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SUMMARY OF THE WORK

PART 1- GENERAL

1.01

A The furnishing of all labor, materials, equipment, services, and transportation of Facility & Support Operations for the project identified as GUSD FASO YARD IMPROVEMENTS located at 333 W Magnolia Ave, Glendale, CA 91204, as set forth in the City of Glendale approved Contraction Documents which is required for the completion of the project in accordance with the provisions of the contract.

B Article 3 of the Bid General Conditions requires preparation of a Cost-loaded time logic schedule with a single critical path. If the Board approved lowest responsive and responsible bid Contractor and the Project Manager, on behalf of the District, cannot agree on the contract construction schedule and the project single critical path within fifteen (15) days after Notice to Proceed, the District may terminate the Contract, for convenience, as outlined in the Project General Conditions. In the event this is necessary, compensation to the General Contractor and all subcontractors or materialmen shall be limited to Mobilization costs only.

C The liquidated damages shown in the Supplementary General Conditions shall apply to each phase of the phased construction plan, as defined by and within the plans and specifications.

D No warranties or guarantees shall go into effect, for any trade, regardless of when completed in the sequence of the project erection, until one (1) day after the Board of Education has accepted the project at a noticed meeting. Attention: Bidders. This will require certain trades to bid for, and provide, a warranty of longer than one (1) year in length from the time of installation or furnishing of their materials to the project, depending upon the sequencing of their work within the overall schedule.

E All project close-out/punch list items, project record documents, submittals, and operations manuals and spare parts, warranties and guarantees and Contractor's Final Verified Report shall be reviewed and accepted prior to the Architect/District agreed upon authorization to file the Notice of Completion with the Los Angeles County Recorder.

F In the event that any materials requiring Inspection (steel, concrete, masonry grout, etc.) are manufactured in an area located more than one hundred miles (100 miles) by air radius from the project site, all round-trip travel and all per diem costs incurred by the District on behalf of the Deputy Inspector who must perform on-site examination of the materials shall be borne 100% by the Contractor as an added expense. This charge shall be subtracted from the monthly "Application for Payment" submitted to the District on behalf of the project.

G In the event the General Contractor or any subcontractor or materialman (on or off site) voluntarily accelerates the schedule for their own purposes, and/or voluntarily performs work in excess of eight (8) hours per day, or on the weekends or holidays, the additional cost of the Inspectors' overtime premiums which are required to inspect the work during these hours shall be paid 100% by the Contractor. This charge shall also be subtracted from the monthly "Application for Payment" submitted to the District on behalf of the project.

H In the event that the Contractor fails to complete all punch list items and turn over all "deliverables, warranties, As-builts, etc." within sixty (60) days after acceptance of completion by the Board of Education, the full salary costs of one (1) construction Project Manager (16 hours per week @ $120.00/hour) and one Inspector of record (actual hours spent @$80.00/hour) shall be back-charged to the Contractor, in addition to the liquidated damages, if any, imposed upon the Contractor for late performance. THIS PARAGRAPH WILL BE STRICTLY ENFORCED.

I The intent of these contract documents is that the work of alteration, rehabilitation or construction is to be accordance with Title 24, California Code of Regulations. Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the Contract Documents wherein the finished work will not comply with Title 24, California Code of Regulations, a

PART 2- SCOPE OF WORK

2.01

A Scope of Work: Contractor shall perform, within the time stipulated, the Contract including all of its component parts, and everything required to be performed, and to provide and furnish any and all of the labor, materials, tools, expendable

equipment, and all applicable taxes, and all utility and transportation services necessary to perform the Contract and complete, in a workmanlike manner, all of the Work required in connection with the following titled Project in strict conformity with the Contract Documents:

B Facilities & Support Operations GUSD FASO YARD IMPROVEMENTS Project at 333 W Magnolia Ave, Glendale, CA 91204

(1) FACILITY WALL AND GATE SCOPE

a. General Contractor shall pull all required permits and inspections and include the cost for such in their bid.

b. Removal of existing turf, shrubs, roots, planter, fences and pavement from site.

c. Install 6ft high concrete masonry unit wall (8x8x16 standard precision blocks) on property line approximately 535-feet.

d. Install one 25ft long automatic rolling gate.

e. Install one 30ft double leaf manual swing gate.

f. Install electrical underground wires for one gate.

g. Install one post mounted keypad for gate access at the automatic rolling gate on the gate entrance side.

h. Install sensors in the ground on the exit side of the automatic rolling gate to sense a vehicle and automatically open the gate.

i. Install proximity sensors to keep the gate open when obstructions are present and to allow the gate to close when obstructions are not.

j. Install concrete pad and metal cages for gate motors

k. Pave approx. 2314 sqft.

l. Stripe parking lot.

m. Provide required accessibility parking signs and emblems.

n. Provide Door opening loops for going out of parking

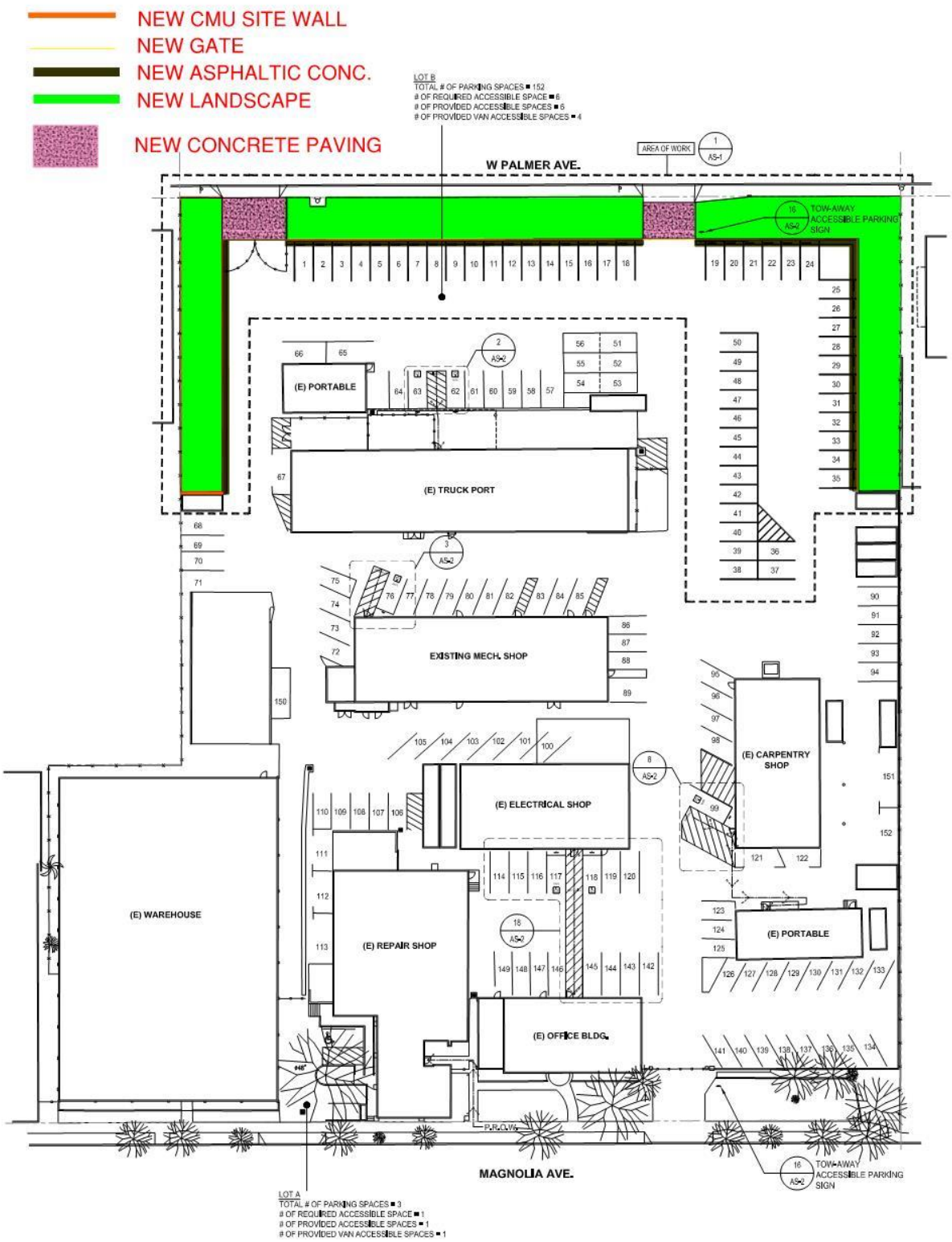
o. Provide a system to be programmable so that gates will automatically remain open between certain hours of operation.

p. Provide all electrical to gate for power

q. Provide all plants for the side and front of the yards

r.

PART 3- SITE MAP



1.

SECTION 01730

DEMOLITION PROCEDURES

PART 1- GENERAL

1.01 SECTION INCLUDES

A General requirements for special project procedures pertaining to the alteration or modification of existing construction, and are complimentary to like requirements indicated or specified elsewhere. Principals items included are:

1. Removals, cutting, alterations and repairs to existing facilities as required to complete work.
2. Relocation and reinstallation of existing construction and finish.
3. Salvage, storage and protection of existing items to be reinstalled.
4. Salvage and delivery to the District of items so designated for removal and salvaged by Contractor, as directed.

1.02 RELATED SECTIONS

A Requirements of other Sections of this Specification apply to this Section.

1.03 PROPERTY INVENTORY

A District property that the District intends to remove, will be removed at no cost to Contractor, before a room or space is vacated for the Work. Before performing any Work in each room or space the District and Contractor shall prepare a detailed initial written inventory of District property remaining therein and condition thereof including equipment and telephone instruments, and each shall retain a copy of the inventory dated and signed by both. In same manner, prior to the District re-occupancy of each such room or space the parties shall again inventory District property therein and all discrepancies between the inventories shall be Contractor's responsibility as specified above.

1.04 JOB CONDITIONS

A General: Coordinate the Work of all trades and with the District to assure correct sequence, limits, methods, and times of performance. Arrange the Work to impose minimum hardship on operation and use of the facilities. Install protection for existing facilities, contents, and new work against dust, dirt, weather, damage, and vandalism, and maintain and relocate as the Work progresses.

B Access: Confine entrance and exit operations to access routes designated by the District.

C Existing Conditions: Intent of Drawings is to indicate existing site and facility conditions with information developed from original construction documents, field surveys, and the District records, and to generally indicate amount and type of demolition and removals required to prepare existing areas for new work.

D Verification of Conditions: Perform a detailed survey of existing site and building conditions pertaining of the Work before starting Work. Report to the District Inspector discrepancies or conflicts between Drawings and actual conditions in writing for clarification and instructions and do not perform Work where such discrepancies or conflicts occur prior to receipt of the Architect’s instructions

E Special Noise Restrictions: Use care to prevent generation of unnecessary noise and keep noise levels to minimum possible. When ordered by the District Inspector, immediately discontinue such methods that produce noise disruptive or harmful to facility functions and occupants, and employ unobjectionable methods. Equip air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with "residential" grade mufflers, and muffle the unloading cycle of compressors. Remove from site any equipment producing objectionable noise as determined by the District Inspector.

F Shoring and Bracing: Provide supports, shoring, and bracing required to preserve structural integrity and prevent collapse of existing construction that is cut into or altered as a part of the Work.

G Overloading: Do not overload any part of structures beyond safe carrying capacity by placing of materials, equipment, tools, machinery, or any other item thereon.

H Building Security: Secure building entrances and exits with locking or other approved method in accordance with the District's instructions.

I Safeguarding the District Property: Contractor shall assume care, custody, and responsibility for safeguarding all the District's property of every kind, whether fixed or portable, remaining in rooms and spaces vacated and turned over to the Contractor by the District for his exclusive use in performance of the Work until the Work therein or related thereto is completed and the rooms or spaces are reoccupied by the District. Furnish all forms of security and protection necessary to protect the District's property. Regardless of cause, Contractor shall repair or replace all of the District's property under the Contractor's care, custody, and safeguarding that is damaged, injured, missing, lost, or stolen from time each such room or space is turned over the Contractor for the Work until re-occupied by the District, at Contractor's expense and as directed by the District.

J Covering and Cleaning: Cover and protect surfaces of rooms and spaces turned over for the Work, including the District's property remaining therein, as required to prevent soiling or damage by dust, dirt, water, fumes, or otherwise, and protect other areas where Work is performed in same manner, as deemed adequate by the District. Prior to District's re-occupancy of any such room or space, clean all surfaces including District's property in accordance with General Conditions and other cleaning instructions as may be specified in other Sections.

K Use of District's Telephones: Do not use nor allow anyone other than District employees to use telephone in rooms and spaces turned over to Contractor for the Work except in the case of a bona fide emergency. Install temporary dial locks on telephone instruments to prevent all unauthorized use or arrange and pay for temporary removal and reinstallation of instruments. Reimburse to the District all telephone toll charges originating from the telephones in such rooms and spaces except those arising from emergencies or use by District employees.

L Welding: Conform to following requirements where welding is performed in or on existing facilities.

1. Protection During Welding: Conform to Title 8, CAC. Further protect occupants and the public with portable solid vision barricades around locations where welding is performed plus signs warning against looking at welding without proper eye protection, or equivalent.

2. Fire Extinguishers: Maintain a fully charged UL-labeled minimum 6 pound 40B:C dry chemical fire extinguisher at every location where welding is performed within or on the facilities.

3. Welding Smoke Control: Verify locations of existing smoke detectors. Perform welding operations by methods that produce the minimum feasible smoke and fumes. Furnish portable type smoke collection and ventilating equipment as required to prevent smoke and fume nuisances. Notify District at least 48 hours in advance if temporary deactivation of any smoke detector is required to prevent false alarms from the welding operations. The District's personnel will deactivate detectors only for the time welding is actually in progress.

4. Fire Prevention: Before welding, examine existing construction and backing for all combustible materials and finishes and for conditions where heat conduction in metals may bring adjoining materials to ignition temperature. Use positive fire prevention measures including temporary removal and reinstallation of combustible materials, installation of temporary shields and/or heat sinks, and other necessary means. When actual field conditions are such that positive fire prevention measures cannot be achieved, notify Architect and do not proceed with the involved work until receipt of Architect's instructions.

5. Protection of Floors: Use care to protect all floor surfaces and coverings from damage. Equip mobile equipment with pneumatic tires.

PART 2- PRODUCTS

2.01 MATERIALS:

A General: When patching existing work in place, use materials that match existing materials in performance, thickness and finish.

PART 3- EXECUTION

3.01 PROTECTION:

A Glass: Provide such protection as may be required to prevent glass breakage for all glass to be reused or to remain. At no additional cost, replace in kind all broken glass.

B Existing Work to Remain: Provide such forms of protection as may be necessary to prevent damage to and dust or dirt contamination of existing work and equipment to remain.

C Items to be Reused: Exercise the greatest possible care when removing items scheduled for reuse. Use only mechanics skilled in the appropriate trades. Identify point of reuse, store and protect at locations directed.

D If required due to damage, replace with new materials to match existing in same manner and technique originally utilized.

3.02 REMOVALS, ALTERATIONS, AND REPAIRS:

A Basic Requirement: Restore and refinish all new and existing construction and improvements that are cut into, altered, damaged, relocated, reinstalled, or left unfinished by removals to original condition or to match adjoining work and finishes unless otherwise shown, specified, directed, or required. Workmanship and materials shall conform to applicable provisions of other Sections. Provide new fasteners, connectors, adhesives, and other accessory materials as required to fully complete approved reinstallations and restorations. Where restorations and refinishing are defective or are otherwise not acceptable to Architect, remove all the defective or rejected materials and provide new acceptable materials and finish at no extra cost to District.

B Extent: Perform removals to extent required plus such additional removals as are necessary for completion even though not indicated or specified. More or less of the existing construction may be removed if such variation will expedite the work and reduce cost to the District, subject to prior approval in each case.

C Removals: Carefully remove work to be salvaged or reinstall and store under cover.

3.03 MECHANICAL AND ELECTRICAL:

A Demolish existing mechanical, plumbing and electrical items as indicated in the Drawings and Specifications.

3.04 REMOVED MATERIAL AND DEBRIS:

A All removed material, not otherwise designated, and all debris becomes the property of the Contractor who shall remove it from the site and dispose of it in a legal manner.

B Do not allow materials and debris generated by demolition activities to accumulate. Remove daily.

C Leave all spaces broom clean with all ledges and corners properly cleaned.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1- GENERAL

1.01 DELIVERY, STORAGE, AND HANDLING

A Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.02 PROJECT CONDITIONS

A Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

B Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for oil-based materials or 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

1.

PART 2- PRODUCTS

2.01 ASPHALT MATERIALS

A Provide materials of the class, grade, or type indicated on the Drawings, conforming to relevant provisions of Section 203 – Bituminous Materials of the Standard Specifications for Public Works Construction.

2.02 HEADERS AND STAKES

A Concrete: Per Specification Section 321313. B. Redwood

1. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated.
2. Stakes: 2 x 4 redwood or 2 x 3 Douglas Fir, Construction Grade.
3. Nails: Common, galvanized, 12d minimum.

PART 3- EXECUTION

3.01 EXAMINATION

A Verify that subgrade is dry and in suitable condition to begin paving.

B Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C Proceed with paving only after unsatisfactory conditions have been corrected.

D Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.02 PATCHING

A Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact.

1. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.03 REPAIRS

A Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.04 SURFACE PREPARATION

A General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to

1. 0.7 L/sq. m).
2. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
3. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.05 HOT-MIX ASPHALT PLACING

A Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.06 JOINTS

A Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.07 COMPACTION

A General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or
2. AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
3. Average Density: 92 percent of reference maximum theoretical density according to
4. ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.08 INSTALLATION TOLERANCES

A Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

C Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch (3 mm) of height indicated above pavement surface.

3.09 SURFACE TREATMENTS

A Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m) to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.10 PAVEMENT MARKING

A Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B Allow paving to age for 30 days before starting pavement marking. C. Sweep and clean surface to eliminate loose material and dust.

C Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal. (0.72 kg/L).

3.11 FIELD QUALITY CONTROL

A Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

B Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

C Replace and compact hot-mix asphalt where core tests were taken.

D Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.12 DISPOSAL

A Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION

SECTION 02300

EARTHWORK

PART 4- GENERAL

4.01 SECTION INCLUDES:

A Clearing and Grubbing.

B Over-excavation and Re-compaction.

C Excavation, Grading, Filling and Compaction of entire site.

D Excavation, Backfilling, and compacting Backfill for pipe trenches.

E Export of excess excavated materials.

F Control of surface and ground water.

G Clean up.

H Testing and Inspection of Work of this Section.

4.02 RELATED WORK SPECIFIED ELSEWHERE:

A Final preparation for asphaltic concrete paving areas.

B Landscaping including planting and irrigation systems.

C Storm Drainage, site water, sewer, and other site utilities.

4.03 QUALITY ASSURANCE

A Codes and Standards: Perform work in this Section in compliance with all applicable requirements of governing authorities having jurisdiction.

1. Refer to Construction Safety Orders, Title 8, California Code of Regulations, Section 1503 and Article 6 (CCR); secure and pay for all required permits.
2. For off-site work, conform to all requirements of City of Glendale and any other agencies having jurisdiction. Coordinate and obtain all required permits and inspections.
3. Provide materials and perform work in compliance with the "Standard Specifications for Public Works Construction", current edition (PWC Specifications).

9.

B Professional Observation: A soils engineer will be retained by the Owner for purposes of inspection, testing and approval of all work under this section. Perform work of this Section under inspection and approval of the soils engineer. Give soils engineer not less than 48 hours advance notice of readiness for inspection.

C Source Quality Control: Obtain written approval of the soils engineer of all imported fill material before material is brought to site. Obtain same approval of excavated material for use in fills or backfills prior to placing.

D Comply with all requirements of permit for export of soil from site. Permit is to be obtained and paid for by Contractor. Furnish copies of all permits and licenses required by the City of Glendale to Owner's representative.

4.04 JOB CONDITIONS

A Data: Maps, boring logs, geotechnical and foundation investigation reports, and like reference data, not included in Contract Documents but made available to Contractor by Architect or Owner are for information only, and the Architect and Owner assume no responsibility for any conclusions Contractor may draw from such information. Should questions or issues arise, contact Architect or Owner for clarification.

1. Contractor shall determine existing conditions under which the Contractor will operate in performing the Work.

B Protection: Refer to CCR, Section 1503 and Article 6. Contractor shall secure permits. District will pay for all required permits. Provide and maintain protection as required by governing agencies to prevent injury to persons or damage to property.

1. Barricade open excavations and post with warning lights as recommended by authorities having jurisdiction.
2. Protect slopes, structures, utilities, sidewalks, pavement, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
3. Noise and Dust Abatement: Exercise all reasonable and necessary means to abate dust and rising dirt. Perform necessary sprinkling and wetting of construction site to prevent nuisance. Exercise all reasonable and necessary means to abate undue noise.

C Existing utilities: Locate existing underground utilities in all areas of work prior to excavation or commencement of work. If utilities are to remain in place provide adequate means of protection during earthwork operations.

1. Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult Utility Owner immediately for direction. Cooperate with Owner and Utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of Utility Company.
2. Do not interrupt existing utilities serving facilities occupied or used by Owner, or others, except when permitted in writing by Owner's Representative, and then only after acceptable temporary services have been provided.
3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut off of services if lines are active.

D Water for Grading: Contractor shall obtain and pay for all water required for his grading operation. This may include, but is not limited to, payment of deposits to utility for construction meter, and payment of all monthly service and water charges. Construction meter shall be in place throughout construction period unless alternative arrangements are made with the Water Department to provide construction water for all purposes. Contractor shall be aware of water moratoriums and restrictions, and shall immediately advise Owner of effects on construction schedules.

E Use of Explosives: The use of explosives is not permitted.

F Existing Conditions: Prior to commencing work at site, verify agreement of existing conditions with indicated conditions. Notify Owner's Representative in writing of discrepancies found. Start of work without notification constitutes acceptance of conditions, without cause for extra compensation.

PART 5- PRODUCTS

5.01 MATERIALS: Provide approved imported material, as required, if the quantity of approved site and excavated materials are insufficient to complete the work.

A Earthwork Materials: The Soil Engineer shall evaluate Excavated soils for re-use during grading. Approved excavated or imported material shall be granular soil such as silty sand of the non-expansive type with a liquid limit of 25 or less, a plastic index of 12 or less and be uniformly graded, containing not more than 30% (by weight) of material passing the No. 200 sieve. All fill soil whether from on-site or imported shall be free from trash, roots, organic material, clay lumps, and rocks over 3" in size. Materials shall be from a legal export site only, in accordance with City of Glendale requirements. Materials shall be from a legal export site or obtain soils engineer's approval of material before bringing any of it onto project site.

B Gravel Fill Material: Shall be from an approved source, having the following gradation: 90-100% passing a 3/4" sieve, 0% to 10% passing a No. 4 sieve, and 0% to 3% passing a No. 100 sieve.

C Oversized Materials: Oversize material defined as rock or other irreducible material with a maximum dimension greater than 3" shall not be buried or placed in fills unless the location, materials and disposal methods are specifically approved by the soils engineer.

D Topsoil: Friable loam, free of subsoil, roots, grass, weeds, stones larger than 1/2", and foreign matter. Topsoil, excavated or imported to be used in areas receiving planting, shall be of such quality as to support plant life. Refer to Section 01400 for required testing. Approval of topsoil by the Owner's representative will be required prior to placement.

PART 6- EXECUTION

6.01 SITE CLEARING AND PREPARATION

A Clearing and Grubbing:

1. Before starting grading/earthwork operations, remove trash including stairways, foundations pavements, underground utilities and strip all vegetation in work area, including roots, and remove all this debris to a legal offsite disposal area. Any buried debris or other contaminated material exposed during subsequent earthwork operations should also be removed.
2. For trees that are to be left standing, carefully and cleanly cut roots and branches that obstruct new construction. Use only hand methods for grubbing inside the drip lines of these trees. Excavations made for removal of any existing tree roots should be cleared of loose materials and backfilled with clean compacted soil.

3. All areas disturbed by clearing and grubbing operations or by surface soil removal shall be scarified to a minimum depth of 10" to 12" inches prior to placing new fill. The material shall be compacted to 90 percent maximum density, unless otherwise specified in accordance with ASTM Standard Test Material D-1557-S1.

4. The stripping work shall include the removal of loose fill that in the judgement of the Geotechnical Engineer, is compressible or contains significant voids. The stripping operation must expose a firm, non-yielding that is free of large voids. The exposed soils should be observed by the Geotechnical Engineer prior to the placement of any fill or sub-ballast.

5. All Oak Bay or Sycamore trees on the subject property and within 20 feet of all adjoining properties shall be identified on the site plans! The trees shall be identified by trunk diameter, 125% drip line and species. Call Parks, Recreation & Community Services at (818) 548-3736 for Tree fence inspection prior to commencing work.

6. Prohibit trenching or continuous digging, grading (removing or adding soil) or storage of equipment or building materials within the drip line of the Oak & Bay Sycamore tree(s). Piers and grade beam footings shall not be required within the drip line plus 25% of the Oak & Bay Sycamore tree(s). (The 125% Drip line shall be defined as that area where the branches stop or terminate and shall be equal to 125% of the distance of the line from the trunk to the farthest leaf drip point.) The leaf drip line for each tree shall be measured and confirmed by the contractor in the four major compass directions. The soil in the 125% drip line area under the trees shall remain fenced off from the construction work and shall remain undisturbed.)

B Demolition:

1. Remove all structures indicated on the drawings as "To Be Removed" and dispose of debris in a legal offsite disposal area.

6.02 EXCAVATION

A General:

1. Adverse Subsurface Conditions: Immediately notify District Inspector should unsuitable bearing soil or other adverse subsurface conditions be found which are not indicated by the Drawings or Specifications.

2. Engineered fill beneath and the upper two feet of sub-grade for pavement structural sections should be compacted to at least 95 percent relative compaction as per ASTM D1557. Engineered fill beneath slab-on-grade, pavements, walkways, and backfill along foundations and behind retaining walls should be compacted to at least 90 percent relative compaction. All fill and backfill, structural or non-structural should be placed in loose lifts less than 8 inches thick and moisture conditioned to 1 to 2 percent above optimum moisture content prior to compaction. Compaction tests should be performed every 2 to 18 vertical inches and/or 500 cubic yards of fill, or as determined necessary by the field engineer to verify adequate compaction and ensure proper soil-water content.

3. All fill and backfill in the vicinity of structures and retaining walls should consist of on-site soils, excluding clay fills with high plasticity and/or moderate to high expansion potential. For planning purposes of estimating earthwork quantities, the existing soil will compress an average of approximately 10 percent when water conditioned and placed in as an engineering fill.

4. Unauthorized Excavation: If excavations are carried below the elevations indicated without written authorization, the Contractor shall provide satisfactory construction and compaction if necessary to correct the fault as approved by the Soils Engineer at no extra cost to Owner.

5. Excavations and Cut-slopes: Excavations and Cut-slopes shall be examined during grading by the soils engineer. If required, further excavation, over-excavation and refilling, and/or remedial grading of cut slopes shall be performed as directed by the Soils Engineer. Where fill-over-cut slopes are to be graded, unless otherwise approved, the cut portion of the slopes shall be made and approved by the Soils Engineer prior to placement of materials for construction of the fill portions of the slopes. Care should be taken to avoid spillage of loose material down the face of slopes. All loose material shall be removed from the face and toe of slopes prior to completion.

6. Construct all slopes in a workmanlike manner so that they are positioned at their design orientation and slope ratio. Achieving a uniform slope surface by subsequent thin wedge filling will not be allowed. Any add-on correction to a fill slope shall be conducted under the direction and recommendation of the Soils Engineer. The completed face of all exposed fill slopes shall be either overfilled then cut back to a firm compacted surface or, compacted by track rolling or some other acceptable method.

9.

7. Contractor will take care to avoid erosion or unwanted runoff of slopes or debris due to existing irrigation systems or adverse weather.

B Structures:

1. Perform excavation to a minimum depth of 60” below the depth of foundations and to the dimensions and elevations indicated on drawings within a tolerance of 0.10 feet. Provide additional space as required for the installation of services, the performance of other construction work as required, the inspection of the various types of work, and the installation and stripping of forms, except where approval may be given by the Owner's Representative to deposit certain miscellaneous concrete directly against earth banks. Avoid loosening of soils in bottoms and sides of excavations.

2. Foundations shall be placed at a minimum depth of 18” below the adjacent grade for both interior and exterior footings (bottom of slab at interior). Continuous footings shall have a minimum width of 18”. The foundations shall bear on a minimum of five feet of engineered fill.

C Retaining Walls:

1. Retaining wall foundations shall be a minimum of 24” into competent material and shall be a minimum of 24” in width.

D Existing Utilities:

1. Excavations made for the removal of existing underground structures, etc., should be cleared of loose material and backfilled with clean, approved, compacted soil in accordance with these specifications.

E Protection:

1. Provide adequate cribbing, sheathing and shoring as necessary to safely retain the earth sides of all excavations and trenches from caving and other damage resulting from excavating and/or erosion. Provide suitable forms of protection against property damage and bodily injury to personnel employed on the work and the general public.

2. The design, installation and maintenance of required cribbing and shoring shall be entirely that of the Contractor and shall meet the approval of the State Division of Occupational Safety and Health, and the local governing agencies.

3. It shall be the Contractor's full responsibility to furnish and maintain all temporary barricades, warning lights, and other types of protection and prevent accidental injury to the general public and all personnel employed on the project.

6.03 GRADING, GENERAL:

A Uniformly grade all areas within the limits of this project, including adjacent transition areas. Smooth grade the finished surfaces within the tolerances specified in this Section, and grade with uniform slopes between points where elevations are shown, or between such points and existing grades.

B Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Where grades are not indicated, grade uniformly level or slope between points for which elevations are given. In absence of more specific grading information, ground shall slope away from building for a minimum distance of 20 feet and a minimum slope of 2 percent. Grade trenches and other drainage flow lines to slope uniformly to avoid standing water.

C Finished surfaces shall be free from irregular surface changes and shall be constructed to the line, grade and cross section as shown on the plans or as specified herein. Tolerances for these finished surfaces are as follows:

1. Lawn or unpaved areas: 0.10' above or below required elevation; playfields and contour-graded landscape areas may be finished to looser tolerances where required to balance earthwork or blend finished areas, subject to approval by Owner's representative.

2. Walks, Pavements and Building Pads: .05' above or below required sub-grade.

11.

6.04 FILL/BACKFILL, GENERAL

A The Contractor shall backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, damp proofing, water proofing, and perimeter installation.
2. Inspection, testing, approval, and recording locations of underground utilities.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structure or utilities, if required.
5. Removal of trash and debris.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

B Placement and Compaction: Place fill or backfill materials in layers not more than 8" in loose depth and compacted to at least 90% of maximum dry density.

1. Before compaction, moisten or aerate each layer as necessary to provide a moisture content above 1 to 2 percent of optimum.
2. The upper 24” of pavement sub-grade shall be compacted to at least 95% of relative compaction per ASTM D1557.
3. Engineered fill beneath foundations shall be compacted to at least 95% relative compaction per ASTM D1557.
4. Place backfill materials evenly, adjacent to structures, piping, or conduit. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.
5. Compaction and Moisture Testing: The soils engineer will perform field tests to check the moisture content and the degree of compaction. The locations and frequency of the test will be taken at the soils engineer's discretion.

6.05 TRENCH EXCAVATION AND BACKFILL: Trenching operations for all underground conduits, and related systems shall be performed under the provisions of this Section. Provide trench shoring, sheeting and bracing in conformance with Title 8 of the California Code of Regulations.

A Trenches: Excavate trenches to width required for proper installation of underground systems with banks as nearly vertical as practical. Bring bottoms of trenches to required depth, all accurately graded to provide uniform bearing on undisturbed soils for the entire length of each section of piping or conduit, except where necessary to excavate for pipe bells or for pipe bedding indicated or specified in other sections.

B Remove soft or moving trench bottom soils down to firm native ground, and replace with crushed rock or pea gravel as approved by the soils engineer to provide firm, stable sub-grade. Trench width shall include a minimum clearance on both sides of pipe or conduit of one half the pipe diameter, unless otherwise specified.

C Where rock is encountered, carry excavation 6" below required elevation and backfill with a 6" layer of crushed rock or pea gravel as approved by the soils engineer prior to installation of pipe.

D Where utility trenches fall within the zone of influence of footings as defined on the Structural plans, contractor shall deepen footings, relocate piping, or, if approved by the Soils Engineer, modify trench/backfill conditions, materials, or methods, all at no additional cost.

E The pipe haunches shall be carefully backfilled with bedding material (clean sand, approved granular soil, or other material specified). This bedding material shall be brought to a depth of at least one foot over the top of pipe. The bedding material shall be uniformly tamped and compacted to 90% Maximum Relative Density. Jetting or water flooding will not be allowed unless specifically approved by the Owner's Representative. Refer to specific utility sections for additional or more restrictive bedding requirements.

F On-site materials or other soils approved for backfill by the soils engineer shall be watered and mixed as required to obtain a moisture content within 2% of optimum prior to placement in lifts over the bedding material. All backfill shall be done under the supervision of soils engineer and shall be compacted to at least 90% of the Maximum Relative Density as determined by ASTM D1557. The backfill shall be placed in lifts appropriate to the type of compaction equipment being utilized. Trench backfill compaction by jetting or flooding is not permitted unless approved in advance by the Owner's Representative and provided that all excess water can be safely and completely removed from the work area.

G Field density tests and inspection of the backfill procedures shall be made by the soils engineer during backfilling to see that the proper moisture content and uniform compaction is maintained. The Contractor shall provide test holes and exploratory pits as required by the soils engineer to enable sampling and testing.

H Cracking or settlement of paving and finish materials over utility trench locations shall be conclusive proof of trench failure. The Contractor at no additional cost to the Owner shall complete removal and re-compaction of the trench and replacement of damaged paving as required.

I Temporary excavations with vertical side slopes within the onsite soils are expected to be generally stable to a maximum height of 5 feet provided they are free of adverse geologic conditions. Excavations deeper than 4 feet should be shored or sloped back to 1 to 1 or flatter if construction workers are to enter such excavations. Excavations below the ground water table will likely require special equipment and/or techniques (i.e. shoring, dewatering, etc.).

6.06 DEWATERING:

A Prevent surface water, subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to flow into City storm drains unless designated as approved disposal point for water runoff. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of sub-grades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

6.07 CLEAN UP:

A Clean up and remove all trash, debris, waste, and surplus and rejected earthwork materials from the Owner's property to a legal disposal area. Conform to pertaining laws, codes and regulations, obtain and pay for hauling and dumping permits, pay all dumping charges, and furnish receipts to Owner's Representative upon demand. Remove planks used to protect surfaces subject to public traffic at finish of each day's operations. Maintain public streets and sidewalks in broom clean condition.

1. Comply with all Environmental Agency regulations relating to the spillage of oil-based products and other environmentally hazardous materials.

6.08 MAINTENANCE

A Install and maintain all erosion control devices, including sandbag and gravel bag dikes, silt fences, de-silting basins, inlet barricades, vehicle wash traps, and other features called for on the storm water pollution prevention plan (SWPPP) required per Section 01055. Maintain a copy of the approved SWPPP on jobsite, and make it available for inspection by authorized individuals at all times.

B Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape to required tolerances, and compact to required density prior to further construction.

6.09 DISPOSAL OF EXCESS AND WASTE MATERIALS

A Waste Material:

1. Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it in a legal disposal site away from Owner's property. Advise Owner's representative of dump location, and provide receipts for each load of material leaving site.

B Excess Material:

1. The contractor shall export all excess materials excavated from project site.
2. Contractor will be responsible for delivering acceptable imported material to the site stockpile and placing it as directed by the Soil Engineer.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1- GENERAL

1.01 SECTION INCLUDES

A Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B Openings for other work.

C Form accessories.

D Form stripping

1.02 RELATED REQUIREMENTS

A Section 03 20 00 - Concrete Reinforcing.

B Section 03 30 00 - Cast-in-Place Concrete: General requirements for concrete construction, including finish qualities..

C Section 04 20 00 - Unit Masonry: Reinforcement for masonry.

D Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

E Section 05 21 00 - Steel Joist Framing: Placement of embedded steel anchors, plates and joist seats in cast-in-place concrete.

F Section 05 31 00 - Steel Decking: Placement of steel anchors in composite decking.

G Section 05 50 00 - Metal Fabrications: Placement of embedded steel anchors and plates in cast-in-place concrete.

H Section 32 13 13 - Concrete Paving: Sidewalks, curbs and gutters.

1.03 REFERENCE STANDARDS

A ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B ACI 301 - Specifications for Structural Concrete; 2016.

C ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2017).

1. Use 2014 as indicated in 2016 CBC Referenced Standards.

D ACI 347R - Guide to Formwork for Concrete; 2014.

E PS 1 - Structural Plywood; 2009.

F CBC Chapter 19A.

1.04 DEFINITIONS

A Unexposed Finish: A general-use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.

B Exposed Finish: A general-use finish applicable to all formed concrete exposed to view and including surfaces which may receive a paint coating (if any).

1.05 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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

1. Form release agent.

C Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.06 QUALITY ASSURANCE

A Industry Standard: Formwork design and construction shall be in accordance with ACI 301, ACI 318, and ACI 347R.

B Maintain one copy of each installation standard on site throughout the duration of concrete work.

C Regulatory Requirements: Conform to formwork construction requirements of the California Building Code (CBC) Title 24, Part 2, Chapter 19A as amended and adopted by authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A Deliver prefabricated forms and installation instructions in manufacturer's packaging.

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

PART 2- PRODUCTS

2.01 FORMWORK - GENERAL

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

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

C Chamfer outside corners of beams, joists, columns, and walls.

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

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

F Provide materials for contact with concrete which impart suitable surface quality to completed concrete. Use the following form types:

1. Forms for Exposed Finish Concrete:
   a. Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces.
   b. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on the Drawings.
2. Forms for Unexposed Finish Concrete:
   a. Plywood, lumber, metal, or another acceptable material.
   b. Provide lumber dressed on at least two edges and one side for tight fit.
   c. When unexposed concrete is intended to receive waterproofing, provide form as for exposed finish concrete.

G Provide materials to construct formwork to support forming materials in contact with concrete, of sufficient capacity to withstand pressures of concrete placement and to support concrete in place until cured, without distortion.

2.02 WOOD FORM MATERIALS

A Softwood Plywood for Concealed Surfaces: PS 1,undamaged face C Grade, Group 2 Plugged EXT or APA Structural I Sheathing.

B Hardboard: For curved surfaces, tempered hardboard, Masonite Corp., or equal.

C Lumber: Douglas fir or douglas fir-larch species; appropriate for intended use grade; with grade stamp clearly visible.

1. Sound and undamaged straight edges, and solid knots, to maintain principal shores to support concrete until minimum strength is achieved as approved by Structural Engineer.

D Embedded Nailers: Clear all heart redwood or pressure preservative-treated (PPTDF) douglas fir, edges reverse beveled to key into concrete.

2.03 FORMWORK ACCESSORIES

A Form Ties: Removable, adjustable-length or snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.

B Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Do not use materials containing diesel oil or petroleum-based compounds.
2. Does not impair subsequent treatments of concrete surfaces or bond of applied coatings.
3. VOC Content: None; water-based.
4. Products:
   a. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com/sle.
   b. W. R. Meadows, Inc; Duogard: www.wrmeadows.com/sle.
   c. Substitutions: See Section 01 60 00 - Product Requirements.

C Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.

D Filler Strips for Chamfered Corners: Wood strip type; 3/4 x 3/4 inch size; maximum possible lengths. Wood molding at plywood or lumber forms; rigid plastic at steel, fiberglass and plastic forms.

E Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

F Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 50 00 .

G Screed Pins and Chairs:

1. Provide units that leave no metal closer than 1-1/2 inch to the plane of the exposed concrete surface.
2. Manufacturers:
   a. Grann Adjustable Quick Screed (800/554-7266).

9.

b. Dayton Richmond (800/745-3700).

c. Aztek (877/531-3344).

d. Substitutions: See Section 01 60 00 - Product Requirements.

H Waterstops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 4 inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

PART 3- EXECUTION

3.01 EXAMINATION

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

3.02 SYSTEM REQUIREMENTS

A Formwork Design Requirements: Formwork products and execution specified herein are for finish surface quality only.

1. Design, layout and construction of formwork shall be solely the responsibility of the Contractor.
2. Design and construct formwork, shoring and bracing to conform to California Building Code (CBC), Title 24, Part 2, Chapter 19A requirements and ACI 318.
3. Resulting concrete shall conform to shapes, lines and dimensions indicated and required.

B Coordination:

1. Coordinate Work specified in this Section with other Sections which require placement of embedded products and provision of openings and recesses.
2. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from the Architect before proceeding.

3.03 EARTH FORMS

A Earth (Soil) Forms, General: Except as otherwise indicated on Drawings, conform to ACI 301, ACI 347R and California Building Code (CBC) requirements. Refer also to notes on Structural Drawings.

B Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.04 ERECTION - FORMWORK

A Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301, ACI 347R and California Building Code (CBC) Title 24, Part 2 requirements.

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

1. Use form ties of sufficient strength and sufficient quantities to prevent formwork spreading.
2. Maintain principal shores to support concrete until minimum required strength is achieved.

C Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

1. Design and fabricate forms for easy removal, without impact, shock, or damage to concrete surfaces or other portions of the work.
2. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.

D Align joints and make watertight. Keep form joints to a minimum. Make forms watertight to prevent leakage of concrete mortar. Locate form joints, at exposed concrete, to be symmetrical about center of panel, unless otherwise noted. Align joints symmetrically at exposed conditions.

E Permanent openings: Provide openings to accommodate Work specified in other Sections. Size and locate openings accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.

F Temporary openings: Provide temporary openings for cleaning and inspection. Provide drain openings at bottoms of formwork to allow water to drain. Locate temporary openings in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete Work.

G Obtain approval before framing openings in structural members that are not indicated on drawings.

H Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

I Coordinate this section with other sections of work that require attachment of components to formwork.

J If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

K Inspection: Before placing of concrete, and after placement of reinforcing steel in the forms, provide notification so that proper inspection can be made. Make such notification at least 2 working days in advance of placing concrete.

L Rejection of Defective Work: Any movement or bellying of forms during construction or variations in excess of the tolerances specified shall be considered just cause for the removal of such forms and, in addition, the concrete construction so affected. Reconstruct forms, place new concrete and required reinforcing steel at no additional cost to the District.

3.05 APPLICATION - FORM RELEASE AGENT

A Form Release Agent: Provide either form materials with factory applied non-absorptive liner or field applied form coating which shall comply with applicable air quality regulations for VOC. If field applied coating is employed, thoroughly clean and recondition formwork and reapply coating before each use. Rust on form surfaces is not acceptable.

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

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

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

3.06 INSERTS, EMBEDDED PARTS, AND OPENINGS

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

1. Install accessories in accordance with manufacturer's instructions and referenced standards, level, straight and plumb.

B Locate and set in place items that are cast directly into concrete.

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

1. Openings: Size and locate formed openings, depressions, recesses and chases to accommodate products to be applied to, built into and pass through concrete Work. Coordinate size, location and placement of inserts, embedded products, openings and recesses with Work specified in other Sections.
2. Anchors and Other Devices: Set and build into concrete formwork anchorage devices and other embedded products required for Work to be attached to or supported by concrete elements.
3. Locating Embedded Products and Openings: Use setting drawings, diagrams, instructions and templates to set embedded products.
4. Screeds: Set screeds and establish level for tops of concrete slabs and leveling for finish surfaces. Shape surfaces as indicated on the Drawings. Provide cradle, pad or base type screed supports for concrete over waterproof membranes and vapor retarders.

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

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

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

G Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints are not apparent in exposed concrete surfaces.

3.07 FORM CLEANING

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

B Clean formed cavities of debris prior to placing concrete.

1. At above grade forms, flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

C Formwork Reuse: Do not reuse wood and plywood forming materials which contact concrete, except as follows:

1. High density plywood may be cleaned and reused for exposed concrete.
2. Unfaced plywood may be reused for concealed concrete.
3. Steel and fiberglass forming materials may be cleaned and reused.

D Patching and Repairs: Patch tie holes with sheet metal patches and restore forms to like new condition prior to reuse.

3.08 FORMWORK TOLERANCES

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

1. Also as specified in ACI 301, ACI 318, and ACI 347R, unless otherwise specified or indicated.

9.

3.09 FIELD QUALITY CONTROL

A An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

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

1. Comply with CBC Table 1705A.3, item 12.

C Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.10 FORM REMOVAL

A Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

1. Comply with California Building Code (CBC) requirements.
2. Formwork supporting weight of concrete may not be removed until concrete has reached a minimum of specified 28-day compressive strength and no earlier than 21 days after pour.
3. Removal of Load Bearing Formwork:
    a. Do not remove shoring and forms supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, until concrete has attained its 28 day specified compressive strength, unless otherwise specified or permitted by the Structural Engineer of Record.
    b. Determine the actual compressive strength has attained is adequate to support the weight of the concrete and superimposed loads.
    c. Maintain curing and protection operations after form removal.
4. Removal of Non Load Bearing Formwork After Superimposed Loads or as Approved by Engineer:
    a. Provided that concrete has hardened sufficiently, that it is not damaged, and has achieved sufficient strength to support its own weight and all imposed construction and design loads, forms not actually supporting weight of concrete or weight of soffit forms may be removed after concrete has cured at not less than 50 degrees F for 24 hours.
    b. Maintain curing and protection operations after form removal.

B Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

1. Remove formwork progressively so no unbalanced loads are imposed on structure. Remove formwork without damaging concrete surfaces.
2. Remove or snap off metal spreader ties inside wall surface. Cut nails and form ties off flush and leave surfaces level and clean.

C Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.11 PATCHING

A Schedule: Patch forming and tie holes immediately after form removal.

B Cleaning: Clean surface of all loose materials and soiling.

C Patching: Patch all holes and depressions with grouting gun and grout mix of one part cement and 2-1/2 parts mortar sand.

3.12 FORMWORK SCHEDULE

A Footings and Walls, Not Exposed to View: Site fabricated plywood or lumber, coated with form release agent.

B Footings and Walls, Exposed to View: Site fabricated plywood, coated with form release agent compatible with applied finish coatings.

END OF SECTION

03 20 00

CONCRETE REINFORCEMENT

PART 1- GENERAL

1.01 SECTION INCLUDES

A Reinforcing steel for cast-in-place concrete and concrete masonry units.

B Supports and accessories for steel reinforcement.

1.02 RELATED SECTIONS

A Section 03 10 00 - Concrete Forms and Accessories. Section 03 30 00 - Cast-in-Place Concrete.

B Section 03 45 00 - Architectural Precast Concrete: Reinforcement for precast concrete panels. REFERENCES

1.03 ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.

A ACI 318- Building Code Requirements For Reinforced Concrete and Commentary; American Concrete Institute International.

B ACI SP-66 - ACI Detailing Manual; American Concrete Institute International.

C ASTM A 82- Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

D ASTM A 184/A 184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.

E ASTM A 185- Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete. ASTM A 497/A 497M- Standard Specification for Steel Welded Wire Reinforcement, Deformed,for Concrete.

F ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel 1;3ars for Concrete Reinforcement.

G ASTM A 704/A 704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

H ASTM A 706/A 706M- Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

I ASTM A 996/A 996M -Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

J AWS D1.4 - Structural Welding Code- Reinforcing Steel; American Welding Society.

K California Code of Regulations (CCR) Title 24 California Building Code (CBC). 2010 Edition. N. CRSI (DA4)- Manual of Standard Practice; Concrete Reinforcing Steel Institute.

L CRSI (P1)- Placing Reinforcing Bars; Concrete Reinforcing Steel Institute.

1.04 SUBMITTALS

A Shop Drawings: Only when deviations are made from the contract documents, submit shop drawings under provision of Section 01 33 13 with deviations clearly identified.

1. Indicate sizes, spacings, locations and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting and spacing devices.

B Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

C Reports: Submit certified copies of mill test report of reinforcement materials analysis, indicate physical and chemical analysis.

D Welders Certificates: Submit certifications for welders employed on the project, verifying AWS qualifications within the previous 12 months.

1.05 QUALITY ASSURANCE

A Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, and ACI SP-66.

B Tests of Reinforcing bars shall be in conformance with 2010 CBC Sections 1916A.2 and 1704A.4.1.

PART 2- PRODUCTS

2.01 REINFORCEMENT

A Reinforcing Steel: ASTM A 615/A 615M Grade 60.

1. Deformed billet-steel bars.
2. Unfinished.

B Reinforcing Steel: ASTM A 706/A 706M, deformed low-alloy steel bars.

1. Unfinished.

C Steel Welded Wire Reinforcement: ASTM A185/A 185M, plain type.

1. Welded Wire Mat Reinforcing: mesh size and gage as indicated on drawings.

D Steel Welded Wire Reinforcement: ASTM A 497, deformed type.

1. Flat Sheets.
2. Mesh Size and Wire Gage: As indicated on drawings.

E Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gage acceptable patented system.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement, including load bearing pad on bottom to prevent vapor barrier puncture.
3. Provide stainless steel, plastic, or plastic coated steel components for placement within 1%" of weathering surfaces.

2.02 FABRICATION

A Fabricate concrete reinforcing in accordance with CRSI (DA4)- Manual of Standard Practice.

B Welding of reinforcement, in conformance with 2010 CBC Section 1903A.7 with Table 1704A.3, is permitted only with the specific approval of Structural Engineer. Perform welding in accordance with AWS D1.4.

C Obtain approval from the architect/engineer for additional reinforcing splices not indicated on drawings.

PART 3- EXECUTION

3.01 PLACEMENT

A Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

C Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

D Do not displace or damage vapor barrier.

E Accommodate placement of formed openings.

3.02 FIELD QUALITY CONTROL

A An independent testing agency, as specified in Section 01 40 00, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1- GENERAL

1.01 SECTION INCLUDES

A Reinforcing steel for cast-in-place concrete.

B Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A Section 03 10 00 - Concrete Forming and Accessories.

B Section 03 30 00 - Cast-in-Place Concrete.

C Section 04 20 00 - Unit Masonry: Reinforcement for masonry.

D Division 26 - Electrical: Grounding connection to concrete reinforcement.

1.03 REFERENCE STANDARDS

A ACI 301 - Specifications for Structural Concrete; 2016.

B ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2017).

1. Use 2014 as indicated in 2016 CBC Referenced Standards.

C ACI SP-66 - ACI Detailing Manual; 2004.

D ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

1. Use 2012 as indicated in 2016 CBC Referenced Standards.

E ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement; 2017.

F ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.

1. Use 2009b as indicated in 2016 CBC Referenced Standards.

G ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

H AWS A5.5/A5.5M - Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding; 2006.

I AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

J CRSI (DA4) - Manual of Standard Practice; 2009.

K CRSI (P1) - Placing Reinforcing Bars; 2011.

1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B Product Data:

1. Reinforcement supporting and spacing devices at exposed concrete only, to demonstrate non-corroding and non-staining characteristics.
2. Adhesive compounds.

C Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

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.

F Quality Control Submittals: Submit the following information related to quality assurance requirements specified:

1. Certifications: Submit to the testing laboratory mill test certificates for all reinforcing steel, showing physical and chemical analysis. If steel is to be welded, include in chemical analysis the percentages of carbon, manganese, copper, nickel, and chromium, and optionally the percentages of molybdenum and vanadium.
2. Certifications: If steel is to be welded, submit certifications to the testing laboratory signed by AWS Certified Welding Inspector (CWI) of prequalified welding procedures, qualifications of welding procedures unless prequalified, qualification of welding operators, and qualification of welders.

G Welding Procedure Specification Submittal: Submit to Testing Laboratory written Welding Procedure Specifications (WPS) as defined by AWS D1.4/D1.4M. The WPS shall be prepared by the Fabricator for review and approval by the Architect (Structural Engineer) and Testing Laboratory as complying with specified criteria, and shall be readily available to the welding inspector.

1.05 QUALITY ASSURANCE

A Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, and ACI 318.

1. Maintain one copy of each document on project site.

B Regulatory Requirements: Conform to California Building Code (CBC) Title 24 Part 2, Chapter 19A requirements as amended and adopted by authorities having jurisdiction, for details of reinforcement.

C Provide Architect, Project Inspector, and Special Inspector with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

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

1. Qualification of Welds, Welding Operators, and Welders: Comply with applicable Building Code standard. Perform welding procedure qualification, except for prequalified procedures, as required by AWS D1.4/D1.4M, prior to executing any welding of reinforcing steel.
   a. Only AWS Certified Welding Inspectors shall be used for tests and qualifications associated with welding of reinforcing steel.
   b. Only AWS qualified welders or welding operators shall perform welding of reinforcing steel.

E Coordinate Work specified in this Section with other Sections which require placement of embedded products and provision of openings and recesses.

F If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect (Structural Engineer) before proceeding.

1.06 DELIVERY, STORAGE AND HANDLING

A Delivery: Deliver reinforcement bars new and free from rust and mill scale in original bundles marked with durable identification tags.

B Storage: Store reinforcement to avoid excessive rusting or fouling with grease, oil, dirt or other bond-weakening coatings.

C Handling: Take precautions to maintain reinforcement identification after bundles are broken.

PART 2- PRODUCTS

2.01 REINFORCEMENT

A Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).

1. Deformed billet-steel bars.

B Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.

1. Carbon Content: 0.55 % maximum.

C Reinforcing Steel Mat: ASTM A704/A704M, using ASTM A615/A615M, Grade 40 (40,000 psi) steel bars or rods, unfinished.

D Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.

E Steel Welded Wire Reinforcement (WWR): Galvanized, plain type; ASTM A1064/A1064M.

1. Form: Flat Sheets.
2. WWR Style: As indicated on drawings.

F Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.

2. Chairs, Bolsters, Bar Supports, Spacers: Wire-bar-type devices, complying with CRSI (DA4), for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Sized and shaped for adequate support of reinforcement during concrete placement.

   a. Supports at Slab on Grade: Provide devices with load-bearing pads or horizontal runners where base material does not support chair legs, to prevent puncture of vapor retarder/barrier or provide precast concrete block bar supports of equal or greater strength to specified concrete.

   b. Corrosion Resistance:

3. Provide stainless steel or plastic components for placement within 1-1/2 inches of weathering surfaces.

   a. Provide plastic coated, plastic-tipped (CRSI, Class 1) or stainless steel types at exposed-to-view concrete surfaces.

   b. Provide only stainless steel (CRSI Class 2) at exterior exposed surfaces to be painted.

4. Welding Electrodes: AWS A5.5/A5.5M E80XX, low hydrogen, with a minimum yield point of 80,000 psi, for welding grade 60 reinforcing steel.

2.02 RE-BAR SPLICING:

A Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing 160% of steel reinforcing design strength in tension and compression.

B Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; Type II capable of developing 160% of steel reinforcing design strength in tension and compression.

C Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.03 FABRICATION

A Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

C Fusion welded reinforcing steel assemblies are not permitted.

D Locate reinforcing splices not indicated on drawings at point of minimum stress. See Structural Drawings,

1. Review locations of splices with Architect (Structural Engineer) before fabrication and placement. .

PART 3- EXECUTION

3.01 PREPARATION

A Cleaning: Clean reinforcement to remove loose rust and mill scale, soil, and other materials which may reduce or destroy bond with concrete.

B Adjustment and Inspection: Do not bend or straighten reinforcement in a manner injurious to material. Do not use bars with kinks or bends not shown on Drawings and reviewed shop drawings, or bars with reduced cross-section due to corrosion or other cause.

C Do not bend bars No. 5 and larger in the field.

D Do not bend bars more than once in the same location.

3.02 PLACEMENT

A General: Place and secure reinforcement as specified herein, as indicated and noted on Drawings and in compliance with recommended details and methods of reinforcement placement and support specified in CRSI Placing Reinforcing Bars.

B Place, support and secure reinforcement against displacement. Do not deviate from required position.

1. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

C Do not displace or damage vapor barrier.

D Accommodate placement of formed openings.

E Maintain concrete cover around reinforcing as indicated on Structural Drawings:

F Conform to applicable code for concrete cover over reinforcement.

1. If not otherwise indicated on Drawings or specified herein, provide concrete cover in compliance with ACI 318.

G Bond and ground all reinforcement to requirements of Division 26.

H Coordination: Locate reinforcement to accommodate embedded products and formed openings and recesses.

I Slab on Grade Reinforcement: Do not displace or damage vapor retarder/barrier at slab on grade.

J Wire Reinforcement Placement: Place reinforcement in sheets as long as practicable, lapping adjoining pieces at least one full mesh and lace splices with 16 gage wire. Offset end laps in adjacent widths to prevent continuous laps. Extend reinforcement to within 1-inch of edge at slabs on grade. Cut mesh at expansion joints and full depth control joints.

K Dowels: Secure tie dowels in place before depositing concrete. Provide No. 3 bars for securing dowels where no other reinforcement is provided.

L Reinforcement Splices, General: Provide standard reinforcement splices by lapping ends, placing bars in contact and tightly wire tying. Comply with details and requirements of ACI 318 for minimum lap of spliced bars and criteria indicated on the Drawings.

1. Clearances for Splices: Wherever possible, provide minimum 1-1/2 inch clearance between sets of splices. Stagger horizontal bars so that adjacent spices are minimum 48 inches apart.

M Reinforcement Supports: Support reinforcement on metal chairs, spacers or metal hangers to provide required coverage and to properly locate reinforcement. Do not use wood. Avoid cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

1. Support Spacing: Space chairs and accessories in conformance with CRSI Placing Reinforcing Bars.

N Welding of Reinforcement Steel

1. Welding: Perform welding under continuous inspection and supervision of a qualified Registered Deputy Inspector employed by testing and inspection agency. Weld reinforcement as indicated on Drawings.
2. Carbon Equivalent (CE): CE of reinforcing bars or splice materials shall be calculated from chemical composition as indicated in mill report by following formula:
   a. ASTM A706/A706M Bars:
   b. CE = % C + (%Mn/6) + (%Cu/40) + (%Ni/20) + (%CR/10) - (%Mo/50) - (%V/10)
   c. Where: C = Carbon; MN = Manganese; CU = Copper; NI = Nickel; CR = Chromium; MO = Molybdenum; V = Vanadium
   d. If mill test report is not available, make chemical analysis of bars representative of bars to be welded. Bars with CE above 0.75 shall not be welded.
3. No welds shall be made at bends in reinforcing bars. Welds to be 1 inch minimum from bends

O Corrections During Concrete Placement: Maintain reinforcing steel workers on-site during placement of concrete for resetting reinforcement displaced by runways, workers and other causes.

3.03 FIELD QUALITY CONTROL

A An independent testing agency, as specified in Section 01 40 00, will inspect installed reinforcement for conformance to contract documents before concrete placement.

1. Concrete floor slabs on grade are to be continuously inspected as recommended in the geotechnical report.

B Inspector of Record, as specified in Section 01 45 33 - Code Testing, Special Inspections and Procedures, will inspect installed reinforcement for conformance to contract documents before concrete placement.

1. Concrete floor slabs on grade are to be continuously inspected as recommended in the geotechnical report.

C Defective Reinforcement Work: The following shall be considered defective and may be ordered to be removed and reconstructed at no change in Contract Time or Sum.

1. Bars with kinks or bends not shown on Drawings.
2. Bars injured due to bending or straightening.
3. Bars heated or bent.
4. Reinforcement not placed in accordance with Drawings and Specifications.
5. Rusty or oily bars.
6. Bars exposed in surface of concrete or without adequate concrete cover.

END OF SECTION

04 20 00

MASONRY

PART 1- SUMMARY

1.01 Principal Work Items Are:

A Masonry Work:

1. Concrete unit masonry.

B Mortar.

C Work Installed But Furnished By Another Section:

1. Setting steel reinforcement for masonry.
2. Setting rough hardware and other embedded items.

1.02 Related Work:

A Requirements in Addenda, Alternates, Conditions, and Division 1 collectively apply to this work.

B Furnishing fabricated rebar for masonry: Section 03 21 00, Steel Reinforcement.

C Furnishing and setting rebar dowels in concrete for masonry: Section 03 21 00, Steel Reinforcement.

D Cast-In-Place Concrete: Section 03 30 00.

E Furnishing rough hardware and other embedded items: Respective Sections.

F Filled Cell Concrete Masonry High Lift Grout Method: Section 04 05 16.

1.03 SUBSTITUTIONS

A Only written approval of the Architect will permit substitutions for materials specified. Refer to General Conditions and Section 01 25 13 - Product Options and Substitutions for procedure.

1.04 QUALITY ASSURANCE

A Design Criteria; Formwork, Shoring, Scaffolding, and Protection:

1. The Contractor shall be solely responsible for items and shall:
   a. Design, construct, and maintain items to safely support loads.
   b. Obtain Governing Agency approval, when such is required.

9.

B Testing Agency: District designated Testing Laboratory.

C Requirements of Regulatory Agencies; Codes: Conform to Part 2, Title 24, CCR; and CBC, 2010 Edition.

D Tests and Inspection; General: Refer to Section 01 45 00, Quality Control and Testing Services.

E Allowable Tolerances; Surface Smoothness: 1/8" maximum permissible variation from a true plane measured from a 10' straight edge placed at any point on the surface.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A Storage; Mortar and Grout Materials:

1. Cement: Store in weather tight enclosures and protect against dampness, contamination, and warehouse set.
2. Aggregates: Stockpile and handle to prevent contamination by other materials.
3. Admixtures:
   a. Store to prevent contamination, evaporation or damage.
   b. Protect liquid admixtures from freezing or harmful temperature range.
   c. Agitate emulsions prior to use.
4.

B Masonry Units:

1. Stack on pallets to break contact with earth, and permit air circulation.
2. Protect from weather and wetting prior to use.
3. Handle to prevent chipping and damage.

1.06 JOB CONDITIONS

A Environmental Requirements; Temperatures: Do not lay masonry units when air temperatures are below 40°F. Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 90°F (37°C) in the shade with relative humidity less than 50%.

B Protection:

1. Protect masonry work from rain or snow for 24 hours after erection.
2. Protect masonry work from too rapid drying in hot dry weather.

C Sequencing, Scheduling: Coordinate work with concrete, foundation dowels, steel, framing, Specifications Sections furnishing embedded items, steel reinforcement, and other related work.

PART 2- PART 2 - PRODUCTS

2.01 MATERIALS

A General:

1. Conform to Codes, and additional requirements stated herein.
2. Conform to Title 24, CBC Section 2103A, Masonry Construction Materials.

B Concrete Unit Masonry:

1. Hollow Load Bearing Units:
   a. ASTM C90, Type 1, Grade N, center scored exposed faces, precision units.
   b. Nominal face dimension: 8" x 16"; thickness as shown on Drawings.
   c. Units shall be medium weight, open end units.
   d. Units shall have a compressive strength of not less than 2,000 pounds per square inch when tested in accordance with ASTM C140-10.
   e. Units shall have a net ultimate compressive strength of not less than 1,500 pounds per square inch when subjected to a prism test in accordance with ASTM C1314-10 per Section 2105A.1.2.3 of CBC, Title 24.
2. Hollow Non-Load Bearing Units:
   a. ASTM C129-10, Type 1, centered scored exposed faces, precision units.
   b. Nominal face dimension: 8" x 16"; thickness as shown on Drawings.
   c. Medium weight units.
3. Provide all bond beams, pilasters, lintels and other shaped units as indicated on the Drawings.
4. Joint Reinforcement: All masonry is required to be reinforced. Provide required width and place at every other course, continuous around corners and though intersections - 9 gauge Dur-o-Wall in truss design.

C Mortar and Grout for Concrete Unit Masonry:

1. Portland Cement:
   a. Type II, low alkali; per Title 24, CBC 2010 Edition, Section 2103A.8, and shall conform to ASTM C210-10.
   b. Use tested cement only. Use same cement brand for all exposed work. Do not use mortar cement or plastic cement.
   c. Color: Gray, unless otherwise noted.
2. Aggregates:
   a. General: Per Title 24, Section 2102A.2, 2010 CBC.
   b. Sand for Mortar: Based on ASTM C144.
   c. Coarse aggregate grout shall be used in grout spaces 2 inches (51mm) or more in width and in all filled-celled masonry construction per 2103A-12.3 CBC Title 24.
   d. Pea Gravel for Grout: Per CBC Section 2103A.4 for Coarse Aggregate (which is based on ASTM C404).
3. Water: Clean, fresh, potable water, free of injurious amounts of minerals, organic substances, salts, acids, or alkali.
4. Hydrated Lime: Based on ASTM C207-06; Type
5. Admixtures: Must be approved by the Division of the State Architect.
   a. For High-Lift Grout: Sika Grout Aid, manufactured by Sika Corp; Lyndhurst, NJ; 1-800-933-7452, or approved equivalent.

D Wire Wall-Ties for Concrete Unit Masonry.

1. No. 9 wire size; formed into rectangles, 4" wide, with a length which is 2" less than the wall width.
2. No kinks, deformations or water drips permitted.

9.

E Non-Shrink Grout:

1. Provide non-shrink grout at embeds, dowels and other steel reinforcements in concrete. New concrete shall be cured for a minimum of seven days. Surfaces coming in contact with non-shrink grout shall be completely dry and entirely free of oil, grease, laitance or other foreign substances.

2. General purpose non-shrink grouting shall be performed with Five Star Non-Shrink Grout as manufactured by Five Star Products Inc.; Fairfield, CT; 800-243-2206, or approved equivalent. Submit information verifying that the non-shrink grout submitted exhibits the following properties.

   a. Working Life: The mixed grout system shall have a minimum working life of 45 minutes at 75°F.

   b. Non-shrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827/C-827M-10.

   c. Effective Bearing Area: The grout shall exhibit a minimum EBA of 95%. This test shall consist of filling a 2" diameter x 4" high metal cylinder mold covered with a glass plate treated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the surface of the grout shall be probed with a sharp instrument to locate voids.

   d. Peak Exotherm: The peak exotherm of a 2" diameter by 4" cylinder shall not exceed 110°F when tested with 75°F material at laboratory temperature.

   e. Compressive Strength: The hardened grout shall attain a minimum compressive strength of 5,500 psi in 24 hours and 7,000 psi in seven days when tested according to ASTM C-579-01 (2006), Method B.

   f. Thermal Coefficient: The grout shall exhibit a maximum thermal coefficient of 30 x 10-6 in./in./°F when tested according to ASTM C-531-00 (2005) or ASTM D-696-99 (2005).

3. Epoxy grout shall be stored in a cool, dry place in accordance with the manufacturer's recommendations. Components shall be conditioned to 70°F to 80°F prior to use.

2.02 MIXES (CONCRETE UNIT MASONRY)

A Mortar:

1. General: Per Title 24, Section 2103A.8 and 2103A.10, Type S.
2. Strength: 1,800 psi minimum at 28 days.
3. Proportions: By dry loose volume.
   a. Portland Cement: 1 part
   b. Sand: 3 1/2 parts
   c. Water: To provide a workable mix.
   d. Dry Hydrated Lime: 1/4 part must be added.
4.

B Grout:

1. General: Per Title 24, Section 2103A.12.2.
2. Strength: 2,000 psi minimum at 28 days.
3. Proportions: By dry loose volume.
4. Fine Grout
   a. Portland Cement: 1 part
   b. Sand: 3 parts
   c. Water: To produce consistency for pouring without admixture for high-lift grout
   d. Admixture High-Lift Grout: Sika Grout Aid Type II/sack cement.

11.

5. Coarse Grout:
   a. Composed of fine grout with 2 parts pea gravel added.
   b. Hydrated Lime: 0 - 1/10 by volume for masonry construction. CBC Section 2103A.12.

C Mixing Mortar and Grout:

1. Measuring:
   a. Measure accurately by volume using suitable calibrated devices.
   b. Do not measure by shovel.
   c. Definition: 1 part cement = 94 lbs. = 1 sack.
2. Equipment: Drum-type mechanical batch mixer, at least 1 sack capacity.
3. Mixing:
   a. General: Do not mix partial batches, unless partial sacks of cement are weighed.
   b. First Stage Mixing:
      i. Load sand/aggregate, then cement, then water into mixer.
      ii. Mechanically mix 2 minutes minimum.
   c. Second Stage Mixing:
      i. For mortar, add lime.
      ii. For grout, add admixture.
      iii. Mechanically mix until thoroughly blended into a uniform mass; but not less than 10 minutes.
      iv. Retempering (Mortar Only):
         I. Retemper only by forming a mortar basin, adding water, and carefully working mortar into water.
         II. Do not retemper by dashing water over mortar.

PART 3- EXECUTION

3.01 PREPARATIONS

A Layout: Accurately layout work to properly position all elements to lines, planes, levels, modules, and patterns.

B Shoring: Erect shoring, bracing, centering as required to support work at openings and spans.

C Cutting: Use masonry saws to cut and fit masonry units.

D Preparation of Construction Joints: Prior to joining fresh masonry to set or partially set masonry construction, clean existing exposed surfaces and remove loose mortar.

3.02 INSTALLATION

A General:

1. Lay as Reinforced Hollow Unit Masonry per Title 24, CBC Section 2104A.5.1.2; all cells filled with grout.
2. Units to be sound, clean, free of cracks, chips, defacement, dry when laid. Such imperfections in completed work are cause for rejection.
3. For exposed work, all units to be full-length typically; but in no case less than 1/2 length, unless specifically indicated otherwise.

9.

4. Set units plumb, true to line, level courses, accurately spaced to module and pattern, plumb square corners, uniform joints.

5. Any mortar or grout unused within one hour after initial mixing shall not be used.

B Laying Units:

1. Bottom Course:
   a. Lay level, establish module.
   b. Lay with full mortar coverage on bottom of unit.
   c. Keep grout cell areas free of mortar, so grout will bond to foundation.
2. Lay with full mortar coverage on horizontal and vertical face shells.
3. Fill head joints solid for a 2" minimum distance in from face of unit, and shove tight.
4. Do not furrow mortar.
5. Adjust masonry unit to final position while mortar is soft and plastic.
6. If units must be reset after mortar has stiffened, remove, clean joints and units of mortar. Relay with fresh mortar.
7. Cells:
   a. Maintain vertical alignment.
   b. Keep free of overhanging mortar and droppings.
   c. Maintain clear unobstructed minimum area of 2" x 3" from top to bottom; 3" x 3" for high-lift grout method.
8. Lay accent units to stacked joint alignment with 1/4" width at cast-on face.
9. Stopping Work:
   a. If necessary to stop off a horizontal run of masonry, rack back each course.
   b. Toothing is not permitted.
10. Adjust shelf angles to keep masonry level and at proper elevation.
11. Fill jambs and head of hollow metal frames with mortar.
12. Reinforce as shown on Structural Drawings.

C Pattern and Joining:

1. Exposed Masonry:
   a. Pattern: To match existing masonry walls.
   b. Module and Joint Dimensions: 8" face x 3/8" nominal joint.
   c. Joint Treatment: Rake to depth of score; flat tool smooth.
2. Concealed Masonry:
   a. Pattern: Running bond.
   b. Module and Joint Dimensions: Match exposed work.
   c. Joint Treatment: Cut flush with trowel.
3. Jointing; General:
   a. Tool when mortar is partially set, but still sufficiently plastic to bond.
   b. Use tool which compacts mortar by pressing out excess, not dragging out excess.
   c. After tooling, finished joints to have a smooth, hard, dense surface with edges well bonded to block.
4. minimum; but not less than 1/2" in any case.

11.

9.

D Steel Reinforcement:

1. General:
   a. Install as work progresses.
   b. Install straight bars, except where bends and hooks are indicated.
   c. Install horizontal bars in bond beam units.
   d. Center bars in grout space typically, unless otherwise detailed.
   e. Maintain required clearances and spacings.
   f. Embed all bars firmly in grout.
   g. Prior to placement and/or grouting, bars to be clean.
2. Vertical Rebar: Hold firmly in place with frames or suitable devices; maximum spacing 192 bar diameters.
3. Laps and Splices:
   a. Splice only where indicated.
   b. Minimum Lap: See Structural Drawings.
   c. Wire tie lap splices to prevent displacement.
4. Clearances between Masonry Unit and Rebar: One bar diameter

E Embedded Items:

1. Place accurately; anchor securely to prevent displacement.
2. Coordinate, notify, and provide access for other Specifications Sections to set their required work.
3. Solidly grout around items with minimum 1" grout surrounding.

F Grouting:

1. Grout Type:
   a. Fine Grout: For grout spaces 2" or less.
   b. Coarse Grout: For grout spaces exceeding 2".
2. Grouting Method:
   a. High-Lift Method: For lifts exceeding 2'. Refer to Section 04 05 16.
3. Grouting; General:
   a. Assure that grout cells, and foundation surfaces and/or horizontal construction joints are clean of mortar, drippings, and other deleterious material.
   b. Grout beams over openings in one continuous operation.
   c. Fully embed horizontal steel in one continuous operation.
   d. Mechanically vibrate during and after placement to ensure complete filling of all voids, and grout consolidation.
   e. Stop grout 1" below top of masonry joint when grouting is to be stopped for one hour or more.
   f. Grout all cells solid.
4. High-Lift Method; Refer to Section 04 05 16:
   a. Conform to CBC, Section 2104A.5.1.2.
   b. Provide cleanout openings at bottom of each pour.
   c. Seal cleanouts after inspection, and prior to grouting.
   d. Provide barriers to control horizontal flow of grout.

11.

G Curing: Keep masonry continuously damp for three days minimum after laying.

H Bracing and Shoring Removal: Do not remove until masonry has hardened sufficiently to permit safe removal, and support imposed loads including its own weight.

I Epoxy Grout Installation:

1. Forms and Control Joints: Make forms liquid tight using putty or caulking compound to seal joints. Areas where bond is not desired must be treated with paste or auto wax, polyethylene, or resin release agent. Control joints should be placed on 3' to 4' centers. For pours deeper than 4" thickness, contact manufacturer.
2. Mixing: Pour all Component B (Hardener) into pail containing Component A (Resin). Mix thoroughly by hand or low speed mixer. Pour all mixed material into mortar box, mortar mixer or wheelbarrow. Add 100 lbs. (one bag) Five Star Epoxy Grout Aggregate or approved equivalent and mix only until all aggregate is wetted and no dry pockets remain. Follow printed instructions on each package.
3. Methods of Placing: Non-shrink grout should be placed from one side to avoid air entrapment. Rods and plungers may be used to facilitate placement.
4. Post-Placement Procedures: Do not wet cure non-shrink grout. It is a self-curing material. Surfaces, equipment, and tools may be cleaned with lacquer thinner, trichloroethylene, ketones, or similar solvent before grout hardens, in-service operation may begin immediately after minimum required grout strengths have been achieved. Final finishing of exposed surfaces is aided by applying a very light mist of solvent just before material becomes unworkable.

3.03 MORTAR BEDS

A Hollow Units:

1. Lay with full mortar coverage on horizontal and vertical face shells.
2. Provide full mortar coverage on horizontal and vertical face shells and webs in all courses of the following.
   a. Piers, columns and pilasters.
   b. Starting course on footings and solid foundation walls.
   c. Where adjacent to cells or cavities to be filled with grout.

B Solid Units: Lay with full mortar coverage on horizontal and vertical joints.

3.04 PROTECTION OF WORK

A Protect sills, ledges and offsets from mortar drippings or other damage during construction.

B Remove misplaced mortar or grout immediately.

C Cover the top of walls with non-staining waterproof coverings when work is not in progress.

D Provide minimum 2' overhang of protective covering on each side of wall and securely anchor.

E Protect face materials against staining.

3.05 BUILT-IN WORK

A Avoid cutting and patching after laying units.

B Install bolts, anchors, nailing blocks, inserts, frames, vents, flashings, conduit and other built-in items as masonry work progresses.

C Solidly grout spaces around built-in items.

D Provide outside joint around exterior door and windows frames and other framed wall openings:

1. Width shall be 1/4" (6 mm.) to 3/8" (9 mm.).
2. Rake and tool smooth to a uniform depth of 1/4".

3.06 CHASES

A Build chases in, do not cut.

B The minimum installation distance from jambs of openings shall be one concrete masonry unit length.

3.07 FIELD QUALITY CONTROL

A General: Refer to Specifications Section 01 45 00, Quality Control and Testing Services, for detailed information on required inspections and tests.

B Inspections:

1. Placement of Steel reinforcement.
2. Laying and grouting units.

C Tests:

1. Making compression tests of mortar and grout.
2. Core tests of finished work.
3. Masonry prism tests.

3.08 POINTING AND CLEANING

A Keeping Glaze Clean: Wipe off mortar smears and spatters at once, using clean, soft, damp rags. Do not allow hardening.

B Cut out and repoint defective joints.

C Dry brush masonry surface after mortar has set, at the end of each day's work and after final pointing.

D Leave work and surrounding surfaces clean and free of mortar spots and droppings.

3.09 FINISH

A Site paint per Section 09 90 00.

END OF SECTION

SECTION 26 05 15

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1- GENERAL

1.01 SCOPE

A Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.
2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS}

A Submit product data sheets for all outlet boxes, floor boxes, wiring devices, device plates, relays, contactors, timeswitches, and disconnects fuses.

B Submit detailed shop drawings including dimensioned plans, elevations, details, schematic and point-to-point wiring diagrams and descriptive literature for all component parts for transformers, relays, time clocks, and photocells.

C Submit transformer test reports.

D Submit material list for outlet boxes. PART 2 PRODUCTS

PART 2- PRODUCTS

2.01 OUTLET AND JUNCTION BOXES

A General

1. Flush or concealed outlet and junction boxes: Pressed steel, steel thickness not less than 0.062-inch, hot-dip galvanized, knockout (KO) type with conduit entrances and quantities size to match conduits shown connecting to respective outlet box. U.L.-514 listed and labeled. Minimum required box depth is exclusive of extension-ring depth.
2. Provide boxes of proper code size for the number of wires or conduits passing through or terminating therein, but in no case shall box be less than 4.0 inch square by 2.125 inch deep, unless specified elsewhere or noted otherwise on the drawings. 2.5 inch minimum depth for box widths exceeding 2-gang.
3. Increase the minimum outlet box size to 4.69 inches square by not less than 2.125 inches deep, where one or more of the following conditions occurs:
   a. More than two (2) conduits connect to the outlet box. b. Conduit "homerun" connects to outlet box.
4. Provide extension rings on flush outlets to finish face of extension ring flush with finished
5. building surfaces. Extension ring shall match outlet box construction and contain "attachment mounting-tabs" for wiring devices. Extension rings shall be "screw-attached" to respective outlet box and maintain "ground" bonding continuity. Boxes installed in masonry or concrete shall be U.L. "concrete-tight" approved for installation in concrete, and shall allow the placing of conduit without displacing reinforcing bars.
6. Provide fixture-supporting device in outlet boxes for surface mounted fixtures as required.

9.

7. Provide solid gang boxes for three or more switches, for mounting behind a common device plate.

8. Provide barriers for all 277 volt devices, between line voltage and low voltage devices and where more than one device is installed in an outlet box.

9. Individual audio/visual, telephone, computer or data outlets: 4.69 inch square by 2.125 inch deep minimum with two gang extension ring on flush boxes.

10. Combination signal/telephone/data or computer outlets: 4.69 inch square by 2.125 inch deep minimum with 2-gang wide extension ring on flush boxes.

B Surface Outlet Boxes

1. Surface mounted outlet boxes, cast iron Type FS or FD, with threaded hubs as required.

2. Box interior dimensions and interior volume capacity not less than required for "press steel boxes", and "sheet steel boxes". Provide plugs in all unused openings. Provide vyeatherproof gaskets for all exterior boxes.

C Floor Boxes and Outlets

1. Recessed Combination Power/Signal Floor Box

a. Floor box shall be cast iron, UL listed for concrete installation with leveling screws.

b. Walker "Resource" RFB4-CI Series or equal. b. Floor box shall be listed for thru wiring.

c. Floor box shall contain four independent, barriered wiring compartments.

d. Overall dimensions shall not exceed 14 1/2" long x 11" 7/8" wide x 3 1/2" deep.

e. Box cover shall be flush with floor and shall provide wire/cable egress points through cover notches. The trim and cover shall be of metal composition. Covers shall be hinged. Walker RAKMTR-BUFF Series or equal.

f. Unit shall include two duplex receptacles as herein specified and two signal system outlets. Walker CIHT-D and CILT-2T.

2. Activation assemblies shall include device mounting brackets, access plates, grommets, partitions, adjusting rings and all associated hardware.

2.02 PULL BOXES

A Sizes as indicated on the drawings and in no case of less size or material thickness than required by the governing code. Exercise care in locating underground pull boxes to avoid installation in drain water flow areas.

1. General purpose sheet steel pull boxes: Install only in dry protected locations with removable screw covers. Manufacturer's standard baked enamel finishes.

2. Weatherproof sheet steel pull boxes: Fabricate of code gauge, hot-dip galvanized steel with gasketed weathertight cover of same material. Manufacturer's standard baked exterior enamel finish.

2.03 SWITCHES

A Provide circuit switches totally enclosed, Bakelite or composition base, toggle type with 277 volt A.C. rating for full capacity or contacts for incandescent or fluorescent lamp loads. Switch ratings shall be 20 ampere only. Color as selected by OWNER'S REPRESENTATIVE. Switches controlling circuits connected to emergency power shall be red.

B Where switches are mounted in multiple gang assembly and are operating at 277 volts and/or 277 volts and 120 volts mounted in same outlet box, there shall be a barrier installed between each switch.

C Switches – Specification Grade Commercial Series

1. Single Pole Switches

	Toggle Type	Lock Type
2. Make	20 Amps	20Amps
Hubbell	#CS1221	#CS1221-L

2. Double Pole Switch

Hubbell #CS1222 #CS1222-L

3. Three-Way Switches

Hubbell #CS1223 #CS1223

4. Four-Way Switches

Hubbell #CS1224 #CS1224-L

5. Momentary Contact Switches- 20A at 277V

	3'-Position Req.	3-Position Lock
Hubbell	#1557	#1557-L

6. Maintained Contact Switches (Double Throw, Center Off), 20A at 277V

	Toggle Type		Lock Type	
Make	1-Pole	2-Pole	1-Pole	2-Pole
Hubbell	#1385	#1386-L	#1385-L	#1226-L

7. Ground Fault Circuit Interrupter (GFCI)

Hubbell GFST15I, or GFST20I

8. Pilot lights used in conjunction with circuit switches shall be neon type with red jewel, P & S #437 (120 volt) or #438 (277 volt) or approved equal.

2.04 DIMMER SWITCHES

A Dimmer switches shall be as indicated herein unless specifically noted otherwise on the drawings.

B Dimmer cover plate shall be the same color as switch cover plates in the same area.

C Dimmer switches shall be self-cooling and shall not require forced air cooling when individually or gang mounted. All dimmers shall be by the same manufacturer and the same appearance.

D Dimmers shall include "RF" filters and is voltage stabilized.

E Incandescent dimmers shall be used for control of line voltage incandescent light fixtures except "low voltage" type lights. Lutron "Centurion" series.

1. Dimmer wattage shall be rated 2000 watt unless noted otherwise on the drawings.

F Fluorescent dimmers, voltages as indicated on the drawings.

1. Fluorescent dimmers (individual dimmers controlling less than 24 lamps per dimmer) Lutron "Nova" series.
2. Fluorescent dimmers (more than 24 lamps)
   a. Lutron #FDA-40 up to 40 lamps per controller.
   b. Lutron #FDA-80 up to 80 lamps per controller.
   c. Provide a minimum of 3-20 amp on all 120 volt units and on 277V 80 amp units.
   d. Control stations Lutron "Nova" series.
   e. Provide all material and labor for a complete and operable system.

G Low voltage (transformer type) incandescent light dimmers shall be specifically designed for dimming low voltage light fixture transformers. Lutron "Nova".

2.05 RECEPTACLES

A All receptacles in flush type outlet boxes shall be installed with a bonding jumper to connect the box to the receptacle ground terminal. Grounding through the receptacle mounting straps is not acceptable. The bonding jumper shall be sized in accordance with the branch circuit protective device as tabulated herein under "Grounding". Bonding jumper shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws 6-32 or larger (except isolated ground receptacles). For receptacles in surface mounted outlet boxes direct metal-to-metal contact between receptacle mounting strap (if it is connected to the grounding contacts) and outlet box may be used. Color as selected by OWNER'S REPRESENTATIVE. Receptacles connected to emergency power circuits shall be red.

B Duplex convenience receptacles shall be grounding type, 120 volt, 15 ampere, and shall have two current carrying contacts and one grounding contact which is internally connected to the frame. Outlet shall accommodate standard parallel blade cap and shall be side wired:

1. Hubbell, Specification Grade Commercial Series, Ivory, or equal.

C Isolated ground receptacles

1. The receptacle insulation barrier shall isolate the receptacle ground contact system from ground. Connect the ground plug contact to a separate dedicated insulated ground- bonding conductor. The receptacle ground plug contact shall not be grounded to the raceway or outlet box. Duplex convenience receptacle 20 amp minimum, with two current carrying contacts and one grounding contact, or as noted on the drawings.
2. Identify receptacle with an orange triangle on the receptacle face and orange receptacle body. Red body for receptacles connected to emergency power.
    a. Hubbell, Specification Grade Commercial Series, Ivory, or equal.

D Weatherproof receptacle: Ground fault type duplex receptacle, mounted in a flush hinged door enclosure with lock and key. Enclosure shall be a P & S #4600 with a #1591F46 receptacle. On exposed conduit runs, weatherproof ground fault type receptacle as hereinbefore specified, installed in "FS" condulet with one of the following spring door type covers:

1. Hubbell, Specification Grade Commercial Series, or equal.

E Special outlets shall be as indicated on the drawings.

2.06 PLATES

A Provide plates for every switch, receptacle, telephone, computer, television and other device outlets. All plates shall be 0.040" stainless steel, Type 302 alloy composed of 18% chromium and 8% nickel. Plates shall be manufactured by P & S, Hubbell, Leviton or General Electric only.

2.07 VANDALPROOF FASTENINGS

A Provide approved vandalproof type screws, bolts, nuts where exposed to sight throughout the project. Screws for such items as switch plates, receptacle plates, fixtures, communications equipment, fire alarm, blank covers, wall and ceiling plates to be spanner head stainless steel, tamperproof type. Provide OWNER with six (6) screwdrivers for this type.

2.08 STRUCTURAL AND MISCELLANEOUS STEEL

A Structural and miscellaneous steel used in connection with electrical work and located out-of-doors or in damp locations, to be hot-dip galvanized unless otherwise specified. Included are underground pull box covers and similar electrical items. Galvanizing averages 2.0 ounce per square foot and conforms to ASTM A123.

2.09 FLASHING ASSEMBLIES

A Provide Semco Fig. #1100-4 lead flashing assemblies at all roof penetrations. Seal the joint between flashing and pipe with waterproofing compound.

2.10 RELAYS, CONTACTORS, AND TIMESWITCHES

A Individual Control Relays (HV/AC Plumbing of the Control Functions)

1. Individual control relays shall have convertible contacts rated a minimum of 10 amperes, 600 volts regardless of usage voltage. Coil voltage, number and type of contacts shall be verified and supplied to suit the specific usage as shown in the wiring diagrams and/or schedules on the electrical and mechanical drawings. Coil control circuit shall be independently fused, sized to protect coil. Relays shall be installed on prefabricated mounting strips. Each relay shall have a surge suppressor to limit coil transient voltages. Furnished in the NEMA Type I enclosure unless indicated otherwise.

2. The following relays are approved:

Manufacturer	IYQg
Arrow Hart	IMP
General Electric	Class CR 2811
I.T.E.	Class J10
Square D Co.	Class 8501, Type A
Westinghouse	Bul. 16-321, Type NH
Allen Bradley	Approved Equal

B Contactors and/or Relays

1. Contactors and/or relays for control of lighting shall be 600 volt A.C., electrically operated,mechanically held units, open type for panel mounting with number of poles and of size as indicated on the drawings. Provide auxiliary control relay for operation of each contactor and/or relay with a two-wire control circuit.

2. Contactors and/or relays shall be mounted in panelboards in barriered section under separate hinged lockable doors or in contactor and/or relay cabinets as called for on the drawings. Contactors and/or relays shall be installed on Lord sound absorbing rubber mounts.

3. Contactors and/or relays shall be Automatic Switch Co. Bulletin #920 Series for 2 and 3 pole, Automatic Switch Co. Bulletin 917 Series with poles as indicated on drawings. Coil control circuit shall be independently fused, sized to protect coil.

4. Contactors and/or relays shall be equipped with a switch, in the proper configuration, to disconnect the control circuit controlling 'the coil of the respective device. Control circuit disconnect switch shall be labeled showing function of device.

C Timeswitches

1. All timeswitches shall have synchronous motor drive for operation on 120 or 277 volts, 60 Hertz, A.C. and shall be furnished with a ten-hour, spring-driven, reserve-power motor. Contacts shall be rated 40A per pole.

   a. Exterior lighting timeswitches for control of individual circuits or electrically operated relays shall have astronomic dial and shall be Tork 7000ZL Series or approved equal by Paragon or Intermatic.

   b. Interior lighting timeswitches for control of individual circuits or electrically operated relays shall be Tork 7000 Series or approved equal by Paragon or Intermatic.

   c. Timeswitches for control of air conditioning or plumbing equipment shall have seven day dial and shall be Tork WL Series or approved equal by Paragon or Intermatic.

2. All timeswitches shall be mounted in separate section in top of panelboards under separate lockable door unless otherwise indicated on drawings. Clear opening for timeswitch shall be a minimum of 12" x 12".

D Contactors and/or Relays/Timeswitch Cabinet

1. Contactors, relays, and/or timeswitches not indicated to be mounted in electrical panels shall be mounted in a cabinet, size as required, with hinged lockable door keyed same as panelboards. Construction of cabinet shall be similar to terminal cabinets.

2. Each contactor, relay or timeswitch mounted in the contactor cabinet shall be barriered in its own compartment, and shall be installed on Lord sound absorbing mounts.

3. Contactor cabinets shall be of the same manufacturer as the panelboards.

4. Where relays and/or contactors occupy the same enclosure as timeswitches they shall have a clear acrylic shield installed over each relay or contactor to guard line exposed parts from accidental contact by nonauthorized personnel.

2.11 DISCONNECTS (SAFETY SWITCHES)

A Disconnect switches shall be rated 600 volt A.C., NEMA Type HD, quick-make, quick-break, h.p.- rated, fused Class "R", in NEMA Type I enclosure, lockable with number of poles and amperage as indicated on the drawings. Provide neutral bus and conductor landing lugs, size to match conductors shown on drawings. Where enclosure is indicated W.P. (weatherproof) switches shall be raintight NEMA Type 3R enclosure, lockable. Maximum voltage, current and horsepower rating clearly marked on the switch enclosure and switches having dual element fuses shall have rating indicated on the nameplate.

2.12 TRANSIENT VOLTAGE SURGE PROTECTOR (TVSS)

A General

1. The unit shall be modular in construction and operate in parallel with 60 H.Z. A.C. line voltage, four (4) wire or five (5) wire, grounded or ungrounded systems, as applicable; voltage, KVA and ampere capacity as indicated on the drawings. Suitable for connection through a external circuit breaker or combination switch/fuse protective device rated 30 ampere, continuous duty, rated for Service Entrance equipment connection.

2. The unit shall operate correctly with any combination of resistive, inductive, or capacitive loads. The unit shall automatically shunt to ground the electrical transients and EMI/RFI noise occurring above the specified values. The unit shall automatically reset after transient condition has passed. Operating temperature - 40° centigrade to 85° centigrade.

3. Provide one or more individual self-contained protection module(s) for each line voltage phase, plug-in type. Provide one spare individual plug-in protection module. Provide incoming line, neutral and ground conductor termination lugs rated CU/AL #14 thru #4 AWG. Lugs shall be barriered from and prewired to the respective protection modules.

4. Provide a NEMA 12 housing to contain all unit modules, devices and conductor terminations. The housing shall include a hinged padlockable door. Surface mounted, with conduit entrance knockouts. Maximum housing size shall not exceed 36" wide x 72" high x 8" deep.

5. As manufactured by EFI Corporation Model #MXPB/TVSS; MCG Electronics; Current Technology; Liebert or equal.

B Operational Characteristics

1. Transient voltage protection, testing, listing and certification.

   a. UL 1449 (latest edition) and CSA, for Transient Voltage Surge Suppresser, UL 1283 for transient voltage electrical noise attenuation, ANSI/IEEE C62.45, C62.1 for C62.41, (latest edition) transient clamping voltages for both Normal Mode and Common Modes against Category A & B ring wave and Category B impulse wave.

   b. The unit connected to the service entrance shall also withstand a minimum of 1000 sequential ANSI/IEEE C62.41 Category C surges without failure following IEEE test procedures in C62.1, C62.41 and C62.45.

2. Transient voltage protection, EMI noise rejection, and RFI noise rejection shall be provided for Common Mode (line-to-neutral), Normal Mode (line-to-line) and neutral to ground.

3. EMI and RFI noise rejection. Conducted line noises interference both electromagnetic (EMI) and radio frequency (RFI) shall be reduced by the unit over a continuous spectrum of 0.5 MHZ to 1.0 MHZ. The basis for reduction shall be a standardized 50-0HM insertion loss MIL -STD-220A test. Provide spectrum analysis test dB attenuation reports showing RFI filtering over specified frequencies. Test data based on calculated or computer simulation is not acceptable.

4. Three phase and grounded 'WYE" performance requirements.

Characteristics	208/120 Volt	480/277 Volt a.
Nominal line to line	208 Volt	480 Volt
b. Nominal line to neutral	120 Volt	277 Volt c.
Internal capacitance (Microfarads)	2.5	2.5
d. Maximum response time e. 5.	1-nanosecon6.	1-nanosecond
e . EMI/RFI noise rejection	25-35DB	25-35DB
f. Nominal peak clamp voltage line to neutral and line to ground	205 Volts	330 Volts
g. Minimum transient energy dissipation per phase (at 8 x 20 microseconds (waveform))	1000 Joules	1500 Joules
h. Peak transient withstand (at 8 X 20 microseconds waveform)		

without failure of the unit		50000 Amp	60000 Amp
1.Category-C3		80,000Amp	100,000Amp
2.Category-B3		60,000Amp	80,000Amp
3.Category-A3	7.	50,000Amp	8. 60,000Amp

21.

C Diagnostic indicators

1. Shall display the "Normal" and "Fault" status of each line suppression circuit, along with protection circuit "on" indication.
2. Shall provide a sonic audible fault alarm with silence push-button.

D Surge Suppressor Protection Categories

1. Surge protectors shall comply with ANSI C62.41 (Latest Revision) Standard Protection Categories for "impulse" and "ringwave" transients, based on the installation locations shown in the contract documents.
   a. Service entrance, main switchboard or substation locations - Category "C3", high exposure.
   b. Mid building, distribution panels, distribution panels over 400 ampere main bus rating locations- Category "B3", high exposure.
   c. Branch circuit panelboards 400 ampere or less main bus rating - Category "A3", high exposure.
2. The TVSS short circuit current withstand rating shall exceed the actual short circuit current available at the TVSS installation location

2.13 WIREWAY

A General

1. Unobstructed lay in type, metal wireway, fittings and connectors U.L. listed for use as wireway and auxiliary gutter. Length, elbows and "T-S" as shown on drawings. Minimum cross-section size 4 inches X 4 inches, but not less then shown on the drawings. Suitable for mounting in any position orientation.

B Construction

1. Minimum metal gauge shall not be less then 14 gage.
2. Cover shall be hinged entire length of cover. Cover shall be held in the closed position with bolts and nuts.
3. Provide spring nuts on all hardware fastener penetrations into the interior of the wireway to protect against wire insulation damage.
4. The inside of 90-degree corners in the wireway shall be a 45-degree bevel.
5. Grounding continuity between wireway sections and fittings shall be continuous the entire length of the wireway.

C Finish

1. Indoor non-raintight, rust inhibitor phosphatizing base coating and baked enamel finish, manufacturer's standard color.
2. Raintight or outdoor-galvanized metal, with corrosion resistant phosphate primer and baked enamel finish, manufacturer's standard color, Nema 3R construction.
3. All hardware shall be plated to prevent corrosion. PART 3 EXECUTION

PART 3- EXECUTION

3.01 GROUNDING (ADDITIONAL REQUIREMENTS)

A Grounding shall be executed in accordance with all applicable codes and regulations, both of the State of California, and local authorities having jurisdiction.

B Each pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

C The maximum resistance to ground shall not exceed 5 ohms.

3.02 OUTLET AND JUNCTION BOXES

A Accurately place boxes and securely fastens to structural members. Where outlets are shown at same location but at different mounting heights, install outlets in one vertical line. Where outlets are shown at same location and mounting height, mount outlets as close together in a horizontal row as possible. Where the outlet boxes for switches and receptacles are shown at the same location and mounting height, mount in common outlet box with barriers between devices. Provide single piece multigang cover plate for close mounted outlet boxes. Where switches are shown on wall adjacent to hinge side of doors, box shall be installed to clear door when door is fully opened.

B Flush mounted boxes shall be attached to two studs or structure members by means of metal supports.

C Boxes above accessible ceilings shall be attached to structural members. Where boxes are suspended, they shall be supported independently of conduit system by means of hanger rods and/or preformed steel channels. Boxes shall be supported independently of all piping, ductwork, equipment, ceiling hanger wires and suspended ceiling grid system.

D Surface mounted outlets shall be attached to concrete or masonry walls by means of expansion shields.

E Floor boxes shall be installed level with finish floor and within adjustable limits of floor ring. Where outlets are shown at same or adjacent location, use multigang boxes.

F Outlet Box Horizontal and Vertical Separation: Outlet boxes and device outlet rings installed flush in walls shall be horizontally and vertically separated by not less than 24 inches (edge of box to edge of box) from device outlet boxes and rings in common wall surfaces located on the opposite (back) side of the same wall.

1. Where the separation cannot be maintained, provide a solid backing behind and completely enclosing each outlet box.
2. The backing shall extend the width of the wall cavity (i.e. between "studs" or masonry cells) behind the box and 12 inches above and below the outlet box centerline, completely enclosing the outlet box.
3. The backing shall consist of the following:
    a. 5/8 inch thick gypsum board anchored in place for "stud" wall construction.
    b. Solid "mortar" to completely fill the outlet box "cell" behind the box in masonry construction.

21.

G In fire rated walls and ceilings provide fire rated "box-wrap" around the outside of each outlet box placed in fire rated wall or ceiling inside the wall, to maintain the fire rating of wall with the installed outlet boxes.

H Plug-in type receptacle installation orientation:

1. The "ground-pin" shall face "up" at the receptacle top location {double duplex) 4-plex, individual and vertically mounted individual duplex receptacles.
2. The "neutral-blade" shall face "up" at the receptacle top location on horizontally mounted duplex receptacles.

3.03 DIMMER SWITCHES

A Do not break off dimmer cooling fins.

B Large dimmers shall be surface wall mounted at the location indicated on the drawings.

3.04 TRANSIENT SURGE PROTECTOR INSTALLATION (TVSS)

A Installation

1. Install unit cabinet to insure a maximum connected circuit length of less than 8 feet from the equipment the transient surge unit is connected to, approximately +48" on wall.
2. Install TVSS inside switchgear, switchboards, panelboards, etc. where shown on the drawings.
3. Connect between transient surge unit and supply equipment with not less than 1 1/4" conduit containing 5#4 AWG, copper conductor, 600 volt THHN/THWN insulation, connection circuit.

B Install, connect and test unit in accordance with manufacturer's recommendations.

C Connect transient surge unit to main building ground bus with 1 1/4"C - 1#2 AWG copper conductor 600 volt, THHN/THWN insulation.

D Provide a subfeed overcurrent protective device in the respective panel or switchboard to supply the TVSS connection circuit, whether or not shown on the drawings. The protective subfeed device shall be a thermal magnetic circuit breaker rated not less than 30 ampere - 3 pole or a safety switch and fuse unit rated not less than 60 ampere - 3 pole, voltage and short circuit interrupting class to match the respective circuit voltage.

3.05 WIREWAY INSTALLATION

A Wireway hangers shall provide clamp type, hanger rod type, direct bolted bracket type from ceiling or walls as indicated on the drawings and required for field installation locations. Supports shall be installed a minimum of 5 ft. on center.

END OF SECTION

21.

SECTION 26 05 30

CONDUIT AND WIRE

PART 1- GENERAL

1.01 SCOPE

A Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.
2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A Submit product data sheets for all wire, supports, conduit, fittings and splicing materials.

B Submit material list for all conduit and conduit fittings.

C Submit details and structural engineering calculations for conduit support systems.

PART 2- PRODUCTS

2.01 CONDUIT

A General

1. The interior surfaces of conduits and fittings shall be continuous and smooth with a constant interior diameter. Conduits and conduit fittings shall provide conductor raceways of fully enclosed circular cross section. The interior surfaces of conduits and fittings shall be without ridges, burrs irregularities or obstructions. Conduits and fittings of the same type shall be of the same uniform weight and thickness.
2. Type of conduit, type of conduit fittings and conduit supports shall be suitable for the conditions of use and the conditions of location of installation, based on the manufacturer's recommendations and base on applicable codes.
3. All fittings for metal conduit shall be suitable for use as a grounding means, pursuant to the applicable code requirements. All metal conduit and metal conduit fittings shall provide 3 second duration ground fault current carrying ratings, when installed and connected to the perspective conduit, as follows:
    a. RMC and EMT conduit fittings.
        i. 0.75 inch through 1.5 inch conduit/fitting size - 10,000 ampere RMS.
        ii. 2.0 inch and larger conduit/fitting size - 20,000 ampere RMS.
    b. FMC and LTFMC Conduit Fittings
        i. 0.75 inch through 1.25-inch conduit/fitting size-1,000 ampere RMS (without external bonding jumper).
        ii. 1.5 inch through 4.0-inch fitting size-10,000 ampere RMS with bonding jumper.
4. Protective corrosion resistant finish for metal conduit fabricated from steel and metal conduit fittings fabricated from steel, shall be as follows:

21.

a. Clean all metal surfaces (including metal threads) with acid bath "pickle" prior to coating, to remove dirt, oil and prepare surfaces for galvanizing.

b. Hot-dip galvanized zinc coating on all interior and exterior steel surfaces. Minimum finish zinc coating thickness shall not be less than 0.002 inches.

c. Threads shall be hot-dip zinc coated after machine fabrication.

d. Exterior metal surfaces shall be finished with clear organic polymer topcoat layer, after galvanizing.

e. The inner metal surfaces of conduit fittings shall be finished with a lubricating topcoat after galvanizing, to facilitate conductor pulling through the conduit/fitting.

5. Threads for metal conduit and metal conduit fittings shall be taper-pipe-thread, National Pipe Standards (NPS) and shall comply with ANSI-B1.20.1.

6. Metal conduit termination connector fittings shall be provided with a manufacturer installed, insulating throat bushing inside the fitting. The bushing shall protect the wire conductor insulation from cutting, nicks and abrasion during conductor installation and electrical load "cycling" after installation is complete. The bushing shall comply with UL 94V-0 flammability.

7. Provide conduit bonding/grounding jumper from metal enclosures with "concentric ring" knockouts, to positively ground/bond each respective conduit(s) to the metal enclosure.

8. Metal conduit fittings connecting to PVC coated metal conduit shall be PVC coated to match the conduit.

9. The conduit and fittings shall be watertight and airtight without cracks and pinholes.

B Rigid Metal Conduit (RMC)

1. Rigid metal, round tubing, machine threaded at both ends.

a. The conduit and conduit fittings shall comply with the requirements for an equipment grounding conductor, pursuant to applicable codes.

2. RMC raceway types shall be as follows:

a. Rigid galvanized steel conduit (RGS), minimum yield strength shall be 35,000 PSI. Shall comply with NEMA standard 5-19 (latest revision); ANSI C80.1 and ANSI-C80.4 (latest revision); UL 514-B and UL 6 (latest revisions); National Pipe Standard Specification (latest revision).

b. Intermediate steel conduit (IMC). Shall comply with NEMA Standard 5-19 (latest revision) ANSI-C80.6 (latest revision); UL 2142 (latest revision).

3. RMC fittings:

a. Fittings shall be compatible with RGS and IMC.

b. Fittings shall be rated "liquid tight".

c. Fittings imbedded in concrete shall be rated "liquid tight" and "concrete tight".

d. Connectors and couplings for terminating, connecting and coupling to RMC conduit shall be threaded metal.

e. Fittings shall comply with ANSI C80.4 and ANSI C33-84 (latest revision); NEMA FB1 (latest revision); UL 514 (latest revision).

f. Conduit seal fittings:

1) Conduit seals shall prevent the passage of gasses, liquids and vapors past the location of the seal installation in the conduit.

2) Conduit seals shall be suitable for installation in both vertical and horizontal conduit locations.

3) Conduit seals shall be visible and accessible for inspection after installation is complete.

4) Conduit seals shall be rated for the following locations:

i) Wet locations

ii) Classified hazardous location materials NEC Class 1 Division 1.

21.

iii) Temperature ranges from 0 [minus 20] degrees centigrade through 90 degrees centigrade.

5) Conduit seals, sealing compound and sealing compound dam shall be the products of the same manufacturer.

4. RMC fittings as manufactured by:

a. For threaded enclosure, termination connection.

a) Thomas & Betts - 106 Series bonding locknut, 5302 series sealing ring with stainless steel retainer.

b. For non-threaded enclosure, termination connector.

a) Thomas & Betts - 370 Series watertight threaded sealing hub, 106 series threaded bonding lock nut, Sta-Con Series enclosure bonding jumper and 3870 Series threaded ground bushing.

b) Emerson-OZ/Gedney-CHMT/CHT watertight threaded hub with bonding locknut and GH50G Series enclosure bonding jumper.

c. For RMC to RMC conduit-to-conduit coupling

a) Thomas & Betts/Erickson - 674 (threaded) Series

b) Emerson-OZ/Gedney Type TPC (threaded) Series

c) Threaded RMC conduit couplings, product of the same manufacturer as the RMC conduit.

d. For RMC Conduit Seals

a) Emerson-OZ/Gedney-EYA and EYAM (threaded) Series

b) Appleton-EYF and EYM (threaded) Series

C Electrical Metallic Tubing (EMT)

1. Rigid metal round tubing, “thin wall” steel construction, with non-threaded ends.

a. The conduit and conduit fittings shall comply with the requirements for an equipment ground conductor pursuant to applicable codes.

b. The conduit shall be watertight and airtight without cracks and pinholes.

2. EMT shall be allowed for conduit size ranges from 0.75-inch through 2.0-inch. EMT is not allowedfor exterior locations, including under covered walks, shelters, or roof overhangs. EMT is not allowed less than ten (10) feet above FF, not in concrete, not underground, and not in runs longer than 100’.

3. Comply with ANSI C80.3, C80.4, and ANSI C33.98 (latest revisions); UL 594 and UL 797 (latest revisions); CEC Section 12500 (latest revision).

4. EMT fittings:

a. Connectors and couplings for terminating, connecting and coupling to EMT conduit shall be non-threaded steel fabrication.

b. EMT termination connector fittings shall be as follows:

a) Set screw type “concrete tight” when installed in dry interior locations.

b) Compression types “raintight” and “concrete tight” when installed in wet or damp locations, outdoors and in concrete or masonry construction.

c. Fittings shall comply with ANSI C33.84 (latest revision); UL 514 (latest revision); NEMA FB-1.

5. EMT fittings as manufactured by:

a. For threaded and non-threaded enclosure, termination connector

a) Thomas & Betts – CT721A (set screw type) Series (with locknuts)

b) Emerson – OZ/Gendney – TC5001 (set screw type) Series (with locknuts).

c) Thomas & Betts – 5123 (compression type) Series (with 2 locknuts).

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d) Emerson-OZ/Gedney – TC6001 (compression type) Series (with locknut)

e) Thomas & Betts – 4240 (compression type) Series (90-degree angle with locknut).

f) Emerson-OZ/Gedney – TWL (compression type) Series (90-degree angle with locknut).

b. Fo EMT to EMT conduit-to-conduit coupling:

a) Thomas & Betts TK121A (Set Screw Type) Series (with locknut).

b) Emerson – OZ/Gedney – 5000 (set screw type) Series (with locknut).

c) Thomas & Betts-5120 (compression type) Series

d) Emerson-OZ/Gedney-TC600 (compression type) Series.

c. Fo EMT to EMT conduit-to-conduit coupling:

a) Thomas & Betts-HT221 (set screw type) Series.

b) Emerson-OZ/Gedney-ESR (set screw type) Series.

c) Thomas & Betts-530 (compression type) Series.

d) Emerson-OZ/Gedney-ETR (compression type) Series.

D Flexible Metal Conduit (FMC)

1. Round flexible conduit, fabricated from a single continuous steel strip. The steel shall be factory formed into continuous interlocking convolutions to form a complete lock between steel strips and provide raceway flexibility.
2. Metal to metal grounding contact shall be maintained throughout the length of the FMC conduit.
3. FMC shall be used only for making motor connections, conduit drop from remote junction boxes to fixtures installed above the suspended ceiling, and as specifically noted on the drawings. FMC shall not be used for runs longer than 8 feet; at any exposed locations; for any conduit size larger than 1-1/4".
4. FMC shall comply with ANSI-C.33.84 and ANSI C33.92; NEMA FB-1; CEC 12-1100.
5. FMC Fittings
   a. FMC fittings shall be malleable iron construction or steel construction.
   b. Fitting shall automatically cause the FMC raceway throat opening to be centered with respect to the fitting throat opening.
   c. Straight and angled connector termination fittings shall be threaded on one end and shall include a threaded locknut, suitable for connection to threaded and unthreaded enclosures.
   d. The attachment of the fittings to FMC shall be angled saddle type, to engage and interlock with the FMC spiral groove, and shall be unaffected by vibration. Direct bearing screw type fittings shall not be used.
   e. Direct FMC conduit-to-FMC conduit coupling of FMC shall not be permitted.
   f. Shall comply with ANSI C33.9, and ANSI C33.92 (latest revision); NEMA FB1 (latest revision); U.L. 514.
6. FMC fittings as manufactured by:
   a. Straight Termination Connectors — 45 & 90 Degree Angle Connectors

   a) Thomas & Betts-3110 Series (with locknut) — Thomas & Betts-3130 Series (with locknut)

   b. FMC to EMT conduit combination coupling:

   a) Thomas & Betts 503TB Series.

E Liquid Tight Flexible Metal Conduit (LTFMC)

1. The metal conduit core of LTFMC shall comply with the same requirements as FMC conduit, with the addition of a thermoplastic exterior flexible jacket over the metal core.

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2. The exterior jacket shall be positively locked to the metal core to prevent jacket “sleeving”.

3. The LTFMC shall be rated for installation and operating service temperatures of between minus 20 degrees centigrade through plus 90 degrees centigrade.

4. The LTFMC jacket shall be suitable for continuous exposure to sunlight, rainwater, water vapor, mineral oils and liquid solvents, without penetrating into the conduit and without deteriorating the jacket.

5. LTFMC sizes from 0.75-inch through 1.25-inches shall include an additional internal ground conductor, fabricated by the manufacturer, as an integral part of the conduit core.

6. Direct LTFMC conduit-to-LTFMC conduit coupling of LTFMC shall not be permitted.

7. LTFMC shall be allowed for conduit size ranges from 0.75-inch through 4.0-inches.

8. In addition to the requirements for FMC conduit, LTFMC shall also comply with ANSI C- 33.84 (latest revision); NEMA-FB1 (latest revision); CEC 12-1400 (latest revision).

9. LTFMC fittings

   a. Fittings shall include an external mechanical ground/bond wire connector.

   b. The attachment of the fitting to LTFMC shall be threaded compression type onto the conduit core with locknut and liquid tight jacket compression seal. The fitting shall automatically prevent “sleeving” of the jacket.

   c. Straight and angled termination connector fittings shall be threaded on one end and shall include locknut suitable for connection to threaded and unthreaded enclosures.

10. LTFMC fittings as manufactured by:

    a. Termination connector fittings:

Straight	45 and 90 Degree Angle Connectors
1) Thomas & Betts-5331 GR Series.	Thomas & Betts-5341GR and 5351GR Series.
2) Appleton-STB Series; STN-L Series for use with preformed“knockouts”.	Appleton-STB-L Series; STN-L Series for use with preformed “knockouts”.
3) Emerson- OZ/Gedney-4QSeries.	Emerson-OZ/Gedney-4Q Series

    b. LTFMC to RMC conduit to conduit combination coupling fittings:

a) Thomas & Betts-5271 GR Series.

b) Emerson-OZ/Gedney-4Q Series

F Rigid Non Metallic Conduit (RNMC)

1. General

   a. Conduit and fittings shall be 90 degree centigrade conductor rated. Fabricated from homogeneous material, free from visible cracks, holes or foreign inclusions, with integral “end-bell”. The conduit and conduit fittings shall be watertight and airtight.

   b. Conduit, conduit fittings and conduit fitting assembly “solvent cement” shall all be the product of the same manufacturer. Conduit fittings shall be solvent cement welded watertight.

   c. Conduit and fittings shall be identified with legible markings showing ratings, size and manufacturers name.

   d. RNMC and fitting shall be corrosion resistant, watertight.

   e. Conduit shall be suitable for conductor operating temperatures from minus 20 degrees centigrade to 90 degrees centigrade.

   f. RNMC shall comply with NEMA TC-2 (PVC 40 conduit, latest revision) NEMA TC-6 (EB conduit latest revision) and NEMA TC-3 (fittings, latest revision); UL 514 and UL 651 (latest revision).

2. Polyvinyl Chloride (PVC)-RNMC

   a. PVC-schedule 40 heavy wall construction.

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b. PVC-schedule 80 extra heavy wall construction.

c. PVC-type EB.

3. RNMC fittings connecting to metallic raceways shall be provided with a ground/bond jumper connection.

G Combi-Duct

1. Rigid nonmetallic conduit combining an continuous linear outer raceway (duct) with factory installed (inside the outer duct) multiple, segregated inner raceway (ducts). Rigid, schedule 40 PVC construction. Shall be modular lengths of 20-feet for each duct segment.

2. The conduit shall be suitable for use with signal/ telecommunications, fiber optic, telephone and computer/data circuits, operating at 100 volts or less, UL listed and labeled.

3. Outer Duct, outer enclosing Schedule-40 PVC duct size. The outer enclosing duct shall be 4.2-inches inside nominal duct diameter and 4.5-inches outer duct nominal diameter.

4. Inner-ducts (Contained inside the enclosing outer duct), non-metallic SDR-19 or Type- C/CAO-8546: Triple Combi-Duct

a. Quantity of three (3) continuous round rigid inner linear ducts, nominal size inside diameter 1.5-inches for each inner duct: Quad Combi-Duct

b. Quantity of four (4) continuous round rigid inner linear ducts, nominal size inside diameter 1.19-inches for each inner duct.

5. Manufacturer's standard bends and offsets, minimum 72-inches radius.

6. Combi-duct and combi-duct fittings shall be airtight and watertight. Approved for direct burial in earth and approved for encasement in concrete.

7. As manufactured by Carlon # Multi-Guard/Multi-Cell Series; American Pipe and Plastic (AMTEL) #Multi-Bore series; or equal.

H Expansion Joint, Deflection Joint and Seismic Joint Conduit Fittings

1. Expansion Conduit Fitting - Fitting shall provide for a minimum of 2-inches straight line movement between two connecting conduits in each direction (total 4-inches conduit expansion and contraction) parallel to the respective conduit lengths. Fitting shall be watertight.

2. Deflection Conduit Fitting - Fitting shall provide for a minimum of 30 degrees angular deflection movement ("Shear" deflection) between two connecting conduits, in any direction perpendicular to the length of the respective conduits. Fitting shall be watertight.

3. Combination Expansion/Deflection Conduit Fitting - Fitting shall provide the combined "expansion" and "deflection" movement capacity between two connecting conduits as described for separate "expansion" and "Deflection" conduit fittings. Fitting shall be approved for installation concealed in both masonry/ concrete construction and exposed non-masonry/concrete construction. Fitting shall be watertight.

4. Fittings shall comply with UL.

5. Fittings as manufactured by:

a. Conduit expansion fittings exposed or concealed locations as manufactured by:

a) Emerson-OZ/Gedney – AXB-8 Series for RMC conduit.

b) Emerson-OZ/Gedney - TX Series for EMT conduit.

c) Appleton – AXB or XJ8 Series for RMC conduit and EMT conduits. Provide RMC to EMT combination conduit coupling fittings for each end of the expansion fitting.

b. Combination expansion/deflection conduit fittings exposed, or concealed conduit locations as manufactured by:

a) Emerson-OZ/Gedney - AXDX Series for RMC conduit.

b) Emerson-OZ/Gedney - AXDX Series for EMT conduit.

c) Appleton-DX Series for RMC conduit.

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d) Provide RMC to EMT combination conduit coupling fittings for each end of the expansion/deflection fitting.

c. Conduit expansion/deflection fittings for FMC and LTFMC conduit.

a) Provide a minimum of 12-inches of "slack" LTFMC in each FMC or LTFMC conduit at building and structure seismic or expansion joint conduit crossings.

b) Note: Each FMC "slack" expansion/deflection location, shall be considered as not less than a 90 degree conduit bend location, for compliance with the maximum quantity of conduit bends allowed in a raceway.

6. Conduit fitting bonding jumper:

a. The grounding/bonding path of metal conduit shall be maintained by the fitting.

b. Provide a bonding jumper at each expansion, deflection and combination expansion deflection conduit fitting.

c. The jumper shall be a bare flexible copper "braid". The copper braid electrical current carrying capacity shall be equal to the metal conduit.

d. Provide a factory terminated ground clamp on each end of the braid with adjusting steel conduit grounding clamps and connect to each respective conduit end.

e. The jumper braid length shall be 8-inches longer than the respective conduit fitting. f. Bonding jumper for FMC and EMT fittings as manufactured by:

a) Emerson-OZ/Gedney – BJ and BJE Series

b) Appleton – BJ/XJ Series

I Conduit Bodies Conduit Fitting

1. Conduit bodies shall provide conductor access with a removable conduit body cover and wiring area enclosed in metal housing. The conduit body shall facilitate pulling conductors.

2. In-line form "C" conduit bodies shall be prohibited.

3. The interior space "length" of 90 degree "elbow" conduit bodies shall not be less than six (6) times the diameter size of the largest conduit connecting to the conduit body.

4. Conduit body covers shall be removable, gasketed; watertight "domed" metal covers "Mogul-Type" with threaded screw attachment to the conduit body.

5. Lubricated, reusable, wire roller guards inside the conduit body shall protect wire from insulation damage during wire "pulling".

6. Conduit body fittings shall comply with UL 514.

7. Conduit bodies as manufactured by:

a. For RMC Conduit

a) Hubbell/Killark – LB/Mogul (90-degree elbow) Series – threaded body.

b) 2) Emerson-OZ/Gedney - LB 6X/Mogul (90 degree elbow) Series - threaded body.

c) Appleton – NEC6X-LB/Mogul (90 degree elbow) Series - threaded body.

b. For EMT Conduit

a) Same as for RMC conduit. Provide EMT to RMC conduit combination coupling fitting for each outlet body connection.

8.

2.02 PVC COATING

A PVC coatings shall be provided as described for specified metal products.

B PVC coating shall be factory applied, to comply with NEMA-RN1 and 5-19.

C The adhesion of the PVC coating to the coated metal shall exceed the strength of the coating itself, based on 0.5-inch "strip-pull" test.

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D Uniform coating thickness shall be continuous without “breaks” or “pinholes” and shall not be less than the following:

1. Exterior metal surfaces, 40-millimeter coating thickness.
2. Interior metal surfaces, 10-millimeter PVC or urethane coating thickness (i.e. interior of conduits, interior of conduit fittings etc.).

2.03 CONDUIT SUPPORTS

A General

1. Conduit Supports, hangers and fasteners for metal conduit shall be steel, hot dip zinc
2. Conduit supports, hangers and fasteners for PVC coated conduit shall be PVC coated to match the conduit PVC coating
3. Threaded hardware shall be continuous, free running threads.
4. Conduit support systems, including support channels, pipe clamps, branches, anchors, hardware, fasteners, shall be sized to support the full capacity conduit conductors weight, plus the installed conduit weight, plus the conduit fitting weight and support hardware weight, plus a 300% additional weight capacity safety factor.
5. Provide lock washer at each “bolted”/threaded connection.
6. Conduit supports, fasteners, channels, braces, hardware, anchors, pipe clamps, and hangers as manufactured by Unistrut or Kindof.
7. Supports shall be free of “Burrs” and sharp edges.
8. Metal supports cut in the field shall be zinc galvanized after cutting to prevent rust.

B Conduit Hangers

1. Threaded steel hanger rods.
    a. Hanger rods smaller than 0.375-inches in diameter shall not be used for support of individual conduits.
    b. Hanger rods smaller than 0.5-inches in diameter shall not be used for support of multiple conduits.
2. Conduit hanger wires shall be not less than 12-gauge steel.
3. Conduit hangers shall attach to structure fasteners with steel “Clevis” or “Swing” hangers and shall provide a minimum of 45 degrees of angular movement in any direction at the point of the conduit hanger attachment to the structure fasteners.
4. Conduits individually suspended by conduit hangers shall fasten to the respective hangers with “Clevis” type pipe hangers. The pipe hangers shall be steel, adjustable to fit conduit size and shall completely enclose the conduit circumference.

C Conduit Support Channels

1. “C” channels shall be factory preformed with a minimum 12 gauge thickness metal. The channel shall be factory “punched” with regularly spaced slotted holes for fastener attachments along the length of the channel.
2. The “C” channel shall not deflect more than 0.1 inches between channel supports at maximum installed design load, including required safety factor.
3. Channels shall comply with ANSI-1008 (latest revision) and ASTM-A569 latest revision).
4. Channels shall provide “turned lips” at longitudinal edges to hold (lock-in) fasteners.
5. Conduit support channels suspended from conduit hangers shall attach to conduit hangers with treaded connections. Provide a minimum of two hangers (trapeze style) connected to each channel.
6. Non-suspended conduit support channels shall connect to structure fasteners with threaded connectors.

D Fasteners, Seismic Earthquake Rated

1. Channel fasteners:
    a. Channel fasteners shall “prelocate” and lock into the channel ”turned lips” and channel “walls”.

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b. A separate metal strap shall “tie” each conduit to each channel with conduit channel fasteners.

2. Structure fasteners:

a. Structure fasteners for wall and floor mounted conduit attachments shall attach to existing masonry and concrete structures with structure fasteners using drilled, mechanical, expansion shield anchors.

b. Structure fasteners for wall and floor mounted conduit attachments shall attach to new masonry and concrete structures with structure fasteners using steel threaded inserts precast into the structures.

c. Structure fasteners shall center the support load above or below the beam flanges and reduce torsion-rotation forces exerted on the structural beam. Attach to steel structural members with “swing-beam clamps”, with set-locking screw structure fasteners.

a) Beam clamps shall include integral safety rod, strap or “J”-hook to secure the attachment clamp to the beam flanges on both sides of the beam, with integral hanger rod attachment.

b) Or double-ended beam clamp to secure the attachment clamp to the beam flanges on both sides of the beam, with integral hanger rod attachment.

d. Structure fasteners for wall and floor mounted conduit attachments shall attach to wood structural members with flush “through-bolted” wood beam/wood framing stud structure fasteners.

e. Structure fasteners for wall mounted conduit attachments shall attach to steel framing studs and steel structural elements with spot welded steel structure fasteners or drilled and bolted structure fasteners.

E Brace Connectors

1. Provide lateral brace connectors to resist horizontal, lateral and vertical movement of suspended conduits during seismic earthquakes.

2. The braces shall connect from each conduit support, attach as close to the conduit as possible, and attach to fixed rigid, nonsuspended building “main” structural elements with fixed anchoring.

3. Brace attachment connectors and fasteners shall be rigid preformed steel channels or flexible #10 gauge steel hanger wire.

4. Connect and attach the brace connectors to fixed structural elements in the same manner as conduit support hangers. The connection of braces to structural elements shall be independent of the conduit support hanger structure fasteners.

2.04 ELECTRICAL POWER WIRE AND CABLE

A General

1. All wire and cable shall be single-conductor, annealed copper, insulated 600 volt, #12AWG minimum unless specifically noted otherwise on the drawings.

2. Conductors #10AWG and smaller shall be solid. Conductors #8AWG and larger shall be stranded.

3. Insulation of conductor connected to circuit protection devices required to be "100%" rated, shall be 90 degree centigrade rated insulation.

4. Insulation of conductors installed outdoors, on grade or underground, insulation shall be rated for wet locations.

5. Insulation of conductors installed outdoors, installed exposed to the sun, installed in exposed conduits, insulation shall be rated for high-temperature 90 degrees centigrade.

6. Insulation of branch circuit conducts installed in light fixtures, insulation shall be rated for 90 degrees centigrade.

7. Conductor exposed to oil, insulation and jacket shall be oil resistant, complying with “Oil Resistant-1” and “Oil Resistant-2” UL 83.

B Conductor Insulation

1. 600 Volt AC and/or DC insulated conductors installed entirely inside conduits, or enclosed inside wireways, or enclosed inside raceways, insulation shall be rated as follows.

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2. Indoor above Grade locations either concealed or exposed.

   a. Dual rated THHN and THWN

   b. Individually rated THHN-2 c. Individually rated THWN-2 d. XHHW-2

3. Outdoor above Grade either concealed or exposed.

   a. XHHW-2

   b. THWN-2

   c. THW-2

4. Outdoor below Grade or outdoor on Grade.

   a. A XHHW-2

   b. THWN-2

   c. THW-2

5. All other enclosed raceway locations not described above.

   a. XHHW-2

   b. THWN-2

   c. THW-2

6. Health Care facilities all circuits insulation shall be XHHW -2, rated Hospital-Grade.

7. 600 Volt AC and/or DC insulated conductors installed in open cable tray or open wireway or exposed insulation also shall be rated for exposed install locations.

C Insulation Color Coding and Identification

1. The following color code for branch circuits:

   a. Neutral . . . White (Tape feeder neutrals with white tape near connections)

   b. Normal Power:

120/208 Volt		480/277 Volt	Ground Green
		Ground	Green
Phase A	Black	Phase A	Brown
Phase B	Red	Phase B	Orange
Phase C	Blue	Phase C	Yellow

   c. Isolated ground insulation shall be green with a longitudinal yellow stripe.

   d. Emergency power same insulation color as normal power except as follows:

120/208 Volt	480/277 Volt
Provide a continuous stripe on each insulation, orange or yellow, except ground	Provide a continuous stripe on each conductor conductor insulation blue or black, except ground

2. When individual neutral conductors are shown for each branch circuit, the color code for the neutral conductors shall be as follows:

   a. 120/208 volt; Phase A - White with Black stripe; Phase B - White with Red stripe; Phase C - White with Blue stripe.

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b. 277/480 volt; Phase A - White with Brown stripe; Phase B - White with Orange stripe; Phase C - White with Yellow stripe.

3. Feeders identified as to phase or leg in each, switchboard, switchgear, panelboard and junction location with printed identifying tape.

4. Fire alarm conductors: Use 600-volt, type THHN-2/THWN-2 conductors and color-coded per equipment manufacturer's recommendations and approved and listed for use on fire alarm systems by the State Fire Marshal.

5. Color coding for mechanical and plumbing control wiring shall be an agreed upon color code between the Mechanical/Plumbing CONTRACTOR and the Electrical CONTRACTOR, and color code shall be submitted to the DISTRICT'S REPRESENTATIVE in writing for approval prior to installation.

D Panel feeders shall be copper:

1. Wire size shown on the drawings is for copper conductors, unless specifically indicated otherwise.

2. If the conductor termination is to be made on a bus bar or similar flat surface, a Burndy Type YA-A HYPLUG compression terminal intended for the specific conductor size, factory filled with oxide inhibitor compound shall be used. Terminal must be installed using a hydraulic compression tool equipment with a die head for the particular terminal used. Only Burndy Hypress tools shall be used for compression.

3. If the conductor termination is to be made into a circuit breaker or similar insert compartment it shall be terminated by use of a Burndy AYP HYPLUG compression connector intended for the specific conductor size, factory filled with oxide inhibitor compound. Connector must be installed using only Burndy Hydraulic compression tool specifically approved for each respective connector.

4. Connector aid shall be used for all terminations and connections. Connector aid shall be Burndy Pentrox A, NO-OX-1D Grade "A".

5. When an aluminum lug is terminated to a copper bus with a steel or copper stud or bolt, place aluminum lug on stud or bolt followed by a flat steel washer, a Belleville washer, and steel or copper nut, in that order.

2.05 CHEMICAL GROUND ROD

A General

1. Self contained ground rod(s) using chemically enhanced grounding shall be provided where specifically indicated on the drawings. As manufactured by Lyncole XIT Grounding Systems, 22412 South Normandie Avenue, Torrance, CA. Telephone #(800) 962-2610; or Superior Grounding Systems, Irwindale, CA. Telephone #(800) 747-7925; or ERICO – Eritech Chemical Ground Electrode.

2. The ground rod shall operate from changes in atmospheric pressure pumping air through the ground rod, hygroscopically extracting moisture from the air to activate the ground electrolytic chemicals and improve the ground rod performance.

3. Ground rod system shall be UL-467 listed.

4. Ground rod system shall be 100% self-activating, sealed and maintenance free. The addition of chemical or water solutions shall not be required.

B Ground Rod

1. Ground rod shall consist of a 2-inches nominal diameter hollow, copper tube. The tube shall be permanently capped on the top and bottom. Air breather holes shall be provided in the top of tube. Drainage holes shall be provided in the bottom and sides of the tube for electrolyte drainage into the surrounding soil.

2. The ground rod shall be chemically filled at the factory with environmentally non-hazardous water-soluble metallic salts to enhance electrical grounding performance.

3. Ground rod shall be a minimum of 10-feet long for straight (vertical) installation; or "L" shape minimum 20-feet long for horizontal installation.

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4. Ground wire clamping “U-Bolt” with pressure plate on the top end of the tube sized for 1#2 through 500 MCM AWG ground electrode conductor connection, and stranded 4/0AWG copper pigtail exothermically welded to the side of rod for ground electrode conductor connection.

C Ground Box

1. Precast concrete box with slots for conduit entrances. Approximately 10-inch diameter by 12-inches high. Cast iron grate flush cover with “Breather” slots XIT Box #XB-12.

D Backfill Material

1. Natural volcanic, non-corrosive Bentonite Clay backfill material.
2. Shall absorb water at a minimum of thirteen times its dry volume or approximately 14 gallons for 50 pounds of clay.
3. PH value 8-10 with maximum resistivity of 2.5 OHMS-M at 300% moisture content by weight.

2.06 FLEXIBLE CORDS AND PORTABLE CABLES

A General

1. Multi-conductor insulated flexible cable with jacket rated extra heavy duty, extra hard-use and high abuse duty; ozone, sunlight, grease, oil resistant-UL 83 and water resistant; rated for indoor/outdoor use.
2. Quantity of conductors and conductor sizes as indicated on the drawings but in no case less than five 16AWG.
3. Characteristics:
   a. a. Conductors - stranded copper, soft annealed conforming to ASTM-B-174 and ASTM-B-172. 600 volt individually insulated and color-coded. Separate green insulated ground conductor. Aluminum conductors shall not be permitted for cords and cables.
   b. Insulation - rubber conforming to UL 62; temperature range plus 105 Centigrade to minus 50 Centigrade.
   c. Flame resistance shall conform with MSHA-P123-103.
   d. Jacket - black for equipment connections and yellow for outlet connections. Rated for
4. temperature range plus 105 Centigrade to minus 50 Centigrade, water, sunlight and ozone resistant. Permanently mark jacket a minimum of 40-inches on center with rated voltage, manufacturer's name, wire/insulation type, AWG conductor size and quantity (minimum 24-inches on center).

2.07 CABLE RACKS

A Cable racks, installed on the vertical walls of the structure, including hooks and porcelain insulator cable cradles, shall be sufficient to accommodate the cables and splices.

B Vertical racks shall be installed on all walls of the structure a minimum of 24-inches on center within 6-inches of floor and top of wall. A rack shall be installed within 18-inches of each corner of each wall. Additional racks spaced equally on each wall shall be installed; spacing between vertical wall racks shall not exceed 24-inches.

1. Wall racks shall be slotted to accept removable hooks and lock hooks into place.
2. Non-metallic, 50% (minimum) glass reinforced nylon or non-metallic material of the same characteristics.
3. The installed cable racks, cable support hooks with arms and wall anchor bolts shall support the following minimum loads for each hook/arm, with a 200% minimum safety factor. Based on multiple hook/arms located not less than 9-inches on center along the entire vertical length of the support rack:

Hook/Arm Length	Min. Weight Each Hook/ Arm Supported	Max. Allowable Hook/ Arm Deflection

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a. 8-inch	450 pounds	0.25-inch b.
b . 14-inch	350 pounds	0.37-inch
c. 20-inch	250 pounds	0.37-inch (Based on load concentrated 1-inch from the end of each hook/arm.)

4. Racks shall be bolted to the precast and cast-in place structure walls, within 3-inches of each rack end and not less than 9-inches on center. Provide cast-in place or after-set drilled expansion concrete anchors.

5.

PART 3- EXECUTION

3.01 TRENCHING, FOOTINGS, SLEEVES

A Provide trenching, concrete encasement of conduits, backfilling, and compaction for the underground electrical work, in accordance with applicable sections of this specification.

B Provide footings for all post and/or pole-mounted lighting fixtures: concrete shall conform to the applicable sections of this specification.

C Sleeves

1. Provide sleeves for raceways, conduit and wire/cables passing through the following construction elements:
   a. Concrete and masonry foundations, floors, walls and slabs.
   b. Gypsum, Lath, and plaster walls and ceilings.
   c. Building structures (i.e., foundations, walls, floors, ceilings, beams, and roofs) with a fire rating exceeding 20-minutes.
2. Sleeves shall extend 1.5-inches above and below floors, except under floor standing electrical equipment. Sleeves shall be flush with wall ceiling foundations and partitions exposed to public view and extend approximately 0.5-inches past penetration in fire rated construction. Sleeves shall be installed at exact penetration locations and angles to accommodate wire/cable, raceway and conduit routings.
3. Joists, girders, beams, columns or reinforcing steel shall not be cut or weakened. Where construction necessitates the routing of conduit or raceways through structural members, framing or footings, written permission to make such installation shall first be obtained from the DISTRICT'S REPRESENTATIVE. Such permission will not be granted, however, if any other method of installation is possible.
4. The layout and design of raceways and conduits located in or routed through masonry or reinforced beams or the DISTRICT'S REPRESENTATIVE shall review walls before any work is performed. All sleeving shall be accomplished according to the instructions of the DISTRICT'S REPRESENTATIVE and shall be accepted before any concrete is poured.
5. Sleeves, raceways and conduit shall be located to clear steel reinforcing bars in beams. Reinforcing bars in walls shall be offset to clear piping and sleeves.
6. Provide a continuous clearance between the inside of a sleeve and exterior of wire/cables, conduits and raceways passing through the sleeve not less than the following:
   a. 0.5-inch clearance except as required otherwise.
   b. 1.0-inch clearance through outside walls below grade.
   c. 3.0-inch clearance through seismic joints.
7. Sleeves set in fire rated construction shall be caulked between sleeve and building structure, additionally sleeves shall be caulked between the sleeve and the wire/cables, conduits/raceways passing through the sleeve. The caulking shall be a fireproof sealant, equal to the fire rating and temperature being penetrated. Clearance between components inside of sleeve and exterior of components passing through sleeve and between components inside the sleeve shall comply with fireproof sealant manufacturer's recommendations.

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8. Sleeve material:

a. In floor construction: Schedule 40 black steel pipe, with upper surface to be sealed watertight.

b. In concrete or masonry walls roofs or ceilings: Schedule 40 black steel pipe. When installed in roofs or outside walls, seal outer surface watertight.

c. In fire rated construction; 24 gauge galvanized iron or steel.

d. Sleeves through waterproof membranes: Cast iron or Schedule 40 steel with flashing clamp device and corrosion resistant clamping bolts. Caulk space between pipe and sleeve and surfaces between sleeve and conduits sealed watertight.

3.02 GROUNDING

A Grounding shall be executed in accordance with all applicable codes and regulations, both of the State and local authorities having jurisdiction.

B Where nonmetallic conduit is used in the distribution system, the CONTRACTOR shall install the proper sized copper ground wire in the conduit with the feeder for use as an equipment ground. The electrical metallic raceway system shall be grounded to this ground wire.

C The maximum ground/bond resistance to the grounding electrode shall not exceed 1 ohms from any location in the electrical system. The maximum ground resistance of the grounding electrode to earth shall not exceed 5 ohms.

D Ground/Bond Conductors

1. Provide an additional, dedicated, green insulation equipment ground/bond wire inside each conduit type and raceway as follows. Size the ground/bond conductors to comply with CEC/NEC requirements. The metal conduit or raceway shall not be permitted to serve (function) as the only (exclusive) electrical ground return path:

a. All types of nonmetallic conduit and all types of non-metallic raceways including but not limited to: RNMC - Rigid Nonmetallic Conduit.

b. FMC - Flexible Metal Conduit.

c. LTFMC - Liquid Tight Flexible Metal Conduit.

d. Metal and non-metal raceways.

e. RMC - Rigid Metal Conduit.

f. EMT - Electrical Metal Tubing.

2. The equipment ground/bond wire shall be continuous from the electrical circuit source point of origin to the electrical circuit end termination utilization point as follows:

a. Every conduit and raceway path containing any length of the above identified conduits or raceway.

b. Every conduit path and raceway path connected to any length of the above-identified conduits and raceways.

3. The equipment ground/bond wire shall be sized as follows, but in no case smaller than indicated on the drawings. Install equipment ground/bond wire in each conduit/raceway, with the respective phase conductors:

a. Feeder, Subfeeders & Branch Circuit Protection Min. Equipment Ground Wire Size

15 Amp	#12
20 Amp	#12
30 to 60Amp	#10
70 to 100 Amp	#8
101 to 200 Amp	#6

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201 to 400 Amp	#2
401 to 600 Amp	#1
801 to 1000 Amp	2/0
1001 to 1200 Amp	3/0
1201 to 1600 Amp	4/0
1601 to 2000 Amp	250 MCM
2001 to 2500 Amp	350 MCM
2501 to 4000 Amp	500 MCM

4. Isolated grounds - Raceways containing branch circuit or feeder phase conductors connected to panelboards equipment, or receptacles with isolated grounds or isolated ground bus shall contain a dedicated insulated ground conductor connected to the isolated ground system only. The isolated ground conductor shall be continuous the length of the raceways and connected only to the isolated ground terminals in addition to and independent of the equipment bonding/ground conductor. The isolated ground conductor shall be sized as indicated above, for equipment ground/bond wire.

5. Splices in ground/bond wires shall be permitted only at the following locations:

   a. Ground buses with listed and approved ground lugs.

   b. Where exothermic welded ground/bond wire splices are provided.

6. Provide ground/bond wire jumpers for conduit fittings with ground lugs, expansion and deflection conduit fittings at conduit fittings connecting between metallic and non-metallic raceways and to bond metal enclosures to conduit fittings with ground lugs.

E Where conductors are run in parallel in multiple raceways, the grounding conductor shall be run in parallel. Each parallel equipment-grounding conductor shall be sized on the basis of the ampere rating of the overcurrent device protecting the circuit conductors in the raceway. When conductors are adjusted in size to compensate for voltage drop, grounding conductors, where required, shall be adjusted proportionately in size.

F Ground conductors for branch circuit wiring shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws, 6-32 or larger.

G Each panelboard, switchboard, pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

H UFER Ground

1. In addition to all cold water and structural steel grounds provided to meet this specification, there shall be a main ground system of the UFER ground style.

2. The UFER ground electrodes shall be a minimum of two (2) 20-feet lengths of #4/0 AWG bare stranded copper cable embedded horizontally in the cast in place concrete footing, extending in opposite directions in the footings. All portions of the ground electrodes shall be placed inside the concrete, between 2-inches and 4-inches from the earth surrounding the concrete.

3. The lengths of cable shall extend in opposite directions in the footings, with the center end of each cable terminated onto the main electrical service ground bus for the main electrical service equipment.

4. All wire cable connection terminations onto the ground bus shall be exothermic weld type.

5. The “UFER” grounding electrode, embedded in concrete, shall be exothermically welded to each steel reinforcing bar (rebar) and each steel anchor bolt located within 18-inches of the grounding electrode inside the concrete. Note: Reinforcing steel (rebar), in concrete foundations, attached with metal “tie-wraps” and in direct physical

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contact to other adjacent rebar that is in turn exothermic welded to the UFER grounding electrode, may be classified as attached to the UFER grounding electrode, and does not require additional exothermic weld connections to the UFER grounding electrode.

I Provide a separate ground/bond insulated grounding electrode conductor, copper wire from the main electrical service ground bus to each of the following locations. The ground/bond conductor shall be sized to comply with applicable codes and as indicated on the drawings, but in no case smaller than the following:

1. Main service entrance equipment ground bus:
   a. Services smaller than 1200 ampere 1.5-inch conduit with 1#4/0.
   b. Services 1200 ampere and larger 2.5-inch conduit with 1#500MCM.
   c. Where a separate ground bus is not required, connect ground to electrical equipment metal housing
2. Each telephone backboard and signal system backboard location, 1.25-inch conduit with 1#1.
3. Metal cold water pipe located inside the building, 1.5-inch conduit with 1#4/0.
4. Outdoor underground metal cold water pipe, make connection five feet from the building, 1.5-inch conduit with 1#4/0.
5. Each transformer (size as indicated and to comply with applicable codes).
6. Each service entrance ground bus and each separately derived ground rod system:
   a. Services smaller than 1200 ampere 1.5-inch conduit with 1#4/0.
   b. Services 1200 ampere and larger 2.5-inch conduit with 1#500MCM.
7. Separate 1.25 inch conduit with 1#2 (AWG) bonding conductor to each interior metal pipe system located in the same building, including but not limited to, the following:
   a. Fire sprinkler system each stand pipe location (water based and non-waterbased).
   b. HVAC chilled water supply and return, at each pump location.
   c. Roof drains.
   d. Waste liquid disposal systems.
   e. Metal gas pipe service entrance and service meters. f. Hydraulic elevator hydraulic pipes.

3.03 CONDUIT

A General

1. The sizes of the conduits for the various circuits shall be as indicated on the drawings, but not less than the conduit size required by code for the size and quantity of conductors to be installed in the conduit.
2. Conduits shall be installed concealed from view. Install conduits concealed in walls, concealed below floors and concealed above ceilings, except as specifically noted otherwise.
   a. Conduits shall not be installed in concrete floors.
3. The following systems shall be considered as circuits 100 volts and less, all other circuits shall be considered to be over 100-volts (power circuits) unless specifically noted otherwise: Fire alarm, energy management control, telephone, public address, data, computer, television, intercom, intrusion alarm and nurse call.
4. Conduits shall be provided complete with conduit bends, conduit fittings, outlet boxes, pullboxes, junction boxes, conduit anchors/supports, grounding/bonding for a complete and operating conductor/wire raceway system.
5. Metal and nonmetal conduits shall be provided mechanically continuous between termination connection points. Metal conduit shall be provided electrically continuous between termination connection points.
6. Individual conduit paths and home runs shown on the drawings shall be maintained as separate individual conduits for each homerun and path.

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7. Conduits, conduit fittings and installation work occurring in classified hazardous materials locations shall comply with applicable code Class 1 Division 1 requirements, unless specifically noted otherwise.

8. Transitions between conduits constructed of different materials and occurring in above grade locations shall be allowed only at outlet boxes, junction boxes, pull boxes, and equipment enclosures unless specifically indicated otherwise. Provide outlet boxes and junction boxes.

9. Metal conduit terminating to nonmetal enclosures; terminating into metal enclosures with "concentric.ring" knockouts; terminating into metal enclosures with knockout reducing washers, including but not limited to equipment housings, outlet boxes, junction boxes, pull boxes, cable trenches, manholes, shall be provided with a ground/bonding lug integrated with the conduit termination conductor fitting construction, by the fitting manufacturer. The lug shall provide for connection of a grounding/bonding conductor (insulated or uninsulated). The grounding lug shall be located on the fitting, inside the termination enclosure.

10. The type of conduit, type of conduit fittings, and type of conduit supports and method of conduit installation shall be suitable for the conditions of use and conditions of location of installation based on the manufacturer's recommendations; based on the applicable codes and based on the requirements of the contract documents.

B RMC Installation Locations - RGS, IMC conduits and RGS, IMC fittings shall be installed in the following locations:

1. Embedded in floors, walls, ceilings, roofs, foundations, and footings constructed with concrete.
2. Embedded in walls and foundations constructed with brick and masonry.
3. Interior of buildings, within 9-feet of finish floor lines for exposed conduit locations.
4. Exterior of building for exposed conduit locations.
5. Damp or wet locations, exposed or concealed locations.
6. Exposed on roofs.
7. In hazardous materials areas and locations; below hazardous materials areas and locations; above hazardous materials areas and locations.
8. Exposed on utility service poles, for pole risers less than 9-feet above finish grade.
9. RMC conduit and RMC fittings may be installed in any location where EMT and FMC conduit is permitted to be installed.

C PVC Coated RMC Installation Locations - PVC coated RMC conduit and PVC coated RMC fittings shall be installed in the following locations:

1. Underground conduit locations for elbows and bends with a radius of less than 36-times the conduit diameter.
2. Underground vertical risers extending above grade.
3. Entire length of underground conduits for the following circuits:
    a. Audio microphones
    b. Lighting dimming controls
4. Installed in contact with earth or corrosive materials.
5. Exposed in "cold" rooms and "refrigerated" rooms, rooms with a maintained temperature below 65 degrees Fahrenheit.

D EMT Installation Locations - EMT conduit and EMT fittings may be installed in the following locations, for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials"; only dry locations:

1. Concealed in hollow non masonry/non-concrete, metal stud frame and wood stud frame walls and floors.
2. Concealed above ceilings.
3. Exposed inside interior enclosed crawl spaces.

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4. Exposed interior locations placed 10-feet or higher above finished floors (except as described in paragraph below at lower heights).

5. Exposed on walls and ceilings (any height) in the following dedicated function areas, interior enclosed room locations:

   a. Indoor enclosed electrical equipment rooms and closets.

   b. Indoor enclosed data and telecommunication terminal rooms and closets. c. Indoor enclosed HVAC equipment rooms and closets.

6. Any location where FMC is described to be installed, except as the final connection to rotating or vibrating equipment.

E FMC Installation Locations - FMC conduit and FMC fittings may be installed in the following locations for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials"; only dry, interior locations:

1. Concealed in hollow non-masonry metal stud frame and wood stud frame fully enclosed walls.

2. Concealed above fully enclosed ceiling spaces.

3. FMC conduit shall be installed in continuous lengths between termination points. FMC shall not be "spliced" or coupled directly to FMC or any other conduit type under any circumstance.

4. The maximum continuous length of FMC that shall be installed between termination end points is 8-feet. Circuits requiring continuous conduit lengths exceeding 8-feet between termination end points shall be installed using either RMC or EMT conduits. FMC lengths shorter than 16-inches are prohibited.

5. The minimum size FMC conduit shall be as shown on the drawings but not be less than the following:

   a. FMC lengths of six feet or less, minimum FMC conduit size shall be 0.75-inch.

F LTFMC Installation Locations - LTFMC conduit and LTFMC fittings shall be installed in the following locations for circuit conductors operating below 600 volts to ground; locations containing only "non-hazardous materials":

1. Final electrical connection to vibrating or rotating equipment; control and monitoring devices mounted on vibrating and rotating equipment including the following. Minimum conduit length shall not be less than 24-inches:

   a. Motor, engines, boilers, solenoids, and valves.

   b. Fixed mounted "shop" (manufacturing) production equipment.

   c. Fixed mounted food preparation equipment and "kitchen" equipment.

2. All locations where exposed flexible conduit connections are required, both indoor and outdoor.

3. Final connection to indoors electrical transformers. Minimum conduit length shall not be less than 24-inches; maximum conduit length shall not exceed 72-inches.

4. Do not install LTFMC located in environmental air plenums.

G RNMC Installation Locations - RNMC conduit and RNMC fittings shall be installed in the following locations containing only "non-hazardous material":

1. Underground, concealed below earth grade, unless specifically noted or specified otherwise.

2. Exposed on utility service poles, for pole risers at 9-feet or higher above finish grade, schedule 80 PVC only.

3. RNMC type "EB" conduit(s) shall be concrete encased along the entire length of the conduits for all installation locations.

4. Non-metal type raceways and RNMC type conduit shall not be installed inside buildings.

H Combi-Duct Installation Locations - Combi-duct conduits shall be installed where shown on the drawings. Combi-duct shall be installed underground (below grade) as follows:

1. Do not install exposed or inside buildings above grade.
2. Provide a 0.25-inch pull rope in each inner duct.
3. Radius and elbows shall be rigid non-metallic, PVC, manufacturer factory fabricated, in lieu of PVC coated RMC conduit.
4. Inner ducts shall be supported by internal spacers inside the enclosing outer duct.
5. Provide end bell and three (3) hole "snug-plugs" at each entrance end of Combi-duct into pullboxes, manholes, equipment cabinets stubups and Combi-duct terminations. Compression type “snug-plugs” shall provide watertight and airtight seal between inner and outer ducts and around future cables installed in inner duct.

I Conduit Installation

1. Conduit Supports

a. Securely and rigidly support all raceways/conduits from the building structure. Raceways/Conduits shall be supported independent of all piping, air ducts, equipment ceiling hanger wires, and suspended ceiling grid systems. Secure conduit to structural element by means of UL listed and approved hangers, fasteners, “C” channels and pipe clamps.

b. Provide conduit supports spaced along the length of the conduit as follows:

a) RMC and EMT conduit, maximum not to exceed 96-inches on center; within 24- inches of each conduit bend and conduit termination location.

b) FMC and LTFMC conduit, maximum not to exceed 24-inches on center; within 6- inches of each conduit bend and conduit termination location.

c. Suspended conduit methods:

a) Individual, suspended raceways/conduits separated by more than 12-inches from any other conduit and suspended from ceilings and roofs shall be supported as follows:

i) Conduits smaller than 1.5-inches by means of hanger rods or hanger wires.

ii) Conduits 1.5-inches and larger by means of hanger rods.

iii) The conduit shall attach to the hangers with pipe clamps.

b) Suspended raceways/conduits positioned within 24 inches of any other conduit shall be grouped and supported by hanger rods using trapeze type conduit support channels ("C" channels). Conduits shall individually attach to common channels side-by-side, with pipe clamps.

d. Non-suspended conduit methods:

a) Individual raceway/conduits placed against wall/ceiling/floors, placed inside hollow wall/ceiling construction or structure framing (i.e., “dry- wall” or plaster hollow wall construction), shall be secured by means of individual pipe clamps and fasteners attached to the framing studs or other structural members and the conduit/raceway.

b) Provide common “C" channel supports for all multiple raceway/conduits placed against vertical or horizontal surfaces and positioned within 24-inches of other raceways/conduits. Attach channels to the framing studs or other structural members. Attach the conduits/raceway individually to common channels, side-by- side, with pipe clamps.

c) The use of toggle bolts is prohibited.

e. Conduit rising from floor for motor connection shall be independently supported if extending over 18-inch above floor. Support shall not be to a motor or ductwork, which may transmit vibrations.

f. Provide conduit anchoring, conduit support and conduit bracing systems conforming to Earthquake Seismic Zone 4 requirements. The conduit support/ anchoring system capacity shall include the weight of the conduits, conduit fittings, conduit supports and conductors/wires/cables installed in the conduits plus a 300% safety factor. Submit shop-drawing details showing each typical conduit anchor, conduit support and conduit brace location. Submit

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structural calculations performed by and signed by a Professional Structural Engineer (P.E.) with a P.E. license, registered in the state of California, U.S.A.

2. Conduit separation:

a. Conduit installed underground or below building slab without full concrete encasement: Shall be separated from adjacent conduits of identical systems (i.e. signal to signal, data to data, power to power, control to control etc.) by a minimum of 3-inches. Conduits of non-identical systems (i.e. signal to power; data to power; power to control; signal to control, etc.) shall be separated by a minimum of 12-inches.

b. Conduit installed underground with full concrete encasement; shall be separated from adjacent conduits of similar systems (100 volt and less) by a minimum of 2-inches; conduits for non power systems (100 volts and less to ground) shall be separated by a minimum of 6-inches from power circuits (over 100 volts to ground); conduits for power circuits shall be separated from adjacent conduits of similar power systems (over 100 volts to ground) by a minimum of 3-inches.

c. Separation of conduits entering termination points or crossing other conduits may be reduced as required within 60-inches of the termination or crossing points.

d. Conduits containing Utility Company service circuits (i.e. electrical power, telephone, or cable television) shall be separated a minimum of 12-inches from all other utilities and conduits, with or without concrete encasement; metallic or non-metallic conduit, above grade or underground conduit locations.

e. Conduits shall be separated from hot water piping, exhaust flues/chimneys, steam piping, boilers, furnaces, ovens by a minimum of 12-inches.

3. Conduit stubs:

a. Branch circuit and telephone conduits turned up from floor at the following locations shall terminate each conduit in a flush conduit coupling at the floor and then extend into partition or to equipment. Refer to DISTRICT'S REPRESENTATIVE'S drawings for location of walls and partitions.

a) Interior demountable partitions.

b) Below, into or adjacent to equipment not installed directly adjoining to a wall.

c) Up from below the floor into hollow stud frame walls.

b. From each panel, and signal cabinet which is wall mounted, stub up from top of the panel/cabinet a minimum of (3) three 1-inch conduits to the nearest accessible ceiling spaces or other accessible location. Where the floor below the panel is accessible or is a ceiling space, stub an additional (3) three 1-inch conduits from the bottom of the panel into the accessible space below the panel. Cap conduits for future use.

c. Conduits stubbed underground outside of building line for future use shall be terminated a minimum of five feet clear (whichever distance is greater) of building or adjacent concrete walks and AC paving. The stubout conduit shall be capped. Provide concrete monuments, 6-inches by 6-inches by 15-inches deep, buried flush with grade over the capped ends. The face of monument shall be furnished with 3-inch square brass plates securely mounted and engraved with the number and size of conduits and type of service (i.e., "POWER", "TEL.", etc.).

d. Conduits stubbed into ceiling or floor spaces from outlets for telephone, video, computer/data or television shall be provided with an insulated throat bushing, on the end of each conduit stubout.

e. Conduit stubouts from outlet boxes and equipment located in hollow stud walls, into ceiling and floor spaces, shall be EMT or RMC conduit. The stubouts shall terminate into the ceiling and floor spaces with a conduit termination connector fitting.

f. Empty conduit stubs into building spaces and equipment shall be individually identified with a "ID-tag" located at each end of the conduit. The ID-tag shall state the origination point and termination point of the respective conduit (i.e., "from PNL-A/to Room #121"; "from outlet #24/to outlet #17 in Room #120"; etc.).

g. Provide a conduit termination fitting with insulated throat bushing and mechanical ground lugs at each conduit "stub-up" location.

4. Conduit concrete encasement:

a. Conduits which are run underground exterior to building slab shall be continuously concrete encased except, 15 and 20-ampere power branch circuit conduits underground do not require concrete encasement.

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b. PVC rigid-non-metallic-type EB conduit, of any size and any location shall be continuously concrete encased the full length of the conduit installation, including under building slab.

c. Concrete for encasement of underground conduits shall be 2000-PSI 28-days cure strength with a mix of cement, sand, water and maximum of ¾-inch gravel. Concrete encasement of conduits shall be continuous without voids. The encasement shall extend 3-inches past the edges of all conduits on all sides of the circuit. Provide ten pounds of red oxide cement coloring uniformly mixed with each cubic yard of concrete for conduit encasement.

d. Conduits located below or adjacent to structural foundations shall be separated from the foundation by a minimum of 12-inches. Conduits located below structural foundations shall be fully and continuously concrete backfilled and encased between the bottom of the foundation to the bottom of the conduits. The concrete shall be 4000 PSI 28 day cure strength instead of 2000-PSI concrete.

e. Conduits of any size and type (including 15 ampere and 20 ampere power branch circuits) located under roads, paved areas and "transit-system" right of way shall be concrete encased.

5. Underground conduits:

a. Three or more underground conduits larger than 1-inch in size and occupying the same trench shall be separated and supported on factory fabricated, non-metallic, duct/ conduit support spacers. The spacers shall be modular, keyed interlocking type, "built- up" to accommodate quantity, size orientation and spacing of installed conduits. The spacers shall maintain a constant distance between adjacent conduit supports and hold conduits in place during trench backfill operations. Minimum support spacer installation interval along with length of the conduits shall be as follows:

a) Concrete encased conduits, not less than 8-feet on center.

b) Non-concrete encased conduits, not less than 5-feet on center.

b. Provide trenching, excavation, shoring and Backfilling required for the proper installation of underground conduits. Tops of backfill shall match finish grade.

c. Bottoms of trenches shall be cut parallel to "finish grade" elevation. Make trenches 12- inches wider than the greatest diameter of the conduit.

d. Back-filling Trenches for Conduits without Concrete Encasement Requirements

a) Conduits which are not required by the Contract Documents to be concrete encased and are located exterior to building slab, shall be set on a 3-inch bed of damp clean sand. Conduit trenches shall be backfilled to within 12-inches of finished grade with damp sand after installation of conduit is completed. Remainder of backfill shall be native soil.

b) Conduits located under a building which are not required by the Contract Documents to be concrete encased, shall be completely backfilled and compacted with clean damp sand to the same level as the building foundation pad.

c) Provide a continuous yellow 12-inches wide flat plastic tracer tape, located 12- inches above the conduits in the trench. The tracer tape shall be imprinted with "Warning-Electric Circuits" a minimum of 24-inches on center.

e. Backfilling trenches for conduits under paved areas:

a) In addition to the requirements of conduit concrete encasement, conduits under walkways, roads, parking lots, driveways, and buildings shall be cast in place concrete "slurry mix" backfill. The slurry mix shall cover each side and top of conduits and conduit concrete encasement. The slurry mix shall be continuous to the underside of the finish subgrade surface.

f. Backfilling trenches for conduits with concrete encasement requirements by the contract documents:

a) Trenches with all conduits concrete encased, shall be backfilled with clean damp sand when located under building pads.

b) Trenches with all conduits concrete encased and not located under a building pad and not located under paved areas, shall be backfilled with clean damp sand or native soil.

g. Backfill material:

a) Sand and native soil backfill of trenches shall be machine vibrated in 6-inch lifts to provide not less than 90% compaction of backfill.

21.

b) Soil backfill shall have no stones, organic matter of aggregate greater than 3- inches.

c) Concrete and slurry mix (2000-PSI) shall be machine vibrated during installation to remove “air-voids”.

d) The slurry mix shall consist of concrete, clean rock, clean sand and clean water mixture. Maximum shrinking of slurry mix shall not exceed 5% wet to dry.

h. h. Do not backfill until District’s Representative has approved installation and as-built drawings are up to date. Promptly install conduits after excavation has been done, so as to keep the excavations open as short a time as possible. Excess soil from trenching shall be removed from the site.

i. Install underground conduit, except under buildings, not less than 24-inches below finished grade in non-traffic areas and 30-inches below finished grade in traffic areas, including roads and parking areas. Not less than 48-inches below finished grade under public/ private transit system right of way and railroad right of way. Dimensions shall be measured to the top of the conduit.

j. Conduit crossing existing underground utilities shall cross below the bottom depth of the existing utilities. If the top portion of the existing utility depth below finish grade exceeds 72-inches and the specified separation and depths are maintained when crossing over the top of the existing underground utility, the conduit may cross above the existing underground utility.

k. Provide long radius horizontal bends (minimum radius of 36-times the conduit diameter) in underground conduits where the conduit is in excess of 100-feet long.

l. Conduits installed below grade and on grade below buildings, shall not be smaller than 0.75-inches. Conduits for circuits exceeding 600-volts shall not be smaller than 5.0- inches.

m. Underground conduits entering a building shall be sloped. The conduit direction of slope shall be away from the building, and shall prevent water in the conduit from “gravity draining” towards the building. The conduit slope “high point” shall originate from the building, out to the first exterior pullbox, manhole etc. exterior conduit termination “low point”. The minimum slope angle shall be a constant 8-inches (or greater) of fall for each 100-feet of conduit length.

n. Dewatering:

a) Provide pumping to remove, maintain and dispose of all water entering the excavation during the time the excavation is being prepared, for the conduit laying, during the laying of the conduit, and until the backfill at the conduit zone has been completed. These provisions shall apply on a continuous basis. Water shall be disposed of in a manner to prevent damage to adjacent property. Trench water shall not be drained through the construction. Groundwater shall not be allowed to rise around the pipe until joining compound has firmly set.

b) The DISTRICT’S Representative shall be notified 48 hours prior to commencement of dewatering.

6. Raceway/Conduits, which are installed at this time and left empty for future use, shall have 0.25-inch diameter polyvinyl rope left in place for future use. The pull rope shall be 500- pound minimum tensile strength. Provide a minimum of 5-feet of slack at each end of pull ropes.

7. Unless otherwise restricted by structural drawings and specifications, the maximum size conduit permitted in concrete slab on-grade, walls, ceilings and roofs constructed of masonry or concrete shall not be greater than 20% of the concrete/masonry thickness. Conduits installed in these locations shall not cross.

a. Conduits shall not be installed in cast-in-place concrete floors.

8. Provide openings in building structures for conduit penetrations:

a. New construction shall be provided with conduit sleeves, to provide conduit penetrations.

b. Existing construction shall be drilled (core drill masonry and concrete) and provide conduit sleeves installed after drilling, to provide conduit penetrations.

c. Where the structure penetrations for underground conduits penetrating through foundations will not comply with the (restriction/penetration) shown in the Contract Documents, install the conduits below and clear of the foundation lowest point.

9. Conduit bends risers and offsets:

a. The minimum bend radius of “factory or field” fabricated conduit bends shall not be less than the following. The bend radius shall be measured at the surface, inside radius of the conduit wall:

21.

a) FMC and LTFMC conduit - conduit minimum bend radius 12-times the conduit diameter.

b) RMC and EMT conduit minimum bend radius - conduit for power circuits over 100 volts and less than 600 volts, 8-times conduit diameter. Conduit for power circuits over 600 volt, 12-times conduit diameter. Conduit for low voltage, signal and fiber optic circuits, 10-times conduit diameter.

c) RNMC conduit - conduit minimum bend radius 36-times the conduit diameter.Under building reduce minimum bend radius to 10-times the conduit diameter. Conduit bends and offsets in RNMC with less than 36-times conduit diameter bend/offset radius, shall be RNMC PVC schedule 80 or PVC coated RGS.

d) Conduits for utility company conductors. Conduit minimum bend radius shall comply with the respective utility company requirements.

b. Bends and offsets in conduits shall be kept to an absolute minimum. The total summation of all bends and offsets permitted in a conduit segment, occurring between two conduit termination/ connection end points, shall not exceed the following, including conduit fittings:

a) RMC and EMT conduit - 360 angular degrees

b) FMC and LTFMC conduit - 180 angular degrees

c) RNMC conduit - 270 angular degrees

c. Each field fabricated conduit offset, bend and elbow which are not the standard product of the raceway/conduit manufacturer shall be mandrel tested. The test shall be conducted after the conduit installation is complete and prior to pulling-in any wire, in the same manner as for underground conduits.

d. Factory manufactured angle connector conduit fittings shall be installed in exposed conduit locations only. Installation in locations normally concealed from view shall not be permitted. Not more than one (1) factory manufactured angle connector shall be permitted in any length of conduit between conduit termination end points.

e. RNMC conduit risers from below grade shall be PVC coated RGS. Conduit risers, bends or offsets entering into a building shall be PVC coated RGS.

f. If three (3) or more conduit-bends of the same conduit size and same conduit material type, installed, as part of the contract work, fail to comply with the required minimum conduit bend radius or conduit angular degree limits. The following corrective actions shall occur:

a) The CONTRACTOR shall remove all the non-complying conduit bends and the respective wire in the conduit from the project site. Provide new conduit and wire, complying with the contract documents.

b) Where the conduit bends similar to the non-complying conduit bends are installed concealed in walls, floors, above ceilings or below grade, the Contractor shall expose the conduit bends to allow visual observation.

c) The CONTRACTOR shall remove the non-complying conduit bends and dispose off the project site. The CONTRACTOR shall provide new conduit bends and conductors complying with the contract documents.

d) All the costs to correct the deficient material and work along with costs to repair the direct, indirect, incidental damages and contract delays shall be the sole responsibility of the CONTRACTOR and shall be included in the bid price.

10. Expansion joint, deflection joint and seismic joint fittings.

a. Provide a conduit expansion fitting for each conduit length and conduit type as follows (Note - The installation of specified combination expansion/deflection fittings at seismic joints shall satisfy this spacing requirement also):

	Conduit Type	Conduit	Fitting Length Spacing
a)	RMC and EMT	Exposed exterior locations	200-feet
b)	RMC and EMT	Interior weather protected locations	400 feet

b. Provide a conduit combination expansion/deflection fitting for each conduit, crossing the following elements:

a) At each building or non-building structure seismic joint.

b) At each building on non-building structure expansion joint.

c) At each conduit penetration of a “sound-rated” wall, floor or ceiling.

21.

11. Provide two (2) locknuts and an insulated throat bushing at each metal conduit terminating at enclosures, including but not limited to outlet boxes, junction boxes, terminal cabinets, switchgear, transformers, switchboards, distribution panels and panelboards.

12. Provide metallic or plastic closure caps on all conduit ends during construction, until installation of conductors in the respective conduit.

13. Conduit run exposed, shall be run at right angles or parallel to the walls or structures. All changes in directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds, OZ or equal. Conduits run on exposed beams or trelliswork shall be painted to match surrounding surfaces.

14. Conduit exposed on roof:

    a. Conduits installed exposed on roofs shall be limited on the project and be approved by Architect beforehand. When approved, they shall be installed on conduit sleepers. Place the conduit sleepers a maximum 5-foot on center along the entire length of the conduit; under conduit expansion/deflection fittings; under each junction box and within 24- inches of each conduit bend.

    b. Provide a conduit support "C" channel continuous along the top length of the sleeper and rigidly bolted to the sleeper. Conduits shall be loosely fastened to each sleeper "C" channel with pipe clamps to allow for relative movement between the sleeper and conduit.

    c. Conduits shall not block or interfere with roof hatches, doors, ventilation openings, dampers, equipment access panels/doors, roof water drainage.

    d. Conduit sleepers shall be fabricated, MIFAB C-Port Rubber Support or MIRO Industries with Polycarbonate base, or equal. Sleeper length shall extend a minimum of 9-inches past the conduits attached to the sleeper, but in no case shall the length of the sleeper be less than 24- inches.

    e. Provide a pad under each sleeper, sleepers shall not be installed in direct contact with the roofing. Sleeper pads shall extend a minimum of 6 inches past each side of the sleeper. The sleeper pad shall be semirigid mineral surfaced composition board, not less than 0.375-inch thickness, bituminous impregnated, manufactured for application on the specific roofing material. Remove roofing "ballast" (gravel) under pad, prior to installation of sleeper pad. Do not puncture roof membrane.

    f. Position the "length" of the conduit sleepers' perpendicular to the roof slope, to prevent obstruction of roof drainage water flow. Where the conduit routing prevents placing the conduit sleeper parallel to the roof slope, provide two separate sleeper pads for the conduit sleeper, with a continuous 3-inches wide water drainage gap between the

    g. sleepers. Align the water drainage gap to allow unimpeded water travel along the roof slope drainage flow line between the pads.

15. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.

16. RMC conduit threads:

    a. Machine cut threads on RMC conduit required for field fabrication shall comply with NPS and ANSI-B1.20.1.

    b. The length of bare metal exposed during thread fabrication shall be completely covered by conduit couplings and fittings. Additionally, the thread length shall insure that conduit joints will reach "torque" tightness and become secure before conduit ends "butt" together and before conduit ends "butt" into the "shoulders" of other conduit fittings.

    c. Running threads or right/left handed threads shall not be used to connect RMC.

17. RNMC conduit:

    a. Joints and fittings shall be solvent welded to RNMC conduit. Joints and fittings shall be watertight and airtight after fabrication.

18. Tighten each conduit fittings and fitting appurtenance, to the "torque" (allowable tolerance 5%) value recommended by the fitting manufacturer and applicable code. If three (3) or more conduit fittings are found to not be in compliance with the manufacturer's "torque" (tightness) recommendations, the following corrective actions shall occur:

21.

a. The CONTRACTOR shall tighten “re-torque” the defective fittings and all similar conduit fittings installed as part of the contract documents in the presence of the District’s Representative.

b. If the respective conduit fittings similar to the deficient “torque tightness” fittings are installed concealed in walls, floors, above ceilings or below grade, the CONTRACTOR shall expose the fitting, to allow retightening each similar conduit fitting to the manufacturers recommended “torque” values.

c. All the cost to repair the direct, indirect, incidental damages and contract delays resulting from complying with these requirements shall be the sole responsibility of the CONTRACTOR and shall be included in the bid price.

19. Horizontal directional boring for underground conduit:

a. Provide a directional guided horizontal “bore-hole” underground conduit installation where one or more of the following conduits occur:

a) Continuous trenching excavation and backfill for conduit installation is not permitted by the contract.

b) Where continuous trenching excavation due to the existing surface and below grade conditions and restrictions, is not possible or practical to excavate a trench.

b. Provide “path-tracing” of the underground bore head, from the surface, along the entire horizontal bore length. Path tracing shall use electronic transmitters and receivers, continuously communicating the underground bore head locations and depth to the bore equipment operator. The directional boring system shall employ active tracking and directional position/steering control of the bore equipment drill head location. The active tracking system shall provide a portable receiver/transmitter unit for tracking the position of the moving drill head; a sensor “Sonde” unit on the drill head for tracking signals to the receiver /transmitter; and a drill head tracking data view display located at the boring equipment operator position to view the drill head position information sent from the portable receiver/ transmitter. As manufactured by SPX-Radiodetection Company or similar products.

c. Provide vertical pilot excavations not more than 50-feet on center along the path of the bore-hole to intercept the horizontal bore-hole routing, provide excavations at the beginning and end terminals staging points of the horizontal bore-hole.

d. Provide full-depth “shoring” of the vertical pilot excavations. Remove the shoring, backfill, compact and repair the excavations when conduit installation is complete.

e. “Drilling-fluid” shall be used during “back-reaming” and “pullback”, pumped through the drill pipe to the bore drill head.

f. Directional guided horizontal drilling shall employ equipment specifically designed and manufactured for the process. The equipment manufacturer shall train bore equipment operating personal in the proper operation of said equipment.

g. Locate the position, size, depth and identify all underground “cross-bore” existing underground utilities, pipes, structures and conflicts along the entire bore path of each underground bore, prior to initiating directional boring work. Notify respective agency for each “cross bore” potential crossing. Comply with the recommendations of the Cross Bore Safety Association (CBSA).

h. Horizontal, directionally guided boring equipment, as manufactured by Ditch Witch; Vermeer Manufacturing; or Case Corporation.

J Conduit Seals

1. Provide conduit seal fittings at each location where a conduit transitions or passes through the following areas and where indicated on the drawings:

a. Refrigerated areas.

b. Temperature control rooms including warming rooms, steam rooms, saunas etc.

c. Classified hazardous material areas.

d. Water intrusion areas.

2. Provide conduit seals on each conduit entering a building from a below grade area located outside the building (i.e., basement, vault etc.) and connecting to the following types of equipment

a. Transformers

21.

b. Panelboards

c. Motor control centers

d. Switchboards

e. Switchgear

f. Motors

g. Terminal cabinets

h. Terminal backboards

i. Cable trenches

3. Conduit seals shall be installed in locations where the fitting is visible and accessible.

K Nailing Shields

1. Provide “nail” shields where FMC conduit and conductors not installed in a conduit are installed through wood stud and wood frame construction. The nail shield shall provide a barrier resistant to “nailing” fasteners through the stud, and penetrating into the FMC and conductors.

2. The nail shields shall be flat nominal 1.5-inch x 3-inches, 14-gauge steel, and hot dip zinc galvanized with “nailing spurs”.

3. Provide nailing shields on the front face and rear face of each FMC penetration. The shield shall be centered on each penetration through the respective framing, stud framing blocking, and stud framing plates.

L Conduit Bodies

1. Conduit bodies shall be installed in exposed conduit locations only or above accessible ceilings.

2. Conduit bodies shall be accessible for removing body cover and pulling wire through the conduit body.

3. Conduit bodies shall not be installed inside enclosed walls.

M Preparation of Reuse of Existing Conduits

1. Prepare existing conduits shown to be reused as part of contract work as follows: Complete the required work prior to installing any conductors or cables in respective existing conduits.

a. “Rod” out existing raceways to be used under this contact, with approved test and flexible mandrels to remove all obstructions to clear debris from inside conduits.

b. Use test mandrels at least 12-inches long, 0.25-inches less than diameter of duct at center, tapering to 0.5-inches less than duct size at ends.

2. If test mandrels cannot be pulled through raceways, CONTRACTOR shall perform the following to clear the existing raceways:

a. Force rigid or semi-rigid rods through the raceways to clear the obstructions from one to both ends of the raceway.

b. Force a power driven rotating router device through the conduit from one or both ends of raceways. Device shall incorporate small diameter cutting blades. Repeat the “router” process in incremental stages to a cutting blade diameter approximately ⅛- inch smaller than the raceway inside diameter.

3. After clearing the raceway of obstructions, pull a test mandrel or brush through the raceway to clear the remaining debris from the raceway.

21.

3.04 WIRE AND CABLE

A Branch circuit and fixture joints for #10AWG and smaller wire shall be made with UL-approved connectors listed for 600 volts, approved for use with copper and/or aluminum wire. Connector to consist of a cone-shaped, expandable coil spring insert, insulated with a nylon shell and two (2) wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by 3M-"Scotchlok".

B Branch circuit joints of #8AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with both copper and/or aluminum wire as manufactured by Thomas & Betts. Joints shall be insulated with plastic splicing tape, tapered half-lapped and at least the thickness equivalent to 1.5-times the conductor insulation. Tapes shall be fresh and of quality equal to Scotch.

C Use UL listed pulling compound for installation of conductors in conduits.

D Correspond each circuit to the branch number indicated on the panel schedule shown on the drawings except where departures are approved by the DISTRICT'S REPRESENTATIVE or the DISTRICT'S Representative.

E All wiring, including low voltage, shall be installed in conduit.

F Control wiring to conform to the wiring diagrams shown on the mechanical drawings and the manufacturer's wiring diagrams.

G All splices in exterior pull boxes and light poles shall be cast resins encapsulated.

1. Power conductor splices - 3M Scotchcast Series 82/85/90; Plymouth or equal.
2. Control and signal circuits 3M Scotchcast series 8981 through 8986, Plymouth or equal.

H Neatly group and lace all wiring in panelboards, motor control centers and terminal cabinets with plastic ties at 3-inch on centers. Tag all spare conductors.

3.05 CHEMICAL GROUND ROD

A General

1. Install ground rod system in compliance with manufacturer's instructions.
2. Install rods vertically. Where subterranean hard rock conditions prevent vertical installation horizontal "L" shape ground rod shall be installed.
3. Where ground rod is installed in an indoors dry location set ground box flush with finish floor. Where ground rod is installed outdoors set the top of the ground box four inches above finish grade.
4. Do not remove sealing tape from ground rod holes until time of installation in ground.
5. Separate ground rods from all other grounding electrodes and from each other by not less than 12-feet horizontal distance.

B Excavation

1. Vertical installation bore a 12-inch diameter vertical hole in the ground six inches deeper than ground rod length.
2. Horizontal installations excavate a 12-inches wide trench, slope rod and trench to insure end cap of rod is 2-inches lower than the elbow.

21.

C Backfill

1. 1. Surround the entire rod with a minimum of 10 inches of bentonite clay mixed with water at six times volume to form a paste. Approximately 14-gallons for each 50-pounds of clay. Remove any excavation liners from the rod excavation area.

2. Install ground box and complete backfill.

D Connect grounding electrode conductor(s) to ground rod.

3.06 CABLE RACKS

A General

1. Provide cable racks in precast and cast-in place concrete pullboxes, manholes and cable trenches, and ensure that all cables, conduits, or conductors of line or high voltage, are neatly assembled and are a minimum of 4" from the bottom of the boxes.

3.07 TESTING

A Testing Conduit and Conduit Bends - The CONTRACTOR shall demonstrate the usability of all underground raceways, and field fabricated conduit bends installed as part of this contract.

1. A round tapered segmented semi-rigid mandrel with a diameter approximately ¼-inch smaller than the diameter of the raceway, shall be pulled through each new raceway.

2. The mandrel shall be pulled through after the raceway installation is completed. Conduits which stubout only, may have the mandrel pulled after the concrete encasement is completed, but prior to completing the backfill.

3. DISTRICT'S REPRESENTATIVE shall witness the raceway testing for usability. A Representative of the Respective Utility Company shall witness the raceway testing where applicable.

4. CONTRACTOR shall repair/replace any conduit and conduit bend provided under this contract which will not readily pass the mandrel during this test.

END OF SECTION

SECTION 26 05 43

PULLBOXES

PART 4- GENERAL

4.01 SCOPE

A Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.
2. General provisions and requirements for electrical work.

4.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A Submit product data sheets for all racks, hooks, supports, ladders, covers, grounding, manholes, vaults, pullboxes, joint sealing compound etc.

B Submit detailed shop drawings including dimensioned plans, elevations, details, structural calculations signed by a California State registered Structural ENGINEER and descriptive literature for all component parts.

PART 5- PRODUCTS

5.01 GENERAL

A Each concrete precast section shall be identified by having the manufacturer's name and address, along with respective section weight cast into an interior face or permanently attached thereto. Associated Concrete Products, Jensen Precast Products, Brooks Products or equal.

B Structure Construction

1. The precast steel reinforced concrete structure walls, floor and roof shall safely sustain the loads and pressure resulting from vertical and lateral earth loading and vehicular loading. Based on the following criteria:
   a. Minimum earth density shall be 120 lbs./cu.ft.
   b. Minimum equivalent fluid pressure for lateral pressure due to earth shall be 85 lbs./sq.ft. undrained earth conditions, minimum safety factor for buoyancy shall be 1.25.
   c. Vehicular load rating shall be H-20 in compliance with latest AASHO specifications.
   d. Design shall be based on maximum depth of fill over the structure as indicated on the drawings, but not less than 36 inches.
   e. Design and details shall comply with minimum ACI 318-63 code requirement. Minimum concrete 28 day cure strength shall be 3,000 psi.
2. Precast structure shall be designed to withstand forces due to additional inward load of 4,000 pounds (working load) with safety factor of two (2), acting perpendicular to the surface at any pulling iron.
3. Structures shall be single piece or horizontal multi-section construction as required for field installation conditions. Multi-sections shall interlock with "Tongue and groove" joint mating surfaces to insure a rigid assembly.

21.

4. All structure precast joints shall be sealed with preformed cold field applied plastic joint sealing compound. Joint sealing compound shall not leak, sag or flow at the joints with 10 psi water pressure applied for 24 hours. Chemically resistant to acid, alkali's and saturated hydrogensulfide.

5. Each precast structure section shall have suitable knockouts or openings in the vertical walls for the duct banks and conduits entering the structure. Provide a 1 inch diameter knockout in each corner of the floor slab, 6 inch from adjacent walls, for installation of ground rods.

C Intercept Manhole/Pullbox Structures

1. Intercept type manhole/pullbox structures shall comply with the requirements of non-intercept manholes and pullboxes, respectively. Plus the additional requirements listed below.

2. Manholes/pullboxes shown to be installed at the same location as replacement for existing manhole/pullbox shall be custom fabricated "intercept" multi-section type.

3. The structure shall be provided with multiple, vertical and horizontal custom fabricated sections for fitting around existing manholes/conduits/duct banks/conductors entrances into the structure during manhole installation without disturbing existing manholes/pullboxes. The structures shall allow placement of the structures without disconnecting or disrupting existing circuits during the installation. The structure walls shall be slotted to fit around existing concrete encased conduit entrances.

4. Provide cast-in-place concrete steel reinforced foundation/footings and floor for the intercept structure. The foundation shall be installed prior to removal of existing manhole/ pullbox. The floor shall be installed after removal of the existing manhole/pullbox structure. The foundation/footing and floor shall be designed, and engineered as part of precast structure.

5. The structure foundation/footings shall be "keyed" to match keying of manhole precast wall sections.

5.02 PULLBOXES

A Pullboxes shall have deep recess conduit knockout concrete extensions at two opposite end walls. Additional shallow recess knockouts shall be provided on the other two walls for conduit entrances.

B Pullboxes shall be provided with a minimum of one precast concrete 6 inch extension grade ring "tongue and groove" matting surfaces to insure rigid assembly.

C Pullbox sizes shall be as indicated ori drawings but in no case less than required by applicable codes. Minimum depth of the pullbox shall not be less than 42 inch.

D The pullbox floor sump shall extend through the concrete floor into the gravel bedding, below the pullbox.

5.03 COVERS AND FRAME ASSEMBLIES

A Traffic rated per AASHO for H20 loading.

B Pullboxes

1. Hot dip galvanized steel single piece flush fitting with threaded flush hold down, slotted head, stainless steel studs.

2. Topping frame shall be hot dip galvanized steel angle frame where the pullbox is installed in paving or concrete work.

3. Top ring frame shall be armor band type where the pull box is installed in exposed earth or landscaping.

4. Cover openings larger than eight (8) square feet of surface area, shall be provided with "split" two (2) piece cover type. Each "split" cover shall be hinged open-close with Torsion- Spring type cover, to assist in the ease of opening and closing the cover.

5. Cover openings eight (8) square feet or smaller surface area shall be single piece covers.

C Covers shall be permanently marked in the cover metal as follows:

21.

1. "E" or "Electric" for covers on structures containing power circuits under 600 volts and "HV" or "High voltage" for covers on structures containing power circuits over 600 volts.

2. "Signal" for covers containing signal circuits.

5.04 CABLE RACKS

A Cable racks, installed on the vertical walls of the structure, including hooks and porcelain insulator cable cradles, shall be sufficient to accommodate the cables and splices.

B Vertical racks shall be installed on all walls of the structure a minimum of 24-inches on center within 6-inches of floor and top of wall. A rack shall be installed within 18-inches of each corner of each wall. Additional racks spaced equally on each wall shall be installed, spacing between vertical wall racks shall not exceed 24 inches.

1. Wall racks shall be slotted to accept removable hooks and lock hooks into place.

2. Non-metallic, 50 percent (minimum) glass reinforced nylon or non-metallic material of the same characteristics.

3. The installed cable racks, cable support hooks with arms and wall anchor bolts shall support the following minimum loads for each hook/arm, with a 2000 percent minimum safety factor. Based on multiple hook/arms located not less than 9-inches on center along the entire vertical length of the support rack:

Hook/Arm Length a.	Minimum Weight Each Hook/Arm Supported	Maximum Allowable Hook/Arm Deflection
a . 8-inch	450 pounds	0.25-inch
b. 14-inch	350 pounds	0.37-inch
c. 20-inch	250 pounds	0.37-inch

(Based on load, concentrated 1-inch from the end of each hook/arm.

4. Racks shall be bolted to the precast and cast-in place structure walls, within 3-inches of each rack end and not less than 9-inches on center. Provide cast-in place or after set drilled expansion concrete anchors.

5.05 PULL-IN-IRONS

A Pull-in-irons shall be a galvanized steel bar bent in a "U" shape, and cast in the structure walls and floors.

B A floor pull-in-iron shall be centered under the manhole entry ring in the structure floor.

C Pull-in-irons shall not be less than 6 inches above or below, in the opposite wall from each knockout panel for conduiUduct entrances.

D Pull-in-irons shall project from the structure wall into the structure approximately four inches.

5.06 DRAINAGE SUMPS

A Provide drainage sump with cast iron metal grate in the floor of each structure. Minimum diameter of 12-inches by 4-inches deep. Provide a removable cast iron grate over the sump.

PART 6- EXECUTION

6.01 EXCAVATION

A Excavate for installation of precast structures removes excess excavated material from the site. Saw cut existing paving and concrete as required for excavation.

B Provide a minimum of 6-inches deep bedding base of crushed rock 3/8-inch - Y:!-inch size in the bottom of the excavation. Bedding shall be level and well compacted by a minimum of four passes with a plate type mechanical vibrator.

C Back fills and compact earth around precast structure after installation of the structure to 90- percent minimum compaction in 12-inch lifts. Replace paving concrete, landscaping above structure to match existing.

6.02 INSTALLATION

A Install precast structures per manufacturer recommendations to provide a dry watertight installation. Set cover flush with existing grade or finish surface. Where precast structure is installed in pedestrian walkway or vehicular traffic way with a sloping finish grade. Slope cover to match existing finish surface slope.

B Install structures to avoid surface water drainage flow lines, and existing utilities.

C Exterior concrete walls tops and bases of precast structure shall be damp-proofed with two coats of a bituminous damp-proofing material, minimum finish thickness 4-mil.

D Connections to Precast Structure

1. Lines connecting to precast structures shall be constructed to have a cast in place concrete tapered section adjacent to the structure and extending a minimum of 48 inch out from the structure to provide shear strength.

2. Precast structure shall be constructed to provide for keying the concrete envelope of the conduiUduct line into the wall of the structure. Mechanical vibrators shall be used when this portion of the envelope is poured to assure a seal between the envelope and the wall of the precast structure.

E Entrances of conduits/ducts shall terminate with endbells inside the precast structure. Slope conduit entrances into manhole to insure top of conduit entrances into manhole are a minimum of 6-inches below manhole ceiling. Maximum conduit slope shall not exceed 1-inch per "running" foot of conduit.

F Manholes and pullboxes shown to intercept existing conduit, remove portion of existing conduit approximately 4-feet back from manhole wall, regrade and excavate conduit entrance and extend existing conduit into manhole or

pullbox to match existing conduit quantity and size. Provide "horizontal, split" conduit and split conduit coupling to extend existing conduit into manholes and pullboxes.

6.03 GROUNDING

A Provide 10-feet long by 0.75-inch diameter copper clad, steel, driven ground rods through the floor of the precast structure. Provide a minimum of two ground rods in opposite corners in manholes and vaults, one ground rod in pullboxes. Ground rod shall extend 6-inches above the floor line. Where rock bottom is encountered, bury ground rod in horizontal trench with projection into precast structure. Seal off openings around ground rods.

B Ground permanently and effectively together all metal equipment cases, metallic, cable racks, ladders, etc., with #4 bare copper bonding conductor. Provide U.L. compression bonding fittings at each ground connection.

END OF SECTION

EXECUTION

PART 7- EXECUTION

7.01 USE OF PREMISES

A CONTRACTOR shall coordinate Work of all trades, Subcontractors, utility service providers, with OWNER and/or Separate Work Contract. CONTRACTOR shall sequence, coordinate, and perform the Work to impose minimum hardship on the operation and use of the existing facilities and/or Project site. CONTRACTOR shall install all necessary protection for existing improvements, Project site, property, and new Work against dust, dirt, weather, damage, vandalism, and maintain and relocate all protection to accommodate progression of the Work.

B CONTRACTOR shall confine entrance and exiting to the Project site and/or facilities to routes designated by the DISTRICT

C Within existing facilities, OWNER will remove portable equipment, furniture, and supplies from Work areas prior to the start of Work. CONTRACTOR shall cover and protect remaining items in areas of the Work

D CONTRACTOR is advised school may be in session during performance of the Work. CONTRACTOR shall utilize all available means to prevent generation of unnecessary noise and maintain noise levels to a minimum. When required by the DISTRICT, CONTRACTOR shall immediately discontinue noise-generating activities and/or provide alternative methods to minimize noise generation. CONTRACTOR shall install and maintain air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with mufflers, including unloading cycle of compressors. CONTRACTOR shall discontinue operation of equipment producing objectionable noise as required by the DISTRICT.

E CONTRACTOR shall furnish, install, and maintain adequate supports, shoring, and bracing to preserve structural integrity and prevent collapse of existing improvements and/or Work modified and/or altered as part of the Work.

F CONTRACTOR shall secure building entrances, exits, and Work areas with locking devices as required by the DISTRICT.

G CONTRACTOR assumes custody and control of OWNER property, both fixed and portable, remaining in existing facilities vacated during the Work.

H CONTRACTOR shall cover and protect surfaces of rooms and spaces in existing facilities turned over for the Work, including OWNER property remaining within as required to prevent soiling or damage from dust, dirt, water, and/or fumes. CONTRACTOR shall protect areas adjacent to the Work in a similar manner. Prior to OWNER occupancy, CONTRACTOR shall clean all surfaces including OWNER property.

I CONTRACTOR shall not use or allow anyone other than OWNER employees to use facility telephones and/or other equipment, except in an emergency. CONTRACTOR shall reimburse OWNER for telephone toll charges originating from the facility except those arising from emergencies or use by OWNER employees.

J CONTRACTOR shall protect all surfaces, coverings, materials, and finished Work from damage. Mobile equipment shall be provided with pneumatic tires.

K CONTRACTOR is advised OWNER will award Separate Work Contracts at this Project site.

L CONTRACTOR shall not permit the use of portable and/or fixed radio's or other types of sound producing devices including walk mans and similar devices.

7.02 PROPERTY INVENTORY

A Property, OWNER intends to remove; will be removed by OWNER before a room or space is vacated for the Work. Before performing Work in each room or space, DISTRICT and CONTRACTOR shall prepare a detailed initial written inventory of OWNER property remaining within, including equipment and telephone instruments and the condition thereof. DISTRICT and CONTRACTOR shall retain a signed copy of the inventory dated and signed by both parties. Prior to subsequent OWNER occupancy of each such room or space, DISTRICT and CONTRACTOR shall perform a final inventory of OWNER property and all discrepancies between the initial inventory and final inventory shall be the responsibility of CONTRACTOR.

7.03 FURNITURE, FIXTURES AND EQUIPMENT (MATERIALS) OWNER FURNISHED CONTRACTOR INSTALLED (OFCI)

A Certain materials identified in the Contract Documents as OWNER Furnished CONTRACTOR Installed, OFCI, will be delivered to the Project site by the OWNER.

B If designated in the Contract Documents to be OWNER furnished CONTRACTOR installed, (OFCI), and CONTRACTOR shall unload, store, uncrate, assemble, install, and connect OWNER supplied materials.

C Forty Eight (48) hours before the date the CONTRACTOR needs to have the OFCI materials on site, CONTRACTOR shall notify OWNER of the scheduled date for needed OFCI materials. Upon delivery to Project site, CONTRACTOR shall store OFCI materials inside rooms and/or protected spaces and will be responsible for security of OFCI materials until Substantial Completion. DISTRICT will sign receipt or bill of lading as applicable.

D CONTRACTOR shall, within one (1) day after delivery, uncrate and/or unpack OFCI materials in presence of OWNER who shall inspect delivered items. OWNER shall prepare an inspection report listing damaged or missing parts and accessories. OWNER shall transmit one (1) copy of the report to CONTRACTOR. OWNER will procure and/or replace missing and or damaged OFCI materials, as indicated in inspection report.

E CONTRACTOR shall install OFCI materials in the locations and orientation as indicated in the Contract Documents. CONTRACTOR shall verify exact locations with DISTRICT before final installation of OFCI materials.

F If required, DISTRICT will furnish setting and or placement drawings for OFCI materials.

G CONTRACTOR shall install OFCI materials by proper means and methods to ensure an installation as recommended by the manufacturer. CONTRACTOR shall furnish and install all necessary fasteners and required blocking to properly install OFCI materials.

H CONTRACTOR shall install OFCI materials with manufacturer recommended fasteners for the type of construction to which the OFCI materials are being fastened and/or anchored.

I CONTRACTOR shall provide final connections of any electrical, signal, gas, water, waste, venting and/or similar items to OFCI materials. CONTRACTOR shall, prior to final connection, verify the operating characteristics of OFCI materials are consistent with the designated supply.

J General: All such work indicated in Contract Documents and/or specified herein.

K Coordination:

1. Contractor shall schedule and coordinate Owner work with his work; give 5 days min. advance notice of all dates; verify that Owner work has been accomplished prior to beginning his work

L Owner Furnished Items or Products (IF ANY):

1. Owner Responsibilities:
    a. Delivery of items or products to site.
    b. Schedule delivery date with supplier in accord with Contractor's schedule.
    c. Obtain installation drawings and instructions.
    d. Submit claims for transportation damages.
    e. Arrange guarantees, warranties.
2. Contractor's Responsibilities:
    a. Schedule required delivery date for each product, and inform Owner.
    b. Promptly inspect delivered products, report damaged or defective items.
    c. Unload; handle at site, including uncrating and storage.
    d. Protect from exposure to elements, from damage.
    e. Repair or replace items damaged as result of Contractor's operations.
    f. Install, connect, finish products.

M The Contractor shall provide adequate storage within his fenced staging area, to store the equipment. The Contractor is solely responsible for the storage of this equipment within his staging area and all subsequent movement of this equipment. The Contractor shall be solely responsible for the maintenance and protection of all material.

N Bidders submitting under this Contract shall include the price for all necessary coordination with the District and the equipment manufacturer, as required for proper and complete coordination between all trades and all Contractors, within their bid.

7.04 WORK BY OTHERS

A The District reserves the right to do other work in connection with the project or adjacent thereto by contract or otherwise, and Contractor shall at all times conduct the work so as to impose no hardship on District or others engaged in District's work nor to cause any unreasonably delay or hindrance thereto.

B Where two or more Contractors are employed on related or adjacent work, each shall conduct their operation in such a manner as not to cause delay or additional expense to the other.

C Contractor shall be responsible to others engaged in the related or adjacent work for all damage to work, to persons, or for loss by failure to finish the work within the specified time for completion. Contractor shall coordinate his work with the work of others so that no discrepancies shall result in the project.

PART 8- GENERAL NOTES

8.01 GENERAL NOTES

A Work areas and detailed scope of work are shown under PART 2.01.

B It is the responsibility of the contractor to examine the site of the work and after investigation to decide for himself the character of materials, equipment and utilities to be encountered and all other conditions affecting the work. It is also his responsibility to provide sufficient costs to cover the provisions of all items of work under the existing conditions referred to herein.

C CONTRACTOR is responsible to review the AHERA – Inspection reports for any presence of asbestos containing materials (ACM). CONTRACTOR shall immediately notify OWNER of the presence or suspected presence of any ACM found during the course of the work, prior to the disturbance of the subject materials. At the sole direction of the OWNER, contractor may be required to stop all work on all or any portion of the project until ACM materials are properly abated by OWNER.

D All work areas have available access. The Contractor will be issued keys for the sites through the District Facilities and Support Operations Department to allow access at the sites. Contractor will ensure they secure all areas that are accessed by their personnel to ensure the security of the site.

E Contractor shall provide trash bins and storage facilities for use at the site. The contractor shall not use school facilities for these purposes. It will be the contractor's responsibility to maintain and keep those facilities neat and clean at all times.

F There may be other contractors or District workers working at the job site. Contractor will be responsible to coordinate his work with their schedules.

G The Representative will have the right to stop the work immediately in case he sees a discrepancy or work not following the specifications. The contractor will not be let to continue to work until corrections are made and approval and permission given by the District Representative.

8.02 RESTRICTIONS

A Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the work areas in which the work is indicated. Allow for Owner occupancy and use by the public.

B Use of the Existing Buildings: Repair damages caused by construction operations. Take all precautions necessary to protect the existing buildings and their occupants during the construction period.

C Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, other contractors working, and emergency vehicles at all times.

D Full Owner Occupancy: The Owner may occupy the site and existing buildings during the entire construction period. Cooperate with the owner during construction operations to minimize conflicts and facilitate owner usage. Perform the work so as not to interfere with the Owner's operations.

8.03 PERMISSIBLE WORKING DAYS AND HOURS

A Work may be conducted as follows:

B This school is on a traditional school year calendar, August through June. During the period of this contract, school events and educational requirements will limit or prevent access, and will affect Contractor work hours for a portion or all of the school building (s) pertinent to the contract. Contractor shall maintain schedule with full knowledge of these times and dates to be determined. A site-specific calendar will include currently known dates of limited access, or times of the school day that noise will have to be limited, or ceased. These shall include during the time of the project, but not be limited to:

1. No work after 6:00 p.m. on six (6) weekday evenings for back-to-school, open house, and other events per school year at each school site.
2. No work between 8:00 a.m. and 10:00 a.m. on five (5) student attendance weekdays for assembly events per school year.
3. NO NOISE/WORK will be allowed on an Elementary school site between 8:00 a.m. and 12:30 p.m. on twelve (12) student attendance weekdays for testing (four (4) consecutive weekdays, three times) per school year. Second shift work may be accommodated with the request pre-approved by the District Project Manager.
4. NO NOISE/WORK will be allowed on a Middle School or High School site between 8:00 a.m. and 1:30 p.m. on twenty (20) student attendance weekdays for testing (four (4) consecutive weekdays during the first semester; sixteen (16) consecutive weekdays during the second semester) per school year. Second shift work may be accommodated with the request pre-approved by the District Project Manager.

C It shall be noted that there are students in the Early and Extended Education Learning Program in attendance on the Elementary school sites from 6:00 a.m. through 6:00 p.m. on a daily basis throughout the school year, and on each day that Classified Staff are assigned working hours (see specific EEELP calendar for each site, per each school year).

1.

D Work hours for the Project shall be from 7:00 a.m. until 10:00 p.m. Monday through Saturday, unless advance permission to deviate from these hours is obtained from the City of Glendale per Glendale Municipal Code, Title 8, Chapter 36, and this request is also approved in writing five working days beforehand by the District Project Manager.

E E. Subject to local ordinances, CONTRACTOR may work any hours on Saturdays, Sundays, and any non-school session days, when written notification to the District has been submitted and the anticipated schedule of work has been approved.

SECTION 01 74 10

CLEANING

PART 9- GENERAL

9.01 SECTION INCLUDES:

A Maintain premises and adjacent public and private properties free from accumulations of waste, debris, and rubbish, caused by operations during the project.

B At completion of Work, remove waste materials rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces; leave project clean and ready for occupancy.

9.02 PRODUCTS

A MATERIALS:

1. Use only cleaning materials recommended by the manufacturer of surface to be cleaned.
2. Use cleaning materials only on proper surfaces recommended by the manufacturer.

9.03 EXECUTION

A DURING CONSTRUCTION:

1. Execute daily cleaning plans from each trade to ensure that buildings, grounds, and public and private properties are maintained free from accumulations of waste materials, rubbish and trash on a daily basis.
2. Wet down dry materials and rubbish to prevent blowing dust and debris on and from the construction work.
3. Daily, during progress of work, clean construction site and utilized public properties, and dispose of waste materials, debris and rubbish.
4. Provide on-site steel dump containers and appropriately sized trash containers for collection of waste materials, debris and rubbish. DO NOT USE SITE CONTAINERS.
5. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off the District's property.
6. Vacuum clean and wet wipe interior building walls, floors, doors, windows, and hardware in preparation for and when ready to receive finish preparation and painting. Continue vacuum cleaning on an as-needed basis until building is ready final inspection by the Architect, Inspector, and Project Manager and determined to be ready for substantial completion and occupancy.
7. Handle materials in a controlled manner to minimize any unnecessary waste or debris emanating from the construction areas. Do not drop or throw materials from heights: rather, a closed chute shall be used, to minimize unnecessary dust, waste or debris from the construction area.
    a. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not migrate into new equipment or furniture, or onto wet, newly painted, or finished surfaces.

B FINAL CLEANING:

1. Employ experienced workmen, or professional cleaners, for final cleaning.
2. Exterior: Clean surfaces of the construction and site including, but not limited to, fixtures, walls, soffits, floors, hardware, roofs, window and opening ledges and sills, horizontal projections, steps and platforms, walkways, rails and all like surfaces, and adjoining private and public property to the extent soiled by the Contractor's operations.

3. Interior: Leave all horizontal and vertical surfaces in vacuum cleaned, wet-wiped condition with all dust, dirt, stains, hand marks, paint spots, droppings, and other blemishes and defects completely removed, and conform to the following requirements:

   a. Hard Floors: Freshly administer specified product sealants, and Wet mop/wash and dry, concrete, Portland cement flooring, tile, elastomeric, epoxy, refinished and colored concrete, and similar hard floor surfaces free of dust, streaks or stains.

   b. Resilient Flooring: Freshly wax and buff as specified in Section 09 65 00.

   c. Wood Flooring: Remove defects and blemishes by sanding surface and painting according to Section 09 90 00.

   d. Resilient Bases: Clean off adhesive smears and wipe clean with wet-wipe methods.

   e. Unpainted and Painted Surfaces: Clean of dust, lint, streaks or stains, utilizing wet-wipe methods as necessary.

   f. Tile Walls: Clean and polish per manufacturer's specifications.

   g. Hardware and Metal Surfaces: Clean and polish all exposed surfaces using non-corrosive and nonabrasive materials.

   h. Glass: Wash and polish both sides, and leave free of dirt, spots, streaks, and labels. Clean and polish mirrors.

   i. Ceilings: Clean and free of stains, hand marks, and defacing.

   j. Replace air conditioning filters as specified in Mechanical Specifications.

   k. Clean ducts, blowers and coils, if air conditioning units are found to have been operated without filters during construction, and after final inspection.

   l. Lighting fixtures: Replace lamps and clean fixtures and lenses if fixtures or lamps are dirty or have smudges or dust.

   m. Fixtures and Equipment: Clean and polish mechanical and electrical fixtures and like items. Leave lighting fixtures free of dust, dirt, stains or waste material. Clean and service equipment and machinery, leaving ready for use.

   n. Surfaces Not Mentioned: Clean according to the intent of this Section and as required for Architect's approval.

4. Contaminated Earth: Final clean-up operation includes the removal and disposal of earth that is contaminated or unsuitable for support of plant life in planting areas, and filling the resulting excavations with suitable soil as directed and approved by the Architect, Inspector, and/or Project Manager.

5. Contaminated areas include those used for disposal of waste concrete, mortar, plaster, masonry, paints, and similar materials, and areas in which washing out of concrete and plaster mixers or washing of tools and like cleaning operations have been performed, and all areas and adjacent areas that have been oiled, paved, or chemically treated.

6. Do not dispose of waste, oil, solvents, paints, solutions, or like penetrating material by depositing or burying on School property; dispose of such material in a lawful manner.

END OF SECTION

PART 1- Electric Gate opener and Accessories

1. Doorking

- Solid state motor control - no relay contacts to wear out or burn
- Adjustable speed motor drive, and slow-start / slow-stop
- Direct drive limit switches for precise gate control, and easy adjustment

Main Tabs

Overview

DoorKing's Maximum Security operators are designed to operate vehicular slide gates in limited (Class III) and restricted (Class IV) applications only. These operators should never be used in applications serving the general public. These operators are designed so that they can easily be mounted in the front, center or rear of the gate without any costly and time consuming field modifications. Center mounting the operator requires the pedestal mounting base (optional on 9210, 9220). The speed control on these operators (except 9210) allows the user to set the speed of the gate from 1/2 to 2 feet/sec., and provides slow-start and slow-stop functions as well.

Specifications:

9210

- Maximum gate length 100-feet.
- Maximum gate weight 3000 Lb., #60 chain*. (*Assumes gate is on level ground, in good condition with properly adjusted hardware. Other external factors may affect the performance of the gate operator.)
- Set speed 1 Ft./sec.
- 40:1 gear reduction running in a continuous oil bath.
- 1 HP continuous-duty motor.
- 115, 208, 230 VAC single-phase, 208, 230, 460 VAC three-phase.
- Operator is shipped with chain brackets and 20-feet of #60 chain.

- Class III and IV applications only.
- ETL Listed. **(Note: To be compliant with UL 325 and industry safety guidelines, a secondary entrapment prevention device(s) is required to be installed with this gate operator.** Your professional DKS system installer can provide you with more details on these devices and on current industry safety standards.)
- Dimensions: 20 "W x 35.5"H x 18"D

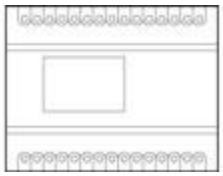
- Prevent gates from closing on vehicles

Main Tabs

DKS Single & Two-Channel Loop Detectors

- Model 9411-010 DKS Single Channel Loop Detector with Auxiliary Relay (use with barrier operators to help prevent arm from lowering on personnel)
- Model 9410-010 DKS Single Channel Loop Detector
- Model 9409-010 DKS Two Channel Loop Detector
- These are plug-in detectors - use with DKS gate operators only

2600-795 Time Clock - 365 Day



- 7-Day and 24 hour programming features
- 24 Volt AC input power
- Holiday programming
- Automatic leap-year adjustment through 2095
- Daylight savings time
- 24 Volt AC input power

-
- 1504-120

Model 1504-120

- Wiegand keypad plus built in intercom substation that can be connected to an existing intercom master station

    - With automobile manufacturers building code copiers directly into todays cars, it's easy for a supposedly "secure" RF transmitter code to get into the wrong hands. And, how many car owners remember to delete their code when they sell or trade-in their car? This is the equivalent to leaving a copy of your front door key on the keyring when you hand the keys over to the new owner. This can't happen with MicroPLUS RF controls. MicroPLUS RF controls provide you with the highest level of security available with RF access controls. Our coding and encryption schemes are not shared with other producers, resulting in transmitter codes that cannot be duplicated or copied. With MicroPLUS controls, you are assured that only the original intended transmitter will activate your access system.
    -
    - MicroPLUS controls are not compatible with the Homelink® system found in many automobiles. Use our MicroCLIK product line (less secure) for compatability with the Homelink system.
    -
    - **Model 8040 Receiver**
    - The 8040 sends the transmitter codes to a access controller (such as a DKS 1830 Series System) in wiegand format. This receiver can also be programmed as a stand-alone device. It is also ideal for solar-powered applications as it has an extremely low power draw while in stand-by mode.

8040 receiver