SECTION 16000

ELECTRICAL WORK, GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Requirements of Division 1, General Conditions and Supplementary Conditions apply to Work of this Section as if fully repeated herein.

B. The Requirements of this Section apply to all Work of Division 16.

1.02 WORK INCLUDED

A. Provide all electrical equipment and systems as shown on the Drawings and described in this Division of the Specifications to provide a complete and working installation. This work includes but not limited to: all materials and labor required for a complete installation of electrical systems. The Contract Documents do not undertake to show or specify every item to be provided. When an item not shown or specified is necessary for proper operation of equipment shown or specified, provide the item, which will allow the system to function properly, at no increase in Contract Price.

B. Make electrical connections for equipment furnished as part of Work of other Sections.

1. Wherever term "electrical connections" is used, it shall be taken to include all operations and materials associated with completing electrical connection starting with pulled-in wire or cable including, but not limited to, the following:

a. Stripping of jacket(s).

b. Checking for continuity.

c. Meggering.

d. Tracing or wire and cables.

e. Fanning.

f. Measuring and cutting to final termination lengths.

g. Permanent identification of conductors in manner specified.

h. Stripping of insulation.

i. Installation of lugs, connectors or terminals.

j. Fastening wire or cable to designated terminal point, motor leads, or other designated points.

k. Taping as required.

l. Installing wire markers.

1.03 DEFINITIONS

A. "Listed": Equipment is "listed" if it is of a kind which is mentioned in a list which:

1. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.

2. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specific manner.

B. "Labeled": Equipment is labeled if:

1. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.

2. The laboratory makes periodic inspection of the production of such equipment.

3. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specific manner.

C. "Certified": Equipment is "certified" if:

1. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specific manner.

2. Production periodically inspected by a nationally recognized testing laboratory.

3. It bears a label, tag or other record of certification.

D. "Nationally Recognized Testing Laboratory": A testing laboratory which is approved, in accordance with OSHA regulation, by the Secretary of Labor.

E. "The Contractor": Refers to the prime contractors.

F. "The Architect": Refers to the Professional Architect.

G. "The Owner": Refers to the legally registered owner of the project or their authorized representative.

H. "The Engineer": Refers to the Professional Electrical Engineer.

I. "Provide": Construed to mean furnish (supply), install and connect complete and ready for safe and regular operation of particular work referred to unless otherwise noted.

J. "Furnish": Construed to mean purchase, procure, acquire and deliver complete with related accessories to project site.

K. "Install": Construed to mean to physically erect and mount the item(s) complete with related accessories in-place.

L. "Connect": Construed to mean make final electrical connections for a complete operating piece of equipment with related accessories.

M. "As directed": As told by the Owner or their authorized representative in written directives.

N. "Work": Labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.

O. "Wiring": Raceway, fittings, wire, boxes and related items.

P. "Concealed": Embedded in or below masonry or other construction, installed in furred spaces, within partitions, above suspended ceilings, in trenches, or in enclosures.

Q. "Exposed": Not installed underground or "concealed" as defined above.

R. "Indicated", "shown" or "noted": As indicated, shown or noted on drawings or specifications.

S. "Utility Companies": Construed to mean either the electric utility or the telephone utility company or the cable television utility company.

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. All work and materials shall be in full accordance with the latest rules, codes, and/or regulations as follows: California Building Code (CBC); California Electrical Code (CEC); NFPA Bulletins; Utility Company Rules and Regulations; and all other application regulatory documents.

2. Nothing in the Contract Documents shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.

3. When the Contract Documents exceed requirements of applicable laws, ordinances, rules or regulations, Contract Documents shall take precedence.

4. It is not the intent of the Contract Documents to repeat requirements of Codes except where necessary for completeness or clarity.

B. Reference Standards:

1. All materials and equipment shall comply with all applicable standards and requirements of the following:

a.	ADA	Americans with Disabilities Act
b.	ANSI	American National Standards Institute.
c.	CEC	California Electrical Code, 2001.
d.	CCR	California Code of Regulations, Title 8 and Title 17 Public Health.
e.	CAL/OSHA	State of California Low-Voltage Electrical Safety Orders.
f.	CPUC Order 128.	California Public Utilities Commission, General
g.	EIA	Electronic Industries Association.
h.	ETL	Electrical Testing Laboratories.
i.	FS	Federal Specifications.

j.	IEEE	Institute of Electrical and Electronic Engineers.
k.	ICEA	Institute of Power Cable Engineers Association.
l.	NIST	National Institute of Standards and Technology.
m.	NESC	National Electrical Safety Code (ANSI-C2)
n.	NEMA	National Electrical Manufacturers' Association.
o.	NFPA	National Fire Protection Association.
p.	SFM	California State Fire Marshal.
q.	CBC	California Building Code, 2001.
r.	CMC	California Mechanical code, 2001.
s.	UL	Underwriter's Laboratories, Inc.
t.	WUESSC	Western Utilities Electric Service Standardization Committee.

u. Codes and regulations noted in other SECTIONS in DIVISION 16.

v. Applicable State and Local Codes and Ordinances.

2. If any of the requirements of the above are in conflict with one another, or with the requirements of these specifications, the most stringent requirement shall govern.

1.05 FEES, PERMITS AND UTILITY SERVICES

A. Obtain all permits and licenses required and pay all fees incidental to construction.

B. All required utility fees and extension charges shall be determined and itemized for payment by the owner as required. A complete itemized list of these fees and charges shall be provided with the bid including the amounts to be paid where these amounts can be determined prior to the bid.

C. Inspections required by Utilities, prevailing Local Authorities, and/or existing local ordinances, shall be coordinated and scheduled by the contractor only after prior written approval from the Owner and Architect of Record is received. Provide the Architect with a schedule of inspections, where applicable, and submit all certificates of inspections to the Architect.

D. The Contractor shall cooperate with the Architect and shall provide assistance at all times for the inspection of the electrical work. Remove covers, operate equipment, or perform any reasonable work that, in the opinion of the Architect, will be necessary to determine the quality or adequacy of the work. Work shall not be closed in or covered before inspection and approval by the Architect. Cost of uncovering and making repairs where uninspected work has been closed in shall be borne by the Contractor. If any material does not conform with these specifications the Contractor shall, within three days after being notified by the Architect, remove the materials from the premises.

E. Obtain and pay for permits and service charges required in installation of Work.

1.06 SUBMITTALS

A. General:

1. Submit shop drawings and supplemental data for all materials and equipment specified in all Sections of this Division, in accordance with the requirements of Division 1 (section on submittals), and as specified hereinafter.

   a. Product data submittals shall include catalog product cut sheets, equipment size and weight, rough-in dimensions and templates, manufacturer's installation instructions, wiring diagrams, size and weights have materials proposed for the project identified. Catalog cuts containing unidentified materials or superfluous information will not be accepted.

2. All submittals shall be reviewed by the Contractor and stamped with his approval prior to submittal to the Architect. Contractor shall indicate in writing any deviation in submittals from requirement of Contract Documents.

3. Forward all submittals to the Architect, together, at one (1) time. Individual or incomplete submittals will not be acceptable. Organize submittals in binders, in the same sequence as they appear in Specification Sections, article or paragraphs. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. The words "as specified" will not be sufficient identification.

4. The contractor is responsible for submitting in a timely manner to allow for proper review and so that material can be order early enough to meet the construction schedule. If material is not ordered in time for whatever reason, the contractor is responsible to pay premium prices and special handling charges as are required to meet the construction schedule. No substitution of an "approved" item will be allowed due to failure to plan for adequate material procurement lead time.

5. Identify each submittal item by reference to Specification Section paragraph in which the item is specified, or Drawing and Detail number.

6. As a minimum, submittals are required for the following items:

   a. Raceway and fitting

   b. Conductors, wire and cables

   c. Wiring devices

   d. Panelboards

   e. Switchboards

   f. Pullboxes and ground boxes

   g. Safety switches, disconnect switches and circuit breakers

   h. Utility metering equipment

   i. Transformers

j. Lighting system (Lighting fixtures, lamps, ballast, poles and controls)

k. Fire alarm system (Complete including but not limited to; devices and wiring)

l. Professional sound system (Complete)

7. Wherever catalog numbers and specific brands or trade names, not preceded by the designation "equal to", or followed by the designations "or equal", "or accepted equal", or "or approved equal", are mentioned in these Specifications or Drawings, no substitutions will be accepted.

8. All catalog numbers and specific brand names indicated in these Specifications or Drawings shall be subject to a substitution request on an "equal to" basis. All substitutions shall meet all of the quality and performance requirements of that specified and all substitutions shall be approved by the Electrical Engineer and the Architect.

9. Review of submittals will be for general conformance with the design concept and general compliance with the information given in the Construction Documents. Review does not relieve the Contractor from responsibility for coordinating work with other trades

B. Shop Drawings:

1. Shop Drawings shall show physical arrangement, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and weight. Reuse of the Contract Drawings as Shop Drawings will not be acceptable.

a. Specifically show, by drawn detail or note, that equipment complies with each specified requirements of the Contract Documents.

b. Drawings shall be to scale and dimensioned (except wiring diagrams need not be to scale), and may be prepared by a vendor but shall be submitted as instruments of Contractor, thoroughly checked and stamped by Contractor before submission to Architect for review.

c. Catalog cuts and published material may be included to supplement scale drawings.

2. Internal wiring diagrams of equipment shall show wiring as actually furnished for this project, with all optional items clearly identified as included or excluded. Clearly identify external wiring connections. Identify and obliterate superfluous material.

3. External system wiring diagrams shall show wiring as actually installed, connected and identified for this project. Include identification of cables, cable conductors, terminals in terminal cabinets, and connections to the identified external wiring connection points on equipment. Prepare Drawings on twenty-two inches (22") by thirty-four inches (34") tracing sheets bearing title block of equipment manufacturer, manufacturer's local engineering distributor, or Contractor, prepared to accepted drafting standards and bearing Contractor's approved stamp.

4. Acceptance of a substitute is not to be considered a release from the Specifications. Correct any deficiencies in an item, even though approved, at Contractor's expense.

5. Be response for installation of approved substitution. Make any changes required for installation of approved substituted equipment at no increase in Contract Sum.

6. Provide design and details of anchorages and/or restraints conforming to 2001 California Building Code.

C. Substitutions:

1. Requests for changes in products, materials, equipment, and methods of construction required by the Construction Documents, proposed by the Contractor after award of the Contract, is considered request for "substitutions". Contractor shall submit a Substitution Request Form for all substitution requests in accordance with Division 1.

2. All catalog numbers and specific brand names indicated in these Specifications or Drawings shall be subject to a substitution request on an "equal to" basis. All substitutions shall meet all of the quality and performance requirements of that specified and all substitutions shall be approved by the Electrical Engineer and the Architect.

3. Only one substitution will be considered for any item. Substitute materials must be equal in quality and function to that specified. Allowance of substitution does not permit any reduction of system performance or utility, and contractor is responsible for additional cost incurred because of additional work and or charges required to incorporate the proposed substituted item into the project. If the proposed substitute item is "rejected", the specified item shall be provided. (Re-submittal is required).

4. Acceptance of a substitute is not to be considered a release from the Specifications. Correct any deficiencies in an item, even though approved, at Contractor's expense.

D. Operating and Maintenance Instructions and Materials:

1. Subsequent to final completion and testing operations, part of the Work of this Division shall be responsible for instructing the Owner's authorized representatives in operation, adjustment and maintenance of electrical plant. Submit three (3) copies of certificate, signed by Owner's representatives, attesting to their having been instructed.

2. Before Owner's personnel assume operation of systems, submit three (3) bound sets of Operating and Maintenance Instructions, Manuals, and Parts Lists on the electrical plant and its component parts, including all major equipment and that which requires or for which manufacturer recommends, maintenance in a specified manner. Provide names, addresses and telephone numbers of source of supply for parts.

1.07 ELECTRONIC MEDIA

A. Computer aided design (CAD) working copy shall be available to Contractor for preparation of shop or record drawing submittals. Each CAD drawing as shown on Contract Documents will be released in AutoCAD Release 2002 format by means of electronic mail. CAD drawings will be released upon receiving signature of Electronic Data Transfer Agreement. A sample form is at the end of this section. Release of CAD drawings shall be subject to approval of Architect and Engineer.

1.08 PROJECT RECORD DOCUMENTS

A. The Contractor shall keep a separate set of Electrical Drawings at the job site to be used as AS-BUILT Drawings. These Drawings are to be kept current and in a neat and clean condition at all times. They are to be available for inspection by the Architect or Engineer at any time during site visitations. These Drawings shall be "red lined" to indicate all changes in equipment, device, and outlet locations; and to indicate the true locations of all concealed or underground work where different from that shown on the Drawings. Each sheet of this set shall be clearly and permanently marked "AS-BUILT".

B. Upon completion of Work, obtain one set of reproducible vellums from the Architect and transfer all comments from the field set of prints to the vellums. Transfer work shall be of professionally quality as performed by a professional draftsperson.

C. Provide full size copies of "As Built" One Line Diagrams, in metal frames with glass front. Have "As Built" prints framed by a firm normally engaged in this work. Locate diagrams in main electrical room.

D. All symbols and designations used in preparing "As-Built" Drawings shall match those used in Contract Drawings.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable to owner.

B. All electrical equipment shall be protected from damage or degradation during construction. Electrical equipment stored or installed shall be protected from dust, water, inclement weather conditions and all damage from all other foreseeable sources. Replace lost or damaged materials and equipment with new at no increase in Contract Sum.

1.10 SITE EXAMINATION AND CONDITIONS

A. The contractor is to have visited the site of construction prior to bid to determine existing conditions and their effect upon the work he will be required to perform. No additional compensation will be allowed for any extra expense incurred by failure to detect and evaluate all existing conditions which will affect his work.

B. Information shown relative to services is based upon available records and data but shall be regarded as approximate only. Make deviations found necessary to conform with actual locations and conditions with no increase in Contract Sum. Verify locations and elevation of utilities prior to commencement of new installations.

1.11 DRAWINGS AND COORDINATION WITH OTHER WORK

A. Drawings:

1. The Drawings are, by necessity, diagrammatic in nature, locations of devices, equipment, outlets, and lighting fixtures are to be verified and coordinated with all disciplines prior to installation of conduit.

2. The information presented in these Specifications and on the Drawings is intended to describe the utilitarian and physical aspects of the systems shown as well as the quality of the entire installation. All information is as complete and thorough as possible, but every condition or situation cannot be anticipated. Exact locations,

dimensions, elevations, etc., must be determined "on the job" with careful attention to the "intent" of the Drawings and Specifications.

3. The above paragraph shall not be construed as to allow significant deviation from either the Drawings or Specifications without prior approval of the Architect, but minor changes in conduit routing or equipment locations may be required or desired due to specific conditions encountered. This work shall be accomplished in accordance with these Specifications and no "extra charges" are to be created for any unanticipated labor or material.

4. Prior to any significant departures from the contract Drawings or Specifications, as considered necessary by the Contractor, details of the changes along with a letter of justification shall be submitted to the Architect of record within thirty days after award of contract. Only after written approval is received from the Architect of record shall any contractual departures to be considered part of contract documents.

5. Where existing underground or otherwise concealed facilities are indicated on the Drawings, these are located as well as can be determined from available information. The Contractor is required to verify actual locations as necessary for this construction.

6. Drawings indicate, generally, routes of all branch circuits. All runs to panels are indicated as starting from nearest outlet, pointing to direction of panel. Continue all such branch circuits, conduits to panel as though routes were indicated in their entirety.

7. Exact routing of conduit and wiring and location of outlets, panels, and other items, shall be governed by structural conditions, and materials and equipment already in place. Use data in the Contract Documents. In addition, the Architect reserves the right, at no increase in Contract Sum, to make any reasonable change in locations of exposed electrical items, to group them into orderly relationship and/or increase their utility. Verify the Architect's requirements in this regard prior to roughing-in.

8. Dimensions, locations of doors, partitions and similar physical features shall be taken from Architectural Drawings, and verified at the site as part of the Work of this Division. Consult the Architectural Drawings for exact location of outlets to center with architectural features, panels, and similar items, at the approximate locations shown on the Electrical Drawings.

9. Mounting heights of brackets, outlets, and similar items, shall be as required.

B. Coordination:

1. Contractor shall be responsible to coordinate the installation of his work in relation to the Work of other trades.

2. Contractor shall provide coordination shop drawings in order to show that Division 16 work is not in conflict with other trades so as to prevent or resolve installation conflicts in the field.

   a. Coordination shop drawings shall include detailed layouts of Division 16 equipment in relationship to work by other trades. Division 16 equipment shall include, but not limited to the following: switchboards, distribution panels, panelboards, transformers, emergency generators, feeder conduits, floor outlet boxes, conduit serving floor boxes, cable tray and any other equipment that may be affected by the Work of other trades.

b. Items of other trades that shall be considered for coordination shall include, but not limited to: structural elements (footings, grade beams, beams, column, slabs, seismic bracing etc.) including penetrations of framing members or concrete slab, mechanical ducts, plumbing pipes, fire sprinkler pipes and sprinkler heads.

3. Work out all "tight" conditions involving Work of this division and Work of other Divisions prior to installation. Provide additional Work necessary to overcome "tight" conditions. Space conflicts which occur during or after installation of work caused by failure to consider all such requirements shall be resolved by the Contractor to the satisfaction of the Architect and Owner at no increase in the Contract Sum.

4. Differences of disputes concerning coordination, interference or extent of Work between Divisions shall be decided by Contractor. The Contractor's decision, if consistent with Contract Document requirements, shall be final.

5. Where apparatus and equipment have been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. Carefully check the shop drawings to see that the equipment will fit into the spaces provided.

6. Provide adequate working space around electrical equipment in compliance with 2001 C.E.C. In general, provide size and one-half feet (6 1/2') of headroom and thirty inches (30") wide minimum clear work space in front of panelboards and controls. In addition, provide the following working clearances:

Voltage to Ground		Equipment Front to Workman's Back Minimum clear Distance
0-150	(208/120V, 120/240V systems)	3 feet
151-600	(480/277V system)	3 1/2 feet

7. Coordinate electrical connection of mechanical equipment with the Work of Division 15, Mechanical.

8. Provide templates, information and instructions for Work of other Divisions to properly locate holes and openings to be cut or provided for Electrical Work.

9. Size all feeders (conduit and wiring), motor starters, overload protection and circuit breakers to suit horsepower of motors or wattages of equipment furnished as part of the Work of the various Sections of the Specifications. In no case shall feeders and branch circuits (conduit and wiring) and circuit breakers be of smaller capacities or sizes than those shown or specified.

C. Equipment Rough-In:

1. Rough-in locations shown on Electrical Drawings for equipment furnished by the Owner and for equipment furnished under other Divisions are approximate only. Obtain exact rough-in locations from the following sources:

a. From Shop Drawings for Contractor-furnished and installed equipment.

b. From the Architect for Owner-furnished, Contractor-installed equipment.

c. From the Architect for existing equipment where such equipment is relocated as part of the Work of this Contract.

2. Verify electrical characteristics of equipment before starting rough-in.

3. Unless otherwise shown or specified, equipment which requires electrical connection shall be installed as part of the Work of the Division in which specified. Internal components shall be wired to a single point with wiring in raceway direct connection (hardwired) to building electrical system or internal wiring and connections with cord and plug for receptacle connection to building wiring.

4. Unless otherwise shown or specified, provide direct raceway and conductor connections from building wiring system to equipment terminals for direct-connected equipment terminals for direct-connected equipment which is Contractor-furnished and Contractor-installed, Owner-furnished and Contractor-installed, and for existing equipment relocated by the Contractor.

5. Insert plug in receptacle for cord-connected equipment which is Contractor-furnished and Contractor-installed, Owner-furnished and Contractor-installed and for existing equipment relocated by the Contractor. Provide new cord and plug if required on Owner-furnished and Contractor-installed equipment.

6. Provide disconnect switches, flush type in finished spaces, where shown or required by Codes for direct-connected equipment.

1.12 GUARANTEE

A. All electrical work, material, and equipment shall be guaranteed to be free from defects in workmanship or material for a period of one (1) year from the date of final acceptance. Repair or replace all such defects in a timely manner and any damage to the owner's property resulting from such defect or repair thereof. All equipment and material provided and all work accomplished under the requirements of this section shall be at no expense to the owner.

B. Furnish one (1) year guarantee in accordance with and in form required under Division 1. Repair or replace as may be necessary any defective work, material or part with no increase in Contract Sum including repair or replacement of other Work, furnishing, equipment or premises caused by such repair or replacement of defective work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Unless otherwise noted, all materials shall be new and free from manufacturer defects and all damages incurred during shipping and installation.

B. Identify materials and equipment by manufacturer's name and nameplate data. Remove unidentified materials and equipment from site.

C. Equipment specified by manufacturer's number shall include all accessories, controls and other components, listed in catalog as standard with equipment. Furnish optional or additional accessories as specified. All materials shall be UL labeled and in accordance with NEMA Standards.

D. Where no specific make of material or equipment is mentioned, any high quality product of a reputable manufacturer may be used, provided it conforms to requirements of system and meets with Architect's acceptance.

E. Conflicts between Plans and Specifications, exclusive of the General Conditions of the Contract, the most stringent and higher quality requirement shall govern.

F. If the Contract Documents are not complete as to any detail such as accessories or hardware, or a required construction system or with regard to manner of installing of parts, materials, or equipment, but there exists an accepted trade standard for good and workmanlike construction, such detail or accessories shall be deemed to have been implicitly required by the Contract Documents in accordance with such standard.

G. Equipment and material damaged during transportation, installation, or operation will be considered as totally damaged. Replace with new. Variance from this will be permitted only with written acceptance.

H. Provide an authorized representative to constantly supervise the Work of this Division and to check all materials prior to installation for conformance with the Contract Documents.

I. Do not use equipment exceeding dimensions indicated for equipment, or arrangements that reduce required clearances, or exceed specified maximum dimensions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Manufacturer's Directions: Follow manufacturer's directions where manufacturers of articles used furnish directions covering points not specified or shown.

B. Equipment: Accurately set and level, neatly place support and anchor properly. Anchorage shall conform to the requirements of 2007 California Building Code Part 2, Table 13A-0. No allowance will be made for negligence to foresee means of placing, installing or supporting equipment in position.

C. Assemble together all equipment which requires assembling including Contractor-supplied bussing, internal wire connections where required; connect all incoming conduit, cable and wires properly; and adjust and make ready for service electrical equipment and material required by this Contract.

D. All Work shall be done in orderly, workmanlike manner and present neat appearing installation when completed.

E. Provide metal backing plates, anchor plates, and similar items that are required for anchorage for the Work of this Section; securely weld or bolt to metal framing. Wood blocking or backing will not be permitted in combination with metal framing.

F. Special forming, recesses, chases, and similar items, and wood blocking, backing, and grounds necessary for the proper installation of Electrical Work will be provided as part of the Work of other Sections.

G. Protection: In performance of Work, protect existing facility and protect Work of other Sections as well as Work of this Section from damage.

3.02 EQUIPMENT ANCHORING

A. Seismic Withstand Requirements: Freestanding or wall-hung equipment shall be anchored in place to resist forces produced by lateral loads with methods complying to requirements for Seismic Zone No. 3 in the 2001 California Building Code.

B. For all seismic bracing systems, The CONTRACTOR shall submit calculations in accordance with "Contractor Submittals", for the design of the anchoring systems for all equipment, including panels, transformers, etc. in excess of 250 pounds. Calculations shall be performed, signed and stamped by a Structural Engineer or a Civil Engineer experienced in structural design and licensed in the State of California. These calculations shall provide an analysis of lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5. They shall also provide an analysis of both the anchoring system and the foundation, or wall system, to receive the anchor loads and shall show that the foundation is capable of resisting all anchor loads. Submittal shall include data on attachment hardware and methods that will satisfy withstand criteria.

C. Cable, or pendant, light fixtures suspended from ceiling or roof structure shall be seismic braced to restrain and prevent the fixture from swaying 45^0 in either direction of the suspension point toward the nearest obstacle. Contractor shall use the same type and rated cable used to suspend light fixtures. Where pendants are used the contractor shall seismic brace fixtures with 1/16" "aircraft" light fixture suspension cable. Submittal shall include data on attachment hardware and methods that will satisfy withstand criteria referred to in 3.07A.

3.03 PERFORMANCE

A. Excavation and Backfill:

1. Excavation and backfill shall be accomplished as required for installation of electrical equipment as shown on the Drawings. Restore all surfaces, roadways, walks, etc., and any existing underground structures which might be disturbed during this work to their original condition in a manner acceptable to the Architect.

2. Trenches shall be straight except where otherwise indicated. Depth shall be as noted on the Drawings and at least as required to provide the minimum cover specified by applicable codes and regulations for the equipment installed. Bottom of trench shall be smooth and free of any rock points. Place a 4" inch sand bed in trench if these conditions cannot be met with native material.

3. Backfill shall be clean and free of rocks and debris. Backfill is to be tamped in 6" inch layers to nominal 95% compaction using a mechanical tamper manufactured specifically for this purpose. In an area of engineered fill or other area of specified compaction, backfill shall be compacted to match that specified for that area.

4. Cooperate and coordinate with others in planning for and execution of all trench work. All final trench locations are required to be verified with the Architect of record and the general contractor prior to excavation.

5. The Contractor is required to exercise due care when excavating in an area of existing utilities to avoid damage to these facilities. Where it can be determined that underground facilities are likely to exist (either from the Drawings or inspection of the site), the Contractor is required to discover the exact locations of these existing installations prior to excavation. Damage to existing facilities, due to failure to properly accomplish the above, shall be repaired at the Contractors expense to the satisfaction of the owner.

6. Trenching requirements shall comply with the Earthwork Section.

7. Provide all necessary shoring, sheeting, pumping as part of Work of this Division. Excavate and backfill as required for installation of Electrical Work.

8. In asphalt or concrete paved areas, backfill only to subgrade level.

9. Support conduit for entire length on undisturbed original earth. Minimum conduit depth of pipe crown shall be two feet (2') below finished or natural grade.

10. Restore all surfaces, roadways, walks, curbs, walls, existing underground installations, and other construction or improvements damaged by installation of Electrical Work, to original condition in an acceptable manner.

11. Maintain all warning signs, barricades, flares, and lanterns as required.

B. Concrete:

1. Concrete for conduit encasement shall be a mixture of approximately 50% sand and 50% rock, which will pass a 1 inch square screen, and four sacks of cement to the cubic yard of finished concrete. It shall be thoroughly consolidated.

2. Concrete used for encasement of electrical conduits shall contain red oxide in mix, five (5) pounds per cubic yard.

3. Concrete for other than concrete encasement shall be as specified in Division 3.

C. Sleeves, Chases, and Concrete Inserts:

1. This Division shall provide, to cause no delay, all required sleeves, chases, concrete inserts, anchor bolts, and similar items before concrete is placed, and be responsible for correct location and installation of same.

2. Sleeves and chases are prohibited in structural members, except where shown or as otherwise approved in writing.

D. Cutting and Patching:

1. Do all cutting and patching, including structural reinforcing, necessary for the Work of this Division.

2. Obtain the Architect's approval prior to cutting existing surfaces or new surfaces under construction. Repair damage done by cutting and patching equal to original condition, and to the satisfaction of the Architect.

3.04 TESTING AND ADJUSTING

A. Furnish all labor and test equipment required for the Work of this Division. Testing work is defined as that work necessary to establish that equipment has been properly assembled, connected, and checked to verify that intent and purpose of Drawings, manufacturer's instruction manuals, and directions of Architect have been accomplished in satisfactory manner.

B. Test all wiring continuity and grounds before any fixtures or equipment are connected. Where such tests indicate faulty installation or other defects, the fault(s) shall be located and repaired at the Contractor's expense. The repaired installation shall then be retested.

C. Test each individual circuit at panel with equipment connected for proper operation. Verify control circuit integrity: Field tests to verify component compliance with Specifications, adjusting, calibrating, and setting circuit breakers, relays, timers, etc.

D. Ground tests shall meet requirements stated in Specification Section 16450.

E. Tighten nuts, bolts, lugs, connections, and similar items of switchboards, panels and motor control centers to manufacturer's torque values.

F. After completion of testing and adjustment, operate the different systems and equipment under normal working conditions and show specified performance. If, in the opinion of the Architect, performance of equipment or systems is not in accordance with Contract Document or submitted data, alter or replace equipment at no increase in Contract Sum.

G. Do not allow or cause any Work installed hereunder to be covered up or enclosed before it has been inspected and accepted. Should any Work be enclosed or covered up before it has been approved, uncover such Work, and after it has been inspected and approved, make all repairs necessary to restore Work of Others to condition in which it was found at time of cutting, all at no increase in Contract Sum.

H. At completion of Work provide written certification that all Systems are functioning properly without defects.

3.05 CLEANING AND PAINTING

A. After all other work has been accomplished, such as plastering, painting, etc., and prior to final review by the Architect; all electrical equipment, specifically equipment enclosures, panelboards, switchboards, and lighting fixtures shall be thoroughly cleaned (inside and out) of all dirt, water, grease, plaster, paint, or other construction debris. All surfaces shall be clean and in "new" condition. All scratches, dents, marks, cracks, etc., shall be repaired to the satisfaction of the Architect or the equipment shall be replaced at no additional cost.

B. Properly prepare Work of this Division to be finish painted as part of the Work of Painting Section.

C. Refinish Work supplied with final finish as part of the Work of this Division if damaged as part of the Work of this Division to satisfaction of Architect.

D. Clean out and remove from site all surplus materials and debris resulting from this Work, including surplus excavated materials.

3.06 EQUIPMENT IDENTIFICATION

A. Properly identify panelboards, convertible circuit breakers in panelboards, motor disconnect switches, starters, and other apparatus used for operation of, or control of, circuits, appliances or equipment, by means of engraved three thirty-secondths inch (3/32") thick laminated plastic descriptive nameplates, with black background and white letters. Mount the nameplates on the apparatus using round-head brass machine screws or pop rivets. Cardholders in any form will not be acceptable.

END OF SECTION

SECTION 16010

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 CONDITIONS

A. The Requirements of the General Conditions and Special Conditions apply to Work of this Section as if fully repeated herein.

B. The Requirements of this Section apply to all Work of Division 16 as applicable.

C. Where items specified in other Sections of Division 16 conflict with requirements of this Section, the most stringent requirements shall govern.

1.02 WORK INCLUDED

A. Furnish and install all equipment according to latest revision of California Electrical Code unless otherwise specified or shown.

1.03 QUALITY ASSURANCE

A. The publications listed below form a part of this Specification to the extent referenced.

1. FS - Federal Specification

W-C-586	Conduit, Outlet Boxes, Bodies and Entrance Caps (Cast Metal).
W-J-800	Junction Box, Extension, Junction Box; Cover, Junction Box (Steel, Cadmium, or Zinc-Coated).
HH-1-595	Insulated Tape, Electrical, Pressure Sensitive Adhesive, Plastic.
WW-C-563	Conduit, Metal, Rigid: Electrical, Thin-wall Steel Type (Electrical Metallic Tubing), Straight Length, Elbows, and Bends.
WW-C-566	Conduit, Metal, Flexible.

2. NEMA - National Electrical Manufacturer's Association

WD-1	General-Purpose Wiring Device.
RN-1	Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.
TC-6	PVC and ABS Plastic Utilities Ducts for Underground Installation.

3. UL - Underwriter's Laboratories

6 Rigid Metal Conduit.

50 Cabinets and Boxes.

67 Electric Panelboards.

360 Liquid-Tight Flexible Steel Conduit.

467 Grounding and Bonding Equipment.

514 Outlet Boxes and Fittings.

651 Schedule 40 and 80 PVC Conduit.

797 Electrical Metallic Tubing.

1242 Intermediate Metal Conduit.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All items of materials in each category of equipment shall be products of one (1) manufacturer and shall be labeled by Underwriters' Laboratories, Inc.

B. Use only self-extinguishing, non-hygroscopic corrosion-resistant material and equipment.

C. Conform with conditions shown and specified. Coordinate with other trades for best possible assembly of combined Work. Relocate equipment when necessitated by failures to coordinate Work or to advise Architect of conflicts in writing.

D. Use printed descriptions, specifications and recommendations of manufacturers as a guide for installation of Work.

E. Design of wiring systems is generally based on product of one (1) of the manufacturers cited. Where wiring for product installed necessitates modification of wiring shown on Plans, Contractor is responsible for installation of wiring appropriate to product installed.

F. Effectively bond electrical cabinets, enclosures, and conduit raceways to Code approved grounds as parts of continuous grounding system.

G. Materials and Equipment - General Requirements:

1. New.

2. Approved for use by State Fire Marshal and local building inspection department when applicable.

3. Testing agency labeled or with other identification wherever standards have been established.

4. Architect reserves right to reject items not in accordance with this Specification either before or after installation.

5. Comprised to render complete and operable systems; provide additional item needed to complete installation to realize design.

6. Groups of items having same or similar function (motor starters, circuit breakers, etc.) shall be by single manufacturer to facilitate maintenance and service.

7. Compatible with space allocated. Modifications necessary to adjust items to space limitations at Contractor's expense.

8. Installed fully operating and without objectionable noise or vibration.

H. Electrical Equipment and Material Categories:

1. Conduit:

   a. Rigid Steel Conduit: UL 6.

   b. Intermediate Metallic Conduit (IMC): UL 1242, Type 1.

   c. Coated Rigid Steel Conduit: NEMA RN 1, forty (40) mil. thick polyvinyl-chloride (PVC) coating factory bonded to the galvanized outer surface of the conduit.

   d. PVC Conduit: Type 40 and Type 80, NEMA TC 6, UL 651.

   e. Electrical Metallic Tubing (EMT): UL 797, F.S. WW-C-563.

   f. Flexible Conduit: UL 360, F.S. WW-C-566.

2. Outlet Boxes and Fittings: UL 514, F.S. W-C-586, W-J-800.

3. Cabinets and Boxes: UL 50.

4. Wires: Insulated copper conforming to the Requirements of the 2001 California Electrical Code for application.

5. Tape: Plastic F.S. HH-I-595.

6. Safety Switches: F.S. W-S-865, Type "HD" with externally operated handle. Switches shall be rated 250 and 600 volts AC, of size and poles as shown.

7. Fuses:

   a. All fuses rated up to 600 amperes: UL labeled as Class RK1 or Class J (RK5) with time delay and suitable for up to 200,000 amperes, current limiting, such as Gould/Shawmut Amp-Trap, Bussman Low-Peak, (Fusetron) or equal. Time delay: ten (10) seconds minimum at five hundred percent (500%) of fuse rating.

   b. Spare Fuses: Provide minimum of three (3) of each ampere rating.

   c. Fuseholders: Rejection type. Where Class J fuses are used, holders will required Class J spacing.

8. Pull Line: Jet Line No. 232, Greenlee No. 430, or equal, one-eight inch (1/8") diameter braided line of polypropylene line of continuous fiber polyolefin; minimum break strength, two hundred (200) pounds. Furnish pull line in all unused (empty) raceways.

I. Fabrication and Manufacture: Follow manufacturer's directions where manufacturers of articles used furnish directions covering points not shown or specified.

J. Miscellaneous Accessories: Channels, joiners, hangers, rods, caps, nuts, and bolts and associated parts shall be plated electrolytically with zinc, followed immediately thereafter by treating the freshly deposited zinc surfaces with chromic acid to obtain a surface which will not form a white deposit on surface for an average of one hundred twenty (120) hours when subjected to a standard salt spray cabinet test; or accessories shall be hot-dipped galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUIT AND BOXES

A. Installation:

1. Install into complete, integrated arrangement with like elements to make Work neat appearing and finished.

2. Clearance: Do not obstruct spaces required by Code in front of electrical equipment, access doors, and similar items.

3. Flash and counterflash all conduit through roof.

4. Capping: Cap conduits during construction with manufactured seals; swab out conduits before wires are pulled in.

5. Supports: Sizes of rods and cross channels shall be capable of supporting four (4) times actual load. Hanger rods shall have safety factor of five (5) based on ultimate strength of material used.

6. Provide polypropylene pull line in each empty conduit run.

7. Installation of conduit and outlet boxes in fire-resistive walls and partitions shall comply with Title 24, Part 2, Section 709.

8. Installation of conduit and outlet boxes in fire-resistive floors, floor-ceiling or roof-ceiling assemblies shall comply with Title 24, Part 2, Section 710.

B. Outlet Boxes and Junction Boxes: Install in accordance with 2001 C.E.C. Article 370.

C. Conductors: Stranded. Section 16070 2.1.A.1.

1. Install Class 2 systems and line voltage wires in conduit, but do not pull into conduit until all construction which might damage insulation or fill conduit with foreign material has been completed and conduits and outlets have been thoroughly cleaned. Swab as necessary to remove water and debris.

2. Color Coding: Color code all secondary branch circuit and feeder conductors.

3. Use #12 AWG minimum size wire for lighting and power circuits.

4. Install feeder cables in one (1) continuous length unless splices are approved by the electrical engineer of record.

a. Swab conduits before installing cables and exercise care in pulling to avoid damage or disarrangement of conductors. Use approved grips.

b. Provide linen tags to color code feeder cables at terminals in each pullbox. They shall identify equipment served and panel origination.

5. Use THW wire for sizing conduit fill. See Section 16021 3.1.A.5.

D. Motor Connections:

1. Receive, uncrate and store equipment furnished as part of the Work of other Divisions, but installed and connected as part of the Work of this Division.

2. Install individual magnetic and manual motor starters.

3. Provide motor power circuit complete, for all equipment furnished as part of the Work in other Divisions as specified.

a. Provide all disconnect switches.

b. Line and low voltage temperature control and interlock wiring is provided as part of the Work of Division 15, Mechanical.

E. Miscellaneous Equipment Connections:

1. Coordinate the exact method of making connections to equipment provided as part of the Work of other Divisions and this Division. Provide additional labor, materials required for complete connections. Determine exact stub-up locations and outlet heights from equipment installers.

3.02 GROUNDING

A. Ground Fittings: Approved manufactured type, installed and connected in accordance with Code requirement; UL 467.

B. Ground neutral bus and non-current-carrying parts of equipment at each installation in accordance with applicable Codes. Ground Conductor: Copper having a current capacity in accordance with 2007 C.E.C. and Electrical Safety Orders, but not smaller than #6 AWG.

C. Exercise every precaution to obtain good contact at all panelboards, outlets, and similar items. Where it is not possible to obtain good contact, bond conduits around boxes with an insulated conductor, #6 AWG minimum, connected to conduit by means of approved clamps.

D. Completely ground all equipment cases, motor frames, and other items to be grounded in accordance with requirements of 2007 C.E.C. Install bond wire in flexible conduit. Install copper bond wire, sized in accordance with 2007 C.E.C., in all non-metallic raceways and bond to all metallic parts using approved fittings. Bond Wire: Copper.

END OF SECTION

SECTION 16021

CONDUIT, FITTINGS AND SUPPORTS

PART 1 - GENERAL

1.01 CONDITIONS

A. The Requirements of this Section apply to all Work of Division 16, as applicable.

B. Where items specified in other Sections of Division 16 conflict with Requirements of this Section, the most stringent requirements shall govern.

1.02 WORK INCLUDED

A. Furnish, assemble, erect, install, connect, and test all power, control, lighting, and communication conduits, including fittings, boxes, sealing materials, drain fittings and any other miscellaneous equipment and material required and as specified herein and as shown to form complete installation.

B. Install all equipment in accordance with Requirements of 2007 California Electrical Code unless otherwise specified or shown.

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. ANSI - American National Standards Institute

C80.3	Specification for Electrical Metallic Tubing, Zinc-Coated.
C80.1	Specification for Rigid Steel Conduit, Zinc-Coated.
C33.91	Specification for Rigid PVC Conduit.

2. FS - Federal Specifications

WW-C-563	Conduit, Metal, Rigid: Electrical, Thin-Wall Steel Type (Electrical Metallic Tubing); Straight Lengths, Elbows, and Bends.
WW-C-566	Conduit, Metal, Flexible.
WW-C-581E	Conduit, Metal, Rigid; and Coupling, Elbow, and Nipple, Electrical Conduit: Zinc-Coated.
W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid.

3. NEMA - National Electrical Manufacturer's Association

RNI	Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.
TC-2	Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
TC-3	PVC Fittings for Use with Rigid PVC Conduit and Tubing.

4. UL - Underwriter's Laboratories, Inc.

6	Rigid Metal Electrical Conduit.
514	Metallic Outlet Boxes, Electrical.
651	Schedule 40 and 80 PVC Conduit.
797	Electrical Metallic Tubing.
1242	Intermediate Metal Conduit.

PART 2 - PRODUCTS

2.01 MATERIALS Use only self-extinguishing, non-hygroscopic corrosion- resistant material and equipment.

A. Conduit, Fittings and Supports:

1. Rigid Steel Conduits (RSC), Condulets, and Fittings: Hot-dipped galvanized; ANSI C80.1, UL 6, and FS WW-C-581E.

2. Intermediate Metallic Conduit (IMC): Hot-dipped galvanized; UL 1242 and FS WW-C-581E.

3. Electrical Metallic Tubing (EMT): Electro-galvanized; ANSI C80.3, UL 797, and FS WW-C-563. EMT only on interior of buildings.

4. Coated Rigid Steel Conduit: Polyvinyl-chloride (PVC) coating factory bonded to outer surface of RSC conduit. Bond between PVC coating and conduit surface shall be greater than the tensile strength of PVC. Thickness of Coating: Forty (40) mil. minimum. Tensile Strength: 3500 psi. All fittings with same coating as conduit. PVC sleeve over fittings shall extend beyond the hub or coupling approximately one (1) diameter or one and one-half inches (1 1/2"), whichever is smaller. Coated Conduit: NEMA Standard RNI (Type A). Occidental Coating Company "OCCAL-40", Plastic Applicators "KorKap", RobRoy Industries "Plasti-Bond" or equal.

5. PVC Conduit: Type 40 and Type 80, ninety degrees (90°) C., composed of polyvinyl-chloride, NEMA TC-2, TC-3 (fittings UL 514), FS W-C-1094A, UL 651 and ANSI C33.91. Tensile Strength: 7,000 psi at seventy-three point four degrees (73.4°) F. Flexural Strength: 11,000 psi. Compressive Strength: 8,600 psi. Fittings shall be by same manufacturer. Joints: Solvent welded.

6. Flexible Conduit: FS WW-C-566. Flexible steel, zinc coated on both inside and outside by hot-dipping process, interlocked spirally wound steel strip. Liquid tight flexible conduit shall be with extruded polyvinyl covering and with continuous copper bonding conductor wound spirally between convolutions or installed with ground type end fittings at each end to accommodate grounding jumper to provide continuous ground bond. Minimum size: One-half inch (1/2") except where supplied as part of an approved manufactured assembly integrally wired into recessed light fixtures.

8. Fittings: UL Standard No. UL 514 and listed in UL Electrical Construction Materials List.

9. Fitting types:

   a. Condulets: Crouse-Hinds "Form 8" or equal.

   b. Flexible Conduit Fittings: Squeeze type, clamp type or water- tight type with gland nut where required with insulated throats. Set screw type, not acceptable.

   c. EMT Fittings: Steel set screw type. Box connector with insulated throat. Do not use insulated throat for #4 AWG conductors or larger, use separate insulated bushings.

   d. RSC and IMC Couplings and Unions Four Inch (4") Diameter and Smaller: Threaded type.

   e. Chase Nipple with Insulators, Steel Locknuts, and Insulated Bushings: Thomas & Betts Company or equal.

   f. Reducing Bushings, Condulet Gaskets, and Condulet Covers: Crouse-Hinds types or equal.

   g. Threadless Metallic Insulating Bushings for EMT, EMT Straps, Rigid Steel Conduit Straps and Rigid Steel Conduit Couplings: EFCOR or equal.

10. Electrical Support Types:

   a. Electrical Supports: One and five-eighths inches (1 5/8") by one and five-eighths inches (1 5/8") hot dipped galvanized ASTM A-123 and A-153 (outdoor use), electrogalvanized ASTM B-633-85 (indoor use) channel formed from U.S.S.G. No. 12 or 0.109 inch material; cold formed from prime pickled and oiled mild strip steel. Length of Each Section: Ten feet (10').

   b. All Electrical Supports, Fittings, and Accessories: Of same manufacturer and shall fit together as system without modification.

   c. Threaded Rods, Couplings, Screws, and Nuts: Electrogalvanized in compliance with ASTM B-633-85.

   d. Finish On All Other Items: For outdoor use, hot-dipped galvanized after fabrication; after cutting, de-burring, and hole drilling; zinc weight two ounces (2 oz) per square foot of surface; ASTM A123 and A153. For indoor use, electrogalvanized ASTM B-633-85 after fabrication, cutting, de-burring, and hole drilling.

B. Outlet and Junction Boxes:

1. Outlet Boxes and Fittings: UL 514.

2. Outlet Boxes: Galvanized sheet steel for indoor locations and of proper Code size for required number of conductors; four inch (4") square unless specifically shown on Drawings; complete with approved type of connectors and required accessories. Boxes for one-inch (1") conduit or larger, four and eleven-sixteenths inches (4 11/16") minimum trade size.

3. Outlet boxes shall be complete with raised device covers as required to accept device installed. Securely fasten all outlet boxes in position with exposed edge of raised device cover set flush with finished surface. Install approved factory made knockout seals where knockouts are not intact.

4. Surface Mounted Outlet Boxes Located Indoor Below Eight Feet (8') Above Floor Line: Threaded Cast boxes.

5. Outlet Boxes Located on Exterior in Damp or Wet Locations or As Otherwise Shown or Specified: NEMA 4 threaded cast boxes.

6. Equip receptacle outlet boxes with grounding lead. Connect to grounding terminal of device.

7. Where more than two (2) switches are located together, mount in gang outlet box with gang cover. Where switches that serve both normal and emergency loads or switches that serve 120 volts and 277 volt systems and share the same junction box a barrier shall be provided for the separation of branch circuit conductors. Switches with pilot lights, switches with overload motor protection, and other special switches that will not conveniently fit under gang wall plates may be individually mounted.

8. Furnish lighting fixture outlet boxes with necessary accessories to install fixture. Supports must be such as not to depend on outlet box supporting fixture. Supports for lighting fixture shall be independent of ceiling system. Ceiling outlet boxes shall be equipped with raised circular coverplates with edge set flush with surface of finished ceiling.

9. Pullboxes: Galvanized sheet steel, Code gauge, except 12 gauge shall be minimum.

10. Paint for Touch-up for Wrench Marks: Glyptal, PVC paste or equal.

11. Ceramic Fiber: Babcock & Wilcox "Kaowool", Carborundum "Fiberflex", John Mansville "Ceraflex" or equal.

12. Channel Supports for Conduit and Larger Junction and Pullboxes: B-Line, Unistrut, Superstrut or equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUIT AND BOXES

A. Installation:

1. Install into complete, integrated arrangement with like elements to make Work neat appearing and finished.

2. Do not install conduit in concrete slabs unless specifically directed by Architect. Conduit will not be permitted to interfere with proper placement of reinforcement steel and shall be located between the upper and lower layers of steel. Space conduits 8 inches (8") minimum on centers except at cabinet locations where slab thickness shall be increased as directed by the Architect.

3. Do not install PVC conduit above ground.

4. All Conduits Shall Be Rigid Steel or IMC, except EMT may be used at the following locations:

   a. In dry locations in furred spaces.

   b. In partitions other than concrete or solid masonry.

   c. In exposed (above eight feet (8') except conduit located on roof, see below) interior/exterior locations and in electrical/mechanical/communications rooms made up with watertight compression type connectors and couplings. Connectors to outlets shall be insulated throat type with integral non-removable plastic insulator lining.

5. Minimum Size Conduit: Half inch (1/2"). Minimum size PVC conduit outside foundation line shall be one inch (1"). Use Type THW wire for sizing conduit fill.

6. All Conduit Embedded in Floor Slab or in Concrete Walls or on Roof: Rigid steel or IMC conduit.

7. Use coated rigid steel conduit in soil or underground.

8. PVC Conduit with Code Size Ground Wire may be Used in Soil or in Concrete under the following conditions:

   a. Terminate with coated rigid steel elbows and short length of coated rigid steel conduits out of soil or concrete.

   b. Install PVC conduit in sand or fine earth envelope of at least three inches (3") all around inside foundation line. Bends and elbows shall be PVC Type 40.

   c. Underground PVC conduit runs outside foundation line shall be installed under the following conditions:

      1) Bends and ells shall be PVC Type 40 coupled with proper adapters. Conduit through foundation wall shall have one length of PVC Schedule 40 conduit centered at foundation line.

      2) Install PVC conduit in sand or fine earth envelope of at least a minimum of three inches (3") all around. Burial depth on building exterior shall be twenty-four inches (24") minimum cover to top of all raceways. Utility Company Service Conduit Installation Depths: As directed by the Utility Company.

      3) Lay runs straight. Make couplings watertight.

      4) Terminate conduit entering pull hole with manufactured end bells.

      5) Place approximately twelve inches (12") below finished grade and over primary and secondary service conduit duct line, a five (5) mil. brightly colored plastic tape not less than three inches (3") in width and suitably inscribed at not more than ten feet (10') on centers with a continuous metallic backing and a corrosion resistant one (1) mil. metallic foil core to permit easy location of the duct line.

d. Patch all coated conduit according to the manufacturer's recommendation. Completely coat all holidays and tool marks using paste recommended by manufacturer.

9. Cut conduit square, thread, and paint. Remove burrs and sharp edges at ends of each conduit with tapered reamer. Field Threads: Same type and have same effective lengths as factory threads.

10. Cap open ends of conduits with manufactured conduit seals as soon as installed and keep capped until ready to install conductors.

11. Terminate conduit with insulated bushings. Seal ends of conduit to prevent entrance of foreign material and protect threads.

12. Provide flexible connections of short length with stranded conductors to equipment subject to vibration or movement, and to all motors. Length: Twenty-four inches (24") maximum. Use flexible conduits for connections to light fixtures above ceilings. Length: Six feet (6') maximum. Provide a separate bonding conductor recessed in all flexible connections. Use liquid tight type flexible conduit in wet locations.

    a. In wood frame construction, flexible conduit with ground wire may be used for horizontal run of branch circuits.

13. Conceal conduit in all areas except within mechanical and electrical areas where they may be run exposed, if they cannot be concealed.

    a. Assemble conduit threads with anti-corrosion, conductive, anti- seize compound and tighten joints securely. Where conduit is embedded, paint wrench marks with "Glyptol" or equal.

    b. Install conduit so there will be no traps to collect condensation.

    c. Fasten conduit securely to boxes with locknuts and bushings to provide good grounding continuity. Terminate all conduit with insulating bushing or insulated throat.

    d. Rigid Steel Feeder Conduit Bushings shall be complete with non-removable insulated lining, O.Z. type "BLG" with lug type grounding connector, except where otherwise shown or specified.

    e. Make long radius conduit bends free from kinks, indentations or flattened surfaces. Make bends carefully to avoid injury or flattening. Bends in conduit one and one-quarter inch (1-1/4") size and larger shall be factory made ells, or be made with a manufactured mechanical bender. Heating of steel conduit to facilitate bending will not be permitted. Bend conduit cold to prevent damage to galvanized coating. Remove burrs and sharp edges at end of each conduit with tapered reamer.

    f. Where exposed, run conduit parallel with walls or structural elements; vertical runs plumb; horizontal runs level or parallel with structure as appropriate; groups racked together neatly with both straight runs, bends parallel, and uniformly spaced. Exposed conduit below eight feet (8') from floor shall be rigid type. Maintain a minimum of six inches (6") clearance from steam or hot water pipes.

14. Install exposed conduit as high as practical to maintain adequate headroom as shown or required. Notify Architect before installation whenever headroom of less than eight feet six inches (8'6") will result. Coordinate with Work of other Divisions to achieve proper headroom as specified in this Division.

15. Clearance: Do not obstruct spaces required by Code in front of electrical equipment, access doors, and similar items.

16. Flash and counterflash all conduit through roof.

    a. Use a sheet lead cap with mastic between conduit and cap, and apply a tightening band to seal cap to conduit. Use two (2) collars for tar or asphalt composition roofing. Set one (1) collar directly on roof deck and second collar set over it on top of roofing felts. Lead sheet flashing shall be made of four-pound (4 lb.) sheet lead.

17. Penetrations:

    a. Pack space between conduit and walls with non-combustible materials. Make penetrations through floors watertight, even when concealed within wall or furred space.

    b. Make penetrations through any dampproofed/ waterproofed surfaces dampproof/waterproof by appropriate means to maintain integrity of system penetrated. This includes penetrations made by hangers suspended from such surfaces.

    c. Provide chrome plated escutcheon plates at exposed wall, ceiling and floor conduit penetrations.

18. Firestopping:

    a. Seal all conduit penetrations through fire rated walls and floors fire and smoke tight in conformance with CBC Sections 709 and 710, and 2001CEC 300-21.

    b. Refer to provisions of Section 07840.

19. To facilitate pulling of feeder conductors, install pullboxes as shown or required, junction boxes where specified.

20. Conduit Stubs for Future: Provide capped conduit stubs for all systems as shown for extension of circuits and all systems to future additions. Mark locations of same by precast reinforced concrete pullbox set flush in ground with stamped brass disc identification plate tied to conduit end with "Ty-Rap" or "Quick- Wrap" or equal. Location of stubs shall be shown on Record Drawings dimensioned from the structure.

21. Stubs: Stub conduits through concrete floors for connections to freestanding equipment with top of coupling set flush with finished floor. Install pipe plugs to protect coupling threads and debris from entering conduit. Extend wiring in rigid threaded conduit to equipment, except that where required, flexible conduit may be used six inches (6") above floor.

22. Chasing: Do not "chase" concrete to install conduit unless specifically directed by the Architect.

23. Expansion Joints: Where crossing of expansion joints is unavoidable, cross concealed conduit in concrete structure at right angles with expansion sleeve fitting. Expansion Fitting: Designed to compensate for expansion and contraction in line of conduit. Seal expansion end by high grade packing which will prevent entrance of water or moisture. Provide end of conduit with insulated bushings. Provide copper grounding rings or auxiliary flexible bonding jumper, equal to at least three (3) times the nominal width of joint, carefully installed to insure proper operation, to secure continuous ground between conduit and fitting. Provide expansion fitting as follows:

    a. Provide conduit expansion fitting in each conduit run which is mechanically attached to separate structures to relieve strain caused by shift of one structure in relation to another.

    b. Provide conduit expansion fitting in each conduit run wherever it crosses expansion joint in structure to which it is attached.

    c. Provide expansion fittings where expansion and contraction are a consideration in long runs of exposed conduits (one inch [1"] or larger conduit in excess of one hundred feet [100']).

24. Seal underground conduit terminating in exposed or outdoor equipment and junction boxes and underground conduit entering equipment with Babcock & Wilcox "Kaowool", Carborundum "Fiberflex", John Mansville "Ceraflex", and Flammastic "Mastic" or equal.

25. Supports: Sizes of rods and cross channels shall be capable of supporting four (4) times actual load. Hanger rods shall have safety factor of five (5) based on ultimate strength of material used. Anchorage shall support combined weight of conduit, hanger and conductors.

    a. Support individual horizontal conduit one and one-half inch (1 1/2") size and smaller by means of two (2) hole straps or individual hangers. Support larger size conduit with hangers. Perforated strap hangers not acceptable.

        1) Exposed EMT shall be supported with one (1) hole strap within thirty-six inches (36") of connector or within thirty-six inches (36") on each side of coupling.

    b. Galvanized iron hanger rods sizes one-quarter inch (1/4") diameter and larger with spring steel fasteners, clips or clamps specifically designed for purpose for conduit up to one inch (1") size may be used.

    c. Individual conduit three-quarter inch (3/4") and smaller run above suspended ceilings shall be supported from an independent hanger wire with approved spring steel clips. Conduit shall not be secured to, or supported by, the ceiling assembly, including ceiling support wires.

    d. Conduit one inch (1") size and smaller in metal stud partitions and over metal lath ceilings shall be tied to studs or runner channels with 14 gauge galvanized tie wire provided support spacing does not exceed four feet (4').

    e. Support multi-parallel horizontal conduit runs with trapeze type hangers consisting of two (2) or more steel hanger rods, preformed cross channels, J-bolts, clamps, and similar items.

f. Support conduit to wood structure by means of bolts or lag screws in shear, to concrete by means of insert or expansion bolts and to brickwork by means of expansion bolts.

g. Support multi-parallel vertical conduit runs with galvanized "Unistrut", or approved equal, type supports anchored to wall. Where larger conduit of multi-story buildings pass through floors, support conduit with riser clamps at each floor.

h. Accurately place boxes for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy duty box hangers. Secure boxes with metal box hangers to metal studs. Secure boxes installed in masonry with auxiliary plates, bars or clips and grouted in place. Do not use nails to support outlet boxes.

26. Conduit support spacings shall be in accordance with NECA Standard of Installation, as follows:

Conduit Size Inches	No. of Conductors In run	Location	Max. Spacing of Supports Ft.
Horizontal Runs			
3/4	1 or 2	Flat ceiling or wall	5
3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction	7
3/4	3 or more	Any location	7
1 and larger	1 or 2	Flat ceiling or wall	6
1 and larger	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction	10
1 and larger	3 or more	Any location	10
Any	- - -	Concealed	10
Vertical Runs			
3/4	- - -	Exposed	7
1, 1-1/4	- - -	Exposed	8
1-1/2 & larger	- - -	Exposed	10
Up to 2	- - -	Shaftway	14
2-1/2 & larger	- - -	Shaftway	28
Any	- - -	Concealed	10

Screw Sizes for Conduit Supports

3/4" RSC, 1/2" - 1-1/4" EMT:	#10
1" RSC, 1-1/2" EMT:	1/4"
1-1/2" - 2" RSC, 2" - 3" EMT:	3/8"
3" RSC, 4" EMT:	1/2"
4" RSC:	5/8"

B. Large Junction Boxes and Pullboxes:

1. Install large junction boxes and pullboxes with "Kindorf", "Unistrut", or equal channel supports on walls or ceilings where required.

a. Fasten covers to boxes with brass machine screws to assure continuous contact.

b. Line up surface box covers evenly with edges of boxes.

3.02 SPECIAL SEISMIC REQUIREMENTS

A. Conduits shall be supported and braced per OSHPD Anchorage Pre-approval No. R-0010, the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems", No. R-0003 the "Superstrut Seismic Restraint System" for pipes and conduits only, or No. R-0071 the "Kin-Line Seismic Restraint System" for pipes and conduits only.

3.03 INSTALLATION - OUTLET, JUNCTION BOXES, PULLBOXES

A. Before locating outlet boxes, check Drawings for type of construction and make sure that there is no conflict with other equipment. Locate outlet boxes as shown and locate so as not to interfere with other Work or equipment. Also note any detail of outlets shown on Drawings.

B. Where boxes are used in connection with exposed conduit, plain covers attached to box with suitable number of countersunk flathead machine screws may be used.

C. Securely fasten outlet boxes. Set in position with exposed edge of raised device cover flush with finished surface.

D. For sound control, separate outlets on opposite sides of walls 16" minimum. Where outlets are less than 16" or in sound rated walls, seal air tight with fire rated sheet putty pads. Fill gap between junction box and wall with acoustical sealant all around perimeter of junction box. Fill conduits larger than 1 1/4" with fire rated caulk or putty.

E. Outlet boxes mounted in fire rated walls shall comply with Title 24 Part 2, 709.7.

F. Flush outlet boxes located on exterior building wall: Standard flush type.

G. Coverplates on Building Exterior: Cast gasketed spring lift type.

H. Install pullboxes as required in accessible spaces but do not install in finished areas unless directed by Architect.

I. Mounting Heights: Refer to Architectural interior elevations and details shown for exact location of electrical outlets for switches, receptacles, and special equipment. In general, locate outlets at following heights above floor unless otherwise shown or specified.

1. Convenience Outlets: Eighteen inches (18") (six inches [6"] above counter or splash).

2. Local Switches: Forty-eight inches (48").

3. Telephone Outlets: Eighteen inches (18") (forty-eight inches [48"] for wall phone).

4. Verify all mounting heights by checking interior elevations on Architectural Drawings.

5. Where above heights do not suit building construction or finish, consult Architect.

J. Pull Holes/Pullboxes: Top flush in finished areas and one inch (1") above finished grade in landscape areas. Install two inch (2") drain at bottom to a dry well eight inches (8") diameter

by thirty inches (30") deep filled with gravel. Seal all conduit terminating in pull hole watertight. Covers/lids shall be removable without damage to adjacent finish surfaces.

END OF SECTION

SECTION 16070

INSULATED CONDUCTORS

PART 1 - GENERAL

1.01 CONDITIONS

A. The Requirements of the General Conditions and Special Conditions apply to the Work of this Section as if fully repeated herein.

1.02 WORK INCLUDED

A. Provide all wire for all systems including lighting systems, mechanical systems, receptacles, communication system, fire detection systems, electrical service and distribution system.

1.03 PRODUCT, DELIVERY, STORAGE, AND HANDLING

A. Deliver wire to site in its original unbroken packages, plainly marked or tagged as follows:

1. Underwriters' labels.
2. Size, kind, and insulation of wire.
3. Name of manufacturing company and trade name of wire.

1.04 QUALITY ASSURANCE

A. Reference Standards:

1. UL - Underwriter's Laboratories, Inc.:

44	Wires and Cables, Rubber-Insulated.
83	Wires and Cables, Thermoplastic-Insulated.
719	Non-Metallic Sheathed Cables.
1569	Metal-Clad Cables. *

2. NEMA - National Electrical Manufacturer's Association:

WC 5	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electric Energy.
WC 7	Cross-Linked-Thermosetting-Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

3. FS - Federal Specification:

HH-I-595	Insulated Tape, Electrical, Pressure- Sensitive Adhesive, Plastic.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wire and Cable:

1. Single conductor, stranded, soft drawn copper wire having conductivity of not less than ninety-eight percent (98%) of that of pure copper, with insulation rated at 600 volts AC, seventy five degrees (75°) C. conductor temperature, type THHN-THWN or equal and ninety degrees (90°) C. conductor temperature, type XHHW or equal. Wire sizes No. 10 AWG and smaller may be solid copper.

*

2. Non-metallic sheath cables shall be Type NM with solid copper conductors and solid copper ground wire.

*

3. Minimum Wire Size: No. 12 unless otherwise shown or otherwise stated herein.

4. Factory color code with separate color for each phase and neutral used consistently through system. Isolated grounding conductor shall be green with one yellow stripe.

Phases	A	B	C	N	G
208/120 volts:	Black	Red	Blue	White	Green
480/277 volts:	Brown	Orange	Yellow	White/Grey	Green

B. Termination Lugs and Tools:

1. Terminal lugs: Square D Co., Thomas and Betts, or equal.

2. Terminal lugs for wire sizes from No. 18 to No. 10 AWG: Ring tongue funnel entry, pre-insulated with vinyl.

3. Terminal lugs for wire sizes from No. 8 and larger: Compression connectors T&B series 54000, two-hole long barrel lugs or equal. Bolting pad tin-plated for low contact resistance. Use Belleville compression washers when ambient temperature exceeds thirty degrees (30°) C., T&B series 60800 or equal.

4. Terminating tools: Hexagonal or circumferential type with coding systems for inspection purposes.

5. Reducing Adapters for Copper Cables: Burndy, Mac Products, Inc., or equal.

C. Plastic Tape: F.S. HH-I-595.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Splices and Joints:

1. Twist together #10 AWG or smaller wiring, electrically and mechanically strong, and insulate with insulated electrical spring connectors, Scotchlok, Ideal or equal. Threaded type wire nuts are not acceptable.

2. Make joints and connections for #8 AWG or larger with solderless tool applied pressure lugs and connectors. Insulate with layers of plastic tape equal to inslation

of wire and with all irregular surfaces properly padded with "Scotchfil" putty prior to application of tape for uninsulated lugs and wire ends.

3. Where permitted, make feeder splicing with high compression sleeve type connector followed by a heavy wall heat shrink tubing, UL approved for direct burial per UL 786D, Thomas & Betts, Series HS or equal.

4. Where oversized cables are used to accommodate voltage drop, whether a single or parallel feeder, provide appropriate reducing adapter and conductors for termination.

B. Install wires or pull line in conduit and furnish all equipment and material required to complete installation. Install all wire connectors where required, cable supports, tape and insulating materials, or any other item of material and equipment to properly install wires and cables.

C. Install all termination lugs used to connect conductors to terminal blocks with ratchet type crimping tool as recommended by manufacturer of connector. No spade-type lugs will be permitted. All work shall be in accordance with 1998 California Electrical Code unless otherwise directed or specified herein.

D. Pull cable into conduit with sufficient length left at ends of cable to make connections conveniently to all equipment or devices. Do not pull wire and cable into conduit until conduit runs are swabbed clean and free from obstructions, sharp corners and inspected for pulling by Project Coordinator.

Install wire and cable so there will be no cuts or abrasions in insulation or protective covering or kinks in conductors. Make no splices in conductors except where devices are supplied with internal leads. Make splices in nearest condulet or junction box or, where devices are physically too small to accept scheduled wires and associated lugs, splices may be made in nearest condulet or junction box with minimum No. 16 AWG size wire.

E. Install all cables in straight and orderly arrangement with no interlacing. Take care to avoid sharply bending or kinking conductor, damaging insulation or stressing cable beyond manufacturer's recommendations during pulling. Protect cable from absorption of moisture during storage, before pulling and after pulling.

F. Cable attachment for pulling shall be of patent cable grips. Difficult pulling is not anticipated. However, maximum pull tension shall not exceed manufacturer's recommended value for cable being measured with tension dynometer. Use pulling compound approved by cable manufacturer to facilitate pulling of cables. Cable pulling to be witnessed by Project Coordinator. Notify Project Coordinator in reasonable amount of time before pull begins.

G. Form cable to avoid sharp bends over edges of conduit bushings upon entering or leaving boxes or cabinets and to avoid bearing against edges of enclosures and supports when entering or leaving enclosures. Neatly cable or clamp conductors using nylon "ty-raps".

H. In installation of power cables which are single conductors, form Phases A, B, and C in pyramid method in order to keep circuits together.

I. Install cables in specific conduit specified. Remove cables installed in incorrect conduit or raceways and if length is not correct, install new cable all at no increase in Contract Sum.

J. Remove and replace any cable damaged during installation with new cable at no increase in Contract Sum.

K. Install all wiring so that when completed system shall be free from short-circuits and non-intentional grounds.

L. Use green insulation on conductors intended solely for grounding purposes.

M. Leave twelve inches (12") minimum of slack wire in every outlet box whether it be in use or left for future use.

N. Install power circuits from distribution panels to individual outlets or control equipment, as shown. Conductors: Size and type shown.

O. Install branch circuit conductors for general lighting system from panelboards to outlets and between outlets. If single distance from panelboard to first outlet exceeds one hundred feet (100'), minimum size conductor for such run shall be 10 gauge.

P. Provide branch circuits to receptacle outlets as shown. For excessively long runs (fifty feet [50'] or more) from panelboard to first receptacle outlet, minimum size wire shall be 10 gauge to first outlet with conductors between outlets being 12 gauge. Make up connections to devices from "thru-feed" branch circuit conductors with pigtails with no interruption of branch circuit conductors.

Q. Neatly and securely bundle all conductors located in branch circuit panelboards and switchboards. Neatly and securely cable all conductors larger than No. 10 located in switchboards and pullboxes in individual circuits. Use nylon cable straps for bundling and cabling cable straps.

R. Where conductors are to be connected to metallic surfaces, coated surfaces shall be cleaned to base metal surface before installing connector. Remove lacquer coating of conduits where ground clamps are to be installed.

S. Provide supports required to make complete cable installation.

T. Provide 12 gauge stranded (green) wire from ground terminal of receptacle to ground bond wire or to stud in outlet box.

U. Installation of metal-clad cables shall comply with 2007 C.E.C. Article 330 and Article 517.*

V. Installation of nonmetallic-sheathed cables shall comply with 2007 C.E.C. Article 334.

3.02 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard, gutters, pullboxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's Shop Drawings for control wiring.

3.03 TESTING

A. Notify Architect when installed cable is ready to be tested.

B. Apply megger tests. Supply labor, materials and test equipment required to perform continuity checks and megger tests. Submit test data for approval.

C. If any failure is detected, locate failure, determine cause and, as directed by Architect, replace or repair cable or conductor to satisfaction of Architect at no increase in Contract Sum.

D. Subject feeder cables rated 600 volts AC to one (1) minute withstand test, or until stable reading is obtained with 1000-volt megger. Provide written report of megger test results. Test report to include all test conditions.

E. Do not megger any cables after connecting to any equipment, unless specifically directed to do so by Architect.

END OF SECTION

SECTION 16080

WIRING DEVICES

PART 1 - GENERAL

1.01 CONDITIONS

A. The Requirements of the General Conditions and Special Conditions apply to the Work of this Section as if fully repeated herein.

1.02 WORK INCLUDED

A. Furnishing and complete installation of electrical materials for construction of Work as shown and/or specified herein. Such Work includes, but is not limited to, wiring devices.

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. NEMA - National Electrical Manufacturer's Association.

   a. WD I - General Purpose Wiring Devices.

   b. WD 6 - Specific Purpose Wiring Devices.

2. UL - Underwriter's Laboratories, Inc.

   a. 20 - Switches, Snap, General-Use.

PART 2 - PRODUCTS

2.01 WIRING DEVICES

A. Wall Switches:

1. Specification grade, quiet, A.C. rated, mechanical, snap type with silver alloy contacts.

2. Rating: 20 ampere, 120/277 volts, unless otherwise shown on Drawings.

3. Local switches: White finish

Manufacturer	Single Pole	3-Way
Hubbell	2121	2123
Leviton	5621-2	5623-2
Cooper	DECB120	DECB320

4. Screw type terminals shall accommodate wire up to 10 gauge.

B. Receptacles:

1. Industrial/specification grade, NEMA, 5-20R configuration.

2. White color for types shown on Drawings, connected to normal power system, red color for types connected emergency power system. Bodies nylon with terminals to accommodate 10 gauge conductors.

3. Receptacles connected to the emergency power system shall be identified per 2001 CEC 517-19 (a).

4. Grounding type duplex 120V AC receptacles.

Manufacturer	Duplex 3-Wire Groundable 20A
Hubbell	2162
Leviton	16352
Cooper	6362
Leviton (GFI)	8898
Hubbell (GFI)	GF5362

5. Special-purpose or heavy duty receptacles shall be of type and of rating and number of poles indicated or required for the anticipated purpose.

C. Plates:

1. "High abuse" smooth nylon, color to be compatible to device color, with number of openings required for location.

2. 0.040 satin finished stainless stell, UL listed, with number of openings required for location, to be located on stainless steel wall finish.

3. Galvanized, raised type for exposed boxes.

4. Receptacles installed in wet locations where intended to be plugged into and attended while in use (e.g., portable tools, work lights, etc.) shall have a UL listed weatherproof rated "While-In-Use" cover installed as required in NEC/CEC Section 406.8 (B)(1). Use Pass & Seymour #WIUC10-CA cast box with self-closing hinged and lockable door or equal. High impact thermal plastic will not be accepted.

5. Attach plates with matching screws.

D. Nameplates and Inscriptions:

1. Receptacle Identification: Engraved coverplates shall be provided on all receptacles indicating the panel and circuit number of the branch circuit feeding the outlet. "Dymo" type embossed labels shall not be used. Inscriptions shall be made with a lettering device, with terminology approved by the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Small scale Electrical Drawings are generally diagrammatic and indicate only general character and approximate location and extent of Work. All Work shall be installed complete, including minor details necessary to perform function indicated. Actual locations of electrical outlets and devices shall be coordinated with building features as indicated on electrical layout Drawings.

B. Mount and align devices and coverplates level and plumb. Insure coverplates fit flat against wall and tight against device without strain on plate.

C. Outlet boxes on opposite sides of wall requiring protected openings shall be separated by a horizontal distance of twenty-four (24") inches. Title 24 Part 2, 709.7.

END OF SECTION