NOTE TO CONSULTANTS: Edit with Track Changes turned on, any text in this section that appears in bold and italics then turn off the bold and italics for the final approved version. (Remove this Note).

PART 1 - GENERAL

1.01 Description:

A. Work included:

1. This work shall consist of furnishing, installing, testing, and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide electrical service and necessary power to all equipment hereinafter specified and/or shown on the Plans.
2. The work shall include all materials, equipment and apparatus not specifically mentioned herein or noted on the Plans, but which are necessary to make a complete working installation of all electrical systems shown on the Plans or described herein.
3. Provide all excavation, trenching and backfill required for the underground electrical work indicated by the contract documents.

B. Work not included:

1. Motors, controllers and equipment as described in other Divisions of this specification shall be furnished under those divisions, but shall be set and wired under this Section.
2. Telephone system wires and equipment are not a part of this contract.

1.02 Related Work:

Section 31 00 00 - Earthwork
Section 26 56 00 - Exterior Lighting

1.03 Definitions and Abbreviations:

Definitions: Refer to Division 00.

Abbreviations:	ANSI	American National Standards Institute
	NEC	National Electrical Code
	NEMA	National Electrical Manufacturers Association
	NFPA	National Fire Protection Association
	UL	Underwriters Laboratories, Inc.
	IES	Illuminating Engineering Society

1.04 Quality Assurance:

A. Regulatory Requirements: Comply with the National Electrical Code, NFPA regulations, and all other applicable national, state, and local codes and ordinances. The Contractor shall undertake all work in strict accordance with the National Electrical Code and any Washington State WAC 296-45, "Safety Standards for Electrical Workers" and WAC 296-46B, "Electrical Safety Standards, Administration, and Installation".

1. Local Codes and Ordinances
2. State and Federal Law
3. National Electrical Code (NEC)
4. Life Safety Code (NFPA-101)
5. State Fire Marshall
6. Underwriters' Laboratory
7. National Electric Safety Code (NESC)
8. American National Standards Institute (ANSI)
9. National Electrical Manufacturers' Association (NEMA)
10. Institute of Electrical and Electronics Engineer (IEEE)
11. Insulated Power Cable Engineers Association (IPCEA)
12. The Occupational Safety and Health Act (OSHA)
13. Federal, State and Local Building Codes

B. Responsibilities of the Contractor:

1. Complete all work specified under these Specifications and Drawings.
2. Coordinating with other trades.
3. Referring to all of the Drawings, Specifications, and shop drawings pertaining to equipment containing electrical components.
4. Furnishing and installing all incidental items not specifically shown or specified which required by good practice to provide the complete systems specified.

C. Nothing in these Drawings and Specifications shall be construed to permit work not conforming to governing codes or regulations.

D. Wherever the requirements of the Specifications or Drawings exceed those of the governing codes and regulations, the requirements of the Specifications or Drawings shall govern. Nothing in these Drawings or Specifications shall be construed as relieving the Contractor from complying with any requirements of the Plans and Specifications which may be in excess of the requirements of governing codes or regulations.

E. Inspection: All materials, equipment, and workmanship shall be subject to inspection at any time by the Engineer. The Contractor shall correct any work, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective, in a manner satisfactory to the Engineer, at no additional cost to the Owner.

1.05 Project Conditions:

A. Protection During Construction:

1. Throughout this Contract, provide protection for materials and equipment against loss or damage. Protect everything from the effects of weather. Prior to installation, store items in indoor, dry locations. Store in indoor, heated, dry location items subject to corrosion under damp conditions, and items containing insulation, such as controllers, motors, etc.
2. Following installation, protect materials and equipment from corrosion, physical damage and the effects of moisture on insulation. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction.
3. All debris shall be removed from premises during work, as directed and at completion of job.
4. The electrical subcontractor shall furnish and place on his portion of work proper guards for prevention of accidents. Provide and maintain construction required for the safety of life or property including the maintenance of sufficient light during night hours.

B. Temporary Utilities:

1. Temporary or interim use of any and all portions of the electrical system shall be under the supervision of the Contractor.
2. Provide all temporary facilities as required in Section 01 50 00 - Temporary Facilities & Controls.

1.06 Contract Documents:

A. Intent of Drawings:

1. Drawings are partly diagrammatic. Installation of conduit stub-ups shall be in accordance with field conditions and actual manufacturer's shop drawings. The Contractor shall be responsible for verifying all dimensions before proceeding with the work.
2. The electrical work shown on the Drawings do not indicate all fittings, hardware or appurtenances required for a complete operating installation.

B. Departures from Contract Documents: Refer to Section 01 26 00 - Modification Procedures for any necessary, proposed departures from these Contract Documents, and the reasons therefore. Submit such requests as soon as practicable. Make no such departures without the written approval of the Engineer.

1.07 Record Documents: Provide red-lined as-builts and final record documents as directed in Section 01 78 39 - Record Documents.

1.08 Warranty: Refer to Division 00 for warranty information and requirements.

1.09 Permits and Fees:

A. The Contractor shall obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection.

B. The Contractor shall coordinate with and follow the requirements of Seattle City Light (SCL). Make application at the DPD Applicant Services Center (ASC) located on the 20th floor of Seattle Municipal Tower at 700 Fifth Ave. in downtown Seattle, Ph. (206) 684-8850 or www.seattle.gov/dpd/Permits/Inspections.

1.10 Submittals:

A. Submit product data for each item specified in these Specifications. Product data shall include the following:

1. Voltage and continuous current rating.
2. Short circuit with stand rating of bus.
3. Main breaker frame current rating.
4. Main breaker short circuit rating.
5. Main breaker trip rating.

PART 2 - MATERIALS

2.01 Galvanized Rigid Steel Conduit (GRS):

A. Above Grade Raceways shall be hot dipped galvanized inside and out, UL listed as manufactured by Republic Steel, Triangle, Allied, Western, National or approved equal. Minimum size shall be 3/4 inch. Field cut threads shall be protected and damaged galvanizing shall be repaired per the conduit manufacturer's recommendations.

B. Steel Fittings: Galvanized malleable iron or non-corrosive alloy compatible with galvanized conduit. Erickson couplings and watertight split couplings (O.Z. type or equivalent) are permitted. Running thread or set screw type fittings are not approved except as noted.

C. Conduit used in underground runs shall be Scheduled 40 heavy wall rigid PVC, gray in color, UL labeled with fittings of the same materials.

D. All conduits shall be capped during construction by means of manufactured seals to prevent entrance of water and debris. The conduits shall be cleaned before pulling of the wire. Spare conduits shall include a nylon pull rope.

2.02 Wire and Cable:

A. Wire:

1. Above Grade: All wires shall be copper with insulation Type THW. Type THWN/THHN or XHHW wire may be utilized, subject to code requirements. Wire and cable shall be brought to the project site in original containers bearing the Underwriters Label.
2. Underground: All conductors shall be type USE. Increase raceway size when necessary to accommodate conductors per Code. Exception: Underground conductors completely contained in Code recognized raceway and boxes may be Type THW, THWN or XHHW. Type UF direct burial permitted for branch circuits only when noted on the drawings.
3. Aluminum conductors are not approved for use on this project.

B. Splices:

1. Above Grade: Solderless type only. Pre-insulated "twist-on" type (limited to size #10 and smaller) shall be Scotch-Lok, Ideal wire nut, or approved equal. Bolt on compression type with application of preformed insulated cover, heat shrinkable tubing or plastic insulated tape is acceptable for all sizes.
2. Below Grade: Splices below grade shall be in hand holes and shall be made watertight with epoxy resin type splicing kits, Scotchcast, or approved equal.

C. Plastic Ties: Cable ties shall be nylon or equivalent, locking type.

2.03 Junction Boxes and Hand Holes:

A. Junction boxes and hand holes for the underground circuit runs shall be composite material with bolt down cover designed to withstand a 20,000 pound static load. They shall be suitable for use in driveway, parking lot and road shoulder applications that may be subject to occasional, non-deliberate heavy vehicles. Covers shall be labeled “Electric”. They shall be as manufactured by Christy Concrete Products, Fogtite, or approved equal. The hand hole shall be similar in size to WSDOT J-11a, Type I, II or III and in accordance with the following table.

WSDOT Type	Composite Type	Size
I - (Christy)	FL9/FL9T Box/Cover	10" x 16" x 12"
II - (Christy)	FL30BOX18/FL30T Box/Cover	14" x 24" x 18"
III - (Christy)	FL36BOX18/FL36T Box/Cover	17" x 31" x 18"

B. Each conduit entering the box shall be neatly upswept and shall terminate not less than 5 inches or more than 10 inches below the lid.

C. All hand holes shall be set on a 6 inch free draining, compacted pea gravel base and be leveled to match surrounding grades. The lid shall be set flush with finish grade. Conduits into the junction boxes and service cabinet foundations shall have bell ends installed. Sufficient slack wire shall be provided to enable the splice to be raised a minimum of 18 inches outside of the box.

2.04 Panelboards:

A. Acceptable Manufacturers: Square D, General Electric, I.T.E, or approved equal.

B. Bussing Assembly:

1. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedules. Such ratings shall be established by heat rise tests with maximum hot spot temperature, on any connector or bus bar that does not exceed 50 degrees C. rises above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests.
2. Panelboard bus shall be Copper sized at 1000 amps per square inch.
3. Provide 100% rated insulated neutral bus where shown.
4. Provide separate fully rated ground bus bonded to panelboard cabinet.

C. Circuit Breakers:

1. Circuit breakers shall be thermal magnetic trip equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large permanent individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers.
2. Circuit breakers shall be bolted securely to the panelboard bus. "Push on" or "plug in" breakers are not acceptable.

D. Integrated Equipment Short Circuit Rating:

1. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans or as specified. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short-circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short-circuit current or greater. Testing of panelboard overcurrent devices for short-circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short-circuit current rating at the supply voltage and shall be UL listed.
2. Provide panelboards with short circuit rating as shown on the panelboard schedule.

E. Cabinets and Fronts:

1. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel is to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67 for panelboards.
2. Fronts shall include doors and have flush, stainless steel, cylinder tumbler-type locks with latches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Fronts shall be adjustable indicating trim clamps, which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Provide cabinets of sufficient dimensions to allow for future expansion and addition of circuit breakers within the panelboards as indicated on panel schedules. Panel fronts shall be of the door-in-door type so that opening the inner door can access breaker handles and opening the outer door can access panel wiring. Provide two keys for each panel.
3. Circuit Directory: A circuit directory frame and card with a transparent protective plastic covering shall be provided on the inside of the door. The directory card shall provide a writing space at least 1/4" high x 3" long or equivalent for each circuit.
4. Finish: Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish, ANSI 61 gray color.

F. Barriers: The panel board interior assembly shall be dead in front with panelboard front removed. Main lugs and main breaker shall be barriered on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall be barriered.

G. Panelboard Nameplate

1. Provide nameplates with the following information attached with screws to each panelboard front:
   a. Panel Name 1/2" high characters
   b. Voltage, Phase, Wire (i.e. 240/120, 3 phase, 4 wire) 3/8 inch high characters.
   c. Short circuit withstand capability rating (i.e. 22,000 AIC symmetrical) 3/8 inch high characters
2. Nameplate colors shall be white letters on black background.

2.05 Magnetic Motor Starter:

A. Provide starter consisting of a 3 pole, 3-phase full voltage non-reversing motor starter unless otherwise shown.

B. Provide three overload relays with one-piece interchangeable thermal unit. The starter shall be inoperable if the thermal unit is removed. A reset button shall be mounted in the cover and operable from the outside without opening the door.

C. Provide a Hand-Off-Automatic switch mounted in the cover.

D. Provide auxiliary contacts, 2 minimum, or more, if shown.

E. Acceptable manufacturers: Square D, by General Electric, or approved equal.

2.06 Power Disconnect Switch: Shall be Square D, or approved equal, with 15 amp breaker.

PART 3- EXECUTION

3.01 General:

A. Install materials and equipment in a good workmanlike manner, utilizing craftsmen who are skilled in that particular trade. Provide work, which has a neat and finished appearance.

B. Check the approximate locations of electrical system components shown on Drawings for conflicts with other systems and equipment having fixed locations. In the event of conflicts, consult the Engineer. The Engineer's decision shall govern. Make necessary changes at no cost to Owner.

C. Follow manufacturers' installation instructions explicitly, unless otherwise indicated. Wherever any conflict arise between manufacturers' instructions, codes and regulations, and these Contract Documents, follow Engineer's direction at no additional cost to Owner. Keep copy of manufacturers' installation instructions on the job site available for review at all times.

3.02 Coordination: The work of this section, if applicable, shall be coordinated with that of the other divisions and trades and all drawings shall be examined for construction details and necessary coordination.

3.03 Existing Utilities:

A. Underground utilities and elements: The Contractor shall call **Utility Notification Center at (811) or (800) 424-5555 or click www.callbeforeyoudig.org** to locate all underground utilities (on or near Public Rights-of-Way / Property Lines) prior to digging and/or driving stakes. The Contractor can also engage the services of a private utilities locating service for location of utilities within the site by calling **Locating, Inc. @ (425) 392-6412, CNI @ (206) 255-8650 or Applied Professional Services @ (425) 313-1034** to locate utilities within the site. **(Note: these firms will charge for services rendered)**. The Contractor is also **required** to call the **SPR Inspection Request Line @ (206) 684-7034 or by email at parksconstruction.inspection@seattle.gov** to make arrangements for utility locates within park property, in addition to contacting the professional utility location services. The Contractor shall request that the SPR plumbing, electrical, and sewer crews, along with the SPR Environmental Services staff be contacted with at least 48 hours notice. The Contractor can also contact the Engineer for "as-built" information for on-site underground utility system information by calling the **SPR Inspection Request Line @ (206) 684-7034 or by email at**

parksconstruction.inspection@seattle.gov to make arrangements for as-built information**.**

B. Existing utilities shown on the contract drawings have been plotted from available records.

C. The Contractor shall protect shown, visible and located utilities from damage and promptly repair all active utilities damaged by construction. This repair shall be made solely at the expense of the Contractor.

D. When, despite all care and caution, damage occurs to active utilities not visible, located or indicated on the contract documents, immediately obtain a decision from the Engineer as to repair. When so directed, the repair shall be made immediately by the Contractor whose trade is involved. The contract price shall not change when the conditions outlined above and utmost possible care and caution have not been followed.

E. Adjust the depth of electrical utilities to avoid existing utilities with no change to contract price.

3.04 Securing Site Work: The Contractor alone is solely responsible for securing all electrical site work with adequate barriers, warning indicators and shoring.

3.05 Electrical Trenches:

A. Trenching:

1. Trenching shall be to depths as required by code, the particular installation, or as shown on the drawings, whichever is deeper. All trenching for electrical conduit is to be done by pneumatic mole method. All holes and cavities are to be filled, compacted and reseeded with turf mix.
2. Trench bottom shall be free of debris and graded smooth. Where trench bottom is rock, or rocky, or contains debris larger than 1”, or material with sharp edges, Contractor shall over excavate 3" and fill with 3" of builder’s sand.
3. Separation between new electrical utilities and other utilities shall be 6" minimum except gas lines shall be 12" (vertical and horizontal) and shall be 36" (horizontal) for all water service lines.
4. All crossings of concrete or asphalt shall be performed only after the surface material has been saw cut to required width and removed. Conduit shall also be placed in a PVC sleeve that is at least 2 times the OD of the conduit.
5. Detect-A-Tape (red) marking ribbon shall be place in trenches 6” directly above all buried electrical conduit.

B. Backfill and Compaction:

1. Backfill around vaults and hand holes to be free of debris larger than 2" in all directions to 6" from vault and free of debris larger than 2" for all directions to 12" from vault.
2. Bedding for vaults and hand holes shall be 6" of pea gravel or sand.

3. All other backfill shall be free of debris larger than 6" in diameter.
4. All backfill material shall be placed so as to obtain a minimum degree of compaction of 95 percent of the maximum density at optimum moisture content. Moisten backfill material as required to obtain proper compaction.
5. Broken pavement, concrete, sod, roots and debris shall not be used for backfill.
6. Contractor shall, within one-year guarantee period, refill and compact all settled areas to match adjacent grade.

3.06 Raceways:

A. General:

1. Cut raceway ends square, ream and extend maximum distance into all couplings and connectors. Tighten all fittings securely.
2. Provide and install manufactured end caps on all raceway ends during construction to prevent the entrance of water or dirt. Tape, as a cover, is not permitted.
3. After final assembly is in place, all raceways shall be thoroughly cleaned and a mandrel, correctly sized for each size of conduit, shall be pulled through all raceways, prior to installing wires or pull cords. Mandreling shall be done in the presence of the Engineer.
4. All elbows for GRS and PVC raceway shall be factory elbows. For all other raceway, use factory ells for bends of 1-1/4" and larger diameter.
5. Size all raceways per code unless specifically noted to be larger on the drawings.

B. Galvanized Rigid Steel Conduit:

1. All connections shall be watertight. Install for all raceways in concrete or where subject to damage.
2. Where hazardous areas are indicated, use GRS and seals to conform to the requirements of the National Electrical Code.

C. Raceways Underground:

1. Galvanized rigid steel conduit - painted with two coats of bitumastic paint -or galvanized rigid steel conduit with 15 mil. Polyvinyl Chloride (PVC) jacket (repair abrasions with PVC base paint or PVC).
2. PVC raceways may be used for underground runs when permitted by code. Field bends, when necessary, shall be formed only with factory recommended heater with radius not less than that noted in the NEC. Penetrations through slabs shall be galvanized rigid steel conduit.
3. Ground wires shall be provided in all PVC Raceway.

D. Inserts, Shields and Sleeves:

1. Furnish and set in place, in advance of pouring slabs and walls, all inserts and sleeves needed to execute Division 26 equipment installation, if applicable to this project.
2. Where supports in slabs are required after wall has been poured, use a drilled-in threaded insert, installed as recommended by manufacturer.

E. Raceways That Stub Up Through Concrete:

1. Install at such depth that the exposed raceway is vertical and no curved section of the elbow is visible.
2. PVC raceway shall not be stubbed through concrete.

F. Sealing of Raceway Penetrations: Exterior surfaces below grade: Cast raceway into concrete or use manufactured seal assembly (such as o.z. type "FSK") cast in place.

G. Raceway Supports:

1. Raceways, whether exposed or concealed, shall be securely supported and fastened.
2. When more than two raceways will use the same routing, group together on a patented channel support system (such as Unistrut).

3.07 Wiring:

A. General: Install all wiring in raceway unless shown or specifically authorized (in writing) otherwise.

B. Wire Size:

1. Minimum wire size for power circuits shall be #12 AWG.
2. Provide stranded wire for all applications.

C. Tests: Test all wiring connections for continuity and ground before any fixtures or other loads are connected. Test cable with a DC "Megger" type tester. If tests indicate faulty insulation (less than 2 megohms) such defects shall be corrected and tested again. Contractor shall provide all apparatus and material required to make tests and shall bear all expense of required testing. Results of tests shall be recorded and submitted to the Engineer.

D. Conductor Sizes, Referenced on Plans: All conductors shall be copper with type THW insulation unless noted otherwise. For conductor sizes see equipment manufacturer's specifications.

E. Splices:

1. Feeder, service and branch circuit conductors 8 AWG and larger shall not be spliced.
2. Branch circuits may be spliced in boxes where circuits divide.

3. All splices shall be made mechanically and electrically secure.

F. Pulling: Use no mechanical means for pulling Number 8 AWG conductors and smaller. Use approved lubricants only.

G. Termination:

1. Do not score the conductor when stripping insulation, always pare or pencil when using a blade. Use of a stripping tool is preferable.
2. Terminate all wires and cables at their assigned points of connection at panels, switches, equipment, etc.
3. All terminations shall be secure and tightened in accordance with the manufacturer's recommendations.

H. Conductors in Panels and Switchboards: Conductors in panels, switchboards and terminal cabinets shall be neatly grouped, fastened and formed in a manner to "fan" into terminals with regular spacing.

I. Cable Supports: Provide conductor support devices as required by code in vertical cable runs.

J. Color Coding:

1. Conductor identification of each phase shall be by color-coded insulation. The color of the insulation of the underground conductors of different voltage systems shall be as follows: 120/240 volt, 3-phase: A-phase black, B-phase red, C-phase blue. Neutral conductors shall be white. Equipment grounding conductors shall be green.
2. Control circuit conductor identification shall be made by sleeve type identifiers, sized for the conductor, or done by equivalent means, as approved by the Engineer. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Control circuit terminals of equipment shall be properly identified.
3. Terminal and conductor identification shall match that shown on approved shop drawings. Hand lettering or marking is not acceptable. Where insulation of the required color is not available, electrical tape of the required color shall be half-lapped for the entire length within the indicated enclosures.

K. Underground Installation:

1. Wire and cable shall be inspected for damage during installation.
2. Wire and cable pulling equipment shall be equipped with an accurate gauge to allow continuous monitoring of pulling tension. Pulling tension shall not exceed the manufacturers recommended values. A cable grip shall be used for pulling wire and cable. The pulling force shall be applied directly to the conductor.
3. A swivel shall be placed between the pulling rope and pulling grip.

4. The cable reel shall be mounted on the pulling side of the pay-off manhole to prevent any reverse bending when the cable pays off and be mounted so that it can turn freely.
5. The wire and cable shall be fed through a cable feeder or over sheaves in such a way that it never contacts the edge of the manhole or duct. Bending radius shall never be less than 10 times the conductor or cable diameter. The cable must be fed straight into the duct in the pay-off manhole or handhole and straight out of the duct at the pulling manhole or handhole.
6. Cable under tension shall not be pulled through sheaves (multiple roller or otherwise) without prior approval of the Engineer.
7. Wire and cable shall be adequately lubricated at pay-off end with approved Cable Lubricant.
8. The pay-off reel shall be tended throughout the pulling process.
9. The rate of pull shall be constant and shall not exceed 50 feet per minute.
10. Manholes, handholes and duct banks shall be free from water prior to cable pulling and shall be kept dry until the cable is spliced.

3.08 Power Disconnect Switch: Install disconnect switch inside controller housing per code requirements.

3.09 Panelboard:

A. Mounting: Secure in place, plumb and square. Firmly anchor cabinet to mounting panel inside enclosure per Details.

B. Circuit Index: For each branch circuit panelboard: Provide a typewritten index listing each circuit in the panelboard by number with its proper load designation. Mount with a transparent protective cover in a metal frame inside the cabinet door. The listing shall match circuit breaker arrangements typically with odd numbers on the left and even numbers on the right.

C. Cabinet Painting: Clean and touch-up exposed surfaces with paint to match factory finish.

D. Bolted Connections: Inspect all bolted connections after installation and retighten all connections not securely tightened.

3.10 Motor Starter:

A. Installation:

1. Three phase motor starters shall be installed in an accessible location.
2. Install thermal units according to full load current of motors provided and the National Electrical Code.

B. Tests: For each motor, record the name of the load served nameplate full load current, catalog number and ampere rating off the corresponding thermal element and submit to Engineer at the completion of work.

3.11 Grounding:

A. General: Provide all grounding for electrical systems and equipment as required by codes and as specified herein.

B. Ground Rods: Provide as shown and/or required. Connect the grounding conductor to each rod.

C. Grounding Conductor:

1. Provide as required by code and as shown on the drawings.
2. Run grounding conductors inside raceways.

D. Ground Connection of Enclosure: Metal enclosure shall be grounded, as part of this Contract.

E. Connection to the Ground Bus: Provide connections in accordance with the codes; including but not limited to conduit system, switchboard frames, service neutral and electrically operated equipment and devices. No device or equipment shall be connected for electrical service which has a neutral conductor connected to a grounding conductor or to the frame within the device or equipment.

F. Method of Connection: Make all buried grounding connections by a (exothermic) welding process. Unless shown otherwise, make other connections brazing, thermite, welding, or with approved pressure terminals. When making thermite welds, wire brush or file the point of contact to a bare metal surface. Use thermite welding cartridges and molds in accordance with the manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and thoroughly clean the joint.

G. Controllers: Ground all irrigation controllers per manufacturer's specifications and as shown in SPR Standard Details.

H. Testing: Measure the OHMIC value of the electric service entrance metallic "system ground" with reference to "earth ground" using the "multiple ground rod" method and suitable instruments. Maximum resistance to ground shall be less than 2 OHMS. If this resistance is not obtained, then add additional ground rods and retest until the resistance is below 2 OHMS.

END OF SECTION