SECTION 16121

PRIMARY VOLTAGE POWER CABLE INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work included in this Section: Primary Voltage Cable Installation and Termination. Removal and return of old cable is included in cable replacement work.

B. Primary voltage cable, stress cone kits, termination kits (200 Amp and 600 Amp elbows) and equipment-grounding conductor will be furnished by Stanford. Provide all other materials including all labor for a complete and fully functioning installation.

1.2 RELATED WORK:

A. Section 16120 – Medium Voltage Power Cable
B. Section 16271 – Pad Mounted Transformers

1.3 REFERENCES

A. California Electrical Code, most recent edition

B. Cal/OSHA regulations, especially lock-out requirements and requirements for work in vaults and manholes.

C. Code compliance is mandatory. Nothing in the Drawings and Specifications implies acceptance of work that does not comply with Codes.

1.4 SUBMITTALS

A. Manufacturer's literature describing Contractor furnished splice kits and other Contractor furnished equipment

B. Field high potential test reports

C. Submit proposed splicing materials and methods to the Project Manager for approval prior to starting work.

1.5 CLOSEOUT SUBMITTALS

A. Changes to the original contract documents shall be marked, recorded and transmitted to the Project Manager.

1.6 QULIFICATIONS

A. Qualifications are detailed in Section 3.3a

1.7 DELIVERY, STORAGE & HANDLING

A. Seal ends of cables before shipment to prevent entrance of moisture.

1.8 COORDINATION

A. Contractor is responsible for safety on the work site

B. Barricade open manholes and pull boxes at all times. Provide for safe flow of traffic and pedestrians.

C. Provide for continuous, mechanically supplied, fresh air to manholes and vaults when workers are inside.

D. All switching of Stanford circuits shall be performed by Stanford personnel. Contractor shall personally verify that circuits are de-energized and locked out prior to starting work. Provide Contractor's locks in addition to Stanford locks.

E. Scheduled outages that may be required to complete the work will be arranged by the Project Manager/SHC Engineering and Maintenance Shop

F. All workers working in Manholes shall have OSHA Certification 29CFR1910.146 for Confined Space Access.

PART 2 - PRODUCTS

2.1 GENERAL

A. Standards: Confirm to applicable standards of AEIC, IPCEA, IEEE, AND NEMA, latest edition.

B. Voltage class: 15,000 volts (and occasionally 5,000 volts) 90 degree C normal operating temperature, 130 degree C emergency overload temperature.

2.2 PRIMARY VOLTAGE CABLE (materials furnished by Stanford)

A. Single conductor, stranded copper, sizes as shown on Drawings.

B. Insulation: Ethylene propylene rubber, 220 mils or as shown on the Drawings.

C. Conductor shielding: Semi-conducting non-metallic shield over the conductor.

D. Insulation shielding: Wires imbedded in jacket or copper tape or copper wires.

2.3 WIRE FOR GROUND AND NEUTRAL (materials furnished by Stanford)

A. Provide 600 volt, THWN insulated, copper wire for equipment grounding conductors (circuit neutrals, were required, shall be of the same material).

2.4 TERMINATIONS

A. Stress cone kits: Premolded, heatshrink, or cold shrink; Elastimold, Raychem or equal.

B. 200 Amp Elbows: Premolded rubber loadbreak, Elastimold or equal.

C. 600 Amp Elbows: Premolded rubber, non-loadbreak, Elastimold or equal

D. Bushing inserts accessories and wall bracket splices will be provided to match cables and terminations.

2.5 FAULT INDICATORS (devices furnished by Stanford)

A. Clamp-on type fault indicators will be provided as required by the Project Manager.

2.6 SPLICES

A. Make splices by hand taping or approved pre-manufactured splicing kits. Splices shall be rated for continuous submersion in water.

B. Splices shall be made in strict compliance with the cable manufacturer's and the splicing materials manufacturer's instructions. All splicing materials shall be compatible with the cables.

C. Use only copper compression sleeves for splicing copper cables. Do not use sleeves containing aluminum.

2.7 BROUND RODS AND CONNECTIONS

A. Ground rods shall be ¾" x 10' copper clad steel, driven to a depth of at least 9". Provide sectional rods to achieve depth in manholes.

B. Make connections by exothermic welds (Cadweld or equal) or by approved solid copper clamps. Do not use clamps with steel or aluminum parts.

C. Make grounding connections to existing ground bus by copper lugs and copper or stainless steel nuts, bolts and lock washers. Do not use lugs containing aluminum.

D. Splice neutral and grounding conductors passing through manholes and vaults by compression type "T" connectors with the leg of the "T" connected to the ground bus. Do not use the ground bus as a splice point.

2.8 CABLE RACKS AND SUPPORTS

A. Provide galvanized steel racks with porcelain insulators or non-metallic racks.

PART 3 – EXECUTION

3.1 INSTALLATION OF MEDIUM VOLTAGE POWER CABLE

A. Protect cables from weather and damage during storage. Keep cable ends sealed during storage and prior to the time cables are terminated.

B. Test conduit with a mandrel and clean with a brush to remove foreign material prior to cable installation.

C. Cable Pulling installation equipment shall be complete with instruments for reading pulling tension.

D. Pulling tensions and bending radii shall in no case exceed maximum values recommended by cable manufacturer.

E. Use only lubricants approved by the manufacturer for cable pulling.

F. Pull a stiff brush, mandrel and swab through the conduit prior to pulling cable.

G. Use only plain Manila rope or other non-abrasive material for pulling cable into conduit or duct.

H. Pull at an even rate not to exceed 50 feet per minute.

I. Basket grips may be used only for pulling short lengths and cables between switchgear and transformers. Pulling tension shall not exceed 1000 pounds per grip.

J. Support cable reels on sturdy reel supports located sufficiently near the manhole to permit feeding the cable through the manhole opening without rubbing on the sides or on the ground.

K. Attach pulling line to power cable with an approved swivel clevis to prevent twisting of cables.

L. Keep cable ends sealed prior to splicing or termination to prevent the entrance of moisture.

M. All sheaves and similar equipment around which cable is pulled shall have a radius not less than 15 times the outside diameter of the cable. The pull angle shall not exceed 90 degrees.

N. Install cables along those walls providing the longest route and the maximum spare cable lengths. The bending radius of trained cables shall be not less than 12 times the outside diameter of the cable.

O. Provide galvanized steel channels and brackets and porcelain blocks, Unistrut or approved equal, and support cable and splices on maximum 4-ft centers. Use heavy duty plastic cable ties to secure cables to insulators. Approved non-metallic cable supports are acceptable.

P. Return unused cable to the Project Manager on the original reels with the cable ends sealed against moisture. Record the length of the cable used on the reel flange.

Q. Where old cable is replaced, remove the old cable and return it to the Project Manager for salvage. Cut removed primary voltage cable into approximately four-foot lengths and store on forklift pallets at the location directed by the Project Manager. Do not cut usable 600-volt ground and neutral wires.

3.2 INSTALLATION OF GROUND / NEUTAL

A. Provide an insulated, 600-volt, TW, THW, or THHN copper equipment grounding conductor with all primary cable runs.

B. Size shall be shown on drawings.

C. Splice grounding conductor with “T” connectors and bond leg of “T” to ground bus in each manhole. Do not use manhole ground bus as a splice point.

D. Ground cable shield at splices and terminations with #6 AWG stranded copper wire or approved equal.

E. Non-current carrying metal parts shall be grounded.

F. Make ground connections with exothermic welding or approved solid copper connectors and brass nuts and bolts.

3.3 CABLE SPLICES AND TERMINATIONS

A. Cable splices and terminations shall be made by certified cable splicers with a minimum five years experience in splicing cables of the type being provided under the Contract. Provide qualifications to the Project Manager prior to splicing or termination of cables. Splicing and terminating shall be in strict accordance with manufacturer's recommendations, utilizing factory furnished materials in kit form, or as specifically shown on the Drawings.

B. Materials and methods used shall conform to manufacturer's recommendations

C. Cable splices and terminations shall be completed without delay once the conductors and insulation are exposed to the atmosphere.

D. The cable shall be installed with the minimum number of splices. Splices are permitted only in accessible locations.

E. Ground the metallic cable shield at splices and terminations.

3.4 CABLES IN MANHOLES

A. Contractor shall install Stanford furnished cable I.D. tags with double plastic tie wraps in all manholes and pull-boxes. 4kV circuits shall be tagged with red tags with black letters and 12kV circuits shall be tagged with blue tags with black letters. Stanford furnished Cable I.D. tags will show cable numbers with routing information (to and from).

B. Support cables at 4' maximum intervals with galvanized steel racks and channels and porcelain insulators or nonmetallic cable racks. Fasten cables to supports with plastic cable ties. Do not allow cable weight to rest on the terminations.

C. Ground metallic non-current carrying components such as cable racks, switches, and transformers. Use a #6 solid copper conductor, minimum.

3.5 PHASING

A. Verify by "hot phase" test that cables on loop and tie circuits are matched phase-to-phase at every splice or termination that occurs at an open point. Use an approved live-line phasing meter and follow safety and switching procedures. This test may only be performed by personnel experienced in and qualified for testing of energized circuits. Do not rely on color markings or assurance of proper phasing.

B. Verify correct phase rotation when cables on radial circuits are replaced. Use approved secondary voltage rotation testers or verify that rotation of existing motors is correct.

C. All hot phasing and Rotation testing shall be witnessed by Stanford personnel

3.6 PRIMARY VOLTAGE CABLE HIGH POTENTIAL TEST

A. All primary cables shall be given D.C. high potential tests after installation. All tests shall be performed in the presence of the Project Manager's representatives and shall be performed to their complete satisfaction. Testing of cables shall be done after all splices and cable terminations are made, but before connections to equipment are made. Open cable ends shall be wrapped with plastic or provided with similar coronal protection. Test each cable with the shields and other cables grounded. A high potential test set shall be used to read the leakage current in microamperes in the cable at two-minute intervals during the test.

B. Raise the test voltage in 5kV increments from zero to the final test value over a minimum period of 10 minutes. Testing time shall be started when the voltage on the cable has attained final test value and shall be continued for at least 10 minutes thereafter.

C. Results of the tests shall be plotted, current against voltage, at each 5kV increment of rise after 2 minutes minimum or after value has been stabilized, to a maximum test value, and current against time for 10 minutes thereafter in one minute intervals on a separate sheet for each length of cable tests. Curves shall be identified with the cable to which they apply and shall be certified. Time of day, outside temperature and humidity at time of each test shall appear on each curve sheet.

D. If any primary cable fails, or shows unacceptable cable defects, all cables in that conduit between the nearest pulling points on each side of the failure shall be withdrawn. If, other cables that may have been installed in the same duct are inspected and not over stressed during pulling or visually damaged, they may be reinstalled, but the failed cable shall be replaced with new cable without additional charge.

E. After replacement of the faulty cable, and any other damaged cables, all cables of the circuit in that conduit shall be re-tested. If cable fails again, or if tests, show unacceptable cable defects, all cables shall be replaced without charge and this procedure shall be repeated until tests prove satisfactory.

3.7 FIELD QUALITY CONTROL

A. Cables, splices, and terminations shall be tested as described in Section 16402: Underground Power Distribution.

END OF SECTION