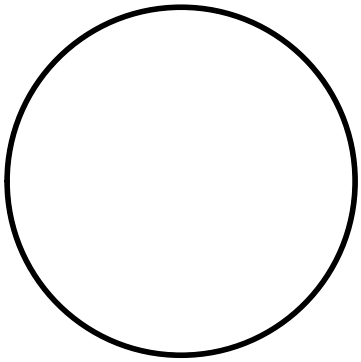
IMPERIAL VALLEY COLLEGE

BUILDING 700 TRANSFORMER UPGRADE

IMPERIAL COLLEGE DISTRICT

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP. 04-118941 INC:
REVIEWED FOR
SS ☑ ☑ ACS ☐
DATE: 01.14.20



December 17, 2019

Michael Wall Engineering

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H. The submittal shall be complete and with catalog data and information properly marked to show, among other things, materials, capacity and performance data to meet the specified requirements.

I. Incomplete submittals will be rejected at the discretion of the reviewing Engineer.

J. Review of the submittal is only for general conformance with the contract documents. The Contractor is responsible for confirmation and coordination of dimensions, quantities, sizes, fabrication, installation methods, and for coordination of work of other trades with electrical work.

K. Detailed working drawings shall be prepared and submitted showing items which are to be fabricated including transformer mounting racks, unistrut mounting frames, equipment room layouts, pull boxes, splice boxes, gutters, etc.

L. Minimum scale for submitted drawings shall be 1/8". Details shall be drawn to 1/4" scale. All drawings shall be 8.5"x11" or larger.

M. Submittal brochures shall be complete and descriptive of the type, make, manufacturer, application, quantity, performance, capacity, ratings, options, dimensions, clearances, weights, nameplate data, special installation requirements, mounting method, NEMA type, NEMA class, environmental restrictions, layout requirements or other information as may be necessary for review of the material.

N. Submittal brochures for switchgear shall include, as a minimum, the following: singleline diagrams; fault current ratings of buses and devices; device identification, ratings, layout and characteristics; dimensions; circuit identification; identification label type and method of affixing; mounting; conduit entry point and quantities; NEMA enclosure type; and additional data as required for a complete review.

O. Submittal brochures for lighting systems shall include, as a minimum, the following: manufacturer; detailed drawing or photograph; dimensions; lamp data; ballast data; certified photometric data from a third-party testing agency; U.L. label listing; fixture number or identification from the drawings; finish color and material; mounting equipment; socket type and rating; environmental ratings (damp location, watertight, explosion-proof, etc.); voltage; input wattage; and additional information as necessary for a complete review.

P. The Contractor shall be responsible for all aspects of substitutions of material including any additional cost or delay incurred as a result of the substitution. The Contractor shall coordinate all substitutions with other trades, verify code compliance, verify clearances, photometric performance, appearance, suitability, constructability, and availability of the material prior to submitting the substitution for review. The Contractor shall bear the responsibility of any increased costs to other trades which are directly related to the substitution.

1.5 MATERIAL HANDLING

A. The Contractor shall deliver all equipment and material to the site in the manufacturer's original packaging without seals broken.

B. The Contractor shall handle, store, protect, and unpack all equipment and materials in accordance with the manufacturer's recommendations.

C. The Contractor shall inspect the equipment and materials in a timely manner to ensure the completeness and appropriateness of the shipment.

D. The Contractor shall immediately replace damaged or defective equipment or materials with identical new equipment or material at no cost, inconvenience, or delay to the College.

1.6 EXISTING CONDITIONS

A. The Contractor shall verify all existing conditions prior to bid and include all costs associated

A. The Contractor shall coordinate all shutdowns, outages, and service interruptions with the College's Representative. Electrical shutdowns shall be kept to the minimum number necessary to complete the work.

B. The Contractor shall coordinate all work done on overtime or premium time with College's Representative prior to commencement of work.

C. All work performed in or through occupied spaces, or other work disruptive to existing occupants shall be considered as performed during premium time or as overtime for the purposes of the bid; include all costs in bid.

D. The Contractor shall notify College Representative of all shutdowns or disruptive work a minimum of 72 hours prior to commencement of work. The Contractor shall obtain written approval from the College Representative prior to commencement of work.

E. The Contractor shall provide all necessary temporary power, including temporary power generation, to accommodate shutdowns and minimize disruption of the College activities.

F. The College reserves the right to provide emergency repairs or temporary power to maintain service continuity at the Contractor's cost in the event Contractor fails to provide adequate service continuity.

1.10 RECORD DOCUMENTS

A. The Contractor shall prepare as-built documents depicting all revisions to branch circuits, conduit routing, equipment, panel schedules, lighting control schedules, or materials. Drawings shall be in AutoCAD .dwg format and Adobe .pdf formats. Contractor shall provide (1) full-size hard copy print and (1) USB memory stick of all as-built drawings and files. Hand-drawn or “red-line” drawings shall not be accepted. Drawings shall be legible, reproducible, and properly identified such they may be used as a reference for maintenance or construction.

B. The Contractor shall provide a minimum of three copies of the operation and maintenance manuals to the College Representative at the completion of the project. Each copy shall be bound in a three-ring binder and labeled indicating: the project name; system name; Contractor’s name, telephone number, and contact person; and College name. The Contractor shall provide the following minimum information within each manual:

1. List of the Subcontractors performing work on the system including contact names, telephone numbers, and email addresses.
2. Routine and emergency service contact names, telephone numbers, and email addresses for each system.
3. Description of system operation.
4. Single line diagrams and control wiring diagrams.
5. Detailed product literature with technical information.
6. Local factory representative contact name, telephone number, and email address.
7. Sequence of starting, shutdown and operation.
8. Installation instructions and safety requirements.
9. Maintenance schedule, testing instructions and performance parameters.
10. Parts list including recommended spare parts.

problems, or deficiencies experienced during this period due to defective materials or faulty workmanship shall be immediately corrected by the Contractor without cost to the College. The Contractor shall be responsible for all damages to the College due to deficiencies in the electrical system. Equipment guarantees in excess of one year shall not be superseded by this guarantee.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be new, of prime quality, listed as suitable for the application, and bear

I. The Contractor shall coordinate and cooperate with all other trades for a successful completion of the project.

3.2 SEISMIC BRACING

A. The Contractor shall seismically brace all equipment in accordance with requirements of the California Code of Regulations, Title 24, Seismic Design Category D and provide certification of seismic compliance upon request, including structural calculations as required.

3.3 CUTTING AND PATCHING

A. The Contractor shall provide cutting and patching as required to install the electrical system in this contract.

B. Coordinate the schedule of all cutting such that the work may be performed in an expeditious manner with minimum inconvenience to the College.

C. Remove or cut structures or materials as necessary for demolition prior to the installation of new electrical work.

6. Voltage drop tests on the main grounding electrode of system.
7. Determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral points.
8. Check rated voltage and phase balance at all equipment, motors and selected devices at full load conditions. Measure no load voltage conditions at each location.
9. Furnish all material, equipment, instruments and labor as required to complete testing.
10. Provide all test results properly bound in a three-ring binder.

3.5 TRAINING

A. Furnish at least one copy operating instructions from the manufacturer for all electrical equipment to the College's Representative. Instructions shall be clean, legible, and properly bound in a three-ring binder.

B. The Contractor shall provide training for the College’s staff as directed by the College's Representative for a minimum of one man-day (eight hours).

C. Provide classroom training by a qualified instructor for the operation, installation, and maintenance of designated equipment or systems including, but not limited to, generation systems, transfer switches, uninterruptible power supplies, energy management systems, lighting control systems, power distributions systems, and other systems which may require instruction.

3.6 CLEANING

A. Contractor shall clean all equipment, panelboard interiors, conduit interiors, fixtures, devices, etc. of all extraneous paint, drywall mud, overspray, dust, dirt, debris, trash, grease or markings. All cleaning shall be performed by the Contractor in accordance with the appropriate manufacturer’s recommendations.

END OF SECTION 26 05 00

4. Termination materials and methods

B. Complete data sheet for cable construction, shielding, insulation material, insulation rating, thickness of insulation, jacket cable stranding, voltage rating, and total amount of order in feet.

C. Certified test reports for:

1. Sample test on insulation: physical properties, solvent extraction, heat distortion, and accelerated water absorption.
2. Insulation resistance, power factor corona level, AC dielectric.
3. Certified Factory Test Report including the results of the test plus cable identification, factory order number, cable length and all cable specifications. No cable shall be installed in any duct or conduit until a related test report has been accepted by the College Representative.
4. Field Test Report.
5. Submit a certification for the approval of the College Representative containing the names and the qualifications of persons recommended to perform the splicing and termination of medium voltage cables approved for installation. Refer to Section 01400 including Exhibit A for certification requirements and information regarding cable installation termination and testing.
6. A complete test shall be done on each length of cable at the factory in accordance with ICEA S-93-639, and UL-1072. In addition, a corona test shall be done per AEIC CS8.

7. Complete cable pull-tension study. Study shall model the route of each conductor in 3-dimensions and shall indicate pull-tensions, conduit sidewall pressures, pulling rates, minimum bend radius, and suggested pulling directions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cable manufacturers shall be Okonite, Southwire, Pirelli or equal.

B. Cable terminations and splices shall be manufactured by 3M, Elastimold, or equal.

C. Fire-proofing and arc-proofing tape shall be manufactured by Bishop (Model 43A), 3M (Model 7700), or equal.

C. To operate satisfactorily, both electrically and mechanically, at conductor temperatures not exceeding 105 degrees C continuous for normal loading; 140 degrees C for emergency loading, emergency of 36 hours; 250 degrees C for short circuit loading assuming a short circuit duration of two seconds. Emergency overload operation may occur for periods up to 100 hours per year and with as many as five (5) such 100-hour periods within the lifetime of the cable.

D. Cable to meet the specifications and the minimum requirements of the latest revisions of ICEA S-93-639 and AEIC CS8.

E. Soft, annealed copper, compact Class B stranded per ASTM B-496 for sizes up to and including 1,000 Kcmil.

F. Thermoset EPR based material with a volume resistivity not in excess of 100 ohm-meters at 105°C; chemically compatible with the conductor and the cable insulation; firmly and

for continuous operation at 15kV for single-conductor shielded power cables. The system components shall be designed according to the specifications listed in ANSI/IEEE Standard 386-1985 for 15kV 600A dead-break interfaces. The system shall be made up of specific kits designed for splicing, tapping (adding-on) dead-ending, and 600A equipment connecting. Each

vulcanizing tapes used to provide the cable insulation shall have an EPR base. All cable splices shall be 15kV, 133% rated. Cable splices shall be constructed per IEEE #404 1986 standard.

M. Single conductor cables in gutters or wireways, or racks in vaults, shall have the three

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.

B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 QUALITY ASSURANCE AND STANDARDS

A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.

B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:

1. American Disabilities Act (ADA)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. Institute of Cable Engineers Association (ICEA)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. Local Code Enforcement Agency Requirements
7. National Electrical Code (NEC)
8. National Electrical Contractor's Association (NECA)
9. National Electrical Manufacturer's Association (NEMA)
10. National Electrical Testing Association (NETA)
11. National Fire Protection Association (NFPA)
12. Underwriter's Laboratories, Inc.(UL)
13. International Building Code (IBC)
14. California Electrical Code (CEC 2016)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer and College Representative by the contractor.

C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.

D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.3 SUBMITTALS

A. Submit shop drawings per Section 26 05 00 for review including the following:

1. Conductor materials and stranding.
2. Connector and termination materials.
3. Installation materials and methods.
4. Termination materials and methods.

PART 2 - PRODUCTS

2.1 Conductors shall be copper; conductors size #12AWG and smaller shall be solid, conductors size #10AWG and larger shall be stranded. Conductors shall be minimum size #12AWG for power and lighting circuits; control circuits shall use a minimum conductor size of #14AWG.

2.2 Insulation shall be type THW or THHN/THWN for all branch circuits up to and including size #2AWG. Insulation for conductors over size #2AWG shall be XHHW.

2.3 Jackets shall be nylon or PVC material.

2.4 All cables shall be UL listed for the application.

2.5 All conductors shall be installed in conduit in the field, unless specifically noted otherwise in these documents. Type AC and type NM cable is not acceptable; type MC cable may be used where specifically noted for purposes of flexibility, maintenance, or ease of installation but shall not be used without explicit permission and direction of the Engineer.

2.6 Multi-conductor flexible cords shall be types SO, SJO, STO, or SJTO.

2.7 Electrical connectors shall be UL listed and suitable for the conductor material being connected and rated appropriately. Connectors shall be solderless helical metal spring pressure type for conductors #10AWG and smaller. Push-in connectors (WAGO) shall not be used. Connectors shall be compression type for conductors #8AWG and larger.

PART 3 - EXECUTION

3.1 All wiring methods shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.

3.2 Conductors shall be installed in clean raceways using nylon cord, polypropylene cord, hemp rope, or other material which will not damage the conductors or conduit. Do not use metal fish tape to pull conductors. Use a listed cable pulling lubricant when necessary for pulling.

3.3 Conductors shall be pulled into conduit simultaneously so as to not damage conductors during pulling.

3.4 Conductors installed at outlets and switches shall have a minimum of 6" pigtail left in the box for future connections. All conductors not connected to devices shall be terminated with splice caps and tape.

3.5 Conductors shall be terminated such that no copper material is exposed. Conductors shall be trained and labeled at terminations in a neat and workmanlike manner.

3.6 Mechanical lugs for conductor terminations at equipment (switchboard bussing, circuit breakers, disconnect switches, etc.) shall be sized and rated to accept the conductors specified. Oversized conductors shall utilize reducing pins to facilitate terminations.

3.7 All terminations shall be mechanically sound, featuring helical twisting of the terminating conductors prior to the application of an electrical connector. The electrical connector shall not be used for the mechanical connection of the conductors.

3.8 All terminations shall comply with the manufacturer's installation and torquing requirements.

3.9 Splices on conductors #10AWG and smaller shall be made with splice caps twisted onto the conductors. Tape all splices.

3.10 Splices on conductors #8AWG and larger shall be made with pressure connectors and terminal lugs. Where exposed to water, damp air, or moisture splices shall be watertight.

3.11 Splices shall be not be made in feeders; splices to branch circuits shall not be made within panelboards or similar enclosures.

3.12 When combining homeruns, the Contractor shall derate all conductors per NEC requirements including reducing the conductor ampacity and using high temperature insulation where necessary. Conduit sizes shall be adjusted by the Contractor, per NEC requirements, for any conductor revisions.

3.13 The Contractor shall provide a code-sized insulated grounding conductor, in addition to the feeder conductors indicated on the drawings, for all feeder circuits.

3.14 Conductors shall be color-coded as follows:

208Y/120V	Phase	480Y/277V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green

3.15 Where tape or labels are used for color-coding, apply material at each end of the conductor, at all splices, within all boxes, and at all terminations.

END OF SECTION 26 05 19

GROUNDING AND BONDING

1.5 ACCEPTABLE MANUFACTURERS

A. Burndy Corporation

B. Cadweld Division

C. Crouse-Hinds

D. Thomas and Betts Corporation

E. Okonite Company

F. Tecto Weld

PART 2 - PRODUCTS

2.1 GROUNDING MATERIAL

A. Rod Electrode: Material to be copper clad steel rod, 3/4 inch diameter with minimum 10 feet length.

B. Mechanical Connectors: Material shall be copper and of sound continuity when installed.

C. Exothermic Connectors: Material shall be of low emission, electric-start type and of sound continuity when installed.

D. Bare Ground Conductors

1. Conductor shall be 7-strand annealed copper.
2. Individual members of stranded conductor shall meet the requirements of ASTM B-3.
3. Stranded conductors shall be assembled in accordance with the requirements of ASTM B-8.

E. Insulated Conductor (Equipment grounding conductor)

1. Size in accordance with NEC Article 250-95 unless otherwise shown as oversize.

F. Grounding Well Components

1. Well Pipe: Material shall be 8 inch diameter by 24 inch long concrete pipe with belled end.
2. Well Cover: Material shall be cast iron with the text "GROUND" embossed on cover.

G. Ground Bus Bar

1. ASTM B187, 98% conductivity copper bus bar, size 4 inches wide by 1/4inch thick by 24 inches long.

H. Terminal Lugs

1. For 4/0 AWG and smaller conductors: Copper compression lugs.
2. For 250kcmil and larger: Aluminum mechanical lugs.

I. Bonding Plates, Connectors, Terminals and Clamps

1. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.

J. Jumpers

1. Copper braided or leaf-type flexible jumper, size as necessary.

K. Bus Bar Insulators

1. Fiberglass reinforced polyester insulator with 2 inch diameter threaded holes at both ends for bus bar installation.

L. Electrical Grounding Connection Accessories

1. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service indicated.

M. Field Welding

1. Field Welding: Comply with AWS Code for procedures, appearance, and quality of welds; and for methods used in correction welding work. Provide welded connections where grounding conductors connect to underground grounding and plate electrodes.

N. Grounding Resistors

1. Provide a low-resistance grounding resistor in compliance with the latest IEEE-32 standard.
2. Temperature rise shall not exceed 760 degrees C above an ambient temperature of 30 degrees C for a ten-second duration.
3. Neutral grounding relays shall be set to protect the resistor and clear the fault within ten-seconds.
4. For resistors above 600V, an applied high potential test shall be performed equal to 2.25 times the rated voltage, plus 2000 volts.
5. Grounding resistors shall be UL or CSA listed and labeled.

PART 3 - EXECUTION

3.1 GENERAL

A. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer’s instructions and applicable portions of NEC, NECA’s Standard of Installation, and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

C. Ground each separately-derived system neutral to nearest cold water piping, service entrance equipment grounding electrodes, and electrically continuous building steel.

C. Test results shall be provided in writing and shall show temperature, humidity and condition of the soil at the time of the tests.

END OF SECTION 26 05 26

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b. Manufacturers: Subject to compliance with requirements, provide products by one

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

END OF SECTION 26 05 29

PART 1 - GENERAL REQUIREMENTS

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1.3 SUBMITTALS

A. Submit shop drawings per Section 26 05 00 for review including the following:

1. Box materials
2. Accessory materials

PART 2 - PRODUCTS

2.1 Boxes shall be flat rolled steel sized as required by code and as suitable for the application. Boxes shall have mounting holes and knock-outs in sides and back. Grounding shall be accommodated by means of threaded holes.

2.2 Provide accessories, extension rings, gaskets, supports, trim rings, hangers, straps, and other material as necessary for a complete code complying installation.

2.3 Boxes installed outdoors shall be weathertight, dusttight, and corrosion resistant. Provide gaskets and conduit hubs.

2.4 Provide type FS boxes for surface mounted applications.

2.5 Provide additional support for boxes as necessary when mounting fixtures or devices from boxes.

2.6 Provide ganged boxes for multiple switches and devices; provide barriers for boxes served by separate voltages.

2.7 Acceptable manufacturers shall be Appleton, Crouse Hinds, Steel City, or Raco.

PART 3 - EXECUTION

3.1 All box installation methods shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.

3.2 Install all boxes plumb, square, and securely fastened to structure.

3.3 Boxes shall be placed such that they are readily accessible.

3.4 Cover or plug all unused openings in boxes where knockout blanks have been removed.

3.5 Install boxes such that they are flush with the finished surface of the wall or surface within which they are mounted.

3.6 Install all boxes at mounting heights per plans, NEC requirements, and ADA requirements.

3.7 Boxes shall not be mounted back to back in walls. Minimum offset shall be 12”.

3.8 Boxes in sealed environments shall be sealed with an approved sealant suitable for the application.

3.9 Boxes penetrating fire rated walls or surfaces shall be sealed with a Fire Marshal approved fire sealant to maintain the fire rating of the wall or surface.

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1.3 SUBMITTALS

A. Submit shop drawings per Section 26 05 00 for review including the following:

1. Handhole material
2. Installation materials and methods

B. Product data: For the following:

1. Shop drawings for precast or factory-fabricated handholes: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Reinforcement details.
c. Grounding details.
d. Joint details.

2. Shop drawings for factory-fabricated handholes other than precast concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Cover design.
c. Grounding details.

3. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.
4. Qualification Data: For professional engineer and testing agency.
5. Source quality-control test reports.
6. Field quality-control test reports.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

required to suit field conditions and to ensure that duct runs drain to handholes, and as approved by College.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE HANDHOLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Christy Concrete Products.
2. Oldcastle Precast Group.
3. Utility Vault Co.

C. Comply with ASTM C 858 for design and manufacturing processes.

D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
3. Cover Legend: Molded lettering, as indicated for each service.
4. Configuration: Units shall be designed for flush burial and have Integral closed bottom, unless otherwise indicated.
5. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
6. Handholes located in vehicle areas shall feature a minimum full traffic H-20 rating.

2.2 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONCRETE HANDHOLES

A. Precast Concrete Handhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.

3.2 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.4 CLEANING

A. Clean internal surfaces of handholes. Remove foreign material.

END OF SECTION 26 05 44

PART 1 - GENERAL REQUIREMENTS

1.1 It is the intent of these acceptance tests to assure that all Contractor supplied equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with designed specifications.

1.2 The acceptance tests and inspections shall determine suitability for energization of switchgear and cables.

1.3 Items that shall be checked, inspected, and tested include, but are not limited to, the following:

A. Relays

B. AUX compartment with control power transformer

C. AUX compartment with potential transformer

D. AUX compartment with batteries and rectifier

E. Sets of Current Transformers

F. Surge arrestors

G. Grounding system

H. Power/Lighting panelboards

I. 15kV rated cable

J. 600V rated cable

K. Substations and distribution switchgear

1.4 APPLICABLE CODES

A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
1. California Electrical Code (CEC 2016)**.**
2. National Electrical Manufacturer's Association - NEMA.
3. American Society for Testing and Materials - ASTM.
4. Institute of Electrical and Electronic Engineers - IEEE.
5. National Electrical Testing Association - NETA.
6. American National Standards Institute - ANSI:

    a. C2, National Electrical Safety Code
    b. Z244-1, American National Standard for Personnel Protection

7. State Codes and Ordinances.
8. Insulated Cable Engineers Association - ICEA.
9. Association of Edison Illuminating Companies - AEIC.
10. Occupational Safety and Health Administration:

a. Part 1910, Subpart S, 1910.308
b. Part 1926, Subpart V, 1926.950 through 1926.960

11. National Fire Protection Association - NFPA:

1. Occupational Safety and Health Act of 1970 - OSHA.
2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.
3. Applicable State safety operating procedures.
4. NETA Safety/Accident Prevention Program.
5. College safety practices.
6. National Fire Protection Association - NFPA 70E.
7. ANSI Z244.1 American National Standards for Personnel Protection.

B. All tests shall be performed with apparatus de-energized except where otherwise specifically required.

C. The testing firm shall have a designated safety representative on the project to supervise operations with respect to safety.

PART 2 - PROTECTIVE DEVICE COORDINATION STUDY

2.1 A protective coordination study shall be performed using SKM's Dapper or equal software to select or check the selection of power fuse ratings, protective relay characteristics and settings, ratios, and characteristics of associated voltage breaker trip characteristics and settings.

2.2 The coordination study shall include all voltage classes of equipment from the College main incoming line and down to and including panelboards. The entire electrical system shall be included in the coordination study including all emergency feeders. Verify characteristics and settings of existing devices in the field and from the manufacturer.

2.3 The time-current characteristics of the specified protective devices shall be plotted on the appropriate log-log paper. The plots shall include complete titles, representative one-line diagrams of both buildings and legends, associated relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves, and fuse curves. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the current National Electrical Code shall be adhered to. Reasonable coordination intervals and separation of characteristic curves shall be maintained. Separate coordination plots for phase and ground protective devices shall be provided on a system basis. Separate curves

and specified in other Sections of these Specifications.

B. The Contractor shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections.

C. All tests shall be performed in compliance with the recommendations and requirements of the National Electrical Testing Association, Inc. (NETA), and applicable codes and standards.

D. Upon completion of the tests and inspections noted in these Specifications, a label shall be attached to all serviced devices. These labels shall indicate date serviced and the service company responsible.

E. The test and inspections shall determine suitability for continued reliable operation.

F. All tests shall be conducted in the presence of the College Representative. Provide a minimum of two weeks notice to the College Representative.

G. Furnish the necessary equipment and personnel to perform all required tests of all wiring and connections for continuity, short circuit, and improper grounds. Included, but not limited to, the following systems: substations, SF6 switches, air interrupting switches, low voltage main and feeder circuit breakers, interlocking controls, panelboards, distribution transformers, branch circuits.

3.2 SWITCHGEAR AND DISTRIBUTION BOARDS

A. Visual and mechanical inspection:

1. Inspect for physical damage and code violations.
2. Clean interior and exterior surfaces.
3. Inspect for proper alignment, anchorage, and grounding.
4. Check tightness of accessible bolted bus joints by torque wrench method. Tighten connections in accordance with industry standard torque levels.
5. Make closure attempt on locked open devices. Make opening attempt on locked closed devices.
6. Make exchange with devices operated in off-normal positions.

B. Electrical tests:

1. Measure insulation resistance of each bus section phase-to-phase and phase-to-ground.
2. Inspect all accessible bus joints and cable connections by infrared scanner to detect loose or high-resistance connections and other circuit anomalies.
3. Inspect correctness of control wiring.

3.3 MEDIUM VOLTAGE SWITCHES AND OVERCURRENT PROTECTION

A. Visual and mechanical inspection:

1. Inspect for physical condition.
2. Inspect alignment and grounding.
3. Perform mechanical operator and contact alignment tests on the breaker and its operating mechanism in accordance with manufacturer’s instructions.
4. Perform insulation resistance test on control wiring.
5. Clean mechanism, insulating surfaces and contacts.

B. Electrical Tests

1. Measure contact resistance.
2. Trip overcurrent protective device by operation of each protective device.
3. Perform an insulation resistance test phase-to-ground, phase-to-phase and across open contacts.
4. Perform insulation resistance test in accordance with Doble procedure.
5. Perform timing test with Travel Analyzer to insure proper contact overtravel and pressure.

3.4 SURGE ARRESTERS

A. Visual and mechanical inspection:

1. Inspect for physical damage such as chipped or fractured porcelain.
2. Inspect ground and discharge counter connections for integrity.

B. Electrical tests:

1. Perform a 60Hz sparkover test.

1. Perform insulation resistance tests winding-to-winding and winding-to-ground. Apply appropriate guard circuit over all bushings.
2. Perform dielectric absorption test winding-to-winding and winding-to ground for ten (10) minutes. Compute the polarization index.
3. Perform turns ratio test between windings for all top positions.
4. Perform insulation power factor tests on all high and low-voltage windings.
5. Check output voltages.

3.7 PROTECTIVE RELAYS

A. Visual and mechanical inspection:

1. Inspect relays for physical damage, presence of foreign material, moisture, condition of spiral spring, disc clearance and corrosion.
2. Clean cover glass interior and relay components.
3. Check for freedom of movement, proper travel and alignment, and tightness of mounting hardware and top screws.

B. Electrical test:

1. Perform insulation resistance tests on each circuit branch to frame.
2. Perform the following tests at the settings specified by College Representative:

    a. Pickup parameters on each operating element.
    b. Timing at three (3) points on time dial curve.
    c. Pickup target and seal in units.
    d. Special test as required to check operation of restraint, and other elements per manufacturer's instructions.

3. Perform phase angle and magnitude contribution tests on all differential type relays after energization to vectorially prove proper polarity and connection.
4. Check polarity and correctness of control wiring.

C. Relay calibration and tests:

1. Two relay wiring tests shall be made.

    a. Primary circuit polarity test shall include a DC test from the current transformer to each terminal block and relay terminal.
    b. Relay and circuit breaker operation test by application of power from the portable relay test set.

D. Relay testing shall be accomplished after completion of the switchgear installation, using standard portable test set equipment and the relay manufacturer's testing directions and parameters to determine conformance of the relay to the time-overcurrent information given in the manufacturer's performance curves and the tap settings provided by coordination study. Overcurrent relay testing shall include:

1. Zero set tests.
2. Pickup tests.
3. Time-current characteristic (operation at currents 3 and 4 times the directed tap settings), and instantaneous at the directed tap setting.
4. Target and seal-in operation.

E. Target differential relays shall be tested similarly, except for the following additional tests:

3. Perform an insulation resistance test phase-to-ground, phase-to-phase and across open contacts.
4. Perform insulation resistance test in accordance with Doble procedure.
5. Perform timing test with Travel Analyzer to insure proper contact overtravel and pressure.

3.10 CABLES, LOW VOLTAGE (600 VOLTS AND LESS)

A. Visual and mechanical inspections:

1. Inspect cables for physical damage and proper connection.
2. Torque test cable connection. Tighten connections in accordance with industry standards.
3. Perform infrared scan of all connections under loaded conditions.

B. Electrical tests:

1. Perform insulation resistance test of each cable with respect to ground and adjacent cables.

3.11 GROUNDING SYSTEMS

A. Visual and mechanical inspection:

1. Inspect ground system connections for completeness and adequacy.

cables.

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.

B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 QUALITY ASSURANCE AND STANDARDS

A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.

B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:

1. American Disabilities Act
2. American National Standards Institute
3. American Society for Testing and Materials
4. Institute of Cable Engineers Association
5. Institute of Electrical and Electronic Engineers
6. Local Code Enforcement Agency Requirements
7. National Electrical Code
8. National Electrical Contractor’s Association
9. National Electrical Manufacturer’s Association
10. National Electrical Testing Association
11. National Fire Protection Association
12. Underwriter’s Laboratories, Inc.
13. International Building Code (IBC)
14. California Electrical Code (CEC 2016)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract

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Secondary voltage: 208Y/120V 3PH 4W, 60Hz with (2) 2 ½% full capacity above normal taps and (2) 2 ½% full capacity below normal taps. Impedance shall be 5.75% or manufacturer's standard impedance, +7 ½%. Basic impulse level of the primary winding shall be 95kV as

1. Turns ratio
2. Polarity
3. Phase rotation
4. No-load loss
5. Excitation current
6. Impedance voltage
7. Load loss
8. Applied potential
9. Induced potential
10. QA Impulse Test

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that concrete pads are ready to receive work.

B. Verify field measurements.

C. Verify that required utilities are available, in proper location, and ready for use.