



SOUTHERN CALIFORNIA PUBLIC POWER AUTHORITY

Request for Proposals for Generator Step Up Transformer, Apex GS

Issuance Date: 05 December 2016

Response Deadline: 19 January 2017

I. Introduction

The Southern California Public Power Authority (SCPPA), on behalf of its Member Utilities, is hereby soliciting competitive proposals for a Generator Step Up Transformer, as described below in Parts III and IV.

SCPPA is interested in discovering all Respondent's capabilities related to specified Areas of Interest and associated pricing to enable informed decisions to be made leading to more specific negotiations on contract development with one or more qualified Respondents to this Request for Proposals (RFP). Any contract resulting from this RFP shall not be made binding on SCPPA until approved by the SCPPA Board of Directors.

RESPONSES TO THIS RFP ARE DUE ON OR BEFORE 19 JANUARY 2017, AT 2:00 P.M. Instructions for submitting a Response and other important information can be found in Parts V through IX of this RFP, beginning on page 52.

II. Background

SCPPA is a joint powers authority and a public entity organized under the California Joint Exercise of Power Act found in Chapter 5 of Division 7 of Title 1 of the Government Code of the State of California, and through the SCPPA Joint Powers Agreement, for the purposes of planning, financing, developing, acquiring, constructing, operating and maintaining projects for the generation or transmission of electric energy. SCPPA also facilitates joint service contracts, at the request of its members, to aggregate like project efforts among its Members for the purposes of developing energy efficiency, demand response and resource procurement Programs or Projects to improve operating efficiencies and reduce costs.

Membership of SCPPA consists of eleven cities and one irrigation district, which supply electric energy within Southern California, including the municipal utilities of the cities of Anaheim, Azusa, Banning, Burbank, Cerritos, Colton, Glendale, Los Angeles, Pasadena, Riverside, and Vernon, and the Imperial Irrigation District. SCPPA is governed by its Board of Directors, which consists of representatives from each of its Members. The management of SCPPA is under the direction of an Executive Director who is appointed by the Board.

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SCPPA owns the Apex Generation Station (“AGS”), a 541 megawatt natural-gas fired combined cycle power plant located near North Las Vegas, Nevada. The Generator Step-Up Transformer that is the subject of this RFP would be deployed at AGS.

In this RFP, the terms “Respondent” and “Contractor” are synonymous, both referring to the person or firm submitting a proposal in response to it.

III. Areas of Interest

1. General:

Scope

- a. Furnish and deliver a Generator Step-Up (GSU) Transformer, 162/215/270-MVA (at 55°C temperature rise) & 181/240/302-MVA (at 65°C temperature rise), ONAN/ONAF1/ONAF2, 525-kV/18-kV for Apex Generating Station. GSU Transformer cooler groups shall be configurable per **VA Tech Drawing No. 961400C3501 & 961400C3503** (Attachment A). GSU transformer is to be constructed to be reconfigurable to allow installation and connection in the existing Steam Turbine Generator (STG) or Combustion Turbine Generator 1A (CTG 1A) or Combustion Turbine Generator 1B (CTG 1B) GSU transformer positions. These different positions are shown in photographs attached to this specification (Attachment C).
- b. Assemble, vacuum, oil-fill and test the GSU Transformer at Apex Generating Station (AGS).
- c. Construct two spare GSU concrete pads (pad “A” and “B”) for storage of spare transformer and to allow storage upon delivery and swapping out of GSU transformers. Install conduits, lighting and power connections to both concrete pads which shall be connected to existing plant electrical system. See Attachment A for reference drawings. Reference drawings show a firewall, this is not needed for the GSU concrete pads.
- d. Provide spare parts as per Part IV Section 26 titled “Spare Parts”
- e. Remove existing VA Tech GSU Steam Turbine Generator (STG) Transformer and relocate to spare GSU concrete pad (Pad “A”). Move new transformer from spare GSU concrete pad (Pad “B”) to existing STG transformer pad.
- f. Install and connect new GSU Transformer for the STG.
- g. Make all necessary structural, electrical, and mechanical connections and provisions for long term storage of spare transformer. Provisions to include maintaining the ability to perform Doble testing, take oil samples, run the pumps to circulate the oil, run the fans weekly and any other manufacturer recommended tests for long term storage.
- h. Develop lifting plans for the spare, and existing transformers. Provide signed copies of the lifting plans so that they may be used at a later date for changing out transformers.

Miscellaneous

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- i. Southern California Public Power Authority (SCPPA) is the owner of AGS. Los Angeles Department of Water and Power (LADWP) functions as the Operating Agent for AGS. Contract Administration, Engineering, Construction Management Quality Assurance and similar services are provided by LADWP. All project correspondence, to include invoicing, is to be sent to Project Manager with contact information provided in the correspondence section.
- j. Project Manager is Mr. David Alba, or his assigned representative. The representative for site access or deliveries is Mr. Edin Manzukic. Their contact information is listed in the correspondence section of this RFP.

2. Delivery:

SCPPA requires delivery of the transformer and spare parts by 01 March 2018, contingent on a contract award by 20 April 2017.

The Contractor shall provide all crane & trucking support for delivery of GSU transformer and installation.

The Contractor shall notify Mr. Edin Mandzukic not less than 10 working days prior to any delivery. Contact information provided in the correspondence section of this RFP.

Deliveries shall be made between the hours of 8:00 a.m. and 2:30 p.m. only, Monday through Friday, to the following address:

Apex Generating Station
15555 Apex Power Parkway
Las Vegas, NV 89165

3. Installation:

SCPPA requires the installation of the two new spare GSU concrete pad and associated conduits and power connections by 01 February 2018.

SCPPA requires the installation, testing, connection and commissioning of the new transformer between 16 April 2018 and 12 May 2018.

The Contractor shall notify Mr. Edin Mandzukic not less than 60 working days prior to any construction. Contact information provided in the correspondence section of this RFP.

4. Printed Documents:

All printed documents, including drawings and instruction books, if applicable, shall be in the English language. All units of measurement shall be in the foot-pound-second system.

5. Safety:

The Contractor shall comply and require that all subcontractors comply with the following requirements:

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- a. The Contractor shall possess and shall have available at the jobsite, at all times, for inspection by the Project Manager, an Injury and Illness Prevention Program (IIPP) complying with OSHA regulations.
- b. The Contractor shall furnish and require all subcontractors to furnish all necessary safety equipment, including, but not limited to, personal protective equipment, safety devices, and safeguards.
- c. The AGS reserves the right to review safety programs and practices and to make recommendations to the Contractor. Any such review or recommendation by AGS shall not increase the AGS's liability or responsibility and shall not relieve the Contractor from providing a safe work environment and complying with legal requirements.
- d. If the AGS determines that there is a material deviation from any regulatory agency's requirements or the IIPP that could result in serious injury, the Contractor may be ordered to stop work. Failure by the Contractor to comply with any regulatory agency's requirements or the Contractor's IIPP may result in termination of the contract.
- e. Submit as part of the bid response package a Contractor Safety Pre-Qualification form (Attachment B).

6. Contractor's Liability:

The Contractor shall defend, hold harmless, and fully indemnify SCPPA, the City of Los Angeles, the Department of Water and Power of the City of Los Angeles, Ethos Energy, and their respective officers, agents, and employees from any and all liability whatsoever that may arise or be claimed by reason of any acts of said Contractor, the Contractor's employees, and agents in connection with the work to be performed under the contract.

7. Kick Off Meeting:

A preconstruction meeting will be held at AGS, 15555 Apex Power Parkway Las Vegas, NV 89165, at which time the Contractor shall meet with Project Manager, Facility Manager, Operations Manager and Contract Administrator. The meeting will be held no later than 30 calendar days after contract award. The meeting will consist of a discussion of the specifications, schedule, and all inquiries regarding the contract.

8. Contractor's Drawings:

- a. Within 45 calendar days after date of award of the contract, the Contractor shall submit to Project Manager for review each outline, assembly, and detailed drawing of the equipment to be furnished under the contract. These drawings shall show the following:
 - (1) Transformer outline drawings and dimensions of the completely assembled transformer.
 - (2) The weight and center of gravity of the completely assembled, oil-filled transformer and the separate weight of the core and coil assembly, and the quantity of oil in the completely assembled transformer.

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- (3) The welds recommended by the Contractor to anchor the transformer to the existing transformer pad imbedded steel plates.
 - (4) Dimensions and layout of the transformer base and the location of the jacking pads.
 - (5) Design saturation curves with the per-unit rms values for excitation current on the abscissa and the per-unit rms values for voltage on the ordinate.
 - (6) Outline drawing and description of each type of bushing.
 - (7) Outline drawing and description of each type of surge arrester.
 - (8) Lifting Plan and Drawings for moving the GSU.
- b. Within 60 calendar days after date of award of the contract, the Contractor shall submit to the Project Manager for review each outline, assembly, and detailed drawing of the equipment to be furnished under the contract. These drawings shall show the following:
- (1) Complete schematic and wiring drawings for all control wiring, pump and fan wiring, automatic transfer switch and loads, heaters, and auxiliary equipment and relay wiring with control cabinet layout and termination locations. The schematic and wiring drawings shall contain all necessary information, including the terminal or sliding link locations and wire designations, to verify that the wiring circuit is in accordance with the schematic.
 - (2) The location and the sizes of all valves, flanges, and maintenance hole covers, including the oil-processing valves, flanges, and fittings.
 - (3) The location of all auxiliary equipment, including all gauges, Buchholz relays, Qualitrol-type sudden pressure relays, auxiliary power transformer, fans, and pumps, if equipped.
 - (4) The size, the material, the surface finish, and the location of each cabinet on the transformer, with details of the door and the latch and the internal light location.
 - (5) Complete manufacturer's drawings and information on the tap changer.
 - (6) Winding diagrams, showing the electrical circuit of each coil, including all tap changers and tap positions, current transformers with polarity marks shown, and the size and type of conductor for each winding.
 - (7) Internal layout drawing, showing the physical location of all internal parts and components, including all winding coils and coil clamping assemblies, the core and core clamping assembly, torque values for nuts and clamps, all lead work and supports, internal portions of bushings, tap changer assemblies, and other internal details.
 - (8) Cooling group drawings, showing the manufacturer's type or model of fans and pumps, if equipped. The drawings shall also show the manufacturer's type or model of the radiator or heat exchanger with material, thickness, and surface finish of all major parts. The swing-out direction of the fans shall also be shown.

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- (9) Nameplate drawing for all nameplates.
- (10) Manufacturer's drawings and instructions for all auxiliary equipment, showing locations, dimensions, materials, ratings of contacts, calibration and settings, and other useful information.
- (11) Tank drawings, showing the locations and the details of the grounding pads, the locations of cabinets, conduits, and the recommended sizes and locations of the conduits enclosing the SCPPA's field wiring to the main control cabinet.
- (12) Details and drawings of the safety barricade, showing materials and dimensions.
- (13) Details and drawings of the torque for all bolts used, with torque table.

Any combination of items listed above may be shown on a single drawing, if the clarity is not thereby impaired. Each drawing shall be identified by a number and a descriptive title.

Additional drawings, instructions, or information, which may be requested by the Project Manager for erection, operation, and maintenance of the equipment or to determine compliance with the contract, shall likewise be submitted for review.

It is imperative that the drawings be furnished within the time required herein, in order that the design of related facilities may be progressed on schedule.

All drawings shall be accompanied by a letter of transmittal and shall be submitted in such sequence that the Project Manager will have all of the information necessary for reviewing each drawing at the time the drawing is submitted.

The drawings shall fully demonstrate that the equipment to be furnished will comply with the provisions of these specifications and shall furnish a true and complete record of the equipment as manufactured and delivered. Review of the Contractor's drawings by the Project Manager shall not relieve the Contractor of the responsibility to meet all of the requirements of these specifications or of the responsibility for the correctness of the drawings furnished by the Contractor. The Contractor shall have no claim for additional costs or extension of time on account of delays due to revisions of the drawings which may be found necessary to comply with the contract. In case of later discovery of errors, omissions, or inconsistencies in the Contractor's drawings, the Contractor shall promptly submit revised transparencies to the Project Manager for re-review.

Within 30 calendar days after receipt of the drawings for review, one print of each will be returned to the Contractor by letter designated "no exceptions noted", "corrections needed", "rejected", or "not required".

If a drawing is designated "no exceptions noted", the Contractor may proceed with the work covered by the drawing.

If a drawing is designated "corrections needed", the Contractor may proceed with the work covered by the drawing and the corrections needed. However, the Contractor shall revise the drawing in accordance with the corrections needed and shall resubmit the revised transparency to the Project Manager within 21 calendar days after receipt of that drawing.

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If a drawing is designated "rejected", the Contractor shall revise the drawing to comply with the requirements of these specifications and shall resubmit the revised transparency for review before proceeding with the work covered by the drawing.

If a drawing is designated "not required", it is not required under the contract.

Revised drawings shall be submitted in the same size as the original submitted, except when completely redrawn.

If the drawings contain information which does not pertain to the equipment being furnished, the Contractor shall either delete the information which is not applicable or plainly identify the pertinent information.

9. Required Contract Submittals:

The Contractor shall submit the following drawings, schedules, requests, plans, and samples for review or testing and acceptance by the Project Manager not later than 45 days after award:

- a. Outline drawings and related data.
- b. Production schedules.
- c. Request for acceptance of non-AWS welding codes and certifications.
- d. Test Plans and Testing schedule which includes Production Schedule and Inspection and Test Plan.
- e. Detailed drawings.
- f. Seismic engineer's qualifications, if the Contractor desires to use other than a Nevada-licensed civil or structural engineer to sign all required seismic and structural reports.
- g. Instruction books.
- h. Seismic-withstand capability report.
- i. Impact recorder's acceptable limits and ranges of impact.
- j. Material safety data sheets. If no additional hazardous materials are used in the transformer delivered after the first delivery, no additional submittals will be required.
- k. Certification of Freedom of PCBs for each transformer.
- l. Lifting Plan and Drawings for moving the GSU.

10. Computer Aided Design (CAD) Submittals:

The Contractor shall submit all drawings specified in the section titled "Contractor's Drawings" of this Division in digital form. The digitized drawing format and media type shall be as follows:

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- a. Drawing Format: Preliminary drawings, or drawings used for review may be submitted in PDF format only. Final drawings shall also include Microstation Version 8.5 or higher and PDF. Microstation drawings must not be locked, must include all reference files, and not have any restrictions against modification.
- b. Media Type: Media type shall be DVD and USB. The Contractor shall furnish the associated Microstation-compatible font library.

11. National Standards:

The equipment furnished under these specifications shall be designed, constructed, and tested to meet all of the applicable requirements of the IEEE, ANSI, NEMA, and ASME Standards.

12. Earthquake Design:

- a. General: The transformer shall be qualified according to the requirements of IEEE 693-2005, except as modified herein.
- b. The transformer shall meet the requirements of the high seismic qualification level. Bushings 161 kV and higher shall be time history tested to the performance level in accordance with IEEE 693-2005. Surge arresters 161-kV and higher shall be sine beat tested in accordance with IEEE 693-2005 in addition to the required time history test. Frequency modifying devices will not be allowed. Composite polymer bushings and surge arresters shall successfully pass the shed seal test in accordance with Annex A.4.4 of IEEE 693-2005. The shed seal test in accordance with IEEE 693-1997 is no longer acceptable.
- c. Qualified Seismic Specialist: The seismic report shall be signed by a Nevada-licensed civil or structural engineer who meets the requirements for the specialist defined in IEEE 693-2005.
- d. Test Plan: If equipment has not been previously tested according to IEEE 693-2005, the test plan shall be submitted to the Project Manager for review and approval not less than 45 calendar days prior to the test and within 35 calendar days after the date of award of contract. The Project Manager will return a disposition within 14 calendar days after date of receipt of the test plan. The Project Manager shall be allowed to witness all testing and shall be notified of any changes in the testing date not less than 18 calendar days before the testing is to begin.
- e. Seismic Qualification Methods: Seismic withstand capability shall be demonstrated as follows for the transformer:
 - (1) Bushings 161 kV and higher shall be qualified by time history testing on a rigid stand. The tests shall be conducted in stages as follows:
 - (a) **Stage 1 - Resonant Frequency Search:** A resonant frequency search shall be conducted to determine resonant frequencies in accordance with the requirements of Annex A.1.2.1 of IEEE 693-2005.
 - (b) **Stage 2 - Time History Test:** Bushings shall be tested in accordance with the requirements of Annex A.1.2.2 and D.4.4 of IEEE 693-2005. Bushings shall be

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tested at an input motion of 4 times the response spectra shown in Figure A.1 of IEEE 693-2005.

(2) Surge arresters 161 kV and higher shall be qualified by time history testing and sine beat shake-table testing mounted directly to the table or on a rigid stand. The tests shall be conducted in stages as follows:

- (a) **Stage 1 - Resonant Frequency Search:** A resonant frequency search shall be conducted to determine resonant frequencies in accordance with the requirements of Annex A.1.2.1 of IEEE 693-2005.
- (b) **Stage 2 - Time History Test:** Surge arresters shall be tested in accordance with the requirements of Annex A.1.2.2 and D.4.6 of IEEE 693-2005. Surge arresters shall be tested at an input motion of 2 times the response spectra shown in Figure A.1 of IEEE 693-2005.
- (c) **Stage 3 - Sine Beat Test:** Surge arresters shall be tested in accordance with the requirements of Annex A.1.2.3 of IEEE 693-2005. The amplitude of the input acceleration for surge arresters shall be 1.0g. In lieu of the sine beat test, a performance level time history test is acceptable. The input motion shall be 4 times the response spectra shown in Figure A.1 of IEEE 693-2005.

(3) Transformer tank, tank components, and appendages shall be qualified by static analysis in accordance with the requirements of Annex A1.3.1 and D.4.1 of IEEE 693-2005.

f. Test Report and Analysis Report: The test report and analysis report shall be prepared in accordance with Annex (S) and (T) of IEEE 693-2005.

The report shall be submitted to the Project Manager for review and approval in accordance with any of the following circumstances:

- (1) Within 60 calendar days after completion of testing.
- (2) Within 180 calendar days after date of award of contract if report is by analysis.
- (3) Within 21 calendar days after date of award of contract, if testing or analysis will be completed prior to the bid opening date.

The Project Manager will return a disposition of the report within 21 calendar days after date of receipt.

g. Deflections: Maximum allowable deflection of bushings or surge arresters shall be as follows:

- (1) For less than 138 kV - 3.5 inches.
- (2) For 138 kV to 230 kV - 6.5 inches.
- (3) For greater than 230 kV - 8.0 inches.

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Deflection shall be as measured at the top of the bushing or surge arresters from the base of the bushing or arrester, neglecting deflection and rotation of the base support structure, if any.

- h. Anchorage: The transformer base will be welded to steel embeds in the foundation by the Contractor. The manufacturer shall design the anchorage welds in accordance with Annex A.4.2 of IEEE 693-2005. The manufacturer shall ensure that the transformer base can accommodate the required anchor welds. Anchor bolts shall not be allowed.

13. Threaded Fasteners:

Nuts, bolts, studs, and screws shall conform to the ANSI or Metric Standards of pitch, thread shapes, dimensions, and tolerances; however, the equipment may have a mixture of threaded fasteners complying with one or the other of such standards.

14. Locking Devices for Threaded Fasteners:

The Contractor shall furnish locking devices for threaded fasteners which will lock them in such a manner as to prevent them from coming loose in transit and in service. No locking device shall be furnished within the tank that will cause electrical hazard due to breakage or formation of loose metallic particles or that will loosen in event the work shrinks. No sealant shall be used as a locking means on metallic threaded fasteners, and no split lock washers or wire shall be used within the tank as a locking device for any threaded fastener.

15. Production Schedule:

Within 30 calendar days after receiving a contract award notification from SCPPA, the Contractor shall furnish SCPPA and Project Manager a production schedule. The schedule shall include starting dates and the time allotted for engineering, manufacturing, testing, and shipment.

16. Preparation for Shipment:

Transformers shipped without oil shall be prepared for shipment by filling the dried transformer with either dry air or dry nitrogen gas under sufficient pressure to ensure, upon arrival at destination, a positive pressure above atmospheric based upon a 30°F minimum ambient temperature. **Dry air is preferred.** The Contractor shall attach a tag of suitable material to each transformer, showing the name of manufacturer, the serial number, the date of filling, whether air or nitrogen was used, and the pressure and temperature of the air or nitrogen at the time of shipment. If the transformer arrives with insulation surface-moisture content higher than 0.4 percent as determined by using Figure 4 of IEEE 514, as last revised, the windings shall be dried out at no additional cost to SCPPA.

17. Shipment:

All shipments shall be properly boxed, crated, packed, or otherwise protected to prevent damage in transit and in storage. All parts shall be prepared for shipment so that slings for handling can be readily attached while the parts are on the car or truck. Where it is unsafe to attach slings to the box, boxed parts shall be packaged with slings attached to the parts so that attachments can readily be made. Before shipment, all finished iron and steel external parts shall be covered with a readily removable rust-preventing compound, and all finished bright work shall be suitably wrapped or otherwise protected from damage. All

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pipe flanges shall be protected by flange protectors bolted on, metal plugs shall be screwed into all tapped holes, and all other openings shall be adequately protected to prevent entrance of dirt and moisture during shipment.

Shipments involving sea transportation shall be crated with dry materials, shall be packed with a desiccant, shall be sprayed or treated with a fungicide or given equivalent treatment, and shall be otherwise protected to insure delivery with no fungus growth, rust, or other damage due to such transportation.

Each package shall be plainly marked with the following:

- a. An identifying number, which also shall appear on the bill of lading and other documents relating to shipment.
- b. Name and address of consignor and Contractor.
- c. SCPPA contract number, sub-purchase order number (if applicable), and Item number.
- d. Sufficient information to identify the contents, and when possible, the name of the machine or the equipment of which the contents form a part.
- e. Consignee's name and address as shown in the Proposal Schedule.
- f. Shipping weight.

Each package shall contain a detailed packing list, containing package and contract numbers, and a description of the contents, including quantities, part or unit identifications, and part numbers, if applicable.

Spare parts shall not be packaged with other material.

All equipment delivered by truck shall be capable of being unloaded from 3 sides of the truck bed with a forklift loader or from above with an overhead crane. All equipment delivered by rail shall be on flat cars.

The Contractor shall be fully acquainted with weight limitations, clearance limitations, permit requirements, and all other pertinent information to transport the transformer to the various locations identified on the purchase orders.

The Contractor shall furnish and install a minimum of two 3-way, battery-operated impact recorders before shipment of the Transformer. The impact recorders shall not be subject to de-energization due to battery failure or other foreseeable causes during the maximum expected shipping time from the factory to Transformer pad. The impact recorder(s) shall be opened in the presence of the Project Manager upon arrival and two copies of the recorded data shall be provided to the Project Manager.

The Contractor shall furnish to the Project Manager, prior to shipment, the limits of acceleration and the appropriate steps required should those limits be exceeded during transportation. This information shall also be included in the instruction books as detailed in Section 20 of this Division. If approved instruction books have not been received by the Project Manager prior to shipment, this information shall be furnished to the Project Manager in accordance with Section 9 of this Division. The Contractor shall furnish all additional transportation information requested by the Project Manager prior to shipment of the transformer.

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18. Technical Services Furnished by Contractor:

SCPPA shall have the right and option at any time, up to the final completion and acceptance of the entire contract work, to require the Contractor to furnish at the price(s) quoted in the Proposal Schedule a competent service Project Manager to direct the disassembly, assembly, installation, checking, and testing of the equipment covered by these specifications. The service engineer shall not assume executive charge of such work but shall provide technical direction so that SCPPA, to the extent that it follows the recommendations of the Contractor, shall be relieved of claims by the Contractor that failure is due to improper work of installation during the employment of the Contractor's engineer.

The service engineer shall be able to speak, write, and understand the English language.

The commissioning engineer shall sign a release, certifying that the transformer has been fully tested and is ready to energize.

19. Right to Operate Unsatisfactory Equipment:

If the operation of the equipment after installation proves to be unsatisfactory to the Project Manager, SCPPA shall have the right to operate such equipment until it can be taken out of service without injury to SCPPA for the correction of defects, errors, or omissions, provided the period of such operation pending the correction of defects, errors, or omissions shall not exceed one year without written consent of SCPPA and the Contractor.

20. Instruction Books:

Within 150 calendar days after date of award of contract, the Contractor shall furnish 2 complete identical sets of detailed instruction books for all equipment furnished under these specifications for acceptance. These books shall be accompanied by a letter of transmittal and shall contain all illustrations, detailed drawings, wiring diagrams, torque table for every bolt used in manufacturing the equipment, and instructions necessary for installing, operating, and maintaining the equipment. The illustrated parts shall be numbered for identification. All information contained therein shall apply specifically to the equipment furnished and shall not include instructions not applicable. Instruction books shall contain limits of acceleration, which should not be exceeded during shipping and appropriate steps to be taken, should those limits be exceeded. Instruction books shall contain standard Safety Data Sheets for all materials used in the transformer that are considered hazardous materials by Nevada, and/or United States environmental regulations. Photographs, ozalids, Xerox, and similar types of reproductions shall not be attached to pages. All such illustrations shall be incorporated within the printing of the page to form a durable and permanent reference book.

The instruction books shall also include a section describing the complete evacuation and oil filling instructions. These instructions shall pertain to any and all applicable compartments within the transformer furnished and where applicable shall include, but not be limited to, the following:

- a. A list of all items that will not withstand full vacuum.
- b. Transformer oil filling location.
- c. Recommended oil temperature for filling and rate of fill.

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- d. Information on whether or not the tap-changer compartment should be filled concurrently with the main tank.
- e. A statement whether or not the cold trap used in the vacuum evacuation process can be placed on the transformer.
- f. Method of breaking vacuum in the diverter switch and information on whether or not the diverter switch requires a nitrogen blanket.
- g. Method of venting the bushing pockets, oil pumps, conservator, and diverter switch.
- h. A statement whether or not the tap-changer compartment is vacuum proof when the main tank is at atmospheric pressure and filled with oil and other limitations imposed during normal or emergency transformer maintenance and inspection.

SCPPA will inform the Contractor by letter within 21 calendar days after receipt of the instruction books, either that there are no exceptions noted or that there are corrections needed. If corrections are requested, the Contractor shall promptly update the instruction books to incorporate the corrections at no additional cost to SCPPA.

Upon final approval by SCPPA, in writing, the Contractor shall promptly furnish 10 additional sets identical to the submitted hard copy, 10 USB sticks containing soft copies in PDF format. These sets will be considered the “final and approved” Instruction Books.

In addition, one approved instruction book, inside a weatherproof pocket inside the control cabinet, shall be included with each transformer shipped.

21. Inspection and Test Plan (ITP):

- a. The Contractor shall furnish a detailed ITP, covering all the design tests, routine tests, factory tests, and the seismic-withstand tests required by the specifications for review as to compliance with these specifications. The testing plan shall include the testing facility in which each test shall be performed, the order in which the tests will be conducted and the test method being used. The testing shall be performed in accordance with such ITP. The testing plan shall not be changed without review by the Project Manager as to compliance with these specifications.
- b. Project Manager may inspect and reject materials, services, equipment, or other Work tendered or purchased under the Contract at any reasonable location. Project Manager may choose any location to conduct equipment inspection.
- c. Inspection may include, but shall not be limited to, any testing that Project Manager deems necessary or convenient to determine compliance with these specifications.
- d. The expense of testing is included in the Contract price. All expenses of subsequent or additional tests will be charged against Contractor when due to failure of first-offered materials, services, equipment, or other Work to comply with these specifications.

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- e. Project Manager and/or representative by Project Manager will witness factory tests and any/all associated tests per ITP.

22. Testing Schedule:

Within 60 calendar days after date of award of contract the Contractor shall furnish a testing schedule covering all the design tests, routine tests, and seismic-withstand tests required by the specifications for review as to compliance with these specifications. The testing schedule shall include the order in which the tests will be conducted and the test method being used. The testing shall be performed in accordance with such testing schedule. The testing schedule shall not be changed without review by the Project Manager as to compliance with these specifications.

In lieu of performing the seismic-withstand tests, the Contractor may furnish for review as to compliance with these specifications the method, input data, and results of the seismic analysis used.

23. Safety Data Sheets:

- a. The Contractor shall evaluate all substances, used in the materials or the equipment furnished, in accordance with the requirements of General Industry Safety Order and Nevada Code of Regulations, and Nevada Labor Code, as applicable.
- b. The Contractor shall furnish a Safety Data Sheet (SDS) for each hazardous substance and for each hazardous mixture of substances used. The SDSs shall be furnished to SCPPA on or prior to the date of the first delivery of the materials or the equipment.
- c. The SDSs shall also be included in the instruction books.

24. Certification of Freedom of PCBs for Transformer:

Not less than 7 calendar days prior to each delivery, the Contractor shall furnish a certificate to SCPPA, showing that the oil and other materials used in the manufacturing or the testing of the transformer are free of PCBs alone or in combinations with other materials present at any temperature, including combustion. The certificate shall be accompanied by a letter of transmittal.

25. Correspondence:

All correspondence must be sent according to the following matrix:

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Name and Address	Invoices	RFI, Drawings & Submittals	Project & Construction Management	Deliveries	Schedules & Testing
LADWP C/O David Alba 111 N. Hope St. Room 1263 Los Angeles, CA 90012 david.alba@ladwp.com	Email	Mail & Email	Email	Email	Email
AGS C/O Edin Mandzukic 15555 Apex Power Parkway Las Vegas NV, 89165 edin.mandzukic@ ethosenergygroup.com	Email	Mail & Email	Email	Email	Email

26. Quality Assurance and Method and Timing of Acceptances:

- a. Project Manager has the right to subject any or all materials, services, equipment, or other work furnished and delivered under the Contract to rigorous inspection and testing. (Unless otherwise specifically provided in the Contract with respect to specific materials, services, equipment, or other work. SCPPA has no duty to inspect, test or specifically accept.)
- b. Before offering any material, services, equipment, or other work for inspection, testing, delivery, or acceptance, the Contractor shall eliminate all items or portions where are defective or do not meet the requirements of these specifications. If any items or portions are found not to meet the requirements of these specifications, the lot, or any faulty portion thereof, may be rejected.
- c. The fact that the materials, services, equipment, or other work have or have not been inspected, tested accepted, or paid for by SCPPA, whether voluntarily or as required by any specific provision in the Contract, shall not relieve Contractor of responsibility in case of later discovery of nonconformity, flaws or defects, whether patent or latent.
- d. SCPPA shall, upon delivery of the transformer to the Delivery Point, examine the Impact Recorders (minimum two) and conduct a Core Ground Test.
- e. If the Impact Recorders show that the transformer was subjected to unacceptable impacts during transit, or if the core ground test reveals unintended core grounding, SCPPA may reject

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delivery of the transformer. The Contractor shall then make such repairs to the transformer, as are necessary to repair any damage to the satisfaction of

- f. Within 5 calendar days after completion of such repairs and acceptance tests, Project Manager will issue a notice of Conditional Acceptance.

27. Guarantees and Warranties:

- a. Contractor guarantees and warrants that for a period of **five years** after the transformer is in Commercial Operation, but in no event longer than the five years and one month from delivery, all materials, services, equipment, workmanship, and other work furnished under the Contract are and will be free from defects and otherwise conform to the terms of the Contract.
- b. The Contractor shall repair or replace, at Contractor's option, all defective materials, services, equipment, or other work. Such repair or replacement shall be delivered delivery duty paid at the Delivery Point. SCPPA has the right to demand repair or replacement, in addition to any other remedies that may be available for breach of the foregoing guarantee and warranty.
- c. THE GUARANTEES AND WARRANTIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES AND GUARANTEES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

28. Time is of the Essence:

The LADWP/ SCPPA and Contractor shall recognize that "Time is of the Essence" for performance of the work contemplated by this RFP and that LADWP/ SCPPA will suffer financial loss if the services, equipment, or Work are not delivered, installed, and completed at Plant on the dates agreed in the contract. It will be impracticable or extremely difficult to fix the actual damage that may result from any delay in completion of the work at the times agreed upon. It is, therefore, stipulated and agreed that:

- a. In the event Contractor is late in delivering the Work, and delivery to the Delivery Point is not complete by the Delivery Date, Contractor shall pay to SCPPA as liquidated damages and not as a penalty the sum of 1.0% of the price of the late Work per week. Contractor's maximum aggregate liability for these liquidated damages shall not exceed 10% of the price of the Work that is late.
- b. Assessment of liquidated damages shall constitute Contractor's sole liability and SCPPA's sole remedy for any late delivery, until such time as the 10% cap is reached, in which case sub-clause (c) shall apply.
- c. SCPPA may terminate the Contract if the 10% cap on liquidated damages set forth in Section 28.b. has been reached, whereupon the following will apply:
 - (1) If Contractor's failure to deliver is caused by reasons other than Force Majeure, Contractor shall be entitled to no further payments under the Contract.

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- (2) If Contractor's failure to deliver is caused by Force Majeure, SCPPA shall pay Contractor those amounts owed to it under the Contract for Work performed prior to termination.
- (3) Regardless whether Section 28.c.(1) or 28.c.(2) applies, SCPPA shall be entitled to possession of all Work, either in-process or delivered, for which payment has been made.

29. Payment Terms:

Payment for Transformer Manufacturing Portion of the Work:

- a. First Payment: Ten percent of the price will be paid within 30 calendar days after the latest of
 - (1) Signing the Proposal and
 - (2) Project Manager's approval of drawing submittals and
 - (3) Project Manager's approval of final production schedule and
 - (4) Receipt of invoice.
- b. Second Payment: Seventy Five percent of the price will be paid within 30 calendar days after:
 - (1) Delivery of the Transformer to Apex GS site and
 - (2) Installation of Transformer to Apex GS site and
 - (3) Energization of Transformer at Apex GS site and
 - (4) Storage of existing Transformer at Apex GS site and
 - (5) Project Manager's approval of Installation Commissioning Report and
 - (6) Project Manager's approval of final Operation and Maintenance Manuals and
 - (7) Receipt of invoice.
- c. Third Payment: Fifteen percent of the price will be paid within 30 calendar days after:
 - (1) Project Manager's approval of As Built Drawings and
 - (2) Receipt of invoice.

IV. Detailed Specifications

1. Equipment:

a. Scope:

The transformer furnished shall operate as a unit transformer, directly connected to a generator, rated up to 270-MVA at 18-kV and shall supply stepped-up voltage, through a circuit breaker, to a nominal 525-kV, 3-phase, effectively grounded transmission system.

The transformer shall be furnished with an off-load tap-changer on the high-voltage windings and shall be a 60-hertz, oil-immersed outdoor type.

The transformer shall be connected for delta operation on the low-voltage windings. The high-voltage windings shall be connected for grounded wye operation, with the neutral brought out and externally grounded.

The phase relation shall be as detailed on drawing E13-1, by Power Engineers Inc.

b. Performance Requirements:

The power transformer furnished shall meet the following performance requirements:

(1) Power Ratings and Winding Temperature Rise:

The transformer shall have power rating of not less than the following:

- (a) 162/215/270 MVA continuous at 55°C temperature rise
- (b) 181/240/302 MVA continuous at 65°C temperature rise

Each transformer shall have a continuous full load output rating of 270-MVA at 0.80 power factor, based on a maximum average copper temperature rise of 55°C, a maximum hottest-spot copper temperature rise of 65°C above an average ambient temperature of 40°C, and a maximum ambient temperature of 50°C.

Each transformer shall deliver a continuous 3-phase output of not less than 302-MVA at 0.80 power factor, at 65°C average winding temperature rise, and 80°C hottest-spot winding temperature rise, with no loss of life.

(2) Voltage Ratings:

The voltage ratings and connections of the power transformer shall be as follows:

Secondary Voltage (kV)	Primary Voltage (kV)
525.0 grounded	18.0 delta

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Wye/303	
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One per-unit voltage shall be defined as 525-kV.

(3) Voltage Taps:

Each transformer shall be furnished with a Reinhausen de-energized tap changer on the high voltage windings to provide the following taps:

- (a) 538-kV grounded wye
- (b) 532-kV grounded wye
- (c) 525-kV grounded wye
- (d) 518-kV grounded wye
- (e) 512-kV grounded wye

The 525-kV is designated as the neutral tap position.

(4) Cooling Class:

The transformer cooling class shall be ONAN/ONAF1/ONAF2. However, the transformer shall meet the dimensional constraints of the Specifications, in drawings 961400C3501 & 961400C3503, by VA Tech.

(5) Voltage Class, Basic Impulse Level, and Switching Surge Level:

The minimum voltage class, Basic Impulse Level (BIL), and Switching Surge Level (SSL) of the windings shall be as follows:

Winding	Voltage		
	Class (kV)	BIL (kV)	SSL (kV)
High-Voltage	525	1425	1180
High-Voltage Neutral	34.5	200	N/A
Low-Voltage	25	150	N/A

(6) Impedance Voltage:

The percent impedance voltage at 60-hertz, 525-kV, 162-MVA, with the tap changer in neutral position, shall be 9.05 percent.

(7) Exciting Current:

The exciting current at 110 percent rated voltage shall not exceed 5 percent of the rated current.

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(8) Audible Noise Levels:

The average audible noise level, when measured in accordance with IEEE C57.12.90, shall not exceed 85 decibels at 270-MVA.

Special coatings or the addition of sound-absorbing or sound-insulating materials shall not be used to reduce the audible noise level.

c. Construction:

The power transformer furnished shall be constructed as follows:

(1) Windings:

The 3-phase power transformer shall be connected delta primary/grounded wye secondary. The angular displacement between the high-voltage and low-voltage terminal voltages shall be 30 degrees with the low-voltage lagging the high-voltage.

Each winding shall be designed to have substantially uniform voltage distribution at 60-hertz.

The windings shall be copper. Core-form design transformer coils shall be circular. Shell-form design transformer coils shall be rectangular.

Joints made by the cold-pressure welding process shall not be used in the winding except for cable connections to windings.

All conductors used in the transformer shall be clean, shall be free from oxide or scale, and shall have all rough or high points smoothed down to remove burrs and slivers.

All coils shall be firmly wound, and tap leads and series connections shall be securely fastened or braced so adjacent turns or coils shall not be displaced or deformed during assembly by vibration incidental to handling and shipment, or by the mechanical stresses induced by rated short-circuit currents for transformer as specified in the IEEE Standards.

Transpositions in windings or coils wound with multi-conductors in parallel shall be arranged so they will not deform the shape of a coil, and also be so arranged that the voltage difference between adjacent conductors will be kept at a minimum value at the point of transposition.

All high-voltage windings shall be insulated with thermally upgraded paper, for use in 65°C average winding temperature rise oil-filled transformer. Use of netting tape (CTCE) is acceptable on low-voltage windings. All insulating material shall maintain its stability in the transformer oil when the transformer is subjected to the maximum temperatures permitted by NEMA Standards for Transformer.

The crossover conductors between coil groups of the high-voltage winding shall have additional insulation installed between the crossover conductor and the adjacent windings and leads.

All leads or taps leaving the coils shall be furnished with thermally upgraded paper insulation. The insulation shall be done so as to prevent undue bending or breaking of the lead insulation.

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All coils shall be supported at frequent intervals by insulating spacers arranged not to interfere with oil circulation. All spacers shall be aligned and parallel with the coil. All spacers shall be securely and rigidly locked or clamped in place, to prevent loosening in shipment or in operation.

All spacers for windings shall be of sufficient thickness to ensure separation of adjacent parts after compression.

Double nutting or other approved methods by the Engineer shall be used for the core and coil, and lead support clamping structures.

The clamping for all windings shall provide full-circumference clamping. The top coil support for each phase shall be a one-piece, high-strength, oil-impregnable insulating material which completely surrounds the core leg. The coil support shall be designed so that when pressure is applied the support from above, the pressure shall be transmitted uniformly around the top of the windings, including the portion under the top core yoke.

The clamping system shall result in sufficient pressure to restrict the movement of coils during shipment, installation, and short-circuits during the life of the transformer. The clamping shall be designed with enough mechanical strength to support the coils under the sudden shock of short-circuit forces.

(2) De-energized Tap Changer:

Each transformer shall be equipped with a Reinhausen de-energized tap changer to provide the no-load voltage ratios as specified in Sub article B(3). The operating handle shall be permanently mounted on one side of the tank, not higher than 5.5 feet above the base of the tank. The tap changer operating handle shall be bronze or aluminum. The tap changer shall be able to carry the full short-circuit current rating of the transformer as specified in the ANSI/IEEE Standards.

Provision shall be made for locking the tap changer handle in any tap position with a padlock having a 3/8-inch diameter shackle. The padlock is not required.

The tap position indicator shall be labeled 1-5, where 1 is the highest voltage tap setting, 3 is the neutral tap position, and 5 is the lowest voltage tap setting.

(3) Core and Coil Clamping Structure:

The core shall be constructed of laminations of the highest quality, highly grain-oriented, low-loss transformer core steel, shall be free from rust, properly annealed, and coated with a heat-resistant, flux-insulating coating. Maximum burr height shall not exceed 0.02mm.

The core-clamping structure shall rigidly hold the core in place to form a sturdy unit structure, which shall protect the core and the coils from mechanical damage due to shipping accelerations or repeated short-circuits.

The core-clamping structure shall be electrically and magnetically insulated from the core. The main transformer core shall be grounded separately from the core frames. The conductors, which connect the core and the core frames to ground, shall do so through bushings mounted

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on the tank cover. The bushings shall be enclosed in a weathertight, non-oil-filled external terminal box. Similar means shall also be provided for grounding cores of any other transformer used (e.g. series transformer, preventive autotransformer, etc.). The top bushing terminals shall connect to the grounded tank with a conductor, which shall be removable for convenient core-ground isolation megger tests.

All steel components of the core-clamping structure shall be shot-blasted prior to construction to remove all rust and mill scale. All corners of the core-clamping structure which are in close proximity to the coils shall be rounded to minimize Radio Interference Voltage (RIV).

All pressboard parts except formed parts shall be made from pre-compressed material having a minimum density of 1.15 gm/cc. The formed parts shall be made from pressboard having a minimum density of 0.9 gm/cc. Samples of substitute materials, complete with technical descriptions and test results, shall be submitted within 30 calendar days after award of contract. The Project Manager will reply with acceptance or rejection of the proposed material within 21 calendar days after receipt of all samples and documentation.

The transformer shall have a core saturation curve that has the slope of the saturated region intercept the ordinate at 130 percent of rated voltage. The ordinate of this curve shall be per unit rms volts, and the abscissa shall be per unit rms amperes excitation current. Per unit excitation current shall be defined as the excitation current at one per unit voltage or rated voltage.

(4) Locking Devices and Threaded Fasteners:

The Contractor shall provide a proven, suitable method for securing the threaded fasteners in place, which will secure them in a manner so as to prevent them from coming loose in transit and in service. The securing method is subject to the Project Manager's approval. No method shall be provided which furnishes a mechanism within the tank that will cause an electrical hazard due to breakage or formation of loose metallic particles, or that will loosen in the event the work shrinks. Split lock washers shall not be used. No sealant or wire shall be used as a locking means on metallic threaded fasteners.

Nuts, bolts, studs, and screws shall conform to the ANSI or Metric Standards of pitch, thread shapes, dimensions, and tolerances; however, the equipment may have a mixture of threaded fasteners complying with one or the other of such standards. Certified test reports of the locking devices and fasteners shall be provided for the Project Manager's approval.

(5) Transformer Tank:

The transformer tank shall be constructed as follows:

- (a) **Tank and Cover:** The tanks and the covers of the transformer shall be steel or stainless steel, capable of withstanding, without damage, severe strains that may be induced in them under ordinary operating conditions or during shipping and handling.

The tank cover may be either welded or bolted.

There shall be no corner welds on the transformer tank.

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The center of gravity shall be marked on the transformer and visible after complete assembly.

The lifting lugs of the transformer tank shall be furnished with a minimum 1.3 inch radius saddle to accommodate a 3-inch wide nylon sling. Jack points shall be provided and have a minimum 13-inch lift. Additional structural supports shall be provided at the jack points to ensure no structural fatigue occurs.

Tanks, covers, and joints shall be free of leaks. Tank shells and covers shall be capable of withstanding, without damage or permanent deformation, the collapsing forces produced by completely evacuating the tanks for vacuum filling. Tank covers shall be free from pockets where water can accumulate.

The inside of the transformer shall be clean and free from metal cuttings, slivers, welding spatter, and other foreign matter.

Guides or other means shall be furnished that will center and vertically align the winding and core assembly in the tank to facilitate tanking and to prevent damage due to shifting of the core while handling or during transportation.

Eye bolts, lugs, or other means shall be furnished to remove the core and coil assembly, as a unit, from the tank.

- (b) **Base:** An all-welded skid base shall be welded to the tank bottom of the transformer. The transformer base shall be designed to permit the transformer, complete and filled with oil, to be rolled over a floor on three 2-inch steel rods without distortion of base members.

Unless alternate acceptable provision is made to prevent corrosion of the exterior of the bottom of the tank, the transformer tank design shall be such that ventilation is provided between the concrete supporting slab and the bottom of the transformer tank. Only supporting steel beneath the transformer tank may touch the concrete slab. Design of the steel supporting the transformer tank bottom shall be such that the bottom is accessible for inspection after installation.

The base shall meet all dimensional requirements specified on Drawing 961400.C35.03, by VA Tech.

- (c) **Flanges, Gaskets, and Bolted Surfaces:** The bolted cover, if so equipped, and all flanged pipe fittings shall be equipped with gaskets. A milled recess shall be provided to limit the pressure applied to the cover gasket. Milled recess or gasket stops shall be used on all flanged pipe fittings to prevent over compression of the gaskets.

All bushing flanges, maintenance hole flanges, and accessory mounting locations shall be raised above the top surface of the transformer tank by not less than one inch. Bolted, threaded, or gasketed items shall not be mounted flush with the top of the tank.

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Cover flanges shall be of adequate thickness to prevent distortion when bolting the cover to the tank. Surfaces in contact with the gaskets shall be true, smooth, and parallel. Gaskets shall be made of Nitrile Rubber or Viton. Gaskets shall be oil-resistant and shall not require cementing. Gaskets and gasket material containing asbestos shall not be used in any part of the transformer or its auxiliary equipment. Spare gaskets shall be provided.

- (d) **Welding:** All welding shall be in accordance with the American Welding Society, AWS D1.1 Code or equivalent code, if the welding is performed outside of the United States, provided the codes are approved by the Project Manager.

All welds and steel surfaces adjacent or exposed to welding shall be completely free from welding slag and spatter. All welds shall be smooth and free from welding defects such as lack of fusion, porosity, undercut, or drips.

SCPPA reserves the right to require dye-penetrant, magnetic-particle, or x-ray testing of any welds in or on the transformer which the Project Manager judges to contain possible welding defects. All welds which fail these tests shall be repaired and retested.

- (e) **Surface Protection:** Surface protection requirements shall be as follows:

- (i) **Plating:** Cadmium plating shall not be used anywhere in the construction of the transformer, including all surfaces and parts inside and outside the tank.

- (ii) **Surface Preparation and Painting:** Galvanized surfaces shall not be painted. Metal shall be prepared for painting by either nonmetallic blast cleaning or by chemical-etching phosphate coating process.

All welds shall be thoroughly cleaned to remove weld flux or spatter, slag, and heat oxides to obtain a rust-free, grease-free surface, suitable for painting. Paint shall then be applied to provide a moisture barrier. This moisture barrier shall consist of mica flakes in a suitable vehicle, a melamine resin-base paint, a vinyl resin-base paint, an acrylic base paint, or equivalent paint for the intended purpose.

Exterior surface finish color shall be ANSI No. 70, Light Gray. The finish on external surfaces shall be resistant to heat, oil, and weather. The cover shall have a non-skid coating.

Interior tank surfaces, if painted, shall be white. All paints used inside the tank or on the core-clamping structure shall be resistant to high temperatures under oil.

- (f) **General Layout:** The general layout and location of the bushings, the conservator, and the control cabinet for the transformer shall be in accordance with Drawing 961400C3501 & 961400C3503, by VA Tech. Contractor is responsible for verifying all dimensions shown on existing equipment drawings. Pictures are provide (Attachment C) showing the details of existing transformer.

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The transformer center of gravity, the pad center of gravity and the spacing of the low side bushings shall align such that no modifications are needed to the iso-phase buswork if the spare GSU was installed on the existing transformer pads for STG 1, CTG 1A or CTG 1B.

Provisions will be made for the conservator to be installed on either end of the transformer tank so that the transformer can be installed on the existing transformer pads for STG 1 or CTG 1A, or CTG 1B. Provisions will be made for transformer oil cooler groups to be removed so that the transformer can be installed on the existing transformer pads for STG 1 or CTG 1A, or CTG 1B. Existing general arrangements are shown on drawing E13-1 from Power Engineers Inc.

(6) Connections to the Metal-Enclosed Isolated Phase Bus: Terminations, additional bus bars, braid connectors and enclosure compartments shall be furnished for connecting from the transformer to the 10,000-ampere metal-enclosed isolated phase bus sections, as shown on Drawing 13308-DE-410C-0 from Stone & Webster.

(7) Cooling Equipment: Cooling group manifolds or headers shall be painted steel. The transformer shall have its unique cooling group equipment mounted during factory acceptance tests. Each cooling group shall be subjected at the factory to a sustained internal pressure test of 30 psig to ensure that all parts are sealed and free from oil leaks and seepage.

Cooling group equipment shall be capable of withstanding vacuum oil-filling forces.

Cooling groups shall be equipped with isolating valves to allow draining and removal or isolation of cooling groups.

The proximity of the building walls shown on Drawing 13308-DC-336A-D, by Stone and Webster shall not adversely affect the efficiency of the cooling groups.

With half of the cooling out of service, the transformer shall have a continuous output rating of not less than 80 percent of the rated kilovolt-ampere, with temperature rises not exceeding those specified for the normal full rating.

- (a) **Radiators:** If supplied, each radiator shall be equipped with one ½-inch pipe diameter, or greater, threaded coupling, with plug, at both the highest and lowest points on the radiators to allow draining of the oil inside the radiator.

Each radiator shall be connected to the main tank through flanged isolating valves. Valves shall clearly indicate open or closed position and shall be padlock-able. Radiators shall be oil-tight with all seams and joints welded, and shall be capable of withstanding, without damage or permanent deformation, the collapsing forces produced by completely evacuating the radiators for vacuum filling. There shall be no pockets, joints, or crevices where water can accumulate and cause corrosion.

- (b) **Fans:** Fans shall be equipped for outside use, 480-volt, 3-phase, a minimum service factor of 1.2, and shall be furnished with stainless steel fan blades and

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stainless steel fan guards. Fan guards shall have openings not larger than ½-inch when any part of the fan is less than 7 feet above the ground level in compliance with OSHA regulations.

Fans shall be equipped with weatherproof terminal connection boxes and shall be designed to prevent the entrance of water into the bearings along the motor shaft.

Fan motors shall be equipped with sealed, grease-lubricated ball bearings and shall not require lubrication during the life of the bearings.

- (c) **Forced-Cooling Control Equipment:** The control equipment shall be fully automatic in operation, and shall be arranged so that the cooler groups shall be placed in service, when required, as determined by transformer hot-spot temperature.

Temperature control contacts shall be located in the grounded side of the control circuits. The controls for each cooler group shall be in separate cabinets or separated by a sheet metal barrier so that smoke or flame in the control equipment of one cooler group shall not affect the operation of the controls for the other cooler groups.

All control switches shall be Electro-switch Type 24.

The control equipment shall have a nameplate, shall be grouped in a logical manner to facilitate operation and maintenance, shall be mounted in a metallic NEMA Type 4 rated cabinet on the transformer case, and shall include, but not be limited to, the following:

- (i) A main supply circuit breaker with ambient compensating thermal overload protection for each group of fans or cooling units.
- (ii) An adjustable control device with a hottest-spot indicating thermometer actuated by transformer hot-spot temperature.
- (iii) A contactor for each group of fans or cooling units. The coil voltage shall be 120 volts alternating current. Auxiliary contacts shall be furnished for remote indication of contactor positions.
- (iv) Test switches for "automatic-off-test" control of each cooler group.
- (v) An "off-on" switch for manual operation of each cooler group.
- (vi) A selector switch for interchanging the sequence of automatic operation of the cooler groups.
- (vii) A 480/120-volt control transformer.

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- (viii) A manually reset thermal overload device and single-phase protection with ambient compensation together with alarm contacts for each fan motor. Klixon motor protectors shall not be used. Tripping of overload device shall not result in single-phasing motors.
 - (ix) Circuit breakers with ambient compensating thermal overload protection for the cooling control circuits. An overload contact from each motor starter shall be furnished and brought to a single point for alarming.
 - (x) Means shall be provided to disconnect all fans or cooling units from their sources of power upon operation of the transformer's differential relays, which will be furnished by AGS.
 - (xi) Alarm contacts and indication lights for loss of power supply, feeder, and cooling equipment control voltages with provisions for blocking such alarms for maintenance.
 - (xii) The cooling equipment shall be connected for 480-volt, 3-phase operation.
 - (xiii) The control cabinet shall contain a 120-volt ac heater, adequately sized to maintain a dry environment, with thermostatic control, safety shield, and an on-off selector switch.
 - (xiv) Cooper/Bussman PDB series, 600-volt mounted type power distribution terminal blocks shall be furnished for all wires termination the 480-volt circuits.
- (d) **Auxiliary Power:** The auxiliary equipment shall be designed to operate from 2 independent 480-volt, 3-phase, 60-hertz sources, each with its own separate terminals clearly identified. There will be a preferred power source and one emergency power source furnished by the SCPPA. Two main circuit breakers shall be furnished, and each shall be installed as a means of disconnecting one auxiliary power source. The auxiliary control circuits shall be designed for 120-volt alternating current and shall be supplied from a 480/120-volt control transformer connected to the power circuit by means of a circuit breaker with ambient-compensated thermal overload protection. The 480/120-volt control transformer shall have an additional 20 percent spare capacity for future loads.

The auxiliary equipment shall be arranged for approximate balanced loading of the auxiliary power supply.

A 480-volt automatic transfer switch such as Eaton ATC-3 with ATC-300 controller shall be furnished, which can select either one of the 2 power sources furnished for each cooler group. The transfer switch shall be automatic on failure of one power source, and there shall be a switch to select either source as a preferred source.

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(8) Vibration: Transformer shall be free from undue or harmful vibrations, which would be detrimental to the operation of the transformer or the accessories mounted on the tank or connected to the transformer.

(9) Cabinets: All cabinets, including the main control cabinet, shall be Hoffman, steel, weather-tight, and dust proof; they shall have a NEMA Type 4 rating. An IP rating alone is not acceptable. They shall be equipped with a drip shield and shall be accessible from grade.

All cabinets shall be equipped with a 120-volt ac fluorescent light inside the cabinet which will automatically switch on whenever any cabinet door is opened and switch off whenever all doors on the cabinet are closed. If the cabinet is equipped with more than one door, the light shall be switched on whenever any door is opened and switched off when all doors are closed. The light shall be enclosed by a rugged frame, designed to protect the light from breakage and allow convenient replacement of lamps.

All cabinet doors shall be mounted to the cabinet with hinges and shall be equipped with a 3-point latching operating handle with padlock provisions. All doors shall open left to right or right to left and shall provide means to safely secure the door in an open position. A print pocket shall be installed on one door of each cabinet. Each door shall be bonded to the cabinet by a dedicated ground bond terminal.

The center of the control cabinet shall be between 43 inches and 67 inches from the top of the foundation.

All readout – information windows shall be mounted on the lower half of the cabinet doors. The information shall be readable from windows with doors closed.

All ferrous material, except stainless steel, shall be thoroughly and completely galvanized in accordance with the requirements of ASTM A 153.

- (a) **Control Cabinet:** Control equipment shall include the necessary fused switches or circuit breakers, fuses, fuse clips, control transformer, temperature control relays, alarm actuating devices, and associated equipment required to provide a complete control system. All auxiliary relays shall be furnished in their own individual enclosure. All control switches shall be Electroschwitch Type 24. A complete set of spare fuses shall be furnished. All electrical components inside the control cabinet shall be Underwriters Laboratory (UL) Listed or UL Recognized.

All accessory wiring shall be terminated in one main control cabinet. The control cabinet terminal blocks shall be States-type sliding links.

All wires from current transformers, auxiliary switches, and operating mechanisms shall be brought to readily accessible terminal blocks mounted on a vertical surface in the control cabinet. The terminal block sliding links shall open to the right and close to the left. The wiring shall be terminated on the left side of the terminal blocks and arranged to read from top to bottom.

Cooper/Bussman PDB series, 600-volt mounted type power distribution terminal blocks shall be furnished for all wires terminating the 480-volt circuits.

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The control cabinet shall contain a 120-volt ac heater, adequately sized to maintain a dry environment, with thermostatic control, an on-off selector switch and safety shield.

The control cabinet shall be equipped with a dual outlet, 125-volt ac, 15-ampere, GFCI power receptacle, located inside the cabinet.

The control cabinet shall be attached to transformer tank at a reasonable human height such that all control devices shall be no higher than 6 feet.

AGS will provide a separate, independent 120-volt AC power source for the cabinet heater, receptacle, and light.

- (b) **Safety Barricade Cabinet:** Each transformer shall be equipped with an additional cabinet for storage of the safety barricade poles, rope, and hardware. No wiring, other than that required for the light, shall be inside the safety barricade cabinet.

(10) Conduit: All wiring and cable installed on and around the sides of the transformer shall be enclosed in weatherproof, rigid, or flexible steel conduit and shall comply with all applicable Articles of NFPA 70 and the IEEE/ANSI standards.

Conduit supports or connectors shall not provide sharp protuberances which may create safety hazards. Short, flexible leads from fan motors, less than 3 feet in length, do not need to be enclosed.

All conduits, conduit bodies, and conduit fittings shall be UL listed and marked with a UL label. Conduit bodies shall be gasketed.

Conduit seals shall be Appleton Type EYF, EYM, or ESU sealing fittings for rigid steel conduit. Where condensate may collect on top of a seal, provide a drain by using Crouse Hinds Type EYD or EZD drain seal and Crouse Hinds ECD drain fittings.

Conduit bodies for rigid steel conduit shall be Appleton Form 35 threaded inlets and shall be sized per NEC.

Use grounding type bushings with integral plastic bushings rated for 105°C for all conduits.

Conduit bodies shall not be modified to prohibit more conduits than what they were designed for.

Equipment and materials shall not be modified in any way where it will void UL listing.

(11) Wiring: All wiring shall be in accordance with NFPA 70. In general, all equipment and devices furnished under these Specifications and requiring electrical connections shall be designed for wiring into electrical enclosures with terminal blocks. Terminal blocks shall be furnished for conductors requiring connection to circuits external to the specified equipment and where equipment parts replacement and maintenance will be facilitated.

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Wiring shall be provided between devices and outgoing terminal blocks. All wiring accessories, including connectors, wire clamps and supports, terminal blocks, and terminal test links and their supports shall be provided.

Splices shall not be permitted in power, lighting, control wiring or instrument leads.

All electrical cables shall be selected for the electrical and environmental conditions of the installation. All wiring shall be of stranded copper, synthetic flame retardant, moisture and heat resistant thermosetting insulation. Oil-resistant and proper temperature application cable shall be used throughout.

All wiring for current transformer circuits shall be No. 10 AWG minimum.

All wiring internal to panels shall be capable of passing the flame test requirements of UL 44, Section 56.

- (a) **Internal Control Cabinet Wiring:** Wiring provided as part of the internal wiring of control cabinets or panels, shall be as follows:
 - (i) All power wiring shall be 600 V, No. 12 AWG minimum. Power cable No. 8 AWG and larger shall have copper conductors, with 90°C, heat, moisture, and flame-resistant Ethylene-Propylene-Rubber (PER) insulation and CPE jacket. Power cables which are No. 10 AWG and No. 12 AWG shall be Type SIS with copper conductors and Class D stranding.
 - (ii) All control wiring shall be 600 V, Type SIS, No. 14 AWG minimum, copper conductors with Class D stranding.
 - (iii) Low level instrumentation wiring (mV or mA signals) shall be individually shielded twisted pairs, No. 16 AWG minimum, with copper shielding and flame retardant insulation and an overall flame retardant jacket for multi-conductor cable. Overall shield shall be 1.5 mil aluminum or copper-mylar laminate tape. No PVC materials allowed.
 - (iv) All 480 VAC wiring shall be segregated from other control wiring and low voltage devices for personnel safety by means of an insulated barrier or other isolating means.
- (b) **General Wiring:** Service wiring integral to the equipment furnished, but not part of the internal wiring of control cabinets or panels, shall be as follows:
 - (i) Power cables shall be rated for the maximum service voltage, but not less than 600 V. Conductors shall be copper, Class B stranded, annealed, with a tin or lead alloy coating, and No. 12 AWG minimum. Insulation shall be EPR and 90°C rated. Jacket shall meet NFPA 70 requirements and UL listed as type TC.
 - (ii) Control cables shall be rated for the maximum service voltage, but not less than 600 V. Conductors shall be copper, Class B stranded, annealed, with a tin or lead alloy coating, and No. 14 AWG minimum. Insulation shall be EPR

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or XLPE, and 90°C rated. Jacket for single conductor or multiplexed cables shall meet NFPA 70 requirements and UL listed as type TC. Overall jacket shall be Hypalon or CPE.

- (iii) Instrument cables shall be rated for the maximum service voltage, but not less than 300 V. Conductors shall be copper and stranded. Insulation material shall be FRXLPE and EPR for less than or equal to 90°C cables or shall be TFW Teflon tape and Kapton tape over the Teflon for greater than 90°C cables. Jacket shall meet NFPA 70 requirements and UL listed as type PLTC. Each pair shall be individually shielded, with an overall shield of 1.5mil aluminum or copper-mylar laminate tape. A drain wire shall be provided for each pair.
- (iv) All thermocouple wire shall be solid conductor with twisted and shielded conductor pairs. Conductors shall be Type K chromel-alumel, and #18 AWG minimum Insulation shall be FRXLPE for less than or equal to 90°C cables or shall be TFW Teflon tape and Kapton tape over the Teflon for greater than 90°C cables. Insulation shall be color coded in accordance with the requirements of ANSI MC96.1. Jacket shall meet NFPA 70 requirements and UL listed as type PLTC. Each pair shall be individually shielded, with an overall shield of 1.5 mil aluminum or copper-mylar laminate tape. These requirements also apply to thermocouple extension wire which is furnished internal to Seller-furnished equipment. The shield wire for each thermocouple furnished for external connections shall be terminated on an ungrounded terminal, each being a separate terminal for each thermocouple.
- (v) Wiring landing on strap-screw terminal blocks shall be terminated using solder-less, compression-type, ring-tongue non-insulated terminals which firmly grip the conductor. Wiring terminated on IEC screw clamp terminal blocks shall be with wire ferrules and approved tooling. Connectors shall be Thomas & Betts Sta-Kon or approved equal. The connectors shall be constructed of copper and shall be tin-plated. Both ends and at each terminating point of each wire shall be uniquely identified with permanent, heat shrinkable wire markers. Adhesive wire labels are not acceptable.
- (vi) Wire stripping shall be accomplished with a tool that assures that the wire shall not be nicked. Terminals shall be attached to the stripped wire by means of a ratchet-type crimping tool, which makes a full crimp, to the specified pressure before allowing the wire with the terminal to be released. No solder or “quick” type connectors shall be used with any wiring except solder type shall be acceptable for indicating light resistors.
- (vii) Conductors shall have insulated ferrules whenever the spacing between adjacent terminations is such that they could make contact with one another.

(12) Limiting Dimensions: The transformer shall comply with the dimensional requirements shown on Drawings 961400C3501 & 961400C3503, by VA Tech and 13308-DC-336A-D, by Stone and Webster (Attachment A). The high-voltage bushings, cooler groups, and terminal cabinet shall be located as shown on the drawings. Horizontal air flow cooler groups shall be

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not less than 8 feet from the wall when measured along the axis of air flow. Vertical air flow coolers shall be not less than 4 feet from the wall.

Pictures are provided (Attachment C) showing the existing transformer.

(13) Grounding: Grounding pads shall be provided on the steel tank with standard 4-hole stainless steel or tin-plated copper flat pads in accordance with IEEE C57.12.10, Section 5.5.

(14) Labeling: Conductor and Cable Identification: Identify each cable or conductor with circuit identification markers in each pull box, maintenance hole, panel board, cable tray or termination. Use an approved, wire marker for cable or wire number, destination code and terminal identification of the device involved. This cable or wire number and destination code shall correspond to the respective cable or wire numbers and device identification shown on the drawings. Tag cables at all jacket end points and within 12 inches of entering a conduit from a cable tray. Identify all power, control, alarm, and instrumentation conductors, to correspond to the single-line diagram circuit numbers and signal cable pair designations shown on the drawings.

- (a) **Point-to-Point Drawings For External Equipment Connections:** Where cables or wires are used to connect from one piece equipment or enclosure to another the drawings shall be shown using the cable, wire, and terminal block designations as shown in Figure 1.

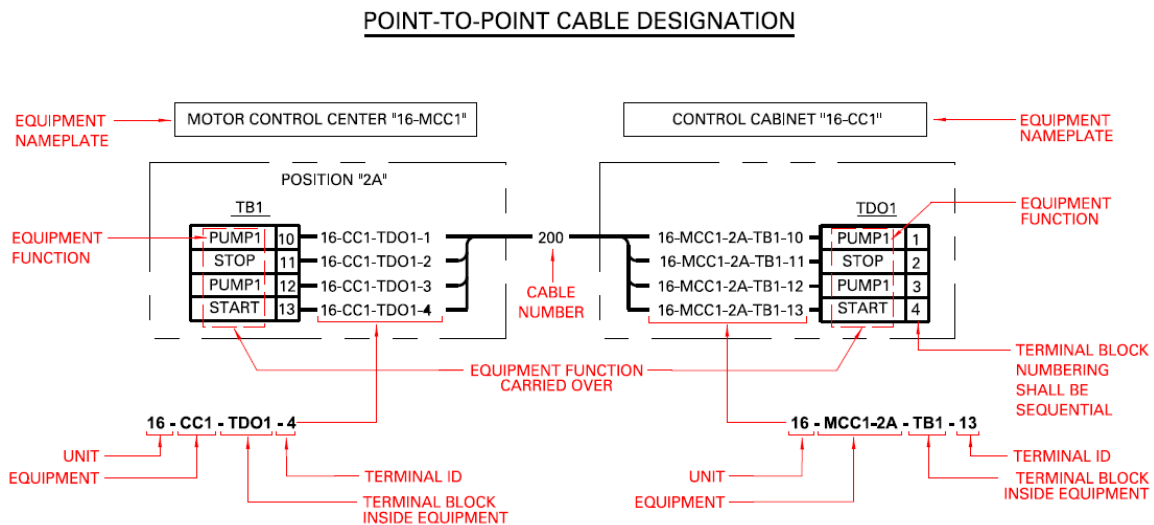
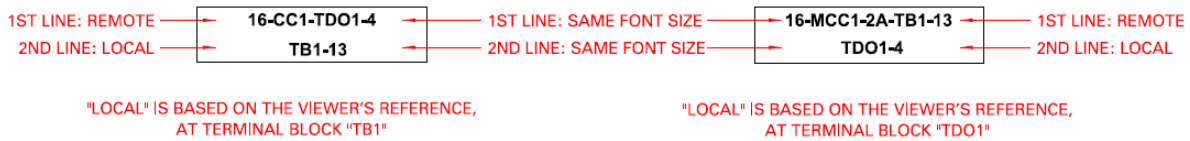


Figure 1

- (b) **Wire Termination Labels For External Equipment Connections:** Where cables or wires are used to connect from one piece equipment or enclosure to another the wire termination labels shall be marked as shown in Figure 2.

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CABLE TERMINATION LABEL



NOTES:

1. THE SPACE LIMITATION FOR THE LABEL IS 23 CHARACTERS PER LINE AT 8 POINT ARIAL FONT. IF THE WIRE DESCRIPTOR IS MORE THAN 23 CHARACTERS, THEN USE BOTH LINES ON ONE SIDE OF THE SLEEVE FOR THE "REMOTE" AND THE OTHER SIDE FOR THE "LOCAL" DESCRIPTOR.

Figure 2

- (c) **Point-to-Point Drawings For Internal Equipment Connections:** Within the same equipment or enclosure the drawings shall be shown using the wire and terminal block designations as shown in Figure 3.

POINT-TO-POINT WIRE DESIGNATION INSIDE THE SAME EQUIPMENT

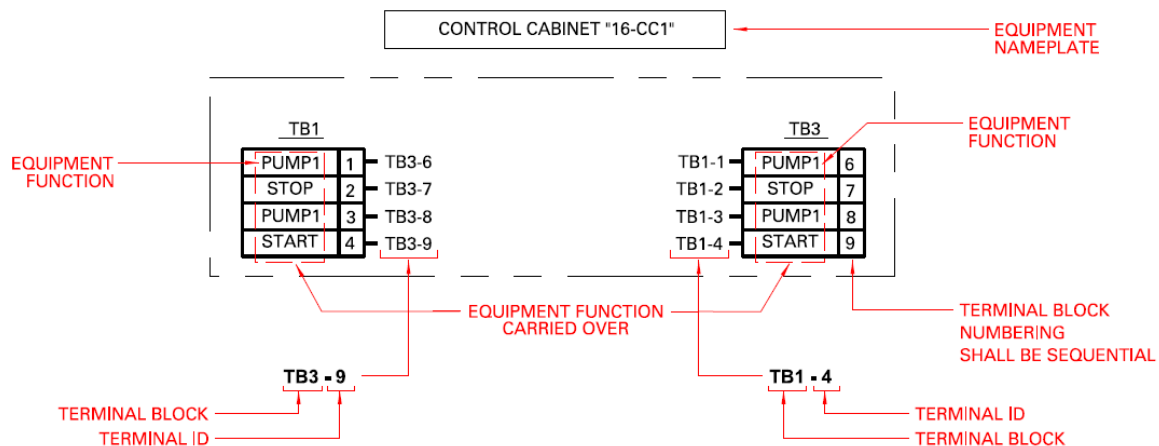


Figure 3

- (d) **Wire Termination Labels For Internal Equipment Connections:** Within the same equipment the wire termination labels shall be marked as shown in Figure 4.

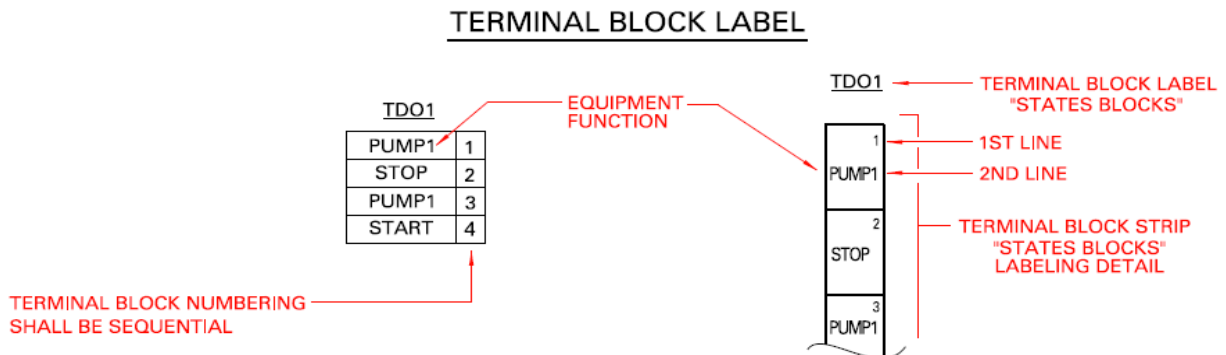
WIRE TERMINATION LABEL INSIDE THE SAME EQUIPMENT



Figure 4

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- (e) **Terminal Block Labels:** The terminal blocks shall be labeled as shown in Figure 5. The equipment function label shall not contain more than six characters.



- (f) **Marker Types:** Individual wire labels shall be heat-shrink white Polyolefin as manufactured by Brady with a 2-inch length. The space limitation is 23 characters per line at 8 point Arial font. Should the wire label be more than 23 characters, both lines on one side of the sleeve for the Local shall be printed and the other side shall be for the Remote.

The heat shrink labels shall be kept loose and not shrunk down onto the wires.

Markers for other cables shall be self-laminating white transparent vinyl as manufactured by Brady.

The wire markers shall be legible machine-printed only with the corresponding Brady printer. The printer shall be capable of printing on both sides of the heat-shrink.

- (g) **Equipment Labels:** All equipment labels shall be phenolic type, colored black with white letters for all labels inside control cabinets. All labels on the exterior of the transformer shall be stainless steel, except for warning nameplates, which shall be phenolic, colored red with white letters. Nameplates shall be fastened with stainless steel screws.

Nameplates shall be provided for all equipment and instruments, including electrical cabinets, junction boxes, control panels, and transformer. Nameplates should be stamped with the serial number, the name and address of the manufacturer, rated capacity, speed, electrical characteristics, and other pertinent data as applicable and as specified hereinafter. Nameplates of distributing agents will not be acceptable.

Provide visible, permanent nameplates identifying each instrument, instrument switch, meter, relay, control switch, indicating light, circuit breaker compartment, potential transformer compartment, fuse block, and auxiliary compartment. Identify equipment and terminal blocks, terminal strips, PLC modules, and all other

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electrical equipment within control panels, boxes and compartments with nameplates. This shall include the backside of door-or panel-mounted items.

- (h) **Transformer Serial Number:** The serial number shall be engraved on the core and coil assembly, transformer tank, and control cabinet. The engraving shall be machine engraved, machine printed, and visibly legible. The serial number engraving on the core and coil shall be visually accessible from a manhole positioned at the top of the transformer. All serial numbers shall match upon complete assembly of the unit.

(15) Bushings: The bushings for the transformer furnished shall be as follows:

- (a) **All Bushings:** Bushings shall be cover-mounted. Bushings shall withstand a gas pressure test of 10 pounds per square inch for 5 minutes without leakage. The gasket at the flange shall not cover the cemented joint during the test.

Each bushing flange shall be furnished with an oil-resistant gasket. A milled recess and gasket stops shall be provided to limit the pressure applied to the gasket to that which will ensure the proper amount of compression for the type of material used for the gasket.

Bushings shall be suitable for washing by a stream of water under high pressure when the transformer is energized without admitting water internally into the bushing, regardless of the angle at which the stream of water impinges on the bushing.

All bushing rods shall be copper. The current density in the bushing conductor and in the terminal connector shall be such that when the bushing is tested separately from the transformer, the temperature rise of the bushing shall not exceed the thermal rise specified in IEEE C57.19.00. The bushings shall have a capacitance tap for measuring bushing power factors.

The creepage distance of bushings shall not be reduced by the proximity of any lifting eyes or other structural parts.

The color of all bushings shall be ANSI No. 70.

Phase-to-ground and phase-to-phase clearance dimensions shall be indicated on all electrical drawings.

Gas collection lines from the top of the bushing pocket or turret assembly to the Bucholtz relay shall be provided.

Each bushing shall be designed so there will be no undue mechanical or electrical stress in any part during operation. The bushings shall be condenser type. Means shall be provided to accommodate conductor expansion and to dissipate internal heat. All bushings shall be weathertight and of sturdy construction to safely withstand shipping, handling, and shocks in service. Bushings shall be designed so they can readily be changed in the field. Bushings shall be free from

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oil leakage, shall have ample provision for oil expansion, and shall be furnished with an oil level indicator.

(b) 500-kV Composite Bushings:

(i) **General:** The 500-kV bushings furnished shall be composite-insulated and shall be resin-impregnated paper-insulated, capacitance-graded, draw-lead type. Resin-bonded paper-insulated bushings shall not be furnished.

The bushings shall comply with IEEE Standards C57.19.00 and C57.19.01, unless stated otherwise in these specifications.

The bushing ratings shall be in accordance with Section 5 of IEEE C57.19.00, except as follows.

The rated BIL shall be minimum 1675 kV and the rated continuous current for the draw-lead stud and mating top terminal shall be not less than 2000 amperes. The minimum creep distance shall be in accordance with IEEE C57.19.01.

The creepage distance of the bushings shall not be reduced by the proximity of auxiliary equipment, conduits, lifting lugs, or any other external components of the tank or the structure.

The bushing in-board shank (lower end), flange, and terminal dimensions shall be in accordance with Table 3 of IEEE C57.19.01.

(ii) Insulating Envelopes:

(1) **Outdoor Insulating Envelope:** The insulating envelope used above the bushing mounting flange shall consist of an epoxy-impregnated, seamless, void-free fiberglass tube with silicone rubber sheath and weather sheds and metal end fittings.

The tube end fittings shall be heat-shrunk and glued onto the tube.

The tube-sheath and sheath-shed interfaces shall be bonded or molded into one piece by hot vulcanization. The strength of the tube to rubber interface shall be greater than the tearing strength of the rubber alone.

The interface between the metal end fittings and the silicon rubber shall be permanently sealed to prevent moisture and foreign material from contacting the tube-to-metal interface.

The silicone rubber sheath and weather shed material shall have a chemical backbone of 100 percent silicone polymer before fillers are added.

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(2) **In-Board Shank Insulating Envelope:** The insulating envelope used below the bushing mounting flange for the in-board shank shall be cast epoxy.

(iii) **Mounting Flange:** The mounting flange shall be void-free, cast-aluminum and shall be equipped with an ANSI Type A potential tap.

(iv) **Current-Carrying Parts:** All current-carrying parts shall be copper.

(v) **Silver Plating:** The top and bottom terminals shall be silver-plated.

(vi) **Bushing Head:** The bushing head shall be void-free, cast-aluminum.

(c) **Porcelain Bushings:** The bushings furnished with the transformer shall have the following characteristics:

Voltage Class (kV)	Amperes	Minimum Creepage Distance (Inches)	Withstand Test		BIL (kV)
			Voltage, Dry (kV)	60 Hertz Wet (kV)	
Neutral 34.5	800	35	80	75	200
25	10,000	17	60	50	150

Bushings shall be free from oil leakage, shall have ample provision for oil expansion, and shall be furnished with an oil level indicator.

All porcelain used in the bushings shall be homogenous, free from laminations, cavities, or other flaws affecting its mechanical strength or dielectric quality, and shall be vitrified, tough, and impervious to moisture. The glazing of the porcelain parts shall be free from imperfections such as blisters, burns, or unglazed spots.

Each transformer shall be furnished with internal connection points, to which tertiary bushings may be connected during testing and commissioning, or at a later date by SCPPA, or left unused for buried tertiary operation.

(16) **Bushing Terminals:** Each high voltage bushing terminal shall be thread type copper stud connector, tinned, in accordance with NEMA CC1.

The terminal connectors for the low-voltage bushings shall be as shown on Drawing 961400.C35.03, by VA Tech.

(17) **Bushing Current Transformers:** The Contractor shall furnish the following current transformers (CT) in accordance with IEEE C57.13 with each power transformer:

(a) Each high-voltage terminal shall have the following:

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- (i) One, multi-ratio, 1,200 to 5, relaying bushing (CT). The accuracy class shall be C-800.
- (ii) One, multi-ratio, 1,200 to 5, metering bushing CT. The accuracy class shall be 0.3-2.0.
- (b) One, single ratio, 2,400 to 5 metering bushing CT shall be furnished on the high-voltage neutral terminal. The accuracy class shall be 0.3 B-2.0.
- (c) One, single ratio, 1,200 to 5 relaying bushing CT shall be furnished on the high-voltage neutral terminal. The accuracy class shall be C-800.

All current transformers (CT) secondary wiring shall be continuous, with no splices between the CT and the control cabinet. If required, the CT secondary wiring may be terminated at an intermediate terminal, adjacent to the bushing turrets or pockets, enclosed by an ancillary weather-proof cabinet. These terminals shall be non-opening, labeled, post-type connectors. The CT wiring shall be terminated, with crimped, ring connectors securely attached to the post, if the ancillary cabinet is used.

Each CT shall be shorted and individually grounded. The shorted and grounded wires shall be terminated on top of the CT wires.

The polarity mark for each current transformer shall be located toward the top of the bushing. The secondary polarity mark for each current transformer shall be located on the top of the terminal block associated with the wiring from each current transformer.

(18) High-Voltage Surge Arresters: The high-voltage surge arresters shall not be mounted on the transformer. The arresters shall be station class, silicone-rubber-housed, gapless, metal oxide, valve type.

Each arrester shall be capable of withstanding power frequency temporary overvoltage, multiple stroke currents, long-duration discharges, and switching surges.

Following discharges, the arrester shall reseal against the waveform appearing across it.

The normal voltage gradient across the arrester elements shall not be impaired by surface contamination or atmospheric conditions, including salt fog.

The arresters shall be designed for base mounting and shall be completely self-supporting.

The weather-shed of the arrester housings shall be made of elastomers of the type High-Temperature-Vulcanized (HTV) or Low-Temperature-Vulcanized (RTV). The entire weather-shed including end-fitting seals shall be 100 percent pure silicone rubber before the addition of any fillers and additives, and shall not contain any ethylene-propylene rubber (EPR). The final weather-shed rubber compound shall contain not less than 35 percent pure silicone rubber.

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End seals shall be constructed by molding the silicone-rubber material onto the end fittings. Glued-type and friction-type shall not be used.

The top plate of each surge arrester shall have one 4-hole tinned copper pad for connection to a vertical or horizontal cable terminal.

The hole size and spacing of all 4-hole pads shall be in accordance with NEMA CC1, Figure C-4.

A minimum 2-hole NEMA ground cable terminal shall be furnished on the bottom of each arrester for connection to a 500 kcmil copper cable for all surge arresters.

Each arrester shall have a pressure relief device, which shall act positively to vent gas pressures for the prevention of explosion of the porcelain in the event of arrester failure.

(19) Accessories: All indicators and gauges shall be mounted at eye level between 5 and 6 feet high, placed so they can be read at the control cabinet, and shall be labeled accordingly. All indicator, monitor, and gauge contacts and outputs shall be wired to the control cabinet.

The transformer shall be furnished with standard accessories in accordance with IEEE C57.12.10, with the following modifications:

- (a) **Nameplates:** The nameplates for each transformer shall be 20-gauge minimum thickness stainless steel. Each nameplate shall state manufacturer's name and location, the kVA rating, high-voltage and low-voltage ratings, tap positions and their respective voltage ratings, connection diagrams, type of cooling, temperature rise ratings, "SCPPA Contract _____", year of manufacture, BIL ratings, X/R ratio, material used for windings, reduced audible sound level, maximum and minimum operation pressures of the liquid preservation system, oil level, and that the mineral oil does not contain any detectable amount of Polychlorinated Biphenyls (PCBs).

Actual values rather than nominal values of reduced audible sound level, impedance, weight of the un-tanked transformer, weight of the tank and fittings, quantity and weight of oil, and total weight of the transformer, and quantity of oil shall be indicated on the nameplate. The design values shall be indicated on the nameplate drawings for the purpose of review and approval.

Nameplates shall be in accordance with the applicable IEEE, ANSI, and NEMA Standards, shall list MVA ratings for all available cooling classes and 55C and 65C winding temperature rises, and shall contain the seismic identification tag information as defined in IEEE 693A.8.

Separate CT nameplates, in accordance with IEEE C57.13, shall be furnished and installed inside of the control cabinet door of each transformer.

- (b) **Drain Valve:** The transformer shall be furnished with a flanged-typed drain valve with sampling device. The valve size shall be 2-inch complete with an oil-sampling valve, United Brass Works, Inc., Catalog No. 125TSSB, with Sampling Device No. 84, and shall be located so as to permit oil to be drawn to within one inch of the bottom of the tank.

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- (c) **Oil Sampling Valve:** The transformer shall be furnished with a flanged-typed or threaded oil sampling valve. The valve size shall be ½-inch and shall be located at the same height or above the drain valve.
- (d) **Pressure-Relief Device:** The transformer shall be furnished with one Qualitrol model XPRD pressure-relief device for every 10,000 gallons of oil in the main tank. Each device shall be furnished with galvanized steel piping and screen for direct discharge to ground. Each device shall have ungrounded DPDT Form C contacts suitable for operation on 125 volts dc. Contacts on the pressure-relief device shall actuate when the valve opens. A semaphore shall be installed for local indication of actuation.
- (e) **Gas-Sampling Valve:** The transformer shall have a gas-sampling valve and a gas inlet valve. The valve shall be Hoke, Inc., Catalog No. 3752M4B, furnished with a hose spud fitting for ¼-inch hose connection and shall be located not more than 6½-feet above the base of the transformer.
- (f) **Sudden Pressure Relays:** The transformer shall be furnished with 2 Qualitrol model 900 sudden pressure relays shall be provided to close a contact for relay operation in case the internal pressure rises suddenly. Isolation valves and bypass piping shall be installed on either side of the devices. One of the 2 Qualitrol devices shall be located at the transformer drain. The devices shall be wired in parallel. An individual Qualitrol model 909 auxiliary seal-in relay shall be furnished for each device. The auxiliary relay shall have 2 Form C open contacts suitable for operation on 125 volts dc. A reset push-button shall be provided.
- (g) **Maintenance Hole:** The cover of each transformer shall be furnished with a 36-inch maintenance hole. Maintenance holes or hand-holes shall be located in the cover only, except that the core section ground access hand-hole may be located as required by the manufacturer. Inspection maintenance holes and hand-holes shall be flange type. Manholes shall be placed in convenient locations that are accessible without requiring the removal of transformer equipment such as radiators. Manholes and access hatches shall allow for visual inspection of inside the transformer. Internal parts shall not obstruct access at the manholes and access hatches. Provisions shall be provided for SCPPA to inspect the interiors of the transformer prior to tanking.
- (h) **Other Valves:** Each transformer shall be equipped with a 2-inch valve in the upper part of the tank for oil filling and a three-inch valve on the opposite upper side of the tank for vacuum treatment during filling. A one-inch valve shall be located on the cover for vacuum equipment. The vacuum valve shall be located a distance away from the fill valve so as not to interfere with the oil filling process.
- (i) **Temperature and Liquid-Level Gauges:** Each transformer shall be furnished with Qualitrol model AKM OITWTI dial thermometers for transformer winding and oil temperature and a Qualitrol model 039 remote liquid-level gage. Gauges shall be furnished with a 4-20 mA signal output and an ungrounded double-pole double-throw Form C alarm contacts suitable for operation on 125 volts dc. Contacts on the thermometers shall be factory set and field adjustable from the ground level. A

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bushing current transformer, balancing transformer, thermowell, and a resistance temperature detector shall be provided, if required, for operation of the winding temperature indicator. Two sets of contacts for the liquid-level gage shall be furnished, one shall be set for the minimum liquid level and the other shall be set for the maximum liquid level in accordance with the manufacturer's printed recommendations.

- (j) **Winding Temperature Monitor:** Each transformer shall be furnished with a fiber-optic transformer winding temperature monitor, Qualitrol model 509 DW. The 509 DW shall be mounted within the transformer control cabinet. The following options for the 509 DW shall be furnished and installed: a platinum resistance temperature detector for oil temperature, CT (for calculated winding temperatures), direct winding temperature measurement using fiber optic cables with four spare fibers, a 4-20 mA input from the liquid level gauge, and a cooling fan current sensor for each cooling group. The latest software, including configuration, set points, and passwords shall be provided. The fiber-optic cables shall be installed to measure the high and low voltage windings and protected from physical damage. The 509 DW shall communicate via DNP3, MODBUS, and IEC 61850. Connections for RS-232, RS-485, RJ45 Ethernet, and Fiber Optic Ethernet shall be furnished.
- (k) **Standoff Insulators:** Standoff insulators of adequate size shall be provided for surge arresters and the transformer neutral grounding.
- (l) **Terminal Markings:** External terminal markings shall be provided that match the terminal markings shown on the nameplate.

(20) Safety Barricade: Permanent mounting brackets shall be provided on the top or the upper sides of the transformer tank which will be used as the points of attachment for a temporary safety barricade.

Temporary steel safety poles, not less than 42 inches in height, shall be furnished for each transformer which shall be designed to be inserted and secured in or to these brackets to provide the vertical fence posts for the barricade. The poles shall be painted bright yellow or orange. The mounted poles shall be not greater than 6 feet apart, and 2 poles, not less than 4 feet apart, shall be included for access through the barricade. All locking bolts, pins, or other hardware required to secure the barricade shall be furnished with the transformer.

The Contractor shall furnish a sufficient quantity of rope, not less than ½-inch in diameter, and rated for loads of not less than 500 pounds, to provide the inter-pole safety barrier. The safety poles shall be equipped with not less than 2 eyelets each, at approximately the mid-point and the top of the poles, to which the rope may be attached. The access shall be equipped with rings and rope or light chain and shall be equipped with clips or carabiners to allow easy and secure opening and closing of the access.

In addition, not less than 4 permanent steel eyelets or other similar devices shall be attached to the top of the tank to provide convenient attachment points for assembly worker's safety belt lines. The attachment points shall withstand the sudden force applied by a safety line attached to a falling worker without deformation or failure.

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All bushings and equipment mounted on or attached to the top of the transformer shall be enclosed by the safety barrier when erected.

The safety barrier poles with the rope and the hardware shall be housed in a cabinet mounted on the transformer, and shipped inside the cabinet with the transformer.

(21) Oil and Oil Preservation: The Contractor shall furnish oil for the transformer after delivery. The Contractor shall provide all equipment necessary to perform oil processing on-site.

The transformer shall be equipped with a sealed conservator system. A Wier-Electrical Instrument Company or VEM gas-type oil-operated, Buchholz relay shall be furnished with the conservator system for the detection of gas accumulation at transformer faults. The Buchholz relay shall be connected to terminal blocks for AGS use and not interconnected with other alarms or signaling devices. The relay shall be readily removable for maintenance purposes without draining the oil from the conservator or transformer. The relay shall be provided with an external device with which it shall be possible to operate the switch contacts and thereby test the contact operation and circuit continuity of the relay.

The relay shall be provided with a trip circuit with one normally open and one normally closed contact. The Buchholz relay shall not depend on a mercury switch for operation, and shall have the ability to withstand earthquake shock requirements hereinafter specified.

An automatic oil shutoff valve, Sergi Company (TL-334 or latest model), as well as a manual Ball valve, shall be furnished between the Buchholz relay and the conservator. The automatic shutoff valve device shall be furnished to detect and stop any backrush of oil from the conservator to the tank in the event of rupture in oil system. Manual shut off valves shall be furnished on both sides of the Buchholz relay. A by-pass valve shall also be furnished.

The Buchholz relay shall have a petcock furnished for taking samples and releasing gas from the top of the relay housing shall be so located that gas samples may be taken within 5 feet above ground level.

An air cell failure relay shall be furnished to provide an alarm for the conservator system when it detects a bladder leak. The alarm contacts for the air cell failure relay shall be wired to the control cabinet.

The conservator shall be furnished with a fill cap, drain/filter valve, magnetic liquid level gage with low level alarm contacts, and a silica-gel breather.

The tank or tanks shall slope approximately one inch downward toward the end with the drain valve. A maintenance hole shall be provided for access to the interior of each compartment or tank.

Piping between the conservator and the transformer tank shall allow for the conservator to be isolated, removed, and installed on the opposite side of the tank with a minimum of joints and fitted with a vacuum tight valve.

The conservator shall be designed for installation on either ends of the transformer.

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(22) Insulation Surface-Moisture Content: The transformer shall be designed such that the insulation surface-moisture content shall not exceed 0.4 percent.

(23) Paper Insulation: The thermally upgraded paper insulation used in the transformer furnished shall meet the requirements of IEEE Standard C57.100-2011 Test Procedure for Thermal Evaluation of Insulation Systems for Liquid-Immersed Distribution and Power Transformers . Temperature of 65°C to be used.

(24) Factory Inspection and Tests: Inspection will be made, and tests shall be performed in the Contractor's mill, factory, yard, or warehouse in accordance with the following:

- (a) Access:** The Project Manager shall have the right to inspect the Contractor's and the subcontractor's work in the course of manufacture or fabrication and shall make such tests from time to time as may be deemed advisable, provided such tests will cause no delay in the production of acceptable materials or equipment. The Contractor shall furnish, at the Contractor's own expense, reasonable facilities, including tools and instruments, for so doing and for obtaining such information as the Project Manager desires, respecting the progress and the manner of the work and the character of the materials used.
- (b) Notification:** The Contractor shall notify the Project Manager David Alba not less than 45 calendar days in advance of the day when:
 - (i)** Manufacture or fabrication starts.
 - (ii)** The core and coils are ready for in-tanking inspection.
 - (iii)** The finished product is ready for final testing and inspection.

The notification shall include the contract number and the contract title.

Should the Project Manager elect to waive the right of inspection, or of witnessing tests, and accept certified test reports instead, the Project Manager will promptly inform the Contractor.

- (c) Witness Tests:** Mill or factory witness tests shall be made in the presence of the Project Manager. The test procedure shall be subject to review and acceptance by the Project Manager. The Contractor shall bear all costs of such tests, except for the compensation and expenses of the Project Manager.
- (d) Certified Reports:** Five copies of certified reports shall be furnished to SCPPA as follows:
 - (i)** All tests except for those tests that are furnished and reviewed under Article 22 of Division III.
 - (ii)** Detailed method used in demonstrating seismic-withstand capability in accordance with the requirements of Section 12 of Division III. This report shall include, but not be limited to, the method of estimating natural frequencies and natural damping factors, the estimated static and

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dynamic horizontal and vertical forces, the overturning moments which the foundation can sustain, the permissible displacements and rotation of the equipment, and the detailed calculations used in all of the foregoing. This report shall be certified by an engineer who is duly registered as a Professional Engineer in the State of Nevada.

SCPPA will notify the Contractor within 20 calendar days after receipt of the certified reports either that there are no exceptions noted or that the reports show noncompliance with the specifications.

If any certified report shows noncompliance then the Contractor shall not ship the equipment covered by such report until the noncompliance is corrected or until otherwise instructed by the Project Manager.

- (e) **Release:** Materials or equipment to be inspected by the Project Manager at the Contractor's mill, factory, yard, or warehouse shall not be released for shipment until they have satisfactorily passed the Project Manager's inspection and test. Materials or equipment shipped without respecting this requirement may be rejected.
- (f) **Delivery:** The Contractor shall not schedule for any delivery until confirmation by Project Manager, in writing.
- (g) **Tests:** Unless specified otherwise, factory tests shall be made in accordance with IEEE C57.12.90 and the Contractor shall perform routine tests as described in IEEE C57.12.00, Table 18.

The tolerances shall be those permitted by IEEE C57.12.00.

Oscillograms shall record both voltage and ground current. Tests shall be performed in accordance with IEEE C57.98.

Digital recording and presentation of impulse Oscillograms may be allowed, provided the digital recording equipment is detailed and approved in the Testing Schedule.

Impulse tests shall precede the applied and the induced potential tests.

- (i) **Factory Design Tests:** The following tests shall be performed on one transformer under each Item:

- (1) Temperature rise at 162-MVA and 270-MVA at 55C, and at 303-MVA at 65C.

Temperature rise at 80 percent of full load rating at 55C, with 50 percent cooling.

The hot-spot temperature shall be determined by the Qualitrol Winding Temperature Monitor.

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- (2) Audible sound.
- (3) Function testing of the control cabinet and cooler group as a complete assembly.

(ii) Factory Routine Tests: The following tests shall be performed on each transformer at the factory:

- (1) Winding resistance measurements.
- (2) Ratio tests.
- (3) Polarity and phase relation tests.
- (4) Insulation resistance measurements.
- (5) No-load losses by the average-voltage voltmeter method at rated voltage and at 110 percent of rated voltage.
- (6) Exciting current by the average-voltmeter and rms ammeter method at rated voltage and at 110 percent of rated voltage. If required, corrections to a sine-wave basis shall be made by the crest-ammeter method.
- (7) Load losses.
- (8) Impedance voltage.
- (9) Zero-phase-sequence impedance.
- (10) Regulation at unity power factor and 0.8 power factor lagging, calculated.
- (11) Efficiency at 25, 50, 75, 100, and 125 percent of rated capacity, calculated.
- (12) Impulse test consisting of:
 - [1] One reduced full wave.
 - [2] Two chopped waves.
 - [3] One full wave.
- (13) Applied potential tests.
- (14) Induced potential tests.
- (15) Partial discharge tests in accordance with IEEE C57.12.90 and C57.113.

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- (16) **24-Hour Current Run:** The transformer shall be operated for not less than 24 hours at 100 percent rated current at the tap position resulting in the highest current. A gas-in-oil analysis through manual sampling shall be performed before, at approximately the mid-point, and at the end of the test to monitor possible gas generation.
- (17) **Continuous Online Oil-Phase Monitor Tests:** In addition to the gas-in-oil analysis, readings from a continuous online monitoring device shall be recorded and reported throughout the 24-hour current run test, at least every four hours. Readings shall also be recorded and reported immediately before and after all impulse tests and the applied and induced potential tests.
- (18) **Power Factor Tests:** Power factor tests shall be performed on all windings and bushings on the completely assembled and oil filled power transformer. Power factor tests shall record current in milliamps, power loss in watts, power factor in percent, capacitance in picofarads, oil and winding temperatures, and ambient temperature and humidity. Ambient conditions, test configurations, and test voltage levels shall be in accordance with Doble test procedures.
- (19) **Core Megger Test:** The connection from the core ground bushing to ground shall be disconnected and the core resistance to ground shall be Megger tested at not less than one-kV.
- (20) **Vacuum Test:** After the transformer is fully assembled, the entire tank assembly shall be evacuated to 250 microns or less. The Vacuum pump shall be sealed and pressure readings shall be taken every hour for 24 hours. The pressure rise shall not be more than 10 microns per hour.
- (21) **Sweep Frequency Analysis (SFRA) Test:** The manufacturer shall perform a Sweep Frequency Analysis (SFRA) Test on each transformer with and without oil by using Doble M5400 system. The contractor shall submit to the contract administrator a complete diagram of the test processor and test report in hard copy and electronically upon delivery of transformer. SCPPA will perform another SFRA test by using Doble M5400. The two tests shall not deviate materially. Manufacturer shall provide SFRA test bushings for field testing.
- (iii) **Bushing Tests:** All bushings shall be subjected to design and routine tests in accordance with IEEE C57.19.00.

Routine tests and design tests shall be as follows:

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- (1) **Routine Tests:** All bushings shall be subjected to the routine tests specified in Subarticle 7.4 of IEEE C57.19.00.
- (2) **Design Tests:** Design tests shall be performed in accordance with Subarticle 7.2 of IEEE C57.19.00.

In lieu of the bushing design tests, the Contractor may furnish 5 copies of certified test reports of design tests conducted on bushings of the same design and rating provided that such reports are submitted to the Project Manager for review as to compliance with these specifications within 60 calendar days after date of award of contract.

- (3) **Seismic Withstand Tests:** Seismic Withstand tests shall be performed in accordance with Section 12 of Division III.
- (iv) **High-Voltage Surge Arrester Tests:** All arresters shall be subjected to the following tests:

- (1) **Design Tests:** In addition to those applicable tests required by the IEEE, ANSI, IEC, and NEMA Standards and the requirements specified herein, either the design tests specified in this Subarticle shall be performed on one surge arrester to be furnished or certified test reports of design tests conducted on surge arresters of the same design, type, and rating shall be furnished.

The following design tests shall be performed or have been performed:

- [1] Arrester Insulation Withstand Tests in accordance with Section 8.1 of IEEE C62.11.
- [2] Discharge-Voltage Characteristics Tests in accordance with Section 8.2 of IEEE C62.11.
- [3] High-Current Short-Duration and Low-Current Long-Duration Withstand Tests in accordance with Sections 8.12 and 8.13, respectively, of IEEE C62.11.
- [4] Duty-Cycle Tests in accordance with Section 8.16 of IEEE C62.11.
- [5] Internal Ionization Voltage and Radio-Influence Voltage (RIV) Tests in accordance with Section 8.10 of IEEE C62.11.
- [6] Contamination Test in accordance with Section 8.8 of IEEE 62.11.

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[7] Temporary Overvoltage (TOV) Tests in accordance with Section 8.15 of ANSI C62.11.

[8] Operating Duty Tests in accordance with Section 7.5 of IEC 99-4.

(b) **Routine Tests:** Routine tests shall be performed on all surge arresters in accordance with IEEE C62.11, Section 12.

(c) **Seismic Withstand Tests:** Seismic Withstand tests shall be performed in accordance with Section 12 of Division III.

(d) **Seismic Design Coefficients:** Seismic design coefficients shall be determined in accordance with the latest edition of the Nevada Building Code, Las Vegas Building Code, and ASCE 7 based on a site-specific Geotechnical Report.

(h) **External Inspection:** The external inspections shall be performed by the mill or factory in the presence of the Project Manager. The inspection procedure shall be subject to review and acceptance by the Project Manager. The Contractor shall bear all costs of such inspections, except for the compensation and expenses of the Project Manager. External inspections shall include, but not be limited to, the following:

(i) Dimensions of each transformer shall be measured and checked against the outline drawing.

(ii) Major components and accessories of each transformer shall be checked against the outline drawing and verified with the specifications.

(iii) Each transformer shall be weighed and checked against the nameplate information.

(iv) Pressure tests shall be performed for oil leak check. 125 percent rated pressure shall be pumped into the transformer. The pressure shall be applied to the transformer for up to 24 hours.

(v) Tank weld seams to be checked for pin holes using a dye penetrant prior to applying vacuum.

(i) **Witness Tests:** Mill or factory witness tests shall be made in the presence of the Project Manager. The test procedure shall be submitted to the Project Manager 60 days prior to the witness tests and subject to review and acceptance by the Project Manager. The Contractor shall bear all costs of such tests, except for the compensation and expenses of the Project Manager.

(25) **Dielectric Tests:** SCPPA will repeat all normal frequency dielectric tests at the point of delivery, using test voltages equal to 75 percent of the ANSI/IEEE factory test voltages, to determine whether insulation has withstood shipment. Failure under this test will be considered as not fulfilling these specifications and will be cause for rejection.

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Final inspection will be made upon receipt at SCPPA's specified receiving points; and, if any materials or equipment do not meet the requirements of these specifications, the lot or any faulty portion thereof may be rejected.

All expenses of the dielectric acceptance tests will be borne by SCPPA. The expense of subsequent tests due to failure of materials or equipment first offered will be charged against the Contractor. The fact that the materials or equipment have been successfully inspected, tested, and accepted by the Project Manager shall not relieve the Contractor of responsibility in the case of later discovery of flaws or defects.

(26) Spare Parts: The following spare parts shall be included:

Description	Quantity
High side bushing	1
Low side bushing	1
Cooler group fan & motor	1
Cooler group	1
Sudden Pressure Relay	1
Pressure Relief Device	1
Buchholz Relay	1
Suggested Critical Spares (Respondent to itemize and include individual costs)	1
Serveron TM8-F with latest software	1

(27) Shipment: All shipments shall be protected to prevent damage in transit and in storage. The transformer shipment shall be fitted with multiple impact recorders for recording all excessive impacts during the shipment of the transformer from the manufacturer's facility to the power plant. Impact recorders shall be digital, with real-time tracker, GPS, and shall have batteries capable of powering the impact recorders throughout the duration of shipment. The recorder shall record date, time and magnitude of each impact during shipment. The recorders shall measure the X, Y, and Z-axis. Maximum shipment impact levels shall be specified by the transformer manufacturer and agreed upon by SCPPA prior to shipment of the transformer. After the transformer is off loaded at the power plant, AGS shall be notified and the impact recorder information shall be made available for examination by SCPPA. If it is determined by SCPPA that excessive impacts have occurred SCPPA shall open each transformer and examine all components for possible damage. Based on recommendations from SCPPA review corrective action shall be taken by the Contractor.

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The transformer shall be delivered in such a manner as to allow unloading from a flatbed truck by a forklift truck or an overhead crane. If the transformer is shipped with crates, they need to be uncrated prior to delivery.

A packing list shall be attached to the transformer and shall contain SCPPA contract number, SCPPA purchase or subpurchase order number, SCPPA material code, and the transformer serial number.

All transformer bushings and pipes shall be factory “match marked” prior to shipping.

Upon SCPPA’s request, not less than one 12-ounce pressurized can or one 16-ounce can of touch-up paint shall be furnished.

The transformer equipment, including the insulating oil, shall be shipped Delivered Duty Paid (DDP) to the existing transformer pad at AGS. If the existing transformer pad is not available due to system needs, the transformer will be shipped to a spare pad at AGS installed by the Contractor.

(28) Delay in Performance:

(i) Delivery Date: Contractor agrees and warrants that once a manufacturing slot is assigned to the Work, Contractor will not alter that slot except with the express written consent of SCPPA, or if doing so will not negatively affect the Delivery Date.

(ii) Liquidated Damages: In the event Contractor is late in delivering the Work, and delivery to the Delivery Point is not complete by the Delivery Date, refer to “Time is of the essence” Section 28, Part III.

2. Site Construction Scope:

a. Installation of Two Spare Concrete Pad

- (1) The Contractor shall perform a site investigation to determine the location to construct the spare concrete pads. The Contractor shall provide a Preliminary Engineering Package to the Project manager for review prior to detailed design or construction. This is to confirm that the proposed locations for construction the pads are acceptable. Substructure obstructions, metal bases, soil studies shall be included in the site investigation. Any removal of obstructions, installation of grounds, grating, permitting and inspections shall be within scope.
- (2) The Contractor shall construct two spare concrete pads for the existing VA Tech GSU Transformer and new spare. The concrete pads shall be designed to withstand 20% of additional weight of the VA Tech GSU Transformer and shall have a 40’x40’ dimension. Each pad will have oil containment. Oil containment shall encompass the concrete pad and shall be able hold 24,000 gallons of oil and a 50 year, 24 hour rain event. The concrete pads shall have embedded plates for the transformer base to be welded on. The design drawings shall be stamped by a licensed Civil Engineer.

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- (3) The Contractor shall install power connections from the existing Station electrical system to both spare concrete pad locations. The power connections shall include 120/208V, 3-Phase 200 Amp Panelboard, 480V, 200A, 3-Phase Panelboard, 75kVA, 480V to 120V/208V dry type transformer and two (2) GFCI 120V, 20A convenience outlets. Contractor shall install the conduit and cable infrastructure and perform all terminations. All electrical equipment shall be UL Listed and shall be suitable for outdoor use.
- (4) The Contractor shall install a lighting system similar to existing at both of the spare concrete pad locations.

b. Offloading new GSU

- (1) The Contractor shall arrange crane support, develop a lift plan, and execute offloading the new GSU and setting it on one of the concrete storage pads.
- (2) Make necessary provisions and supply spare nitrogen or dry air bottles for short term storage of the transformer. Contract shall arrange a means to monitor the pressure in the GSU for short term storage.

3. Installation Scope:

a. Relocation of Existing VA Tech GSU Transformer

The Contractor shall remove the existing VA Tech GSU Transformer and relocate it to the new spare concrete pad. Contractor shall be responsible to verify all existing electrical, mechanical and structural connections prior to removal of the GSU Transformer. Care shall be taken by the Contractor on all disconnections. Cables, conduits, pipes and other associated peripheral equipment shall not be cut. Methods of disconnections shall be provided by the Contractor to the Project Manager prior to performing the work. The Contractor shall remove the 500kV bushings and cooler groups, if necessary, and shall empty the oil from the existing VA Tech GSU Transformer during the relocation. Once relocated, contractor shall reassemble the transformer, reprocess the oil through the transformer and perform electrical tests. The VA Tech GSU Transformer bushings shall be grounded for safety purposes. Contractor shall weld at four corners of the transformer base to the embedded plates. The Contractor shall connect the VA Tech GSU Transformer control cabinet to the power connection provided.

b. Installation and Assembly of the New GSU Transformer

The Contractor shall install and assemble the new GSU Transformer in place of the existing VA Tech GSU Transformer. The Contractor shall have a manufacturer's technical advisor on-site throughout the assembly and energization of the GSU Transformer. Contractor shall take inventory of the parts arrived. Contractor shall perform all the necessary preassembly electrical tests on the GSU Transformer and bushings. The Contractor shall also take as-found readings of the moisture content of the transformer and flush radiator cooler groups. An internal inspection shall be performed to determine any loose parts or shifting has occurred in the main tank during transportation from the factory.

The Contractor shall assemble the GSU Transformer. All necessary connections to the Isophase bus and 500kV lines shall be furnished by the contractor.

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The Contractor shall work with Apex GS to install interconnections on the plant's Distributed Control System (DCS). All interconnections shall be furnished by the Contractor. Interconnections shall include the secondary wiring of current transformers, protective relays, power, signals and alarms. All interconnections shall be tested and their functions verified through Apex GS DCS.

The Contractor shall connect the Serveron TM8 Online DGA Monitor and be responsible for the monitor's complete functionality.

The Contractor shall perform a complete functional test of the cooler groups after assembly. Fans shall be actuated during the test by temperature set points from the Temperature Gauge and Winding Temperature Monitor.

After complete assembly, the Contractor shall perform as-installed electrical tests prior to energization.

The Contractor shall provide all electrical test data and software set points in a report for AGS recordkeeping. All data shall be typed and legible. Electrical test data shall be certified by the Contractor's test engineers.

V. Timeline / Schedule

SCPPA RFP for Generator Step Up Transformer, Apex GS Selection Process	
Schedule of Requirements	Target Date(s)
Issue RFP	05 December 2016
Bidder's Conference (on site)	14 December 2016
Responses Due	19 January 2017, 2:00 PM
Evaluation of Responses	06 April 2017
Selection of Respondent	13 April 2017
Approval of Contract by SCPPA Board of Directors	20 April 2017

VI. Proposal Submission Required Elements

1. Transmittal Letter Content:

a. A brief statement of the Respondent's understanding of the work to be done and commitment to perform the work as scheduled, including:

- (1) statement of work specifications; and
- (2) reference to any proposed contractual terms and conditions required by the Respondent; and
- (3) a summary of exceptions taken to the RFP requirements; and
- (4) any and all expectations from SCPPA including, but not limited to: requirements definitions, strategy refinement, and staffing requirements to support the proposed project or program implementation.

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- b. An officer authorized to bind must sign the proposal on behalf of the Respondent and must include the following declarations on the transmittal letter:

“This proposal is genuine, and not sham or collusive, nor made in the interest or in behalf of any person not herein named; the Respondent has not directly or indirectly induced or solicited any other Respondent to put in a sham bid, or any other person, firm or corporation to refrain from submitting a proposal; and the Respondent has not in any manner sought by collusion to secure for themselves an advantage over any other Respondent.”

2. **Respondent Information:** Provide legal name of Company or Individual, physical street address, the name(s) and title(s) of the individual(s) authorized to represent the Respondent, including telephone number(s) and email address(es).
3. **Proposal:** Proposals must include a description of the proposed project or program, how it meets (or does not meet) each of the objectives of this RFP, and a detailed description addressing all of the Areas of Interest. Respondents may also include additional services, products, tasks, task elements and/or functions that may not be part of or included in the RFP, but are deemed by the Respondent to be pertinent and potentially valuable to SCPPA or its Members. SCPPA will have full discretionary authority to consider, accept and/or reject without cause such supplemental information that is not directly requested, included in or made part of the RFP.
4. **Fees:** Pricing in all Proposals should be made based on good faith estimates of the requirements defined in this RFP. Please include all necessary details of specific examples or estimates of the fees, labor rates and service charges. Describe how the fees, rates or charges will be determined. Respondents shall also be prepared to provide a breakdown of the applicable overheads and fringe benefit costs that are part of any labor rates and other direct costs associated with the services to be performed.
5. **Experience:** Respondent shall clearly identify project participants and management team, including:
 - a. Describe your firm's experience as may be applicable to this RFP, your organizational structure, management qualifications, and other contract related qualifications, including number of years firm has been in business.
 - b. Specify key employees and describe their qualifications, experience and duties related to this RFP, including the office location(s) where work will be performed, in addition to the physical street address referenced above.
 - c. Provide a commitment statement for the retention and use of key employees as proposed, their availability to initiate and sustain the proposal, as well as planned supplemental employees if key personnel are not available to assure project delivery.
 - d. State whether Respondent will use subcontractors to perform services pursuant to the contract. Should the use of subcontractors be offered, the Respondent shall provide the same assurances of competence for the subcontractor, plus the demonstrated ability to manage and supervise the subcontracted work. Subcontractors shall not be allowed to further subcontract

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with others for work. The provisions of any contract resulting from this RFP shall apply to all subcontractors in the same manner as to the Respondent.

- f. Respondent shall indicate any and all pending litigation that could affect the viability of Respondent's proposal, continuance of existing contracts, operation or financial stability.

6. References:

- a. Describe whether the Respondent has, within the last five (5) years, rendered any service to SCPPA or to any of SCPPA's Members, either as a contractor or subcontractor, either under the current Respondent's name or any other name or organization. If so, please provide details (status as prime or subcontractor, brief description of the contract, contract start and end date, the contract administrator name, and total actual contract expenditures).
- b. If the Respondent has not rendered any service within the last five (5) years to SCPPA or to any of SCPPA's Members, then please provide references over that period with the details described above including the counterparty for which services were provided.
- c. Identify existing related or relevant projects or programs which Respondent developed and/or operates that would demonstrate Respondent's capabilities in this area.
- d. Describe relevant program development and implementation experience, approach, and provide a list of references for similar projects completed.

7. Safety:

Submit a Contractor Safety Pre-Qualification form (Attachment B) along with bid response.

VII. Proposal Submission Delivery Requirements

An initial Respondents' conference for interested parties and potential Respondents to ask questions related to this RFP will be held on 14 December 2016 at 8:00 AM, at Apex GS in Las Vegas Nevada. The address is 15555 Apex Power Parkway Las Vegas NV, 89165.

Three (3) hard copies of your response, including one transmittal letter of authentic offer with wet-ink authority signature, and any supporting documentation should be delivered no later than 2:00 pm PST on 19 January 2016 to:

SCPPA
c/o Katherine Ellis
Generator Step Up Transformer, Apex GS
Attention: David Alba
1160 Nicole Court
Glendora, CA 91740

Three (3) electronic copy of your proposal should also be delivered to the address above, preferably on a DVD/CD or USB flash drive no later than the time and date referenced above.

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No contact should be made with the Board of Directors, committees or working group representatives, or SCPPA Members concerning this RFP.

All information received by SCPPA in response to this RFP is subject to the California Public Records Act and may be subject to the California Brown Act and all submissions may be subject to review in the event of an audit.

1. Check or Bonds

- a. **General:** A certificate of deposit or an unconditional irrevocable letter of credit issued by a responsible bank, in a format acceptable to SCPPA, will be accepted as a substitute to the requirements specified in Sub-articles b and c of this Article. Wherever in these specifications reference is made to the check or the bonds required by Sub-articles b and c

of this Article, it shall be deemed to include such substitutes. No substitution will be accepted in lieu of the labor and material payment bond, specified in Sub-article d of this Article.

- b. **Check or Bid Bond:** The bidder shall submit either a check or a bid bond (surety bond) as part of the bid submittal, unless a sufficient annual bid bond has been previously filed with SCPPA.

- (1) **Check:** If the bidder elects to submit a check in lieu of a bid bond issued by a surety company, the bidder shall submit the check by mail or by a messenger service at or before the bid closing time and date.

When mailing or sending using a messenger service, the bidder shall write the IFB number, title of the IFB, bid closing date, and name of buyer on the envelope containing the check.

If mailed or sent by messenger, a check shall be sent to the following address:

SCPPA
c/o Katherine Ellis
Generator Step Up Transformer, Apex GS
1160 Nicole Court
Glendora, CA 91740

at or before the bid closing date and time.

The check shall be a cashier's check issued by a responsible bank, payable to the order of SCPPA, in an amount not less than 10 percent of the aggregate sum of the proposal.

- (2) **Bid Bond:** If the bidder elects to submit a bid bond (surety bond) in lieu of a check, the bidder shall submit a surety bond issued by a responsible corporate surety company in an amount not less than 10 percent of the aggregate sum of the proposal. Individual sureties will not be considered as meeting the

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requirements of this Article and therefore will not be accepted. The bid bond shall be submitted on SCPPA's "Bidder's Bond" The bond shall be executed by a responsible corporate surety, authorized to issue such bonds in the State of California and in other states where work is to be performed, and shall be secured through an authorized agent with an office in California. form

- c. **Performance Bond:** The successful bidder shall furnish and maintain a satisfactory performance bond. The bond shall be executed by a responsible corporate surety, authorized to issue such bonds in the State of California and in other states where work is to be performed, and shall be secured through an authorized agent with an office in California. The bond shall be in an amount of not less than 100 percent of the contract amount and shall be accompanied by a current copy of the surety company's license issued by the Department of Insurance of the State of California. The performance bond shall guarantee faithful performance of the contract in a manner satisfactory to SCPPA, and that materials furnished and quality of work shall be free from defects. The bond shall extend to work performed pursuant to Change Orders and to Extensions of Time, although such changes or extensions be ordered without notice to the surety. The performance bond shall be furnished by the successful bidder within 30 calendar days after receiving a "Notice of Approval" by e-mail.
- d. **Labor and Material Payment Bond:** The successful bidder shall furnish and maintain a satisfactory labor and material payment bond. The bond shall be executed by a responsible corporate surety, authorized to issue such bonds in the State of California and in other states where work is to be performed, and shall be secured through an authorized agent with an office in California. The bond shall be in an amount of not less than 100 percent of the contract amount and shall be accompanied by a current copy of the surety company's license issued by the Department of Insurance of the State of California. The labor and material payment bond shall be maintained in accordance with the Civil Code of the State of California and the laws of other states where work is performed. Such bonds shall extend to work performed pursuant to Change Orders and to Extensions of Time, although such changes or extensions be ordered without notice to the surety. The labor and material payment bond shall be furnished by the successful bidder within 30 calendar days after receiving a "Notice of Approval" by e-mail.

2. **Debarment and Suspension**

a. **Provisions for Debarment and Suspension**

- (1) The bidder certifies, by submission of this bid, that it and its principals:
- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal agencies;
 - (b) Have not within a 3-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or

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commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

- (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
- (d) Have not within a 3-year period preceding this bid had one or more public transactions (Federal, State, or local) terminated for cause or default.

- (2) Where the bidder is unable to certify to any of the statements in this certification, the bidder shall attach an explanation to this proposal. To comply with the provisions for Debarment and Suspension, the bidder shall complete, sign, and submit to SCPPA the "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion" (1 page) affidavit.

VIII. Terms and Conditions

1. SCPPA reserves the right to cancel this RFP at any time, reject any and all proposals and to waive irregularities.
2. SCPPA shall determine at its sole discretion the value of any and/or all proposals including price and non-price attributes.
3. Proposals may be sub-divided or combined with other proposals, at SCPPA's sole discretion.
4. SCPPA shall perform an initial screening evaluation to identify and eliminate any proposals that are, for example, not responsive to the RFP, do not meet the minimum requirements set forth in the RFP, are not economically competitive with other proposals, or are submitted by Respondents that lack appropriate creditworthiness, sufficient financial resources, or qualifications to provide dependable and reliable services for this RFP.
5. SCPPA reserves the right to submit follow up questions or inquiries to request clarification of information submitted and to request additional information from any one or more of the Respondents.
6. SCPPA reserves the right, without qualification and in its sole discretion, to accept or reject any or all proposals for any reason without explanation to the Respondent, or to make any award to that Respondent, who, in the opinion of SCPPA, will provide the most value to SCPPA and its Members.
7. A binding agreement between SCPPA and the Respondent selected to perform the work is subject to the negotiation and execution of a definitive, mutually acceptable written contract. SCPPA may decline to enter into any potential contract with any Respondent, terminate negotiations with any Respondent, or to abandon the request for proposal process in its entirety.
8. SCPPA reserves the right to make an award, at its sole discretion, irrespective of price or technical ability, if SCPPA determines that to do so would result in the greatest value to SCPPA and its Members.

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9. Those Respondents who submit proposals agree to do so without legal recourse against SCPPA, its Members, their directors, officers, employees and agents for rejection of their proposal(s) or for failure to execute or act on their proposal for any reason.
10. SCPPA shall not be liable to any Respondent or party in law or equity for any reason whatsoever for any acts or omissions arising out of or in connection with this RFP.
11. SCPPA shall not be liable for any costs incurred by any Respondents in preparing any information for submission in connection with this RFP process or any and all costs resulting from responding to this RFP. Any and all such costs whatsoever shall remain the sole responsibility of the Respondent.
12. SCPPA may require certain performance assurances from Respondents prior to entering into negotiations for work that may result from this RFP. Such assurances may potentially include a requirement that Respondents provide some form of performance security.
13. Prior to contract award, the successful Respondent shall supply a detailed breakdown of the applicable overheads and fringe benefit costs that are part of the labor rates and other direct costs associated with the services to be performed.
14. SCPPA Members, either collectively or individually may contact Respondents to discuss or enter into negotiations regarding a proposal. SCPPA is not responsible or liable for individual Members interactions with the Respondent which are not entirely conducted through SCPPA or at SCPPA's option or election to engage the Respondent as defined within the RFP.
15. Submission of a Proposal constitutes acknowledgement that the Respondent has read and agrees to be bound by the terms and specifications of this RFP and any addenda subsequently issued by SCPPA.
16. Information in this RFP is accurate to the best of SCPPA's and its Members' knowledge but is not guaranteed to be correct. Respondents are expected to complete all of their due diligence activities prior to entering into any final contract negotiations with SCPPA.
17. SCPPA reserves the right to reject any Proposal for any reason without cause. SCPPA reserves the right to enter into relationships with more than one Respondent, can choose not to proceed with any Respondent with respect to one or more categories of services, and can choose to suspend this RFP or to issue a new RFP that would supersede and replace this RFP.

IX. Additional Requirements for Proposal

1. **Consideration of Responses:** Submitted proposals should be prepared simply and economically, without the inclusion of unnecessary promotional materials. Proposals should be submitted on recycled paper that has a minimum of thirty percent (30%) post-consumer recycled content and duplex copied (double-sided pages) where possible.
2. **Insurance, Licensing, or other Certification:** If selected, the Respondent will be required to maintain sufficient insurance, licenses, or other required certifications for the type of work being performed.

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SCPPA or its Members may require specific insurance coverage to be established and maintained during the course of work and as a condition of award or continuation of contract.

3. **Non-Discrimination/Equal Employment Practices/Affirmative Action Plan:** If selected, the Respondent and each of its known subcontractors may be required to complete and file an acceptable Affirmative Action Plan. The Affirmative Action Plan may be set forth in the form required as a business practice by the Department of Water and Power of the City of Los Angeles which is SCPPA's largest Member.
4. **Living Wage Ordinance:** If selected, the Respondent may be required to comply with the applicable provisions of the City of Los Angeles Living Wage Ordinance and the City of Los Angeles Service Contract Workers Retention Ordinance. The Living Wage Ordinance provisions are found in Section 10.36 of the Los Angeles City Administrative Code; and the Service Contract Workers Retention Ordinance are found in Section 10.37 of the Los Angeles Administrative Code (SCWRO/LW0).
5. **Prevailing Wage Rates:** If selected, the Respondent may be required to conform to prevailing wage rates applicable to the location(s) where any work is being performed. Workers shall be paid not less than prevailing wages pursuant to determinations of Office of Labor Commissioner, Department of Business and Industry of the State of Nevada, available at: http://labor.nv.gov/PrevailingWage/Public_Works/Prevailing_Wages/.
6. **Child Support Policy:** If selected, Respondent may be required to comply with the City of Los Angeles Ordinance No. 172401, which requires all contractors and subcontractors performing work to comply with all reporting requirements and wage earning assignments and wage earning assignments relative to court ordered child support.
7. **Supplier Diversity:** Respondents may be required to take reasonable steps to ensure that all available business enterprises, including Small Business Enterprises (SBEs), Disadvantaged Business Enterprises (DBEs), Women-Owned Business Enterprises (WBEs), Minority-Owned Business Enterprises (MBEs), Disabled Veteran Business Enterprises (DVBES), and other Business Enterprises (OBEs), have an equal opportunity to compete for and participate in the work being requested by this RFP. Efforts to obtain participation of these business enterprises may reasonably be expected to produce a twenty-five percent (25%) participation goal for SBEs. For the purpose of this RFP, SCPPA's Supplier Diversity program is modeled after that of the Los Angeles Department of Water and Power. Further information concerning the Supplier Diversity Program may be obtained from the Supply Chain Services Division of the Los Angeles Department of Water and Power.
8. **SCPPA-Furnished Property:** SCPPA or a Member's utility drawings, specifications, and other media furnished for the Respondent's use shall not be furnished to others without written authorization from SCPPA or the applicable Member(s).
9. **Contractor-Furnished Property:** Upon completion of all work under any agreement developed as a result of this RFP, ownership and title to reports, documents, drawings, specifications, estimates, and any other document produced as a result of the agreement shall automatically be vested to SCPPA and no further agreement will be necessary for the transfer of ownership to SCPPA. SCPPA has the sole right to distribute, reproduce, publish, license, or grant permission to use all or a portion of the deliverable documentation, work product or presentations as it determines in its sole discretion.

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10. Iran Contracting Act of 2010 (applies to contracts ≥\$1 Million)

In accordance with California Public Contract Code Sections 2200-2208, all bidders submitting proposals for, entering into, or renewing contracts with SCPPA for goods and services estimated at \$1 Million or more are required to complete, sign, and submit the “Iran Contracting Act of 2010 Compliance Affidavit” **(1 Page) provided in Appendix D of this RFP.**

End of Written Spec. Attachments Follow.