550kV COUPLING CAPACITOR VOLTAGE TRANSFORMER

1. SCOPE

1.1 The Seller shall design, fabricate, test and deliver 550kV coupling capacitor voltage transformers (CCVTs) according to this specification. The CCVTs will be used for metering and relaying transmission lines.

1.2 The following items are not included:

- Unloading and Installation
- All external connections
- Foundations, anchor bolts, and steel support structure

2. CODES AND STANDARDS

2.1 All electrical design, materials, tests and construction shall conform to the latest applicable standards of ANSI, IEEE and NEMA. In case of conflicting requirements of these standards, they shall apply in sequence in which they are listed here, and ultimately this specification shall govern.

2.2 The following specific standards shall apply except as modified herein:

ANSI C93.1–1999	Requirements for Power-line Carrier Coupling Capacitors and Coupling Capacitor Voltage Transformers (CCVT)
ANSI C57.13–2008	Requirements for Instrument Transformers
NEMA 107–1987 (R1993)	Measurement of Radio Influence Voltage (RIV) High Voltage Apparatus

2.3 All structural steel design shall conform to the latest standard of the American Institute of Steel Construction.

2.4 All design, materials, tests and construction shall also conform to all applicable codes, laws and regulations of the State of Arizona or other local regulating bodies having jurisdiction over this apparatus. The material shall be new, of recent manufacture, and free of defects. The design, workmanship, and material shall be of the highest quality and most suitable for the application.

2.5 If a Seller has any reason for deviation from the stated standards of design, the Seller shall state in the proposal the exact nature of the change and the reason for making the change.

2.6 In the event of conflict between the referenced standards, Buyer's drawings, and this specification, Seller shall notify the Buyer and secure written clarification before proceeding.

3. SERVICE CONDITIONS

3.1 Specific standard service conditions are to be in accordance with ANSI C57.13 except as noted in section 3.2 below.

3.2 Specific unusual service conditions are as follows:

3.2.1 Exposure is outdoors subject to solar radiation, rain, humidity, wind, hail and severe windblown sand and dust.

3.2.2 Temperatures are **50°C** maximum ambient, -8°C minimum ambient and 40°C maximum 24 hour average ambient. This does not include direct solar heating.

3.2.3 Average relative humidity is 40 percent.

3.2.4 Seismology: All equipment specified herein shall be designed to conform to IEEE Practices for Seismic Design of Substations, IEEE Standard 693-latest version. The seismic design shall be per Annex F. The seismic level shall be classified as 'Low Level'. The seismic response spectra shall be obtained from Fig. 1 of IEEE Std. 693 and the equipment shall be Class "A". (See NOTE)

3.2.5 Wind Loading: All equipment and structures shall be designed for 90 mph wind speed, exposure C, in accordance with the International Building Code. (See NOTE)

NOTE: Seismic and wind loading forces are not to be construed as occurring simultaneously.

3.2.6 Altitude: Less than 3,300 feet above sea level.

3.2.7 Solar Radiation: **1000 Watts/m^2** (peak), 8526 Watt-hours/m^2 in a given daylight period

4. DESIGN AND CONSTRUCTION

4.1 Electrical Requirements

4.1.1 The voltage transformers shall be designed for 60 Hz.

4.1.2 The voltage transformers shall be ANSI Group 3 with rated primary voltage of 318,000 volts for 550,000 volts Grounded Y. The primary connection will be line to ground. The Nominal System Voltage is 550kV.

4.1.3 The B.I.L. shall be at least 1,800kV.

4.1.4 The marked ratio shall be 2500/4500:1 and 2500/4500:1 and 2500/4500:1.

4.1.5 The total thermal burden rating shall be a minimum of 1500 VA.

4.1.6 The minimum creepage distance shall be 500 inches.

4.1.7 The CCVT shall have a corona shield at the high voltage terminal.

4.1.8 The voltage transformer shall have a ground shield isolating the high voltage winding from the secondary winding and core.

4.1.9 The high voltage insulation system shall be comprised of polypropylene film, kraft paper, and a synthetic oil combination.

4.1.10 Ferroresonance Suppression shall be provided. The seller shall provide descriptions of ferroresonance suppression methods and ratings with quotation.

4.1.11 As an option, provide ability to monitor system harmonics up to the 50th harmonic. The seller shall provide descriptions of of this monitoring method with quotation.

4.1.12 The secondary box shall have a terminal block.

4.1.13 Specific stock code requirements can be found in Table 1, below.

Table 1. Unique 550kV CCVT Stock Code Requirements

Capacitance (minimum)	Accuracy Class		Burden Class		Mounting	PLC Accessories	SRP Stock Code
[pF]	X & Y	Z	X & Y	Z			
3000	1.2R (Relaying)	1.2R (Relaying)	W, X, Y, Z, ZZ	W, X, Y	Pedestal	NO	5028205
3000	0.3 (Metering)	1.2R (Relaying)	W, X, Y, Z, ZZ	W, X, Y	Pedestal	NO	5028206
5000	0.3 (Metering)	1.2R (Relaying)	W, X, Y, Z, ZZ	W, X, Y	Pedestal	NO	5028212
5000	0.3 (Metering)	1.2R (Relaying)	W, X, Y, Z, ZZ	W, X, Y	Suspension*	NO	‡ 5028213

* Suspension mounting kit shall be provided for CCVT. The kit shall include but not be limited to a terminal designed to support the weight of the CCVT plus other ambient loads and provide with a suitable means to attach the tie down spring or weight. This kit shall not prevent the CCVT from being used in a pedestal mount.

‡ "**UNIVERSAL SPARE**" shall be inscribed on the nameplate for stock code number 5028213.

4.2 Physical Requirements

4.2.1 The voltage transformer shall be suitable for outdoor installation, and the high voltage bushing shall be POLYMER.

4.2.2 The high voltage bushing exterior (or housing) material shall be composed of silicone rubber. EDPM rubber is not acceptable.

4.2.3 The interface between the polymer housing and the internal elements must be filled with a silicone dielectric compound. Also, a housing that is bonded directly to the internal elements is permitted.

4.2.4 Bushings shall be warranted against failure due to deterioration caused by ultraviolet light for a period of 5 years from shipment. The seller shall replace the CCVT at no charge in such a case.

4.2.5 The color of all bushing insulators shall be gray.

4.2.6 The color of any sealants visible from the outside shall be gray.

4.2.7 All external metal parts shall be made of corrosion resistant material which is gray in color and does not require paint for protection.

4.2.8 The voltage transformer shall be provided with an oil level indicator that shall be high temperature and ultraviolet resistant.

4.2.9 The high voltage terminal shall be one (1) NEMA 4-hole pad.

4.2.10 The ground terminal shall be two (2) NEMA 2-hole pads on opposite sides of the CCVT.

4.2.11 Nameplates shall be stamped, corrosion resistant, and permanently affixed in a readily visible location. They shall meet ANSI C93.1 requirements, include the month and year of manufacture, and shall include the location of the manufacturing facility. ‡

4.2.12 The voltage transformer shall be designed to be installed on a steel support structure with 4 - 7/8" bolt holes in a rectangle 11–½" x 16-½".

4.2.13 If spacers or adapter plates are required to meet the Buyer's attachment requirements, they shall be shipped installed on the voltage transformer.

4.2.14 Cork-neoprene gaskets shall not be used.

5. TESTS

5.1 The unit shall be tested in the following according to ANSI C93.1, section 6.3 as a minimum.

5.1.1 Capacitance and dissipation factor measurements, section 6.3.1.

5.1.2 Dielectric tests, section 6.3.2.

5.1.3 Carrier protective device, section 6.3.3.

5.1.4 Electromagnetic unit protective device, section 6.3.4.

5.1.5 Accuracy, section 6.3.5.

5.1.6 Polarity, section 6.3.6.

5.2 The unit shall be tested and verified to be partial discharge free (less than or equal to 2 pico-coloumbs @ 20°C) at 130% of operating voltage.

5.3 Certified test report copies of the tests listed in section 5.1 and 5.2 above shall be sent to the Buyer in the following Physical AND Electronic formats:

- The Physical copy shall be included with the unit it pertains to and with a copy of the manual, inside the secondary box of the unit.
- The Electronic copy shall be sent in the searchable Adobe PDF format within one week after completion.

5.4 With each bid or term order proposal, an electronic copy of the impulse tests in ANSI C93.1 section 6.2.1.4 & 6.2.1.5 shall be sent to the Buyer. See section 8.5, "Required Document List."

6. INSPECTION

Inspection of apparatus may be at the Seller's factory or the delivery point at the option of the Buyer. Apparatus shall not be prepared for shipment or shipped before the Buyer has either inspected the apparatus at the factory or waived inspection. Waiving of the inspection at the factory shall in no way relieve the Seller of the responsibility of furnishing apparatus in accordance with the specification.

7. SHIPPING

7.1 PACKAGING

7.1.1 All containers shall be clearly marked with the purchase order number, item number, serial number, and designation of parts enclosed and such additional identifying data as may be specified by the Buyer. All individual parts and components shall be designated and marked in a manner that will facilitate installation in the field.

7.1.2 All hardware required for assembly, other than large pieces of steel, shall be packaged in a wood crate with the unit with which they are intended.

7.1.3 All packages shall be suitable for outdoor storage for up to one year. Crates shall be constructed of wood. The crate shall have a skid to clear a forklift fork.

7.1.4 All insulators shall be protected with heavy non-corrugated cardboard material or other UV resistant material during shipping.

7.1.5 All CCVTs shall be crated individually. Failure to do so will result in a re-crating charge at the time of delivery.

7.1.6 The Seller shall be responsible for and make good any and all damages due to improper preparation for shipment. Heavy or bulky parts shall be provided with eyebolts, lugs, or other lifting devices to facilitate handling with a crane. Instructions for handling and lifting all parts, boxes, and crates shall be clearly painted on or attached to the part or crate

7.2 POINT OF DELIVERY

Delivery shall be made to the following point after proper notification of the designated company representative.

Salt River Project
East Valley Warehouse – Warehouse #54
7050 East University Drive
Mesa, AZ 85207
(602) 236-6126

SRP Company Representative:
Rana Saeed
Apparatus Engineering Dept.
602-236-5475
rana.saeed@srpnet.com

8. DOCUMENTATION REQUIREMENTS

8.1 General Requirements

8.1.1 Compliance with the stipulations of this section is an essential element of the terms and conditions of this negotiation. Failure to comply will result in a negative evaluation factor on future negotiations and may result in a cash penalty as previously stated.

8.1.2 The English language shall be used at all times for documents, drawings, and other correspondence. All dimensions shall be in U.S. (pounds, feet, inches, US gallons, etc.) customary units. Metric units may also be shown in parenthesis.

8.1.3 All drawings and documents shall have “SALT RIVER PROJECT” placed in a prominent location with the Buyer’s purchase order number (P.O. #), Seller’s shop order number (S.O.#), and apparatus serial number (S.N.). Example shown below:

SALT RIVER PROJECT “P.O.#_____”, “S.O.#_____“, “S.N._____”.

If multiple apparatus are ordered under the same P.O. and the serial numbers are continuous, a hyphen may be used as a short hand. For example, “S.N.1001-1004,” instead of S.N.1001, 1002, 1003, 1004.

8.2 Transmittals

8.2.1 All electronic documents (drawings, test reports, etc.) shall be submitted to DocumentCoordinators@srpnet.com and rana.saeed@srpnet.com by either:

- Email (<10Mb per email), or
- For download from a Seller database, where an email shall provide notification that the drawings are available or SRP’s Managed File Transfer – invitation to be initiated by the Buyer’s Engineer.

The email shall describe the document status included (For Review, Approved, Record, As-built, etc.). Acknowledgement will be provided by the Buyer’s document coordinators upon receipt.

8.3 Drawing Requirements

All drawings shall be of high quality to ensure that the finest details are readable.

Buyer reserves the right to reject any drawing or CAD file that does not meet specifications, and in such event will require the Seller to furnish acceptable drawings or CAD files.

8.3.1 Standard Drawings - "Typical," "standard", or "off-the-shelf" drawings will be accepted if they are specifically certified for use in this application. These drawings shall have all non-applicable sections either removed or noted on each drawing.

8.3.2 Drawing Revisions - When drawings are revised, the revision shall be clearly documented, with a new revision number (i.e. Rev.1, Rev. 2. etc.) including revision date, and an explanatory revision description, made clearly legible, and should be placed as close as possible to the title block. The affected areas on the drawing shall be back circled with the corresponding revision number.

8.3.3 CAD Files - All CAD file drawings (Microstation preferred) involving dimensions shall be drawn one to one (1:1). If Seller has three dimensional, 3D, outline drawing CAD files for the equipment, it shall be provided in addition to the other drawings required by this specification.

8.4 Drawing Review & Approval

8.4.1 Review Time - Drawings submitted by the Seller will be processed by the Buyer within 15 calendar days after receipt. Drawings submitted for comment will be reviewed and one print will be returned by the Buyer’s Engineer marked “approved – no changes, work may proceed”, “approved – as marked, work may proceed with changes as marked” or “rejected – resubmit, work shall not proceed”.

8.4.2 Response Time - Seller shall incorporate changes as required by comments on drawings and resubmit corrected drawings for approval within **15 calendar days**. Approved drawing(s) shall not be changed without notification to the Buyer and the re-submittal of drawing(s). This review process shall continue until the Buyer has approved all drawings. Drawings must not be released to the Seller's production area until all drawings are approved or approved with changes by the Buyer. Fabrication prior to approval shall be at the Seller's risk.

8.4.3 Seller Obligation - Approval of Seller's drawings by the Buyer shall not relieve the Seller of any part of their obligation to meet all of the requirements of the specification and other contract documents. Seller is also responsible for the correctness of such drawings, the adequacy and suitability of materials and equipment represented thereon for the intended function.

8.5 Required Documentation List

When Due	Document	**Type of Reproduction
With Bid or Term Order Proposal	1) Evidence of the Seller's current total quality management system	PDF
	2) Seller's warranty	PDF
	3) Copies of the Type-test reports for each unique design in the proposal	PDF
	4) Instruction Manual for Installation, Operation, and Maintenance for each model of CCVT	PDF
	5) Storage, Decommissioning, and Disposal Instructions	PDF
	6) Material Safety Data Sheet (MSDS)	PDF
	7) Electromagnetic unit oil technical data sheet	PDF
	8) Capacitor insulating fluid technical data sheet	PDF
After Award	INITIAL DRAWING REVIEW:	PDF & CAD
	1) Equipment Outlines	
	2) Nameplates	
	3) Schematic & Connection Diagrams	
	4) Other Kits or Hardware Outlines	
After Receipt of EACH Purchase Order (PO) - for Approval	PO & S/N's INCLUDED:	PDF & CAD
	1) Equipment Outlines	
	2) Nameplates	
	3) Schematic & Connection Diagrams	
	4) Other Kits or Hardware Outlines	

15 Calendar Days After Drawings Approved (If Changes Required)	FINAL UPDATED DRAWINGS: 1) Equipment Outlines 2) Nameplates 3) Schematic & Connection Diagrams 4) Other Kits or Hardware Outlines	PDF & CAD
Within 1 Week After Completion of Tests	Certified Test Reports (Sec. 5.1 & 5.2)	PDF
Within EACH Unit at Delivery	1) Instruction Manual for Installation, Operation, and Maintenance for the particular model of CCVT that it's in.	HARDCOPY
	2) Hard Copy of the Certified Test Report (Sec. 5.1 & 5.2) for the respective unit that it's contained in.	HARDCOPY

**PDF – Searchable Adobe PDF File

^ This specification covers all 550kV CCVT stock codes, as listed in Table 1. It also combines the following SMs:

SM-545016-5028205
SM-545017-5028206
SM-545048-5028212
SM-545050-5028213