CITY OF AUSTIN ELECTRIC UTILITY DEPARTMENT
PURCHASE SPECIFICATION
FOR
145 KV EXTERNALLY FUSED
SUBSTATION SHUNT CAPACITOR BANK

DATE	PREPARED BY	ISSUANCE/REVISION	APPROVAL
02/14/1995	David Wood	Revision	-
12/21/2009	Homer Portillo	Revision	
05/19/2016	Roy Priebe	Revision	

REASON FOR REVISION	AFFECTED PARAGRAPHS
Update specification for bid solicitation	all

This specification, until revised or rescinded, shall apply to each future purchase and contract for the commodity described herein. Retain for future reference.

CITY OF AUSTIN ELECTRIC UTILITY DEPARTMENT PURCHASE SPECIFICATION FOR 145 KV EXTERNALLY FUSED SUBSTATION SHUNT CAPACITOR BANK

1.0 SCOPE AND CLASSIFICATION

1.1 SCOPE

1.1.1 The City of Austin Electric Utility Department is hereafter referred to as Austin Energy (AE). This specification establishes the minimum requirements for 72.5kV / 145kV outdoor, open rack, externally fused, substation shunt capacitor banks to be used for power factor correction or voltage regulation on an electric utility transmission system.

1.1.2 The manufacturer shall have a minimum of five (5) years of experience in the production of 72.5kV / 145kV outdoor, open rack, externally fused, substation shunt capacitor banks for the United States electric utility market.

1.1.3 The device furnished under this specification shall have been in commercial service in an electric utility in the United States for a minimum of five (5) years in the configuration being offered.

1.1.4 The area available to install this capacitor bank is 540 in. (45 ft.) [Width] X 180 in. (15 ft.) [Depth]. This is the area of the equipment itself, not the equipment foundation.

1.2 CLASSIFICATION

1.2.1 The capacitor bank shall be a grounded-wye design, for use on a 3-phase, 60Hz, solidly grounded neutral system. The dual rated capacitor bank will be installed in either a 69kV or 138kV outdoor substation.

1.2.2 The capacitor bank will be installed in an outdoor electric utility substation below an altitude of 1000 meters and subjected to an annual ambient temperature variance of -25°C to +45°C at 100% humidity. The average temperature for any twenty-four (24) hour period will not exceed 30°C.

2.0 APPLICABLE STANDARDS

Any device furnished under this specification shall conform to the latest edition of the National Electric Safety Code [NESC] [ANSI/IEEE C2] and the latest edition of all ANSI, IEEE, ANSI/IEEE, and NEMA Standards applicable to the device being furnished.

3.0 FUNCTIONAL REQUIREMENTS

The capacitor bank shall be used outdoors for power factor correction and voltage regulation in either a 69kV or 138kV transmission and distribution substation.

4.0 PERFORMANCE REQUIREMENTS

4.1. The capacitor bank shall be rated 31,200 KVAR, three-phase, 60 Hz, grounded wye, for operation on a nominally rated 138 KV solidly grounded system.

4.2. The capacitor bank shall have a basic insulation level of 650 KV.

4.3. The capacitor bank shall be capable of being switched in one step with a separately furnished three-phase switching device.

4.4. The bidder shall determine the optimal capacitor unit voltage and KVAR rating along with the appropriate number of units per phase. The bidder shall supply the capacitor unit data with the bid submittal.

4.5. The design shall allow the dual rated capacitor bank to be to be configured for operation at either 69 kV or 138 kV operations. The original configuration shall be for 138kV rating.

4.7.1 The design shall minimize the number of series/parallel connections to re-configure the capacitor bank for a change in the operating voltage.

4.7.2 Changing the operating voltage of the capacitor bank shall not require re-stacking the capacitor units/sections.

4.7.3 The capacitor bank shall maintain the 31.2 MVAR rating at either operating voltage.

4.8 The capacitor unit stacking racks shall be mounted on eight (8) foot tall elevating structures. The elevating structures and the stacking racks shall be designed to meet all of the following NESC wind and ice loading requirements:

4.8.1 NESC Light: wind velocity of 60 miles per hour, wind pressure of 9 pound per square foot, no ice.

4.9.2 NESC Heavy: wind velocity of 40 miles per hour, wind pressure of 4 pounds per square foot, ½ inch radial ice.

4.9.3 NESC Basic Wind Loading: 90 MPH with an importance factor of 1.1.

4.9 The capacitor bank and the capacitor units shall meet the requirements of the latest edition of IEEE STD 18 [IEEE Standard for Shunt Power Capacitors].

5.0 ENERGY EFFICIENCY REQUIREMENTS

5.1. The energy efficiency shall be a factor in the award of this contract. The bidder shall submit with his bid, **and guarantee**, the losses, in watts per KVAR, of the capacitor units offered.

5.2 The maximum amount of losses allowed for the capacitor units under this bid shall be 0.15 watts/kVAR.

6.0 MATERIAL REQUIREMENTS

6.1. Capacitor Bank

6.1.1 The capacitor bank shall be furnished complete, with all hardware to allow for field installation and connection to the separately furnished switching device; and shall include as a minimum, the following:

1) Capacitor units
2) Capacitor connectors
3) Bus-mounted individual capacitor fuse assemblies and links
4) Aluminum alloy or galvanized steel stacking racks
5) Aluminum alloy or galvanized steel eight (8) foot tall elevating structures
6) All required bus and bus insulators
7) Porcelain bus and stack insulator
8) Grounding switches (See 6.1.5)

6.1.2 Stacking racks are to be factory assembled but may be shipped in sections to be bolted together in the field. The manufacturer shall provide a list of the stacking order (arrangement) that produces the lowest capacitor bank unbalance.

6.1.3 The following spare equipment shall be furnished with each complete capacitor bank shipped:

1) Three (3) capacitor units
2) Three (3) individual fuse assemblies
3) Twenty (20) fuse links

The price of the equipment shall be included in the bid price.

6.1.4 The manufacturer shall size and supply the following components per phase for each capacitor bank ordered, to be used in a voltage differential protection scheme.

1) LV Capacitor, un-fused, 95kV BIL
2) Transformer protection resistor
3) Voltage transformer, 95kV BIL
4) Junction Box.
5) Mounting hardware for all protection components (LV capacitor, voltage transformer and protection resistor)

6.1.5 The capacitor bank shall be equipped with a manual, single pole, grounding switch on each phase. The switch shall be 145 kV, 600 A, 650 BIL. The switch shall open 180 degrees and be lockable in the open position.

6.1.6 Primary connections to the capacitor bank will be by overhead bus. The capacitor bank manufacturer shall furnish one (1) NEMA 4 hole, 4 inch pad, per phase for customer connection.

6.1.7 All capacitor bank components of the same design and rating furnished on given order shall be mechanically and electrically interchangeable

6.1.8 A control box shall be mounted on the center phase capacitor stack structure. This box shall be NEMA 4 rated. The box shall contain 6 (six) terminal blocks for the voltage transformers from the voltage differential protection scheme [3 phases, 1 transformer per phase, 2 terminals per transformer], 3 (three) class CC fuses and associated fuse blocks, and 4 (four) terminal blocks for customer connection. The terminal blocks shall be rated 30 amps, 600 volts.

6.1.9 The maximum installed width of the capacitor bank shall be no more than 540 inches (45 feet). The maximum installed width of the capacitor bank shall be no more than 180 inches (15 feet). These are the dimensions of the capacitor bank itself, not the dimensions of the foundation.

6.2 Capacitor Units

6.2.1 Capacitor units shall be suitable for and capable of continuous operation in accordance with IEEE Std 18.

6.2.2 Capacitor units shall be capable of withstanding, with full life expectancy, transient and temporary over-voltages and over-currents in accordance with IEEE STD 18.

6.2.3 Capacitor units furnished shall be the all-film/all-foil type design and impregnated with a low toxicity and biodegradable dielectric fluid.

6.2.4 The dielectric fluid contained in the capacitor units shall be PCB free (less than 1 ppm). The test method used for analysis of PCB content shall be EPA Method 608-1990. Each capacitor unit shall have a blue weather resistant NON-PCB decal noting that the capacitor unit is PCB free (less than 1 ppm).

6.2.5 Capacitor units shall be equipped with an internal discharge device which will reduce the residual voltage to 50 volts or less within five (5) minutes after the capacitor is disconnected from rated voltage in accordance with IEEE Std 18.

6.2.3 Capacitor units shall not be damaged by partial discharges when energized under any conditions of ambient temperature or continuous voltage permitted in IEEE Std 18.

6.2.4 Capacitor units shall not generate a radio influence voltage (RIV) in excess of 250 microvolts as determined in accordance with IEEE Std 18.

6.2.5 Capacitor units shall be designed for switched or continuous operation in outdoor locations with unrestricted ventilation and direct sunlight in accordance with IEEE Std 18.

6.2.6 Capacitor units furnished shall have one or two glazed wet processed porcelain bushings in accordance with IEEE 18.

6.2.7 Capacitor unit bushings shall be provided with a clamp type terminal connector to accommodate a minimum range of copper or aluminum conductors from number 8 solid through number 2 stranded, AWG.

6.2.8 Capacitor units shall be individually fused with positive indicating, bus-mounted expulsion type fuses.

6.2.9 Capacitor units furnished shall have a number 409 stainless steel case and be hermetically sealed by solder sealing or welding.

6.2.10 Capacitor unit cases and bushings shall be ANSI No. 70, light gray in accordance with ANSI Z55.1.

6.2.11 Capacitor units shall be furnished with heavy duty stainless steel mounting brackets. The mounting bracket contact surface shall be unpainted.

6.3 Name Plates

Nameplates shall be provided as described below. All nameplates shall be made from non-rust stainless steel. The information contained on the nameplates shall be inscribed and painted black. All the information shall be in English and in standard non-metric units of measure.

6.3.1 The capacitor bank shall be provided with a master nameplate mounted on the junction box door that includes the following minimum information:

1) Manufacturer's name
2) Manufacturer's model
3) Manufacturer's unique serial number
4) AE purchase order number
5) Year of manufacture

6) Rated reactive power
7) Rated voltage, rms
8) Number of phases
9) Rated frequency
10) Basic Insulation Level (BIL)
11) Statement as to whether the insulating fluid is or is not flammable
12) Total number of gallons of dielectric fluid contained in the capacitor bank
13) Total weight in pounds of the assembled capacitor bank
14) Statement that capacitor units contain an internal discharge device

6.3.2 Each capacitor unit shall be provided with a nameplate mounted on the unit that includes the following minimum information:

1) Manufacturer's name
2) Manufacturer's model
3) Manufacturer's unique serial number
4) AE purchase order number
5) Year of manufacture
6) Rated reactive power
7) Rated voltage, rms
8) Rated frequency
9) Basic Insulation Level (BIL)
10) Statement as to whether the insulating fluid is or is not flammable
11) Number of gallons of dielectric fluid contained in the capacitor unit
12) Weight in pounds of the capacitor unit
13) Statement that capacitor unit contains an internal discharge device

7 TESTING

7.1 The following **production** tests shall be performed by the manufacturer on each capacitor unit in accordance with ANSI/IEEE 18:

1) Short time overvoltage test
2) Capacitance test
3) Leak test
4) Discharge resistor test
5) Loss determination test

7.2 The following **design** tests in accordance with ANSI/IEEE 18 shall have been performed by the manufacturer .Test reports of those tests shall be available on request to demonstrate compliance of the design with this specification:

1) Impulse withstand test
2) AC Voltage tests
3) Thermal stability test
4) Radio influence voltage test
5) Short circuit discharge test
6) Performance test

7.3 The manufacturer shall provide copies of certified test reports to verify the proper performance of the equipment supplied. Copies of these test reports shall be included in the instruction book for the capacitor bank.

7.4 The dielectric fluid contained in the capacitor units shall be tested to guarantee that they are PCB free (less than 1 ppm). The test method used for analysis of PCB content shall be EPA Method 608-1990. The manufacturer shall supply certified test reports indicating that the dielectric fluid is PCB free.