Technical Specification
For
Outdoor Substation Capacitor Bank

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CONTENTS

1.0 Scope

This specification provides manufacturing and testing guidelines, description, packaging, and other provisions required for an outdoor shunt capacitor bank.

2.0 Standards

The capacitor bank furnished shall be designed, fabricated, tested, and delivered in accordance with ANSI/IEEE Std. 18-2002.

3.0 Technical Requirements

3.1 General

The equipment supplied under this specification shall conform to the requirements of the standards referenced in Paragraph 2.0 of this specification and to the requirements stated herein.

3.2 Capacitor Bank

3.2.1 The shunt capacitor bank shall be outdoor, open structured type with capacitors connected in series and parallel groups and mounted as specified in the "Technical Specifications".

3.2.2 All hardware and materials for electrical and mechanical connections shall be furnished with the capacitor bank.

3.3 Capacitor Units

3.3.1 All capacitors shall have 15 5/8" mounting centers.

3.3.2 All capacitors shall have stainless steel tanks. Type 400 or approved equivalent.

3.3.3 All capacitors shall be equipped with one or two bushings as specified on the inquiry. Bushings shall be wet-process porcelain, glazed, light-gray (Munsell 5BG-7.0/0.4, ANSI 70).

3.3.4 Capacitor tanks shall have a light-gray epoxy topcoat (Munsell 5BG-7.0/0.4, ANSI 70).

3.3.5 The underside of all hangers shall be left unpainted for positive grounding.

3.3.6 Bushings shall be hermetically sealed to the capacitor tank.

3.3.7 Bushing terminals shall be the parallel -groove type to accommodate copper or aluminum conductors from no. 8 solid to no. 1 stranded.

3.3.8 All capacitors shall be equipped with a dark blue NON-PCB decal on the tank to provide quick and easy identification.

3.3.9 All capacitors shall be equipped with a stainless steel nameplate containing complete rating information and month and year of manufacture.

3.3.10 All capacitors shall have an internal discharge resistor in accordance with the latest applicable NEMA and ANSI standards.

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3.3.11 Design

All capacitors shall be the all-film dielectric type. Paper/film dielectric capacitors will not be considered.

The dielectric fluid shall be NON-PCB.

All capacitors shall be designed so that the DIV ratio to operating stress will not be less than 180% at room temperature.

Internal pack construction shall be of the extended foil, mechanically crimped type. Tab style construction will not be accepted.

3.4 Capacitor Blocks

3.4.1 The capacitor blocks shall be made from structural marine grade aluminum.

3.4.2 All blocks shall be furnished with four lifting eyes capable of supporting a completely equipped block.

3.4.3 The capacitor block fuse bus shall be supported on station post insulators.

3.5 Capacitor Fuses

3.5.1 Capacitor units shall be supplied with a bus mounted, external, expulsion type fuse holder complete with flipper spring, and fuse link. The fusing system shall be capable of handling continuous current, transient currents, and fault currents. The fuse protecting the capacitor unit shall be chosen such that its continuous current capability is equal to or greater than 135% of rated capacitor current. The maximum clearing curve for the fuse link must coordinate with the tank rupture curve for the capacitor. In addition, the fuses and the capacitor must be capable of handling the available stored energy with up to 9300 kvar (30 kj) connected in parallel.

The flipper spring shall be **Cooper Power Systems** Opti-G double spring type.

3.5.2 Where an expulsion type fuse cannot be used, then the fuse must be current limiting type. The fuse must be full range, one piece, non-expulsion current limiting capable of interrupting 250,000 amps of capacitor discharge current with a 2400 volt recovery voltage.

Two part current limiting fuses consisting of a current limiting section in series with an expulsion fuse are not permitted.

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4.0 Tests

4.1 All routine tests shall be performed in accordance with NEMA CP1-1988 or ANSI/IEEE Std. 18-1992. All units shall be routine tested at 4.3 times rated voltage DC or 2.0 times rated voltage AC.

4.2 Type test reports previously performed must be made available upon request.

4.3 The manufacturer shall monitor the capacitance value of each capacitor during processing to insure complete impregnation.

4.4 All NEMA routine production tests shall be performed.

4.5 Five percent of the capacitor units from each impregnation lot shall be energized at 130% of rated voltage for a minimum of 2 hours in a room temperature ambient. If a unit subjected to this sample test fails, the production lot represented is placed on hold until the following analysis has been made:

The failed capacitor is dissected and inspected carefully for any major problems such as improper construction or poor impregnation.

If none are found, additional units are selected from the production lot and are subjected to the energization sample test.

Should inspection reveal any major problem or if failures occur during additional tests, all of the units represented by the sampling are rejected.

After the successful completion of these tests, the production lot represented is released and all capacitor units are then subjected to final electrical tests in accordance with applicable NEMA standards.

5.0 Bid Data

5.1 The manufacturer shall submit with his proposal a curve demonstrating the average losses vs. ambient temperature from -40 to +46°C.

5.2 The manufacturer shall submit with his proposal the tank-rupture time-current curve (TCC) of the capacitors being offered. The curve shall be a definite, not a probability curve. The curve must indicate that the capacitor can withstand up to 10,000 amps of fault current without rupture when coordinated with expulsion fuse links. The capacitor must be able to withstand 2,000,000 amp ^{2} seconds of fault current without rupturing. The capacitor must be able to withstand 30 KJ without rupturing. Certified test data

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must be submitted showing that the fuse can interrupt 250,000 amps with a 2400 AC rms recovery voltage.

5.3 The manufacturer shall submit with his proposal information confirming the quality control procedures used in the manufacture of the capacitors complies with CSA Standard Z299 level 3.

6.0 Packaging and Shipping

6.1 Adequate protection shall be provided to prevent damage during shipment and handling.

6.2 The equipment, packages, etc. shall be clearly marked for shipment as follows:

a. Project and location.

b. Purchase order number.

c. Item number.

d. Supplier's order number.

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Technical Requirements Of Capacitor Bank

Data To Be Submitted With Request for Quote

1. Bank voltage _____kV
2. Frequency _____HZ
3. Bank Capacitance: _____Initial _____Future
4. Bank KV-BIL: _____
5. Connection _____Grounded _____Ungrounded Wye
6. Capacitor mounting _____Horizontal _____Vertical
7. Fusing _____Expulsion _____Current limiting
8. Bushing creepage: _____10" _____18" _____22" _____26"
9. Elevating structure: _____Ht. in inches
10. Temp Range: _____Min _____Max
11. Unbalanced scheme to be supplied with tender: ___Yes ___No
12. Describe any unusual service conditions.

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