

## **Automatic Harmonic Filter / Power Factor Correction Capacitor Medium Voltage Standard Specification**

### **1. Enclosure**

- 1.1 The capacitor bank shall consist of a single (1) enclosure with a NEMA 1, 3R or 4X rating, which will house all components, including fuses, capacitors and switches. Associated controls shall be housed in a control compartment which shall be an integral part of the enclosure. Two enclosure systems requiring nipple connections will not be allowed.
- 1.2 The enclosure shall be fabricated from 11 gauge cold rolled steel, and all seams shall be continuously welded and ground smooth to present an attractive appearance. Pre-fabricated, or transclosure type enclosures shall not be used. Outdoor units shall consist of painted galvanized steel.
- 1.3 The enclosure shall have a C-Channel base for rigidity and skidding into place.
- 1.4 The enclosure shall be white enamel inside, ANSI gray-61 enamel outside. All enamels to be corrosion resistant. Special paint and color schemes shall be available when required.
- 1.5 The enclosure shall have a \_\_\_\_\_ A main bus and continuous ¼” x 2” ground bus at the front of the enclosure.
- 1.6 The door shall be provided with a heavy-duty 3-point latching mechanism with rollers installed on the latch bar ends for easy door operation. The doors shall be equipped with 3 stainless steel pin hinges which are removable in the fully open position only. Outdoor cubicles shall be equipped with door stopper/holder.
- 1.7 All fastening hardware, inside and out, shall be stainless steel.
- 1.8 Nameplates and warning labels shall be composed of lamicaid, aluminum or galvanized steel and shall be blind riveted to enclosure. White RTV shall be placed on back side of rivet.

## 2. Capacitors

- 2.1 The capacitor bank, with all stages energized, shall be rated \_\_\_\_ KVAR at \_\_\_\_ kV and 60 hertz. The bank shall contain (NUMBER OF CANS) (KVAR OF CANS) kvar at (CAPACITOR VOLTAGE) low loss, single bushing, all-film capacitors. The capacitors shall be connected in one of the following configurations, dependent on system requirements:
- Ungrounded Y Configuration
  - Delta Configuration
  - Y grounded Configuration
  - Double Y Grounded Configuration
  - and switched in increments of \_\_\_\_ kvar.
- 2.2 The capacitors shall include a stainless steel tank and mounting brackets with a light gray finish. All capacitors shall meet the latest applicable ANSI standards. The dielectric fluid is to contain no PCB's and capacitors are to be labeled PCB free. Each capacitor shall contain an internal discharge resistor to reduce the stored voltage to 50 volts or less within 5 minutes from disconnection.
- 2.3 Capacitors shall have a \_\_kV BIL rating. (choose 75kV, 95kV or 150kV)
- 2.4 Capacitors shall be mounted in either an upright position with terminals pointing toward the ceiling of the enclosure or sideways with bushings pointing toward the front of the enclosure.
- 2.5 Capacitors shall be protected from sustained over voltages due to capacitor unit failure and/or system ground faults.
- 2.6 Capacitor unit shall preferably be internally fused protected

## 3. Protection

- 3.1 Capacitor bank shall be supplied with three (3) single phase distribution class incoming lightning arrestors.
- 3.2 Each capacitor shall be protected by a full range current limiting fuse with blown fuse indicators. Fuses shall be rated 4.3kV, 5.5kV, 8.3kV, 15.5kV or 23kV, dependant on system requirements.
- 3.3 A phase unbalance/blown fuse protections scheme shall be provided with the capacitor bank and shall be designed to protect capacitors against unbalance conditions. Protection scheme shall be appropriately designed based on capacitor connection scheme specified in section 2.1 of this specification.
- 3.4 The control power transformer shall be equipped with both primary and secondary fuses. Fuses shall be of the current limiting type.

#### **4. Load Interrupter, Air Disconnect Switch and Ground Switch**

- 4.1 The capacitor bank shall be supplied with an externally operated load interrupting switch that has minimal capacitive current interruption capability. The switch shall have a 600 amp continuous rating and a 40 kA RMS momentary asymmetrical rating.
- 4.2 A mechanically interlocked ground switch shall be provided so that capacitors can be grounded during maintenance. The ground switch shall be ANSI tested and shall have a fault current rating of 40 kA asymmetrical. It shall be externally operated and shall be mechanically interlocked with the load break switch in section 4.1.
- 4.3 Three group operated single phase 13kV, 15kV or 20KV, 125kV or 150kV BIL vacuum or oil switches shall be supplied with unit for switching the capacitors xxx kvar steps on and off. The switches shall be interlocked with the Kirk-key interlock system.

#### **5. Interlocks**

- 5.1 The capacitor bank shall be equipped with a Kirk Key interlock system to prevent unauthorized and out of sequence entry into the capacitor bank.
- 5.2 The interlock scheme shall include the upstream protective device, the capacitor banks load break switch, vacuum or oil switches, ground switch, and the doors of the enclosure. The interlock scheme shall prevent the opening of the disconnect switch (*and the closing of the ground switch*) before the capacitor bank is de-energized.
- 5.3 The kirk key locks shall be mounted behind the door and project through the door. Surface mount locks will not be accepted.
- 5.4 Kirk key scheme shall enable all doors to be opened at once for service.

#### **6. Power Factor Controller**

- 6.1 The capacitor bank shall be equipped with a digital power factor controller. The controller shall have a digital display that shows plant power factor, plant current level and plant voltage level. Set point power factor shall be set by digital display.

## 7. Harmonic filtering reactors

- 7.1 Each phase of each step of the automatic harmonic filter bank shall be equipped with an iron core reactor (for 25 kV network and below) or air core reactor for above network voltage. The capacitor / reactors system shall be tuned to the \_\_\_\_ harmonic. The reactor shall be equipped with a thermal sensing device for overheating protection.

## 8. Submittals

- 8.1 Upon issue of a purchase order, the supplier shall provide 5 copies of approval drawings. The submittals shall include:
- Installation Instructions
  - Single Line and three line diagrams
  - Drawings showing component layout
  - Data sheets for all internal components
  - Bill of material
  - Transient current simulations

## 9. Acceptable Product & Suppliers

- 9.1 Suppliers must offer a minimum 1-year warranty and have available extended warranty programs.
- 9.2 Suppliers will be responsible for cable coordination.
- 9.3 Acceptable Product:

MV PowerVar Filter manufactured by Power Survey International

## 10. Bid Requirements

- 10.1 Suppliers must state exceptions in proposal. If no exceptions are taken, suppliers must state “no exceptions were taken” in proposal.
- 10.2 Suppliers must submit bill of material and drawings with proposal. Drawings must show component layout and outside view of capacitor bank.
- 10.3 Bids will be rejected if 10.1 and 10.2 are not supplied with proposal.