

# Specification for: **IEC STATION CLASS SOLID CORE HOUSED SURGE ARRESTERS**

## **1.0 Scope**

- 1.1 This specification covers polymer type solid core station class metal oxide varistor (MOV) surge arresters.
- 1.2 Arresters shall be gapless type and retain less than 10% of their volume in the form of gas.
- 1.3 Arresters shall be tested according to the station class requirements of the latest edition of IEC 60099-4.
- 1.4 If a conflict exists between the above referenced standard and this specification, this specification shall prevail.

## **2.0 General Requirements**

- 2.1 Guarantee
  - 2.1.1 Bidder must provide certification that the supplier has at least 25 years of experience in manufacturing gapless solid core station class surge arresters and have an installed base of at least 700,000 of these arresters in service.
  - 2.1.2 Bidders that cannot comply with section 2.1.1 will not be considered.
- 2.2 Information supplied with bid
  - 2.2.1 The bid documentation supplied will include as a minimum the following information:
    - 2.2.1.1 Outline drawings of the arrester including the external mounting hardware
    - 2.2.1.2 Residual voltage levels
    - 2.2.1.3 Type test reports in accordance with the latest revision of IEC 60099-4
    - 2.2.1.4 Example routine test report with tests as required in IEC 60099-4
    - 2.2.1.5 ISO 9001 quality certification
    - 2.2.1.6 ISO 14001 environmental certification
  - 2.2.2 All of the documentation will be supplied in English.

## **3.0 Applicable Standards**

- 3.1 IEC 60099-4 (Latest Revision)

## **4.0 General Characteristics**

- 4.1 The arrester shall be gapless MOV type.
- 4.2 The allowed housing materials shall be a blend of silicone and EPDM rubber, or silicone rubber.
- 4.3 The interface between the polymer housing must be filled with a silicone dielectric compound. A polymer housing that is bonded to the internal elements is also permitted.
- 4.4 Each arrester shall be capable to be supplied with NEMA 4-hole terminal pad for line and ground end connection. The bidder shall offer other hardware options, as required.
- 4.5 Each arrester shall be supplied with line and ground terminal connectors suitable for clamping conductors from 0.25 inches (7 mm) to 0.81 inches (21 mm) in diameter. The bidder shall offer additional clamping options for other applications, as required.



- 4.6 All external metal parts shall be stainless steel, zinc plate or hot dip galvanized to protect against corrosion, unless otherwise approved.
- 4.7 Nameplate data shall include the following information:
- 4.7.1 Arrester designation per Table 1 of IEC 60099-4
  - 4.7.2 Manufacturer's name or trademark
  - 4.7.3 Manufacturer's product type and identification number
  - 4.7.4 Continuous Operating Voltage ( $U_c$ ) of the arrester
  - 4.7.5 Rated voltage ( $U_r$ ) of the arrester
  - 4.7.6 Year of manufacture
  - 4.7.7 Rated short-circuit current in kA
  - 4.7.8 Serial number
- 4.8 Station Low (SL) arresters will have a minimum fault current withstand capability of 40 kA when tested per section 10.8.10 of IEC Standard 60099-4:2014. Station Medium (SM) and Station High (SH) arresters will have a minimum capability of 63 kA.
- 4.9 The bidder shall offer means to mount the arrester in an upright or underhung configuration. Both options may require different part numbers to differentiate the mounting style.
- 4.10 If required, grading rings shall be provided by the bidder. All grading rings will be aluminum and have a sand blasted finish to prevent surface scratches and scuff marks.
- 4.11 If required, seismic capability shall be determined according to the requirements of IEEE 693. The bidder shall provide seismic capability reports for each product family. The reports shall be stamped by a licensed Structural Engineer (SE) or Professional Engineer (PE).
- 4.12 Physical Dimensions and Mechanical Capability
- 4.12.1 Creepage distance - The arrester shall have a minimum external creepage distance corresponding to its designated pollution zone per Table C.1 of IEC Standard 60099-4:2014.
  - 4.12.2 Height - The height of the arrester with and without the terminal pad shall be provided.
  - 4.12.3 Strike distance - The arrester strike distance shall be provided.
  - 4.12.4 Clearances - The recommended phase-to-phase and phase-to-ground clearances shall be provided.
  - 4.12.5 Bending Moment Test - Cantilever capability shall be tested per section 10.8.11 of IEC Standard 60099-4-2014 for both the Specified Long-term Load (SLL) and Specified Short-term Load (SSL).
  - 4.12.6 Arresters shall have three mounting feet spaced 120° apart on an adjustable 8.0-inch (203 mm) to 10-inch (254 mm) bolt circle, with holes sized to accommodate 0.5-inch (12 mm) mounting bolts. Smaller bolt circle diameters are also permitted.
- 4.13 Electrical Characteristics
- 4.13.1 Residual Voltages - Arresters shall be assembled with the correct number of MOV blocks to obtain proper operating characteristics for a given  $U_c$ . The sum of the residual voltages of blocks assembled in an arrester will be reported by the bidder.
  - 4.13.2 Power-frequency voltage versus time (TOV) Capability - The bidder shall provide both prior duty and no-prior duty TOV capability curves in per unit of  $U_r$  for times of 0.1 s, 1 s, 10 s, 100 s, and 1000s. The TOV value with prior duty and 10 s time duration shall be at least equal to  $U_r$ .
  - 4.13.3 Operating Duty Capability (Wth) - The bidder shall provide a rated thermal energy rating in kJ/kV-  $U_r$  for each family of arresters.



4.13.4 Repetitive Charge Transfer Rating Capability (Qrs) - The bidder shall provide a repetitive charge rating for each arrester in Coulombs.

4.13.5 Insulation Withstand - The bidder shall provide lightning, switching and power frequency insulation withstand capabilities.

## 5.0 Routine and Quality Assurance Testing

### 5.1 MOV block requirements

#### 5.1.1 Routine (100%) tests:

5.1.1.1 Residual voltage (10 kA) - Each MOV block shall be subjected to a 10 kA discharge with a wave shape of 8/20 and the resulting residual voltage shall be measured with an accuracy of 1.5%. This measured value must be stamped on the block and used as the basic reference value in assembling multiple blocks into complete arresters.

5.1.1.2 Rated Energy Test - Each block shall receive multiple high energy square wave impulses. The magnitude of the discharge current shall be maintained such that the resulting total energy per test is greater than  $193 \pm 10$  percent J/cc of block material.

#### 5.1.2 Quality assurance tests:

5.1.2.1 The following tests shall be performed on samples of MOV blocks taken from each manufacturing batch of blocks.

5.1.2.2 Square-wave energy test - Sample blocks shall be subjected to a two shot series of high energy discharges which are increased in magnitude on successive series until the block fails. This indicates the ultimate energy capability by the magnitude of the energy absorbed on the last shot prior to failure. The minimum energy of the block shall exceed 210 J/cc block material.

5.1.2.3 High Current Test 100kA - Sample blocks shall be subjected to two 100 kA discharges with permissible wave shape 4-6/10-15. After a minimum one-hour cooling period, blocks shall have a maximum increase in 10 kA residual voltage of less than 3%.

5.1.2.4 AC Tests - Sample blocks shall be energized to  $\geq 30$  mA<sub>pk</sub>, following which the current shall be reduced to I<sub>refpk</sub> and the reference voltage measured (U<sub>refpk</sub>). The voltage shall then be reduced to U<sub>c</sub> and the watts loss and capacitive current are measured. The measured watts loss shall not exceed  $\leq 0.065$  Watts per kV of 10 kA residual voltage for the block under test.

5.1.2.5 Accelerated aging test - A sample of blocks from each batch shall be subjected to an accelerated aging test in which the blocks shall be energized at  $\geq U_c$  at 135°C for 160 hours. At the conclusion of the test, the curve of watts loss vs. time shall exhibit a negative slope. The final/minimum watts loss shall not exceed 1.08 and the final watts loss is less than or equal to the initial watts loss.

### 5.2 Arrester routine test requirements:

5.2.1 The following tests shall be performed on 100% of assembled arrester units.

5.2.2 Reference Voltage - The voltage necessary to produce a manufacturer determined reference current shall be measured and shall not be less than the minimum value designated by the manufacturer for the arrester unit.

5.2.3 Partial Discharge (PD) - The power-frequency voltage shall be raised to the duty-cycle voltage rating of the arrester unit, held for at least 2 seconds and then lowered to 1.05 times U<sub>c</sub>. The arrester PD shall be measured at 1.05 times U<sub>c</sub> and shall not exceed 10 pC.



- 5.2.4 Power Frequency Test – Each arrester unit shall be energized at 1.20 times  $U_c$  for a minimum of 1 second during which time the watts loss shall be measured. The watts loss shall not exceed the maximum value designated by the manufacturer for the arrester unit.
- 5.2.5 Current Sharing – This test only applies to arrester units consisting of two or more parallel columns of MOV blocks. Current sharing between any two columns shall not exceed the limit specified by the manufacturer.
- 5.3 Documentation – Upon request the manufacturer shall supply certification that all of the above tests have been performed and that all requirements were met. It shall not be necessary to provide actual test values.
- 5.4 Facility requirements
  - 5.4.2 All arresters shall be manufactured in an ISO 9001 certified facility.
  - 5.4.3 All arresters shall be manufactured in an ISO 14001 certified facility.

*This specification does not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to Hubbell Power Systems, Inc.*

