Surge Arresters

COOPER Power Systems

Electrical Apparatus

235-65

Metal Oxide Varistor Elbow (M.O.V.E.) Surge Arrester

GENERAL

The M.O.V.E. Surge Arrester combines metal (zinc) oxide varistor technology in a premolded rubber elbow to provide overvoltage system protection in an insulated, fully shielded, submersible, deadfront device.

The arrester housing interface conforms to **IEEE Standard 386**™ — Separable Insulated Connector Systems. The arrester housing is molded of EPDM insulating rubber, which provides deadfront safety in a small, hotstick operable unit.

M.O.V.E. Arresters are used on underground systems in pad-mounted transformer and entry cabinets, vaults, switching enclosures and other installations to provide shielded deadfront arrester protection. They are designed for use with 200 A loadbreak interfaces that conform to **IEEE Standard 386**™ to limit overvoltages to acceptable levels, protect equipment and extend cable life.

CONSTRUCTION

The rubber body is constructed of high quality precision molded peroxide-cured EPDM insulation and semi-conductive materials.

The copper alloy probe and probe retainer are connected to the MOV block stack via welded flexible tin-plated copper leads. This ensures that the column cannot be damaged during installation and that a reliable current path to the MOV blocks is maintained. The disk column is composed of MOV disks bonded together with high-conductivity, silver-loaded epoxy to yield the most reliable electrical connection and eliminate air voids. The #4 AWG flexible copper ground lead, which reliably carries current to ground during voltage surges, is attached to the housing by a brass magneformed end cap. The brass end cap provides a tight, weatherproof seal.

OPERATION

Installing a M.O.V.E Arrester at the end of a radial system or at both ends of an open point on a loop system provides excellent overvoltage protection. The addition of a second M.O.V.E. Arrester at the mid-point on a rotatable feedthru insert provides optimum protection.

Figure 1.
M.O.V.E. Surge Arresters shown from left to right: 35 kV, 25 kV and 15 kV.

600 A feeder circuits can be protected with elbow arresters installed on the Cooper T-OP II Separable Connector Systems.

STANDARDS

The M.O.V.E. Arrester complies with the latest revisions of **IEEE Standard C62.11**™ "IEEE Standard for Metal Oxide Surge Arresters for AC Power Circuits" and **IEEE Standard 386**™ "Separable Insulated Connectors for Power Distribution Systems Above 600 Volts."

INSTALLATION

All Cooper M.O.V.E. Arresters can be installed or removed from energized bushings with a hotstick. No special tools are required. The arrester is placed on a 200 A interface by using a hotstick. Refer to Installation Instruction Sheet S235-55-1 for more details.

PRODUCTION TESTS

Tests conducted in accordance with **IEEE Standard 386**™:

- Corona Extinction Voltage Level
- AC 60 Hz 1 Minute Withstand

Tests conducted in accordance with Cooper Power Systems requirements:

- Physical Inspection
- Periodic Dissection
- MOV Blocks:
  — Voltage at 1 mA
  — Batch Life Test
- Arrester Assembly:
  — Voltage at 1 mA
- Periodic X-ray Analysis

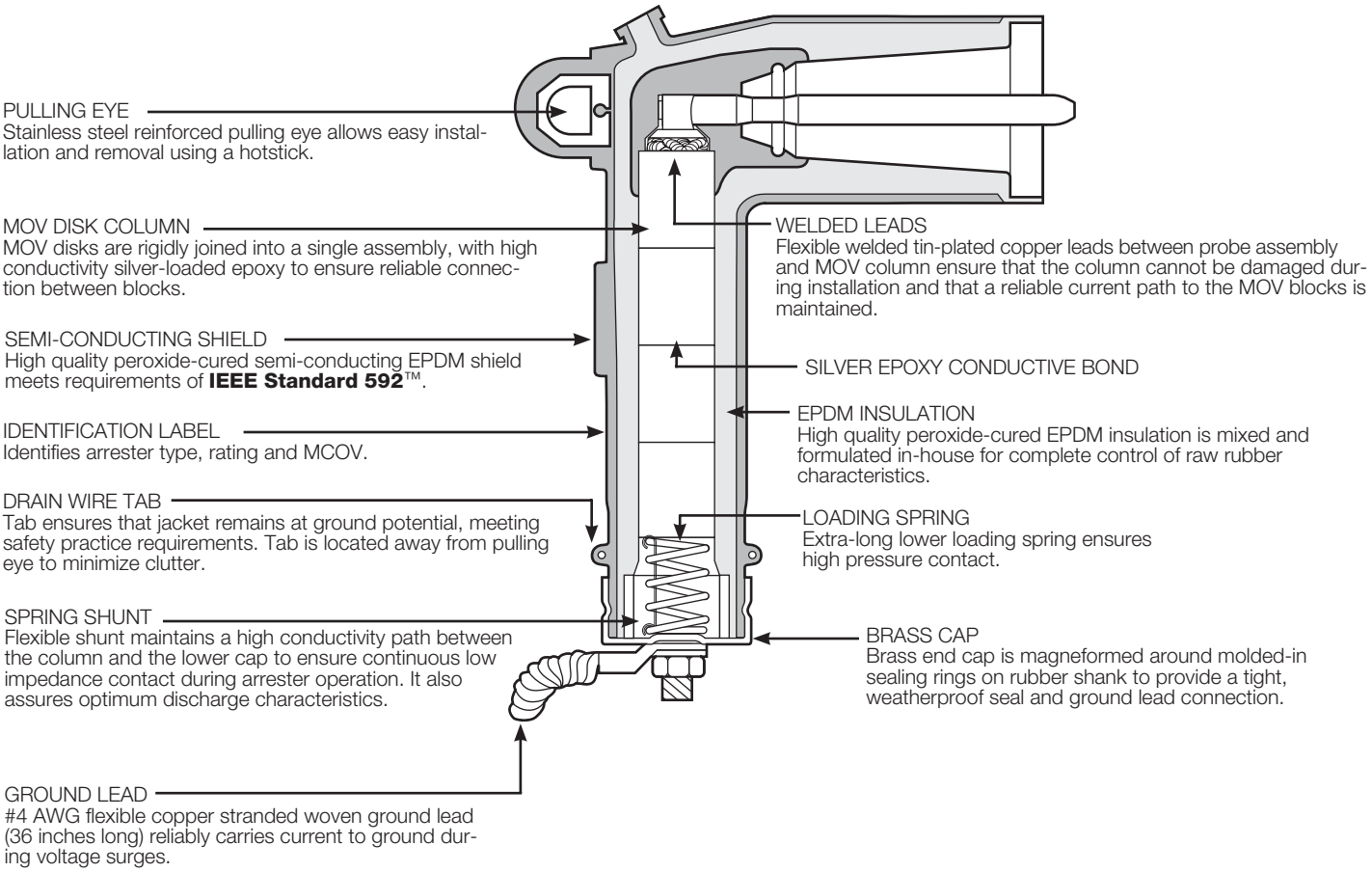


Figure 2.
Cutaway illustration shows 25 kV Class Metal Oxide Varistor Elbow Surge Arrester.

PROTECTIVE CHARACTERISTICS

The protective characteristics of the M.O.V.E. Surge Arresters are shown in Table 1.

TABLE 1
Electrical Ratings and Characteristics

Duty Cycle Voltage Rating (kV)	MCOV (kV)	Equivalent Front-of-Wave (kV crest)*	Maximum Discharge Voltage (kV crest) 8/20 µs Current Wave				
			1.5 kA	3 kA	5 kA	10 kA	20 kA
3	2.55	13.7	10.7	12.0	12.8	13.4	15.7
6	5.1	27.4	21.9	24.5	26.2	28.6	34.9
9	7.65	37.4	27.4	29.9	31.4	34.7	38.4
10	8.4	39.7	28.4	30.6	32.9	36.7	40.4
12	10.2	56.1	41.1	44.8	47.1	52.0	57.6
15	12.7	63.0	45.0	49.2	52.5	57.8	66.0
18	15.3	74.8	54.7	59.7	62.7	69.3	76.8
21	17.0	81.7	58.7	64.2	68.2	75.2	85.2
24	19.5	95.8	69.7	76.1	80.2	88.6	98.8
27	22.0	105.0	75.0	82.0	87.4	96.2	110.0
30	24.4	112.0	79.5	85.7	91.8	100.0	115.0

* Equivalent front-of-wave voltage is the expected discharge voltage of the arrester when tested with a 5 kA current surge cresting in 0.5 µs.

TEMPORARY OVERVOLTAGE (TOV) CAPABILITY

The Temporary Overvoltage (TOV) capability of the M.O.V.E. Arrester is shown in Figure 3.

PERFORMANCE TEST CHARACTERISTICS

The M.O.V.E. Surge Arrester consistently withstands the following design tests as described by **IEEE Standard C62.11™**:

- **Duty Cycle:**
  22 current surges of 5 kA crest 8/20 µs waveshape.
- **High-Current, Short-Duration Discharge:**
  2 current surges of 40 kA crest 4/10 µs waveshape.
- **Low-Current, Long-Duration Discharge:**
  20 current surges of 75 A crest 2000 µs rectangular wave duration.

Following each of these tests, the arresters remain thermally stable as verified by:

- Continually decreasing power values during a thirty minute power monitoring period.
- No evidence of physical or electrical deterioration.

STANDARDS

The M.O.V.E. Surge Arrester complies with the latest revision of **IEEE Standard C62.11™** "IEEE Standard for Metal Oxide Surge Arresters for AC Power Circuits" and **IEEE Standard 386™** "Separable Insulated Connectors for Power Distribution Systems Above 600 Volts."

TABLE 2
Commonly Applied Voltage Ratings of M.O.V.E. Surge Arrester

System Voltage (V rms)		Commonly Applied Arrester Duty-cycle (MCOV) Voltage Rating (kV rms) on Distribution Systems		
Nominal Voltage	**Maximum Voltage range B**	**4-Wire Multigrounded Neutral Wye**	**3-Wire Low Impedance Grounded**	**Delta and 3-Wire High Impedance Grounded**
2400	2540	—	—	3 (2.55)
4160 Y/2400	4400 Y/2540	3 (2.55)	6 (5.1)	6 (5.1)
4260	4400	—	—	6 (5.1)
4800	5080	—	—	6 (5.1)
6900	7260	—	—	9 (7.65)
8320 Y/4800	8800 Y/5080	6 (5.1)	9 (7.65)	—
12000 Y/6930	12700 Y/7330	9 (7.65)	12 (10.2)	—
12470 Y/7200	13200 Y/7620	9 (7.65) or 10 (8.4)	15 (12.7)	—
13200 Y/7620	13970 Y/8070	10 (8.4)	15 (12.7)	—
13800 Y/7970	14520 Y/8388	10 (8.4) and 12 (10.2)	15 (12.7)	—
13800	14520	—	—	18 (15.3)
20780 Y/12000	22000 Y/12700	15 (12.7)	21 (17.0)	—
22860 Y/12000	22000 Y/12700	15 (12.7)	21 (17.0)	—
23000	24340	—	—	30 (24.4)
24940 Y/14400	26400 Y/15240	18 (15.3)	27 (22.0)	—
27600 Y/15935	29255 Y/16890	21 (17.0)	30 (24.4)	—
34500 Y/19920	36510 Y/21080	27 (22.0)	—	—

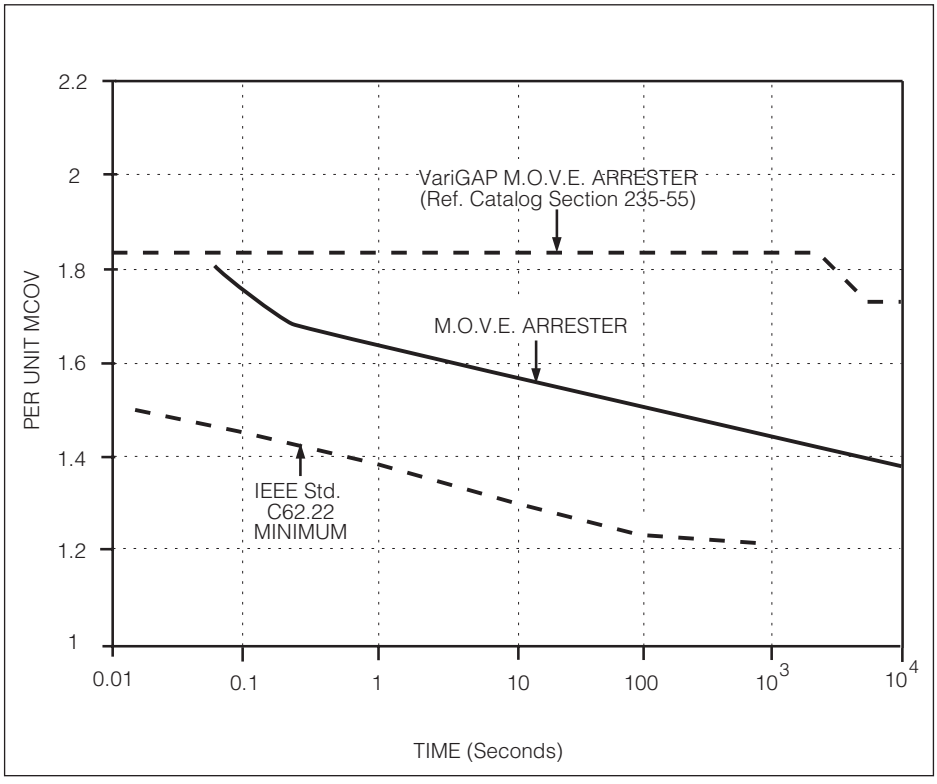
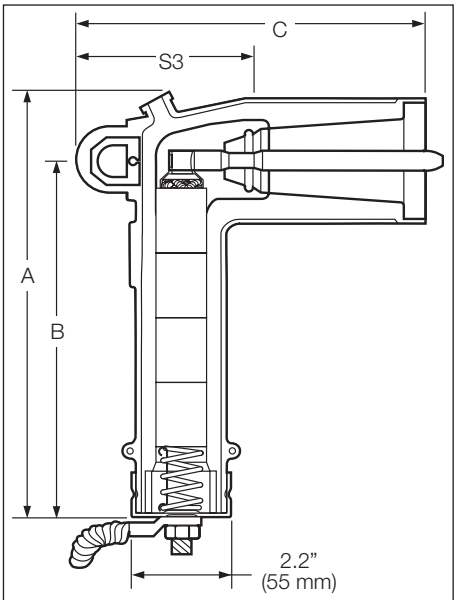


Figure 3.
Temporary overvoltage curve. No prior duty at 85û C ambient.

ORDERING INFORMATION

To order a M.O.V.E. Surge Arrester kit, determine the arrester Maximum Continuous Operating Voltage (MCOV) rating for the intended application using Table 2 and specify the appropriate catalog number from Table 3. Contact the Cooper Power Systems sales engineer in your location for applications not listed.



Voltage Class	S3
15 kV	4.2" (107 mm)
25 kV	4.2" (107 mm)
35 kV	4.7" (120 mm)

Figure 4.
Dimensional information of M.O.V.E. Arrester (refer to Table 3).

Note: Dimensions given are for reference only.

TABLE 3
M.O.V.E. Surge Arrester Selection Chart

IEEE Standard 386™ Interface	Duty Cycle (kV)	MCOV Rating (kV)	Dimensions in./(mm)			Catalog Number
			A	B	C	
15 kV Class	3	2.55	8.5 (216)	7.0 (178)	7.9 (201)	3238018C03M
	6	5.1	8.5 (216)	7.0 (178)	7.9 (201)	3238018C06M
	9	7.65	8.5 (216)	7.0 (178)	7.9 (201)	3238018C09M
	10	8.4	8.5 (216)	7.0 (178)	7.9 (201)	3238018C10M
	12	10.2	8.5 (216)	7.0 (178)	7.9 (201)	3238018C12M
	15	12.7	8.5 (216)	7.0 (178)	7.9 (201)	3238018C15M
	18	15.3	8.5 (216)	7.0 (178)	7.9 (201)	3238018C18M
25 kV Class	9	7.65	8.5 (216)	7.0 (178)	7.9 (201)	3238019C09M
	10	8.4	8.5 (216)	7.0 (178)	7.9 (201)	3238019C10M
	12	10.2	8.5 (216)	7.0 (178)	7.9 (201)	3238019C12M
	15	12.7	8.5 (216)	7.0 (178)	7.9 (201)	3238019C15M
	18	15.3	8.5 (216)	7.0 (178)	7.9 (201)	3238019C18M
	21	17.0	8.5 (216)	7.0 (178)	7.9 (201)	3238019C21M
35 kV Class Interface 1A Large Interface	18	15.3	13.3 (338)	11.2 (284)	10.4 (264)	3238020C18M
	21	17.0	13.3 (338)	11.2 (284)	10.4 (264)	3238020C21M
	24	19.5	13.3 (338)	11.2 (284)	10.4 (264)	3238020C24M
	27	22.0	13.3 (338)	11.2 (284)	10.4 (264)	3238020C27M
	30	24.4	13.3 (338)	11.2 (284)	10.4 (264)	3238020C30M

ADDITIONAL INFORMATION

Refer to the following reference literature for additional information:

- 500-13, 200 A 15 kV Class Loadbreak Rotatable Feedthru Insert Catalog Section
- 500-30, 200 A 25 kV Class Rotatable Feedthru Insert Catalog Section
- 600-12, 600 A 15 kV Class T-OP II Deadbreak Connector Catalog Section
- 600-32, 600 A 25 kV Class T-OP II Deadbreak Connector Catalog Section
- 600-51, 600 A 35 kV Class T-OP II Deadbreak Connector Catalog Section

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