Surge Arresters

COOPER Power Systems

Electrical Apparatus

235-101

M.O.V.E. DirectConnect Elbow Arrester

Figure 1.
M.O.V.E. DirectConnect Elbow Arresters with threaded adapters shown from left to right: 30 kV and 27 kV.

GENERAL

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

The arrester housing interface conforms to IEEE Std 386™ standard – Separable Insulated Connector Systems. The arrester housing is molded of EPDM insulating rubber, which provides deadfront safety in a small, clampstick operable unit.

M.O.V.E. DirectConnect Elbow 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 600 A 35 kV Class deadbreak interfaces that conform to IEEE Std 386™ standard 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. DirectConnect Elbow Arrester at the end of a radial system or at both ends of an open point on a loop system provides excellent overvoltage protection.

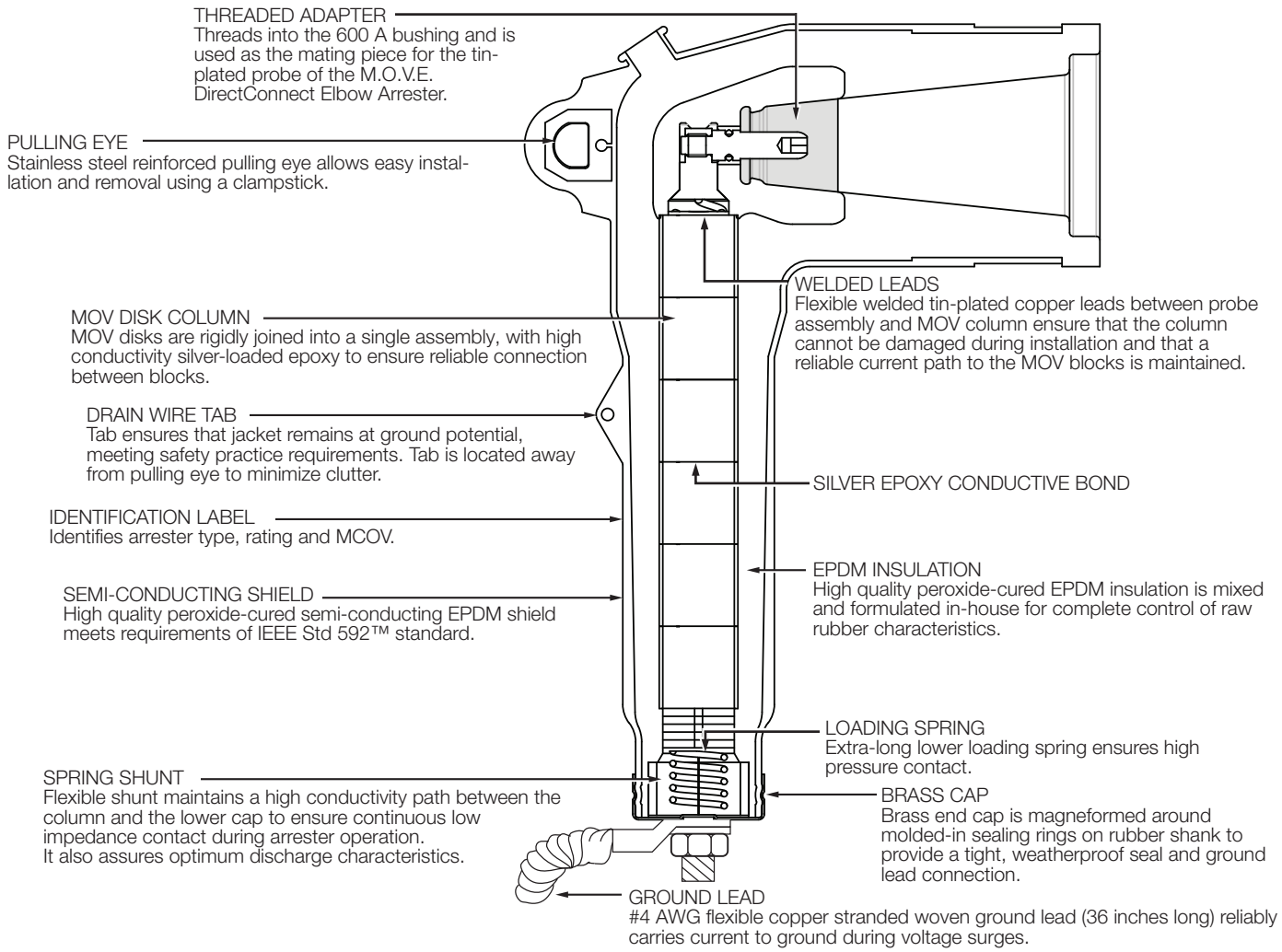

Figure 2.
Cutaway illustration shows 35 kV Class M.O.V.E. DirectConnect Elbow Arrester.

STANDARDS

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

INSTALLATION

All Cooper M.O.V.E. DirectConnect Elbow Arresters must be installed on or removed from de-energized systems. No special tools are required. An adapter is threaded into the 600 A apparatus bushing. The M.O.V.E. DirectConnect Elbow Arrester is then placed on the 600 A apparatus bushing using a clampstick. Refer to Installation Instruction Sheet S235-100-1 for more details.

PRODUCTION TESTS

Tests conducted in accordance with IEEE Std 386™ and IEEE Std C62.11™ standards:

- Partial Discharge Extinction Voltage Level
- AC 60 Hz 1 Minute Withstand
- AC 60 Hz Watts Loss

Tests conducted in accordance with Cooper Power Systems requirements:

- Physical Inspection
- Periodic Dissection
- Arrester Assembly:
  – Voltage at 1 mA
- Periodic X-ray Analysis

PRODUCTION TESTS OF MOV BLOCKS

A complete production test program ensures a quality product. Each metal oxide varistor receives a series of electrical tests. Quality is demonstrated by a series of destructive tests performed on every batch of varistors. Listed are the tests performed on the varistors:

- 100% Physical Inspection
- 100% Discharge Voltage test
- 100% V_{1mA/cm^2}
- 100% Leakage Current at 80% of V_{1mA/cm^2} Voltage (Watts Loss)
- Batch High-current, Short-duration test
- Batch Thermal Stability test
- Batch Aging test

GENERAL APPLICATION RECOMMENDATIONS

The rating of an arrester is the maximum power frequency line-to-ground voltage at which the arrester is designed to pass an operating duty-cycle test. Table 2 provides a general application guide for the selection of the proper arrester rating for a given system voltage and system grounding configuration as outlined in the IEEE Std C62.22™ standard application guide.

Under fault conditions and other system anomalies, higher voltages can be experienced by the arrester. To ensure that the arrester ratings will not be exceeded, Cooper Power Systems application engineers are available to make recommendations. The following information is normally required:

1. System maximum operating voltage.

2. System grounding conditions.

A. For four-wire circuits, grounding conditions depend upon whether the system is multi-grounded, whether it has a neutral impedance and whether common primary and secondary neutrals are used.

B. For three-wire circuits, grounding conditions depend upon whether the system is solidly grounded at the source, grounded through neutral impedance at the source transformers or ungrounded.

Consult your Cooper representative to have your individual system application needs studied.

PROTECTIVE CHARACTERISTICS

The protective characteristics of the M.O.V.E. DirectConnect Elbow Arrester is 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
27	22.0	87.2	71.4	76.9	82.4	90.1	103
30	24.4	97.1	79.5	85.7	91.8	100.0	115.0
33	27	108	87.8	95.1	102	112	127
36	29	116	95.3	103	110	120	137

* 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.

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

System Voltage (kV rms)		Commonly Applied Arrester Duty-cycle (MCOV) Voltage Rating (kV rms) on Distribution Systems		
Nominal Voltage (kV)	Maximum Voltage Range B (kV)	4-Wire Multigrounded Neutral Wye	3-Wire Low Impedance Grounded[1]	Delta and 3-Wire High Impedance Grounded
24.94 Y/14.4	26.4 Y/15.24	18 (15.3)	27 (22.0)	–
27.6 Y/15.93	29.255 Y/16.89	21 (17.0)	30 (24.4)	–
34.5 Y/19.92	36.51 Y/21.1	27 (22.0)	36 (29.0)	–
46 Y/26.6	48.3 Y/28	36 (29)	–	–

1. Line-to-ground fault duration not to exceed 30 minutes. For longer durations, contact the factory for proper rating.

TEMPORARY OVERVOLTAGE (TOV) CAPABILITY

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

PERFORMANCE TEST CHARACTERISTICS

The M.O.V.E. DirectConnect Elbow Arrester consistently withstands the following design tests as described by IEEE Std C62.11™ standard:

- **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.

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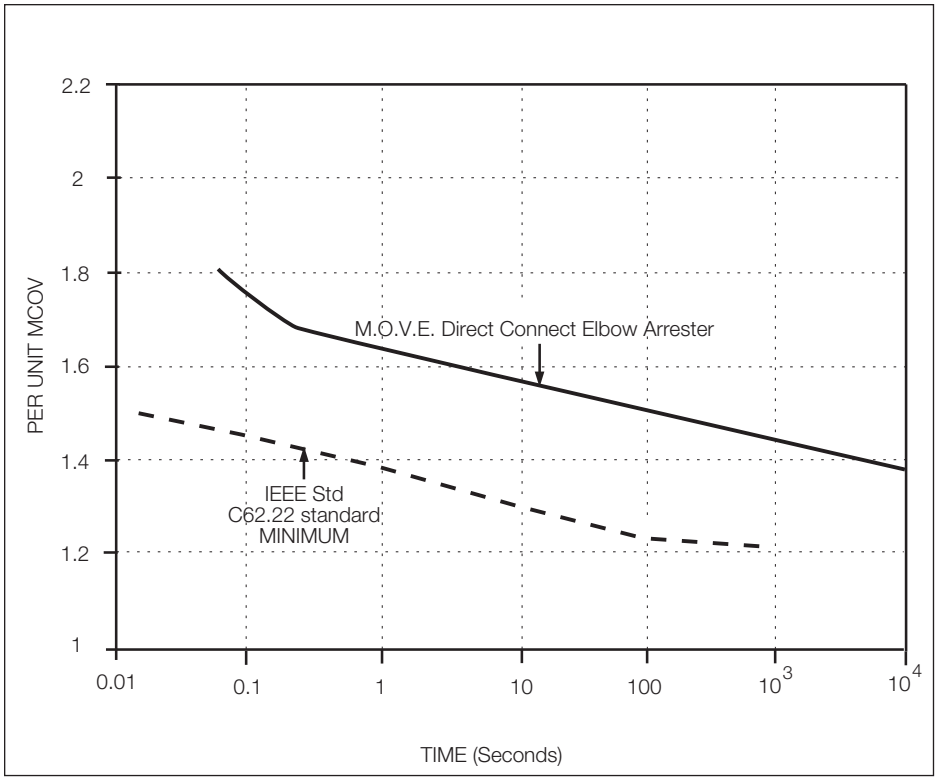
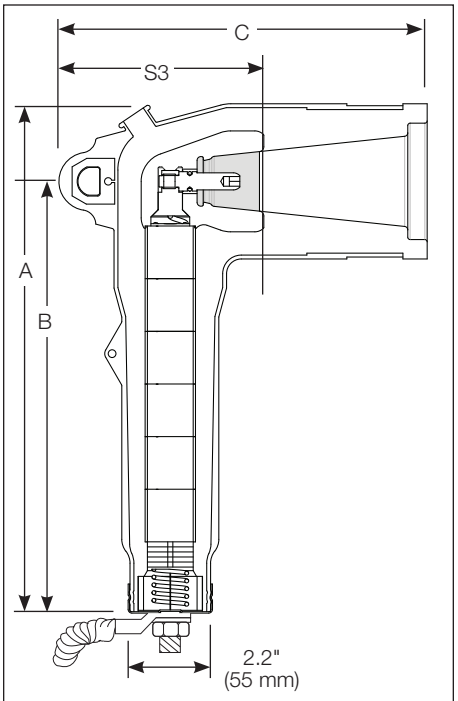


Figure 3.
Temporary overvoltage curve. No prior duty at 85 °C ambient.

TABLE 3
M.O.V.E. DirectConnect Elbow Arrester Selection Chart

IEEE Std 386™ standard Interface	Duty Cycle (kV)	MCOV Rating (kV)	Dimensions in./(mm)			Catalog Number
			A	B	C	
35 kV Class Interface 1A Large Interface	27	22.0	13.3 (338)	11.2 (284)	9.49 (241)	DCEA635M27
	30	24.4	13.3 (338)	11.2 (284)	9.49 (241)	DCEA635M30
	33	27.0	13.3 (338)	11.2 (284)	9.49 (241)	DCEA635M33
	36	29.0	13.3 (338)	11.2 (284)	9.49 (241)	DCEA635M36



Voltage Class	S3
35 kV	4.85" (123 mm)

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

Note: Dimensions given are for reference only.

ORDERING INFORMATION

To order a M.O.V.E. DirectConnect Elbow 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.

ADDITIONAL INFORMATION

Refer to the following reference literature for additional information:

- 800-47, 600 A 35 kV Class Deadbreak Apparatus Bushing
- S235-100-1, 35 kV Class M.O.V.E. DirectConnect Elbow Arrester Installation Instructions
- B235-10052, DirectConnect Product Brief
- 235-65, Metal Oxide Elbow (M.O.V.E.) Surge Arrester
- CP9314 Deadfront Arresters Certified Test Report

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