

# Surge Arresters

## VariSTAR® Type AZU Heavy-duty Distribution Class Under-oil MOV Arrester

Electrical Apparatus  
**235-64**

### GENERAL

The Cooper Power Systems VariSTAR® Type AZU under-oil MOV arrester is designed in accordance with ANSI/IEEE C62.11 heavy-duty distribution class requirements. It is designed for either horizontal or vertical mounting inside the distribution transformer tank to eliminate the difficulties associated with externally mounted arresters.

In recent years, under-oil arresters have gained increased acceptance due to the distinct advantage the under oil environment offers. When placed under oil the MOV arrester benefits from the cooling effect of the circulating oil. In addition, under-oil mounting of the arrester eliminates the possibility of shortened arrester life due to high surface contamination, wildlife, vandalism or moisture ingress. The under-oil arrester also offers improved transformer protection since internal mounting eliminates the need for long lead lengths to the arrester.

When properly coordinated with a current-limiting fuse, cover retention can be maintained through 50,000 A of available fault current. The VariSTAR Type AZU under-oil MOV arrester is available in ratings of 3 through 27 kV.

### PRODUCTION TESTS

A complete production test program ensures a quality product. Each VariSTAR metal oxide varistor receives a series of 100% electrical tests. Quality is further ensured by a series of destructive tests performed on every batch of varistors. Listed are the tests that are performed on the varistors:

- 100% Physical Inspection
- 100% Discharge Voltage Test
- 100% V1mA/cm<sup>2</sup>
- 100% Leakage Current at 80% of V1mA/cm<sup>2</sup> Voltage
- Batch High-current Short-duration Test
- Batch Thermal Stability Test



**Figure 1.**  
VariSTAR Type AZU100L Heavy-duty Distribution Class Under-oil MOV Arrester.

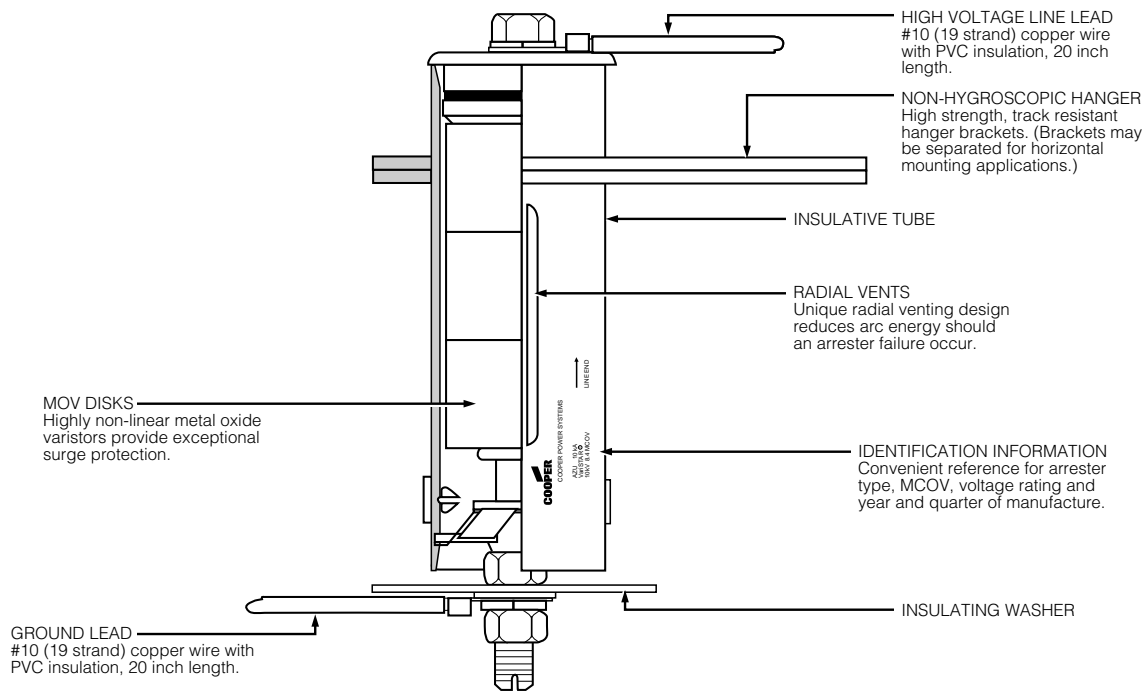
Each VariSTAR Type AZU arrester must pass the following production tests:

- 100% Physical Inspection
- 100% Leakage Current Test
- 100% RIV Test

### STANDARDS

The VariSTAR Type AZU arrester complies with the latest revision of ANSI/IEEE C62.11 "IEEE Standard for Metal Oxide Surge Arresters for AC Power Circuits".

# Features and Detailed Description



**Figure 2.**  
**Cutaway illustration of VariSTAR Type AZU100L Arrester.**

NOTE: Optional design available with adaptor terminals (see Figure 5).

**TABLE 1**  
**Protective Characteristics**

Arrester Rating (kV rms)	MCOV (kV rms)	Front-of-Wave Protective Level* (kV crest)	Maximum Discharge Voltage 8/20 $\mu$ s Current Wave (kV crest)						Switching Surge** (kV crest)
			1.5 kA	3 kA	5 kA	10 kA	20 kA	40 kA	
3	2.55	10.7	8.2	8.7	9.2	10.0	11.3	13.6	7.4
6	5.10	21.4	16.4	17.4	18.4	20.0	22.5	27.1	14.7
9	7.65	32.1	24.5	26.1	27.5	30.0	33.8	40.7	22.1
10	8.40	35.3	27.0	28.7	30.3	33.0	37.2	44.7	24.3
12	10.2	42.8	32.7	34.7	36.7	40.0	45.0	54.2	29.4
15	12.7	53.5	40.9	43.4	45.9	50.0	56.3	67.8	36.8
18	15.3	64.2	49.1	52.1	55.1	60.0	67.6	81.4	44.1
21	17.0	74.9	57.3	60.8	64.3	70.0	78.8	94.9	51.5
24	19.5	84.3	64.4	68.4	72.3	78.8	88.7	106.8	57.9
27	22.0	95.2	72.8	77.3	81.7	89.0	100.2	120.7	65.5

\*Based on 10 kA current impulse that results in a discharge voltage cresting in 0.5  $\mu$ s.

\*\*45-60  $\mu$ s rise time 500 A current surge.

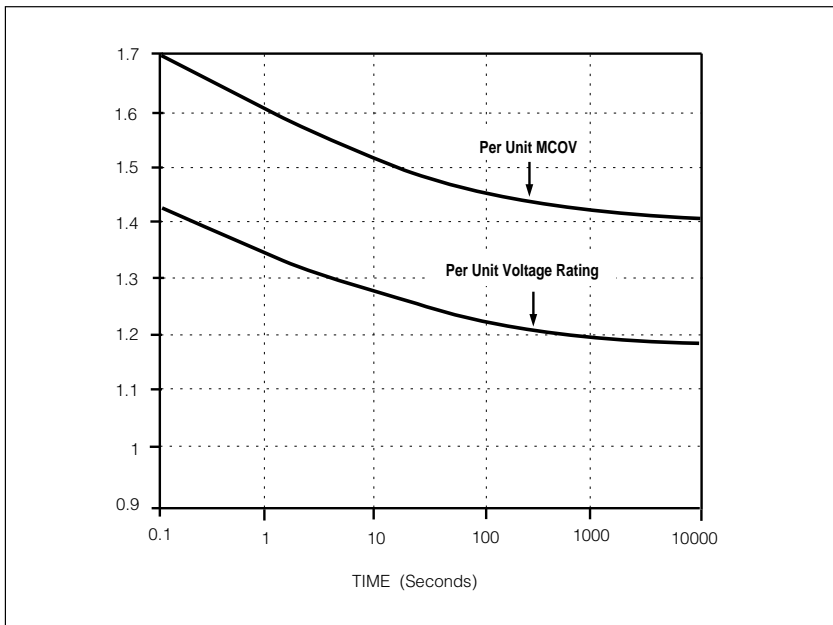
**TABLE 2**  
**Performance Test Characteristics\***

Description	Characteristics
Duty Cycle	20 current surges of 10 kA crest 8/20 $\mu$ s waveshape followed by 2 current surges of 40 kA crest 8/20 $\mu$ s waveshape
High-current, Short-duration Discharge	2 current surges of 100 kA crest 4/10 $\mu$ s waveshape
Low-current, Long-duration Discharge	20 current surges of 250 A crest 2000 $\mu$ s rectangular wave duration

\*Per latest revision of ANSI/IEEE C62.11.

**TABLE 3**  
Commonly Applied Voltage Ratings of the Type AZU Arrester

System Voltage (kV rms)		Recommended Arrester Rating (kV rms)		
Nominal	Maximum	Four-Wire Wye; Multi- Grounded Neutral	Three-Wire Wye; Solidly Grounded Neutral	Delta and Ungrounded Wye
2.4	2.54	—	—	3
4.16Y/2.4	4.4Y/2.54	3	6	6
4.16	4.4	—	—	6
4.8	5.08	—	—	6
6.9	7.26	—	—	9
8.32Y/4.8	8.8Y/5.08	6	9	—
12.0Y/6.93	12.7Y/7.33	9	12	—
12.47Y/7.2	13.2Y/7.62	9	15	—
13.2Y/7.62	13.97Y/8.07	10	15	—
13.8Y/7.97	14.52Y/8.38	10	15	—
13.8	14.52	—	—	18
20.78Y/12.0	22Y/12.7	15	21	—
22.86Y/13.2	24.2Y/13.87	18	24	—
23	24.34	—	—	27
24.94Y/14.4	26.4Y/15.24	18	27	—
27.6Y/15.93	29.3Y/16.89	21	—	—
34.5Y/19.92	36.5Y/21.08	27	—	—



**Figure 3.**  
Temporary overvoltage curve. No prior duty — 100 C ambient.

## GENERAL APPLICATION RECOMMENDATIONS

The rating of an arrester is the power frequency line-to-ground voltage at which the arrester is designed to pass an operating duty-cycle test. Table 3 provides a general application guide for the selection of the proper arrester rating for a given system voltage and system grounding configuration.

Cooper Power Systems application engineers are available to make application 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, 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.

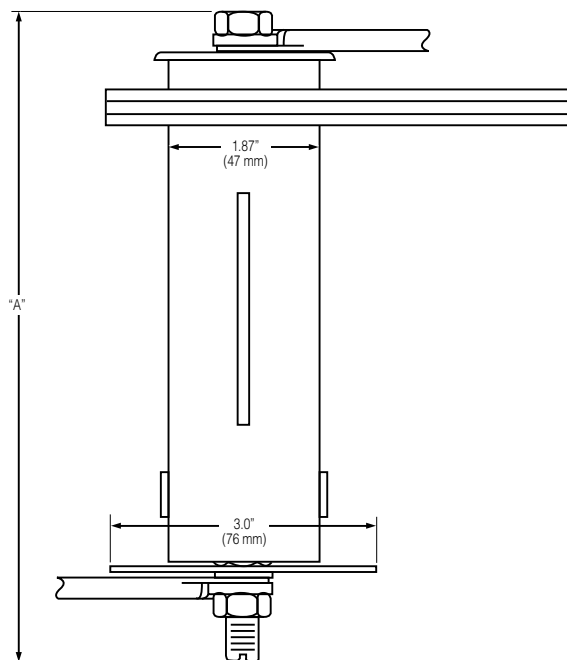
Where unusual conditions exist (high ground resistance, high capacitive load, arc-welding equipment, etc.) the following supplementary information is necessary:

1. The unusual condition.
2. Type of construction, phase spacing, length of line, conductor size.
3. BIL of equipment and line insulation.
4. Phase-sequence components of impedances on the load side of the distribution substation.

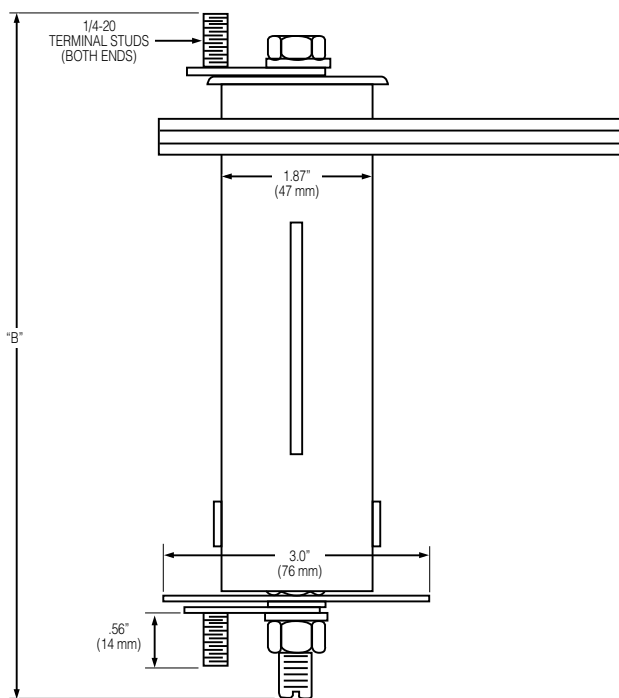
The impedance of the transformer and the impedance and grounding of supply to the substation all affect the voltage during faults.

## TEMPORARY OVERVOLTAGE (TOV) CAPABILITY

The Temporary Overvoltage (TOV) capability of the VariSTAR Type AZU arrester is shown in Figure 3.



**Figure 4.**  
Dimensional information of VariSTAR Type AZU100L arresters.



**Figure 5.**  
Dimensional information of VariSTAR Type AZU101L arresters.

**TABLE 4**  
VariSTAR Type AZU Dimensional Information

Arrester Rating (kV rms)	Dimensions	
	A* in. (mm)	B** in. (mm)
3	4.8 (121)	5.0 (126)
6	5.9 (150)	6.1 (155)
9	7.0 (178)	7.2 (184)
10	7.0 (178)	7.2 (184)
12	8.2 (207)	8.4 (212)
15	9.3 (236)	9.5 (241)
18	10.3 (262)	10.5 (266)
21	11.5 (293)	11.7 (298)
24	11.5 (293)	11.7 (298)
27	12.7 (322)	12.9 (327)

\*Dimension A from Figure 4.

\*\*Dimension B from Figure 5.

**TABLE 5**  
Catalog Numbers for AZU Arrester With 20" Line/Ground Leads\*

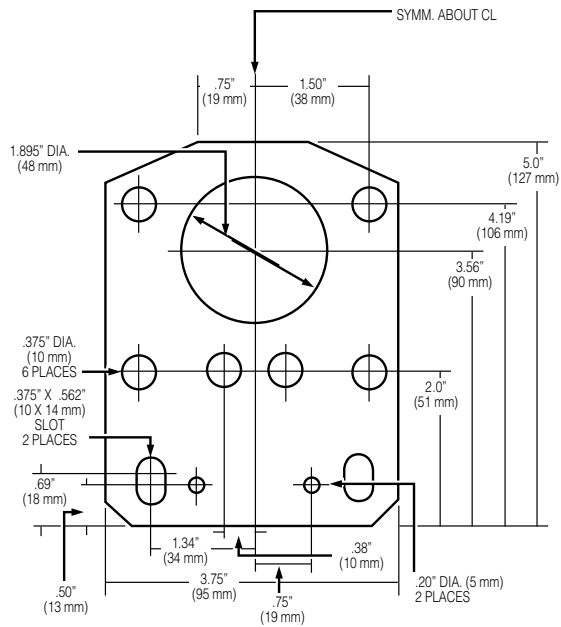
Arrester Rating	Catalog Number
3	AZU100L003
6	AZU100L006
9	AZU100L009
10	AZU100L010
12	AZU100L012
15	AZU100L015
18	AZU100L018
21	AZU100L021
24	AZU100L024
27	AZU100L027

\*See Figure 4.

**TABLE 6**  
Catalog Numbers for AZU Arrester Without Line/Ground Leads\*

Arrester Rating	Catalog Number
3	AZU101L003
6	AZU101L006
9	AZU101L009
10	AZU101L010
12	AZU101L012
15	AZU101L015
18	AZU101L018
21	AZU101L021
24	AZU101L024
27	AZU101L027

\*With adapter terminals (See Figure 5).



**Figure 6.**  
Dimensional information of mounting bracket.

NOTE: Hanger material thickness is 0.125 inches (3 mm). Dimensions given are for reference only.

### ORDERING INFORMATION

To order a Cooper Power Systems VariSTAR Type AZU arrester, determine the arrester rating for the intended application using Table 3 and specify the appropriate catalog number from Table 5. Contact your Cooper Power Systems sales engineer in your location for applications not listed.

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