

VariSTAR® Type AZS Normal Duty Distribution Class MOV Arrester

Electrical Apparatus

235-73

GENERAL

The Cooper Power Systems VariSTAR® Type AZS normal duty distribution class MOV arrester (Figure 1) in ratings of 3 through 36 kV, incorporates the latest in metal oxide varistor (MOV) technology in a porcelain design. With this combination of technologies, Cooper Power Systems can offer reliable and cost effective overhead protection of distribution systems.

CONSTRUCTION

The VariSTAR Type AZS arrester consists of highly nonlinear metal oxide varistors enclosed in a porcelain housing. The highly nonlinear nature of the MOV disks results in conduction of leakage current of milliamperes at nominal line-to-ground operating voltage. This small amount of leakage current (which is primarily capacitive current with a small component of resistive current) can be tolerated on a continuous basis.

The VariSTAR Type AZS design is available with or without an isolator and can be supplied with a variety of mounting brackets to satisfy a wide range of applications.

OPERATION

The operation of the VariSTAR Type AZS is typical of gapless metal oxide arresters. During steady state conditions, nominal line-to-ground voltage is applied continuously across the arrester's terminals. When overvoltages occur, the VariSTAR Type AZS arrester limits the overvoltage to required protective levels by conducting the surge current. Upon passage of the overvoltage condition, the arrester returns to a highly nonlinear steady state, conducting minimal leakage current.

The superior protective characteristics of the VariSTAR Type AZS arrester provide excellent protection for distribution transformers with lower impulse withstand capabilities. Its superior reliability makes it an ideal choice for areas with moderate isokeraunic levels.



Figure 1.
VariSTAR Type AZS Normal Duty Distribution Class MOV Arrester.

PRODUCTION TESTS

A complete production test program ensures a quality product. Each VariSTAR metal oxide varistor receives a series of 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% $V1\text{mA}/\text{cm}^2$
- 100% Leakage Current at 80% of $V1\text{mA}/\text{cm}^2$ Voltage
- Batch High-current, Short-duration Test
- Batch Thermal Stability Test
- Batch Disk Aging Test

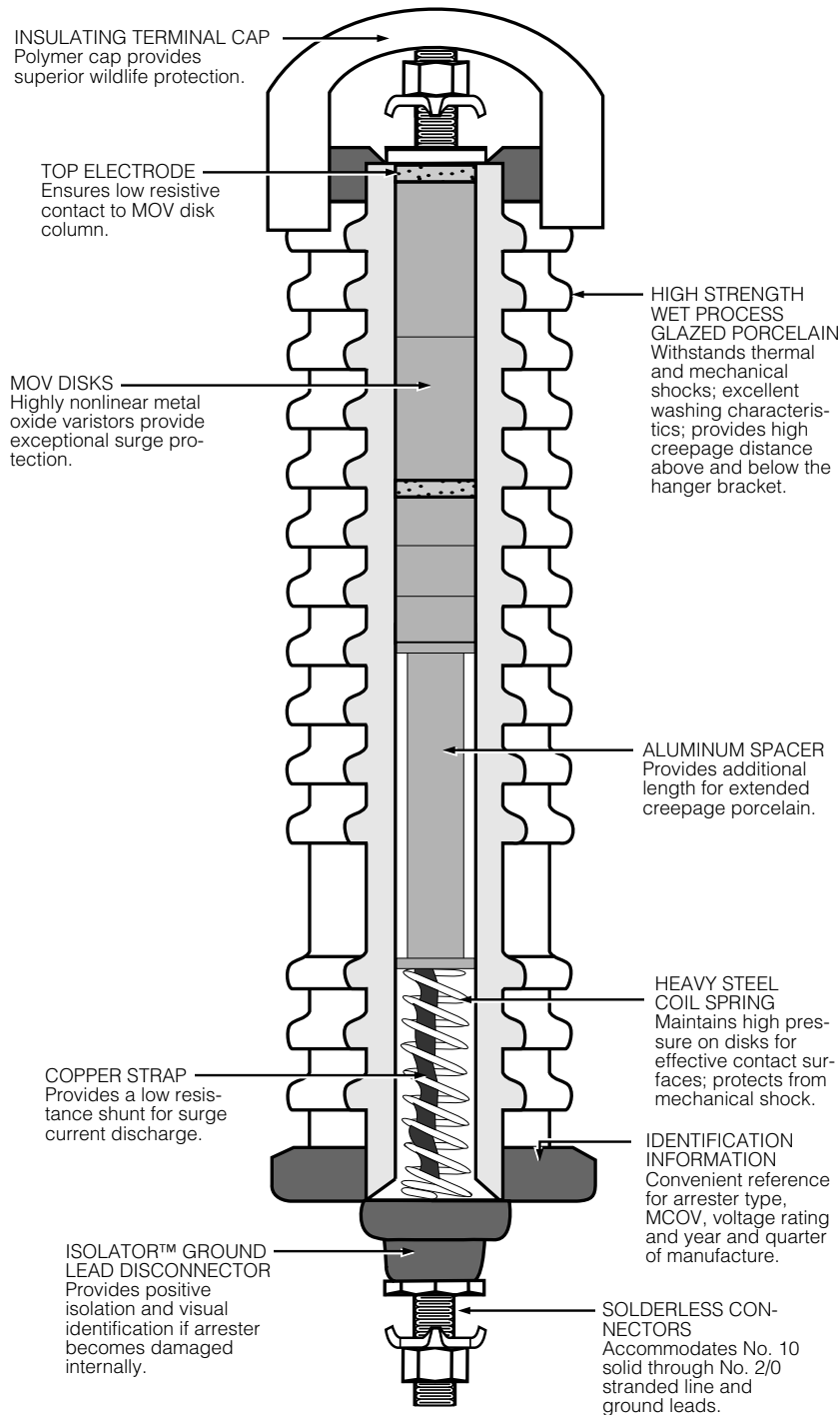
Each VariSTAR Type AZS arrester must pass the following production tests:

- 100% Physical Inspection
- 100% Vacuum over Fluid Seal Test
- 100% Leakage Current Test
- 100% RIV Test

STANDARDS

The VariSTAR Type AZS 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



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 1 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 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.

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.

Figure 2.
Cutaway illustration of VariSTAR Type AZS Arrester.

TABLE 1
Commonly Applied Voltage Ratings of the VariSTAR Type AZS 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	13.9Y/8.07	10	15	—
13.8Y/7.97	14.5Y/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	—	—	30
24.94Y/14.4	26.4Y/15.24	18	27	—
27.6Y/15.93	29.3Y/16.89	21	30	—
34.5Y/19.92	36.5Y/21.08	27	36	—
46Y/26.6	48.3Y/28	36	—	—

TEMPORARY OVERVOLTAGE (TOV) CAPABILITY

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

PERFORMANCE TEST CHARACTERISTICS

The VariSTAR Type AZS arrester consistently withstands the following design tests as described by ANSI/IEEE C62.11:

■ Duty Cycle:

22 current surges of 5 kA crest
8/20 μ s waveshape.

■ High-current, Short-duration Discharge:

2 current surges of 65 kA crest
4/10 μ s waveshape.

■ Low-current, Long-duration Discharge:

20 current surges of 75 A crest
2000 μ s rectangle 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.
- The 5 kA (8/20 μ s) discharge voltages measured after each test changed by less than 10% from the initial values.

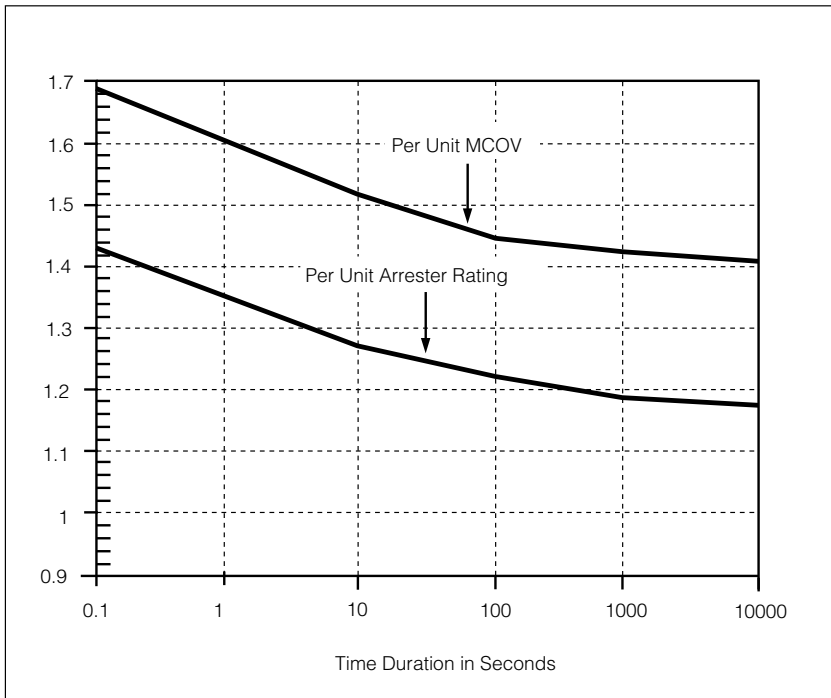


Figure 3.
Temporary overvoltage curve. No prior duty – 60° C ambient.

PROTECTIVE CHARACTERISTICS

The protective characteristics of the VariSTAR Type AZS arresters are shown in Table 2.

TABLE 2
Protective Characteristics

Arrester Rating (kV rms)	MCOV (kV rms)	Front-of-wave Protective Level* (kV crest)	Maximum Discharge Voltage (kV crest) 8/20 μ s Current Wave					
			1.5 kA	3 kA	5 kA	10 kA	20 kA	40 kA
3	2.55	10.2	8.6	9.2	9.8	10.8	12.8	15.9
6	5.10	20.4	17.2	18.4	19.6	21.7	25.5	31.9
9	7.65	30.6	25.8	27.6	29.4	32.5	38.3	47.8
10	8.40	33.7	28.4	30.5	32.4	35.9	42.2	52.7
12	10.20	40.8	34.4	36.8	39.2	43.4	51.0	63.8
15	12.70	51.0	43.0	46.1	49.0	54.2	63.8	79.7
18	15.30	61.2	51.6	55.3	58.8	65.1	76.6	95.7
21	17.00	71.3	60.2	64.5	68.6	75.9	89.3	111.6
24	19.50	80.4	67.8	72.7	77.4	85.6	100.7	125.8
27	22.00	91.9	77.5	83.1	88.4	97.9	115.1	143.8
30	24.40	101.1	85.2	91.4	97.2	107.6	126.6	158.1
36	29.00	119.5	100.8	108.1	115.0	127.2	149.7	187.0

*Based on 5 kA current impulse that results in a discharge voltage cresting in 0.5 μ s.

INSULATION CHARACTERISTICS

The insulation characteristics of the VariSTAR Type AZS arresters are shown in Table 3.

TABLE 3
Insulation Characteristics

Arrester Rating (kV rms)	Characteristics for AZS100M, AZS101M and AZS103M series*							Characteristics for basemount (AZS100C series)						
	Creepage		Strike		1.2/50 μ s Impulse (kV crest)	1 min Dry (kV rms)	10 sec Wet (kV rms)	Creepage		Strike		1.2/50 μ s Impulse (kV crest)	1 min Dry (kV rms)	10 sec Wet (kV rms)
	(in.)	(cm)	(in.)	(cm)				(in.)	(cm)	(in.)	(cm)			
3	2.8	7.1	2.0	5.1	45	15	13	10.9	27.7	8.7	22.1	125	70	60
6	6.6	16.8	4.5	11.4	60	21	20	10.9	27.7	8.7	22.1	125	70	60
9	10.4	26.4	7.0	17.8	75	27	24	13.5	34.3	10.4	26.4	150	80	70
10	10.4	26.4	7.0	17.8	75	27	24	13.5	34.3	10.4	26.4	150	80	70
12	13.2	33.5	8.9	22.6	95	35	30	13.5	34.3	10.4	26.4	150	80	70
15	13.2	33.5	8.9	22.6	95	35	30	16.6	42.2	12.6	32.0	175	90	80
18	17.9	45.5	12.0	30.5	125	42	36	16.6	42.2	12.6	32.0	175	90	80
21	17.9	45.5	12.0	30.5	125	42	36							
24	21.7	55.1	14.4	36.6	150	70	60							
27	21.7	55.1	14.4	36.6	150	70	60							
30**	26.4	67.1	17.5	44.5	200	95	80							
36**	26.4	67.1	17.5	44.5	200	95	80							

*Refer to pages 5 and 6.

**Not applicable to AZS103M Series.

DIMENSIONS AND CLEARANCES

The dimensions and clearances of the VariSTAR Type AZS arresters are shown in Figures 4, 5 and 6.

Arrester Rating (kV rms)	Dimensions				Minimum Recommended Clearances*			
	A		B		Phase-to-Ground		Phase-to-Phase	
	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)
3	9.19	23.3	5.20	13.2	3.4	8.6	5.2	13.2
6	11.67	29.6	5.20	13.2	4.4	11.2	6.5	16.5
9	14.77	37.5	5.82	14.8	5.6	14.2	8.0	20.3
10	14.77	37.5	5.82	14.8	5.6	14.2	8.0	20.3
12	17.25	43.8	6.44	16.4	6.4	16.3	8.7	22.1
15	17.25	43.8	6.44	16.4	7.1	18.0	9.7	24.6
18	20.97	53.3	7.06	17.9	9.6	24.4	12.2	31.0
21	20.97	53.3	7.06	17.9	9.6	24.4	12.2	31.0
24	24.07	61.1	7.68	19.5	11.1	28.2	14.2	36.1
27	24.07	61.1	7.68	19.5	11.1	28.2	14.2	36.1
30	27.79	70.6	8.30	21.1	11.1	28.2	14.2	36.1
36	27.79	70.6	8.30	21.1	13.1	33.3	17.2	43.7

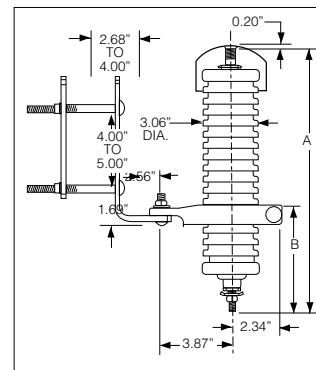


Figure 4.
Dimensions for AZS100M and AZS101M series.

*All clearances are measured from centerline of arrester per IEEE C62.22.

Arrester Rating (kV rms)	Dimensions										Minimum Recommended Clearances*			
	A		B		C		D		E		Phase-to-Ground		Phase-to-Phase	
	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)
3	9.19	23.3	5.20	13.2	6.04	15.3	10.77	27.4	4.12	10.5	3.4	8.6	5.2	13.2
6	11.67	29.6	5.20	13.2	8.52	21.6	13.25	33.7	4.12	10.5	4.5	11.4	6.5	16.5
9	14.77	37.5	5.82	14.8	11.00	27.9	15.73	40.0	4.12	10.5	5.6	14.2	8.0	20.3
10	14.77	37.5	5.82	14.8	11.00	27.9	15.73	40.0	4.12	10.5	5.6	14.2	8.0	20.3
12	17.25	43.8	6.44	16.4	12.86	32.7	17.59	44.7	4.12	10.5	6.4	16.3	8.7	22.1
15	17.25	43.8	6.44	16.4	12.86	32.7	17.59	44.7	4.12	10.5	7.1	18.0	9.7	24.6
18	20.97	53.3	7.06	17.9	15.96	40.5	20.69	52.6	4.12	10.5	9.6	24.4	12.2	31.0
21	20.97	53.3	7.06	17.9	15.96	40.5	20.69	52.6	4.12	10.5	9.6	24.4	12.2	31.0
24	24.07	61.1	7.68	19.5	18.44	46.8	23.17	58.9	4.12	10.5	11.1	28.2	14.2	36.1
27	24.07	61.1	7.68	19.5	21.22	53.9	32.20	81.8	4.38	11.1	11.1	28.2	14.2	36.1

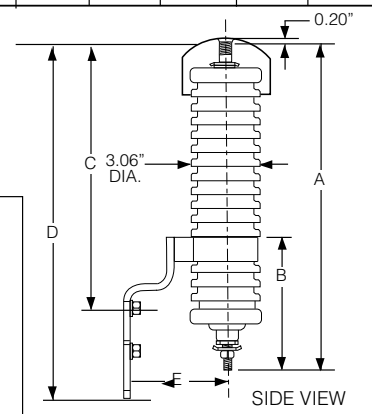
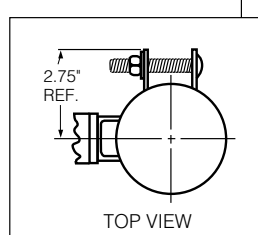
Figure 5.
Dimensions for AZS103M series.

NOTE: Columns B, C, & D are calculated with the bracket located at the top of the bellyband region
NOTE: Mounting Lug Spacing for 3 through 24 kV is 2.5" (6.4 cm) and for 27 kV is 9.25" (23.5 cm).

*All clearances are measured from centerline of arrester per IEEE C62.22.



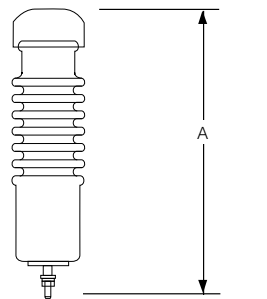
CAUTION: The values shown in Figures 4, 5, and 6 are the minimum clearances recommended by Cooper Power Systems. These clearances may be revised to meet local or system requirements for spacing or energized equipment. However, safe operating procedures must always be followed.



**VariSTAR® Type AZS Normal Duty
Distribution Class MOV Arrester**

Quality from
Cooper Industries

Arrester Rating (kV rms)	Minimum Recommended Clearances*								Dimension A	
	Enclosure Application				Outdoor Application					
	Phase-to-Ground		Phase-to-Phase		Phase-to-Ground		Phase-to-Phase			
	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)	(in.)	(cm)
3	3.2	8.1	4.9	12.4	3.6	9.1	5.1	13.0	11.2	28.4
6	4.2	10.7	6.2	15.7	4.7	11.9	6.5	16.5	11.2	28.4
9	5.5	14.0	7.7	19.6	6.2	15.7	8.1	20.6	13.0	33.0
10	5.5	14.0	7.7	19.6	6.2	15.7	8.1	20.6	13.0	33.0
12	6.2	15.7	8.4	21.3	7.0	17.8	8.8	22.4	13.0	33.0
15	7.0	17.8	9.4	23.9	7.8	19.8	9.9	25.1	15.1	38.5
18	9.5	24.1	11.9	30.2	10.6	26.9	12.5	31.7	15.1	38.5

A technical diagram of an arrester, showing its vertical profile. It has a series of horizontal sheds in the middle section. A vertical dimension line with arrows at both ends is placed to the right of the arrester, spanning from the top of the top shed to the bottom of the base, and is labeled with the letter 'A'.

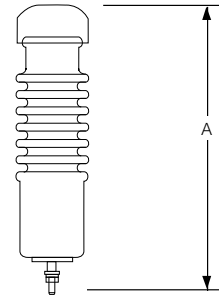


Figure 6.
Dimensions for AZS100C series.

*All clearances are measured from centerline of arrester per IEEE C62.22.

ORDERING INFORMATION

To order a Cooper Power Systems VariSTAR Type AZS arrester, determine the voltage rating for the intended application using Table 1. Specify the appropriate catalog number from Table 4. Contact the Cooper Power Systems sales engineer in your location for applications not listed.

TABLE 4
Ordering Information

Arrester Rating (kV rms)	Catalog Numbers: VariSTAR Type AZS Arrester			
	With NEMA Crossarm Bracket*	Without NEMA Crossarm Bracket*	Transformer Mounting Bracket*	Base Mounted (Without Isolator)
3	AZS101M003R	AZS100M003R	AZS103M003R	AZS100C503
6	AZS101M006R	AZS100M006R	AZS103M006R	AZS100C506
9	AZS101M009R	AZS100M009R	AZS103M009R	AZS100C509
10	AZS101M010R	AZS100M010R	AZS103M010R	AZS100C510
12	AZS101M012R	AZS100M012R	AZS103M012R	AZS100C512
15	AZS101M015R	AZS100M015R	AZS103M015R	AZS100C515
18	AZS101M018R	AZS100M018R	AZS103M018R	AZS100C518
21	AZS101M021R	AZS100M021R	AZS103M021R	
24	AZS101M024R	AZS100M024R	AZS103M024R	
27	AZS101M027R	AZS100M027R	AZS103M027R	
30	AZS101M030R	AZS100M030R		
36	AZS101M036R	AZS100M036R		

*Protective terminal cap option available. To order option, change 0 after M in catalog number to 5.
(Example: AZS101M503R)

COOPER Power Systems

VariSTAR® is a registered trademark of Cooper Industries, Inc.
Isolator™ is a trademark of Cooper Industries, Inc.

P.O. Box 1640, Waukesha, WI 53187