

Surge Arresters

Service Information

VariSTAR Type AZF Intermediate Class Installation and Maintenance Instructions

S235-70-1

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PRODUCT INFORMATION

Introduction

The Cooper Power Systems VariSTAR® AZF intermediate class arrester incorporates the latest in metal-oxide varistor (MOV) technology. Designed without series or parallel gaps, the MOV disks in the type AZF are stacked in a single column. The Type AZF arrester utilizes a pressure venting system unparalleled in the industry for intermediate class arresters. The metal top AZF arrester has achieved a 40 kA station class arrester pressure relief capability – extending its application range to include installations where increased fault current levels exist.

Read This Manual First

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional Information

These instructions cannot cover all details or variations in the equipment, procedures, or process described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your representative.

Acceptance and Initial Inspection

The factory take special precautions to ship arresters in well-designed containers that prevent damage which may occur during transit. Carefully inspect the porcelain for chips or cracks. In case of improper handling or shipping damage, immediately file a claim with the carrier and promptly notify Cooper Power Systems or your distributor.

Handling and Storage

Be careful during handling and storage of this arrester to minimize the possibility of damage. Always handle VariSTAR arresters carefully. Dropping or jarring an arrester may cause serious damage to the porcelain and/or internal parts. If the arrester is to be stored for any length of time prior to installation, provide a clean, dry storage area.

Standards

ISO 9001:2000 Certified Quality Management System

CAUTION: Never open an arrester. The arrester's internal components may be under spring compression and could be expelled with such force as to cause personal injury.

CAUTION: Mark all electrical connections — ground and line — so that no mechanical stress is applied to the surge arrester. Mechanical stress may damage the arrester in such a manner that its service life is shortened significantly.

CAUTION: Before performing any test on an arrester, contact your Cooper Power Systems sales engineer. Some test procedures may damage the arrester externally and/or internally, making it incapable of protecting the apparatus or the circuit on which it is installed or shortening its service life significantly.

WARNING: Always consider an arrester to be energized until both the line and the ground leads have been disconnected from the circuit.

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.



SAFETY FOR LIFE



Cooper Power Systems products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Cooper Power Systems employees involved in product design, manufacture, marketing and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high-voltage lines and equipment and support our “Safety For Life” mission.

SAFETY INFORMATION

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians, who are familiar with this equipment should install, operate and service it.


A competent technician has these qualifications:


- *Is thoroughly familiar with these instructions.*
- *Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.*
- *Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.*
- *Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, hotstick, etc.*


Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

 **DANGER:** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.


 **WARNING:** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.


 **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.


CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.


Safety Instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

 **DANGER:** Hazardous voltage. Contact with high voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.

 **WARNING:** Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage.

 **WARNING:** This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply may result in death, severe personal injury and equipment damage.

 **WARNING:** Power distribution equipment must be selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install or maintain this equipment can result in death, severe personal injury, and equipment damage.

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.

For three-wire circuits, grounding conditions depend upon whether the system is solidly grounded at the source, grounded through neutral impedance at the source, grounded through transformers, or ungrounded. Where unusual conditions exist (high ground resistance, high capacitive load, arc-welding equipment, etc.) the following supplementary information is necessary:

- A. A general description of the unusual condition.
- B. Type of construction, phase spacing, length of line, conductor size.
- C. BIL of equipment and line insulation.
- D. Phase-sequence components of impedances on the source side of the arrester location.

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

3. Available fault current.
4. Maximum line-to-ground voltage during faults and overvoltage duration.
5. Unusual environmental conditions (temperature and contamination).

IDENTIFICATION

Nameplates (Figure 1) are attached to the lower base casting of each arrester unit. An additional stacking nameplate (Figure 2) is supplied for arresters composed of two or more units. Figures 1 and 2 show the information that is listed on the nameplates. Attach the stacking nameplate shown in Figure 2 to a mounting bolt between the two lower arresters.

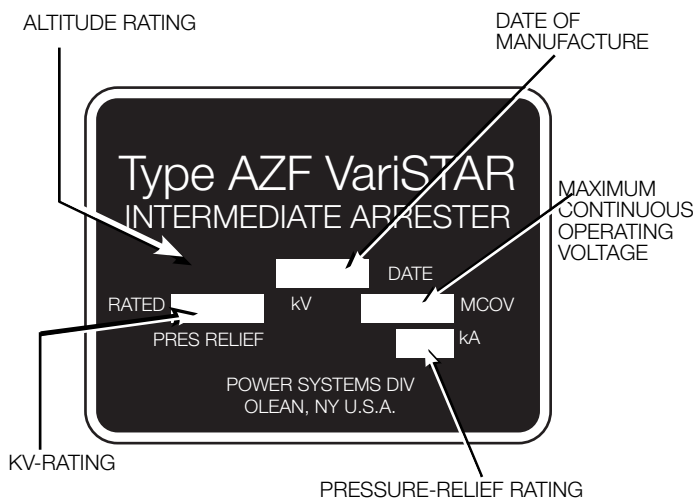
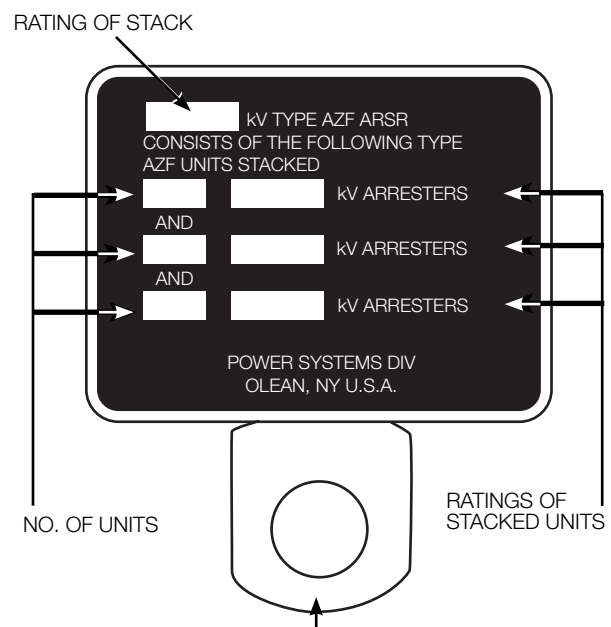


Figure 1.
Lower base nameplate.

TABLE 1
Recommended Arrester Applications for the Type AZF Arrester

System Voltage (kV) Line to Line		Recommended Arrester Rating (kV)	
Nominal	Maximum	Three Wire or Four Wire Wye Solidly Grounded Neutral	Delta and Ungrounded Wye
2.40	2.25	3/4.5	3/4.5
4.16	4.37	3/4.5	6/7.5
4.80	5.04	3/4.5	6/7.5
6.90	7.24	6/7.5	6/7.5
8.32	8.74	6/7.5	9/10
12.00	12.70	9/10	12 15
12.47	13.20	9/10* 12	15
13.20	14.00	9/10* 12	15
13.80	14.50	9/10* 12	15
20.78	21.80	15* 21	24
22.90	24.20	18* 21	24* 27
24.90	26.40	18* 21	24 27*
34.50	36.50	27* 30	36* 39
46.00	48.30	36* 39	45 48* 51
69.00	72.50	54* 60	69 72*
115.00	121.00	90* 96	108 120*
138.00	145.00	108* 120	—
161.00	169.00	120	—

* Preferred arrester rating for this system voltage.



NOTE: BEND TAB UP 90° AT TIME OF INSTALLATION AND ATTACH TO BOTTOM OF LOWEST UNIT WITH ONE OF THE MOUNTING BOLTS.

Figure 2.
Stacking nameplate.

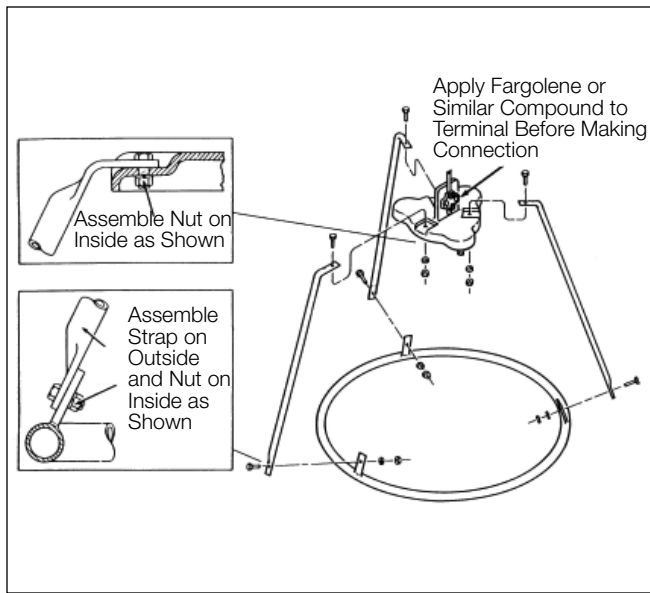


Figure 3.
Stacking nameplate.

ASSEMBLY

The 3/4.5 through 39-kV arresters are shipped ready for installation. The 45 through 72-kV arresters require the assembly of two units stacked in series; the 90 through 120-kV arresters require the assembly of a grading ring supplied with complete unit.

To allow for closer mounting spacing in enclosures, the top “L-shaped” terminal assembly and reinforcing plate is removable on all porcelain-top VariSTAR Type AZF arresters. For these applications, the Type AZF can easily be converted to a cubicle mount design.

Grading rings are supplied with arresters rated 90, 96, 108, and 120 kV. Figure 3 illustrates the assembly of these rings. In addition to Cooper Power Systems standard terminal clamps, the top castings or the grading-ring assemblies are provided with two .562” (1.43 cm) diameter holes on 1.75” (4.44 cm) vertical centers. These holes accommodate two-hole terminal connectors per NEMA Standard SG1-4.03.

Follow the identification instructions described previously. When stacking two or three units in series, the vent ports must be aligned to facilitate proper venting of each unit in the arrester stack.

INSTALLATION

Cubicle Mounting

The porcelain-top arrester rated 3/4.5 through 27 kV can be installed outdoors or in any enclosure, such as those housing NX® fusing, load transfer, oil or vacuum switching, or metal-clad switchgear equipment. Refer to Figure 4 for base-mounting-bolt locations.

The minimum phase-to-ground (Dimension B) and minimum phase-to-phase (Dimension C) clearances are shown in Figure 5 and 6. These values are shown in Table 2. Figure 7 shows the porcelain-top arrester height (Dimension A).

Outdoor Mounting

Choose a permanent location so that the arresters will be installed as close as possible (electrically) to the equipment being protected. Minimum clearance distance between any line potential surface of an arrester and ground or another plane is listed in Table 2 as minimum phase-to-ground (Dimension B) and minimum phase-to-phase (Dimension C) and illustrated in Figures 5 and 6. Figures 8, 9, and 10 show the metal-top arrester height (Dimension A).



CAUTION: The values show in Table 2 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 practices must always be followed.

Base or Foundation Mounting

Extend all pier footings below the frost line. Elevate the foundation sufficiently above the ground line to prevent contamination from ground splash, drifting snow, flood water, or other contaminating conditions. If the top of the foundation is not level, shims may be required for leveling. Lay out mounting studs on the foundation as shown in Figure 4. Arresters rated 90 through 120 kV should be foundation mounted; however, they can be mounted on a steel structure if this structure is rigid.



CAUTION: The vent port in the base must be directed away from the equipment being protected to prevent ionized gases from damaging equipment in the unlikely event of an arrester failure.

Bracket or Structure Mounting

When mounting arresters on brackets or bolting them directly to structures, make the assembly rigid enough to prevent arrester movement.

Suspension Mounting

Arresters rated through 72 kV can be suspension mounted. Either the top or bottom of suspension-mounted arresters can be connected to the line.



CAUTION: Prevent strains in arrester stacks by suspending them freely from a non-rigid suspension. Make flexible connections to line and ground terminals.



TABLE 2
Dimensional Information

Arrester Rating (kV)	Mounting	Figure	Normal Number of Units in Stacks	Dimension A Arrester Height in. (cm)*	Dimension B Minimum Phase-to-Ground in. (cm)**	Dimension C Minimum Phase-to-Phase in. (cm)**
3/4.5	Cubicle	7	1	12.3 (31.2)	5.2 (13.2) †	9.0 (22.9)
6/7.5	Cubicle	7	1	12.3 (31.2)	5.2 (13.2) ‡	9.0 (22.9)
9/10	Cubicle	7	1	12.3 (31.2)	5.2 (13.2)	9.0 (22.9)
	Outdoor	8	1	17.7 (45.0)	8.0 (20.3)	12.0 (30.5)
12	Cubicle	7	1	13.6 (34.5)	5.2 (13.2)	9.0 (22.9)
	Outdoor	8	1	17.7 (45.0)	10.0 (25.4)	14.0 (35.6)
15	Cubicle	7	1	13.6 (34.5)	7.2 (18.3)	9.0 (22.9)
	Outdoor	8	1	22.7 (57.6)	10.0 (25.4)	14.0 (35.6)
18	Cubicle	7	1	14.9 (37.8)	8.0 (20.3)	9.0 (22.9)
	Outdoor	8	1	22.7 (57.6)	15.0 (38.1)	19.0 (48.3)
21	Cubicle	7	1	16.8 (42.7)	9.2 (23.4)	11.5 (29.2)
	Outdoor	8	1	22.7 (57.6)	16.0 (40.6)	20.0 (50.8)
24	Cubicle	7	1	18.8 (47.8)	10.0 (25.4)	12.5 (31.8)
	Outdoor	8	1	26.4 (67.0)	18.0 (45.7)	22.0 (55.9)
27	Cubicle	7	1	18.8 (47.8)	10.0 (25.4)	12.5 (31.8)
30	Outdoor	8	1	26.4 (67.0)	18.0 (45.7)	22.0 (55.9)
33	Outdoor	8	1	26.4 (67.0)	18.0 (45.7)	22.0 (55.9)
36	Outdoor	8	1	31.4 (79.8)	20.0 (50.8)	25.0 (63.5)
39	Outdoor	8	1	31.4 (79.8)	21.0 (53.3)	26.0 (66.0)
45	Outdoor	9	2	49.1 (124.7)	23.0 (58.4)	28.0 (71.1)
48	Outdoor	9	2	52.9 (134.3)	24.0 (61.0)	29.0 (73.7)
60	Outdoor	9	2	52.9 (134.3)	29.0 (73.7)	34.0 (86.4)
72	Outdoor	9	2	62.9 (159.7)	33.0 (83.8)	38.0 (96.5)
90	Outdoor	10	3	79.3 (201.4)	51.0 (129.5)	68.0 (172.7)
96	Outdoor	10	3	84.3 (214.1)	53.0 (134.6)	70.0 (177.8)
108	Outdoor	10	3	94.3 (239.5)	58.0 (147.3)	74.0 (188.0)
120	Outdoor	10	3	94.3 (239.5)	62.0 (157.5)	79.0 (200.7)

* See Figures 7-10.

** See Figures 5 and 6.

† Minimum phase-to-ground spacing from metal portion of top terminal is 2.4" (6.1 cm).

‡ Minimum phase-to-ground spacing from metal portion of top terminal is 3.6" (9.1 cm).

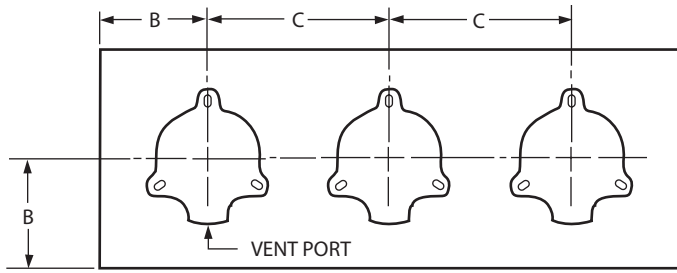


Figure 6.
Three-phase in-line mounting.

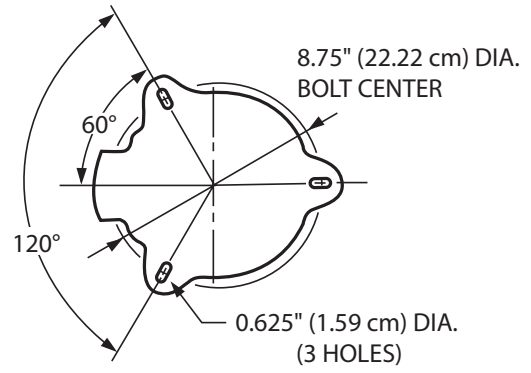


Figure 4.
Mounting bolt locations.

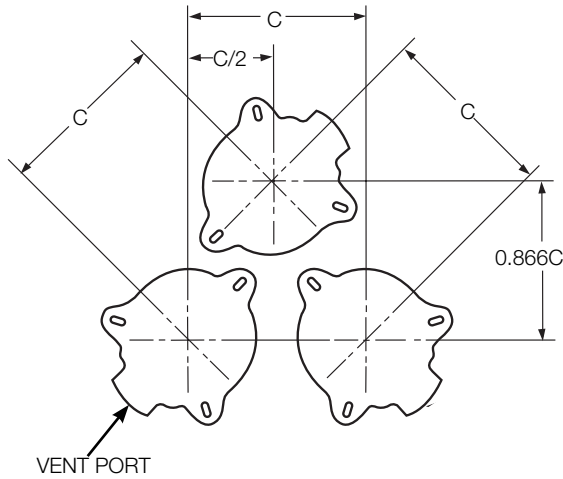


Figure 5.
Three-phase triangle mounting.

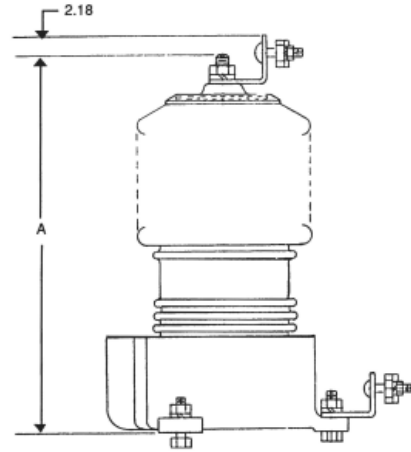


Figure 7.
Type AZF arrester rated 3/4.5 through 27 kV..

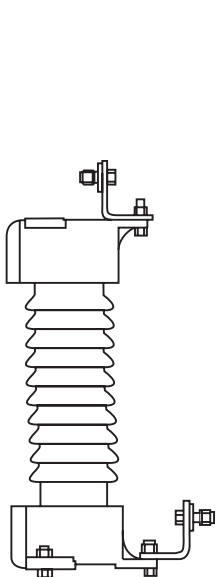


Figure 8.
Type AZF arrester rated 9/10 through 39 kV.

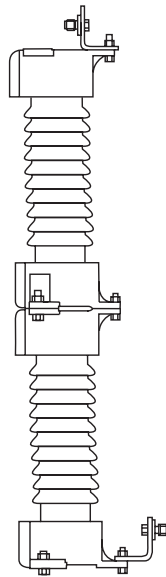


Figure 9.
Type AZF arrester rated 45 through 72 kV.

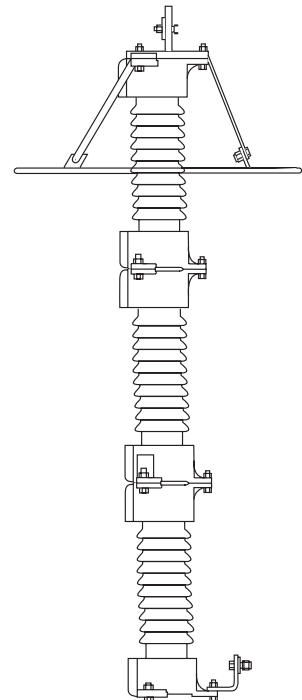


Figure 10.
Type AZF arrester rated 90 through 120 kV.

ELECTRICAL CONNECTIONS

CAUTION: Make electrical connections so that no mechanical stress is applied to the arrester.

Install the arrester as close as possible (electrically) to the apparatus being protected. Line and ground connections should be short and direct. Make the ground connection to a solid, effective and permanent low-resistance ground.

NOTE: Equipment protection may be improved by interconnecting the arrester ground connections with the transformer tank and system neutral whenever possible.

Two “L-shaped” electrical connectors, one ground and one line terminal, are supplied with arresters rated 3/4.5 through 72 kV. See Figure 11. The ground terminal connector is also used on arresters rated 90 kV through 120 kV, while the line terminal (top) connector on these arresters is an integral part of the top cap on the grounding-ring assembly as illustrated in Figures 3 and 12. The line and ground terminals include connector clamps that accommodate No. 6 solid through 500 mcm stranded copper or aluminum conductor.

To allow for closer mounting spacing in enclosures, the top “L-shaped” terminal assembly and reinforcing plate shown in Figure 13 is removable on all porcelain-top VariSTAR Type AZF arresters rated 3/4.5 through 27 kV. For these applications, a separate “U-shaped” line lead terminal clamp accommodating conductor sizes from No. 6 solid through no. 1/0 stranded is supplied.

On arresters rated 72 kV and below, line and ground leads may be brought in either vertically or horizontally. Line leads should be brought in from above the arrester and ground leads from below. On arresters rated 90 through 120 kV, the ground lead may be brought in vertically or horizontally; however, the line lead must be brought in vertically using the clamp provided.

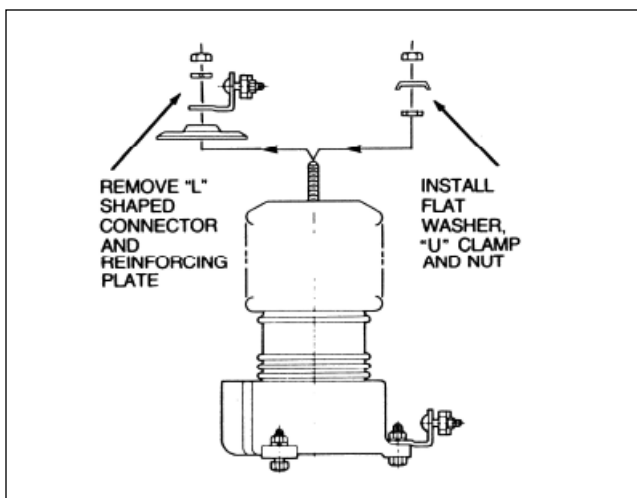


Figure 13
Installation of “U”-shaped line terminal clamp.

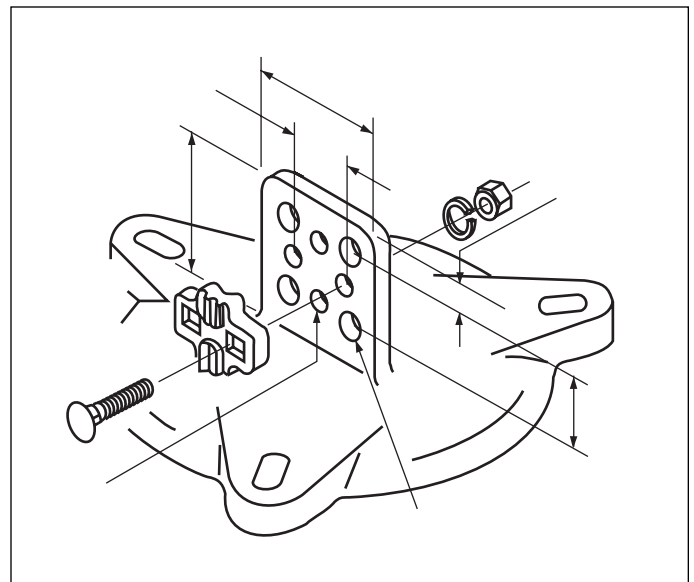


Figure 7.
Type AZF arrester rated 3/4.5 through 27 kV..

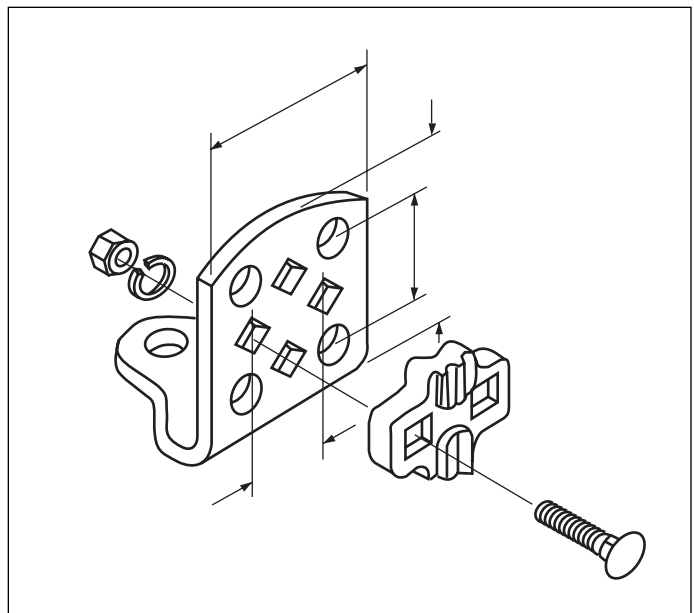




Figure 7.
Type AZF arrester rated 3/4.5 through 27 kV..

MAINTENANCE

 **WARNING:** Before working on an arrester, disconnect all line leads. Consider any part of an arrester dangerous when connected to the line, including a base not solidly grounded

VariSTAR Type AZF arresters require no special maintenance under normal conditions. If the arrester is installed in an area of severe contamination, keep the arrester housing, reasonably clean by washing periodically. Keep line and ground connections tight.

 **WARNING:** It is recommended that arresters should be de-energized before washing.