

UltraSIL™ polymer-housed variSTAR™  
U2 surge arresters (15-digit catalog number)  
installation and maintenance instructions

VariSTAR® SURGE ARRESTER

Cat. No.	<input type="text"/>		
Ser. No.	<input type="text"/>	<input type="text"/>	Yr
Rating/Ur	<input type="text"/>	kV rms	<input type="text"/>
MCOV/Uc	<input type="text"/>	kV rms	<input type="text"/>
Pres. Relief	<input type="text"/>	kA rms sym.	<input type="text"/>
Class	<input type="text"/>		
Cert.	<input type="text"/>		
Frequency	50-60 Hz		
	Alt. 0-12000 Ft. 0-3600 M		



Powering Business Worldwide

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## Safety for life



Eaton's Cooper Power series 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 Eaton 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 arc flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, 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 hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.**

G103.3

#### 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.**

G101.0

#### 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 can result in death, severe personal injury and equipment damage.**

G102.1

#### WARNING

**Power distribution and transmission equipment must be properly 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 power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.**

G122.3

## Product information

### Introduction

Eaton's Cooper Power series UltraSIL™ Polymer-Housed VariSTAR™ U2 surge arresters incorporate the latest in metal oxide varistor (MOV) technology. These arresters are gapless and are constructed of a single series column of MOV disks. They are used for overvoltage protection of high voltage equipment, either indoors or outdoors. These arresters are designed and tested to meet or exceed the requirements set forth in IEC 60099-4.

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### CAUTION

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**Eaton's Cooper Power series UltraSIL Polymer-Housed VariSTAR Surge Arresters are designed to be operated in accordance with safe operating procedures. These instructions are not intended to supersede or replace proper safety and operating procedures. Read all instructions before installing the arrester.**

**Surge arresters should be installed and serviced only by personnel familiar with good safety practice and the handling of high-voltage electrical equipment.**

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### Read this manual first

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**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. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Eaton sales representative.

### Initial inspection

The factory takes special precautions to ship the arresters in well-designed containers that reduce the possibility of damage, which may occur during transit. Carefully inspect each arrester for physical damage. In case of improper handling or shipping damage, immediately file a claim with the carrier and promptly notify Eaton's Cooper Power series representative.

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### CAUTION

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**Do not attempt to install arresters that have evidence of damage.**

### Handling and storage

If the arrester is to be stored for an appreciable time before installation, provide a clean, dry storage area. Locate the arrester so as to minimize the possibility of physical damage.

## Quality standards

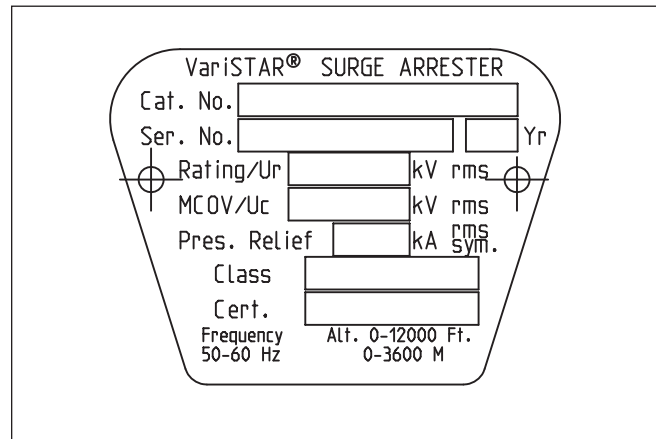
ISO 9001 Certified Quality Management System

## General application recommendations

Eaton's Cooper Power series product application engineers are available to make specific application recommendations.

### Identification

A nameplate attached to the base of each arrester indicates its catalog number, voltage rating ( $U_r$ ), continuous operating voltage ( $U_c$ ), rated frequency, pressure-relief current rating, class, reference to the type test standard, altitude range, serial number, and year of manufacture. Refer to Figure 1 for an example of a blank nameplate.



**Figure 1. Arrester base nameplate (English version)**

For multi-unit arresters with housing codes greater than 60 an additional nameplate is provided on the base that includes information regarding the catalog number, serial number, unit identification, and unit  $U_c$ . Refer to Figure 2. Information regarding unit identification is etched on the top plate for each arrester section.

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### CAUTION

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**Always handle surge arresters carefully. A damaged arrester may cause catastrophic failure upon energization.**

### Lifting instructions

All UltraSIL polymer-housed VariSTAR surge arresters must be lifted vertically by the line terminal. Use of a lifting strap (user supplied) is recommended. Refer to Figure 3 for detailed lifting instructions.

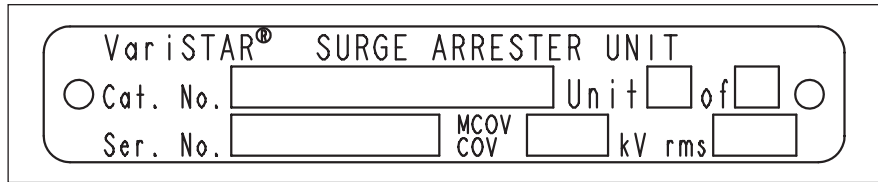


Figure 2. Detail of blank unit nameplate on arrester base

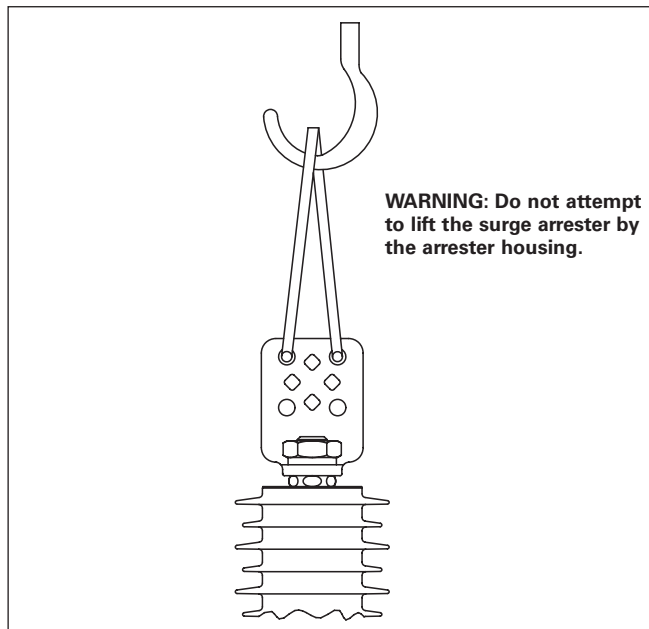


Figure 3. Detail of recommended lifting instructions

### Grading ring

Arresters with housing codes greater than 60 will be supplied with a grading ring. When a grading ring is supplied, it must be placed on the arrester to guarantee correct operating performance. Refer to Figure 4 for correct placement of the grading ring.

### **⚠ WARNING**

**Use only the grading ring supplied with the arrester. No other manufacturer's grading ring can be substituted.**

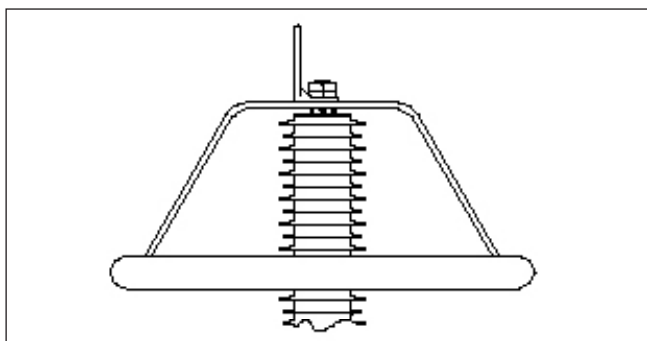


Figure 4. Detail of grading ring placement

## Arrester installation

### For arresters with housing codes 60 or less

UltraSIL polymer-housed U2 surge arresters are shipped assembled with housing codes 60 or less. For these arresters choose a permanent installation location so that the arresters will be installed as close as possible (electrically) to the equipment being protected. Minimum clearance distances between any line potential surface to an arrester, and to any earth plane are listed in Table 1. Figure 6 shows the minimum phase-to-earth and minimum phase-to-phase clearances. Refer to Table 1 and Figure 7 for standard arrester dimension and weight information.

### Packaged components

- Assembled arrester ready for installation.
- The line and earth terminal connectors are shipped unattached in the box, and should be assembled after the arrester is installed.

### Detailed assembly instructions

#### Step 1

After the arrester is in place and ready to be secured, the earth terminal connector should be placed so that the mounting hole, found on the connector, is directly over one of the three mounting slots on the base of the arrester.

#### Step 2

The bolt (user supplied) used to secure the arrester is then run through the hole of the connector, the mounting slot, and the structure the arrester is attached to.

#### Step 3

Secure the arrester to the structure with the hex nuts (user supplied).

#### Step 4

Position the line terminal connector on the top of the arrester. Secure the supplied lock washer and nut until tight.

# UltraSIL™ polymer-housed variSTAR™ U2 surge arresters (15-digit catalog number) installation and maintenance instructions

## For arresters with housing codes greater than 60

UltraSIL polymer-housed U2 surge arresters are shipped unassembled with housing codes greater than 60. These arresters are also supplied with a grading ring, that is packaged with the arrester. For these arresters choose a permanent installation location so that arresters will be installed as close as possible (electrically) to the equipment being protected. Minimum clearance distances between any line potential surface to an arrester and to any earth plane are listed in Table 1. Figure 6 shows the minimum phase-to-earth and minimum phase-to-phase clearances. Refer to Table 1 and Figure 8 for standard arrester dimension and weight information.

Multi-unit arresters must be erected with the units in the correct order as shown in Figure 5. All units in a multi-unit arrester have the same serial number and are marked with the appropriate unit number. Refer to the unit nameplate on the base of the arrester for the correct placement order.

## Packaged components

Unit A - Arrester identified with "Unit A" on top plate and with mounting base attached

Unit B - Arrester identified with "Unit B" on top plate

Unit C - Arrester identified with "Unit C" on top plate

Unit D - Arrester identified with "Unit D" on top plate, if supplied

Unit E - Arrester identified with "Unit E" on top plate, if supplied

Unit F - Arrester identified with "Unit F" on top plate, if supplied

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## CAUTION

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**Do not attempt to remove the large stud on either end of the arrester. They are an integral to the moisture seal of the arrester.**

Line and earth terminal connectors and mounting hardware are supplied separately in a bag.

## Detailed assembly instructions

Multi-unit arresters can be assembled prior to installation into a permanent location if desired, however, the recommended installation is shown below.

### Step 1

After Unit A is in place and ready to be secured, the ground terminal connector should be placed so that the mounting hole, found on the connector, is directly over one of the three mounting slots on the base of the arrester.

### Step 2

The bolt (user supplied) used to secure the arrester is then run through the holes of the connector, the mounting slot, and the structure the arrester is attached to.

### Step 3

Secure the arrester to the structure with mounting hardware (user supplied).

### Step 4

Attach Unit B onto Unit A using four (4) sets of 8 mm hardware, which includes bolts, lock washer and nuts with a **MAXIMUM ALLOWABLE** torque of 15 ft-lbs. Applying too much torque will strip the threads.

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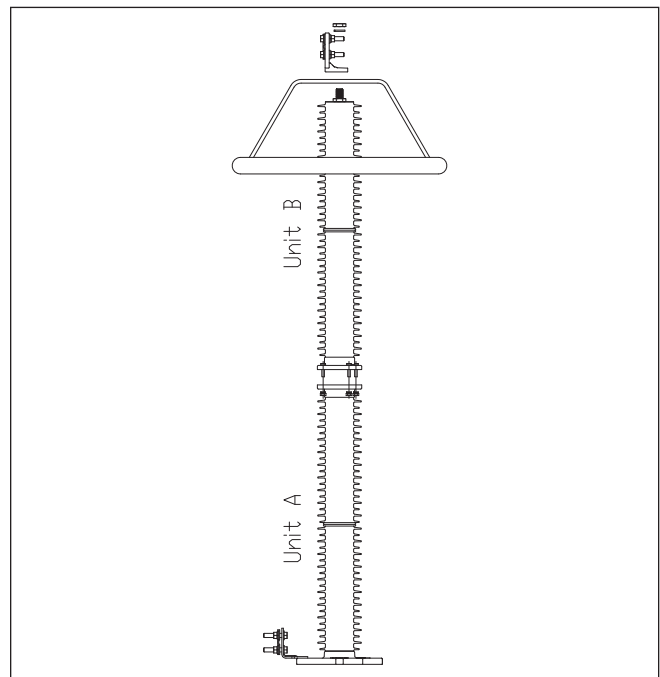
## WARNING

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**Do not attempt to lift an arrester assembly of more than 4 units at one time.**

### Step 5

Position the supplied grading ring onto the top unit as shown in Figure 4. Next, situate the line terminal connector followed by the supplied lock washer and nut as shown in Figure 5. Secure until tight.



**Figure 5. Example of arrester assembly**

**Note:** Recommended minimum torque level for the 20 mm or 1.0" terminal nut is 100 ft-lbs.

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## CAUTION

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**While torquing the nut, do not use the grading ring as a support**

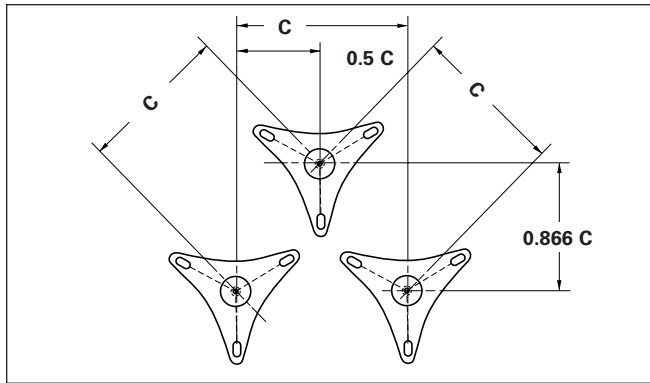


Figure 6a. Three-phase triangular mounting

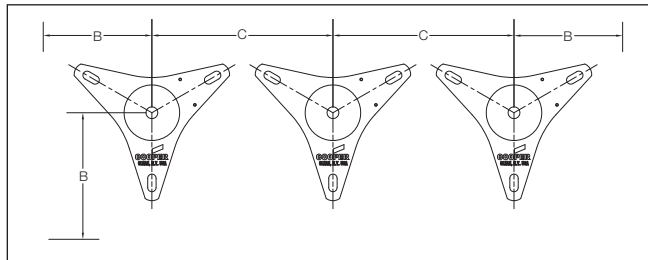


Figure 6b. Three-phase in-line mounting arrangement

**Note:** Refer to Table 1 for Dimensions “B” and “C”.

### Mechanical strength



### CAUTION

The values shown in Table 1 are the minimum clearances recommended by Eaton. These minimum clearances may be increased to meet local or system requirements for spacing of energized equipment. Safe operating practices must always be followed.

In order to achieve rated cantilever strength use a 254 mm bolt circle mounting diameter and 12 mm hardened bolts with flat washers.



### CAUTION

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

### Base or foundation mounting

Pier footings should extend below the frost line. Elevate the foundation sufficiently for personnel safety and to prevent contamination. If the top of the foundation is not level, shims will be required for leveling. Layout mounting dimensions for the arrester mounting base are shown in Figure 7.

### Bracket or structure mounting

When bolting arresters directly to structures, or mounting brackets, the assembly should be rigid enough to prevent mechanical failure.

### Suspension mounting

U2 surge arresters can be suspension-mounted. Either the top or bottom of suspension-mounted arresters can be connected to the line. It is important that the arrester is mounted so that the outer sheds of the housing are angled downward. For additional information regarding suspension mounting, contact your Eaton factory representatives.

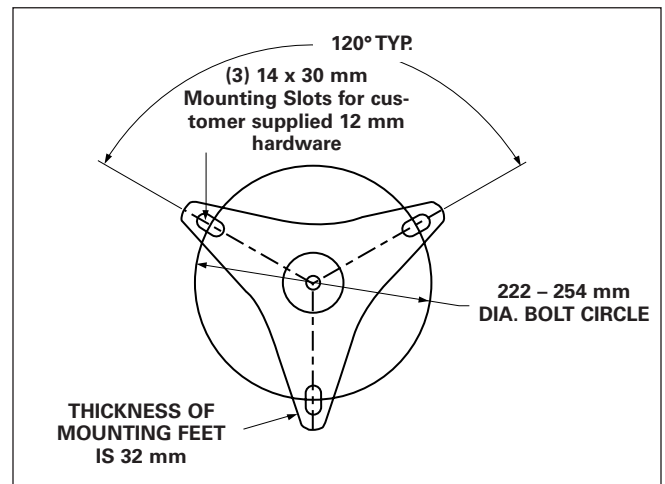


Figure 7. Mounting base details

### Horizontal mounting

U2 surge arresters can be horizontal mounted with housing codes 60 or less.



## Electrical connections

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

**Note:** Equipment protection will be improved by interconnecting the arrester earth connections with the transformer tank and system neutral whenever possible.



### CAUTION

**To prevent strains on the arrester when suspension-mounting, suspend it freely. Always make flexible connections to line and earth terminals.**

### Line terminal connector

Refer to detailed assembly instructions on pages 4 and 5. After installation and adjustment of the line terminal to the desired position, secure until tight.

The standard line terminal (as shown in Figure 8) is suitable for copper or aluminum conductors through 29 mm Ø.

### Earth terminal connector

Connect the earth terminal connector to the common earth system with as short a conductor as possible. The earth terminal can be attached to any of the bottom base mounting bolts (not supplied). The standard earth terminal (as shown in Figure 8) accommodates copper or aluminum conductor through 20 mm Ø.



### WARNING

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

## Maintenance

All UltraSIL polymer-housed U2 surge arresters, when properly applied, require no special maintenance under normal operating conditions. If the arrester is installed in an area of severe contamination, keep the arrester housing clean by washing periodically. Arresters must be spray washed evenly in order to avoid overheating. Do not use high pressure water. Keep all line and earth terminals secure.



### WARNING

**Arresters can be washed while energized provided standard live washing procedures are followed.**

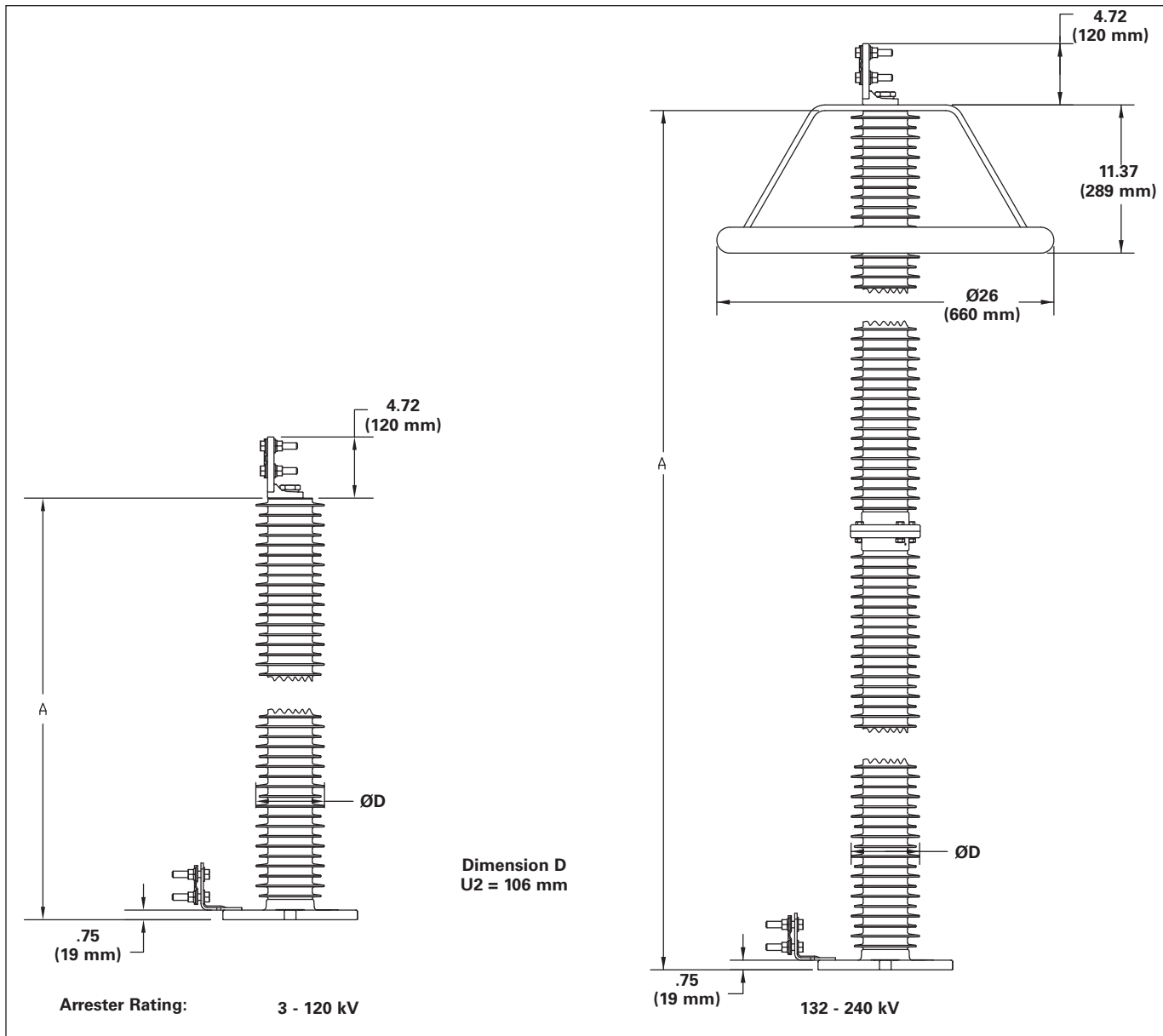
**Table 1.**  
**Dimensions, Clearance Requirements, and Weights of UltraSIL Polymer-Housed Station-Class Arresters (Standard Configuration)**

Arrester Rating U <sub>r</sub> (kV, rms)	Arrester COV U <sub>c</sub> (kV, rms)	Dimension A (mm)	Dimension B Minimum Phase-to-Earth Clearance (mm)	Dimension C Minimum Phase-to-Phase Clearance (mm)
			U2	
3	2.6	207	95	171
6	5.1	246	98	174
9	7.7	246	109	185
10	8.4	246	114	190
12	10.2	285	126	202
15	12.7	324	148	224
18	15.3	324	173	249
21	17.0	364	171	248
24	19.5	403	195	272
27	22.0	403	219	295
30	24.4	442	242	318
33	27.5	481	272	348
36	29.0	481	286	362
39	31.5	481	312	388
42	34.0	520	335	411
45	36.5	559	359	435
48	39	559	383	459
54	72	598	412	488
60	48	637	468	544
66	53	838	518	594
72	57	916	556	632
78	62	994	604	680
84	68	994	659	736
90	70	1033	698	774
96	76	1073	736	812
108	84	1190	813	889
120	98	1229	948	1024
132	106	1618	1279	1609
138	111	1657	1326	4656
144	115	1657	1364	1694
162	130	1814	1509	1839
168	131	1814	1518	1848
172	140	1853	1603	1933
180	144	1892	1641	1972
192	152	2170	1721	2051
198	160	2249	1798	2128
204	165	2288	1845	2175
216	174	2366	1930	2260
228	182	2405	2007	2337
240	190	2483	2083	2414

**Note:**

1. Refer to Figure 8 for illustration of dimensions A and D and dimension D.
- \* Phase-to-Phase clearances are expressed as minimum arrester center-to-center distances. Phase-to-Earth clearances are expressed as minimum arrester centerline-to-ground distances.
- \*\* Leakage distances shown are for standard housing. Refer to Figures 6a and 6b for illustration of dimensions B and C.

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**Figure 8. Standard ultrasil polymer-housed variSTAR U2 surge arrester dimensions.**

**Note:**

Refer to Table 1 for dimension A. Arresters shown with standard line terminal, Option 4 (in digit 11) and with standard earth terminal Option 5 (in digit 12).

Outlines in Figure 8 represent standard arrester catalog numbers from Table 1. Outline dimensions will vary when optional housing codes are selected. Consult factory for more information.

**Additional information**

CA235033EN UltraSIL Polymer-Housed VariSTAR  
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Publication No. MN235010EN/Rev 1116  
November 2016

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