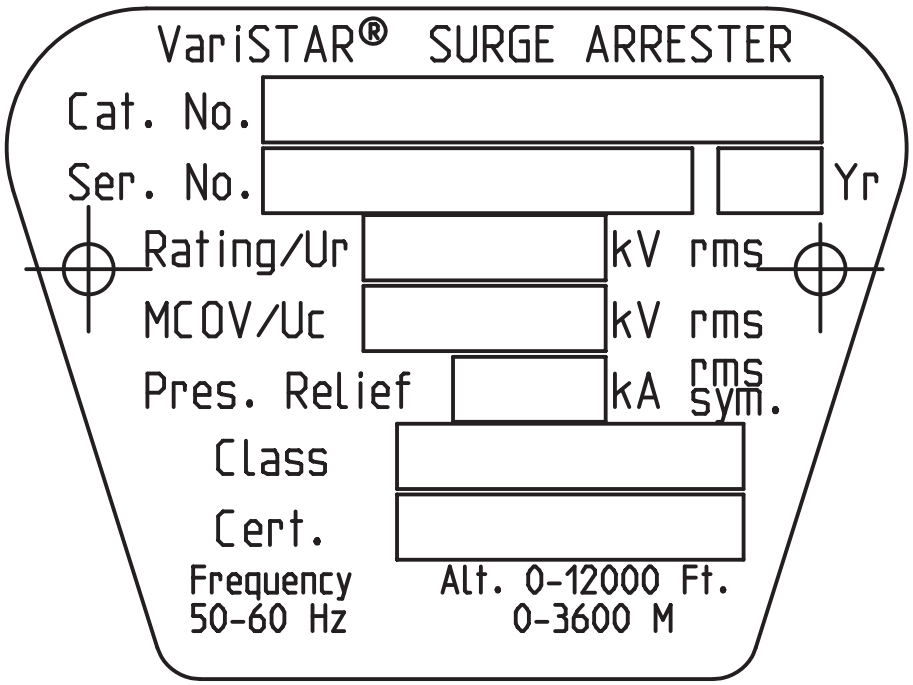
UltraSIL™ polymer-housed variSTAR™ types U3/U4 surge arresters installation and maintenance instructions



Powering Business Worldwide

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Contents

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

⚠ CAUTION:

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.

Product information

Introduction

Eaton's Cooper Power series UltraSIL™ Polymer-Housed VariSTAR™ Types U3 and U4 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.

⚠ 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. 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 or your local representative.

⚠ CAUTION:

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 (Ur), continuous operating voltage (Uc), 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.

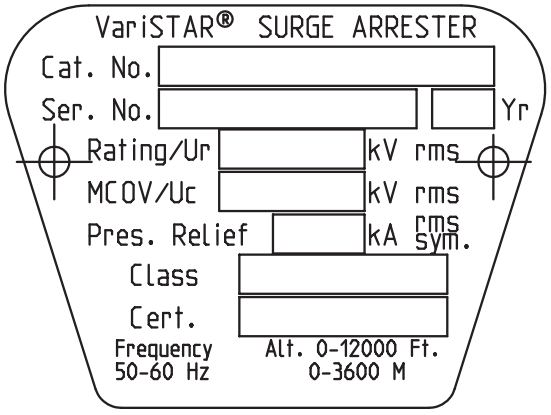


Figure 1. Arrester base nameplate (English version).

For multi-unit arresters with housing codes greater than 64 an additional nameplate is provided that includes information regarding the catalog number, serial number, unit identification, and unit Uc. Refer to Figure 2. Information regarding unit identification is etched on the unit nameplate for each arrester section.

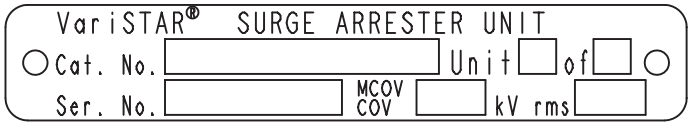


Figure 2. Detail of blank unit nameplate on arrester base.

⚠ CAUTION

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.

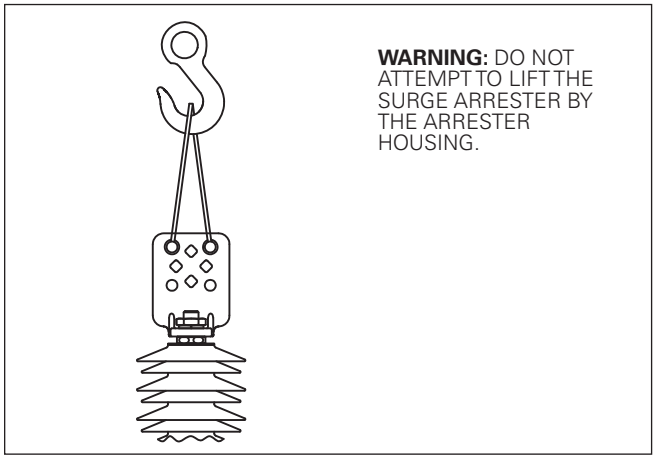


Figure 3. Detail of recommended lifting instructions.

Grading ring

Arresters with housing codes greater than 64 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.

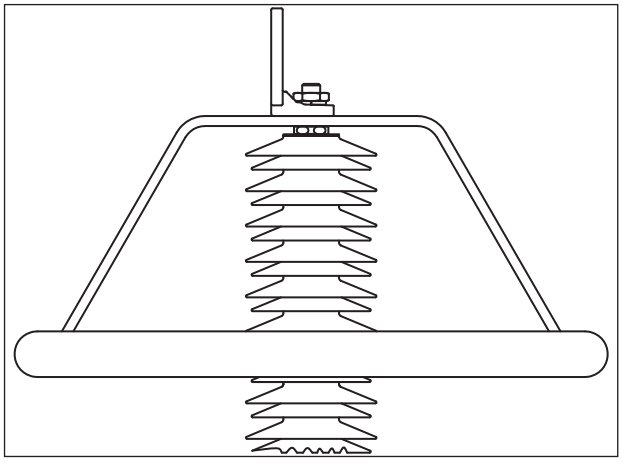


Figure 4. Detail of grading ring placement.

Arrester installation

For arresters with housing codes 64 or less

UltraSIL Polymer-Housed Type U3 and U4 surge arresters are shipped assembled with housing codes 64 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 dimensions.

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 a torque value of 136 Nm is reached.

For arresters with housing codes greater than 64

UltraSIL Polymer-Housed Types U3 and U4 surge arresters are shipped unassembled with housing codes greater than 64. 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 dimensions.

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.

Packaged components

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

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

Unit C Arrester identified with "Unit C" on top plate if shed count is above 128

⚠ CAUTION

Do not attempt to remove the large bolt on either end of the arrester. They are integral to the moisture seal of the arrester. If required, loosen the top nut to allow orientation of the line terminal connector to the desired position, secure until tight.

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 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 holes 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

Attach Unit B onto Unit A using four (4) sets of 8 mm hardware supplied with the arrester, which includes bolts, lock washer and nuts with a MAXIMUM ALLOWABLE torque of 20 Nm. Applying too much torque will strip the threads.

⚠ WARNING

Do not attempt to lift an arrester assembly of more than two (2) 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 a torque value of 135 Nm is reached.

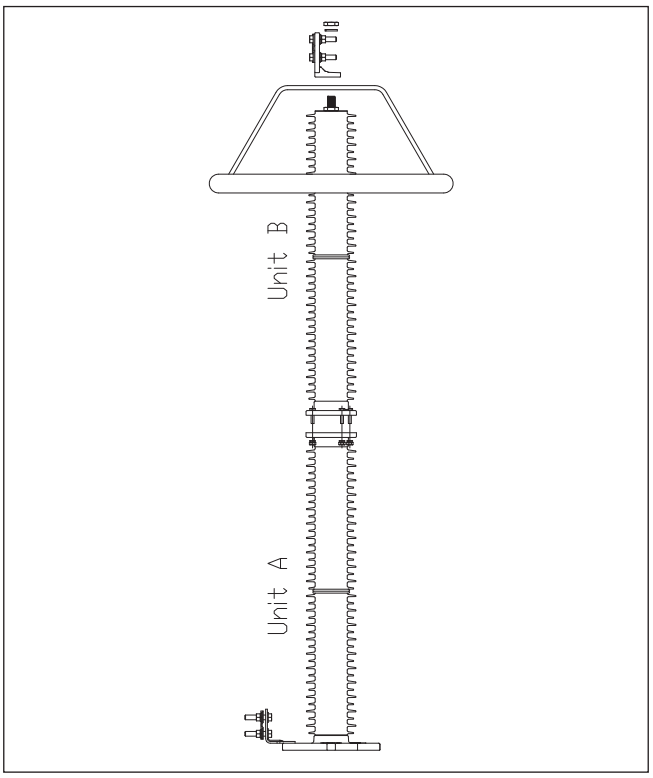


Figure 5. Example of arrester assembly.

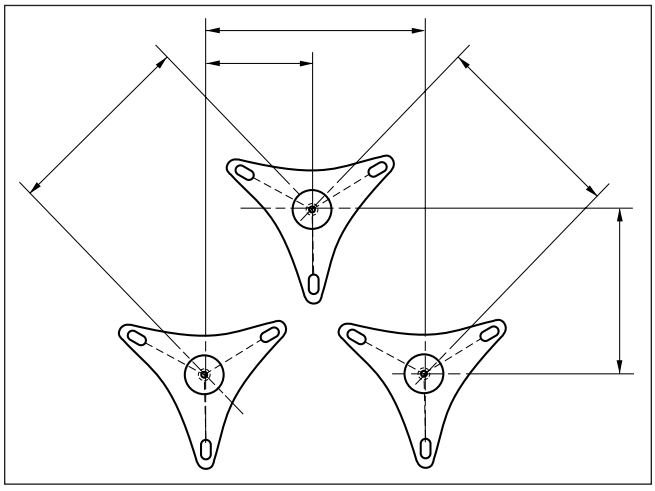


Figure 6a. Three-phase triangular mounting.

Note: Refer to Table 1 for Dimension C

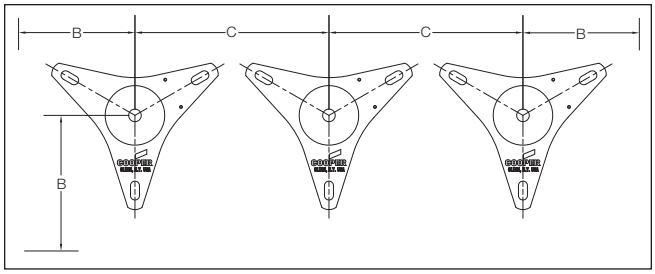


Figure 6b. Three-phase in-line mounting arrangement.

Note: Refer to Table 1 for Dimensions "B" and "C".

⚠ 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.

Mechanical strength

Type U3 (3-240 kV) station-class arresters have an ultimate cantilever strength rating of 2400 Nm. Type U4 (3-240 kV) station-class arresters have an ultimate cantilever strength rating of 4000 Nm.

In order to achieve rating 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

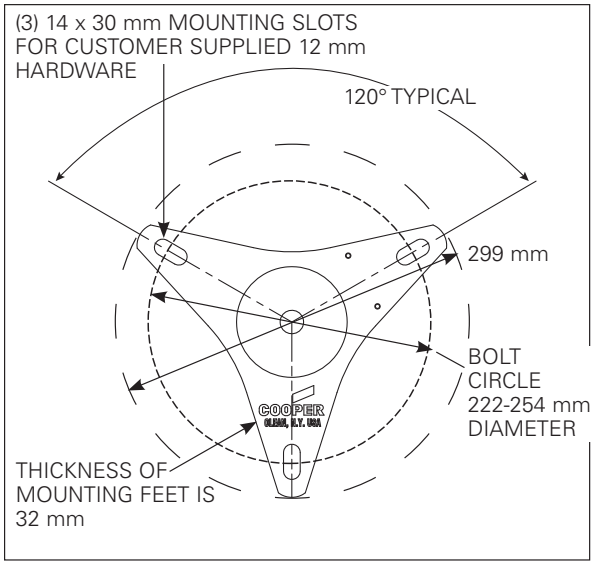
When bolting arresters directly to structures, or mounting brackets, the assembly should be rigid enough to prevent mechanical failure.

Suspension mounting

Types U3 and U4 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.

Horizontal mounting

Types U3 and U4 arresters can be horizontal mounted with housing codes 64 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 Types U3 and U4 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 and clearance requirements of ultrasil polymer-housed station-class arresters (standard configuration)

		U3			U4		
Arrester Rating Ur (kV, rms)	**Arrester COV Uc (kV, rms)**	**Dim. A (mm)**	**Dimension B Minimum Phaseto-Earth Clearance* (mm)**	**Dimension C Minimum Phase-to-Phase Clearance* (mm)**	**Dim. A (mm)**	**Dimension B Minimum Phase-to-Earth Clearance* (mm)**	**Dimension C Minimum Phase-to-Phase Clearance* (mm)**
3	2.55	208	140	254	208	140	254
6	5.1	247			247	140	254
9	7.65		143	258		141	255
10	8.4		147	261		144	258
12	10.2	287	158	272	287	153	267
15	12.7		176	290		168	283
18	15.3	326	198	312	326	188	302
21	17		218	332		218	332
24	19.5	366	218	332	366	218	332
27	22		239	353		225	339
30	24.4	405	260	374	405	244	358
33	27.5		287	401		269	384
36	29		300	415		282	396
39	31.5	484	322	436	484	302	416
42	34		344	458		322	436
45	36.5	523	366	480	523	342	457
48	39	563	388	502	563	363	477
54	42		414	528		387	501
60	48	602	467	581	602	436	550
66	53	642	510	625	642	476	591
72	57	681	546	660	681	509	623
78	62	842	589	704	842	549	664
84	68	921	642	756	921	598	712
90	72	960	677	791	960	630	745
96	76	999	712	826	999	663	777
	77	1039	721	835	1039	671	785
108	84	1079	782	896	1079	728	842
120	98	1157	905	1019	1157	841	956
132	106	1237	1191	1521	1237	1122	1452
138	111	1315	1234	1565	1315	1163	1493
144	115		1269	1600		1195	1525
150	120	1696	1313	1643	1696	1236	1566
162	130	1735	1401	1731	1735	1317	1647
168	131	1774	1410	1740	1774	1325	1655
172	140	1814	1488	1819	1814	1398	1728
180	144	1853	1523	1854	1853	1430	1761
192	152	1893	1594	1924	1893	1495	1826
198	160	1971	1664	1994	1971	1560	1890
204	165	2011	1707	2038	2011	1601	1931
216	174	2250	1786	2116	2250	1674	2004
228	180	2328	1856	2187	2328	1722	2053
240	190	2367	1926	2257	2367	1804	2134

Note:

1. Refer to Figure 8 for illustration of dimensions A and 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.

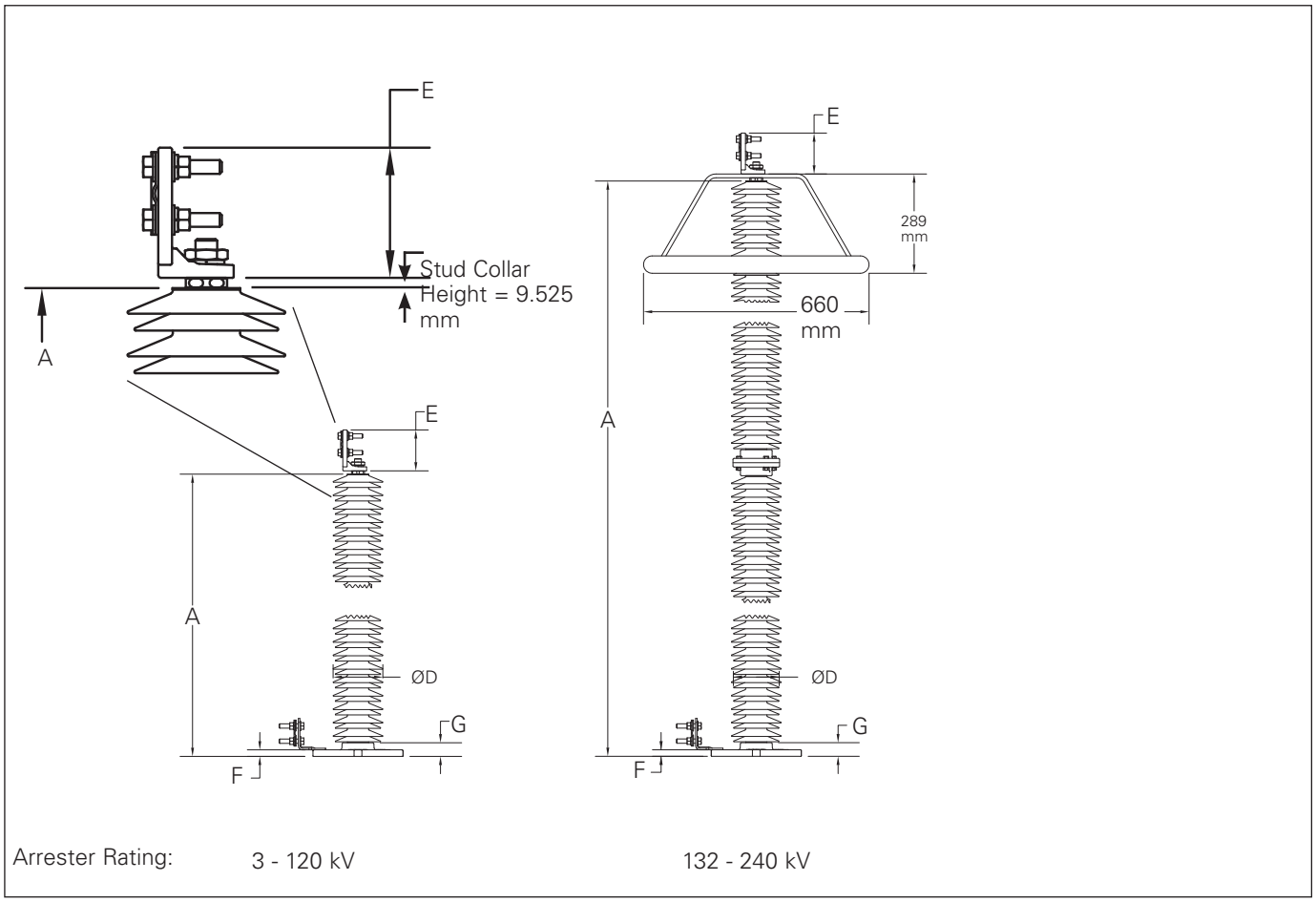


Figure 8. Standard UltraSIL polymer-housed variSTAR types U3 and U4 surge arrester dimensions.

Note: Refer to Table 1 for dimension A. Arresters shown with standard line and earth terminals.
Refer to Table 2 for dimension E.
Outlines in Figure 8 and data from Table 1 represent standard arrester catalog numbers. Outline dimensions will vary when optional housing codes are selected. Consult factory for more information.

Terminal option dimensions

Table 2. Terminal options dimensions

Description of Line Terminal Option	Dimension (mm)
	Types U3 and U4
NEMA Four-hole Pad	120
Cylindrical Stem Connector	156
Eyebolt Connector	81
Clamp-Style Connector	-

Note: Refer to Figure 8 for illustration of dimension E.

Table 3. Base dimensions "F, G"

Arrester Type	F (Flange height, mm)	G (Total Base Height, mm)
U3 and U4 (2-240 kV)	32	49

Note: Refer to Figure 8 for illustration of dimensions F and G.

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