UltraSIL™ polymer-housed variSTAR™
U2 surge arresters (15-digit catalog number)
installation and maintenance instructions
DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY

The information, recommendations, descriptions and safety notations in this document are based on Eaton Corporation’s (“Eaton”) experience and judgment and may not cover all contingencies. If further information is required, an Eaton sales office should be consulted. Sale of the product shown in this literature is subject to the terms and conditions outlined in appropriate Eaton selling policies or other contractual agreement between Eaton and the purchaser.

THERE ARE NO UNDERSTANDINGS, AGREEMENTS, WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, OTHER THAN THOSE SPECIFICALLY SET OUT IN ANY EXISTING CONTRACT BETWEEN THE PARTIES. ANY SUCH CONTRACT STATES THE ENTIRE OBLIGATION OF EATON. THE CONTENTS OF THIS DOCUMENT SHALL NOT BECOME PART OF OR MODIFY ANY CONTRACT BETWEEN THE PARTIES.

In no event will Eaton be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of use of equipment, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities, or claims against the purchaser or user by its customers resulting from the use of the information, recommendations and descriptions contained herein. The information contained in this manual is subject to change without notice.
Contents

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY ........................................... I

SAFETY FOR LIFE ........................................................................................................ III

SAFETY INFORMATION ............................................................................................... III
  Safety instructions ........................................................................................................ iii

PRODUCT INFORMATION ......................................................................................... 1
  Safety Information ......................................................................................................... 2
  General Application Recommendations .................................................................... 3
  Arrester Installation ..................................................................................................... 4
  Electrical Connections ............................................................................................... 6
  Maintenance ................................................................................................................ 6
  Additional Information ............................................................................................... 8
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.

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

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

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.

警告
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.

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’s Cooper Power
series representative.

警告
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.
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.
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

CAUTION

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.

WARNING

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.

CAUTION

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

**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.

---

**Figure 6a. Three-phase triangular mounting**

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

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

**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)

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

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.
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 U2 Surge Arrester Catalog Section