VariSTAR Type AZG3 Surge Arresters for Systems through 345 kV IEC 10-kA; Line Discharge Class 3



Figure 1. VariSTAR Type AZG3 Surge Arrester, Ur = 96 kV.



General

Eaton's Cooper Power series VariSTARTM AZG3 Surge Arresters offer the latest in metal oxide varistor (MOV) technology for the economical protection of medium-voltage class power and substation equipment. These arresters are gapless and are constructed of a single series column of 63 mm diameter MOV disks. The arrester is designed and tested exclusively to the requirements of the International Electrotechnical Commission Standard IEC 99-4, and is available in ratings suitable for the transient overvoltage protection of electrical equipment on systems through 345 kV.

Eaton assures the design integrity of the Cooper Power series AZG3 arrester through a rigorous testing program conducted at the Thomas A. Edison Technical Center and at the factory in Olean, NY USA. The availability of complete "in-house" testing facilities assures that as continuous process improvements are made, they are professionally validated to the highest technical standards.

Construction

External

The wet-process porcelain housing features an alternating shed design ($U_r > 48 \text{ kV}$) that provides excellent resistance to the effects of atmospheric housing contamination. AZG3 arresters are optionally available with extra creepage porcelains for use in areas with extreme conditions of natural atmospheric and man-made pollution.

The dielectric properties of the porcelain are coordinated with the electrical protective characteristics of the arrester in accordance with the requirements of IEC 99-4. The unit end castings are of a corrosion-resistant aluminum alloy configured for interchangeable mounting with many manufacturers' arresters for ease in upgrading to VariSTAR Arrester Technology. This three-footed mounting is provided on a 111 to 127 mm radius pattern for customer supplied 12 mm diameter hardware. High cantilever strength assures mechanical integrity. Housings are available in standard grey or optional brown glaze color.

Standard line and earth terminal connectors accommodate up to 335 mm² conductor. Insulating bases and discharge counters are optionally available for in-service monitoring of arrester discharge activity.

The end fittings and porcelain housing of each arrester unit are sealed and tested by means of a sensitive helium mass spectrometer; this assures that the quality and insulation protection provided by the arrester is never compromised over its lifetime by the entrance of moisture. A corrosion resistant nameplate is provided and contains all information required by IEC Standards; in addition, stacking arrangement information is provided for multi-unit arresters. Voltage grading rings are included for arresters rated 172 kV and above.

VariSTARType AZG3 Surge Arresters for Systems through 345 kV IEC 10-kA; Line Discharge Class 3

Table 1.

| System Application Voltages | 3-345 kV |
|---|---|
| Rated Arrester Voltages, U _r | 3-312 kV |
| Power System Frequency | 50 or 60 Hz |
| Applicable Design and Test Standard | IEC 99-4 |
| Nominal Discharge Current | 10 kA |
| Line Discharge Class | 3 |
| High Current Withstand | 100 kA |
| Pressure Relief Class | 63 kA rms sym |
| Rated Discharge Energy | 5.6 kJ/kV of U _C or 4.5 kJ/kV of U _r |

Features and detailed description

Internal

The VariSTAR AZG3 arrester's reliability is enhanced by its totally gapless design. Gapless construction makes a significant contribution to the performance of arresters through the elimination of gap reseal as a consideration associated with the discharge of switching surge currents. The specially formulated metal-oxide varistors, manufactured under Eaton's exclusive quality control, provide exceptional non-linear protective characteristics, durability, and dependable energy dissipation capabilities.

Operation

The VariSTAR AZG3 Arrester conducts only a few milliamperes of leakage current when energized at normal system voltage. When an overvoltage event occurs, the arrester conducts only the current and consequently the energy necessary to limit the overvoltage to its protective level. By doing so it provides precise and predictable protection, minimizes the absorbed energy, and discharges no power frequency system currents.

VariSTAR Arresters are ideal for the protection of critical substation apparatus in areas of moderate lightning incidence and for protection against switching surges generated on transmission systems.

A controlled and directed pressure relief system is incorporated in the VariSTAR AZG3 Arrester Design. In the unlikely event of an arrester failure, this pressure venting system rapidly relieves internal pressure and transfers the internal arc to the outside of the arrester porcelain through vent ports in the end castings.

When called upon to operate, this mechanism vents internal pressures in fractions of a cycle preventing violent arrester failure. This mechanism is effective for system fault currents up to 63,000 amperes rms symmetrical (163,000 A first crest).

General application recommendations

The rating of an arrester is the power frequency line-to-earth voltage $\rm U_r$ at which the arrester is designed to pass the IEC 99-4 operating duty test. Table 2 provides a general guide for the selection of the proper arrester for a given system voltage. Eaton's application engineers are available to make specific system application recommendations.

Selection of arrester rating

In arrester rating selection it is preferable to determine the lowest arrester rating that will ensure satisfactory operation. This is the optimum solution because the arrester selected will not only provide the greatest margin of insulation protection but also be the most economical choice.

Increasing arrester rating above the minimum increases the likelihood of arrester survival during potential system

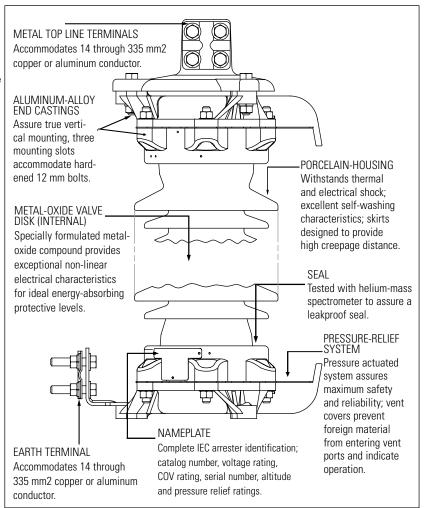
contingencies but compromises the protection of equipment insulation. Table 2 lists VariSTAR AZG3 Arrester Ratings commonly used on various 3-phase systems.

Rating selection should begin with consideration of the maximum system operating voltage. The maximum power frequency voltage expected under normal system conditions (expressed line-to-earth) should not exceed the selected arrester's continuous operating voltage (U_C).

The temporary overvoltage (TOV) capability of the VariSTAR AZG3 Arrester is shown in Figure 3. The curves indicate the arrester's ability to withstand abnormal system power frequency (sinusoidal) overvoltages for various durations. The values shown assume that the arrester has been energized at COV (Uc) prior to an overvoltage event and that the arrester is in an ambient temperature of 60 degrees celsius. After the overvoltage durations shown, the arrester will thermally recover when once again energized at COV (Uc).

It is not recommended that the TOV curve be extended for periods in excess of 10,000 seconds (2.8 hrs). For ungrounded systems, systems utilizing high impedance or resonant grounding and other systems where the line-to-earth voltage may be elevated to line-to-line voltages for extended periods, arresters having a COV ($\rm U_{\rm C}$) equal to line-to-line voltage may be required.

For non-sinusoidal transient voltages caused by system switching operations, a transient network analyzer (TNA) study is recommended; Eaton's engineers are available to make these studies.



VariSTARType AZG3 Surge Arresters for Systems through 345 kV IEC 10-kA; Line Discharge Class 3

Figure 3 also illustrates the arrester's TOV capabilities with and without prior switching surge duties of up to a maximum capability of 5.6 kJ/kV of COV ($\rm U_C$).

To assure proper application, the following information is normally required:

- 1. Maximum system operating voltage.
- 2. System grounding conditions.

A. For four-wire circuits, grounding conditions depend upon whether the system is multi-grounded, whether it has 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, grounded through transformers, or ungrounded.

Where unusual conditions exist (high ground resistance, high capacitive load, unusual switching surge duty, etc.), the following supplementary information is required:

- 1. Type of unusual condition.
- BIL of equipment and separation distance to protected equipment.
- Type of construction (phase spacing, length of line, conductor size, etc.).
- Grounding and phase-sequence components of source impedances.
- 5. Phase-sequence components of load impedances.
- 6. Available fault current.
- 7. Potential for loss of neutral earthing during system events.

Table 2. Arrester Ratings Commonly Used on 3-Phase Systems

| System Voltag | ges L-L (kV) | Arreste | r Ratings (kV) |
|---------------|--------------|----------------------|---|
| Nominal | Max | Grounded Circuits | High-Impedance/ Ungrounded Circuits |
| 3.3 | 3.7 | 3 | - |
| 6.6 | 7.3 | 6 | 9 |
| 10.0 | 11.5 | 9 | 12-15 |
| 11.0 | 12.0 | 9-10 | 12-15 |
| 16.4 | 18.0 | 15 | 18-21 |
| 22.0 | 24.0 | 18-21 | 24-27 |
| 33.0 | 36.3 | 27-30 | 36-39 |
| 47.0 | 52.0 | 39-48 | 54-60 |
| 66.0 | 72.0 | 54-60 | 66-84 |
| 91.0 | 100 | 78-84 | 90-96 |
| 110 | 123 | 96-108 | 120-138 |
| 132 | 145 | 108-120 | 132-144 |
| 155 | 170 | 132-144 | 162-172 |
| 220 | 245 | 180-198 | 204-240 |
| 275 | 300 | 216-240 | 258-294 |
| 345 | 362 | 258-288 | 294-312 |
| | | | |

Performance and protective characteristics

Table 4, "Residual Voltages – Maximum Guaranteed Protective Characteristics For Type AZG3 Surge Arresters" displays the Arrester Rating (U_r), Continuous Operating Voltage (U_c) and the guaranteed protective characteristics.

The Steep Current Impulse protective level is the maximum residual voltage for an impulse current of specified magnitude rising to crest in one microsecond. Lightning Impulse Residual Voltages represent the maximum protective levels exhibited by the arrester when discharging lightning currents of the standard 8/20 microsecond waveshape. The maximum Switching Impulse Residual Voltages are based on a switching surge current having a time to crest of 30 microseconds. For all ratings the switching surge energy absorption capability is 5.6 kJ/kV of COV (U_c).

Routine tests

A complete production test program assures the quality of every VariSTAR AZG3 Surge Arrester. Each completed arrester is required to satisfactorily pass the following test regimen conducted in accordance with the procedures established in IEC 99-4:

- Partial Discharge Test at 1.05 times U_C.
- Reference Voltage Test (U_{ref}), voltage measured at Reference
- Current (I_{ref}).
- Leakage current is measured at U_c.
- · Residual Voltage Test.
- Sealing Effectiveness Test of Housing by helium mass spectrometer.

Standards

The VariSTAR AZG3 Surge Arrester has been tested and certified to IEC Standard 99-4. Guaranteed performance characteristics are specified in this catalog section and in the relevant "Design Certification Test Report," CP9818.

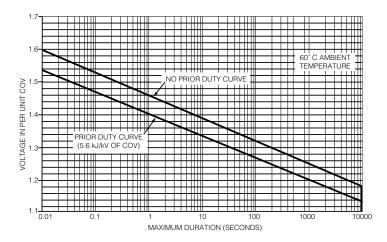


Figure 3. Temporary overvoltage capability of VariSTAR AZG3 Surge Arresters.

Table 3. Type AZG3 Surge Arrester Insulation Withstand Characteristics

| 01 234 132 130 35 ************************************ | Housing Designation* | Leakage Distance (mm) | Arc Distance (mm) | BIL - kV Pk 1.2/50 Wave | 50/60 Hz Wet (60s)- kV rms | Switching-Wet (kV Pk) |
|--|-------------------------|-----------------------------|-------------------------|----------------------------|-------------------------------|-----------------------|
| 03 665 291 230 90 ** 04 922 386 265 125 ** 05 1267 513 320 165 ** 06 1848 600 365 170 ** 07 1872 672 385 195 ** 08 2540 889 505 250 ** 08 3226 1108 660 285 ** 11 3292 1199 725 345 ** 12 3518 1272 735 360 ** 13 3744 1344 770 385 ** 14 4186 4189 865 415 ** 15 4412 1561 880 450 ** 16 4872 1706 985 450 ** 18 3518 1218 780 370 ** 18 | 01 | 234 | 132 | 130 | 35 | ** |
| 63 60 251 250 80 04 922 386 265 125 ** 05 1267 513 320 165 ** 06 1646 600 365 170 ** 07 1872 672 385 195 ** 08 2540 889 506 250 ** 09 3226 1106 650 285 ** 11 3292 1199 725 345 ** 12 3518 1272 735 360 ** 13 3744 1344 770 395 ** 14 4186 4189 865 415 ** 15 4412 1561 880 450 ** 16 4872 1706 885 450 ** 17 3292 1150 705 335 ** 18 351 | 02 | 406 | 195 | 170 | 60 | ** |
| 65 1267 513 320 165 ** 06 1646 600 365 170 ** 07 1872 672 385 195 ** 08 2540 389 505 250 ** 09 3226 1106 650 285 ** 11 3292 1199 725 345 ** 12 3518 1272 735 360 ** 13 3744 1344 770 395 ** 14 4186 4189 865 415 ** 15 4412 1561 880 450 ** 16 4872 1706 985 450 ** 17 3292 1150 705 335 ** 18 3518 1218 780 370 ** 20 4186 140 895 400 ** <t< td=""><td>03</td><td>665</td><td>291</td><td>230</td><td>90</td><td>**</td></t<> | 03 | 665 | 291 | 230 | 90 | ** |
| 06 1646 600 365 170 ** 07 1872 672 385 195 ** 08 2540 889 505 250 ** 09 3226 1106 650 265 ** 11 3292 1199 725 345 ** 12 3518 1272 735 360 ** 13 3744 1344 770 395 ** 14 4186 4189 865 415 ** 15 4412 1561 880 450 ** 16 4872 1706 886 450 ** 17 3292 1150 705 335 ** 18 3518 1218 780 370 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** | 04 | 922 | 386 | 265 | 125 | ** |
| 60 60 30 170 07 1872 672 385 195 *** 08 2540 889 505 250 *** 09 3226 1106 650 285 *** 11 3292 1199 725 345 *** 12 3518 1272 735 360 *** 13 3744 1344 770 395 *** 14 4186 4189 865 415 *** 15 4412 1561 880 450 *** 16 4872 1706 985 450 *** 17 3292 1150 705 335 *** 18 3518 1218 780 370 *** 19 3744 1291 790 385 *** 20 4186 1440 850 400 *** 21 4412 <td>05</td> <td>1267</td> <td>513</td> <td>320</td> <td>165</td> <td>**</td> | 05 | 1267 | 513 | 320 | 165 | ** |
| 07 1672 1672 305 189 08 2540 889 505 250 *** 09 3226 1106 650 285 *** 11 3292 1199 725 345 *** 12 3518 1272 735 360 *** 13 3744 1344 770 395 *** 14 4186 4189 865 415 *** 15 4412 1561 880 450 *** 16 4872 1706 985 450 *** 17 3292 1150 705 335 *** 18 3518 1218 780 370 *** 19 3744 1291 790 385 *** 20 4186 1440 850 400 *** 21 4412 1508 92 440 750 23 | 06 | 1646 | 600 | 365 | 170 | ** |
| 08 326 1106 550 285 ** 11 3292 1199 725 345 ** 12 3518 1272 735 360 ** 13 3744 1344 770 395 ** 14 4186 4189 865 415 ** 15 4412 1561 880 450 ** 16 4872 1706 985 450 ** 17 3292 1150 705 335 ** 18 3518 1218 780 370 ** 19 3744 1291 790 385 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 810 24 5766 1839 1065 530 915 | 07 | 1872 | 672 | 385 | 195 | ** |
| 11 3292 1199 725 345 ** 12 3518 1272 735 360 ** 13 3744 1344 770 395 ** 14 4186 4189 865 415 ** 15 4412 1561 880 450 ** 16 4872 1706 985 450 ** 17 3292 1150 705 335 ** 18 3518 1218 780 370 ** 19 3744 1291 790 385 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 750 23 5096 1620 930 480 810 24 5766 1839 1065 530 915 | 08 | 2540 | 889 | 505 | 250 | ** |
| 11 3222 1138 725 340 12 3518 1272 735 360 ** 13 3744 1344 770 395 ** 14 4186 4189 865 415 ** 15 4412 1561 880 450 ** 16 4872 1706 985 450 ** 17 3292 1150 705 335 ** 18 3518 1218 780 370 ** 19 3744 1291 790 385 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 | 09 | 3226 | 1106 | 650 | 285 | ** |
| 12 316 1272 735 306 13 3744 1344 770 395 *** 14 4186 4189 865 415 *** 15 4412 1561 880 450 *** 16 4872 1706 985 450 *** 17 3292 1150 705 335 *** 18 3518 1218 780 370 *** 19 3744 1291 790 385 *** 20 4186 1440 850 400 *** 21 4412 1508 920 440 *** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 <t< td=""><td>11</td><td>3292</td><td>1199</td><td>725</td><td>345</td><td>**</td></t<> | 11 | 3292 | 1199 | 725 | 345 | ** |
| 14 4186 4189 865 415 ** 15 4412 1561 880 450 ** 16 4872 1706 985 450 ** 17 3292 1150 705 335 ** 18 3518 1218 780 370 ** 19 3744 1291 790 385 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 ** 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 | 12 | 3518 | 1272 | 735 | 360 | ** |
| 14 4166 4179 869 4179 15 4412 1561 880 450 ** 16 4872 1706 985 450 ** 17 3292 1150 705 335 ** 18 3518 1218 780 370 ** 19 3744 1291 790 385 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 300 655 1100 | 13 | 3744 | 1344 | 770 | 395 | ** |
| 16 4872 1706 985 450 *** 17 3292 1150 705 335 *** 18 3518 1218 780 370 *** 19 3744 1291 790 385 *** 20 4186 1440 850 400 *** 21 4412 1508 920 440 *** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 253 1475 710 1250 | 14 | 4186 | 4189 | 865 | 415 | ** |
| 17 3292 1150 705 335 ** 18 3518 1218 780 370 ** 19 3744 1291 790 385 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1285 | 15 | 4412 | 1561 | 880 | 450 | ** |
| 17 3232 1100 763 353 18 3518 1218 780 370 ** 19 3744 1291 790 385 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1150 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 | 16 | 4872 | 1706 | 985 | 450 | ** |
| 19 3744 1291 790 385 ** 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 </td <td>17</td> <td>3292</td> <td>1150</td> <td>705</td> <td>335</td> <td>**</td> | 17 | 3292 | 1150 | 705 | 335 | ** |
| 19 3744 1291 780 388 20 4186 1440 850 400 ** 21 4412 1508 920 440 ** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 <td>18</td> <td>3518</td> <td>1218</td> <td>780</td> <td>370</td> <td>**</td> | 18 | 3518 | 1218 | 780 | 370 | ** |
| 21 4412 1508 920 440 *** 22 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 19 | 3744 | 1291 | 790 | 385 | ** |
| 27 4872 1548 925 440 750 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 20 | 4186 | 1440 | 850 | 400 | ** |
| 23 5098 1620 930 480 810 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 21 | 4412 | 1508 | 920 | 440 | ** |
| 24 5766 1839 1065 530 915 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 22 | 4872 | 1548 | 925 | 440 | 750 |
| 25 6452 2055 1185 545 1015 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 23 | 5098 | 1620 | 930 | 480 | 810 |
| 27 6744 2099 1265 625 1065 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 24 | 5766 | 1839 | 1065 | 530 | 915 |
| 28 6970 2171 1300 655 1100 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 25 | 6452 | 2055 | 1185 | 545 | 1015 |
| 29 7412 2316 1375 675 1150 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 27 | 6744 | 2099 | 1265 | 625 | 1065 |
| 30 7638 2389 1405 705 1190 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 28 | 6970 | 2171 | 1300 | 655 | 1100 |
| 31 8098 2533 1475 710 1250 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 29 | 7412 | 2316 | 1375 | 675 | 1150 |
| 32 8306 2606 1515 760 1280 34 8992 2750 1440 760 1235 | 30 | 7638 | 2389 | 1405 | 705 | 1190 |
| 34 8992 2750 1440 760 1235 | 31 | 8098 | 2533 | 1475 | 710 | 1250 |
| | 32 | 8306 | 2606 | 1515 | 760 | 1280 |
| 35 9677 2967 1535 810 1315 | 34 | 8992 | 2750 | 1440 | 760 | 1235 |
| | 35 | 9677 | 2967 | 1535 | 810 | 1315 |

^{*} Housing designation is indicated in the 6th and 7th position of the catalog number.

^{**} IEC Standard 60099-4 (99-4) 1991 does not require Wet Switching Surge Withstand tests for arresters with rated voltage (Ur) below 200 kV. Housing designations 21 and below are not used in arresters rated above 198 kV

Table 4. Residual Voltages - Maximum Guaranteed Protective Characteristics for Type AZG3 Surge

| Arrester Rating | Arrester MCOV | Steep Current Residual Voltage | uaranteed Protective Characteristics for Type AZG3 Surge Lightning Impulse Residual Voltage (kV Crest) 8/20 µs Current Wave | | | | | | Switching Impulse Residual Voltage (kV Crest) 30/60 Current Wave | |
|--------------------|------------------|-----------------------------------|---|------|------|-------|-------|-------|---|-------|
| Ur (kV, rms) | Uc (kV, rms) | (kV Crest) 10 kA | 1.5 kA | 3 kA | 5 kA | 10 kA | 20 kA | 40 kA | 125 A | 500 A |
| 3 | 2.55 | 13.1 | 7.0 | 7.4 | 7.7 | 8.3 | 9.4 | 10.7 | 6.5 | 6.7 |
| 3 | 5.10 | 22.0 | 13.8 | 14.6 | 15.2 | 16.3 | 18.2 | 20.5 | 12.9 | 13.4 |
| 9 | 7.65 | 31.0 | 20.7 | 21.8 | 22.7 | 24.3 | 27.0 | 30.3 | 19.3 | 20.0 |
| 10 | 8.40 | 33.7 | 22.7 | 24.0 | 24.9 | 26.7 | 29.6 | 33.2 | 21.2 | 22.0 |
| 12 | 10.2 | 40.0 | 27.6 | 29.1 | 30.2 | 32.4 | 35.9 | 40.2 | 25.7 | 26.7 |
| 15 | 12.7 | 48.8 | 34.3 | 36.1 | 37.5 | 40.2 | 44.5 | 49.7 | 32.0 | 33.2 |
| 18 | 15.3 | 57.9 | 41.3 | 43.5 | 45.2 | 48.4 | 53.5 | 59.8 | 38.5 | 33.9 |
| 21 | 17.0 | 64.0 | 46.0 | 48.4 | 50.2 | 53.8 | 59.4 | 66.4 | 42.8 | 44.4 |
| 24 | 19.5 | 72.8 | 52.7 | 55.5 | 57.6 | 61.7 | 68.1 | 76.1 | 49.1 | 51.0 |
| 27 | 22.0 | 81.5 | 59.4 | 62.5 | 64.9 | 69.5 | 76.7 | 85.6 | 55.4 | 57.4 |
| 30 | 24.4 | 90.1 | 65.9 | 69.4 | 72.0 | 77.1 | 85.0 | 94.9 | 61.5 | 63.7 |
| 33 | 27.5 | 101 | 74.3 | 78.2 | 81.2 | 86.9 | 95.8 | 107 | 69.3 | 71.8 |
| 36 | 29.0 | 106 | 78.4 | 82.4 | 85.6 | 91.6 | 101 | 113 | 73.0 | 75.7 |
| 39 | 31.5 | 115 | 85.1 | 89.5 | 93.0 | 99.5 | 110 | 122 | 79.4 | 82.3 |
| 42 | 34.0 | 120 | 89.2 | 93.8 | 97.4 | 104 | 115 | 128 | 83.1 | 86.2 |
| 45 | 36.5 | 128 | 95.2 | 100 | 104 | 111 | 123 | 137 | 88.7 | 91.9 |
| 48 | 39 | 137 | 102 | 107 | 111 | 119 | 131 | 146 | 95.1 | 98.6 |
| 54 | 42 | 147 | 110 | 115 | 120 | 128 | 141 | 158 | 102 | 106 |
| 60 | 48 | 167 | 125 | 132 | 137 | 146 | 161 | 180 | 117 | 121 |
| 66 | 53 | 184 | 138 | 145 | 151 | 161 | 177 | 198 | 129 | 133 |
| 72 | 57 | 199 | 149 | 157 | 163 | 174 | 192 | 214 | 139 | 144 |
| 78 | 62 | 216 | 162 | 170 | 177 | 189 | 208 | 232 | 151 | 157 |
| 84 | 68 | 236 | 177 | 187 | 194 | 207 | 228 | 254 | 165 | 171 |
| 90 | 70 | 242 | 183 | 192 | 199 | 213 | 235 | 262 | 170 | 176 |
| 96 | 76 | 263 | 198 | 208 | 216 | 231 | 254 | 284 | 185 | 191 |
| 108 | 84 | 291 | 219 | 231 | 240 | 256 | 282 | 314 | 205 | 212 |
| 120 | 98 | 338 | 255 | 269 | 279 | 298 | 328 | 366 | 238 | 247 |
| 132 | 106 | 368 | 276 | 290 | 301 | 322 | 355 | 396 | 257 | 267 |
| 138 | 111 | 386 | 290 | 305 | 316 | 338 | 372 | 415 | 270 | 280 |
| 144 | 115 | 401 | 301 | 317 | 328 | 351 | 387 | 431 | 280 | 291 |
| 162 | 130 | 450 | 339 | 356 | 370 | 395 | 435 | 485 | 316 | 327 |
| 168 | 131 | 455 | 342 | 360 | 373 | 399 | 440 | 490 | 319 | 331 |
| 172 | 140 | 485 | 365 | 384 | 399 | 426 | 469 | 523 | 340 | 353 |
| 180 | 144 | 498 | 375 | 395 | 410 | 438 | 482 | 538 | 350 | 363 |
| 192 | 152 | 526 | 397 | 417 | 433 | 463 | 510 | 568 | 370 | 384 |
| 198 | 160 | 553 | 417 | 439 | 456 | 487 | 536 | 598 | 389 | 403 |
| 204 | 165 | 570 | 430 | 452 | 470 | 502 | 553 | 616 | 401 | 416 |
| 216 | 174 | 601 | 454 | 478 | 496 | 530 | 583 | 650 | 424 | 439 |
| 228 | 182 | 628 | 475 | 499 | 518 | 554 | 610 | 680 | 443 | 459 |
| 240 | 190 | 655 | 495 | 521 | 541 | 578 | 636 | 709 | 462 | 479 |
| 258 | 209 | 725 | 546 | 574 | 596 | 638 | 702 | 782 | 509 | 528 |
| 264 | 212 | 735 | 554 | 582 | 604 | 647 | 711 | 793 | 516 | 535 |
| 276 | 220 | 761 | 573 | 603 | 626 | 670 | 737 | 821 | 535 | 554 |
| 288 | 230 | 796 | 601 | 632 | 656 | 702 | 772 | 860 | 560 | 581 |
| 294 | 235 | 813 | 614 | 645 | 670 | 717 | 788 | 879 | 572 | 593 |
| 200 | 239 | 827 | 624 | 656 | 681 | 729 | 802 | 893 | E02 | 603 |
| 300 | 239 | 027 | 024 | 030 | 001 | 723 | 002 | 000 | 582 | 003 |

Dimensions and mounting

Figure 4 illustrates an in-line mounting arrangement; the applicable values of "C" and "D" may be found in Table 5. Line and earth terminal details are shown in Figure 5; the supplied terminals accommodate aluminum and copper conductors to a maximum size of 335 mm2. For other conductors the terminal drilling pattern shown will accommodate industry standard two (2) and four (4) hole flat pad connectors having a 45mm spacing. Figure 6 provides the dimensional details for universal base mounting.

The vent port in the base must be directed away from any adjacent equipment to control and prevent ionized gases from damaging other equipment in the unlikely event of arrester failure.

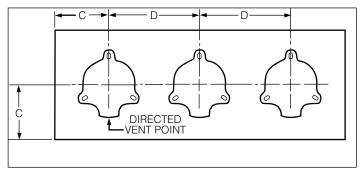


Figure 4.
Three-phase in-line mounting.

Note: Refer to Table 5 for dimensions C and D.

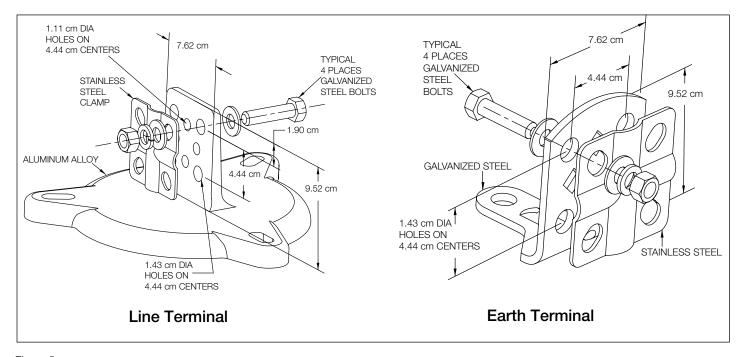


Figure 5.
Line and earth terminals (suitable for copper or aluminum conductors up to 335 mm2 (up to a maximum diameter of 20 mm)).

Table 5. Catalog Numbers and Dimensional Information (See Figures 4 & 8)

| U _r Arrester Rating (kV, rms) | U _C Arrester COV (kV, rms) | Catalog Number | Dim. A (mm) | Figure 6 View Number | Dim. C Minimum Phase-to-Earth* Clearance (mm) | Dim. D Minimum Phase-to-Phase* Clearance (mm) | Housing Leakage Distance (mm) | Arrester Mass (kg) |
|---|--|----------------------------------|----------------|----------------------------|--|--|--|--------------------------|
| 3 | 2.55 | AZG3001G002003 | 471 | 1 | 163 | 308 | 234 | 19 |
| 6 | 5.10 | AZG3001G005006 | 471 | 1 | 166 | 310 | 234 | 19 |
| 9 | 7.65 | AZG3001G007009 | 471 | 1 | 176 | 320 | 234 | 20 |
| 10 | 8.40 | AZG3002G008010 | 535 | 1 | 180 | 324 | 406 | 22 |
| 12 | 10.2 | AZG3002G010012 | 535 | 1 | 191 | 336 | 406 | 23 |
| 15 | 12.7 | AZG3002G012015 | 535 | 1 | 211 | 355 | 406 | 23 |
| 18 | 15.3 | AZG3003G015018 | 630 | 1 | 234 | 379 | 665 | 26 |
| 21 | 17.0 | AZG3003G017021 | 630 | 1 | 251 | 395 | 665 | 27 |
| 24 | 19.5 | AZG3003G019024 | 630 | 1 | 255 | 400 | 665 | 26 |
| 27 | 22.0 | AZG3004G022027 | 725 | 1 | 278 | 422 | 922 | 31 |
| 30 | 24.4 | AZG3004G024030 | 725 | 1 | 300 | 444 | 922 | 31 |
| 33 | 27.5 | AZG3004G027033 | 725 | 1 | 328 | 473 | 922 | 31 |
| 36 | 29.0 | AZG3004G029036 | 725 | 1 | 342 | 486 | 922 | 32 |
| 39 | 31.5 | AZG3005G031039 | 852 | 1 | 365 | 509 | 1267 | 37 |
| 42 | 34.0 | AZG3005G034042 | 852 | 1 | 378 | 522 | 1267 | 37 |
| 45 | 36.5 | AZG3005G036045 | 852 | 1 | 398 | 543 | 1267 | 37 |
| 48 | 39.0 | AZG3005G039048 | 852 | 1 | 421 | 566 | 1267 | 37 |
| 54 | 42.0 | AZG3006G042054 | 929 | 1 | 447 | 592 | 1646 | 41 |
| 60 | 48.0 | AZG3006G048060 | 929 | 1 | 499 | 644 | 1646 | 42 |
| 66 | 53.0 | AZG3007G053066 | 1002 | 1 | 543 | 687 | 1872 | 46 |
| 72 | 57.0 | AZG3007G057072 | 1002 | 1 | 580 | 725 | 1872 | 47 |
| 78 | 62.0 | AZG3008G062078 | 1219 | 1 | 624 | 768 | 2540 | 56 |
| 84 | 68.0 | AZG3008G068084 | 1219 | 1 | 676 | 821 | 2540 | 56 |
| 90 | 70.0 | AZG3008G070090 | 1219 | 1 | 693 | 838 | 2540 | 57 |
| 96 | 76.0 | AZG3008G076096 | 1219 | 1 | 745 | 890 | 2540 | 58 |
| 108 | 84.0 | AZG3009G084108 | 1436 | 1 | 818 | 962 | 3226 | 77 |
| 120 | 98.0 | AZG3009G098120 | 1436 | 1 | 940 | 1084 | 3226 | 79 |
| 132 | 106 | AZG3012G106132 | 1816 | 2 | 1009 | 1154 | 3518 | 88 |
| 138 | 111 | AZG3012G111138 | 1816 | 2 | 1055 | 1200 | 3518 | 89 |
| 144 | 115 | AZG3013G115144 | 1898 | 2 | 1093 | 1238 | 3744 | 93 |
| 162 | 130 | AZG3014G130162 | 2034 | 2 | 1220 | 1365 | 4186 | 100 |
| 168 | 131 | AZG3015G131168 | 2106 | 2 | 1232 | 1377 | 4412 | 104 |
| 172 | 140 | AZG3021G140172 | 2116 | 3 | 1496 | 1826 | 4412 | 107 |
| 180 | 144 | AZG3022G144180 | 2261 | 3 | 1531 | 1861 | 4872 | 122 |
| 192 | 152 | AZG3022G152192 | 2261 | 3 | 1603 | 1933 | 4872 | 123 |
| 198 | 160 | AZG3022G152132 AZG3023G160198 | 2333 | 3 | 1673 | 2003 | 5098 | 128 |
| 204 | 165 | AZG3023G100130 AZG3024G165204 | 2550 | 3 | 1716 | 2046 | 5766 | 137 |
| 216 | 174 | AZG3024G173204 AZG3024G174216 | 2550 | 3 | 1710 | 2128 | 5766 | 138 |
| 228 | 182 | AZG3024G174Z16 AZG3025G182228 | 2768 | 3 | 1867 | 2128 | 6452 | 157 |
| 240 | 190 | AZG3025G182228 AZG3025G190240 | 2768 | 3 | 1936 | 2266 | 6452 | 157 |
| 258 | 209 | | 3148 | 4 | 2313 | 2847 | 6744 | 172 |
| 264 | | AZG3027G209258 | | | | | | |
| | 212 | AZG3027G212264 | 3148 | 4 | 2339 | 2873 | 7412 | 173 |
| 276 | 220 | AZG3029G220276 | 3366 | 4 | 2406 | 2939 | 7412 | 182 |
| 288 | 230 | AZG3029G230288 | 3366 | 4 | 2499 | 3032 | 7412 | 183 |
| 294 | 235 | AZG3030G235294 | 3438 | 4 | 2542 | 3075 | 7638 | 191 |
| 300 | 239 | AZG3030G239300 | 3438 | 4 | 2577 | 3110 | 7638 | 192 |
| 312 | 245 | AZG3031G245312 | 3583 | 4 | 2629 | 3162 | 8098 | 207 |

Catalog Data CA235031EN Effective November 2016

VariSTARType AZG3 Surge Arresters for Systems through 345 kV IEC 10-kA; Line Discharge Class 3

Table 5 Notes:

- 1. All arresters are available in grey (standard) or brown porcelain glaze. For brown glaze substitute "B" for "G" in the eighth position of the catalog number.
- 2. Cantilever strength for all ratings is 10,200 NM. Maximum working load should not exceed 40% of this value.
- 3. Refer to Figure 4 for Illustration of Dimensions C and D and Figure 8 for Dimension A.
- * Phase-to-phase clearances are expressed as minimum arrester center-to-center distances. Phase-to-earth clearances are expressed as minimum arrester centerline-to-earth

Figure 6. Base mounting

Note: To develop rated cantilever strength use 254 mm bolt circle mounting diameter and hardened bolts.

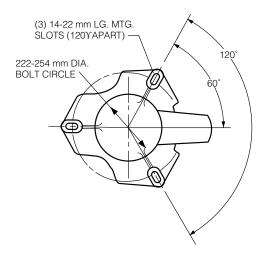


Figure 7. Arrester Nameplate.

Note: Refer to Figure 2.

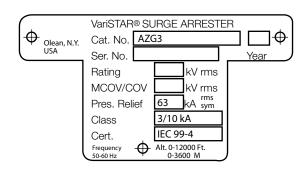
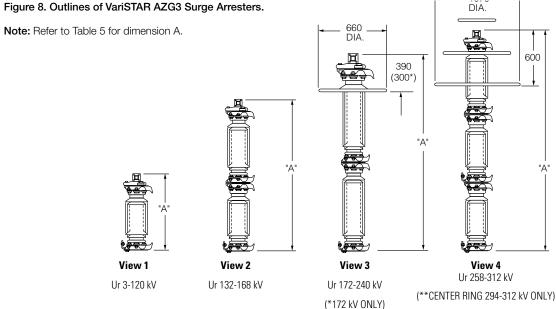


Figure 8. Outlines of VariSTAR AZG3 Surge Arresters.



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