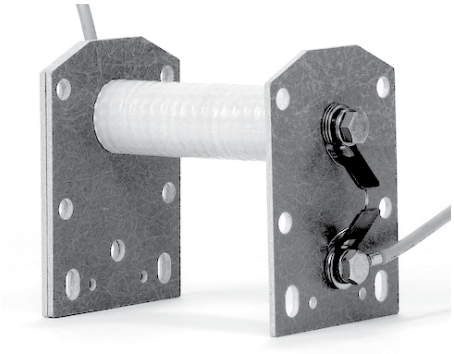
Surge Arresters
Catalog Data
CA235023EN

Effective August 2015
Supersedes TD235010EN September 2014

COOPER POWER SERIES

VariSTAR® composite light-duty under-oil (CLU) MOV arrester



General

Eaton's Cooper Power™ series VariSTAR® composite light-duty under-oil (CLU) MOV arrester is designed in accordance with IEEE Std C62.11™-1999 standard light-duty distribution-class requirements. It is designed for either horizontal or vertical mounting inside the distribution transformer tank to eliminate the difficulties associated with externally mounted arresters.

Construction

The unique construction of the CLU arrester begins with world class glass-collared Metal Oxide Varistor (MOV) disks produced at our dedicated manufacturing facility in Olean, New York. By manufacturing our own disks we maintain strict quality control over the entire production process; from initial raw material inspections to final physical and electrical testing of each disk. In addition, by controlling the manufacturing process of both disks and arresters, we achieve the optimal combination of quality and performance. Eaton produces its Cooper Power series MOV disks of unsurpassed quality through continuous improvements in disk formulation and manufacturing technology. The end result is a long history of in-service reliability with outstanding durability and protective capability.

Arrester production begins by stacking glass-collared MOV disks in series with aluminum end electrodes. Our proprietary manufacturing process wraps the assembly with a high-strength woven fiberglass-reinforced epoxy composite that seals the MOVs from the transformer fluids. When cured the arrester module withstands the high temperature conditions of being submersed in an oil environment. The addition of an industry unique isolation link to the composite wrapped MOV module creates the only under-oil arrester with a non-fragmenting failure mode. This design feature has excellent over-voltage protection while allowing transformer designers to provide less tank clearance for the arrester because they do not have to allow space for MOV ejection out of the arrester body at the end of the arrester life.

Features

- The CLU arrester design features a fail open or fail short option. The fail open version utilizes an isolation link as illustrated in Figure 1 on page two. Since the isolation link is external of the arrester components, no components will be expelled into the transformer tank upon operation. The time-current characteristic curve is illustrated in Figure 3. The fail short version does not include the isolation link and will remain intact upon operation.
- Rigid mounting plates for a stronger mounting configuration.
- The CLU arrester is compatible with mineral oil and Envirotemp™ FR3™ fluid.
- The fiberglass-reinforced epoxy composite acts as a seal against all fluids; protecting the active components within the module.

Powering Business Worldwide

Production tests

A complete production test program ensures a quality product. Each VariSTAR metal oxide varistor receives a series of 100% electrical tests. Quality is further ensured by a series of destructive tests performed on every batch of varistors. Listed are the tests that are performed on the varistors:

- 100% Physical Inspection
- 100% Discharge Voltage Test
- 100% V1mA/cm^2
- 100% Leakage Current at 80% of V1mA/cm^2 Voltage
- Batch High-current Short Duration Test
- Batch Thermal Stability Test

Each VariSTAR CLU arrester must pass the following production tests:

- 100% Physical Inspection
- 100% Leakage Current Test
- 100% RIV Test
- 100% Power Loss Test at 1.05 times MCOV

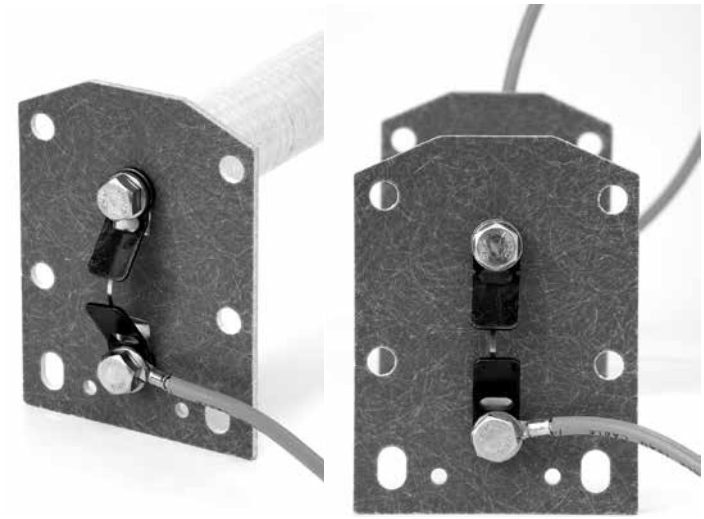


Figure 1. Detail photographs of isolation link assembly.

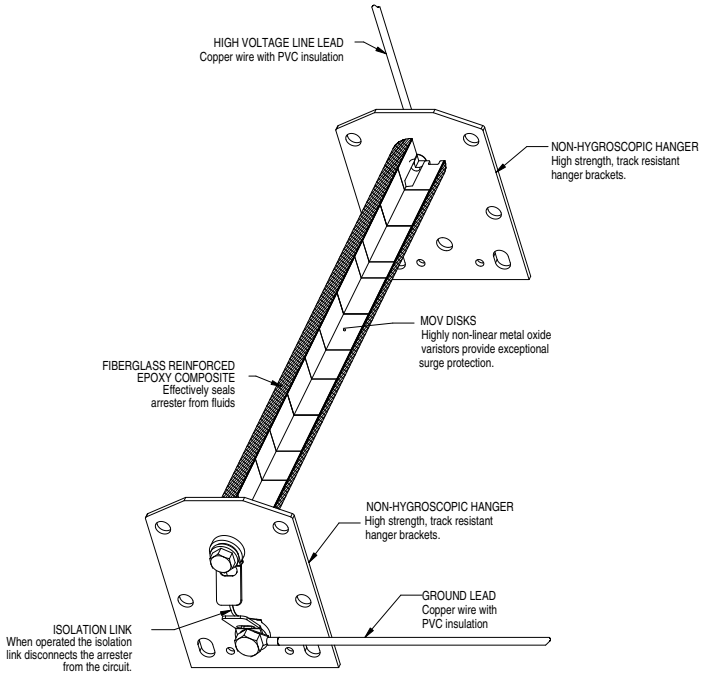


Figure 2. Cutaway of CLU arrester.

Table 1. Protective Characteristics

Duty Cycle Voltage Rating (kV)	MCOV (kV)	Front-of-Wave Protective Level (kV, crest)	Maximum Discharge Voltage (kV, peak) 8/20 µs Current Wave						Switching Surge (kV, peak) 30/60 µs Current Wave	
			1.5 kA	3 kA	5kA	10kA	20kA	40kA	125A	500A
3	2.55	10.5	8.6	9.2	9.9	10.8	12.4	14.4	7.5	8.1
6	5.1	20.9	17.1	18.5	19.8	21.6	24.7	28.7	15	16.2
9	7.65	31.5	25.8	27.8	29.8	32.6	37.2	43.2	22.6	24.3
10	8.4	33.4	27.4	29.5	31.6	34.5	39.4	45.9	24	25.8
12	10.2	42	34.4	37	39.7	43.4	49.5	57.6	30.1	32.4
15	12.7	50.8	41.6	44.8	48	52.5	59.9	69.6	36.4	39.2
18	15.3	63.1	51.6	55.6	59.6	65.1	74.4	86.5	45.2	48.7
21	17	66.9	54.7	59	63.2	69.1	78.9	91.7	48	51.6
24	19.5	77.3	63.3	68.2	73.1	79.9	91.2	106	55.5	59.7
27	22	89.8	73.5	79.2	84.9	92.8	106	123	64.4	69.4
30	24.4	97.8	80	86.2	92.4	101	115	134	70.1	75.5
33	27	111	90.9	98	105	115	131	152	79.7	85.8
36	29	117	96.1	104	111	121	139	161	84.2	90.7

General application recommendations

The rating of an arrester is the power frequency line-to-ground voltage at which the arrester is designed to pass an operating duty-cycle test. Table 3 provides a general application guide for the selection of the proper arrester rating for a given system voltage and system grounding configuration.

Eaton application engineers are available to make application recommendations. The following information is normally required:

1. System maximum operating voltage.
2. System grounding conditions.
   A. For four-wire circuits, grounding conditions depend upon whether the system is multi-grounded, has a 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 transformers, or ungrounded.

Where unusual conditions exist (high ground resistance, high capacitive load, arc-welding equipment, etc.) the following supplementary information is necessary:

1. The unusual condition.
2. Type of construction, phase spacing, length of line, conductor size.
3. BIL of equipment and line insulation.
4. Phase-sequence components of impedances on the load side of the distribution substation.

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

Table 2. Performance Test Characteristics

Description	Characteristics
Duty Cycle	20 current surges of 5 kA crest 8/20 µs waveshape followed by 2 current surges of 5 kA crest 8/20 µs waveshape
High Current, Short Duration Discharge	2 current surges of 40 kA crest 4/10 µs waveshape
Low Current,Long Duration Discharge	20 current surges of 75 A crest 2000 µs rectangular wave duration

Table 3. Commonly Applied Voltage Rating of the CLU Arrester

System Voltage (kV rms)		Recommended Arrester Rating (kV rms)		
Nominal	Maximum	Four-Wire Wye; Multi Grounded Neutral	Three-Wire Wye; Solidly Grounded Neutral	Delta and Ungrounded Wye
2.4	2.54	–	–	3
4.16Y/2.4	4.4Y/2.54	3	6	6
4.16	4.4	–	–	6
4.8	5.08	–	–	6
6.9	7.26	–	–	9
8.32Y/4.8	8.8Y/5.08	6	9	–
12.0Y/6.93	12.7Y/7.33	9	12	–
12.47Y/7.2	13.2Y/7.62	9	15	–
13.2Y/7.62	13.97Y/8.07	10	15	–
13.8Y/7.97	14.52Y/8.38	10	15	–
13.8	14.52	–	–	18
20.78Y/12.0	22Y/12.7	15	21	–
22.86Y/13.2	24.2Y/13.87	18	24	–
23	24.34	–	–	27
24.94Y/14.4	26.4Y/15.24	18	27	–
27.6Y/15.93	29.3Y/16.89	21	–	–
34.5Y/19.92	36.5Y/21.08	27	–	–

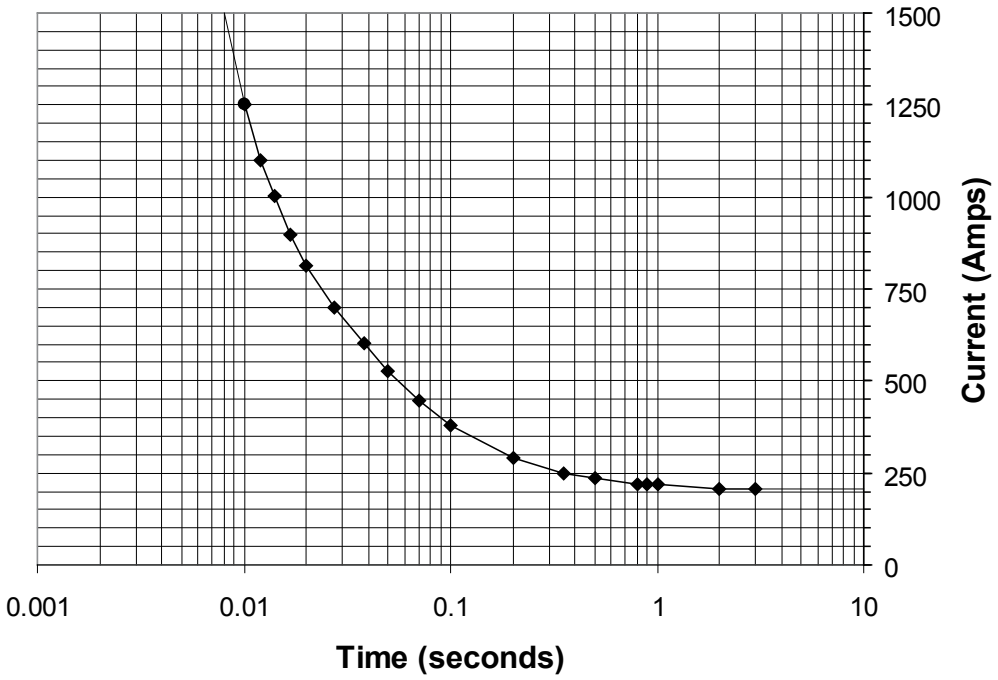


Figure 3. Time current characteristic curve of isolation link.

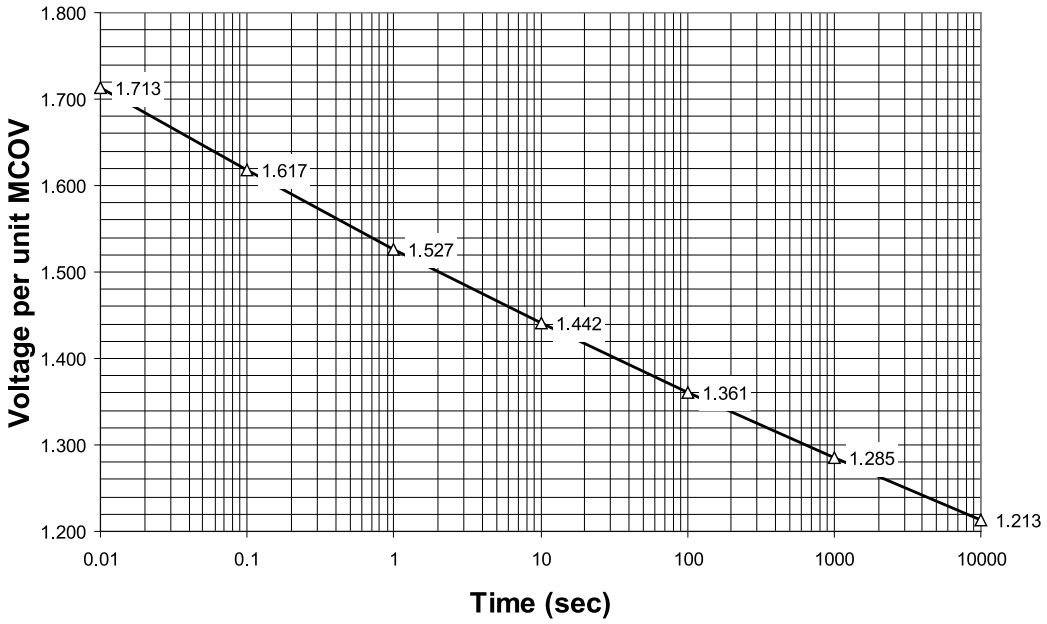


Figure 4. Temporary overvoltage curve of CLU arrester family.

Temporary overvoltage (TOV) capability

The Temporary overvoltage (TOV) capability of the VariSTAR CLU arrester is shown in Figure 4.

Ordering information

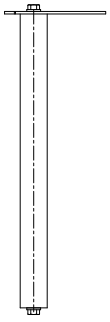
To order a VariSTAR Type CLU arrester, please specify the intended base unit and terminal option, and determine the arrester rating for the intended application using Table 3. Contact your Eaton representative for applications not listed.

For further information, please reference *Report Summary CP0605, VariSTAR CLU Arrester Certified Test Report* and *Service Information S235-95-1, VariSTAR CLU Arrester Installation Instructions*.

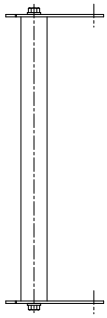
Catalog number digits
Digits 1, 2, 3: Composite Light Duty Under-Oil

C	L	U					
1	2	3	4	5	6	7	8

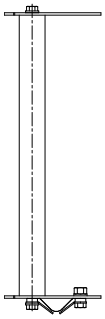
Digits 4, 5: Base Unit



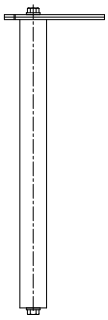
10.
One mounting bracket on top



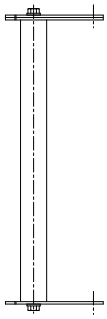
11.
One mounting bracket on top;
One mounting bracket on bottom



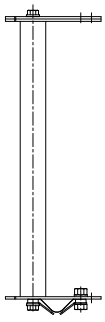
13.
One mounting bracket on top;
One mounting bracket on bottom;
Isolation link



20.
Two mounting brackets on top

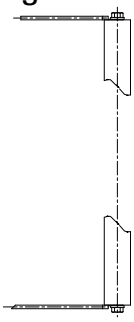


21.
Two mounting brackets on top;
One mounting bracket on bottom

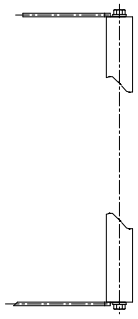


23.
Two mounting brackets on top;
One mounting bracket on bottom;
Isolation link

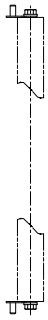
Digit 6: Terminal Option



A.
Line and Ground Terminals are #10 AWG Copper Wire, Durometer A85, Orange Insulation, w/Ring Terminal



B.
Line Terminal is #10 AWG Copper Wire, Ground Terminal is #4 AWG Copper Wire Line and Ground Terminals are Durometer A85, Orange Insulation, w/Ring Terminal



C.
¼-20 Terminal Studs (Both Ends)

Digits 7, 8: Arrester Rating (03-36)

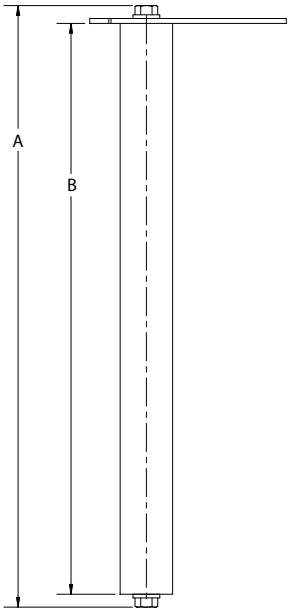


Figure 5. CLU10A and CLU10B arrester.

Table 4. CLU10A and CLU10B Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	3.96 (100.58)	3.11 (78.99)
6	4.87 (123.70)	4.02 (102.11)
9	5.78 (146.81)	4.93 (125.22)
10	5.78 (146.81)	4.93 (125.22)
12	6.69 (169.93)	5.84 (148.34)
15	7.14 (181.36)	6.29 (159.77)
18	8.51 (216.15)	7.66 (194.56)
21	8.51 (216.15)	7.66 (194.56)
24	9.42 (239.27)	8.57 (217.68)
27	10.78 (273.81)	9.93 (252.22)
30	11.24 (285.50)	10.39 (263.91)
33	12.60 (320.04)	11.75 (298.45)
36	12.60 (320.04)	11.75 (298.45)

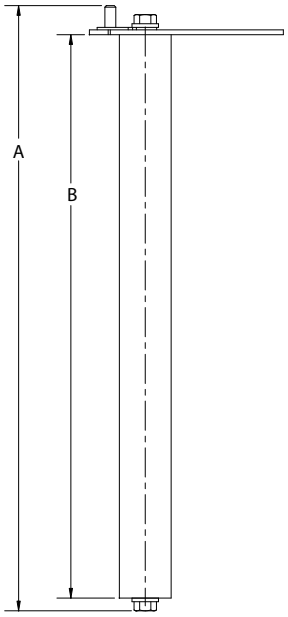


Figure 6. CLU10C arrester.

Table 5. CLU10C Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.49 (114.05)	3.11 (78.99)
6	5.40 (137.16)	4.02 (102.11)
9	6.31 (160.27)	4.93 (125.22)
10	6.31 (160.27)	4.93 (125.22)
12	7.22 (183.39)	5.84 (148.34)
15	7.67 (194.82)	6.29 (159.77)
18	9.04 (229.62)	7.66 (194.56)
21	9.04 (229.62)	7.66 (194.56)
24	9.95 (252.53)	8.57 (217.68)
27	11.31 (287.27)	9.93 (252.22)
30	11.77 (298.96)	10.39 (263.91)
33	13.13 (333.50)	11.75 (298.45)
36	13.13 (333.50)	11.75 (298.45)

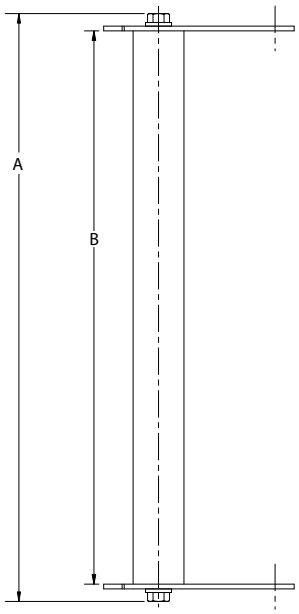


Figure 7. CLU11A and CLU11B arrester.

Table 6. CLU11A and CLU11B Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.09 (103.89)	3.11 (78.99)
6	5.00 (127.00)	4.02 (102.11)
9	5.91 (150.11)	4.93 (125.22)
10	5.91 (150.11)	4.93 (125.22)
12	6.82 (173.23)	5.84 (148.34)
15	7.27 (184.66)	6.29 (159.77)
18	8.64 (219.46)	7.66 (194.56)
21	8.64 (219.46)	7.66 (194.56)
24	9.55 (242.57)	8.57 (217.68)
27	10.91 (277.11)	9.93 (252.22)
30	11.37 (288.80)	10.39 (263.91)
33	12.73 (323.34)	11.75 (298.45)
36	12.73 (323.34)	11.75 (298.45)

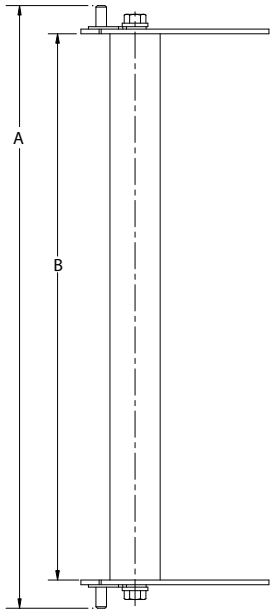


Figure 8. CLU11C arrester.

Table 7. CLU11C Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.62 (117.35)	3.11 (78.99)
6	5.53 (140.46)	4.02 (102.11)
9	6.44 (163.58)	4.93 (125.22)
10	6.44 (163.58)	4.93 (125.22)
12	7.35 (186.69)	5.84 (148.34)
15	7.80 (198.12)	6.29 (159.77)
18	9.17 (232.92)	7.66 (194.56)
21	9.17 (232.92)	7.66 (194.56)
24	10.08 (256.03)	8.57 (217.68)
27	11.44 (290.58)	9.93 (252.22)
30	11.90 (302.26)	10.39 (263.91)
33	13.26 (336.80)	11.75 (298.45)
36	13.26 (336.80)	11.75 (298.45)

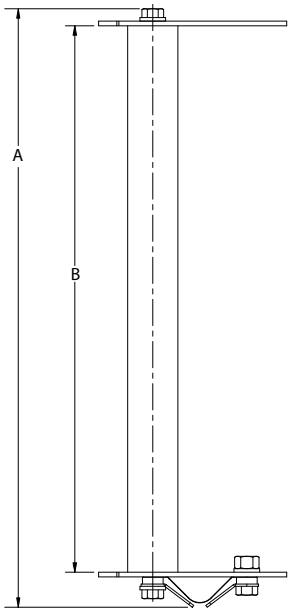


Figure 9. CLU13A and CLU13B arrester.

Table 8. CLU13A and CLU13B Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.53 (115.06)	3.11 (78.99)
6	5.44 (138.18)	4.02 (102.11)
9	6.35 (161.29)	4.93 (125.22)
10	6.35 (161.29)	4.93 (125.22)
12	7.26 (184.40)	5.84 (148.34)
15	7.71 (195.83)	6.29 (159.77)
18	9.08 (230.63)	7.66 (194.56)
21	9.08 (230.63)	7.66 (194.56)
24	9.99 (253.75)	8.57 (217.68)
27	11.35 (288.29)	9.93 (252.22)
30	11.81 (299.97)	10.39 (263.91)
33	13.17 (334.52)	11.75 (298.45)
36	13.17 (334.52)	11.75 (298.45)

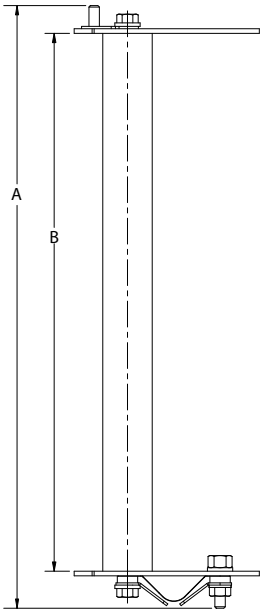


Figure 10. CLU13C arrester.

Table 9. CLU13C Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.62 (117.35)	3.11 (78.99)
6	5.53 (140.46)	4.02 (102.11)
9	6.44 (163.58)	4.93 (125.22)
10	6.44 (163.58)	4.93 (125.22)
12	7.35 (186.69)	5.84 (148.34)
15	7.80 (198.12)	6.29 (159.77)
18	9.17 (232.92)	7.66 (194.56)
21	9.17 (232.92)	7.66 (194.56)
24	10.08 (256.03)	8.57 (217.68)
27	11.44 (290.58)	9.93 (252.22)
30	11.90 (302.26)	10.39 (263.91)
33	13.26 (336.80)	11.75 (298.45)
36	13.26 (336.80)	11.75 (298.45)

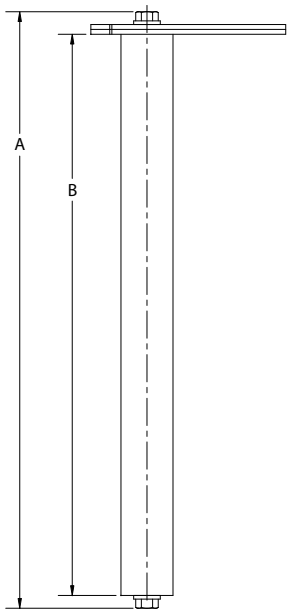


Figure 11. CLU20A and CLU20B arrester.

Table 10. CLU20A and CLU20B Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.09 (103.89)	3.11 (78.99)
6	5.00 (127.00)	4.02 (102.11)
9	5.91 (150.11)	4.93 (125.22)
10	5.91 (150.11)	4.93 (125.22)
12	6.82 (173.23)	5.84 (148.34)
15	7.27 (184.66)	6.29 (159.77)
18	8.64 (219.46)	7.66 (194.56)
21	8.64 (219.46)	7.66 (194.56)
24	9.55 (242.57)	8.57 (217.68)
27	10.91 (277.11)	9.93 (252.22)
30	11.37 (288.80)	10.39 (263.91)
33	12.73 (323.34)	11.75 (298.45)
36	12.73 (323.34)	11.75 (298.45)

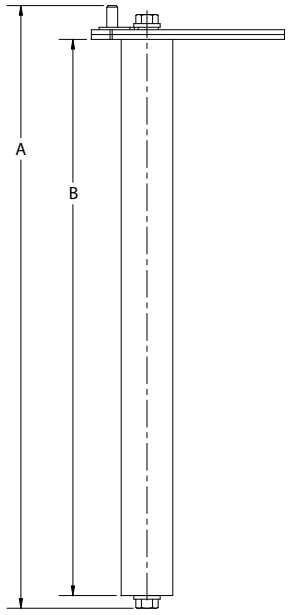


Figure 12. CLU20C arrester.

Table 11. CLU20C Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.62 (117.35)	3.11 (78.99)
6	5.53 (140.46)	4.02 (102.11)
9	6.44 (163.58)	4.93 (125.22)
10	6.44 (163.58)	4.93 (125.22)
12	7.35 (186.69)	5.84 (148.34)
15	7.80 (198.12)	6.29 (159.77)
18	9.17 (232.92)	7.66 (194.56)
21	9.17 (232.92)	7.66 (194.56)
24	10.08 (256.03)	8.57 (217.68)
27	11.44 (290.58)	9.93 (252.22)
30	11.90 (302.26)	10.39 (263.91)
33	13.26 (336.80)	11.75 (298.45)
36	13.26 (336.80)	11.75 (298.45)

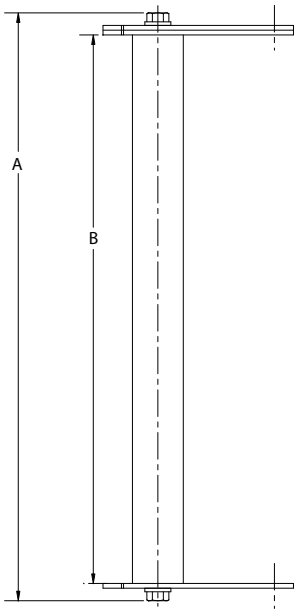


Figure 13. CLU21A and CLU21B arrester

Table 12. CLU21A and CLU21B Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.22 (107.19)	3.11 (78.99)
6	5.13 (130.30)	4.02 (102.11)
9	6.04 (153.42)	4.93 (125.22)
10	6.04 (153.42)	4.93 (125.22)
12	6.95 (176.53)	5.84 (148.34)
15	7.40 (187.96)	6.29 (159.77)
18	8.77 (222.76)	7.66 (194.56)
21	8.77 (222.76)	7.66 (194.56)
24	9.68 (245.87)	8.57 (217.68)
27	11.04 (280.42)	9.93 (252.22)
30	11.50 (262.10)	10.39 (263.91)
33	12.86 (326.64)	11.75 (298.45)
36	12.86 (326.64)	11.75 (298.45)

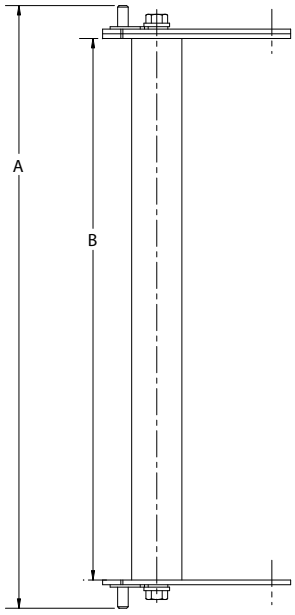


Figure 14. CLU21C arrester.

Table 13. CLU21C Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.75 (120.65)	3.11 (78.99)
6	5.66 (143.76)	4.02 (102.11)
9	6.57 (166.88)	4.93 (125.22)
10	6.57 (166.88)	4.93 (125.22)
12	7.48 (189.99)	5.84 (148.34)
15	7.93 (201.42)	6.29 (159.77)
18	9.30 (236.22)	7.66 (194.56)
21	9.30 (236.22)	7.66 (194.56)
24	10.21 (259.33)	8.57 (217.68)
27	11.57 (293.88)	9.93 (252.22)
30	12.03 (305.56)	10.39 (263.91)
33	13.39 (340.11)	11.75 (298.45)
36	13.39 (340.11)	11.75 (298.45)

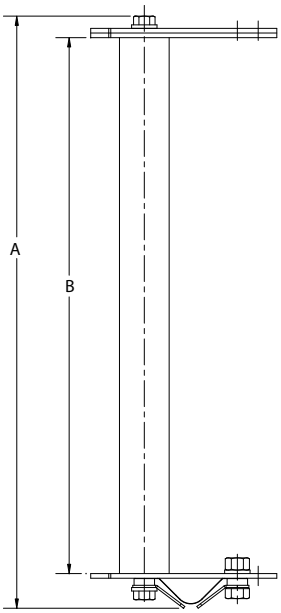


Figure 15. CLU23A and CLU23B arrester.

Table 14. CLU23A and CLU23B Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	4.66 (118.36)	3.11 (78.99)
6	5.57 (141.48)	4.02 (102.11)
9	6.48 (164.59)	4.93 (125.22)
10	6.48 (164.59)	4.93 (125.22)
12	7.39 (187.71)	5.84 (148.34)
15	7.84 (199.14)	6.29 (159.77)
18	9.21 (233.93)	7.66 (194.56)
21	9.21 (233.93)	7.66 (194.56)
24	10.12 (257.05)	8.57 (217.68)
27	11.48 (291.59)	9.93 (252.22)
30	11.94 (303.28)	10.39 (263.91)
33	13.30 (337.82)	11.75 (298.45)
36	13.30 (337.82)	11.75 (298.45)

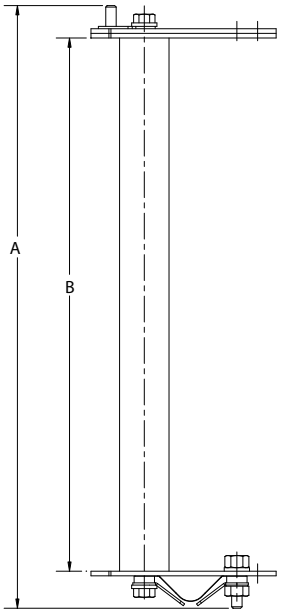


Figure 16. CLU23C arrester

Table 15. CLU23C Dimensions

Arrester Rating (kV rms)	A in. (mm)	B in. (mm)
3	5.19 (131.83)	3.11 (78.99)
6	6.10 (154.94)	4.02 (102.11)
9	7.01 (178.05)	4.93 (125.22)
10	7.01 (178.05)	4.93 (125.22)
12	7.92 (201.17)	5.84 (148.34)
15	8.37 (212.60)	6.29 (159.77)
18	9.74 (247.40)	7.66 (194.56)
21	9.74 (247.40)	7.66 (194.56)
24	10.65 (270.51)	8.57 (217.68)
27	12.01 (305.05)	9.93 (252.22)
30	12.47 (316.74)	10.39 (263.91)
33	13.83 (351.28)	11.75 (298.45)
36	13.83 (351.28)	11.75 (298.45)

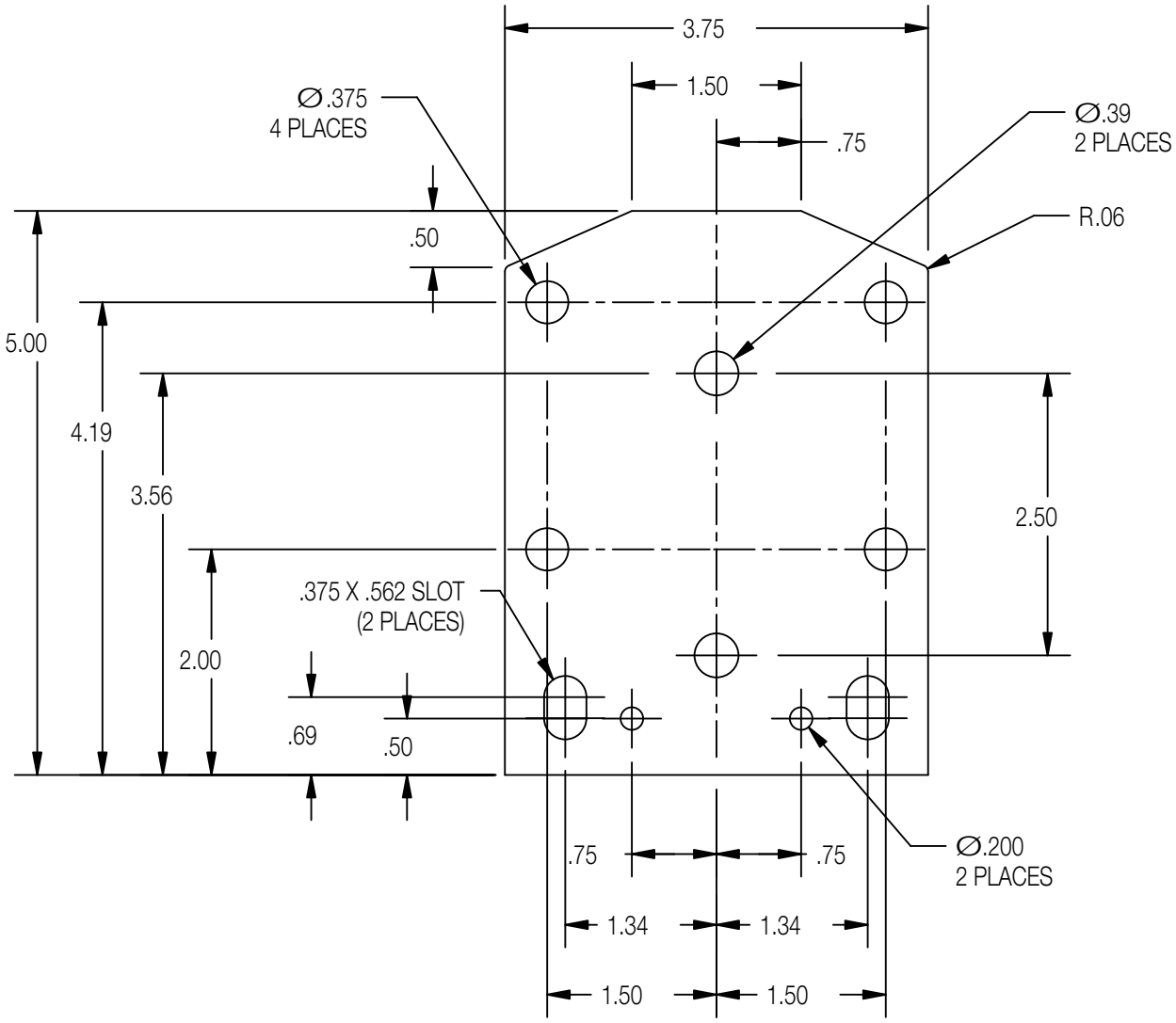


Figure 17. Mounting bracket dimensions.

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