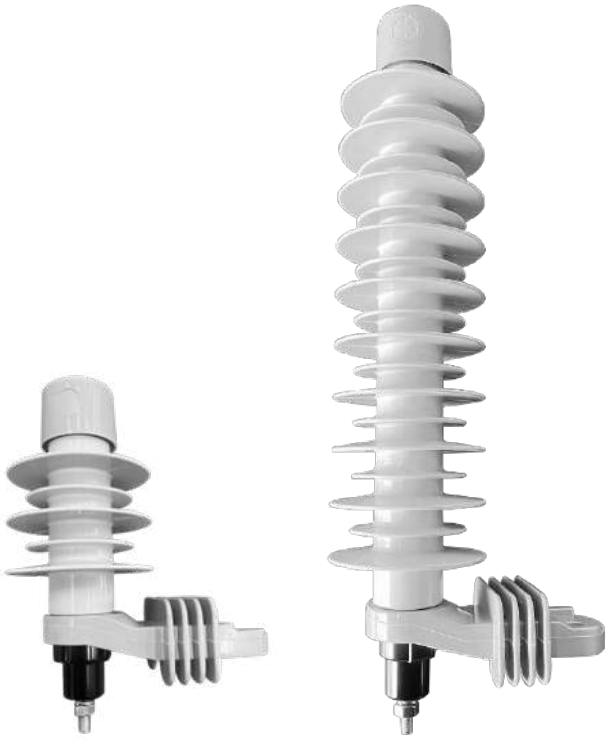
MHD: Molded polymer-housed IEC distribution class DH surge arrester for MV Systems to 48 KV



General

Eaton's Molded Polymer-housed series MHD distribution class DH surge arrester for systems up to 48 kV meet or exceed the requirements of IEC 60099-4.

Table 1. MHD arrester ratings and characteristics

Arrester characteristic	Ratings
Voltage ratings: U_r (kV)	3–48
Continuous operating voltages: U_c (kV)	2.55–39
Arrester IEC 60099-4 classification	DH
Nominal discharge current: I_n (kA)	10
Repetitive charge transfer rating: Q_{rs} (C)	0.4
Thermal charge transfer rating: Q_{th} (C)	1.1
High current impulses (peak current 4/10 µs kA)	100
Rated short-circuit current: I_s (kA)	20
System frequency (Hz)	50/60

Construction

Eaton's MHD arresters begin with MOVs that must pass a series of physical and electrical tests designed to ensure that only disks meeting the required standards are used.

The MOV disks are combined with aluminum end electrodes, then wrapped with a composite weave to form the MOV disk module. The silicone rubber polymer housing is then molded onto the module to create the external moisture barrier.

Following assembly, each arrester is subjected to a series of electrical tests to ensure quality and performance.

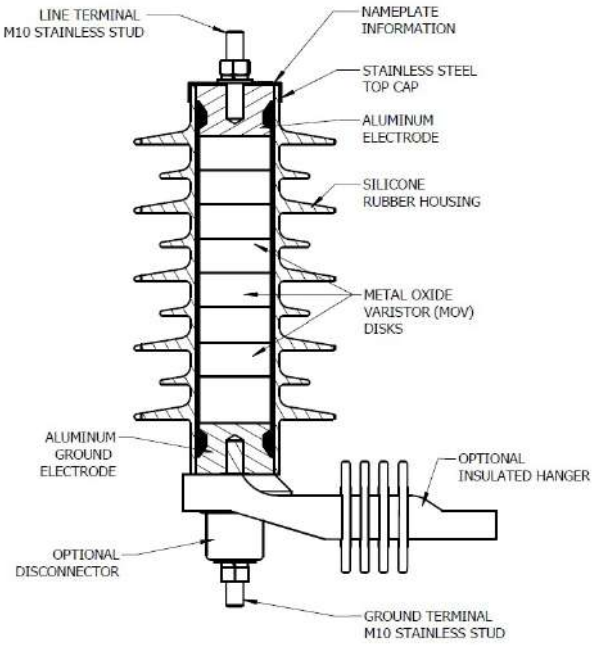


Figure 1. Cutaway illustration of a molded polymer-housed surge arrester

Features and detailed description

An optional insulated mounting hanger is available to allow connecting to a wide variety of brackets, and has been designed to provide the needed mechanical strength for standard loading conditions.

A ground lead disconnector is available for use on systems having 20 A or more of available fault current If an end-of-life event where to occur, the disconnector will separate, preventing a permanent line-to-ground short across the arrester. A disconnector that has operated also provides a visual indication of an arrester that had an end-of-life event and requires replacement. **Figure 2** shows the disconnector operating characteristics.

Line terminal wildlife guards are available to provide additional protection from wildlife-related outages caused by birds or other animals inadvertently bridging the voltage potential across the arrester. See **Figure 11** for additional details.

A variety of line terminal and ground terminal hardware and wiring options are available through the catalog configurator, see **Table 8**.

Seven different optional high creepage housings are available for MHD surge arrester, see **Table 8 Digits 6&7**.

Operation

The operation of the MHD surge arrester is typical of gapless metal oxide arresters. During steady- state conditions, line-to-ground voltage is continuously across the arrester terminals. When overvoltages occur, the surge arrester immediately limits the overvoltage to the required protective level by conducting only the necessary level of surge current to earth. Upon passage of the overvoltage condition, the surge arrester returns to its initial condition once again, conducting only minimal leakage current.

Design testing

The housing material, internals, and hardware work together as a system and must stand up to exposure to environmental conditions.

The components and the assembled arresters meet the relevant IEC 60099-4 requirements as certified by an independent laboratory.

Routine tests

A complete automated production test program ensures a quality product. Each MOV receives a series of electrical tests. Quality is further demonstrated by tests performed to destruction on samples from every lot of varistors.

Listed are the varistor tests performed in accordance with IEC 60099-4:

- Physical inspection
- Discharge voltage
- Reference voltage
- Leakage current
- Single-impulse charge transfer
- Batch high-current, short-duration
- Batch thermal stability
- Batch aging

Each fully assembled MHD arrester must pass the following production tests:

- Physical inspection
- Leakage current
- Partial discharge

General application recommendations

The rating of an arrester is the maximum power frequency line-to- ground voltage at which the arrester is designed to pass the IEC operating duty test. **Table 2** provides a general application guide for the selection of the proper arrester rating for a given system voltage and system grounding configuration.

Gapless surge arresters must be selected with sufficient steady- state self impedance to withstand the application of line-to-earth power frequency voltages under all system conditions of operation.

Consult with your Eaton representative to have your individual system application needs reviewed.

Table 2. Commonly applied voltage ratings (Ur)

System voltage (kV rms)		Arrester rating—Ur (kV rms)		
Nominal	**Maximum**	**Four-wire star multi-grounded neutral**	**Three-wire star solidly grounded neutral at source**	**Delta, ungrounded, and resonant impedance grounded star**
3.3	3.7	3	6	6
6.6	7.3	6	9	9
10.0	11.5	9	12	12-15
11.0	12.0	9-10	12	12-15
16.4	18.0	15	-	18-21
22.0	24.0	18-21	24	24-27
33.0	36.3	27-30	36	36-36
35	38.5	39-42	42-45	48

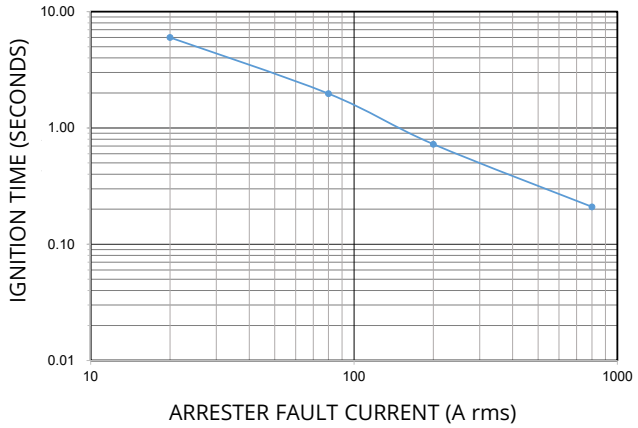


Figure 2. MHD disconnector operating characteristics

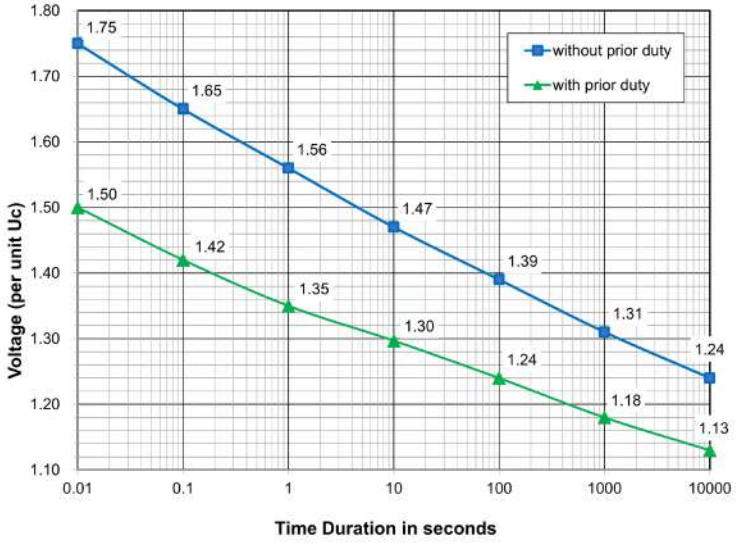


Figure 3. Temporary overvoltage capability

Table 3. Protective characteristics—MHD, I_n = 10 kA, Class DH IEC 60099-4

			Lightning impulse residual voltage (kV crest) 8/20 µs current wave						30/60 switching surge	
Ur arrester rating (kV rms)	U_c MCOV (kV rms)	Steep current residual voltage (kV peak)	1.5 kA	3 kA	5 kA	10 kA	20 kA	40 kA	125A	500 A
3	2.55	10.5	8.0	8.3	8.5	9.0	10.0	12.0	7.1	7.5
6	5.1	21.0	16.0	16.6	17.0	18.0	20.0	24.0	14.1	15.0
9	7.65	31.5	24.0	24.9	25.5	27.0	30.0	36.0	21.3	22.5
10	8.4	34.4	26.0	27.7	28.3	30.0	33.3	39.4	22.6	24.1
12	10.2	42.0	32.0	33.2	34.0	36.0	40.0	48.0	28.3	30.0
15	12.7	52.2	39.6	41.5	42.5	45.0	50.0	59.8	34.3	36.6
18	15.3	63.0	48.0	49.8	51.0	54.0	60.0	72.0	42.6	45.0
21	17	68.8	52.5	56.0	58.0	63.0	70.0	78.7	45.1	48.2
24	19.5	79.5	60.2	64.1	67.0	72.0	80.0	91.1	52.2	55.8
27	22	92.4	70.0	74.7	76.5	81.0	90.0	106.0	60.6	64.8
30	24.4	100.5	76.1	81.0	84.7	90.0	100.0	115.0	66.0	70.5
33	27	114.2	86.5	91.3	93.5	99.0	110.0	131.0	75.0	80.1
36	29	120.8	91.5	97.3	102.0	108.0	120.0	138.0	79.3	84.7
39	31.5	133.0	98.9	105.0	110.0	117.0	130.0	149.0	85.7	91.6
42	34	144.0	107.0	114.0	116.0	123.0	140.0	162.0	92.8	99.2
45	36.5	155.0	115.0	123.0	128.0	133.0	146.0	174.0	100.0	107.0
48	39	166.0	124.0	132.0	133.0	138.0	152.0	187.0	107.0	114.0

Insulation withstand characteristics

The insulation characteristics of arrester family are shown in **Table 4.**

Table 4. Housing insulation withstand voltages, U_r 3–48 kV, I_n = 10 kA Class DH

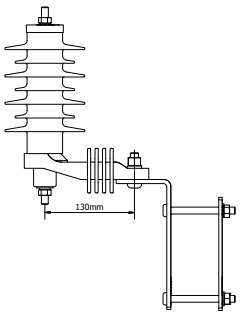
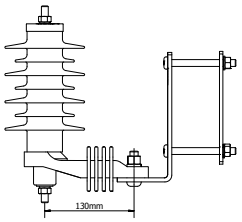
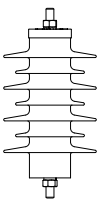
Arrester mounting configuration / Arrester housing designation (digits 6 & 7)	Leakage distance (mm)	Strike (mm)	 1.2/50 µs impulse (kV crest)	1 min. dry (kV rms)	1 min. wet (kV rms)	 1.2/50 µs impulse (kV crest)	1 min. dry (kV rms)	1 min. wet (kV rms	 1.2/50µs impulse (kV crest)	1 min. dry (kV rms)	1 min. wet (kV rms)
H1	375	152	82	51	42	82	51	42	82	51	42
H2	500	192	100	62	51	100	62	51	100	62	51
H3	625	232	125	89	74	125	89	74	125	89	74
H4	750	272	135	92	76	135	92	76	135	92	76
H5	875	312	140	109	90	140	109	90	140	109	90
H6	1000	352	177	130	108	177	130	108	177	130	108
H7	1250	432	245	152	128	245	152	128	245	152	128

Table 5. Insulation withstand characteristics of optional insulated mounting bracket

Insulated mounting bracket	Bracket mounting length center-to-center (mm)	Leakage distance (mm)	Strike (mm)	Power frequency voltage withstand (10 sec, wet, kV)	1.2/50 µs impulse (kV crest)
Standard for U_r = 3–48 kV	130	226	104	48	85

Dimensions and clearances

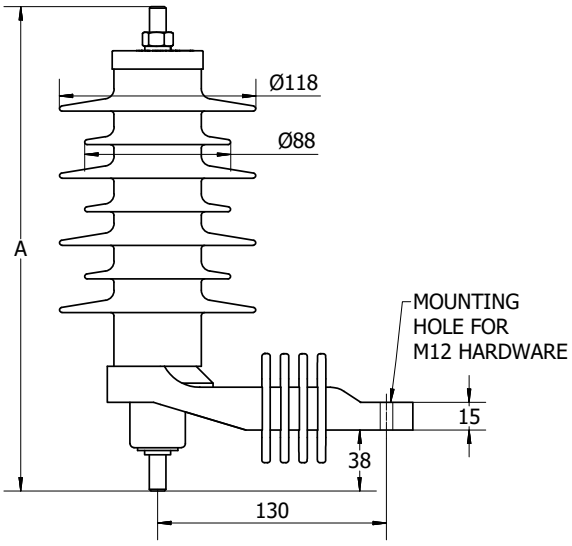


Figure 4. Polymer-housed surge arrester— with optional insulated mounting bracket and disconnector

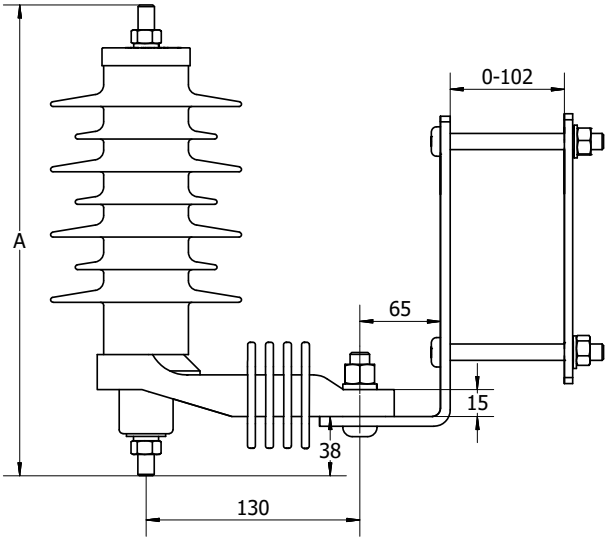


Figure 6. Polymer-housed surge arrester as in Figure 4 with NEMA cross-arm hanger, see Figure 8

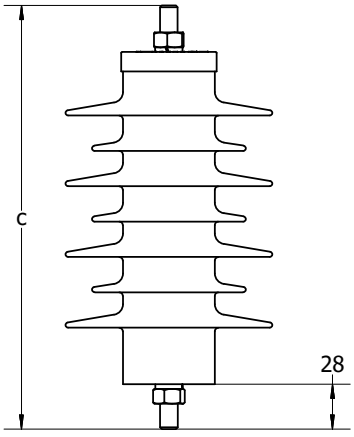


Figure 5. Polymer-housed surge arrester without disconnector, for base or cable riser mounting (arrester may be horizontal or vertical with either end at line potential)

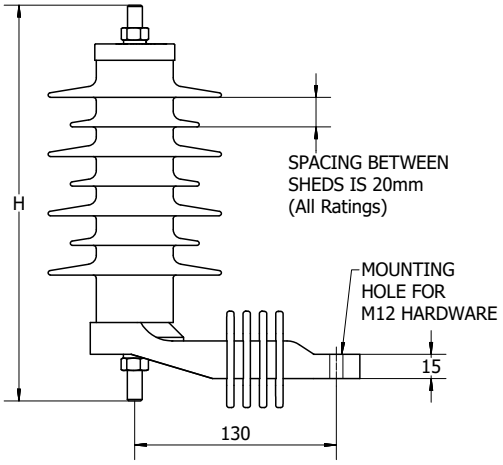


Figure 7. Polymer-housed surge arrester—with optional disconnector mounting bracket (no disconnector)

Table 6. Dimensional data

Arrester rating (kV rms)	Standard housing code (digits 6 and 7 Table 10)	Dimensions - Figure 4 - Figure 7 (mm)			Clearances ① minimum recommended (mm)	
		A	C	H	Phase-to- ground	Phase-to- phase
3	H1	265	215	215	76	108
6	H1	265	215	215	102	140
9	H2	305	255	255	133	178
10	H2	305	255	255	133	178
12	H2	305	255	255	152	197
15	H3	345	295	295	171	222
18	H3	345	295	295	235	286
21	H5	425	375	375	235	286
24	H5	425	375	375	273	337
27	H6	465	415	415	273	337
30	H6	465	415	415	273	337
33	H7	545	495	495	324	413
36	H7	545	495	495	324	413
39	H7	545	495	495	324	413
42	H7	545	495	495	324	413
45	H7	545	495	495	324	413
48	H7	545	495	495	324	413

① All clearances are measured between center lines of arresters or from center line to earth.

Table 7. Catalog numbers—distribution-class surge arresters

Arrester rating	With isolator and insulated hanger (Figure 4)	Without isolator and insulated hanger (Figure 5)	With isolator, insulated hanger, and NEMA cross-arm bracket (Figure 6)	With insulated hanger without isolator (Figure 7)
3	MHD03H10ADA1AA3	MHD03H10AAD0AA3	MHD03H10ADA1BA3	MHD03H10AAA1AA3
6	MHD06H10ADA1AA3	MHD06H10AAD0AA3	MHD06H10ADA1BA3	MHD06H10AAA1AA3
9	MHD09H20ADA1AA3	MHD09H20AAD0AA3	MHD09H20ADA1BA3	MHD09H20AAA1AA3
10	MHD10H20ADA1AA3	MHD10H20AAD0AA3	MHD10H20ADA1BA3	MHD10H20AAA1AA3
12	MHD12H20ADA1AA3	MHD12H20AAD0AA3	MHD12H20ADA1BA3	MHD12H20AAA1AA3
15	MHD15H30ADA1AA3	MHD15H30AAD0AA3	MHD15H30ADA1BA3	MHD15H30AAA1AA3
18	MHD18H30ADA1AA3	MHD18H30AAD0AA3	MHD18H30ADA1BA3	MHD18H30AAA1AA3
21	MHD21H50ADA1AA3	MHD21H50AAD0AA3	MHD21H50ADA1BA3	MHD21H50AAA1AA3
24	MHD24H50ADA1AA3	MHD24H50AAD0AA3	MHD24H50ADA1BA3	MHD24H50AAA1AA3
27	MHD27H60ADA1AA3	MHD27H60AAD0AA3	MHD27H60ADA1BA3	MHD27H60AAA1AA3
30	MHD30H60ADA1AA3	MHD30H60AAD0AA3	MHD30H60ADA1BA3	MHD30H60AAA1AA3
33	MHD33H70ADA1AA3	MHD33H70AAD0AA3	MHD33H70ADA1BA3	MHD33H70AAA1AA3
36	MHD36H70ADA1AA3	MHD36H70AAD0AA3	MHD36H70ADA1BA3	MHD36H70AAA1AA3
39	MHD39H70ADA1AA3	MHD39H70AAD0AA3	MHD39H70ADA1BA3	MHD39H70AAA1AA3
42	MHD42H70ADA1AA3	MHD42H70AAD0AA3	MHD42H70ADA1BA3	MHD42H70AAA1AA3
45	MHD45H70ADA1AA3	MHD45H70AAD0AA3	MHD45H70ADA1BA3	MHD45H70AAA1AA3
48	MHD48H70ADA1AA3	MHD48H70AAD0AA3	MHD48H70ADA1BA3	MHD48H70AAA1AA3

Note: All catalog numbers listed above include a universal wildlife protector.

Table 8. UltraQUIK™ catalog numbering system for Polymer-housed surge arresters

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	**H**	**D**												

Catalog number digits

1 = Molded polymer-housed arrester, **M**

2 & 3 = Arrester class: **HD** = I_n = 10 kA, Class DH

4 & 5 = Arrester rating U_r (U_c):

03 = 3 kV (2.55 kV)
06 = 6 kV (5.1 kV)
09 = 9 kV (7.65 kV)
10 = 10 kV (8.4 kV)
12 = 12 kV (10.2 kV)
15 = 15 kV (12.7 kV)
18 = 18 kV (15.3 kV)
21 = 21 kV (17.0 kV)
24 = 24 kV (19.5 kV)
27 = 27 kV (22.0 kV)
30 = 30 kV (24.4 kV)
33 = 33 kV (27.0 kV)
36 = 36 kV (29.0 kV)
39 = 39 kV (31.5 kV)
42 = 42 kV (34.0 kV)
45 = 45 kV (36.5 kV)
48 = 48 kV (39.0 kV)

6 & 7 = Housing options per arrester rating—select from table below.

★ = Standard housing **O** = Housing options

Digits 6 & 7	H1	H2	H3	H4	H5	H6	H7
Arrester rating (kV rms) \ Leakage distance (mm)	375	500	625	750	875	1000	1250
3	★	O					
6	★	O					
9		★	O				
10		★	O				
12		★	O				
15			★	O			
18			★	O			
21					★	O	
24					★	O	
27						★	O
30						★	O
33							★
36							★
39							★
42							★
45							★
48							★

Table 9. UltraQUIK catalog numbering system for polymer-housed surge arresters (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	**H**	**D**												

8 = Line stud and lead options:

• 10 mm line terminal options—all threaded studs are 10 mm x 30 mm long, stainless steel

0 = without line lead

2 = with 300mm 5mm diameter insulated lead wire having one ring terminal

3 = with 300mm 5mm diameter insulated lead wire having two ring terminals

5 = with 450mm 5mm diameter insulated lead wire having one ring terminal

6 = with 450mm 5mm diameter insulated lead wire having two ring terminals

8 = with 750mm 5mm diameter insulated lead wire having one ring terminal

9 = with 750mm 5mm diameter insulated lead wire having two ring terminals

• 12 mm line terminal options—all threaded studs are 12 mm x 30 mm long, stainless steel

A = without line lead

C = with 300 mm long, 5 mm diameter insulated lead wire having one ring terminal

D = with 300 mm long, 5 mm diameter insulated lead wire having two ring terminals

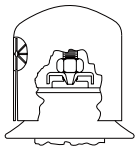
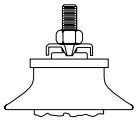
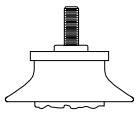
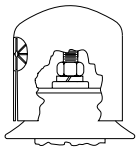
F = with 450 mm long, 5 mm diameter insulated lead wire having one ring terminal

G = with 450 mm long, 5 mm diameter insulated lead wire having two ring terminals

J = with 750 mm long, 5 mm diameter insulated lead wire having one ring terminal

K = with 750 mm long, 5 mm diameter insulated lead wire having two ring terminals

9 = Line terminal accessories

			
A = Stainless steel nut, stainless steel wire clamp and universal wildlife protector	**B** = Stainless steel nut and stainless steel wire clamp	**C** = No hardware	**D** = Stainless steel nut, lock washer, flat washer, and universal wildlife protector (for leads with ring terminals)

Notes:

1. Maximum allowable torque on line terminal is 27 Nm.

Table 10. UltraQUIK catalog numbering system for Polymer-housed surge arresters (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	**H**	**D**												

10 = Ground terminal options

• 10 mm ground terminal options

With ground lead disconnector and stainless steel stud length of:

D = 10 mm Ø x 25 mm
(requires "1" in digit 12)

Without ground lead disconnector, stainless steel stud length of:

A = 10 mm Ø x 30 mm
B = 10 mm Ø x 45 mm
C = 10 mm Ø x 65 mm

• 12 mm ground terminal options

With ground lead disconnector and stainless steel stud length of:

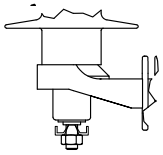
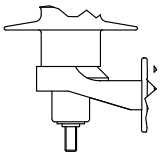
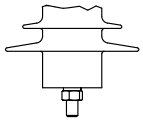
E = 12 mm Ø x 25 mm
(requires "1" in digit 12)

Without ground lead disconnector, stainless steel stud length of:

F = 12 mm Ø x 30 mm
G = 12 mm Ø x 45 mm
H = 12 mm Ø x 65 mm

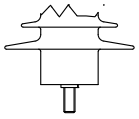
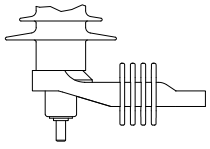
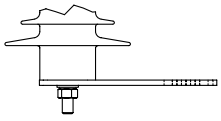
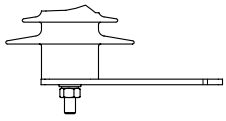
11 = Ground terminal hardware

All ground terminal accessory hardware is stainless steel (10 mm Ø, as required for digit 10)

		
A = Wire clamp with stainless steel nut (shown with optional isolator and insulated hanger)	**B** = No hardware (shown with optional isolator and insulated hanger)	**D** = Stainless steel washer, lock washer, stainless steel nut

Notes: Maximum allowable torque on ground terminal is 27 Nm.

12 = Bracket configurations

			
0 = Base mounted arrester	**1** = Insulated mounting bracket (required with optional disconnector)	**2** = Conductive mounting bracket For 3/8 inch hardware **(requires "A", "B" or "C" in digit 10 and "D" in digit 11)** See **Figure 9** for dimensional information.	**3** = Conductive mounting bracket for 12 mm hardware **(requires "F", "G" or "H" in digit 10 and "D" in digit 11)** See **Figure 10** for dimensional information.

13 = Ground terminal hardware

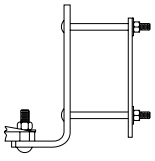
	
A = Without a mounting bracket	**B** = NEMA cross-arm hanger (mounting hardware included) **(requires "1", "2", or "3" in digit 12)** See **Figure 8** for dimensional information.

Table 11. UltraQUIK catalog numbering system for polymer-housed surge arresters (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	**H**	**D**												

14 = Nameplate information, see Figures 12 and 13

Nameplate information is per IEC 60099-4.

A = English

15 = Packaging

1 = Individual carton. Each arrester with accessories is shipped in an individual cardboard carton.

3 = Three-phase cardboard carton. Three arresters and their accessories are packed in one cardboard carton, which is suitable for ocean shipping.

Accessories for the Polymer-housed surge arrester

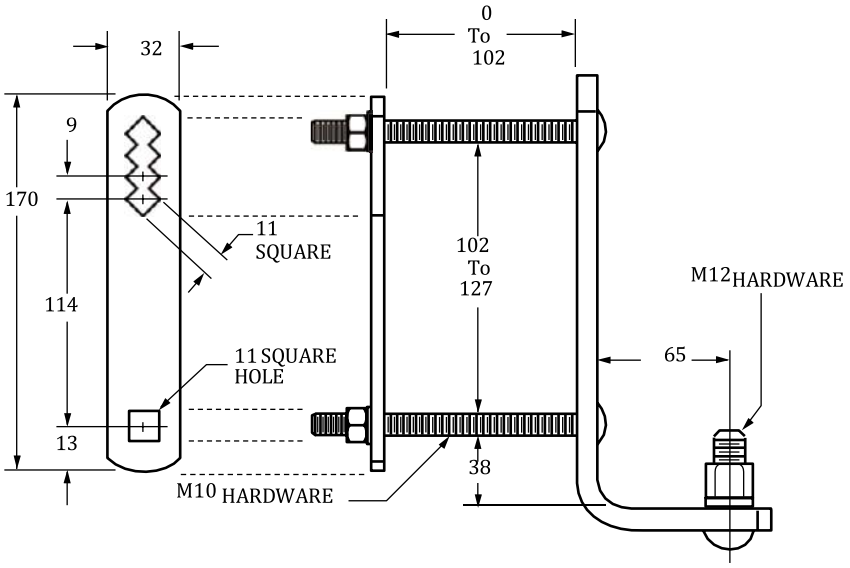


Figure 8. NEMA cross-arm hanger can be specified with a "B" in digit 13 (all dimensions are as required to be in inches, per NEMA)

The universal wildlife protector has two self-adjusting valve style openings that vary from 0 to 0.75 inches in diameter, thus allowing for a large variety of conductor/insulation sizes while providing optimum wildlife protection.

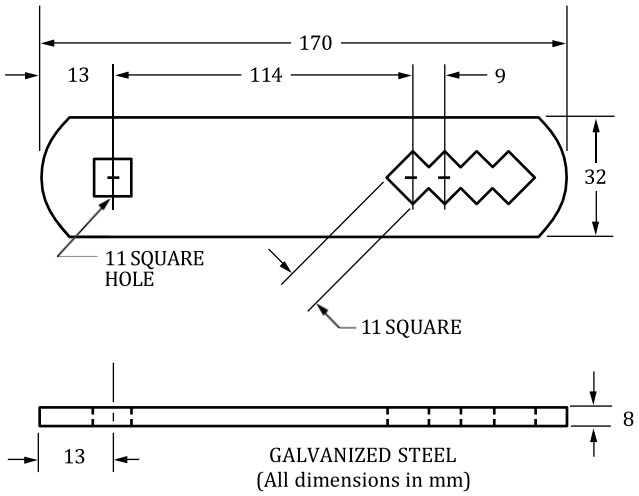


Figure 9. Conductive base mounting for use with 3/8 inch hardware. Can be specified with a "2" in digit 12. (Requires "A", "B" or "C" in digit 10, "D" in digit 11)

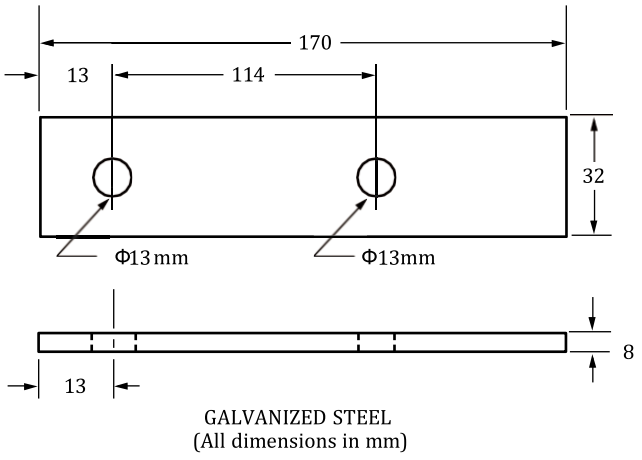


Figure 10. Conductive base mounting for use with 12 mm hardware. Can be specified with a "3" in digit 12. (Requires "A", "B" or "C" in digit 10, "D" in digit 11)

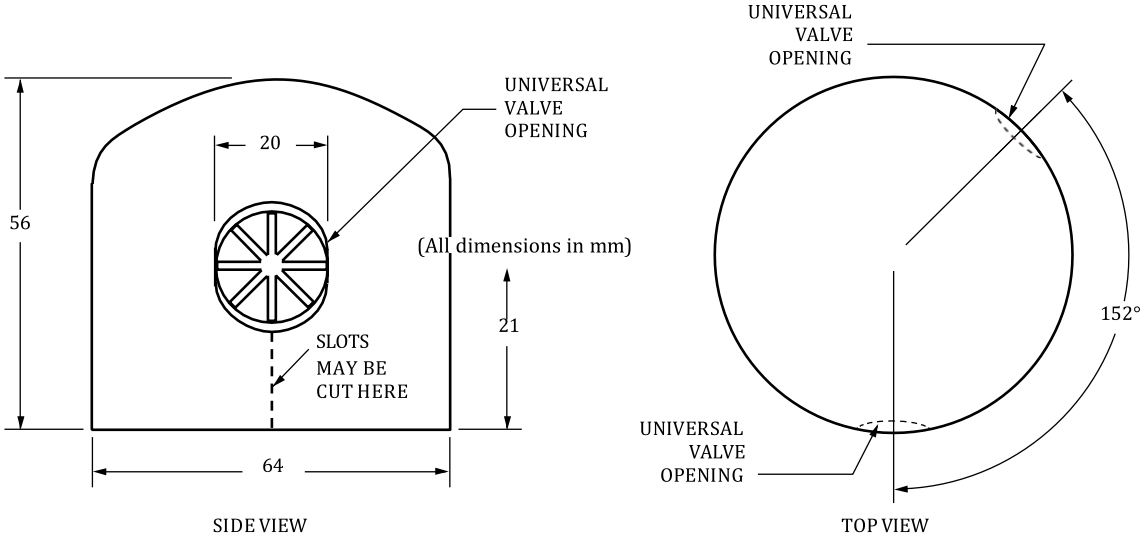


Figure 11. Universal wildlife protector for line terminal adds 5 mm to arrester height above line terminal stud. To be used only with 10 mm or 12 mm Ø line hardware of standard length, 30 mm.

Figure 12. I_n = 10 kA, Class DH, nameplate—stamped in stainless steel top cap

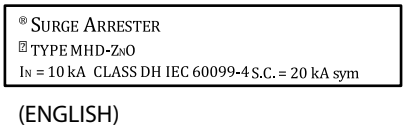


Figure 13. I_n = 10 kA, Class DH, auxiliary nameplates

Additional information

- MN235XXXEN, Molded Polymer-housed Surge Arresters IEC 60099-4 for MV Systems to 48 kV Installation Instructions
- CPXXXX, Design Test Report Summary, 10 kA, MHD

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