Under-Oil Arresters

HUBBELL

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Tests, inspections and acceptance of all material must be made at the factory. Buyer's inspectors are welcome at the factories and are provided with the necessary facilities for carrying out their work. Name and phone number of who should be contacted for inspection should be given to HPS no later than two weeks prior to scheduled shipment date.

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Any claim by Buyer that a product is defective or non-conforming shall be deemed waived by Buyer unless submitted to HPS in writing within thirty (30) days from the date Buyer discovered, or by reasonable inspection should have discovered the alleged defect or non-conformity. Any warranty claim must be brought within one year of discovery of the alleged defect or non-conformity. Upon prompt written notice by the Buyer that a product is defective or non-conforming, HPS' liability shall be limited to repairing or replacing the product, at HPS' option.

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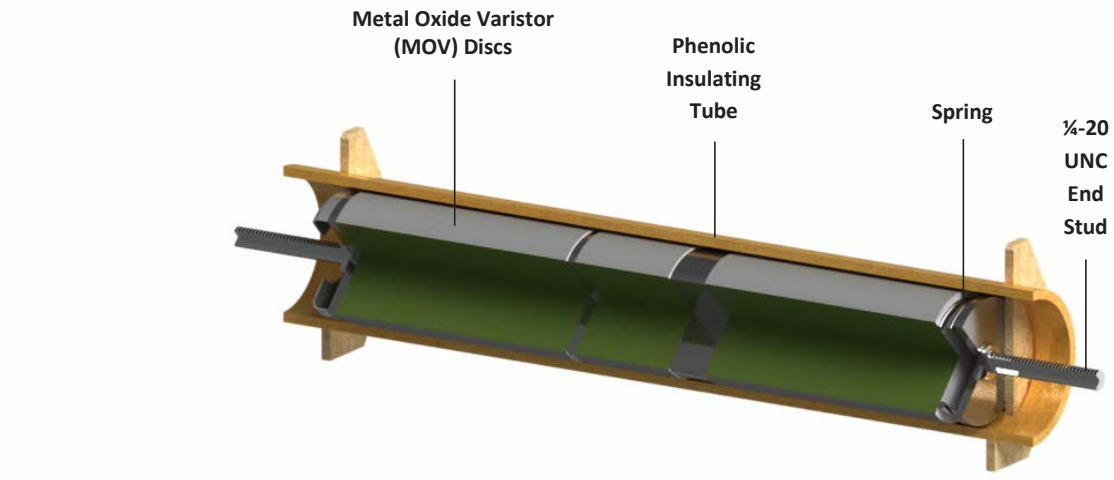
NOTE: Because Hubbell Power Systems Inc., has a policy of continuous product improvement, we reserve the right to change design and specifications without notice.

Introduction

The HPS under-oil arrester is designed to be installed inside a distribution transformer, immersed in an insulating liquid. The arrester can be used where the maximum temperature does not exceed 125 °C, and where the weighted average temperature does not exceed 90 °C. The under-oil arrester is designed to limit surge voltage by discharging the surge current to ground. The arrester is designed for in oil applications. It will meet or exceed the application requirements of IEEE C62.11 and IEC 60099-4 standards for metal oxide surge arresters for AC Power Circuits.

The under-oil arrester contains several MOV discs mounted securely inside a phenolic housing. The MOV discs are manufactured by Hubbell in our Wadsworth, Ohio manufacturing facility. The arrester is shipped fully assembled with optional mounting brackets and lead wires. The catalog number, duty cycle rating and Maximum Continuous Operating Voltage (MCOV) are printed on the phenolic housing.



A thorough routine production test program ensures the under-oil design satisfies the IEC 60099-4 requirements, as well as the IEEE C62.11 requirements. HPS maintains stringent testing controls in accordance with IEC 60099-4 & IEEE C62.11 standards to guarantee that the customer receives consistent quality with every product.

Under-oil arresters qualify for fail "OPEN" per IEEE C62.11 and IEC 60099-4 when the short circuit current exceeds a certain value. An arrester fails "OPEN" if, after the fault current is interrupted by an over-current protective device, the resultant arrester is an open circuit. Tests have indicated that the force of fragmentation will be damped by the surrounding insulating liquid, thereby preventing damage to adjacent components such as core and coils.

The arrester can be mounted inside a distribution transformer tank in a horizontal or vertical position. In a vertical-mount position, alongside the transformer coils, the ejected internal parts will fall to the bottom of the tank in the remote instance of arrester failure. If the arrester is mounted above the core and coils, a pressboard (or similar) shield should be used to prevent ejected parts from falling into the windings of the transformer.

Application

Normal care taken in handling the arrester will prevent the possibility of damage to the MOV elements. For example, do not allow the arrester to be impacted by, or on, other objects and be shocked mechanically. The arrester is constructed of materials that have little or no moisture absorbing capacity. Special precautions are not necessary to prevent the arrester from being exposed to moisture laden air prior to installation. A normal transformer treat or bake out should be sufficient to remove any moisture which may have been introduced into the transformer and absorbed by the arrester surfaces. The arrester does not require testing. No test which applies power-frequency voltage in excess of arrester voltage rating should be made without consulting Hubbell.

Selecting the appropriate MCOV of a surge arrester is a critical step in the protection of vital utility equipment. The MCOV of an arrester should be selected to ensure it can withstand the maximum continuous line to ground voltage. The table below provides general guidelines for solidly grounded applications, as well as impedance or undergrounded circuits. A higher or lower rated arrester may be required depending on the exact application.

System Voltage (kV)		Commonly Applied Arrester MCOV (kV)		
Nominal Voltage	Maximum Voltage	Four-Wire Multigrounded Neutral Wye	Three-Wire Low Impedance Grounded	Three-Wire High Impedance Grounded
2.4	2.54			2.55
4.16Y/2.4	4.4Y/2.54	2.55	5.1	5.1
4.16	4.4			5.1
4.8	5.08			5.1
6.9	7.26			7.65
8.32Y/4.8	8.8Y/5.08	5.1	7.65	
12Y/6.93	12.7/7.33	7.65	10.2	
12.47Y/7.2	13.2Y/7.62	7.65 or 8.4	12.7	
13.2Y/7.62	13.97Y/8.07	8.4	12.7	
13.8Y/7.97	14.52Y/8.38	8.4 or 10.2	12.7	
13.8	14.52			15.3
20.78Y/12	22Y/12.7	12.7	17	
22.86Y/13.2	24.2Y/13.97	15.3	19.5	
23	24.34			24.4
24.94Y/14.4	26.4Y/15.24	15.3	22	
27.6Y/15.93	29.25Y/16.89	17	24.4	
34.5Y/19.92	36.51Y/21.08	22	29	

The actual MCOV of each arrester will be determined according to the exact system parameters. Smaller or higher rated arresters may be required based on system fault durations and the associated overvoltage magnitude. Arrester selection is additionally dictated by the insulation being protected. Please consult with Hubbell for additional support to select the appropriate MCOV for your specific arrester application.

Electrical Characteristics

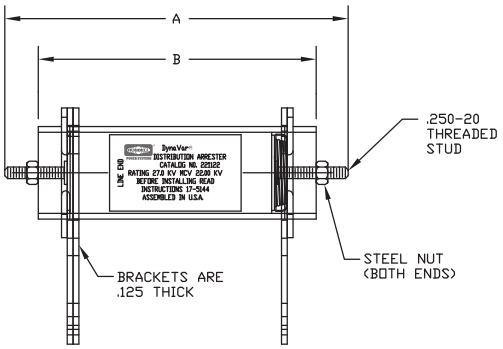
Base Catalog Number	MCOV (kV)	Duty Cycle Rating (kV)	Max steep current impulse residual voltage	Max switching impulse residual voltage (kV)	Max lightning impulse residual voltage (kV)					
			10 kA	0.5 kA	1.5 kA	3 kA	5 kA	10 kA	20 kA	40 kA
221103	2.55	3	11.4	7.3	8.5	8.9	9.3	10.0	11.0	12.8
221105	5.1	6	22.6	14.6	17.0	17.7	18.5	19.9	22.0	25.5
221108	7.65	9	33.2	22.0	25.5	26.6	27.7	29.8	33.0	38.2
221109	8.4	10	38.1	25.3	29.3	30.6	31.8	34.3	37.9	43.9
221110	10.2	12	44.1	29.3	34.0	35.5	36.9	39.8	44.0	50.9
221113	12.7	15	54.8	36.5	42.4	44.1	46.0	49.5	54.7	63.4
221115	15.3	18	65.9	43.9	51.0	53.2	55.4	59.7	65.9	76.4
221117	17	21	73.2	48.8	56.7	59.1	61.5	66.3	73.3	84.9
221122	22	27	94.6	63.2	73.4	76.5	79.6	85.8	94.8	109.8
221124	24.4	30	104.9	70.1	81.4	84.8	88.3	95.2	105.2	121.8

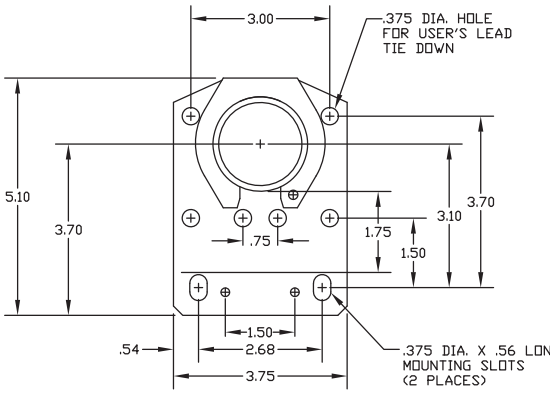
Physical Characteristics

Base Catalog Number	MCOV	Duty Cycle Rating	Overall Length (A)	Tolerance Range (A)	Overall Tube Length (B)	Lightning Withstand Voltage	Fail Open Current Rating
	kV	kV	Inches (mm)	Inches (mm)	Inches (mm)	kVpk	Arms
221103	2.55	3	3.71 (94)	3.32 (84) - 4.10 (104)	2.94 (75)	75	*
221105	5.1	6	5.73 (146)	5.34 (136) - 6.12 (155)	4.96 (126)	75	2000
221108	7.65	9	5.73 (146)	5.34 (136) - 6.12 (155)	4.96 (126)	95	1000
221109	8.4	10	6.01 (153)	5.62 (143) - 6.40 (163)	5.24 (133)	95	1000
221110	10.2	12	6.77 (172)	6.38 (162) - 7.16 (182)	6.00 (152)	95	500
221113	12.7	15	7.67 (195)	7.28 (185) - 8.06 (205)	6.90 (175)	125	500
221115	15.3	18	8.79 (223)	8.40 (213) - 9.18 (233)	8.02 (204)	125	500
221117	17	21	9.45 (240)	9.06 (230) - 9.84 (250)	8.68 (220)	125	500
221122	22	27	11.90 (302)	11.51 (292) - 12.29 (312)	10.90 (277)	150	500
221124	24.4	30	12.86 (327)	12.47 (317) - 13.25 (337)	11.86 (301)	150	500

Arrester Accessories

Hubbell offers various hardware options which can include both mounting brackets and lead wires. Standard dimensions for under-oil arresters and mounting brackets are displayed in the following figures.





Available hardware configurations are shown in the following table. Mounting brackets are included in the standard 3001 configuration. Lead wires can additionally be added and sized to length for each application. Hubbell provides a #10 AWG insulated wire for Under-oil applications. The wire is oil resistant per class 43 UL 1581. If an additional configuration is required please contact your Hubbell representative for assistance.

Hardware Codes

Hardware Code	Mounting Brackets Included	Lead Wires - Inches (mm)
3001	Yes	N/A
3002	No	N/A
3003	Yes	20 (508)
3004	Yes	30 (762)
3005	Yes	48 (1219)
3006	No	20 (508)
3007	No	30 (762)
3008	No	48 (1219)

Ordering

Hubbell under-oil arresters are specified using a 10-character part number. The first four digits characterize the arrester type. The fifth and six characters identify the arrester MCOV. The next four characters define the arrester accessories and hardware. Additional characters may be used to define special requirements based on the application.

An example is given below to select an under-oil arrester catalog number. Please contact your Hubbell representative for additional support with your application.

To select an 8.4 kV MCOV under-oil arrester the base prefix would be 221109. Next, hardware will be defined. A common option includes transformer mounting brackets and no additional hardware. The corresponding hardware code is 3001.

2 2 1 1 0 9 - 3 0 0 1

Routine Testing

The transformer should not be tested (impulse or hipot) with the arrester connected. If the arrester is connected to the transformer during impulse test, the arrester will clamp the voltage; thus, the transformer will not be subjected to full test voltage. If the arrester is connected to the transformer during hipot test, it is possible the arrester will be damaged by this overvoltage.

Hubbell performs routine acceptance testing on 100% of arresters manufactured. Testing is done in accordance with IEEE C62.11 and IEC 60099-4 surge arrester standards. Additional testing is performed in accordance with internal Hubbell design specifications. If required, please contact your Hubbell representative for a copy of the routine arrester test certification.

After assembly, the arresters are 100% tested as follows:

Discharge Voltage: Determined by the sum of the MOV elements, each arrester is tested to be within a manufacturer specified range that aligns with the arrester's published ratings.

Reference Voltage: The voltage at which the arrester conducts 5 mA of peak resistive current. This test verifies the proper MOV blocks were used in the assembly.

Power Frequency (PF): A minimum voltage of 1.25 times the MCOV of the arrester is applied to the overvoltage withstand capability.

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