UHS Class Distribution- DH Arrester Certified Test Report IEC 60099-4 2014

CERTIFIED TEST REPORT ADDENDUM USING THIRD PARTY DISKS

Statements made and data shown are, to the best of our knowledge and belief, correct and within the usual limits of commercial testing practice.

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INTRODUCTION

This addendum test report certifies that the UltraSIL VariSTAR arresters UHS Class Distribution – DH were successfully tested to IEC 60099-4:2014 “Metal-Oxide surge arresters without gaps for a.c. systems” for all the type tests related to using a third party sourced MOV Disk. This supplements the main certified test report.

TEST PROGRAM

OBJECTIVE

To demonstrate that the UltraSIL VariSTAR Arresters Class Distribution - DH meet all disk type test performance requirements using a third party manufacturer of our MOV Disk.

PROCEDURE

The following design tests were performed on a sufficient number of samples to demonstrate all performance requirements are met.

TYPE TESTS

	Test Description	Per IEC60099-4 ™-2014 section
B.	Residual voltage test	10.8.3
C.	Test to verify long term stability under continuous operating voltage	10.8.4
D.	Repetitive charge transfer withstand	10.8.5
E.	Heat dissipation behavior of test sample	10.8.6
F.	Operating duty test	10.8.7
G.	Power-frequency voltage versus time test	10.8.8

RESULTS

The UltraSIL VariSTAR arresters met all performance requirements of IEC 60099-4:2014 related to an external supplier of the MOV disk.

TEST B:
Residual Voltage Tests

Test Report Number:
Certifying Laboratory: EATON Olean, NY

Objective: To determine the maximum discharge voltage for each discharge current.

Lightning Impulse Residual Voltage Test
Procedure: A lightning current impulse was applied to each sample for approximately 0.5, 1, and 2 times the nominal discharge current. The current impulse had a front time between 7µs to 9µs and the virtual time to half-value on the tail was between 18µs to 22µs.

Steep Current Impulse Residual Voltage Test
Procedure: One steep current impulse was applied to each sample with a peak value equal to the nominal discharge current of the arrester. The current impulse had a front time between 0.9µs to 1.1µs and the virtual time to half-value on the tail was not longer than 20µs.

Results: Table 1 shows the impulse Protective Levels for the UltraSIL VariSTAR arresters UHS Class Distribution – DH

Table 1: Maximum Residual Voltage Characteristics

UHS		1/2 Wave	8/20 Wave Forms						30/60 Switching Surge	
Rating	MCOV	(kV, peak)	(kV, peak)	(kV, peak)	(kV, peak)	(kV, peak)	(kV, peak)	(kV, peak)	(kV, peak)	(kV, peak)
		10 kA	1.5 kA	3 kA	5 kA	10 kA	20 kA	40 kA	125 A	500 A
3	2.55	10.8	8.2	8.7	9.1	9.9	10.9	12.3	7.1	7.6
6	5.1	21.5	16.3	17.4	18.2	19.8	21.9	24.7	14.1	15.1
9	7.65	32.4	24.6	26.1	27.3	29.8	33.0	37.1	21.3	22.7
10	8.4	34.4	26.0	27.7	29.0	31.6	34.9	39.4	22.6	24.1
12	10.2	43.2	32.7	34.8	36.4	39.7	43.9	49.5	28.3	30.3
15	12.7	52.2	39.6	42.1	44.0	48.0	53.1	59.8	34.3	36.6
18	15.3	64.8	49.1	52.3	54.7	59.6	65.9	74.2	42.6	45.5
21	17	68.8	52.1	55.4	58.0	63.2	69.9	78.7	45.1	48.2
24	19.5	79.5	60.2	64.1	67.0	73.1	80.8	91.1	52.2	55.8
27	22	92.4	70.0	74.5	77.9	84.9	93.9	106	60.6	64.8
30	24.4	100.5	76.1	81.0	84.7	92.4	102	115	66.0	70.5
33	27	114.2	86.5	92.1	96.3	105	116	131	75.0	80.1
36	29	120.8	91.5	97.3	102	111	123	138	79.3	84.7

TEST C:
Test to Verify Long Term Stability under Continuous Voltage

Test Report Number:
Certifying Laboratory: EATON Olean, NY

Objective: To demonstrate the ability of the metal-oxide resistors to remain thermally stable (decreasing power loss) throughout the expected lifetime of the arrester in the surrounding medium applicable for the design

Procedure: The sample were heated in an oven to 115°C and energized to a corrected voltage Uc' and further corrected by unbalancing factor due to voltage distribution for a duration of 1000 hours.

Results: During the aging test, all measurements of power loss including final measurements were not greater than 1.1 x the starting power loss and have satisfied the acceptance criteria showing a decreasing trend

TEST D:
Repetitive Charge Transfer Withstand

Test Report Number:
Certifying Laboratory: EATON Olean, NY

Objective: To demonstrate the ability of the arrester to transfer charge

Procedure: The 10 samples were subject to twenty lightning impulses 8/20 with an amplitude resulting in a current density of 0.5kA/cm^2, divided into ten groups of two operations, with approximately 60 seconds between impulses. The samples cooled to ambient temperature between impulses.

Results: The samples met test requirements with less than 5% change in residual voltage and 5% change in reference voltage and no mechanical damage after the final application of a current impulse of 8/20 as revealed by visual inspection.

TEST E:
Heat Dissipation Behavior Verification of Test Sample

Test Report Number:
Certifying Laboratory: EATON Olean, NY

Objective: To demonstrate the thermal equivalent section cools equal to or slower than the complete arrester

Procedure: The complete arrester equipped with fiber optic temperature probes was placed in the testing laboratory at still ambient air of 19.5°C and was heated to a temperature of approximately 140°C by applying a power frequency over-voltage above the reference voltage. After the goal temperature of 140°C was reached, the source was disconnected and the cooling curve was monitored for more than two hours. The thermal equivalent section was then placed in was placed in the testing laboratory at still ambient air of 20.2°C and was heated to a temperature of approximately 140°C (corrected for differences in ambient temperature) by applying a power frequency over-voltage above the reference voltage. After the goal temperature of 140°C was reached, the source was disconnected and the cooling curve was monitored for more than two hours

Results: The thermal equivalent section met the goal by cooling slower than the complete arrester throughout the cool curve time range of more than two hours.

TEST F:
OPERATING DUTY TEST

Test Report Number:
Certifying Laboratory: EATON Olean, NY

Objective: To demonstrate the ability to recover after transfer of the thermal charge Q_{th}

Procedure: After application of a high current impulse 4/10 µs at 100kA. The thermal equivalent section was then heated in an oven at the temperature of 61°C till thermal equilibrium was reached. The section was then injected with two lightning current impulses 8/20 µs at the thermal charge transfer of Q_{th} of 0.55 C per impulse. Within 100ms of the second impulse, the sample shall be energized at U_R' for 10 s and U_C' for 30 minutes.

Results: The samples met test requirements with less than 5% change in residual voltage, no sign of breakdown as verified by the oscillograms, achieving thermal stability. After the samples had cooled to ambient temperature, two current impulses 8/20 µs one-minute apart at the nominal discharge current have been applied to check the integrity of the internal parts.

TEST G:
POWER FREQUENCY VOLTAGE VS. TIME

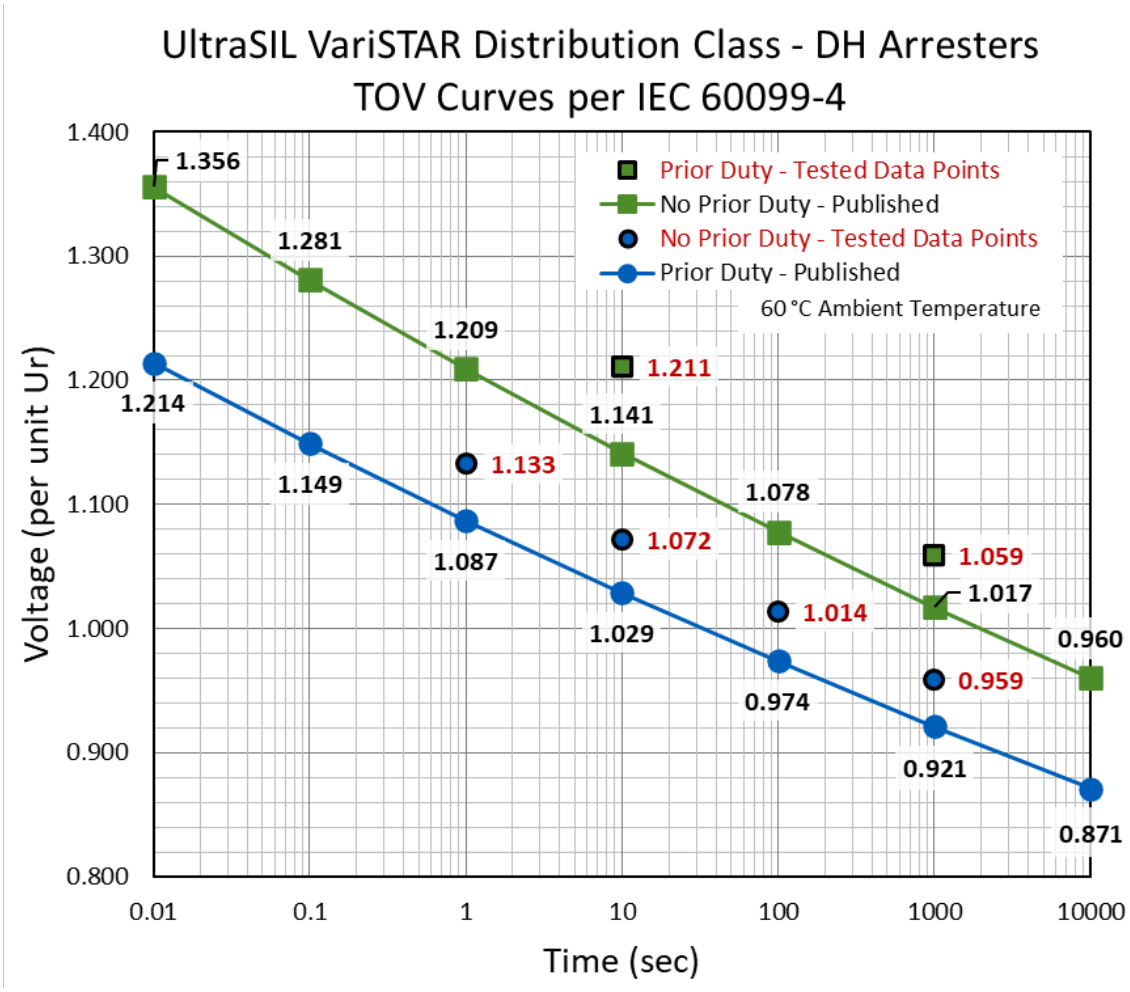
Test Report Number:
Certifying Laboratory: EATON Olean, NY

Objective: To determine the over voltage values and time durations for the arrester design.

Procedure: Two samples were tested with no prior duty. Four samples were tested with prior duty. The samples were heated in an oven to 60 °C until thermal equilibrium was reached. The two samples with no prior duty were tested at:
1.211 x Ur' for 10 sec and
1.059 x Ur' for 1000 sec
The recovery voltage of U_C' was applied to the sample for thirty minutes.

The four samples were subject to two lightning current impulses 8/20 at the rated thermal charge transfer Qth of 1.1 C then tested at:
1.133 x Ur' for 1 sec
1.072 x Ur' for 10 sec
1.014 x Ur' for 100 sec
0.959 x Ur' for 1000 sec
The recovery voltage of U_C' was applied to the sample for thirty minutes.

Results: The variation of lightning impulse residual voltage before and after the test was less than 5% The thermal stability was achieved.



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