CERTIFIED
TEST REPORT

UltraSIL™ Polymer-Housed VariSTAR™ Type UXL Strength Options B & C Station-Class Surge Arresters

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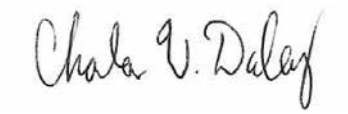
CERTIFICATION

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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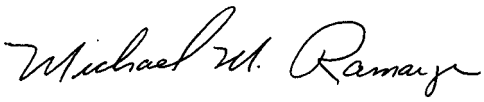

Michael M. Ramarge
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INTRODUCTION

This test report certifies that the UltraSIL™ Polymer-Housed VariSTAR™ Type UXL Station-Class Surge Arresters were successfully tested to IEEE Std C62.11™-2012 standard "IEEE Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits".

TEST PROGRAM

OBJECT

To demonstrate that the UltraSIL Polymer-Housed VariSTAR Type UXL Station-Class Surge Arresters meet all performance requirements.

PROCEDURE

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

DESIGN TESTS

A.	Insulation Withstand	Per IEEE Std C62.11™-2012 standard, Section 8.1.2.4
B.	Discharge Voltage Current Characteristics	Per IEEE Std C62.11™-2012 standard, Section 8.2
C.	Discharge Voltage Time Characteristics	Per IEEE Std C62.11™-2012 standard, Section 8.4
D.	Accelerated Aging Procedure	Per IEEE Std C62.11™-2012 standard, Section 8.5
E.	Switching Surge Energy Rating Test	Per IEEE Std C62.11™-2012 standard, Section 8.14
F.	Single – impulse Withstand Rating Test	Per IEEE Std C62.11™-2012 standard, Section 8.15
G.	Duty Cycle	Per IEEE Std C62.11™-2012 standard, Section 8.16
H.	Short Circuit Test (Design B)	Per IEEE Std C62.11™-2012 standard, Section 8.18
I.	Contamination Test	Per IEEE Std C62.11™-2012 standard, Section 8.8
J.	Temporary Overvoltage (TOV)	Per IEEE Std C62.11™-2012 standard, Section 8.17
K.	Accelerated Aging by Exposure to Salt Fog	Per IEEE Std C62.11™-2012 standard, Section 8.7
L.	Maximum Design Cantilever Test for Polymer-Housed Arresters	Per IEEE Std C62.11™-2012 standard, Section 8.22
M.	Moisture Ingress Test for Polymer Housed Arresters	Per IEEE Std C62.11™-2012 standard, Section 8.22
N.	Partial Discharge (PD) Test	Per IEEE Std C62.11™-2012 standard, Section 8.11

RESULTS

UltraSIL Polymer-Housed VariSTAR Type UXL Station-Class Surge Arresters met all performance requirements.

TEST A
INSULATION WITHSTAND

OBJECTIVE

To verify that the assembled insulating members of the VariSTAR Type UXL Station-Class Surge Arresters withstand impulse and power frequency voltage tests in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

Arresters rated 3-48 kV:

- New, clean arresters of each rating, with internal parts rendered inoperative, were subjected to positive and negative 1.2 x 50 µs voltage impulses which exceeded the minimum values in IEEE Std C62.11™-2012 standard Table 4.
- These samples were also subjected to both wet and dry 60 Hertz withstand voltages which exceeded the minimum values in IEEE Std C62.11™-2012 standard, Table 4.

Arresters rated ≥ 54 kV:

- For each arrester rating the maximum 8 x 20, 20 kA discharge voltage was determined. This value was multiplied by a factor of 1.42. This calculated value established the minimum 1.2 x 50 µs impulse withstand level.
- New, clean arrester samples of each rating, with internal parts removed, were subjected to positive and negative 1.2 x 50 µs voltage impulses which exceeded the minimum withstand levels as calculated above.
- For each arrester rating, the maximum switching impulse discharge voltage was determined. This value was multiplied by a factor of 0.82. This calculated value established the minimum 10 seconds, wet 60 Hz withstand voltage in rms volts for each arrester.
- Arrester samples of each rating having the internal parts removed, were wetted and subjected to 10 seconds of 60 Hz rms voltages exceeding the minimum withstand voltages as calculated above.

RESULTS

None of the samples flashed over during any of the above tests in accordance with the insulation withstand requirements of IEEE Std C62.11™-2012 standard. Tables 1 and 2 shows the insulation withstand voltages for VariSTAR Type UXL Station-Class Surge Arresters.

TEST B
DISCHARGE VOLTAGE CURRENT CHARACTERISTICS

OBJECTIVE

To determine the maximum discharge voltage characteristics of the VariSTAR Type UXL Station-Class Surge Arresters at 1.5, 3, 5, 10, 20 and 40 kA crest in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- Sample arresters were impulsed using an 8 x 20 µs wave shape at 1.5, 3, 5, 10, 20 and 40 kA crest.
- The discharge voltage crest was measured.

RESULTS

Table 3 shows the maximum 8 x 20 discharge voltages for the VariSTAR Type UXL Station-Class Surge Arresters.

TEST C
DISCHARGE VOLTAGE TIME CHARACTERISTICS

OBJECTIVE

To obtain the front-of-wave and switching impulse protective levels of the VariSTAR Type UXL Station-Class Surge Arresters in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

Determination of FOW discharge voltage:

- A current of 10 kA was used to determine the front-of-wave protective level.
- The samples were impulsed using front time of 1 µs
- The samples were impulsed using front time of 8 µs (Test B)
- A metal block was impulsed using front time of 1 µs.
- For each sample, the voltage trace of the metal block was subtracted from the voltage trace measured on the sample
- The normalized FOW discharge voltage for each sample was determined by dividing the maximum voltage of the sample with 1 us front time (excluding inductive voltage) by the 8 usec front time voltage.

Switching Impulse Protective Level:

- Currents of 500, 1000 and 2000 Amperes crest were used to determine the switching impulse protective level.
- The arresters were impulsed with switching impulse current waves having a time to actual crest of 45 to 60 µs.
- The discharge voltage crest was measured.

RESULTS

Table 3 shows the front-of-wave and switching impulse protective levels for the VariSTAR Type UXL Station-Class Surge Arresters.

TEST D
ACCELERATED AGING PROCEDURE

OBJECTIVE

To verify the K_C and K_R ratios of the VariSTAR Type UXL Station-Class Surge Arresters in accordance with IEEE Std C62.11™-2012 standard.

K_C = MCOV Ratio
K_R = Duty Cycle Ratio

These ratios were determined to calculate the test values of MCOV and duty cycle voltages used during testing.

PROCEDURE

- Samples were placed in an oven at 115 °C and energized at MCOV for 1,000 hours.
- The watts loss was measured at the MCOV and duty cycle voltage levels within two to five hours after the start of the test.
- The watts loss was remeasured at 1,000 hours at MCOV and duty cycle voltage levels.

$$K_C = \frac{\text{Watts Loss @ 1,000 Hrs @ MCOV}}{\text{Watts Loss @ 2-5 Hrs @ MCOV}}$$

$$K_R = \frac{\text{Watts Loss @ 1,000 Hrs @ Rated Voltage}}{\text{Watts Loss @ 2-5 Hrs @ Rated Voltage}}$$

If K_C and K_R, - 1, then K_C, and K_R are equal to 1.

RESULTS

K_C and K_R = 1.

TEST E
SWITCHING SURGE ENERGY RATING TEST

OBJECTIVE

To demonstrate that the VariSTAR Type UXL Station-Class Surge Arrester series meets the multiple discharge switching surge energy capability withstand (thermal energy) claimed for station and intermediate arresters in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- Three prorated equivalent thermal sections were used for this test.
- Each sample was impulsed with the switching surge classifying current per Table 7.
- Each sample was subjected to six groups of three current impulses, each with a virtual duration of 2000 to 3200 µs timed to occur 50 to 60 seconds apart. The amplitude of the impulses was in the range of Table 13 for the conditioning impulses for the energy class being tested as defined in IEEE Std C62.11™-2012 standard.
- The samples were permitted to cool after each group of three impulses.
- The samples were then subjected to two 65 kA 4/10 µs impulses with a time between impulses of 50 to 60 seconds apart.
- The prorated sections were placed into an oven until they stabilized at 60 °C.
- Within five minutes upon removal from the oven, two thermal recovery impulses were applied 50 to 60 seconds apart. The amplitude of the impulses was in the range of Table 13 for the thermal recovery impulses for the energy class being tested as defined in IEEE Std C62.11™-2012 standard.
- Within 100 ms after the second discharge, the sample was energized at duty cycle rated voltage for 10 sec, followed by the power frequency recovery voltage was applied and the watts loss was monitored for a minimum of 30 minutes to verify thermal recovery.

RESULTS

VariSTAR Type UXL Station-Class Surge Arrester series met the Energy Class H – 15 kj/kV of MCOV two shot thermal energy rating and demonstrated thermal recovery, no sign of physical damage, and the switching surge discharge voltage at the classifying current changed by less than 5 %.

TEST F
SINGLE-IMPULSE WITHSTAND RATING TEST

OBJECTIVE

To demonstrate that the VariSTAR Type UXL Station-Class Surge Arrester series meets the single impulse withstand capability. The capability expressed in Coulombs represents the maximum charge transfer of a single current impulse that the arrester can withstand multiple times without causing physical or electrical damage for station and intermediate arresters in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- Ten VariSTAR samples of the 76 mm nominal diameter with the greatest nominal length used in the arrester design with the highest discharge voltage at the classifying current that is used in the design.
- Each sample was impulsed with the switching surge classifying current and the reference voltage was measured at the reference current.
- Each sample was subjected to ten groups of two current impulses, each with a virtual duration of 2000 to 4000 µs timed to occur 50 to 60 seconds apart. The charge content of the impulses were 1.1 times the Single – impulse withstand rating claimed for the test as defined in IEEE Std C62.11™-2012 standard.
- The samples were permitted to cool after each group of two impulses.

RESULTS

VariSTAR Type UXL Station-Class Surge Arresters met the Single –Impulse withstand rating of 6 C as claimed with ten samples passing the requirements of 20 impulses, <5% change in discharge voltage and reference voltage, and no physical damage.

TEST G
DUTY CYCLE

OBJECTIVE

To demonstrate that the VariSTAR Type UXL Station-Class Surge Arresters meet the duty cycle requirements in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- Three prorated equivalent thermal sections were used for this test.
- Each sample was impulsed with 10 kA crest, 8 x 20 µs wave and the discharge voltage measured.
- Each sample was energized at K_R times the duty cycle voltage (K_R = 1), for the duration of time needed to allow 20 impulses.
- Each sample was impulsed with 10 kA crest surges of 8 x 20 µs wave shape.
- Each impulse occurred at approximately 60° before the crest on the power frequency wave.
- Each sample was impulsed once every 50 to 60 seconds for 20 consecutive impulses.
- After the 20th impulse, the samples were de-energized and placed into an oven until they stabilized at 60 °C.
- Each sample was removed from the oven and immediately energized at K_C times the MCOV (K_C = 1) and impulsed twice more with a 10 kA crest, 8/20 µs wave within one minute.
- Samples remained energized at the thermal recovery voltage per IEEE Std C62.11™-2012 standard (MCOV x K_W x K_C) for 30 minutes minimum to verify thermal recovery.
- Each sample was then impulsed with a 10 kA crest, 8 x 20 µs wave and the discharge voltage measured. The discharge voltage was compared to the discharge voltage taken prior to duty cycle to make sure that it did not vary by more than ±10%.
- The samples were inspected after testing to assure that no physical damage occurred.

RESULTS

VariSTAR Type UXL Station-Class Surge Arresters met the duty cycle test requirements of 22 impulses, thermal recovery, <10% change in discharge voltage, and no physical damage.

TEST H
SHORT CIRCUIT TEST
(DESIGN B)

OBJECTIVE

To verify that the pressure-relief capability of VariSTAR Type UXL Station-Class Surge Arresters meet the requirements in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- 66 kV rated samples were used in the testing for the UXL Option B design and 66 kV rated samples were used for the UXL Option C design, which represent the highest voltage rating in a single unit housing.
- The arrester samples were mounted to simulate service conditions as specified by IEEE Std C62.11™-2012 standard.

High-Current Pressure-Relief Testing:

- Samples were pre-failed by power frequency overvoltage.
- The test circuit was adjusted to produce a 60 Hz, 63 kA (rms) current for a minimum of 0.2 seconds.
- The above noted current was initiated within 5° of the applied 60 Hz voltage zero.
- The arresters were monitored to assure venting occurred without violent shattering.

Low-Current Pressure-Relief Testing:

- Samples were pre-failed by power frequency overvoltage.
- The test circuit was adjusted to produce a 60 Hz current of 600 A determined by the average for the duration of the current flow.
- The current duration lasted until the arrester vented up to a maximum of 1 second or until venting occurs.

RESULTS

VariSTAR Type UXL Station-Class Surge Arresters passed the described high and low-current pressure-relief tests based on oscillograph recordings showing test current magnitude and duration, from the evidence of the time at which the venting occurred, and from the confinement of all components of the arrester within the specified enclosures.

TEST I
CONTAMINATION TEST

OBJECTIVE

To demonstrate the ability of the VariSTAR Type UXL Station-Class Surge Arresters to withstand the electrical stresses caused by contamination on the housing, in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- 360 kV sample was used in this test.
- Arrester samples were energized for a minimum of one hour at MCOV.
- The watts loss at MCOV was measured at the end of the hour.
- The samples were de-energized. Within 13 minutes, a 400-500 Ωm slurry was applied to the housing heavily enough to form drops on the skirts.
- The samples were energized at the MCOV voltage.
- The watts loss was measured after 15 minutes.
- The samples were de-energized again and another slurry application was performed.
- The samples were energized at MCOV for 30 minute intervals and the watts loss was monitored to verify decreasing levels towards the original measurement.
- Once the samples were cleaned and dried, they were inspected for internal damage using partial discharge measurements at MCOV.

RESULTS

VariSTAR Type UXL Station-Class Surge Arrester samples passed the test by having stabilized lower watts loss over time, by not flashing over and by not having any internal physical damage in accordance with IEEE Std C62.11™-2012 standard.

TEST J
TEMPORARY OVERVOLTAGE (TOV)

OBJECTIVE

To verify what levels of power frequency temporary overvoltage the VariSTAR Type UXL Station-Class Surge Arresters survive in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- Prorated equivalent thermal sections were used for this test.
- Each sample was impulsed with a 10 kA crest, 8 x 20 µs wave and the discharge voltage measured.
- Samples were preheated to 60 °C.
- Each sample was removed from the oven and immediately energized at the overvoltage.
- The overvoltage was removed before sample failure.
- Within 1 second, each sample was energized at the thermal recovery voltage per IEEE Std C62.11™-2012 standard (MCOV x K_W x K_C) for 30 minutes. Sample current and power loss were monitored for thermal runaway.
- Each sample was impulsed with a 10 kA crest, 8 x 20 µs wave and the discharge voltage measured. The discharge voltage was compared to the discharge voltage taken prior to the Temporary Overvoltage testing to make sure that it did not vary by more than 10%.
- The samples were inspected after testing to assure that no physical damage occurred.
- Temporary overvoltage test points were plotted.
- The above test procedures were repeated with "prior duty" energy applied to the arrester before the TOV is applied.
- The "prior duty" energy applied to the arrester before the TOV was the energy generated in two switching surge discharges defined by the Switching Surge Energy Rating claimed.
- The "prior duty" energy applied to Type UXL (3-360 kV) arresters was 15 kJ/kV of MCOV as defined by the Switching Surge Energy Rating of H – 15kJ/kV of MCOV (two shot thermal).

RESULTS

Figure 1 show the performance results.

TEST K
ACCELERATED AGING BY EXPOSURE TO SALT FOG

OBJECTIVE

The purpose of this test is to demonstrate the ability of the VariSTAR Type UXL Station-Class Surge Arresters to withstand electrical stresses on the arrester housing caused by exposure to salt fog, in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- Complete 66 kV Samples were used for this test.
- The Reference Voltage at specified Reference Current and Partial Discharge at 1.05 x MCOV were recorded.
- Samples were mounted vertically in a moisture-sealed corrosion-proof chamber.
- The fog should continually fill the chamber.
- The samples were energized at MCOV for time duration of 1,000 hours.
- The samples were inspected after testing to assure no physical damage occurred.
- The Reference Voltage at specified Reference Current and Partial Discharge at 1.05 x MCOV were recorded.

RESULTS

VariSTAR Type UXL Station-Class Surge Arresters met the Accelerated Aging by Exposure to Salt Fog requirements of no tracking occurring, erosion did not penetrate through housing material, sheds and housing were not punctured, reference voltage did not decrease by more than 5% from initial measurements, and partial discharge did not exceed 10 pc before and after testing.

TEST L
MAXIMUM DESIGN CANTILEVER TEST FOR POLYMER HOUSED ARRESTERS

OBJECTIVE

To evaluate the Maximum Design Cantilever Load (MDCL-Static) specified by the manufacturer for polymer housed arresters in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- The sample consisted of the longest mechanical unit of the design family consisting of an end casting and top terminal assembly.
- Power loss at 80-100% MCOV (noting ambient temperature) and Nominal Discharge Current at 1.5 kA measurements are recorded.
- Terminal torque levels of 150 ft-lbs for samples using 1.0" top studs for time durations of 30s.
- Thermomechanical Preconditioning.
  - The sample is subject to the Maximum Design Cantilever Load with variations in load direction and temperature according to IEEE Std C62.11™-2012 standard, Figure 4.
  - Maximum Design Cantilever Load is 32,000 in-lbs for Type UXL (3-360 kV) for cantilever strength option B and 36,800 in-lbs for Type UXL (132-360 kV) cantilever strength option C.
  - Each temperature shall be maintained for a minimum of 16 hours and no longer than 24 hours.
  - The sample is subject to 0° load direction at 60 ° ±3 °C.
  - The sample is subject to 180° load direction at -25 ° ±3 °C.
  - The sample is subject to 270° load direction at 45 ° ±3 °C.
  - The sample is subject to 90° load direction at -40 ° ±3 °C.
  - The deflection at each direction shall be noted.
  - The sample is then subjected to loads at each direction in ambient temperature for a period of 24 hrs per direction. The deflection at each direction shall be noted.
- Power loss at 80-100% MCOV (noting ambient temperature) and Nominal Discharge Current at 1.5 kA measurements are recorded.

RESULTS

VariSTAR Type UXL Station-Class Surge Arresters met Maximum Design Cantilever test requirements of the power loss and did not increase by more than 20% from the initial measurement. The residual voltage at 1.5 kA did not deviate more than 5% from the initial measurement. The oscillograms did not reveal any voltage or current breakdown, and partial discharge at 1.05 x MCOV did not exceed 10 pC.

TEST M
MOISTURE INGRESS TEST FOR POLYMER-HOUSED ARRESTERS

OBJECTIVE

To evaluate the mechanical load specified by the manufacturer and the seal for polymer-housed arresters in accordance with IEEE Std C62.11™-2012 standard.

PROCEDURE

- Complete 66 kV rated sample was used for cantilever strength B and 60 KV rated for cantilever strength C were used in this test, one of each type of the longest mechanical unit of the arrester.
- Power loss at 80-100% MCOV (noting ambient temperature) and Nominal Discharge Current at 1.5 kA measurements are recorded.
- Terminal torque levels 150 ft-lbs for samples using 1.0" top studs for time durations of 30s.
- Thermomechanical Preconditioning.
  - The sample is subject to the Maximum Design Cantilever Load with variations in load direction and temperature per IEEE Std C62.11™-2012 standard, Figure 4.
  - Maximum Design Cantilever Load is 32,000 in-lbs for Type UXL (3-360 kV) for cantilever strength option B and 36,800 in-lbs for Type UXL (132-360 kV) for cantilever strength option C.
  - Each temperature shall be maintained for a minimum of 16 hours and no longer than 24 hours.
  - The sample is subject to 0° load direction at 60 ° ±3 °C.
  - The sample is subject to 180° load direction at -25 ° ±3 °C.
  - The sample is subject to 270° load direction at 45 ° ±3 °C.
  - The sample is subject to 90° load direction at -40 ° ±3 °C.
  - The deflection at each direction was noted.
  - The sample is then subjected to loads at each direction in ambient temperature for a period of 24 hrs per direction. The deflection at each direction shall be noted.
- The arrester shall be immersed in boiling water (100 °C) with 1 kg/m3 of NaCl for 42 hours OR the arrester shall be immersed in water at a minimum temperature of 80 °C for a period of 168 hours (1 week).
- Power loss at 80-100% MCOV (noting ambient temperature) and Nominal Discharge Current at 1.5 kA measurements are recorded.

EVALUATION

VariSTAR Type UXL Station-Class Surge Arresters met Moisture Ingress test requirements of the power loss did not increase by more than 20% from the initial measurement. The residual voltage at 1.5 kA did not deviate more than 5% from the initial measurement. The oscillograms did not reveal any voltage or current breakdown, and partial discharge at 1.05 x MCOV did not exceed 10 pC.

TEST N
PARTIAL DISCHARGE (PD) TEST

OBJECTIVE

The purpose of this test is to verify that the VariSTAR Type UXL Station-Class Surge Arresters do not generate unacceptable levels of partial discharge according to IEEE Std C62.11™-2012 standard.

PROCEDURE

- The samples was 360 kV arresters.
- The corrected Rated and MCOV voltages were calculated based on the correction factor of Vref measured/ Vref minimum.
- The voltage was raised to rated voltage for 2 seconds, then lowered to 1.05 x corrected MCOV.
- The partial discharge was measured at this level voltage.

EVALUATION

VariSTAR Type UXL Station-Class Surge Arresters met Partial Discharge test requirements. Partial discharge at 1.05 x corrected MCOV did not exceed 10pC.

Table 1. Creepage Distances and Insulation Withstand Voltages of UXLB High-Strength Station-Class Surge Arresters

Arrester Rating (kV, rms)	Arrester MCOV (kV rms)	Catalog Number	Creepage Distance (in)	Strike (in)	1.2/50 Impulse (kV, crest)	60Hz, dry 60 seconds (kV, rms)	60Hz, wet 10 seconds (kV, rms)	Switching Surge Impuse (kV)	Grading Ring
3	2.55	UXLB003002A1045A11	38	9.0	149	90.8	65.2	N/A	No
6	5.1	UXLB006005A1245A11	46	10.7	170	105	83.6	N/A	No
9	7.65	UXLB009007A1245A11	46	10.7	170	105	83.6	N/A	No
10	8.4	UXLB010008A1245A11	46	10.7	170	105	83.6	N/A	No
12	10.2	UXLB012010A1445A11	54	12.3	191	118	97.8	N/A	No
15	12.7	UXLB015012A1445A11	54	12.3	191	118	97.8	N/A	No
18	15.3	UXLB018015A1645A11	61	13.9	208	131	116	N/A	No
21	17	UXLB021017A1645A11	61	13.9	208	131	116	N/A	No
24	19.5	UXLB024019A1845A11	69	15.4	232	143	125	N/A	No
27	22	UXLB027022A1845A11	69	15.4	232	143	125	N/A	No
30	24.4	UXLB030024A2045A11	77	17.0	253	155	138	N/A	No
33	27.5	UXLB033027A2245A11	84	18.5	274	169	154	N/A	No
36	29	UXLB036029A2245A11	84	18.5	274	169	154	N/A	No
39	31.5	UXLB039031A2445A11	92	20.1	294	180	158	N/A	No
42	34	UXLB042034A2445A11	92	20.1	294	180	158	N/A	No
45	36.5	UXLB045036A2645A11	100	21	313	195	163	N/A	No
48	39	UXLB048039A2845A11	108	23	336	205	184	N/A	No
54	42	UXLB054042A2845A11	108	23	336	205	184	N/A	No
60	48	UXLB060048A3245A11	123	26	379	227	208	N/A	No
66	53	UXLB066053A3245A11	123	26	379	227	208	N/A	No
72	57	UXLB072057A4445A11	169	37	548	338	308	N/A	No
78	62	UXLB078062A4645A11	177	39	568	349	312	N/A	No
84	68	UXLB084068A4845A11	184	40	588	360	316	N/A	No
90	72	UXLB090072A5045A11	192	42	607	375	321	N/A	No
96	76	UXLB096076A5245A11	200	43	626	390	326	N/A	No
108	84	UXLB108084A5645A11	215	46	672	410	368	N/A	No
120	98	UXLB120098A6445A11	246	53	758	454	416	N/A	No
132	106	UXLB132106A6445A11	246	44	689	424	375	N/A	Yes
138	111	UXLB138111A8045A11	307	58	884	543	477	N/A	Yes
144	115	UXLB144115A8045A11	307	58	884	543	477	N/A	Yes
162	130	UXLB162130A8645A11	330	62	946	580	513	856	Yes
168	131	UXLB168131A8645A11	330	62	946	580	513	856	Yes
172	140	UXLB172140A9245A11	353	67	1012	612	551	906	Yes
180	144	UXLB180144AA445A11	399	78	1178	723	635	1072	Yes
192	152	UXLB192152AB045A11	422	83	1239	763	666	1122	Yes
198	160	UXLB198160AB245A11	430	85	1262	773	687	1140	Yes
204	165	UXLB204165AB445A11	438	86	1282	785	697	1156	Yes
216	174	UXLB216174AB645A11	445	88	1305	795	711	1173	Yes
228	180	UXLB228180AB845A11	453	89	1322	809	717	1188	Yes
240	190	UXLB240190AC645A11	484	95	1416	857	773	1252	Yes
258	209	UXLB258209AC845A11	614	116	1666	970	879	1550	Yes
264	212	UXLB264212AC845A11	614	116	1666	970	879	1550	Yes
276	220	UXLB276220AE845A11	691	113	1916	1131	1015	1784	Yes
288	230	UXLB288230AF245A11	706	136	1959	1153	1039	1817	Yes
312	245	UXLB312245AF645A11	722	137	2019	1175	1063	1804	Yes
330	267	UXLB330267AH245A11	783	151	2227	1312	1172	1999	Yes
336	269	UXLB336269AH245A11	783	151	2227	1312	1172	1999	Yes
360	289	UXLB360289AJ845A11	845	163	2398	1402	1271	2137	Yes

* Creepage distances are based on standard arrester build configurations.

Table 2. Creepage Distances and Insulation Withstand Voltages of UXLC High-Strength Station-Class Surge Arresters

Arrester Rating (kV, rms)	Arrester MCOV (kV rms)	Catalog Number	Creepage Distance (in)	Strike (in)	1.2/50 Impulse (kV, crest)	60Hz, dry 60 seconds (kV, rms)	60Hz, wet 10 seconds (kV, rms)	Switching Surge Impuse (kV)	Grading Ring
132	106	UXLC132106A8445A11	322.4	61	929	573	501	835	Yes
138	111	UXLC138111A8445A11	322.4	61	929	573	501	835	Yes
144	115	UXLC144115A8645A11	330.1	62	948	588	506	851	Yes
162	130	UXLC162130A9045A11	345.5	66	991	610	537	885	Yes
168	131	UXLC168131A9045A11	345.5	66	991	610	537	885	Yes
172	140	UXLC172140AB045A11	422.2	83	1246	763	673	1118	Yes
180	144	UXLC180144AB245A11	429.9	84	1261	783	669	1133	Yes
192	152	UXLC192152AB645A11	445.3	87	1304	805	700	1167	Yes
198	160	UXLC198160AC045A11	460.6	90	1347	827	731	1201	Yes
204	165	UXLC204165AC045A11	460.6	90	1347	827	731	1201	Yes
216	174	UXLC216174AC245A11	468.3	92	1370	837	745	1218	Yes
228	180	UXLC228180AC045A11	460.6	90	1347	827	731	1201	Yes
240	190	UXLC240190AC645A11	483.7	95	1416	857	773	1252	Yes
258	209	UXLC258209AE845A11	690.9	133	1914	1130	1009	1782	Yes
264	212	UXLC264212AF045A11	698.6	134	1933	1145	1014	1798	Yes
276	220	UXLC276220AF445A11	714	138	1976	1167	1045	1832	Yes
288	230	UXLC288230AF645A11	721.7	139	1999	1177	1059	1849	Yes
312	245	UXLC312245AH645A11	798.4	154	2271	1330	1195	2036	Yes
330	267	UXLC330267AJ445A11	829.1	160	2352	1382	1236	2102	Yes
336	269	UXLC336269AJ645A11	836.8	162	2375	1392	1257	2120	Yes
360	289	UXLC360289AK245A11	859.8	167	2441	1424	1295	2170	Yes

Table 3. Protective Characteristics of the UltraSIL Polymer-Housed UXL Arrester

Arrester Rating (kV, rms)	Arrester MCOV (kV rms)	TOV*		Front-of-wave Protective Level** (kV Crest)	Maximum Discharge Voltage (kV Crest) 8/20 µs Current Wave						Switching Surge Protective Level (kV Crest)			
		1 Sec	10 Sec		1.5 kA	3 kA	5 kA	10 kA	20 kA	40 kA	125 A	250 A	500 A***	1000 A
3	2.55	3.5	3.3	7.7	6.2	6.5	6.8	7.3	7.8	8.6	5.5	5.7	5.8	6
6	5.1	6.9	6.6	15.3	12.5	13	13.5	14.6	15.6	17.2	11	11.3	11.6	12
9	7.65	10.4	9.9	22.5	18.4	19.2	20	21.5	23	25.3	16.2	16.6	17.1	17.7
10	8.4	11.4	10.8	24.7	20.2	21.1	21.9	23.6	25.2	27.8	17.8	18.3	18.8	19.5
12	10.2	13.9	13.1	30	24.5	25.6	26.6	28.7	30.6	33.8	21.7	22.2	22.8	23.6
15	12.7	17.2	16.4	37.3	30.4	31.9	33.1	35.7	38.1	42	27	27.6	28.4	29.4
18	15.3	20.8	19.7	45	36.7	38.4	39.9	43	45.9	50.6	32.4	33.2	34.2	35.4
21	17	23.1	21.9	50	40.7	42.6	44.3	47.7	51	56.2	36	36.9	38	39.3
24	19.5	26.5	25.1	57.3	46.7	48.9	50.8	54.8	58.5	64.5	41.3	42.3	43.6	45.1
27	22	29.9	28.4	64.7	52.7	55.2	57.3	61.8	66	72.7	46.6	47.8	49.2	50.9
30	24.4	33.1	31.5	71.7	58.4	61.2	63.6	68.5	73.2	80.7	51.7	53	54.5	56.4
33	27.5	37.3	35.4	80.8	65.8	68.9	71.6	77.2	82.5	90.9	58.3	59.7	61.4	63.6
36	29	39.4	37.4	85.2	69.4	72.7	75.5	81.4	87	95.9	61.5	62.9	64.8	67.1
39	31.5	42.8	40.6	92.6	75.4	79	82	88.4	94.5	105	66.8	68.4	70.4	72.9
42	34	46.2	43.8	99.9	81.4	85.2	88.6	95.4	102	113	72	73.8	76	78.6
45	36.5	49.6	47	108	87.4	91.5	95.1	103	110	121	77.4	79.2	81.6	84.4
48	39	53	50.3	115	93.4	97.7	102	110	117	129	82.6	84.6	87.1	90.2
54	42	57	54.1	124	101	106	110	118	126	139	89	91.1	93.8	97.1
60	48	65.2	61.9	141	115	121	125	135	144	159	102	105	108	111
66	53	72	68.3	156	127	133	138	149	159	176	113	115	119	123
72	57	77.4	73.5	168	137	143	149	160	171	189	121	124	128	132
78	62	84.2	79.9	183	149	156	162	174	186	205	132	135	139	144
84	68	92.3	87.7	200	163	171	178	191	204	225	144	148	152	158
90	72	97.8	92.8	212	173	181	188	202	216	238	153	157	161	167
96	76	103.2	98	224	182	191	198	214	228	252	161	165	170	176
108	84	114.1	108.3	247	201	211	219	236	252	278	178	183	188	195
120	98	133.1	126.3	288	235	246	256	275	294	324	208	213	219	227
132	106	143.9	136.6	312	254	266	276	298	318	351	225	230	237	246
138	111	150.7	143.1	326	266	279	289	312	333	367	236	241	248	257
144	115	156.2	148.2	338	276	289	300	323	345	380	244	250	257	266
162	130	176.5	167.6	382	312	326	339	365	390	430	276	282	291	301
168	131	177.9	168.9	385	314	329	342	368	393	433	278	285	293	303
172	140	190.1	180.5	412	335	351	365	393	420	463	297	304	313	324
180	144	195.6	185.6	423	345	361	375	404	432	476	305	313	322	333
192	152	206.4	195.9	447	364	381	396	427	456	503	322	330	340	352
198	160	217.3	206.2	470	383	401	417	449	480	529	339	347	358	370
204	165	224.1	212.7	485	395	414	430	463	495	546	350	358	369	382
216	174	236.3	224.3	512	417	436	453	489	522	575	369	378	389	403
228	180	244.4	232	529	431	451	469	505	540	595	382	391	402	417
240	190	258	244.9	558	455	476	495	533	570	628	403	412	425	440
258	209	283.8	269.4	614	501	524	545	587	627	691	443	454	467	484
264	212	287.9	273.3	623	508	532	552	595	636	701	449	460	474	490
276	220	298.8	283.6	647	527	552	573	618	660	727	466	478	492	509
288	230	312.3	296.5	676	551	577	599	646	690	760	488	499	514	532
312	245	332.7	315.8	720	587	614	638	688	735	810	519	532	548	567
330	267	362.6	344.2	758	618	647	672	724	774	853	547	560	577	597
336	272	369.4	350.6	820	668	699	727	783	837	922	591	605	623	645
360	289	392.5	372.5	849	692	724	753	811	867	955	613	627	646	668

* Temporary Overvoltage (TOV) with Prior Duty.

** Based on a 10 kA current impulse that results in a discharge voltage cresting in 0.5 µs.

*** 45-60 µs rise time for a 500 A peak current surge.

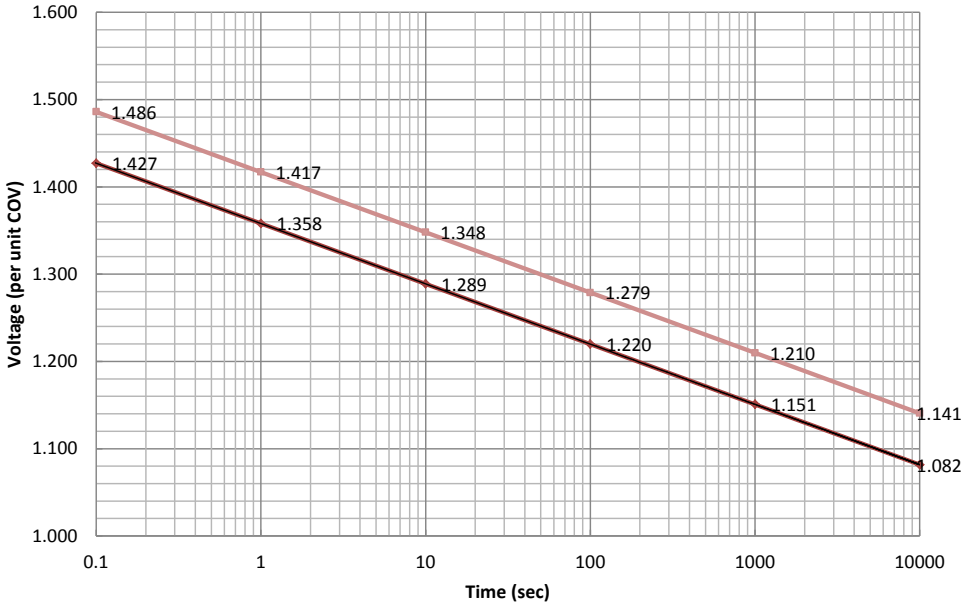

Figure 1. Temporary overvoltage curve – 60° ambient temperature.

Revision No.	Date	What was added/changed:
0	11/01/2013	New Document

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