CERTIFIED
TEST REPORT

UltraSIL™ Polymer-Housed VariSTAR™ Type UI Intermediate-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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INTRODUCTION

This test report certifies that the UltraSIL Polymer-Housed VariSTAR Type UI Intermediate-Class Surge Arresters were successfully tested to IEEE Std C62.11™-2005 standard "IEEE Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits". The Pressure Relief Test was performed in accordance with IEEE Std C62.11a™-2008.

TEST PROGRAM

OBJECT
To demonstrate that the UltraSIL Polymer-Housed VariSTAR Type UI Intermediate-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™-2005 standard, Section 8.1.2.4
B. Discharge Voltage Current Characteristics . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.3.1
C. Discharge Voltage Time Characteristics . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.4
D. Accelerated Aging Procedure . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.5
E. High-Current, Short-Duration . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.12
F. Transmission-Line Discharge Test . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.13.1
G. Duty Cycle . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.14
H. Short Circuit Test (Design B) . . . . . Per IEEE Std C62.11a™-2008 standard, Section 8.21
I. Contamination Test . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.8
J. Temporary Overvoltage (TOV) . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.15
K. Accelerated Aging Tests by Exposure to Salt Fog . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.7
L. Maximum Design Cantilever Test for Polymer-Housed Arresters . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.22
M. Moisture Ingress Test for Polymer-Housed Arresters . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.22
N. Partial Discharge (PD) Test . . . . . Per IEEE Std C62.11™-2005 standard, Section 8.11

RESULTS
UltraSIL Polymer-Housed VariSTAR Type UI Intermediate-Class Surge Arresters met all performance requirements.

TEST A
INSULATION WITHSTAND

OBJECT
To verify that the assembled insulating members of the VariSTAR Type UI Intermediate-Class Surge Arresters withstand impulse and power frequency voltage tests.

PROCEDURE
- 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 second, 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
The samples did not flash over during the tests performed. Table 1 shows the insulation withstand voltages for VariSTAR Type UI Intermediate-Class Surge Arresters.

TEST B
DISCHARGE VOLTAGE CURRENT CHARACTERISTICS

OBJECT
To determine the maximum discharge voltage characteristics of the VariSTAR Type UI Intermediate-Class Surge Arresters at 1.5, 3, 5, 10, 20 and 40 kA crest.

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
Chart 2 shows the maximum 8 x 20 discharge voltages for the VariSTAR Type UI Intermediate-Class Surge Arresters.

TEST C
DISCHARGE VOLTAGE TIME CHARACTERISTICS

OBJECT
To obtain the front-of-wave and switching impulse protective levels of the VariSTAR Type UI Intermediate-Class Surge Arresters.

PROCEDURE
Front-of-Wave Protective Level:
- A current of 10 kA was used to determine the front-of-wave protective level.
- The arresters were impulsed using front times of 8 µs, 2 µs and 1 µs.
- The maximum discharge voltage and the time to voltage crest were measured.
- The voltage/time measurements were plotted on linear voltage versus log time paper and the maximum voltage at 0.5 µs was determined.

Switching Impulse Protective Level:
- Currents of 500 A 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 2 shows the front-of-wave and switching impulse protective levels for the VariSTAR Type UI Intermediate-Class Surge Arresters.

TEST D
ACCELERATED AGING PROCEDURE

OBJECT
To verify the K_C and K_R ratios of the VariSTAR Type UI Intermediate-Class Surge Arresters.

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 $K_R \leq 1$, then K_C and K_R are equal to 1.

RESULTS
K_C and $K_R = 1$.

TEST E
HIGH-CURRENT, SHORT-DURATION

OBJECT
To demonstrate that the VariSTAR Type UI Intermediate-Class Surge Arresters meet the high-current, short-duration requirements.

K_W = Watts Loss Ratio

PROCEDURE
- Three prorated equivalent thermal sections were used for this test.
- Each sample was impulsed with a 100 kA crest current with a wave shape of 4 x 10 µs. This exceeded the required peak current of 65 kA.
- The samples were allowed to cool to ambient temperature.
- Each sample was impulsed a second time.
- Immediately following the second impulse, the samples were energized at the thermal recovery voltage equivalent to MCOV x K_W x K_C for 30 minutes to verify thermal recovery.
- The samples were inspected after testing to verify that there was no physical damage.
- K_W = Voltage at max watts/MCOV

RESULTS
VariSTAR Type UI Intermediate-Class Surge Arresters met the high-current, short-duration requirements of two impulses, thermal recovery, and no physical damage.

TEST F
TRANSMISSION-LINE DISCHARGE TEST

OBJECT
To demonstrate that the VariSTAR Type UI Intermediate-Class Surge Arresters meet the transmission-line discharge test.

PROCEDURE
- Three 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 was measured.
- Each sample was subjected to three groups of six consecutive Transmission-Line Discharge (TLD) operations timed to occur 50 to 60 seconds apart.
- The samples were permitted to cool after each group of six impulses.
- After the 18th impulse the samples were heated to 60 degrees centigrade and allowed to thermally stabilize.
- Within two minutes upon removal from the oven, two additional TLD impulses were applied 50 to 60 seconds apart.
- Within one minute the appropriate 60 Hz voltage was applied and the watts loss was monitored for a minimum of 30 minutes to verify thermal recovery.
- Each sample was subjected to a final 10 kA crest, 8 x 20 µs impulse 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 UI Intermediate-Class Surge Arresters met the Transmission-Line Discharge test requirements of 20 impulses, less than 10% change in discharge voltage, and no physical damage.

TEST G
DUTY CYCLE

OBJECT
To demonstrate that the VariSTAR Type UI Intermediate-Class Surge Arresters meet duty cycle requirements.

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 equivalent to 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 UI Intermediate Class Surge Arresters met the duty cycle test requirements of 22 impulses, thermal recovery, less than 10% change in discharge voltage, and no physical damage.

TEST H
SHORT CIRCUIT TEST
(DESIGN B)

OBJECT
To verify arrester internal fault is not likely to create an explosive event in accordance with IEEE Std C62.11a™-2008 standard.

PROCEDURE
- Samples were prefailed by power frequency overvoltage.
- 60 kV rated samples were used in this testing (the highest voltage rating in a single unit housing).
- The arrester samples were mounted to simulate service conditions.

High-Current Short Circuit Testing:

- The test circuit was adjusted to produce a 60 Hz, 40 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 Short Circuit Testing:

- Samples were prefailed 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 occurred.

RESULTS
VariSTAR Type UI Intermediate-Class Surge Arresters passed the described high and low-current 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

OBJECT
To demonstrate the ability of the VariSTAR Type UI Intermediate-Class Surge Arresters to withstand the electrical stresses caused by contamination on the housing.

PROCEDURE
- 108 kV samples were 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 Ωcm slurry was applied to the lower half of the arrester 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 UI Intermediate-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.

TEST J
TEMPORARY OVERVOLTAGE (TOV)

OBJECT
To verify what levels of 60 cycle temporary overvoltage the VariSTAR Type UI Intermediate-Class Surge Arresters survive.

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 equivalent to MCOV x K_W x K_C for 30 minutes. Sample current and temperature 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 applied was that generated in two transmission line discharges.
- The "prior duty" absorbed in these arresters was 3.9 kJ/kV of MCOV.

RESULTS
Graph 1 and Table 3 show the performance results.

TEST K
ACCELERATED AGING BY EXPOSURE TO SALT FOG

OBJECT
The purpose of this test is to demonstrate the ability of the VariSTAR Type UI Intermediate-Class Surge Arresters to withstand electrical stresses on the arrester housing caused by exposure to salt fog.

PROCEDURE
- Complete 72 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 continually filled the chamber. The starting value of the salt content of the water was 10 kg/m^3.
- The samples were energized at MCOV for time duration of 1000 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 UI Intermediate-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 10pc before and after testing. No trips or interruptions occurred during testing.

TEST L
MAXIMUM DESIGN CANTILEVER TEST FOR POLYMER-HOUSED ARRESTERS

OBJECT
To evaluate the Maximum Design Cantilever Load (MDCL-Static) specified by the manufacturer for polymer housed arresters.

PROCEDURE
- The sample consisted of the longest two mechanical 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 of 35 ft-lbs was applied to sample for time duration of 30s.
- Thermomechanical Preconditioning
  - The sample is subject to the maximum continuous cantilever load with variations in load direction and temperature according to IEEE Std C62.11™-2005 standard, Figure 5.
  - Maximum Design Cantilever Load is 4,000 in-lbs.
  - 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 according to IEEE Std C62.11™-2005 standard, Figure 4. 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.

EVALUATION
VariSTAR Type UI Intermediate-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 10pC.

TEST M
MOISTURE INGRESS TEST FOR POLYMER-HOUSED ARRESTERS

OBJECT
To evaluate the mechanical load specified by the manufacturer and the seal for polymer-housed arrester.

PROCEDURE
- Three Complete 72 kV samples were used in this test.
- Power loss at 80-100% MCOV (noting ambient temperature) and Nominal Discharge Current at 1.5 kA measurements are recorded.
- Terminal torque of 35 ft-lbs was applied to the sample for the time duration of 30s.
- Thermomechanical Preconditioning
  - The sample is subject to the maximum continuous cantilever load with variations in load direction and temperature per IEEE Std C62.11™-2005 standard, Figure 4.
  - Maximum Design Cantilever Load is 4,000 in-lbs.
  - 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 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 UI Intermediate Class Surge Arrester met Moisture Ingress test requirements of the power loss did not and 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 10pC.

TEST N
PARTIAL DISCHARGE (PD) TEST

OBJECT
The purpose of this test is to verify that the VariSTAR Type UI Intermediate-Class Surge Arresters do not generate unacceptable levels of partial discharge.

PROCEDURE
- The highest rated arrester manufactured was tested.
- The corrected Rated and MCOV voltages were calculated based on the correction factor of $V_{ref\ measured}/V_{ref\ minimum}$.
- 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 UI Intermediate-Class Surge Arresters met Partial Discharge test requirements. Partial discharge at 1.05 x corrected MCOV did not exceed 10pC.

TABLE 1:
Dimensions, Clearance Requirements, and Weights - VariSTAR Type UI Intermediate-Class Surge Arresters with Standard Creep Housings

Arrester Rating (kV, rms)	Arrester MCOV (kV, rms)	Figure 5 Dim. "A" (Inches)	Figure 4 Dim. "B" Minimum Phase-to-Ground Clearances (Inches)	Figure 4 Dim. "C" Minimum Phase-to-Phase Clearances (Inches)	Creepage Distance (Inches)	Insulation Withstand Voltages			Weight (lbs.)
						1.2/50 Impulse (kV, Crest)	60 Hz, dry 60 Seconds (kV, rms)	60 Hz, wet 10 Seconds (kV, rms)	
3	2.55	4.7	5.5	10	23	86	60	48	9.6
6	5.1	4.7	5.5	10	23	86	60	48	9.6
9	7.65	6.3	5.9	10.4	30.7	115	80	64	10.7
10	8.4	6.3	6.1	10.6	30.7	115	80	64	10.7
12	10.2	6.3	6.6	11.1	30.7	115	80	64	10.7
15	12.7	6.3	7.5	12	30.7	115	80	64	10.7
18	15.3	7.8	8.6	13.1	38.4	134	94	75	11.4
21	17.0	7.8	8.6	13.1	38.4	134	94	75	11.4
24	19.5	9.4	9.5	14	46.1	155	109	88	12.4
27	22.0	10.9	10.5	15	53.7	176	123	101	13.6
30	24.4	10.9	11.5	16	53.7	176	123	101	13.6
33	27.5	12.5	12.7	17.2	61.4	201	140	113	14.8
36	29.0	12.5	13.3	17.8	61.4	201	140	113	14.8
39	31.5	14	14.3	18.8	69.1	217	151	126	15
42	34.0	14	15.2	19.7	69.1	217	151	126	15
45	36.5	15.6	16.2	20.7	76.8	237	164	139	16.8
48	39.0	17.2	17.2	21.7	84.4	252	172	152	17.7
54	42.0	17.2	18.4	22.9	84.4	252	172	152	17.7
60	48.0	20.3	20.8	25.3	99.8	294	201	173	19.7
66	53.0	20.3	22.7	27.2	99.8	294	201	173	19.7
72	57.0	21.8	24.3	28.8	107.5	316	212	187	20.6
78	62.0	26.6	26.3	30.8	130.5	418	291	239	22.5
84	68.0	28.1	28.7	33.2	138.2	434	302	252	22.7
90	72.0	29.7	30.2	34.7	145.9	454	315	265	24.5
96	76.0	31.2	31.8	36.3	153.5	474	328	278	26.3
108	84.0	34.4	35	39.5	168.9	504	344	304	28.1

TABLE 2: Discharge Voltages - Maximum Guaranteed Protective Characteristics for VariSTAR Type UI Intermediate-Class Surge Arresters

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		1.5kA	3kA	5kA	10kA	20kA	40kA	500A
3	2.55	3.5	3.3	8.8	6.8	7.2	7.6	8.3	9.1	10.4	6.3
6	5.1	6.9	6.6	17.5	13.6	14.4	15.2	16.6	18.2	20.7	12.5
9	7.65	10.4	9.9	26.2	20.4	21.6	22.7	24.9	27.3	31.1	18.8
10	8.4	11.4	10.8	28.8	22.4	23.7	24.9	27.3	29.9	34.1	20.6
12	10.2	13.9	13.1	34.9	27.2	28.8	30.3	33.1	36.3	41.4	25
15	12.7	17.2	16.4	43.5	33.8	35.8	37.7	41.3	45.2	51.5	31.1
18	15.3	20.8	19.7	52.4	40.8	43.1	45.4	49.7	54.5	62.1	37.5
21	17.0	23.1	21.9	58.2	45.3	47.9	50.4	55.2	60.5	69	41.6
24	19.5	26.5	25.1	66.7	51.9	55	57.8	63.3	69.4	79.1	47.8
27	22.0	29.9	28.4	75.3	58.6	62	65.2	71.4	78.3	89.2	53.9
30	24.4	33.1	31.5	83.5	65	68.8	72.3	79.2	86.8	98.9	59.8
33	27.5	37.3	35.4	94.1	73.2	77.5	81.5	89.3	97.9	112	67.3
36	29.0	39.4	37.4	99.2	77.2	81.7	86	94.2	104	118	71
39	31.5	42.8	40.6	108	83.9	88.8	93.4	103	113	128	77.1
42	34.0	46.2	43.8	117	90.5	95.8	101	111	121	138	83.2
45	36.5	49.6	47.0	125	97.2	103	109	119	130	148	89.4
48	39.0	53.0	50.3	134	104	110	116	127	139	159	95.5
54	42.0	57.0	54.1	144	112	119	125	137	150	171	103
60	48.0	65.2	61.9	165	128	136	143	156	171	195	118
66	53.0	72.0	68.3	182	142	150	158	172	189	215	130
72	57.0	77.4	73.5	195	152	161	169	185	203	232	140
78	62.0	84.2	79.9	213	165	175	184	202	221	252	152
84	68.0	92.3	87.7	233	181	192	202	221	242	276	167
90	72.0	97.8	92.8	247	192	203	214	234	257	292	177
96	76.0	103.2	98.0	260	203	215	226	247	271	309	186
108	84.0	114.1	108.3	288	224	237	249	273	299	341	206

* Temporary Overvoltage with Prior Duty.

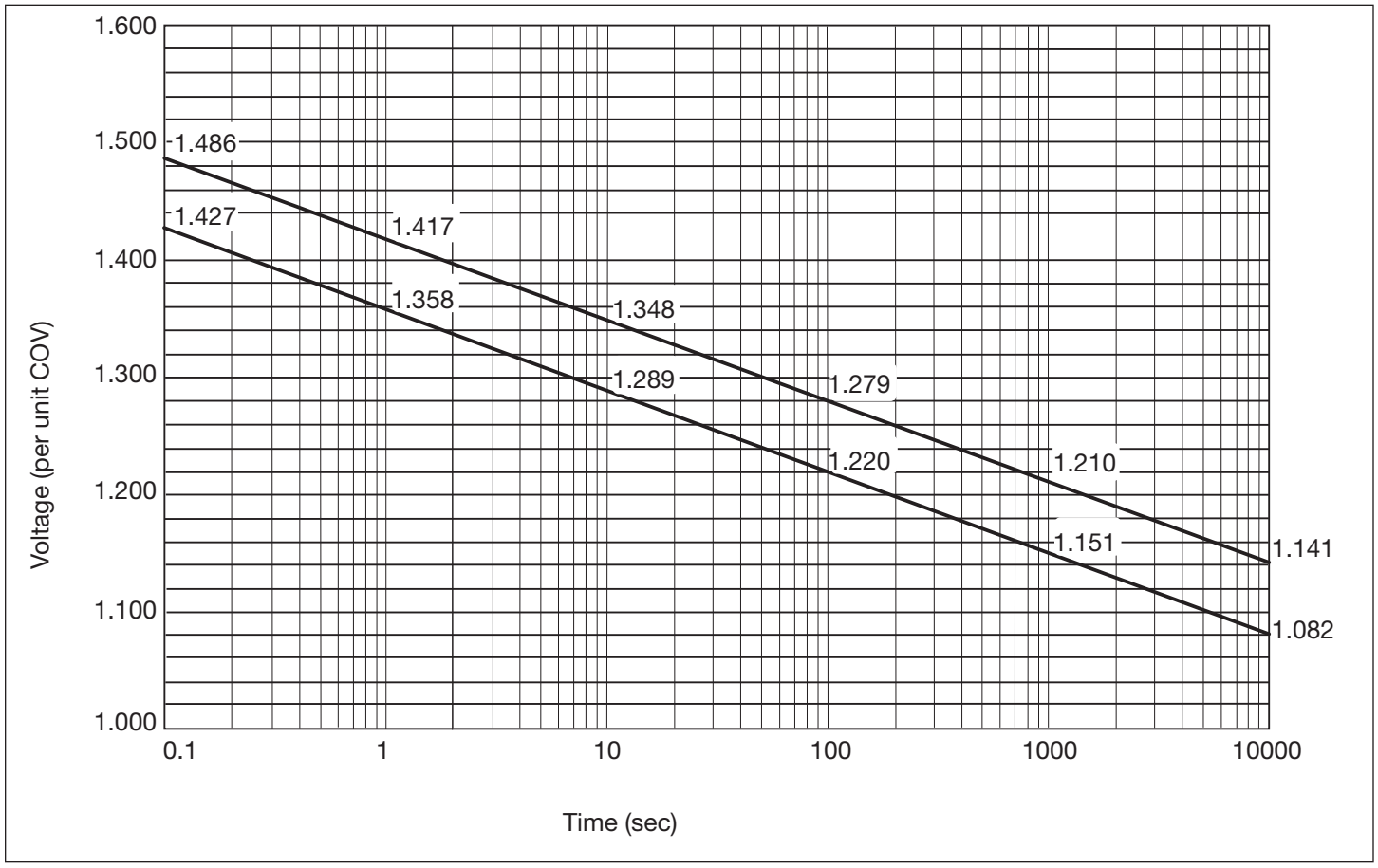
** Based on a 10 kA current impulse that results in a discharge voltage cresting in 0.5 µs

*** Contact manufacturer for alternate electrical builds.

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

GRAPH 1

TOV Recovery Curve of VariSTAR Type UI Intermediate-Class Surge Arresters



* With rated energy applied (3.9 kJ/kV of MCOV).

TABLE 3
TOV Recovery Capability of VariSTAR Type UI Intermediate-Class Surge Arresters

Time (Seconds)	TOV (Per unit MCOV)	
	No Prior Duty	Prior Duty
0.1	1.486	1.427
1	1.417	1.358
10	1.348	1.289
100	1.279	1.220
1000	1.210	1.151
10000	1.141	1.082

COOPER Power Systems

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