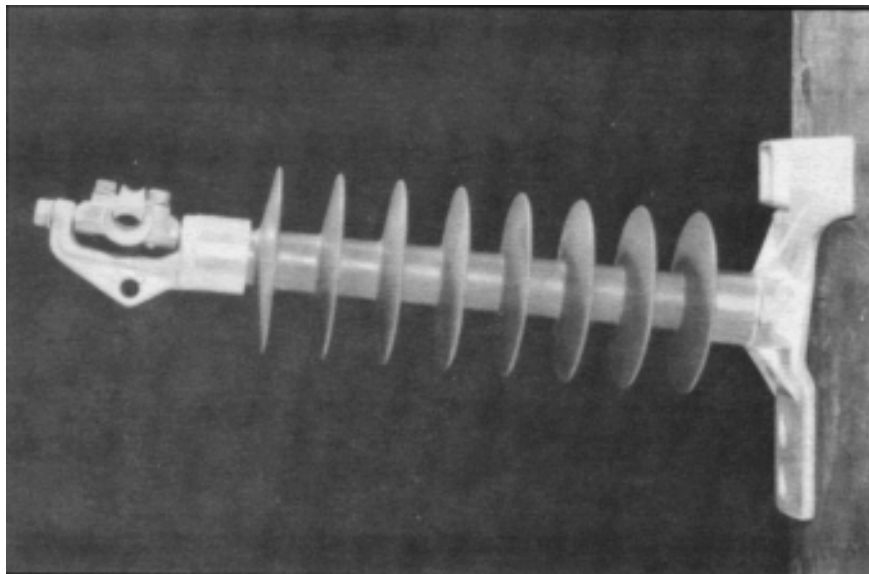


Design Tests

Veri*Lite™ 69kV Line Post Insulator

Performed in Accordance with all applicable ANSI/IEEE Standards



March 1992

This design test report records the results of laboratory tests made on the Ohio Brass Veri*Lite 69 kV line post insulators.

Test Reference was the standard procedures of ANSI C29.1 and IEC Standards where applicable.

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I. 60 Hz Dry Flashover and Withstand

Tests were performed in accordance with ANSI C29.1, sections 4.2 and 4.4. Three insulators designed for horizontal mounting and three for vertical mounting were tested. The results, corrected to standard atmospheric conditions according to ANSI C29, are summarized as follows:

Catalog No. 402069-0100 (Horizontal)

	Insulator Sample		
	1	2	3
Flashover, kV	242	244	230
Withstand, kV	226	226	215

Catalog No. 402069-0209 (Vertical)

	Insulator Sample		
	4	5	6
Flashover, kV	216	220	224
Withstand, kV	201	206	206

II. 60 Hz Wet Flashover and Withstand

Tests were performed in accordance with ANSI C29.1, sections 4.3 and 4.5. Three insulators designed for horizontal mounting and three for vertical mounting were tested. The results, corrected to standard atmospheric conditions according to ANSI C29.1, are summarized as follows:

Catalog No. 402069-0100 (Horizontal)

	Insulator Sample		
	1	2	3
Flashover, kV	195	191	194
Withstand, kV	168	183	183

Catalog No. 402069-0209 (Vertical)

	Insulator Sample		
	4	5	6
Flashover, kV	171	175	174
Withstand, kV	159	165	165

III. Critical Impulse Flashover and Withstand

Tests were performed in accordance with ANSI C29.1, sections 4.7 and 4.8. Three insulators designed for horizontal mounting and three for vertical mounting were tested. The results, corrected to standard atmospheric conditions according to ANSI C29, are summarized as follows:

Catalog No. 402069-0100 (Horizontal)

	Insulator Sample		
	1	2	3
Positive Flashover, kV	362	354	361
Positive Withstand, kV	348	334	334
Negative Flashover, kV	406	408	408
Negative Withstand, kV	384	384	384

Catalog No. 402069-0209 (Vertical)

	Insulator Sample		
	4	5	6
Positive Flashover, kV	377	373	378
Positive Withstand, kV	359	344	349
Negative Flashover, kV	415	411	410
Negative Withstand, kV	400	396	400

IV. RIV (Radio Influence Voltage)

Tests were performed in accordance with ANSI C29.1, section 4.9. Three insulators designed for horizontal mounting and three for vertical mounting were tested. The results are shown in figures 1 and 2

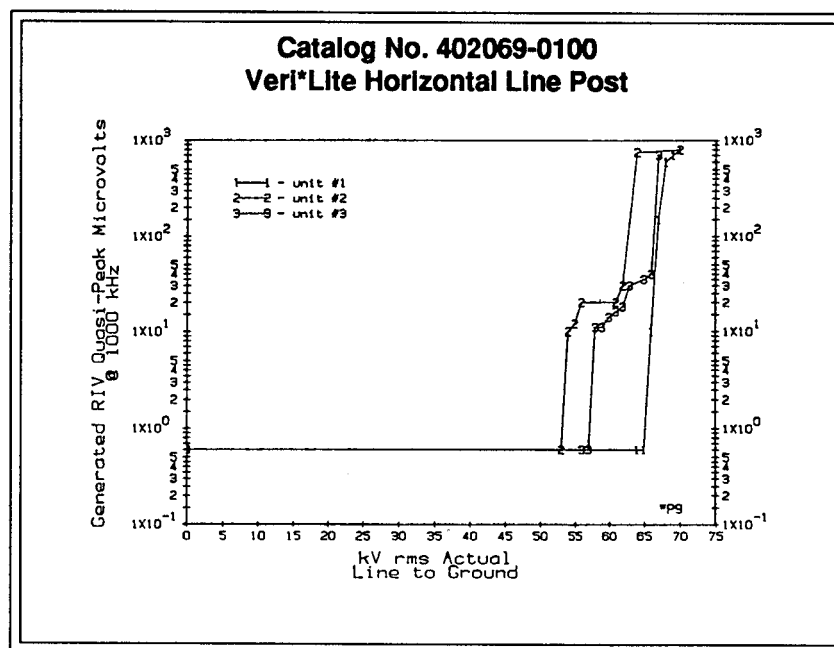


Figure 1

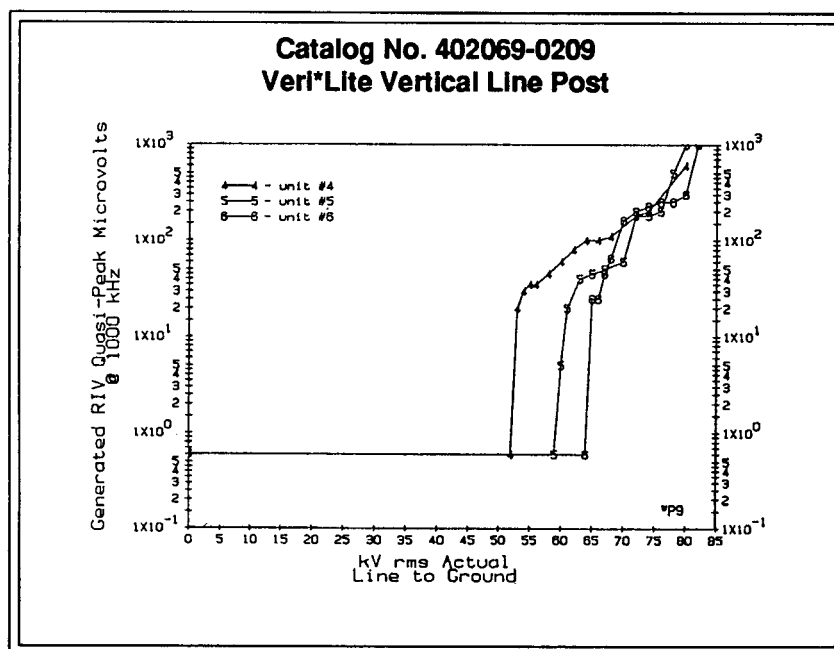


Figure 2

V. Cantilever to Fracture

The insulator is subjected to a cantilever load which is applied rapidly but smoothly from zero to 1,800 lbs. After reaching 1,800 lbs., the rate of load increase is reduced to approximately 20 lbs. per second to failure.

Catalog No. 402069-0910 (Horizontal)

	Insulator Sample		
	1	2	3
Ultimate Load, lbs.	2,677	2,890	2,720

Catalog No. 402069-0900 (Horizontal)

	Insulator Sample		
	1	2	3
Ultimate Load, lbs.	2,601	2,542	2,677

VI. Dye Penetration Rod/Weathershed Subassembly

Rod/weathershed subassemblies without end fittings were cycled between hot and cold water containing fuchsin dye. The test consisted of 10 cycles between a tank containing water and dye at 36°F and a tank containing water and dye at 205°F. The subassemblies were left in each tank for two hours per cycle.

At the completion of the tenth cycle, the insulators were removed from the dye tank and allowed to dry naturally. When completely dry, the specimens were carefully inspected for dye penetration into the rod/weathershed interface. The inspection consisted of carefully cutting the weathershed away from the rod.

Results: Three samples were tested and there was no evidence of dye penetration.

VII. Dye Penetration Insulator Assembly

Complete insulator assemblies were cycled between hot and cold water containing fuchsin dye. The test consisted of 10 cycles between a tank containing water and dye at 36°F and a tank containing water and dye at 205°F. The insulators were left in each tank for two hours per cycle.

At the completion of the tenth cycle, the insulators were removed from the dye tank and allowed to dry naturally. When completely dry, the specimens were carefully inspected for dye penetration into the rod/weathershed, end fitting/weathershed and end fitting/rod interfaces.

Results: Three 402069-0910 insulators were tested. There was no dye penetration into interface.

VIII. Rod/Weathershed Interface Electrical Puncture

Interface puncture specimens were cut from molded rod/weathershed subassemblies. The specimens included one weathershed and a precise interface length. The samples were fitted with metal electrodes and submerged in insulating oil. Power frequency voltage was applied between the electrodes and raised at a rate of 1 kV per second until puncture.

Results: Eight samples were made from two rod/weathershed subassemblies for a total of 16 puncture test samples. The mean interface puncture strength was 172 rms volts per mil with a standard deviation of 23 rms volts per mil

IX. Conclusions

The insulator test results described in this test report met or exceeded all electrical and mechanical design and catalog requirements established for Veri*Lite 69 kV line post insulators.

Appendix A

Details of Dry and Wet Flashover and Withstand Tests

I. Dry Flashover and Withstand

402069-0100 (Horizontal)

Test Date: October 1, 1991

Test Conditions:

Dry bulb temperature 77.5°F

Wet bulb temperature 62.5°F

Barometric pressure 28.93 in Hg

Vapor pressure 0.40 in Hg

Relative humidity 42.0%

Dry arc distance 21.0 inches

Leakage distance 51.0 inches

Flashover Voltage (kV)

	Insulator #1	Insulator #2	insulator #3
Test 1	210	220	205
Test 2	215	215	208
Test 3	225	225	215
Test 4	225	223	212
Test5	223	225	205
Average flashover (kV)	220	222	209
Corrected flashover (kV)	242	244	230
Withstand - 60 sec. (kV)	205	205	195
Corrected withstand (kV)	226	226	215

Corrected to standard atmospheric conditions:

Dry bulb temperature 77°F

Barometric pressure 29.92 in Hg

Vapor pressure 0.6085 in Hg

II. Dry Flashover and Withstand

402069-0209 (Vertical)

Test Date: October 1, 1991

Test Conditions:

Dry bulb temperature 72.5°F

Wet bulb temperature 61.0°F

Barometric pressure 28.98 in Hg

Vapor pressure 0.41 in Hg

Relative humidity 51.5%

Dry arc distance 21.0 inches

Leakage distance 51.0 inches

Flashover Voltage (kV)

	Insulator #4	Insulator #5	insulator #6
Test 1	193	200	205
Test 2	203	205	205
Test 3	200	205	205
Test 4	200	197	203
Test5	200	210	210
Average flashover (kV)	199	203	206
Corrected flashover (kV)	216	220	224
Withstand - 60 sec. (kV)	185	190	190
Corrected withstand (kV)	201	206	206

Corrected to standard atmospheric conditions:

Dry bulb temperature 77°F

Barometric pressure 29.92 in Hg

Vapor pressure 0.6085 in Hg

III. Wet Flashover and Withstand

402069-0100 (Horizontal)

Test Date: October 25, 1991

Test Conditions:

Dry bulb temperature 71.0°F

Wet bulb temperature 65.0°F

Barometric pressure 29.05 in Hg

Relative air density 0.981

Dry arc distance 21.0 inches

Leakage distance 51.0 inches

Flashover Voltage (kV)

	Insulator #1	Insulator #2	insulator #3
Test 1	190	195	184
Test 2	192	192	190
Test 3	193	202	196
Test 4	186	189	190
Test5	194	175	188
Average flashover (kV)	191	191	190
Corrected flashover (kV)	195	195	194
Withstand - 10 sec. (kV)	165	180	184
Corrected withstand (kV)	168	183	188

Corrected to relative air density = 1.0

IV. Wet Flashover and Withstand

402069-0209 (Vertical)

Test Date: October 18, 1991

Test Conditions:

Dry bulb temperature 71.0°F

Wet bulb temperature 60.0°F

Barometric pressure 28.78 in Hg

Relative air density 0.972

Dry arc distance 21.0 inches

Leakage distance 51.0 inches

	Flashover Voltage (kV)		
	Insulator #4	Insulator #5	insulator #6
Test 1	160	173	170
Test 2	162	172	168
Test 3	175	170	170
Test 4	160	169	168
Test5	180	165	170
Average flashover (kV)	167	170	169
Corrected flashover (kV)	172	175	174
Withstand - 10 sec. (kV)	155	160	160
Corrected withstand (kV)	159	165	165

Corrected to relative air density = 1.0

Appendix B

Details of Critical Impulse Flashover and Withstand Tests

I. 402069-0100 (Horizontal) Insulator #1

Test Date: November 13, 1991

Test Conditions:

Dry bulb temperature 74.0°F

Wet bulb temperature 54.5°F

Barometric pressure 28.85 in Hg

Vapor pressure 0.215 in Hg

Relative humidity 26.0%

Crest Voltage (kV)

Impulse	Positive Polarity	Negative Polarity
	(F=Flashover; W=withstand)	
1	303 W	384 F
2	318 W	377 F
3	332 F	369 W
4	318 W	377 F
5	329 F	369 F
6	321 W	362 W
7	325 W	373 F
8	332 F	366 W
9	321 F	369 F
10	314 W	362 W
11	325 W	369 F
12	329 W	362 W
13	340 F	373 F
14	332 F	366 F
15	325 W	358 W
16	332 F	366 F
17	325 F	355 W
18	318 W	362 F
19	325 F	355 W
20	318 W	362 W
Critical flashover (kV)		
	324	367
Corrected flashover (kV)		
	362	406
Withstand voltage (kV)		
	310	347
Corrected withstand (kV)		
	346	384

Corrected to standard atmospheric conditions:

Dry bulb temperature 77°F

Barometric pressure 29.92 in Hg

Vapor pressure 0.6085 in Hg

II. 402069-0100 (Horizontal) Insulator #2

Test Date: November 13, 1991

Test Conditions:

Dry bulb temperature 74.0°F

Wet bulb temperature 54.5°F

Barometric pressure 28.85 in Hg

Vapor pressure 0.215 in Hg

Relative humidity 26.0%

Crest Voltage (kV)

Impulse	Positive Polarity	Negative Polarity
	(F=Flashover; W=withstand)	
1	303 W	377 F
2	310 W	369 W
3	318 F	380 F
4	310 W	369 W
5	318 F	377 F
6	310 W	366 F
7	321 F	366 W
8	310 W	369 W
9	318 F	377 F
10	310 W	369 F
11	318 W	362 F
12	325 W	355 W
13	332 F	366 W
14	325 F	369 F
15	318 W	362 W
16	325 F	369 W
17	314 W	377 F
18	325 F	369 F
19	318 F	366 W
20	310 W	373 F
Critical flashover (kV)	317	369
Corrected flashover (kV)	354	408
Withstand voltage (kV)	299	347
Corrected withstand (kV)	334	384

Corrected to standard atmospheric conditions:

Dry bulb temperature 77°F

Barometric pressure 29.92 in Hg

Vapor pressure 0.6085 in Hg

III. 402069-0100 (Horizontal) Insulator #3

Test Date: November 13, 1991

Test Conditions:

Dry bulb temperature 74.0°F
 Wet bulb temperature 54.5°F
 Barometric pressure 28.85 in Hg
 Vapor pressure 0.215 in Hg
 Relative humidity 26.0%

Crest Voltage (kV)

Impulse	Positive Polarity	Negative Polarity
	(F=Flashover; W=withstand)	
1	318 W	377 F
2	329 F	373 W
3	318 W	384 F
4	325 F	373 F
5	321 F	369 W
6	318 W	377 W
7	321 W	380 F
8	332 F	373 F
9	329 W	366 F
10	332 F	354 W
11	325 F	362 F
12	314 F	358 W
13	310 W	369 F
14	314 W	366 W
15	325 F	373 F
16	314 W	362 W
17	325 W	369 W
18	332 F	373 F
19	325 W	358 W
20	332 F	369 F
Critical flashover (kV)		
	323	369
Corrected flashover (kV)		
	361	408
Withstand voltage (kV)		
	299	347
Corrected withstand (kV)		
	334	384

Corrected to standard atmospheric conditions:

Dry bulb temperature 77°F
 Barometric pressure 29.92 in Hg
 Vapor pressure 0.6085 in Hg

V. 402069-0209 (Vertical) Insulator #6

Test Date: October 3, 1991

Test Conditions:

Dry bulb temperature 72.0°F

Wet bulb temperature 63.0°F

Barometric pressure 28.79 in Hg

Vapor pressure 0.48 in Hg

Relative humidity 61.0%

Crest Voltage (kV)

Impulse	Positive Polarity	Negative Polarity
	(F=Flashover; W=withstand)	
1	360 W	401 F
2	378 F	392 W
3	364 F	401 F
4	341 W	392 W
5	360 W	401 F
6	373 F	392 W
7	360 W	401 F
8	378 F	396 W
9	355 F	401 F
10	346 F	392 W
11	332 W	396 F
12	355 F	392 W
13	332 W	396 F
14	350 W	401 W
15	360 W	392 F
16	373 F	392 F
17	360 F	392 W
18	346 W	392 F
19	360 W	392 W
20	378 F	392 W
Critical flashover (kV)	358	395
Corrected flashover (kV)	378	410
Withstand voltage (kV)	330	387
Corrected withstand (kV)	349	400

Corrected to standard atmospheric conditions:

Dry bulb temperature 77°F

Barometric pressure 29.92 in Hg

Vapor pressure 0.6085 in Hg

Appendix C

Details of Radio Influence Voltage Tests

I. 402069-0100 (Horizontal)

Test Date: September 30, 1991

Insulator #1		Insulator #2		Insulator #3	
Voltage (kV)	RIV (uV)	Voltage (kV)	RIV (uV)	Voltage (kV)	RIV (uV)
0	.6	0	.6	0	.6
64	.6	53	.6	56	.6
65	.6	54	10	57	.6-15
66	10-1000	55	12-13	58	11-15
67	150-600	56	20-25	59	11-15
68	600-700	61	20-25	60	14-16
69	700-800	62	30-40	61	16-20
70	800-900	64	750	62	18-25
69	750-800	70	800	63	30-35
68	500-750	64	750	65	35-45
67	500-600	58	750	66	40-50
66	10-500	56	300-500	67	700-800
65	.6	54	2-1000	66	25-35
		53	.6	65	25-30
				64	20-25
				63	18-20
				62	14-16
				61	.6-10
				60	.6

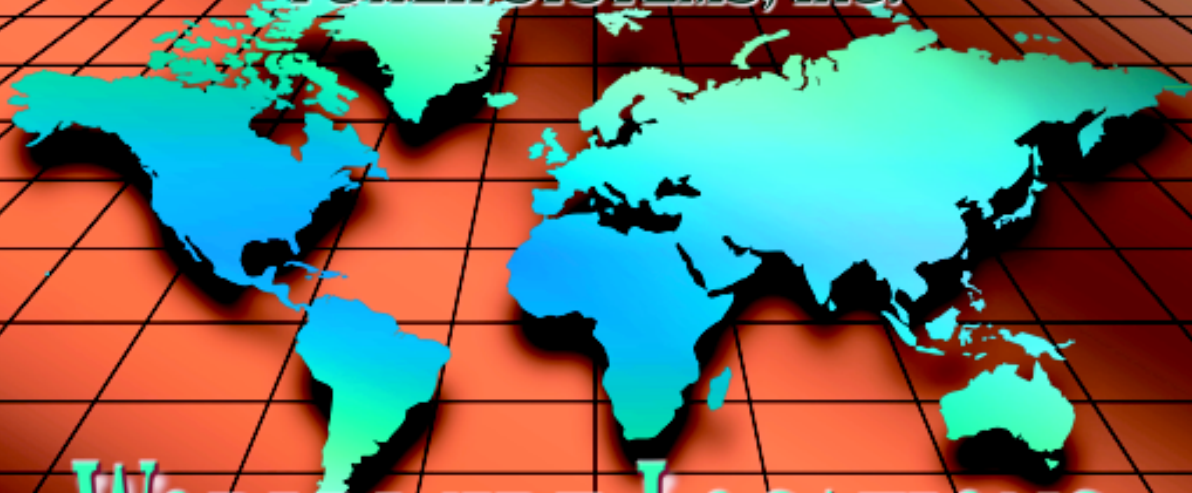
II. 402069-0209 (Vertical)

Test Date: October 1, 1991

Insulator #4		Insulator #5		Insulator #6	
Voltage (kV)	RIV (uV)	Voltage (kV)	RIV (uV)	Voltage (kV)	RIV (uV)
0	.6	0	.6	0	.6
52	.6	59	.6	64	.6
53	20-25	60	5-12	65	25-30
54	30	61	20-50	66	25-50
55	35-40	63	40-50	67	45-50
56	35-40	65	45-55	68	65-70
58	45-50	67	50-60	70	160-200
60	60-70	70	60-70	72	200-250
62	80-100	72	180-200	74	225-250
64	100-110	74	180-200	76	250-275
66	100-110	76	200-1000	78	250-300
68	110-115	78	500-1000	80	300-1000
72	180-200	80	1000-1200	82	1000-1200
74	200-225	78	200-1000	80	200-800
74	200-250	76	150-750	78	250-700
80	200-1000	74	150-700	76	225-250
74	200-225	72	160-180	74	225-250
70	100-160	70	70-100	72	190-210
66	80-100	68	60-80	70	160-180
62	70-80	66	40-60	68	50-60
58	40-50	64	35-45	67	.6-70
56	25-30	63	30-35	66	.6
55	25-30	62	30-35		
54	.6	60	25-30		
		59	20-25		
		58	.6		



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