Westinghouse Electric Corporation
T&D Components Division
Bloomington, Indiana 47401

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New Information
Mailed to: E, D, C/38-000A

Indoor/Outdoor
Altitude 0-10,000 Feet
3-120 kV

IMX Gapless Metal Oxide Surge Arresters

Gapless Design
The Westinghouse Type IMX metal oxide arresters are completely gapless for all ratings offered. The use of Westinghouse developed MOXIDE™ metal oxide discs result in superior protective levels without the aid of either series or parallel gaps.

The Type IMX gapless arresters conduct only a few milliamperes at normal operating voltage. During a voltage surge, the arrester only conducts enough current to limit the voltage to the required protective levels.

Arrester Rating
Arresters in service are continually exposed to line-to-ground power frequency voltage. For each system voltage, there may be several arrester ratings available.

The minimum IMX arrester rating for a specific system voltage can be used for solidly grounded systems. The arrester rating must be selected so that the maximum continuous voltage applied to the arrester terminals is less than or equal to the maximum continuous operating voltage (MCOV) of the arrester. For temporarily ungrounded, impedance grounded or ungrounded systems, higher rated arresters may be required.

The IMX arresters are rated in accordance with duty cycle tests established by ANSI 62.1 and Working Group Draft 3.3.11 (standard for metal oxide surge arresters for alternating current power circuits). These duty cycle tests were performed at a voltage level above the maximum continuous operating voltage rating (MCOV) of the arrester to verify that the IMX arrester will remain thermally stable when applied within the limits of its MCOV rating. The voltage at which the duty cycle was performed is the voltage rating on the arrester nameplate.

Protective Characteristics
The gapless feature of the IMX design eliminates the need for impulse and switching surge sparkover values to establish protective characteristics. New performance criteria have been established for the gapless metal oxide arrester which can be compared to system insulation strength to insure proper coordination.

Maximum .5 μsec Discharge Voltage:
The front-of-wave impulse sparkover has been replaced by a .5 μsec discharge voltage. This is defined to be the equivalent of a fast front 10 kA current producing a voltage wave cresting in .5 microseconds. This value can be compared to the insulation strength for fast rising voltages.

Maximum Switching Surge Protection Level:
The switching surge sparkover is replaced by the maximum switching surge protection level. This is defined as the maximum discharge voltage produced by slow-front current waves of 500 amps. This value can be compared to the switching surge insulating strength of the protected insulation.

The IMX arrester provides an excellent margin of protection for the various current front times.

The protective characteristics of the Westinghouse IMX are shown in Table A.

Table A: Westinghouse IMX Surge Arrester Characteristics

Rating kV-RMS	Maximum Continuous Operating Voltage	Maximum .5 μsec Discharge Voltage kV-Crest①	Maximum Switching Surge (500A) Protective Level kV-Crest②	Maximum Discharge Voltage with an 8 × 20 μsec Current Wave kV-Crest					
				1.5 kA	3.0 kA	5.0 kA	10 kA	20 kA	40 kA
3	2.8	10.0	7.4	8.0	8.4	8.8	9.4	10.3	11.8
4.5	3.7	13.0	9.6	10.4	10.9	11.4	12.2	13.4	15.3
6	5.1	17.6	13.0	14.1	14.8	15.4	16.5	18.1	20.7
7.5	5.6	19.5	14.4	15.6	16.4	17.1	18.3	20.1	23.0
9	7.6	26.0	19.2	20.8	21.9	22.8	24.4	26.8	30.6
10.5	8.4	29.3	21.8	23.6	24.8	25.9	27.7	30.4	34.7
12	9.2	32.5	24.0	26.0	27.3	28.5	30.5	33.5	38.3
15	11.3	39.0	28.8	31.2	32.8	34.2	36.6	40.2	45.9
18	15.1	52.0	38.4	41.5	43.8	45.6	48.8	53.6	61.2
21	16.5	58.5	43.2	46.7	49.2	51.3	54.9	60.3	68.9
24	18.4	65.0	48.0	51.9	54.7	57.0	61.0	67.0	76.5
27	22.0	78.0	57.6	62.3	65.6	68.4	73.2	80.4	91.8
30	23.8	84.5	62.4	67.5	71.1	74.1	79.3	87.1	99.5
33	25.6	91.0	67.2	72.7	75.6	79.8	85.4	93.8	107
36	28	97.5	72.0	77.9	82.1	85.5	91.5	101	115
39	31	111	81.6	88.2	93.0	96.9	104	114	130
42	33	117	86.4	93.4	98.5	103	110	121	138
45	37	130	96.0	104	109	114	122	134	153
48	39	137	101	109	115	120	128	141	161
51	40	143	106	114	120	125	134	147	168
54	42	150	111	119	126	131	140	154	176
60	47	163	120	130	137	143	153	168	191
72	57	202	149	161	170	177	189	208	237
75	59	208	154	166	175	182	195	214	245
84	66	234	173	187	197	205	220	241	275
90	70	247	183	197	208	217	232	255	291
96	75	267	197	213	224	234	250	275	314
102	80	286	212	228	241	251	268	295	337
108	86	299	216	239	252	262	281	308	352
120	94	325	240	259	274	285	305	335	383

① This is the equivalent fast-front current producing a voltage wave cresting in .5 μsec. The protective level is the maximum discharge voltage for a 10 kA impulse current.
② The switching surge protective level is the maximum discharge voltage produced by slow-front current waves of 500 amps.

Arrester Insulation Withstand ANSI C62.1

The assembled insulating members of the IMX arresters rated 3-120 kV are capable of withstanding impulse and power frequency voltages as listed in Table B.

Table B

Voltage Rating of Arrester kV Rms	Impulse Test 1.2 x 50 Microsecond Full Wave kV Crest① (BIL)	Alternating Current 60 Hz, Test Voltage kV Rms 1-Minute Dry	10-Second Wet
3	110	50	45
4.5	110	50	45
6	110	50	45
7.5	110	50	45
9	110	50	45
10.5	110	50	45
12	110	50	45
15	150	70	60
18	150	70	60
21	150	70	60
24	150	70	60
27	200	95	80
30	200	95	80
33	200	95	80
36	200	95	80
39	250	120	100
42	250	120	100
45	250	120	100
48	250	120	100
51	250	120	100
54	250	120	100
60	350	175	145
72	350	175	145
75	350	175	145
84	450	225	190
90	450	225	190
96	450	225	190
102	550	280	230
108	550	280	230
120	550	280	230

● The values given apply for either positive or negative waves.

Contamination Performance

The gapless IMX metal oxide arrester has excellent capability of withstanding the effects of external contamination. Salt slurry contamination tests were conducted per ANSI C62.1-1981 as updated by Working Group 3.3.11, 1/3/83. The IMX arresters passed this test on all criteria.

Cantilever Strength

The lateral force such as line lead pull that may be applied to the top of the arrester is determined by dividing the cantilever strength by the height of the arrester.

Arrester Rating (kV)	Cantilever Strength Inch-Pounds	Foot-Pounds
3-120	84,000	7,000

Pressure Relief Capability

The type IMX arrester is designed to transfer the fault current arc to the outside of the arrester in the unlikely event that the arrester may be damaged or its thermal capability exceeded. Internal pressure buildup is safely vented to the outside providing that the arrester fault current is within the pressure relief capability of the arrester.

The IMX gapless metal oxide surge arresters were tested in the Westinghouse High Power Laboratory in compliance with the latest pressure relief standards for intermediate arresters (ANSI C62.1). The 3 kV through 120 kV Westinghouse metal top IMX surge arresters described in the test report are conservatively rated at 30,000 amperes symmetrical current, having successfully passed currents in excess of that value. 16.1 kA, however, is the highest classification shown in the IEEE ANSI 62.1 standard for these voltage ratings. (Pressure relief ratings for porcelain top arresters are not required by standards.)

Arrester Energy Capability

Metal oxide arresters have much higher energy absorbing capability than conventional arresters of the same class and rating. For most applications, the energy requirements of the application are well within the energy capability of the arrester selected on the basis of continuous operating voltage and short time overvoltage. The Westinghouse IMX gapless surge arrester can absorb 3.8 kilojoules per kilovolt of arrester rating either in one single discharge or smaller multiple discharges within seconds. After allowing sufficient time to cool, the maximum energy discharge can be repeated many times.

Figure 1 below shows the short time overvoltage capability of the IMX Arrester.

Applications which may require special attention are in substations with large capacitor banks, at the end of long cable sections, and at the end of long transmission lines where the switching surge energy may be high.

Arrester Short Time Overvoltage Capability

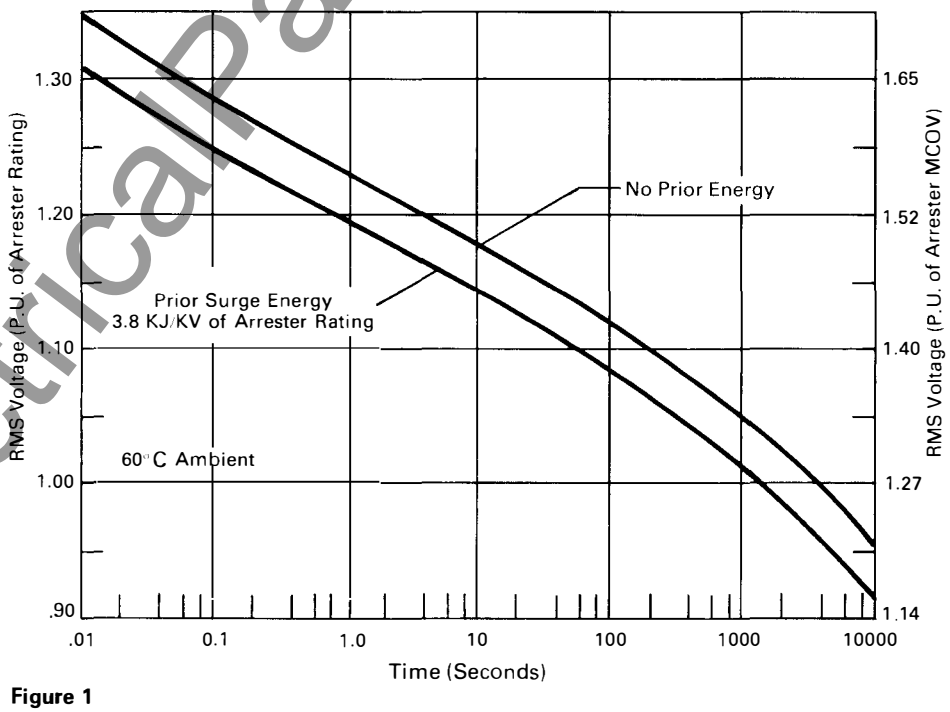

Figure 1

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