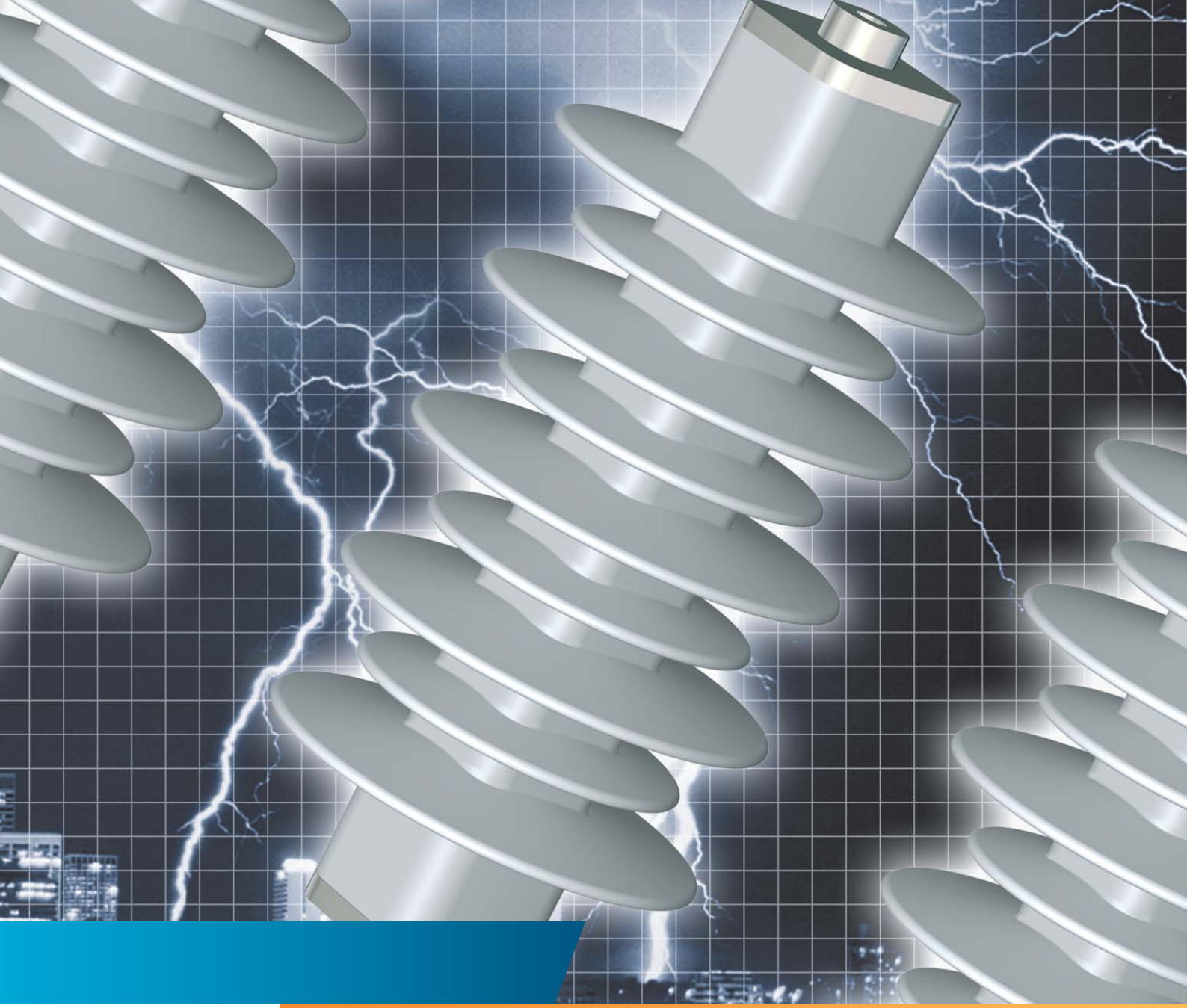


Energy Division

Bowthorpe MV Surge Arresters
OCP, Open Cage Polymeric series

Tyco Electronics

Our commitment. Your advantage.

Bowthorpe Surge Arresters
OCP, Open Cage Polymeric series

Bowthorpe pioneered the development of polymeric housed surge arresters in the early 1980's and since 1986 have a proven service experience across the globe, operating in the worlds toughest environments.

Bowthorpe "OCP" silicone surge arresters have been designed and tested to meet our customers toughest environmental conditions and to meet the requirements of IEC60099-4. Our gapless zinc oxide polymeric arresters have been in service since 1994 and now the OCP ranges builds on this experience and know how.

OCP is the latest gapless, zinc oxide arrester family from Bowthorpe. The OCP development was based on 25 years of internal experience in arrester design and manufacture within the Tyco Electronics Energy Division. The final "OCP" qualification was performed in independent laboratory facilities in Europe. OCP cores are manufactured using superior ZnO varistors, which display excellent thermal and current handling characteristics due to the guaranteed homogeneity of the varistor volume. This superior thermal behavior yields products with:

- Excellent TOV performance.
- Safe, non-shattering failure in the short circuit test by pre-failing to higher fault currents.
- High energy handling capability.

Bowthorpe OCP benefits:

Tested in accordance with IEC60099-4 at independent accredited laboratories

Superior protection margins

Direct molded housing to prevent moisture ingress

Low residual voltages

High-energy handling

Superior TOV performance

Safe non-shattering short circuit behavior to higher current levels

Maintenance free

Hydrophobic silicone housing: (Tracking and erosion resistant)

Excellent cantilever and tensile performance

Excellent mechanical, vibration and impact withstand capability

Quality design and manufacturing, ISO 9001 and 14001 compliant

TRUST Bowthorpe Surge Arresters

	OCPO	**OCP1**	**OCP2**
Uc	3-29kV	3-29kV	3-29kV
I_N	5kA	10kA	10kA
High current impulse	65kA	100kA	100kA
Long duration energy (2 shots / kJ/kV Uc)	1.2 kJ/kV Uc	4.1 kJ/kV Uc	6.0 kJ/kV Uc
Long duration waveform	200A / 1ms	350A / 2ms	530A / 2ms
10 second TOV,(U_{TOV} / Uc)	1.44	1.43	1.35
High current short circuit	20kA	25kA	40kA
Core technology	OCP	OCP	OCP

Please contact your local sales representative for higher Uc arresters.

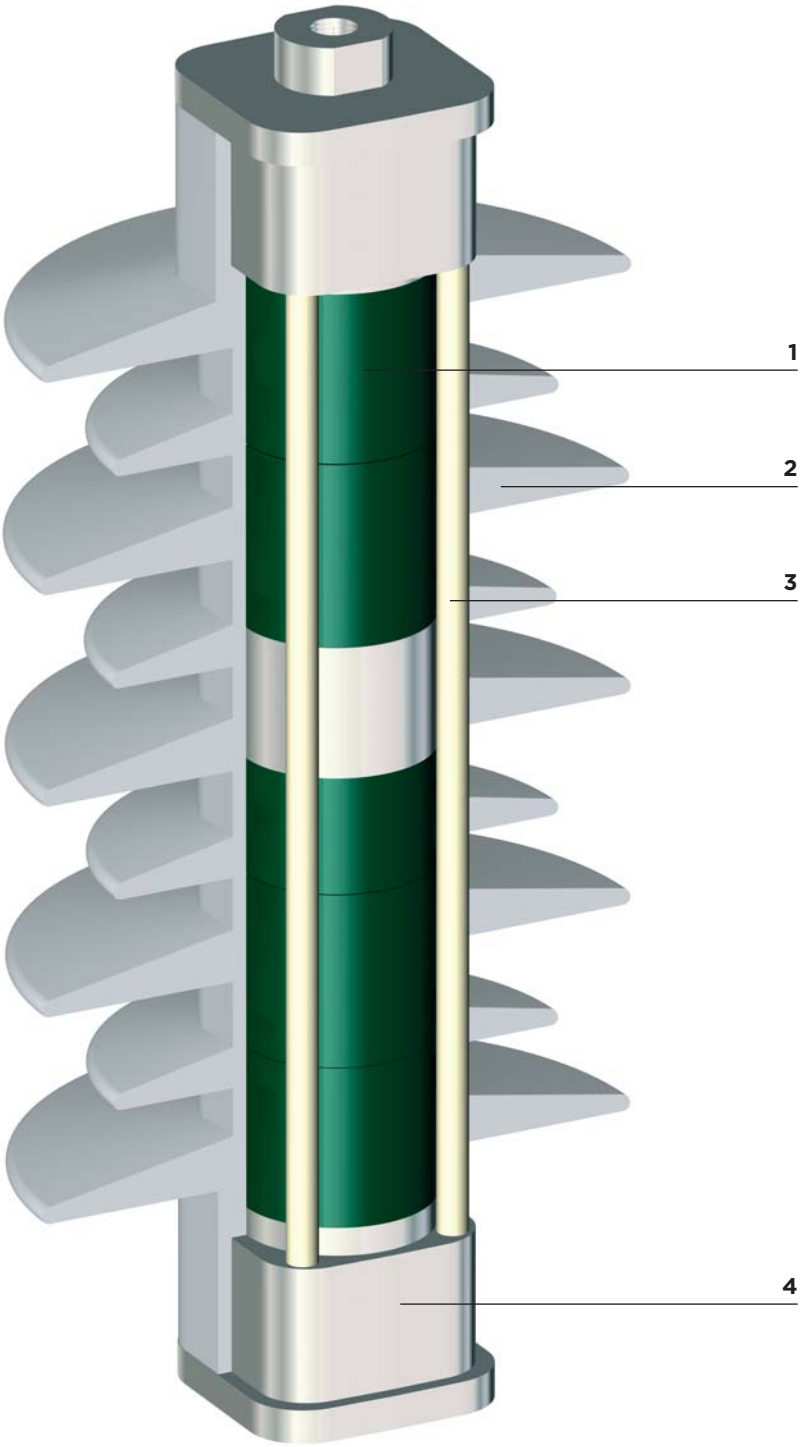
At the core of the Bowthorpe OCP design is our improved ZnO varistor disk, which has superior thermal and electrical characteristics and stability. The resulting new varistor and OCP design combination has resulted in superior energy handling and TOV performance.

The construction of the OCP design comprises of:
1 ZnO, (Zinc Oxide) varistors
2 Bowthorpe proprietary silicone housing
3 Flame retardant FRP structure
4 Corrosion resistant aluminium fittings

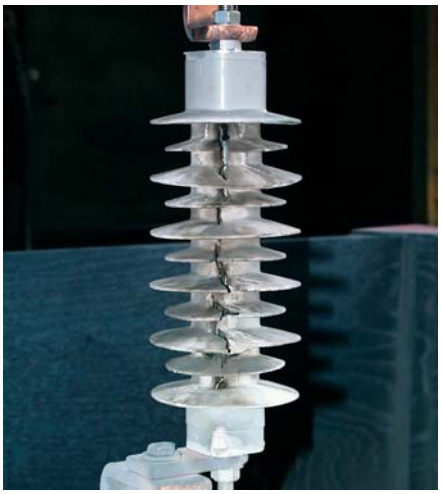
The crimped structural construction ensures light weight product with optimal mechanical strength.
The manufacturing process ensures void free construction and optimum interface sealing. This is achieved by bonding the silicone housing directly to the ZnO discs and aluminium fittings using a Bowthorpe proprietary bonding solution.

The silicone housing was developed using the knowledge accumulated over 35 years of internal materials science expertise and experience, resulting in an optimum shed profile and a material with excellent tracking and erosion resistance.

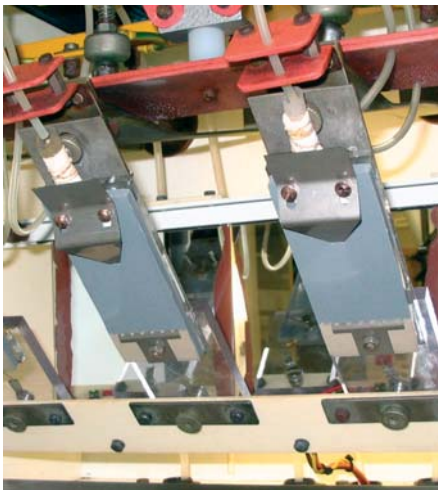
Features of our new hydrophobic silicone OCP design are:
- Alternating sheds for superior pollution flash over resistance
- Superior TERT performance
- Constant voltage: 4.5kV, >360min
  - Stepped voltage: >300min
  - All eventual failures by erosion only, ie no tracking in step voltage test
- Housing tested to IEC 1000hr salt fog test



Excellent hydrophobicity



Safe short circuit failure



Superior TERT performance

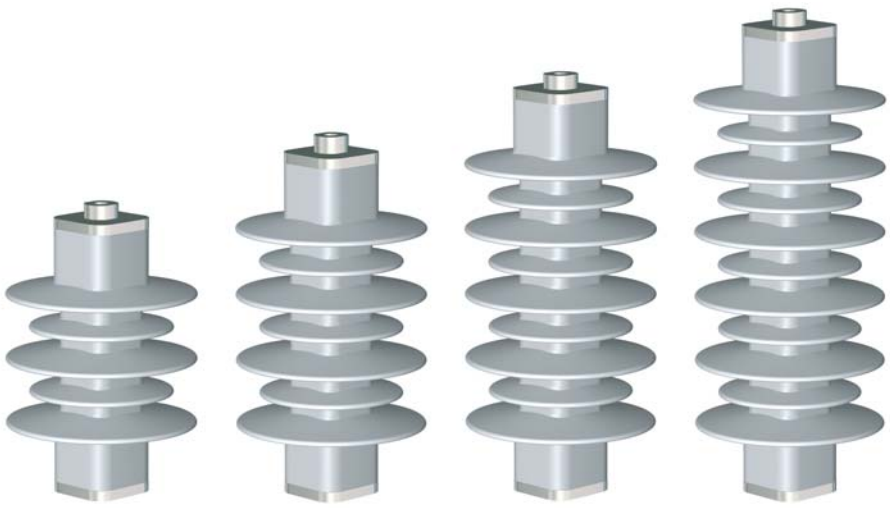
Bowthorpe EMP Open Cage Polymeric series arresters OCP0

Application:

Protection of MV networks and equipment from moderate lightning and switching surge related over-voltages in areas with relatively low iso-keraunic levels. Suitable for both outdoor and indoor use to protect transformers and cable end terminations.

Generic technical data:

OCP0 series		3-29kV Uc
Rated discharge current (8/20µs):		5kA
Operating duty impulse withstand current (4/10µs):		65kA
Long duration current impulse (1000µs):		200A
High current short circuit: (pre-failing method) (Safe non-shattering failure mode)		20kA
Energy	2 Long duration impulses:	1.2kJ/kVUc



Bowthorpe OCP benefits:

Tested in accordance with IEC60099-4 at independent accredited laboratories

Superior protection margins

Direct molded housing to prevent moisture ingress

Low residual voltages

High-energy handling

Superior TOV performance

Safe non-shattering short circuit behavior to higher current levels

Maintenance free

Hydrophobic silicone housing: (Tracking and erosion resistant)

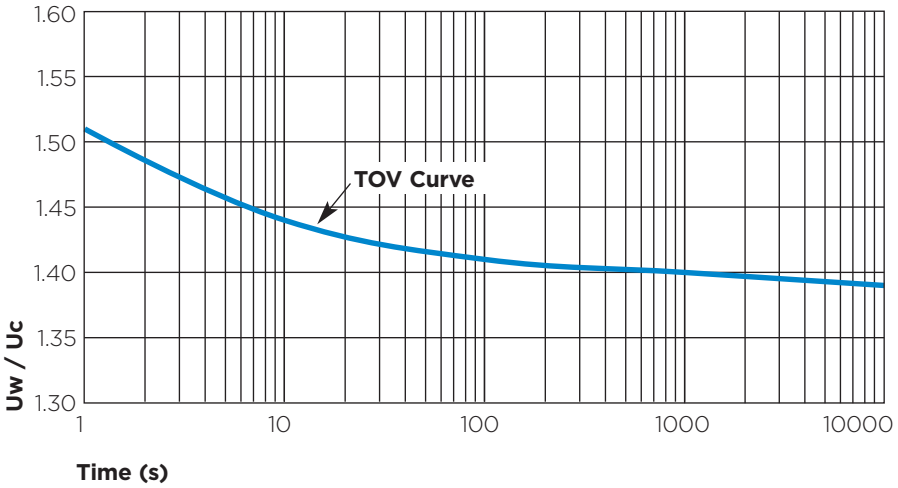
Excellent cantilever and tensile performance

Excellent mechanical, vibration and impact withstand capability

Quality design and manufacturing, ISO 9001 and 14001 compliant

TRUST Bowthorpe Surge Arresters

TOV of OCP0 with 65kA single shot high current prior energy



Temperature of samples (pre-heated): 60° C according to IEC 60099-4, Ed 2.0 2004. TOV Curve applies to an arrester which has a pre-stress applied prior to TOV verification. This pre-stress is equivalent to one high current impulse of 65kA, 4/10 as per the switching surge operating duty test.

Uw = TOV withstand voltage; Uc = continuous operating voltage

Bowthorpe EMP Open Cage Polymeric series arresters OCP0

OCP0	U continuous kV(r.m.s)	U rated kV(r.m.s)	U residual in kV when tested to the following impulse waveforms			
			Lightning (8/20µs)			Steep lightning (1/20µs)
			2.5kA	5kA	10kA	5kA
3	3	3.7	9.12	9.78	10.68	10.18
4	4	5.0	12.16	13.04	14.24	13.57
5	5	6.2	15.20	16.30	17.80	16.96
6	6	7.5	18.24	19.56	21.36	20.35
8	8	10.0	24.32	26.08	28.48	27.14
9	9	11.2	27.36	29.34	32.04	30.53
10	10	12.5	30.40	32.60	35.60	33.92
12	12	15.0	36.48	39.12	42.72	40.70
15	15	18.7	45.60	48.90	53.40	50.88
18	18	22.5	54.72	58.68	64.08	61.06
20	20	25.0	60.80	65.20	71.20	67.84
21	21	26.2	63.84	68.46	74.76	71.23
22	22	27.5	66.88	71.72	78.32	74.62
24	24	30.0	72.96	78.24	85.44	81.41
29	29	36.3	88.16	94.54	103.24	98.37

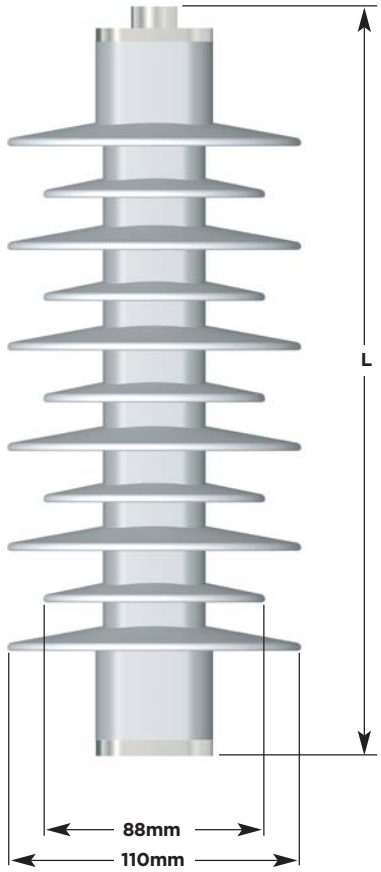
OCP0-xxS; Standard housing parameters

OCP0	Sheds	Impulse voltage 1.2/50µs (kV)	Power frequency voltage withstand, wet (kV)	Flash over distance (mm)	Creepage (mm)	Height L (mm)
3	5	145	47	176	379	183
4	5	145	47	176	379	183
5	5	145	47	176	379	183
6	5	145	47	176	379	183
8	5	145	47	176	379	183
9	5	145	47	176	379	183
10	5	145	47	176	379	183
12	5	145	47	176	379	183
15	7	165	57	214	503	220
18	9	180	70	254	629	260
20	9	180	70	254	629	260
21	11	200	80	293	755	299
22	11	200	80	293	755	299
24	11	200	80	293	755	299
29	13	230	95	334	882	340

OCP0-xxL; Extended housing parameters

OCP0	Sheds	Impulse voltage 1.2/50µs (kV)	Power frequency voltage withstand, wet (kV)	Flash over distance (mm)	Creepage (mm)	Height L (mm)
3	7	165	57	214	503	220
4	7	165	57	214	503	220
5	7	165	57	214	503	220
6	7	165	57	214	503	220
8	7	165	57	214	503	220
9	7	165	57	214	503	220
10	7	165	57	214	503	220
12	7	165	57	214	503	220
15	9	180	70	254	629	260
18	11	200	80	293	755	299
20	11	200	80	293	755	299
21	13	230	95	334	882	340
22	13	230	95	334	882	340
24	13	230	95	334	882	340

Tested in accordance with IEC 60099-4, Ed 2.0 2004



Notes:

Mechnical strength data:

Cantilever	Nm	250
Tensile	kN	2
Torque	Nm	50

For accessory and ordering information, please refer to page 10

Bowthorpe EMP Open Cage Polymeric series arresters OCP1

Application:

Protection of MV networks and equipment from lightning and switching surge related over-voltages in areas with relatively high iso-keraunic levels. Suitable for both outdoor and indoor use to protect transformers and cable end terminations.

Generic technical data:

OCP1 series		3-29kV Uc
Rated discharge current (8/20µs):		10kA
Line discharge class 1 according to		IEC 60099-4
Operating duty impulse withstand current (4/10µs):		100kA
Long duration current impulse (2000µs):		350A
High current short circuit: (pre-failing method) (Safe non-shattering failure mode)		25kA
Energy	2 Long duration impulses:	4.1kJ/kVUc

Bowthorpe OCP benefits:

Tested in accordance with IEC60099-4 at independent accredited laboratories

Superior protection margins

Direct molded housing to prevent moisture ingress

Low residual voltages

High-energy handling

Superior TOV performance

Safe non-shattering short circuit behavior to higher current levels

Maintenance free

Hydrophobic silicone housing: (Tracking and erosion resistant)

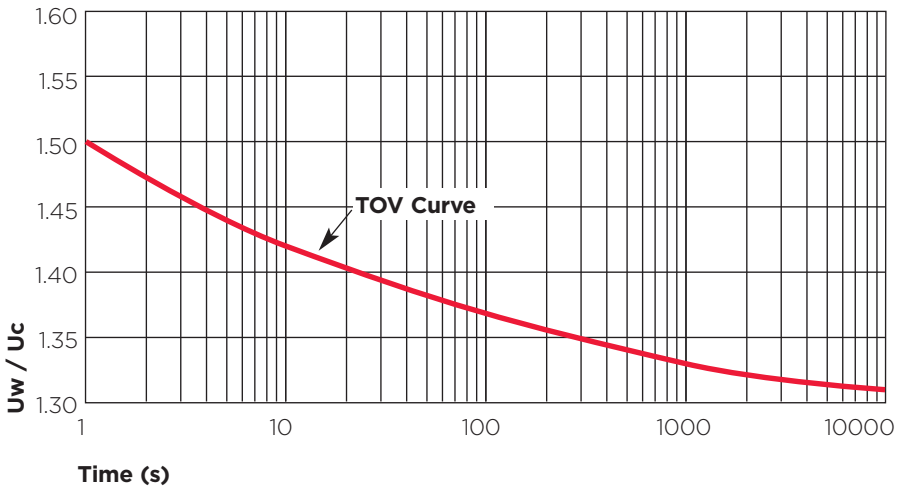
Excellent cantilever and tensile performance

Excellent mechanical, vibration and impact withstand capability

Quality design and manufacturing, ISO 9001 and 14001 compliant

TRUST Bowthorpe Surge Arresters

TOV of OCP1 with 100kA single shot high current prior energy



Temperature of samples (pre-heated): 60° C according to IEC 60099-4, Ed 2.0 2004. TOV Curve applies to an arrester which has a pre-stress applied prior to TOV verification. This pre-stress is equivalent to one high current impulse of 100kA, 4/10 as per the switching surge operating duty test.

Uw = TOV withstand voltage; Uc = continuous operating voltage

Bowthorpe EMP Open Cage Polymeric series arresters OCP1

OCP1	U continuous kV(r.m.s)	U rated kV(r.m.s)	U residual in kV when tested to the following impulse waveforms					
			Lightning (8/20µs)			Steep lightning (1/20µs)	Switching (30/60µs)	
			5kA	10kA	20kA	10kA	125A	500A
3	3	3.7	9.77	10.37	11.48	11.28	7.81	8.08
4	4	5.0	13.03	13.83	15.31	15.04	10.42	10.77
5	5	6.2	16.29	17.29	19.14	18.80	13.02	13.46
6	6	7.5	19.55	20.75	22.97	22.56	15.62	16.15
8	8	10.0	26.06	27.66	30.62	30.08	20.83	21.54
9	9	11.2	29.32	31.12	34.45	33.84	23.44	24.23
10	10	12.5	32.58	34.58	38.28	37.60	26.04	26.92
12	12	15.0	39.10	41.50	45.94	45.12	31.25	32.30
15	15	18.7	48.87	51.87	57.42	56.40	39.06	40.38
18	18	22.5	58.64	62.24	68.90	67.68	46.87	48.46
20	20	25.0	65.16	69.16	76.56	75.20	52.08	53.84
21	21	26.2	68.42	72.62	80.39	78.96	54.68	56.53
22	22	27.5	71.68	76.08	84.22	82.72	57.29	59.22
24	24	30.0	78.19	82.99	91.87	90.24	62.50	64.61
29	29	36.3	94.48	100.28	111.00	109.04	75.52	78.07

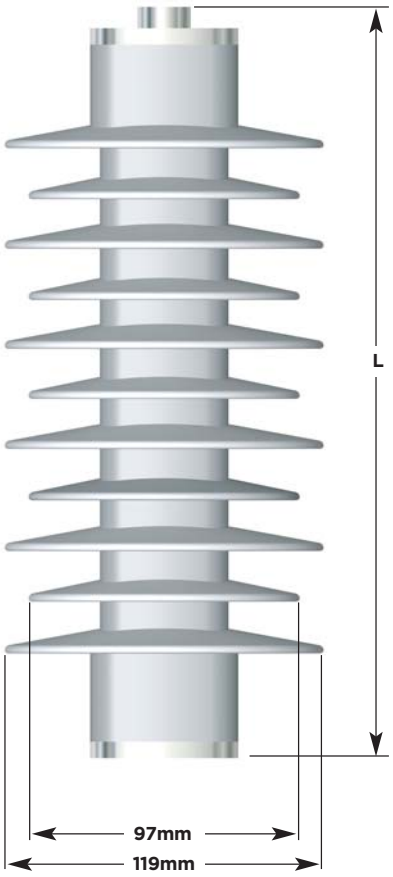
OCP1-xxS; Standard housing parameters

OCP1	Sheds	Impulse voltage 1.2/50µs (kV)	Power frequency voltage withstand, wet (kV)	Flash over distance (mm)	Creepage (mm)	Height L (mm)
3	5	145	47	176	380	183
4	5	145	47	176	380	183
5	5	145	47	176	380	183
6	5	145	47	176	380	183
8	5	145	47	176	380	183
9	5	145	47	176	380	183
10	5	145	47	176	380	183
12	5	145	47	176	380	183
15	7	165	57	214	505	220
18	9	180	70	254	632	260
20	9	180	70	254	632	260
21	11	200	80	293	758	299
22	11	200	80	293	758	299
24	11	200	80	293	758	299
29	13	230	95	334	885	340

OCP1-xxL; Extended housing parameters

OCP1	Sheds	Impulse voltage 1.2/50µs (kV)	Power frequency voltage withstand, wet (kV)	Flash over distance (mm)	Creepage (mm)	Height L (mm)
3	7	165	57	214	505	220
4	7	165	57	214	505	220
5	7	165	57	214	505	220
6	7	165	57	214	505	220
8	7	165	57	214	505	220
9	7	165	57	214	505	220
10	7	165	57	214	505	220
12	7	165	57	214	505	220
15	9	180	70	254	632	260
18	11	200	80	293	758	299
20	11	200	80	293	758	299
21	13	230	95	334	885	340
22	13	230	95	334	885	340
24	13	230	95	334	885	340

Tested in accordance with IEC 60099-4, Ed 2.0 2004



Notes:

Mechnical strength data:

Cantilever	Nm	350
Tensile	kN	2
Torque	Nm	50

For accessory and ordering information, please refer to page 10

Bowthorpe EMP Open Cage Polymeric series arresters OCP2

Application:

Protection of MV networks, sensitive equipment and substations from lightning and switching surge related over-voltages in areas with relatively high iso-keraunic levels.

Generic technical data:

OCP2 series		3-29kV Uc
Rated discharge current (8/20µs):		10kA
Line discharge class 2 according to		IEC 60099-4
Operating duty impulse withstand current (4/10µs):		100kA
Long duration current impulse (2000µs):		530A
High current short circuit: (pre-failing method) (Safe non-shattering failure mode)		40kA
Energy	2 Long duration impulses:	6.0kJ/kVUc

Bowthorpe OCP benefits:

Tested in accordance with IEC60099-4 at independent accredited laboratories

Superior protection margins

Direct molded housing to prevent moisture ingress

Low residual voltages

High-energy handling

Superior TOV performance

Safe non-shattering short circuit behavior to higher current levels

Maintenance free

Hydrophobic silicone housing: (Tracking and erosion resistant)

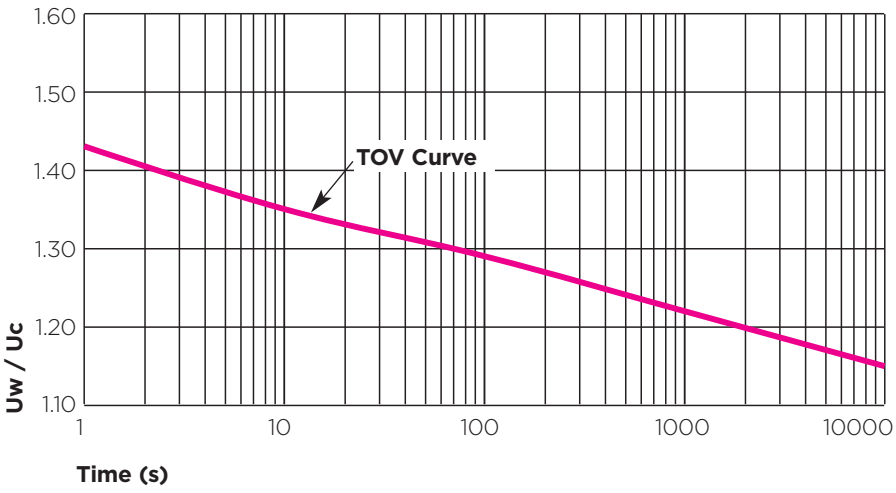
Excellent cantilever and tensile performance

Excellent mechanical, vibration and impact withstand capability

Quality design and manufacturing, ISO 9001 and 14001 compliant

TRUST Bowthorpe Surge Arresters

TOV for OCP2 with prior energy



Temperature of samples (pre-heated): 60° C according to IEC 60099-4, Ed 2.0 2004. TOV Curve applies to an arrester which has a pre-stress applied prior to TOV verification. This pre-stress is equivalent to two long duration current impulses having duration of 2000µs and total energy equal to 6.0 kJ/kV Uc.

Uw = TOV withstand voltage; Uc = continuous operating voltage

Bowthorpe EMP Open Cage Polymeric series arresters OCP2

OCP2	U continuous kV(r.m.s)	U rated kV(r.m.s)	U residual in kV when tested to the following impulse waveforms					
			Lightning (8/20µs)			Steep lightning (1/20µs)	Switching (30/60µs)	
			5kA	10kA	20kA	10kA	125A	500A
3	3	3.7	9.18	9.72	10.84	10.10	7.37	7.76
4	4	5.0	12.24	12.96	14.46	13.47	9.83	10.35
5	5	6.2	15.30	16.20	18.07	16.84	12.29	12.94
6	6	7.5	18.36	19.44	21.68	20.21	14.75	15.53
8	8	10.0	24.48	25.92	28.91	26.94	19.66	20.70
9	9	11.2	27.54	29.16	32.53	30.31	22.12	23.29
10	10	12.5	30.60	32.40	36.14	33.68	24.58	25.88
12	12	15.0	36.72	38.88	43.37	40.42	29.50	31.06
15	15	18.7	45.90	48.60	54.21	50.52	36.87	38.82
18	18	22.5	55.08	58.32	65.05	60.62	44.24	46.58
20	20	25.0	61.20	64.80	72.28	67.36	49.16	51.76
21	21	26.2	64.26	68.04	75.89	70.73	51.62	54.35
22	22	27.5	67.32	71.28	79.51	74.10	54.08	56.94
24	24	30.0	73.44	77.76	86.74	80.83	58.99	62.11
29	29	36.3	88.74	93.96	104.81	97.67	71.28	75.05

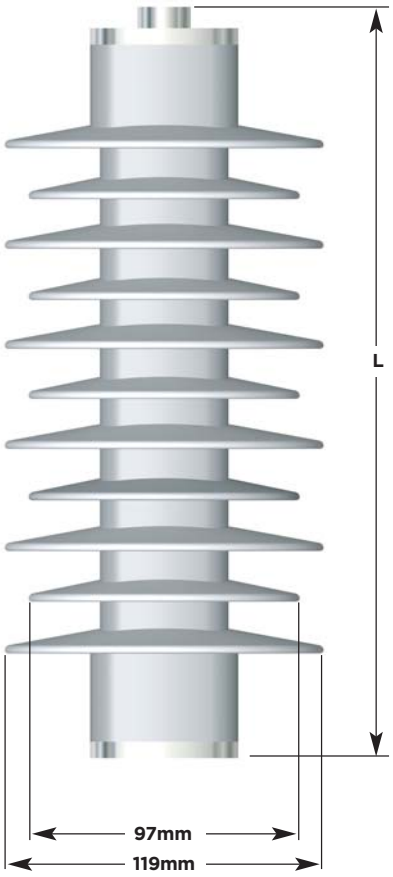
OCP2-xxS; Standard housing parameters

OCP2	Sheds	Impulse voltage 1.2/50µs (kV)	Power frequency voltage withstand, wet (kV)	Flash over distance (mm)	Creepage (mm)	Height L (mm)
3	5	145	47	176	380	183
4	5	145	47	176	380	183
5	5	145	47	176	380	183
6	5	145	47	176	380	183
8	5	145	47	176	380	183
9	5	145	47	176	380	183
10	5	145	47	176	380	183
12	5	145	47	176	380	183
15	7	165	57	214	505	220
18	9	180	70	254	632	260
20	9	180	70	254	632	260
21	11	200	80	293	758	299
22	11	200	80	293	758	299
24	11	200	80	293	758	299
29	13	230	95	334	885	340

OCP2-xxL; Extended housing parameters

OCP2	Sheds	Impulse voltage 1.2/50µs (kV)	Power frequency voltage withstand, wet (kV)	Flash over distance (mm)	Creepage (mm)	Height L (mm)
3	7	165	57	214	505	220
4	7	165	57	214	505	220
5	7	165	57	214	505	220
6	7	165	57	214	505	220
8	7	165	57	214	505	220
9	7	165	57	214	505	220
10	7	165	57	214	505	220
12	7	165	57	214	505	220
15	9	180	70	254	632	260
18	11	200	80	293	758	299
20	11	200	80	293	758	299
21	13	230	95	334	885	340
22	13	230	95	334	885	340
24	13	230	95	334	885	340

Tested in accordance with IEC 60099-4, Ed 2.0 2004



Notes:

Mechnical strength data:

Cantilever	Nm	350
Tensile	kN	2
Torque	Nm	50

For accessory and ordering information, please refer to page 10

Bowthorpe EMP Open Cage Polymeric series OCP accessories

OCP series naming and order query description:

Example: OCP = "Open Cage Polymeric"

OCP0 – 12S – ABC

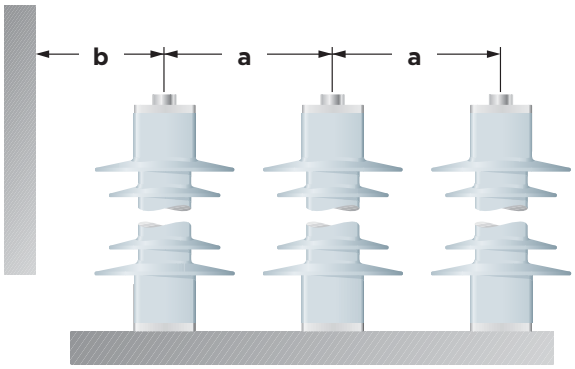
Line discharge class:
0 = 5kA, 65kA high current
1 = 10kA, 100kA high current, class 1
2 = 10kA, 100kA high current, class 2

Uc

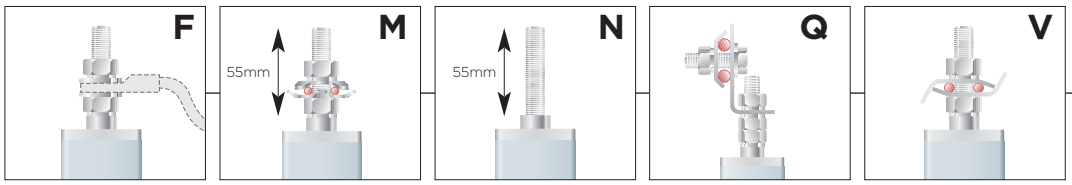
Housing creepage:
S = standard creepage
L = extended creepage

Accessory selection
M = Mounting bracket
E = Earth connection
L = Line connection

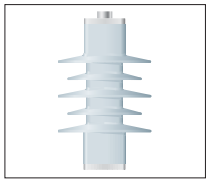
System Voltage Um	ph/ph (a)	ph/ground (b)
12	185	165
24	315	295
36	445	425



Line lead accessories



Arrester Type = Continuous Operating Voltage U_c in kV

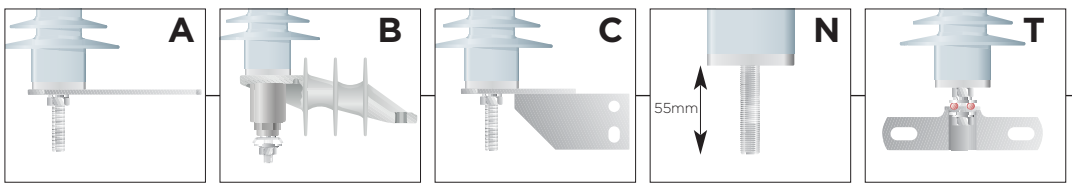


OCP □-

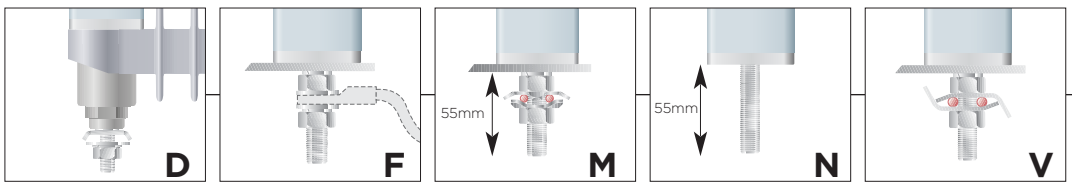
03	04	05	06
08	09	10	12
15	18	20	21
22	24	29	

OCP□ – 12□ – □□□

Mounting accessories



Ground lead accessories



Additional accessory options available on request. Please contact: surgearresters@tycoelectronics.com with your specific requirement.

The complete solution...

Polymer Composition

More than 35 years of systematic research into new materials for the needs of the electrical power industry resulted in a wide range of products with a unique combination of properties.

Materials Testing

- Non-tracking and low erosion rates in polluted & non-polluted environments
- Long term weatherability, resistance to thermal ageing
- UV resistant and chemical resistant
- Tough, tear & impact resistant
- Compliant to International specifications, such as ANSI, AS, CEA and IEC

Product Design and Testing

Tyco Electronics Energy Division controls its own materials development, some compounding, product design, testing & qualification, moulding, extrusion and applications through sales. We have our own HV testing facilities in Brighton and Munich.

Manufacturing

Tyco Electronics Energy Division arrester manufacturing sites are accredited to ISO 9001 and 14001. Our vendor routine tests and internal incoming inspection confirm performance of all critical components used in the assembly of our arresters. We offer competitive lead times on all standard products.

Quality Control

Our high quality molding and six sigma approach to process control ensures that product housings are shipped defect free to our customers.

Field Experience

Tyco Electronics Energy Division has over 35 years experience in materials, products and solving customer problems in the electrical utility world. We are the original inventor of the MV polymeric arrester. Our strong brands teams, Raychem, Axicom, Bowthorpe, Morylnn, all contribute expertise to the continued development and launching of new and improved products.

Consideration of Environment

Tyco Electronics Energy Division MV surge arrester team supply technical support and training for customers to aid arrester selection to meet the electrical, mechanical and pollution performance requirements.

SUCCESS

TRUST Bowthorpe Surge Arresters

Other products and brochures available from Energy Division

Asset protection	Insulation enhancement systems for substations and overhead. Designed to prevent unplanned outages due to accidential bridging. Contact us at: assetprotection@tycoelectronics.com	
Low-voltage surge arresters	LV arresters are used to provide protection for LV overhead lines, consumer in-house supplies, distribution tranformers and other applicances. Contact us at: surgearresters@tycoelectronics.com	
Medium-voltage surge arresters	Metal oxide varister, distribution arresters for indoor and outdoor applications for protection of overhead lines, DC locomotives and switchgear applications. Contact us at: surgearresters@tycoelectronics.com	
High-voltage surge arresters	Porcelain and polymeric series parallel and single column contructed arresters for protection of transmission systems up to 550 kV. Contact us at: hvsurgearrester@tycoelectronics.com	
Polymeric insulators	Insulators and insulating components/housings providing reliable solutions for power utilities and railway customers with installations in high pollution environments and applications up to 400 kV. Contact us at: insulators@tycoelectronics.com	
Porcelain insulators	Insulators for applications up to system voltages of 132 kV. This range of insulators offers a cost-effective solution for low and medium polluted environments. Contact us at: insulators@tycoelectronics.com	

Energy Division – innovative and economical solutions for the electrical power industry: cable accessories, connectors & fittings, insulators & insulation, surge arresters, switching equipment, lighting controls, power measurement and control.

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Our commitment. Your advantage.