Surge Arresters

Supply Program

Power Transmission and Distribution

SIEMENS

Surge Arresters from Siemens – Always the Best Solution

We offer an extensive range of surge arresters suitable for every application – economical and ensuring stable continuous duty, with excellent protection levels and loading capacity.

Short delivery periods for fast availability
Metal-enclosed 3ES surge arresters from Siemens. The 420-kV switchgear in Macclesfield/Great Britain was retrofitted with Siemens surge arresters in a very short time.

Developments in technology and practical experience have resulted in three different designs of surge arresters, which differ with regard to the housings used:

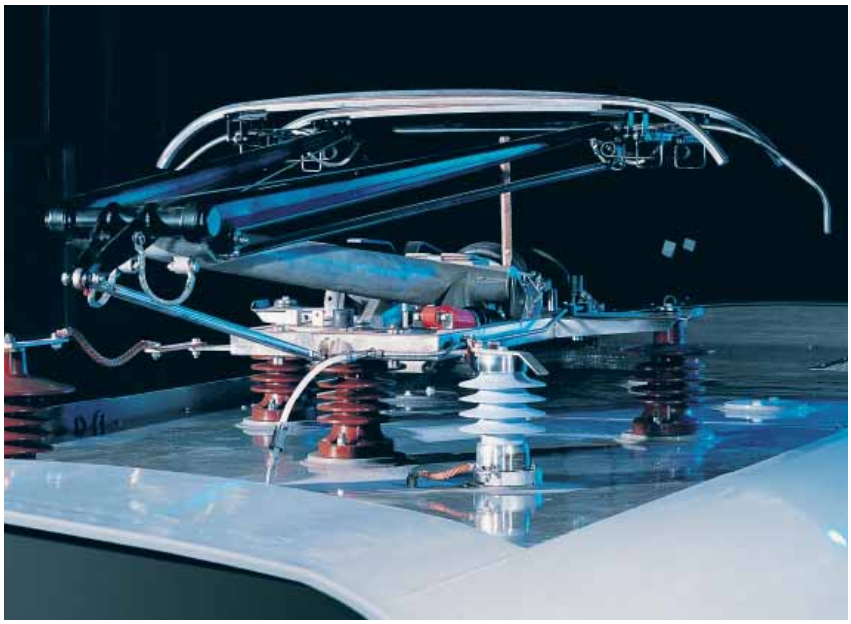
- Surge arresters with porcelain housings
- Surge arresters with polymer housings
- Surge arresters with metal enclosures.

Siemens offers each of these three types of housing in various versions and this enables us to provide the optimum surge arrester for every conceivable application.
Thus Siemens surge arresters can be specifically and optimally tailored to the following requirements and applications:

- Excellent pollution layer characteristics for coastal and desert regions or in areas with extreme industrial air pollution
- High mechanical stability, e.g. for use in seismic zones
- Extremely reliable pressure relief behavior for use in areas requiring special protection.

What is more, all Siemens surge arresters are sized for decades of operation in their design and material used and provide a contribution towards the protection of the environment.

Surge Arresters for Every Requirement



With our comprehensive supply program, we are able to offer the right arrester for every application – for economical and reliable operation.
Our surge arresters protect transformers, generators, motors, capacitors, traction vehicles, and cables as well as complete switchgear.

Arresters for special applications are possible, too. These include the following:

- For motors and dry-type transformers extremely sensitive to surges
- Vibration-resistant surge arresters and limiters for AC and DC traction systems
- High short-circuit-proof versions for generators in power plants
- Metal-enclosed versions for high-voltage gas-insulated switchgear
- For thyristors in HVDC transmission systems
- For capacitor batteries in static compensators
- For airfield lighting systems
- For electric furnaces in the glass and metal industries
- For test bays.

Transmission Line Surge Arrester
Transmission line surge arresters from Siemens reliably protect your overhead power lines.

- Maintained or better reliability when stepping up system voltages
- No need of further guard wires
- No need to replace existing insulators
- Fewer switching surges
- Cost-efficient solution

Our Product Range is Being Continually Extended by Other Innovative Products

Our arresters and limiters cover all areas of application. What is more, we are continuously adding innovative product ideas to our supply program – to the benefit of our customers.

An example of this are surge arresters with polymeric composite housings. This housing consists of a glass-fiber-reinforced plastic tube with a silicone rubber insulation. Thanks to its design and the high quality of the materials used, this arrester offers a number of advantages, such as absolutely reliable pressure relief behavior and high mechanical strength – even after pressure relief. Of particular advantage is the water-repellent effect of the silicone rubber which is also transmitted to pollution layers.

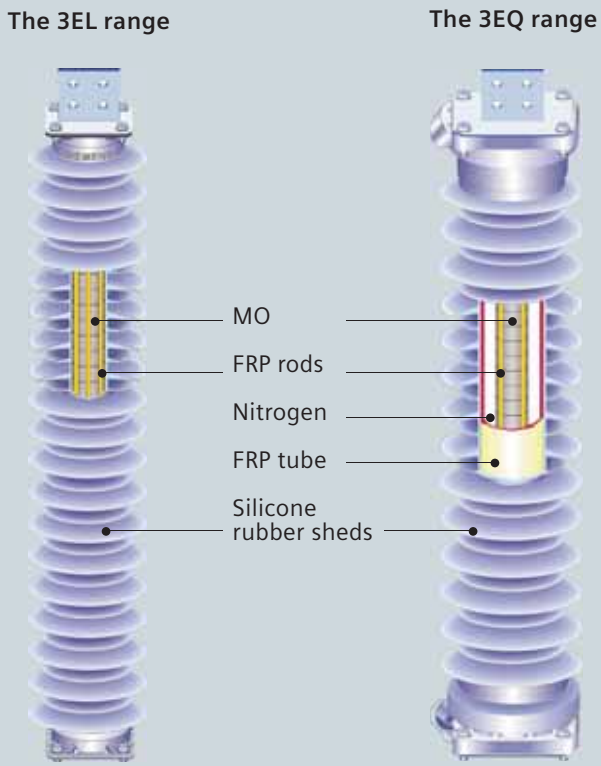
Besides their high resistance in outdoor conditions, Siemens surge arresters with polymeric housings also have a long service life and can be disposed of in an uncomplicated manner.

Fig. above
Innovative products for extreme requirements
In Tian-Guang, China, Siemens modernized 4 sections of an HVDC transmission system. The Siemens thyristor valves were protected by state-of-the-art 3EQ3 arresters.

Fig. below
Reliability under extreme climatic conditions
In Montagnais, Canada, Siemens erected three advanced series 3-phase static compensators protected by arrester banks (consisting of parallel-connected multi-stack arresters) to improve the quality of power transmission.These arresters even withstand extreme temperatures of –50 °C to +40 °C.

Fig. above right
Resistant to wind and weather
Our 3EQ surge arresters with polymeric composite housing are particularly resistant against contamination and all kinds of weather conditions.

Siemens High-Voltage Surge Arresters with Polymeric Housing



The 3EL range

Siemens surge arresters of cage design: cage of prestressed FRP rods for high mechanical strength, silicone directly molded onto MO blocks.

Best price-performance ratio for applications up to U_m = 300 kV.

The 3EQ range

Siemens surge arresters of tube design: FRP tube for highest mechanical strength, silicone directly molded onto FRP tube.

Best choice for applications up to U_m = 800 kV, especially applications with advanced or highest technical requirements.

Siemens offers you two different arrester types with polymeric housing for standard applications as well as for applications with advanced or highest technical requirements: 3EL and 3EQ. Choosing one or the other, you will always get the best price-performance ratio whatever your application is.

Our 3EL and 3EQ arresters use the same MO blocks as our arresters with porcelain housing resulting in the same excellent electrical performance. The use of polymeric housings consisting of FRP's and silicone rubber leads to additional advantages:

- Highly improved pollution performance and
- Flexibility of erection due to reduced weight.

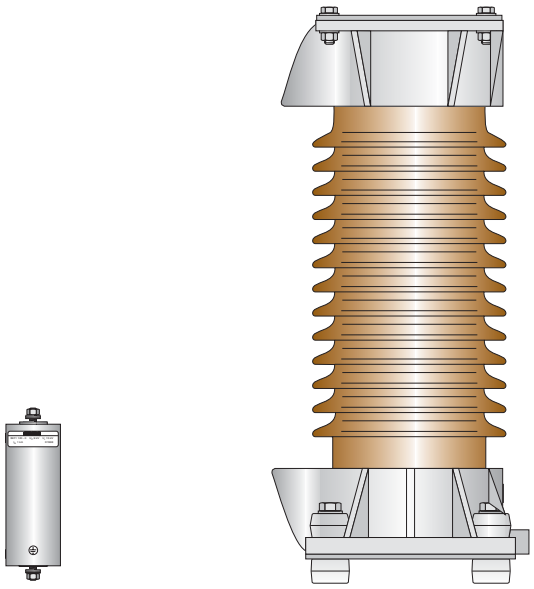
Silicone rubber has been used as outdoor insulation material for more than 25 years with good service experience even under severe climatic and environmental conditions. Today it is the most widely used polymeric material for HV outdoor equipment.

Silicone is highly hydrophobic. There are many polymeric materials with hydrophobic properties, but most of them loose their hydrophobicity after a relatively short period. Only silicone has the ability to maintain its hydrophobicity during its lifetime. This results in a long service life of our 3EL and 3EQ arresters.

Additional important properties of silicone are:

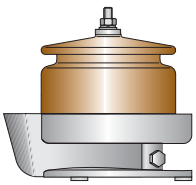
- Its resistance to tracking erosion and UV radiation that also enhances the working life of our arresters
- The fact that silicone is fire-retardant and self-extinguishing
- Silicone is directly molded onto MO blocks and fiber-glass rods ensuring total enclosure of all components to prevent from partial discharges or moisture ingress
- Good mechanical performance for standard applications
- Short circuit: Low-pressure escape of the arc due to the silicone shielding, no need of any pressure relief device
- Easy transport and installation due to considerably lower weight compared to porcelain arresters
- Suitable as station arrester and/or transmission line arrester
- Design with FRP tube offers outstanding mechanical stability (much stronger than porcelain) combined with an excellent sealing system to prevent from moisture ingress and partial discharges
- Highest degree of safety in the event of short circuit due to pressure relief device, no ejection of any internal components
- At least 75 % mechanical strength retained even after short circuit, therefore arrester can be used as post insulator
- Less weight than comparable porcelain arresters
- Ideal for areas with potential seismic activity, heavy windloads and any other advanced mechanical requirements

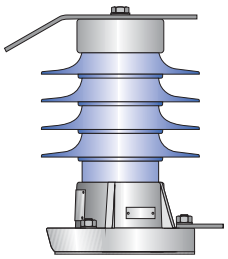
Medium-Voltage Metal Oxide Surge Arresters and Limiters 300 V to 72.5 kV

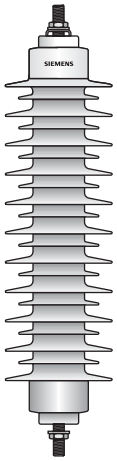


		Special applications	
		3EF1 3EF3 3EF4 3EF5	3EE2
Applications		Motors, dry-type transformers, airfield lighting systems, sheath voltage limiters, protection of converters for drives	Generators, motors, melting furnaces, 6-arrester connection, power plants
Nominal system voltage (max.)	kV	10	30
Highest voltage for equipment (max.)	kV	12	36
Maximum rated voltage	kV	15	45
Nominal discharge current	kA	3EF1 1 3EF3 1 3EF4 10 3EF5 10	10
Maximum energy absorption capability (at thermal stability)	kJ/kV_r	3EF1 0.8 3EF3 4 3EF4 12.5 3EF5 8	10
Maximum long duration current impulse, 2 ms	A	3EF4 1500 3EF5 1200	1200
Maximum short-circuit rating	kA	40	300
Housing material		Polyethylene	Porcelain
Design principle		3EF1 – Polyethylene directly molded onto MO; 3EF3/3EF4/ 3EF5 – Hollow insulator	Hollow insulator
Pressure relief device		no	yes

1) Silicone rubber sheds



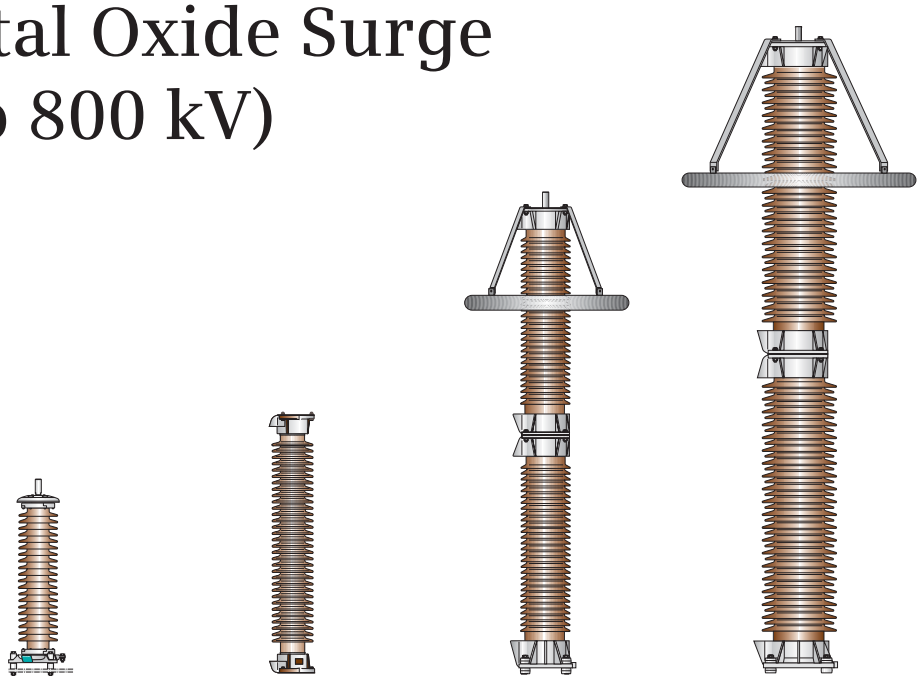




Railway applications			Medium voltage Distribution class
3EB2	**3EC3**	**3EB1**	**3EK7**
DC overhead contact lines	DC systems (locomotives, overhead contact lines)	AC and DC systems (locomotives, overhead contact lines)	Distribution systems and medium-voltage switchgear
1.5 2	3 4	25 30	70 72.5
2	4	37 (AC) 4 (DC)	60
10	10	10	10
10	10	10	3.5[2)]
1200	1200	850 (AC) 1200 (DC)	325
40	40	40	20
Silicone	Porcelain	Silicone	Silicone
Directly molded	Hollow insulator	Hollow insulator, silicone directly molded onto FRP tube	Cage design, silicone directly molded onto MO
no	yes	yes	no

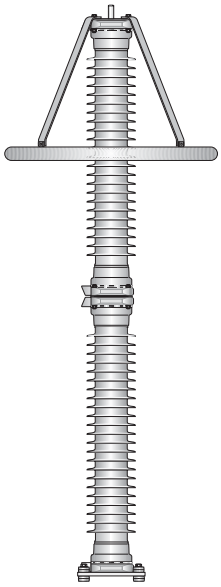
2) Energy absorption capacity under the conditions of the operating duty test acc. to IEC 60099-4

High-Voltage Metal Oxide Surge Arresters (72.5 to 800 kV)



		Porcelain			
		3EP5	3EP4	3EP2	3EP3
Applications		Medium- and high-voltage systems, outdoor installations	Medium- and high-voltage systems, outdoor installations	High-voltage systems, outdoor installations	High-voltage systems, outdoor installations, HVDC, SC&SVC applications
Nominal system voltage (max.)	kV	110	345	500	765
Highest voltage for equipment (max.)	kV	123	362	550	800
Maximum rated voltage	kV	96	288	468	612
Maximum nominal discharge current	kA	10	10	20	20
Maximum line discharge class		3	3	5	5
Maximum energy absorption capability (at thermal stability)	kJ/kV_r	8	8	13	25
Maximum long duration current impulse, 2 ms	A	850	850	1600	5000
Maximum short-circuit rating	kA	40	65	65	100
Maximum permissible service load	kNm	2[1)]	4.5[1)]	12.5[1)]	34[1)]
Housing material		Porcelain			
Design principle		Hollow insulator			
Pressure relief device		yes			

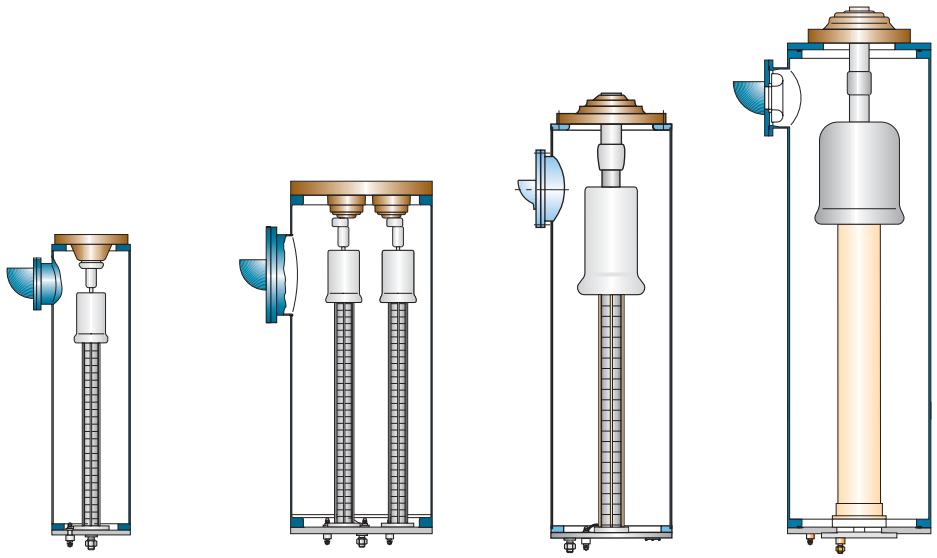
1) MPDSL acc. to IEC 60099-4



Silicone			
3EL2	**3EQ1**	**3EQ4**	**3EQ3**
Medium- and high-voltage systems, station and transmission line arrester	Medium- and high-voltage systems, outdoor installations	High-voltage systems, outdoor installations	High-voltage systems, outdoor installations, HVDC, SC&SVC applications
500 550	345 362	500 550	765 800
420	288	468	612
20	10	20	20
4	3	5	5
10	8	18	27
1200	850	2100	5500
65	50	65	80
4.0[2)]	6[2) 3)]	21[2) 3)]	72[2) 3)]
Silicone	Silicone		
Silicone directly molded onto MO	Hollow insulator, silicone directly molded onto FRP tube		
no	yes		

2) MPSL acc. to IEC 60099-4 3) > 75 % of this value are maintained after pressure relief

Metal Oxide Surge Arresters for GIS (72.5 to 800 kV)



		3ELS-D/3ES2-E single-phase	3ES5-B/C three-phase	3ES5-F/3ES5-G/3ES5-H single-phase	3ES9-J single-phase
Applications		High-voltage systems, protection of metal-enclosed gas-insulated switchgear and transformers			
Nominal system voltage (max.) Highest voltage for equipment (max.)	kV kV	150/220 170/245	150 170	220/345/525 245/362/550	765 800
Maximum rated voltage	kV	156/216	156	216/288/444	612
Maximum nominal discharge current	kA	20	20	20	20
Maximum line discharge class		4	4	4/5/5	5
Maximum energy absorption capability (at thermal stability)	kJ/kV_r	10	10	10/13/13	18
Maximum long duration current impulse, 2 ms	A	1200	1200	1200/1600/1600	2100
Maximum short-circuit rating	kA	50	50	65	65
Maximum permissible service load	kNm	–			
Housing material		Metal			
Pressure relief		yes			

Siemens Facilities

Siemens manufactures arrresters in Berlin, Germany and Wuxi, China. All arrester-related testing facilities as well as research and development, sales and order processing are located in Berlin.

In close vicinity are some of the most powerful high-voltage and high-power test facilities, the “Siemens test laboratories“. Close collaboration of research, design and manufacturing ensures continuous improvement and perfect quality.

Safe due to extensive tests
One example of the extensive tests carried out with highly modern testing equipment is the measuring of residual voltage with a nominal discharge current of 10 kA, 8/20 µs on a 3EP2 arrester for a 245-kV system.

Control devices for surge arresters
Recording, signaling and monitoring devices supply the necessary information on the discharge process and the condition of the arresters.

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