Catalog HG 21 · 2007

3EE Surge Arresters
3EF Surge Limiters

Medium-Voltage Equipment
Selection and Ordering Data

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3EE Surge Arresters
3EF Surge Limiters

Medium-Voltage Equipment
Catalog HG 21 · 2007

Invalid:
Catalog HG 21.2.3 · 1999
Catalog HG 21.2.7 · 1998

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Industrial application: Refinery

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Surge arresters and limiters – The Indispensable

Surge arresters and surge limiters are used for protection of motors, generators and transformers against internal and external overvoltages. Thus, they are an indispensable protection device for safe operation of medium-voltage switchgear. Their application makes sure that the arising overvoltages do not exceed the permissible withstand voltages of the equipment to be protected. So, their action in the power system is confined to the limitation of lightning and switching overvoltages. Apart from that they are passive devices.

3EE surge arresters

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3EF surge limiters

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Surge arresters protect operational equipment, such as motors, generators and transformers both against external overvoltages from lightning strikes in overhead lines and internal overvoltages caused by switching operations or earth faults. As the voltage rises, the conductivity increases overproportionally, so that the load can be discharged to earth.

Surge limiters limit impermissibly high switching overvoltages that could be dangerous for the windings of high-voltage motors. Such overvoltages can appear when switching devices are used whose contact gap recovers extremely fast after current zero.

Surge limiters are provided for use in cable systems and are usually installed in indoor switchgear.

Construction and mode of operation of 3EE arresters

Application

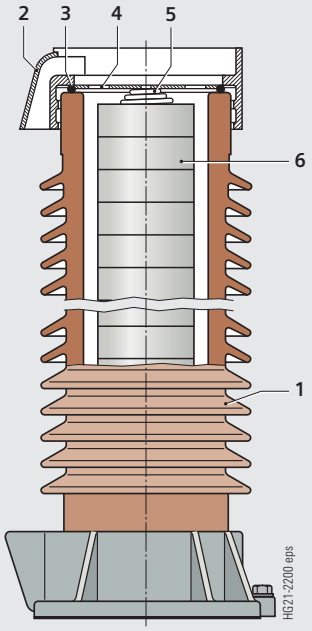
For protection of sensitive equipment – such as rotating machines or other devices with windings in air – against switching overvoltages and atmospheric overvoltages, special arresters are available. They stand out due to low protection levels and a fine grading of the rated voltage. For generator protection, designs with a short-circuit current capability up to 300 kA are available. The arresters can be used in AC power systems from 48 Hz to 62 Hz, and both in outdoor and indoor installations for site altitudes up to 1,000 m.

The decisive factor for protection against switching overvoltages is the residual voltage at an impulse current of 0.5 A waveshape 30/60. This residual voltage value is the protection level the switching overvoltages are limited to. If power is supplied through an overhead line, additional surge arresters, e.g. type 3EK7, must be installed at the entrance of the overhead line in order to avoid the residual voltages appearing at higher discharge currents.

Construction

The active elements of the arrester are metal-oxide resistors (6), which are installed in a hermetically sealed porcelain housing (1). The flanges with integrated gas diverting nozzles (2) are made of an outdoor-resistant light metal alloy, and are cemented with the porcelain housing. Long-time tightness is achieved by means of weather-proof and ozone-resistant seals (3) as well as corrosion-resistant metal diaphragms (4). Each component is equipped with pressure relief devices and gas diverting nozzles at both ends.

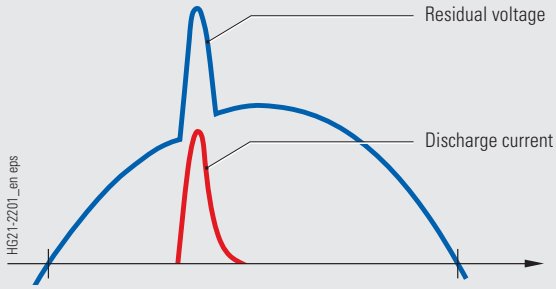
In the very seldom case of overload, these pressure relief devices open at a pressure of 20 % of the pressure resistance of the porcelain housing. Then, due to the shape of the gas diverting nozzles, the gas jets are directed towards each other in order to make the arc burn outside the porcelain housing until the line is shut down.



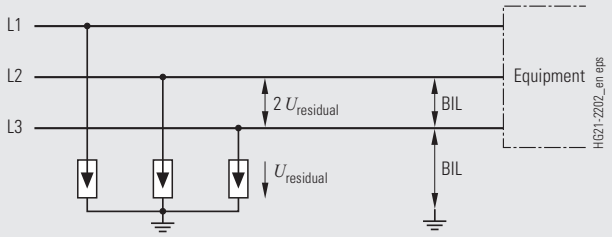
Sectional view of a 3EE arrester

1 Insulator
2 Flange with gas diverting nozzle
3 Seal
4 Pressure relief diaphragm
5 Compression spring
6 Metal-oxide resistor (non-linear)

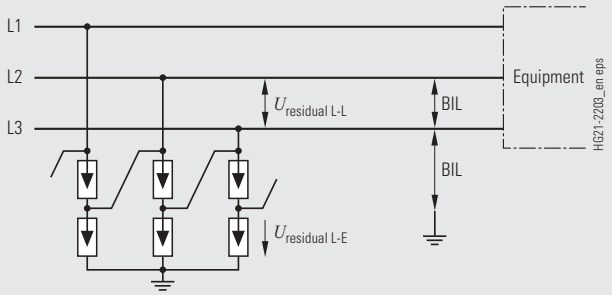
1



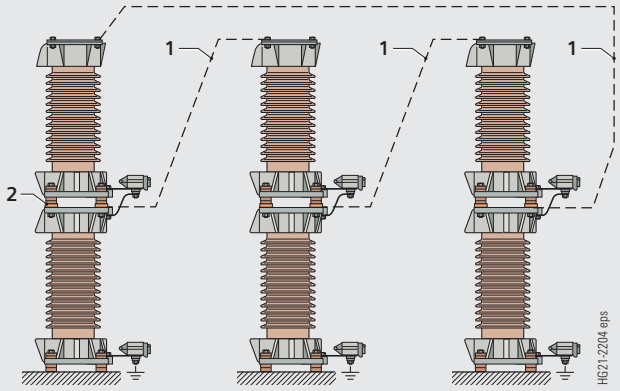
Mode of operation of metal-oxide arresters



Arresters in phase-to-earth connection



6-arrester connection



6-arrester connection with mounted tell-tale spark gaps

1 Not included in the scope of supply
2 Copper bars for delta connection

Mode of operation

Metal-oxide resistors are strongly non-linear, i.e. they have a strongly curved current-voltage characteristic, so that – below a certain voltage – only a small leakage current flows. The arresters are designed in such a way that only the small leakage current flows at the continuous operating voltage applied in normal operation.

When lightning or switching overvoltages occur, the resistors become very conductive. This makes an impulse current flow to earth, reducing the overvoltage to the value of the voltage drop at the arrester ("residual voltage"). Thereby, the impulse currents can be up to 1 kA in the case of switching overvoltages and from 1 kA to 20 kA in case of lightning overvoltages.

If the switching overvoltages can reach impermissibly high values, the arresters must be designed to limit the over-voltages to permissible values, both between phases (L-L) and to earth (L-E). The target is to manage with three arresters in phase-to-earth connection. If this is not possible, a 6-arrester connection must be provided.

Installation

Normally, arresters are mounted in vertical position and with the high-voltage terminal at the top. If the construction requires this, the devices can also be installed in suspended or horizontal position.

When ordering, these special installation conditions – as well as the 6-arrester connection – must be specified in clear text as a special version.

Monitoring

The arresters do not require any monitoring or maintenance. The frequency of operation of the surge arresters as well as the magnitude of the discharge currents and the type of possible overvoltages can be determined by installation of a tell-tale spark gap 3EX6040 in the earthing cable.

Selection criteria

The opposite table offers an overview of typical arresters for the typical system voltages defined in the IEC standards. For differing system voltages or intermediate values, the selection condition applicable to the respective type of power system must be complied with. The short-circuit current capability to be selected for the arrester must be greater than or equal to the maximum short-circuit current occurring in the power system.

The following selection conditions apply to the different power systems:

System with solidly earthed neutral

$$U_c \geq 1.05 \times U_{LE} = 1.05 \times \frac{U_m}{\sqrt{3}} \times \varepsilon \quad (\text{for } \varepsilon = 1.0)$$

System with impedance-earthed neutral

$$U_c \geq U_{LE} = \frac{U_m}{\sqrt{3}} \times \varepsilon = \frac{U_m}{1.25} \quad (\text{for } \varepsilon = 1.4)$$

System with isolated neutral

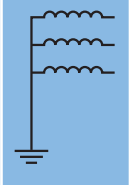
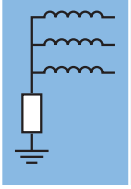
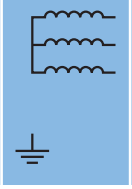
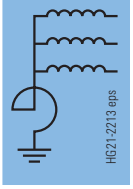
$$U_c \geq U_{LE} = \frac{U_m}{\sqrt{3}} \times \varepsilon = U_m \quad (\text{for } \varepsilon = 1.73)$$

System with resonant-earthed neutral

$$U_c \geq U_{LE} = \frac{U_m}{\sqrt{3}} \times \varepsilon = U_m \quad (\text{for } \varepsilon = 1.73)$$

U_c Continuous operating voltage
U_{LE} Phase-to-earth voltage in case of a fault
U_m Maximum system voltage
ε Earth-fault factor

The energy absorption capacity of 8kJ/kV is generally enough. Arresters with 10 kJ/kV are available when a higher energy absorption capacity is needed. The actual energy absorption capacity required can be determined by means of a network calculation.

Maximum voltage for equipment U_m kV	System with solidly earthed neutral	System with impedance-earthed neutral	System with isolated neutral	System with resonant-earthed neutral
				
3.6	3EE2 056	3EE2 056	3EE2 056	3EE2 056
7.2	3EE2 056	3EE2 075	3EE2 090	3EE2 090
12	3EE2 120	3EE2 120	3EE2 150	3EE2 150
17.5	3EE2 150	3EE2 190	3EE2 230	3EE2 230
24	3EE2 190	3EE2 230	3EE2 300	3EE2 300
36	3EE2 270	3EE2 340	3EE2 450	3EE2 450
40.5	3EE2 340	3EE2 450	–	–

Typical 3EE arresters for system voltages

1

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3EF1 surge limiter

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3EF3 surge limiter

Construction and mode of operation of 3EF limiters

Application

3EF1 surge limiters are used in cable systems up to 15 kV. For power stations and extensive cable systems, surge limiters type 3EF3 should be used, as they have a higher energy absorption capacity and a lower, i.e. better, protection level.

If the cable system is interconnected with overhead lines, one set of surge arresters, e.g. type 3EK7, must be provided at each point of transition between the cable and the overhead line.

Construction and mode of operation

The housing is made of plastic. Inside, spark gaps and non-linear resistors are connected in series. These active inner parts are hermetically sealed against the outer atmosphere. For connection at both ends, threaded bolts are used.

The spark gap has a low sparkover voltage, and separates the non-linear resistor from the power system during normal operation.

A metal-oxide varistor with a strongly curved current-voltage characteristic is used as a resistor. As the voltage rises, the current flow through the varistors increases overproportionally, decreasing accordingly as the voltage drops. Due to these properties, the surge limiter already operates at an early stage when an overvoltage occurs, and limits it to low values.

In contrast to type 3EF1, the surge limiter type 3EF3 is equipped with a pressure relief device which prevents the housing from tearing open in the extremely seldom case of overload.

Installation

Surge limiters can be mounted in any position. They are connected phase-to-earth. During operation, the rated voltage U_r marked on the surge limiter must not be exceeded at the place of installation. This equally applies to any kind of tests performed on the surrounding parts of the switchgear. If necessary, the electrical connection to the surge limiter must be interrupted for the duration of the voltage test.

Selection criteria

Which surge limiter must be selected largely depends on the factors “energy absorption capacity” and “overload performance”. The limiters of the type series 3EF3 can absorb up to 5 times the energy of those of the 3EF1 series. The magnitude of the necessary energy absorption capacity must be determined in a network calculation.

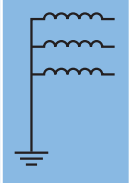
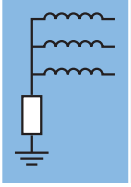
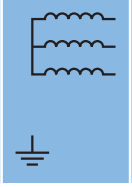
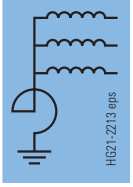
In case of overload, which cannot be excluded in the case of intermittent earth-faults, the housing of 3EF1 limiters can be torn open and the arc can escape. Limiters type 3EF3 have integrated rupture diaphragms which tear open in order to protect the housing from pressure damages. The gases escaping as the pressure is relieved are deflected to the outside due to the shape of the aluminium cap, and this ignites an arc between the counter electrode and the cap.

The arc resulting from an overload burns until the circuit is interrupted by the upstream overcurrent protection devices. Surge limiters which failed due to overload must be replaced.

The opposite table offers an overview of typical limiters for motor protection for typical rated motor voltages. For differing rated motor voltages or intermediate values, the following selection condition applicable to the respective type of power system must be complied with in order to select a suitable limiter:

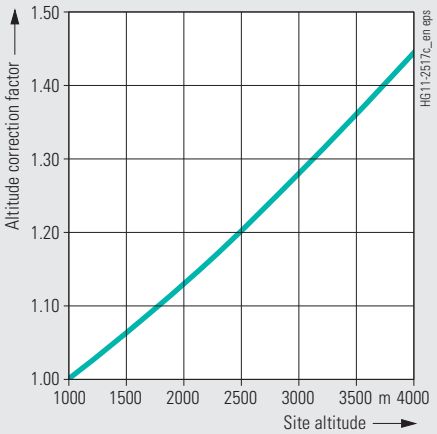
$$U_r \geq U_m$$

U_m Maximum system voltage
U_r Rated voltage

Maximum voltage for equipment U_m kV	System with solidly earthed neutral	System with impedance-earthed neutral	System with isolated neutral	System with resonant-earthed neutral
				
3.6	3EF1 036-0A 3EF3 036-0	3EF1 036-0A 3EF3 036-0	3EF1 036-0A 3EF3 036-0	3EF1 036-0A 3EF3 036-0
4.8	3EF1 048-0A 3EF3 048-0	3EF1 048-0A 3EF3 048-0	3EF1 048-0A 3EF3 048-0	3EF1 048-0A 3EF3 048-0
7.2	3EF1 072-0A 3EF3 072-0	3EF1 072-0A 3EF3 072-0	3EF1 072-0A 3EF3 072-0	3EF1 072-0A 3EF3 072-0
12	3EF1 120-1	3EF1 120-1	3EF1 120-1	3EF1 120-1
15	3EF1 150-0A	3EF1 150-0A	3EF1 150-0A	3EF1 150-0A

Typical 3EF limiters for rated motor voltages

1



Dielectric strength

The dielectric strength of air insulation decreases with increasing altitude due to low air density. According to IEC 60694, the rated lightning impulse withstand voltage values specified in the chapter "Technical Data" apply to a site altitude of 1000 m above sea level. For an altitude above 1000 m, the insulation level must be corrected according to the opposite diagram.

The characteristic shown applies to the rated short-duration power-frequency withstand voltage and the rated lightning impulse withstand voltage.

To select the devices, the following applies:

$U \geq U_0 \times K_a$

U Rated withstand voltage under standard reference atmosphere
U_0 Rated withstand voltage requested for the place of installation
K_a Altitude correction factor according to the opposite diagram

Example

For a requested rated lightning impulse withstand voltage of 75 kV at an altitude of 2500 m, an insulation level of 90 kV under standard reference atmosphere is required as a minimum:

90 kV $\geq$ 75 kV x 1.2

Standards

3EE surge arresters conform to the following specifications and recommendations:

IEC 60099-4

3EF1 and 3EF3 surge limiters are special devices which are not described by any of the standards applicable today. However, they are designed, manufactured and tested to a large extent in accordance with IEC 60099-4.

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3EE surge arrester

R-HG21-102.eps

3EF1 and 3EF3 surge limiters

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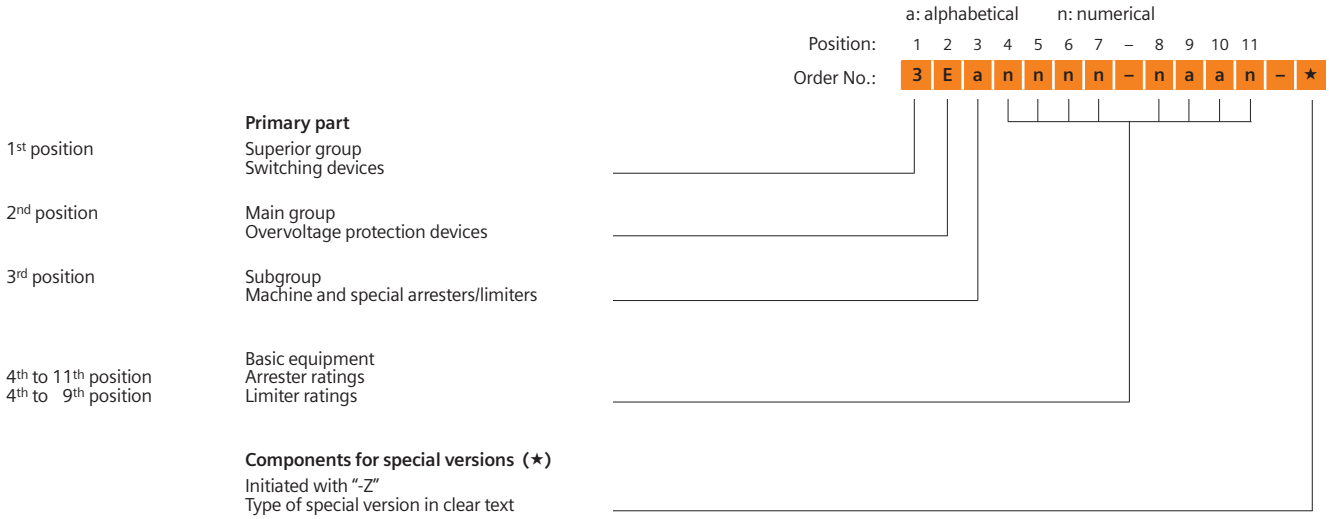
Order number structure

The surge arresters and surge limiters are described by an order number consisting of 8 to 11 digits. The positions 12 to 16 which are normally used for the 16-digit order number are not required.

Special versions (★)

There are special arrester versions available. In this case, **"-Z"** is added to the order number and a descriptive code for the special version follows (6-arrester connection, or suspended respectively horizontal installation).



Configuration example

In order to simplify the selection of the correct order number for the requested arrester or limiter, you will find a configuration example on each page of the chapter "Equipment Selection".

On the foldout page we offer a configuring aid. Here you can fill in the order number you have determined for your arrester or limiter.

Example for Order No.:	3	E	E	2	2	2	0	–	2	C	A	0			
Special version:															

Equipment Selection
Selection of 3EE arresters

Arresters for motors

Maximum continuous operating voltage U_c kV	Rated voltage U_r kV	Short-circuit current capability (0.2 s) kA	Energy absorption capacity kJ / kV	Position: 1 2 3 4 5 6 7 – 8 9 10 11 – ★ / Order No.:
4.5	5.6	**50**	8	3 E E 2 0 5 6 – 1 A A 0
		63	8	3 E E 2 0 5 6 – 1 A B 0
		100	8	3 E E 2 0 5 6 – 1 A C 0
		200	8	3 E E 2 0 5 6 – 1 A D 0
6	7.5	**50**	8	3 E E 2 0 7 5 – 1 A A 0
		63	8	3 E E 2 0 7 5 – 1 A B 0
		100	8	3 E E 2 0 7 5 – 1 A C 0
		200	8	3 E E 2 0 7 5 – 1 A D 0
7.2	9	**50**	8	3 E E 2 0 9 0 – 1 A A 0
		63	8	3 E E 2 0 9 0 – 1 A B 0
		100	8	3 E E 2 0 9 0 – 1 A C 0
		200	8	3 E E 2 0 9 0 – 1 A D 0
9.6	12	**50**	8	3 E E 2 1 2 0 – 1 A A 0
			10	3 E E 2 1 2 0 – 2 A A 0
		63	8	3 E E 2 1 2 0 – 1 A B 0
			10	3 E E 2 1 2 0 – 2 A B 0
		100	8	3 E E 2 1 2 0 – 1 A C 0
			10	3 E E 2 1 2 0 – 2 A C 0
		200	8	3 E E 2 1 2 0 – 1 A D 0
			10	3 E E 2 1 2 0 – 2 A D 0
		300	8	3 E E 2 1 2 0 – 1 A E 1
			10	3 E E 2 1 2 0 – 2 A E 1
12	15	**50**	8	3 E E 2 1 5 0 – 1 A A 0
			10	3 E E 2 1 5 0 – 2 A A 0
		63	8	3 E E 2 1 5 0 – 1 A B 0
			10	3 E E 2 1 5 0 – 2 A B 0
		100	8	3 E E 2 1 5 0 – 1 A C 0
			10	3 E E 2 1 5 0 – 2 A C 0
		200	8	3 E E 2 1 5 0 – 1 A D 0
			10	3 E E 2 1 5 0 – 2 A D 0
		300	8	3 E E 2 1 5 0 – 1 A E 1
			10	3 E E 2 1 5 0 – 2 A E 1
15	19	**50**	8	3 E E 2 1 9 0 – 1 A A 0
			10	3 E E 2 1 9 0 – 2 A A 0
		63	8	3 E E 2 1 9 0 – 1 A B 0
			10	3 E E 2 1 9 0 – 2 A B 0
		100	8	3 E E 2 1 9 0 – 1 A C 0
			10	3 E E 2 1 9 0 – 2 A C 0
		200	8	3 E E 2 1 9 0 – 1 A D 0
			10	3 E E 2 1 9 0 – 2 A D 0
		300	8	3 E E 2 1 9 0 – 1 A E 1
			10	3 E E 2 1 9 0 – 2 A E 1

Configuration example
3EE2 surge arrester
Maximum continuous operating voltage U_c = **7.2 kV**
Rated voltage U_r = **9 kV**
Short-circuit current capability **100 kA / 0.2 s**
Energy absorption capacity **8 kJ/kV**
Version for **motors**

Order No.: 3 E E 2 0 9 0 – 1 A C 0
Special version:

Arresters for motors

Maximum continuous operating voltage U_c kV	Rated voltage U_r kV	Short-circuit current capability (0.2 s) kA	Energy absorption capacity kJ / kV	Position: 1 2 3 4 5 6 7 – 8 9 10 11 – ★ / Order No.:
18	23	**50**	8	3 E E 2 2 3 0 – 1 A A 0
			10	3 E E 2 2 3 0 – 2 A A 0
		63	8	3 E E 2 2 3 0 – 1 A B 0
			10	3 E E 2 2 3 0 – 2 A B 0
		100	8	3 E E 2 2 3 0 – 1 A C 0
			10	3 E E 2 2 3 0 – 2 A C 0
		200	8	3 E E 2 2 3 0 – 1 A D 0
			10	3 E E 2 2 3 0 – 2 A D 0
		300	8	3 E E 2 2 3 0 – 1 A E 1
			10	3 E E 2 2 3 0 – 2 A E 1
22	27	**50**	8	3 E E 2 2 7 0 – 1 A A 0
			10	3 E E 2 2 7 0 – 2 A A 0
		63	8	3 E E 2 2 7 0 – 1 A B 0
			10	3 E E 2 2 7 0 – 2 A B 0
		100	8	3 E E 2 2 7 0 – 1 A C 0
			10	3 E E 2 2 7 0 – 2 A C 0
		200	8	3 E E 2 2 7 0 – 1 A D 0
			10	3 E E 2 2 7 0 – 2 A D 0
		300	8	3 E E 2 2 7 0 – 1 A E 1
			10	3 E E 2 2 7 0 – 2 A E 1
24	30	**50**	8	3 E E 2 3 0 0 – 1 A A 0
			10	3 E E 2 3 0 0 – 2 A A 0
		63	8	3 E E 2 3 0 0 – 1 A B 0
			10	3 E E 2 3 0 0 – 2 A B 0
		100	8	3 E E 2 3 0 0 – 1 A C 0
			10	3 E E 2 3 0 0 – 2 A C 0
		200	8	3 E E 2 3 0 0 – 1 A D 0
			10	3 E E 2 3 0 0 – 2 A D 0
		300	8	3 E E 2 3 0 0 – 1 A E 1
			10	3 E E 2 3 0 0 – 2 A E 1
27	34	**50**	8	3 E E 2 3 4 0 – 1 A A 0
			10	3 E E 2 3 4 0 – 2 A A 0
		63	8	3 E E 2 3 4 0 – 1 A B 0
			10	3 E E 2 3 4 0 – 2 A B 0
		100	8	3 E E 2 3 4 0 – 1 A C 0
			10	3 E E 2 3 4 0 – 2 A C 0
		200	8	3 E E 2 3 4 0 – 1 A D 0
			10	3 E E 2 3 4 0 – 2 A D 0
		300	8	3 E E 2 3 4 0 – 1 A E 1
			10	3 E E 2 3 4 0 – 2 A E 1

Configuration example
3EE2 surge arrester
Maximum continuous operating voltage U_c = **22 kV**
Rated voltage U_r = **27 kV**
Short-circuit current capability **50 kA / 0.2 s**
Energy absorption capacity **10 kJ/kV**
Version for **motors**

3 E E 2 2 7 0 – 2 A A 0

Example for Order No.: 3 E E 2 2 7 0 – 2 A A 0
Special version:

Arresters for motors

Maximum continuous operating voltage U_c kV	Rated voltage U_r kV	Short-circuit current capability (0.2 s) kA	Energy absorption capacity kJ / kV	Position: 1 2 3 4 5 6 7 – 8 9 10 11 – ★ / Order No.:
30	38	**50**	8	3 E E 2 3 8 0 – 1 A A 0
			10	3 E E 2 3 8 0 – 2 A A 0
		63	8	3 E E 2 3 8 0 – 1 A B 0
			10	3 E E 2 3 8 0 – 2 A B 0
		100	8	3 E E 2 3 8 0 – 1 A C 0
			10	3 E E 2 3 8 0 – 2 A C 0
		200	8	3 E E 2 3 8 0 – 1 A D 0
			10	3 E E 2 3 8 0 – 2 A D 0
		300	8	3 E E 2 3 8 0 – 1 A E 1
			10	3 E E 2 2 8 0 – 2 A E 1
36	45	**50**	8	3 E E 2 4 5 0 – 1 A A 0
			10	3 E E 2 4 5 0 – 2 A A 0
		63	8	3 E E 2 4 5 0 – 1 A B 0
			10	3 E E 2 4 5 0 – 2 A B 0
		100	8	3 E E 2 4 5 0 – 1 A C 0
			10	3 E E 2 4 5 0 – 2 A C 0
		200	8	3 E E 2 4 5 0 – 1 A D 0
			10	3 E E 2 4 5 0 – 2 A D 0
		300	8	3 E E 2 4 5 0 – 1 A E 1
			10	3 E E 2 4 5 0 – 2 A E 1

Configuration example
3EE2 surge arrester
Maximum continuous operating voltage U_c = **36 kV**
Rated voltage U_r = **45 kV**
Short-circuit current capability **100 kA / 0.2 s**
Energy absorption capacity **8 kJ/kV**
Version for **motors**

Example for Order No.: 3 E E 2 4 5 0 – 1 A C 0
Special version:

Arresters for generators

Maximum continuous operating voltage U_c kV	Rated voltage U_r kV	Short-circuit current capability (0.2 s) kA	Energy absorption capacity kJ / kV	Position: 1 2 3 4 5 6 7 – 8 9 10 11 – ★ / Order No.:
4.5	5.6	**50**	8	3 E E 2 0 5 6 – 1 B A 0
		63	8	3 E E 2 0 5 6 – 1 B B 0
		100	8	3 E E 2 0 5 6 – 1 B C 0
		200	8	3 E E 2 0 5 6 – 1 B D 0
6	7.5	**50**	8	3 E E 2 0 7 5 – 1 B A 0
		63	8	3 E E 2 0 7 5 – 1 B B 0
		100	8	3 E E 2 0 7 5 – 1 B C 0
		200	8	3 E E 2 0 7 5 – 1 B D 0
7.2	9	**50**	8	3 E E 2 0 9 5 – 1 B A 0
		63	8	3 E E 2 0 9 0 – 1 B B 0
		100	8	3 E E 2 0 9 0 – 1 B C 0
		200	8	3 E E 2 0 9 0 – 1 B D 0
9.6	12	**50**	8	3 E E 2 1 2 0 – 1 B A 0
			10	3 E E 2 1 2 0 – 2 B A 0
		63	8	3 E E 2 1 2 0 – 1 B B 0
			10	3 E E 2 1 2 0 – 2 B B 0
		100	8	3 E E 2 1 2 0 – 1 B C 0
			10	3 E E 2 1 2 0 – 2 B C 0
		200	8	3 E E 2 1 2 0 – 1 B D 0
			10	3 E E 2 1 2 0 – 2 B D 0
		300	8	3 E E 2 1 2 0 – 1 B E 1
			10	3 E E 2 1 2 0 – 2 B E 1
12	15	**50**	8	3 E E 2 1 5 0 – 1 B A 0
			10	3 E E 2 1 5 0 – 2 B A 0
		63	8	3 E E 2 1 5 0 – 1 B B 0
			10	3 E E 2 1 5 0 – 2 B B 0
		100	8	3 E E 2 1 5 0 – 1 B C 0
			10	3 E E 2 1 5 0 – 2 B C 0
		200	8	3 E E 2 1 5 0 – 1 B D 0
			10	3 E E 2 1 5 0 – 2 B D 0
		300	8	3 E E 2 1 5 0 – 1 B E 1
			10	3 E E 2 1 5 0 – 2 B E 1
15	19	**50**	8	3 E E 2 1 9 0 – 1 B A 0
			10	3 E E 2 1 9 0 – 2 B A 0
		63	8	3 E E 2 1 9 0 – 1 B B 0
			10	3 E E 2 1 9 0 – 2 B B 0
		100	8	3 E E 2 1 9 0 – 1 B C 0
			10	3 E E 2 1 9 0 – 2 B C 0
		200	8	3 E E 2 1 9 0 – 1 B D 0
			10	3 E E 2 1 9 0 – 2 B D 0
		300	8	3 E E 2 1 9 0 – 1 B E 1
			10	3 E E 2 1 9 0 – 2 B E 1

Configuration example
3EE2 surge arrester
Maximum continuous operating voltage U_c = **15 kV**
Rated voltage U_r = **19 kV**
Short-circuit current capability **300 kA / 0.2 s**
Energy absorption capacity **10 kJ/kV**
Version for **generators**

Example for Order No.: 3 E E 2 1 9 0 – 2 B E 1
Special version:

Equipment Selection

Selection of 3EE arresters

Arresters for generators

Maximum continuous operating voltage U_c kV	Rated voltage U_r kV	Short-circuit current capability (0.2 s) kA	Energy absorption capacity kJ / kV	Position: 1 2 3 4 5 6 7 – 8 9 10 11 – ★ / Order No.:
18	23	**50**	8	3 E E 2 2 3 0 – 1 B A 0
			10	3 E E 2 2 3 0 – 2 B A 0
		63	8	3 E E 2 2 3 0 – 1 B B 0
			10	3 E E 2 2 3 0 – 2 B B 0
		100	8	3 E E 2 2 3 0 – 1 B C 0
			10	3 E E 2 2 3 0 – 2 B C 0
		200	8	3 E E 2 2 3 0 – 1 B D 0
			10	3 E E 2 2 3 0 – 2 B D 0
		300	8	3 E E 2 2 3 0 – 1 B E 1
			10	3 E E 2 2 3 0 – 2 B E 1
22	27	**50**	8	3 E E 2 2 7 0 – 1 B A 0
			10	3 E E 2 2 7 0 – 2 B A 0
		63	8	3 E E 2 2 7 0 – 1 B B 0
			10	3 E E 2 2 7 0 – 2 B B 0
		100	8	3 E E 2 2 7 0 – 1 B C 0
			10	3 E E 2 2 7 0 – 2 B C 0
		200	8	3 E E 2 2 7 0 – 1 B D 0
			10	3 E E 2 2 7 0 – 2 B D 0
		300	8	3 E E 2 2 7 0 – 1 B E 1
			10	3 E E 2 2 7 0 – 2 B E 1
24	30	**50**	8	3 E E 2 3 0 0 – 1 B A 0
			10	3 E E 2 3 0 0 – 2 B A 0
		63	8	3 E E 2 3 0 0 – 1 B B 0
			10	3 E E 2 3 0 0 – 2 B B 0
		100	8	3 E E 2 3 0 0 – 1 B C 0
			10	3 E E 2 3 0 0 – 2 B C 0
		200	8	3 E E 2 3 0 0 – 1 B D 0
			10	3 E E 2 3 0 0 – 2 B D 0
		300	8	3 E E 2 3 0 0 – 1 B E 1
			10	3 E E 2 3 0 0 – 2 B E 1
27	34	**50**	8	3 E E 2 3 4 0 – 1 B A 0
			10	3 E E 2 3 4 0 – 2 B A 0
		63	8	3 E E 2 3 4 0 – 1 B B 0
			10	3 E E 2 3 4 0 – 2 B B 0
		100	8	3 E E 2 3 4 0 – 1 B C 0
			10	3 E E 2 3 4 0 – 2 B C 0
		200	8	3 E E 2 3 4 0 – 1 B D 0
			10	3 E E 2 3 4 0 – 2 B D 0
		300	8	3 E E 2 3 4 0 – 1 B E 1
			10	3 E E 2 3 4 0 – 2 B E 1

Configuration example
3EE2 surge arrester
Maximum continuous operating voltage U_c = **27 kV**
Rated voltage U_r = **34 kV**
Short-circuit current capability **63 kA / 0.2 s**
Energy absorption capacity **10 kJ/kV**
Version for **generators**

Example for Order No.: 3 E E 2 3 4 0 – 2 B B 0
Special version:

2

Equipment Selection

Selection of 3EE arresters

Arresters for generators

Maximum continuous operating voltage U_c kV	Rated voltage U_r kV	Short-circuit current capability (0.2 s) kA	Energy absorption capacity kJ / kV	Position: 1 2 3 4 5 6 7 – 8 9 10 11 – ★ / Order No.:
30	38	**50**	8	3 E E 2 3 8 0 – 1 B A 0
			10	3 E E 2 3 8 0 – 2 B A 0
		63	8	3 E E 2 3 8 0 – 1 B B 0
			10	3 E E 2 3 8 0 – 2 B B 0
		100	8	3 E E 2 3 8 0 – 1 B C 0
			10	3 E E 2 3 8 0 – 2 B C 0
		200	8	3 E E 2 3 8 0 – 1 B D 0
			10	3 E E 2 3 8 0 – 2 B D 0
		300	8	3 E E 2 3 8 0 – 1 B E 1
			10	3 E E 2 3 8 0 – 2 B E 1
36	45	**50**	8	3 E E 2 4 5 0 – 1 B A 0
			10	3 E E 2 4 5 0 – 2 B A 0
		63	8	3 E E 2 4 5 0 – 1 B B 0
			10	3 E E 2 4 5 0 – 2 B B 0
		100	8	3 E E 2 4 5 0 – 1 B C 0
			10	3 E E 2 4 5 0 – 2 B C 0
		200	8	3 E E 2 4 5 0 – 1 B D 0
			10	3 E E 2 4 5 0 – 2 B D 0
		300	8	3 E E 2 4 5 0 – 1 B E 1
			10	3 E E 2 4 5 0 – 2 B E 1

Arresters for furnace transformers

Maximum continuous operating voltage U_c kV	Rated voltage U_r kV	Short-circuit current capability (0.2 s) kA	Energy absorption capacity kJ / kV	Order No.
17.5	22	**50**	10	3 E E 2 2 2 0 – 2 C A 0
24	30	**50**	10	3 E E 2 3 0 0 – 2 C A 0
26	32	**50**	10	3 E E 2 3 2 0 – 2 C A 0
29	36	**50**	10	3 E E 2 3 6 0 – 2 C A 0
36	45	**50**	10	3 E E 2 4 5 0 – 2 C A 0
42	52	**50**	10	3 E E 2 5 2 0 – 2 C A 0

Configuration example

3EE2 surge arrester
Maximum continuous operating voltage U_c = **42 kV**
Rated voltage U_r = **52 kV**
Short-circuit current capability **50 kA / 0.2 s**
Energy absorption capacity **10 kJ/kV**
Version for **furnace transformers**
Special version: **6-arrester connection**

3	E	E	2											
				5	2	0	–	2	C	A	0			
												–	Z	
Example for Order No.:	3	E	E	2	5	2	0	–	2	C	A	0	–	Z
Special version:	**6-arrester connection**													

Accessories for arresters

The order numbers are applicable to surge arresters and surge limiters of current manufacture. When components or spare parts are being ordered for existing arresters and limiters, always quote the type designation and the year of manufacture of the arrester or limiter to be sure to get the correct delivery.

Note: Spare parts must only be replaced by instructed personnel.

Designation	Remarks		Order No.
Bolt terminal	Suitable for arrester type 3EE according to dimension drawing 1 or 2 (see chapter "Technical data", page 26)	30 mm, complete with set of screws	**3EX6 006**
Flat terminal	Suitable for arrester type 3EE according to dimension drawing 1 or 2 (see chapter "Technical data", page 26)	complete with set of screws	**3EX6 034**
	Suitable for arrester type 3EE according to dimension drawing 3 (see chapter "Technical data", page 26)	complete with set of screws	**3EX7 008**

Equipment Selection

Selection of 3EF limiters

3.6 kV

50/60 Hz

Rated voltage U_r kV	Continuous operating voltage U_c kV	Energy absorption capacity kJ / kV	Position: 1 2 3 4 5 6 7 – 8 9 / Order No.:
3.6	**2.9**	0.8	3 E F 1 0 3 6 – 0 A
3.6	**3.2**	4	3 E F 3 0 3 6 – 0

4.8 kV

50/60 Hz

U_r kV	U_c kV	kJ / kV	
4.8	**3.6**	0.8	3 E F 1 0 4 8 – 0 A
4.8	**4.1**	4	3 E F 3 0 4 8 – 0

7.2 kV

50/60 Hz

U_r kV	U_c kV	kJ / kV	
7.2	**5.4**	0.8	3 E F 1 0 7 2 – 0 A
7.2	**6.1**	4	3 E F 3 0 7 2 – 0
7.2	**4.9**	4	3 E F 3 0 7 2 – 1

12 kV

50/60 Hz

U_r kV	U_c kV	kJ / kV	
12	**9**	0.8	3 E F 1 1 2 0 – 0 A
12	**10.2**	4	3 E F 3 1 2 0 – 0
12	**8.2**	4	3 E F 3 1 2 0 – 1

15 kV

50/60 Hz

U_r kV	U_c kV	kJ / kV	
15	**11**	0.8	3 E F 1 1 5 0 – 0 A

Configuration example

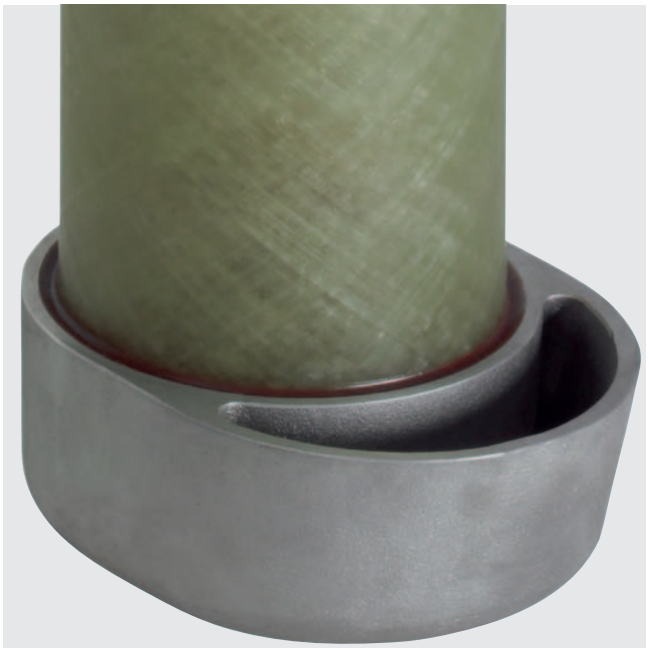
3EF surge limiter
Rated voltage U_r = **12 kV**
Continuous operating voltage U_c = **10.2 kV**
Energy absorption capacity **4 kJ/kV**

3 E F 3 1 2 0 – 0

Example for Order No.: 3 E F 3 1 2 0 – 0
Special version:

R-HG21-105.eps

3EE2, flat terminal



R-HG21-106.eps

3EF3, gas diverting nozzle

Contents Page

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Technical Data

Electrical data, dimensions and weights: 3EE arresters

Order No.	Rated voltage U_r	Maximum continuous operating voltage U_c	Short-circuit current capability (0.2 s)	Energy absorption capacity	Maximum residual voltage at discharge current with 0.5 kA waveshape 30/60 µs	1 kA waveshape 30/60 µs	5 kA waveshape 8/20 µs	10 kA waveshape 8/20 µs	20 kA waveshape 8/20 µs	Rated lightning impulse withstand voltage U_p	Rated power-frequency withstand voltage, dry	Rated power-frequency withstand voltage, under rain	Arcing distance	Creepage distance	Catalog dimension drawing (see page 26)	Weights
	kV	kV	kA	kJ/kV	kV cr	kV cr	kV cr	kV cr	kV cr	kV	kV	kV	mm	mm		kg
3EE2 056-□□A0	5.6	4.5	50	8	11.5	12	13	14	16	150	80	65	255	605	1	25
3EE2 056-□□B0	5.6	4.5	63	8	11.5	12	13	14	16	150	80	65	255	605	1	25
3EE2 056-□□C0	5.6	4.5	100	8	11.5	12	13	14	16	150	80	65	255	605	1	25
3EE2 056-□□D0	5.6	4.5	200	8	11.5	12	13	14	16	150	80	65	255	605	1	25
3EE2 075-□□A0	7.5	6	50	8	15.5	16	18	19	21	150	80	65	255	605	1	25
3EE2 075-□□B0	7.5	6	63	8	15.5	16	18	19	21	150	80	65	255	605	1	25
3EE2 075-□□C0	7.5	6	100	8	15.5	16	18	19	21	150	80	65	255	605	1	25
3EE2 075-□□D0	7.5	6	200	8	15.5	16	18	19	21	150	80	65	255	605	1	25
3EE2 090-□□A0	9	7.2	50	8	18.5	19.5	22	23	26	150	80	65	255	605	1	25
3EE2 090-□□B0	9	7.2	63	8	18.5	19.5	22	23	26	150	80	65	255	605	1	25
3EE2 090-□□C0	9	7.2	100	8	18.5	19.5	22	23	26	150	80	65	255	605	1	25
3EE2 090-□□D0	9	7.2	200	8	18.5	19.5	22	23	26	150	80	65	255	605	1	25
3EE2 120-□□A0	12	9.6	50	8/10	25	26	29	31	35	150	80	65	255	605	1	25
3EE2 120-□□B0	12	9.6	63	8/10	25	26	29	31	35	150	80	65	255	605	1	25
3EE2 120-□□C0	12	9.6	100	8/10	25	26	29	31	35	150	80	65	255	605	1	25
3EE2 120-□□D0	12	9.6	200	8/10	25	26	29	31	35	150	80	65	255	605	1	25
3EE2 120-□□E1	12	9.6	300	8/10	25	26	29	31	35	220	105	90	360	640	3	75
3EE2 150-□□A0	15	12	50	8/10	31.5	33	37	39	44	150	80	65	255	605	1	30
3EE2 150-□□B0	15	12	63	8/10	31.5	33	37	39	44	150	80	65	255	605	1	30
3EE2 150-□□C0	15	12	100	8/10	31.5	33	37	39	44	150	80	65	255	605	1	30
3EE2 150-□□D0	15	12	200	8/10	31.5	33	37	39	44	150	80	65	255	605	1	30
3EE2 150-□□E1	15	12	300	8/10	31.5	33	37	39	44	220	105	90	360	640	3	75
3EE2 190-□□A0	19	15	50	8/10	39.5	41	49	49	55	150	80	65	255	605	1	30
3EE2 190-□□B0	19	15	63	8/10	39.5	41	49	49	55	150	80	65	255	605	1	30
3EE2 190-□□C0	19	15	100	8/10	39.5	41	49	49	55	150	80	65	255	605	1	30
3EE2 190-□□D0	19	15	200	8/10	39.5	41	49	49	55	150	80	65	255	605	1	30
3EE2 190-□□E1	19	15	300	8/10	39.5	41	49	49	55	220	105	90	360	640	3	75
3EE2 220-□□A0	22	17.5	50	10	43	45	50	53	59	150	80	65	255	605	1	30
3EE2 230-□□A0	23	18	50	8/10	48	49	55	59	66	150	80	65	255	605	1	30
3EE2 230-□□B0	23	18	63	8/10	48	49	55	59	66	150	80	65	255	605	1	30
3EE2 230-□□C0	23	18	100	8/10	48	49	55	59	66	150	80	65	255	605	1	30
3EE2 230-□□D0	23	18	200	8/10	48	49	55	59	66	150	80	65	255	605	1	30
3EE2 230-□□E1	23	18	300	8/10	48	49	55	59	66	220	105	90	360	640	3	75
3EE2 270-□□A0	27	22	50	8/10	56	58	65	69	77	150	80	65	255	605	1	30
3EE2 270-□□B0	27	22	63	8/10	56	58	65	69	77	150	80	65	255	605	1	30
3EE2 270-□□C0	27	22	100	8/10	56	58	65	69	77	150	80	65	255	605	1	30
3EE2 270-□□D0	27	22	200	8/10	56	58	65	69	77	150	80	65	255	605	1	30
3EE2 270-□□E1	27	22	300	8/10	56	58	65	69	77	220	105	90	360	640	3	85

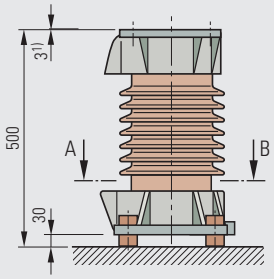
Technical Data

Electrical data, dimensions and weights: 3EE arresters

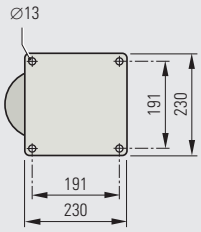
Order No.	Rated voltage U_r	Maximum continuous operating voltage U_c	Short-circuit current capability (0.2 s)	Energy absorption capacity	Maximum residual voltage at discharge current with 0.5 kA waveshape 30/60 µs	1 kA waveshape 30/60 µs	5 kA waveshape 8/20 µs	10 kA waveshape 8/20 µs	20 kA waveshape 8/20 µs	Rated lightning impulse withstand voltage U_p	Rated power-frequency withstand voltage, dry	Rated power-frequency withstand voltage, under rain	Arcing distance	Creepage distance	Catalog dimension drawing (see page 26)	Weights
	kV	kV	kA	kJ/kV	kV cr	kV cr	kV cr	kV cr	kV cr	kV	kV	kV	mm	mm		kg
3EE2 300-□□A0	30	24	50	8/10	62	64	72	77	86	240	130	110	435	1095	2	40
3EE2 300-2CA0	30	24	50	10	59	61	66	72	80	150	80	65	255	605	1	30
3EE2 300-□□B0	30	24	63	8/10	62	64	72	77	86	240	130	110	435	1095	2	40
3EE2 300-□□C0	30	24	100	8/10	62	64	72	77	86	240	130	110	435	1095	2	40
3EE2 300-□□D0	30	24	200	8/10	62	64	72	77	86	204	130	110	435	1095	2	40
3EE2 300-□□E1	30	24	300	8/10	62	64	72	77	86	220	105	90	360	640	3	85
3EE2 320-□□A0	32	24	50	10	63	65	73	77	86	150	80	65	255	605	1	30
3EE2 340-□□A0	34	27	50	8/10	70	73	82	87	97	240	130	110	435	1095	2	40
3EE2 340-□□B0	34	27	63	8/10	70	73	82	87	97	240	130	110	435	1095	2	40
3EE2 340-□□C0	34	27	100	8/10	70	73	82	87	97	240	130	110	435	1095	2	40
3EE2 340-□□D0	34	27	200	8/10	70	73	82	87	97	240	130	110	435	1095	2	40
3EE2 340-□□E1	34	27	300	8/10	70	73	82	87	97	240	105	90	360	640	3	85
3EE2 360-□□A0	36	29	50	10	71	74	82	87	97	240	130	110	435	1095	2	40
3EE2 380-□□A0	38	30	50	8/10	78	81	91	97	109	240	130	110	435	1095	2	40
3EE2 380-□□B0	38	30	63	8/10	78	81	91	97	109	240	130	110	435	1095	2	40
3EE2 380-□□C0	38	30	100	8/10	78	81	91	97	109	240	130	110	435	1095	2	40
3EE2 380-□□D0	38	30	200	8/10	78	81	91	97	109	240	130	110	435	1095	2	40
3EE2 380-□□E1	38	30	300	8/10	78	81	91	97	109	220	105	90	360	640	3	85
3EE2 450-□□A0	45	36	50	8/10	92	96	108	115	129	240	130	110	435	1095	2	40
3EE2 450-2CA0	45	36	50	10	88	91	102	108	120	240	130	110	435	1095	2	40
3EE2 450-□□B0	45	36	50	8/10	92	96	108	115	129	240	130	110	435	1095	2	40
3EE2 450-□□C0	45	36	50	8/10	92	96	108	115	129	240	130	110	435	1095	2	40
3EE2 450-□□D0	45	36	50	8/10	92	96	108	115	129	240	130	110	435	1095	2	40
3EE2 450-□□E1	45	36	50	8/10	92	96	108	115	129	220	105	90	360	640	3	85
3EE2 520-2CA0	52	42	50	10	100	105	118	125	139	240	130	110	435	1095	2	40

3

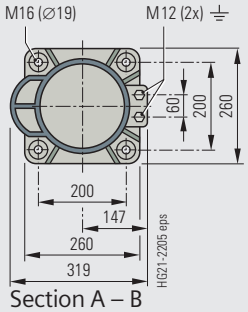
Dimension drawings for 3EE surge arresters



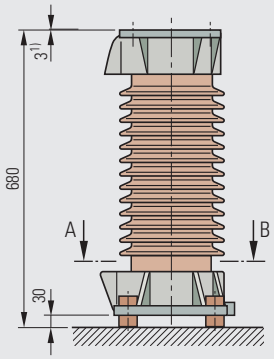
Dimension drawing 1



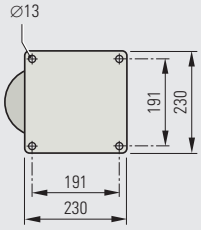
Top view



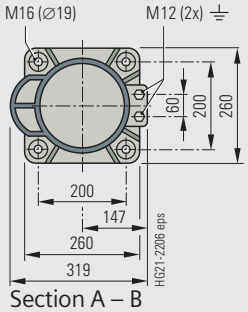
Section A – B



Dimension drawing 2

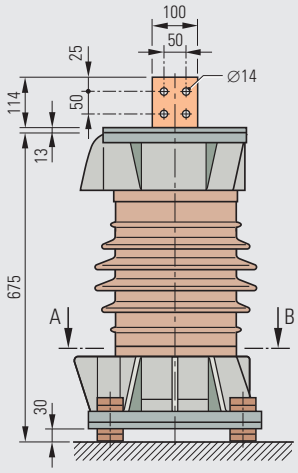


Top view

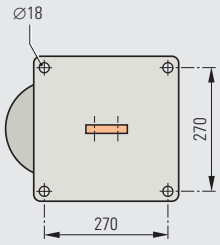


Section A – B

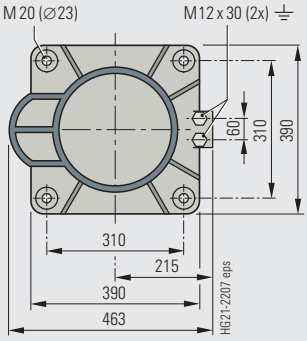
1) 5 mm for a short-circuit capability of 100 kA and 200 kA



Dimension drawing 3

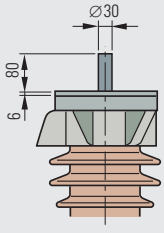


Top view

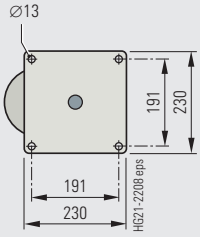


Section A – B

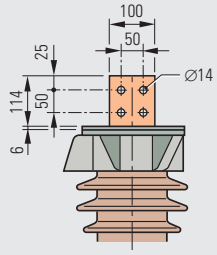
Accessories for arresters according to dimension drawings 1 and 2



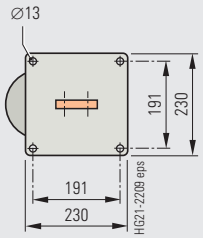
Bolt terminal
3EX6 006 for
housing sizes 1 and 2



Top view



Flat terminal 3EX6 034
for housing sizes 1 and 2



Top view

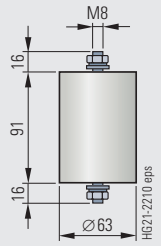
Technical Data

Electrical data, dimensions and weights: 3EF limiters

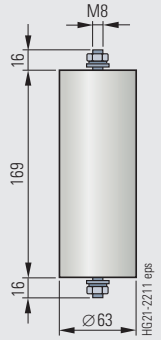
Order No.	Rated voltage U_r kV	Continuous operating voltage U_c kV	Switching impulse sparkover voltage (wave 5/200 µs) U_a kV	Residual voltage at impulse current 0.5 kA (wave 30/60 µs) U_{res} kV	Energy absorption capacity kJ/kV	Weights kg	Catalog dimension drawing (see below)
3EF1 036-0A	3.6	2.9	8	8	0.8	0.73	4
3EF1 048-0A	4.8	3.6	10	10	0.8	0.73	4
3EF1 072-0A	7.2	5.4	15	15	0.8	0.73	4
3EF1 120-0A	12	9	25	25	0.8	1.2	5
3EF1 150-0A	15	11	31	31	0.8	1.2	5
3EF3 036-0	3.6	3.2	8	8	4	3	6
3EF3 048-0	4.8	4.1	10	10	4	3.5	6
3EF3 072-0	7.2	6.1	15	15	4	4	6
3EF3 072-1	7.2	4.9	12	12	4	4	6
3EF3 120-0	12	10.2	25	25	4	5	6
3EF3 120-1	12	8.2	20	20	4	5	6

3

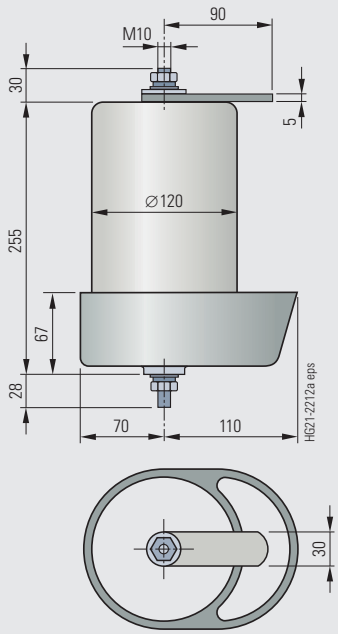
Dimension drawings for 3EF surge limiters



Dimension drawing 4



Dimension drawing 5



Dimension drawing 6

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R-HG11-180.eps

Switchgear Factory in Berlin, Germany

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4

Annex

Inquiry form

Please copy, fill in and return to your Siemens partner.

Inquiry concerning

☐ 3EE surge arresters
☐ 3EF surge limiters

Please

☐ Submit an offer
☐ Call us
☐ Visit us

Your address

Company

Dept.

Name

Street

Postal code/city

Phone

Fax

E-mail

Siemens AG

Dept.

Name

Street

Postal code/city

Fax

Technical data of 3EE surge arresters

				Other values
Rated voltage	☐ 5.6 kV ☐ 15 kV ☐ 27 kV ☐ 36 kV	☐ 7.5 kV ☐ 19 kV ☐ 30 kV ☐ 38 kV	☐ 9 kV ☐ 22 kV ☐ 32 kV ☐ 45 kV	☐ 12 kV ☐ 23 kV ☐ 34 kV ☐ 52 kV ☐ ___ kV
Maximum continuous operating voltage	☐ 4.5 kV ☐ 12 kV ☐ 22 kV ☐ 29 kV	☐ 6 kV ☐ 15 kV ☐ 24 kV ☐ 30 kV	☐ 7.2 kV ☐ 17.5 kV ☐ 26 kV ☐ 36 kV	☐ 9.6 kV ☐ 18 kV ☐ 27 kV ☐ 42 kV ☐ ___ kV
Earthing type	☐ Solidly earthed neutral	☐ Isolated neutral	☐ Impedance-earthed neutral	☐ Resonant-earthed neutral
Short-circuit current capability	☐ 50 kA/0.2 s ☐ 200 kA/0.2 s	☐ 63 kA/0.2 s	☐ 100 kA/0.2 s ☐ 300 kA/0.2 s	
Energy absorption capacity	☐ 8 kJ/kV	☐ 10 kJ/kV		☐ ___ kJ/kV
Application	☐ Motor	☐ Generator	☐ Furnace transformer	

Technical data of 3EF surge limiters

				Other values
Rated voltage	☐ 3.6 kV ☐ 12 kV	☐ 4.8 kV ☐ 15 kV	☐ 7.2 kV	☐ ___ kV
Maximum continuous operating voltage	☐ 2.9 kV ☐ 4.9 kV ☐ 9 kV	☐ 3.2 kV ☐ 5.4 kV ☐ 10.2 kV	☐ 3.6 kV ☐ 6.1 kV ☐ 11 kV	☐ 4.1 kV ☐ 8.2 kV ☐ ___ kV
Energy absorption capacity	☐ 0.8 kJ/kV	☐ 4 kJ/kV		☐ ___ kJ/kV
Application	☐ Cable system up to 15 kV		☐ Power station or extensive cable system	

Other requirements

☐ Please check off ___ Please fill in

You prefer to configure your surge arrester/limiter on your own?
Please follow the steps for configuration and enter the order number in the fold-out configuration aid.

For configuration of your surge arrester/limiter

Instructions for selection

Selection of a surge arrester (see pages 15 to 20)

Please specify the following ratings:	Possible options
Rated voltage (U_r)	U_r: 5.6 kV to 52 kV
Short-circuit current capability	50 kA/0.2 s to 300 kA/0.2 s
Energy absorption capacity	8 kJ/kV or 10 kJ/kV
Application	Motors, generators, furnace transformers

These ratings define the positions 5 to 11 of the order number.

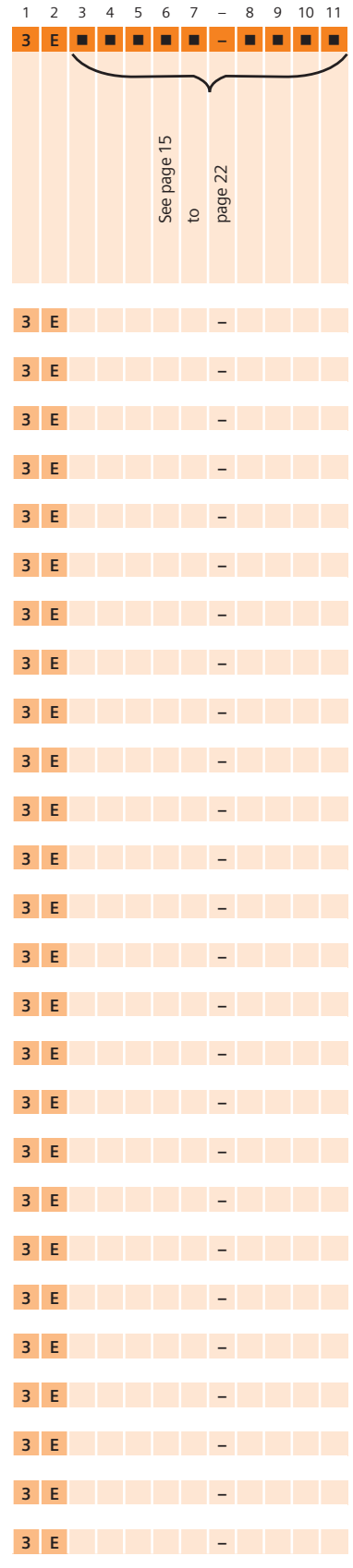
Selection of a surge limiter (see page 22)

Please specify the following ratings:	Possible options:
Rated voltage	U_r: 3.6 kV to 15 kV
Maximum continuous operating voltage	U_c: 2.9 kV to 11 kV
Energy absorption capacity	8 kJ/kV or 10 kJ/kV

These equipment features define the positions 4 to 9 of the order number.

Do you have any further requirements concerning the equipment?

Should you still need more options than the possible equipment, please contact your responsible sales partner.



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If not stated otherwise, all dimensions in this catalog are given in mm.

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The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases.
The required features should therefore be specified in each individual case at the time of closing the contract.

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