DEHN ITALIA

DEHN protects Medium Voltage Systems.

How to choose the right DEHNmid Surge Arrester.

There are three decisive application parameters for choosing the right DEHNmid surge arrester:

- Max. voltage U_m between the phases
- Method of neutral earthing of the medium voltage system
- Environmental conditions (e.g. pollution level) at site

The max. voltage U_m between the phases is defined as the effective value of the max. phase-to-phase voltage in an uninterferred system operation. If there are no provisions by the system management, the following flat value is assumed for U_m:

[Formula 0:]

$\mathbf{U_m = 1.2 \bullet U_{L\text{-}L}}$ $U_{L\text{-}L}$= system voltage (line-to-line voltage)

The proceeding of choosing the right surge arrester can be defined in two basic steps:

Step 1:

Considering U_m and the method of neutral earthing results the max. continuous load voltage U_c the surge arrester has to be designed for. The rated voltage U_r important for the DEHNmid devices can be determined as follows:

[Formula 1:]

$\mathbf{U_r = 1.25 \bullet U_c}$

According to standard IEC 60099-4, rated voltage U_r is defined as the max. permissible effective value of the ac voltage the surge arrester is designed for. This allows it to function as intended at temporary voltage rises as provided by the operating duty test procedure.

U_r defines all electrical characteristics of the medium voltage arrester.

The indication of the rated voltage is an inherent part of the type description of DEHNmid surge arresters, e.g. DMI 30 10 1 N ≙ U_r = 30 kV.

Step 2:

The environmental conditions at site define the mechanical characteristics of the arrester. Apart from the devices for indoor application DMI ... L, there are also two types of devices for outdoor application. Types DMI ... N are designed for "normal" environmental conditions, types DMI ... H for zones with a higher pollution level.

The following will illustrate how to proceed for choosing the right medium voltage arrester according to the method of neutral earthing of the medium voltage system. There are three kinds of installation to be distinguished: line to earth, neutral to earth and line to line.

Systems with isolated neutral or earth fault neutralisation

Characteristics:

Systems with isolated neutral do not include transformer neutrals that are earthed directly or indirectly. In such kinds of network the total earth fault current can flow for a longer period of time at every earth fault. In systems with earth fault neutralisation the transformer neutrals are earthed via reactances. At earth faults within the system, the sum of the inductive currents in these earthing coils is nearly equal to the capacitive earth fault current. This leads to the extinction of arc-over earth faults.

Arrester specification:

At single-pole earth faults, the line-to-line voltage of the "sound" phases rises to voltage U_m. As the earth fault can last up to several hours, the max. continuous load voltage U_C of the arrester has to be provided to be equal to the system voltage U_m.

[Formula 2:]

$\mathbf{U_C \geq U_m \rightarrow U_r \geq 1.25 \bullet U_m}$ arrester between line and earth

Example:

20 kV system, no defined disconnecting time
U_m = 24 kV;
U_r = 1.25 • 24 kV = 30 kV
→ DMI 30 ...

If surge arresters are supposed to be used at the transformer neutral for protecting the earthing coils, these arresters have to be rated according to formula 3.

[Formula 3:]

$\mathbf{U_C \geq \frac{U_m}{\sqrt{3}} \rightarrow U_r \geq \frac{1.25 \bullet U_m}{\sqrt{3}}}$ arrester between neutral and earth

Example:

20 kV system, no defined disconnecting time
U_m = 24 kV;
$U_r = \frac{1.25 \bullet 24\ kV}{\sqrt{3}} = 17.33\ kV$
→ DMI 18 ...

Systems with isolated neutral and earth fault disconnection

Characteristics:

Beside in systems with isolated neutrals only, single-pole earth faults can also cause a rise of the voltage from line to earth in systems with isolated neutrals and earth fault disconnection. Due to the early disconnection of the earth fault, however, the max. continuous load voltage U_C on the arresters can be reduced via factor T.

Factor T is an arrester-specific value characterising the withstand capability of the arrester against temporary overvoltages U_{TOV}. The characteristics of diagram 1 show this for DEHNmid arresters.

Arrester specification:

For arresters to be installed between phase and earth results the following criterion:

[Formula 4:]

$$U_C \geq \frac{U_m}{1.25 \bullet T} \rightarrow U_r \geq \frac{U_m}{T}$$

arrester between line and earth

Example:

20 kV system, disconnecting time t_d = 10 s
U_m = 24 kV; T (10 s) = 1
$U_r = U_c$ = 24 kV
➔ DMI 24 ...

Arresters to be installed between the transformer neutral and earth are rated as follows:

[Formula 5:]

$$U_C \geq \frac{U_m}{1.25 \bullet T \bullet \sqrt{3}} \rightarrow U_r \geq \frac{U_m}{\sqrt{3} \bullet T}$$

arrester between neutral and earth

Example:

20 kV system, disconnecting time t_d = 10 s
U_m = 24 kV, T (10 s) = 1

$$U_r \geq \frac{24\ kV}{\sqrt{3}} = 13.86\ kV$$

➔ DMI 15 ...

Systems with low-resistance neutral earthing (earth fault factor < 1.4)

Characteristics:

Systems with low-resistance neutral earthing (solid earthing) include at least as many transformers earthed at a low resistance as to prevent the phase voltage within the entire system from exceeding factor 1.4 (earth fault factor ≤ 1.4) at earth faults.

Due to the high earth and/or short-circuit current, systems with a low-resistance neutral earthing are quickly disconnected.

Arrester specification:

For achieving a low protection level between phase and earth, it is possible to choose arresters with a low continuous voltage U_C corresponding to formula 6. The factor 1.05 used in formula 6 is a safety factor based on experience. If detailed information about the system is available, the factor can be reduced to 1.0.

[Formula 6:]

$$U_C \geq \frac{1.4 \bullet U_m \bullet 1.05}{1.25 \bullet T \bullet \sqrt{3}} \rightarrow U_r = \frac{1.4 \bullet U_m \bullet 1.05}{\sqrt{3} \bullet T}$$

arrester between line and earth

Example:

20 kV system, disconnecting time t_d = 3 s
U_m = 24 kV, T (3 s) = 1.04

$$U_r = \frac{1.4 \bullet 24\ kV \bullet 1.05}{\sqrt{3} \bullet 1.04} = 19.59\ kV$$

➔ DMI 21 ...

For arresters to be installed at non-earthed transformer neutrals, the max. continuous voltage has to be calculated corresponding to formula 7.

[Formula 7:]

$$U_C \geq \frac{0.4 \bullet U_m}{1.25 \bullet T} \rightarrow U_r = \frac{0.4 \bullet U_m}{T}$$

arrester between neutral and earth

Example:

20 kV system, disconnecting time t_d = 3 s
U_m = 24 kV, T (3 s) = 1.04

$$U_r = \frac{0.4 \bullet 24\ kV}{1.04} = 9.23\ kV$$

➔ DMI 12 ...

Choice of DEHNmid surge arresters upon system voltage, method of neutral earthing in

System voltage U_{L-L} [kV]	Max. voltage U_m [kV]	System with isolated neutral earthing/earth fault neutralisation		System with high and earth
			t_d = 0.1 sec. T = 1.15	t_d = 0.5 sec. T = 1.10
6	7.2	DMI 9 ...	DMI 9 ...	DMI 9 ...
10	12	DMI 15 ...	DMI 12 ...	DMI 12 ...
15	17.5	DMI 24 ...	DMI 18 ...	DMI 18 ...
20	24	DMI 30 ...	DMI 21 ...	DMI 24 ...
30	36	DMI 45 ...	DMI 33 ...	DMI 33 ...

Systems with low-resistance neutral earthing but including system sections with earth fault factor > 1.4

Characteristics:

Not all transformer neutrals are earthed inductively with a low resistance or earthed directly. Earth faults within the system might cause the phase voltage to exceed factor 1.4.

Arrester specification:

For choosing the right arrester, the analogue proceeding is recommendable, e.g. for systems with high-resistant isolated neutrals and earth fault disconnection. Their rating for a max. continuous load voltage is determined via formula 4.

Systems with impedance neutral earthing

Characteristics:

Systems with an impedance neutral earthing are characterised by the earthing of the transformer neutrals via low-resistance earthing coils. This causes a short-circuit current at every earth fault, which is limited to max. 2 kA by the correspondingly rated earthing coils.

In case of an earth fault the voltage in the "sound phases" can rise to U_m. In case of ohmic neutral earthing the voltage can even rise to 5 % over U_m.

Arrester specification:

The following rule applies to the rating of the arresters:

[Formula 8:]

$$U_C \geq \frac{1.05 \bullet U_m}{1.25 \bullet T} \rightarrow U_r \geq \frac{1.05 \bullet U_m}{T}$$

arrester between line and earth

Example:

20 kV system, disconnecting time t_d = 10 s
U_m = 24 kV, T (10 s) = 1
U_r = 1.05 • 24 kV = 25.2 kV
→ DMI 27 ...

Installing arresters between phases

Characteristics:

Additionally to the arresters installed between line and earth it is advantageous for special applications to limit switching overvoltages between the three phases.

Arrester specification:

Principally there are two possibilities to limit the surges between line and earth and from line to line.

Possibility No. 1:

Installation of three surge arresters between line and earth and three arresters between the phases. All arresters have to be rated as follows:

[Formula 9:]

$$U_r = 1.25 \bullet U_m$$

The advantage of this solution, which, however, requires a lot of material, is a very low protection level in all protective circuits.

Possibility No. 2 (Neptun circuit):

One arrester between each line and a virtual neutral that is sufficiently isolated from earth. Additionally, one arrester between this virtual neutral and earth. Rating the arresters by means of

[Formula 10:]

$$U_r = 1.25 \bullet 0.667 \bullet U_m$$

leads to a protection level that is sufficient for many applications at reduced material requirements.

the system and disconnecting time (t_d) from earth faults. Each arrester has to be installed between conductor and earth.

-resistance isolated neutral fault disconnection			System with low-resistance neutral earthing (earth fault factor < = 1.4)					System with impedance neutral earthing		
t_d = 1.0 sec. T = 1.08	t_d = 3.0 sec. T = 1.04	t_d = 10.0 sec. T = 1.00	t_d = 0.1 sec. T = 1.15	t_d = 0.5 sec. T = 1.10	t_d = 1.0 sec. T = 1.08	t_d = 3.0 sec. T = 1.04	t_d = 10.0 sec. T = 1.00	t_d = 1.0 sec. T = 1.08	t_d = 3.0 sec. T = 1.04	t_d = 10.0 sec. T = 1.00
DMI 9 ...	DMI 9 ...	DMI 9 ...	DMI 6 ...	DMI 6 ...	DMI 6 ...	DMI 6 ...	DMI 9 ...	DMI 9 ...	DMI 9 ...	DMI 9 ...
DMI 12 ...	DMI 12 ...	DMI 12 ...	DMI 9 ...	DMI 12 ...	DMI 12 ...	DMI 12 ...	DMI 12 ...	DMI 12 ...	DMI 15 ...	DMI 15 ...
DMI 18 ...	DMI 18 ...	DMI 18 ...	DMI 15 ...	DMI 15 ...	DMI 15 ...	DMI 15 ...	DMI 15 ...	DMI 18 ...	DMI 18 ...	DMI 21 ...
DMI 24 ...	DMI 24 ...	DMI 24 ...	DMI 18 ...	DMI 21 ...	DMI 21 ...	DMI 21 ...	DMI 21 ...	DMI 24 ...	DMI 27 ...	DMI 27 ...
DMI 36 ...	DMI 36 ...	DMI 36 ...	DMI 27 ...	DMI 30 ...	DMI 30 ...	DMI 30 ...	DMI 31 ...	DMI 36 ...	DMI 39 ...	DMI 39 ...

DEHN Products protect Lives and secure Material Assets.

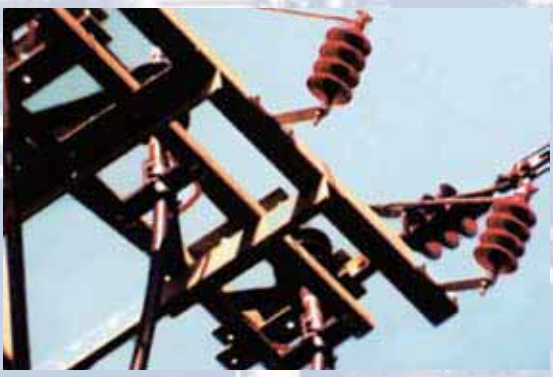
Safety Equipment

Lightning Protection / Earthing

Surge Protection for
IT Systems

Surge Protection for
Power Supply Systems

New – Surge Protection
for Medium Voltage Systems



DEHN – Your safety is our concern.

TOV Characteristics.

The arrester-specific factor T defines the withstand capability of the arrester at upcoming increased, temporary overvoltages (U_{TOV}).

The causes for such temporary overvoltages are mostly earth faults in the system, but can also arise at unexpected load changes.

Factor T results from the ratio of temporary overvoltages and the rated voltage of the arrester ($T = U_{TOV} / U_r$) depending on the duration of the temporary overvoltage.

The duration of the temporary overvoltage is defined by the system-specific disconnection conditions.

Each of the TOV characteristics of the DEHNmid and DEHNtrack product families are indicated after preloading the arresters with a high current impulse of 100 kA (4/10 µs). This preloading takes the practical performance of the arresters into account and thus increases the safety of using DEHNmid and DEHNtrack arresters.

AC voltage-time characteristics of DEHNmid arresters

Initial temperature + 60° C

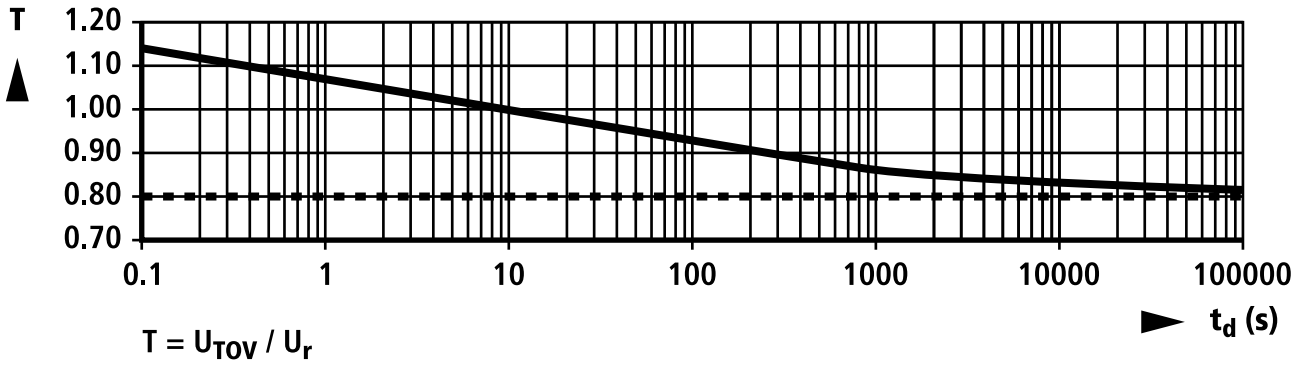


Diagram 1

DC voltage-time characteristics for DEHNtrack arresters

Initial temperature + 60° C

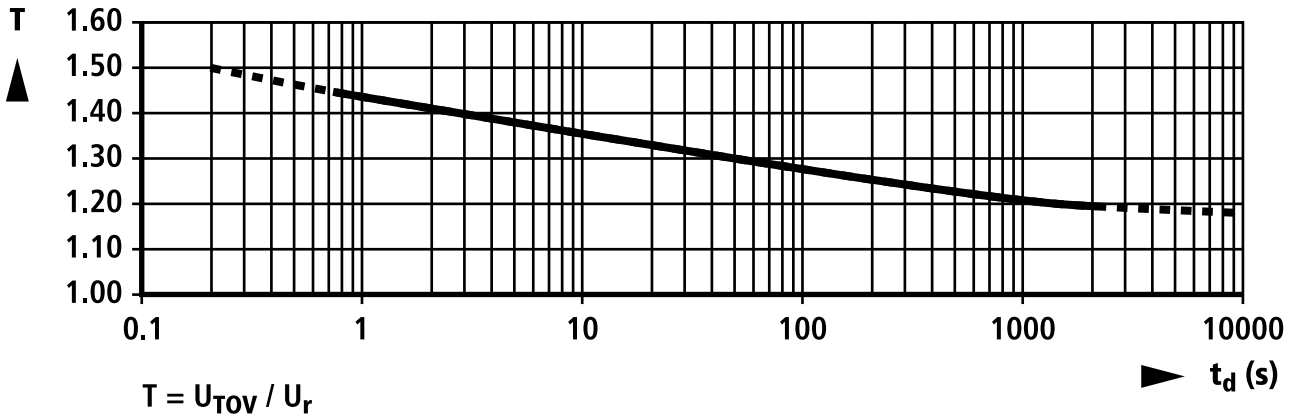


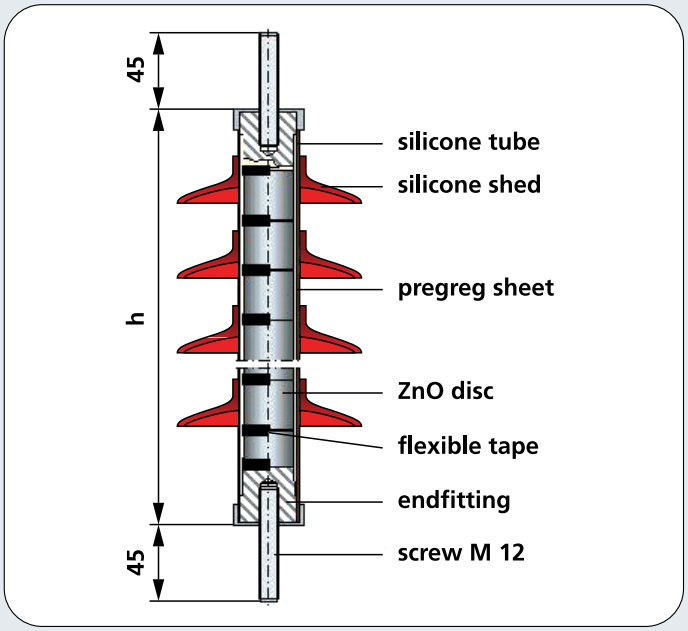
Diagram 2

Modular Structure of the Arrester.

The modular structures of DEHNmid and DEHNtrack arresters feature an especially high flexibility.

The arresters are dimensioned according to their rated voltage and the required creepage distance. This provides a compact structure adjusted to the respective operating conditions.

Thanks to its pregreg sheet the arresters feature a high mechanical stability and a high isolating capacity because of their enclosing silicone rubber.



Resistant against environmental Influences thanks to Hydrophobic Silicone Enclosure.

Wherever DEHNmid and DEHNtrack arresters may be used – their resistive enclosure made of high temperature vulcanized (HTV) silicone rubber is leakproof and avoids the formation of creepage current circuits.

The unique hydrophobic characteristics of this material prevent the formation of continuous dirt and water films even under extreme environmental influences.

Even aggressive saline fog in connection with a high ambient temperature cannot affect the enclosure of the arrester or the stainless steel conductors.

Fig. 1: DEHNmid arrester with considerable salt deposits after a 5000 hours test with cyclically alternating stress including rain, saline fog, temperature fluctuations and UV radiation at a continuous voltage U_C.

Fig. 2: Regeneration of the water resistance of the arrester already some hours after the stressful 5000 hours test.

DEHNmid

DMI ... L: Unit without Shed; for Indoor Application

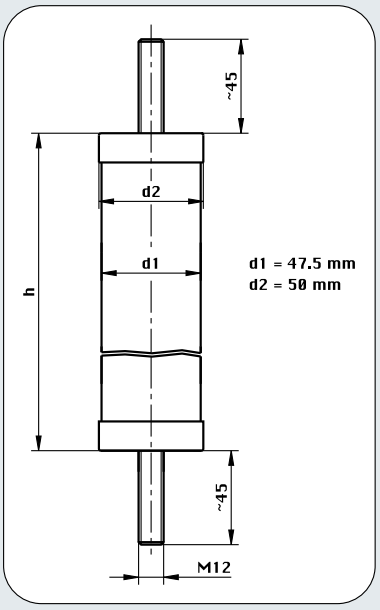
- "Low Duty" for indoor application (no shed)
- Nominal discharge current 10 kA (8/20)
- High current withstand capability 100 kA (4/10)
- High temperature vulcanized (HTV) silicone enclosure avoids formation of dirt or water films
- High bending resistance and unbreakable at overloads thanks to pregreg sheet
- High durability thanks to powerful metal oxide varistors

For time characteristics, please see "Further technical information"

	DMI 3 10 1 L	DMI 6 10 1 L	DMI 9 10 1 L	DMI 12 10 1 L	DMI 15 10 1 L	DMI 18 10 1 L	DMI 21 10 1 L	DMI 24 10 1 L
Rated voltage ac [U_r]	3 kV	6 kV	9 kV	12 kV	15 kV	18 kV	21 kV	24 kV
Continuous operating voltage ac [U_C]	2.4 kV	4.8 kV	7.2 kV	9.6 kV	12.0 kV	14.4 kV	16.8 kV	19.2 kV
Temporary overvoltage TOV 1 sec [U_{1s}]	3.2 kV	6.4 kV	9.6 kV	12.8 kV	16.1 kV	19.3 kV	22.5 kV	25.7 kV
Temporary overvoltage TOV 100 sec [U_{100s}]	2.8 kV	5.6 kV	8.4 kV	11.2 kV	14.0 kV	16.7 kV	19.5 kV	22.3 kV
Residual voltage at 10 kA (1/2 µs) [$\hat{u}_{rss}$]	9.6 kV	19.3 kV	28.9 kV	37.5 kV	42.8 kV	52.4 kV	62.1 kV	70.6 kV
Residual voltage at 20 kA (1/2 µs) [$\hat{u}_{rss}$]	10.8 kV	21.6 kV	32.4 kV	42.0 kV	48.0 kV	58.8 kV	69.6 kV	79.2 kV
Residual voltage at 5 kA (8/20 µs) [$\hat{u}_{rs}$]	8.4 kV	16.7 kV	25.1 kV	32.6 kV	37.2 kV	45.6 kV	53.9 kV	61.4 kV
Residual voltage at 10 kA (8/20 µs) [$\hat{u}_{rs}$]	9.0 kV	18.0 kV	27.0 kV	35.0 kV	40.0 kV	49.0 kV	58.0 kV	66.0 kV
Residual voltage at 20 kA (8/20 µs) [$\hat{u}_{rs}$]	10.0 kV	20.0 kV	30.0 kV	38.9 kV	44.4 kV	54.4 kV	64.4 kV	73.3 kV
Residual voltage at 40 kA (8/20 µs) [$\hat{u}_{rs}$]	11.3 kV	22.5 kV	33.8 kV	43.8 kV	50.0 kV	61.3 kV	72.5 kV	82.5 kV
Residual voltage at 250 A (30/75 µs) [$\hat{u}_{rsch}$]	6.8 kV	13.6 kV	20.3 kV	26.4 kV	30.1 kV	36.9 kV	43.7 kV	49.7 kV
Residual voltage at 500 A (30/75 µs) [$\hat{u}_{rsch}$]	7.0 kV	14.0 kV	21.1 kV	27.3 kV	31.2 kV	38.2 kV	45.2 kV	51.5 kV
Residual voltage at 1000 A (30/75 µs) [$\hat{u}_{rsch}$]	7.3 kV	14.6 kV	21.9 kV	28.4 kV	32.4 kV	39.7 kV	47.0 kV	53.5 kV
Residual voltage at 3000 A (30/75 µs) [$\hat{u}_{rsch}$]	7.9 kV	15.8 kV	23.7 kV	30.7 kV	35.1 kV	43.0 kV	50.9 kV	57.9 kV
Insulation for arrester housing / p.f. withstand voltage (dry) [U_{nstw}]	24 kV	32 kV	40 kV	46 kV	50 kV	54 kV	62 kV	68 kV
Insulation for arrester housing / lightning – impulse withstand voltage [U_{nstw}]	36 kV	46 kV	58 kV	68 kV	74 kV	78 kV	90 kV	100 kV
Height [h]	93 mm	111 mm	134 mm	152 mm	175 mm	193 mm	216 mm	234 mm
Weight [M]	0.7 kg	0.9 kg	1.0 kg	1.2 kg	1.3 kg	1.5 kg	1.7 kg	1.8 kg
Creepage distance	69 mm	87 mm	110 mm	128 mm	151 mm	169 mm	192 mm	210 mm

Ordering information								
Type	DMI 3 10 1 L	DMI 6 10 1 L	DMI 9 10 1 L	DMI 12 10 1 L	DMI 15 10 1 L	DMI 18 10 1 L	DMI 21 10 1 L	DMI 24 10 1 L
Part No.	990 001	990 002	990 003	990 004	990 005	990 006	990 007	990 008
Packing Unit / pcs	1	1	1	1	1	1	1	1

Nominal discharge current 10 kA; Line discharge class 1



Nominal discharge current (8/20 µs) [I_n]	10 kA
High current impulse (4/10 µs)	100 kA
Long duration current impulse	250 A / 2000 µs
Pressure relief class	B (20 kA)
Line discharge class	1 (2.8 kJ/kV$_{Ur}$)
Torsional strength (MML)	78 Nm
Bending resistance (MML)	230 Nm
Tensile strength (MML)	1400 Nm
Ambient temperature [T_U]	(-40 ... +55) °C
Altitude	up to 1000 m a.s.l.
Rated frequency [f_N]	15 Hz to 62 Hz
Housing	HTV-silicone
Colour	red-brown, RAL 3013
Fittings	connection clamps, nuts and screws of stainless steel
Conductor clamp	diameters up to 16 mm
Test standards	IEC 99-4; EN 60099-4

DMI 27 10 1 L	DMI 30 10 1 L	DMI 31 10 1 L	DMI 33 10 1 L	DMI 36 10 1 L	DMI 39 10 1 L	DMI 42 10 1 L	DMI 45 10 1 L	DMI 48 10 1 L	DMI 51 10 1 L
27 kV	30 kV	31 kV	33 kV	36 kV	39 kV	42 kV	45 kV	48 kV	51 kV
21.6 kV	24.0 kV	25.0 kV	26.4 kV	28.8 kV	31.2 kV	33.6 kV	36.0 kV	38.4 kV	40.8 kV
28.9 kV	32.1 kV	33.2 kV	35.3 kV	38.5 kV	41.7 kV	44.9 kV	48.2 kV	51.4 kV	54.6 kV
25.1 kV	27.9 kV	28.8 kV	30.7 kV	33.5 kV	36.3 kV	39.1 kV	41.9 kV	44.6 kV	47.4 kV
80.3 kV	85.6 kV	91.0 kV	94.2 kV	104.9 kV	114.5 kV	124.1 kV	128.4 kV	141.2 kV	147.7 kV
90.0 kV	96.0 kV	102.0 kV	105.6 kV	117.6 kV	128.4 kV	139.2 kV	144.0 kV	158.4 kV	165.6 kV
69.8 kV	74.4 kV	79.1 kV	81.8 kV	91.1 kV	99.5 kV	107.9 kV	111.6 kV	122.8 kV	128.3 kV
75.0 kV	80.0 kV	85.0 kV	88.0 kV	98.0 kV	107.0 kV	116.0 kV	120.0 kV	132.0 kV	138.0 kV
83.3 kV	88.8 kV	94.4 kV	97.7 kV	108.8 kV	118.8 kV	128.8 kV	133.2 kV	146.5 kV	153.2 kV
93.8 kV	100.0 kV	106.3 kV	110.0 kV	122.5 kV	133.8 kV	145.0 kV	150.0 kV	165.0 kV	172.5 kV
56.5 kV	60.2 kV	64.0 kV	66.3 kV	73.8 kV	80.6 kV	87.3 kV	90.4 kV	99.4 kV	103.9 kV
58.5 kV	62.4 kV	66.3 kV	68.6 kV	76.4 kV	83.5 kV	90.5 kV	93.6 kV	103.0 kV	107.6 kV
60.8 kV	64.8 kV	68.9 kV	71.3 kV	79.4 kV	86.7 kV	94.0 kV	97.2 kV	106.9 kV	111.8 kV
65.8 kV	70.2 kV	74.5 kV	77.2 kV	85.9 kV	93.8 kV	101.7 kV	105.2 kV	115.8 kV	121.0 kV
72 kV	84 kV	92 kV	92 kV	118 kV	128 kV	132 kV	144 kV	146 kV	150 kV
106 kV	122 kV	132 kV	132 kV	170 kV	180 kV	192 kV	208 kV	214 kV	218 kV
256 mm	274 mm	283 mm	297 mm	384 mm	407 mm	430 mm	447 mm	466 mm	488 mm
2.0 kg	2.1 kg	2.2 kg	2.4 kg	3.0 kg	3.2 kg	3.4 kg	3.6 kg	3.8 kg	4.0 kg
232 mm	250 mm	259 mm	273 mm	360 mm	383 mm	406 mm	423 mm	442 mm	464 mm

DMI 27 10 1 L	DMI 30 10 1 L	DMI 31 10 1 L	DMI 33 10 1 L	DMI 36 10 1 L	DMI 39 10 1 L	DMI 42 10 1 L	DMI 45 10 1 L	DMI 48 10 1 L	DMI 51 10 1 L
990 009	**990 010**	**990 011**	**990 012**	**990 013**	**990 014**	**990 015**	**990 016**	**990 017**	**990 018**
1	1	1	1	1	1	1	1	1	1

DEHNmid

DMI ... N: Normal Creepage Distance; for Outdoor Application

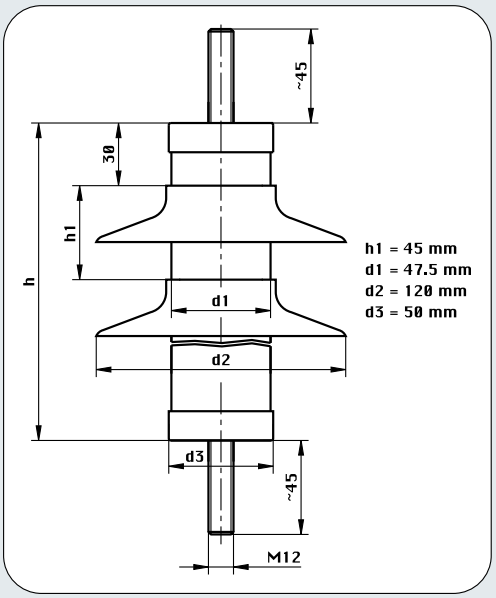
- "Normal Duty" for outdoor application (shed distance 45 mm)
- Nominal discharge current 10 kA (8/20)
- High current withstand capability 100 kA (4/10)
- High temperature vulcanized (HTV) silicone enclosure avoids formation of dirt or water films
- High bending resistance and unbreakable at overloads thanks to pregreg sheet
- High durability thanks to powerful metal oxide varistors

For time characteristics, please see "Further technical information"

	DMI 3 10 1 N	DMI 6 10 1 N	DMI 9 10 1 N	DMI 12 10 1 N	DMI 15 10 1 N	DMI 18 10 1 N	DMI 21 10 1 N	DMI 24 10 1 N
Rated voltage ac [U_r]	3 kV	6 kV	9 kV	12 kV	15 kV	18 kV	21 kV	24 kV
Continuous operating voltage ac [U_C]	2.4 kV	4.8 kV	7.2 kV	9.6 kV	12.0 kV	14.4 kV	16.8 kV	19.2 kV
Temporary overvoltage TOV 1 sec [U_{1s}]	3.2 kV	6.4 kV	9.6 kV	12.8 kV	16.1 kV	19.3 kV	22.5 kV	25.7 kV
Temporary overvoltage TOV 100 sec [U_{100s}]	2.8 kV	5.6 kV	8.4 kV	11.2 kV	14.0 kV	16.7 kV	19.5 kV	22.3 kV
Residual voltage at 10 kA (1/2 µs) [$\hat{u}_{rss}$]	9.6 kV	19.3 kV	28.9 kV	37.5 kV	42.8 kV	52.4 kV	62.1 kV	70.6 kV
Residual voltage at 20 kA (1/2 µs) [$\hat{u}_{rss}$]	10.8 kV	21.6 kV	32.4 kV	42.0 kV	48.0 kV	58.8 kV	69.6 kV	79.2 kV
Residual voltage at 5 kA (8/20 µs) [$\hat{u}_{rs}$]	8.4 kV	16.7 kV	25.1 kV	32.6 kV	37.2 kV	45.6 kV	53.9 kV	61.4 kV
Residual voltage at 10 kA (8/20 µs) [$\hat{u}_{rs}$]	9.0 kV	18.0 kV	27.0 kV	35.0 kV	40.0 kV	49.0 kV	58.0 kV	66.0 kV
Residual voltage at 20 kA (8/20 µs) [$\hat{u}_{rs}$]	10.0 kV	20.0 kV	30.0 kV	38.9 kV	44.4 kV	54.4 kV	64.4 kV	73.3 kV
Residual voltage at 40 kA (8/20 µs) [$\hat{u}_{rs}$]	11.3 kV	22.5 kV	33.8 kV	43.8 kV	50.0 kV	61.3 kV	72.5 kV	82.5 kV
Residual voltage at 250 A (30/75 µs) [$\hat{u}_{rsch}$]	6.8 kV	13.6 kV	20.3 kV	26.4 kV	30.1 kV	36.9 kV	43.7 kV	49.7 kV
Residual voltage at 500 A (30/75 µs) [$\hat{u}_{rsch}$]	7.0 kV	14.0 kV	21.1 kV	27.3 kV	31.2 kV	38.2 kV	45.2 kV	51.5 kV
Residual voltage at 1000 A (30/75 µs) [$\hat{u}_{rsch}$]	7.3 kV	14.6 kV	21.9 kV	28.4 kV	32.4 kV	39.7 kV	47.0 kV	53.5 kV
Residual voltage at 3000 A (30/75 µs) [$\hat{u}_{rsch}$]	7.9 kV	15.8 kV	23.7 kV	30.7 kV	35.1 kV	43.0 kV	50.9 kV	57.9 kV
Insulation for arrester housing / p.f. withstand voltage (dry) [U_{nstw}]	34 kV	42 kV	48 kV	60 kV	60 kV	64 kV	70 kV	78 kV
Insulation for arrester housing / p.f. withstand voltage (wet) [U_{nstw}]	22 kV	26 kV	32 kV	40 kV	40 kV	42 kV	46 kV	52 kV
Insulation for arrester housing / lightning – impulse withstand voltage [U_{nstw}]	50 kV	60 kV	70 kV	86 kV	86 kV	92 kV	104 kV	114 kV
Height [h]	93 mm	111 mm	134 mm	152 mm	175 mm	193 mm	216 mm	234 mm
Number of sheds	1	1	1	2	2	2	3	3
Weight [M]	0.7 kg	0.9 kg	1.0 kg	1.2 kg	1.3 kg	1.5 kg	1.7 kg	1.8 kg
Creepage distance	144 mm	162 mm	185 mm	278 mm	301 mm	319 mm	417 mm	435 mm

Ordering information								
Type	DMI 3 10 1 N	DMI 6 10 1 N	DMI 9 10 1 N	DMI 12 10 1 N	DMI 15 10 1 N	DMI 18 10 1 N	DMI 21 10 1 N	DMI 24 10 1 N
Part No.	**990 101**	**990 102**	**990 103**	**990 104**	**990 105**	**990 106**	**990 107**	**990 108**
Packing Unit / pcs	1	1	1	1	1	1	1	1

Nominal discharge current 10 kA; Line discharge class 1



Nominal discharge current (8/20 µs) [I_n]	10 kA
High current impulse (4/10 µs)	100 kA
Long duration current impulse	250 A / 2000 µs
Pressure relief class	B (20 kA)
Line discharge class	1 (2.8 kJ/kV$_{Ur}$)
Torsional strength (MML)	78 Nm
Bending resistance (MML)	230 Nm
Tensile strength (MML)	1400 Nm
Ambient temperature [T_U]	(-40 ... +55) °C
Altitude	up to 1000 m a.s.l.
Rated frequency [f_N]	15 Hz to 62 Hz
Housing	HTV-silicone
Colour	red-brown, RAL 3013
Fittings	connection clamps, nuts and screws of stainless steel
Conductor clamp	diameters up to 16 mm
Test standards	IEC 99-4; EN 60099-4

DMI 27 10 1 N	DMI 30 10 1 N	DMI 31 10 1 N	DMI 33 10 1 N	DMI 36 10 1 N	DMI 39 10 1 N	DMI 42 10 1 N	DMI 45 10 1 N	DMI 48 10 1 N	DMI 51 10 1 N
27 kV	30 kV	31 kV	33 kV	36 kV	39 kV	42 kV	45 kV	48 kV	51 kV
21.6 kV	24.0 kV	25.0 kV	26.4 kV	28.8 kV	31.2 kV	33.6 kV	36.0 kV	38.4 kV	40.8 kV
28.9 kV	32.1 kV	33.2 kV	35.3 kV	38.5 kV	41.7 kV	44.9 kV	48.2 kV	51.4 kV	54.6 kV
25.1 kV	27.9 kV	28.8 kV	30.7 kV	33.5 kV	36.3 kV	39.1 kV	41.9 kV	44.6 kV	47.4 kV
80.3 kV	85.6 kV	91.0 kV	94.2 kV	104.9 kV	114.5 kV	124.1 kV	128.4 kV	141.2 kV	147.7 kV
90.0 kV	96.0 kV	102.0 kV	105.6 kV	117.6 kV	128.4 kV	139.2 kV	144.0 kV	158.4 kV	165.6 kV
69.8 kV	74.4 kV	79.1 kV	81.8 kV	91.1 kV	99.5 kV	107.9 kV	111.6 kV	122.8 kV	128.3 kV
75.0 kV	80.0 kV	85.0 kV	88.0 kV	98.0 kV	107.0 kV	116.0 kV	120.0 kV	132.0 kV	138.0 kV
83.3 kV	88.8 kV	94.4 kV	97.7 kV	108.8 kV	118.8 kV	128.8 kV	133.2 kV	146.5 kV	153.2 kV
93.8 kV	100.0 kV	106.3 kV	110.0 kV	122.5 kV	133.8 kV	145.0 kV	150.0 kV	165.0 kV	172.5 kV
56.5 kV	60.2 kV	64.0 kV	66.3 kV	73.8 kV	80.6 kV	87.3 kV	90.4 kV	99.4 kV	103.9 kV
58.5 kV	62.4 kV	66.3 kV	68.6 kV	76.4 kV	83.5 kV	90.5 kV	93.6 kV	103.0 kV	107.6 kV
60.8 kV	64.8 kV	68.9 kV	71.3 kV	79.4 kV	86.7 kV	94.0 kV	97.2 kV	106.9 kV	111.8 kV
65.8 kV	70.2 kV	74.5 kV	77.2 kV	85.9 kV	93.8 kV	101.7 kV	105.2 kV	115.8 kV	121.0 kV
82 kV	94 kV	100 kV	100 kV	126 kV	134 kV	142 kV	152 kV	156 kV	168 kV
54 kV	62 kV	66 kV	66 kV	84 kV	88 kV	94 kV	100 kV	104 kV	112 kV
120 kV	136 kV	146 kV	146 kV	184 kV	194 kV	206 kV	222 kV	226 kV	246 kV
256 mm	274 mm	283 mm	297 mm	384 mm	407 mm	430 mm	447 mm	466 mm	488 mm
4	4	5	5	6	7	7	8	8	9
2.0 kg	2.1 kg	2.2 kg	2.4 kg	3.0 kg	3.2 kg	3.4 kg	3.6 kg	3.8 kg	4.0 kg
532 mm	550 mm	634 mm	648 mm	810 mm	908 mm	931 mm	1023 mm	1042 mm	1139 mm

DMI 27 10 1 N	DMI 30 10 1 N	DMI 31 10 1 N	DMI 33 10 1 N	DMI 36 10 1 N	DMI 39 10 1 N	DMI 42 10 1 N	DMI 45 10 1 N	DMI 48 10 1 N	DMI 51 10 1 N
990 109	**990 110**	**990 111**	**990 112**	**990 113**	**990 114**	**990 115**	**990 116**	**990 117**	**990 118**
1	1	1	1	1	1	1	1	1	1

DEHNmid

DMI ... H: Increased Creepage Distance; for Outdoor Application

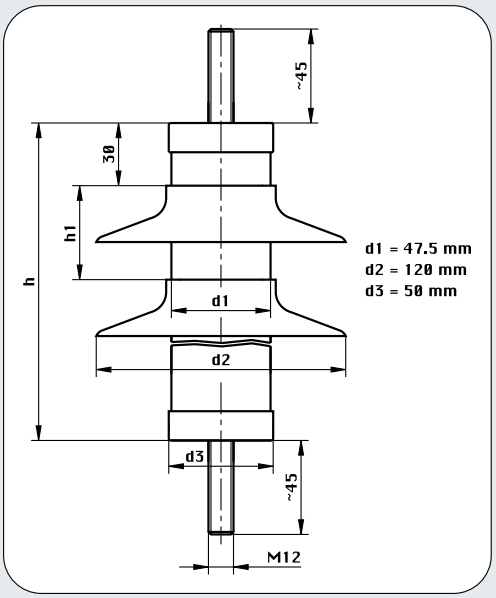
- "Heavy Duty" for outdoor application at increased pollution level (shed distance 30 mm)
- Nominal discharge current 10 kA (8/20)
- High current withstand capability 100 kA (4/10)
- High temperature vulcanized (HTV) silicone enclosure avoids formation of dirt or water films
- High bending resistance and unbreakable at overloads thanks to pregreg sheet
- High durability thanks to powerful metal oxide varistors

For time characteristics, please see "Further technical information"

	DMI 15 10 1 H	DMI 18 10 1 H	DMI 21 10 1 H	DMI 24 10 1 H	DMI 27 10 1 H	DMI 30 10 1 H
Rated voltage ac [U_r]	15 kV	18 kV	21 kV	24 kV	27 kV	30 kV
Continuous operating voltage ac [U_C]	12.0 kV	14.4 kV	16.8 kV	19.2 kV	21.6 kV	24.0 kV
Temporary overvoltage TOV 1 sec [U_{1s}]	16.1 kV	19.3 kV	22.5 kV	25.7 kV	28.9 kV	32.1 kV
Temporary overvoltage TOV 100 sec [U_{100s}]	14.0 kV	16.7 kV	19.5 kV	22.3 kV	25.1 kV	27.9 kV
Residual voltage at 10 kA (1/2 µs) [$\hat{u}_{rss}$]	42.8 kV	52.4 kV	62.1 kV	70.6 kV	80.3 kV	85.6 kV
Residual voltage at 20 kA (1/2 µs) [$\hat{u}_{rss}$]	48.0 kV	58.8 kV	69.6 kV	79.2 kV	90.0 kV	96.0 kV
Residual voltage at 5 kA (8/20 µs) [$\hat{u}_{rs}$]	37.2 kV	45.6 kV	53.9 kV	61.4 kV	69.8 kV	74.4 kV
Residual voltage at 10 kA (8/20 µs) [$\hat{u}_{rs}$]	40.0 kV	49.0 kV	58.0 kV	66.0 kV	75.0 kV	80.0 kV
Residual voltage at 20 kA (8/20 µs) [$\hat{u}_{rs}$]	44.4 kV	54.4 kV	64.4 kV	73.3 kV	83.3 kV	88.8 kV
Residual voltage at 40 kA (8/20 µs) [$\hat{u}_{rs}$]	50.0 kV	61.3 kV	72.5 kV	82.5 kV	93.8 kV	100.0 kV
Residual voltage at 250 A (30/75 µs) [$\hat{u}_{rsch}$]	30.1 kV	36.9 kV	43.7 kV	49.7 kV	56.5 kV	60.2 kV
Residual voltage at 500 A (30/75 µs) [$\hat{u}_{rsch}$]	31.2 kV	38.2 kV	45.2 kV	51.5 kV	58.5 kV	62.4 kV
Residual voltage at 1000 A (30/75 µs) [$\hat{u}_{rsch}$]	32.4 kV	39.7 kV	47.0 kV	53.5 kV	60.8 kV	64.8 kV
Residual voltage at 3000 A (30/75 µs) [$\hat{u}_{rsch}$]	35.1 kV	43.0 kV	50.9 kV	57.9 kV	65.8 kV	70.2 kV
Insulation for arrester housing / p.f. withstand voltage (dry) [U_{nstw}]	60 kV	64 kV	70 kV	78 kV	82 kV	94 kV
Insulation for arrester housing / p.f. withstand voltage (wet) [U_{nstw}]	40 kV	42 kV	46 kV	52 kV	54 kV	62 kV
Insulation for arrester housing / lightning – impulse withstand voltage [U_{nstw}]	86 kV	92 kV	104 kV	114 kV	120 kV	136 kV
Height [h]	175 mm	193 mm	216 mm	234 mm	256 mm	274 mm
Shed distance [h_1]	30 mm	30 mm	30 mm	30 mm	30 mm	30 mm
Number of sheds	3	3	4	5	5	6
Weight [M]	1.3 kg	1.5 kg	1.7 kg	1.8 kg	2.0 kg	2.1 kg
Creepage distance	376 mm	394 mm	492 mm	585 mm	607 mm	700 mm

Ordering information						
Type	DMI 15 10 1 H	DMI 18 10 1 H	DMI 21 10 1 H	DMI 24 10 1 H	DMI 27 10 1 H	DMI 30 10 1 H
Part No.	**990 201**	**990 202**	**990 203**	**990 204**	**990 205**	**990 206**
Packing Unit / pcs	1	1	1	1	1	1

Nominal discharge current 10 kA; Line discharge class 1



Nominal discharge current (8/20 µs) [I_n]	10 kA
High current impulse (4/10 µs)	100 kA
Long duration current impulse	250 A / 2000 µs
Pressure relief class	B (20 kA)
Line discharge class	1 (2.8 kJ/kV$_{Ur}$)
Torsional strength (MML)	78 Nm
Bending resistance (MML)	230 Nm
Tensile strength (MML)	1400 Nm
Ambient temperature [T_U]	(-40 ... +55) °C
Altitude	up to 1000 m a.s.l.
Rated frequency [f_N]	15 Hz to 62 Hz
Housing	HTV-silicone
Colour	red-brown, RAL 3013
Fittings	connection clamps, nuts and screws of stainless steel
Conductor clamp	diameters up to 16 mm
Test standards	IEC 99-4; EN 60099-4

DMI 31 10 1 H	DMI 33 10 1 H	DMI 36 10 1 H	DMI 39 10 1 H	DMI 42 10 1 H	DMI 45 10 1 H	DMI 48 10 1 H	DMI 51 10 1 H
31 kV	33 kV	36 kV	39 kV	42 kV	45 kV	48 kV	51 kV
25.0 kV	26.4 kV	28.8 kV	31.2 kV	33.6 kV	36.0 kV	38.4 kV	40.8 kV
33.2 kV	35.3 kV	38.5 kV	41.7 kV	44.9 kV	48.2 kV	51.4 kV	54.6 kV
28.8 kV	30.7 kV	33.5 kV	36.3 kV	39.1 kV	41.9 kV	44.6 kV	47.4 kV
91.0 kV	94.2 kV	104.9 kV	114.5 kV	124.1 kV	128.4 kV	141.2 kV	147.7 kV
102.0 kV	105.6 kV	117.6 kV	128.4 kV	139.2 kV	144.0 kV	158.4 kV	165.6 kV
79.1 kV	81.8 kV	91.1 kV	99.5 kV	107.9 kV	111.6 kV	122.8 kV	128.3 kV
85.0 kV	88.0 kV	98.0 kV	107.0 kV	116.0 kV	120.0 kV	132.0 kV	138.0 kV
94.4 kV	97.7 kV	108.8 kV	118.8 kV	128.8 kV	133.2 kV	146.5 kV	153.2 kV
106.3 kV	110.0 kV	122.5 kV	133.8 kV	145.0 kV	150.0 kV	165.0 kV	172.5 kV
64.0 kV	66.3 kV	73.8 kV	80.6 kV	87.3 kV	90.4 kV	99.4 kV	103.9 kV
66.3 kV	68.6 kV	76.4 kV	83.5 kV	90.5 kV	93.6 kV	103.0 kV	107.6 kV
68.9 kV	71.3 kV	79.4 kV	86.7 kV	94.0 kV	97.2 kV	106.9 kV	118.8 kV
74.5 kV	77.2 kV	85.9 kV	93.8 kV	101.7 kV	105.2 kV	115.8 kV	121.0 kV
100 kV	100 kV	126 kV	134 kV	142 kV	152 kV	156 kV	168 kV
66 kV	66 kV	84 kV	88 kV	94 kV	100 kV	104 kV	112 kV
146 kV	146 kV	184 kV	194 kV	206 kV	222 kV	226 kV	246 kV
283 mm	297 mm	384 mm	407 mm	430 mm	447 mm	466 mm	488 mm
30 mm	30 mm	30 mm	30 mm	30 mm	45 mm	45 mm	45 mm
7	7	9	10	10	11	12	13
2.2 kg	2.4 kg	3.0 kg	3.2 kg	3.4 kg	3.6 kg	3.8 kg	4.0 kg
784 mm	798 mm	1035 mm	1133 mm	1156 mm	1248 mm	1342 mm	1439 mm

DMI 31 10 1 H	DMI 33 10 1 H	DMI 36 10 1 H	DMI 39 10 1 H	DMI 42 10 1 H	DMI 45 10 1 H	DMI 48 10 1 H	DMI 51 10 1 H
990 207	**990 208**	**990 209**	**990 210**	**990 211**	**990 212**	**990 213**	**990 214**
1	1	1	1	1	1	1	1

DEHNtrack

DTR ...: Arrester for dc Systems > 1 kV

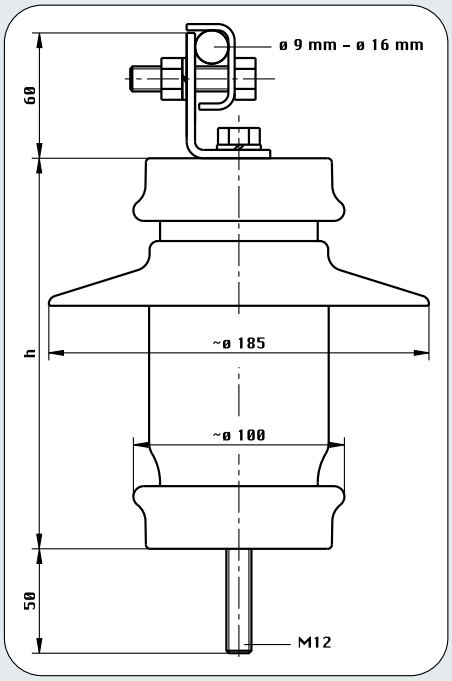
For dc voltage time characteristics, please see "Further technical information"

- Metal oxide arrester, line discharge class 3, for dc systems up to 4.8 kV
- Nominal discharge current 10 kA (8/20)
- High current withstand capability 100 kA (4/10)
- High temperature vulcanized (HTV) silicone enclosure avoids formation of dirt or water films
- High bending resistance and unbreakable at overloads thanks to pregreg sheet
- High durability thanks to powerful metal oxide varistors
- Mechanical shock and vibration resistance according to DIN IEC 68
- Flexible installation

Nominal discharge current (8/20 µs) [I_n]	10 kA
High current impulse (4/10 µs)	100 kA
Long duration current impulse	1000 A / 2000 µs
Line discharge class	3 (6 kJ/kV$_{Ur}$)
Mechanical shock resistance acc. to DIN IEC 68 part 2 - 29	15 g
Vibration resistance acc. to DIN IEC 68 part 2 - 6	3 g (10 - 500 Hz)
Ambient temperature [T_U]	(-55 ... +55) °C
Housing	Silicone
Colour	grey, RAL 7040
Fittings	Al alloy
Connections	clamps and screws of stainless steel

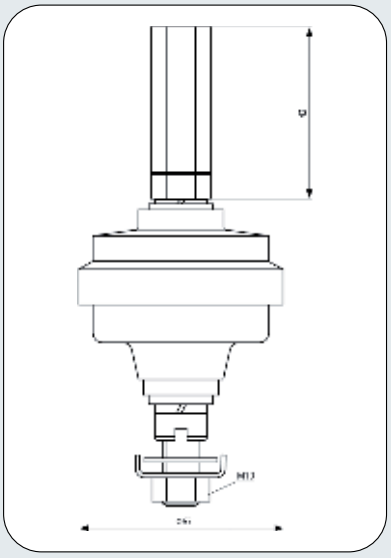
	DTR 1.2 10 3	DTR 2.4 10 3	DTR 3.6 10 3	DTR 4.8 10 3
Rated voltage dc [U_r]	1.2 kV	2.4 kV	3.6 kV	4.8 kV
Continuous operating voltage dc [U_C]	1.0 kV	2.0 kV	3.0 kV	4.0 kV
Residual voltage at 10 kA (1/2 µs) [$\hat{u}_{rss}$]	2.9 kV	5.5 kV	8.3 kV	10.9 kV
Residual voltage at 5 kA (8/20 µs) [$\hat{u}_{rs}$]	2.5 kV	4.8 kV	7.3 kV	9.5 kV
Residual voltage at 10 kA (8/20 µs) [$\hat{u}_{rs}$]	2.6 kV	5.0 kV	7.6 kV	10.0 kV
Residual voltage at 20 kA (8/20 µs) [$\hat{u}_{rs}$]	2.9 kV	5.5 kV	8.3 kV	10.9 kV
Residual voltage at 250 A (30/70 µs) [$\hat{u}_{rsch}$]	2.1 kV	4.0 kV	6.1 kV	7.9 kV
Residual voltage at 500 A (30/70 µs) [$\hat{u}_{rsch}$]	2.2 kV	4.1 kV	6.2 kV	8.1 kV
Residual voltage at 1000 A (30/70 µs) [$\hat{u}_{rsch}$]	2.3 kV	4.2 kV	6.4 kV	8.3 kV
Insulation for arrester housing / p.f. withstand voltage (wet) [U_{nst}]	≥ 40 kV	≥ 40 kV	≥ 40 kV	≥ 40 kV
Insulation for arrester housing / switching – impulse withstand voltage (wet) [U_{nstsch}]	≥ 50 kV	≥ 50 kV	≥ 50 kV	≥ 50 kV
Height [H]	173 mm	180 mm	187 mm	193 mm
Weight [M]	3 kg	3 kg	3 kg	3 kg
Creepage distance	230 mm	237 mm	244 mm	250 mm

Ordering information				
Type	DTR 1.2 10 3	DTR 2.4 10 3	DTR 3.6 10 3	DTR 4.8 10 3
Part No.	990 301	990 302	990 303	990 304
Packing Unit / pcs	1	1	1	1



DIC 10: Disconnection Unit for DEHNmid Arresters

- Disconnects overloaded arresters from the system
- Prevents potential earth faults
- Ensures the faultless operation of the medium voltage system
- Spark gap/Thermal effect principle, no blasting agents
- No maintenance



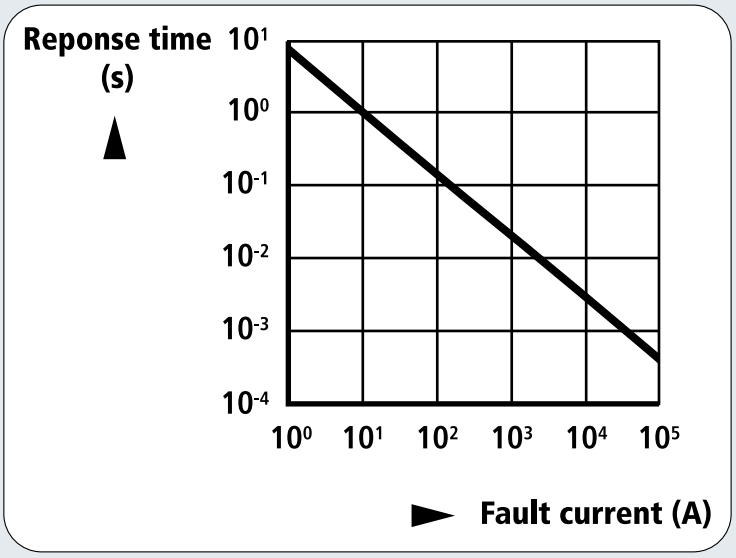
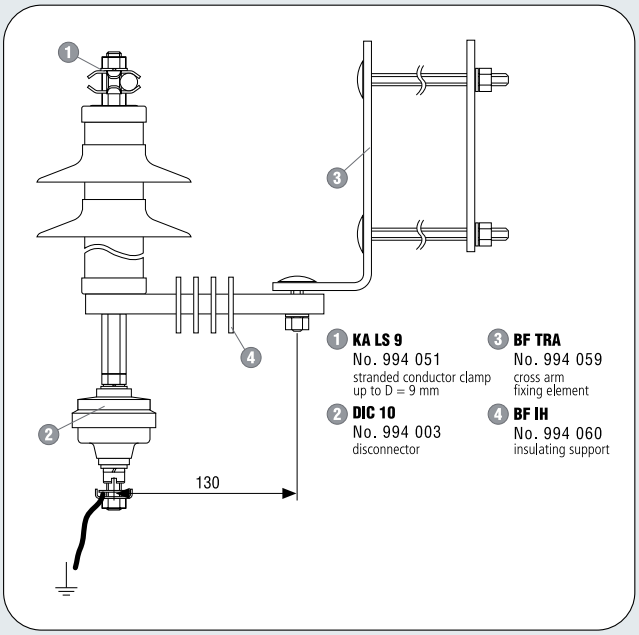


Diagram 3



Application example: Disconnector DIC 10

	DIC 10
Weight	0,18 kg
Ambient temperature [T_U]	(-40 ... +55) °C
Altitude	up to 3000 m a.s.l.
Rated frequency [f_N]	48 Hz to 62 Hz
Response time	see diagram 3
Housing	ultra violet-stabilized low-presure polyethylene
Colour	green
Fittings	nuts and screws of stainless steel
Conductor clamp	diameters up to 12 mm

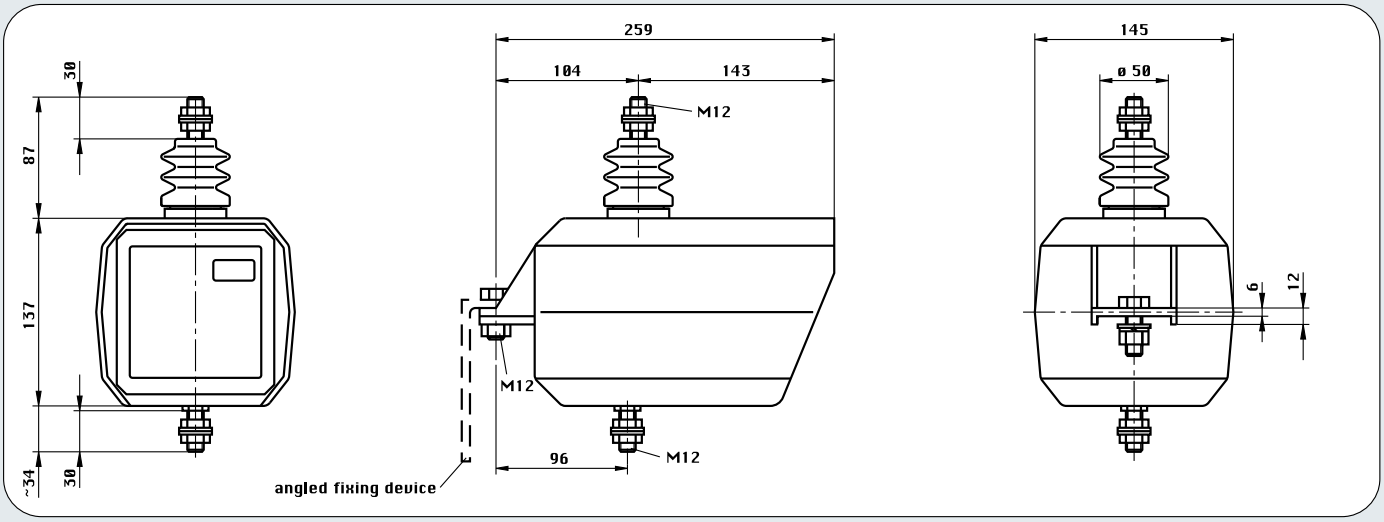
Ordering information	
Type	DIC 10
Part No.	**994 003**
Packing Unit / pcs	1

Impulse Meter
IZ(M) 100: for all SPD Types

- Registration of discharges of surge arresters
- Control of the durability of the arresters by registration of leakage currents at IZM 100 impulse meter
- High current withstand capability 100 kA (4/10)
- Quick data acquisition
- Mechanically stable with aluminium enclosure
- Corrosion-resistant
- Water-proof IP 67 unit

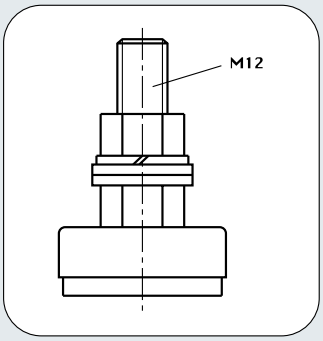
IZM 100: Impulse meter with counter and measuring scale for recording discharge currents and registration of leakage currents

IZ 100: Impulse meter with counter for registration of discharge currents

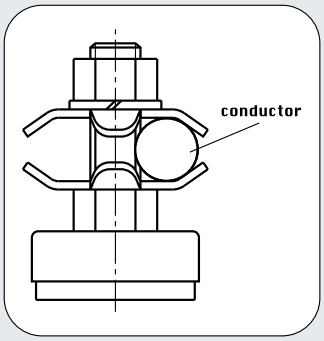


	IZ 100	IZM 100
Display-Meter	6 digit cyclometer	6 digit cyclometer
Minimum count current	200 A (8/20 µs)	200 A (8/20 µs)
Maximum high current withstand capability	100 kA (4/10 µs)	100 kA (4/10 µs)
Nominal residual voltage at 100 kA (4/10 µs)	5 kV_p	5 kV_p
Measuring scale	—	0 ... 21 mA_{rms}
Maximum count rate	min. 5 counts / sec.	min. 5 counts / sec.
Housing	Aluminium, powder coated	Aluminium, powder coated
Colour	grey	grey
Earth Connection	M12 nickel-plated brass fitted with 2 brass locknuts	M12 nickel-plated brass fitted with 2 brass locknuts
Phase Connection	M12 nickel-plated brass fitted with 2 brass locknuts	M12 nickel-plated brass fitted with 2 brass locknuts
Mounting	cast lug on the reverse side M12 or additional fixing angle	cast lug on the reverse side M12 or additional fixing angle
Ordering information		
Type	IZ 100	IZM 100
Part No.	**994 001**	**994 002**
Packing Unit / pcs	1	1

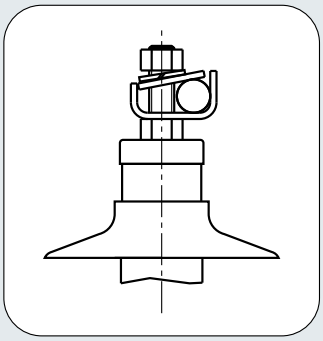
Conductor Clamps



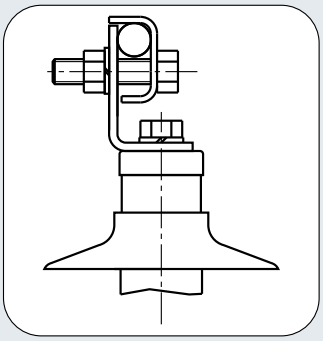
Cable lug connection
Type: KA KS
Part No.: 994 050



Stranded conductor clamp up to D = 9 mm
Type: KA LS 9
Part No.: 994 051

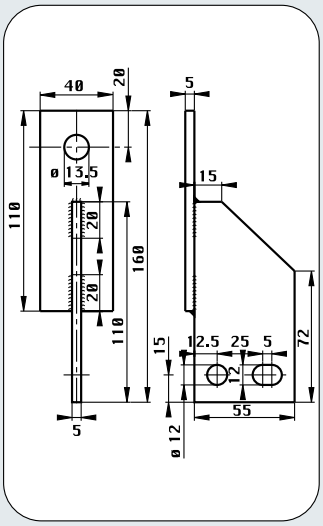


Stranded conductor clamp up to D = 16 mm
Type: KA LS 16
Part No.: 994 052

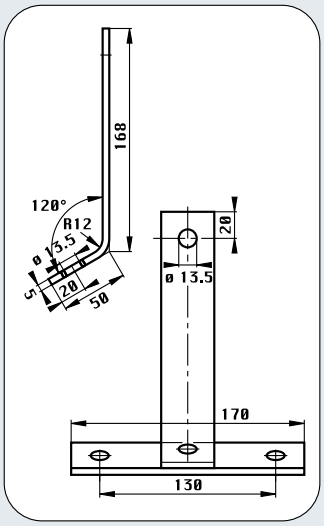


Stranded conductor clamp for D = 9 up to 16 mm
Type: KA LS 9.16
Part No.: 994 053

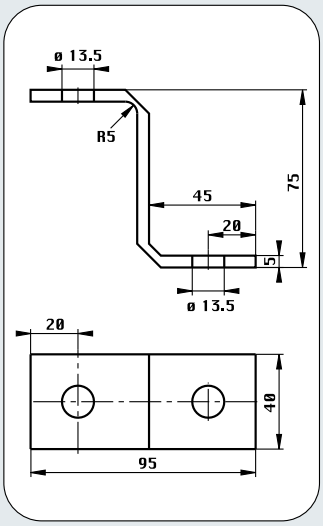
Fixing Elements



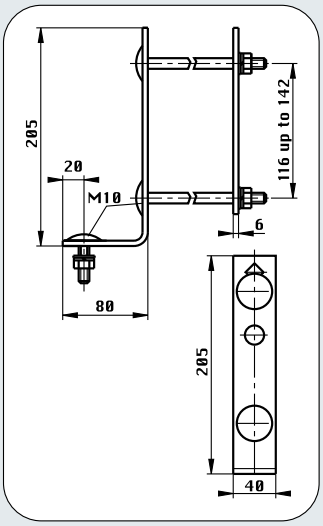
Acc. to DIN
Type: BF DIN
Part No.: 994 054



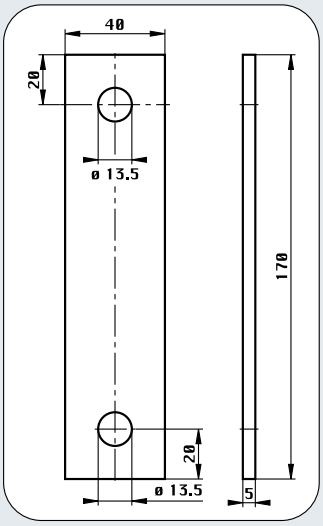
Acc. to TGL
Type: BF TGL
Part No.: 994 058



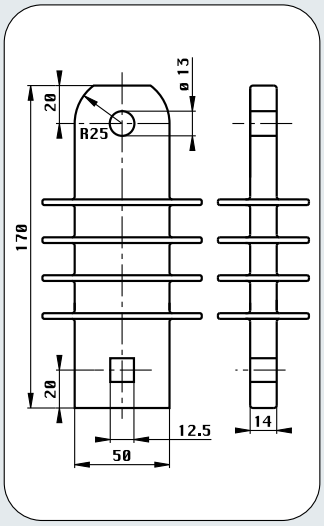
Angled fixing element
Type: BF WI
Part No.: 994 055



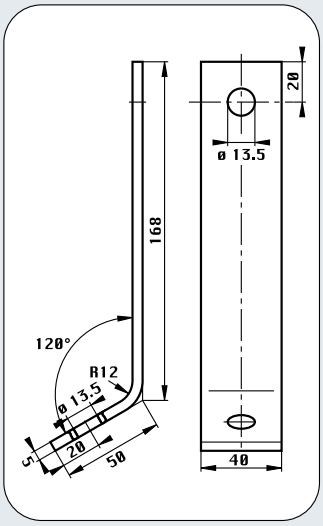
Cross-arm-fixing element
Type: BF TRA
Part No.: 994 059



Acc. to NEMA
Type: BF NEMA
Part No.: 994 056



Insulating support
Type: BF IH
Part No.: 994 060



Wall fixing element
Type: BF WA
Part No.: 994 057

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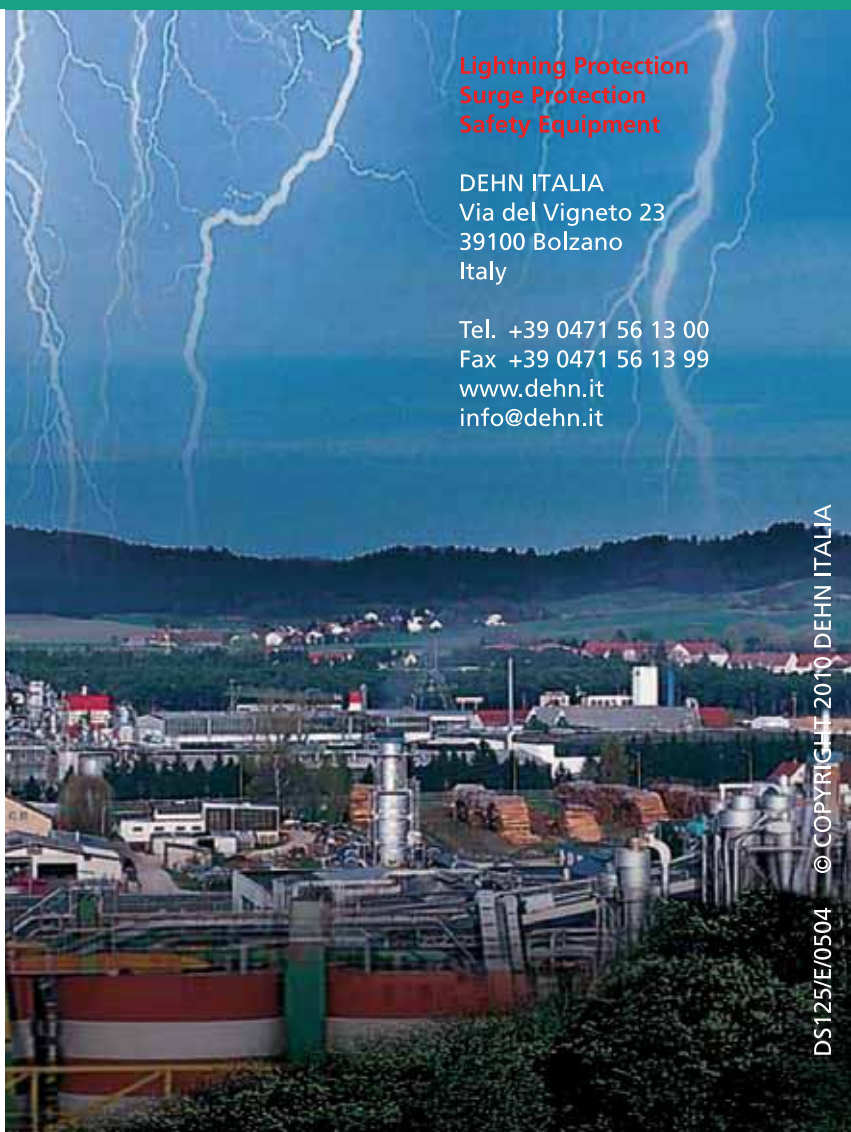

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Safety Equipment

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