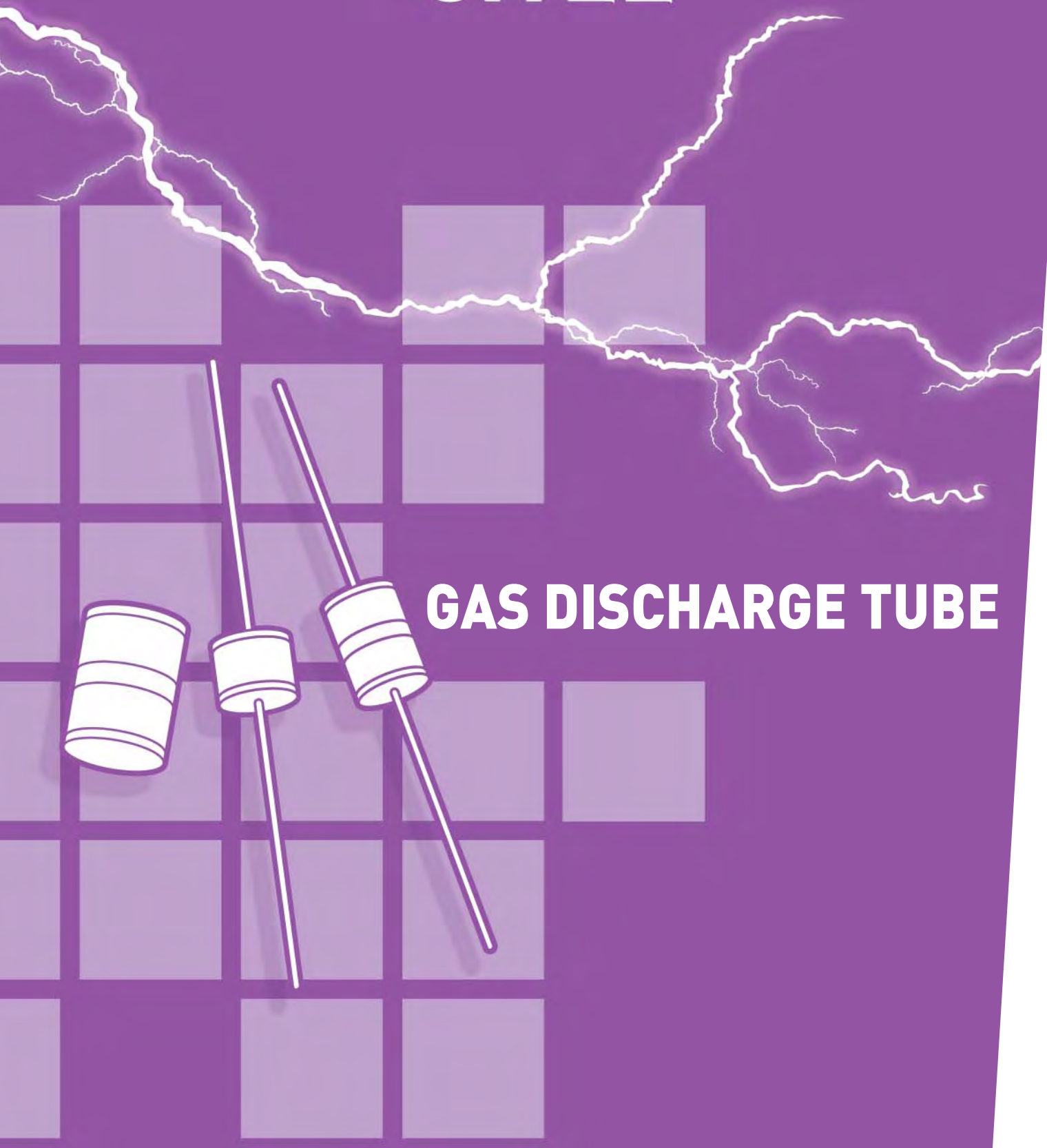
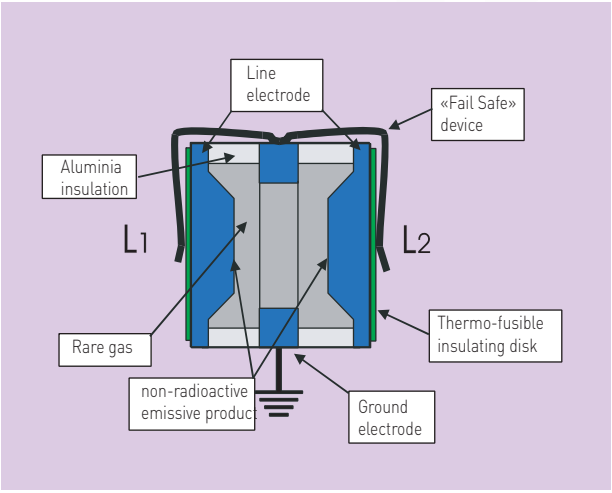
CITEL



GAS DISCHARGE TUBE

Gas Discharge Tubes

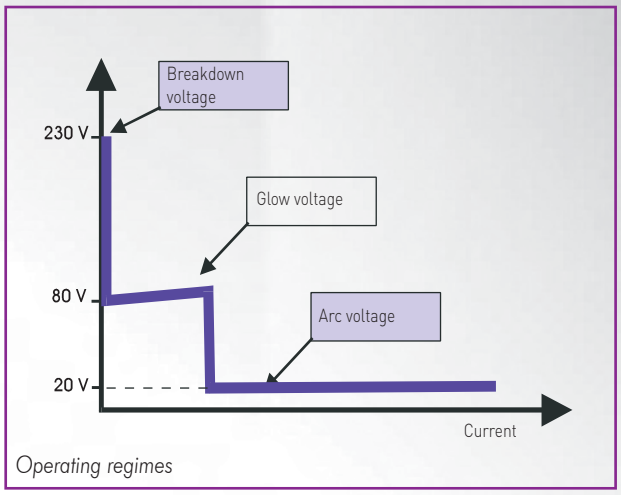
These components are made of two or three electrodes in an enclosure filled with a (non-radioactive) rare gas at a controlled pressure. The enclosure is a ceramic tube with its ends closed off by metal caps that also serve as electrodes.
Their main use is to protect telecommunications lines, but other uses are possible.



Operation

The gas discharge tube may be regarded as a sort of very fast switch having conductance properties that change very rapidly, when breakdown occurs, from open-circuit to quasi-short circuit (arc voltage about 20V). There are accordingly four operating domains in the behavior of a gas discharge tube:

- ***Non-operating domain***, characterized by practically infinite insulation resistance;
- ***Glow domain*** : At breakdown, the conductance increases suddenly; if the current drained off by the gas tube is less than about 0.5A (this is a rough value that differs according to the type of component), the glow voltage across the terminals will be in the 80-100V range;
- ***Arc regime*** : as the current increases, the gas discharge tube shifts from the glow voltage to the arc voltage (20V). It is in this domain that the gas discharge tube is most effective, because the current discharged can reach several thousand amperes without the arc voltage across its terminals increasing.
- ***Extinction*** : At a bias voltage roughly equal to the glow voltage, the gas tube recovers its initial insulating properties.



Operating regimes

Electrical characteristics

The main electrical characteristics defining a gas discharge tube are:

- DC sparkover voltage (Volts)
- Impulse sparkover voltage (Volts)
- Discharge current capacity (kA)
- Insulation resistance (Gohms)
- Capacitance (pF).

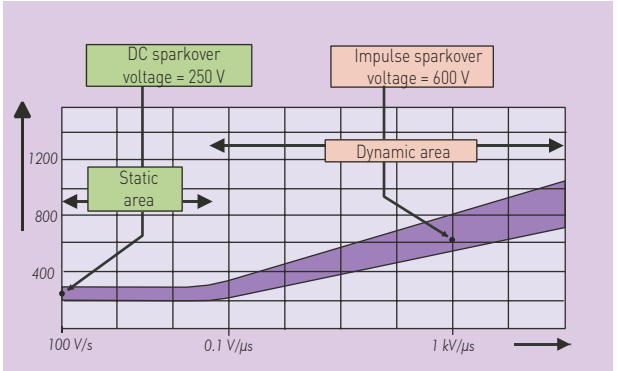
DC sparkover voltage

This is the main characteristic defining the gas discharge tube.
It is the voltage at which breakdown will occur between the electrodes when a slowly increasing voltage (dV/dt = 100 V/s) is applied to the component; it depends on the electrode spacing, the pressure, and the properties of the gas mixture and of the emissive substance.

Range of DC sparkover voltages available:

- minimum 75V
- average 230V
- high voltage 500V
- very high voltage 1000 to 3000V

The tolerance on the breakdown voltage is generally ± 20%. .



DC and Impulse sparkover voltages

Gas Discharge Tubes

Discharge current
This depends on the properties of the gas, the volume, and the material and treatment of the electrodes. It is the major characteristic of the GDT and the one that distinguishes it from other protection devices (Varistor, Zener diode, etc.): 5 to 20kA with an 8/20µs impulse for the standard components. This is the value the device can withstand repeatedly (say for ten impulses) without destruction or alteration of its basic specifications.

Impulse sparkover voltage
Sparkover voltage in the presence of a steep rise front (dV/dt = 1kV/µs): the impulse sparkover voltage increases with increasing dV/dt.

Insulation resistance and capacitance
These characteristics make the gas discharge tube practically «invisible» in a line in a steady-state context: insulation resistance very high (>10 Gohm), capacitance very low (<1 pF).

3-electrode configuration

Protecting a two-wire line (for example a telephone pair) with two 2-electrode gas discharge tubes (connected between the wires and ground) may cause the following problem:
The line is subjected to an overvoltage in common mode; because of the dispersion of the sparkover voltages (± 20%), one of the gas discharge tubes sparks over a very short time before the other (a few microseconds); the wire that has sparked over is therefore grounded (neglecting the arc voltages), turning the common-mode overvoltage into a differential-mode overvoltage, very dangerous for the terminal equipment. This risk disappears when the second gas discharge tube arcs over (a few microseconds later).
3-electrode geometry eliminates this drawback: the sparkover of one pole causes a «general» breakdown of the device almost instantaneously (a few nanoseconds) because there is only one gas-filled enclosure.

End of life

Gas discharge tubes are designed to withstand several impulses without destruction or loss of the initial characteristics (typical impulse tests: 10 times 5 kA impulses of each polarity).
On the other hand, a sustained strong current (e.g. 10 A rms for 15 seconds, simulating the fall of a AC power line onto a telecommunication line) will put the device out of service definitively.
If a fail-safe end of life is desired (i.e. a short-circuit that will report the fault to the user when the line fault is detected), gas discharge tubes with the fail-safe feature (external short-circuit) should be chosen.

Standards

CITEL gas discharge tubes comply with the specifications of main telecom operators (France Telecom, British Telecom, etc.) and with the ITU-T K12 international recommendation and standards IEC 61643-31x.

The CITEL line

CITEL proposes a full line of gas discharge tubes to meet most configuration needs and specifications found on the market :

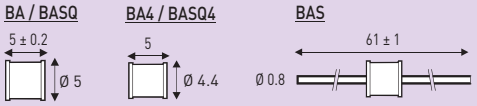
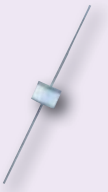
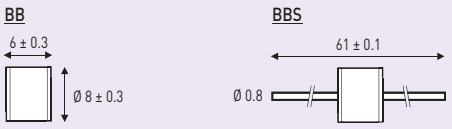
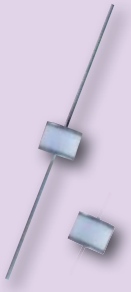
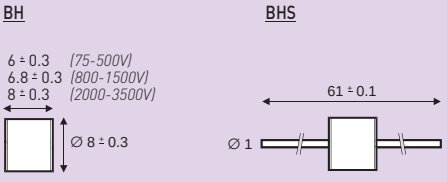
- 2- and 3-electrode gas discharge tubes
- Sparkover voltages from 75 to 3500 V
- Discharge capacities from 5 to 150 kA (8/20µs)
- Optional external short-circuit device
- Installation on support, on printed circuit, or surface-mounted devices.

GSG series

Thanks to our inherent knowledge and experience in the field of gas discharge tubes, CITEL has developed a specific technology: GSG (Gas-filled Spark Gap).
These components are designed to be used on an AC network: they have an increased extinction capability and a higher current discharge capability with either a 8/20us or 10/350us waveform.
The GSG components are the heart of the VG technology which insures matching performance with allair gap technologies without any of downside.

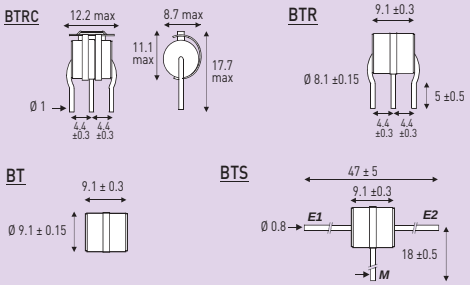
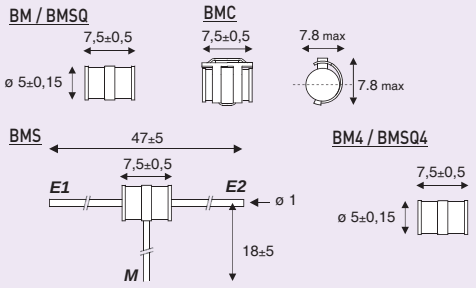
Selection guide

2-ELECTRODE

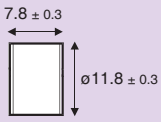
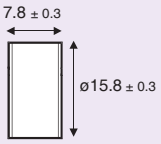
Range	CITEL part number	DC sparkover voltage (100V/s)	Impulse sparkover voltage (1kV/µs)	Insulation resistance (100Vdc)	Capacitance	Holdover voltage (R = 300 ohms in serie R = 150 ohms; 100nF in parrallel)	AC discharge current (50Hz)	Max. discharge current (8/20µs ; 1 time)	Nominal discharge current (8/20µs ; 10 times)	Mechanical
BA 	**BA90**	72-108 V	<640 V	>10GΩ	<0.3 pF	>60 V	10 A	25 kA	10 kA	 Options : Lead termination : BAS External fail-safe : BAC SMD version : BA CMS in 90V/20, 230V/20, 350V/20 Tape : Taped and reeled
	BA150	120-180V	<700 V	>10GΩ	<0.3 pF	>80 V	10 A	25 kA	10 kA	
	BA230	184-276 V	<700 V	>10GΩ	<0.3 pF	>80 V	10 A	25 kA	10 kA	
	BA300	240-360 V	<900 V	>10GΩ	<0.3 pF	>80 V	10 A	25 kA	10 kA	
	BA350	280-420 V	<900 V	>10GΩ	<0.3 pF	>80 V	10 A	25 kA	10 kA	
	BA550	440-660 V	<1200 V	>10GΩ	<0.3 pF	>80 V	10 A	25 kA	10 kA	
BB 	**BB75**	60-90 V	<640 V	>10GΩ	<0.8 pF	>60 V	10 A	25 kA	10 kA	 Options : Lead termination : BBS External fail-safe : BBC
	BB90	72-18 V	<640 V	>10GΩ	<0.8 pF	>60 V	10 A	25 kA	10 kA	
	BB150	120-180 V	<640 V	>10GΩ	<0.8 pF	>75 V	10 A	25 kA	10 kA	
	BB230	184-276 V	<700 V	>10GΩ	<0.8 pF	>80 V	10 A	25 kA	10 kA	
	BB350	280-420 V	<850 V	>10GΩ	<0.8 pF	>80 V	10 A	25 kA	10 kA	
	BB500	400-600 V	<1200 V	>10GΩ	<0.8 pF	>80 V	10 A	25 kA	10 kA	
BH 	**BH75**	60-90 V	<640 V	>10GΩ	<0.8 pF	>60 V	15 A	30 kA	15 kA	 Options : Lead termination (Ø 1 or 0.8 mm) : BHS External short-circuit : BHC (from 90 to 600 V)
	BH90	72-108 V	<640 V	>10GΩ	<0.8 pF	>80 V	20 A	40 kA	20 kA	
	BH230	184-276 V	<700 V	>10GΩ	<0.8 pF	>80 V	20 A	40 kA	20 kA	
	BH350	280-420 V	<850 V	>10GΩ	<0.8 pF	>80 V	20 A	40 kA	20 kA	
	BH470	376-564 V	<1100 V	>10GΩ	<0.8 pF	>80 V	20 A	40 kA	20 kA	
	BH500	400-600 V	<1200 V	>10GΩ	<0.8 pF	>80 V	20 A	40 kA	20 kA	
	BH600	480-720 V	<1200 V	>10GΩ	<0.8 pF	>80 V	20 A	40 kA	20 kA	
	BH800	640-690 V	<1400 V	>10GΩ	<0.8 pF	>80 V	10 A	25 kA	10 kA	
	BH1400	1120-1680 V	<2000 V	>10GΩ	<0.8 pF	>120 V	10 A	25 kA	10 kA	
	BH2500	2000-3000 V	<3800 V	>10GΩ	<0.8 pF	>120 V	10 A	25 kA	10 kA	
	BH3500	2800-4200 V	<4600 V	>10GΩ	<0.8 pF	>120 V	10 A	25 kA	10 kA	

Selection guide

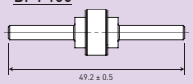
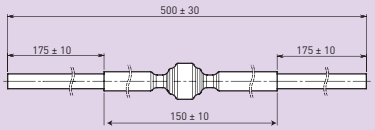
3-ELECTRODE

Range	CITEL part number	DC sparkover voltage (100V/s)	Impulse sparkover voltage (1kV/µs)	Insulation resistance (100Vdc)	Capacitance	Holdover voltage (R = 300 ohms in serie R = 150 ohms; 100nF in parrallel)	AC discharge current (50Hz)	Max. discharge current (8/20µs ; 1 time)	Nominal discharge current (8/20µs ; 10 times)	Mechanical
BT 	BT90	72-108 V	<640 V	>10GΩ	<0.9 pF	>70 V	20 A	25 kA	20 kA	
	BT150	120-180 V	<640 V	>10GΩ	<0.9 pF	>80 V	20 A	25 kA	20 kA	
	BT230	184-276 V	<750 V	>10GΩ	<0.9 pF	>80 V	20 A	25 kA	20 kA	
	BT350	280-420 V	<900 V	>10GΩ	<0.9 pF	>80 V	20 A	25 kA	20 kA	
	BT500	400-600 V	<1100 V	>10GΩ	<0.9 pF	>80 V	20 A	25 kA	20 kA	
BM 	BM90	72-108 V	<640 V	>10GΩ	<0.5 pF	>60 V	10 A	25 kA	10 kA	
	BM150	120-180 V	<700 V	>10GΩ	<0.5 pF	>80 V	10 A	25 kA	10 kA	
	BM230	184-276 V	<800 V	>10GΩ	<0.5 pF	>80 V	10 A	25 kA	10 kA	
	BM350	280-420 V	<1000 V	>10GΩ	<0.5 pF	>80 V	10 A	25 kA	10 kA	
	BM500	400-600 V	<1200 V	>10GΩ	<0.5 pF	>80 V	10 A	25 kA	10 kA	

GSG (IEC 61643-11)

Range	CITEL part number	DC sparkover voltage (100V/s)	Impulse sparkover voltage (1.2/50µS / 6kV)	Insulation resistance (100Vdc)	Follow current interrupting capability (Ifi) (under voltage AC)	Nominal discharge current (In) (8/20µs, following IEC 61643-11)	Max. discharge current (Imax) (8/20µs ; following IEC 61643-11°)	Max. impulse current (Iimp) (10/350µs ; following IEC 61643-11)	Mechanical
BG 	BG600	450V	<1500 V	>10GΩ	> 100 A	60 kA	100 kA	15 kA	
	BG800	650 V	<1500 V	>10GΩ	> 100 A	60 kA	100 kA	15 kA	
	BG1000	850 V	<1800 V	>10GΩ	> 100 A	60 kA	100 kA	15 kA	
	BG1300	1100 V	<2000V	>10GΩ	> 100 A	60 kA	100 kA	15 kA	
BF 	BF800	650-1000 V	<1500 V	>10GΩ	> 100 a	80 kA	140 kA	40 kA	

Selection guide

GSG (IEC 61643-11)								
Range	***CITEL part number***	***DC sparkover voltage*** *(100V/s)*	***Impulse sparkover voltage*** *(1.2/50µS / 6kV)*	***Insulation resistance*** *(100Vdc)*	***Nominal discharge current (In)*** *8/20µs, suivant IEC 61643-11)*	***Max. discharge current (Imax)*** *(8/20µs ; suivant IEC 61643-11 9)*	***Max. impulse current (Iimp)*** *(10/350µs ; suivant IEC 61643-11)*	***Mechanical***
BF P100	BFP100-230	184-276 V	<900 V	>10GΩ	100 kA	150 kA	40 kA	BF P100  BF P100S 
	BFP100-250	200-300 V	<900 V	>10GΩ	100 kA	150 kA	40 kA	
	BFP100-350	280-420 V	<1000 V	>10GΩ	100 kA	150 kA	40 kA	
	BFP100-500	400-600 V	<1200 V	>10GΩ	100 kA	150 kA	40 kA	
	BFP100-600	480-720 V	<1300 V	>10GΩ	100 kA	150 kA	40 kA	
	BFP100-750	600-900 V	<1500 V	>10GΩ	100 kA	150 kA	40 kA	
	BFP100-800	640-940 V	<1500 V	>10GΩ	100 kA	150 kA	40 kA	