

25
1995–2020

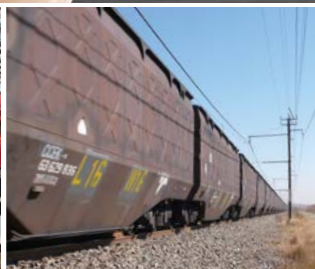


Overvoltage controlled. ANYWHERE.

Catalogue Voltage Limiting Devices

For electric railway systems

2020



Protection of railway systems

Trains – metro – trams

In the rail transport, both the underground and the above-ground railway or tram transport, attention is turned to the safety and reliability of the traffic, and to the protection of persons and animals.

Due to economic reasons, equipment does not have a sufficient dielectric strength for all potential overvoltages and dangerous touch voltages may also occur during normal operation of trains. Therefore, the overvoltage protection has to be adapted to specific requirements of the rail transport.

Electrical safety of persons and animals

During the regular operation of the train/metro/tramway traffic, an impermissible touch voltage can occur at accessible locations between the return path (running rail) and the ground or grounded railway structures (catenary masts, hand-railings and other structures) due to the voltage drop in the return path or failure state, due to the stray currents or due to the indirect induced or direct lightning strike hit. At locations accessible to persons (railway stations, railroads), this voltage is necessary to be limited to a safe value by installing voltage limiting devices (VLDs) – Fig. 1. The VLDs are aimed to create a temporary or permanent connection of exposed parts with the grounding of the traction system if the permissible value of the touch voltage is exceeded. When selecting a VLD, we have to consider (depending on the location of installation) if the VLD-F function or the VLD-O function or both ones are required as defined in EN 50122-1. Exposed conductive parts of trolley or traction lines with DC power supply should be connected to a return path via VLD. The VLD-F voltage limiters are designed for failure states when the traction line touches the non-active conductive part. Voltage limiting devices of the VLD-O type are used in case of a regular operation; VLDs limit the increased touch voltage caused by the train traffic (stray currents, voltage drop on the return path to the power source). The BVL VLDs perform the function of an A2 surge arrester at the same time (acc. to EN 50526-3) and effectively eliminate the high impulse overvoltage induced into the railway equipment by direct or near lightning strikes (values of high repeatable pulse currents see in the datasheet).

The SCG range of VLD class 1, type VLD-F

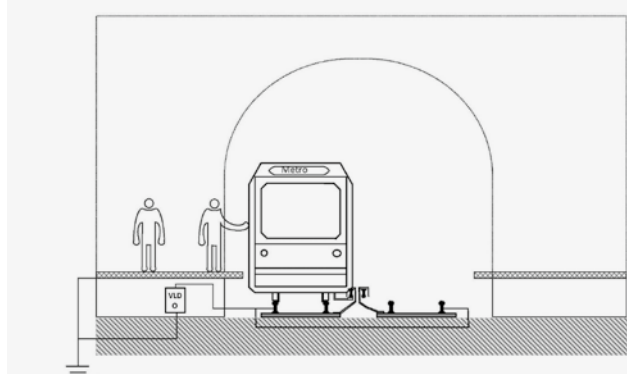
The VLDs of the SCG range limit voltages caused by lightning strikes, failure states, or the induced excessive touch voltage on

exposed parts of railway devices, both in AC and DC traction systems. Persons who can get in touch with these parts, are protected by creating a temporary or permanent connection of exposed conductive parts with the return path if the safe level of touch voltage is exceeded. If the traction line gets in contact with an exposed conductive part of railway equipment (due to breaking and falling, e.g.), the SCG creates a conductive connection with the return path. The short-circuit current is evaluated by appropriate sensors in the traction substation, and the corresponding segment of the traction line is immediately disconnected by an automatic breaker. When passing the short-circuit current, a permanent guaranteed low impedance – electrical bypass of the protective element is achieved by a patented internal short-circuit device. That way, the protective function of VLD class 1 is guaranteed in these cases in accordance with requirements of the standard until it is replaced with the new one. The used protective element simultaneously eliminates high pulse overvoltage induced on the railroad or the railway device by the lightning strike.

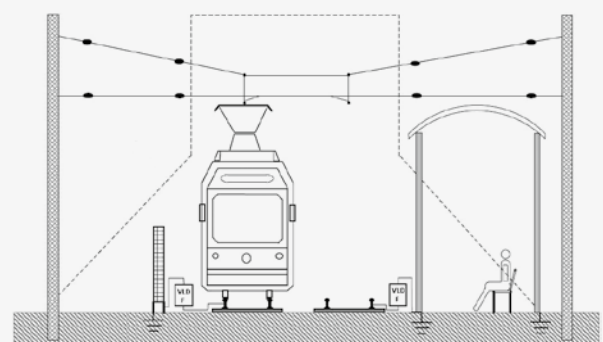
The BVL range of VLD class 2.2, type VLD-O (resp. VLD-O+F)

The VLDs of the BVL range provide reliable temporary connection (recoverable VLD) of the return path with the grounding of the traction system for as long as the permissible value of the touch voltage is exceeded. This protects persons, who can come into contact with these parts, from the excessive touch voltage raised due to the train traffic. The BVL voltage limiting devices can conduct the stray current for a long time, and therefore are suitable for the installation in railway/tramway/metro stations or close to the switching station. The types BVL-50 and BVL-100 meet requirements of the standard EN 50122-1 ed. 2, on voltage limiting devices of the type VLD-F and VLD-O, at the same time. Two anti-parallel power thyristors and an electronic detection circuit, which are connected to the two main terminals, form a voltage limiting device together. A heavy-duty A2 surge arrester is connected in parallel to them. The voltage limiting device responds to all slow and fast, short and long, DC and AC pulses. The varistor responds to the voltage pulse always as the first, and protects the other components from the effects of overvoltages. A pulse lasting for a longer time could cause its

Fig. 1 Protection areas and the typical use of VLD-O and VLD-F (source: EN 50526-3)



VLD-O (BVL-100-120-R01) protects persons from excessively high touch voltage at railway station



Connection of the exposed metal parts at a railway station to the return circuit by the VLD-F (SCG-250-75-R01)

destruction, and therefore, one of the thyristors is activated with a delay of about 1.5 ms, to reduce the excessive voltage. The thyristor will switch off if the current decreases below the value of the latching current of the thyristor. Then, the high impedance state of the whole VLD is restored. VLD is a passive device which does not require external supply. Newly, all SALTEK BVL devices are equipped with special thermal sensors to identify easily the SPD's overload by service personnel.

The small BVL-25 (VLD-O) is designed especially for protection of railway signalling and measuring equipment (e.g. axles counters etc.). These could be affected or destroyed by overvoltage during train passing by.

Typical applications of VLD

- **"Rail grounding"** of catenary masts: VLD class 1, type SCG-250-500-R01. Connection principle is shown in Fig. 2.

- **Protection of persons and animals** by connecting exposed conductive parts in a railway stations and switching stations to the return path: VLD class 2.2, e.g. type BVL-50-120-R01 or BVL-100-120-R01 and VLD class 1, type SCG-250-75-R01. An example of a possible use is shown in Fig. 2.
- **Equipotential bonding of the measuring/signalling device to the return path:** VLD class 2.2, type BVL-25-120-R01 combined with power and signal line surge protectors – see Fig. 2. Combination of VLDs with signal inputs and power supply protectors (SPDs) is necessary to protect sensitive devices against surges completely.
- **Standard recommended application of VLDs into TN systems for DC railways** (e.g. Metro, trams etc.) is shown in Fig. 3 (application into TT systems is similar).
- **In 750 V DC systems the application of A2-arresters** is recommended in substations and also in the first substation behind a tunnel mouth (where the track changes from above ground to tunnel) – Fig. 4.

Fig. 2 Installation of VLD-F (class 1) and VLD-O (class 2.2) to protect persons and animals. Comprehensive railway technology overvoltage protection.

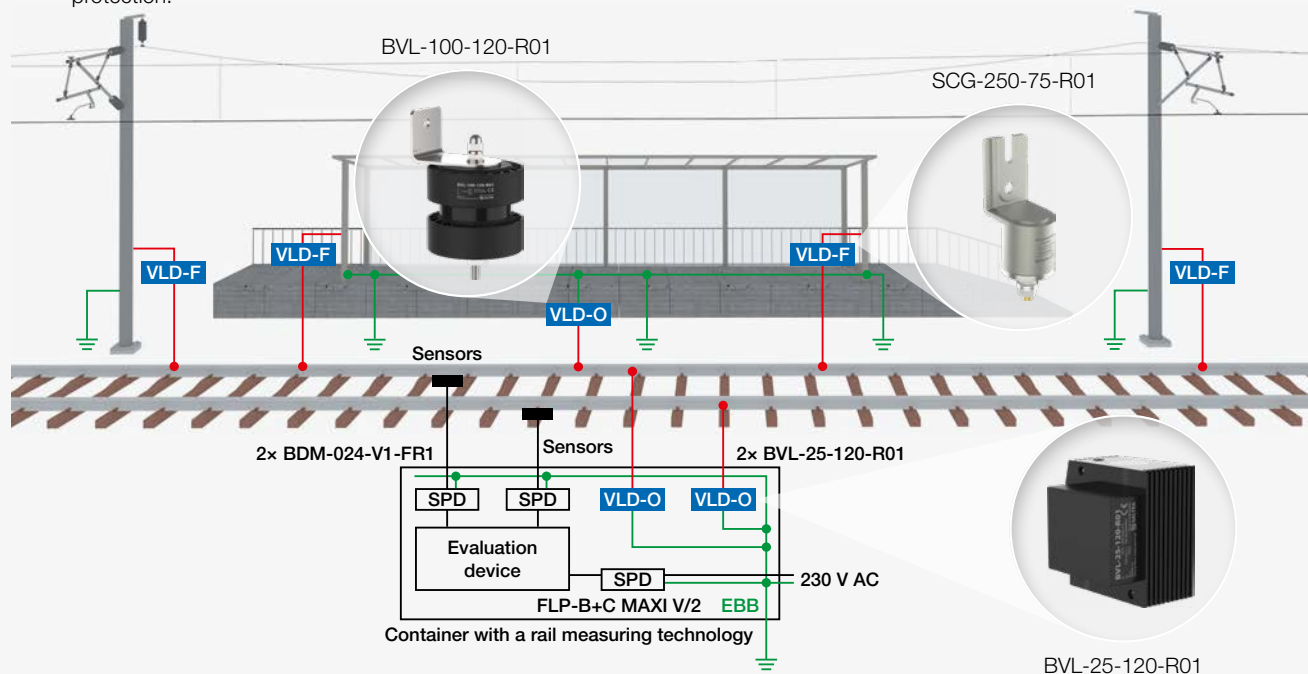


Fig. 3 Standard recommended application of VLDs to TN systems for DC railways (source EN 50122-1 ed.1)

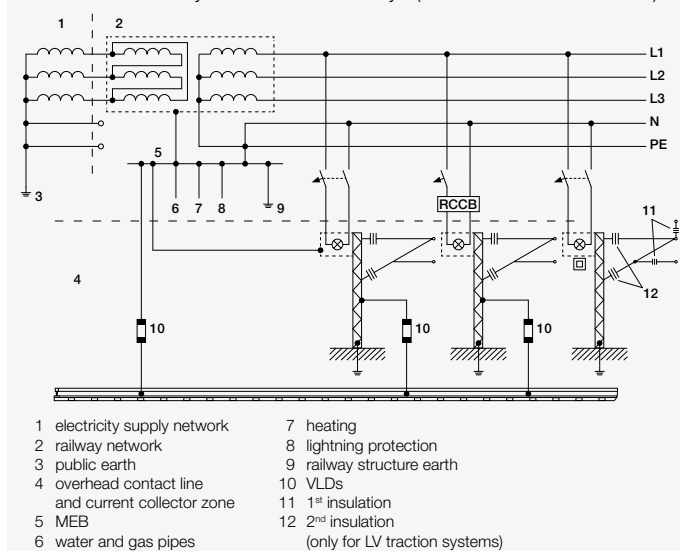
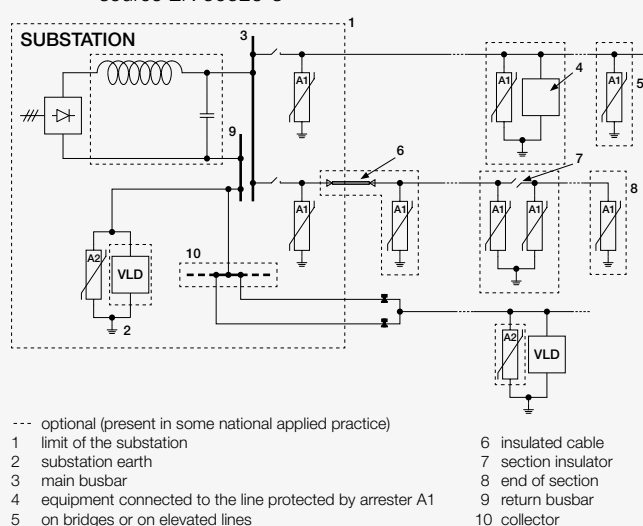


Fig. 4 Diagram of an application of surge arresters and voltage limiting devices (preferred in 1.5 and 3 kV systems) source EN 50526-3



SCG-250-...-R01

Voltage limiting device

VLD class 1, VLD type F

- the VLD is used to restrict excessive high contact voltages arising on an exposed conductive parts of a railway equipment in case of a disturbance (short circuit) in AC and DC railway electric traction systems, thus ensuring protection to persons that may come into a contact with the parts mentioned
- in the event of a failure connection between a live power supply part of the traction system and an exposed

conductive part (e.g. due to the overhead power line fall) the VLD protects the parts affected by causing conductive itself, which results in turning off of the power supply

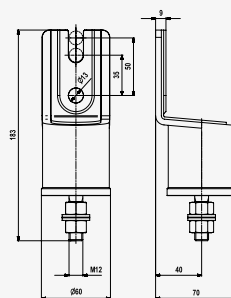
- the SCG is connected between the protected part and the return circuit
- in case of an overload caused by overcurrent in excess of a limit, that may cause harm to the protective element, the internal short-circuiting device

intervenes by establishing a permanent short circuit across the protective element

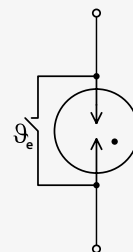
- the integrated surge arrester effectively eliminates high impulse overvoltage induced into the traction mains or railway equipment by a lightning strike
- easy mounting, installation right away on the protected equipment



Dimensions



Wiring diagram



Technical data		SCG-250-075-R01	SCG-250-250-R01	SCG-250-500-R01
Rated current @ 60 min	I_r	250 A	250 A	250 A
Short time withstand current @ 60 ms	I_w	1 kA	1 kA	1 kA
Short circuit current @ 300 ms	I_{sc}	5 kA	5 kA	5 kA
Leakage current at U_w	I_L	< 1 μ A	< 1 μ A	< 1 μ A
Nominal triggering DC voltage	$U_{Tn} (U_{Tn, max})$	75 V	250 V	480 V
Instantaneous triggering voltage	U_{Ti}	75 V	250 V	480 V
Non-triggering voltage	U_w	45 V	130 V	260 V
Maximum residual voltage at I_w	U_{res}	30 V	80 V	100 V
Maximum residual voltage at I_r	U_{res}	15 V	25 V	35 V
Lightning current impulse (8/20 μ s)	I_{imp-n}	100 kA	100 kA	100 kA
High current impulse (8/20 μ s)	$I_{imp-high}$	100 kA	100 kA	100 kA
High charge impulse (10/350 μ s)	I_{imp-hc}	50 kA	50 kA	50 kA
Response time	T_R	10 μ s	10 μ s	10 μ s
Range of operating temperatures		-40 °C ... +70 °C	-40 °C ... +70 °C	-40 °C ... +70 °C
Mounting		surface	surface	surface
Degree of protection (EN 60529)		IP 67	IP 67	IP 67
Weight		0,84 kg	0,84 kg	0,84 kg
Meets the requirements of standard		EN 50122-1:2011; EN 50526-2:2014	EN 50122-1:2011; EN 50526-2:2014	EN 50122-1:2011; EN 50526-2:2014
Ordering number		A06153	A06154	A06155

BVL-25-120-R01

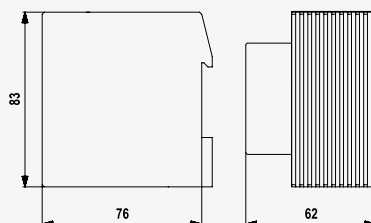
Voltage limiting device

recoverable VLD of class 2.2, type VLD-O, limiting of an occurrence non-permissible touch voltages, equalizing of the earth potential and limiting of an overvoltage of a railway system AC and DC, the surge arrester type A2 integrated

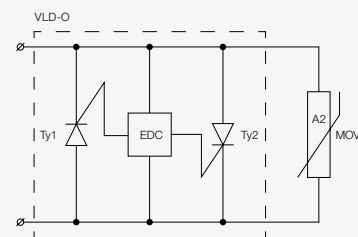
- limits non-permissible high touch voltages on non-live metal parts of a railway equipment in AC and DC railway system
- establishes temporary connection between the return circuit and the earth of the railway electric traction system, during the permissible value of voltage is exceeded
- equalizes the earth potential between the return circuit and the earth
- surrounding an electric and an electronics equipment and prevents their damage
- limits touch voltage and protects persons that might enter into contact with the parts affected
- eliminates high impulse overvoltages induced into the railway electric traction system or the railway equipment by a lightning strike
- overload indicators for easy replacement



Dimensions



Wiring diagram



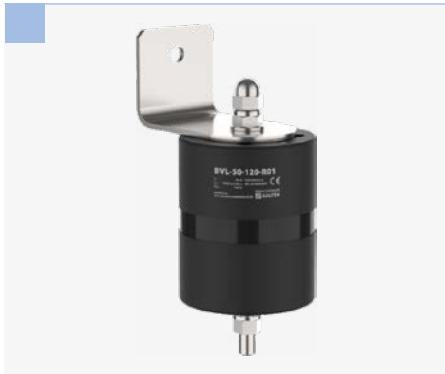
Technical data		BVL-25-120-R01
Rated current @ 60 min	I_r	25 A
Short time withstand current @ 100 ms	I_w	1,0 kA
Leakage current at U_w	I_L	< 120 μ A
Non-triggering voltage	U_w	100 V
Nominal triggering voltage	U_{Tn}	120 V
Instantaneous triggering voltage	U_{Ti}	120 V
Maximum residual voltage at I_w	U_{res}	3,5 V
Maximum residual voltage at I_r	U_{res}	1,2 V
Lightning current impulse (8/20 μ s)	I_{imp-n}	25 kA
High current impulse (8/20 μ s)	$I_{imp-high}$	50 kA
High charge impulse (10/350 μ s)	I_{imp-hc}	5 kA
Response time @ lightning current		25 ns
Response time of thyristors		< 1,5 ms
Range of operating temperatures		-40 °C ... +70 °C
Mounting on		surface/DIN rail 35 mm
Degree of protection (EN 60529)		IP 67
Weight		0,78 kg
According to standards		EN 50526-1, EN 50526-2, EN 50526-3
Ordering number		A06100

BVL-50-...-R01

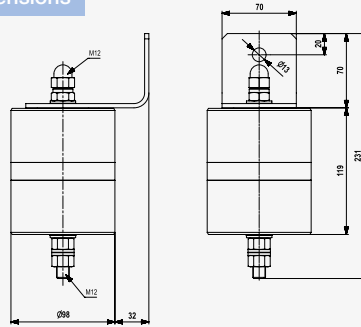
Voltage limiting device

recoverable VLD of class 2.2 (bi-directional), type VLD-O+F, limiting of occurrence non-permissible touch voltages, causing temporary equipotential bonding and limiting of overvoltage of a railway system DC, the surge arrester type A2 integrated

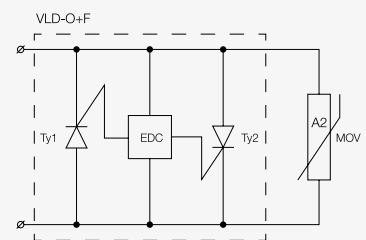
- limits non-permissible high touch voltages on non-live metal parts of a railway equipment in DC railway system
- establishes temporary connection between the return circuit and the earth of the railway electric traction system, during the permissible value of voltage is exceeded
- equalizes the earth potential between the return circuit and the earth surrounding an electric and an electronics equipment and prevents their damage
- limits touch voltage and protects persons that might enter into contact with the parts affected
- eliminates high impulse overvoltages induced into the railway electric traction system or the railway equipment by a lightning strike
- overload indicators for easy replacement



Dimensions

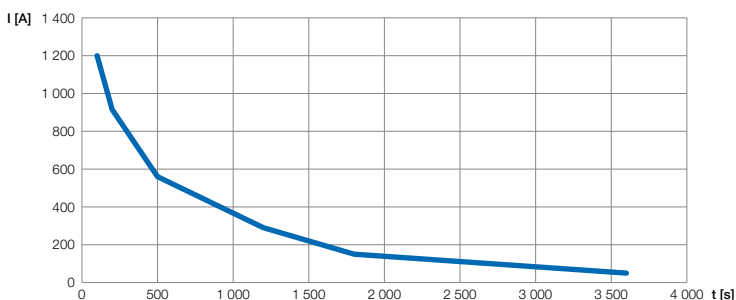


Wiring diagram

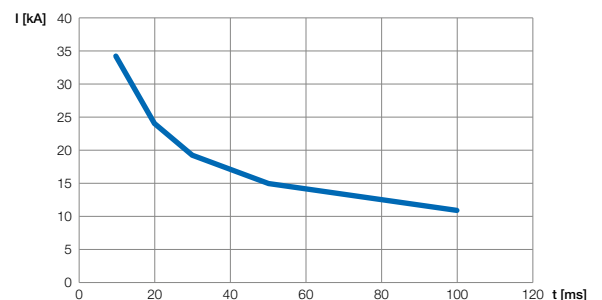


Technical data		BVL-50-45-R01	BVL-50-60-R01	BVL-50-120-R01
Rated DC current @ 60 min	I_r	50 A	50 A	50 A
Rated AC (rms) current @ 60 min	I_r	50 A	50 A	50 A
Short time DC withstand current @ 50 ms	I_w	15 kA	15 kA	15 kA
Short time AC (rms) withstand current @ 36 ms	I_w	16,7 kA	16,7 kA	16,7 kA
Leakage current at U_w	I_L	< 50 μ A	< 70 μ A	< 120 μ A
Non-triggering voltage	U_w	36 V	48 V	100 V
Nominal triggering voltage	U_{Tn}	45 V	60 V	120 V
Instantaneous triggering voltage	U_{Ti}	45 V	60 V	120 V
Maximum residual voltage at I_w	U_{res}	5,0 V	5,0 V	5,0 V
Maximum residual voltage at I_r	U_{res}	1,2 V	1,2 V	1,2 V
Maximum residual voltage at I_{imp-n}	U_{res}	700 V	700 V	700 V
Lightning current impulse (8/20 μ s)	I_{imp-n}	50 kA	50 kA	50 kA
High current impulse (8/20 μ s)	$I_{imp-high}$	75 kA	75 kA	75 kA
High charge impulse (10/350 μ s)	I_{imp-hc}	35 kA	35 kA	35 kA
Response time @ lightning current		25 ns	25 ns	25 ns
Response time of thyristors		< 1,5 ms	< 1,5 ms	< 1,5 ms
Range of operating temperatures		-40 °C ... +70 °C	-40 °C ... +70 °C	-40 °C ... +70 °C
Mounting on		surface	surface	surface
Degree of protection (EN 60529)		IP 67	IP 67	IP 67
Weight		2,8 kg	2,8 kg	2,8 kg
According to standards		EN 50526-2	EN 50526-2	EN 50526-2
Ordering number		A06632	A06602	A06101

Maximum long term current versus time, recoverable (DC)



Maximum short time current versus time, recoverable (DC)



BVL-100-...-R01

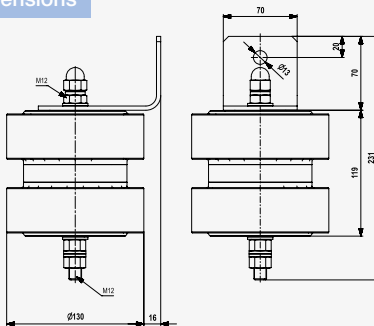
Voltage limiting device

recoverable VLD of class 2.2 (bi-directional), type VLD-O+F, limiting of occurrence non-permissible touch voltages, causing temporary equipotential bonding and limiting of overvoltage of a railway system DC, the surge arrester type A2 integrated

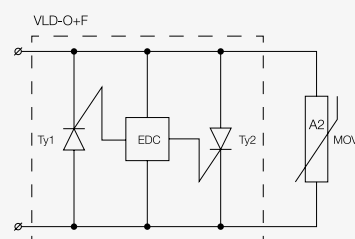
- limits non-permissible high touch voltages on non-live metal parts of a railway equipment in DC railway system
- establishes temporary connection between the return circuit and the earth of the railway electric traction system, during the permissible value of voltage is exceeded
- equalizes the earth potential between the return circuit and the earth surrounding an electric and an electronics equipment and prevents their damage
- limits touch voltage and protects persons that might enter into contact with the parts affected
- eliminates high impulse overvoltages induced into the railway electric traction system or the railway equipment by a lightning strike
- overload indicators for easy replacement



Dimensions

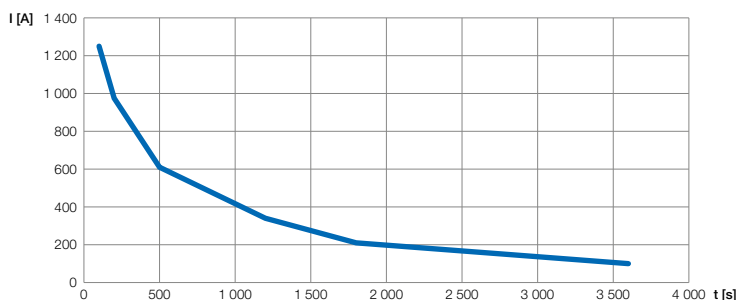


Wiring diagram

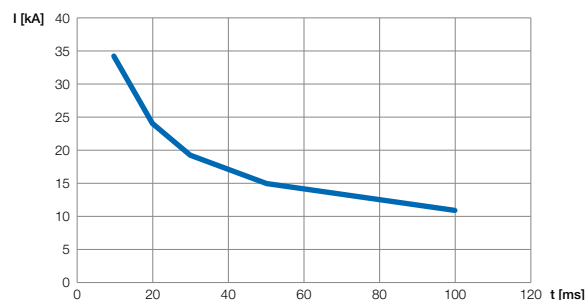


Technical data		BVL-100-45-R01	BVL-100-60-R01	BVL-100-120-R01
Rated DC current @ 60 min	I_r	100 A	100 A	100 A
Rated AC (rms) current @ 60 min	I_r	100 A	100 A	100 A
Short time DC withstand current @ 50 ms	I_w	15 kA	15 kA	15 kA
Short time AC (rms) withstand current @ 36 ms	I_w	16,7 kA	16,7 kA	16,7 kA
Leakage current at U_w	I_L	< 50 μ A	< 70 μ A	< 120 μ A
Non-triggering voltage	U_w	36 V	48 V	100 V
Nominal triggering voltage	U_{Tn}	45 V	60 V	120 V
Instantaneous triggering voltage	U_{Ti}	45 V	60 V	120 V
Maximum residual voltage at I_w	U_{res}	5,0 V	5,0 V	5,0 V
Maximum residual voltage at I_r	U_{res}	1,2 V	1,2 V	1,2 V
Maximum residual voltage at I_{imp-n}	U_{res}	700 V	700 V	700 V
Lightning current impulse (8/20 μ s)	I_{imp-n}	50 kA	50 kA	50 kA
High current impulse (8/20 μ s)	$I_{imp-high}$	75 kA	75 kA	75 kA
High charge impulse (10/350 μ s)	I_{imp-hc}	35 kA	35 kA	35 kA
Response time @ lightning current		25 ns	25 ns	25 ns
Response time of thyristors		< 1,5 ms	< 1,5 ms	< 1,5 ms
Range of operating temperatures		-40 °C ... +70 °C	-40 °C ... +70 °C	-40 °C ... +70 °C
Mounting on		surface	surface	surface
Degree of protection (EN 60529)		IP 67	IP 67	IP 67
Weight		3,5 kg	3,5 kg	3,5 kg
According to standards		EN 50526-2	EN 50526-2	EN 50526-2
Ordering number		A06631	A06603	A06102

Maximum long term current versus time, recoverable (DC)



Maximum short time current versus time, recoverable (DC)



SALTEK s.r.o.

Drážďanská 85
400 07 Ústí nad Labem
Czech Republic
Phone: +420 272 942 470
Fax: +420 475 622 213
E-mail: trade@saltek.cz
www.saltek.eu/en

Distributor: