DEHN + SÖHNE

Safety Equipment

Main Catalogue

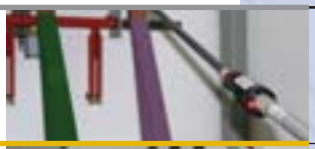
www.dehn.de

. . . Your safety is our concern.

Valid from 1st May 2007

This catalogue replaces the Main Catalogue published in 2005.

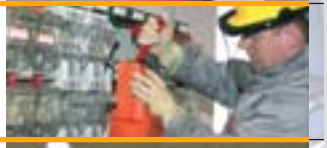
Publication No. DS396/E/2007












Safety Equipment

Product Range DEHNTEC®

Railways

DEHN – Safety with Tradition.

Production around 1930.

Centre of lightning and surge protection and safety.

Production of safety equipment in 2007.

At first there was the idea of diverting lightning to the ground without endangering home or people. This was the challenge, Hans Dehn met in his company founded in Nuremberg in 1910. Since the beginning of the 1920s DEHN has produced lightning protection and earthing components. Over the years, a diversified product range for external lightning protection came into existence.

But not only protecting systems and buildings against the effects of lightning, but also the protection of people installing and maintaining electrical systems became a central requirement.
In 1952, DEHN + SÖHNE amplified their product range by safety equipment for working at electrical installations.

The entering of electrical and electronic equipment in industries, administrations and households showed soon, that conventional lightning protection was not sufficient to protect these devices. With the experience of decades in the field of external lightning protection, the necessity of surge protection came up. Therefore, the first generation of surge protective devices (SPDs) by DEHN + SÖHNE was introduced to the market in 1954.

Today, the location in Neumarkt, Germany, unifies research and development, production, sales and administration in the fields of lightning protection, surge protection and safety equipment.

With more than 750 employees, a process-orientated management, laboratories, computer-controlled production lines and a wide product range for safety, DEHN + SÖHNE is a worldwide recognised and leading family-owned company.

DEHN – Products for Safety.

In the course of its history of nearly 100 years, the initial handicraft business has become a worldwide operating industrial company with three product ranges:

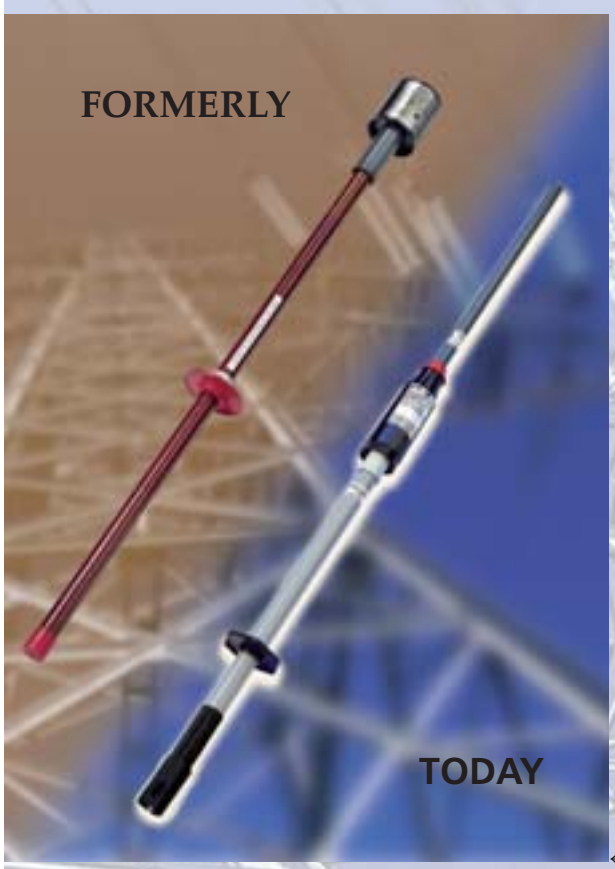
Lightning Protection

Surge Protection

Safety Equipment

DEHN + SÖHNE is a booster of technological progress. We do intensive, application-related research work for customer-orientated solutions. The performance parameters of our impulse current test laboratories are unique worldwide.

With the experience in research and development, production, quality assurance and application of components for lightning and surge protection as well as safety equipment, we have influenced national and international standardisation considerably. Our most important aim is to stipulate a maximum quality and safety level. This has made DEHN + SÖHNE known as a brand of quality far beyond the borders of Germany.



Experience for decades.

High-voltage testing station.

DEHN – Quality and Safety.

DEHN + SÖHNE produce more than 3,500 devices and components for your safety. Our products protect human lives and material assets. High quality requirements and the awareness in the treatment of the environment is therefore a must.

In order to ensure this and make it also transparent for you as our customer, the company was certified in accordance with DIN EN ISO 9001 and DIN EN ISO 14001. Annual examinations and complete reaudits every three years show the central significance of quality and environmental management in the company.

We cooperate intensively with international and national standard committees and take part in congresses worldwide. We are active members of the "Ausschuss für Blitzschutz und Blitzforschung" (ABB) [Commission for Lightning Protection and Research] and in the "Verband Deutscher Blitzschutzfirmen (VDB)" [Association of German Lightning Protection Companies]. Thus, we foster nationally and internationally the aims and further development of lightning protection.

Our aim is to provide sophisticated, customer-orientated solutions to increase the economy of companies. Only those who are accessible can be quick, flexible and efficient.

We provide you with the necessary safety.

DEHN – Global Safety.

DEHN + SÖHNE supplies equipment and provides services covering lightning and surge protection worldwide. We have committed ourselves to continuous market presence, productivity, product quality and delivery in time. Developing innovative and market-related products requires closeness to our customers. They benefit from our strength in innovation, flexibility and short decision processes.

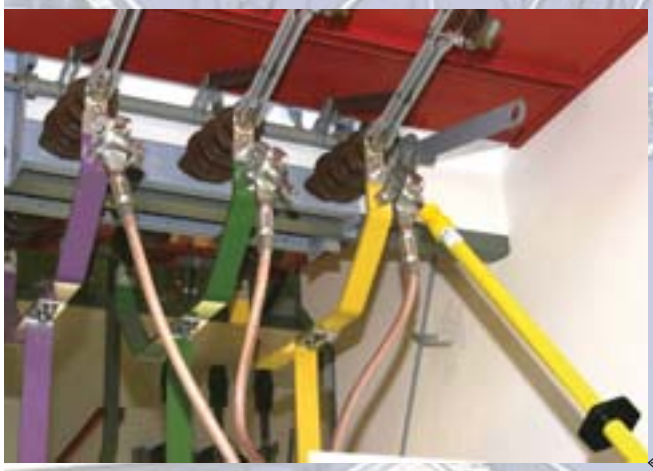
Sustained success in the market is only possible if local conditions are considered.

Our market presence: 17 sales offices and 4 outlets in Germany, subsidiaries or representatives in more than 70 countries. Besides continuous participation in international fairs, DEHN + SÖHNE offers extensive technical support and customer service on the spot. Additionally, we organise seminars and lectures, and supply detailed information and designing material. We contribute to specialist publications and carry out continuous PR work.

Safety is not just related to the features and benefits of our products but can also be applied to the relationship with our customers and suppliers.

This means for our partners that their problems that need to be solved are in safe hands.

Safe verifying of isolation from power supply with DEHN equipment!



Safe earthing and short-circuiting with DEHN equipment!

Safe cleaning under live conditions with DEHN equipment!

DEHN – Worldwide.

Algeria
Argentina
Australia
Austria
Belgium
Belize
Bolivia
Brazil
Bulgaria
Canada
Cap Verde
Chile
China
Columbia
Costa Rica
Croatia
Cuba
Czech Republic
Denmark
El Salvador
Estonia
F.Y.R.O.M
Finland
France
Great Britain
Greece
Guatemala
Honduras
Hungary
Iceland
India
Iran
Ireland
Israel
Italy
Japan
Latvia
Lebanon
Lithuania
Luxembourg
Malaysia
Mauritius
Mexico
Netherlands
New Zealand
Nicaragua
Nigeria
Norway
Oman
Pakistan
Panama
Peru
Poland
Portugal
Romania
Russia
Saudi Arabia
Serbia
Singapore
Slovakia
Slovenia
South Africa
Spain
Sri Lanka
Sweden
Switzerland
Syria
Taiwan
Thailand
Turkey
Uganda
United Arab Emirates
USA
Venezuela

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DEHN – Keeping you informed.

1. VDE Regulations for safety equipment and devices

DIN VDE 0680

"Personal protective equipment, protective devices and apparatus for work on electrically energized systems up to 1000 V".

Part 1 "Personnel protective equipment and protective insulating devices"

Part 3 "Operating rods and current collecting devices"

Part 4 "Fuse handles for low-tension HRC-fuses"

Part 6 "Single-pole voltage tester up to 250 V a.c."

Part 7 "Socket spanner"

DIN VDE 0681

"Operating, testing and safe-guarding devices for work on electrically energized systems with rated voltages exceeding 1 kV"

Part 1 "General requirements" for DIN VDE 0681 Parts 2 to 4

Part 2 "Operating rods"

Part 3 "Fuse tongs"

Part 6 "Voltage detectors to be used for overhead contact systems 15 kV, 16 2/3 Hz"

DIN VDE 0682

"Apparatus and equipment for live working"

Part 201 "Hand tools for use up to 1000 V a.c. and 1500 V d.c." (IEC/EN 60900)

Part 211 "Insulating poles (insulating sticks) and universal tool attachments (fittings) for live working" (IEC/EN 60832)

Part 311 "Live working – Gloves of insulating material" (IEC/EN 60903)

Part 312 "Sleeves of insulating material for live working" (IEC/EN 60984)

Part 401 "Live working – Voltage detectors – Part 3: Two-pole low voltage type "(IEC/EN 61243-3)

Part 411 "Live working – Voltage detectors – Part 1: Capacitive type to be used for voltages exceeding 1 kV a.c." (IEC/EN 61243-1)

Part 412 "Live working – Voltage detectors – Part 2: Resistive type to be used for voltages of 1 kV to 36 kV a.c." (IEC/EN 61243-2)

Part 415 "Live working – Voltage detectors – Part 5: Voltage detective systems (VDS)" (IEC/EN 61243-5)

Part 431 "Live working – Portable phase comparators for voltages of 1 kV to 36 kV a.c." (IEC/EN 61481)

Part 511/A1 "Blankets of insulating material for electrical purposes; Amendment 1" (IEC 78/379/CDV:2001)

Part 512/A1 "Matting of insulating materials for electrical purposes; Amendment 1" (IEC 78/378/CDV:2001)

Part 513 "Live working – Flexible conductor covers (line hoses) of insulating material" (IEC/EN 61479)

Part 551 "Rigid protective covers for live working on a.c. installations" (IEC/EN 61229)

Part 552 "Live working – Insulating protective barriers above 1 kV"

Part 603 "Live working – Telescopic sticks and telescopic measuring sticks (IEC/EN 62193)"

Part 621 "Live working – Suction device for the cleaning of live parts with rated voltages above 1 kV up to 36 kV"

Part 651 "Saddles, pole clamps (stick clamps) and accessories for live working" (IEC/EN 61236)

Part 741 "Aerial devices with insulating boom used for life working exceeding 1 kV a.c." (IEC/EN 61057)

DIN VDE 0683

"Portable equipment for earthing or earthing and short-circuiting"

Part 100 "Live working – Portable equipment for earthing or earthing and short-circuiting" (IEC/EN 61230)

Part 200 "Live working – Earthing or earthing and short-circuiting equipment using lances as a short-circuiting device – Lance earthing" (IEC/EN 61230)

1.1 Supplementary Literature:

"Arbeitsschutz in elektrischen Anlagen"
["Occupational safety in electrical installations"]
Explanations on DIN VDE 0105, 0680, 0681, 0682 and 0683
VDE Series, Volume 48
Dr. P. Hasse, W. Kathrein and H. Kehne
VDE-Verlag GmbH, Berlin-Offenbach, Germany

"Arbeiten unter Spannung (AuS)"
Practical Examples
Dr. P. Hasse, W. Kathrein
WEKA MEDIA GmbH & Co. KG, Kissing, Germany.

2. Abbreviations

2.1 Materials

Abbreviations in catalogue	Material
Al	Aluminium
Cu	Electric copper, copper
St	Steel
StSt	Stainless steel
MCI	Malleable cast iron
ZDC	Zinc die casting
AlMgSi	Aluminium alloy
Ms	Brass
GFP	Glass-fibre-reinforced plastic

2.2 Coating materials

Abbreviations in catalogue	Coating material
gal Sn	Tin-coated
gal Zn	Galvanised
tZn	Hot-dip galvanised
Bronze gal Sn	Bronze, tin-coated

2.3 Symbols

Abbreviations in catalogue	Description
	Fixed ball point
	T pin
	Round / Flat conductor
Light ''	for "Voltage present"
Light '**0**'	for "No voltage present"

4. Designs

Operating rods and equipment are basically distinguished in the following types:

- **Not for use in wet weather**

For indoor and outdoor installations

For use in indoor installations and outdoors, but not in wet weather.

- **Also for use in wet weather**

For indoor and outdoor installations

For use in indoor installations and outdoors under all weather conditions (even if the operating rod gets wet).

- **For indoor installations only!**

3. Minimum lengths of insulating parts

1) Operating rods acc. to DIN VDE 0681
2) Voltage detectors acc. to IEC/EN 61243-1 (DIN VDE 0682 Part 411)
3) Phase comparators acc. to IEC/EN 61481 (DIN VDE 0682 Part 431)

Nominal voltage U_N *)	Rated voltage U_r	Minimum length of the insulating part $L_{I\,min}$ 1)	2)	3)
up to 10 kV	12 kV	500 mm	520 mm	525 mm
20 kV	24 kV	500 mm	520 mm	525 mm
30 kV	36 kV	525 mm	520 mm	525 mm
45 kV	52 kV	720 mm	830 mm	—
60 kV	72.5 kV	900 mm	830 mm	—
110 kV	123 kV	1300 mm	1300 mm	—
150 kV	170 kV	1750 mm	1700 mm	—
220 kV	245 kV	2400 mm	2300 mm	—
380 kV	420 kV	3200 mm	3600 mm	—

*) For nominal voltages exceeding or falling below the preferred nominal voltage values as stated above, a rated voltage shall be applied which is the closest greater than the nominal voltage in question. In borderline cases, the nominal voltage is equal to the rated voltage.

Design of Voltage Detectors

Voltage detectors according to IEC/EN 61243-1 (DIN VDE 0682 Part 411) are designed to verify safe isolation from supply voltages at work locations according to DIN VDE 0105 Part 100.

Safe isolation from supply voltages must be verified on all poles and as close to the work location as possible. This verification may only be performed by a qualified electrician or an electrotechnically instructed person.

Voltage detectors have to be tested for their correct operation, immediately before and after use. For voltage detectors that do not have a self-testing device, the correct operation must be proven by testing the voltage detector on parts of the installation connected to supply voltage.

Verifying safe isolation from power supply with a voltage detector has to be considered as live working.

Voltage detectors may only be used for the nominal voltages / nominal voltage ranges as indicated on the rating plate. The operator may be at risk if the voltage detector is used at higher or lower voltages than indicated on the rating plate (incorrect indication, exposure to high currents and electrical arcing).

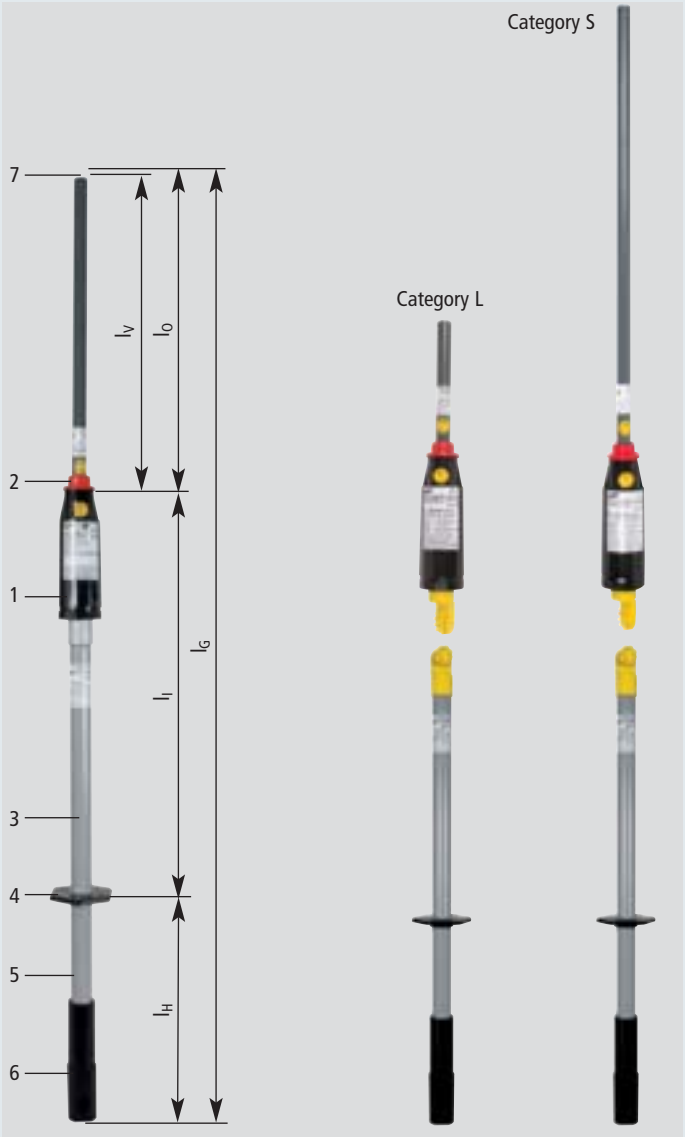
Voltage detectors marked "For indoor use only", may be used indoors only.
Voltage detectors marked "For use in indoor and outdoor installations, also for use in wet weather" may be used for indoor installations and outdoors during all weather conditions (rain, snow, fog or dew).

Restrictions apply to the use of voltage detectors according to IEC/EN 61243-1 (DIN VDE 0682 Part 411) in prefabricated (type-tested) installations. Due to reduced insulation distances, spark overs may occur when inserting the test prod into the installation. It is recommended that the user or operator of the switchgear installation consults with the manufacturer of the type-tested installation, before using the voltage detector.
(Refer to Page 12 Table: Applications of Voltage Detectors in type-tested prefabricated switchgear installations)

Design of a voltage detector

Single-pole voltage detectors according to IEC/EN 61243-1 (DIN VDE 0682 Part 411) are designed to make contact with the part of the electrical installation to be tested.
There are **two mechanically different types** of voltage detectors, i.e. complete or modular voltage detectors.
Complete voltage detectors (PHE III, PHE and PHG II) consist of an insulating rod, indicator and test prod, which have to be tested as a complete unit.
Modular voltage detectors (PHE III Electronic Indicator) must be attached to a suitable insulating rod before use.
The basic design of single-pole **voltage detectors** consists of a **handle**, **insulating part**, **indicator** and **test prod** with its **contact electrode**.
The **insulating part** is the section of the operating rod between the handguard and red ring. This part provides an adequate safety distance and safe isolation from the supply voltage.
The **test prod** (extension for the contact electrode) consists of the part **above the red ring** towards the contact electrode. This part allows the user to reach remote parts of the installation and **eliminates** the influences of **interference voltages**.
Voltage detectors are classified into two categories based on the requirements for performance against the influences of interference voltages or the desired application.
Voltage detector **category "L"** with a short test prod (no extension for the contact electrode) is designed for use on overhead lines.

Voltage detector **category "S"** with a long test prod (with extension for the contact electrode) eliminates the influences of interference voltages. Even though this design is for use in switchgear installations and substations, it may also be used on overhead lines.
The **handguard** is a clearly visible and sensible limit between the handle and insulating part. Its purpose is to prevent the hand of the operator from slipping or passing into contact with the resistive or insulating part.
The **red ring** marks the end of the insulating part. It provides the user with a visible limit of contact with live parts of the system. The insulating part between the red ring and handguard must not touch live parts, but may rest on earthed parts.
The **test electrode** is the part of the indicator that is used to make contact with the installation that has to be tested for supply voltage.



1 Operating head
2 Red ring
3 Insulating part with length l_I
4 Handguard
5 Handle with length l_H
6 Plug-in coupling for handle extension
7 Test electrode

l_V Length of extension
l_O Length of top section
l_G Total length of voltage detector

Applications of Voltage Detectors

in type-tested prefabricated switchgear installations

The applicability of our voltage detectors types PHE, PHE III and PHG II (Category "S") for use in prefabricated switchgear installations (e.g. in accordance with EN/IEC 62271-200 (DIN VDE 0670 or DIN VDE 0671 Part 200)) has been proven in tests performed in cooperation with the switchgear manufacturers.

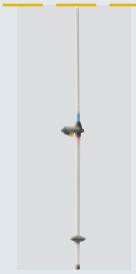
Switchgear manufacturer	Type	Nominal voltages U_N	Suitable voltage detectors
ABB	BA-/BB systems, BAX systems, BD systems	10 ... 30 kV	PHE, PHE III and PHG II
	BC systems		PHE, PHE III and PHG II
ABB Calor Emag	ZE3/4, ZE7/8, ZK4/5, ZK8 L7.6, ZS1, ZS8	10 ... 30 kV	PHE, PHE III and PHG II
	ZW1		PHE and PHE III
	Isopond	10 kV	PHE, PHE III with test probe, Part No. 766 916
AREVA T&D			
AEG	GS, GSD, GSH, H, K, L	10 ... 20 kV	PHE, PHE III and PHG II
Concordia Sprecher + Schuh	PI, PIC, PID, PN 300, PN 500, PN 600, PU, PUADC, PUB, PUD, PUDC, SC, SCC, SCD, SCDC, RMB[1)]	10 ... 30 kV	PHE, PHE III and PHG II
Sachsenwerk	A (HA, MA, SM), FK (A, B, C, E, F), PIX, R (D[1)], L, LI, M[1)], MI[1)]), W (AK,BA, BB, BD, DS), WK (A, B, C, D, E, F, M, T), WZ (K, R, RV)	6 ... 30 kV	PHE, PHE III and PHG II
Starkstromanlagen Dresden	D, WKC-D	10 kV	PHE, PHE III and PHG II
VEB Otto Buchwitz	BSIG, CSIM	20 kV	PHE, PHE III and PHG II
BELUK	BET2308, BET231, BK219, BK216,	20 kV	PHE, PHE III and PHG II
	BMB2, BRS; Compact load-break switchgear installations		PHE, PHE III
Driescher Moosburg	W12, W24, W36, WEL, F24	12 ... 36 kV	PHE, PHE III and PHG II
	E2K, E3K, D12, D24; Compact load-break switchgear installations	12 ... 24 kV	PHE, PHE III with great inserting depth (e.g. Part No. 767 731)
Driescher Wegberg	Mipak, Minor, Minex, RKL, ZLDT, TSL, TSLG, FL, SK400, BS600, HS24, LDTC	10 ... 20 kV	PHE, PHE III and PHG II or PHE III with test prod, Part No. 767 767 for Type Mipak
Eaton Holec	HC, Unitole	3 ... 24 kV	PHE and PHE III with electrode, Part No. 766 927
	Magnefix	3 ... 15 kV	PHE and PHE III with electrode, Part No. 766 915
	MMS, SVS, Xiria	3 ... 24 kV	PHE and PHE III with electrode, Part No. 766 913 or 766 925
Eimers	EKS 10 N, ES 20 N, ES 10 N, EMS 12.190	10 ... 20 kV	PHE, PHE III and PHG II
ORMAZABAL (F & G)	HGKN, EA, MA, KE, EF, WA, K-HGK	10 ... 20 kV	PHE, PHE III and PHG II
Pfisterer	MAG	10 kV	PHE with test prod P2/10
Klöpper	KMG	10 ... 20 kV	PHE, PHE III and PHG II
Krone	KH10, KHS10d, KHS10dp, KHS17I, KHS17II, KHS20, KHS30	10 ... 30 kV	PHE, PHE III and PHG II
	KES10		PHE, PHE III with test prod, Part No. 766 916
Miebach	AS, HUK, TE, TSE, DSS, ASR	10 ... 20 kV	PHE, PHE III and PHG II
NATUS	NES, NESCON, NFwZ	3 ... 20 kV	PHE, PHE III and PHG II
Ritter	GT1, GT3	6 ... 30 kV	PHE, PHE III and PHG II
Senteg	AMS12	3 ... 10 kV	PHE, PHE III and PHG II
Siemens Before testing systems with a circuit breaker, the circuit breaker has to be moved out	8 BD, 8 CK	6 ... 30 kV	PHE, PHE III with modified test electrode (on request), PHG II on request
	8 BK 20, 8 BJ 20, 8 BK 30, 8 AA 10	6 ... 20 kV	PHE, PHE III and PHG II
Wickmann	DZ switchgear cabinet	20 kV	PHE, PHE III and PHG II
Ziegler	AZ cells	10 ... 20 kV	PHE, PHE III and PHG II

[1)] Switchgear panels with integrated division into busbar or cable compartments require special guide adapters for the fixed isolating contacts.

SAFETY EQUIPMENT

Selection Guide

VOLTAGE DETECTORS

	Device	Nominal Voltage U_N / Frequency f_N	Application, Indication	Page
	PHE III and PHE III Electronic indicator PHE III (Kit)	3 / 6 / 10 / 20 / 30 kV / 50 Hz 3...10 / 6...20 / 10...30 kV / 50 Hz 3...10 / 10...30 kV / 50 Hz switchable 6...20 / 10...30 kV / 50 Hz test set 20 kV / 50 Hz 60 ... 132 kV / 50 Hz	Also for use in wet weather For indoor and outdoor installations With self-testing device Visual and acoustic indicator Short transport length Quick battery exchange without tools	14
	PHE	3 / 6 / 10 / 20 / 30 kV / 50 Hz 3...10 / 6...20 / 15...30 kV / 50 Hz 3...10 / 6...20 / 15...30 kV / 50 Hz switchable 60 / 110 kV / 50 Hz	Also for use in wet weather For indoor and outdoor installations With self-testing device Visual indicator Short transport length	30
	PHG II	6 / 10 / 20 kV / 50 Hz	For indoor installations only Visual indication by 3 LEDs LEDs staggered at 120° allow for better observation of the indication Passive voltage detector requiring no batteries	34
	HSA 194 HSA 205	110...420 kV / 50 Hz 1 ... 420 kV / 50 Hz	Also for use in wet weather Non-contact voltage detector For testing of high-voltage and overhead lines for safe isolation from power supply without contact With self-testing device Visual and acoustic indicator	36
	PHE/G	1...7.5 kV / dc voltage	Also for use in wet weather For indoor and outdoor installations With self-testing device Visual indicator Short transport length Two-pole unit (single-/two-pole)	40
	Storage Bags and Transport Cases		Case: Steel plate or plastic Bag: Artificial leather or canvas	68

Routine tests

According to German regulations, voltage detectors have to be tested to ensure compliance with the prescribed limits as stated in the Electrical Safety Rules. This test is performed in the high voltage test laboratory of DEHN + SÖHNE and includes

- test for leakage current,
- test for clear indication,
- test for bridging safety,
- test by visual check, manual test and measuring.

This routine test is documented by a test report and a marking on the device.

The intervals for routine tests depend on the operating conditions of the equipment, e.g. frequency of use, working conditions, transport and storage. According to German regulations, the routine tests **must not exceed 6 years**.

PHE III Voltage Detector

Nominal voltages up to 30 kV / 50 Hz

TÜV Thüringen GS geprüfte Sicherheit

EN/IEC 61243-1 (DIN VDE 0682 Part 411)

- Also for use in wet weather
- For indoor and outdoor installations
- With self-testing device
- Visual and acoustic indicator
- Wide nominal voltage ranges
- Short transport length due to detachable insulating rod and test prod
- Quick battery exchange without tools
- Test set with exchangeable test prods for switchgear installations and overhead lines

PHE III Voltage Detector with visual and acoustic indicator used on an indoor switchgear installation.

Self-testing device
The electronic voltage detector PHE III has an integrated self-testing device. The electronic circuit is automatically tested for correct operation (threshold) when the voltage detector is switched on. The detector will only be operational if the self test has been performed successfully.

Replacing the battery:
The 9 V block battery can be placed by hand without requiring additional tools. By simply unscrewing, the plastic nut allows access for quick and easy battery exchange. Low batteries are indicated by the acoustic signal and both LEDs illuminated when the voltage detector is switched on.

Technical Data	
Test prods	Glass-fibre reinforced expoxy resin tube, Ø20 mm, grey, detachable; Test electrode made of Cu alloy/gal Sn Ø20 mm, tooth shape for reliable contact, with female M8 thread for attaching electrodes and test probes
Indicator	Plastic, fully insulated, black
Indication	Visual: LED indication and Acoustic: Intermittent signal
Ready for operation	Visual: Green permanent light
Voltage present	Visual: Red flashing light and Acoustic: Intermittent signal
No voltage present	Visual: Green permanent light
Insulating rod	Glass-fibre reinforced polyester tube, Ø30 mm, grey, detachable, with handguard for safe handling and plug-in coupling for handle extension
Operating temperature range	– 25° C ... + 55° C, Climatic category N

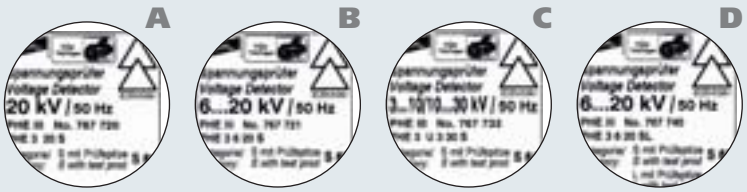
Categories "S" and "L"
The test set includes two interchangeable test prods of different lengths and marked "S" (long test prod) and "L" (short test prod) respectively.
Category "S" test prods can be used for switchgear installations and overhead lines.
Category "L" test prods are less resistant against the influence of interference fields and can therefore be used for overhead lines only.

Special features of the switchable detector 3 ... 10 kV / 10 ... 30 kV:
The nominal voltage selector switch allows for switching between two nominal voltage ranges. For safety reasons, the detector can only be switched on with the selector switched to the most sensitive range of 3 kV to 10 kV. A magnetically operated, wear-resistant reed switch changes the switching position. The switch snapping into the selected position provides protection against unintentional switching.

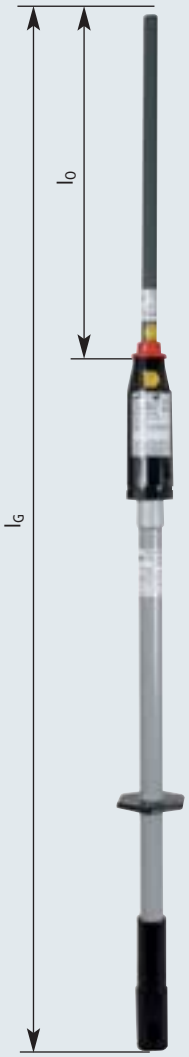
SAFETY EQUIPMENT

VOLTAGE DETECTORS

PHE III Voltage Detector



Type	Nominal voltage U_N	Total length l_G	Inserting depth l_O	Part No.
A Nominal Voltages up to 30 kV / 50 Hz Category "S"				
PHE3 3 S	3 kV	1080 mm	285 mm	**767 703**
PHE3 6 S	6 kV	1080 mm	285 mm	**767 706**
PHE3 10 S	10 kV	1080 mm	285 mm	**767 710**
PHE3 20 S	20 kV	1230 mm	435 mm	**767 720**
PHE3 30 S	30 kV	1415 mm	620 mm	**767 730**
B Nominal Voltage Ranges up to 30 kV / 50 Hz Category "S"				
PHE3 3 10 S	3 ... 10 kV	1415 mm	620 mm	**767 711**
PHE3 6 20 S	6 ... 20 kV	1575 mm	780 mm	**767 721**
PHE3 10 30 S	10 ... 30 kV	1675 mm	880 mm	**767 731**
C Nominal Voltage Ranges up to 30 kV / 50 Hz, switchable Category "S"				
PHE3 U 3 30 S	3 ... 10 / 10 ... 30 kV	1675 mm	880 mm	**767 733**
D Nominal Voltage Ranges up to 30 kV / 50 Hz, Test Set With 2 interchangeble test prods, Category "S" and "L"				
PHE3 6 20 SL	6 ... 20 kV	1575 / 990 mm	780 / 185 mm	**767 740**
PHE3 10 30 SL	10 ... 30 kV	1675 / 990 mm	880 / 185 mm	**767 750**



Voltage detectors for other nominal voltages and frequencies available on request.

Electronic Indicator PHE III

Nominal voltages up to 30 kV / 50 Hz

Electronic indicator according to EN/IEC 61243-1 (DIN VDE 0682 Part 411)
Universal gear coupling according to EN/IEC 60832 (DIN VDE 0682 Part 211)

- Also for use in wet weather
- For indoor and outdoor installations
- With self-testing device
- Standby function
- Visual and acoustic indicator
- Wide nominal voltage ranges
- Quick battery exchange without tools
- Detachable test prod

PHE III Indicator with universal gear coupling and insulating rod.

Self-testing device
The electronic PHE III indicator has an integrated self-testing device. The electronic circuit is automatically tested for correct operation (threshold) when the voltage detector is switched on.

Standby function
The electronic PHE III indicator has a standby function, which will automatically activate the indicator when contact is made with energised equipment (without previous self test) and will signal "voltage present" visually and acoustically. When contacting de-energised equipment, the indicator is not activated.

Categories "S" and "L"
Category "S" devices (long test prod) can be used for both switchgear installations and overhead lines.
Category "L" devices (short test prod) are less resistant against the influence of interference fields and can therefore be used for overhead lines only.

Technical Data	
Test prods	Glass-fibre reinforced epoxy resin tube, Ø20 mm, grey, detachable; Test electrode made of Cu alloy/gal Sn Ø20 mm, tooth shape for reliable contact, with female M8 thread for attaching electrodes and test probes
Indicator	Plastic, fully insulated, black
Indication	Visual: LED indication and Acoustic: Intermittent signal
Ready for operation	Visual: Green permanent light
Voltage present	Visual: Red flashing light and Acoustic: Intermittent signal
No voltage present	Visual: Green permanent light
Operating temperature range	– 25° C ... + 55° C, Climatic category N

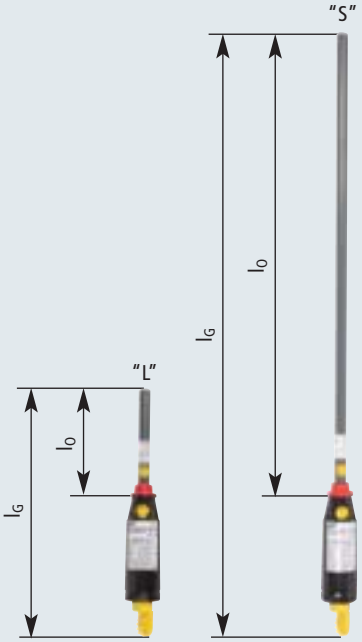
Replacing the battery:
The 9 V Block battery can be placed by hand without requiring additional tools. By simply unscrewing, the plastic nut allows access for quick and easy battery exchange. Low batteries are indicated by the acoustic signal and both LEDs illuminated when the voltage detector is switched on.

Warning!
The PHE III indicator may only be used in combination with a suitable insulating rod from the same equipment series.

SAFETY EQUIPMENT

VOLTAGE DETECTORS

Electronic Indicator PHE III



Type	Nominal voltage U_N	Category	Total length l_G	Inserting depth l_O	Part No.
A PHE III Electronic Indicator with Universal Gear Coupling Category "S" or "L"					
PHE3 6 20 S SB ZK	6 ... 20 kV	S	1010 mm	780 mm	**767 921**
PHE3 10 30 S SB ZK	10 ... 30 kV	S	1110 mm	880 mm	**767 931**
PHE3 6 20 L SB ZK	6 ... 20 kV	L	415 mm	185 mm	**767 922**
PHE3 10 30 L SB ZK	10 ... 30 kV	L	415 mm	185 mm	**767 932**

Voltage detectors for other nominal voltages and frequencies available on request. Electronic indicators with permanently illuminated LEDs and constant acoustic signal available on request.

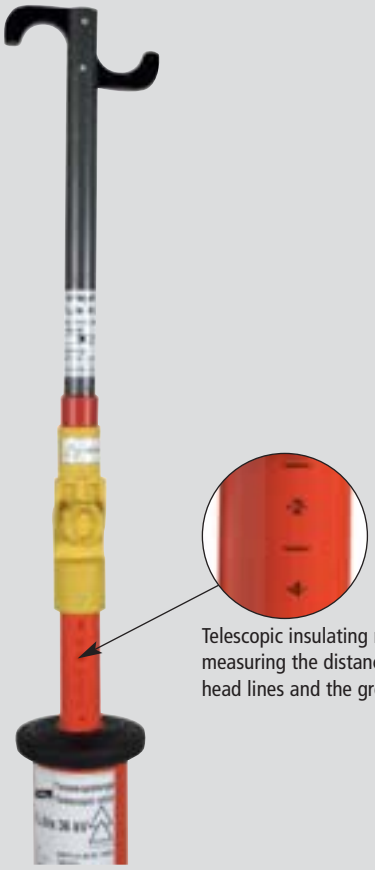
Insulating Rods for PHE III Electronic Indicator

Nominal voltages up to 36 kV / 50 Hz

EN/IEC 61243-1 (DIN VDE 0682 Part 411)
Universal gear coupling acc. to EN/IEC 60832 (DIN VDE 0682 Part 211)

- Also for use in wet weather in combination with PHE III electronic indicator
- For indoor and outdoor installations
- Endpiece with plug-in coupling for handle extension
- Telescopic insulating rod, length up to 10.6 m
- With universal gear coupling for angling PHE III electronic indicator

Telescopic insulating rod for PHE III electronic indicator.



Telescopic insulating rod with scale for measuring the distance between overhead lines and the ground.

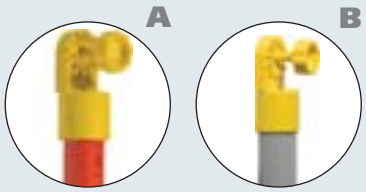
Telescopic insulating rod with support for easy handling.

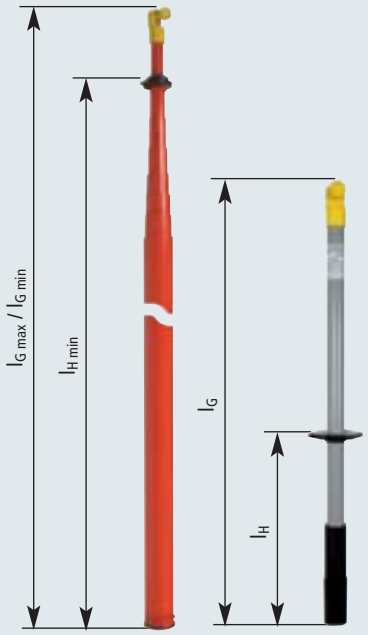
Technical Data	
Insulating rod	Telescopic insulating rod: Glass-fibre reinforced epoxy resin tube Ø27 / 63 mm; Insulating rod: Glass-fibre reinforced polyester tube, Ø30 mm, with handguard for safe handling
Endpiece	Telescopic insulating rod: Non-slip plastic cap; Insulating rod: Plug-in coupling for handle extension

Attaching the extension handle type HV STK to the insulating rod type IS PHE STK.

SAFETY EQUIPMENT
VOLTAGE DETECTORS

Insulating Rods for PHE III Electronic Indicator





Type	Total length $l_{G\,max}$ / $l_{G\,min}$	Handle length $l_{H\,min}$	Part No.
A Telescopic Insulating Rod with Universal Gear Coupling With measuring scale to obtain the distance between the overhead line and the ground.			
ISMTC N 36 ZK 10600	10,600 / 1750 mm	1680 mm	**766 037**
B Insulating Rod with Universal Gear Coupling Endpiece with plug-in coupling for handle extension			
IS PHE ZK STK	645 mm	335 mm	**766 368** new

Accessories for Insulating Rods for PHE III Electronic Indicator

Contacting Aid

For telescopic insulating rods

Type	Total length l_G	Part No.
AK AH ZK ISMTC	340 mm	**766 049** new

Support

For telescopic insulating rods

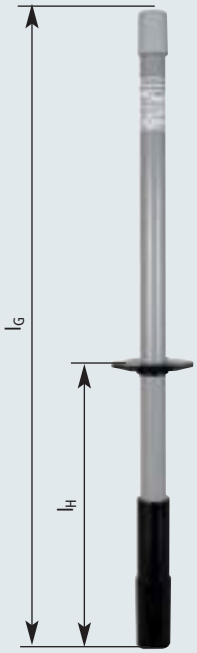
Type	Part No.
AH ISMTC	**766 038**

Canvas Bag, empty

With shoulder strap
Max. capacity:
1 Telescopic insulating rod
1 Contacting aid
1 Test prod

Type	Colour	Dimension	Part No.
STT 180 20	●	Ø200 x 1800 mm	**766 039** new

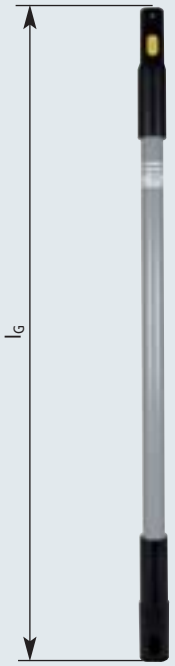
Accessories for PHE III Voltage Detector



Insulating Rod with Plug-in Coupling for Handle Extension

Type	Total length l_G	Length of handle extension l_H	Part No.	
IS PHE M12 STK	635 mm	370 mm	**766 331**	new

Attaching handle extension type HV STK to insulating rod type IS PHE STK.



Handle Extension with Plug-in Coupling

For extending the handle of insulating rods type IS PHE
Both-sided plug-in coupling

Type	Total length l_G	Part No.	
HV STK 710	710 mm	**766 335**	new

Adapter – Plug-in Coupling / T pin Shaft

For extending the handle of insulating rods type IS PHE with insulating rod type IS SQ or earthing rod ES SQ

Type	Total length l_G	Part No.	
AD HV STK SQ	280 mm	**766 313**	new

Accessories for PHE III Voltage Detector

Steel Plate Case, empty

Hammer-finished with foamed insert
Max. capacity:
1 PHE III indicator
1 Insulating rod
1 Handle extension or adapter type STK SQ
2 Test prods (S and L)
3 Electrodes

Type	Colour	Dimension	Part No.
SKL 95 21 10	●	950 x 210 x 100 mm	**767 701**

Plastic Case, empty

With foamed insert
Max. capacity:
1 PHE III indicator
1 Insulating rod
1 Handle extension or adapter type STK SQ
2 Test prods (S and L)
3 Electrodes
Additional equipment in case type KKL PHE3 L:
1 Test probe, straight
1 Test probe, straight, 800 mm

Type	Colour	Dimension	Part No.	
KKL PHE3	●	920 x 200 x 120 mm	**767 997**	new
KKL PHE3 L	●	1270 x 200 x 120 mm	**767 999**	new

Artificial Leather Bag, empty

With shoulder strap
Max. capacity:
1 PHE III indicator
1 Insulating rod
1 Handle extension
2 Test prods (S and L)
3 Electrodes

Type	Colour	Dimension	Part No.
KLT 114 23 5	●	1140 x 230 x 50 mm	**767 702**

Plastic Case, empty

With foamed insert
Max. capacity:
1 PHE III Indicator
1 Test prod (L)
3 Electrodes
1 Spare battery

Type	Colour	Dimension	Part No.
KKL PK PHE3 L	●	395 x 295 x 105 mm	**766 036**

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D30	●	530 mm	**700 007**

PHE III Voltage Detector (Kit)

Nominal voltage 20 kV / 50 Hz

Test head EN/IEC 61243-1 (DIN VDE 0682 Part 411)
Universal gear coupling EN/IEC 60832 (DIN VDE 0682 Part 211)

- For use in wet weather
- For indoor and outdoor installations
- Modular kit system for flexible use in switchgear installations and overhead lines
- With self-testing device
- Visual and acoustic indicator
- Quick battery exchange without additional tools

PHE III voltage detector with attached test probe.

Self-testing device
The electronic PHE III test head has an integrated self-testing device. The electronic circuit ist automatically tested for correct operation (threshold) when the voltage detector is switched on.

Categories "S" and "L"
Category "S" devices (long test prod) can be used for both switchgear installations and overhead lines. Category "L" devices (short test prod) are less resistant against the influence of interference fields and can therefore be used for overhead lines only.

Replacing the battery
The 9 V block battery can be placed by hand without requiring additional tools. By simply unscrewing, the plastic nut allows access for quick and easy battery exchange. Low batteries are indicated by the acoustic signal and both LEDs illuminated when the voltage detector is switched on.

Technical Data	
Test prods	Glass-fibre reinforced expoxy resin tube, Ø20 mm, grey, detachable; Test electrode made of Cu alloy/gal Sn Ø20 mm, tooth shape for reliable contact, with female M8 thread for attaching electrodes and test probes
Indicator	Plastic, fully insulated, black
Indication	Visual: LED indication and Acoustic: Intermittent signal
Ready for operation	Visual: Green permanent light
Voltage present	Visual: Red flashing light and Acoustic: Intermittent signal
No voltage present	Visual: Green permanent light
Insulating rod	Glass-fibre reinforced polyester tube, Ø30 mm, grey, detachable, with handguard for safe handling and plug-in coupling for handle extension
Operating temperature range	– 25° C ... + 55° C, Climatic category N

SAFETY EQUIPMENT
VOLTAGE DETECTORS

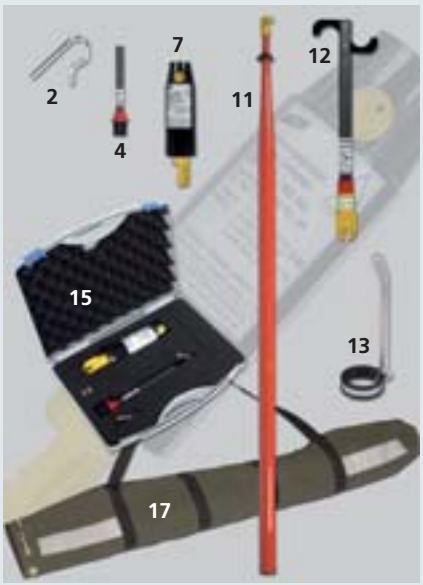
PHE III Voltage Detector (Kit)
Nominal voltage 20 kV / 50 Hz

Example: Switchgear Installation

Pos.	Qty.	Type	Item	Part. No.
1	1	EL M8 V PHE PHV	Y-shape electrode	766 927
3	1	S63 PS PHE 780	Test prod "S 63", l = 780 mm	767 763
6	1	PSO M8 PHE L800	Test probe l = 800 mm	766 960
7	1	PHE3 A 20 SL ZK	PHE III Indicator, 20 kV	767 722
8	1	IS PHE ZK STK	Insulating rod with universal gear coupling	766 368
9	1	HV STK 710	Handle extension l = 710 mm	766 335
or				
10	1	AD HV STK SQ	Adapter STK / SQ	766 313
16	1	KKL PHE3 L	Plastic case, empty	767 999

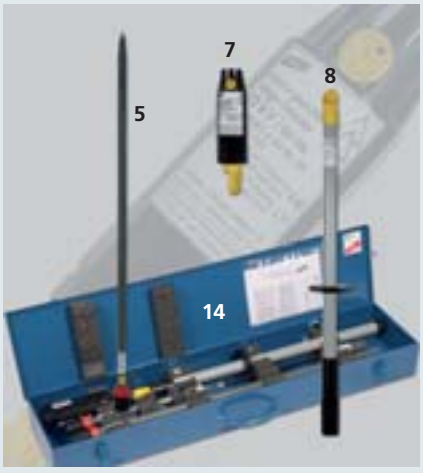
Example: Overhead Line

Pos.	Qty.	Type	Item	Part. No.
2	1	EL M8 H PHE PHV	Hook-shape electrode	766 923
4	1	L71 PS PHE 185	Test prod "L 71", l = 185 mm	767 766
7	1	PHE3 A 20 SL ZK	PHE III Indicator, 20 kV	767 722
11	1	ISMTC N 36 ZK 10600	Telescopic insulating rod with universal gear coupling	766 037
12	1	AK AH ZK ISMTC	Contacting aid for telescopic insulating rod	766 049
13	1	AH ISMTC	Support for telescopic insulating rod	766 038
15	1	KKL PK PHE3 L	Plastic case, empty	766 036
17	1	STT 180 20	Canvas bag, empty	766 039



Example: Siemens 8CK Switchgear Installation

Pos.	Qty.	Type	Item	Part. No.
5	1	S63 PS PHE 8CK	Test prod "S 63 8CK", l = 830 mm	767 768
7	1	PHE3 A 20 SL ZK	PHE III Indicator, 20 kV	767 722
8	1	IS PHE ZK TR16	Insulating rod with universal gear coupling	766 068
14	1	SKL 95 21 10	Steel plate case, empty	767 701



Single Parts for PHE III Voltage Detector (Kit)

Y-shape Electrode

Type	Nominal voltage U_N	Material	Position	Part No.
EL M8 V PHE PHV	from 3 kV	Cu/gal Sn	1	**766 927**

Hook-shape Electrode

Type	Nominal voltage U_N	Material	Position	Part No.
EL M8 H PHE PHV	for overhead lines only	steel/gal Zn	2	**766 923**

Test Prod for Switchgear Installations and Overhead Lines

Category "S"

Type	Total length l_G	Inserting depth l_O	Position	Part No.
S63 PS PHE 780	815 mm	780 mm	3	**767 763**

Test Prod for Overhead Line Applications

Category "L71" for 3 ... 36 kV

Type	Total length l_G	Inserting depth l_O	Position	Part No.
L71 PS PHE 185	220 mm	185 mm	4	**767 766**

Test Prod for Siemens 8CK Switchgear Installations

Category "S" for PHE III voltage detectors, Part Nos. 767 721, 767 722 and 767 740

Type	Total length l_G	Inserting depth l_O	Position	Part No.	
S63 PS PHE 8CK	880 mm	845 mm	5	**767 768**	new

Test Probe, straight, 800 mm

For tower stations and switchgear installations requiring greater inserting depths

Type	Nominal voltage U_N	Diameter Ø	Total length l_G	Position	Part No.	
PSO M8 PHE L800	3 ... 24 kV	14 mm	890 mm	6	**766 960**	new

PHE III Indicator

Category "S" and "L"

Type	Nominal voltage U_N	Length of indicator l_G	Position	Part No.	
PHE3 A 20 SL ZK	20 kV	230 mm	7	**767 722**	new

Insulating Rod with Universal Gear Coupling

Endpiece with plug-in coupling for handle extension

Type	Total length $l_{G\,max}$ / $l_{G\,min}$	Handle length $l_{H\,min}$	Position	Part No.	
IS PHE ZK STK	645 mm	335 mm	8	**766 368**	new

Handle Extension with Plug-in Coupling

For extending the handle of insulating rod type IS PHE
Both-sided plug-in coupling

Type	Total length l_G	Position	Part No.	
HV STK 710	710 mm	9	**766 335**	new

Adapter – Plug-in Coupling / T pin Shaft

For extending the handle of insulating rods type IS PHE with insulating rod type IS SQ or earthing rod ES SQ

Type	Total length l_G	Position	Part No.	
AD HV STK SQ	280 mm	10	**766 313**	new

SAFETY EQUIPMENT
VOLTAGE DETECTORS

Single Parts for PHE III Voltage Detector (Kit)

Telescopic Insulating Rod with Universal Gear Coupling

With measuring scale to obtain the distance between overhead line and the ground.

Type	Total length $l_{G\ max}$ / $l_{G\ min}$	Handle length $l_{H\ min}$	Position	Part No.
ISMTC N 36 ZK 10600	10,600 / 1750 mm	1680 mm	11	**766 037**

Contacting Aid

For telescopic insulating rods

Type	Total length l_G	Position	Part No.
AK AH ZK ISMTC	340 mm	12	**766 049** new

Support

For telescopic insulating rods

Type	Position	Part No.
AH ISMTC	13	**766 038**

Steel Plate Case, empty

Hammer-finished with foamed insert
Max. capacity:
1 PHE III indicator
1 Insulating rod
1 Handle extension or adapter type STK SQ
2 Test prods (S and L)
3 Electrodes

Type	Colour	Dimension	Position	Part No.
SKL 95 21 10	●	950 x 210 x 100 mm	14	**767 701**

Plastic Case, empty

With foamed insert
Max. capacity:
1 PHE III Indicator
1 Test prod (L)
3 Electrodes
1 Spare battery

Type	Colour	Dimension	Position	Part No.
KKL PK PHE3 L	●	395 x 295 x 105 mm	15	**766 036**

Plastic Case, empty

With foamed insert
Max. capacity:
1 PHE III indicator
1 Insulating rod
1 Handle extension or adapter type STK SQ
2 Test prods (S and L)
3 Electrodes
1 Test probe, straight
1 Test probe, straight, 800 mm

Type	Colour	Dimension	Position	Part No.
KKL PHE3 L	●	1270 x 200 x 120 mm	16	**767 999** new

Canvas Bag, empty

With shoulder strap
Max. capacity:
1 Telescopic insulating rod
1 Contacting aid
1 Test prod

Type	Colour	Dimension	Position	Part No.
STT 180 20	●	Ø200 x 1800 mm	17	**766 039**

PHE III Voltage Detector (Kit)

Nominal voltage 60 ... 132 kV / 50 Hz

EN/IEC 61243-1 (DIN VDE 0682 Part 411)

- For use in wet weather
- For indoor and outdoor installations
- Modular kit system for use in switchgear installations and overhead lines
- With self-testing device
- Visual and acoustic indicator
- Short transport length due to detachable test prod and modular insulating rod
- Quick battery exchange without additional tools

PHE III voltage detector used in an outdoor 110 kV installation.

Self-testing device
The electronic PHE III indicator has an integrated self-testing device. The electronic circuit ist automatically tested for correct operation (threshold) when the voltage detector is switched on.

Categories "S" and "L"
Category "S" devices (long test prod) can be used for both switchgear installations and overhead lines. Category "L" devices (short test prod) are less resistant against the influence of interference fields and can therefore be used for overhead lines only.

Replacing the battery
The 9 V block battery can be placed by hand without requiring additional tools. By simply unscrewing, the plastic nut allows access for quick and easy battery exchange. Low batteries are indicated by the acoustic signal and both LEDs illuminated when the voltage detector is switched on.

Technical Data	
Test prods	Glass-fibre reinforced expoxy resin tube, Ø20 mm, yellow, detachable; Test electrode made of Cu alloy/gal Sn Ø20 mm, tooth shape for reliable contact, with female M8 thread for attaching electrodes
Indicator	Plastic, fully insulated, black
Indication	Visual: LED indication and Acoustic: intermittent acoustic signal
Ready for operation	Visual: Green permanent light
Voltage present	Visual: Red flashlight and Acoustic: intermittent acoustic signal
No voltage present	Visual: Green permanent light
Insulating rod	Glass-fibre-reinforced polyester tube, Ø43/30 mm, yellow, modular and detachable, with silicone shields, with handguard for safe handling; Sealing part with non-slip rubber cap
Operating temperature range	– 25° C ... + 55° C, Climatic category N

PHE III Voltage Detector (Kit)

Nominal voltage 60 ... 132 kV / 50 Hz

Example: PHE III Voltage Detector 60 ... 110 kV (S)
Category "S" for use in switchgear installations and overhead lines

Pos.	Qty.	Type	Item	Part No.
1	1	EL M8 G PHE PHV	V-shape electrode	766 924
4	1	S66 PS PHE 880	Test prod "S 66", l = 880 mm	767 771
5	1	PHE3 A 60 110 SL	PHE III Indicator, 60 ... 110 kV	767 723
6	1	ISR PHE 110 P	Insulating rod 110 kV, modular	766 011
10	1	KKL PHE 60 110	Plastic case, empty	766 998

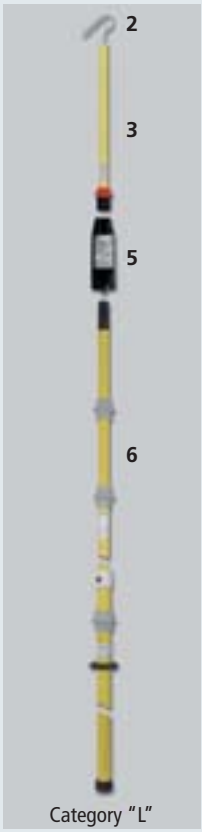
Total length 3020 mm

Category "S"

Example: PHE III Voltage Detector 60 ... 110 kV (L)
Category "L" for use in overhead lines

Pos.	Qty.	Type	Item	Part No.
2	1	EL M8 H PHE PHV	Hook-shape electrode	766 923
3	1	L71 PS PHE 405	Test prod "L 72", l = 380 mm	767 772
5	1	PHE3 A 60 110 SL	PHE III Indicator, 60 ... 110 kV	767 723
6	1	ISR PHE 110 P	Insulating rod 110 kV, modular	766 011
10	1	KKL PHE 60 110	Plastic case, empty	766 998

Total length 2520 mm



Category "L"

Example: PHE III Voltage Detector 60 ... 132 kV (S/L)
Category "S" for use in switchgear installations and overhead lines and category "L" for use in overhead lines

Pos.	Qty.	Type	Item	Part No.
1	1	EL M8 PHE PHV	V-shape electrode	767 924
3	1	L71 PS PHE 405	Test prod "L 72", l = 400 mm	767 772
4	1	S66 PS PHE 880	Test prod "S 66", l = 900 mm	767 771
7	1	PHE3 A 60 132 SL	PHE III Indicator, 60 ... 132 kV	767 732
8	1	ISR PHE 132 P	Insulating rod 132 kV, modular	766 015
11	1	KLT 160 17	Artificial leather bag, empty	766 614

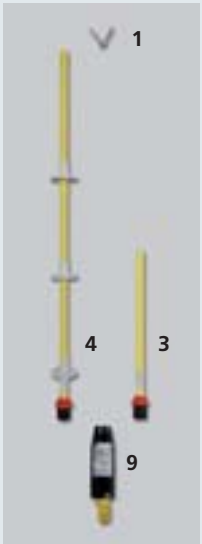
Maximal total length 3620 mm

Category "S/L"

Example: PHE III Voltage Detector 60 ... 132 kV (S/L) with gear coupling
Category "S" for use in switchgear installations and overhead lines and category "L" for use in overhead lines

Pos.	Qty.	Type	Item	Part No.
1	1	EL M8 PHE PHV	V-shape electrode	767 924
3	1	L71 PS PHE 405	Test prod "L 72", l = 400 mm	767 772
4	1	S66 PS PHE 880	Test prod "S 66", l = 900 mm	767 771
9	1	PHE3 A 60 132 SL ZK	PHE III Indicator, 60 ... 132 kV with gear coupling	767 735

Note: PHE III Indicator 60 ... 132 kV with gear coupling may be used with a suitable insulating rod with corresponding voltage level only!



Category "S/L"

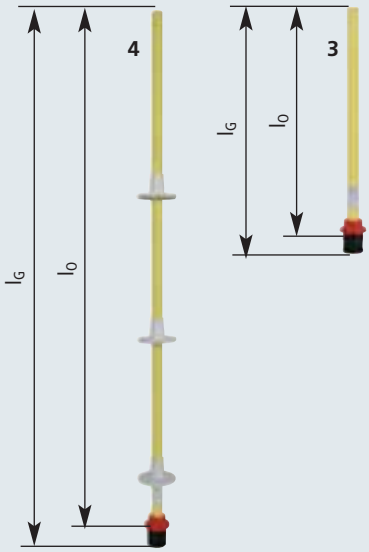
Single Parts for PHE III Voltage Detector (Kit)

V-shape Electrode

Type	Nominal voltage U_N	Material	Position	Part No.
EL M8 G PHE PHV	for overhead lines only	stainless steel	1	**766 924**

Hook-shape Electrode

Type	Nominal voltage U_N	Material	Position	Part No.
EL M8 H PHE PHV	for overhead lines only	steel/gal Zn	2	**766 923**



Test Prod for Overhead Lines

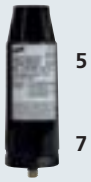
Category "L72" for 60 ... 110 (132) kV

Type	Total length l_G	Inserting depth l_O	Position	Part No.	
L72 PS PHE 405	415 mm	380 mm	3	**767 772**	new

Test Prod for Switchgear Installations and Overhead Lines

Category "S66" for 60 ... 110 (132) kV

Type	Total length l_G	Inserting depth l_O	Position	Part No.	
S66 PS PHE 880	915 mm	880 mm	4	**767 771**	new



Indicator with threaded Pin M12

Cateory "S" and "L"

Type	Nominal voltage U_N	Length of indicator l_G	Position	Part No.	
PHE3 A 60 110 SL	60 ... 110 kV	190 mm	5	**767 723**	new
PHE3 A 60 132 SL	60 ... 132 kV	190 mm	7	**767 732**	new

Indicator with Gear Coupling

Category "S" and "L"

Type	Nominal voltage U_N	Length of indicator l_G	Position	Part No.	
PHE3 A 60 132 SL ZK	60 ... 132 kV	230 mm	9	**767 735**	new

Note: PHE III Indicator 60 ... 132 kV with gear coupling may be used with a suitable insulating rod with corresponding voltage level only!

SAFETY EQUIPMENT

Single Parts for PHE III Voltage Detector (Kit)

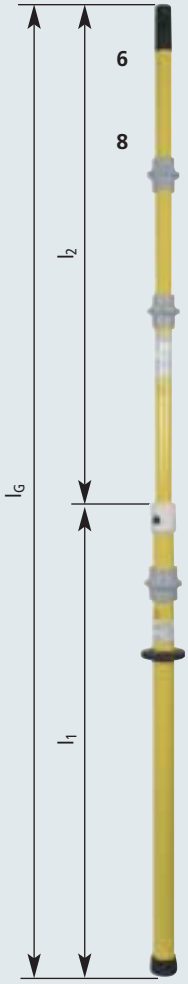
VOLTAGE DETECTORS

Insulating Rod, 110 kV, modular, with M12 female Thread

Type	Total length l_G	Length l_1	Length l_2	Position	Part No.	
ISR PHE 110 P	1940 mm	930 mm	1120 mm	6	**766 011**	new

Insulating Rod, 132 kV, modular, with M12 female Thread

Type	Total length l_G	Length l_1	Length l_2	Position	Part No.	
ISR PHE 132 P	2540 mm	1225 mm	1445 mm	8	**766 015**	new



Plastic Case, empty

With foamed insert
Max. capacity:
1 PHE III Indicator, 60 ... 110 kV
1 Insulating rod 110 kV, modular
2 Test prods (S 66 and L 72)
2 Electrodes (V- or hook-shape electrode)

Type	Colour	Dimension	Position	Part No.	
KKL PHE3 60 110	●	1270 x 200 x 120 mm	10	**766 998**	new

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D40 45	●	530 mm	**700 008**

PHE Voltage Detector

Nominal voltages up to 30 kV / 50 Hz

TÜV Thüringen GS geprüfte Sicherheit

EN/IEC 61243-1 (DIN VDE 0682 Part 411)

- Also for use in wet weather
- Category "S" for indoor and outdoor installations
- With self-testing device
- Visual indicator
- Wide nominal voltage ranges
- Short transport length due to detachable insulating rod

PHE Voltage Detector with visual indicator.

Self-testing device
The electronic voltage detector PHE has an integrated self-testing device. The electronic circuit is automatically tested for correct operation (threshold) when the voltage detector is switched on. The detector will only be operational if the self test has been performed successfully.

Replacing the battery
The PHE voltage detector is supplied with 4 Mignon IEC IR6 batteries. These batteries are situated in a separate battery compartment to allow for easy battery exchange. Low batteries are indicated by both signals illuminated, when the voltage detector is switched on.

Technical Data	
Test prod	Glass-fibre reinforced epoxy resin tube, Ø20 mm, grey; Test electrode made of Cu alloy/gal Sn Ø20 mm, tooth shape for reliable contact, with female M8 thread for attaching electrodes and test probes
Indicator	Plastic, fully insulated, black
Indication	Red light ' ϟ ' (flashing light); Green light '**0**' (permanent light)
Insulating rod	Glass-fibre reinforced polyester tube, Ø30 mm, grey, detachable, with handguard for safe handling; Endpiece with non-slip plastic cap
Operating temperature range	– 25° C ... + 55° C, Climatic category N

Before testing for the safe isolation from supply voltages, the correct operation of the voltage detector must be verified. When pressing the "TEST" button, the red light is flashing.

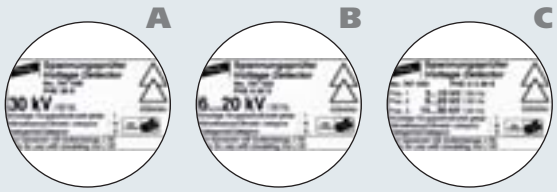
After releasing the button, the green light comes on proving that the detector is ready for operation.

Special features of the switchable detector 3 ... 10 kV / 6 ... 20 kV / 15 ... 30 kV:
The nominal voltage selector switch allows for switching between three nominal voltage ranges. For safety reasons, the detector can only be switched on with the selector switched to the most sensitive range of 3 kV to 10 kV. A magnetically operated, wear-resistant reed switch changes the switching position. The switch snapping into the selected position provides protection against unintentional switching.

SAFETY EQUIPMENT

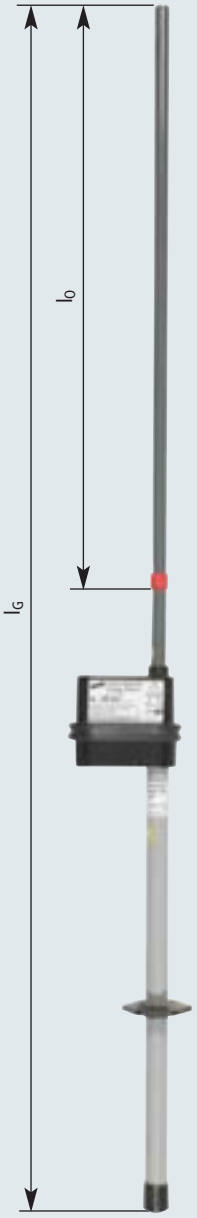
VOLTAGE DETECTORS

PHE Voltage Detector

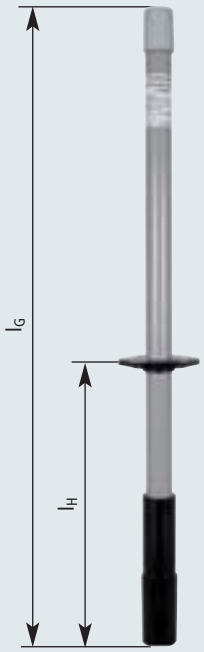


Type	Nominal voltage U_N	Total length l_G	Inserting depth l_O	Part No.
A Nominal Voltages up to 30 kV / 50 Hz Category "S"				
PHE 3 S	3 kV	1115 mm	320 mm	**767 403**
PHE 6 S	6 kV	1115 mm	320 mm	**767 406**
PHE 10 S	10 kV	1115 mm	320 mm	**767 418**
PHE 20 S	20 kV	1300 mm	505 mm	**767 428**
PHE 30 S	30 kV	1460 mm	665 mm	**767 438**
B Nominal Voltage Ranges up to 30 kV / 50 Hz Category "S"				
PHE 3 10 S	3 ... 10 kV	1375 mm	580 mm	**767 410**
PHE 6 20 S	6 ... 20 kV	1565 mm	770 mm	**767 420**
PHE 15 30 S	15 ... 30 kV	1565 mm	770 mm	**767 430**
C Nominal Voltage Ranges up to 30 kV / 50 Hz, switchable Category "S"				
PHE U 3 30 S	3 ... 10 / 6 ... 20 / 15 ... 30 kV	1565 mm	770 mm	**767 433**

Voltage detectors for other nominal voltages and frequencies available on request.



Accessories for PHE Voltage Detector



Insulating Rod with Plug-in Coupling for Handle Extension

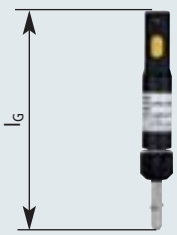
Type	Total length l_G	Length of handle extension l_H	Part No.	
IS PHE M12 STK	635 mm	370 mm	**766 331**	new

Attaching handle extension type HV STK to insulating rod type IS PHE STK.

Handle Extension with Plug-in Coupling

For extending the handle of insulating rods type IS PHE
Both-sided plug-in coupling

Type	Total length l_G	Part No.	
HV STK 710	710 mm	**766 335**	new



Adapter – Plug-in Coupling / T pin Shaft

For extending the handle of insulating rods type IS PHE with insulating rod type IS SQ or earthing rod ES SQ

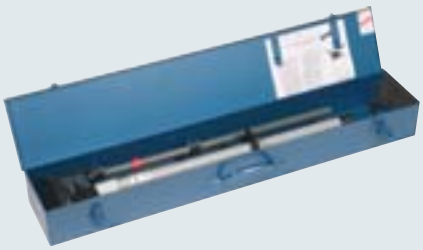
Type	Total length l_G	Part No.	
AD HV STK SQ	280 mm	**766 313**	new

SAFETY EQUIPMENT
VOLTAGE DETECTORS

Accessories for PHE Voltage Detector

Steel Plate Case, empty
Hammer-finished with retaining clips

Type	Colour	Dimension	For PHE Total length	Part No.
SKL 92 16 10	●	920 x 160 x 100 mm	up to 1460 mm	**766 703**
SKL 116 16 10	●	1160 x 160 x 100 mm	from 1460 mm	**766 603**



Plastic Case, empty
With foamed insert

Type	Colour	Dimension	For PHE Total length	Part No.	
KKL PHE	●	920 x 200 x 120 mm	up to 1460 mm	**766 997**	new
KKL PHE L	●	1270 x 200 x 120 mm	from 1460 mm	**766 999**	new

Artificial Leather Bag, empty
With shoulder strap

Type	Colour	Dimension	Part No.
KLT 121 25 16	●	1200 x 250 x 160 mm	**766 601**

Support Bracket
Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D30	●	530 mm	**700 007**

PHG II Voltage Detector

Nominal voltages up to 20 kV / 50 Hz

- For indoor installations
- Category "S" for switchgear installations
- Visual indication by 3 LEDs
- LEDs staggered at 120° allow for better observation of the indication
- Passive voltage detector requiring no batteries

EN/IEC 61243-1 (DIN VDE 0682 Part 411)

PHG II voltage detector used for a type-tested switchgear installation.

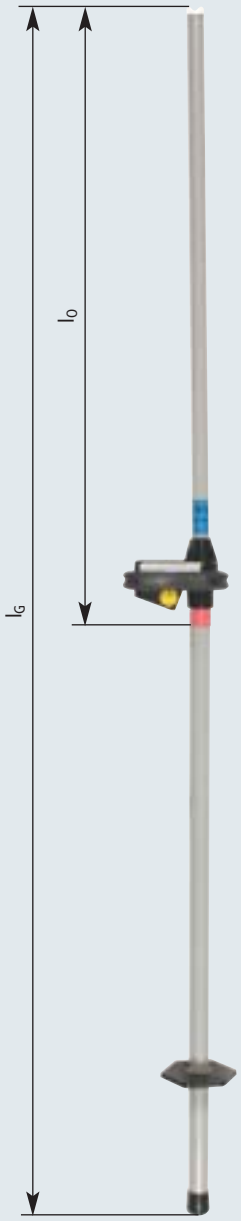
Test for correct operation
EN 50110-1 (DIN VDE 0105 Part 100) requires that voltage detectors must be tested for operating correctly, shortly before and after use. The indication of voltage detectors without self-testing devices, must be proven on parts of the installation that is connected to supply voltage.

Technical Data	
Test prod	Glass-fibre reinforced polyester tube, Ø20 mm, grey; Test electrode made of Cu/gal Sn, y-shape electrode
Indicator	Plastic, black, with 3 LEDs
Indication	Flashing indication by 3 LEDs for 'voltage present'
Insulating rod	Glass-fibre reinforced polyester tube, Ø24 mm, grey, with handguard for safe handling; Endpiece with non-slip plastic cap
Operating temperature range	– 25° C ... + 55° C, Climatic category N

Three flashing LEDs staggered at 120° improve the visibility of the indication "voltage present".

SAFETY EQUIPMENT
VOLTAGE DETECTORS

PHG II Voltage Detector



Type	Nominal voltage U_N	Total length l_G	Inserting depth l_O	Part No.
A Nominal Voltages up to 20 kV / 50 Hz Category "S"				
PHG2 6	6 kV	1425 mm	720 mm	**766 706**
PHG2 10	10 kV	1425 mm	720 mm	**766 710**
PHG2 20	20 kV	1425 mm	720 mm	**766 720**

Units for special switchgear installations available on request.

Accessories for PHG II Voltage Detector

Support Bracket
Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D24		530 mm	**700 006**

HSA 194 Non-Contact Voltage Detector

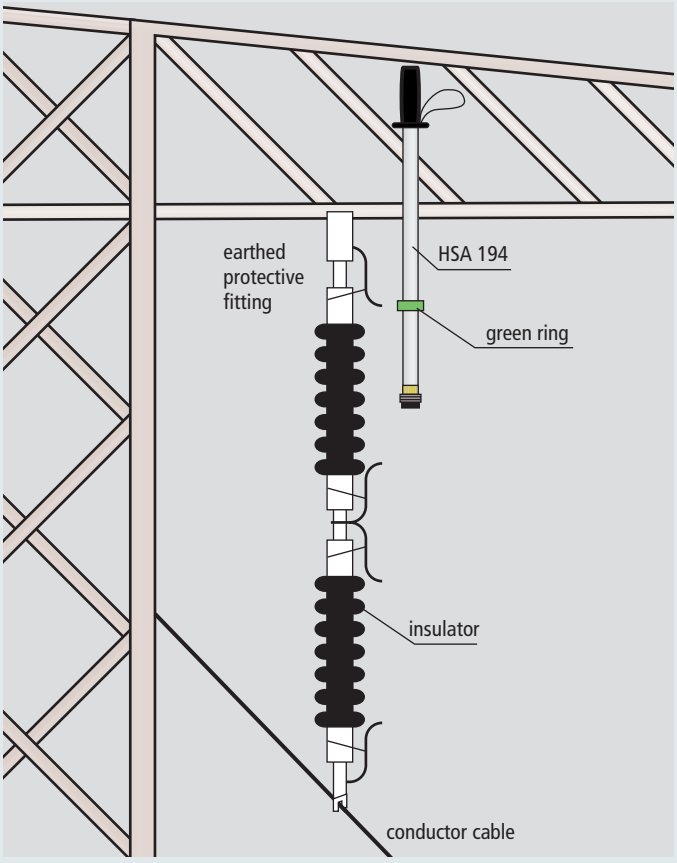
Nominal voltage range 110 ... 420 kV / 50 Hz

- Also for use in wet weather
- For testing of high-voltage overhead lines for safe isolation from power supply without contact
- With self-testing device
- Visual and acoustic indicator
- Storage bag included in delivery

Non-contact voltage detector used for a 110 kV overhead line.

Self-testing device
The electronic HSA non-contact voltage detector has an integrated self-testing device. The test is performed automatically when the detector is switched on.

Batteries
The HSA non-contact voltage detector is supplied with a 9 V block battery. This battery is installed in the battery compartment by releasing the screws and removing the indicator.
Low batteries are indicated by a permanent red light and additionally constant acoustic signal.

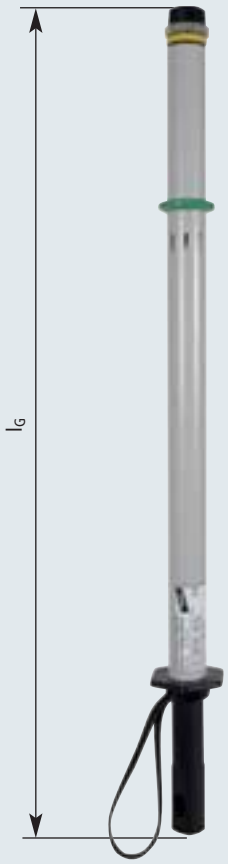


Technical Data	
Ready for operation	Green flashing light and acoustic signal at intervals of 2 seconds
Voltage present	Red flashing light and acoustic signal with increased frequency
No voltage present	Green flashing light and acoustic signal at intervals of 2 seconds
Insulating rod	Glass-fibre reinforced polyester tube, Ø43 mm, grey, with integrated measuring head as well as operating unit and indicator with green ring as contact indication
Operating temperature range	– 25° C ... + 55° C, Climatic category N

Note on application
To verify the safe isolation from supply voltages, the non-contact voltage detector is used from the cross-arm of the overhead line tower. The green ring of the HSA 194 is used to make contact with the last earthed fitting of the line insulator (or earthed insulating cap) with the indicator of the voltage detector pointing in the direction of the conductor supported by that line insulator (axis of the HSA 194 parallel to the longitudinal axis of the insulator). The presence of supply voltage will be indicated visually (by a red flashing light) and acoustically (signal tone).

SAFETY EQUIPMENT
VOLTAGE DETECTORS

HSA 194 Non-Contact Voltage Detector



Type	Nominal voltage U_N	Total length l_G	Part No.
A HSA 194 with Plug-in Coupling Plug-in coupling for handle extension Storage bag included in delivery			
HSA194 110 420 STK	110 ... 420 kV	935 mm	**767 541**

Voltage detector HSA 194 supplied with Lithium batteries available on request.
Non-contact voltage detectors for other nominal voltages and frequencies available on request.

Accessories for HSA 194 Non-Contact Voltage Detector

Handle Extension with Plug-in Coupling

For handle extension
Both-sided plug-in coupling

Type	Total length l_G	Part No.	
HV STK 710	710 mm	**766 335**	new

Adapter – Plug-in Coupling / T pin Shaft

For handle extension

Type	Total length l_G	Part No.	
AD HV STK SQ	280 mm	**766 313**	new

Artificial Leather Bag, empty

With shoulder strap

Type	Colour	Dimension	Part No.
KLT 98 9	●	Ø95 x 980 mm	**767 531**

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D40 45	●	530 mm	**700 008**

HSA 205 Non-Contact Voltage Detector

Nominal voltage range 1 ... 420 kV / 50 Hz

- Also for use in wet weather
- For testing of switchgear installations and high-voltage overhead lines, for safe isolation from power supply without contact
- Wide nominal voltage range
- With self-testing device
- Visual and acoustic indicator
- Storage bag included in delivery

Non-contact voltage detector HSA 205 with attached insulating cap used in a switchgear installation.

Technical Data

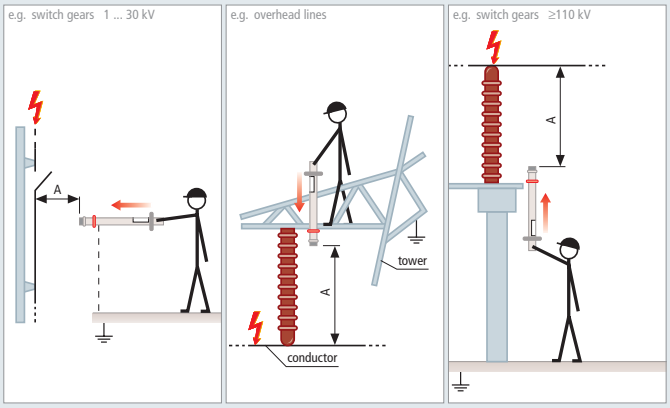
Ready for operation	Green flashing light and acoustic signal at intervals of 2 seconds
Voltage present	Red flashing light and acoustic signal with increased frequency
No voltage present	Green flashing light and acoustic signal at intervals of 2 seconds
Insulating rod	Glass-fibre reinforced polyester tube, Ø43 mm, grey, with integrated measuring head as well as operating and indication unit and green ring as contact indication
Operating temperature range	– 25° C ... + 55° C, Climatic category N

Self-testing device
The electronic HSA non-contact voltage detector has an integrated self-testing device. The test is performed automatically when the detector is switched on.

Batteries
The HSA non-contact voltage detector is supplied with a 9 V block battery. This battery is installed in the battery compartment by releasing the screws and removing the indicator.
Low batteries are indicated by a permanent red light and additionally constant acoustic signal.

Selected Voltage range	Nominal voltage acc. to DIN VDE 0105 Part 1	Min. safety distance A
Red 1 ... 30 kV	1 up to 6 kV	90 mm indoor installations
	6 up to 10 kV	120 mm indoor installations
	1 up to 10 kV	150 mm outdoor installations
	10 up to 20 kV	220 mm indoor and outdoor installations
	20 up to 30 kV	320 mm indoor and outdoor installations
White 30 ... 220 kV	30 up to 45 kV	480 mm indoor and outdoor installations
	45 up to 60 kV	630 mm indoor and outdoor installations
	60 up to 110 kV	1100 mm indoor and outdoor installations
Yellow 110 ... 420 kV	110 up to 220 kV	2100 mm indoor and outdoor installations
	220 up to 420 kV	2900/3400 mm indoor and outdoor installations

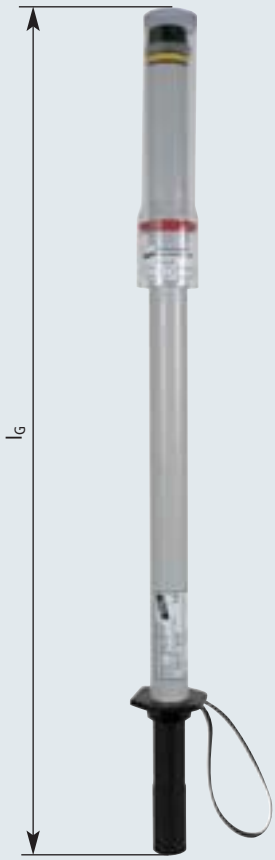
Minimum distances A according to nominal voltage.



Notes on application
The operating head of the HSA 205 non-contact voltage detector has a yellow switching ring which is used to set the required nominal voltage range 1 ... 30 kV / 30 ... 220 kV / 110 .... 420 kV.
For voltage range 1 ... 30 kV, the transparent insulating cap must be used. By attaching the insulating cap, the minimum distance A can be reduced for nominal voltages up to 30 kV, if the insulating tube and insulating cap of the detector are in a clean and dry condition.
Otherwise, the minimum distances A provided must be maintained!

SAFETY EQUIPMENT
VOLTAGE DETECTORS

HSA 205 Non-Contact Voltage Detector



Type	Nominal voltage U_N	Total length l_G	Part No.	
A HSA 205 with Plug-in Coupling Plug-in coupling for handle extension Storage bag and insulating cap included in delivery.				
HSA205 U 1 420 STK	1 ... 30 / 30 ... 220 / 110 ... 420 kV	935 mm	**767 552**	new

Voltage Detector HSA 205 supplied with Lithium batteries available on request.
Non-contact voltage detectors for other nominal voltages and frequencies available on request.

Accessories for HSA 205 Non-Contact Voltage Detector

Insulating Cap

For attaching to HSA 205 within nominal voltage range 1 ... 30 kV

Type	Colour	Dimension	Part No.	
IK HSA205	transparent	Ø60 x 310 mm	**767 559**	new

Handle Extension with Plug-in Coupling

For handle extension
Both-sided plug-in coupling

Type	Total length l_G	Part No.	
HV STK 710	710 mm	**766 335**	new

Adapter – Plug-in Coupling / T pin Shaft

For handle extension

Type	Total length l_G	Part No.	
AD HV STK SQ	280 mm	**766 313**	new

Artificial Leather Bag, empty

With shoulder strap

Type	Colour	Dimension	Part No.
KLT 98 9	●	Ø95 x 980 mm	**767 531**

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D40 45	●	530 mm	**700 008**

PHE/G dc Voltage Detector

Nominal voltages up to 7.5 kV dc

Based on EN/IEC 61243-2 (DIN VDE 0682 Part 412)

- Also for use in wet weather
- For indoor and outdoor installations
- For dc voltage systems (streets and underground, intermediate dc circuits)
- With self-testing device
- Visual indicator
- Optional earthing (positive or negative pole)
- Short transport length due to detachable insulating rod

PHE/G II dc voltage detector for intermediate dc circuits (ICE operating head).

Self-testing device
The electronic dc Voltage Detectors PHE/GI and PHE/GII have an integrated self-testing device. The electronic circuit is automatically tested for correct operation (threshold) when the voltage detector is switched on. The detector will only be operational if the self test has been performed successfully.

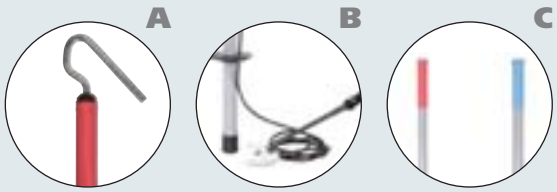
Replacing the battery
The voltage detectors are supplied with 4 Mignon IEC IR6 batteries. These batteries are situated in a separate battery compartment to allow for easy battery exchange. Low batteries of PHE/G I and PHE/G II voltage detectors are indicated by both signals illuminated (permanent light) when the voltage detector is switched on (self test).

The two-pole dc voltage detector PHE/G II is designed especially for testing intermediate dc circuits of electrical locomotives. It has a total length of only 800 mm due to the narrow alleyways. Furthermore, the device is always provided with a nominal voltage of U_N = 3 kV and a threshold voltage of U_A = 120 V (Part No. 767 602 / S18).
Devices with other nominal voltages available on request.

Technical Data	
Test prod	Glass-fibre reinforced polyester tube, Ø20 mm, grey; Test electrodes made of Cu alloy/gal Sn; PHE/G I (A) for contact wires: hook-shape electrode; PHE/G I (B) for switchgear installations and PHE/G II: Ø20 mm, tooth shape for reliable contact, with female M8 thread for attaching electrodes and test probes
Coloured marking	Polarity on the test prod: Positive: red; Negative: blue
Indicator	Plastic, fully insulated, black
Indication	Red light ' ϟ ' (flashing light); Green light '**0**' (permanent light)
Insulating rod	Glass-fibre reinforced polyester tube, Ø43 mm / Ø30 mm, grey; Endpiece with non-slip plastic cap (exception: PHE/G I for contact wires: non-slip loop)
Connecting cable	Highly-flexible Cu cable, plastic-insulated
Earthing terminal	Flexible turnable handle, MCI/gal Zn, clamping range: up to 20 mm
Operating temperature range	– 25° C ... + 55° C, Climatic category N

SAFETY EQUIPMENT
VOLTAGE DETECTORS

PHE/G dc Voltage Detector



Type	Length of connecting cable	Total length l_G	Part No.
A PHE/G I for Contact Wires Single-pole (3-part unit) – For single-ended dc systems – Threshold voltage $U_A = 0.5 \times U_N$ – Please confirm the nominal voltage (U_N) required and the pole (positive or negative) to be earthed when placing your order.			
PHEG1 ... FD	6000 mm	4060 mm	**767 600**
B PHE/G I for Switchgear Installations Single-pole – For single-ended dc systems – Threshold voltage $U_A = 0.5 \times U_N$ – Please confirm the nominal voltage (U_N) required and the pole (positive or negative) to be earthed when placing your order.			
PHEG1 ... S	2000 mm	1065 mm	**767 601**
C PHE/G II Two-pole – For unearthed dc systems – For intermediate dc circuits (electrical locomotives; $U_A \leq 120$ V, $l_G = 800$ mm) – Indicator with red positive pole on test prod – Please confirm the threshold voltage (U_A) and nominal voltage (U_N) required when placing your order.			
PHEG2 ...	1200 mm	1075 mm	**767 602**

Other lengths and threshold voltages (U_A) available on request.

Accessories for PHE/G dc Voltage Detector, Part No. 767 600

Artificial Leather Bag, empty
With shoulder strap

Type	Colour	Dimension	Part No.
KLT 160 17	●	Ø170 x 1600 mm	**766 614**

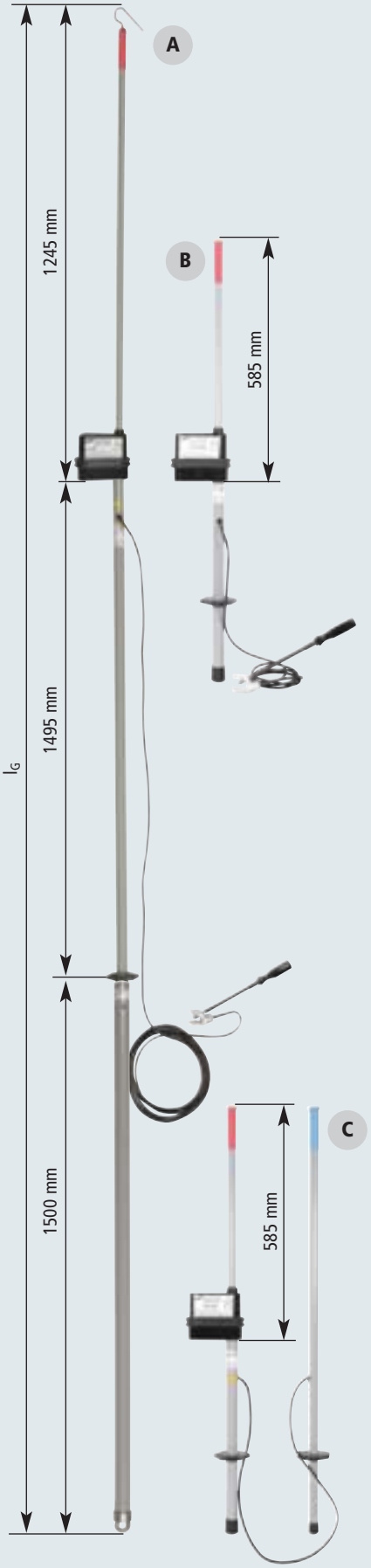
Accessories for PHE/G dc Voltage Detectors, Part No. 767 601 and 767 602

Artificial Leather Bag, empty
With shoulder strap

Type	Colour	Dimension	Part No.
KLT 121 25 16	●	1200 x 250 x 160 mm	**766 601**

Canvas Bag, empty
With shoulder strap

Type	Colour	Dimension	Part No.
STT 120 30 15	●	1200 x 300 x 150 mm	**766 704**



Electrodes

Onion-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 SZ PHE PHV	from 3 kV	Ms/gal CuSn	**766 913**

Pin-shape Electrode

With additional M6 thread

Type	Nominal voltage U_N	Material	Part No.
EL M8 S PHE PHV	from 3 kV	stainless steel	**766 925**

Y-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 V PHE PHV	from 3 kV	Cu/gal Sn	**766 927**

Eaton Holec Magnefix Electrode

For Eaton Holec Magnefix switchgear installations type MA, MD4, MF, MG, MY

Type	Nominal voltage U_N	Material	Part No.
EL M8 MAG PHE PHV	3 ... 15 kV	Ms/gal CuSn, PVC	**766 915**

Hook-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 H PHE PHV	for overhead lines only	steel/gal Zn	**766 923**

V-shape Electrode

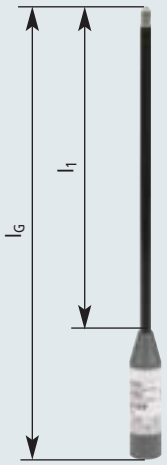
Type	Nominal voltage U_N	Material	Part No.
EL M8 G PHE PHV	for overhead lines only	stainless steel	**766 924**

SAFETY EQUIPMENT
VOLTAGE DETECTORS

Test Probe, straight

For narrow openings of switchgear installations (e.g. Calor Emag/Isopond and Krone/KES)

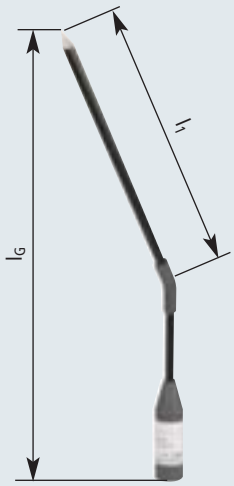
Type	Nominal voltage U_N	Diameter Ø	Total length l_G	Length l_1	Part No.
PSO M8 PHE	3 ... 24 kV	11 mm	420 mm	300 mm	**766 916**



Test Probe, angled (25°)

For narrow openings of switchgear installations

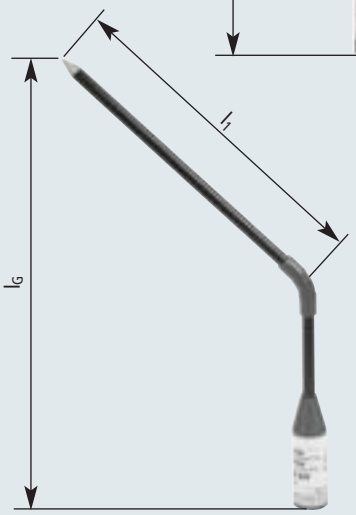
Type	Nominal voltage U_N	Diameter Ø	Total length l_G	Length l_1	Part No.
PSO M8 W25 PHE	3 ... 24 kV	11 mm	450 mm	280 mm	**766 940**



Test Probe, angled (45°)

For narrow openings of switchgear installations

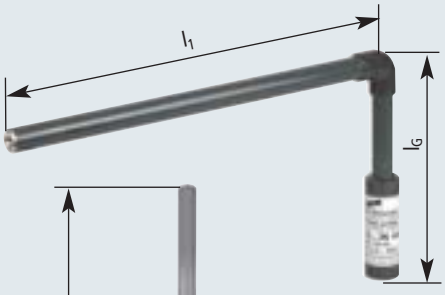
Type	Nominal voltage U_N	Diameter Ø	Total length l_G	Length l_1	Part No.
PSO M8 W45 PHE	3 ... 24 kV	11 mm	395 mm	280 mm	**766 941**



Test Probe, angled (90°)

For switchgear installations where the contacts to be tested can only be reached through an opening (tulip) upwards from the bottom

Type	Nominal voltage U_N	Diameter Ø	Total length l_G	Length l_1	Part No.
PSO M8 W90 PHE	3 ... 36 kV	20 mm	215 mm	370 mm	**766 950**



Test Probe, straight, 800 mm

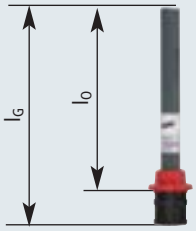
For tower stations and switchgear installations requiring greater inserting depths

Type	Nominal voltage U_N	Diameter Ø	Total length l_G	Part No.	
PSO M8 PHE L800	3 ... 24 kV	14 mm	890 mm	**766 960**	new

Note: Not to be used in wet weather.

Spare Parts

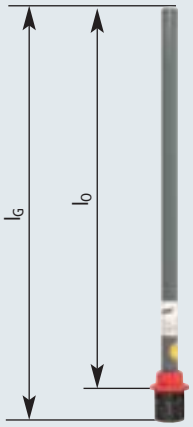
Test Prods for PHE III Voltage Detector



Test Prod for Overhead Line Applications

Category "L71" for 3 ... 36 kV

Type	Total length l_G	Inserting depth l_O	Part No.
L71 PS PHE 185	220 mm	185 mm	**767 766**



Test Prod for Switchgear Installations and Overhead Lines

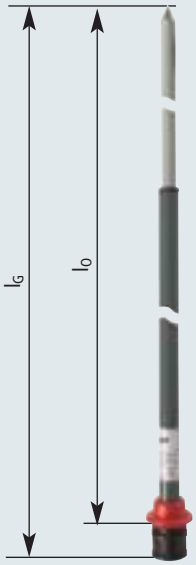
Category "S"

Type	Total length l_G	Inserting depth l_O	Part No.
S60 PS PHE 285	320 mm	285 mm	**767 760**
S61 PS PHE 435	470 mm	435 mm	**767 761**
S62 PS PHE 620	655 mm	620 mm	**767 762**
S63 PS PHE 780	815 mm	780 mm	**767 763**
S64 PS PHE 880	915 mm	880 mm	**767 764**

Test Prod for Siemens 8CK Switchgear Installations

Category "S" for PHE III voltage detectors, Part Nos. 767 721, 767 722 and 767 740

Type	Total length l_G	Inserting depth l_O	Part No.
S63 PS PHE 8CK	880 mm	845 mm	**767 768** new



Test Prod for Mipak Switchgear Installations

Category "S" for PHE III voltage detectors, Part No. 767 731/S and 767 750/S

Type	Total length l_G	Inserting depth l_O	Part No.
S65 M PS PHE 905	940 mm	905 mm	**767 767**

SAFETY EQUIPMENT
VOLTAGE DETECTORS

Electric Bulb

For PHE

Type	Item	Part No.
GL 3.5V 0.2A E10	small electric bulb 3.5 V / 0.2 A	766 605

Mignon Battery

Type	Item	Part No.
MZ 1.5V L91 FR6 LI	Mignon battery 1.5 V, lithium	766 612
MZ 1.5V IEC LR6 AL	Mignon battery, 1.5 V, alkali manganese	766 613

Block Battery

Type	Item	Part No.
EB 9V LI	9 V E block battery, lithium	767 712
EB 9V AL	9 V E block battery, alkali manganese	767 713

Sealing Ring

Type	Item	Part No.
DR PS PHE3	sealing ring for PHE III test prod	767 779

Protective Rubber

Type	Item	Part No.
FSG PHE	protective rubber for PHE	767 776

Protective Rubber

Type	Item	Part No.
FSG PHG2 PHV	protective rubber for PHG II and PHV	767 777

Design of Phase Comparators

Phase comparators according to IEC/EN 61481 (DIN VDE 0682 Part 431) are designed for testing the in-phase condition of three-phase systems.

Testing for in-phase conditions may only be performed by a qualified electrician or electrotechnically supervised person.

Phase comparators have to be tested for their correct operation, immediately before and after use. For phase comparators that do not have a self-testing device, the correct operation must be proven by testing the phase comparator on parts of the installation that are connected to supply voltage.

Verifying in-phase conditions with the phase comparator has to be considered live working.

Phase comparators may only be used for the nominal voltages/nominal voltage ranges as indicated on the rating plate. The operator may be at risk if the phase comparator is used at higher or lower voltages than indicated on the rating plate (incorrect indication, exposure to high currents and electrical arcing).

Phase comparators marked "For indoor and outdoor systems" may not be used in wet weather.

Phase comparators marked "For indoor and outdoor systems, for use in wet weather" may be used for indoor systems and outdoors, even during wet weather conditions (e.g. rain, snow, fog or dew).

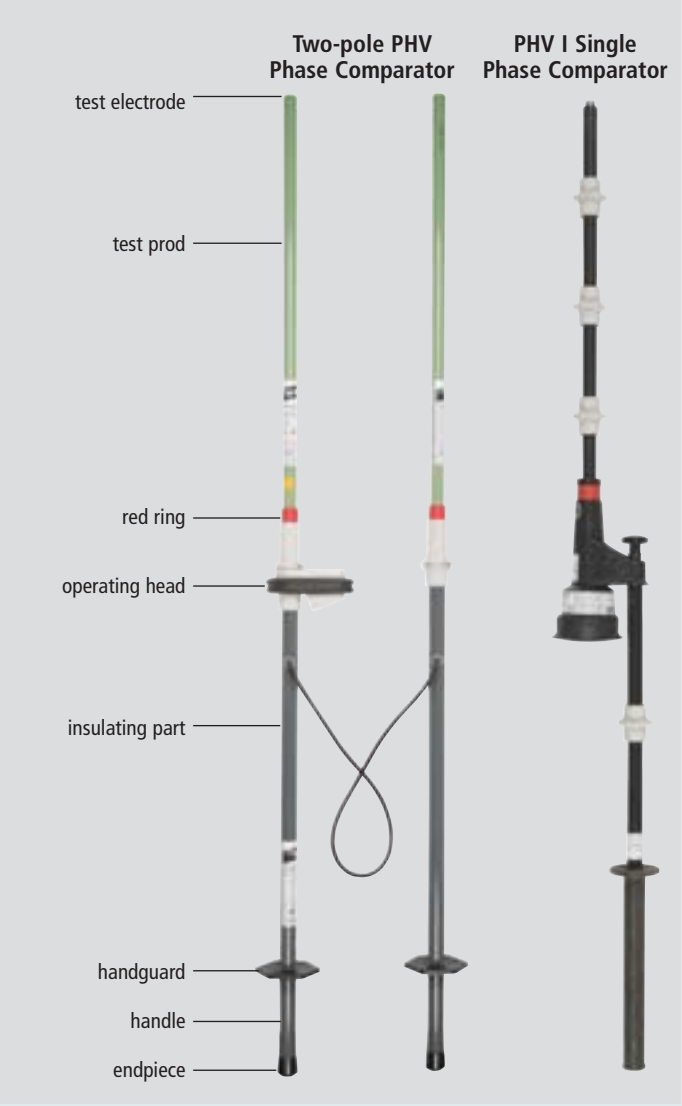
Restrictions apply to the use of phase comparators according to IEC/EN 61481 (DIN VDE 0682 Part 431) in prefabricated (type-tested) installations.
Due to reduced insulation distances, sparkovers may occur when inserting the test prod into the installation. The user or operator of the switchgear installation should consult with the manufacturer of the type-tested installation, before using the voltage detector.

Design of a phase comparator

Phase comparators according to IEC/EN 61481 (DIN VDE 0682 Part 431) can be used as **two-pole devices** (resistive phase comparator) and **single-pole devices** (capacitive phase comparator).

The design of single-pole phase comparators resembles that of a capacitive voltage detector. The principle of operation of the single-pole device is based on a microprocessor-controlled electronic storage system.
Belonging to the complete types of devices, PHV and PHV I are tested as a complete unit.
Single-pole phase comparators consist of a handle with handguard, the insulating part, indicator and test prod with its test electrode. Two-pole phase comparators have an additional connecting cable.
The **insulating part** is the section of the operating rod between the handguard and red ring. This part provides an adequate safety distance and safe isolation from the supply voltage.
The **test prod** consists of the part above the red ring towards the contact electrode (extension for the contact electrode). This part allows the user to reach remote parts of the installation and eliminates the influences of interference voltages.

The **handguard** is a clearly visible and sensible limit of the handguard to the insulating part. It prevents the user from slipping or contacting the insulating part with his hand.
The **red ring** marks the end of the insulating part towards the test electrode. It represents a visible limit for the user from contacting energised parts of the installation. The insulating clearance between the red ring and handguard must not contact energised parts, but contact with earthed parts is allowed.
The **test electrode** is the part of the phase comparator that is used to make contact with the installation that has to be tested.



Two-pole PHV Phase Comparator

Nominal voltages up to 36 kV / 50 Hz

EN/IEC 61481 (DIN VDE 0682 Part 431)

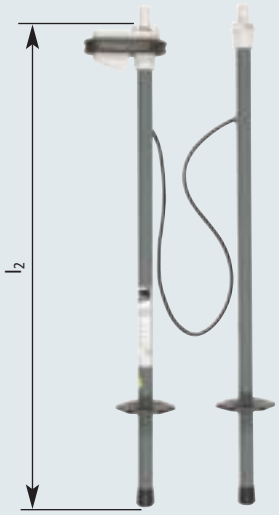
- Not for use in wet weather
- For indoor and outdoor installations
- Resistive, passive phase comparator
- Colour-coded test prods according to nominal voltage
- Eccentric arrangement of the indication allows for good visibility
- Short transport length due to attachable test prods

Two-pole PHV phase comparator with green pair of test prods (15 ... 24 kV) used for a 20 kV switchgear installation.

Bayonet coupling
Test prod / Basic device

Technical Data	
Insulating rod	Glass-fibre reinforced epoxy resin tube, Ø24 mm, grey
Endpiece	Non-slip plastic cap
Indicator	Plastic, fully insulated, grey
Connecting cable	Highly flexible Cu cable, plastic-insulated, 800 mm long
Operating temperature range	– 25° C ... + 55° C, Climatic category N
Test prod	Glass-fibre reinforced epoxy resin tube, Ø20 mm, grey, attachable; Test electrode made of Cu alloy/gal Sn, Ø20 mm, tooth shape for reliable contact, with female M8 thread for attaching electrodes
Indication	Flashing light for 'out of phase'

PHV Basic Device

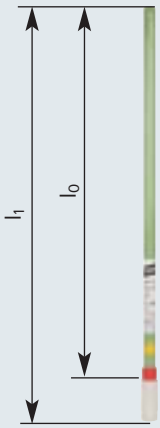


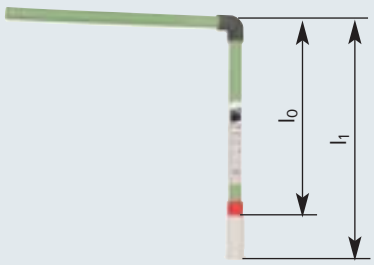
Type	Nominal voltage U_N	Length of basic device l_2	Part No.
A PHV Basic Device			
PHV 3 36	3 ... 36 kV	720 mm	**759 300**

SAFETY EQUIPMENT
PHASE COMPARATORS

Test Prods for PHV
For attaching to the basic device

Type	Nominal voltage U_N		Colour	Prod length l_1	Inserting depth l_0	Part No.
A Test Prods, straight (1 pc. per unit)						
PS 3 3.6 PHV	3 ... 3.6 kV		●	381 mm	316 mm	**759 603**
PS 5 7.2 PHV	5 ... 7.2 kV		○	681 mm	616 mm	**759 605**
PS 10 12 PHV	10 ... 12 kV		●	681 mm	616 mm	**759 610**
PS 15 24 PHV	15 ... 24 kV		●	681 mm	616 mm	**759 620**
PS 25 36 PHV	25 ... 36 kV		●	681 mm	616 mm	**759 630**
B Test Prods, Ø11 mm (1 pc. per unit) For prefabricated type-tested switchgear installations with limited access and remotely situated contacts (e.g. Mipak)						
PS 10 12 PHV D11	10 ... 12 kV		●	415 mm	330 mm	**759 111**
PS 20 24 PHV D11	20 ... 24 kV		●	585 mm	520 mm	**759 121**
C Test Prods, long (1 pc. per unit) For prefabricated type-tested switchgear installations with remotely situated series-connected contacts (e.g. Driescher D600)						
PS 15 24 PHV L880	15 ... 24 kV		●	880 mm	820 mm	**759 621**
D Test Prods, angled (90°) (1 pc. per unit) For prefabricated type-tested switchgear installations with limited access and contacts situated at a plane 90° to the horizontal plane (e.g. Alstom).						
PS 3 3.6 PHV W90	3 ... 3.6 kV		●	359 mm	274 mm	**759 604**
PS 5 7.2 PHV W90	5 ... 7.2 kV		○	359 mm	274 mm	**759 608**
PS 10 12 PHV W90	10 ... 12 kV		●	359 mm	274 mm	**759 611**
PS 15 24 PHV W90	15 ... 24 kV		●	359 mm	274 mm	**759 622**
PS 25 36 PHV W90	25 ... 36 kV		●	359 mm	274 mm	**759 633**





Types for other nominal voltages and special switchgear installations available on request.

Steel Plate Case, empty

Hammer-finished with foamed insert
Max. capacity:
1 PHV Basic device
4 Test prods, l = 681 mm (l = 381 mm available on request)

Type	Colour	Dimension	Part No.
SKL 95 21 10 V2	●	950 x 210 x 100 mm	**759 003**

Plastic Case, empty

With foamed insert
Max. capacity:
1 PHV Basic device
6 Test prods, straight

Type	Colour	Dimension	Part No.	
KKL PHV	●	920 x 200 x 120 mm	**759 999**	new

PHV I Single-pole Phase Comparator

Nominal voltages up to 36 kV / 50 Hz

EN/IEC 61481 (DIN VDE 0682 Part 431)

- For use in wet weather
- For indoor and outdoor installations
- Short transport length due to detachable insulating rod
- Frequency range 49.90 ... 50.10 Hz

Single-pole phase comparator PHV I used for a switchgear installation.

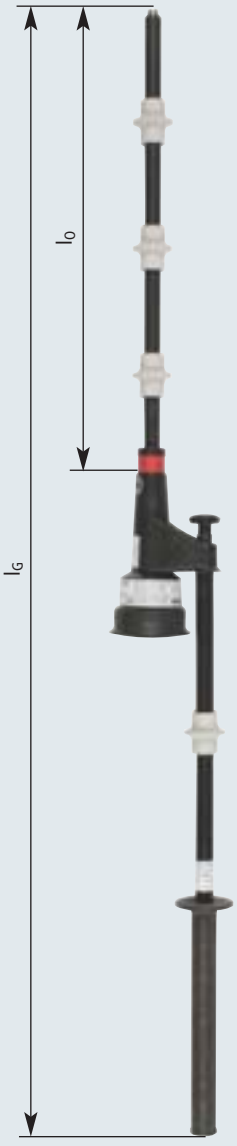
Self-testing device

The electronic Phase Comparator PHV I has an integrated self-testing device. The electronic circuit is automatically tested for correct operation when the phase comparator is switched on. The phase comparator will only be operational if the self test has been performed successfully and the yellow LED is permanently illuminated.

Replacing the battery

The PHV I phase comparator is supplied with 2 Mignon IEC LR 6 batteries. These batteries are situated in a separate battery compartment to allow for easy battery exchange.

When the batteries are low, the device can no longer be switched on or switches off automatically.



Technical Data	
Insulating rod	Glass-fibre reinforced polyester tube, Ø24 mm, black
Indicator	Plastic, fully insulated, black
Test prod	Plastic, Ø22 mm; Test electrode, tooth shape for reliable contact, with female M8 thread for attaching electrodes
Operating temperature range	– 25° C ... + 55° C, Climatic category N
Indication	Visual: LED indication
Ready for operation	Yellow permanent light
In-phase condition	Green permanent light
Out-of-phase condition	Red flashing light

A

B

Type	Nominal voltage U_N	Total length l_G	Inserting depth l_O	Part No.
A Nominal Voltages up to 36 kV / 50 Hz				
PHV1 6 12	6 ... 12 kV	1400 mm	575 mm	**759 606**
PHV1 12 24	12 ... 24 kV	1600 mm	775 mm	**759 612**
PHV1 24 36	24 ... 36 kV	1600 mm	775 mm	**759 624**
B Nominal Voltage Ranges up to 36 kV / 50 Hz, switchable by Selector Switch				
PHV1 U 6 36	6 ... 12 / 12 ... 24 / 24 ... 36 kV	1600 mm	775 mm	**759 616**

SAFETY EQUIPMENT
PHASE COMPARATORS

Accessories

Onion-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 SZ PHE PHV	from 3 kV	Ms/gal CuSn	**766 913**

Pin-shape Electrode

With additional M6 thread

Type	Nominal voltage U_N	Material	Part No.
EL M8 S PHE PHV	from 3 kV	stainless steel	**766 925**

Y-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 V PHE PHV	from 3 kV	Cu/gal Sn	**766 927**

Eaton Holec Magnefix Electrode

For Eaton Holec Magnefix switchgear installations type MA, MD4, MF, MG, MY

Type	Nominal voltage U_N	Material	Part No.
EL M8 MAG PHE PHV	3 ... 15 kV	Ms/gal CuSn, PVC	**766 915**

Artificial Leather Bag, empty

With shoulder strap

Type	Colour	Dimension	Part No.
KLT 121 25 16	●	1200 x 250 x 160 mm	**766 601**

Accessories for PHV I Single Phase Comparator

Plastic Case, empty

With foamed insert

Type	Colour	Dimension	Part No.	
KKL PHV1	●	1270 x 200 x 120 mm	**759 998**	new

Spare Parts

Mignon Battery

Type	Item	Part No.
MZ 1.5V L91 FR6 LI	Mignon battery 1.5 V, lithium	**766 612**
MZ 1.5V IEC LR6 AL	Mignon battery, 1.5 V, alkali manganese	**766 613**

Sealing Ring

Type	Item	Part No.
DR PHV	sealing ring for PHV basic device	**767 778**

Protective Rubber

Type	Item	Part No.
FSG PHG2 PHV	protective rubber for PHG II and PHV	**767 777**

Design of DEHNcap Voltage Detecting Systems

Metal encapsulated switchgear installations, normally SF6 gas-insulated, have become widely accepted in the field of switchgear construction.
Testing for safe isolation from supply voltages in these types of installations can often not be performed with conventional voltage detectors according to IEC/EN 61243-1 (DIN VDE 0682 Part 411). For this reason, capacitive voltage detector systems have been developed in compliance with IEC/EN 61243-5 (DIN VDE 0682 Part 415). The capacitive voltage detecting systems are designed to verify the safe isolation from supply voltages on all poles and at work locations according to DIN VDE 0105 Part 100.

Verifying the safe isolation from supply voltages may only be performed by a qualified electrician or electrotechnically instructed person.

Our delivery programme for capacitive voltage detecting systems consists of:

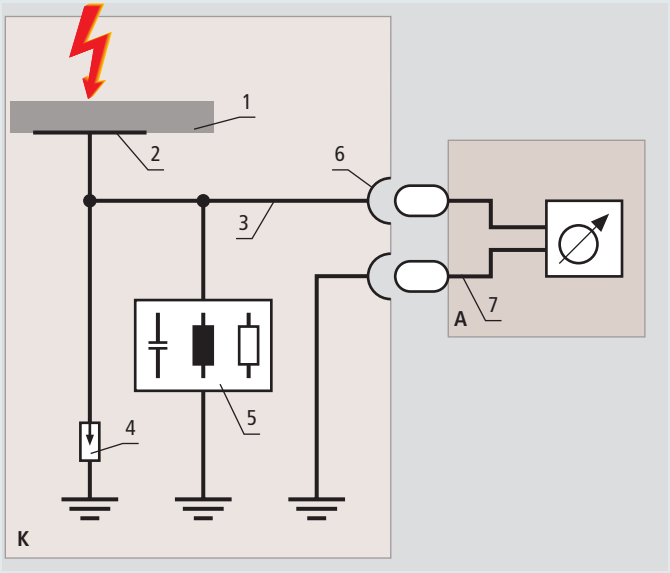
– Coupling units (K): DEHNcap/M...
– Indicators (A): DEHNcap/...

Coupling units, fixed parts of installations

Coupling units are components of a pluggable voltage protective system fixed in switchgear installations. Coupling units consist of a coupling capacitance (2), connecting cable (3), voltage-limiting device (4), measuring circuit (5) and measuring point (6).
The coordinated components, capacitive divider insulator type DEHNcap/TS and interface module type DEHNcap/M, constitute one complete coupling unit. The capacitive divider insulator consists of the coupling capacitance and interface module DEHNcap/M including the voltage-limiting device, measuring circuit and test points.
The DEHNcap/M interface module is designed for three-phase a.c. systems with reference to its threshold values.
The DEHNcap/MDS interface module has a universal coupling electrode and can be coordinated with existing installations where coupling capacitances are readily available e.g. a gap, measurement transformer or another divider insulator. Both the DEHNcap/M and DEHNcap/MDS interface modules can be provided as HR and LRM systems.

Response voltage, clear indication

In order to obtain a clear indication, the coupling units have to be designed to ensure an indication of "voltage present" at a line-to-earth voltage of maximum 45% of the nominal voltage. At a line-to-earth voltage less than 10% of the rated voltage, no indication may appear. These limit values apply to any type of voltage detecting system (HR-, LRM system). This means that the threshold voltages of 90 V ac for HR systems and 5 V ac for LRM systems must be obtained for the above mentioned limits.



Capacitive voltage detecting system for high-voltage installations – Basic circuit diagram

K **DEHNcap/M...** Coupling unit
A **DEHNcap/...** Indicator
1 Active part of the high-voltage installation
2 Coupling capacitance (coupling electrode with coupling dielectric)
3 Connecting cable
4 Voltage-limiting device
5 Measuring circuit
6 Measuring point
7 Connecting cable

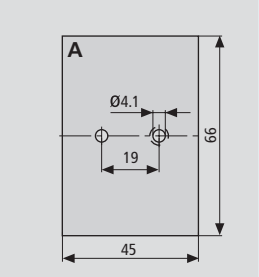
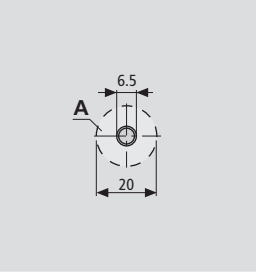
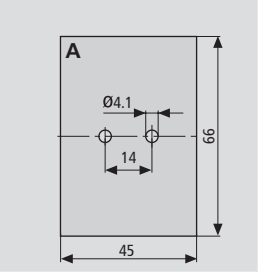
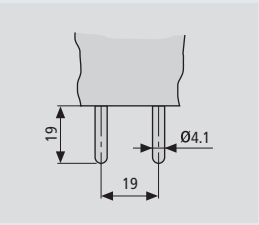
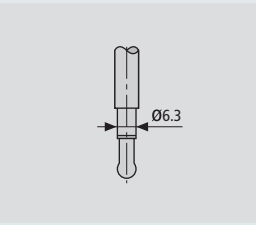
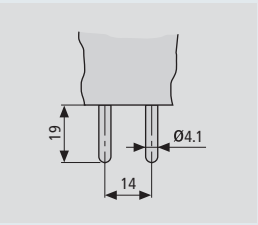
Nominal voltage and rated voltage

Coupling units according to EN/IEC 61243-5 (DIN VDE 0682 Part 415) are preferably installed into medium-voltage switchgear installations according to DIN VDE 0670 Part 6 or EN/IEC 62271-200 (DIN VDE 0671 Part 200). However, these standards define the voltage values differently. EN/IEC 61243-5 (DIN VDE 0682 Part 415) for capacitive voltage detecting systems, defines the voltage as nominal voltage. DIN VDE 0670 Part 6 for medium-voltage switchgear installations, however, defines the voltages as rated voltages.

IEC/EN 61243-5 (DIN VDE 0682 Part 415)	**Nominal voltage**	6 kV	10 kV	20 kV	30 kV
DIN VDE 0670 Part 6 IEC/EN 62271-200 (DIN VDE 0671 Part 200)	**Rated voltage**	7.2 kV	12 kV	24 kV	36 kV

DEHNcap Voltage Detecting System

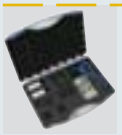
Electrical and mechanical requirements for the interfaces of pluggable HR, LR and LRM voltage detecting systems

System description		HR High resistance	LR Low resistance	LRM Low resistance, modified
Input impedance of the indicator	X_C	36 MΩ	2 MΩ	2 MΩ
Electrical response conditions of the interface	I	2.5 µA	2.5 µA	2.5 µA
Electrical response conditions of the interface	U	90 V	5 V	5 V
Socket arrangement and minimum tooling border A for indicator or plug				
Plug arrangement				

SAFETY EQUIPMENT

VOLTAGE DETECTING SYSTEMS

Selection Guide

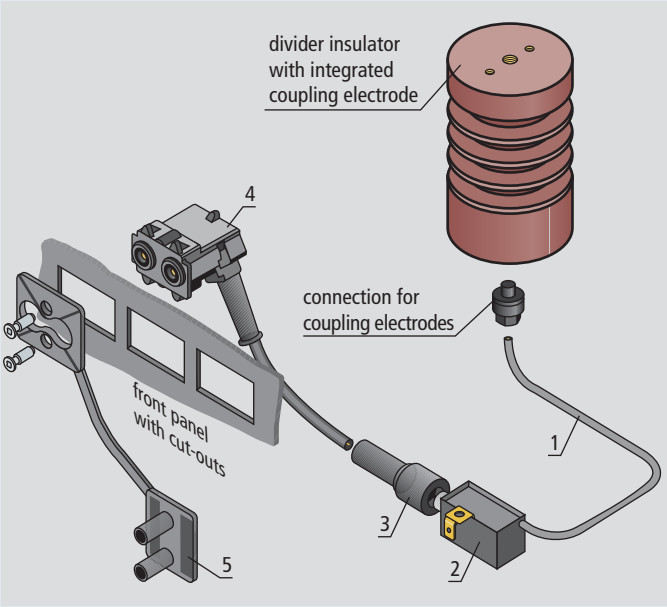
	Device	Nominal voltage U_N / Frequency f_N	Indication, Application	Page
	Coupling Unit DEHNcap/MDS Interface Module	up to 45 kV / 50 Hz	Three-pole cable set Saline fog tested HR and LRM test point Adapted to existing capacitive coupling electrodes Separate coupling and front panel unit	56
	Coupling Unit DEHNcap/M Interface Module	up to 45 kV / 50 Hz	Three-pole cable set Saline fog tested HR and LRM test point Anti-rotation terminal for coupling electrodes	57
	DEHNcap/P Voltage Indicator	up to 45 kV / 50 Hz	Passive detector without batteries LED indication Can also be used as a permanent voltage detector	58
	DEHNcap/P Test Unit	230 V / 50 Hz	Test unit for DEHNcap/P Plugs into 230 V socket outlets For HR and LRM indicators	59
	DEHNcap/A Voltage Indicator	up to 45 kV / 50 Hz	Active voltage detector Indication provided by two separate LEDs With self-testing device and battery control Automatic deactivation	60
	DEHNcap/IT Interface Test Unit	up to 45 kV / 50 Hz	Active indicator test unit for routine tests Indication by two separate LEDs With self-testing device and battery control Automatic deactivation	62
	DEHNcap/PC-LRM Phase Comparator	up to 45 kV / 50 Hz	Active indicator for proving the in-phase condition Can be used for HR systems with two HR-LRM test adapters Indication by three separate LEDs The comparator registers zero crossings of both installations to be compared With battery control	64
 	Storage Bags and Transport Cases		Case: Steel plate or plastic Bag: Artificial leather or canvas	68

DEHNcap/MDS Interface Modules

Nominal voltages up to 45 kV / 50 Hz

EN/IEC 61243-5 (DIN VDE 0682 Part 415)

- Three-pole cable set
- Saline fog tested
- For use as HR or LRM test point (measuring socket) incl. fixing frame and socket cover
- Adapted to existing, capacitive coupling electrodes
- Separate coupling and front panel unit



DEHNcap/MDS Interface module (single-pole unit)

The **front panel unit** consists of a test point (measuring sockets), fixing frame with socket cover and coax connecting cable.
The **coupling unit** consists of a connecting cable for coupling electrodes, integrated voltage-limiting device with earth connection and terminal for connecting cables (coaxial screwed gland) to the front panel unit.

The DEHNcap/MDS interface modules can be coordinated with all types of devices that have capacitive coupling electrodes, e.g. divider insulators, voltage transformers, bushings as well as internal and external cone-type cable connectors.

Please confirm the following data when placing your order:

- Type of test point (measuring socket): _____ HR system or _____ LRM system
- Required length of the connecting/ coaxial cable to the front panel unit (if different from 4500 mm): _____ mm
- Value of existing coupling capacitance: _____ pF
- Nominal voltage of the installation: _____ kV

DEHNcap/MDS Coupling Unit

1 Connecting cable for coupling electrodes
2 Circuit with integrated voltage-limiting device and earth connection
3 Coaxial screwed gland

DEHNcap/MDS Front Panel Unit:

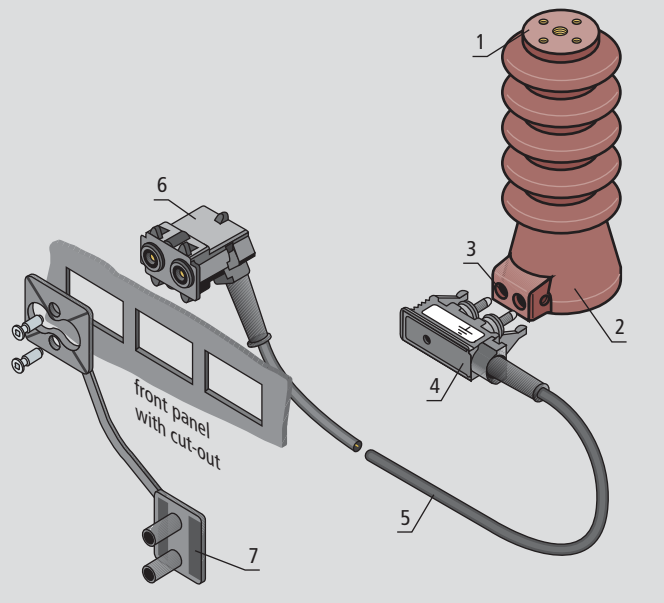
4 Measuring sockets (HR/LRM interface) with coaxial connecting cable
5 Fixing frame with socket cover

Type	Design	Distance between measuring sockets	Cable length	Part No.
A DEHNcap/MDS-HR (consisting of 3 pcs. each)				
FPE DCA HR	front panel unit	19 mm	4500 mm	**767 815**
AKE DCA HR	coupling unit		200 mm	**767 816**
B DEHNcap/MDS-LRM (consisting of 3 pcs. each)				
FPE DCA LRM	front panel unit	14 mm	4500 mm	**767 825**
AKE DCA LRM	coupling unit		200 mm	**767 826**

SAFETY EQUIPMENT
VOLTAGE DETECTING SYSTEMS

DEHNcap/M Interface Modules
Nominal voltages up to 45 kV / 50 Hz

EN/IEC 61243-5 (DIN VDE 0682 Part 415)



DEHNcap/M interface module (single-pole unit)

- Three-pole cable set
- Saline fog tested
- For use as HR or LRM test point (measuring socket) incl. fixing frame and socket cover
- Anti-rotation terminal for coupling electrodes for divider insulators made by Driescher in Moosburg/Germany

Divider insulator

1 Fixing points for busbar
2 Fixing point and earth connection
3 Terminal sockets for coupling electrodes

DEHNcap/M Interface module

4 Terminal plug for coupling electrodes with integrated voltage-limiting device
5 Connecting cable (coaxial)
6 Measuring sockets (HR/LRM interface)
7 Fixing frame with socket cover

Type	Nominal voltage U_N	For divider insulators by Driescher*)	Distance between measuring sockets	Cable length	Part No.
A DEHNcap/M-HR (consisting of 3 pcs. each)					
SM DCA M HR 10 12	10 ... 12 kV	2-45194099	19 mm	4000 mm	**767 810**
SM DCA M HR 10 24	10 ... 24 kV	2-45193948	19 mm	4500 mm	**767 830**
SM DCA M HR 30 36	30 ... 36 kV	2-45165402	19 mm	7000 mm	**767 851**
B DEHNcap/M-LRM (consisting of 3 pcs. each)					
SM DCA M LRM 6 12	6 ... 12 kV	2-45194099	14 mm	4000 mm	**767 820**
SM DCA M LRM 10 24	10 ... 24 kV	2-45193948	14 mm	4500 mm	**767 840**
SM DCA M LRM 20 36	20 ... 36 kV	2-45165402	14 mm	7000 mm	**767 861**

*) Divider insulators can be purchased from the company Driescher in Moosburg/Germany with this Part No. They are not included in our product range.

DEHNcap/P Voltage Indicator

Nominal voltages up to 45 kV / 50 Hz

EN/IEC 61243-5 (DIN VDE 0682 Part 415)

- Passive voltage indicator without batteries
- LED indication
- Can also be used as a permanent voltage detector

Technical Data	
HR system	Threshold of indication 90 V, Input impedance 36 MOhm
LRM system	Threshold of indication 5 V, Input impedance 2 MOhm
Degree of protection	IP 66
Operating temperature range	– 25° C ... + 55° C
Indication	Red flashing LED, repetition frequency min. 1 Hz for 'voltage present'; No indication for 'no voltage present'

Passive DEHNcap/P voltage detector used for an encapsulated switchgear installations.

Testing DEHNcap/P

EN 50110-1 (DIN VDE 0105 Part 100) requires that voltage detectors must be tested for operating correctly, shortly before and after use.
DEHNcap is a passive voltage indicator without self-testing and is tested for operating correctly by plugging into a 230 V supply voltage using the DEHNcap/P test unit.

Type	Dimension	Distance between plugs	Part No.
A DEHNcap/P – HR			
SAG DCA P HR	40 x 48 x 35 mm	19 mm	**767 101**
B DEHNcap/P – LRM			
SAG DCA P LRM	40 x 48 x 35 mm	14 mm	**767 102**

Accessories for DEHNcap/P Voltage Indicator

Plastic Case, empty

With foamed insert

Max. capacity:
1 DEHNcap/PC
2 DEHNcap/A or IT
2 Test adapters
2 DEHNcap/P
1 DEHNcap/P test unit

Type	Colour	Dimension	Part No.
KKL DCA		395 x 295 x 105 mm	**767 107**

SAFETY EQUIPMENT
VOLTAGE DETECTING SYSTEMS

DEHNcap/P Test Unit
Nominal voltage 230 V / 50 Hz

EN/IEC 61243-5 (DIN VDE 0682 Part 415)

Unit for testing a passive DEHNcap/P voltage indicator for correct operation by means of a 230 V socket outlet.

- **Unit for easy testing of DEHNcap/P voltage indicators for correct operation**
- **Plugs into 230 V socket outlets**
- **For HR and LRM indicators**

Unit for easy testing of DEHNcap/P voltage indicators or other voltage indicators for correct operation. Supplied with mains voltage, the test unit generates both test voltages for HR (HO) and LRM detecting systems. Both HR and LRM indicators can be plugged in for testing.

Technical Data	
HR system	Test voltage 90 V ~, distance between sockets 19 mm
LRM system	Test voltage 5 V ~, distance between sockets 14 mm
Nominal power	500 mW
Max. short-circuit current at the test sockets	approx. 20 µA
Operating temperature range	– 25° C ... + 55° C

Type	Dimension	Part No.
A Test Unit for DEHNcap/P HR/LRM		
TG DCA	43 x 75 x 35 mm	**767 110**

Accessories for DEHNcap Test Adapter/Test Impedance

Plastic Case, empty
With foamed insert

Max. capacity:
1 DEHNcap/PC
2 DEHNcap/A or IT
2 Test adapters
2 DEHNcap/P
1 DEHNcap/P test unit

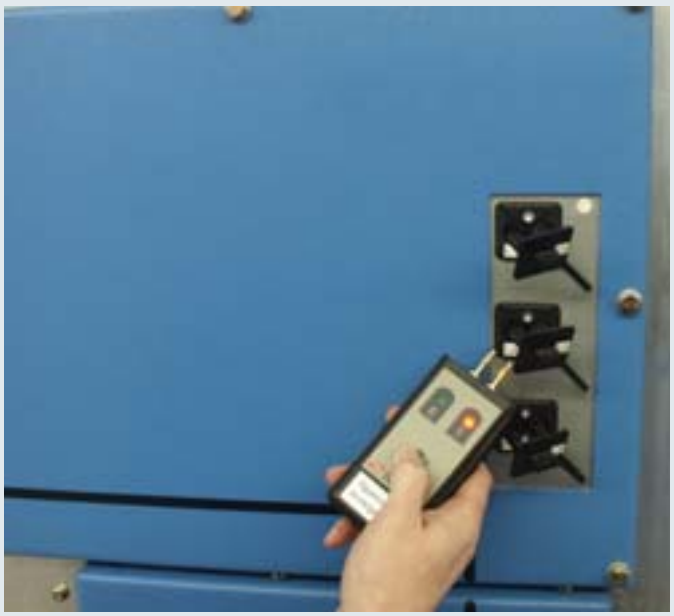
Type	Colour	Dimension	Part No.
KKL DCA		395 x 295 x 105 mm	**767 107**

DEHNcap/A Voltage Indicator

Nominal voltages up to 45 kV / 50 Hz

EN/IEC 61243-5 (DIN VDE 0682 Part 415)

- Active voltage indicator for verifying safe isolation from power supply voltages
- Indication by two separate LEDs
- With integrated self-testing device and battery control
- Automatic deactivation after use

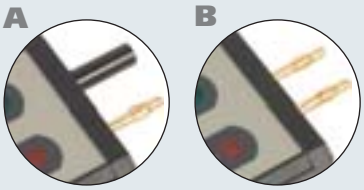


Self-testing of DEHNcap/A voltage indicator.

Self-testing device
The electronic DEHNcap/A voltage indicator has an integrated self-testing device. By pressing the test button, the indicator is switched on and the electronic circuit is tested for correct operation. The voltage indicator will only be operational if the self test has been performed successfully.

Replacing the battery
The 9 V Block battery can be replaced by hand without tools.
Low batteries are indicated by both LEDs illuminated when pressing the test button.

Technical Data	
HR system	Threshold of indication 90 V, Input impedance 36 MOhm
LRM system	Threshold of indication 5 V, Input impedance 2 MOhm
Operating temperature range	– 25° C ... + 55° C
Indication	Red LED '↯' (flashing light) for 'voltage present'; Green LED '**0**' (permanent light) for 'no voltage present'



Type	Dimension	Distance between plugs	Part No.
A DEHNcap/A – HR			
SAG DCA A HR	120 x 60 x 25 mm	19 mm	**767 111**
B DEHNcap/A – LRM			
SAG DCA A LRM	120 x 60 x 25 mm	14 mm	**767 112**

Accessories for DEHNcap/A Voltage Detector

HR-LRM Test Adapter

For electrical and mechanical adaptation of HR (HO) systems to LRM systems
Used as a test impedance with X_C = 36 MOhm. For routine testing of HR coupling units (with suitable µA meter).

Type	Dimension	Distance between plugs	Distance between sockets	Part No.
MA DCA HR LRM	85 x 50 x 30 mm	19 mm	14 mm	**767 133**

LR-LRM Test Adapter

For mechanical adaptation of LR (NO) systems to LRM systems

Type	Dimension	Distance between plugs	Distance between sockets	Part No.
MA DCA LR LRM	105 x 50 x 30 mm	jack 6.3 mm	14 mm	**767 136**

Plastic Case, empty

With foamed insert

Type	Colour	Dimension	Part No.
KKL 26 22 5	●	265 x 225 x 50 mm	**767 106**

Plastic Case, empty

With foamed insert

Max. capacity:
1 DEHNcap/PC
2 DEHNcap/A or IT
2 Test adapters
2 DEHNcap/P
1 DEHNcap/P test unit

Type	Colour	Dimension	Part No.
KKL DCA	●	395 x 295 x 105 mm	**767 107**

DEHNcap/IT Interface Test Unit

Nominal voltages up to 45 kV / 50 Hz

EN/IEC 61243-5 (DIN VDE 0682 Part 415)

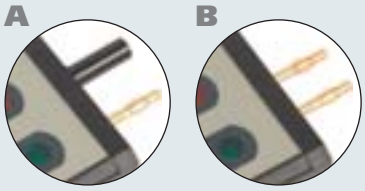
- Active interface test unit used for routine testing of coupling units
- Indication by two separate LEDs
- With integrated self-testing device and battery control
- Automatic deactivation after use

DEHNcap/IT interface test unit allows for routine tests at coupling units of switchgear installations according to EN/IEC 61243-5 (DIN VDE 0682 Part 415).

Self-testing device
The electronic DEHNcap/IT interface test unit has an integrated self-testing device. Pressing the test button, the interface test unit is switched on and the electronic circuit is tested for correct operation. The interface test unit will only be operational, if the self test has been performed successfully.

Battery exchange
The 9 V Block battery can be replaced by hand without tools.
Low batteries are indicated by both LEDs illuminated when pressing the test button.

Technical Data	
HR system	Input impedance 36 MOhm
LRM system	Input impedance 2 MOhm
Test threshold	3.2 µA
Operating temperature range	– 25° C ... + 55° C
Indication	Red LED '**no**' (permanent light) for 'test not passed'; Green LED '**yes**' (permanent light) for 'test passed'



Type	Dimension	Distance between plugs	Part No.
A DEHNcap/IT – HR			
SPG DCA IT HR	120 x 60 x 25 mm	19 mm	**767 121**
B DEHNcap/IT – LRM			
SPG DCA IT LRM	120 x 60 x 25 mm	14 mm	**767 122**

Accessories for DEHNcap/IT Interface Test Unit

HR-LRM Test Adapter

For electrical and mechanical adaptation of HR (HO) systems to LRM systems.
Used as a test impedance with X_C = 36 MOhm. For routine testing of HR coupling units (with suitable µA meter).

Type	Dimension	Distance between plugs	Distance between sockets	Part No.
MA DCA HR LRM	85 x 50 x 30 mm	19 mm	14 mm	**767 133**

LR-LRM Test Adapter

For mechanical adaptation of LR (NO) systems to LRM systems

Type	Dimension	Distance between plugs	Distance between sockets	Part No.
MA DCA LR LRM	105 x 50 x 30 mm	jack 6.3 mm	14 mm	**767 136**

XC-LRM Test Impedance

Used as a test impedance with X_C = 2 MOhm.
For routine testing of LRM coupling units (with suitable µA meter)

Type	Dimension	Distance between plugs	Distance between sockets	Part No.
MA DCA XC LRM	85 x 50 x 30 mm	14 mm	16 mm	**767 135**

Plastic Case, empty

With foamed insert

Type	Colour	Dimension	Part No.
KKL 26 22 5	●	265 x 225 x 50 mm	**767 106**

Plastic Case, empty

With foamed insert

Max. capacity:
1 DEHNcap/PC
2 DEHNcap/A or IT
2 Test adapters
2 DEHNcap/P
1 DEHNcap/P test unit

Type	Colour	Dimension	Part No.
KKL DCA	●	395 x 295 x 105 mm	**767 107**

DEHNcap/PC-LRM Phase Comparator

Nominal voltages up to 45 kV / 50 Hz

EN/IEC 61243-5 (DIN VDE 0682 Part 415)

- Active indicator for proving the in-phase condition of LRM systems
- Can be used for HR systems HR-LRM test adapters
- Indication by three separate LEDs
- The comparator registers zero crossings of both installations to be compared
- With battery control

Use of DEHNcap/PC-LRM phase comparator with two HR-LRM test adapters for an HR switchgear installation.

The DEHNcap/PC-LRM phase comparator can also be used for phase comparison on HR systems by means of two optional HR-LRM adapters (Part No. 767 133). The device is designed as a universal phase comparator in accordance with EN/IEC 61243-5 (DIN VDE 0682 Part 415) and detects zero crossings but no voltage values.

Replacing the battery
The 9 V Block battery can be replaced by hand without tools.
When the batteries are low, the device can no longer be switched on or switches off automatically.

Technical Data	
LRM system	Threshold of indication 5 V, Input impedance 2 MOhm
Measuring cables	3 measuring cables with 4 mm plug
Operating temperature range	-25° C ... +55° C
Indication	Red light '≠' for 'out of phase' (permanent light) if 'phase angle > 60° '; Green light '=' for 'in phase'; Yellow light 'POWER ON' (permanent light) for 'device ready for operation'

Type	Dimension	Length of measuring cable	Part No.
A DEHNcap/PC – LRM			
PV DCA PC LRM	145 x 85 x 32 mm	2000 mm	**767 132**

Accessories for DEHNcap/PC-LRM Phase Comparator

HR-LRM Test Adapter

For electrical and mechanical adaptation of HR (HO) systems to LRM systems
Used as a test impedance with X_C = 36 MOhm. For routine testing of HR coupling units (with suitable µA meter).

Type	Dimension	Distance between plugs	Distance between sockets	Part No.
MA DCA HR LRM	85 x 50 x 30 mm	19 mm	14 mm	**767 133**

LR-LRM Test Adapter

For mechanical adaptation of LR (NO) systems to LRM systems

Type	Dimension	Distance between plugs	Distance between sockets	Part No.
MA DCA LR LRM	105 x 50 x 30 mm	jack 6.3 mm	14 mm	**767 136**

Plastic Case, empty

With foamed insert

Max. capacity:
1 DEHNcap/PC
2 DEHNcap/A or IT
2 Test adapters
2 DEHNcap/P
1 DEHNcap/P test unit

Type	Colour	Dimension	Part No.
KKL DCA	●	395 x 295 x 105 mm	**767 107**

Artificial Leather Bag, empty

Type	Colour	Dimension	Part No.
KLT 23 16 4	●	235 x 160 x 40 mm	**767 500**

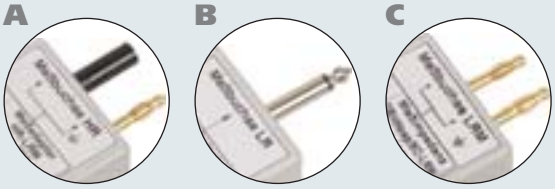
DEHNcap Test Adapter/Test Impedance

EN/IEC 61243-5 (DIN VDE 0682 Part 415)

- Easy mechanical and electrical adaptation to HR, LR or XC test sockets
- Measuring impedance for routine testing of coupling units with suitable µA meter
- 4 mm safety plugs or sockets
- Conductive HR plug, insulated

The HR-LRM test adapter allows for use of an LRM indicator for an HR test socket.

Technical Data	
Terminal plug	Plug 2 x 4 mm or jack
Measuring sockets	Socket 2 x 24 mm
Operating temperature range	– 25° C ... + 55° C



Type	Dimension	Distance between plugs	Distance between sockets	Part No.
A HR-LRM Test Adapter For electrical and mechanical adaptation of HR (HO) systems to LRM systems Used as a test impedance with X_C = 36 MOhm. For routine testing of HR coupling units (with suitable µA meter).				
MA DCA HR LRM	85 x 50 x 30 mm	19 mm	14 mm	**767 133**
B LR-LRM Test Adapter For mechanical adaptation of LR (NO) systems to LRM systems				
MA DCA LR LRM	105 x 50 x 30 mm	jack 6.3 mm	14 mm	**767 136**
C XC-LRM Test Impedance Used as a test impedance with X_C = 2 MOhm. For routine testing of LRM coupling units (with suitable µA meter)				
MA DCA XC LRM	85 x 50 x 30 mm	14 mm	16 mm	**767 135**

Accessories for DEHNcap Test Adapters / Test Impedance

Plastic Case, empty

With foamed insert

Type	Colour	Dimension	Part No.
KKL 26 22 5	●	265 x 225 x 50 mm	**767 106**

Plastic Case, empty

With foamed insert

Max. capacity:
1 DEHNcap/PC
2 DEHNcap/A or IT
2 Test adapters
2 DEHNcap/P
1 DEHNcap/P test unit

Type	Colour	Dimension	Part No.
KKL DCA	●	395 x 295 x 105 mm	**767 107**

Spare Parts

Block Battery

Type	Battery type	Part No.
EB 9V AL	9 V E block battery, alkali manganese	**767 713**
EB 9V LI	9 V E block battery, lithium	**767 712**

Storage Bags and Transport Cases

For Voltage Detectors, Phase Comparators and Voltage Detecting Systems

Type	Dimension	Colour	Part No.
A Steel Plate Case			
SKL 92 16 10	920 x 160 x 100 mm	blue	**766 703**
SKL 95 21 10 V2	950 x 210 x 100 mm	blue	**759 003**
SKL 95 21 10	950 x 210 x 100 mm	blue	**767 701**
SKL 116 16 10	1160 x 160 x 100 mm	blue	**766 603**

B Plastic Case			
KKL 26 22 5	265 x 225 x 50 mm	black	**767 106**
KKL PK PHE3 L	395 x 295 x 105 mm	grey	**766 036**
KKL DCA	395 x 295 x 105 mm	grey	**767 107**
KKL PHV	920 x 200 x 120 mm	black	**759 999**
KKL PHE	920 x 200 x 120 mm	black	**766 997**
KKL PHE3	920 x 200 x 120 mm	black	**767 997**
KKL PHV1	1270 x 200 x 120 mm	black	**759 998**
KKL PHE3 60 110	1270 x 200 x 120 mm	black	**766 998**
KKL PHE L	1270 x 200 x 120 mm	black	**766 999**
KKL PHE3 L	1270 x 200 x 120 mm	black	**767 999**

C Artificial Leather Bag			
KLT 98 9	Ø95 x 980 mm	black	**767 531**
KLT 160 17	Ø170 x 1600 mm	black	**766 614**
KLT 23 16 4	235 x 160 x 40 mm	black	**767 500**
KLT 114 23 5	1140 x 230 x 50 mm	black	**767 702**
KLT 121 25 16	1200 x 250 x 160 mm	black	**766 601**
KLT 247 10 22	2470 x 220 x 100 mm	black	**766 602**

D Canvas Bag			
STT 180 20	Ø200 x 1800 mm	olive	**766 039**
STT 120 30 15	1200 x 300 x 150 mm	olive	**766 704**

Example:

Requested: Storage bag and transport case for PHE III Voltage Detector, Part No. **767 720**

Result:

	Steel Plate Case	Part No. **767 701**
or	Plastic Case	Part No. **767 997** and **767 999**
or	Artificial Leather Bag	Part No. **767 702**

Storage Bags and Transport Cases

Selection Chart

		Steel plate case				Plastic case										Artificial leather bag						Canvas bag	
		766 703	759 003	767 701	766 603	767 106	766 036	767 107	759 999	766 997	767 997	759 998	766 998	766 999	767 999	767 531	766 614	767 500	767 702	766 601	766 602	766 039	766 704
Voltage detector	766 037																					●	
	766 616																				●		
	766 617																						●
	767 214																●						
	767 403	●								●										●			
	767 406	●								●										●			
	767 410	●								●										●			
	767 415				●									●						●			
	767 416				●									●						●			
	767 418	●								●										●			
	767 420				●									●						●			
	767 428	●								●										●			
	767 430				●									●						●			
	767 433				●									●						●			
	767 438	●								●										●			
	767 541															●							
	767 542															●							
	767 600																●						
	767 601																			●			●
	767 602																			●			●
	767 703			●							●				●				●				
	767 706			●							●				●				●				
	767 710			●							●				●				●				
	767 711			●							●				●				●				
	767 720			●							●				●				●				
	767 721			●							●				●				●				
	767 722 Kit			●			●				●				●				●				
	767 723 Kit						●						●										
	767 730			●							●				●				●				
	767 733			●							●				●				●				
	767 740			●							●				●				●				
	767 750			●							●				●				●				
	767 921			●							●				●				●				
	767 922			●			●				●				●				●				
	767 931			●							●				●				●				
	767 932			●			●				●				●				●				
Phase comparator	759 300		●						●														
	759 606											●								●			
	759 612											●								●			
	759 616											●								●			
	759 624											●								●			
Voltage detecting system	767 101							●															
	767 102							●															
	767 110							●															
	767 111					●		●															
	767 112					●		●															
	767 121					●		●															
	767 122					●		●															
	767 132							●										●					
	767 133					●		●															
	767 135					●		●															
	767 136					●		●															

SAFETY EQUIPMENT

Selection Guide

OPERATING RODS

	Device	Nominal voltage U_N / Frequency f_N	Application	Page
	SZ Fuse Tongs	up to 36 kV	Not for use in wet weather Operating head with two adjustable jaws Straight or angled (20°) operating head High clamping Wide clamping range Ø30 ... 90 mm	72
	IS Insulating Rods	up to 123 kV / 50 Hz	Not for use in wet weather For indoor and outdoor installations Attachable operating head allows for use as a switching rod Supporting head for hexagon shaft or T pin shaft Also for use as an earthing rod For use as operating rod for insulating protective shutters	74
	SCS Switching Rods	up to 110 kV / 50 Hz	Not for use in wet weather For indoor and outdoor installations Fully insulated, massive operating head Allows for deep access to the installation For use as operating rod for insulating protective shutters	76
	IS M55 Insulating Rod (Kit)	up to 36 kV / 50 Hz	Not for use in wet weather For indoor and outdoor installations Screw coupling with protection against twisting and bridging Modular kit system for various applications For use as a switching rod, earthing rod, operating rod or insulating rod	77
	RST Rescue Rods	up to 36 kV / 50 Hz	Not for use in wet weather For indoor and outdoor installations Fully insulated rescue hook with protection against twisting For rescuing persons (up to approx. 100 kg) from hazard zones in the event of electrical accidents	80

SZ Fuse Tongs

Nominal voltages up to 36 kV

DIN VDE 0681 Part 3

- Not for use in wet weather
- Operating head with two adjustable jaws
- Straight and angled (20°) operating head
- High clamping (up to 6.8 kg in weight) due to symmetrical clamping jaws with integrated rubber surfaces
- Wide clamping range Ø30 ... 90 mm

Angled (20°) SZ fuse tongs for installing and removing h.v.h.b.c. fuses.

A fuse tong is an operating rod used for working on energised parts of installations with voltages exceeding 1 kV ac. The operating head is used for removing and installing high-breaking capacity fuses (h.v.h.b.c. fuses). The clamping jaws are opened and closed by simply turning the adjusting handle.

Technical Data	
Insulating rod	Glass-fibre reinforced polyester tube, Ø43 mm, grey
Clamping head	Glass-fibre reinforced polyamide, black
Adjustable handle	Polyamide, grey
Reducing insert	Polyamide, grey

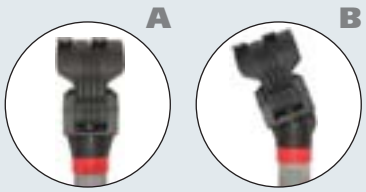
In practise, the angled clamping head (20°) allows for safe and easy handling of h.v.h.b.c. fuses. It makes it also easy to install fuses in high and low located fuse holders.

The fuse tong offers a wide clamping range for fuses 50 mm to 90 mm in diameter. Used with the reducing insert, the clamping range is reduced to allow for fuses 30 mm to 90 mm in diameter. The reducing insert is included in the delivery.

SAFETY EQUIPMENT

SZ Fuse Tongs

OPERATING RODS



Type	Total length l_G	Length of handle l_H	Part No.
A Straight type			
SZ HH 1060	1060 mm	350 mm	**765 040**
SZ HH 1250	1250 mm	530 mm	**765 041**
SZ HH 1500	1500 mm	780 mm	**765 042**
B Angled type (20°)			
SZ HH W20 1070	1070 mm	350 mm	**765 050**
SZ HH W20 1250	1250 mm	530 mm	**765 051**
SZ HH W20 1500	1500 mm	780 mm	**765 052**

Other lengths available on request.

Accessories for SZ Fuse Tongs

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D40 45	●	530 mm	**700 008**

Wall-mounted Support Bracket for h.v.h.b.c. Fuses and Fuse Tongs – Single Parts

Type	Application	Classification	Part No.
HV 3HH ET	for h.v.h.b.c. fuses	A	**700 005**
HV 3HH SZ ET	for h.v.h.b.c. fuses and fuse tongs	B	**700 004**

Wall-mounted Support Bracket for h.v.h.b.c. Fuses and Fuse Tongs – Set

Type	Application	Classification	Part No.
HV 3HH	for 3 h.v.h.b.c. fuses	2 x A	**700 015**
HV 3HH SZ	for 3 h.v.h.b.c. fuses and fuse tongs	A + B	**700 014**

IS Insulating Rods

Nominal voltages up to 123 kV / 50 Hz

Insulating rod according to DIN VDE 0681 Part 1
Switching rod head according to DIN VDE 0681 Part 2

- Not for use in wet weather
- For indoor and outdoor installations
- Attachable operating head allows for use as a switching rod
- Supporting head for hexagon shaft or T pin shaft
- Also for use as an earthing rod
- Also for use as an operating rod for handling insulating protective shutters according to DIN VDE 0682 Part 552

Switching a disconnector by means of an IS SK insulating rod with switching head.

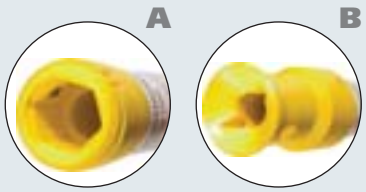
Technical Data	
Insulating tube	Glass-fibre reinforced polyester tube, Ø30 mm, yellow
Endpiece	Non-slip plastic cap

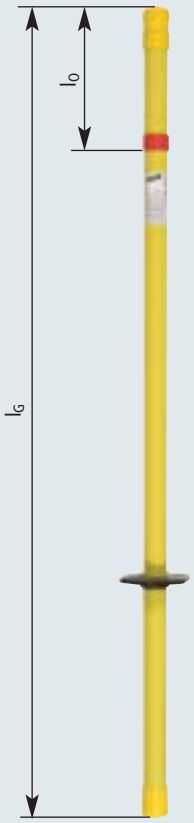
IS SK insulating rod used to apply phase clamps with hexagon type shafts of earthing and short-circuiting devices.

SAFETY EQUIPMENT

IS Insulating Rods

OPERATING RODS





Type	Nominal voltage U_N	Max. weight on the operating head*)	Total length l_G	Inserting depth l_O	Part No.
A IS SK Insulating Rods					
With M12 thread and for hexagon type shafts					
– For use as a switching rod with operating head, Part No. 765 005					
– For use as an earthing rod					
IS 30 SK 1000	36 kV		1000 mm	175 mm	**766 001**
IS 30 SK 1500	36 kV		1500 mm	475 mm	**766 002**
IS 110 SK 2000	123 kV		2000 mm	200 mm	**766 003**
B IS SQ Insulating Rods					
With T pin shaft (bayonet)					
– For use as a switching rod with operating head, Part No. 765 009					
– For use as an earthing rod					
– For use as an operating rod for handling insulating protective shutters					
IS 30 SQ 1000	36 kV	17 kg	1028 mm	150 mm	**766 311**
IS 30 SQ 1500	36 kV	17 kg	1528 mm	500 mm	**766 315**
IS 30 SQ 2000	36 kV	9 kg	2028 mm	900 mm	**766 320**

*) Max. shutter weight
Other lengths for special switchgear installations available on request.

Accessories for IS Insulating Rods

Switching Head for attaching to IS SK Insulating Rods, with M12 Thread

According to DIN VDE 0681 Part 2

Type	Material	Part No.
SSK M12	St, completely plastic-coated	**765 005**

Switching Head for attaching to IS SQ Insulating Rods, with T Pin Shaft (Bayonet)

According to DIN VDE 0681 Part 2, T pin shaft acc. to DIN 48087
Lock nut allows the adapter to be fixed to the insulating rod

Type	Material	Part No.
SSK SQ	Polyamide	**765 009**

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D30		530 mm	**700 007**

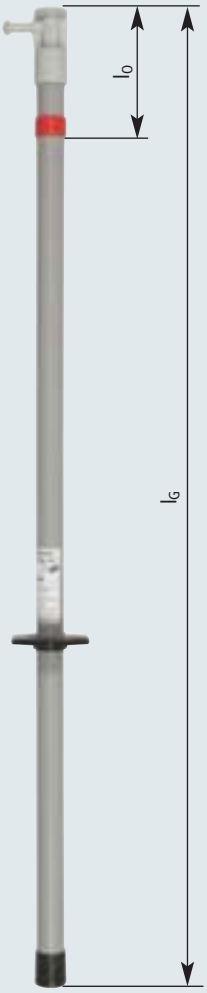
SCS Switching Rods

Nominal voltages up to 110 kV / 50 Hz

DIN VDE 0681 Part 2

- Not for use in wet weather
- For indoor and outdoor installations
- Fully insulated, massive switching head
- Allows for deep access to the installation
- For use as operating rod for handling insulating protective shutters according to DIN VDE 0682 Part 552

Switching a disconnector with an SCS switching rod.



Technical Data	
Insulating tube	Glass-fibre reinforced polyester tube, Ø30 mm, grey
Switching pin	St, completely plastic-coated, fixed
Endpiece	Non-slip plastic cap

Type	Nominal voltage U_N	Max. load on the operating head *)	Total length l_G	Inserting depth l_O	Part No.
A Switching Rods for Voltages up to 110 kV					
SCS 30 1000	30 kV	17 kg	1030 mm	135 mm	**763 610**
SCS 30 1500	30 kV	17 kg	1500 mm	415 mm	**763 611**
SCS 30 2000	30 kV	9 kg	2000 mm	765 mm	**763 612**
SCS 60 1500	60 kV		1500 mm	290 mm	**763 615**
SCS 60 2000	60 kV		2000 mm	690 mm	**763 620**
SCS 60 2500	60 kV		2500 mm	1090 mm	**763 625**
SCS 60 3000	60 kV		3000 mm	1490 mm	**763 630**
SCS 60 4000	60 kV		4000 mm	2290 mm	**763 640**
SCS 110 3000	110 kV		3000 mm	1090 mm	**763 110**

*) Max. shutter weight for handling insulating protective shutters.
Other lengths for special switchgear installations available on request.

Accessories for SCS Switching Rods

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D30		530 mm	**700 007**

SAFETY EQUIPMENT
OPERATING RODS

Insulating Rod IS M55 (Kit)
Nominal voltages up to 36 kV / 50 Hz

Insulating rod acc. to DIN VDE 0681 Part 1 and DIN VDE 0682 Part 411
Head of switching rod acc. to DIN VDE 0681 Part 2

IS M55 Insulating rod with M55 adapter / gear coupling and PHE III electronic indicator used as a voltage detector.

- Not for use in wet weather
- For use in indoor and outdoor installations
- Screw coupling, with protection against twisting and bridging
- Modular kit system for various applications
- For use as switching rod, earthing rod, operating rod and/or insulating rod

Technical Data	
Top section of switching rod	Glass-fibre-reinforced polyester tube, Ø30 mm, grey, switching pin St, completely plastic-coated
Adapter	Universal plastic gear coupling, yellow
Operating head	Plastic coupling (T pin shaft), yellow; Aluminium coupling (T pin shaft)
Insulating tube	Glass-fibre-reinforced polyester tube, Ø43 mm, grey or yellow
Coupling	Screw coupling M55x4 with protection against twisting, plastic, with cap nut Ø65 mm, black

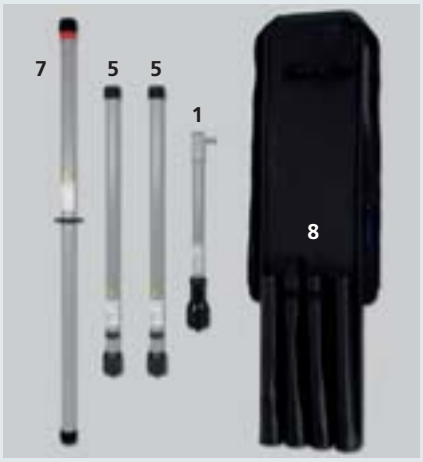
Insulating rod with M55 adapter / gear coupling for attaching PHE III electronic indicator.

The artificial leather bag with reinforced rear allows not only for appropriate transport, but also to take out the required single components quickly and easily.

Plastic screw coupling with M55x4 thread, safe against twisting.

Insulating Rod IS M55 (Kit)

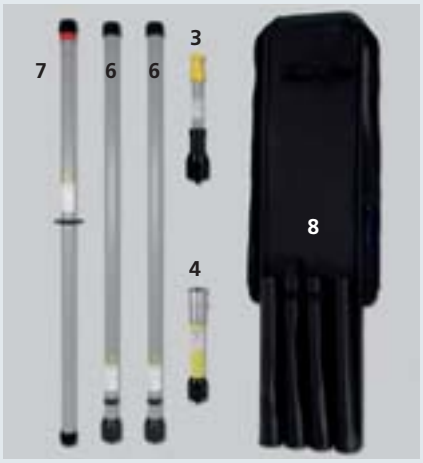
Nominal voltages up to 36 kV / 50 Hz



Example: Switching Rod
according to DIN VDE 0681 Part 1 and 2

Pos.	Qty.	Type	Item	Part No.
1	1	SSK M55 500	Switching head, l = 560 mm	766 064
5	2	ISV M55 850	Extension for insulating rod, l = 910 mm	766 066
7	1	IS 36 V M55 1300	Insulating rod, l = 1280 mm	766 163
8	1	KLT 130 33	Artificial leather bag, empty	766 069

Maximum total length: 3500 mm



Example: Earthing Rod
according to DIN EN 61235

Pos.	Qty.	Type	Item	Part No.
3	1	AK M55 SQ	Operating head M55 / T pin shaft	766 165
4	1	AK M55 SQL	Operating head M55 / T pin shaft (long)	766 167
6	2	ISV M55 1300	Extension for insulating rod, l = 1280 mm	766 166
7	1	IS 36 V M55 1300	Insulating rod, l = 1280 mm	766 163
8	1	KLT 130 33	Artificial leather bag, empty	766 069

Maximum total length: Load on operating head:

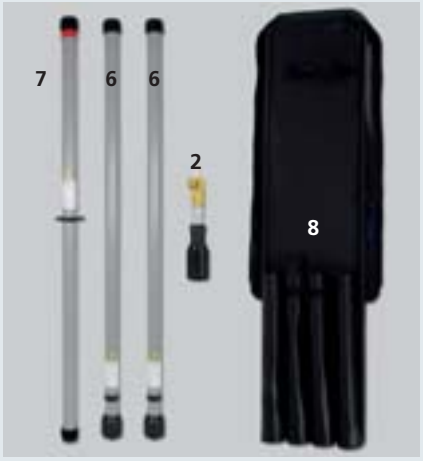
1600 mm	35 kg
2800 mm	7 kg
4000 mm	3 kg

Example: Operating Rod for Insulating Protective Shutters
according to DIN VDE 0682 Part 552

Pos.	Qty.	Type	Item	Part No.
1	1	SSK M55 500	Switching head, l = 560 mm	766 064
3	1	AK M55 SQ	Operating head M55 / T pin shaft	766 165
5	2	ISV M55 850	Extension for insulating rod, l = 910 mm	766 066
7	1	IS 36 V M55 1300	Insulating rod, l = 1280 mm	766 163
8	1	KLT 130 33	Artificial leather bag, empty	766 069

Maximum total length: Load on operating head:

1700 mm	25 kg
2600 mm	10 kg
3500 mm	5 kg



Example: Insulating Rod for PHE III Electronic Indicator
according to DIN VDE 0682 Part 411

Pos.	Qty.	Type	Item	Part No.
2	1	AD M55 ZK	Adapter M55, gear coupling	766 062
6	2	ISV M55 1300	Extension for insulating rod, l = 1280 mm	766 166
7	1	IS 36 V M55 1300	Insulating rod, l = 1280 mm	766 163
8	1	KLT 130 33	Artificial leather bag, empty	766 069

Maximum total length: 4000 mm

SAFETY EQUIPMENT
OPERATING RODS

Single Parts of Insulating Rod IS M55 (Kit)

M55 Switching Head

Type	Diameter	Total length l_G	Position	Part No.	
SSK M55 500	65 / 30 mm	560 mm	1	**766 064**	new

M55 Adapter / Gear Coupling

Universal gear coupling for PHE III electronic indicator

Type	Diameter	Total length l_G	Position	Part No.	
AD M55 ZK	65 / 30 mm	310 mm	2	**766 062**	new

M55 Operating Head / T pin shaft

Plastic coupling (bayonet) for indoor application

Type	Diameter	Total length l_G	Position	Part No.	
AK M55 SQ	65 / 30 mm	360 mm	3	**766 165**	new

M55 Operating Head / T pin shaft (long)

Aluminium cone coupling with switching ring (bayonet) for outdoor application

Type	Diameter	Total length l_G	Position	Part No.	
AK M55 SQL	65 / 43 mm	365 mm	4	**766 167**	new

ISV M 55 Extension for Insulating Rods

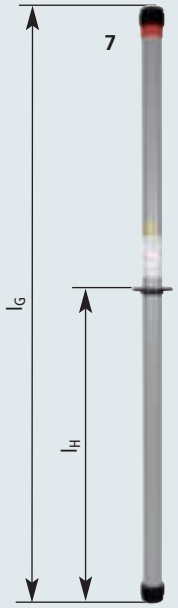
For extending the inserting depth or for handle extension

Type	Diameter	Total length l_G	Position	Part No.	
ISV M55 850	65 / 43 mm	910 mm	5	**766 066**	new
ISV M55 1300	65 / 43 mm	1280 mm	6	**766 166**	new

IS M55 Insulating Rod

Threaded M55x4 insert on both sides for attaching extensions, operating heads or adapters

Type	Nominal voltage U_N	Diameter	Length of handle l_H	Total length l_G	Position	Part No.	
IS 36 V M55 1300	up to 36 kV	43 mm	690 mm	1280 mm	7	**766 163**	new



Accessories for Insulating Rod IS M55 (Kit)

Artificial Leather Bag, empty

With zip-fastener and shoulder strap
Max. capacity:
1 IS M 55 Insulating rod
2 ISV M 55 Extensions for insulating rods
1 M55 Switching head
1 Adapter or operating head

Type	Colour	Dimension	Position	Part No.	
KLT 130 33	●	1300 x 300 mm	8	**766 069**	new

RST Rescue Rods

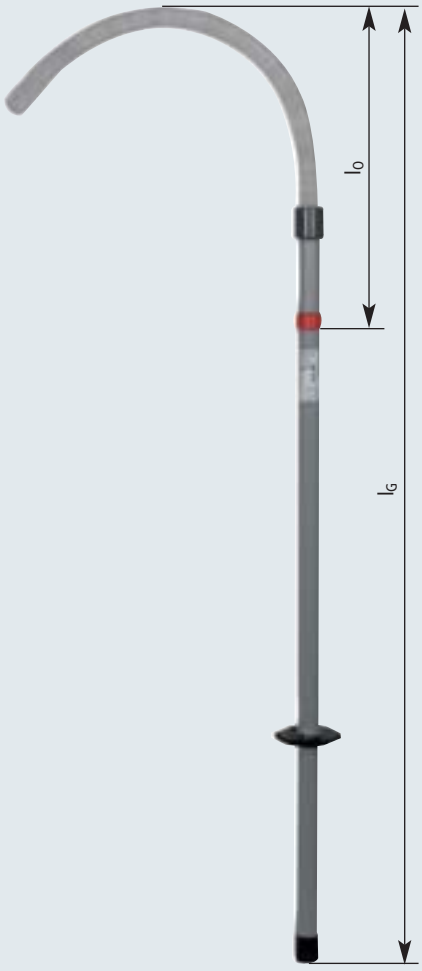
Nominal voltages up to 36 kV / 50 Hz

Based on DIN VDE 0681 Part 1

- Not for use in wet weather
- For use in indoor and outdoor installations
- Fixed rescue hook, safe against bridging
- For rescuing persons (up to approx. 100 kg in weight) from the hazard zone in the event of electrical accidents

Rescuing an accident victim from the hazard zone by means of an insulated RST rescue rod.

Technical Data	
Hook	PVC-HI Complete rod
Insulating tube	Glas-fibre-reinforced polyester tube, Ø30 mm, grey
Sealing unit	Non-slip plastic cap



Type	Total length l_G	Inserting depth l_O	Part No.	
A Rescue Rod up to 36 kV				
RST 36 1000	1000 mm	175	**766 040**	new
RST 36 1500	1500 mm	425	**766 041**	new
RST 36 2000	2000 mm	775	**766 042**	new

Accessories for RST Rescue Rods

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D30		530 mm	**700 007**

SAFETY EQUIPMENT
INSULATING PROTECTIVE SHUTTERS

Insulating Protective Shutters
Rated voltages 1 kV up to 36 kV

DIN VDE 0682 Part 552

Inserting a protective shutter, type A1 by hand

- **For indoor installations only**
- **Provide protection against accidental contact of live parts of the installation with rated voltages of 1 kV to 36 kV**
- **Four different designs allow their use in nearly all types of switchgear installations**
- **Fitting of insulating protective shutters (even under live conditions) can be provided as a service**

According to the five safety rules, adjacent parts are energised parts situated in the danger zone. If parts of an electrical installation close to the work area cannot be isolated, additional safety measures have to be taken before the work can start.

Insulating protective shutters according to DIN VDE 0682 Part 522 are used for protection against accidental contact with energised parts according to DIN VDE 0105. The shutters are portable and are inserted by hand or by using an insulating rod when parts of the installation are connected to supply voltage.
They are designed for short-duration use in electrical indoor installations according to DIN VDE 0101 with supply voltages from 1 kV to 36 kV ac and nominal frequencies below 100 Hz.

Insulating protective shutters may require modifications when used in medium voltage systems. In some cases, it may not be possible to insert the shutters in the danger zone without risk caused by installed switchgear drives, switching components or isolating plates. These types of problems can be solved in accordance with the standard by matching cut-outs and pre-cutting the protective shutters. Accurate technical data will be required from customers in these cases. For this purpose, we have developed a special template for insulating protective shutters. This template can be used to confirm and to mark the exact location of the cut-outs required.

Please request the above mentioned template when placing your order or download it from our website www.dehn.de:

DEHN Form No. 2090 for shutters made of hard PVC

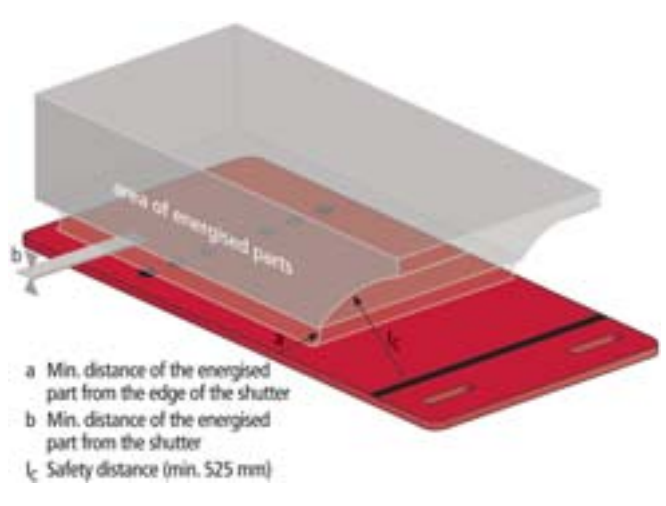
Four different designs are available:

– Type A1, with finger holes, guide and limit marks for inserting on guide rails by hand
– Type A2, with angled handle (90°) and grips for inserting on guide rails by hand
– Type A3, with supporting device (bayonet pin) for inserting on guide rails with an operating rod
– Type A4, with finger holes for inserting by hand, for prefabricated switchgear panels

Service offer
To provide adequate protection, it is normally necessary to install new guide rails and supports for the protective shutters. If you do not have the qualified staff available for this type of work, we would be pleased to assist you with measurements (even under live conditions), adjusting complex shutter arrangements and with the installation of guide rails and supports.

Example of the Danger Zone

Rated voltages 1 kV up to 36 kV



Danger zone of applying an insulating protective shutter Type A1 (Example)

Rated voltage U_r	Minimum distance of the live part	
	from shutter edge a	from shutter b
3.6 kV	60 mm	0 mm
7.2 kV	90 mm	0 mm
12.0 kV	120 mm	20 mm
24.0 kV	220 mm	60 mm
36.0 kV	320 mm	100 mm

Note

Insulating protective shutters are not designed for securing against reconnection. The protected area is the area which is separated by the insulating protective shutter from the area containing live parts of the installation. The shutter and shutter edge must maintain the minimum safety distances from energised parts as indicated in the table.

The protective part (with length l_S and, if required, height h_S) of insulating protective shutters is the part that provides protection from accidental contact with live parts. It provides either a handle or a coupling unit for attaching it to an operating rod.

Outside of the area enclosing the live parts, gaps between shutter edge and cell wall are permissible as follows:

– Up to 10 mm without restriction
– Up to 40 mm, if the distance between the shutter edge and the danger zone is at least 100 mm (i.e. measure "a" + 100 mm)
– Up to 100 mm within the area of a switch subconstruction

SAFETY EQUIPMENT
INSULATING PROTECTIVE SHUTTERS

Designs
Rated voltages 1 kV up to 36 kV

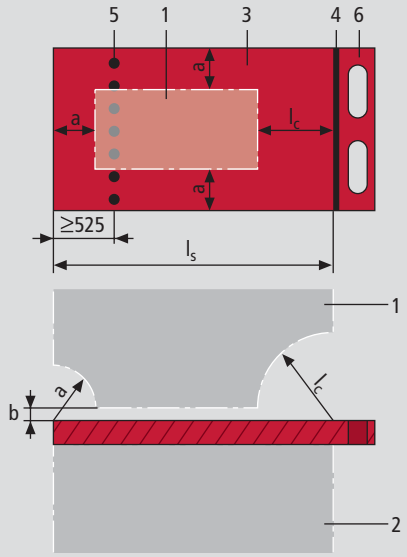
Due to the variety in design of existing switchgear installations, DIN VDE 0682 Part 552 defines four basic types of protective shutters:

– Type **A1**, with finger holes, guide and limit marks for inserting on guide rails by hand

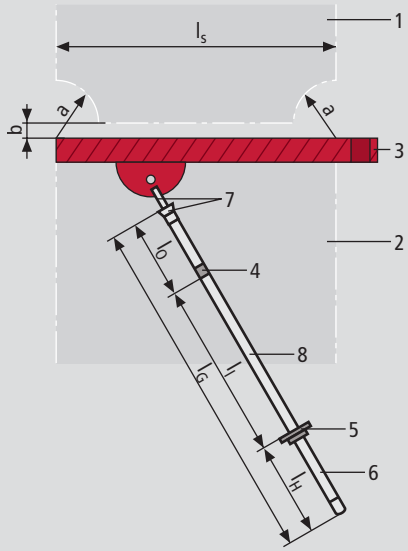
– Type **A2**, with angled handle (90°) and grips for inserting on guide rails by hand

– Type **A3**, with supporting device (bayonet pin) for inserting on guide rails with an operating rod

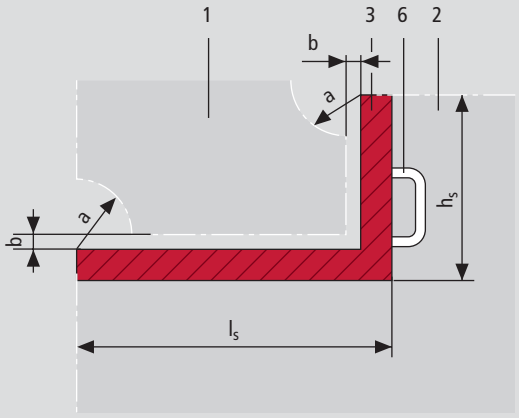
– Type **A4**, with finger holes for inserting by hand, for prefabricated switchgear panels



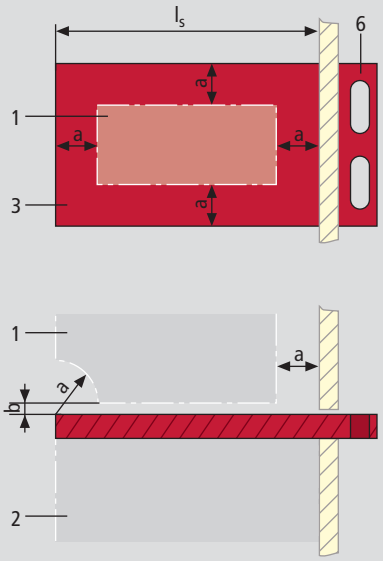
Protective shutter type **A1** – Operation by hand



Protective shutter type **A3** – Operation by operating rod



Protective shutter type **A2** – Operation by hand



Protective shutter type **A4** – Operation by hand

1 Live working area
2 Protected area
3 Protective section with length l_S (and height h_S)
4 Limit mark or red ring
5 Guide mark or handguard
6 Handle
7 Coupling
8 Insulating element of the insulating rod with length l_I

l_G Total length of the operating rod
l_O Length of the upper section of the operating rod
l_H Length of the handle of the operating rod
l_I Length of the insulating element of the operating rod
l_S Length of the protective section
l_C Protected area

a Minimum distance of live parts from insulating shutter edge
b Minimum distance of live parts from insulating shutter

Insulating Protective Shutters, Types 1 and 2

Rated voltages 1 kV up to 36 kV

Inserting an insulating protective shutter, Type A1, by hand.

Type	Rated voltage U_r	Material	Part No.
A Type A1 With finger holes, guide and limit mark for inserting and removing on guide rails by hand. The guide marking is a dotted line with a minimum distance of 525 mm from the rear shutter edge. This marking must not be surpassed when attaching and inserting the shutter. The limit marking is a full line and indicates the limit of the handle from the protective section. This must not be exceeded when inserting the shutter and must be at least 525 mm away from live parts when the shutter has been inserted.			
ISP 36 PVC A1...	36 kV	hard PVC	**763 211**

When placing your order, please fill in the template on pages 253-255 (DEHN Form No. 2090) to confirm important dimensions and fax it to DEHN + SÖHNE.
The template can also be downloaded from the Publications area of the DEHN + SÖHNE website www.dehn.de.
Available guide rails and further accessories are also listed in the above mentioned form.

Inserting an insulating protective shutter (transparent), Type A2.

Type	Rated voltage U_r	Material	Part No.
B Type A2 With angled handles (90°) and hand grips for inserting or removing on guide rails by hand. Other angled handles (70° ... 270°) are available on request. The height of the handle has to be defined to ensure that energised parts of the installation situated above the shutter are completely covered.			
ISP 36 PVC A2...	36 kV	hard PVC	**763 221**

When placing your order, please fill in the template on pages 253-255 (DEHN Form No. 2090) to confirm important dimensions and fax it to DEHN + SÖHNE.
The template can also be downloaded from the Publications area of the DEHN + SÖHNE website www.dehn.de.
Available guide rails and further accessories are also listed in the above mentioned form.

Insulating Protective Shutters, Types 3 and 4
Rated voltages 1 kV up to 36 kV

Type	Rated voltage U_r	Material	Part No.

C Type A3

With supporting device with bayonet coupling for inserting and removing on guide rails by operating rod.

This shutter type is also available with a slotted connection and supports that allow the shutter to be rotated and inserted by means of an operating rod with switching head. Shutter sizes exceeding 1 m² would require 2 persons for installation. For this purpose the shutter can be suppplied with two operating rod couplings and rollers for easier handling.
Moreover, the shutter can also be provided with rolls for easier handling.

ISP 36 PVC A3...	36 kV	hard PVC	**763 231**

When placing your order, please fill in the template on pages 253-255 (DEHN Form No. 2090) to confirm important dimensions and fax it to DEHN + SÖHNE.
The template can also be downloaded from the Publications area of the DEHN + SÖHNE website www.dehn.de.
Available guide rails and further accessories are also listed in the above mentioned form.

Inserting of an insulating protective shutter, Type A3, by operating rod

Operating rod with T pin shaft (bayonet) and insulating protective shutter with T pin shaft coupling.

D Type A4

With finger holes (without additional markings) for use in prefabricated switchgear panels. Instead of the finger holes, the shutters can also be provided with a grip (minimum height 35 mm).

The shutter is normally inserted into the closed installation through a slot.
The protection device of the installation must ensure full protection when inserting and removing the shutter.
In type-tested switchgear installations according to DIN VDE 0670 Parts 6 and 7 or EN/IEC 62271-200 (DIN VDE 0671 Part 200), insulating protective shutters may only be used after consulting with the manufacturer of the switchgear installation.

ISP 36 PVC A4...	36 kV	hard PVC	**763 241**

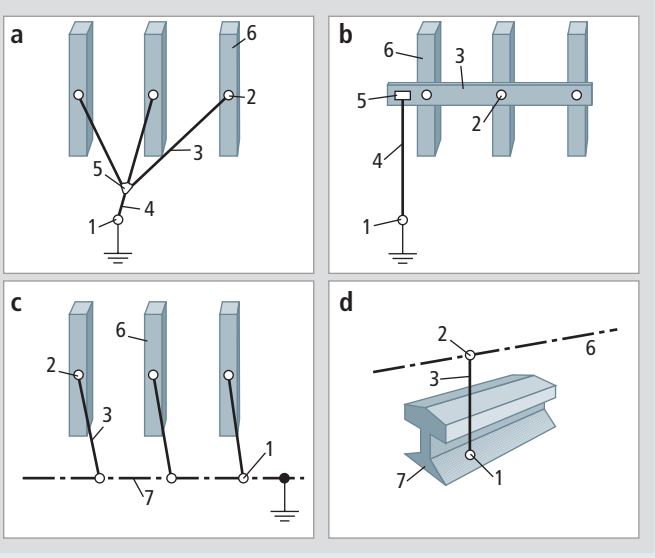
When placing your order, please fill in the template on pages 253-255 (DEHN Form No. 2090) to confirm important dimensions and fax it to DEHN + SÖHNE.
The template can also be downloaded from the Publications area of the DEHN + SÖHNE website www.dehn.de.
Available guide rails and further accessories are also listed in the above mentioned form.

Inserting an insulating protective shutter, Type A4.

EARTHING AND SHORT-CIRCUITING DEVICES

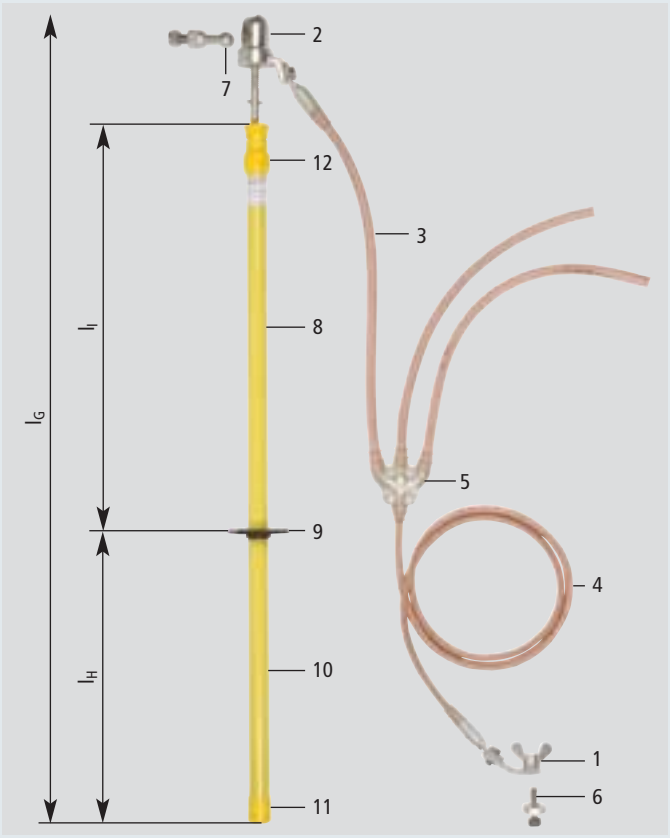
Earthing and short-circuiting of electrical installations is a vital part of the five safety rules. Earthing and short-circuiting ensure the safety of personnel from dangerous voltages that may be caused by induced voltages, atmospheric surges or accidental reconnection of the supply voltage.
Isolation from supply voltages must be verified immediately before installing portable equipment for earthing and short-circuiting at the work area.
When connecting the earthing and short-circuiting device, the earting cable must be connected first in order to discharge any residual potential or induced voltages.

Freely guided equipment for earthing and short-circuiting according to IEC/EN 61230 (DIN VDE 0683 Part 100) are devices used to approach and connect to electrical parts of an installation for earthing and short-circuiting purposes. These devices are applied without restricted guidance offered by guide slots, sockets and guide rails.
The equipment consists of an earthing and short-circuiting device (E+S devices) and earthing rod.
The purpose of **earthing and short-circuiting devices** is both for earthing and short-circuiting of electrical circuits.
The **earthing device** connects the earthing system to a short-circuiting device or to the equipment that must be earthed. It consists of connecting components (Figures a to d – No. 1) and earthing cable (Figs. a to d – No. 4).
A **short-circuiting device** connects the phase conductors that have to be short-circuited (Figs. a to d – No. 6). It consists of connecting components (Figs. a and d – No. 2), short-circuiting cables or short-circuiting busbars (Figs. a and d – No. 3) and connecting terminals, if required (Figs. a and b – No. 5).
A **short-circuiting bar** is a rigid short-circuiting device.
Connecting terminals connect the short-circuiting cables with each other and with the earthing cable, or the short-circuiting bar with the earthing cable.



a 3-pole unit with short-circuiting cables and earthing cable
b 3-pole unit with short-circuiting bar and earthing cable
c Single-pole unit with short-circuiting cables
d Single-pole unit with short-circuiting cable for earthing railways

1 Connecting component to earthing system
2 Connecting component to conductor
3 Earthing and short-circuiting cable or earthing busbar
4 Earthing cable
5 Connecting terminal
6 Phase conductor
7 Earthing system (earthed power line, rail)



Freely guided equipment for earthing and short-circuiting

1 Connecting component to earthing system
2 Connecting component to conductor
3 Short-circuiting cable
4 Earthing cable
5 Connecting terminal
6 Termination point to earthing system
7 Termination point to conductor
8 Insulating part with length l_I
9 Handguard
10 Handle with length l_H
11 Endpiece (rod)
12 Coupling

Connecting components connect the earthing and short-circuiting cables or rails with the earthing system and other parts of the installation either directly or via intermediate connecting units like cable lugs or, if required, termiation points.
Termination points are points in the installation, which are used for connecting the earthing and short-circuiting devices (e.g. cables, bars, fixed ball points, round bars etc.). Maximum short-circuit withstand capability can be achieved by connecting the ball head cap of the earthing and short-circuiting device to fixed ball points.

Two types of ball head caps are available,

– Ball head cap, rigid
– Ball head cap, adjustable (4 x 90°)

The adjustable type allows the user to install the earthing and short-circuiting device in the most favourable working position by adjusting the ball head cap, even in the case of adversely installed fixed ball points. Using angled fixed ball points is therefore mostly unnecessary.


Ball head cap, rigid


Ball head cap, adjustable (4 x 90°)

Earthing and Short-circuiting Devices

An **earthing rod** is an insulating rod used by hand to apply the connecting components of an earthing and short-circuiting device to parts of heavy-current installations for earthing and short-circuiting purposes. It consists of an insulating part, black ring, handle and coupling for attaching the connecting components. Earthing rods are selected according to the **weight** of the earthing and short-circuiting devices to be used (See specification: "max. load on operating head in kg").
The **insulating part** is the part of the earthing rod between the black ring and the end of the earthing rod towards the connecting component. It ensures that the user maintains a safe distance and provides sufficient insulation. The insulating part of the rod must have a minimum length of 500 mm.

A complete device for earthing and short-circuiting according to EN/IEC 61230 (DIN VDE 0683 Part 100) includes e.g.

1 Fixed point / Fixed ball point
2 Single- or three-pole earthing and short-circuiting device or short-circuiting bar
3 Fixed earthing point
4 Earthing rod

Earthing and short-circuiting devices as well as the fixed ball and earth connection points must be rated to withstand the **short-circuit current conditions** expected at the work site.
The required cable cross section depends on the maximum short-circuit current (I_k in A) and maximum short-circuit current duration (T_k in s).

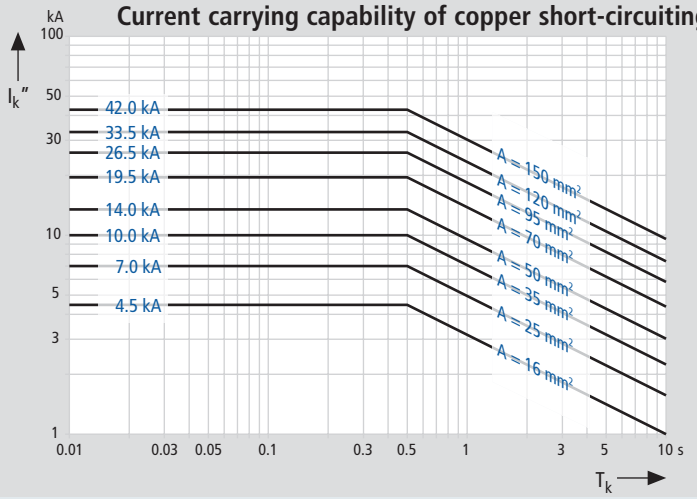
Remark:
In the event of a short-circuit occurring, the short-circuit current will flow via the appropriately designed short-circuiting device. However, this is different with earthing devices, as they do not conduct short-circuit currents and can therefore be rated for lower values.

Cable cross section:
For short-circuiting cables of our three-pole earthing and short-circuiting devices with cross sections of equal to or larger than 50 mm², the cross section of the earthing cable can principally be reduced according to the following table.

Cable cross section:	**Short-circuiting cable**	**Earthing cable**
	25 mm²	25 mm²
	35 mm²	35 mm²
	50 mm²	25 mm²
	70 mm²	35 mm²
	95 mm²	35 mm²
	120 mm²	50 mm²
	150 mm²	50 mm²

These earthing and short-circuiting devices with reduced earthing cable cross sections can be used for all types of installations with **compensated systems** (no solidly earthed systems, i.e. with impedance neutral earthing). For installations with **solid earthing**, both the earthing and short-circuiting cable must have equal cross sections (available on request).

Current carrying capability of copper short-circuiting cables for use in ac and three-phase current systems

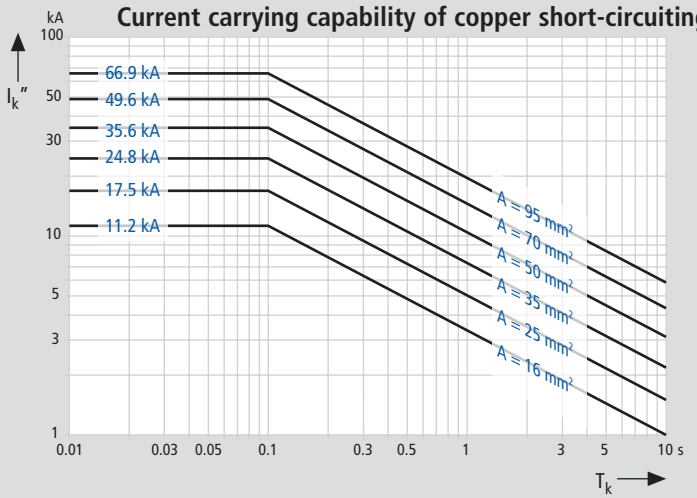


Initial cable temperature 20° C
Final cable temperature 250° C

$A = 5.07\ I_k" \sqrt{T_k}$ for $T_k \geq 0.5$ s

whereby
A Cable cross section in mm²
I_k" Maximum initial short circuit ac current in kA according to DIN VDE 0102
T_k Short-circuit duration in s

Current carrying capability of copper short-circuiting cables for use in dc installations



Initial cable temperature 20° C
Final cable temperature 250° C

$A = 5.07\ I_k" \sqrt{T_k}$ for $T_k \geq 0.08$ s

whereby
A Cable cross section in mm²
I_k" Maximum initial short circuit ac current in kA according to DIN VDE 0102
T_k Short-circuit duration in s

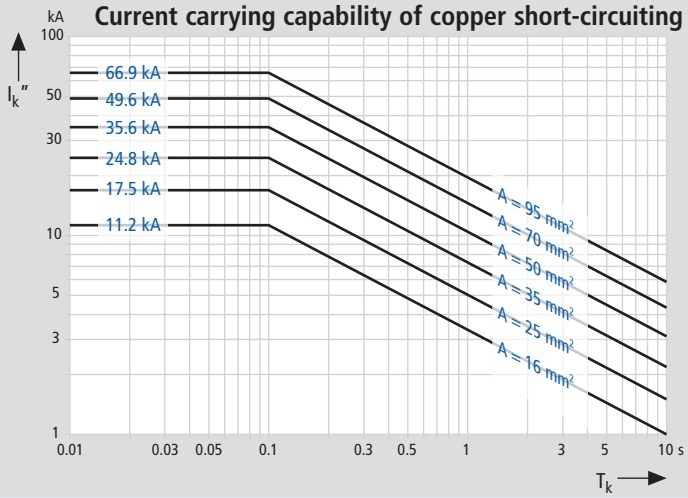
EARTHING AND SHORT-CIRCUITING DEVICES

The **current carrying capability** of the short-circuiting cable and the short-circuiting bar depends on material, cross section (A) and short-circuit duration (T_k).
Calculations were based on the worst case possible, i.e. a remote short circuit ($\mu = 1$) and maximum dc component ($\chi = 1.8$) with I_k'' as maximum initial short-circuit current, which, according to DIN VDE 0102, is equal to the permanent short-circuit current, I_k and equal to the symmetrical breaking current I_a:

$$I_k'' = I_k = I_a$$

The diagrams or the table help to determine the required cable and busbar cross sections of the short-circuiting device according to the short-circuit current and the short-circuit duration for an installation.

Current carrying capability of copper short-circuiting cables for use at overhead contact lines of electrical railways



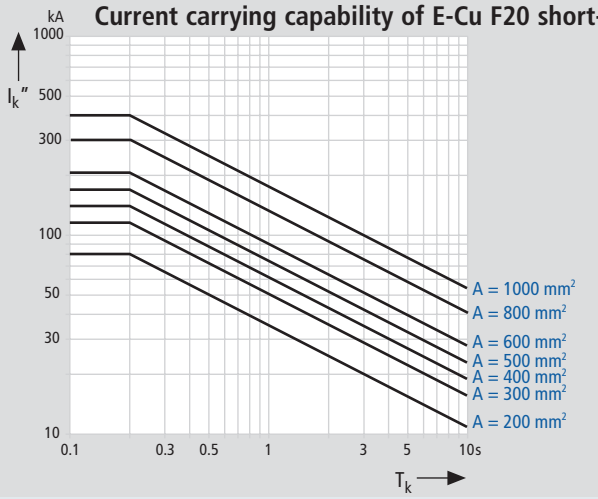
Initial cable temperature 20° C
Final cable temperature 400° C

$A = 4.1\ I_k''\ \sqrt{T_k}$ for $T_k \geq 0.12$ s

whereby

A Cable cross section in mm²
I_k'' Maximum initial short circuit ac current in kA according to DIN VDE 0102
T_k Short-circuit duration in s

Current carrying capability of E-Cu F20 short-circuiting busbars



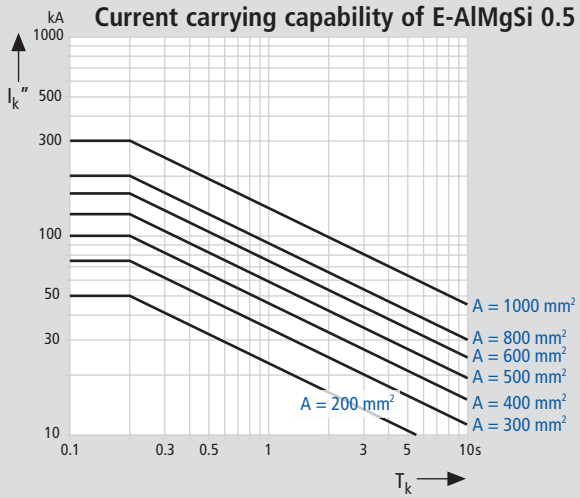
Initial cable temperature 20° C
Final cable temperature 250° C

$A = 5.54\ I_k''\ \sqrt{T_k}$ for $T_k \geq 0.2$ s

whereby

A Cable cross section in mm²
I_k'' Maximum initial short circuit ac current in kA according to DIN VDE 0102
T_k Short-circuit duration in s

Current carrying capability of E-AlMgSi 0.5 F17 short-circuiting busbars



Initial cable temperature 20° C
Final cable temperature 250° C

$A = 8.79\ I_k''\ \sqrt{T_k}$ for $T_k \geq 0.2$ s

whereby

A Cable cross section in mm²
I_k'' Maximum initial short circuit ac current in kA according to DIN VDE 0102
T_k Short-circuit duration in s

Calculation example:

Given: Power-down capacity S_a
Short-circuit duration T_k

Requested: Required cable or bar cross section A.

The calculation is based on a remote short circuit.

Three-phase current $$I_k'' = I_k = I_a = \frac{S_a}{\sqrt{3} \bullet U_N}$$

Single-phase ac current $$I_k'' = I_k = I_a = \frac{S_a}{U_N}$$

With I_k'', the required cable or bar cross section can now be calculated with the above equations or taken from the diagrams. The permissible short-circuit current of an earthing and short-circuting device depends on the duration of the short circuit and is expressed by indicating the cross-sectional area of the short-circuiting cables or bars.

Notes:

- Earthing and short-circuiting devices are rated for loading only once with the permissible short-circuit currents dependent on the duration of the short-circuit current.
- Short-circuiting cables of multi-pole earthing and short-circuiting devices must have equal cross sections.
- Cable lengths of earthing and short-circuiting devices should be as short as possible, as the cables move violently during a short-circuit. They should be at least 120% of the distance between two termination points.
- If earthing and short-circuiting devices are connected in parallel with cables for achieving certain total cable cross sections, the following conditions have to be observed:
  1. Equal cable lengths and cross sections,
  2. Equal connecting components and termination points,
  3. Installing the devices directly next to each other and leading the cables in parallel,
  4. The permissible short-circuit current of each cable has to be reduced to 75% of their normal short-circuit current rating according to their cross section.

  Remark:
  If it is ensured that earthing and short-circuiting devices connected in parallel are loaded with short-circuit currents only once (no interruption of the short circuit), the devices may be loaded to 100%. Generally, this applies to installations with nominal voltages from 110 kV.

Table:

Cable cross section of the earthing and short-circuiting device according to the maximum permissible short-circuit current I_k and maximum short-circuit duration T_k.

Cross section of the copper cable	Max. permissible short-circuit current I_k at a duration of				
	10 s	5 s	2 s	1 s	≤ 0.5 s
16 mm²	1 000 A	1 400 A	2 200 A	**3 200 A**	4 500 A
25 mm²	1 600 A	2 200 A	3 500 A	**4 900 A**	7 000 A
35 mm²	2 200 A	3 100 A	4 900 A	**6 900 A**	10 000 A
50 mm²	3 100 A	4 400 A	7 000 A	**9 900 A**	14 000 A
70 mm²	4 400 A	6 200 A	9 800 A	**13 800 A**	19 500 A
95 mm²	5 900 A	8 400 A	13 200 A	**18 700 A**	26 500 A
120 mm²	7 500 A	10 600 A	16 700 A	**23 700 A**	33 500 A
150 mm²	9 400 A	13 200 A	20 900 A	**29 600 A**	42 000 A
				our catalogue data	

SAFETY EQUIPMENT

Selection Guide

EARTHING AND SHORT-CIRCUITING DEVICES

Fixed Phase and Earthing Points

Fixed ball points, straight and angled, ball Ø20 or 25 mm

EN/IEC 61230 (DIN VDE 0683 Part 100) and DIN 48088 Part 1

- Allows for fixing cable lugs or connecting busbars according to DIN 43673 Part 1
- Self-locking nut
- Formed (not cut) female thread M12 or M16
- Threaded pin, M12 or M16

Straight fixed ball point, installed on a busbar.

Technical Data	
Fixed point	E-Cu/gal Sn
Threaded pin	StSt A2-70
Hexagon nut	DIN 985-M12-8 / gal Zn; DIN 985-M16-8 / gal Zn
Tightening torque	M12: 80 Nm; M16: 150 Nm

Type	Fixed ball point Ø	Dimension	Width across	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Straight, with threaded Pin and Nut						
KFP 20 M12 35 SSM	20 mm	M12 x 35 mm	24 mm	120 mm²	23.7 kA	**754 235**
KFP 20 M16 45 SSM	20 mm	M16 x 45 mm	24 mm	120 mm²	23.7 kA	**754 645**
KFP 25 M12 25 SSM	25 mm	M12 x 25 mm	27 mm	150 mm²	29.6 kA	**755 225**
KFP 25 M12 45 SSM	25 mm	M12 x 45 mm	27 mm	150 mm²	29.6 kA	**755 245**
KFP 25 M16 45 SSM	25 mm	M16 x 45 mm	27 mm	150 mm²	29.6 kA	**755 645**
B Straight, with female Thread						
KFP 20 M12	20 mm	M12	24 mm	120 mm²	23.7 kA	**754 200**
KFP 20 M16	20 mm	M16	24 mm	120 mm²	23.7 kA	**754 600**
KFP 25 M12	25 mm	M12	27 mm	150 mm²	29.6 kA	**755 200**
KFP 25 M16	25 mm	M16	27 mm	150 mm²	29.6 kA	**755 600**
C Angled, with Terminal Lug						
KFP 20 S AL 12	20 mm	45 x 30 x 9 mm		50 mm²	9.9 kA	**706 300**
KFP 25 S AL 12	25 mm	50 x 30 x 9 mm		95 mm²	18.7 kA	**756 300**

Other lengths for threaded pins available on request.

Fixed ball points, angled, ball Ø20 or 25 mm

EN/IEC 61230 (DIN VDE 0683 Part 100) and DIN 48088 Part 1

Angled fixed ball point.

- Allows for fixing cable lugs or connecting busbars according to DIN 43673 Part 1
- Self-locking nut
- Formed (not cut) female thread M12 or M16
- Threaded pin, M12 or M16

Technical Data	
Fixed point	E-Cu/gal Sn
Threaded pin	StSt A2-70
Hexagon nut	DIN 985-M12-8 / gal Zn; DIN 985-M16-8 / gal Zn
Tightening torque	M12: 80 Nm; M16: 150 Nm

Type	Fixed ball point Ø	Dimension	Width across	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Angled 45°, with threaded Pin and Nut						
KFP 20 W45 M12 35SSM	20 mm	M12 x 35 mm	24 mm	70 mm²	13.8 kA	**706 235**
KFP 20 W45 M16 45SSM	20 mm	M16 x 45 mm	24 mm	70 mm²	13.8 kA	**706 645**
KFP 25 W45 M12 45SSM	25 mm	M12 x 45 mm	27 mm	95 mm²	18.7 kA	**756 245**
KFP 25 W45 M16 45SSM	25 mm	M16 x 45 mm	27 mm	95 mm²	18.7 kA	**756 645**
B Angled 45°, with female Thread						
KFP 20 W45 M12	20 mm	M12	24 mm	70 mm²	13.8 kA	**706 200**
KFP 20 W45 M16	20 mm	M16	24 mm	70 mm²	13.8 kA	**706 600**
KFP 25 W45 M12	25 mm	M12	27 mm	95 mm²	18.7 kA	**756 200**
KFP 25 W45 M16	25 mm	M16	27 mm	95 mm²	18.7 kA	**756 600**
C Angled 90°, with threaded Pin and Nut						
KFP 20 W90 M12 35SSM	20 mm	M12 x 35 mm	24 mm	70 mm²	13.8 kA	**707 235**
KFP 20 W90 M16 45SSM	20 mm	M16 x 45 mm	24 mm	70 mm²	13.8 kA	**707 645**
KFP 25 W90 M12 45SSM	25 mm	M12 x 45 mm	27 mm	95 mm²	18.7 kA	**757 245**
KFP 25 W90 M16 45SSM	25 mm	M16 x 45 mm	27 mm	95 mm²	18.7 kA	**757 645**
D Angled 90°, with female Thread						
KFP 20 W90 M12	20 mm	M12	24 mm	70 mm²	13.8 kA	**707 200**
KFP 20 W90 M16	20 mm	M16	24 mm	70 mm²	13.8 kA	**707 600**
KFP 25 W90 M12	25 mm	M12	27 mm	95 mm²	18.7 kA	**757 200**
KFP 25 W90 M16	25 mm	M16	27 mm	95 mm²	18.7 kA	**757 600**

Other lengths for threaded pins available on request.

Fixed Phase and Earthing Points

Fixed ball points, for round conductors, ball Ø20 or 25 mm

EN/IEC 61230 (DIN VDE 0683 Part 100)

- For attaching to round Cu conductors
- Fixing screws made of stainless steel
- Fixed ball points for aluminium conductors available on request

Fixed ball point, attached to the round Cu conductor of a switchgear installation.

Technical Data	
Ball pin	E-Cu/gal Sn
Round conductor clamps	Cu alloy/gal Sn
Fixing screws	Hexagon screws, StSt

Type	Fixed ball point Ø	For round conductor Ø d	Max. short-circuit current I_k 1 s	Part No.
A Round Conductor Ø10-20 mm				
KFP 20 RL 10	20 mm	10 mm	9.9 kA	**720 010**
KFP 20 RL 12	20 mm	12 mm	9.9 kA	**720 012**
KFP 20 RL 14	20 mm	14 mm	9.9 kA	**720 014**
KFP 20 RL 16	20 mm	16 mm	9.9 kA	**720 016**
KFP 20 RL 18	20 mm	18 mm	9.9 kA	**720 018**
KFP 20 RL 20	20 mm	20 mm	9.9 kA	**720 020**
KFP 25 RL 10	25 mm	10 mm	18.7 kA	**725 010**
KFP 25 RL 12	25 mm	12 mm	18.7 kA	**725 012**
KFP 25 RL 14	25 mm	14 mm	18.7 kA	**725 014**
KFP 25 RL 16	25 mm	16 mm	18.7 kA	**725 016**
KFP 25 RL 18	25 mm	18 mm	18.7 kA	**725 018**
KFP 25 RL 20	25 mm	20 mm	18.7 kA	**725 020**

Fixed ball points with other diameters available on request.

Note: Please confirm the conductor diameter d required when placing your order.

Fixed Earthing Points
Grooved ring Ø16 mm

EN/IEC 61230 (DIN VDE 0683 Part 100) and DIN 48088 Part 2

Fixed earthing point with grooved ring and earth connector.

- For connecting earth connectors or earth connection plates according to DIN 48088 Part 2
- Self-locking nut
- Formed (not cut) female thread M12 or M16
- Threaded pin, M12 or M16

Technical Data	
Fixed point	Brass (CuNi2Si) / gal Sn
Threaded pin	StSt A2-70
Hexagon nut	DIN 985-M12-8 / gal Zn; DIN 985-M16-8 / gal Zn
Tightening torque	M12: 80 Nm; M16: 150 Nm

Type	Dimension	Width accross	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Grooved Ring Ø16 mm, threaded Pin and Nut					
EFP 16 RN M12 35 SSM	M12 x 35 mm	22 mm	150	29.6 *) kA	**790 251**
EFP 16 RN M16 45 SSM	M16 x 45 mm	22 mm	150	29.6 *) kA	**790 261**
B Grooved Ring Ø16 mm, with female Thread					
EFP 16 RN M12	M12	22 mm	150	29.6 *) kA	**790 250**
EFP 16 RN M16	M16	22 mm	150	29.6 *) kA	**790 260**

*) For earthing and short-circuiting devices with cable lengths ≥ 2.5 m: 18.7 kA / 1 s

Fixed Earthing Points

Connectors

EN/IEC 61230 (DIN VDE 0683 Part 100) and DIN 48088 Part 5

- For welding or bolting to the earth-side connection of earth connectors with wing nut or wing-nut bolt
- Connection units with threaded pin, M12 or M16
- Female thread, M12 or M16

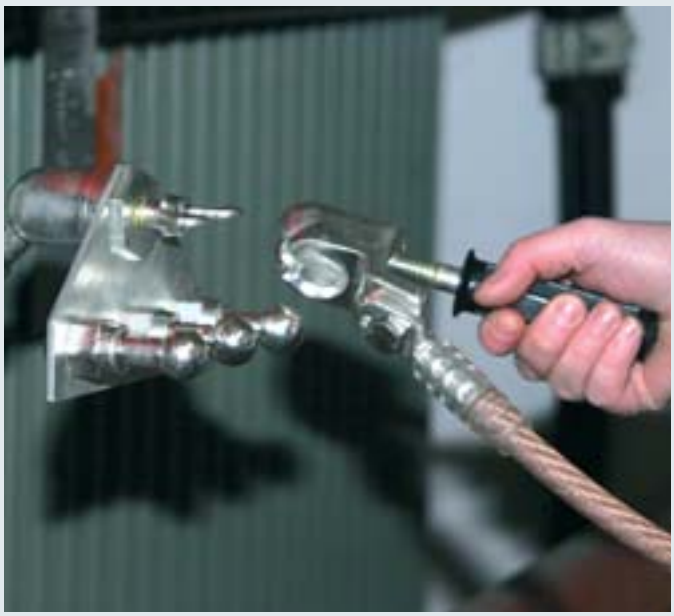
Earth connector with threaded M12 pin for bolting to an earthed part of the installation.

Type	Dimension	Width across	Material	Part No.
A Welding-type Connector, with threaded Pin				
AS SCHW M12 25	M12 x 25 mm		St/gal Zn	**705 501**
AS SCHW M16 30	M16 x 30 mm		St/gal Zn	**755 501**
B Welding-type Connector, with female Thread				
AS SCHW M12	M12		St/gal Zn	**336 020**
AS SCHW M16	M16		St/gal Zn	**336 025**
C Bolted-type Connector, with female Thread				
AS SCHR M12 M12 40	M12 / M12 x 40 mm	27 mm	Cu alloy/gal Sn	**705 504**
D Bolted-type Connector, with threaded Pin and separate hexagon Nut				
AS SCHR M12 55	M12 x 55 mm	32 mm	StSt / Cu alloy/gal Sn / St/tZn	**705 500**
AS SCHR M16 65	M16 x 65 mm	41 mm	StSt / Cu alloy/gal Sn / St/tZn	**750 500**
E Bolted-type Connector, for converting from threaded M12 Pin to M16 Pin				
AS SCHR M16 55 M12	M12 x 20 / M16 x 55 mm	41 mm	StSt / Cu alloy/gal Sn	**705 510**

Earth Connection Plates

EARTHING AND SHORT-CIRCUITING DEVICES

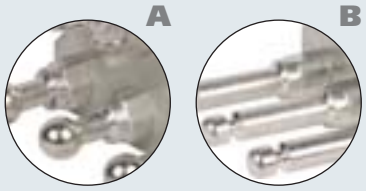
Fixed points according to EN/IEC 61230 (DIN VDE 0683 Part 100) and DIN 48088 Part 1



Earth connection plate with fixed ball points and ball head cap with plastic handle.

- For indoor and outdoor installations
- Connection plate with high short-circuit withstand capability
- Allows for individual connection of the short-circuiting cables
- Unit for fixed ball point Ø20 mm, Ø25 mm or grooved ring Ø16 mm

Technical Data	
Fixed point	Brass (CuNi2Si) / gal Sn
Threaded pin	StSt A2-70
Hexagon nut	DIN 985-M12-8 / gal Zn; DIN 985-M16-8 / gal Zn



Type	Fixed point Ø	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
A With Ball Head Cap and 3 Fixed Ball Points				
EAP 3 20 KKH	20 mm	120 mm²	23.7 kA	**728 300**
EAP 3 25 KKH	25 mm	150 mm²	29.6 kA	**728 500**

B With Earth Connector and 3 Fixed Earthing Points, with grooved Rings

EAP 3 16 RN	16 mm	95 mm²	18.7 kA	**728 520**

Other types available on request.

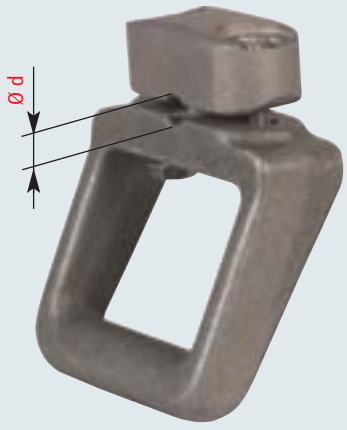
Fixed Phase Points

Coupling aid according to DIN 48088 Part 3

- Coupling aid (stirrup) for phase screw clamps
- For high-voltage installations up to 220 kV
- Other types of coupling aids, e.g. for double conductors or with greater coupling aid widths available on request

Fixed phase point installed on an overhead line.

Technical Data	
Stirrup	Al or Cu alloy
Screws	StSt



A

Type	For conductor Ø d	Width b of coupling aid	Max. short-circuit current I_k 1 s	Part No.
A Fixed Phase Points for attaching to Al and Al/St Conductor Cables				
PFP 11 33 AL 60 82	11.0 ... 33 mm	82 mm	23.7 kA	**731 011**
PFP 34 48 AL 60 98	33.1 ... 48 mm	98 mm	23.7 kA	**731 013**
PFP 49 70 AL 60 126	48.1 ... 70 mm	126 mm	23.7 kA	**731 015**
B Fixed Phase Points for attaching to round Cu Conductors				
PFP 11 33 CU 60 82	11.0 ... 33 mm	82 mm	23.7 kA	**731 027**
PFP 34 48 CU 60 98	33.1 ... 48 mm	98 mm	23.7 kA	**731 037**

Note: Please confirm the conductor diameter d required when placing your order.

SAFETY EQUIPMENT

Quick Overview

EARTHING AND SHORT-CIRCUITING DEVICES

EN/IEC 61230 (DIN VDE 0683 Part 100)

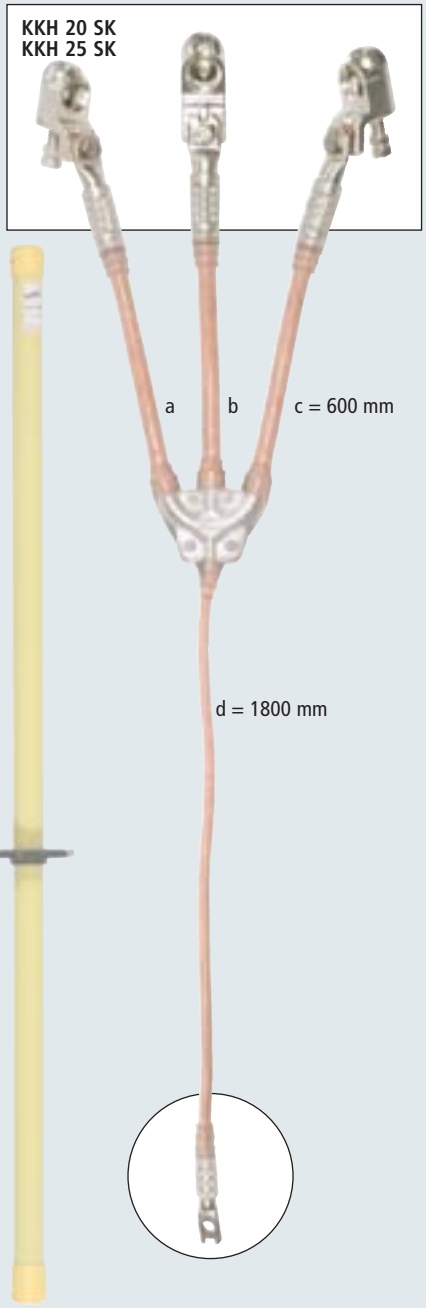
Phase connecting elements	Components	Type	Page
 	Earthing and Short-Circuiting Devices		
	Ball Head Cap, rigid, hexagon Shaft	3-pole	100
		Single-pole	110
	Ball Head Cap, rigid, T pin Shaft	3-pole	101
		Single-pole	111
 	Earthing and Short-Circuiting Devices		
	Ball Head Cap, adjustable (4 x 90°), hexagon Shaft	3-pole	102
		Single-pole	112
	Ball Head Cap, adjustable (4 x 90°), T pin Shaft	3-pole	103
		Single-pole	113
 	Earthing and Short-Circuiting Devices		
	Universal Clamp, Clamping Range 20 mm, hexagon Shaft	3-pole	104
		Single-pole	114
	Universal Clamp, Clamping Range 20 mm, T pin Shaft	3-pole	105
		Single-pole	115
 	Earthing and Short-Circuiting Devices		
	Universal Clamp, Clamping Range 30 mm, hexagon Shaft	3-pole	106
		Single-pole	116
	Universal Clamp, Clamping Range 30 mm, T pin Shaft	3-pole	107
		Single-pole	117

Three-pole Earthing and Short-circuiting Devices

Ball head cap, rigid, hexagon shaft

EN/IEC 61230 (DIN VDE 0683 Part 100)

Phase connecting elements



Earth connecting elements

EAS EK FM 12

EAS EK FS 12

EAB RN 16 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 618	725 317	725 358
20 mm	35/35 mm²	6.9 kA	735 618	735 317	735 358
20 mm	50/25 mm²	9.9 kA	750 350	750 317	750 358
20 mm	70/35 mm²	13.8 kA	770 350	770 317	770 358
20 mm	95/35 mm²	18.7 kA	794 350	794 317	794 358
20 mm	120/50 mm²	23.7 kA	711 350	711 317	711 358
25 mm	95/35 mm²	18.7 kA	795 350	795 317	795 358
25 mm	120/50 mm²	23.7 kA	712 350	712 317	712 358
25 mm	150/50 mm²	29.6 kA	715 350	715 317	715 358

EAS EK FM 16

EAS EK FS 16

EFK FL30 SKN

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 362	725 363	725 360
20 mm	35/35 mm²	6.9 kA	735 362	735 363	735 360
20 mm	50/25 mm²	9.9 kA	750 362	750 363	750 360
20 mm	70/35 mm²	13.8 kA	770 362	770 363	770 360
20 mm	95/35 mm²	18.7 kA	794 362	794 363	794 360
20 mm	120/50 mm²	23.7 kA	711 362	711 363	711 360
25 mm	95/35 mm²	18.7 kA	795 362	795 363	795 360
25 mm	120/50 mm²	23.7 kA	712 362	712 363	712 360
25 mm	150/50 mm²	29.6 kA	715 362	715 363	715 360

KKH 20 FS
KKH 25 FS

KKH 20 HG
KKH 25 HG

UEK 25 FS
UEK 30 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 619	725 357	725 359
20 mm	35/35 mm²	6.9 kA	735 619	735 357	735 359
20 mm	50/25 mm²	9.9 kA	750 356	750 357	750 359
20 mm	70/35 mm²	13.8 kA	770 356	770 357	770 359
20 mm	95/35 mm²	18.7 kA	794 356	794 357	794 359
20 mm	120/50 mm²	23.7 kA	711 356	711 357	711 359
25 mm	95/35 mm²	18.7 kA	795 356	795 357	795 359
25 mm	120/50 mm²	23.7 kA	712 356	712 357	712 359
25 mm	150/50 mm²	29.6 kA	715 356	715 357	715 359

Other cable lengths as well as types with unreduced earthing cable cross sections, other earthing clamps and earth connection units available on request. Earthing rod not included in delivery.

SAFETY EQUIPMENT — Three-pole Earthing and Short-Circuiting Devices

EARTHING AND SHORT-CIRCUITING DEVICES — Ball head cap, rigid, T pin shaft

EN/IEC 61230 (DIN VDE 0683 Part 100)

Earth connecting elements | **Phase connecting elements**

EAS EK FM 12 | EAS EK FS 12 | EAB RN 16 FS

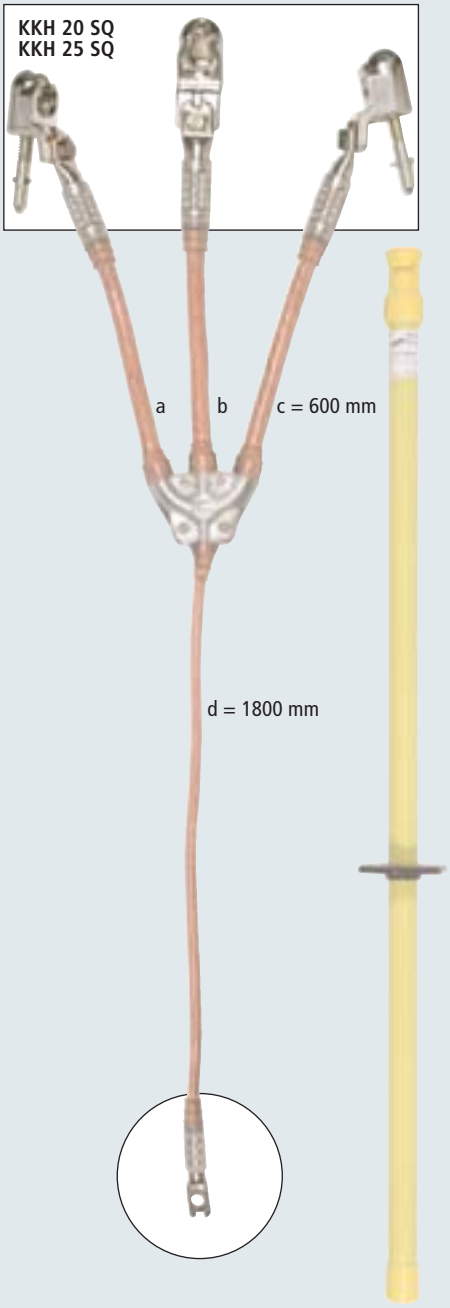
Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 620	725 365	725 368
20 mm	35/35 mm²	6.9 kA	735 620	735 365	735 368
20 mm	50/25 mm²	9.9 kA	750 351	750 365	750 368
20 mm	70/35 mm²	13.8 kA	770 351	770 365	770 368
20 mm	95/35 mm²	18.7 kA	794 351	794 365	794 368
20 mm	120/50 mm²	23.7 kA	711 351	711 365	711 368
25 mm	95/35 mm²	18.7 kA	795 351	795 365	795 368
25 mm	120/50 mm²	23.7 kA	712 351	712 365	712 368
25 mm	150/50 mm²	29.6 kA	715 351	715 365	715 368

EAS EK FM 16 | EAS EK FS 16 | EFK FL30 SKN

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 372	725 373	725 370
20 mm	35/35 mm²	6.9 kA	735 372	735 373	735 370
20 mm	50/25 mm²	9.9 kA	750 372	750 373	750 370
20 mm	70/35 mm²	13.8 kA	770 372	770 373	770 370
20 mm	95/35 mm²	18.7 kA	794 372	794 373	794 370
20 mm	120/50 mm²	23.7 kA	711 372	711 373	711 370
25 mm	95/35 mm²	18.7 kA	795 372	795 373	795 370
25 mm	120/50 mm²	23.7 kA	712 372	712 373	712 370
25 mm	150/50 mm²	29.6 kA	715 372	715 373	715 370

KKH 20 FS
KKH 25 FS | KKH 20 HG
KKH 25 HG | UEK 25 FS
UEK 30 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 621	725 367	725 369
20 mm	35/35 mm²	6.9 kA	735 621	735 367	735 369
20 mm	50/25 mm²	9.9 kA	750 366	750 367	750 369
20 mm	70/35 mm²	13.8 kA	770 366	770 367	770 369
20 mm	95/35 mm²	18.7 kA	794 366	794 367	794 369
20 mm	120/50 mm²	23.7 kA	711 366	711 367	711 369
25 mm	95/35 mm²	18.7 kA	795 366	795 367	795 369
25 mm	120/50 mm²	23.7 kA	712 366	712 367	712 369
25 mm	150/50 mm²	29.6 kA	715 366	715 367	715 369



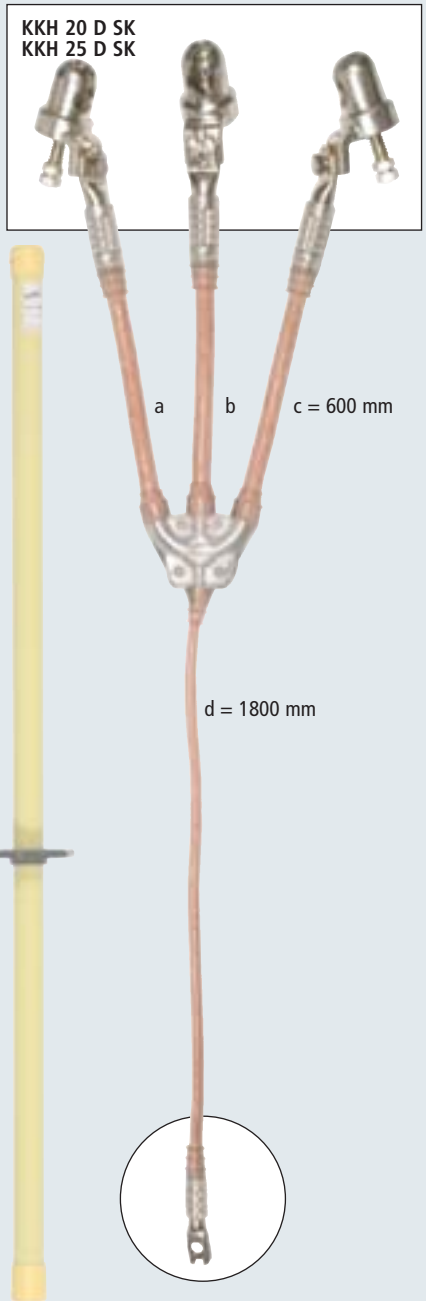
Other cable lengths as well as types with unreduced earthing cable cross sections, other earthing clamps and earth connection units available on request. Earthing rod not included in delivery.

Three-pole Earthing and Short-circuiting Devices

Ball head cap, adjustable (4 x 90°), hexagon shaft

IEC/EN 61230 (DIN VDE 0683 Part 100)

Phase connecting elements



Earth connecting elements

EAS EK FM 12

EAS EK FS 12

EAB RN 16 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 718	725 375	725 378
20 mm	35/35 mm²	6.9 kA	735 718	735 375	735 378
20 mm	50/25 mm²	9.9 kA	750 353	750 375	750 378
20 mm	70/35 mm²	13.8 kA	770 353	770 375	770 378
20 mm	95/35 mm²	18.7 kA	794 353	794 375	794 378
20 mm	120/50 mm²	23.7 kA	711 353	711 375	711 378
25 mm	95/35 mm²	18.7 kA	795 374	795 375	795 378
25 mm	120/50 mm²	23.7 kA	712 374	712 375	712 378
25 mm	150/50 mm²	29.6 kA	715 374	715 375	715 378

EAS EK FM 16

EAS EK FS 16

EFK FL30 SKN

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 382	725 383	725 380
20 mm	35/35 mm²	6.9 kA	735 382	735 383	735 380
20 mm	50/25 mm²	9.9 kA	750 382	750 383	750 380
20 mm	70/35 mm²	13.8 kA	770 382	770 383	770 380
20 mm	95/35 mm²	18.7 kA	794 382	794 383	794 380
20 mm	120/50 mm²	23.7 kA	711 382	711 383	711 380
25 mm	95/35 mm²	18.7 kA	795 382	795 383	795 380
25 mm	120/50 mm²	23.7 kA	712 382	712 383	712 380
25 mm	150/50 mm²	29.6 kA	715 382	715 383	715 380

KKH 20 FS
KKH 25 FS

KKH 20 HG
KKH 25 HG

UEK 25 FS
UEK 30 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 719	725 377	725 379
20 mm	35/35 mm²	6.9 kA	735 719	735 377	735 379
20 mm	50/25 mm²	9.9 kA	750 376	750 377	750 379
20 mm	70/35 mm²	13.8 kA	770 376	770 377	770 379
20 mm	95/35 mm²	18.7 kA	794 376	794 377	794 379
20 mm	120/50 mm²	23.7 kA	711 376	711 377	711 379
25 mm	95/35 mm²	18.7 kA	795 376	795 950	795 379
25 mm	120/50 mm²	23.7 kA	712 376	712 950	712 379
25 mm	150/50 mm²	29.6 kA	715 376	715 950	715 379

Other cable lengths as well as types with unreduced earthing cable cross sections, other earthing clamps and earth connection units available on request. Earthing rod not included in delivery.

SAFETY EQUIPMENT

Three-pole Earthing and Short-circuiting Devices

EARTHING AND SHORT-CIRCUITING DEVICES

Ball head cap, adjustable (4 x 90°), T pin shaft

IEC/EN 61230 (DIN VDE 0683 Part 100)

Earth connecting elements

Phase connecting elements

EAS EK FM 12 | EAS EK FS 12 | EAB RN 16 FS

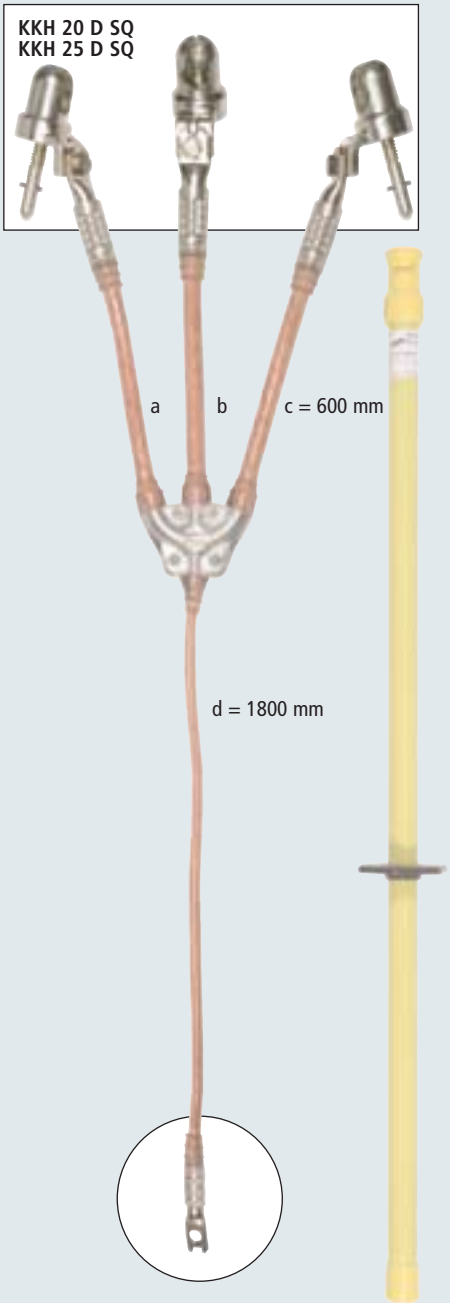
Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 720	725 385	725 388
20 mm	35/35 mm²	6.9 kA	735 720	735 385	735 388
20 mm	50/25 mm²	9.9 kA	750 354	750 385	750 388
20 mm	70/35 mm²	13.8 kA	770 354	770 385	770 388
20 mm	95/35 mm²	18.7 kA	794 354	794 385	794 388
20 mm	120/50 mm²	23.7 kA	711 354	711 385	711 388
25 mm	95/35 mm²	18.7 kA	795 384	795 385	795 388
25 mm	120/50 mm²	23.7 kA	712 384	712 385	712 388
25 mm	150/50 mm²	29.6 kA	715 384	715 385	715 388

EAS EK FM 16 | EAS EK FS 16 | EFK FL30 SKN

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 392	725 393	725 390
20 mm	35/35 mm²	6.9 kA	735 392	735 393	735 390
20 mm	50/25 mm²	9.9 kA	750 392	750 393	750 390
20 mm	70/35 mm²	13.8 kA	770 392	770 393	770 390
20 mm	95/35 mm²	18.7 kA	794 392	794 393	794 390
20 mm	120/50 mm²	23.7 kA	711 392	711 393	711 390
25 mm	95/35 mm²	18.7 kA	795 392	795 393	795 390
25 mm	120/50 mm²	23.7 kA	712 392	712 393	712 390
25 mm	150/50 mm²	29.6 kA	715 392	715 393	715 390

KKH 20 FS
KKH 25 FS | KKH 20 HG
KKH 25 HG | UEK 25 FS
UEK 30 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25/25 mm²	4.9 kA	725 721	725 387	725 389
20 mm	35/35 mm²	6.9 kA	735 721	735 387	735 389
20 mm	50/25 mm²	9.9 kA	750 386	750 387	750 389
20 mm	70/35 mm²	13.8 kA	770 386	770 387	770 389
20 mm	95/35 mm²	18.7 kA	794 386	794 387	794 389
20 mm	120/50 mm²	23.7 kA	711 386	711 387	711 389
25 mm	95/35 mm²	18.7 kA	795 386	795 951	795 389
25 mm	120/50 mm²	23.7 kA	712 386	712 951	712 389
25 mm	150/50 mm²	29.6 kA	715 386	715 951	715 389



Other cable lengths as well as types with unreduced earthing cable cross sections, other earthing clamps and earth connection units available on request. Earthing rod not included in delivery.

Three-pole Earthing and Short-circuiting Devices

Universal clamp, clamping range 20 mm, hexagon shaft

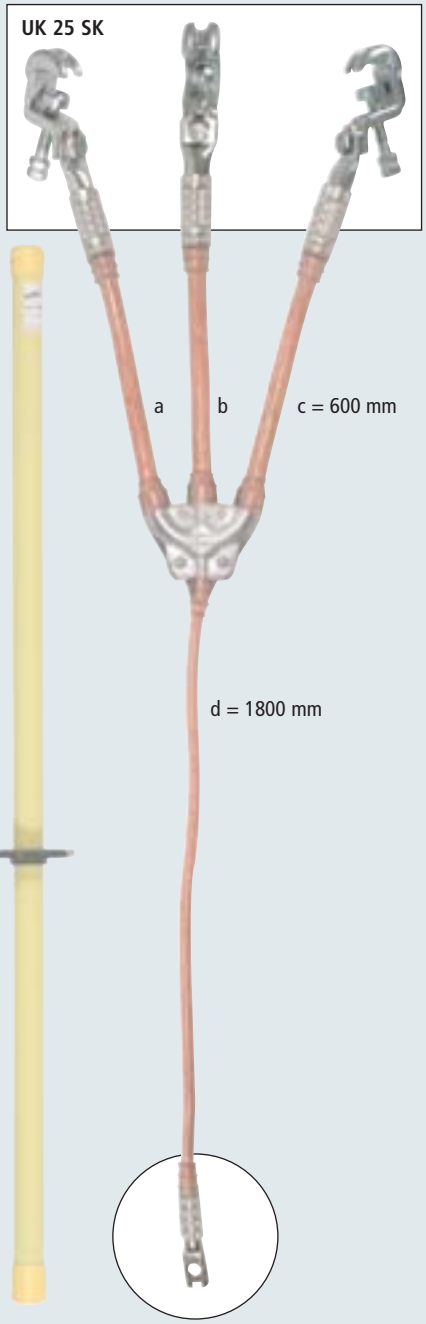
IEC/EN 61230 (DIN VDE 0683 Part 100)

Phase connecting elements

Earth connecting elements

EAS EK FM 12

EAB RN 16 FS



Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 / 25 mm	15 mm	20 mm	25/25 mm²	4.9 kA	**725 823**	**725 826**
20 / 25 mm	15 mm	20 mm	35/35 mm²	6.9 kA	**735 823**	**735 826**
20 / 25 mm	15 mm	20 mm	50/25 mm²	9.9 kA	**750 823**	**750 826**
20 / 25 mm	15 mm	20 mm	70/35 mm²	13.8 kA	**770 823**	**770 826**
20 / 25 mm	15 mm	—	95/35 mm²	18.7 kA	**795 823**	**795 826**
— / 25 mm	—	—	120/50 mm²	23.7 kA	**712 843** new	**712 846** new

UEK 25 FS

EFK FL30 SKN

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 / 25 mm	15 mm	20 mm	25/25 mm²	4.9 kA	**725 822**	**725 821**
20 / 25 mm	15 mm	20 mm	35/35 mm²	6.9 kA	**735 822**	**735 821**
20 / 25 mm	15 mm	20 mm	50/25 mm²	9.9 kA	**750 822**	**750 821**
20 / 25 mm	15 mm	20 mm	70/35 mm²	13.8 kA	**770 822**	**770 821**
20 / 25 mm	15 mm	—	95/35 mm²	18.7 kA	**795 822**	**795 821**
— / 25 mm	—	—	120/50 mm²	23.7 kA	**712 842** new	**712 841** new

UEK 25 HG

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
20 / 25 mm	15 mm	20 mm	25/25 mm²	4.9 kA	**725 825**
20 / 25 mm	15 mm	20 mm	35/35 mm²	6.9 kA	**735 825**
20 / 25 mm	15 mm	20 mm	50/25 mm²	9.9 kA	**750 825**
20 / 25 mm	15 mm	20 mm	70/35 mm²	13.8 kA	**770 825**
20 / 25 mm	15 mm	—	95/35 mm²	18.7 kA	**795 825**
— / 25 mm	—	—	120/50 mm²	23.7 kA	**712 845** new

Other cable lengths as well as types with unreduced earthing cable cross sections, other earthing clamps and earth connection units available on request.
Earthing rod not included in delivery.

SAFETY EQUIPMENT

Three-pole Earthing and Short-circuting Devices

EARTHING AND SHORT-CIRCUITING DEVICES

IEC/EN 61230 (DIN VDE 0683 Part 100)

Universal clamp, clamping range 20 mm, T pin shaft

Earth connecting elements

EAS EK FM 12

EAB RN 16 FS

Phase connecting elements

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 / 25 mm	15 mm	20 mm	25/25 mm²	4.9 kA	**725 833**	**725 836**
20 / 25 mm	15 mm	20 mm	35/35 mm²	6.9 kA	**735 833**	**735 836**
20 / 25 mm	15 mm	20 mm	50/25 mm²	9.9 kA	**750 833**	**750 836**
20 / 25 mm	15 mm	20 mm	70/35 mm²	13.8 kA	**770 833**	**770 836**
20 / 25 mm	15 mm	—	95/35 mm²	18.7 kA	**795 833**	**795 836**
— / 25 mm	—	—	120/50 mm²	23.7 kA	**712 863** new	**712 866** new

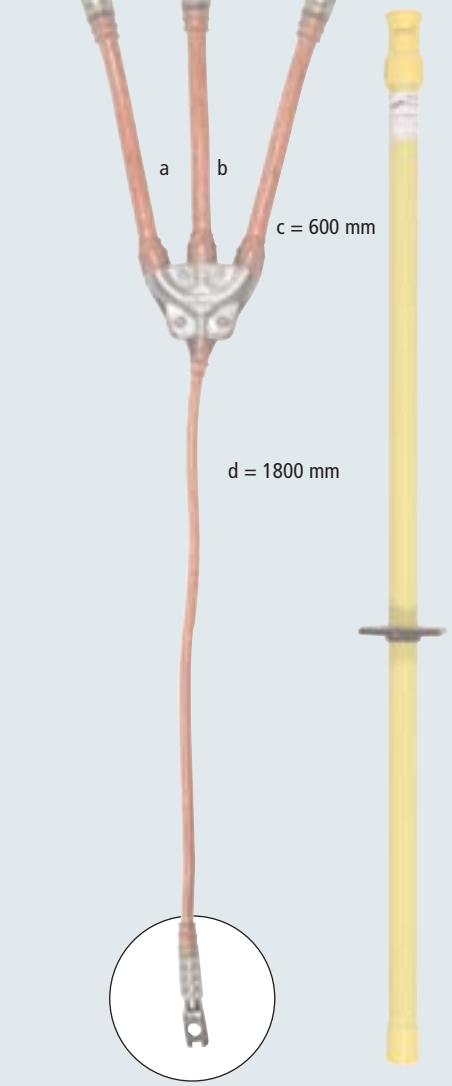
UEK 25 FS

EFK FL30 SKN

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 / 25 mm	15 mm	20 mm	25/25 mm²	4.9 kA	**725 832**	**725 831**
20 / 25 mm	15 mm	20 mm	35/35 mm²	6.9 kA	**735 832**	**735 831**
20 / 25 mm	15 mm	20 mm	50/25 mm²	9.9 kA	**750 832**	**750 831**
20 / 25 mm	15 mm	20 mm	70/35 mm²	13.8 kA	**770 832**	**770 831**
20 / 25 mm	15 mm	—	95/35 mm²	18.7 kA	**795 832**	**795 831**
— / 25 mm	—	—	120/50 mm²	23.7 kA	**712 862** new	**712 861** new

UEK 25 HG

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
20 / 25 mm	15 mm	20 mm	25/25 mm²	4.9 kA	**725 835**
20 / 25 mm	15 mm	20 mm	35/35 mm²	6.9 kA	**735 835**
20 / 25 mm	15 mm	20 mm	50/25 mm²	9.9 kA	**750 835**
20 / 25 mm	15 mm	20 mm	70/35 mm²	13.8 kA	**770 835**
20 / 25 mm	15 mm	—	95/35 mm²	18.7 kA	**795 835**
— / 25 mm	—	—	120/50 mm²	23.7 kA	**712 865** new



Other cable lengths as well as types with unreduced earthing cable cross sections, other earthing clamps and earth connection units available on request.
Earthing rod not included in delivery.

Three-pole Earthing and Short-circuiting Devices

Universal clamp, clamping range 30 mm, hexagon shaft

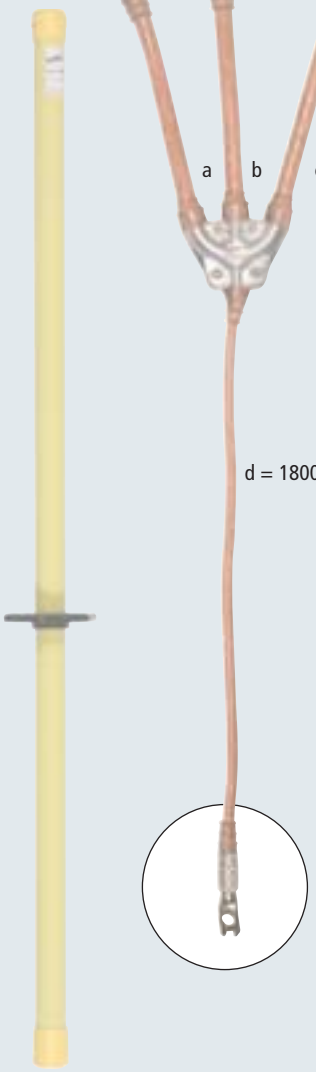
IEC/EN 61230 (DIN VDE 0683 Part 100)

Phase connecting elements

Earth connecting elements

EAS EK FM 12

EAB RN 16 FS



Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
25 / 30 mm	18 mm	30 mm	25/25 mm²	4.9 kA	**725 804**	**725 807**
25 / 30 mm	18 mm	30 mm	35/35 mm²	6.9 kA	**735 804**	**735 807**
25 / 30 mm	18 mm	30 mm	50/25 mm²	9.9 kA	**750 804**	**750 807**
25 / 30 mm	18 mm	30 mm	70/35 mm²	13.8 kA	**770 804**	**770 807**
25 / 30 mm	18 mm	—	95/35 mm²	18.7 kA	**795 804**	**795 807**
25 / 30 mm	—	—	120/50 mm²	23.7 kA	**712 804**	**712 807**

UEK 30 FS

EFK FL30 SKN

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
25 / 30 mm	18 mm	30 mm	25/25 mm²	4.9 kA	**725 115**	**725 802**
25 / 30 mm	18 mm	30 mm	35/35 mm²	6.9 kA	**735 115**	**735 802**
25 / 30 mm	18 mm	30 mm	50/25 mm²	9.9 kA	**750 803**	**750 802**
25 / 30 mm	18 mm	30 mm	70/35 mm²	13.8 kA	**770 803**	**770 802**
25 / 30 mm	18 mm	—	95/35 mm²	18.7 kA	**795 803**	**795 802**
25 / 30 mm	—	—	120/50 mm²	23.7 kA	**712 803**	**712 802**

UEK 30 HG

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
25 / 30 mm	18 mm	30 mm	25/25 mm²	4.9 kA	**725 806**
25 / 30 mm	18 mm	30 mm	35/35 mm²	6.9 kA	**735 806**
25 / 30 mm	18 mm	30 mm	50/25 mm²	9.9 kA	**750 806**
25 / 30 mm	18 mm	30 mm	70/35 mm²	13.8 kA	**770 806**
25 / 30 mm	18 mm	—	95/35 mm²	18.7 kA	**795 806**
25 / 30 mm	—	—	120/50 mm²	23.7 kA	**712 806**

Other cable lengths as well as types with unreduced earthing cable cross sections, other earthing clamps and earth connection units available on request.
Earthing rod not included in delivery.

SAFETY EQUIPMENT

Three-pole Earthing and Short-circuiting Devices

EARTHING AND SHORT-CIRCUITING DEVICES

IEC/EN 61230 (DIN VDE 0683 Part 100)

Universal clamp, clamping range 30 mm, T pin shaft

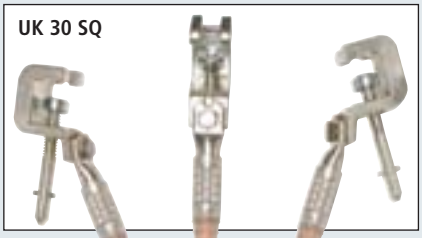
Earth connecting elements

EAS EK FM 12

EAB RN 16 FS

Phase connecting elements

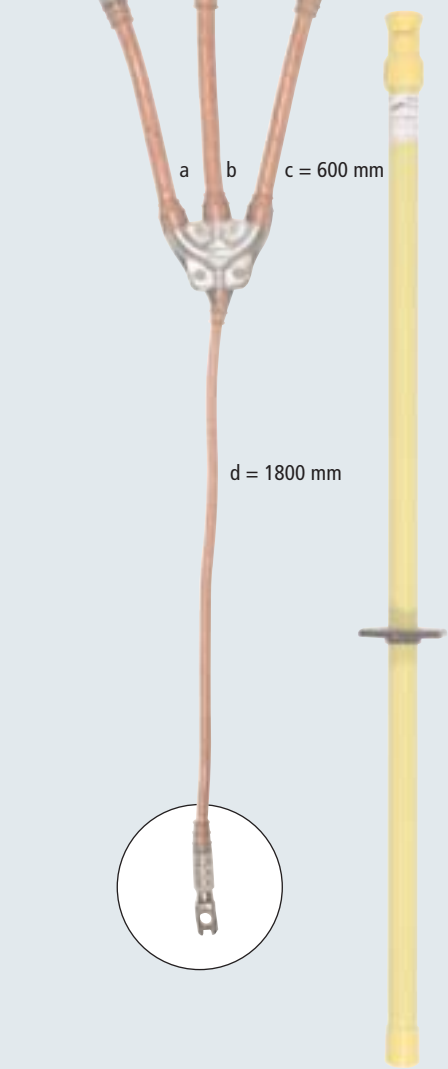
Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
25 / 30 mm	18 mm	30 mm	25/25 mm²	4.9 kA	**725 813**	**725 816**
25 / 30 mm	18 mm	30 mm	35/35 mm²	6.9 kA	**735 813**	**735 816**
25 / 30 mm	18 mm	30 mm	50/25 mm²	9.9 kA	**750 813**	**750 816**
25 / 30 mm	18 mm	30 mm	70/35 mm²	13.8 kA	**770 813**	**770 816**
25 / 30 mm	18 mm	—	95/35 mm²	18.7 kA	**795 813**	**795 816**
25 / 30 mm	—	—	120/50 mm²	23.7 kA	**712 813**	**712 816**



UEK 30 FS

EFK FL30 SKN

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
25 / 30 mm	18 mm	30 mm	25/25 mm²	4.9 kA	**725 117**	**725 811**
25 / 30 mm	18 mm	30 mm	35/35 mm²	6.9 kA	**735 117**	**735 811**
25 / 30 mm	18 mm	30 mm	50/25 mm²	9.9 kA	**750 812**	**750 811**
25 / 30 mm	18 mm	30 mm	70/35 mm²	13.8 kA	**770 812**	**770 811**
25 / 30 mm	18 mm	—	95/35 mm²	18.7 kA	**795 812**	**795 811**
25 / 30 mm	—	—	120/50 mm²	23.7 kA	**712 812**	**712 811**



UEK 30 HG

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
25 / 30 mm	18 mm	30 mm	25/25 mm²	4.9 kA	**725 815**
25 / 30 mm	18 mm	30 mm	35/35 mm²	6.9 kA	**735 815**
25 / 30 mm	18 mm	30 mm	50/25 mm²	9.9 kA	**750 815**
25 / 30 mm	18 mm	30 mm	70/35 mm²	13.8 kA	**770 815**
25 / 30 mm	18 mm	—	95/35 mm²	18.7 kA	**795 815**
25 / 30 mm	—	—	120/50 mm²	23.7 kA	**712 815**

Other cable lengths as well as types with unreduced earthing cable cross sections, other earthing clamps and earth connection units available on request.
Earthing rod not included in delivery.

Three-pole Earthing and Short-circuiting Devices

Short-circuiting bar

EN/IEC 61230 (DIN VDE 0683 Part 100)

- With longitudinal slot for reliable contact
- For Cu or Al busbars, up to 25 mm thick
- Other bars and earthing cable lengths available on request
- Operation by earthing rod, with hexagon shaft or T pin shaft

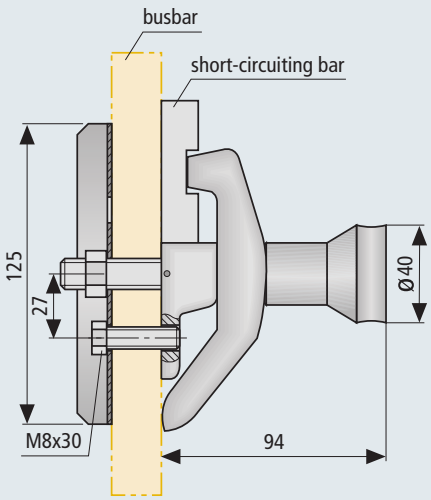
Short-circuiting bar with earthing cable in use in a switchgear installation.

The short-circuiting bar with longitudinal slot can be used for installations with compensated systems.
The earthing cable is supplied with a ball head cap with wing nut for fixed ball points Ø20 mm for connection to the earthing system (other types of equipment available on request).
The short-circuiting bars can be provided with 2 different coupling devices for operation with earthing rods:

Technical Data	
Earthing cable	Cu, highly flexible
Cable cross section	50 mm²
Cable length	2500 mm
Operating temperature range	– 25° C ... + 55° C

SK: Hexagon shaft

SQ: T pin shaft (bayonet)

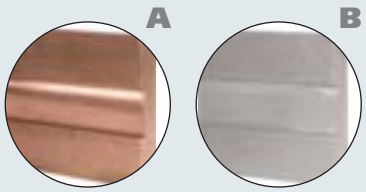


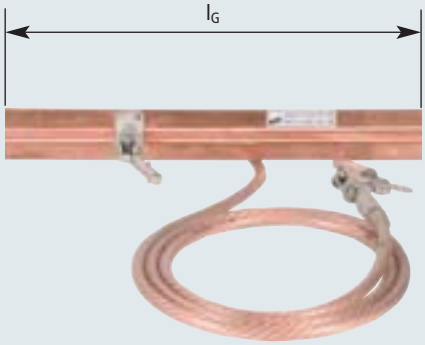
Fixed clamping point with eye and contact claw

SAFETY EQUIPMENT

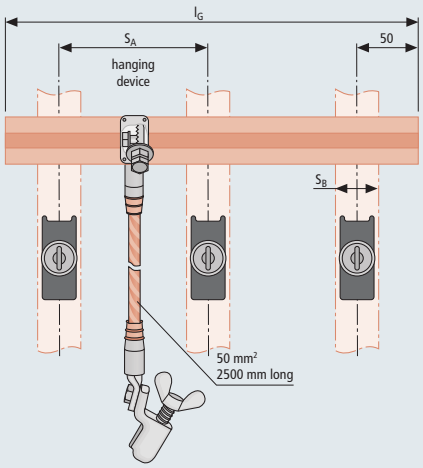
Three-pole Earthing and Short-circuiting Devices

EARTHING AND SHORT-CIRCUITING DEVICES





Type	Coupling device	Profile h x w	Total length I§G	Max. short-circuit current I_k 1 s	Part No.
A Short-circuiting Bar made of E-Cu F20					
KSS 60 8 CU SK	SK	60 x 8 mm	520 mm	70.0 kA	**795 038**
KSS 60 12 CU SK	SK	60 x 12 mm	520 mm	90.0 kA	**795 039**
KSS 60 8 CU SQ	SQ	60 x 8 mm	520 mm	70.0 kA	**795 041**
KSS 60 12 CU SQ	SQ	60 x 12 mm	520 mm	90.0 kA	**795 045**
B Short-circuiting Bar made of AlMgSi 0.5					
KSS 60 8 AL SK	SK	60 x 8 mm	520 mm	45.0 kA	**795 042**
KSS 60 12 Al SK	SK	60 x 12 mm	520 mm	70.0 kA	**795 043**
KSS 60 8 AL SQ	SQ	60 x 8 mm	520 mm	45.0 kA	**795 048**
KSS 60 12 AL SQ	SQ	60 x 12 mm	520 mm	70.0 kA	**795 049**



Note: Please confirm the bar distance (S_A) and bar width (S_B) required when placing your order.

Accessories for Three-pole Earthing and Short-circuiting Devices

Fixed Clamping Points for Busbars

With eye and contact claw

Type	Part No.
KLFP M12 KSS	**795 040**

SK Screw Adapter

Hexagon terminal, width across: SW 19

Type	Total length l_G	Part No.
SA KLFP SK	60 mm	**795 214**

SQ Screw Adapter

T pin shaft (bayonet)

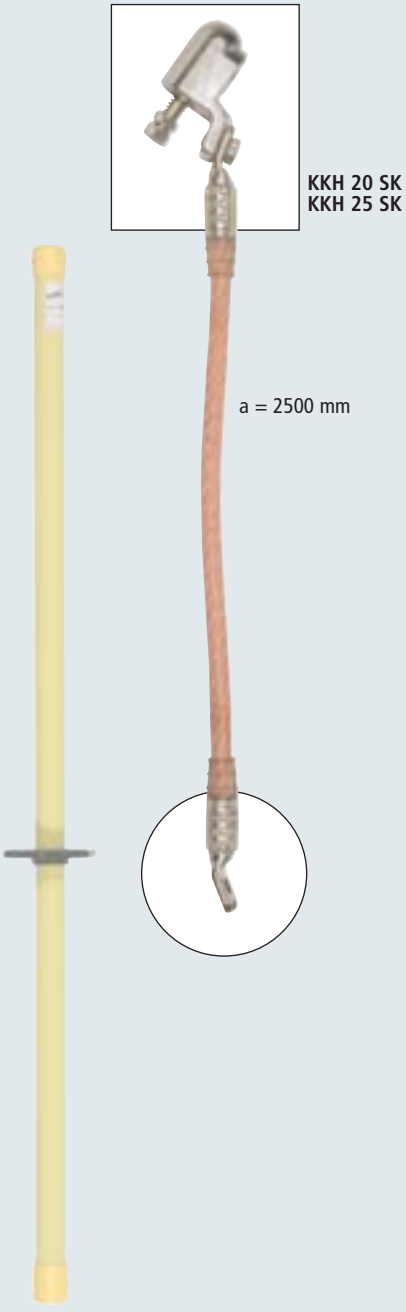
Type	Total length l_G	Part No.
SA KLFP SQ	100 mm	**795 213**

Single-pole Earthing and Short-circuiting Devices

Ball head cap, rigid, hexagon shaft

IEC/EN 61230 (DIN VDE 0683 Part 100)

Phase connecting element



KKH 20 SK
KKH 25 SK

a = 2500 mm

Earth connecting elements

KKH 20 FS
KKH 25 FS

KKH 20 HG
KKH 25 HG

EAB RN 16 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25 mm²	4.9 kA	**725 025**	**725 044**	**725 046**
20 mm	35 mm²	6.9 kA	**735 025**	**735 044**	**735 046**
20 mm	50 mm²	9.9 kA	**750 025**	**750 044**	**750 046**
20 mm	70 mm²	13.8 kA	**770 025**	**770 044**	**770 046**
20 mm	95 mm²	18.7 kA	**794 025**	**794 044**	**794 046**
20 mm	120 mm²	23.7 kA	**711 025**	**711 044**	**711 046**
25 mm	95 mm²	18.7 kA	**795 025**	**795 044**	**795 046**
25 mm	120 mm²	23.7 kA	**712 025**	**712 044**	**712 046**
25 mm	150 mm²	29.6 kA	**715 025**	**715 044**	**715 046**

UEK 25 FS
UEK 30 FS

EFK FL30 SKN

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 mm	25 mm²	4.9 kA	**725 045**	**725 048**
20 mm	35 mm²	6.9 kA	**735 045**	**735 048**
20 mm	50 mm²	9.9 kA	**750 045**	**750 048**
20 mm	70 mm²	13.8 kA	**770 045**	
20 mm	95 mm²	18.7 kA	**794 045***)	
20 mm	120 mm²	23.7 kA	**711 045***)	
25 mm	95 mm²	18.7 kA	**794 048***)	
25 mm	120 mm²	23.7 kA	**712 045***)	

*) Earth side for fixed ball points only

Other cable lengths and earthing clamps available on request.
Earthing rod not included in delivery.

SAFETY EQUIPMENT — Single-pole Earthing and Short-circuiting Devices

EARTHING AND SHORT-CIRCUITING DEVICES — Ball head cap, rigid, T pin shaft

IEC/EN 61230 (DIN VDE 0683 Part 100)

Earth connecting elements

KKH 20 FS
KKH 25 FS

KKH 20 HG
KKH 25 HG

EAB RN 16 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25 mm²	4.9 kA	**725 031**	**725 053**	**725 050**
20 mm	35 mm²	6.9 kA	**735 031**	**735 053**	**735 050**
20 mm	50 mm²	9.9 kA	**750 031**	**750 053**	**750 050**
20 mm	70 mm²	13.8 kA	**770 031**	**770 053**	**770 050**
20 mm	95 mm²	18.7 kA	**794 031**	**794 053**	**794 050**
20 mm	120 mm²	23.7 kA	**711 031**	**711 053**	**711 050**
25 mm	95 mm²	18.7 kA	**795 031**	**795 053**	**795 050**
25 mm	120 mm²	23.7 kA	**712 031**	**712 053**	**712 050**
25 mm	150 mm²	29.6 kA	**715 031**	**715 053**	**715 050**

UEK 25 FS
UEK 30 FS

EFK FL30 SKN

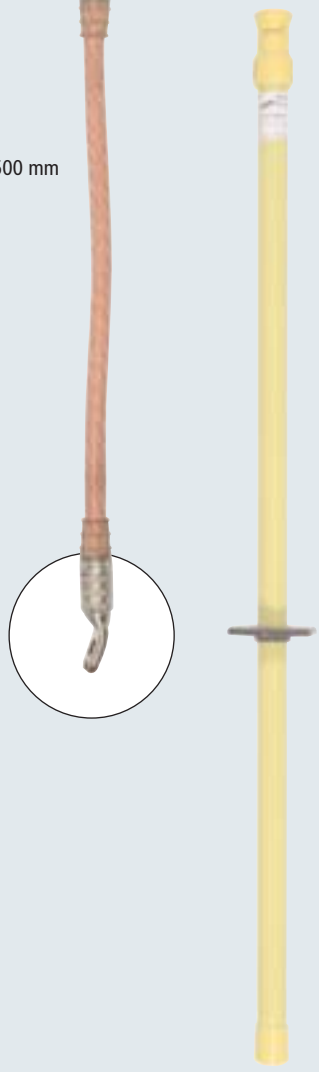
Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 mm	25 mm²	4.9 kA	**725 049**	**725 052**
20 mm	35 mm²	6.9 kA	**735 049**	**735 052**
20 mm	50 mm²	9.9 kA	**750 049**	**750 052**
20 mm	70 mm²	13.8 kA	**770 049**	
20 mm	95 mm²	18.7 kA	**794 049***)	
20 mm	120 mm²	23.7 kA	**711 049***)	
25 mm	95 mm²	18.7 kA	**794 052***)	
25 mm	120 mm²	23.7 kA	**712 049***)	

*) Earth side for fixed ball points only

Other cable lengths and earthing clamps available on request.
Earthing rod not included in delivery.

Phase connecting element

KKH 20 SQ
KKH 25 SQ



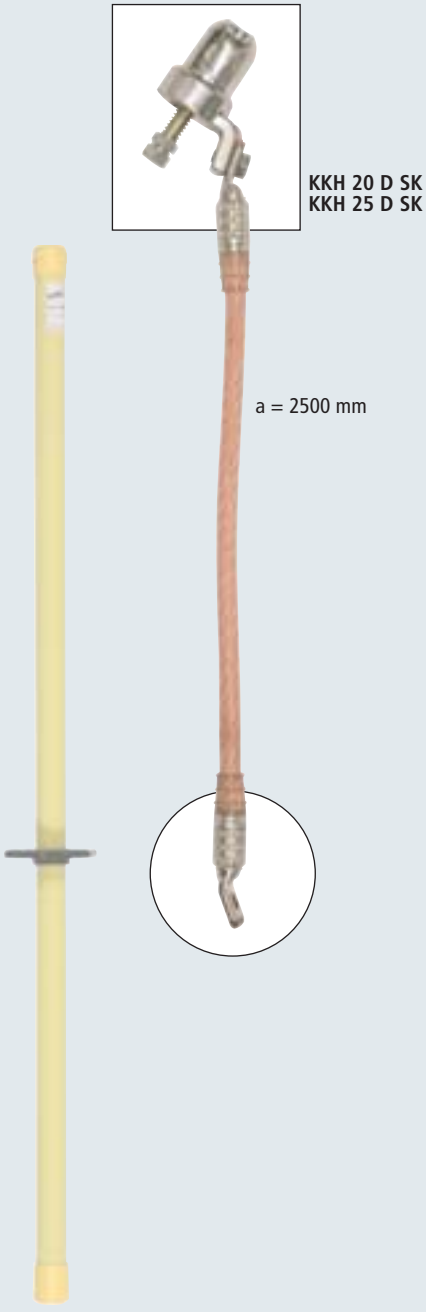
a = 2500 mm

Single-pole Earthing and Short-circuiting Devices

Ball head cap, adjustable (4 x 90°), hexagon shaft

IEC/EN 61230 (DIN VDE 0683 Part 100)

Phase connecting element



KKH 20 D SK
KKH 25 D SK

a = 2500 mm

Earth connecting elements

KKH 20 FS
KKH 25 FS

KKH 20 HG
KKH 25 HG

EAB RN 16 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25 mm²	4.9 kA	**725 325**	**725 068**	**725 061**
20 mm	35 mm²	6.9 kA	**735 325**	**735 068**	**735 061**
20 mm	50 mm²	9.9 kA	**750 325**	**750 068**	**750 061**
20 mm	70 mm²	13.8 kA	**770 325**	**770 068**	**770 061**
20 mm	95 mm²	18.7 kA	**794 325**	**794 068**	**794 061**
20 mm	120 mm²	23.7 kA	**711 325**	**711 068**	**711 061**
25 mm	95 mm²	18.7 kA	**795 325**	**795 068**	**795 061**
25 mm	120 mm²	23.7 kA	**712 325**	**712 068**	**712 061**
25 mm	150 mm²	29.6 kA	**715 325**	**715 068**	**715 061**

UEK 25 FS
UEK 30 FS

EFK FL30 SKN

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 mm	25 mm²	4.9 kA	**725 060**	**725 063**
20 mm	35 mm²	6.9 kA	**735 060**	**735 063**
20 mm	50 mm²	9.9 kA	**750 060**	**750 063**
20 mm	70 mm²	13.8 kA	**770 060**	
20 mm	95 mm²	18.7 kA	**794 060***)	
20 mm	120 mm²	23.7 kA	**711 060***)	
25 mm	95 mm²	18.7 kA	**795 060***)	
25 mm	120 mm²	23.7 kA	**712 060***)	

*) Earth side for fixed ball points only

Other cable lengths and earthing clamps available on request.
Earthing rod not included in delivery.

SAFETY EQUIPMENT — Single-pole Earthing and Short-circuiting Devices

EARTHING AND SHORT-CIRCUITING DEVICES — Ball head cap, adjustable (4 x 90°), T pin shaft

IEC/EN 61230 (DIN VDE 0683 Part 100)

Earth connecting elements

KKH 20 FS
KKH 25 FS

KKH 20 HG
KKH 25 HG

EAB RN 16 FS

Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.	Part No.
20 mm	25 mm²	4.9 kA	**725 331**	**725 069**	**725 065**
20 mm	35 mm²	6.9 kA	**735 331**	**735 069**	**735 065**
20 mm	50 mm²	9.9 kA	**750 331**	**750 069**	**750 065**
20 mm	70 mm²	13.8 kA	**770 331**	**770 069**	**770 065**
20 mm	95 mm²	18.7 kA	**794 331**	**794 069**	**794 065**
20 mm	120 mm²	23.7 kA	**711 331**	**711 069**	**711 065**
25 mm	95 mm²	18.7 kA	**795 331**	**795 069**	**795 065**
25 mm	120 mm²	23.7 kA	**712 331**	**712 069**	**712 065**
25 mm	150 mm²	29.6 kA	**715 331**	**715 069**	**715 065**

UEK 25 FS
UEK 30 FS

EFK FL30 SKN

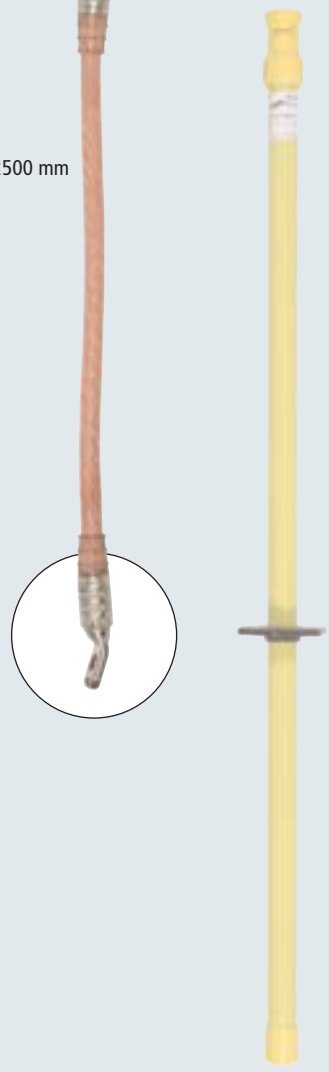
Fixed ball point Ø	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 mm	25 mm²	4.9 kA	**725 064**	**725 067**
20 mm	35 mm²	6.9 kA	**735 064**	**735 067**
20 mm	50 mm²	9.9 kA	**750 064**	**750 067**
20 mm	70 mm²	13.8 kA	**770 064**	
20 mm	95 mm²	18.7 kA	**794 064***)	
20 mm	120 mm²	23.7 kA	**711 064***)	
25 mm	95 mm²	18.7 kA	**795 064***)	
25 mm	120 mm²	23.7 kA	**712 064***)	

*) Earth side for fixed ball points only

Other cable lengths and earthing clamps available on request.
Earthing rod not included in delivery.

Phase connecting element

KKH 20 D SK
KKH 25 D SK



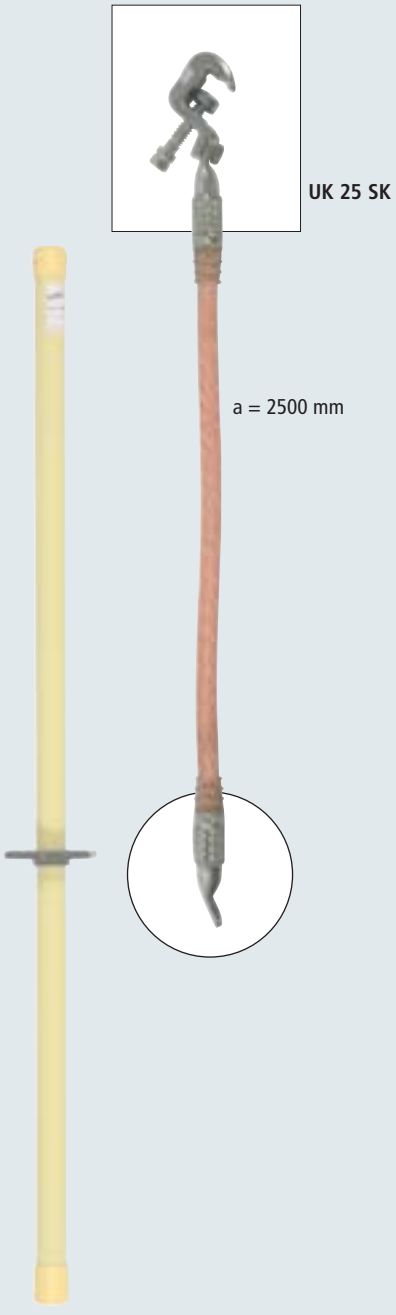
a = 2500 mm

Single-pole Earthing and Short-circuiting Devices

Universal clamp, clamping range 20 mm, hexagon shaft

IEC/EN 61230 (DIN VDE 0683 Part 100)

Phase connecting element



UK 25 SK

a = 2500 mm

Earth connecting elements

UEK 25 FS

UEK 25 HG

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 / 25 mm	15 mm	20 mm	25 mm²	4.9 kA	**725 103**	**725 106**
20 / 25 mm	15 mm	20 mm	35 mm²	6.9 kA	**735 103**	**735 106**
20 / 25 mm	15 mm	20 mm	50 mm²	9.9 kA	**750 103**	**750 106**
20 / 25 mm	15 mm	20 mm	70 mm²	13.8 kA	**770 103**	**770 106**
20 / 25 mm	15 mm	—	95 mm²	18.7 kA	**795 103***)	**795 106***)
— / 25 mm	—	—	120 mm²	23.7 kA	**712 073***) new	**712 076***) new

*) Earth side for fixed ball points only

EFK FL30 SKN

EFK FL40 SKN

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 / 25 mm	15 mm	20 mm	25 mm²	4.9 kA	**725 101**	**725 104**
20 / 25 mm	15 mm	20 mm	35 mm²	6.9 kA	**735 101**	**735 104**
20 / 25 mm	15 mm	20 mm	50 mm²	9.9 kA	**750 101**	**750 104**
20 / 25 mm	15 mm	20 mm	70 mm²	13.8 kA		**770 104**
20 / 25 mm	15 mm	—	95 mm²	18.7 kA		**795 104**

EAB RN 16 FS

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
20 / 25 mm	15 mm	20 mm	25 mm²	4.9 kA	**725 105**
20 / 25 mm	15 mm	20 mm	35 mm²	6.9 kA	**735 105**
20 / 25 mm	15 mm	20 mm	50 mm²	9.9 kA	**750 105**
20 / 25 mm	15 mm	20 mm	70 mm²	13.8 kA	**770 105**
20 / 25 mm	15 mm	—	95 mm²	18.7 kA	**795 105**
— / 25 mm	—	—	120 mm²	23.7 kA	**712 075** new

Other cable lengths and earthing clamps available on request.
Earthing rod not included in delivery.

SAFETY EQUIPMENT — Single-pole Earthing and Short-circuiting Devices

EARTHING AND SHORT-CIRCUITING DEVICES

IEC/EN 61230 (DIN VDE 0683 Part 100)

Universal clamp, clamping range 20 mm, T pin shaft

Earth connecting elements

UEK 25 FS

UEK HG

Phase connecting element

UK 25 SQ

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 / 25 mm	15 mm	20 mm	25 mm²	4.9 kA	**725 110**	**725 114**
20 / 25 mm	15 mm	20 mm	35 mm²	6.9 kA	**735 110**	**735 114**
20 / 25 mm	15 mm	20 mm	50 mm²	9.9 kA	**750 110**	**750 114**
20 / 25 mm	15 mm	20 mm	70 mm²	13.8 kA	**770 110**	**770 114**
20 / 25 mm	15 mm	—	95 mm²	18.7 kA	**795 110***)	**795 114***)
— / 25 mm	—	—	120 mm²	23.7 kA	**712 171***) new	**712 173***) new

*) Earth side for fixed ball points only

a = 2500 mm

EFK FL30 SKN

EFK FL40 SKN

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
20 / 25 mm	15 mm	20 mm	25 mm²	4.9 kA	**725 108**	**725 112**
20 / 25 mm	15 mm	20 mm	35 mm²	6.9 kA	**735 108**	**735 112**
20 / 25 mm	15 mm	20 mm	50 mm²	9.9 kA	**750 108**	**750 112**
20 / 25 mm	15 mm	20 mm	70 mm²	13.8 kA		**770 112**
20 / 25 mm	15 mm	—	95 mm²	18.7 kA		**795 112**

EAB RN 16 FS

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
20 / 25 mm	15 mm	20 mm	25 mm²	4.9 kA	**725 113**
20 / 25 mm	15 mm	20 mm	35 mm²	6.9 kA	**735 113**
20 / 25 mm	15 mm	20 mm	50 mm²	9.9 kA	**750 113**
20 / 25 mm	15 mm	20 mm	70 mm²	13.8 kA	**770 113**
20 / 25 mm	15 mm	—	95 mm²	18.7 kA	**795 113**
— / 25 mm	—	—	120 mm²	23.7 kA	**712 172** new

Other cable lengths and earthing clamps available on request.
Earthing rod not included in delivery.

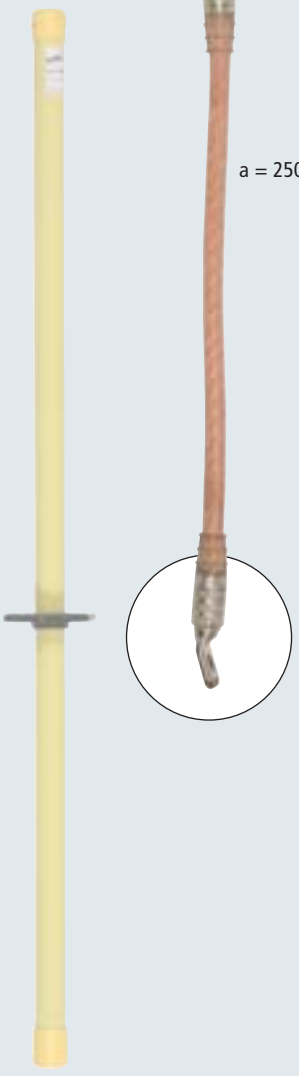
Single-pole Earthing and Short-circuiting Devices

Universal clamp, clamping range 30 mm, hexagon shaft

IEC/EN 61230 (DIN VDE 0683 Part 100)

Phase connecting element

UK 30 SK



a = 2500 mm

Earth connecting elements

UEK 30 FS

UEK 30 HG

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
25 / 30 mm	18 mm	30 mm	25 mm²	4.9 kA	**725 125**	**725 123**
25 / 30 mm	18 mm	30 mm	35 mm²	6.9 kA	**735 125**	**735 123**
25 / 30 mm	18 mm	30 mm	50 mm²	9.9 kA	**750 125**	**750 123**
25 / 30 mm	18 mm	30 mm	70 mm²	13.8 kA	**770 125**	**770 123**
25 / 30 mm	18 mm	—	95 mm²	18.7 kA	**794 125***)	**795 123***)
25 / 30 mm	—	—	120 mm²	23.7 kA	**712 125***)	**712 123***)

*) Earth side for fixed ball points only

EFK FL30 SKN

EFK FL40 SKN

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
25 / 30 mm	18 mm	30 mm	25 mm²	4.9 kA	**725 132**	**725 134**
25 / 30 mm	18 mm	30 mm	35 mm²	6.9 kA	**735 132**	**735 134**
25 / 30 mm	18 mm	30 mm	50 mm²	9.9 kA	**750 132**	**750 134**
25 / 30 mm	18 mm	30 mm	70 mm²	13.8 kA		**770 134**
25 / 30 mm	18 mm	—	95 mm²	18.7 kA		**794 134**

EAB RN 16 FS

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
25 / 30 mm	18 mm	30 mm	25 mm²	4.9 kA	**725 135**
25 / 30 mm	18 mm	30 mm	35 mm²	6.9 kA	**735 135**
25 / 30 mm	18 mm	30 mm	50 mm²	9.9 kA	**750 135**
25 / 30 mm	18 mm	30 mm	70 mm²	13.8 kA	**770 135**
25 / 30 mm	18 mm	—	95 mm²	18.7 kA	**794 135**
25 / 30 mm	—	—	120 mm²	23.7 kA	**712 135**

Other cable lengths and earthing clamps available on request.
Earthing rod not included in delivery.

SAFETY EQUIPMENT — Single-pole Earthing and Short-circuiting Devices

EARTHING AND SHORT-CIRCUITING DEVICES

EN/IEC 61230 (DIN VDE 0683 Part 100)

Universal clamp, clamping range 30 mm, T pin shaft

Earth connecting elements

UEK 30 FS

UEK 30 HG

Phase connecting element

UK 30 SQ

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
25 / 30 mm	18 mm	30 mm	25 mm²	4.9 kA	**725 127**	**725 107**
25 / 30 mm	18 mm	30 mm	35 mm²	6.9 kA	**735 127**	**735 107**
25 / 30 mm	18 mm	30 mm	50 mm²	9.9 kA	**750 127**	**750 107**
25 / 30 mm	18 mm	30 mm	70 mm²	13.8 kA	**770 127**	**770 107**
25 / 30 mm	18 mm	—	95 mm²	18.7 kA	**794 127***)	**795 107***)
25 / 30 mm	—	—	120 mm²	23.7 kA	**712 127***)	**712 107***)

*) Earth side for fixed ball points only

EFK FL30 SKN

EFK FL40 SKN

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.	Part No.
25 / 30 mm	18 mm	30 mm	25 mm²	4.9 kA	**725 136**	**725 138**
25 / 30 mm	18 mm	30 mm	35 mm²	6.9 kA	**735 136**	**735 138**
25 / 30 mm	18 mm	30 mm	50 mm²	9.9 kA	**750 136**	**750 138**
25 / 30 mm	18 mm	30 mm	70 mm²	13.8 kA		**770 138**
25 / 30 mm	18 mm	—	95 mm²	18.7 kA		**794 138**

a = 2500 mm

EAB RN 16 FS

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
25 / 30 mm	18 mm	30 mm	25 mm²	4.9 kA	**725 139**
25 / 30 mm	18 mm	30 mm	35 mm²	6.9 kA	**735 139**
25 / 30 mm	18 mm	30 mm	50 mm²	9.9 kA	**750 139**
25 / 30 mm	18 mm	30 mm	70 mm²	13.8 kA	**770 139**
25 / 30 mm	18 mm	—	95 mm²	18.7 kA	**794 139**
25 / 30 mm	—	—	120 mm²	23.7 kA	**712 139**

Other cable lengths and earthing clamps available on request.
Earthing rod not included in delivery.

Earthing and Short-circuiting Cables

EN/IEC 61230 (DIN VDE 0683 Part 100)

- To be completed with connecting components
- Transparent PVC coating
- Water-proof PVC-coated cable entries and node, with additional protection against kinking
- Crimped cable lugs, standard type PK 1, with protection against twisting

Equipped three-pole earthing and short-circuiting device in a switchgear installation.

Technical Data	
Cable	E-Cu, most finely stranded and highly flexible
Sheath	Thermoplastic (soft PVC compound YM2), clear and transparent
Hole in terminal lug	Ø12.5 mm
Operating temperature range	– 25° C ... + 55° C

Crimped cable lugs, Type **PK1:** Cut-out at cable lug for protection against twisting (standard type).

Crimped cable lugs, Type **PK2:** No cut-out at the cable lug for connection to connecting components of other manufacturers, available on request.

Note:
Other hole diameters for terminal lugs available on request.

Example of price calculation:

For earthing and short-circuiting devices with customised lengths

Three-pole earthing and short-circuiting device, cable cross section 70 mm², like Part No. 770 350, but with required branch lengths of **a = 1000 mm** and **b = 2200 mm**

Standard type: **a**: 70 mm², 3 x 600 = 1800 mm
b: 35 mm², 1 x 1800 = 1800 mm

Customised type: **a**: 70 mm², 3 x 1000 = 3000 mm
b: 35 mm², 1 x 2200 = 2200 mm

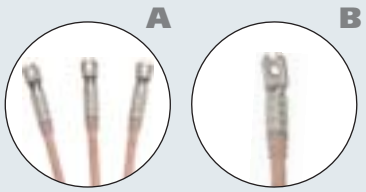
Difference between cable lengths: **a**: 70 mm² = 1200 mm
b: 35 mm² = 400 mm

Price of standard type, Part No. 770 350		Euro	427.–
Price of difference between cable lengths			
Part No. 770 001, 1200 mm x 31.–	per 1000 mm	Euro	45.12
Part No. 735 001, 400 mm x 17.20	per 1000 mm	Euro	8.20
Price of customised unit, complete		Euro	480.32

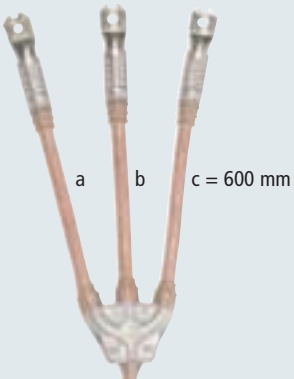
Prices without obligation (as of 2007).

Earthing and Short-circuiting Cables

EARTHING AND SHORT-CIRCUITING DEVICES

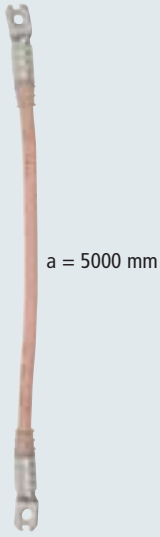


Type	Type of crimped cable lug	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Three-pole Earthing and Short-circuiting Cables Without components				
EKS3 PK1 25 25	PK1	25/25 mm²	4.9 kA	**725 604**
EKS3 PK1 35 35	PK1	35/35 mm²	6.9 kA	**735 604**
EKS3 PK1 50 25	PK1	50/25 mm²	9.9 kA	**750 604**
EKS3 PK1 70 35	PK1	70/35 mm²	13.8 kA	**770 604**
EKS3 PK1 95 35	PK1	95/35 mm²	18.7 kA	**795 604**
EKS3 PK1 120 50	PK1	120/50 mm²	23.7 kA	**712 604**
EKS3 PK1 150 50	PK1	150/50 mm²	29.6 kA	**715 604**



d = 1800 mm

B Single-pole Earthing and Short-circuiting Cables Without components				
EKS1 PK1 25 5000	PK1	25 mm²	4.9 kA	**776 425**
EKS1 PK1 35 5000	PK1	35 mm²	6.9 kA	**776 435**
EKS1 PK1 50 5000	PK1	50 mm²	9.9 kA	**776 450**
EKS1 PK1 70 5000	PK1	70 mm²	13.8 kA	**776 470**
EKS1 PK1 95 5000	PK1	95 mm²	18.7 kA	**776 495**
EKS1 PK1 120 5000	PK1	120 mm²	23.7 kA	**776 412**
EKS1 PK1 150 5000	PK1	150 mm²	29.6 kA	**776 415**



Other cable lengths, types with unreduced earthing cable cross sections available on request, as well as phase and earthing clamps and cables with cable lugs without protection against twisting (PK2).

Accessories for Earthing and Short-circuiting Cables

Earthing Cables

For earthing and short-circuiting devices with customised lengths

Type	Cable cross section	Part No.
ES YM2 16	16 mm²	**716 001**
ES YM2 25	25 mm²	**725 001**
ES YM2 35	35 mm²	**735 001**
ES YM2 50	50 mm²	**750 001**
ES YM2 70	70 mm²	**770 001**
ES YM2 95	95 mm²	**795 001**
ES YM2 120	120 mm²	**712 001**
ES YM2 150	150 mm²	**715 001**

Phase Connecting Elements

Phase screw clamps for overhead line conductors Ø4 to 85 mm

EN/IEC 61230 (DIN VDE 0683 Part 100)
Screw shaft with T pin DIN 48087

- Phase clamps for connecting single- and three-pole earthing and short-circuiting cables to overhead lines
- With coupling aid for safe coupling to overhead line conductors
- Easy coupling due to spring tension
- With protection against twisting, type PK1 or PK2 and long screw shaft with T pin

Phase screw clamps used on an overhead line.

Phase screw clamp with fixed coupling aid for safe coupling

Phase screw clamp with spring tension

Technical Data	
Spring-tension unit	Al alloy
Screw-type unit	Al alloy
Shaft	Cu alloy/gal Sn or StSt
Coupling aid	St/gal Zn

Crimped cable lugs, Type **PK1:** Cut-out at the cable lug for protection against twisting (standard type).

Crimped cable lugs, Type **PK2:** No cut-out at the cable lug for connecting components of other manufacturers, available on request.

Clamp with long shaft and earthing rod with aluminium cone coupling.

SAFETY EQUIPMENT

EARTHING AND SHORT-CIRCUITING DEVICES

Phase Connecting Elements

Type	Clamping range Ø	Protection against twisting	For cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Phase Screw Clamps, Standard Type					
Short-circuit-proof, even in case of corroded conductor cables due to weathering					
PSK 4 30 SQ	4 ... 30 mm	PK1	25 ... 70 mm²	13.8 kA	**784 201**
PSK 10 65 SQ	10 ... 65 mm	PK1	25 ... 120 mm²	23.7 kA	**784 301**
B Phase Screw Clamps with Coupling Aid					
Short-circuit-proof, even in case of corroded conductor cables due to weathering					
PSK 4 30 SQ EH	4 ... 30 mm	PK1	25 ... 70 mm²	13.8 kA	**784 401**
PSK 10 65 SQ EH	10 ... 65 mm	PK1	25 ... 120 mm²	23.7 kA	**784 501**
C Phase Screw Clamp with Spring Tension					
Easy coupling with spring-tensioned clamp					
PSK FV 4 30 SQ	4 ... 30 mm	PK1	25 ... 70 mm²	13.8 kA	**784 480**
D Phase Screw Clamp with wide Clamping Range					
Especially for use with Al and Al/St conductor cables, tubular busbars and fixed phase points					
PSK 10 85 SQ	10 ... 85 mm	PK2	25 ... 120 mm²	23.7 kA	**784 085**
E Phase Screw Clamp					
Especially for use at angled positions					
PSK 12 30 SQ	12 ... 30 mm	PK2	25 ... 95 mm²	18.7 kA	**784 032**

The maximum short-circuit current (I_k in kA/1 s) must be equal for clamps as well as earthing and short-circuiting cables!

Phase Connecting Elements

Ball head caps and universal clamps

EN/IEC 61230 (DIN VDE 0683 Part 100)
Screw shaft with T pin DIN 48087

- **Phase clamps for connecting single- and three-phase earthing and short-circuiting devices**
- **With protection against twisting, type PK1**

Connecting the phase side of a universal clamp to a fixed ball point.

Technical Data	
Clamping unit	Cu alloy/gal Sn
Shaft	Cu alloy/gal Sn
Spring-tension unit	Cu alloy/gal Sn or St/Zn

Ball head caps are available as two types:

– Ball head cap, rigid

– Ball head cap, adjustable (4 x 90°)

The adjustable type enables the user adjust the ball head cap of the earthing and short-circuiting device to even unfavourably arranged fixed points. Using angled fixed ball points is therefore mostly no longer necessary.

Ball head cap, rigid

Ball head cap, adjustable (4 x 90°)

SK: Hexagon shaft

SQ: T pin shaft (bayonet)

Phase Connecting Elements

EARTHING AND SHORT-CIRCUITING DEVICES

A Ball Head Cap, rigid, hexagon Shaft

Type	Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	For cable cross section	Max. short-circuit current I_k 1 s	Part No.
KKH 20 SK	20 mm			25 ... 120 mm²	23.7 kA	**772 310**
KKH 25 SK	25 mm			25 ... 150 mm²	29.6 kA	**772 320**

B Ball Head Cap, rigid, T pin Shaft

KKH 20 SQ	20 mm			25 ... 120 mm²	23.7 kA	**772 311**
KKH 25 SQ	25 mm			25 ... 150 mm²	29.6 kA	**772 321**

C Ball Head Cap, adjustable (4 x 90°), hexagon Shaft

KKH 20 D SK	20 mm			25 ... 120 mm²	23.7 kA	**772 330**
KKH 25 D SK	25 mm			25 ... 150 mm²	29.6 kA	**772 340**

D Ball Head Cap, adjustable (4 x 90°), T pin Shaft

KKH 20 D SQ	20 mm			25 ... 120 mm²	23.7 kA	**772 331**
KKH 25 D SQ	25 mm			25 ... 150 mm²	29.6 kA	**772 341**

E Universal Clamp, hexagon Shaft

UK 25 SK	20 / 25 mm	15 mm	20 mm	25 ... 120 *) mm²	23.7 kA	**773 034**	new
UK 30 SK	25 / 30 mm	18 mm	30 mm	25 ... 120 *) mm²	23.7 kA	**773 130**	

F Universal Clamp, T pin Shaft

UK 25 SQ	20 / 25 mm	15 mm	20 mm	25 ... 120 *) mm²	23.7 kA	**773 234**	new
UK 30 SQ	25 / 30 mm	18 mm	30 mm	25 ... 120 *) mm²	23.7 kA	**773 330**	

***) Clamping range and maximum cable cross section for universal clamps:**

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	For cable cross sections
20 / 25 / 30 mm	15 / 18 mm	—	95 mm²
— / 25 / 30 mm	—	—	120 mm²

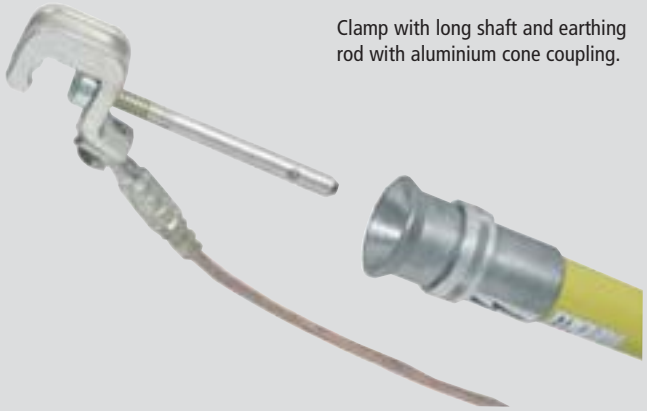
The maximum short-circuit current (I_k in kA/1 s) must be equal for both clamps as well as earthing and short-circuiting cables!

Phase Connecting Elements

Clamps with long shafts

EN/IEC 61230 (DIN VDE 0683 Part 100)
Screw shaft with T pin according to DIN 48087

- Phase clamps for connecting single- and three-phase earthing and short-circuiting cables to overhead lines
- Long screw shaft with T pin for earthing rods with robust aluminium cone coupling
- With protection against twisting, type PK1



Clamp with long shaft and earthing rod with aluminium cone coupling.

Rigid ball head cap with long shaft and earthing rod.

***) Clamping range and maximum cable cross section for universal clamps:**

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	For cable cross sections
20 / 25 / 30 mm	15 / 18 mm	—	95 mm²
— / 25 / 30 mm	—	—	120 mm²

Technical Data	
Clamping unit	Cu alloy/gal Sn
Shaft	Cu alloy/gal Sn
Spring-tension unit	Cu alloy/gal Sn or St/Zn

Type	Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	For cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Ball Head Cap, rigid, long T pin Shaft						
KKH 20 SQL	20 mm			25 ... 120 mm²	23.7 kA	**772 314**
KKH 25 SQL	25 mm			25 ... 150 mm²	29.6 kA	**772 324**
B Universal Clamp, long T pin Shaft						
UK 25 SQL	20 / 25 mm	15 mm	20 mm	25 ... 120 *) mm²	23.7 kA	**773 236** new
UK 30 SQL	25 / 30 mm	18 mm	30 mm	25 ... 120 *) mm²	23.7 kA	**773 331**

The maximum short-circuit current (I_k in kA/1 s) must be equal for clamps as well as earthing and short-circuiting cables!

Earth Connecting Elements

Universal earthing clamps, clamping range 20 or 30 mm

EN/IEC 61230 (DIN VDE 0683 Part 100)

Universal earthing clamp with insulated handle connected to a fixed ball point.

- For earth connection to fixed ball points, phase T pins, round and flat conductors
- For wide clamping ranges up to 30 mm
- With protection against twisting, type PK1

Technical Data	
Clamping unit, shaft	Cu alloy/gal Sn
Spring-tension unit	St/gal Zn

***) Clamping range and maximum cable cross section for universal clamps:**

Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	For cable cross sections
20 / 25 / 30 mm	15 / 18 mm	—	95 mm²
— / 25 / 30 mm	—	—	120 mm²

Type	Fixed ball point Ø	Phase T pin Collar width	Rd / Fl Clamping range	For cable cross section	Max. short-circuit current I_k 1 s	Part No.	
A Universal Earthing Clamps, with Wing Screw							
UEK 25 FS	20 / 25 mm	15 mm	20 mm	25 ... 120 *) mm²	23.7 kA	**774 034**	new
UEK 30 FS	25 / 30 mm	18 mm	30 mm	25 ... 120 *) mm²	23.7 kA	**774 130**	
B Universal Earthing Clamps, with insulated Handle							
UEK 25 HG	20 / 25 mm	15 mm	20 mm	25 ... 120 *) mm²	23.7 kA	**774 234**	new
UEK 30 HG	25 / 30 mm	18 mm	30 mm	25 ... 120 *) mm²	23.7 kA	**774 330**	
C Universal Earthing Clamps, with Tommy Bar							
UEK 25 SKN	20 / 25 mm	15 mm	20 mm	25 ... 120 *) mm²	23.7 kA	**774 434**	new
UEK 30 SKN	25 / 30 mm	18 mm	30 mm	25 ... 120 *) mm²	23.7 kA	**774 530**	

The maximum short-circuit current (I_k in kA/1 s) must be equal for clamps as well as earthing and short-circuiting cables!

Earth Connecting Elements

Ball head caps Ø20 or 25 mm, rigid

EN/IEC 61230 (DIN VDE 0683 Part 100)

- For earth connection to fixed ball points, Ø20 or 25 mm
- Ball head cap with wing-nut bolt or insulated handle
- With protection against twisting, type PK1

Ball head cap with insulated handle connected to an earth connection plate.

Technical Data	
Clamping unit, shaft	Cu alloy/gal Sn
Spring-tension unit	Cu alloy/gal Sn

Type	Fixed ball point Ø	For cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Ball Head Caps, rigid, with Wing Screw				
KKH 20 FS	20 mm	25 ... 120 mm²	23.7 kA	**772 312**
KKH 25 FS	25 mm	25 ... 150 mm²	29.6 kA	**772 322**

B Ball Head Caps, rigid, with insulated Handle				
KKH 20 HG	20 mm	25 ... 120 mm²	23.7 kA	**772 313**
KKH 25 HG	25 mm	25 ... 150 mm²	29.6 kA	**772 323**

The maximum short-circuit current (I_k in kA/1 s) must be equal for clamps as well as earthing and short-circuiting cables!

Earth Connecting Elements

Earth connection units

EN/IEC 61230 (DIN VDE 0683 Part 100)

Earth connection by earth connection unit with wing-nut bolt.

- For earth connection with connecting units M12/M16 or grooved ring Ø16 mm
- Wing-nut bolt or tommy bar
- Protection against twisting, type PK1 or PK2

Technical Data	
Terminal lug	E-Cu/gal Sn
Wing nut	Cu alloy/gal Sn

Type	Dimension	Protection against twisting	For cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Earth Connection Units with Wing Nut					
EAS EK FM 12	M12	PK1	25 ... 150 mm²	29.6 kA	**775 621**
EAS EK FM 16	M16	PK1	25 ... 150 mm²	29.6 kA	**775 631**
B Earth Connection Units with Wing-nut Bolt					
EAS EK FS 12	M12 x 15 mm	PK1	25 ... 150 mm²	29.6 kA	**775 626**
EAS EK FS 16	M16 x 15 mm	PK1	25 ... 150 mm²	29.6 kA	**775 636**
C Earth Connectors for Fixed Earthing Point with grooved Ring *) for cable lengths ≥ 2500 mm: max. up to 95 mm²					
EAB RN 16 FS	Ø16 mm	PK2	25 ... 150 *) mm²	29.6 kA	**790 150**
D Earth Connectors for Fixed Earthing Point with grooved Ring *) for cable lengths ≥ 2500: max. up to 95 mm²					
EAB RN 16 SKN	Ø16 mm	PK2	25 ... 120 *) mm²	23.7 kA	**790 160**

The maximum short-circuit current (I_k in kA/1 s) must be equal for clamps as well as earthing and short-circuiting cables!

Earth Connecting Elements

Earth milling clamps

EN/IEC 61230 (DIN VDE 0683 Part 100)

- For earth connection to flat profiles up to 40 mm
- Milling plate, disc springs and long tommy bar for reliable contact
- Protection against twisting, type PK1

Earth milling clamp used for coated steel masts.

Technical Data	
Clamping unit	MCI/gal Zn
Shaft	St/gal Zn
Milling plate	hardened St/chrome-plated
Spring	Spring steel

A

B

Type	Clamping range	For cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Earth Milling Clamp for flat Profiles With disc springs				
EFK FL40 SKN	up to 40 mm	25 ... 95 mm²	18.7 kA	**792 190**
B Earth Milling Clamp for flat Profiles				
EFK FL30 SKN	up to 30 mm	25 ... 50 mm²	9.9 kA	**792 030**

The maximum short-circuit current (I_k in kA/1 s) must be equal for clamps as well as earthing and short-circuiting cables!

Earth spike with coiled earthing cable.

- For driving into the ground
- Two half sections for supporting earthing and extending cables
- Hot-dip galvanised unit

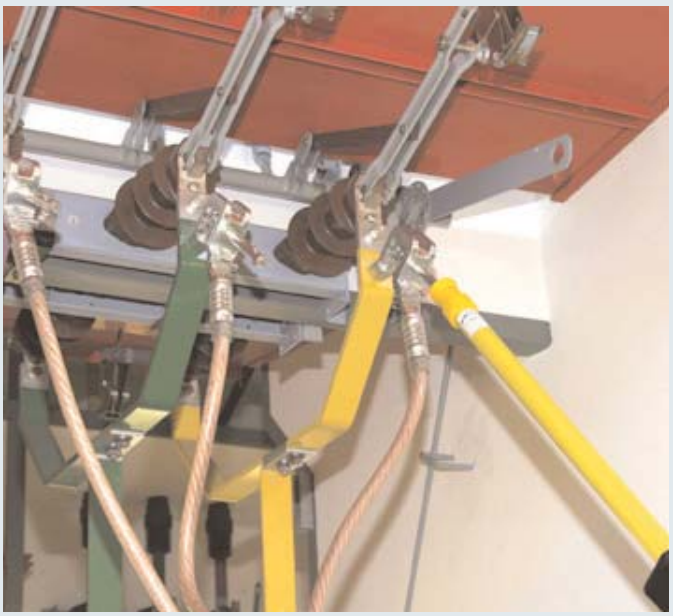
Technical Data	
Spike/Handle unit/Half sections	St/tZn
Screw	StSt

Type	Total length l_G	Part No.
A Earth Spike for driving into the Ground With terminal screw M8		
ESP HVS 1500	1500 mm	**799 006**

Earthing Rods, single-section

EN/IEC 61235 (DIN EN 61235)
T pin shaft according to DIN 48087

- For use with earthing and short-circuiting devices
- Different lengths
- Light-weight construction
- Hexagon shaft (width across 19 mm) or T pin shaft



Using an earthing and short-circuiting device with an earthing rod.

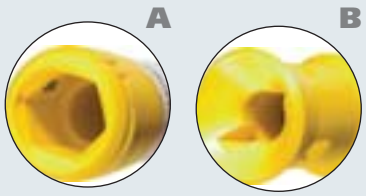
Earthing rods are rods used by hand for approaching the connecting components of earthing and short-circuiting devices to parts of heavy-current installations for earthing and short-circuiting purposes.
They consist of an insulating part, black ring, handle and coupling for attaching connecting components.
Earthing rods have to be selected according to the **weight** of the earthing and short-circuiting device to be used (see also "max. load on the operating head" in kg).
The **insulating part** is the part of the earthing rod between the black ring and end of the earthing rod towards the connecting component. It provides the user with the necessary safety distance and sufficient insulation. The insulating part must have a minimum length of 500 mm.

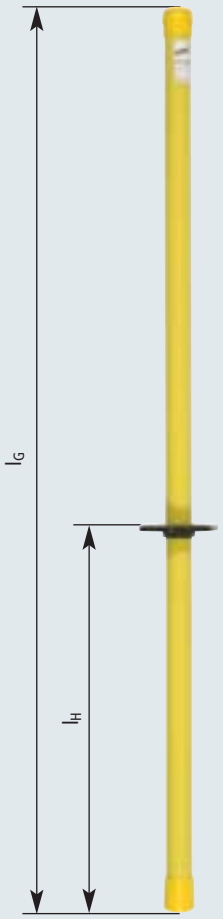
Technical Data	
Insulating tube	Glass-fibre reinforced polyester tube, Ø30 mm, yellow
Clamp coupling	Plastic, yellow
Sealing unit	Plastic, yellow
Handguard	Plastic, black
Operating temperature range	– 25° C ... + 55° C

SAFETY EQUIPMENT

EARTHING AND SHORT-CIRCUITING DEVICES

Earthing Rods, single-section





Type	Total length l_G	Length of handle l_H	Max. load on operating head	Part No.
A Earthing Rod, hexagon Shaft Spring locking				
ES SK 1000	1000 mm	430 mm	35 kg	**761 010**
ES SK 1500	1500 mm	930 mm	35 kg	**761 015**
ES SK 2000	2000 mm	1430 mm	20 kg	**761 020**
B Earthing Rod, T pin Shaft Bayonet locking				
ES SQ 1000	1000 mm	430 mm	35 kg	**761 011**
ES SQ 1500	1500 mm	930 mm	35 kg	**761 016**
ES SQ 2000	2000 mm	1430 mm	20 kg	**761 021**
ES SQ 2500	2500 mm	1430 mm	12 kg	**761 026**
ES SQ 3000	3000 mm	1430 mm	9 kg	**761 031**

Modular units available on request.

Accessories for Earthing Rods, single-section

Adapter for T pin Shaft / hexagon Shaft

For connecting to earthing rods with T pin shaft coupling (bayonet locking) to attach elements with hexagon shafts. The nut lock allows the adapter to be fixed to the earthing rod.

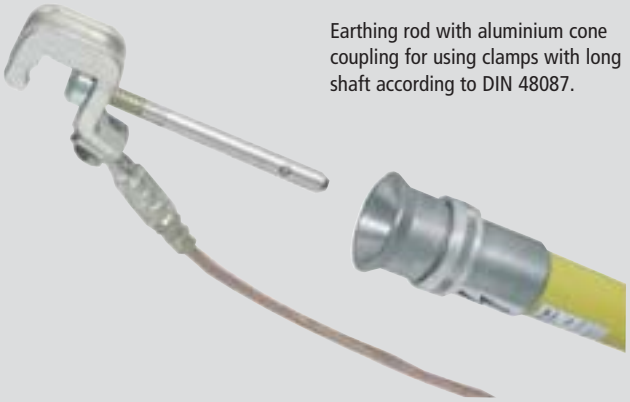
Type	Part No.
AES SQ SK	**765 001**

Earthing Rods, single-section and telescopic units

For T pin shafts (bayonet locking)

EN/IEC 61235 (DIN EN 61235)

- For use in outdoor installations
- Robust aluminium cone coupling
- Telescopic rod, allows for gradual adjustments with the star-shaped handle
- For phase screw clamps and clamps with long T pin shaft



Earthing rod with aluminium cone coupling for using clamps with long shaft according to DIN 48087.

Telescopic earthing rod with aluminium cone coupling and phase screw clamp.

Lockable adjusting ring
An adjusting ring is located on the cone and has the following functions:

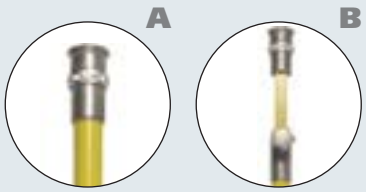
– Position "AUF" (= OPEN):
Rod can be removed from the clamp after connecting the earthing and short-circuiting device

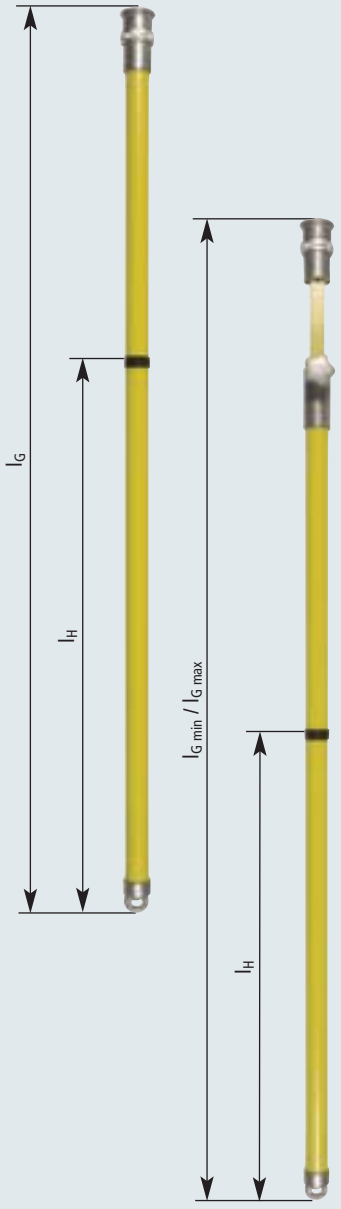
– Position "ZU" (= CLOSED):
Rod and clamp remain coupled even after connecting the earthing and short-circuiting device

Base section with non-slip support (Al/rubber)

Technical Data	
Insulating tube	Glass-fibre reinforced polyester tube, Ø43 mm or square shape 26 mm, yellow
Screw coupling, star-shaped handle	Al alloy
Black ring	plastic
Sealing unit	Al/rubber
Operating temperature range	– 25° C ... + 55° C

Earthing Rods, single-section and telescopic units





Type	Total length $l_{G\,max}$ / $l_{G\,min}$	Length of handle l_H	Max. load on operating head l_{max} / l_{min}	Part No.
A Single-section Earthing Rod				
ES SQL 2100	2100 mm	1500 mm	35 kg	**769 201**
ES SQL 2600	2600 mm	2000 mm	35 kg	**769 251**
ES SQL 3100	3100 mm	2500 mm	35 kg	**769 301**
ES SQL 4100	4100 mm	3500 mm	20 kg	**769 401**
ES SQL 5100	5100 mm	4500 mm	12 kg	**769 501**

B Telescopic Earthing Rod

The round outer insulated tube contains an inner square tube that can be adjusted to any position between l_{min} and l_{max} and locked in position with the star-shaped handle.

ESTC SQL 3000	3000 / 1670 mm	900 mm	18 / 35 kg	**769 300**
ESTC SQL 4000	4000 / 2170 mm	1400 mm	12 / 35 kg	**769 400**
ESTC SQL 5000	5000 / 2670 mm	1900 mm	10 / 35 kg	**769 500**

Other types available on request.

Earthing Rods, multi-section units

For T pin shafts (bayonet locking)

EN/IEC 61235 (DIN EN 61235)

- For use in outdoor installations
- Robust aluminium cone coupling
- Telescopic rod allows for gradual adjustments with the star- shaped handle
- Cone-shaped male and female screw coupling
- Transport length 1500 mm
- Allows for total lengths up to 6000 mm
- For phase screw clamps and clamps with long T pin shaft

Possible combinations:

– Top section (A) single
– Top section (A) + base section (C)
– Top section (A) + max. 2 intermediate sections (B) + base section (C)

Load values for extendible earthing rods

Total length	Unit No.	Max. load on operating head
1500 mm	A	35 kg
3000 mm	A + C	30 kg
4500 mm	A + B + C	15 kg
6000 mm	A + B + B + C	8 kg

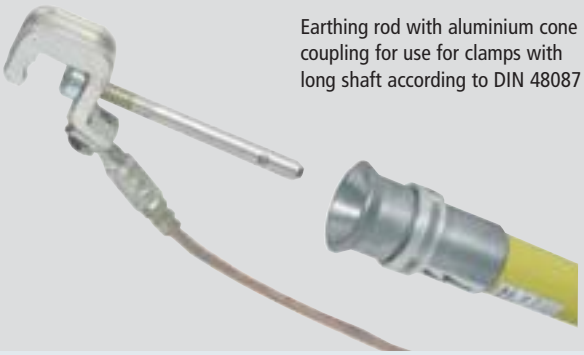
Earthing rod consisting of a top section, intermediate section and base section.

Lockable adjusting ring
An adjusting ring is located on the cone and has the following functions:

– Position "AUF" (= OPEN):
Rod can be removed from the clamp after connecting the earthing and short-circuiting device
– Position "ZU" (= CLOSED):
Rod and clamp remain coupled even after connecting the earthing and short-circuiting device

Robust cone-shaped male and female aluminium screw coupling allows for secure coupling of the earthing rod sections due to the screw-type connection and the locking pins

Technical Data	
Insulating tube	Glass-fibre reinforced polyester tube, Ø43 mm, yellow
Screw coupling	Al alloy
Black ring	Plastic
Sealing unit	Al/rubber
Operating temperature range	– 25° C ... + 55° C



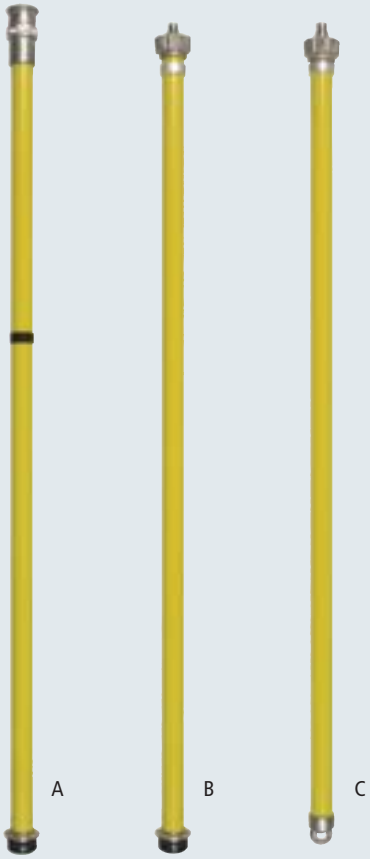
Earthing rod with aluminium cone coupling for use for clamps with long shaft according to DIN 48087

Earthing Rods, multi-section units

EARTHING AND SHORT-CIRCUITING DEVICES

Type	Length	Part No.
A Earthing Rod – Top Section		
With plastic protective cover for the coupling element		
EST KS SQL 1500	1500 mm	**769 503**
B Earthing Rod – Intermediate Section		
With plastic protective cover for the coupling element		
EST ZS 1500	1500 mm	**769 504**
C Earthing Rod – Base Section		
With aluminium / rubber eye		
EST ES 1500	1500 mm	**769 505**

Other types available on request.

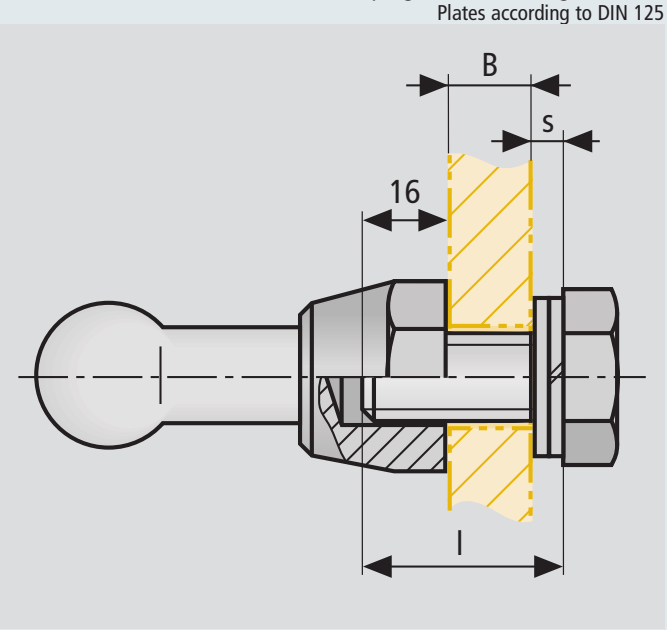


Fixing Devices

For fixed ball points and fixed earthing points

- Hexagon screw for fixing busbar connections according to DIN 43673 Part 1
- Spring-tensioned pressure plate for installing fixed points M12 or M16 to aluminium busbars

Hexagon screws according to DIN 933
Spring washers according to DIN 128
Plates according to DIN 125



Determining the required screw length.

Technical Data	
Hexagon screws	StSt A2-70 (DIN 933)
Spring washers	StSt A2-70 (DIN 128)
Plates	StSt A2-70 (DIN 125)
Pressure plate	Highly resistant Al alloy
Tightening torque	M12: 80 Nm; M16: 150 Nm

Determining screw length l
l (mm) = B + s + 16
Important! Screw length required < l
l = Screw length
B = Thickness of busbar
s = Thickness of spring washer and pressure plate

Type	Dimension	Part No.
A Fixing Devices – Hexagon Screws		
SKS M12 25 V2A	M12 x 25 mm	**561 925**
SKS M12 30 V2A	M12 x 30 mm	**561 930**
SKS M12 35 V2A	M12 x 35 mm	**561 935**
SKS M16 30 V2A	M16 x 30 mm	**561 931**
B Fixing Devices – Spring Washers		
FR A12 V2A	A12 (s = 2.4)	**524 912**
FR A16 V2A	A16 (s = 2.8)	**524 913**
C Fixing Devices – Pressure Plates		
SCH A13 V2A	A13 (s = 2.4)	**525 912**
SCH A17 V2A	A17 (s = 3.0)	**525 916**
D Square Spring-tensioned Pressure Plate For reliable contact and permanent fixing of fixed ball points to aluminium busbars. Pressure plates must be installed on both sides of the busbar.		
DP 40 40 B13 AL	M12, 40 x 40 x 6 mm	**525 001**
DP 50 50 B17 AL	M16, 50 x 50 x 8 mm	**525 002**

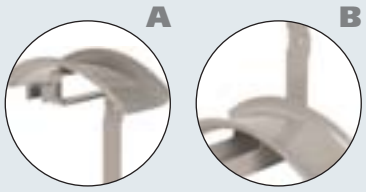
Other lengths available on request.

Retaining Devices

For earthing and short-circuiting devices and earthing rods

- Easy wall-mounting
- For easy and safe storing of earthing and short-circuiting devices and earthing rods Ø30 or 43 mm

Storage device for earthing and short-circuiting devices and earthing rods.



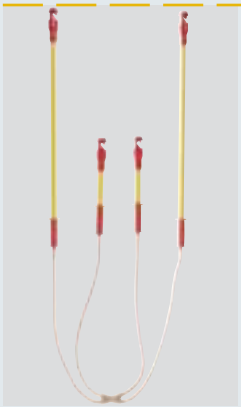
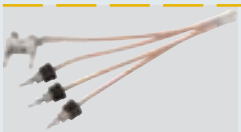
Type	For rod Ø	Material	Part No.
A Retaining Device For earthing and short-circuiting devices and earthing rods of any length Hole distance 424 mm, hole Ø7 mm			
HV EKV ES30	30 mm	steel	**700 000**
HV EKV ES40	43 mm	steel	**700 002**

B Retaining Device For earthing and short-circuiting devices and earthing rods with lengths up to 1.5 m Hole distance 104 mm, hole Ø7 mm			
HV EKV ES30 1500	30 mm	steel	**700 003**

SAFETY EQUIPMENT

Selection Guide

EQUIPMENT UP TO 1000 V

	Equipment	Nominal voltage U_N	Application	Page
	Earthing and Short-circuiting Device, fully insulated, Type VI	up to 1000 V	Fully insulated, shockproof Earthing cartridges with T connection Complete set for cable distribution cabinets	140
	Earthing and Short-circuiting Device, partly insulated, Type TI	up to 1000 V	Earthing cartridges with M10 connection Earthing screw insert for D-type fuse links Complete set for cable distribution cabinets	143
	Earthing and Short-circuiting Device For overhead lines up to Ø12 mm	up to 1000 V	Insulated clamps for overhead line conductors 4-pole unit, extendible to up to 6 poles Reliable conductivity due to a copper bar inside of the insulating tube	147
	Earthing and Short-circuiting Device For street lighting installations	up to 1000 V	For E + S D-type fuse links of cable junction and fuse boxes for street lighting systems Aluminium adapter for converting from E27 to E14 threads Complete Set	148
	Earthing and Short-circuiting Device For crane busbars	up to 1000 V	Allows for locking of the clamping area For insulated or bare busbars	150
	Two-pole Voltage Detector SPN	100 ... 500 V 120 ... 1000 V	Also for use in wet weather 2 types with different measuring ranges No batteries required Can also be used in overhead line systems by attaching extension prods	151

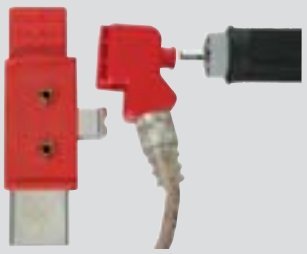
Three-pole Earthing and Short-circuiting Devices Type VI

Set for low-voltage installations, fully insulated, Type VI

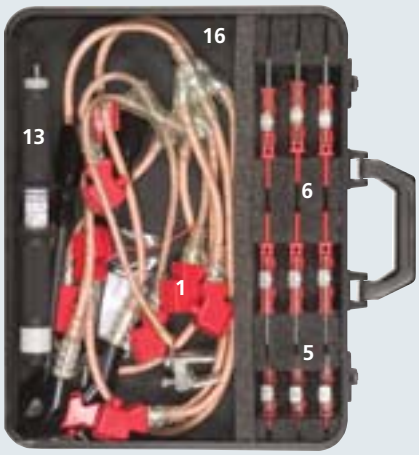
EN/IEC 61230 (DIN VDE 0683 Part 100)

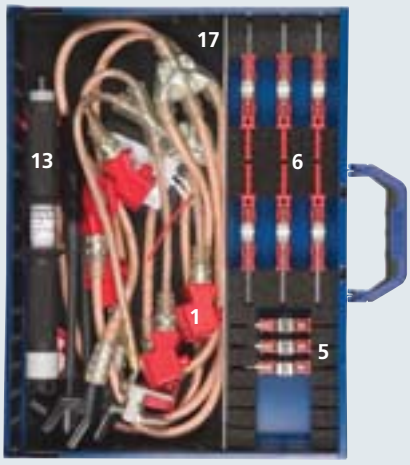
- Fully insulated, shock-proof
- Complete set for cable distribution cabinets (CDC)
- Safe application with insulated earthing handle Type VI (with dual function), suitable for both inserting and removing the earthing cartridges with T connection as well as for attaching the earthing and short-circuiting device (E+S device)
- Water-proof PVC-encapsulated cable entry and node unit, with additional protection against kinking

Inserting the fully insulated earthing and short-circuiting device by using earthing handle Type VI.



Earthing cartridge with T connection, fully insulated connecting unit and earthing handle.
Longer terminal T pin for shifting the connecting point forwards for lower NH fuse holders available on request.





Type	Dimension	Part No.

A Fully insulated Standard Equipment – Plastic Case

Pos.	Qty.	Item	Part No.
1	2	Earthing and short-circuiting device, fully insulated, 25 mm²	745 925
5	3	Earthing cartridges size 00	745 905
6	6	Earthing cartridges size 1 ... 3	745 910
13	1	Earthing handle Type VI	745 922
16	1	Plastic case	745 902

EKS VI 2F KVS KK	445 x 345 x 100 mm	**745 903**

B Fully insulated Standard Equipment – Steel Plate Case

Pos.	Qty.	Item	Part No.
1	2	Earthing and short-circuiting device, fully insulated, 25 mm²	745 925
5	3	Earthing cartridges size 00	745 905
6	6	Earthing cartridges size 1 ... 3	745 910
13	1	Earthing handle Type VI	745 922
17	1	Steel plate case	745 900

EKS VI 2F KVS SBK	440 x 300 x 100 mm	**745 901**

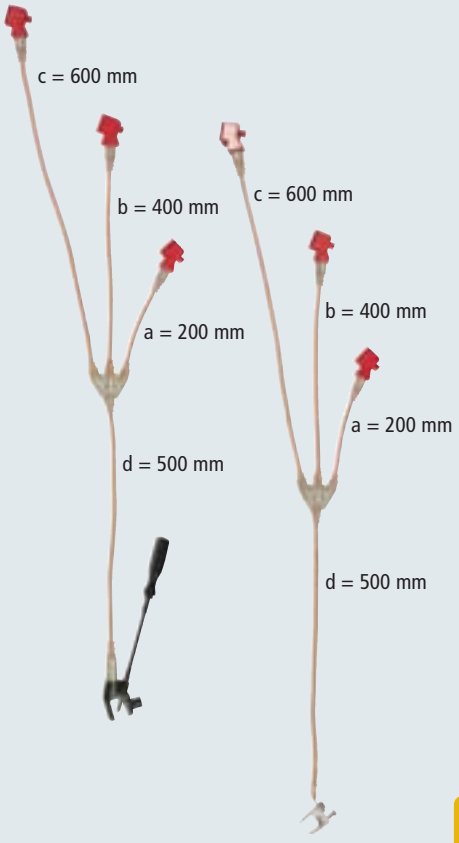
Other cable lengths or further equipment available on request.

Single Parts of three-pole Earthing and Short-circuiting Devices, Type VI

Earthing and Short-circuiting Device Type VI, Earthing Clamp with flexible adjustable Handle

Adjustable handle with 2 positions, clamping range up to 20 mm
For cable distribution cabinets (CDC)

Type	Cable cross section	Max. short-circuit current I_k 1 s	Position	Part No.
EKV3 25 VI KVS DGF	25 mm²	4.9 kA	1	**745 925**
EKV3 35 VI KVS DGF	35 mm²	6.9 kA		**745 935**



Earthing and Short-circuiting Device Type VI, with spring-tensioned Earthing Clamp

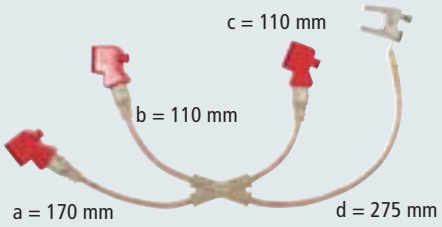
Clamping range up to 24 mm and fixing by adjustable handle, Part No. 745 921
For cable distribution cabinets (CDC)

Type	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
EKV3 25 VI KVS EK24	25 mm²	4.9 kA	**745 926**
EKV3 35 VI KVS EK24	35 mm²	6.9 kA	**745 936**

Earthing and Short-circuiting Device Type VI, with spring-tensioned Earthing Clamp

Clamping range up to 24 mm and fixing by adjustable handle, Part No. 745 921
For service entrance boxes (SEB)

Type	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
EKV3 16 VI HAK EK24	16 mm²	3.2 kA	**745 940**



Earthing Cartridges NH 00

With T pin for inserting into NH fuse holders and blocks, size NH 00
For use with earthing handle Type VI

Type	Size	Max. cable cross section	Max. short-circuit current I_k 1 s	Position	Part No.
EP NH00 VI TA	00	35 mm²	6.9 kA	5	**745 905**

Earthing Cartridges NH 1 ... 3

With T pin for installing into NH fuse holders and blocks, sizes NH 1 ... 3
For use with earthing handle Type VI

Type	Size	Max. cable cross section	Max. short-circuit current I_k 1 s	Position	Part No.
EP NH1 3 VI TA	1 ... 3	35 mm²	6.9 kA	6	**745 910**

Earthing Cartridges NH 4a

With T pin for installing in NH fuse holders and blocks size NH 4a
For use with earthing handle Type VI

Type	Size	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
EP NH4A VI TA	4a	35 mm²	6.9 kA	**745 915**

Single Parts of three-pole Earthing and Short-circuiting Devices, Type VI

Earthing Handle Type VI

With dual function
– For installing the earthing cartridges with T connection into NH fuse holders
– For connecting the earthing and short-circuiting devices Type VI to earthing cartridges

Type	Length	Position	Part No.
EG 00 4A VI	285 mm	13	**745 922**

Adjustable Handle with flexible Shaft

With magnetic socket wrench insert
For connecting with spring-tensioned earthing clamp

Type	Length	Part No.
DGF EKV VI	270 mm	**745 921**

Plastic Case, empty

With foamed insert

Type	Colour	Dimension	Position	Part No.
KKL EKS VI KVS	●	445 x 345 x 100 mm	16	**745 902**

Steel Plate Case, empty

With foamed insert

Type	Colour	Dimension	Position	Part No.
SBKL EKS VI KVS	●	440 x 330 x 100 mm	17	**745 900**

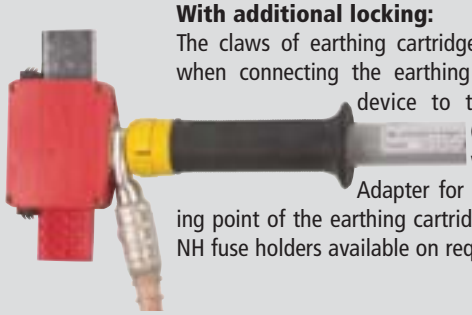
Three-pole Earthing and Short-circuiting Devices

Set for low-voltage installations, partly insulated, Type TI

EN/IEC 61230 (DIN VDE 0683 Part 100)

Installing the partly insulated earthing and short-circuiting device with earthing handle Type TI

- Complete set for cable distribution cabinets (CDC)
- Safe application with insulated earthing handle TI (with dual function), suitable both for installing and removing the earthing cartridges with M10 terminal as well as for attaching to the earthing and short-circuiting device (E+S device)
- Cable entry and node unit coated with water-proof plastic sheath, with additional protection against kinking



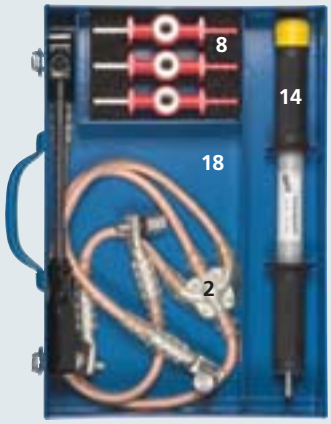
With additional locking:
The claws of earthing cartridge size 1 ... 3 extend when connecting the earthing and short-circuiting device to the NH fuse holder (higher short-circuit withstand capability).
Adapter for shifting the connecting point of the earthing cartridge for lower situated NH fuse holders available on request.

Type	Dimension	Part No.

A Set I – Partly insulated Standard Equipment in Steel Plate Case

Pos.	Qty.	Item	Part No.
2	1	Earthing and short-circuiting device, partly insulated, 25 mm²	745 426
8	3	Earthing cartridges size 1 ... 3	745 018
14	1	Earthing handle Type TI	745 400
18	1	Steel plate case	766 300

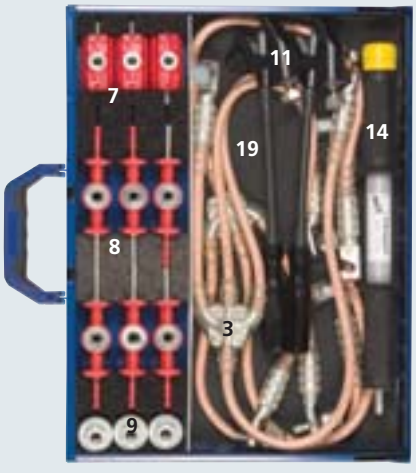
EKS TI KVS SBK	380 x 260 x 80 mm	**766 302**



B Set II – Partly insulated Standard Equipment in Steel Plate Case

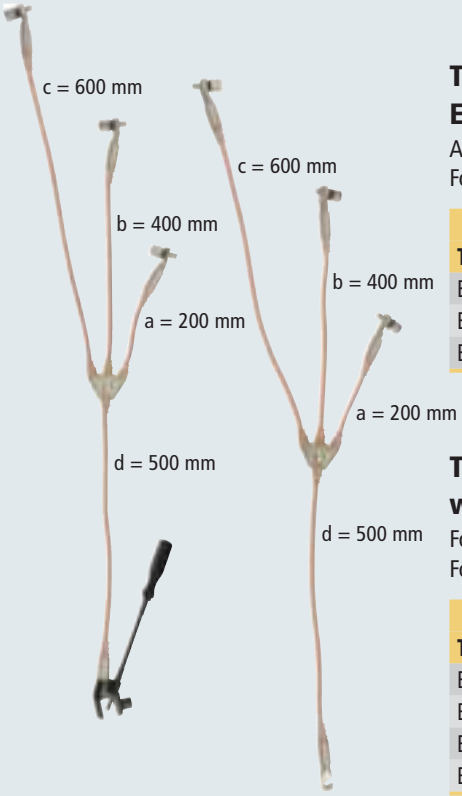
Pos.	Qty.	Item	Part No.
3	2	Earthing and short-circuiting device, partly insulated, 25 mm²	745 458
7	3	Earthing cartridges size 00	745 302
8	6	Earthing cartridges size 1 ... 3	745 018
9	3	Earthing screw inserts size E33	745 202
11	2	Earthing clamps, insulated	745 602
14	1	Earthing handle Type TI	745 400
19	1	Steel plate case	766 298

EKS TI 2F KVS SBK	440 x 330 x 66 mm	**745 500**



Other cable lengths or further equipment available on request.

Single Parts of three-pole Earthing and Short-circuiting Devices, Type TI



TI Earthing and Short-circuiting Device (partly insulated), Earthing Clamp with flexible adjustable Handle

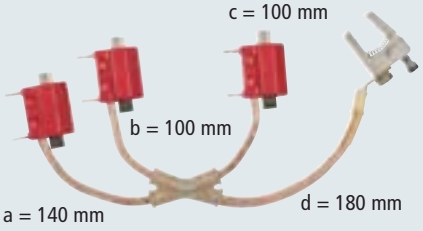
Adjustable handle with 2 operating positions, clamping range up to 20 mm
For cable distribution cabinets (CDC)

Type	Cable cross section	Max. short-circuit current I_k 1 s	Position	Part No.
EKV3 25 TI KVS DGF	25 mm²	4.9 kA	2	**745 426**
EKV3 35 TI KVS DGF	35 mm²	6.9 kA		**745 436**
EKV3 50 TI KVS DGF	50 mm²	9.9 kA		**745 451**

TI Earthing and Short-circuiting Device (partly insulated), with Hook-shape Earthing Cable Lug

For optional installation of earthing clamps, Part No. 745 602 or 745 502
For cable distribution cabinets (CDC)

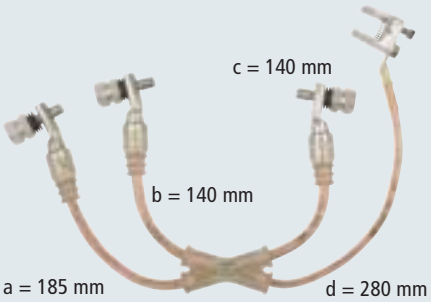
Type	Cable cross section	Max. short-circuit current I_k 1 s	Position	Part No.
EKV3 16 TI KVS HKS	16 mm²	3.2 kA		**745 459**
EKV3 25 TI KVS HKS	25 mm²	4.9 kA	3	**745 458**
EKV3 35 TI KVS HKS	35 mm²	6.9 kA		**745 460**
EKV3 50 TI KVS HKS	50 mm²	9.9 kA		**745 461**



TI Earthing and Short-circuiting Device (partly insulated), with Spring-tensioned Earthing Clamp

Clamping range up to 24 mm and fixing with adjustable handle, Part No. 745 921
Fixed earthing cartridges size 00 on the phase side
For service entrance boxes (SEB)

Type	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
EKV3 NH00 TI EK24	16 mm²	3.2 kA	**745 817**



TI Earthing and Short-circuiting Device (partly insulated), with Spring-tensioned Earthing Clamp

Clamping range up to 24 mm and fixing with adjustable handle, Part No. 745 921
Screw cable lugs on the phase side with M10 hexagon bolt
For attaching to earthing cartridges with M10 terminal at service entrance boxes (SEB)

Type	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
EKV3 SKB M10 TI EK24	16 mm²	3.2 kA	**745 816**

Single Parts of three-pole Earthing and Short-circuiting Devices, Type TI

Earthing Cartridges NH 00

With M10 terminal for use in NH fuse holders and blocks, size NH 00
For use with earthing handle type TI (partly insulated)

Type	Size	Max. cable cross section	Max. short-circuit current I_k 1 s	Position	Part No.
EP NH00 TI M10	00	35 mm²	6.9 kA	7	**745 302**

Earthing Cartridges NH 1 ... 3

With M10 terminal for use in NH fuse holders and blocks, sizes NH 1 ... 3
For use with earthing handle type TI (partly insulated)

Type	Size	Max. cable cross section	Max. short-circuit current I_k 1 s	Position	Part No.
EP NH1 3 TI M10	1 ... 3	35 mm²	6.9 kA	8	**745 018**

Earthing Cartridges NH 4a

With M10 terminal for use in NH fuse holders and blocks, sizes NH 4a
For use with earthing handle type TI (partly insulated), Part No. 745 400/S3

Type	Size	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
EP NH4A TI M10	4a	35 mm²	6.9 kA	**745 016**

Earthing Cartridges NH 1 ... 3 with additional Locking Device

With M10 terminal
The claws of the earthing cartridges spread out when the earthing and short-circuiting device is connected to the NH fuse holder and thus allows for higher short-circuit withstand capability

Type	Size	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
EP NH1 3 TI A M10	1 ... 3	50 mm²	9.9 kA	**745 401**

Earthing Cartridges NH 1 ... 3 with Grip Lugs

With M10 terminal for use with earthing handle type TI or NH fuse handle with sleeve Part No. 785 645

Type	Size	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
EP NH1 3 TI GL M10	1 ... 3	35 mm²	6.9 kA	**745 017**

Screw-in Earthing Insert with M10 Terminal

Insulated thread
For screwing into E27 and E33 threaded fuse holders with earthing handle type TI

Type	Size	Contact pin	Thread	Max. cable cross section	Max. short-circuit current I_k 1 s	Position	Part No.
ESE E27 TI M10	E27	Ms/gal CuSn	plastic	25 mm²	4.9 kA		**745 201**
ESE E33 TI M10	E33	Ms/gal CuSn	plastic	25 mm²	4.9 kA	9	**745 202**

Screw-in Earthing Insert with M10 Terminal

Conductive thread
For screwing into E27 and E33 threaded fuse holders with earthing handle type TI

Type	Size	Contact pin	Thread	Max. cable cross section	Max. short-circuit current I_k 1 s	Part No.
ESE E27 KBI M10	E27	plastic	Ms/gal CuSn	25 mm²	4.9 kA	**745 203**
ESE E33 KBI M10	E33	plastic	Ms/gal CuSn	25 mm²	4.9 kA	**745 204**

Single Parts of three-pole Earthing and Short-circuiting Devices, Type TI

Earthing Clamp with flexible adjustable Handle and dual Setting Positions

For earth connection to earthing and short-circuiting devices for cable distribution cabinets (CDC), with terminal M8 pin, protection against twisting and nut

Type	Clamping range	Position	Part No.
EK I FL20 DGF	up to 20 mm	11	**745 602**

Earthing Clamp, bare, with Wing-nut Bolt

For earth connection to earthing and short-circuiting devices for cable distribution cabinets (CDC), with terminal M8 pin, protection against twisting and nut

Type	Clamping range	Part No.
EK FL20 FS	up to 20 mm	**745 502**

Earthing Handle Type TI

With dual function

– For installing earthing cartridges or screw-in earthing inserts with M10 terminal
– For connecting earthing and short-circuiting devices type TI to earthing cartridges (socket wrench insert SW 19)

Type	Length	Position	Part No.
EG TI EKV	355 mm	14	**745 400**

Adjustable Handle with flexible Shaft

With magnetic socket wrench insert
For connection with spring-tensioned earthing clamp

Type	Length	Part No.
DGF EKV VI	270 mm	**745 921**

Steel Plate Case, empty

Type	Colour	Dimension	Position	Part No.
SBKL EKS TI KVS	●	440 x 330 x 66 mm	18	**766 300**

Steel Plate Case, empty

With foamed insert

Type	Colour	Dimension	Position	Part No.
SBKL EKS TI KVS 2F	●	380 x 260 x 80 mm	19	**766 298**

Four- to six-pole Short-circuiting Devices

For low voltage overhead conductors up to Ø12 mm (95 mm²)

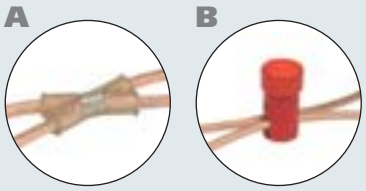
EN/IEC 61230 (DIN VDE 0683 Part 100)

Sample construction of a four-pole short-circuiting device.

- Insulated screw clamps for overhead conductors
- 4 pole unit, extendible to up to 6 poles
- Reliable conductivity due to copper bar in the insulating tube

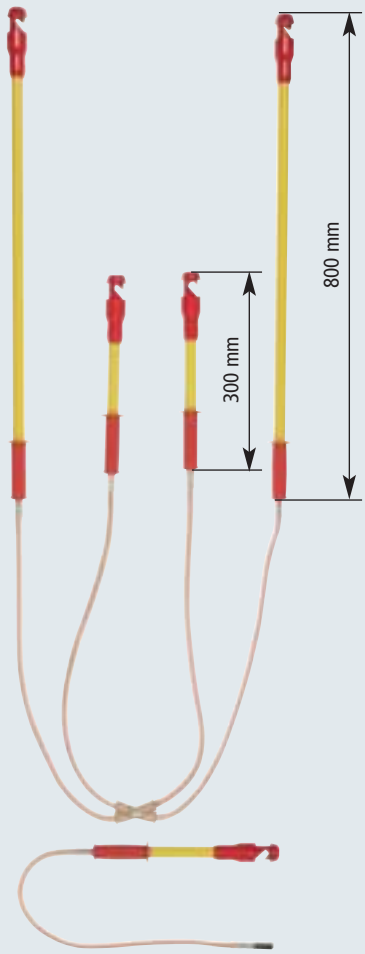
Technical Data	
Insulating tube	Glass-fibre reinforced polyester, Ø20 mm, yellow, Lengths: 2x 300 mm, 2x 800 mm
Clamping unit	Cu alloy, insulated
Short-circuiting cables	Cu, highly flexible, cable lengths 600 mm
Node units	Cu alloy, insulated
Operating temperature range	– 25° C ... + 55° C

The devices have an insulated threaded rod (with handle) for safe contact with the overhead lines and quick attachment of the phase clamps (reliable contact due to spring-tensioned screw clamp) to the conductors. The fully insulated device can be provided as four-pole (with fixed node unit), five- or six-pole type (with extendible node unit).



Type	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Four-pole Node Unit			
KV4 25 NSFL ISK95	25 mm²	4.9 kA	**742 225**
B Four-pole Node Unit, extendible to five or six Poles			
KV4 25 NSFL ISK95 E	25 mm²	4.9 kA	**742 425**

Other cable and insulating tube lengths available on request.



Additional single-pole Branches

With insulated screw clamp, short-circuiting cable, 600 mm long, with termination plug for extending the four-pole short-circuiting device, Part No. 745 425.
The termination plugs are locked by screwing into the node unit (B model).

Type	Cable cross section	Max. short-circuit current I_k 1 s	Length of insulating tube	Part No.
ZA 25 ISK95 300	25 mm²	4.9 kA	300 mm	**740 300**
ZA 25 ISK95 800	25 mm²	4.9 kA	800 mm	**740 800**

Earthing and Short-circuiting Device
Set for street lighting installations

based on EN/IEC 61230 (DIN VDE 0683 Part 100)

- For junction and fuse boxes of street lighting installations
- For E14 fuse holders
- Aluminium adapter for converting from E27 to E14 threads
- Max. backup fuse 32 A power circuit breaker (B characteristic)

Earthing and short-circuiting device for junction and fuse boxes of street lighting installations.

Type	Dimension	Part No.
A Set – Earthing and Short-circuiting Device for Street Lighting Installations		

Pos.	Qty.	Item	Part No.
4	2	Earthing and short-circuiting device, E14 screw-in earthing insert, 6 mm²	745 107
10	6	E27 / E14 adapter	745 108
12	1	Adapter screw fitter	745 109
15	1	Adjustable handle with flexible shaft	745 921
20	1	Plastic case	745 106

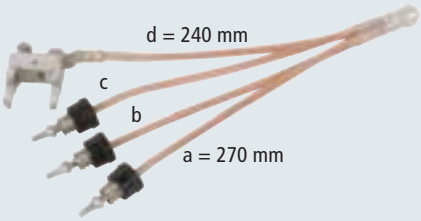
EKV ÜGK MB S	395 x 295 x 105 mm	**745 105**

Other types available on request.

Single Parts of Earthing and Short-circuiting Devices

Earthing and Short-circuiting Device for Street Lighting Installations

With 3 fixed E14 earthing screw inserts and spring-tensioned earthing clamp,
clamping range up to 24 mm (fixing with adjustable handle, Part No. 745 921)



Type	Cable cross section	Position	Part No.
EKV ÜGK MB	6 mm²	4	**745 107**

E27 / E14 Adapter

Reducing insert for converting from E27 to E14 threads
Allows for use of the earthing and short-circuiting device with E14 earthing screw inserts, even for E27 threads

Type	Dimension	Material	Position	Part No.
RED E27 E14 ÜGK MB	Ø30 x 25 mm	Al	10	**745 108**

Adapter Screw Fitter

For screwing the E27/E14 adapter and D-gauge pieces DII and DIII

Type	Dimension	Material	Position	Part No.
PSS DII	Ø30 x 110 mm	plastic	12	**745 109**

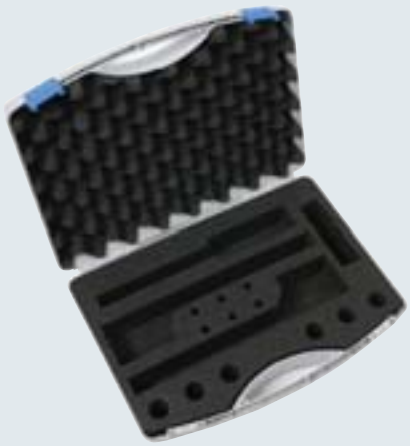
Adjustable Handle with flexible Shaft

With magnetic socket wrench insert
For connecting with spring-tensioned earthing clamp

Type	Length	Position	Part No.
DGF EKV VI	270 mm	15	**745 921**

Plastic Case, empty

With foamed insert



Type	Colour	Dimension	Position	Part No.
KKL EKV ÜGK MB	●	395 x 295 x 105 mm	20	**745 106**

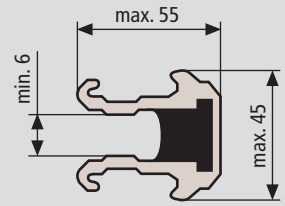
Four-pole Earthing and Short-circuiting Devices

With clamps for crane rails

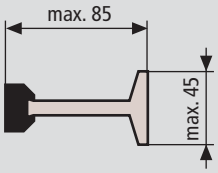
EN/IEC 61230 (DIN VDE 0683 Part 100)

- For insulated or non-insulated electrical rails of cranes and lifting equipment
- Allows for locking the clamping range of the clamps in several positions
- Water-proof PVC-coated cable entries and node unit, with additional protection against kinking

Four-pole earthing and short-circuiting device with clamps.

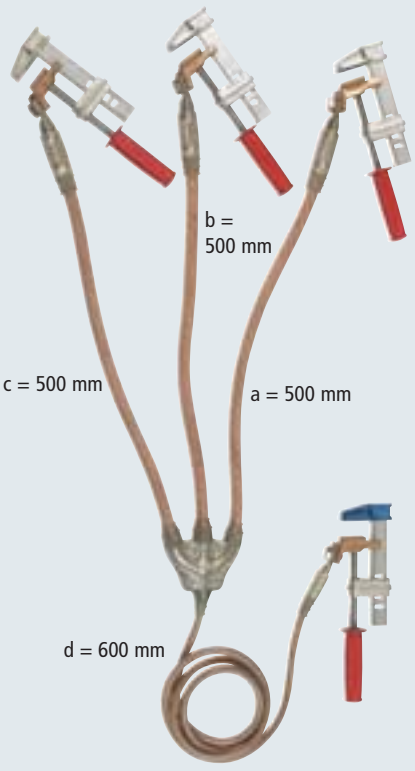


Insulated electrical rails, A model



Non-insulated electrical rails, B model

Technical Data	
Clamping unit	MCI/gal Zn
Pressure units	Cu alloy
Cable entries, node unit	Cu, PVC plastic-coated, clear transparent insulation
Short-circuiting cables	Cu, highly flexible
Operating temperature range	– 25° C ... + 55° C



Type	Cable cross section	Max. short-circuit current I_k 1 s	Part No.
A Clamps for insulated Current Rails Clamping range up to 55 mm			
EKV3 25 IS ZK55	25/25 mm²	4.9 kA	**743 225**
EKV3 35 IS ZK55	35/35 mm²	6.9 kA	**743 235**
EKV3 50 IS ZK55	50/50 mm²	9.9 kA	**743 250**
B Clamps for bare Current Rails Clamping range up to 85 mm			
EKV3 25 BS ZK85	25/25 mm²	4.9 kA	**743 325**
EKV3 35 BS ZK85	35/35 mm²	6.9 kA	**743 335**

The clamp for the PEN conductor is marked with blue colour.

SAFETY EQUIPMENT

EQUIPMENT UP TO 1000 V

Two-pole SPN Voltage Detector

Nominal voltages up to 1000 V

EN/IEC 61243-3 (DIN VDE 0682 Part 401)

Two-pole SPN voltage detector used with extension prods in overhead lines.

- Also for use in wet weather
- Extremely shock-resistant, water- and dust-proof enclosure
- 2 types with different measuring ranges
- Also for use in overhead line systems by attaching extension prods
- No batteries required
- Safe handling with both hands

Technical Data	
Frequency range	0 ... 100 Hz
Indicator	Safe enclosure made of solid rubber
Degree of protection	IP 65
Indication	Iron vane measuring instrument, LCD and LED
Operating temperature range	– 10° C ... + 55° C
Connecting cable	Rubber-sheathed cable, highly flexible, 1000 mm
Overvoltage category	CAT IV acc. to IEC 60664-1

The voltage detector has test buttons in both handles. The buttons activate the measuring circuit and LED indication. High-resistance tests (LCD indication) can be performed without pushing the button and low-resistance tests by pushing the button.

Type	Nominal voltage range U_N	Dimension of indicator	Part No.
A SPN Voltage Detector Basic devices			
SPN 500	100 ... 500 V	274 x 75 x 47 mm	**766 541**
SPN 1000	120 ... 1000 V	274 x 75 x 47 mm	**766 545**

Other types available on request.

Accessories for Two-pole SPN Voltage Detector

Extension Prod

For use in overhead line systems by screwing onto the basic unit

Type	Length	Part No.
VS 500 SPN II	500 mm	**766 542**

Storage Bag, empty

For SPN voltage detectors (basic unit with extension prods)

Type	Material	Part No.
AT SPN II	artificial leather	**766 543**

SAFETY EQUIPMENT

FURTHER EQUIPMENT

Set of Warning Signs

Warning signs displayed at an electrical installation.

- Warning signs for working at electrical installations according to EN 50110-1 (DIN VDE 0105 Parts 100 and 1)
- Complete set with all important warning signs (German language)
- Other warning, mandatory, prevention or information signs available on request

Type	Material	Part No.
A Set of Warning Signs		

Pos.	Qty.	Type of warning sign	Dimension
1	1	Sign "VDE-Bestimmungen für den Betrieb von elektrischen Anlagen" [Engl.: "German national regulations for operation of electrical installations"] (German language)	1000 x 550 mm
2	1	Sign "Erste Hilfe" [Engl.: "First Aid"] acc. to BGI 510 (German language)	595 x 410 mm
3	1	Sign "Merkblatt für Brandbekämpfung im Bereich elektrischer Anlagen" [Engl.: "Information for fire-fighting close to electrical installations"] (German language)	500 x 350 mm
4	1	Prohibition sign "Nicht schalten. Es wird gearbeitet." [Engl.: No switching! Electrical work!] (German language)	300 x 200 mm
5	1	Warning sign "Hochspannung – Lebensgefahr" [Engl.: Danger! High Voltage!] (German language)	237 x 200 mm
6	1	Sign "Achtung! Geerdet und kurzgeschlossen!" [Engl.: "Warning! Earthed and short-circuited system!] (German language)	120 x 200 mm
7	1	Sign "5 Sicherheitsregeln" [Engl.: "5 Safety Rules"] (German language)	120 x 200 mm

WHS ET SET	plastic	**700 011**

Single-pole Earthing and Discharging Devices

- For discharging static charges
- Different contact electrodes
- Coupling electrode, especially for electrical filter systems, for attaching to round counductors Ø12 ... 26.5 mm
- Water-proof PVC-coated cable entries, with additional protection against kinking

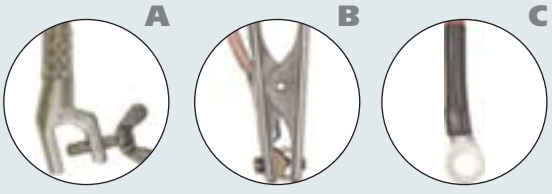
Contact electrode and coupling electrode made of die-cast zinc alloy (A, B, C model)

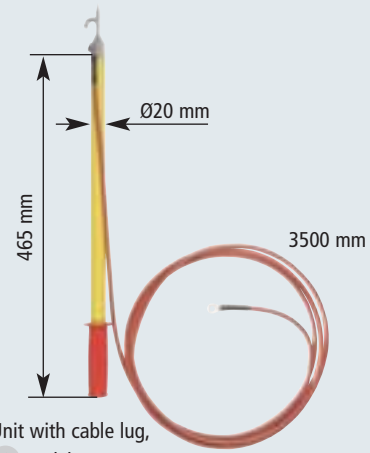
Contact electrode made of Cu alloy/gal Sn, (D, E model)

Coupling electrode made of bronze/gal Sn, (F model)

Single-pole device for discharging static charges.

Technical Data	
Contact electrodes	Die-cast zinc alloy or Cu alloy/gal Sn
Coupling electrode	Bronze/gal Sn
Insulating tube	Glass-fibre reinforced polyester tube, Ø20 mm or Ø30 mm, yellow
Earthing cable	Cu, highly flexible, transparent or red
Cable length	3500 mm



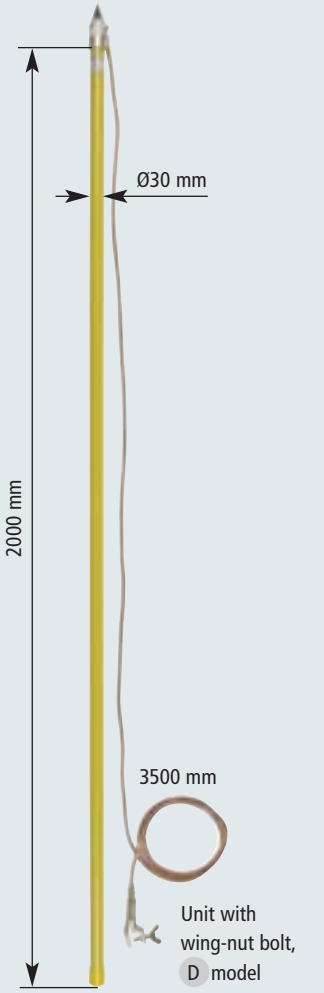


Unit with cable lug, C model

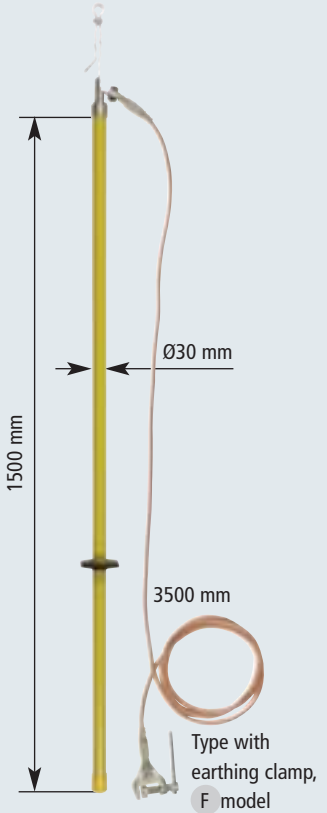
Type	Cable cross section	Cable sheath	Clamping range	Part No.
A Discharging Device with Handle and Earthing Clamp with Wing-nut Bolt				
EV TES 465 EK	16 mm²	transparent	up to 20 mm	**758 020**
B Discharging Device with Handle and Spring-tensioned Earthing Clamp				
EV TES 465 EZ	16 mm²	transparent	up to 18 mm	**758 021**
C Discharging Device with Handle and Earth Cable with Lug Hole Ø8.4 mm and silicone conductor				
EV TES 465 KS10	10 mm²	●		**758 022**

SAFETY EQUIPMENT
Single-pole Earthing and Discharging Devices
FURTHER EQUIPMENT

Type	Cable cross section	Cable sheath	Clamping range	Part No.
D Discharging Device and Earthing Clamp with Wing-nut Bolt				
EV TS 2000 EK	16 mm²	transparent	up to 20 mm	**758 001**
E Discharging Device and Spring-tensioned Earthing Clamp				
EV TS 2000 EZ	16 mm²	transparent	up to 18 mm	**758 003**



Type	Cable cross section	Cable sheath	Clamping range	Part No.
F Earthing Device and Earthing Clamp with Tommy Bar For attaching to round conductors Ø12 ... 26.5 mm of electrical filter systems				
EV EH 1725 EK	25 mm²	transparent	up to 30 mm	**758 015**



Product Programme for Working under Live Conditions

LIVE WORKING

DELTEC® – Product Programme

The permanent availability of electrical energy has become a decisive factor in international competition. At the same time, power interruptions must be reduced due to increasing cost pressures. This makes it difficult to ensure the operating safety of existing installations and to perform maintenance tasks, as entire parts of the installation cannot be isolated and the only remaining alternative is live working.
DEHN + SOHNE and ELSIC have gained considerable experience in this difficult field of live working and have developed the required equipment independently from each other. Both the equipment ranges complement one another in the ideal way. We have now combined the expertise of both companies in the field of **live working** with the **DELTEC** product range.

Isolating installations for maintenance work

Maintenance work on electrical equipment and installations can often not be performed due to the fact that overhead lines, transformer sub stations, transformer cells or cable distribution panels cannot be isolated or can only be isolated with extensive efforts or by working on Sundays and Public Holidays.

Cleaning under live conditions

Clean installations increase operating safety
Dirty electrical installations and adverse weather conditions (moisture) can cause power failures, damage to the equipment and even personal injuries as a result of an electrical arc. In medium voltage installations, layers of dust or insulator lubricants can cause failures. In cable distribution boards and low voltage installations, cobwebs, weeds and dust are considered more likely causes.

Regular cleaning intervals
According to the results of surveys performed, cleaning of open indoor installations and cable distribution panels has to be performed at regular intervals. The recommended period of between 6 months and 2 years is dependent on the intensity and type of dirt.

Dry cleaning by suction combined with damp cleaning
Dry cleaning by suction is performed with operating heads and brush-type operating heads, used to brush the parts of the installation that have to be cleaned while simultaneously allowing the vacuum cleaner to suck the dust away. The damp cleaning process has to be used where the dust adhered to insulator lubricants and oils. These and other stuck pollution layers can be cleaned with the damp cleaning sponges and special insulating cleaning liquid.
This type of work is performed according to "hot stick working" procedures.

Equipment for dry cleaning by suction
Equipment for cleaning by suction consists of a cleaning head (operating heads, brushes), intake tube with handle, extension rod, intake hose and sucking device.
All single parts are made of plastic and are fully insulated. The shape of the brushes and operating heads is largely adapted to the parts of installations to be cleaned.
The special plug-in coupling system of the dry cleaning equipment prevents the accidental use of accessories not designed for this type of applications (e.g. some acessories of industrial vacuum cleaners).

Requirements for the vacuum cleaner
The vacuum cleaner used must meet the following requirements:
- The industrial vacuum cleaner must have a minimum air velocity of 20 m/s and a visual control indication of the intake capacity.
- The intake hose must have a continuous inner diameter ≥ Ø30 mm and contain no metal parts

Equipment for damp cleaning
The equipment for damp cleaning consists of special cleaning heads (sponge supports), insulating rod with handle and extension elements. All single parts are fully insulated. The plug-in device of operating heads and sponges allows for easy and quick exchanging of dirty sponges. Only approved and marked sponges may be used for these applications.

Refilling of cable sealing ends

Refilling insulating oil into cable sealing ends
The newly developed refilling device shortens the cable-refilling procedures considerably and makes it safer and easier. This process requires the use of an electrically insulated screw driver (insulated operating rod with interchangeable operating heads) to open the cable locking screw. The insulating oil is then heated to the manufacturers' specifications and filled into the cable sealing end by simply pushing a button on the refilling lance. This type of work is performed according to "hot stick working" procedures.

Equipment for refilling insulating oil into cable sealing ends
The equipment for refilling cable sealing ends consists of a mobile unit with a conveying pump, a reservoir containing 5 litres of oil, heat regulator, connecting hose and a refilling lance. The insulated screw driver system supplied for opening cable-end locking screws, consists of an insulating rod with a manually operated mechanism (adjustable handle), interchangeable operating heads (straight and angled) with a safety plug-in system that supports different screw type bits. Special plastic screws that can be used with the insulated screw driver, are available for the different sealing ends found in practice. Both the refilling lance and screw driver are fully insulated for voltages up 36 kV ac.

Requirements on the installer

Selection of electricians for working under live conditions
Maintenance work may only be performed by electricians with experience in operating and maintance of electrical installations. The electricians must be trained for by completing the theoretical and practical training required for this type of work.

Training as live worker
The training for specialised live workers is based on detailed prescribed procedures as required by the accident prevention and insurance association for precision and electrical engineering. It includes theoretical and practical training and the issue of a "Live Working" certificate after completion of the training.

Product Programme for Working under Live Conditions

Working procedure "Live working"

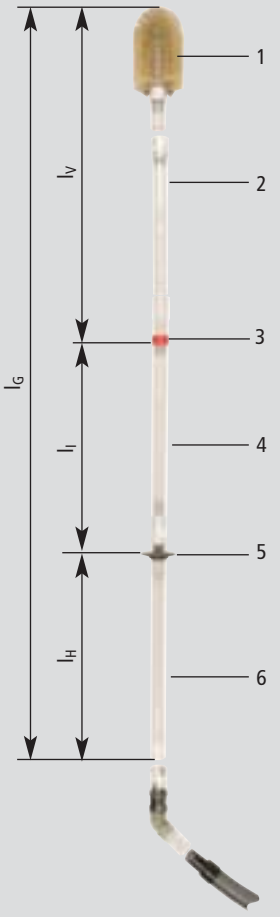
Performing the hot stick working procedure, the worker keeps a predefined distance from energised parts of the installation and carries out his work with insulating rods/operating rods.

Design of operating rods

Operating rods according to DIN VDE 0681/0682 are devices for use by hand for operating, testing and limiting distances from energised equipment. They consist of one or several insulating rods rated for the nominal voltage of the equipment to be handled and of an operating rod for the respective applications. **Operating rods**, **working rods** are e.g. **intake tubes**, **insulating rods**, **locking rods**, **refilling lances** or **insulating screw drivers**. They are marked with the **symbol** ⚠ on their rating plate.

An operating rod consists of a **handle**, **insulating part** and **operating head**.

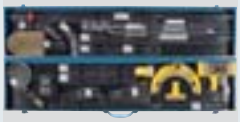
The **operating head** is the part of the operating rod/working rod containing the operating element, e.g. operating heads and brushes of a cleaning set or the sponge supports of a damp cleaning set.
The **insulating part** is the part of the operating rod/working rod between the handguard and red ring. It provides the user with a safety distance and sufficient isolation for safe handling.
The **extension** is the part of the operating/working rod between the insulating part and operating element of the operating head. It allows the user to reach distant parts of the installation and to pass the operating head close to energised parts.
The **handguard** is a clearly visible and sensible limit between the handle and insulating part. It prevents the user's hands from slipping and contacting the insulating part.
The **red ring** marks the end of the insulating part in the direction of the operating head. It represents a visible limit for the user from touching energised parts of the installation. The clearance between the red ring and handguard must not be touched by energised parts. Contacting earthed parts, however, is permissible.



1 Operating head
2 Extension
3 Red ring
4 Insulating part
5 Handguard
6 Handle

Dimension:
l_H Length of handle
l_I Length of insulating part
l_V Length of extension
l_G Total length

PRODUCT PROGRAMME FOR LIVE WORKING

	Devices	Nominal voltage U_N / frequency f_N	Application	Page
	TRS NS Dry Cleaning Set	up to 1000 V / 15 ... 60 Hz	Cleaning by suction under live conditions Specially adapted operating heads for intensive cleaning Plug-in coupling system for quick exchanging of operating heads	160
 	TRS MS TRS MS V1 Dry Cleaning Set	up to 36 kV / 15 ... 60 Hz	Cleaning by suction under live conditions Transparent intake tubes for more safety Specially adapted operating heads for intensive cleaning Plug-in coupling system for quick exchanging of the operating heads	164
	FRS ZK MS Damp Cleaning Set	up to 36 kV / 15 ... 60 Hz	Equipment for damp cleaning under live conditions with special cleaning liquid Universal gear coupling for exchanging and angling operating heads Plug-in operating heads for quick and easy exchange of sponges	168
	TFRS MS Combined Cleaning Set	up to 36 kV / 15 ... 60 Hz	Combined equipment for dry and damp cleaning under live conditions Transparent intake tubes for more safety Specially adapted operating heads for intensive cleaning Universal gear coupling for exchanging and angling the operating heads Plug-in operating heads for quick and easy exchange of sponges	172
	NFG MS Refilling Device	up to 36 kV / 15 ... 60 Hz	Refilling of insulating oil under live conditions Safe, quick and easy refilling procedure	182
	MS Insulating Screw Driver	up to 36 kV / 15 ... 60 Hz	For screwing and unscrewing cable-end locking screws under live conditions With interchangeable operating heads	184

TRS NS Dry Cleaning Set

Nominal voltages up to 1000 V / 15 ... 60 Hz

EQUIPMENT FOR LIVE CLEANING

Based on DIN VDE 0680 Part 3

- Not for use in wet weather
- For indoor and outdoor installations
- Equipment for live cleaning by suction
- For dry cleaning of cable distribution cabinets, open indoor installations and control cabinets
- Specially adapted operating heads for intensive cleaning
- Plug-in coupling system for quick exchange of operating heads
- Intake air regulation in the handle area

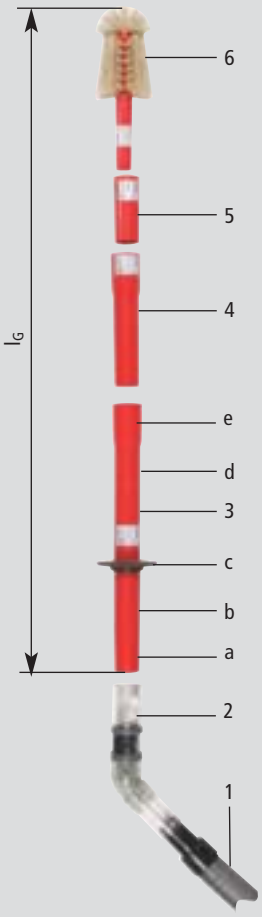
Cleaning a low-voltage switchgear installation under live conditions with TRS NS Dry Cleaning Set

Preconditions

Maintenance work at voltages up to 1000 V is allowed under the supervision of a qualified electrician according to EN 50110-1 "Operation of electrical installations – Minimum Requirements", observing clauses 6.3.1 to 6.3.12, and according to EN 50110-2 "Operation of electrical installations – National Annexes". In Germany apply sections BGV A3 and BGR A3 of the national accident prevention regulations (UVV) "Elektrische Anlagen und Betriebsmittel" [Electrical installations and equipment] issued by the German Employer's Liability Association for Precision and Electrical Engineering (BGFE).

Chamfered flat cleaning head in use.

Tubular brush in use.



Design

1 Intake hose
2 Intake hose adapter
3 Intake tube with
a bottom connecting part
b handle
c handguard
d insulating part
e top connecting part
4 Extension
5 Intake tube adapter
6 Cleaning head

Dimension:

$l_{G\,min}$ = 560 mm
$l_{G\,max}$ = 1350 mm

DELTEC®

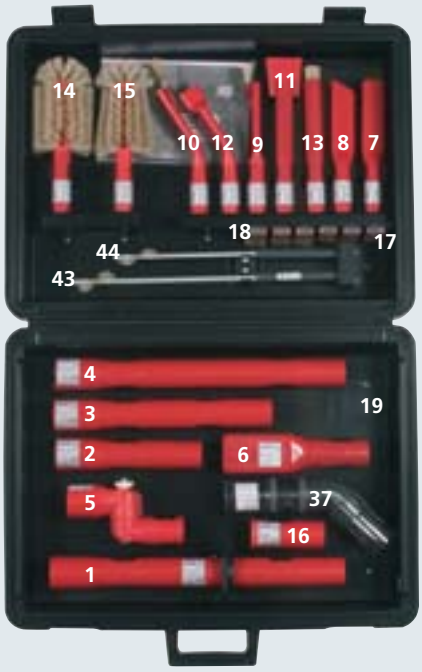
TRS NS Dry Cleaning Set

EQUIPMENT FOR LIVE CLEANING

Type	Type of Set	Part No.
A	TRS NS Dry Cleaning Set	

Standard Equipment

Pos.	Qty.	Type	Item	Part No.
1	1	SRH 400 NS	Intake tube with handle	785 520
2	1	SRV 200 NS	Extension, 200 mm	785 521
3	1	SRV 300 NS	Extension, 300 mm	785 522
4	1	SRV 400 NS	Extension, 400 mm	785 523
5	1	SRW V NS	Fixing angle, adjustable	782 530
6	1	FD 55 NS	Flat cleaning head 55	785 540
7	1	FD 35 NS	Flat cleaning head 35	785 541
8	1	FD 35 S NS	Flat cleaning head 35, chamfered	785 542
9	1	FD 35 P NS	Flat cleaning head 35, straight	785 590
10	1	FD 35 W P NS	Flat cleaning head 35, angled	785 591
11	1	RD 25 S NS	Round cleaning head with scraper	785 560
12	1	QD 35 W NS	Cross cleaning head 35	785 543
13	1	RD 25 P NS	Round cleaning head with brush	785 570
14	1	STB 85 Z NS	Tubular brush, cylindrical bristles	785 550
15	1	STB 85 K NS	Tubular brush, conical bristles	785 555
16	1	SRA NS	Intake tube adapter, for brushes and cleaning heads	785 515
37	1	SSA W D	Intake hose adapter	785 200
17	3	EP 25 K NS	Spare brush, short bristles	785 595
18	3	EP 25 L NS	Spare brush, long bristles	785 596
43	1	RB 40 NS	Cleaning brush for single set parts Ø40 mm	785 580
44	1	RB 20 NS	Cleaning brush for single set parts Ø25 mm	785 585
19	1	KKL TRS NS	Plastic case	785 506



TRS NS	Complete in a plastic case	**785 502**

Single Parts of TRS NS Dry Cleaning Set

Plastic Case, empty

With retaining clips

Type	Colour	Dimension	Position	Part No.
KKL TRS NS	●	530 x 390 x 170 mm	19	**785 506**

Intake Tube with Handle

For use as operating tube with handle and handguard, with top and bottom connecting part

Type	Dimension	Position	Part No.
SRH 400 NS	380 mm	1	**785 520**

Single Parts of TRS NS Dry Cleaning Set

DELTEC®

EQUIPMENT FOR LIVE CLEANING

Extension

Insulating tube, with top and bottom connecting part

Type	Diameter	Dimension	Position	Part No.
SRV 200 NS	40 mm	200 mm	2	**785 521**
SRV 300 NS	40 mm	300 mm	3	**785 522**
SRV 400 NS	40 mm	400 mm	4	**785 523**

Adjustable Angle

Lockable, adjustable due to 15° gearing, with top and bottom connecting part

Type	Diameter	Dimension	Position	Part No.
SRW V NS	40 mm	300 mm	5	**785 530**

Flat Cleaning Head 55

Width: 55 mm

Type	Diameter	Dimension	Position	Part No.
FD 55 NS	40 mm	200 mm	6	**785 540**

Flat Cleaning Head 35

Width: 35 mm

Type	Diameter	Dimension	Position	Part No.
FD 35 NS	25 mm	200 mm	7	**785 541**

Flat Cleaning Head 35

Width: 35 mm, Outlet: 60°, chamfered

Type	Diameter	Dimension	Position	Part No.
FD 35 S NS	25 mm	200 mm	8	**785 542**

Flat Cleaning Head 35

Width: 35 mm, straight, with detachable brush

Type	Diameter	Dimension	Position	Part No.
FD 35 P NS	25 mm	230 mm	9	**785 590**

Flat Cleaning Head 35

Width: 35 mm, angled: 30°, with detachable brush

Type	Diameter	Dimension	Position	Part No.
FD 35 W P NS	25 mm	240 mm	10	**785 591**

Round Cleaning Head

With scraper 50 mm

Type	Diameter	Dimension	Position	Part No.
RD 25 S NS	25 mm	240 mm	11	**785 560**

Cross Cleaning Head 35

Width: 35 mm, angled: 30°

Type	Diameter	Dimension	Position	Part No.
QD 35 W NS	25 mm	200 mm	12	**785 543**

DELTEC®

Single Parts of TRS NS Dry Cleaning Set

EQUIPMENT FOR LIVE CLEANING

Round Cleaning Head
With brush

Type	Diameter	Dimension	Position	Part No.
RD 25 P NS	25 mm	230 mm	13	**785 570**

Tubular Brush
Cylindrical bristles

Type	Diameter	Dimension	Position	Part No.
STB 85 Z NS	25 / 85 mm	240 mm	14	**785 550**

Tubular Brush
Conical bristles

Type	Diameter	Dimension	Position	Part No.
STB 85 K NS	25 / 85 mm	240 mm	15	**785 555**

Intake Tube Adapter
For brushes and cleaning heads Ø25 mm

Type	Diameter	Dimension	Position	Part No.
SRA NS	40 / 25 mm	100 mm	16	**785 515**

Intake Hose Adapter
Adjustable, angled: 120°, with intake air regulation, for use with intake hose system Ø35 mm

Type	Diameter	Position	Part No.
SSA W D	35 / 40 mm	37	**785 200**

Spare Brush
Short bristles, for flat cleaning heads with detachable brush

Type	PU	Dimension	Position	Part No.
EP 25 K NS	3 pc(s)	25 mm	17	**785 595**

Spare Brush
Long bristles, for flat cleaning heads, with detachable brush

Type	PU	Dimension	Position	Part No.
EP 25 L NS	3 pc(s)	40 mm	18	**785 596**

Cleaning Brush
For single set parts Ø40 mm

Type	Diameter	Dimension	Position	Part No.
RB 40 NS	45 mm	410 mm	43	**785 580**

Cleaning Brush
For single set parts Ø25 mm

Type	Diameter	Dimension	Position	Part No.
RB 20 NS	30 mm	330 mm	44	**785 585**

TRS MS Dry Cleaning Set

Nominal voltages up to 36 kV / 15 ... 60 Hz

EQUIPMENT FOR LIVE CLEANING

DIN VDE 0682 Part 621

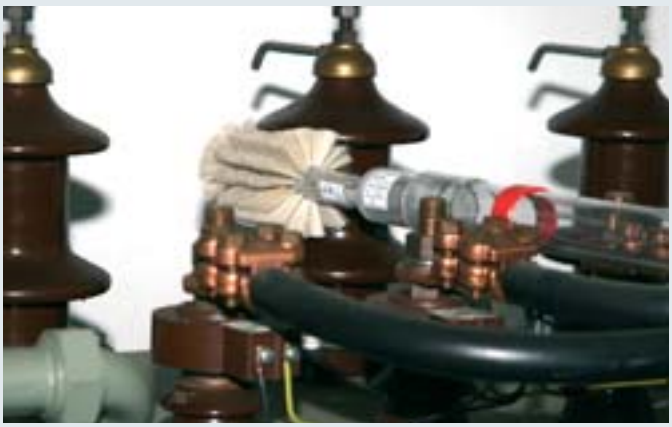
- Not for use in wet weather
- For indoor and outdoor installations
- Equipment for cleaning by suction under live conditions
- For dry cleaning of transformers and switchgear installations
- Transparent intake tubes for more safety
- Specially adapted operating heads for intensive cleaning
- Plug-in coupling system for quick exchanging of the operating heads

Cleaning a transformer with TRS MS Dry Cleaning Set under live conditions.

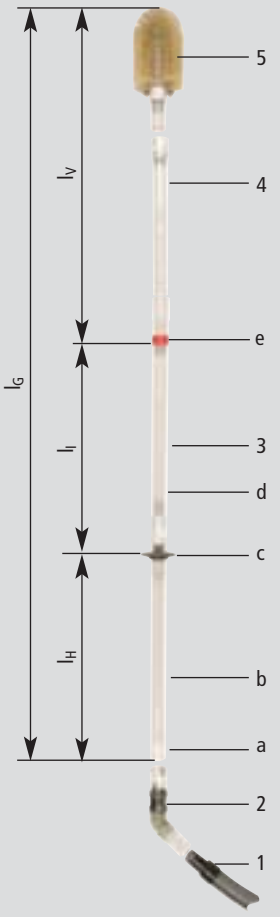
Preconditions

Maintenance work at voltages from 1 to 36 kV is allowed under the supervision of a qualified electrician according to EN 50110-1 "Operation of electrical installations – Minimum Requirements", observing clauses 6.3.1 to 6.3.12, and according to EN 50110-2 "Operation of electrical installations – National Annexes". In Germany apply sections BGV A3 and BGR A3 of the national accident prevention regulations (UVV) "Elektrische Anlagen und Betriebsmittel" [Electrical installations and equipment] issued by the German Employer's Liability Association for Precision and Electrical Engineering (BGFE).

Cleaning an insulator with a flat cleaning head and angled intake tube (135°).



Cleaning an insulator with a tubular brush.



Design

1 Intake hose
2 Intake hose adapter
3 Intake tube with
a bottom connecting part
b handle
c handguard
d insulating part
e red ring
4 Extension tube
5 Cleaning head

Dimension:

l_H Length of handle = 540 mm
l_I Length of insulating part = 535 mm
l_V Length of extension
$l_{V\,min}$ = 115 mm,
$l_{V\,max}$ = 2515 mm
l_G Total length of the intake tube
$l_{G\,min}$ = 1180 mm,
$l_{G\,max}$ = 3580 mm

DELTEC®

TRS MS Dry Cleaning Set

EQUIPMENT FOR LIVE CLEANING

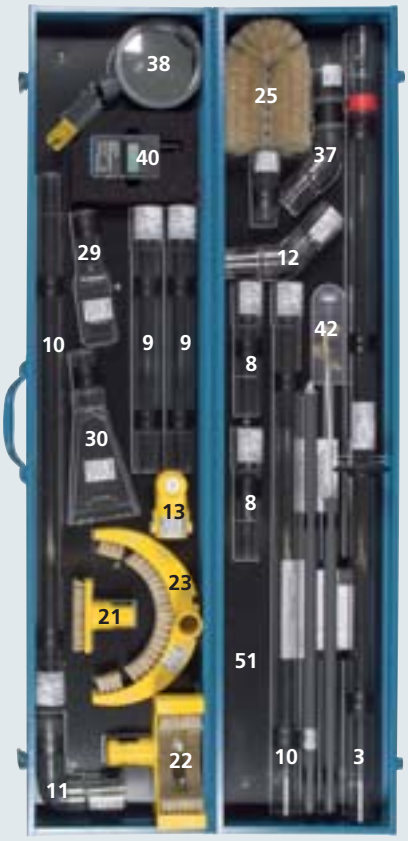
Type	Type of Set	Part No.

A TRS MS Dry Cleaning Set

Standard Equipment

Pos.	Qty.	Type	Item	Part No.
3	1	SRH 1180 MS	Intake tube with handle	785 120
8	2	SRV 200 MS	Extension, 200 mm	785 121
9	2	SRV 400 MS	Extension, 400 mm	785 122
10	2	SRV 800 MS	Extension, 800 mm	785 123
11	1	SRW 90 MS	Angled intake tube, 90°	785 131
12	1	SRW 135 MS	Angled intake tube, 135°	785 132
13	1	SRW V VS	Angled intake tube, lockable	785 130
21	1	REB 1095 MS	Rectangular brush	785 160
22	1	HRB 120 MS	Half-round brush 120	785 140
23	1	HRB 190 MS	Half-round brush 190	785 150
25	1	STB 120 MS	Tubular brush, 250 mm	785 170
29	1	FD 60 MS	Cleaning head 60	785 220
30	1	FD 110 MS	Cleaning head 110	785 221
37	1	SSA W D	Intake hose adapter	785 200
38	1	ISP 135 MS	Insulating mirror	785 190
40	1	DHTM	Digital hygro-/thermometer	785 180
42	1	RB 50 MS	Cleaning brush for single set parts	785 210
51	1	KKL TRS MS	GFP case, blue colour	785 301

TRS MS	Complete in a GFP case	**785 100**

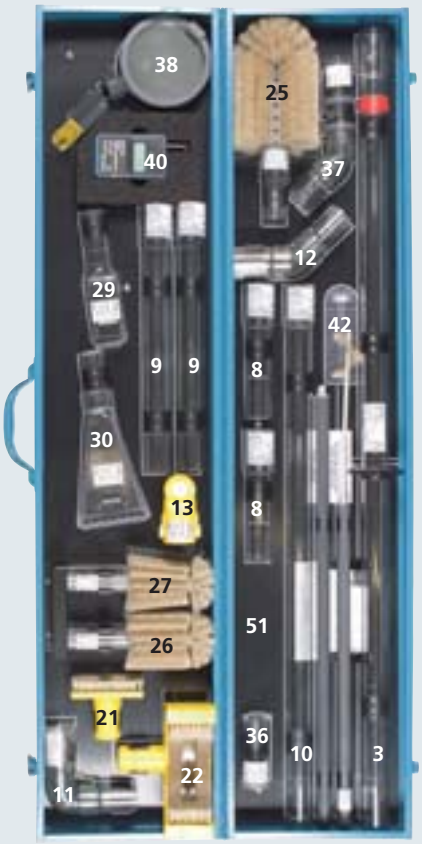


B TRS MS V1 Dry Cleaning Set

Standard Equipment

Pos.	Qty.	Type	Item	Part No.
3	1	SRH 1180 MS	Intake tube with handle	785 120
8	2	SRV 200 MS	Extension, 200 mm	785 121
9	2	SRV 400 MS	Extension, 400 mm	785 122
10	1	SRV 800 MS	Extension, 800 mm	785 123
11	1	SRW 90 MS	Angled intake tube, 90°	785 131
12	1	SRW 135 MS	Angled intake tube, 135°	785 132
13	1	SRW V VS	Angled intake tube, lockable	785 130
21	1	REB 1095 MS	Rectangular brush	785 160
22	1	HRB 120 MS	Half-round brush 120	785 140
25	1	STB 120 MS	Tubular brush, 250 mm	785 170
26	1	STB 80 MS	Tubular brush, cylindrical bristles	785 171
27	1	STB 80 K MS	Tubular brush, conical bristles	785 172
29	1	FD 60 MS	Cleaning head 60	785 220
30	1	FD 110 MS	Cleaning head 110	785 221
36	1	SRA MS	Intake tube adapter	785 212
37	1	SSA W D	Intake hose adapter	785 200
38	1	ISP 135 MS	Insulating mirror	785 190
40	1	DHTM	Digital hygro-/thermometer	785 180
42	1	RB 50 MS	Cleaning brush for single set parts	785 210
51	1	KKL TRS MS	GFP case, blue colour	785 301

TRS MS V1	Complete in a GFP case	**785 112**



Single Parts of TRS MS Dry Cleaning Set

DELTEC®

EQUIPMENT FOR LIVE CLEANING

GFP Case, empty

With retaining clips and printed top and bottom insert

Type	Colour	Dimension	Position	Part No.
KKL TRS MS	●	1200 x 270 x 165 mm	51	**785 301**

Intake Tube with Handle

For use as operating tube with handle, handguard, insulating part, red ring and extension

Type	Diameter	Dimension	Position	Part No.
SRH 1180 MS	40 mm	1180, insulating part 525 mm	3	**785 120**

Extension

Type	Diameter	Dimension	Position	Part No.
SRV 200 MS	40 mm	200 mm	8	**785 121**
SRV 400 MS	40 mm	400 mm	9	**785 122**
SRV 800 MS	40 mm	800 mm	10	**785 123**

Angled Intake Tube, 90°

Type	Diameter	Dimension	Position	Part No.
SRW 90 MS	40 mm	120 mm	11	**785 131**

Angled Intake Tube, 135°

Type	Diameter	Dimension	Position	Part No.
SRW 135 MS	40 mm	100 mm	12	**785 132**

Angled Intake Tube

Lockable, allows for adjustments due to 15° gearing, for positioning the cleaning heads

Type	Diameter	Dimension	Position	Part No.
SRW V MS	40 mm	160 mm	13	**785 130**

Rectangular Brush

Type	Diameter	Dimension	Position	Part No.
REB 1095 MS	40 mm	105 x 90 x 50 mm	21	**785 160**

Half-round Brush

For cleaning insulators as well as horizontal and vertical openings, the brush can be attached to angled intake tube type SRW V MS to be adjustable and can be led around complete insulators.

Type	Diameter	Position	Part No.
HRB 120 MS	40 / 120 mm	22	**785 140**
HRB 190 MS	40 / 190 mm	23	**785 150**

Tubular Brush

Type	Diameter	Dimension	Position	Part No.
STB 120 MS	40 / 120 mm	250 mm	25	**785 170**

DELTEC®

Single Parts of TRS MS Dry Cleaning Set

EQUIPMENT FOR LIVE CLEANING

Tubular Brush
Cylindrical bristles

Type	Diameter	Dimension	Position	Part No.
STB 80 MS	25 / 85 mm	240 mm	26	**785 171**

Tubular Brush
Conical bristles

Type	Diameter	Dimension	Position	Part No.
STB 80 K MS	25 / 85 mm	240 mm	27	**785 172**

Cleaning Head 60
Width: 60 mm

Type	Diameter	Dimension	Position	Part No.
FD 60 MS	40 mm	190 mm	29	**785 220**

Cleaning Head 110
Width: 110 mm

Type	Diameter	Dimension	Position	Part No.
FD 110 MS	40 mm	260 mm	30	**785 221**

Intake Tube Adapter
For brushes and cleaning heads Ø25 mm

Type	Diameter	Dimension	Position	Part No.
SRA MS	40 / 25 mm	100 mm	36	**785 212**

Intake Hose Adapter
Adjustable, angled: 120°, with intake air regulation, for use with intake hose system Ø35 mm

Type	Diameter	Position	Part No.
SSA W D	35 / 40 mm	37	**785 200**

Insulating Mirror
For controlling covered construction elements

Type	Diameter	Position	Part No.
ISP 135 ZK MS	40 / 135 mm	38	**785 190** new

Digital Hygro-/Thermometer
For checking the climatic conditions to be kept.
Measuring range – 20° C ... + 70° C, 10 ... 95% relative air humidity

Type	Dimension	Position	Part No.
DHTM	140 x 65 mm	40	**785 180**

Cleaning Brush
For single set parts Ø40 mm, modular

Type	Diameter	Dimension	Position	Part No.
RB 50 MS	45 mm	1430 mm	42	**785 210**

FRS ZK MS Damp Cleaning Set

Nominal voltages up to 36 kV / 15 ... 60 Hz

EQUIPMENT FOR LIVE CLEANING

TÜV Thüringen GS geprüfte Sicherheit

Based on DIN VDE 0681 Part 1 and DIN VDE 0682 Part 621
Universal gear coupling according to EN/IEC 60832 (DIN VDE 0682 Part 211)

- Not for use in wet weather
- For indoor and outdoor installations
- Equipment for damp cleaning under live conditions with special cleaning liquid
- Universal gear coupling for exchanging and angling operating heads
- Rigid and flexible plug-in operating heads for quick and easy exchange of sponges

Damp cleaning of a transformer with FRS ZK MS Damp Cleaning Set.

Application

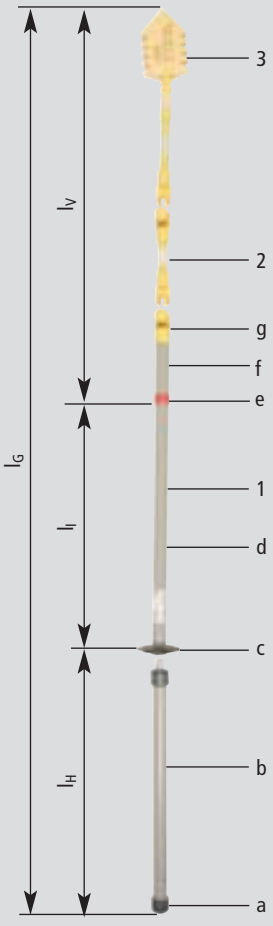
Cleaning with damp sponges allows to remove tough pollution layers and clean oily transformer surfaces. The special insulating cleaning liquid used (e.g. Rivolta SLX 500; SLX TOP or SLX Super made by Bremer & Leguil, Duisburg/Germany, and Florin 2000 made by Flore, Koblenz/Germany) has to be chosen according to the rated voltage of the installation and environmental requirements.

Preconditions

Maintenance work at voltages from 1 to 36 kV is allowed under the supervision of a qualified electrician according to EN 50110-1 "Operation of electrical installations – Minimum Requirements", observing clauses 6.3.1 to 6.3.12, and according to EN 50110-2 "Operation of electrical installations – National Annexes". In Germany apply sections BGV A3 and BGR A3 of the national accident prevention regulations (UVV) "Elektrische Anlagen und Betriebsmittel" [Electrical installations and equipment] issued by the German Employer's Liability Association for Precision and Electrical Engineering (BGFE).

The universal gear coupling allows for quick exchange of the operating head and extensions.

Damp cleaning of an insulator with a dual operating head.



Design

1 Insulating rod with
- a terminal part
- b handle
- c handguard
- d insulating part
- e red ring
- f extension
- g top connecting part

2 Extension tube

3 Operating head with sponge

Dimension:

l_H Length of handle = 510 mm

l_I Length of insulating part = 525 mm

l_V Length of extension
$l_{V\,min}$ = 350 mm,
$l_{V\,max}$ = 2100 mm

l_G Total length
$l_{G\,min}$ = 1450 mm,
$l_{G\,max}$ = 3250 mm

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FRS ZK MS Damp Cleaning Set

EQUIPMENT FOR LIVE CLEANING

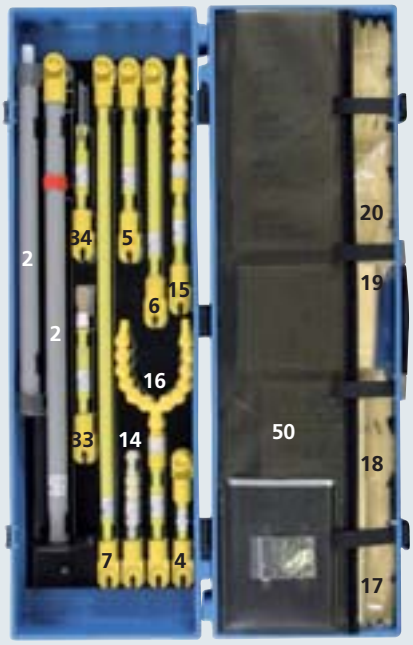
Type	Type of Set	Part No.

A FRS ZK MS Damp Cleaning Set

Standard Equipment

Pos.	Qty.	Type	Item	Part No.
2	1	ISH T 1300 ZK MS	Insulating rod with handle	785 315
4	1	ISV 220 ZK MS	Extension, 220 mm	785 316
5	1	ISV 320 ZK MS	Extension, 320 mm	785 317
6	1	ISV 420 ZK MS	Extension, 420 mm	785 318
7	1	ISV 820 ZK MS	Extension, 820 mm	785 319
14	1	AK RS S ZK MS	Rigid operating head	785 324
15	1	AK RS ZK MS	Single operating head, flexible	785 322
16	1	AK RS 2 ZK MS	Dual operating head, flexible	785 323
17	10	RS 1544 MS	Rectangular cleaning sponge	785 274
18	10	RS 1574 MS	Rectangular cleaning sponge	785 275
19	10	RS 15104 Z MS	Rectangular cleaning sponge, serrated	785 279
20	10	RSD 15104 Z MS	Triangular cleaning sponge, serrated	785 280
33	1	RP 15 ZK MS	Round brush	785 321
34	1	S 30 ZK MS	Scraper	785 320
50	1	KKL FRS ZK MS	GFP case, blue colour	785 229

FRS ZK MS	Complete in a plastic case	**785 940**



Single Parts of FRS ZK MS Damp Cleaning Set

DELTEC®

EQUIPMENT FOR LIVE CLEANING

GFP Case, empty

With retaining clips and printed bottom insert

Type	Colour	Dimension	Position	Part No.
KKL FRS ZK MS	●	850 x 300 x 200 mm	50	**785 229**

Insulating Rod with Handle

For use as operating rod with handle, handguard, insulating part, red ring and extension, detachable handle

Type	Dimension	Position	Part No.
ISH T 1300 ZK MS	1260 mm	2	**785 315**

Extension

Type	Diameter	Dimension	Position	Part No.
ISV 220 ZK MS	20 mm	220 mm	4	**785 316**
ISV 320 ZK MS	20 mm	320 mm	5	**785 317**
ISV 420 ZK MS	20 mm	420 mm	6	**785 318**
ISV 820 ZK MS	20 mm	820 mm	7	**785 319**

Round Brush

Type	Diameter	Dimension	Position	Part No.
RP 15 ZK MS	20 mm	270 mm	33	**785 321**

Scraper

Type	Diameter	Dimension	Position	Part No.
S 30 ZK MS	20 mm	280 mm	34	**785 320**

DELTEC®

Single Parts of FRS ZK MS Damp Cleaning Set

EQUIPMENT FOR LIVE CLEANING

Rigid Operating Head

For attaching cleaning sponges

Type	Diameter	Dimension	Position	Part No.
AK RS S ZK MS	20 mm	200 mm	14	**785 324**

Single Operating Head

Flexible unit for attaching cleaning sponges

Type	Diameter	Dimension	Position	Part No.
AK RS ZK MS	20 mm	400 mm	15	**785 322**

Dual Operating Head

Flexible unit, for attaching cleaning sponges

Type	Diameter	Dimension	Position	Part No.
AK RS 2 ZK MS	20 mm	415 mm	16	**785 323**

Rectangular Cleaning Sponge

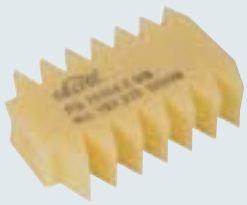
Type	PU	Dimension	Position	Part No.
RS 1544 MS	5 pc(s)	150 x 40 x 40 mm	17	**785 274**

Rectangular Cleaning Sponge

Type	PU	Dimension	Position	Part No.
RS 1574 MS	5 pc(s)	150 x 70 x 40 mm	18	**785 275**

Rectangular Cleaning Sponge, serrated

Type	PU	Dimension	Position	Part No.
RS 15104 Z MS	5 pc(s)	150 x 100 x 40 mm	19	**785 279**



Triangular Cleaning Sponge, serrated

Type	PU	Dimension	Position	Part No.
RSD 15104 Z MS	5 pc(s)	150 x 100 x 40 mm	20	**785 280**

TFRS MS Combined Cleaning Set

Nominal voltages up to 36 kV / 15 ... 60 Hz

EQUIPMENT FOR LIVE CLEANING

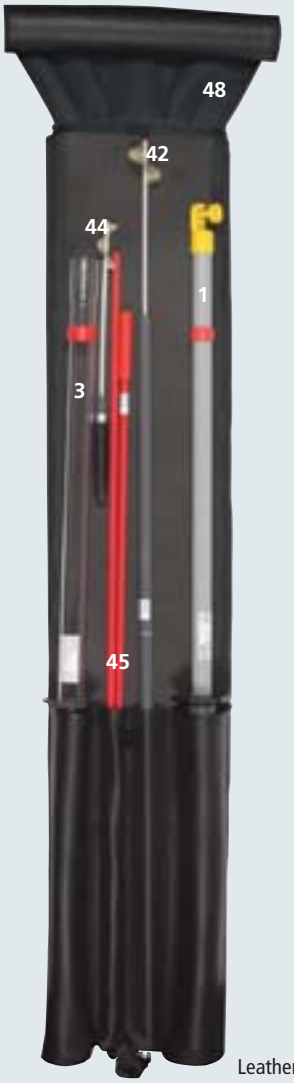
Based on DIN VDE 0681 Part 1 and DIN VDE 0682 Part 621
Universal gear coupling acc. to EN/IEC 60832
(DIN VDE 0682 Part 211)

- Not for use in wet weather
- For indoor and outdoor installations
- Combined device for dry and damp cleaning under live conditions
- Transparent intake tubes for more safety
- Specially adapted operating heads for intensive cleaning
- Universal gear coupling for exchanging and angling operating heads
- Rigid and flexible plug-in operating heads for quick and easy exchange of sponges

Dry and damp cleaning of a transformer under live conditions with TFRS MS Combined Cleaning Set.

Application
Dry cleaning work is performed by suction with operating heads and cleaning or brushing parts of the installations to be cleaned and sucking the dirt at the same time. Loose dust layers and cobwebs are cleaned away quickly and without problem. Oily and tough layers are removed by damp cleaning with sponges moistened with a special insulating cleaning liquid.

Preconditions
Maintenance work at voltages from 1 to 36 kV is allowed under the supervision of a qualified electrician according to EN 50110-1 "Operation of electrical installations – Minimum Requirements", observing clauses 6.3.1 to 6.3.12, and according to EN 50110-2 "Operation of electrical installations – National Annexes". In Germany apply sections BGV A3 and BGR A3 of the national accident prevention regulations (UVV) "Elektrische Anlagen und Betriebsmittel" [Electrical installations and equipment] issued by the German Employer's Liability Association for Precision and Electrical Engineering (BGFE).



Leather bag

A TFRS MS Combined Cleaning Set

Pos.	Qty.	Type	Item	Part No.
Standard Equipment – Leather Bag				
1	1	ISH 1300 ZK MS	Insulating rod with handle, single part	785 325
3	1	SRH 1180 MS	Intake tube with handle	785 120
42	1	RB 50 MS	Cleaning brush, for single set parts	785 210
44	1	RB 20 NS	Cleaning brush, for single set parts Ø25 mm	785 585
45	1	AS MS	Locking rod	785 109
48	1	KLT 140 28 SCH	Storage bag	785 952

DELTEC®

TFRS MS Combined Cleaning Set

EQUIPMENT FOR LIVE CLEANING

Type	Type of Set	Part No.

A TFRS MS Combined Cleaning Set

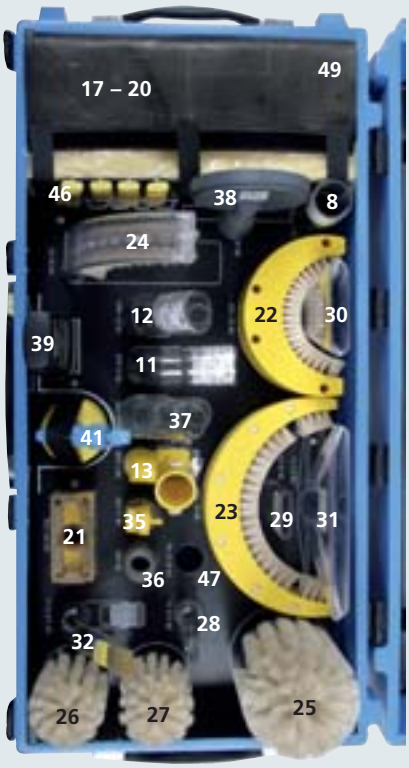
Pos.	Qty.	Type	Item	Part No.
Standard Equipment – Case Cover				
4	1	ISV 220 ZK MS	Extension, 220 mm	785 316
5	1	ISV 320 ZK MS	Extension, 320 mm	785 317
6	1	ISV 420 ZK MS	Extension, 420 mm	785 318
7	1	ISV 820 ZK MS	Extension, 820 mm	785 319
9	2	SRV 400 MS	Extension, 400 mm	785 122
10	2	SRV 800 MS	Extension, 800 mm	785 123
14	1	AK RES S ZK MS	Rigid operating head	785 324
15	1	AK RS ZK MS	Single operating head, flexible	785 322
16	1	AK RS 2 ZK MS	Dual operating head, flexible	785 323
33	1	RP 15 ZK MS	Round brush	785 321
34	1	S 3 30 ZK MS	Scraper	785 320
Standard Equipment – Case Bottom				
8	1	SRV 200 MS	Extension, 200 mm	785 121
11	1	SRW 90 MS	Angled intake tube, 90°	785 131
12	1	SRW 135 MS	Angled intake tube 135°	785 132
13	1	SRW V MS	Lockable angled intake tube	785 130
17	10	RS 1544 MS	Rectangular cleaning sponge	785 274
18	5	RS 1574 MS	Rectangular cleaning sponge	785 275
19	5	RS 15104 Z MS	Rectangular cleaning sponge, serrated	785 279
20	5	RSD 15104 Z MS	Triangular sponge, serrated	785 280
21	1	REB 1095 MS	Rectangular brush	785 160
22	1	HRB 120 MS	Half-round brush 120	785 140
23	1	HRB 190 MS	Half-round brush 190	785 150
24	1	BB 245 MS	Arc brush	785 151
25	1	STB 120 MS	Tubular brush, 250 mm	785 170
26	1	STB 80 MS	Tubular brush, cylindrical bristles	785 171
27	1	STB 80 K MS	Tubular brush, conical bristles	785 172
28	1	FD 35 MS	Flat cleaning head 35	785 551
29	1	FD 60 MS	Cleaning head 60	785 220
30	1	FD 110 MS	Cleaning head 110	785 221
31	1	FD 210 MS	Cleaning head 210	785 223
32	1	FD 35 W P MS	Flat cleaning head with brush	785 552
35	1	AKA TF MS	Operating head adapter	785 259
36	1	SRA MS	Intake tube adapter	785 212
37	1	SSA W D	Intake hose adapter	785 200
38	1	ISP 135 MS	Insulating mirror	785 190
39	1	DHTM T 615	Digital hygro-/thermometer	785 181
41	1	SF FRF MS	Spray bottle	785 953
46	4	EP 25 L MS	Spare brush	785 224
47	1	RSI ...	Reducing insert (not included in delivery)	—
49	1	KKL TFRS MS	GFP case, blue colour	785 951

TFRS MS	Complete in GFP case and leather bag	**785 950**

Note: Other types of sets available on request.

Case cover

Case bottom



Single Parts of TFRS MS Combined Cleaning Set

Standard Equipment – Leather Bag

Artificial Leather Bag, empty

With zip-fastener and shoulder strap

Type	Colour	Dimension	Position	Part No.
KLT 140 28	●	1400 x 280 mm	48	**785 952**

Insulating Rod with Handle

Single-part unit

Type	Diameter	Dimension	Position	Part No.
ISH 1300 ZK MS	30 mm	1300 mm	1	**785 325**

Intake Tube with Handle

For use as operating tube with handle, handguard, insulating part, red ring and extension

Type	Diameter	Dimension	Position	Part No.
SRH 1180 MS	40 mm	1180, insulating part 525 mm	3	**785 120**

Cleaning Brush

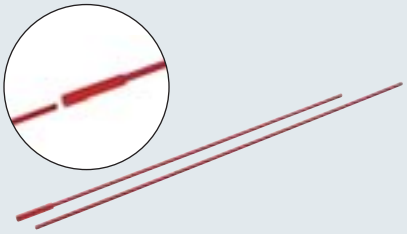
For single set parts Ø40 mm, modular

Type	Diameter	Dimension	Position	Part No.
RB 50 MS	45 mm	1430 mm	42	**785 210**

Cleaning Brush

For single set parts Ø25 mm

Type	Diameter	Dimension	Position	Part No.
RB 20 NS	30 mm	330 mm	44	**785 585**



Locking Rod

Modular, for use as visible working limit

Type	Dimension	Position	Part No.
AS MS	2200 mm	45	**785 109**

DELTEC®

Single Parts of TFRS MS Combined Cleaning Set

EQUIPMENT FOR LIVE CLEANING

Standard Equipment – Case Cover

GFP Case, empty

With retaining clips and printed top and bottom insert

Type	Colour	Dimension	Position	Part No.
KKL TFRS MS	●	850 x 410 x 400 mm	49	**785 951**

Extension

Type	Diameter	Dimension	Position	Part No.
ISV 220 ZK MS	20 mm	220 mm	4	**785 316**
ISV 320 ZK MS	20 mm	320 mm	5	**785 317**
ISV 420 ZK MS	20 mm	420 mm	6	**785 318**
ISV 820 ZK MS	20 mm	820 mm	7	**785 319**

Extension

Type	Diameter	Dimension	Position	Part No.
SRV 200 MS	40 mm	200 mm	8	**785 121**
SRV 400 MS	40 mm	400 mm	9	**785 122**
SRV 800 MS	40 mm	800 mm	10	**785 123**

Angled Intake Tube, 90°

Type	Diameter	Dimension	Position	Part No.
SRW 90 MS	40 mm	120 mm	11	**785 131**

Angled Intake Tube, 135°

Type	Diameter	Dimension	Position	Part No.
SRW 135 MS	40 mm	100 mm	12	**785 132**

Angled Intake Tube

Lockable, allows for adjustments due to 15° gearing, for positioning the cleaning heads

Type	Diameter	Dimension	Position	Part No.
SRW V MS	40 mm	160 mm	13	**785 130**

Single Parts of TFRS MS Combined Cleaning Set

Standard Equipment – Case Cover

Rigid Operating Head

For attaching cleaning sponges

Type	Diameter	Dimension	Position	Part No.
AK RS S ZK MS	20 mm	200 mm	14	**785 324**

Single Operating Head

Flexible unit for attaching cleaning sponges

Type	Diameter	Dimension	Position	Part No.
AK RS ZK MS	20 mm	400 mm	15	**785 322**

Dual Operating Head

Flexible unit, for attaching cleaning sponges

Type	Diameter	Dimension	Position	Part No.
AK RS 2 ZK MS	20 mm	415 mm	16	**785 323**

Rectangular Cleaning Sponge

Type	Dimension	PU	Position	Part No.
RS 1544 MS	150 x 40 x 40 mm	5 pc(s)	17	**785 274**

Rectangular Cleaning Sponge

Type	Dimension	PU	Position	Part No.
RS 1574 MS	150 x 70 x 40 mm	5 pc(s)	18	**785 275**

Rectangular Cleaning Sponge, serrated

Type	Dimension	PU	Position	Part No.
RS 15104 Z MS	150 x 100 x 40 mm	5 pc(s)	19	**785 279**

Triangular Cleaning Sponge, serrated

Type	Dimension	PU	Position	Part No.
RSD 15104 Z MS	150 x 100 x 40 mm	5 pc(s)	20	**785 280**

Rectangular Brush

Type	Diameter	Dimension	Position	Part No.
REB 1095 MS	40 mm	105 x 90 x 50 mm	21	**785 160**

Half-round Brush

For cleaning insulators as well as horizontal and vertical openings, the brush can be attached to angled intake tube type SRW V MS to be adjustable and can be led around complete insulators.

Type	Diameter	Position	Part No.
HRB 120 MS	40 / 120 mm	22	**785 140**
HRB 190 MS	40 / 190 mm	23	**785 150**

DELTEC®

Single Parts of TFRS MS Combined Cleaning Set

EQUIPMENT FOR LIVE CLEANING

Standard Equipment – Case Cover

Arc Brush

Type	Diameter	Dimension	Position	Part No.
BB 245 MS	40 mm	390 mm	24	**785 151**

Tubular Brush

Type	Diameter	Dimension	Position	Part No.
STB 120 MS	40 / 120 mm	250 mm	25	**785 170**

Tubular Brush

Cylindrical bristles

Type	Diameter	Dimension	Position	Part No.
STB 80 MS	25 / 85 mm	240 mm	26	**785 171**

Tubular Brush

Conical bristles

Type	Diameter	Dimension	Position	Part No.
STB 80 K MS	25 / 85 mm	240 mm	27	**785 172**

Flat Cleaning Head 35

Type	Diameter	Dimension	Position	Part No.
FD 35 S MS	40 mm	35 mm	28	**785 551**

Cleaning Head 60

Width: 60 mm

Type	Diameter	Dimension	Position	Part No.
FD 60 MS	40 mm	190 mm	29	**785 220**

Cleaning Head 110

Width: 110 mm

Type	Diameter	Dimension	Position	Part No.
FD 110 MS	40 mm	260 mm	30	**785 221**

Cleaning Head 210

Width: 210 mm

Type	Diameter	Dimension	Position	Part No.
FD 210 MS	40 mm	255 mm	31	**785 223**

Single Parts of TFRS MS Combined Cleaning Set

Standard Equipment – Case Cover

Flat Cleaning Head 35

Width: 35 mm, angled: 30°, with detachable brush

Type	Diameter	Dimension	Position	Part No.
FD 35 W P MS	40 mm	35 mm	32	**785 552**

Round Brush

Type	Diameter	Dimension	Position	Part No.
RP 15 ZK MS	20 mm	270 mm	33	**785 321**

Scraper

Type	Diameter	Dimension	Position	Part No.
S 30 ZK MS	20 mm	280 mm	34	**785 320**

Operating Head Adapter

Universal gear coupling / transparent tube Ø25 mm

Type	Diameter	Dimension	Position	Part No.
AKA TF ZK MS	40 mm	125 mm	35	**785 259**

Intake Tube Adapter

For brushes and cleaning heads Ø25 mm

Type	Diameter	Dimension	Position	Part No.
SRA MS	40 / 25 mm	100 mm	36	**785 212**

Intake Hose Adapter

Adjustable, angled: 120°, with intake air regulation, for use with intake hose system Ø35 mm

Type	Diameter	Position	Part No.
SSA W D	35 / 40 mm	37	**785 200**

DELTEC®

Single Parts of TFRS MS Combined Cleaning Set

EQUIPMENT FOR LIVE CLEANING

Standard Equipment – Case Cover

Insulating Mirror

For controlling covered construction elements

Type	Diameter	Position	Part No.	
ISP 135 ZK MS	40 / 135 mm	38	**785 190**	new

Digital Hygro-/Thermometer

For testing the climatic conditions to be kept.
Measuring range 0° C ... +50° C, 5 ... 95%, relative air humidity

Type	Dimension	Position	Part No.
DHTM T 615	57 x 190 x 42 mm	39	**785 181**

Spray Bottle

For cleaning liquids

Type	Capacity	Position	Part No.
SF FRF MS	500 ml	41	**785 953**

Spare Brush

For flat cleaning heads type FD 39 WP MS

Type	Dimension	PU	Position	Part No.
EP 25 L MS	40 mm	3 pc(s)	46	**785 224**

Accessories for NS and MS Cleaning Sets

Industrial Vacuum Cleaner

For dry cleaning set and combined cleaning set

Equipment

25 l – Special plastic container, 2 big wheels, 2 guide rolls with locking device, grip for carrying and cable hook, socket outlet with automatic closing mechanism, electromagnetic impulse filter cleaning, automatic vibration, regulation of revolutions, volume indication, accelleration rate controller, electronic after-running feature, water identification with sensor-controlled disconnection, 2 new polyester filter cassettes FKP 4300, filter area 2 x 4300 cm^2 = 8600 cm^2 , dust retaining capacity in accordance with BIA Utilisation Category C, supply cable length 8 m

Technical Data

– 2-stage motor blower with bypass cooling
– Nominal capacity max. 1400 Watt, 230 V 50/60 Hz
– Max. air flow (blower) 61 l/s
– Max. low air pressure (blower) 248 mbar
– Container: 25 l gross volume, 20 l for dust, 15 l for water
– Intake hose with straight connecting unit Ø35 mm, 5 m

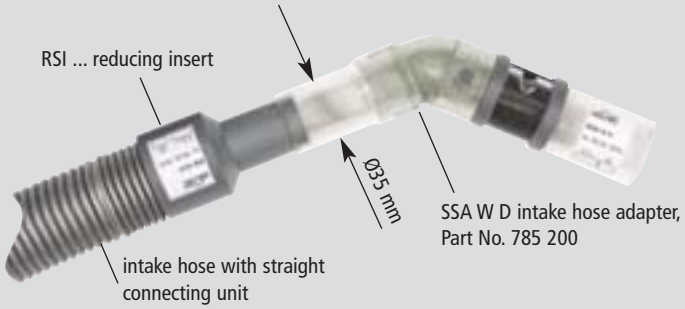
Type	Dimension	Part No.
HIS 1400 TRS	400 x 400 x 560 mm	**785 310**

Reducing Inserts

For use as connecting unit between SSA W D intake hose adapter and intake hoses with straight connecting unit made by other manufacturers.

Type	Diameter	Dimension	Part No.
RSI 32	35 / 32 mm	105 mm	**785 213**
RSI 34	35 / 34 mm	105 mm	**785 214**
RSI 35	35 / 35 mm	105 mm	**785 215**
RSI 38	35 / 38 mm	105 mm	**785 216**
RSI 45	35 / 45 mm	105 mm	**785 217**
RSI 51	35 / 51 mm	105 mm	**785 218**
RSI 58	35 / 58 mm	105 mm	**785 219**

Application:



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Accessories for NS and MS Cleaning Sets

EQUIPMENT FOR LIVE CLEANING

Flat Cleaning Head, angled: 90°, with detachable Brush

For use with TRS NS cleaning sets

Type	Diameter	Dimension	Part No.
FWD 35 P NS	25 mm	200 mm	**785 592**

Intake Tube with Handle

For TRS MS and TFRS MS

Type	Diameter	Dimension	Part No.
SRH 1180 IS 650 MS	40 mm	1180 mm, insulating part 650 mm	**785 119**

Cover

Type	Colour	Dimension	Part No.
AP 152 G	●	1500 x 2000 mm	**785 110**

Canvas Bag, empty

With two separate inside pockets and shoulder strap
For intake hose, cover, helmet with protective shield, working gloves or 2x earthing and short-circuiting devices (set for transport in motor vehicles)

Type	Colour	Dimension	Part No.
STT 55 27 30	●	550 x 270 x 300 mm	**785 111**

NFG MS Refilling Device

Nominal voltages up to 36 kV / 15 ... 60 Hz

EQUIPMENT FOR REFILLING WORK

Based on DIN VDE 0681 Part 1 and DIN VDE 0682 Part 621

- Not for use in wet weather
- For indoor and outdoor installations
- Equipment for refilling hot HT mass into paper-insulated mass-impregnated cables under live conditions
- Safe, quick and easy refilling procedure
- Transparent insulated refilling lance for more safety

Refilling of hot HT mass under live conditions.

Design

The equipment for refilling cable ends consists of a mobile unit with conveying pump, a reservoir containing 5 litres of oil, heat regulator, connecting hose and a refilling lance. The oil reservoir can be removed from the mobile unit and sealed for easy transport. The pump and the insulated refilling lance are connected with a heat-resistant, removable and highly flexible refilling hose with a pump control cable (Ein [On]/Aus [Off] circuit). All the components can be arranged on transport vehicle equipment fitted with the required support brackets.

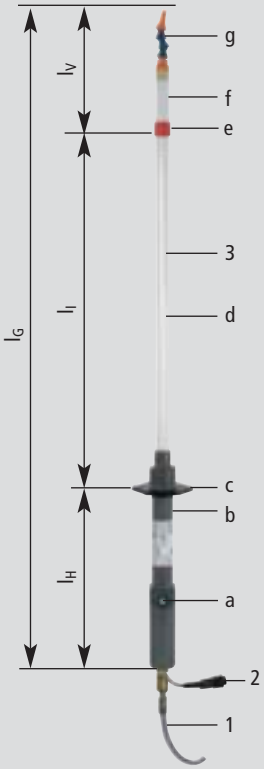
When working under live conditions, the sealing end screws are removed and fixed again by means of an insulated screw driver. Special plastic screws can be used for resealing the cable sealing ends.

Preconditions

Maintenance work at voltages up to 36 kV is allowed under the supervision of a qualified electrician according to EN 50110-1 "Operation of electrical installations – Minimum Requirements", observing clauses 6.3.1 to 6.3.12, and according to EN 50110-2 "Operation of electrical installations – National Annexes". In Germany apply sections BGV A3 and BGR A3 of the national accident prevention regulations (UVV) "Elektrische Anlagen und Betriebsmittel" [Electrical installations and equipment] issued by the German Employer's Liability Association for Precision and Electrical Engineering (BGFE).

Technical Data	
Nominal capacity	1200 W
Power supply	230 V / 50 Hz
Container size	5 litres
Heating control range	0° C ... + 120° C
Indication range of thermometer	0° C ... + 120° C

After pulling out the conveying pump from the HT mass, the oil reservoir can be removed for refilling.



1 Highly flexible filling hose
2 Control line
3 Insulating refilling lance with
a momentary contact switch
b handle
c handguard
d insulating part
e red ring
f extension
g flexible refilling device

Dimension:

l_H Length of handle = 285 mm
l_I Length of insulating part = 525 mm
l_V Length of extension = 180 mm
l_G Total length = 980 mm

Design

DELTEC®

NFG MS Refilling Device

EQUIPMENT FOR REFILLING WORK

Type	Part No.
A MS Refilling Device Complete with refilling lance and oil reservoir	
NFG MS	**785 260**

Other lengths of insulated refilling lances available on request.

Accessories for NFG MS Refilling Device

Insulated Refilling Lance

Operating rod with detachable, highly flexible filling hose (1350 mm), handle, handguard, insulating part, red ring, extension and flexible lance tip

Type	Diameter	Dimension	Part No.	
INFL MS	30 / 20 mm	980 mm	**785 261**	new

Reservoir

Made of stainless steel, with cover and ventilation screw.

Type	Capacity of heating element	Dimension	Part No.	
OEB NFG MS	950 W	320 x 165 x 164 mm	**785 264**	
RFB NFG MS	no heating element	320 x 165 x 164 mm	**785 295**	new

GFP Case, empty

Max. capacity:
3 NFG MS Reservoirs

Type	Colour	Dimension	Part No.	
KKL OEB NFG MS	●	600 x 380 x 220 mm	**785 299**	new

MS Insulated Screw Driver

Nominal voltages up to 36 kV / 15 ... 60 Hz

EQUIPMENT FOR REFILLING WORK

Based on DIN VDE 0681 Part 1

- Not for use in wet weather
- For indoor and outdoor installations
- For screwing and unscrewing sealing screws from cable ends under live conditions
- With interchangeable operating heads (straight and angled)

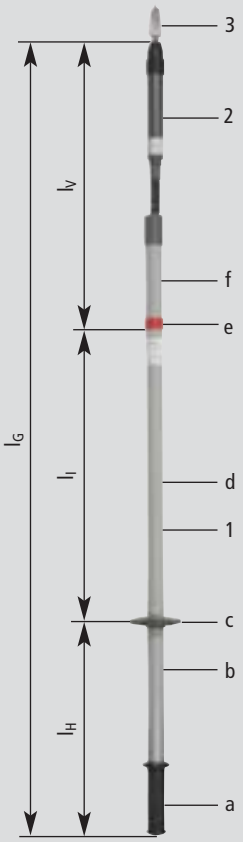
Opening the sealing screw with the MS insulated screw driver.

Application
The insulated screw driver with interchangeable operating heads (straight and angled) for attaching special bits and sealing screws allows to open and close cable sealing ends under live conditions. Only tested operating heads and special sealing screws may be used.

Preconditions
Maintenance work at voltages from 1 to 36 kV is allowed under the supervision of a qualified electrician according to EN 50110-1 "Operation of electrical installations – Minimum Requirements", observing clauses 6.3.1 to 6.3.12, and according to EN 50110-2 "Operation of electrical installations – National Annexes". In Germany apply sections BGV A3 and BGR A3 of the national accident prevention regulations (UVV) "Elektrische Anlagen und Betriebsmittel" [Electrical installations and equipment] issued by the German Employer's Liability Association for Precision and Electrical Engineering (BGFE).

The plastic case allows to transport additionally the insulated refilling lance incl. filling hose and special sealing screws, apart from the insulated screw driver set. These elements, however, are not included in delivery.

Technical Data	
Insulating rod	Glass-fibre reinforced polyester tube, Ø30 mm, grey
Handle	Black plastic
Operating head	PVC, Ø30 mm, for attaching special bits and special sealing screws



Design

1 Operating rod with
a adjustable handle
b handle
c handguard
d insulating part
e red ring
f extension
2 Operating head
straight, angled: 30° or 70°
3 Special bit

Dimension:
l_H Length of handle = 385 mm
l_I Length of insulating part = 525 mm
l_V Length of extension = 430 mm
l_G Total length = 1375 mm

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MS Insulated Screw Driver

EQUIPMENT FOR REFILLING WORK

Type	Part No.
A Screw Driver Set, complete with Plastic Case	

Pos.	Qty.	Type	Item	Part No.
1	1	BS 1125 SD KEV MS	Operating rod with adjustable handle	785 266
2	1	VL 350 SD KEV MS	Extension	785 273
3	1	AK SD KEV MS	Operating head, straight	785 267
4	1	AK SD W30 KEV MS	Operating head, angled (30°)	785 268
5	1	AK SD W70 KEV MS	Operating head, angled (70°)	785 269
6	1	BIT 13 SD KEV MS	Special bit 13 mm	785 271
7	1	BIT 8 SD KEV MS	Special bit 8 mm	785 272
8	1	KKL SDS KEV MS	Plastic case	785 298

SDS KEV MS	**785 265**

Additional extensions for the insulating part, special operating bits and sealing screws available on request.

Single Parts of MS Insulating Screw Driver

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EQUIPMENT FOR REFILLING WORK

Plastic Case, empty

With foamed insert

Type	Colour	Dimension	Position	Part No.
KKL SDS KEV MS	●	1270 x 200 x 120 mm	8	**785 298**

Operating Rod with adjustable Handle

With handle, handguard, insulating part, red ring and extension

Type	Diameter	Dimension	Position	Part No.
BS 1125 SD KEV MS	30 mm	1135 mm	1	**785 266**

Extension

For operating rod

Type	Diameter	Dimension	Position	Part No.
VL 350 SD KEV MS	30 mm	350 mm	2	**785 273**

Operating Head, straight

With hexagon terminal for attaching special bits and special sealing screws

Type	Diameter	Dimension	Position	Part No.
AK SD KEV MS	30 mm	310 mm	3	**785 267**

Operating Head, angled (30°)

With hexagon terminal for attaching special bits and special sealing screws

Type	Diameter	Dimension	Position	Part No.
AK SD W30 KEV MS	30 mm	270 mm	4	**785 268**

Operating Head, angled (70°)

With hexagon terminal for attaching special bits and special sealing screws

Type	Diameter	Dimension	Position	Part No.
AK SD W70 KEV MS	30 mm	300 mm	5	**785 269**

Special Bit 13 mm

With safety plug-in system, for use with operating heads type AK SD ...

Type	Diameter	Dimension	Position	Part No.
BIT 13 SD KEV MS	25 mm	50 mm	6	**785 271**

Special Bit 8 mm

With safety plug-in system, for use with operating heads type AK SD ...

Type	Diameter	Dimension	Position	Part No.
BIT 8 SD KEV MS	25 mm	50 mm	7	**785 272**

DELTEC®

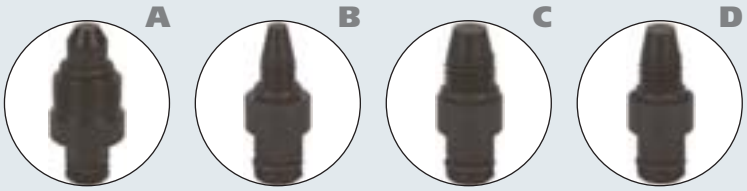
Special Sealing Screws

EQUIPMENT FOR REFILLING WORK

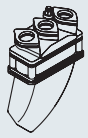
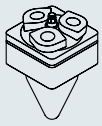
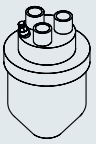
Nominal voltages up to 36 kV

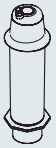
Screwing a special sealing screw into the cable sealing end with an angled operating head.

- Not for use in wet weather
- For indoor and outdoor installations
- For closing cable sealing ends
- For use with operating heads type AK SD ...
- With safety plug-in system
- UV-resistant



Type	Dimension	PU	Part No.
A Special Sealing Screw made by F&G For cable sealing ends			
VS F&G M22 F	M22 x 55 mm	12 pc(s)	**785 281**
B Special Sealing Screw made by Köttgen For cable sealing ends			
VS KOET M10	M10 x 45 mm	12 pc(s)	**785 282**
C Special Sealing Screw made by Raychem For cable sealing ends			
VS RAY M14	M14 x 45 mm	12 pc(s)	**785 283**
D Special Sealing Screw made by GOW For cable sealing ends			
VS GOW M12	M12 x 45 mm	12 pc(s)	**785 284**

Special sealing screws for cable sealing ends made by other manufacturers available on request.

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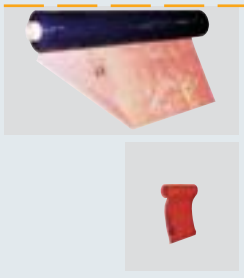
Selection Guide

PROTECTIVE AND AUXILIARY EQUIPMENT

	Device	Nominal voltage U_N	Application	Page
	PPE – Personal Protective Equipment	up to 1000 V	Protective helmet Protective shield NH fuse puller with protective sleeve Insulated gloves	190
	Covering Cloths and Insulating Mats	up to 1000 V	Covering cloths and winding tape Insulating mats for insulating standing surfaces	194
	Locking Elements	up to 1000 V	Insulating plug Insulating blade Locking elements	196

PPE – Personal Protective Equipment

DELTEC®

Nominal voltages up to 1000 V

PROTECTIVE AND AUXILIARY EQUIPMENT

- Protective shield, inside permanently tarnish-free
- U-shape rubber band for attaching to all types of protective helmets with or without drip flap
- Two locking positions: The shield can be locked in working and lift-up position
- Protective helmet available in different colours
- NH fuse puller with protective sleeve made of coated cotton cloth

Protective helmet according to DIN EN 397
Protective shield according to DIN EN 166
NH fuse puller according to DIN VDE 0680 Part 4

Inserting an NH fuse with the necessary personal protective equipment.

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PPE – Personal Protective Equipment

PROTECTIVE AND AUXILIARY EQUIPMENT

Type	Nominal voltage up to U_N	Colour	Material	Part No.
A Protective Helmet Adjustable to head sizes from 52 to 63 cm				
ASH G NS	1000 V		special polyethylene	**785 426**
ASH W NS	1000 V		special polyethylene	**785 429**
ASH O NS	1000 V		special polyethylene	**785 436**
ASH B NS	1000 V		special polyethylene	**785 437**
ASH R NS	1000 V		special polyethylene	**785 438**

B Protective Shield
For protection from electrical arcs
Inside permanently tarnish-free, polished edges, 1.5 mm thick
U-shape rubber band for attaching to all types of protective helmets with or without drip flap.
The shield can be locked in working and lift-up position.

SSC ASH NS	1000 V		plastic	**785 427**

C NH Fuse Puller with Protective Sleeve
For taking NH fuses, sizes 00, 1, 2 and 3

NHS AG 00 3 NS	1000 V		coated cotton cloth	**785 645**

Accessories for Protective Helmet

Chin Strap

Type	Part No.
KR ASH NS	**785 428**

Accessories for PPE – Personal Protective Equipment

Storage Bag, empty

For protective helmet and shield, and NH fuse puller

Type	Colour	Dimension	Part No.
AT PSA NS		Ø300, 500 mm	**785 425**

Insulated Gloves

Nominal voltages up to 1000 V

EN 60903 (DIN VDE 0682 Part 311)

- For working at live parts
- The insulated gloves combine an excellent fit and high elasticity with maximum insulating capacity
- Two different types available according to requirements

Live working with insulated gloves at voltages up to 1000 V.

Routine test

The pneumatic glove tester allows the user to perform the routine tests required by the relevant standards and find even minimal damage. The routine tests should be performed each time before the gloves are used. Therefore, the glove tester is an indispensable and very practical accessory part.

Technical Data	
Category M	For high mechanical stresses
Category RC	Resistant against acids, oil, ozone and higher mechanical stresses as well as extremely low temperatures

DELTEC®

Insulated Gloves

PROTECTIVE AND AUXILIARY EQUIPMENT

Type	Class	Nominal voltage up to U_N	Thickness of elastomer	Size	Part No.
A Category M / Beige					
IHS 00 M 9 NS	00	500 V	0.5 mm	9	**785 491**
IHS 00 M 10 NS	00	500 V	0.5 mm	10	**785 492**
IHS 0 M 9 NS	0	1000 V	1.0 mm	9	**785 493**
IHS 0 M 10 NS	0	1000 V	1.0 mm	10	**785 494**

B Category RC / Black
With internal coating and structured handling area

IHS 00 RC 9 NS	00	500 V	0.9 mm	9	**785 495**
IHS 00 RC 10 NS	00	500 V	0.9 mm	10	**785 496**

Sizes 8 and 11 available on request.

Accessories for Insulated Gloves

Storage Bag, empty

With velcro fastener and coupling hook

Type	Colour	Dimension	Part No.
AT IHS NS	●	400 x 180 x 50 mm	**785 490**

Pneumatic Glove Tester

For routine testing according to standard requirements

Type	Colour	Part No.
PHSP NS	●	**785 497**

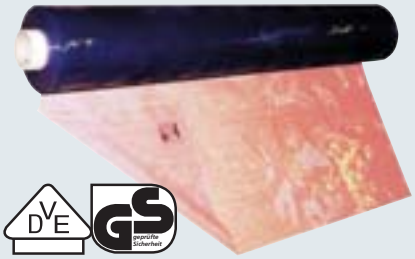
Covering Cloths and Insulating Mats

Nominal voltages up to 1000 V

DIN VDE 0680 Part 1

- For protection from accidental and direct contact with energised parts
- For covering adjacent energised parts
- Different lengths, widths, thickness and colours available
- Insulated rubber mats for insulating installation sites

Covering of energised parts.



Type	Length	Width	Thickness	Colour	Part No.
A Plastic Covering Cloth					
ATK 135 50M NS	50 m	1350 mm	0.5 mm	crystal clear	**785 465**
ATK 135 ..M NS	as required, up to 50 m*)	1350 mm	0.5 mm	crystal clear	**785 466**

B Plastic Covering Cloth					
ATK 120 25M NS	25 m	1200 mm	1.0 mm	transparent	**785 467**
ATK 120 ..M NS	as required, up to 25 m*)	1200 mm	1.0 mm	transparent	**785 468**

C Covering Cloth (Chloropren Rubber) Flexible even at low temperatures					
ATN 140 10M NS	10 m	1400 mm	1.0 mm	●	**785 471**
ATN 140 ..M NS	as required, up to 10 m*)	1400 mm	1.0 mm	●	**785 472**

D Covering Cloth (Chloropren Rubber) For covering insulators					
WBN 200 2,5M NS	2.5 m	200 mm	1.0 mm	●	**785 646**

*) Please confirm the length required when placing your order.

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Covering Cloths and Insulating Mats

PROTECTIVE AND AUXILIARY EQUIPMENT

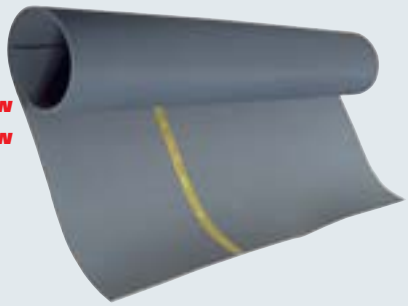
E Insulated Rubber Mats for insulating Standing Surfaces

Type	Length	Width	Thickness	Colour	Part No.
IMG SI 1M NS	1 m	1000 mm	3.0 mm		785 455
IMG SI ..M NS	as required, up to 10 m*)	1000 mm	3.0 mm		785 456
IMG SI 10M NS	10 m	1000 mm	3.0 mm		785 457

F Insulating Mat

For laying out in electrical switching and test rooms,
electric strength: 50 kV, tested according to DIN VDE 0303 Part 2

IMG SAN 1M ..M	as required, up to 10 m*)	1000 mm	4.5 mm		785 458	new
IMG SAN 1M 10M	10 m	1000 mm	4.5 mm		785 459	new



*) Please confirm the length required when placing your order.

Accessories for Covering Cloths and Insulating Mats

Clip

With insulated steel spring

Type	Max. clamping range	Dimension	Material	Part No.
KK 35 NS	35 mm	170 / 110 mm	plastic	785 647

Hook

Type	Dimension	Material	Part No.
HK 8 NS	Ø8, 130 / 72 mm	plastic	785 648

Ring

2-part unit

Type	Dimension	Material	Part No.
OEK 12 NS	Ø12 / 26 mm	plastic	785 649

Locking Elements

DELTEC®

Nominal voltages up to 1000 V

PROTECTIVE AND AUXILIARY EQUIPMENT

National regulations (VBG 125) and DIN 40008

- For indoor installations
- For protection from reconnection
- Symbol "Nicht schalten" [Do not close the circuit] acc. to national regulations (VBG 125)
- Insulating plug for screw insert
- Insulating blade for NH fuse holders
- Locking elements for circuit breakers

Locking element, width: 3 modules (mods.)

Type	Size	Dimension	Part No.
A Insulating Plug For screw insert			
SE E14	E14	Ø20 x 40 mm	**785 639**
SE E18	E18	Ø25 x 40 mm	**785 650**
SE E27 E33	E27 and 33	Ø45 x 55 mm	**785 640**
B Insulating Blade For NH fuse holders and distribution blocks			
SE NH00	00	80 mm	**785 641**
SE NH0	0	125 mm	**785 642**
SE NH1	1	135 mm	**785 643**
SE NH2 3	2 and 3	150 mm	**785 644**
C Locking Element For single- and three-pole circuit breakers with clamping range of 45 mm			
SE REG 1TE	1 mod.	52 x 17 mm	**785 638**
SE REG 2TE	2 mods.	52 x 34 mm	**785 652** new
SE REG 3TE	3 mods.	52 x 51 mm	**785 637**

EQUIPMENT FOR OVERHEAD LINES

SALISBURY
Setting industry standards since 1855

Maintenance work on overhead lines

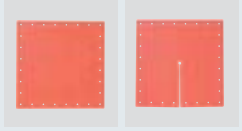
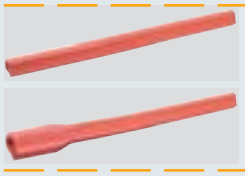
Maintenance work on overhead lines under live conditions is safely performed worldwide for voltages up to 400 kV. The use of this technology provides considerable advantages for power supply authorities and consumers. For performing this type of work in existing installations in Germany, there are established procedures, tools and training standards as well as high safety requirements.

Working with insulated gloves

By using this procedure, the worker comes into direct contact with energised parts while relying on the protection provided by the insulated gloves and insulated sleeves as arm protection, if required. Using insulated gloves will additionally still require use of insulating materials, insulated tools and a suitable standing surface insulation, even if this work is performed on low voltage installations.

The Bavarian Power Supply Authority, E.ON Bayern, performs maintenance work on overhead lines under live conditions with voltages up to 36 kV.

Ref.: Fotostudio Köhler, Bayreuth/Germany

	Equipment	Nominal voltage U_N	Application	Page
	Insulated Gloves	up to 36 kV	For working on energised parts of installations Material: Natural India Rubber Dual-colour design allows for easy identification of cuts, cracks or other damage No fatigue or cramping of the hands due to soft rubber mixture	198
	Protective Leather Gloves		For use as an outer glove to protect insulated gloves against mechanical damage For use as operating glove for cleaning work and refilling of insulating oils Material: Robust neat's leather With safety strap for good fit	199
	Insulated Sleeves	up to 36 kV	For working on energised parts of installations Material: Natural India rubber Dual-colour design allows for easy identification of cuts, cracks or other damage Maximum coverage and thus optimum protection against contact with arm and shoulder area	200
	Insulated Blankets	up to 36 kV	For working on energised parts of installations Material: Natural India rubber Highly flexible with slots for hanging and locking purposes Available with and without slits for installation purposes	202
	Insulating Line Hose	up to 26,5 kV	For covering energised overhead lines Material: Natural India rubber Resistant against UV and ozone radiation With and without coupling for continuous installation	204

Insulated Gloves

Nominal voltages up to 36 kV

DIN VDE 0682 Part 311 or DIN EN 60903

- For working on energised parts of installations
- Glove made of natural India rubber
- High wear comfort due to good fit
- No hand fatigue due to the soft rubber mixture
- Dual-colour design allows for easy identification of cuts, cracks or other damage
- Wide gauntlet for working with insulated sleeves

Ref.: Fotostudio Köhler, Bayreuth/Germany

Conditions:
The gloves have always to be checked for visible damage before use.
Work at operating voltages exceeding 1 kV is allowed to be performed under the instructions of a qualified electrician in accordance with EN 50110-1 "Operation of Electrical Installations – Minimum Requirements", under observance of subclauses 6.3.1 to 6.3.12 and in accordance with EN 50110-2 "Operation of Electrical Installations – National Annexes".

Maintenance Test:
Insulated gloves have to be tested at least every 6 months. This requirement is valid for glove classes 1, 2, 3 and 4 and will also apply to new gloves if the electrical testing was done 6 months prior to use. The gloves will have to be tested before use and the testing will include visual inspection for punctures and surface damage while the glove is inflated and an electrical test for the dielectric strength and discharge currents of the insulating material. For insulated gloves, classes 00 and 0, a check for holes and a visual check are sufficient.

Measuring the back of the hand with a measuring tape

Glove Size
The glove size can be determined by measuring the circumference of the back of the hand.

Circumference	Size
20.3 cm	8
21.5 cm	8.5
22.8 cm	9
24.1 cm	9.5
25.4 cm	10
26.6 cm	10.5
27.9 cm	11
29.2 cm	11.5
30.4 cm	12

Example:
Insulated gloves for application in low voltages are required, U_N = 400 V / 50 Hz at a circumference of the back of the hand = 24 cm.

Your order: Insulated Glove Type IHS 00, Size 9.5

Type	Class	Length	Operating voltage ac	Operating voltage dc	Colour one-/two-coloured	Size Steps of 1/2
A Insulated Glove up to 1000 V						
IHS 00	00	356 mm	500 V	750 V	red	8 to 12
IHS 0	0	356 mm	1 000 V	1 500 V	red / yellow	8 to 12
Reference Data: Insulated Glove, Type _____, Size _____						
B Insulated Glove up to 36 kV						
IHS 1	1	406 mm	7.5 kV	11.5 kV	yellow / black	8 to 12
IHS 2	2	406 mm	17 kV	25.5 kV	yellow / black	8 to 12
IHS 3	3	406 mm	26.5 kV	39.75 kV	yellow / black	8 to 12
IHS 4	4	457 mm	36 kV	54 kV	yellow / black	8 to 12
Reference Data: Insulated Glove, Type _____, Size _____						

Second gloves made of 100% cotton available on request.

DELTEC®

Protective Leather Gloves

EQUIPMENT FOR OVERHEAD LINES

For use as an outer or operating glove

Leather glove for use as an outer glove, for protection against mechanical damage.

- For use as an outer glove to protect insulated gloves against mechanical damage
- For use as an operating glove for cleaning work and refilling of insulating oils
- Made of robust neat's leather
- High-quality tailoring, robust seams
- High wear comfort due to good fit
- With safety strap for good fit

Measuring the back of the hand with a measuring tape

Glove Size

The glove size can be determined by measuring the circumference of the back of the hand.

Circumference	Size
20.3 cm	8
22.8 cm	9
25.4 cm	10
27.9 cm	11
30.4 cm	12

Example:
An outer glove is required for an insulated glove Size 8, Class 00 or 0.

Your order: Protective Leather Glove Type LHS 254, Size 9

Note!
For use as outer gloves for insulated gloves, the size of the outer gloves must be selected one size larger that the insulated gloves.

Type	Length	Size Steps of 1
A Protective Leather Glove Type LHS 254 Without safety strap for insulated gloves, Classes 00 and 0		
LHS 254	254 mm	8 to 12
Reference Data: Protective Leather Glove, Type LHS 254, Size _____		
B Protective Leather Glove Type LHS 356 SR With reflecting gauntlet for insulated gloves, Classes 1 to 4		
LHS 356 SR	356 mm	8 to 12
Reference Data: Protective Leather Glove, Type LHS 356 SR, Size _____		

Accessories for Insulated Gloves and Protective Leather Gloves

Bag for Storage and Transport

Made of jute (burlap) with fastening press buttons and safety carbine for fixing at belt of equipment.

Type	Dimension	Design
AT 229 508	229 x 508 mm	one internal pocket
AT 229 508 2IT	229 x 508 mm	two separate internal pockets
Reference Data: Bag for Storage and Transport, Type _____		

Insulated Sleeves

Nominal voltages up to 36 kV

DIN VDE 0682 Part 312 or DIN EN 60984

- For working on energised parts of installations
- Insulated sleeves made of natural India rubber
- High wear comfort due to good fit
- Maximum coverage and thus optimum protection against contact with arm and shoulder area
- Dual-colour design allows for easy identification of cuts, cracks or other damage

Ref.: Fotostudio Köhler, Bayreuth/Germany

Conditions:
The sleeves must be checked for visible damage before use.
Work at operating voltages exceeding 1 kV is allowed to be performed under the instructions of a qualified electrician in accordance with EN 50110-1 "Operation of Electrical Installations – Minimum Requirements", under observance of subclauses 6.3.1 to 6.3.12 and in accordance with EN 50110-2 "Operation of Electrical Installations – National Annexes".

Maintenance Test:
The insulated sleeves have to be tested at least every 12 months. If the last electrical test has been performed more that 6 months prior to use, the sleeves should tested before use even if these sleeves are still new and have never been used. For class 0 sleeves, testing is required every 6 months and includes a visual inspection and electrical routine testing.

Shoulder support and screw fixing for safe positioning and fit of the insulated gloves.

Example:
Insulated sleeves are required for application in low voltage systems, U_N = 400 V / 50 Hz.

Your order: Insulated Sleeves Type IAE 0

Type	Class	Length	Operating voltage ac	Operating voltage dc	Colour one-/two-coloured
A Insulated Sleeves up to 1000 V, straight					
IAE 0	0	667 mm	1 000 V	1 500 V	● ●
Reference Data: Insulated Sleeves, Type _____					
B Insulated Sleeves up to 36 kV, angled					
IAE 1	1	673 mm	7.5 kV	11.5 kV	● ●
IAE 2	2	673 mm	17 kV	25.5 kV	● ●
IAE 3	3	673 mm	26.5 kV	39.75 kV	● ●
IAE 4	4	673 mm	36 kV	54 kV	● ●
Reference Data: Insulated Sleeves, Type _____					

Note: Other lengths and types available on request.

DELTEC®

Accessories for Insulated Sleeves

EQUIPMENT FOR OVERHEAD LINES

Shoulder Support

For insulated sleeves.

Type
SH IAE
Reference Data: Shoulder Support, Type SH IAE

Supporting Straps

For extending the shoulder supports (4 pcs. required).

Type	Length	VPE Stk.
TR IAE	343 mm	2
Reference Data: Supporting Straps, Type TR IAE		

Screw Fixing

For shoulder supports and supporting straps.

Type	VPE Stk.
SF IAE	4
Reference Data: Screw Fixing, Type SF IAE	

Bag for Storage and Transport

Made of jute (burlap) with fastening press buttons and with safety carbine for fixing at the belt or equipment.

Type	Dimension
AT 836 241	836 x 241 mm
Reference Data: Bag for Storage and Transport, Type AT 836 241	

Insulated Blankets

DELTEC®

Nominal voltages up to 36 kV

EQUIPMENT FOR OVERHEAD LINES

DIN VDE 0682 Part 511 or prEN 61111

- For covering energised parts of installations at operating voltage
- Insulated blanket made of natural India rubber
- Highly flexible with slots for hanging and locking purposes
- Available with and without slits for installation purposes

Ref.: Fotostudio Köhler, Bayreuth/Germany

Conditions:
Insulated blankets must always be checked for damage before use. The use at operating voltages exceeding 1 kV is allowed to be performed under the instructions of a qualified electrician in accordance with EN 50110-1 "Operation of Electrical Installations – Minimum Requirements", under observance of subclauses 6.3.1 to 6.3.12 and in accordance with EN 50110-2 "Operation of Electrical Installations – National Annexes".

Type	Class	Dimension	Operating voltage ac	Operating voltage dc	Number of marginal holes	Colour
A Insulated Blanket, without slit						
IAM 4 559 559	4	559 x 559 mm	36 kV	54 kV	28	●
IAM 4 686 914	4	686 x 914 mm	36 kV	54 kV	6	●
IAM 4 914 914	4	914 x 914 mm	36 kV	54 kV	6	●
Reference Data: Insulated Blankets, without slits, Type _____						

Type	Class	Dimension	Operating voltage ac	Operating voltage dc	Number of marginal holes	Colour
B Insulated Blanket, with slit						
IAMG 4 559 559	4	559 x 559 mm	36 kV	54 kV	28	●
IAMG 4 914 914	4	914 x 914 mm	36 kV	54 kV	28	●
Reference Data: Insulated Blankets, with slits, Type _____						

DELTEC®

Accessories for Insulated Blankets

EQUIPMENT FOR OVERHEAD LINES

Holding Clamp

For fixing insulated blankets.

Type	Length	Opening range	Material	Colour
HK 127	241 mm	127 mm	PVC	●
Reference Data: Holding Clamp, plastic, Type HK 127				

Bag for Storage and Transport

For rolling in insulated blankets.

Type	Dimension	Material	Max. capacity	Colour
AT 1371 1168	1371 x 1168 mm	water-repellent cotton fabric	4 mats	●
Reference Data: Bag for Storage and Transport, Type AT 1371 1168				

Container for Storage and Transport

For insulated blankets and holding clamps.

Type	Dimension	Material	Max. capacity	Colour
AB 152 940	152 x 940 mm	plastic	3 mats	●
AB 178 940	178 x 940 mm	plastic	6 mats	●
Reference Data: Container for Storage and Transport, Type _____				

Insulating Line Hose

DELTEC®

Nominal voltages up to 26.5 kV

EQUIPMENT FOR OVERHEAD LINES

DIN VDE 0682 Part 513 or DIN EN 61479

- For covering energised overhead lines
- Line hoses made of natural India rubber
- Resistant against UV and ozone radiation
- Highly flexible
- Insulating line hose with and without coupling for continuous installation

Ref.: Fotostudio Köhler, Bayreuth/Germany

Conditions:
Line hoses must always be checked for visible damage before use. The use at operating voltages exceeding 1 kV is allowed to be performed under the instructions of a qualified electrician in accordance with EN 50110-1 "Operation of Electrical Installations – Minimum Requirements", under observance of subclauses 6.3.1 to 6.3.12 and in accordance with EN 50110-2 "Operation of Electrical Installations – National Annexes".

Type	Class	Dimension Ø x l	Operating voltage ac	Colour
A Insulating Line Hose, without coupling				
ILSA 2 31 1820	2	31.5 x 1820 mm	17 kV	●
ILSA 2 31 1372	2	31.5 x 1372 mm	17 kV	●
ILSA 2 31 915	2	31.5 x 915 mm	17 kV	●
ILSA 3 40 1820	3	40 x 1820 mm	26.5 kV	●
ILSA 3 40 1372	3	40 x 1372 mm	26.5 kV	●
ILSA 3 40 915	3	40 x 915 mm	26.5 kV	●
Reference Data: Insulating Line Hose without coupling, Type _____				

Type	Class	Dimension Ø x l	Operating voltage ac	Colour
B Insulating Line Hose, with coupling				
ILSAK 2 31 1820	2	31.5 x 1820 mm	17 kV	●
ILSAK 2 31 1372	2	31.5 x 1372 mm	17 kV	●
ILSAK 2 31 915	2	31.5 x 915 mm	17 kV	●
ILSAK 3 40 1820	3	40 x 1820 mm	26.5 kV	●
ILSAK 3 40 1372	3	40 x 1372 mm	26.5 kV	●
ILSAK 3 40 915	3	40 x 915 mm	26.5 kV	●
Reference Data: Insulating Line Hose with coupling, Type _____				

Accessories for Insulating Line Hose

Bag for Storage and Transport

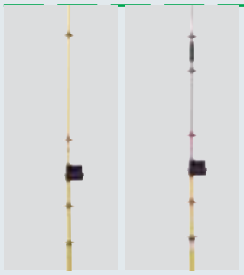
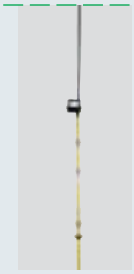
Robust jute (burlap) bag with safety carbine at the traction cable

Type	Dimension	Max. capacity
AT 300 1520	300 x 1520 mm	6 covers for overhead conductors
Reference Data: Bag for Storage and Transport, Type AT 300 1520		

RAILWAYS

Selection Guide

VOLTAGE DETECTORS

	Device	Nominal Voltage U_N / Frequency f_N	Application, Indication	Page
	PHE	15 kV / 16.7 Hz	Also for use in wet weather For use in overhead contact lines of electrical railways With self-testing device Visual indicator Short transport length	206
	PHE	3...10 / 6...20 kV / 50 Hz 6...20 kV / 16.7 Hz switchable 6...20 kV / 16.7 Hz	Also for use in wet weather For use in three-phase and single-ended mono-phase systems For electrical point heating systems With self-testing device Visual indicator Short transport length	208
	PHE	110 kV / 16.7 Hz	Also for use in wet weather For centre-earthed mono-phase railway overhead contact lines Visual indicator Short transport length	210
	HSA 194	110...420 kV / 16.7 Hz	Also for use in wet weather Non-contact voltage detector For centre-earthed mono-phase railway overhead lines With self-testing device Visual and acoustic indicator	212
	PHE/G	1...7.5 kV / dc voltage	Also for use in wet weather For indoor and outdoor installations With self-testing device Visual indicator Two-pole unit (single-/two-pole) Short transport length	214
	Storage Bags and Transport Cases		Case: Steel plate or plastic Bag: Artificial leather or canvas	68

Routine tests

According to German regulations, voltage detectors have to be tested to ensure compliance with the prescribed limits as stated in the Electrical Safety Rules. This test is performed in the high voltage test laboratory of DEHN + SÖHNE and includes

- test for leakage current,
- test for clear indication,
- test for bridging safety,
- test by visual check, manual test and measuring.

This routine test is documented by a test report and a marking on the device.

The intervals for routine tests depend on the operating conditions of the equipment, e.g. frequency of use, working conditions, transport and storage. According to German regulations, the routine tests **must not exceed 6 years**.

DB = Deutsche Bundesbahn [German National Railways]

PHE Voltage Detector

Nominal voltages 15 kV / 16.7 Hz

DIN VDE 0681 Part 6

- Also for use in wet weather
- For use in overhead contact lines for electrical railways
- With self-testing device
- Visual indicator
- Short transport length due to detachable insulating rod (3-part or 5-part unit)
- 5-part detachable insulating rod for transport in motor vehicles
- Storage bag included in delivery

PHE Voltage Detector with visual indicator used on an overhead contact line of the German national railways.

Self-testing device
The electronic Voltage Detector PHE has an integrated self-testing device. The electronic circuit is automatically tested for correct operation (threshold) when the voltage detector is switched on. The detector will only be operational if the self test has been performed successfully.

Replacing the battery
The PHE voltage detector is supplied with 4 Mignon IEC IR6 batteries. These batteries are situated in a separate battery compartment to allow for easy battery exchange.
Low batteries are indicated by both signals illuminated when the voltage detector is switched on.

5-part unit (for transport in motor vehicles)

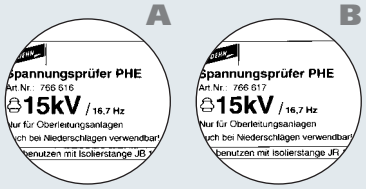
Two-part test prod with robust screw coupling

Insulating rod with aluminium latching spring coupling.

Sealing part with non-slip eye.

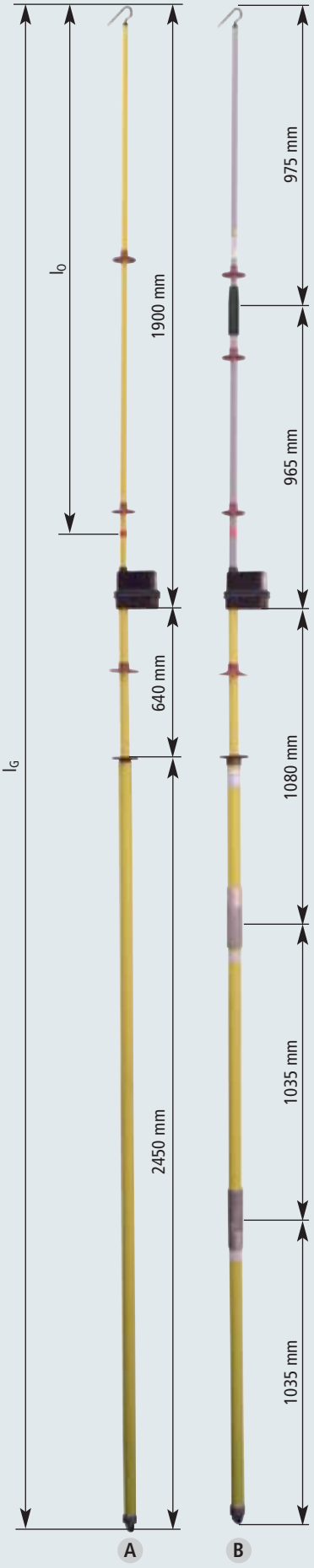
Technical Data	
Test prod	Glass-fibre reinforced polyester tube, Ø20 mm, yellow, with water-proof silicone elastomer shields; For transport in motor vehicles: Ø20/24 mm, with screw coupling; Hook-shape test electrode St/gal Zn
Indicator	Plastic, fully insulated, black
Indication	Red light '↯' (permanent light); Green light '**0**' (permanent light)
Insulating rod	Glass-fibre reinforced polyester tube, Ø30 mm, yellow, detachable, with handguard for safe handling and water-proof silicone elastomer shields; Handle made of glass-fibre reinforced polyester tube, Ø43/30 mm, yellow, with plug-in coupling; For transport in motor vehicles: with latching spring coupling; Sealing part with non-slip eye (Al/rubber)

VOLTAGE DETECTORS



Type	Nominal voltage/ frequency U_N / f_N	Total length l_G	Inserting depth l_O	DB Drawing No.	DB Material No.	Part No.
A Nominal Voltage 15 kV / 16.7 Hz Modular (3-part unit)						
PHE 15 16.7 3T	15 kV / 16.7 Hz	4820 mm	1675 mm	3 Ebgw 02.51	237 129	**766 616**
B Nominal Voltage 15 kV / 16.7 Hz (for Transport in Motor Vehicles) Modular (5-part unit)						
PHE 15 16.7 5T	15 kV / 16.7 Hz	4820 mm	1675 mm	3 Ebgw 02.53	652 975	**766 617**

Voltage detectors for other nominal voltages and frequencies available on request.



Accessories for PHE Voltage Detector, Part. No. 766 616

Artificial Leather Bag, empty

With shoulder strap

Type	Colour	Dimension	DB Drawing No.	Part No.
KLT 247 10 22	●	2470 x 220 x 100 mm	3 Ebgw 02.51	**766 602**

Accessories for PHE Voltage Detector, Part. No. 766 617

Canvas Bag, empty

With shoulder strap

Type	Colour	Dimension	Part No.
STT 120 30 15	●	1200 x 300 x 150 mm	**766 704**

PHE Voltage Detector

Nominal voltage ranges 3 ... 20 kV / 50 Hz and 6 ... 20 kV / 16.7 Hz

EN/IEC 61243-1 (DIN VDE 0682 Part 411)

- Also for use in wet weather
- For three-phase and single-ended mono-phase systems
- For electrical point heating systems
- With self-testing device
- Visual indicator
- Wide nominal voltage ranges
- Short transport length due to detachable insulating rods

Self-testing device
The electronic Voltage Detector PHE has an integrated self-testing device. The electronic circuit is automatically tested for correct operation (threshold) when the voltage detector is switched on. The detector will only be operational if the self test has been performed successfully.

Replacing the battery
The PHE voltage detector is supplied with 4 Mignon IEC IR6 batteries. These batteries are situated in a separate battery compartment to allow for easy battery exchange. Low batteries are indicated by both signals illuminated when the voltage detector is switched on.

Use in type-tested switchgear installations
Restrictions apply to the use of voltage detectors according to IEC/EN 61243-1 (DIN VDE 0682 Part 411) in prefabricated (type-tested) installations. Due to reduced insulation distances, sparkovers may occur when inserting the test prod into the installation. It is recommended that the user or operator of the switchgear installation consults with the manufacturer of the type-tested installation, before using the voltage detector.
(Refer to Page 12-Table: Applications of Voltage Detectors in type-tested prefabricated switchgear installations).

Before testing for the safe isolation from supply voltages, the correct operation of the voltage detector must be verified. When pressing the "TEST" button, the red light is flashing.

After releasing the button, the green light comes on proving that the detector is ready for operation.

PHE Voltage Detector with visual indication used in a switchgear installation.

Technical Data

Test prod	Glass-fibre reinforced epoxy resin tube, Ø20 mm, grey; Test electrode made of Cu alloy/gal Sn, Ø20 mm, tooth shape for reliable contact, with female M8 thread for supporting attachable electrodes and test probes
Indicator	Plastic, fully insulated, black
Indication	Red light '↯' (permanent light); Green light '**0**' (permanent light)
Insulating rod	Glass-fibre reinforced polyester tube, Ø30 mm, grey, detachable, with handguard for safe handling; Sealing part with non-slip plastic cap

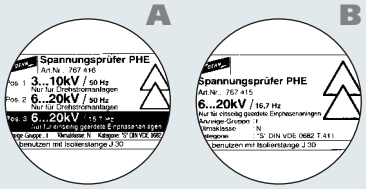
Special features of the switchable voltage detector:
The nominal selector switch allows for switching between three nominal voltage/frequency ranges:
3 ... 10 kV / 50 Hz – Three-phase current
6 ... 20 kV / 50 Hz – Three-phase current
6 ... 20 kV / 16.7 Hz – Single-ended mono-phase systems

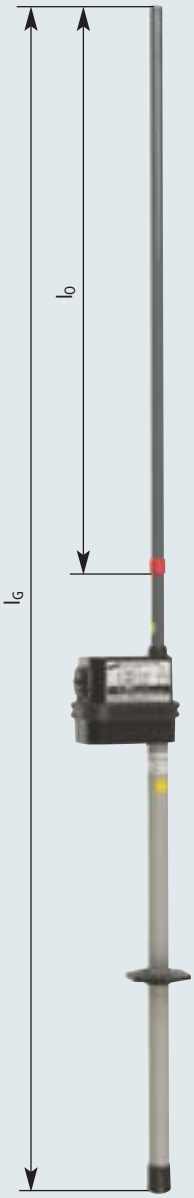
The nominal voltage selector switch allows for switching between three nominal voltage ranges. For safety reasons, the detector can only be switched on with the selector switched to the most sensitive range of 3 kV to 10 kV. A magnetically operated, wear-resistant reed switch changes the switching position. The switch snapping into the selected position provides protection against unintentional switching.

RAILWAYS

PHE Voltage Detector

VOLTAGE DETECTORS





Type	Nominal voltage/ frequency U_N / f_N	Total length l_G	Inserting depth l_O	DB Drawing No.	DB Material No.	Part No.
A Nominal Voltage Ranges up to 20 kV / 50 Hz or 16.7 Hz, switchable For three-phase and single-ended mono-phase switchgear installations						
PHE U 3 20 16.7 50	3...10 kV / 50 Hz 6...20 kV / 50 Hz 6...20 kV / 16.7 Hz	1590 mm	770 mm	3 Ebgw 02.54	743 361	**767 416**
B Nominal Voltage Ranges up to 20 kV / 16.7 Hz For single-ended mono-phase installations and point heating systems						
PHE 6 20 16.7	6 ... 20 kV / 16.7 Hz	1590 mm	770 mm	3 Ebgw 02.52	738 302	**767 415**

Voltage detectors for other nominal voltages and frequencies available on request.

Accessories for PHE Voltage Detector

Onion-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 SZ PHE PHV	from 3 kV	Ms/gal CuSn	**766 913**

Pin-shape Electrode

With additional M6 thread

Type	Nominal voltage U_N	Material	Part No.
EL M8 S PHE PHV	from 3 kV	stainless steel	**766 925**

Y-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 V PHE PHV	from 3 kV	Cu/gal Sn	**766 927**

Plastic Case, empty

With foamed insert

Type	Colour	Dimension	For PHE Total length	Part No.
KKL PHE L	●	1270 x 200 x 120 mm	from 1460 mm	**766 999** new

Artificial Leather Bag, empty

With shoulder strap

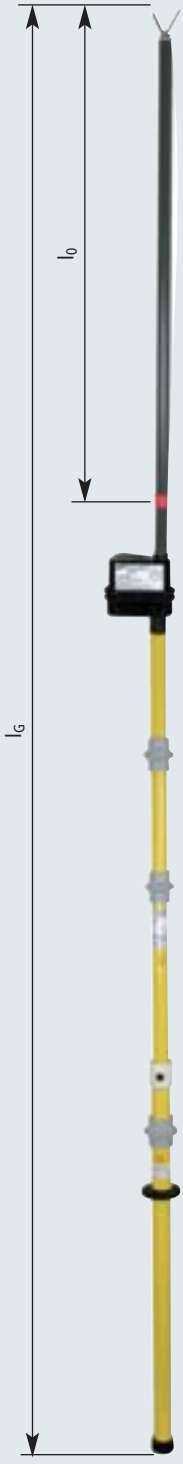
Type	Colour	Dimension	Part No.
KLT 121 25 16	●	1200 x 250 x 160 mm	**766 601**

PHE Voltage Detector

Nominal voltage 100 kV / 16.7 Hz

EN/IEC 61243-1 (DIN VDE 0682 Part 411)

- Also for use in wet weather
- For centre-earthed mono-phase railway overhead contact lines
- With self-testing device
- Visual indicator
- Short transport length due to modular and detachable insulating rod



Self-testing device
The electronic PHE voltage detector has an integrated self-testing device. The electronic circuit is automatically tested for correct operation (threshold) when the voltage detector is switched on. The detector will only be operational if the self test has been performed successfully.

Replacing the battery
The PHE voltage detector is supplied with 4 Mignon IEC IR6 batteries. These batteries are situated in a separate battery compartment to allow for easy battery exchange. Low batteries are indicated by both signals illuminated when the voltage detector is switched on.

PHE Voltage Detector used in an outdoor installation 110 kV.

Technical Data	
Test prod	Glass-fibre reinforced epoxy resin tube, Ø28 mm, with silicone elastomer coating, grey; Test electrode made of Cu alloy/gal Sn, y-shape electrode, detachable
Indicator	Plastic, fully insulated, black
Indication	Red light '↯' (flashlight); Green light '**0**' (permanent light)
Insulating rod	Glass-fibre reinforced polyester tube, Ø43/30 mm, yellow, modular and detachable, with silicone shields, with handguard for safe handling; Endpiece with non-slip plastic cap
Operating temperature range	– 25° C ... + 55° C, Climatic category N

Type	Nominal voltage/ frequency U_N / f_N	Total length l_G	Inserting depth l_O	DB Drawing No.	Part No.	
A Nominal Voltages up to 110 kV / 16.7 Hz						
PHE 110 16.7	110 kV / 16.7 Hz	2970 mm	1000 mm	3 Ekgw 02.52	**767 214**	new

Voltage detectors for other nominal voltages and frequencies available on request.

RAILWAYS

Accessories for PHE Voltage Detector

VOLTAGE DETECTORS

Hook-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 H PHE PHV	for overhead lines only	steel/gal Zn	**766 923**

V-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 G PHE PHV	for overhead lines only	stainless steel	**766 924**

Artificial Leather Bag, empty

With shoulder strap

Type	Colour	Dimension	Part No.
KLT 160 17	●	Ø170 x 1600 mm	**766 614**

Supporting Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D40 45	●	530 mm	**700 008**

HSA 194 Non-Contact Voltage Detector

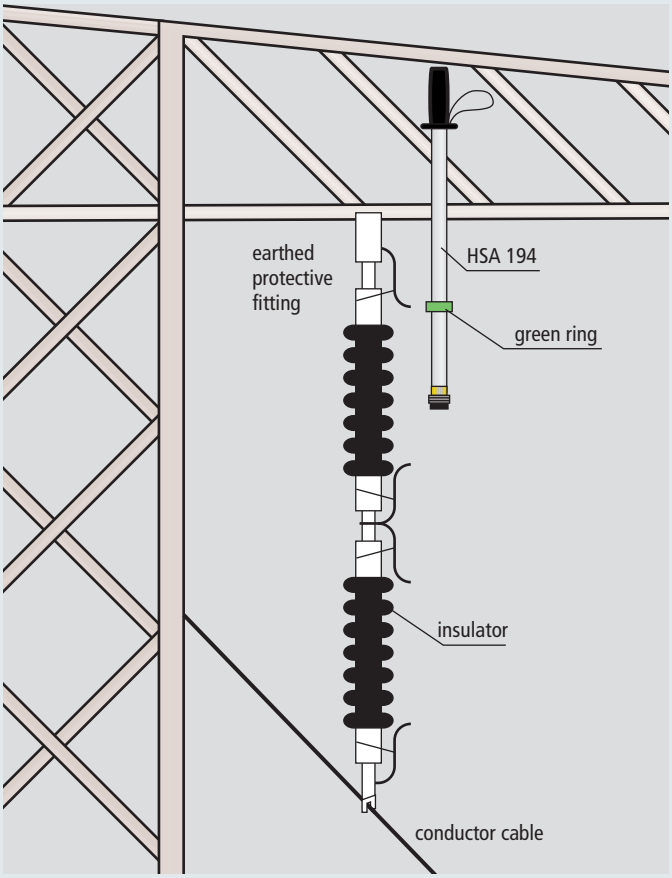
Nominal voltage range 110 ... 420 kV / 16.7 Hz

- Also for use in wet weather
- For testing of high-voltage overhead lines for safe isolation from power supply without contact
- With self-testing device
- Visual and acoustic indicator
- Storage bag included in delivery

Non-contact voltage detector used for a 110 kV overhead line.

Self-testing device
The electronic HSA non-contact voltage detector has an integrated self-testing device. The test is performed automatically when the detector is switched on.

Batteries
The HSA non-contact voltage detector is supplied with a 9 V block battery. This battery is installed in the battery compartment by releasing the screws and removing the indicator.
Low batteries are indicated by a permanent red light and additionally constant acoustic signal.



Technical Data	
Ready for operation	Green flashing light and acoustic signal at intervals of 2 seconds
Voltage present	Red flashing light and acoustic signal with increased frequency
No voltage present	Green flashing light and acoustic signal at intervals of 2 seconds
Insulating rod	Glass-fibre reinforced polyester tube, Ø43 mm, grey, with integrated measuring head as well as operating unit and indicator with green ring as contact indication
Operating temperature range	– 25° C ... + 55° C, Climatic category N

Note on application
To verify the safe isolation from supply voltages, the non-contact voltage detector is used from the cross-arm of the overhead line tower. The green ring of the HSA 194 is used to make contact with the last earthed fitting of the line insulator (or earthed insulating cap) with the indicator of the voltage detector pointing in the direction of the conductor supported by that line insulator (axis of the HSA 194 parallel to the longitudinal axis of the insulator). The presence of supply voltage will be indicated visually (by a red flashing light) and acoustically (signal tone).

RAILWAYS

HSA 194 Non-Contact Voltage Detector

VOLTAGE DETECTORS

Type	Nominal voltage range/ frequency U_N / f_N	Total length l_G	DB Drawing No.	Part No.	
A HSA 194 with Plug-in Coupling Plug-in coupling for handle extension Storage bag included in delivery					
HSA194 110 420 16.7	110 ... 420 kV / 16.7 Hz	935 mm	3 Ekgw 02.54	**767 542**	new

Voltage detector HSA 194 supplied with Lithium batteries available on request.
Non-contact voltage detectors for other nominal voltages and frequencies available on request.

Accessories for HSA 194 Non-Contact Voltage Detector

Handle Extension with Plug-in Coupling

For handle extension
Both-sided plug-in coupling

Type	Total length l_G	Part No.	
HV STK 710	710 mm	**766 335**	new

Adapter – Plug-in Coupling / T pin Shaft

For handle extension

Type	Total length l_G	Part No.	
AD HV STK SQ	280 mm	**766 313**	new

Artificial Leather Bag, empty

With shoulder strap

Type	Colour	Dimension	Part No.
KLT 98 9	●	Ø95 x 980 mm	**767 531**

Support Bracket

Wall-mounted

Type	Colour	Dimension	Part No.
HV P ST D40 45	●	530 mm	**700 008**

PHE/G dc Voltage Detector

Nominal voltages up to 7.5 kV dc

Based on EN/IEC 61243-2 (DIN VDE 0682 Part 412)

- Also for use in wet weather
- For indoor and outdoor installations
- For dc voltage systems (streets and underground, intermediate dc circuits)
- With self-testing device
- Visual indicator
- Optional earthing (positive or negative pole)
- Short transport length due to detachable insulating rod

PHE/G II dc voltage detector for intermediate dc circuits (ICE operating head).

Self-testing device
The electronic dc Voltage Detectors PHE/GI and PHE/GII have an integrated self-testing device. The electronic circuit is automatically tested for correct operation (threshold) when the voltage detector is switched on. The detector will only be operational if the self test has been performed successfully.

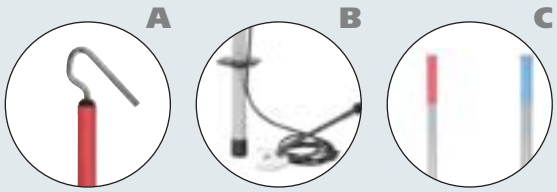
Replacing the battery
The voltage detectors are supplied with 4 Mignon IEC IR6 batteries. These batteries are situated in a separate battery compartment to allow for easy battery exchange. Low batteries of PHE/G I and PHE/G II voltage detectors are indicated by both signals illuminated (permanent light) when the voltage detector is switched on (self test).

The two-pole dc voltage detector PHE/G II is designed especially for testing intermediate dc circuits of electrical locomotives. It has a total length of only 800 mm due to the narrow alleyways. Furthermore, the device is always provided with a nominal voltage of U_N = 3 kV and a threshold voltage of U_A = 120 V (Part No. 767 602 / S18).
Devices with other nominal voltages available on request.

Technical Data	
Test prod	Glass-fibre reinforced polyester tube, Ø20 mm, grey; Test electrodes made of Cu alloy/gal Sn; PHE/G I (A) for contact wires: hook-shape electrode; PHE/G I (B) for switchgear installations and PHE/G II: Ø20 mm, tooth shape for reliable contact, with female M8 thread for attaching electrodes and test probes
Coloured marking	Polarity on the test prod: Positive: red; Negative: blue
Indicator	Plastic, fully insulated, black
Indication	Red light ' ϟ ' (flashing light); Green light '**0**' (permanent light)
Insulating rod	Glass-fibre reinforced polyester tube, Ø43 mm / Ø30 mm, grey; Endpiece with non-slip plastic cap (exception: PHE/G I for contact wires: non-slip loop)
Connecting cable	Highly-flexible Cu cable, plastic-insulated
Earthing terminal	Flexible turnable handle, MCI/gal Zn, clamping range: up to 20 mm
Operating temperature range	– 25° C ... + 55° C, Climatic category N

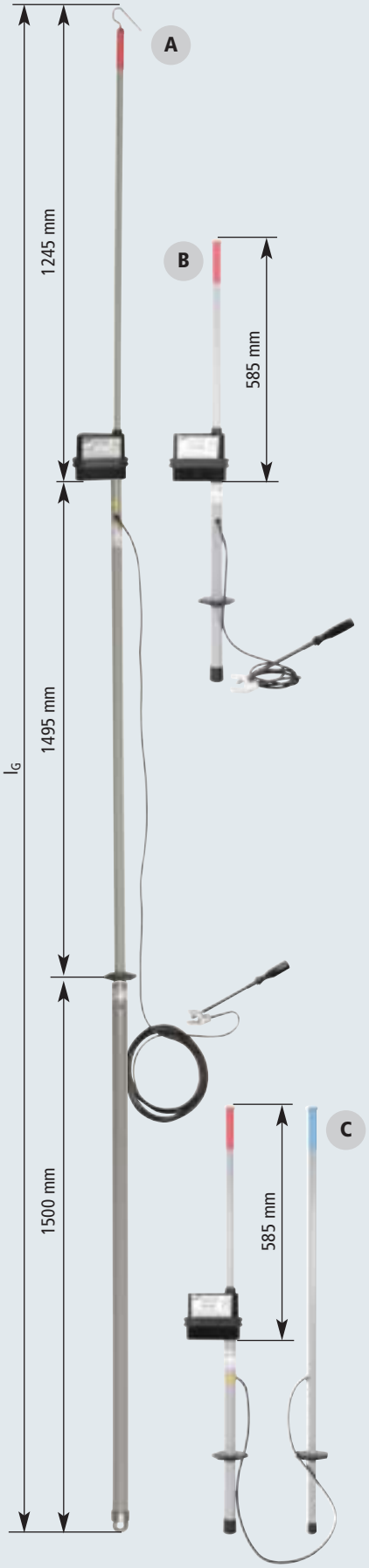
PHE/G dc Voltage Detector

VOLTAGE DETECTORS



Type	Length of connecting cable	Total length l_G	Part No.
A PHE/G I for Contact Wires			
Single-pole (3-part unit) – For single-ended dc systems – Threshold voltage $U_A = 0.5 \times U_N$ – Please confirm the nominal voltage (U_N) required and the pole (positive or negative) to be earthed when placing your order.			
PHEG1 ... FD	6000 mm	4060 mm	**767 600**
B PHE/G I for Switchgear Installations			
Single-pole – For single-ended dc systems – Threshold voltage $U_A = 0.5 \times U_N$ – Please confirm the nominal voltage (U_N) required and the pole (positive or negative) to be earthed when placing your order.			
PHEG1 ... S	2000 mm	1065 mm	**767 601**
C PHE/G II			
Two-pole – For unearthed dc systems – For intermediate dc circuits (electrical locomotives; $U_A \leq 120$ V, $I_G = 800$ mm) – Indicator with red positive pole on test prod – Please confirm the threshold voltage (U_A) and nominal voltage (U_N) required when placing your order.			
PHEG2 ...	1200 mm	1075 mm	**767 602**

Other lengths and threshold values (U_A) available on request.



Accessories for PHE/G dc Voltage Detector

Onion-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 SZ PHE PHV	from 3 kV	Ms/gal CuSn	**766 913**

Pin-shape Electrode

With additional M6 thread

Type	Nominal voltage U_N	Material	Part No.
EL M8 S PHE PHV	from 3 kV	stainless steel	**766 925**

Y-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 V PHE PHV	from 3 kV	Cu/gal Sn	**766 927**

Hook-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 H PHE PHV	for overhead lines only	steel/gal Zn	**766 923**

V-shape Electrode

Type	Nominal voltage U_N	Material	Part No.
EL M8 G PHE PHV	for overhead lines only	stainless steel	**766 924**

Accessories for PHE/G dc Voltage Detector, Part No. 767 600

Artificial Leather Bag, empty

With shoulder strap

Type	Colour	Dimension	Part No.
KLT 160 17	●	Ø170 x 1600 mm	**766 614**

Accessories for PHE/G dc Voltage Detector, Part No. 767 601 and 767 602

Artificial Leather Bag, empty

With shoulder strap

Type	Colour	Dimension	Part No.
KLT 121 25 16	●	1200 x 250 x 160 mm	**766 601**

Canvas Bag, empty

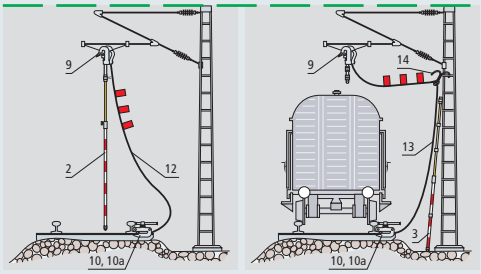
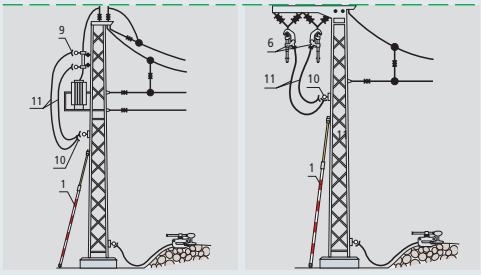
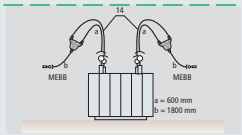
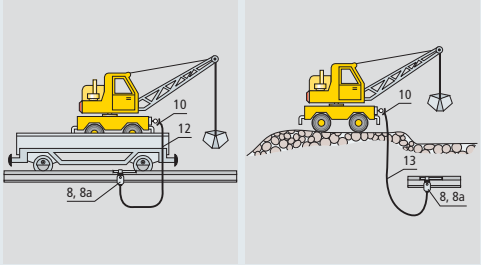
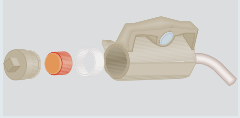
With shoulder strap

Type	Colour	Dimension	Part No.
STT 120 30 15	●	1200 x 300 x 150 mm	**766 704**

RAILWAYS

EARTHING DEVICES

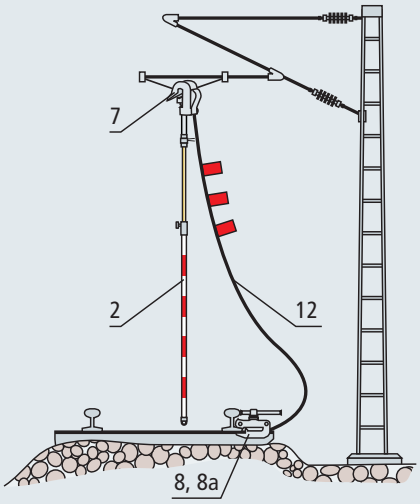
Selection Guide

	Equipment	Application / Device	Page
	Set for Overhead Contact Lines	Profile-free or not profile-free For transport in motor vehicles, profile-free or not profile-free	218
	Set for Transformers at Overhead Line Towers	For earthing at fuse carriers For earthing towers next to rails	220
	Set for Preheating Systems of Railway Points and Trains	For electrical heating systems of railway points For electrical preheating systems of trains	221
	Set for Construction Machinery, Cranes, Staff Cars	For equipment on staff cars For equipment on rails For trackless equipment	222
	Single Parts of Earthing Devices for Railways	Earthing rods Universal clamps Rail earthing clamps Earthing and short-circuiting cables Storage bags Retaining devices Fixed ball points Ø25 mm Earth connection plates Protective cases	224
	Further Equipment Fuse Link	For voltage-limiting devices	230

DB = Deutsche Bundesbahn [German National Railways]

Earthing Devices for Railways

Sets for overhead contact lines

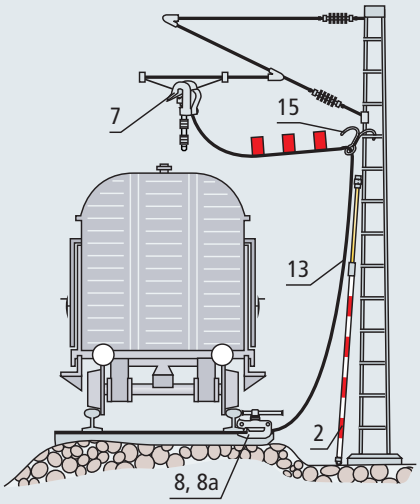


Type	DB Drawing No.	DB Material No.	Part No.
A Set for Overhead Contact Lines (not profile-free) Cable length 8.5 m, telescopic earthing rod with switching ring			
BEV OL NPF	3 Ebgw 01.51	237 117	**750 210**

Equipment

Pos.	Qty.	Item	Part No.
2	1	Telescopic earthing rod with switching ring (max. 5 m long)	769 502
7	1	Earthing clamp for contact wires	784 755
8	1	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
12	1	Earthing and short-circuiting cable (50 mm² , 8.5 m long)	751 085

*) Type 8a available on request

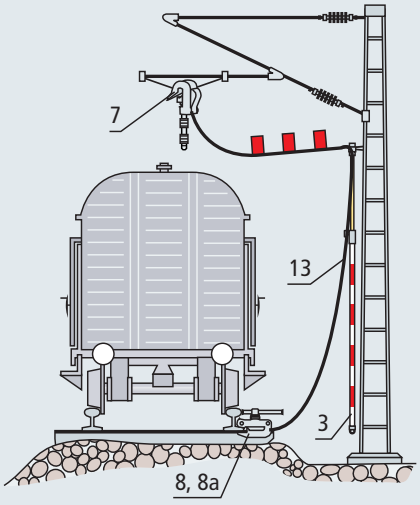


Type	DB Drawing No.	DB Material No.	Part No.
B Set for Overhead Contact Lines (profile-free) Cable length 12 m, removable to one side with additional hook, telescopic earthing rod with switching ring			
BEV OL PF	3 Ebgw 01.51	237 118	**750 211**

Equipment

Pos.	Qty.	Item	Part No.
2	1	Telescopic earthing rod with switching ring (max. 5 m long)	769 502
7	1	Earthing clamp for contact wire	784 755
8	1	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
13	1	Earthing and short-circuiting cable (50 mm² , 12 m long)	751 120
15	1	Hook	740 124

*) Type 8a available on request



Type	DB Drawing No.	DB Material No.	Part No.
C Set for Overhead Contact Lines (profile-free) Cable length 12 m, removable to one side with additional hook, telescopic earthing rod with cable inlet and hook			
BEV OL PF V2	3 Ebgw 01.51	237 115	**750 214**

Equipment

Pos.	Qty.	Item	Part No.
3	1	Telescopic earthing rod without switching ring (max. 5 m long)	769 508
7	1	Earthing clamp for contact wires	784 755
8	1	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
13	1	Earthing and short-circuiting cable (50 mm² , 12 m long)	751 120

*) Type 8a available on request

Earthing Devices for Railways

Sets for overhead contact lines

Type	DB Drawing No.	DB Material No.	Part No.

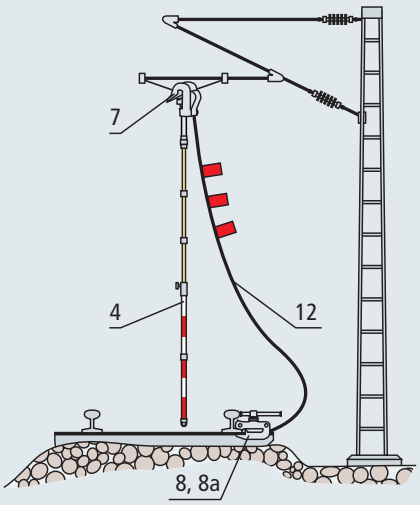
D Set for Overhead Contact Lines for Transport in Motor Vehicles (not profile-free)

For technical emergency service and emergency management
Cable length 8.5 m, telescopic earthing rod with switching ring

Equipment Pos.	Qty.	Item	Part No.
4	1	Modular earthing rod, 5-part unit (incl. canvas bag, Part No. 769 509)	769 506
7	2	Earthing clamp for contact wires	784 755
8	2	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
12	2	Earthing and short-circuiting cable (50 mm² , 8.5 m long)	751 085
16	1	Canvas bag	785 111

*) Type 8a available on request

BEV OL NPF PKW	3 Ebgw 01.67	237 125	**750 196**



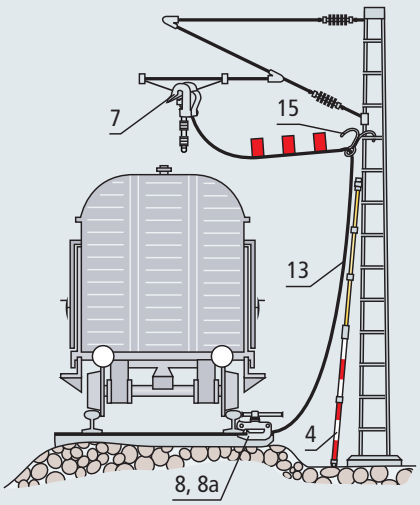
E Set of Overhead Contact Lines for Transport in Motor Vehicles (profile-free)

For technical emergency service and emergency management
Cable length 12 m, removable to one side with additional hook,
Telescopic earthing rod with switching ring

Equipment Pos.	Qty.	Item	Part No.
4	2	Modular earthing rod, 5-part unit (incl. canvas bag, Part No. 769 509)	769 506
7	2	Earthing clamp for contact wires	784 755
8	2	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
13	2	Earthing and short-circuiting cable (50 mm² , 12 m long)	751 120
15	2	Hook	740 124
16	1	Canvas bag	785 111

*) Type 8a available on request

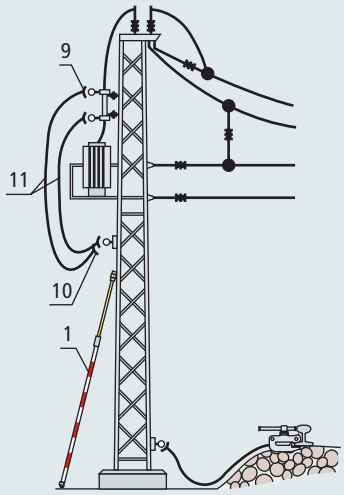
BEV OL PF PKW			**750 200**



Profile-free earthing means that the earthing cable can be moved and supported from the tower to allow for limited operations with diesel locomotives.

Earthing Devices for Railways

Sets for earthing towers

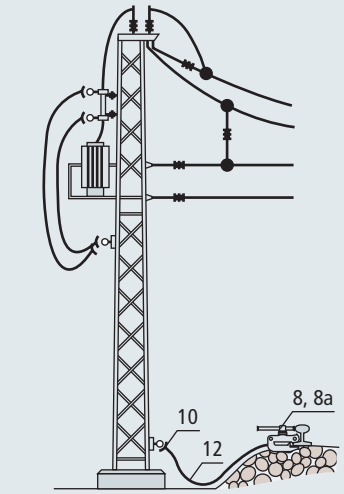


Type	DB Drawing No.	DB Material No.	Part No.

A Set for Transformers at Overhead Line Towers
For earthing at fuse carriers
Cable length 4 m, Telescopic earthing rod with switching ring

Equipment Pos.	Qty.	Item	Part No.
1	1	Telescopic earthing rod with switching ring (max. 3.5 m long)	769 352
9	2	Universal clamp, T pin shaft	773 251
10	2	Universal clamp, with plastic handle	774 251
11	2	Earthing and short-circuiting cable (50 mm², 4 m long)	751 040

BEV US OL ST	3 Ebgw 01.57	237 121	**750 212**

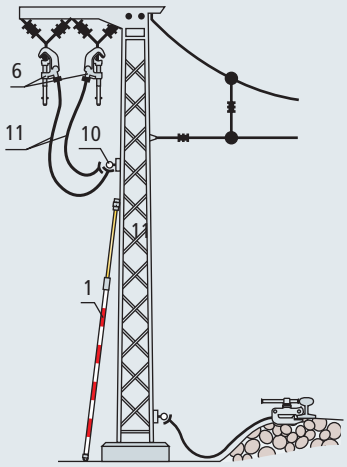


B Set for Earthing Towers next to Rails
For earthing the feeding line
Cable length 8.5 m, Telescopic earthing rod with switching ring

Equipment Pos.	Qty.	Item	Part No.
8	1	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
10	1	Universal clamp, with plastic handle	774 251
12	1	Earthing and short-circuiting cable (50 mm², 8.5 m long)	751 085

*) Type 8a available on request

BEV MF SE	3 Ebgw 01.56		**751 191**



C Set for Feeding, Bypass and other Types of Lines
For earthing the feeding line and railway conductors
Cable length 4 m, Telescopic earthing rod with switching ring

Equipment Pos.	Qty.	Item	Part No.
1	1	Telescopic earthing rod with switching ring (max. 3.5 m long)	769 352
6	1	Conductor clamp	784 352
10	1	Universal clamp, with plastic handle	774 251
11	1	Earthing and short-circuiting cable (50 mm², 4 m long)	751 040

BEV SVUL	3 Ebgw 01.57	237 119	**750 213**

RAILWAYS — Earthing Devices for Railways

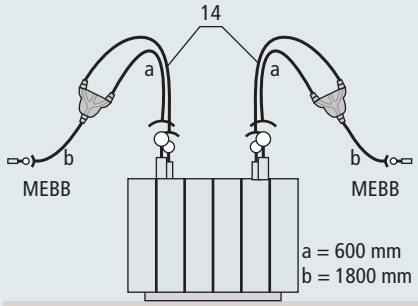
EARTHING DEVICES — For preheating systems of railway ponts and trains

Type	DB Drawing No.	DB Material No.	Part No.
A Set for Preheating Systems of Railway Points and Trains For supply of a transformer used for electrical heating systems for railway points and electrical preheating systems for trains.			

Equipment

Pos.	Qty.	Item	Part No.
5	1	Earthing rod, single-part unit	761 015
14	2	Two-pole earthing and short-circuiting device 50 mm², supplied with ball head caps Ø25 mm	751 150
17	1	Retaining device	700 000

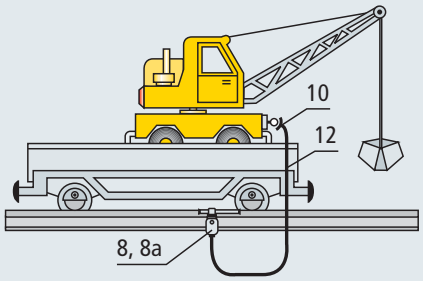
BEV WHA ZVA	3 Ebgw 01.70	742 402	**750 215**



For voltage detectors for electrical heating systems of railway points, see chapter about PHE voltage detector

Earthing Devices for Railways

Sets for construction machinery, cranes, staff cars



Type	DB Drawing No.	DB Material No.	Part No.

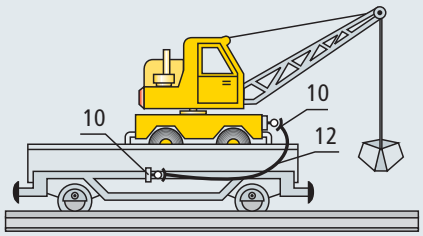
A Set for Earthing next ro Rails

Equipment on staff cars, earthed rails,
earthing at dedicated busbars with earthing clamp for rails

Equipment Pos.	Qty.	Item	Part No.
8	1	Earthing clamp for railways (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
10	1	Universal clamp, with plastic handle	774 251
12	1	Earthing and short-circuiting device (50 mm² , 8.5 m long)	751 085

*) Type 8a available on request

BEV US OL MS	3 Ebgw 01.56		**751 191**

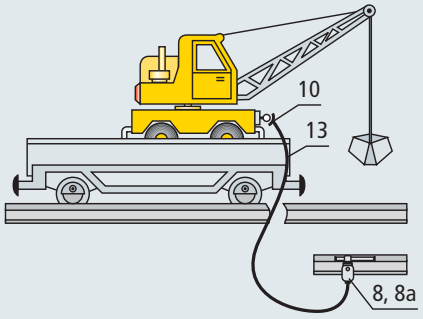


B Set for Earthing at Dedicated Busbars

Equipment on staff cars, earthed rails,
earthing at dedicated busbars with universal clamps

Equipment Pos.	Qty.	Item	Part No.
10	2	Universal clamp, with plastic handle	774 251
12	1	Earthing and short-circuiting cable (50 mm² , 8.5 m long)	751 085

BEV MF LTE	3 Ebgw 01.56		**751 192**



C Set for Earthing at Adjacent Rails

Equipment on staff cars, unearthed rail (construction site)[1] ,
Earthing at adjacent rails with earthing clamp for rails

Equipment Pos.	Qty.	Item	Part No.
8	1	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
10	1	Universal clamp, with plastic handle	774 251
13	1	Earthing and short-circuiting cable (50 mm² , 12 m long)	751 120

*) Type 8a available on request

[1] For single rails, non-existing adjacent rails are replaced with an earth cable. Instead of Pos. 8 or 8a, Pos. 10 has then to be used.

BEV BM HZ BDW	3 Ebgw 01.56	237 120	**751 193**

Earthing Devices for Railways

Sets for construction machinery, cranes, staff cars

Type	DB Drawing No.	DB Material No.	Part No.

D Set for Earthing at Adjacent Rails

Equipment or vehicles on or close to rails,
unearthed rails (construction site)[1] , track vehicles and cranes,
Earthing at adjacent rails with earthing clamp for rails

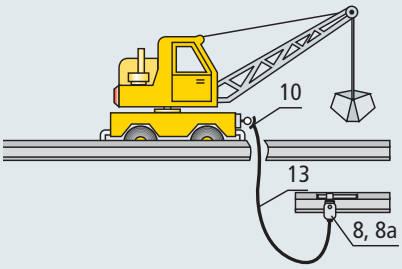
Equipment

Pos.	Qty.	Item	Part No.
8	1	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
10	1	Universal clamp, with plastic handle	774 251
13	1	Earthing and short-circuiting cable (50 mm² , 12 m long)	751 120

*) Type 8a available on request

[1] For single rails, non-existing adjacent rails are replaced with an earth cable. Instead of Pos. 8 or 8a, Pos. 10 has then to be used.

BEV BM HZ BDW	3 Ebgw 01.56	237 120	**751 193**



E Set for Earthing at Adjacent Rails

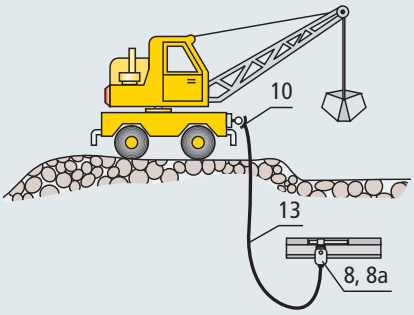
Trackless vehicle,
Earthing at adjacent rails with earthing clamp for rails

Equipment

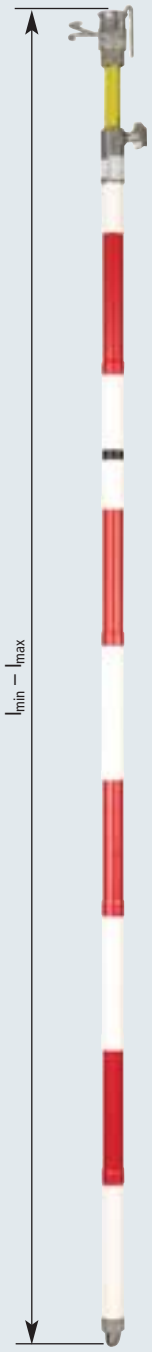
Pos.	Qty.	Item	Part No.
8	1	Earthing clamp for rails (tommy bar)	792 450
8a*)	–	Earthing clamp for rails (ratchet)	792 453
10	1	Universal clamp, with plastic handle	774 251
13	1	Earthing and short-circuiting cable (50 mm² , 12 m long)	751 120

*) Type 8a available on request

BEV BM HZ BDW	3 Ebgw 01.56	237 120	**751 193**



Single Parts of Earthing Devices for Railways



Telescopic Earthing Rod with Switching Ring

(Pos. 1 and 2)

With threaded T pin shaft (bayonet coupling)

A switching ring is situated at the cone and has the following functions:

– Position "AUF" [OPEN]: Rod can be removed after fixing the clamp

– Position "ZU" [CLOSED]: Rod and clamp remain coupled even after fixing the device

Type	Total length $l_{G\ max}$ / $l_{G\ min}$	Maximum load on operating head l_{max} / l_{min}	DB Drawing No.	DB Material No.	Part No.
ESTC SQL RW 3500	3500/1920 mm	12/35 kg	3 Ebgw 01.58	157 534	**769 352**
ESTC SQL RW 5000	5000/2670 mm	10/35 kg	3 Ebgw 01.52	157 533	**769 502**

Telescopic Earthing Rod with Cable Inlet and Hook

(Pos. 3)

For threaded T pin shaft (bayonet coupling)
The clamp coupling is supplied with an additional cable guide at the tower and a hook for removing the earthing cable and earthing rod to one side (no switching ring function)

Type	Total length $l_{G\ max}$ / $l_{G\ min}$	Maximum load on operating head l_{max} / l_{min}	DB Drawing No.	DB Material No.	Part No.
ESTC SQL H RW 5000	5000/2670 mm	12/35 kg	3 Ebgw 01.55	612 142	**769 508**

Single Parts of Earthing Devices for Railways

Earthing Rod with Switching Ring, 5-part unit (for Transport in Motor Vehicles)

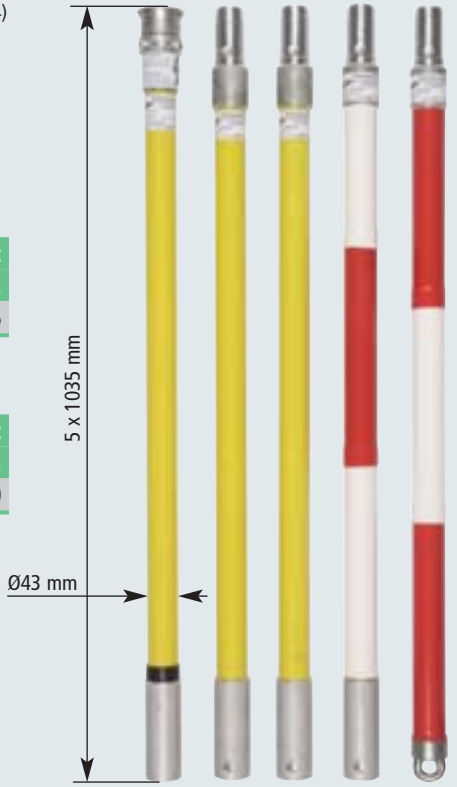
(Pos. 4)

For threaded T pin shaft (bayonet coupling)
A switching ring is situated at the cone and has the following functions:
– Position "AUF" [OPEN]: Rod can be removed after fixing the clamp
– Position "ZU" [CLOSED]: Rod and clamp remain coupled even after fixing the device
With canvas bag, Part No. 769 509

Type	Total length $l_{G\ max}$ / $l_{G\ min}$	Maximum load on operating head l_{max} / l_{min}	DB Drawing No.	DB Material No.	Part No.
EST SQL RW 4855 TA	4855/5x1035 mm	10/35 kg	3 Ebgw 01.68	157 489	**769 506**

Without canvas bag, Part No. 769 509

Type	Total length $l_{G\ max}$ / $l_{G\ min}$	Maximum load on operating head l_{max} / l_{min}	DB Drawing No.	DB Material No.	Part No.
EST SQL RW 4855	4855/5x1035 mm	10/35 kg	3 Ebgw 01.68	157 484	**769 510**



(for Pos. 4)

Canvas Bag, empty

For 5-part earthing rod, for transport in motor vehicles, with shoulder strap

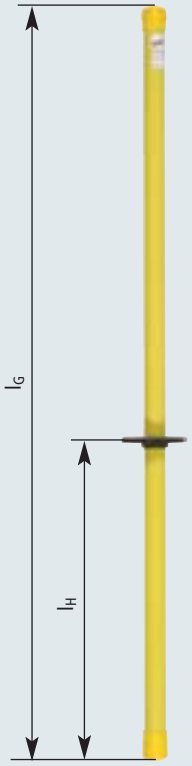
Type	Colour	Dimension	DB Drawing No.	Part No.
STT 110 15	●	Ø150 x 1100 mm	3 Ebgw 01.67	**769 509**

Earthing Rod, hexagon Shaft

(Pos. 5)

Spring locking

Typ	Total length l_G	Length of handle l_H	Max. weight on operating head	DB Drawing No.	DB Material No.	Part No.
ES SK 1500	1500 mm	930 mm	35 kg	3 Ebgw 01.70	742 401	**761 015**



Single parts of Earthing Devices for Railways

Conductor Clamp

(Pos. 6)

With prod and threaded T pin shaft according to DIN 48087
For feeding and overhead contact lines

Type	Clamping range	DB Drawing No.	DB Material No.	Part No.
LK 4 40 TS SQ	Ø4 - 40 mm	3 Ebgw 01.65	157 539	**784 352**

Earthing Clamp for Contact Wires

(Pos. 7)

With prod and flexible threaded T pin shaft according to DIN 48087
For contact wires (round conductors) 80 - 120 mm²

Type	Clamping range	DB Drawing No.	DB Material No.	Part No.
FEK 4 15 TS FSQ	Ø4 - 15 mm	3 Ebgw 01.54	157 536	**784 755**

Earthing Clamp for Rails

(Pos. 8)

With detachable tommy bar
For profile-free earthing of rail profiles S49, S54, S64 and UIC60

Type	DB Drawing No.	DB Material No.	Part No.
SAK PFE KN	3 Ebgw 01.53	157 535	**792 450**

Earthing Clamp for Rails

(Pos. 8a)

With detachable ratchet
For profile-free earthing of rail profiles S49, S54, S64 and UIC60

Type	DB Drawing No.	DB Material No.	Part No.
SAK PFE RA	3 Ebgw 01.53	157 549	**792 453**

Universal Clamp, T Pin Shaft

(Pos. 9)

T pin according to DIN 48087
For flat and round conductors up to 30 mm and fixed ball points, ball Ø25 mm

Type	DB Drawing No.	DB Material No.	Part No.
UK K25 FL30 SQ	4 Ebgw 01.59	157 538	**773 251**

Universal Clamp, with plastic Handle

(Pos. 10)

For flat and round conductors up to 30 mm and fixed ball points, ball Ø25 mm

Type	DB Drawing No.	DB Material No.	Part No.
UK K25 FL30 HG	4 Ebgw 01.64	157 537	**774 251**

RAILWAYS

Single parts of Earthing Devices for Railways

EARTHING DEVICES

Single-pole Earthing and Short-circuiting Cable

(Pos. 11-13)

Without fittings, with red and white-marking and hole in terminal lug, Ø10.5 mm, type PK2, without recess at the cable lug

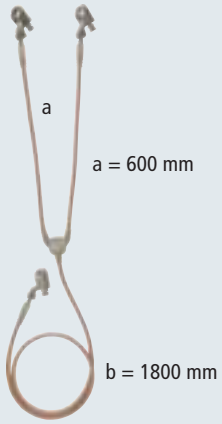
Type	Cable cross section	Cable length	DB Drawing No.	DB Material No.	Part No.
EKS 50 BEV 4M	50 mm²	4000 mm	3 Ebgw 01.57	157 511	**751 040**
EKS 50 BEV 8.5M	50 mm²	8500 mm	3 Ebgw 01.51	157 512	**751 085**
EKS 50 BEV 12M	50 mm²	12000 mm	3 Ebgw 01.51	157 513	**751 120**
EKS 50 BEV 13M	50 mm²	13000 mm	—	—	**751 130**
EKS 50 BEV 14M	50 mm²	14000 mm	—	—	**751 140**

Two-pole Earthing and Short-circuiting Device

(Pos. 14)

Supplied with 3x ball head cap, Ø25 mm, hexagon shaft

Cable cross section	Cable length	DB Drawing No.	DB Material No.	Part No.
50 mm²	600/1800 mm	3 Ebgw 01.70	742 400	**751 150**



Hook

(Pos. 15)

For (profile-free) removing of earthing cables at towers

Type	DB Drawing No.	Part No.
EHH BEV OL	3 Ebgw 01.51	**740 124**

Canvas Bag, empty

(Pos. 16)

With two separate inside pockets and shoulder strap
For 2x earthing and short-circuiting devices (set for transport in motor vehicles)

Type	Colour	Dimension	DB Drawing No.	Part No.
STT 55 27 30	●	550 x 270 x 300 mm	3 Ebgw 01.67	**785 111**

Retaining Device

(Pos. 17)

For earthing and short-circuiting devices and earthing rods of any length
Hole distance 424 mm, hole Ø7 mm

Type	For rod Ø	Material	DB Drawing No.	DB Material No.	Part No.
HV EKV ES30	30 mm	steel	3 Ebgw 01.70	742 395	**700 000**

Fixed Ball Points

EN/IEC 61230 (DIN VDE 0683 Part 100)
DIN 48088 Part 1

- Threaded pin, M12 or M16, with different lengths
- With or without hexagon nut and flat washer
- Allows for fixing of cable lugs or busbar connection according to DIN 43673 Part 1

Fixed ball point at a steel tower with mounted universal clamp.

Technical Data	
Fixed point	E-Cu/gal Sn
Threaded pin	Stainless steel A2-70
Hexagon nut	DIN 985-M12-8 / gal Zn; DIN 985-M16-8 / gal Zn
Tightening torque	M12: 80 Nm / M16: 150 Nm

Type	Fixed ball point Ø	Dimension	DB Drawing No.	DB Material No.	Part No.
A Fixed Ball Point, straight, ball Ø25 mm With threaded pin, hexagon nut and flat washer					
KFP 25 M16 25 SKM	25 mm	M16 x 26 mm	3 Ebgw 01.63	157 541	**755 626**
KFP 25 M12 35 SKM	25 mm	M12 x 35 mm	3 Ebgw 01.63	622 014	**755 627**
KFP 25 M16 45 SKM	25 mm	M16 x 46 mm	3 Ebgw 01.63	157 542	**755 646**
KFP 25 M16 25	25 mm	M16 x 26 mm *)	3 Ebgw 01.63	157 542	**755 636**

*) Unit without hexagon nut and flat washer

Earth Connection Plates

Type	Fixed ball point Ø	DB Drawing No.	DB Material No.	Part No.
A Multiple Terminal Device For interconnecting 2 single-pole earthing and short-circuiting devices and connecting to a fixed ball point. For feeding lines, railway overhead lines and transformers at overhead line towers				
EAP 2 25 KKH HG	25 mm	3 Ebgw 01.66	157 540	**728 501**

B Terminal Lugs For transformers at overhead lines towers – for fuse carriers with 1 fixed ball point – for towers with 2 fixed ball points				
EAP 25 SIT US OL	25 mm	4 Ebgw 01.61	157 545	**728 503**
EAP 2 25 MA US OL	25 mm	3 Ebgw 01.61	157 548	**728 502**

RAILWAYS

EARTHING DEVICES

Storage and Transport Case

Protective case

Combination protective storage case for voltage detectors and earthing devices fixed on supports.

- For safe outdoor storage of railway earthing devices and voltage detectors
- Robust zinc-plated unit
- Wall-mounted or fixed on supports

The clips (supports) are designed to allow for mounting of both cases, but also for the case for railway earthing devices only. Apart from a direct wall mounting, it also allows for fixing on supports Ø55 mm with corresponding pipe clamps.
Fixing elements for concrete posts available on request.

Technical Data	
Enclosure	Rectangular, solid type made of zinc plate, 0.8 mm
Sealing	Sidewise foldable cover with ventilation slots at the front sides of the case
Marking	'Erdungsvorrichtung bzw. Spannungsprüfer' ['Earthing Device or Voltage Detector'], letter size: 50 mm

Zinc-plated protective case for one voltage detector and one earthing rod with two earthing and short-circuiting devices.

Type	Dimension	DB Material No.	Part No.
A Protective Case for Voltage Detectors For max. 1 voltage detector			
SB PHE 250 25 21	2400 x 250 x 110 mm	649 131	**766 907**
B Protective Case for Railway Earthing Devices For max. 2 earthing and short-circuiting devices and 1 earthing rod.			
SB EKV 340 25 20	3400 x 250 x 200 mm	649132	**766 901**
C Protective Case for Voltage Detectors and Railway Earthing Device For max. 1 voltage detector and max. 2 earthing and short-circuiting devices incl. 1 earthing rod			
SB PHE EKV SET	2400 x 250 x 110 / 3400 x 250 x 200 mm	649 133	**766 900**

SDS

Voltage Limiting Device

- **Electrical isolation of insulated track sections and earthed parts of installations**
- **Safe equipotential bonding by heavy-current-resistant welding of the electrodes in case of a short circuit at the overhead contact line or earth fault**
- **Discharging of surges without coming up of short circuits due to lightning-resistant SDS ... voltage limiting device**
- **Short-circuit withstand capability 25 kA_{rms} / 100 ms; 36 kA_{rms} / 75 ms**

Rail adapter incl. SDS fuse link.

DIN EN 50122-1 defines the use of voltage limiting devices for dc and ac railways for socalled "open earthing of railways" in overhead contact lines and current collectors.
In order to prevent any upcoming of hazardous surges between the insulated rails or rail sections of electrical railways and earthed parts of the installation, voltage limiting devices (SDS ...) are used.

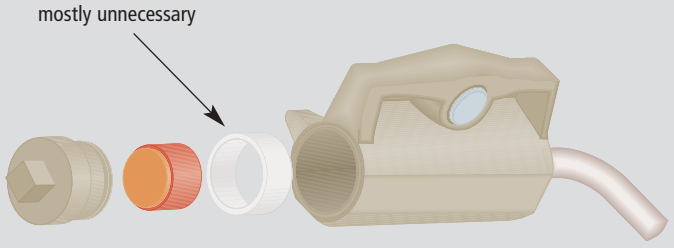
Their function is to connect parts of the installation in overhead contact lines and current collectors permanently with the return circuit, as soon as the threshold voltage is exceeded.

In case of atmospherical overvoltages, the lightning-resistant SDS ... voltage limiting device is capable of returning to the initial condition after discharging impulse currents. Only if the indicated lightning current loads are exceeded, a permanent short circuit is initiated by heavy-current-resistant welding of the electrodes and, consequently, the fuse link has to be replaced.

The SDS voltage limiting device consists of the spark gap unit and the respective terminal set for direct connection with the rail or the overhead contact line tower.

The spark gap unit Type SDS 1, Part No. 923 110, developed by DEHN + SÖHNE has also been approved by the German Federal Railway Authority (EBA).

Type SDS ... NH 00 is designed for installation into NH00 fuse holders or isolators. In connection with the leakage current detecting device DEHNisola, the user can localise a short-circuited spark-gap unit easily and quickly.

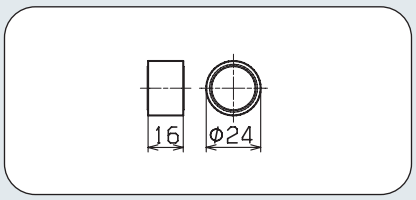


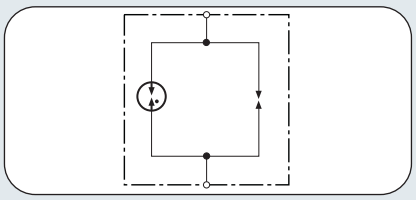
Fuse link Type SDS for support in rail adapter by Siemens, Type No. 431.34

SDS 2 NH00 installed into mains connection box with DEHNisola combined operating state controlling device

RAILWAYS SDS

EARTHING DEVICES

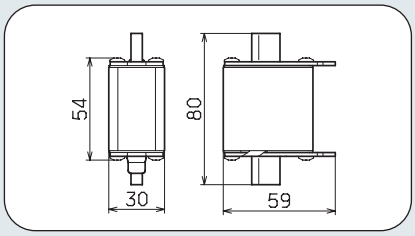




	SDS 1	SDS 2	SDS 3	SDS 4	SDS 5
Power frequency sparkover voltage U_{aw}	≤ 940 V	—	—	—	—
DC sparkover voltage U_{ag}	600 V +/- 20 %	350 V +/- 20 %	550 V	230 V +/- 20%	120 V +/- 20 %
Impulse sparkover voltage	≤ 1400 V (1 kV/µs)	≤ 900 V (1 kV/µs)	≤ 1000 V (1 kV/µs)	≤ 650 V (1 kV/µs)	≤ 600 V (1 kV/µs)
Self-extinguishing capability	300 A / 65 V	—	—	—	—
Lightning current discharge capacity (10/350 µs) I_{imp}	5 kA	2 kA	5 kA	3 kA	2 kA
Lightning current withstand capability (10/350 µs)	25 kA	25 kA	25 kA	25 kA	25 kA
Impulse current discharge capacity (8/20 µs)	—	—	—	20 kA	20 kA
Safe short circuit due to welding of the electrodes at ac currents @ 100 ms	≥ 1.5 kA / 1000 V / 100 ms	—	—	—	—
Safe short circuit due to welding of the electrodes at ac currents @ 30 ms	≥ 2.5 kA / 1000 V / 30 ms	—	—	—	—
Safe short circuit due to welding of the electrodes at dc current	≥ 750 A / 250 ms	≥ 600 A / 250 ms	≥ 600 A / 250 ms	≥ 600 A / 250 ms	≥ 600 A / 250 ms
Short circuit withstand capability	25 kA_{rms} / 100 ms; 36 kA_{rms} / 75 ms	25 kA_{rms} / 100 ms; 36 kA_{rms} / 75 ms	25 kA_{rms} / 100 ms 36 kA_{rms} / 75 ms	25 kA_{rms} / 100 ms; 36 kA_{rms} / 75 ms	25 kA_{rms} / 100 ms; 36 kA_{rms} / 75 ms
Long-term current	1 kA_{rms} for t ≤ 120 s	1 kA_{rms} for t ≤ 120 s	1 kA_{rms} for t ≤ 120 s	1 kA_{rms} for t ≤ 120 s	1 kA_{rms} for t ≤ 120 s
Leakage current I_{lc}	< 1 µA at 100 V dc	< 1 µA at 100 V dc	< 1 µA at 100 V dc	≤ 1 µA at 100 V dc	< 1 µA at 100 V dc
Mounting on	allows for installation into voltage breakdown protector/rail adapter by SIEMENS No. 431.34				
Tightening torque of the fuse link in the busbar adapter	15 Nm	15 Nm	15 Nm	15 Nm	15 Nm
Approvals, Certifications	EBA	—	—	—	—
DB Drawing No.	4 Ebs 15.13.20 Sheet 2	—	—	—	—
Ordering information					
Type	SDS 1	SDS 2	SDS 3	SDS 4	SDS 5
Part No.	**923 110**	**923 117**	**923 116**	**923 118**	**923 119**
Packing unit	10 pc(s)	10 pc(s)	10 pc(s)	10 pc(s)	10 pc(s)

SDS 2 in NH 00 Enclosure

	SDS 2 NH00
DC sparkover voltage U_{ag}	350 V +/- 20%
Impulse sparkover voltage	≤ 900 V (1 kV/µs)
Lightning current discharge capacity (10/350 µs) I_{imp}	2 kA
Lightning current withstand capability (10/350 µs)	25 kA
Safe short circuit due to welding of the electrodes at dc currents	≥ 600 A / 250 ms
Short circuit withstand capability	10 kA_{rms} / 50 ms
Long-term current	1 kA_{rms} for t ≤ 120 s
Leakage current I_{lc}	< 1 µA at 100 V dc
Mounting on	NH fuse holder, size 00
Enclosure material	red thermoplastic, UL 94 V-0
Ordering information	
Type	SDS 2 NH00
Part No.	**923 123**
Packing unit	1 pc(s)



Our safety equipment has been approved in practice and allows for safe working in electrical systems. It complies with the approved engineering rules as well as with the national rules for prevention of accidents (UVV) and exceeds the requirements of international and national standards.

The high quality and reliability of our safety equipment is ensured by a number of process inspections.

The following pictures show type tests on our safety equipment.

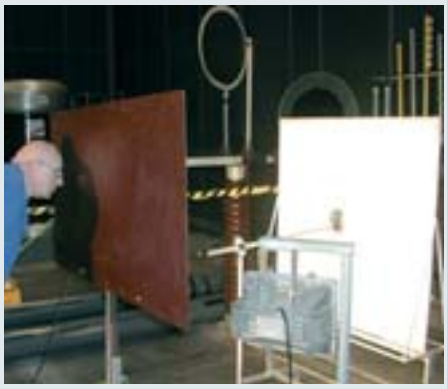


Fig. 1

Fig. 2

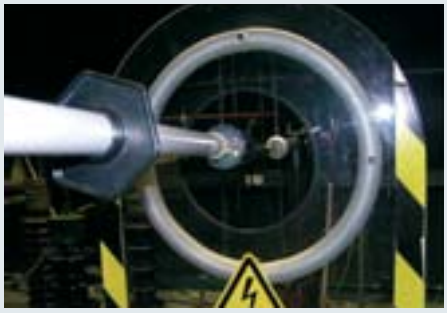


Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 1: Test for visibility
PHG II Voltage Detector
(High-voltage test field, DEHN + SÖHNE, Neumarkt/Germany)

Fig. 2: Testing the discharge current while sprinkling PHE Voltage Detector
(High-voltage test field, DEHN + SÖHNE, Neumarkt/Germany)

Fig. 3: Test for resistance against interference fields of PHE III Voltage Detector
(High-voltage test field, DEHN + SÖHNE, Neumarkt/Germany)

Fig. 4: Test for bridging safety of
PHV Phase Comparator
(High-voltage test field, DEHN + SÖHNE, Neumarkt/Germany)

Fig. 5: 3-pole Earthing and short-circuiting device for fixed ball points
– before testing
(IPH, Berlin/Germany)

Fig. 6: 3-pole Earthing and short-circuiting device for fixed ball points
– after successful test
(IPH, Berlin/Germany)

Fig. 7: Test for isolating capacity of
PHG II Voltage Detector
(High-voltage test field, DEHN + SÖHNE, Neumarkt/Germany)

Fig. 8: Test for bridging safety of
TRS MS Dry Cleaning Set
(High-voltage test field, DEHN + SÖHNE, Neumarkt/Germany)

Fig. 9: Test for bridging safety of
FRS MS Damp Cleaning Set
(High-voltage test field, DEHN + SÖHNE, Neumarkt/Germany)

Index of Part No.

Part No.	Instr No.	Weight kg	VPE/VME	Page
712 803	1011	8.37	1 ST	106
712 804	1011	7.83	1 ST	106
712 806	1011	8.50	1 ST	106
712 807	1011	8.25	1 ST	106
712 811	1011	8.20	1 ST	107
712 812	1011	8.40	1 ST	107
712 813	1011	7.85	1 ST	107
712 815	1011	8.60	1 ST	107
712 816	1011	8.30	1 ST	107
712 841	1011	7.72	1 ST	104
712 842	1011	7.82	1 ST	104
712 843	1011	7.47	1 ST	104
712 845	1011	7.96	1 ST	104
712 846	1011	7.82	1 ST	104
712 861	1011	7.72	1 ST	105
712 862	1011	7.81	1 ST	105
712 863	1011	7.57	1 ST	105
712 865	1011	8.01	1 ST	105
712 866	1011	7.82	1 ST	105
712 950	1011	8.70	1 ST	102
712 951	1011	8.80	1 ST	103
715 001	—	1.52	1 M	119
715 025	1011	6.00	1 ST	110
715 031	1011	6.00	1 ST	111
715 044	1011	6.10	1 ST	110
715 046	1011	5.92	1 ST	110
715 050	1011	5.95	1 ST	111
715 053	1011	6.15	1 ST	111
715 061	1011	6.05	1 ST	112
715 065	1011	6.10	1 ST	113
715 068	1011	6.25	1 ST	112
715 069	1011	6.30	1 ST	113
715 317	1011	8.25	1 ST	100
715 325	1011	6.15	1 ST	112
715 331	1011	6.15	1 ST	113
715 350	1011	8.25	1 ST	100
715 351	1011	8.30	1 ST	101
715 356	1011	8.75	1 ST	100
715 357	1011	8.85	1 ST	100
715 358	1011	8.70	1 ST	100
715 359	1011	8.80	1 ST	100
715 360	1011	8.60	1 ST	100
715 362	1011	8.20	1 ST	100
715 363	1011	8.30	1 ST	100
715 365	1011	8.30	1 ST	101
715 366	1011	8.80	1 ST	101
715 367	1011	8.90	1 ST	101
715 368	1011	8.70	1 ST	101
715 369	1011	8.85	1 ST	101
715 370	1011	8.60	1 ST	101
715 372	1011	8.30	1 ST	101
715 373	1011	8.31	1 ST	101
715 374	1011	8.70	1 ST	102
715 375	1011	8.45	1 ST	102
715 376	1011	9.15	1 ST	102
715 378	1011	9.10	1 ST	102
715 379	1011	9.20	1 ST	102
715 380	1011	9.00	1 ST	102
715 382	1011	8.65	1 ST	102
715 383	1011	8.70	1 ST	102
715 384	1011	8.75	1 ST	103
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715 389	1011	9.30	1 ST	103
715 390	1011	9.10	1 ST	103
715 392	1011	8.75	1 ST	103
715 393	1011	8.80	1 ST	103
715 604	1011	5.80	1 ST	119
715 950	1011	9.10	1 ST	102
715 951	1011	9.35	1 ST	103
716 001	—	0.18	1 M	119
720 010	1018	0.31	1 ST	94
720 012	1018	0.35	1 ST	94
720 014	1018	0.33	1 ST	94
720 016	1018	0.31	1 ST	94
720 018	1018	0.30	1 ST	94
720 020	1018	0.28	1 ST	94
725 001	—	0.21	1 M	119
725 010	1018	0.41	1 ST	94
725 012	1018	0.40	1 ST	94
725 014	1018	0.39	1 ST	94
725 016	1018	0.37	1 ST	94
725 018	1018	0.35	1 ST	94
725 020	1018	0.32	1 ST	94
725 025	1011	1.92	1 ST	110
725 031	1011	1.93	1 ST	111
725 044	1011	2.03	1 ST	110
725 045	1011	1.80	1 ST	110
725 046	1011	2.10	1 ST	110
725 048	1011	2.00	1 ST	110
725 049	1011	2.01	1 ST	111
725 050	1011	2.11	1 ST	111
725 052	1011	1.80	1 ST	111
725 053	1011	2.05	1 ST	111
725 060	1011	2.10	1 ST	112
725 061	1011	2.19	1 ST	112
725 063	1011	2.10	1 ST	112
725 064	1011	2.10	1 ST	113
725 065	1011	2.20	1 ST	113
725 067	1011	2.10	1 ST	113
725 068	1011	2.12	1 ST	112
725 069	1011	2.13	1 ST	113
725 101	1011	2.10	1 ST	114
725 103	1011	2.10	1 ST	114
725 104	1011	2.80	1 ST	114
725 105	1011	2.20	1 ST	114
725 106	1011	1.80	1 ST	114
725 107	1011	2.73	1 ST	117
725 108	1011	2.13	1 ST	115
725 110	1011	2.14	1 ST	115
725 112	1011	2.83	1 ST	115
725 113	1011	2.23	1 ST	115
725 114	1011	2.27	1 ST	115
725 115	1011	4.78	1 ST	106
725 117	1011	4.86	1 ST	107
725 123	1011	2.70	1 ST	116
725 125	1011	2.56	1 ST	116
725 127	1011	2.59	1 ST	117
725 132	1011	2.33	1 ST	116
725 134	1011	3.03	1 ST	116
725 135	1011	2.42	1 ST	116
725 136	1011	2.36	1 ST	117
725 138	1011	3.06	1 ST	117
725 139	1011	2.46	1 ST	117
725 317	1011	3.26	1 ST	100
725 325	1011	2.00	1 ST	112
725 331	1011	2.00	1 ST	113
725 357	1011	3.60	1 ST	100
725 358	1011	3.66	1 ST	100
725 359	1011	3.57	1 ST	100
725 360	1011	3.58	1 ST	100
725 362	1011	3.21	1 ST	100
725 363	1011	3.27	1 ST	100
725 365	1011	3.30	1 ST	101
725 367	1011	3.62	1 ST	101
725 368	1011	3.70	1 ST	101
725 369	1011	3.60	1 ST	101
725 370	1011	3.60	1 ST	101
725 372	1011	3.24	1 ST	101
725 373	1011	3.30	1 ST	101
725 375	1011	3.52	1 ST	102
725 377	1011	3.85	1 ST	102
725 378	1011	3.93	1 ST	102
725 379	1011	3.83	1 ST	102
725 380	1011	3.83	1 ST	102
725 382	1011	3.48	1 ST	102
725 383	1011	3.54	1 ST	102
725 385	1011	3.55	1 ST	103
725 387	1011	3.88	1 ST	103
725 388	1011	3.95	1 ST	103
725 389	1011	3.85	1 ST	103
725 390	1011	3.85	1 ST	103
725 392	1011	3.50	1 ST	103
725 393	1011	3.56	1 ST	103
725 604	1011	1.58	1 ST	119
725 618	1011	3.25	1 ST	100
725 619	1011	3.47	1 ST	100

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725 620	1011	3.28	1 ST	101
725 621	1011	3.50	1 ST	101
725 718	1011	3.53	1 ST	102
725 719	1011	3.74	1 ST	102
725 720	1011	3.54	1 ST	103
725 721	1011	3.76	1 ST	103
725 802	1011	4.55	1 ST	106
725 804	1011	4.24	1 ST	106
725 806	1011	4.91	1 ST	106
725 807	1011	4.65	1 ST	106
725 811	1011	4.63	1 ST	107
725 813	1011	4.32	1 ST	107
725 815	1011	5.00	1 ST	107
725 816	1011	4.75	1 ST	107
725 821	1011	3.86	1 ST	104
725 822	1011	3.87	1 ST	104
725 823	1011	3.55	1 ST	104
725 825	1011	4.00	1 ST	104
725 826	1011	3.97	1 ST	104
725 831	1011	3.95	1 ST	105
725 832	1011	3.95	1 ST	105
725 833	1011	3.65	1 ST	105
725 835	1011	4.10	1 ST	105
725 836	1011	4.05	1 ST	105
728 300	1011	1.21	1 ST	97
728 500	1011	1.82	1 ST	97
728 501	1011	1.57	1 ST	228
728 502	1011	0.71	1 ST	228
728 503	1011	0.45	1 ST	228
728 520	1011	1.55	1 ST	97
731 011	1011	0.62	1 ST	98
731 013	1011	0.85	1 ST	98
731 015	1011	1.00	1 ST	98
731 027	1011	1.97	1 ST	98
731 037	1011	2.66	1 ST	98
735 001	—	0.37	1 M	119
735 025	1011	2.25	1 ST	110
735 031	1011	2.29	1 ST	111
735 044	1011	2.34	1 ST	110
735 045	1011	2.37	1 ST	110
735 046	1011	2.47	1 ST	110
735 048	1011	2.36	1 ST	110
735 049	1011	2.38	1 ST	111
735 050	1011	2.48	1 ST	111
735 052	1011	2.37	1 ST	111
735 053	1011	2.40	1 ST	111
735 060	1011	2.46	1 ST	112
735 061	1011	2.55	1 ST	112
735 063	1011	2.45	1 ST	112
735 064	1011	2.46	1 ST	113
735 065	1011	2.53	1 ST	113
735 067	1011	2.45	1 ST	113
735 068	1011	2.43	1 ST	112
735 069	1011	2.50	1 ST	113
735 101	1011	2.46	1 ST	114
735 103	1011	2.47	1 ST	114
735 104	1011	3.16	1 ST	114
735 105	1011	2.57	1 ST	114
735 106	1011	2.60	1 ST	114
735 107	1011	3.08	1 ST	117
735 108	1011	2.50	1 ST	115
735 110	1011	2.50	1 ST	115
735 112	1011	3.19	1 ST	115
735 113	1011	2.60	1 ST	115
735 114	1011	2.63	1 ST	115
735 115	1011	5.27	1 ST	106
735 117	1011	5.36	1 ST	107
735 123	1011	3.05	1 ST	116
735 125	1011	2.92	1 ST	116
735 127	1011	2.95	1 ST	117
735 132	1011	2.69	1 ST	116
735 134	1011	3.38	1 ST	116
735 135	1011	2.80	1 ST	116
735 136	1011	2.72	1 ST	117
735 138	1011	3.42	1 ST	117
735 139	1011	2.82	1 ST	117
735 317	1011	3.75	1 ST	100
735 325	1011	2.31	1 ST	112
735 331	1011	2.37	1 ST	113
735 357	1011	4.10	1 ST	100
735 358	1011	4.16	1 ST	100
735 359	1011	3.95	1 ST	100
735 360	1011	4.06	1 ST	100
735 362	1011	3.70	1 ST	100
735 363	1011	3.77	1 ST	100
735 365	1011	3.80	1 ST	101
735 367	1011	4.12	1 ST	101
735 368	1011	4.19	1 ST	101
735 369	1011	4.10	1 ST	101
735 370	1011	4.10	1 ST	101
735 372	1011	3.74	1 ST	101
735 373	1011	3.80	1 ST	101
735 375	1011	3.93	1 ST	102
735 377	1011	4.35	1 ST	102
735 378	1011	4.42	1 ST	102
735 379	1011	4.33	1 ST	102
735 380	1011	4.32	1 ST	102
735 382	1011	3.97	1 ST	102
735 383	1011	4.03	1 ST	102
735 385	1011	4.04	1 ST	103
735 387	1011	4.38	1 ST	103
735 388	1011	4.45	1 ST	103
735 389	1011	4.35	1 ST	103
735 390	1011	4.35	1 ST	103
735 392	1011	4.00	1 ST	103
735 393	1011	4.05	1 ST	103
735 604	1011	2.08	1 ST	119
735 618	1011	3.76	1 ST	100
735 619	1011	3.97	1 ST	100
735 620	1011	3.78	1 ST	101
735 621	1011	4.02	1 ST	101
735 718	1011	4.00	1 ST	102
735 719	1011	4.24	1 ST	102
735 720	1011	4.03	1 ST	103
735 721	1011	4.26	1 ST	103
735 802	1011	5.04	1 ST	106
735 804	1011	4.73	1 ST	106
735 806	1011	5.41	1 ST	106
735 807	1011	5.15	1 ST	106
735 811	1011	5.12	1 ST	107
735 813	1011	4.82	1 ST	107
735 815	1011	5.50	1 ST	107
735 816	1011	5.23	1 ST	107
735 821	1011	4.36	1 ST	104
735 822	1011	4.36	1 ST	104
735 823	1011	4.05	1 ST	104
735 825	1011	4.50	1 ST	104
735 826	1011	4.46	1 ST	104
735 831	1011	4.45	1 ST	105
735 832	1011	4.45	1 ST	105
735 833	1011	4.13	1 ST	105
735 835	1011	4.58	1 ST	105
735 836	1011	4.45	1 ST	105
740 124	—	0.26	1 ST	227
740 300	1534	0.70	1 ST	147
740 800	1534	1.25	1 ST	147
742 225	1534	3.49	1 ST	147
742 425	1534	3.78	1 ST	147
743 225	1011	5.86	1 ST	150
743 235	1011	6.07	1 ST	150
743 250	1011	6.57	1 ST	150
743 325	1011	5.61	1 ST	150
743 335	1011	5.54	1 ST	150
745 016	1034	0.47	1 ST	144
745 017	1034	0.28	1 ST	145
745 018	1034	0.27	1 ST	144
745 105	1502	1.83	1 ST	148
745 106	1502	0.89	1 ST	149
745 107	1502	0.29	1 ST	149
745 108	1502	0.02	1 ST	149
745 109	1502	0.02	1 ST	149
745 201	1034	0.07	1 ST	145
745 202	1034	0.09	1 ST	145
745 203	1034	0.10	1 ST	145
745 204	1034	0.15	1 ST	145

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745 302	1034	0.11	1 ST	144
745 400	1034	0.42	1 ST	146
745 401	1034	0.14	1 ST	145
745 426	1034	1.19	1 ST	144
745 436	1034	1.48	1 ST	144
745 451	1034	2.14	1 ST	144
745 458	1034	1.24	1 ST	144
745 459	1034	1.15	1 ST	144
745 460	1034	1.43	1 ST	144
745 461	1034	1.80	1 ST	144
745 500	1155	7.57	1 ST	143
745 502	1034	0.36	1 ST	146
745 602	1034	0.58	1 ST	146
745 816	1034	0.90	1 ST	144
745 817	1034	0.64	1 ST	144
745 900	1034	3.71	1 ST	142
745 901	1351	6.89	1 ST	140
745 902	1034	1.67	1 ST	142
745 903	1351	7.00	1 ST	140
745 905	1351	0.08	1 ST	140
745 910	1351	0.19	1 ST	140
745 915	1351	0.42	1 ST	141
745 921	1351	0.22	1 ST	142
745 922	1351	0.22	1 ST	142
745 925	1351	1.85	1 ST	141
745 926	1351	1.80	1 ST	141
745 935	1351	2.85	1 ST	141
745 936	1351	2.80	1 ST	141
745 940	1358	0.70	1 ST	141
750 001	—	0.54	1 M	119
750 025	1011	2.77	1 ST	110
750 031	1011	2.77	1 ST	111
750 044	1011	2.83	1 ST	110
750 045	1011	2.95	1 ST	110
750 046	1011	2.92	1 ST	110
750 048	1011	2.80	1 ST	110
750 049	1011	2.95	1 ST	111
750 050	1011	2.92	1 ST	111
750 052	1011	2.80	1 ST	111
750 053	1011	2.83	1 ST	111
750 060	1011	2.90	1 ST	112
750 061	1011	2.50	1 ST	112
750 063	1011	2.88	1 ST	112
750 064	1011	2.90	1 ST	113
750 065	1011	3.00	1 ST	113
750 067	1011	2.88	1 ST	113
750 068	1011	2.92	1 ST	112
750 069	1011	2.92	1 ST	113
750 101	1011	2.90	1 ST	114
750 103	1011	3.10	1 ST	114
750 104	1011	3.49	1 ST	114
750 105	1011	3.01	1 ST	114
750 106	1011	3.04	1 ST	114
750 107	1011	3.51	1 ST	117
750 108	1011	2.90	1 ST	115
750 110	1011	2.92	1 ST	115
750 112	1011	3.49	1 ST	115
750 113	1011	3.01	1 ST	115
750 114	1011	3.04	1 ST	115
750 123	1011	3.51	1 ST	116
750 125	1011	3.37	1 ST	116
750 127	1011	3.37	1 ST	117
750 132	1011	3.13	1 ST	116
750 134	1011	3.72	1 ST	116
750 135	1011	3.25	1 ST	116
750 136	1011	3.13	1 ST	117
750 138	1011	3.72	1 ST	117
750 139	1011	3.13	1 ST	117
750 196	1011	25.18	1 ST	218
750 200	1011	29.43	1 ST	218
750 210	1011	13.44	1 ST	218
750 211	1011	15.55	1 ST	218
750 212	1011	13.00	1 ST	220
750 213	1011	8.76	1 ST	220
750 214	1011	15.60	1 ST	218
750 215	1011	7.30	1 ST	221
750 317	1011	3.97	1 ST	100
750 325	1011	2.85	1 ST	112
750 331	1011	2.85	1 ST	113
750 350	1011	3.97	1 ST	100
750 351	1011	3.91	1 ST	101
750 353	1011	4.23	1 ST	102
750 354	1011	4.40	1 ST	103
750 356	1011	4.20	1 ST	100
750 357	1011	4.30	1 ST	100
750 358	1011	4.38	1 ST	100
750 359	1011	4.30	1 ST	100
750 360	1011	4.30	1 ST	100
750 362	1011	3.93	1 ST	100
750 363	1011	4.00	1 ST	100
750 365	1011	3.91	1 ST	101
750 366	1011	4.22	1 ST	101
750 367	1011	4.35	1 ST	101
750 368	1011	4.41	1 ST	101
750 369	1011	4.35	1 ST	101
750 370	1011	4.31	1 ST	101
750 372	1011	4.00	1 ST	101
750 373	1011	4.02	1 ST	101
750 375	1011	4.25	1 ST	102
750 376	1011	4.45	1 ST	102
750 377	1011	4.58	1 ST	102
750 378	1011	4.65	1 ST	102
750 379	1011	4.55	1 ST	102
750 380	1011	4.55	1 ST	102
750 382	1011	4.20	1 ST	102
750 383	1011	4.25	1 ST	102
750 385	1011	4.30	1 ST	103
750 386	1011	4.50	1 ST	103
750 387	1011	4.60	1 ST	103
750 388	1011	4.70	1 ST	103
750 389	1011	4.60	1 ST	103
750 390	1011	4.60	1 ST	103
750 392	1011	4.30	1 ST	103
750 393	1011	4.30	1 ST	103
750 500	—	0.25	1 ST	96
750 604	1011	2.21	1 ST	119
750 802	1011	5.27	1 ST	106
750 803	1011	5.50	1 ST	106
750 804	1011	4.96	1 ST	106
750 806	1011	5.63	1 ST	106
750 807	1011	5.37	1 ST	106
750 811	1011	5.35	1 ST	107
750 812	1011	5.60	1 ST	107
750 813	1011	5.13	1 ST	107
750 815	1011	5.35	1 ST	107
750 816	1011	5.50	1 ST	107
750 821	1011	4.58	1 ST	104
750 822	1011	4.60	1 ST	104
750 823	1011	4.27	1 ST	104
750 825	1011	4.72	1 ST	104
750 826	1011	4.68	1 ST	104
750 831	1011	4.70	1 ST	105
750 832	1011	4.70	1 ST	105
750 833	1011	4.35	1 ST	105
750 835	1011	4.80	1 ST	105
750 836	1011	4.80	1 ST	105
751 040	1011	2.60	1 ST	227
751 085	1011	4.98	1 ST	227
751 120	1011	6.86	1 ST	227
751 130	1011	7.39	1 ST	227
751 140	1011	7.93	1 ST	227
751 150	1011	4.80	1 ST	227
751 191	1011	8.41	1 ST	220
751 192	1011	6.43	1 ST	222
751 193	1011	10.48	1 ST	222
754 200	1018	0.13	1 ST	92
754 235	1018	0.18	1 ST	92
754 600	1018	0.12	1 ST	92
754 645	1018	0.29	1 ST	92
755 200	1018	0.22	1 ST	92
755 225	1018	0.27	1 ST	92
755 245	1018	0.28	1 ST	92
755 501	—	0.30	1 ST	96
755 600	1018	0.20	1 ST	92
755 626	1018	0.30	1 ST	228
755 627	1018	0.31	1 ST	228
755 636	1018	0.31	1 ST	228
755 645	1018	0.32	1 ST	92

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767 430	1428	2.64	1 ST	31
767 433	1428	2.65	1 ST	31
767 438	1428	1.26	1 ST	31
767 500	—	0.24	1 ST	65
767 531	—	0.55	1 ST	37
767 541	1238	1.56	1 ST	37
767 542	1194	0.70	1 ST	213
767 552	1243	1.17	1 ST	39
767 559	—	0.25	1 ST	39
767 600	1121	4.50	1 ST	41
767 601	1121	2.20	1 ST	41
767 602	1479	2.10	1 ST	41
767 701	—	5.70	1 ST	21
767 702	—	1.12	1 ST	21
767 703	1252	0.80	1 ST	15
767 706	1252	0.80	1 ST	15
767 710	1252	0.80	1 ST	15
767 711	1252	0.97	1 ST	15
767 712	—	0.04	1 ST	45
767 713	—	0.04	1 ST	45
767 720	1252	0.90	1 ST	15
767 721	1252	1.08	1 ST	15
767 722	—	0.45	1 ST	24
767 723	1598	0.41	1 ST	28
767 730	1252	1.02	1 ST	15
767 731	1252	1.18	1 ST	15
767 732	—	0.41	1 ST	28
767 733	1252	1.18	1 ST	15
767 735	—	0.45	1 ST	28
767 740	1252	1.27	1 ST	15
767 750	1252	1.33	1 ST	15
767 760	—	0.18	1 ST	44
767 761	—	0.28	1 ST	44
767 762	—	0.35	1 ST	44
767 763	—	0.44	1 ST	24
767 764	—	0.51	1 ST	44
767 766	—	0.13	1 ST	24
767 767	—	0.44	1 ST	44
767 768	—	0.45	1 ST	24
767 771	—	0.60	1 ST	28
767 772	—	0.28	1 ST	28
767 776	—	0.06	1 ST	45
767 777	—	0.05	1 ST	45
767 778	—	0.01	1 ST	52
767 779	—	0.01	1 ST	45
767 810	1325	0.83	1 ST	57
767 815	1352	0.99	1 ST	56
767 816	1352	0.14	1 ST	56
767 820	1325	0.53	1 ST	57
767 825	1352	0.99	1 ST	56
767 826	1352	0.14	1 ST	56
767 830	1325	0.93	1 ST	57
767 840	1325	0.92	1 ST	57
767 851	1325	1.33	1 ST	57
767 861	1325	1.31	1 ST	57
767 921	1451	0.92	1 ST	17
767 922	1451	0.64	1 ST	17
767 931	1451	0.96	1 ST	17
767 932	1451	0.64	1 ST	17
767 997	—	2.15	1 ST	21
767 999	—	3.45	1 ST	21
769 201	1011	1.70	1 ST	133
769 251	1011	2.11	1 ST	133
769 300	1011	2.68	1 ST	133
769 301	1011	2.42	1 ST	133
769 352	1011	4.80	1 ST	224
769 400	1011	3.68	1 ST	133
769 401	1011	3.05	1 ST	133
769 500	1011	4.68	1 ST	133
769 501	1011	3.64	1 ST	133
769 502	1011	6.12	1 ST	224
769 503	1011	1.64	1 ST	135
769 504	1011	1.60	1 ST	135
769 505	1011	1.46	1 ST	135
769 506	1011	7.03	1 ST	225
769 508	1011	4.50	1 ST	224
769 509	—	0.36	1 ST	225
769 510	1011	6.61	1 ST	225
770 001	—	0.75	1 M	119
770 025	1011	3.28	1 ST	110
770 031	1011	3.34	1 ST	111
770 044	1011	3.22	1 ST	110
770 045	1011	3.39	1 ST	110
770 046	1011	3.48	1 ST	110
770 049	1011	3.39	1 ST	111
770 050	1011	3.48	1 ST	111
770 053	1011	3.40	1 ST	111
770 060	1011	3.39	1 ST	112
770 061	1011	3.48	1 ST	112
770 064	1011	3.39	1 ST	113
770 065	1011	3.48	1 ST	113
770 068	1011	3.40	1 ST	112
770 069	1011	3.40	1 ST	113
770 103	1011	3.75	1 ST	114
770 104	1011	4.09	1 ST	114
770 105	1011	3.60	1 ST	114
770 106	1011	3.62	1 ST	114
770 107	1011	4.11	1 ST	117
770 110	1011	3.50	1 ST	115
770 112	1011	4.09	1 ST	115
770 113	1011	3.60	1 ST	115
770 114	1011	3.63	1 ST	115
770 123	1011	4.11	1 ST	116
770 125	1011	3.97	1 ST	116
770 127	1011	3.97	1 ST	117
770 134	1011	4.32	1 ST	116
770 135	1011	3.85	1 ST	116
770 138	1011	4.32	1 ST	117
770 139	1011	3.85	1 ST	117
770 317	1011	4.63	1 ST	100
770 325	1011	3.34	1 ST	112
770 331	1011	3.34	1 ST	113
770 350	1011	4.63	1 ST	100
770 351	1011	4.63	1 ST	101
770 353	1011	4.87	1 ST	102
770 354	1011	4.91	1 ST	103
770 356	1011	4.89	1 ST	100
770 357	1011	4.89	1 ST	100
770 358	1011	5.03	1 ST	100
770 359	1011	4.89	1 ST	100
770 360	1011	4.90	1 ST	100
770 362	1011	4.63	1 ST	100
770 363	1011	4.63	1 ST	100
770 365	1011	4.63	1 ST	101
770 366	1011	4.89	1 ST	101
770 367	1011	4.89	1 ST	101
770 368	1011	5.03	1 ST	101
770 369	1011	4.89	1 ST	101
770 370	1011	4.90	1 ST	101
770 372	1011	4.63	1 ST	101
770 373	1011	4.63	1 ST	101
770 375	1011	4.87	1 ST	102
770 376	1011	5.15	1 ST	102
770 377	1011	5.20	1 ST	102
770 378	1011	5.28	1 ST	102
770 379	1011	5.18	1 ST	102
770 380	1011	5.18	1 ST	102
770 382	1011	4.87	1 ST	102
770 383	1011	4.87	1 ST	102
770 385	1011	4.91	1 ST	103
770 386	1011	5.15	1 ST	103
770 387	1011	5.24	1 ST	103
770 388	1011	5.32	1 ST	103
770 389	1011	5.22	1 ST	103
770 390	1011	5.22	1 ST	103
770 392	1011	4.91	1 ST	103
770 393	1011	4.91	1 ST	103
770 604	1011	2.96	1 ST	119
770 802	1011	5.45	1 ST	106
770 803	1011	5.65	1 ST	106
770 804	1011	5.20	1 ST	106
770 806	1011	5.85	1 ST	106
770 807	1011	5.53	1 ST	106
770 811	1011	5.49	1 ST	107
770 812	1011	5.69	1 ST	107
770 813	1011	5.25	1 ST	107
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770 825	1011	5.33	1 ST	104
770 826	1011	5.30	1 ST	104
770 831	1011	5.25	1 ST	105
770 832	1011	5.25	1 ST	105
770 833	1011	4.95	1 ST	105
770 835	1011	5.35	1 ST	105
770 836	1011	5.35	1 ST	105
772 310	—	0.47	1 ST	123
772 311	—	0.48	1 ST	123
772 312	1011	0.48	1 ST	126
772 313	1011	0.40	1 ST	126
772 314	1011	0.45	1 ST	124
772 320	—	0.79	1 ST	123
772 321	—	0.76	1 ST	123
772 322	1011	0.75	1 ST	126
772 323	1011	0.88	1 ST	126
772 324	1011	0.72	1 ST	124
772 330	—	0.56	1 ST	123
772 331	—	0.57	1 ST	123
772 340	—	0.88	1 ST	123
772 341	—	0.90	1 ST	123
773 034	1011	0.67	1 ST	123
773 130	—	0.80	1 ST	123
773 234	1011	0.69	1 ST	123
773 236	1011	0.65	1 ST	124
773 251	1011	0.90	1 ST	226
773 330	—	0.83	1 ST	123
773 331	1011	0.79	1 ST	124
774 034	1011	0.68	1 ST	125
774 130	1011	0.78	1 ST	125
774 234	1011	0.79	1 ST	125
774 251	1011	0.96	1 ST	226
774 330	1011	0.94	1 ST	125
774 434	1011	0.69	1 ST	125
774 530	1011	0.70	1 ST	125
775 621	1011	0.31	1 ST	127
775 626	1011	0.34	1 ST	127
775 631	1011	0.29	1 ST	127
775 636	1011	0.35	1 ST	127
776 412	1011	7.06	1 ST	119
776 415	1011	8.55	1 ST	119
776 425	1011	1.48	1 ST	119
776 435	1011	2.23	1 ST	119
776 450	1011	3.10	1 ST	119
776 470	1011	4.22	1 ST	119
776 495	1011	5.96	1 ST	119
784 032	1011	0.95	1 ST	121
784 085	1011	0.87	1 ST	121
784 201	1011	0.88	1 ST	121
784 301	1011	1.70	1 ST	121
784 352	1011	0.81	1 ST	226
784 401	1011	1.30	1 ST	121
784 480	1011	0.60	1 ST	121
784 501	1011	1.95	1 ST	121
784 755	1011	1.54	1 ST	226
785 100	1224	18.00	1 ST	165
785 109	1508	0.50	1 ST	174
785 110	—	0.70	1 ST	181
785 111	—	0.61	1 ST	181
785 112	1224	17.80	1 ST	165
785 119	1224	0.70	1 ST	181
785 120	1224	0.70	1 ST	166
785 121	1224	0.11	1 ST	166
785 122	1224	0.22	1 ST	166
785 123	1224	0.43	1 ST	166
785 130	1224	0.13	1 ST	166
785 131	1224	0.16	1 ST	166
785 132	1224	0.15	1 ST	166
785 140	1224	0.34	1 ST	166
785 150	1224	0.32	1 ST	166
785 151	1508	0.26	1 ST	177
785 160	1224	0.09	1 ST	166
785 170	1224	0.33	1 ST	166
785 171	1224	0.11	1 ST	167
785 172	1224	0.10	1 ST	167
785 180	1224	0.15	1 ST	167
785 181	1508	0.18	1 ST	179
785 190	1224	0.35	1 ST	167
785 200	1224	0.18	1 ST	163
785 210	1224	0.26	1 ST	167
785 212	1224	0.07	1 ST	167
785 213	—	0.32	1 ST	180
785 214	—	0.32	1 ST	180
785 215	—	0.32	1 ST	180
785 216	—	0.32	1 ST	180
785 217	—	0.32	1 ST	180
785 218	—	0.32	1 ST	180
785 219	—	0.32	1 ST	180
785 220	1224	0.10	1 ST	167
785 221	1224	0.20	1 ST	167
785 223	1224	0.29	1 ST	177
785 224	1508	0.01	1 ST	179
785 229	—	4.76	1 ST	170
785 259	1508	0.32	1 ST	178
785 260	1396	21.50	1 ST	183
785 261	1396	0.76	1 ST	183
785 264	1396	2.50	1 ST	183
785 265	1444	4.58	1 ST	185
785 266	1444	0.71	1 ST	186
785 267	1444	0.29	1 ST	186
785 268	1444	0.29	1 ST	186
785 269	1444	0.29	1 ST	186
785 271	1444	0.02	1 ST	186
785 272	1444	0.02	1 ST	186
785 273	1444	0.27	1 ST	186
785 274	1379	0.03	1 SA	171
785 275	1379	0.06	1 SA	171
785 279	1379	0.07	1 SA	171
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785 283	—	0.01	1 ST	187
785 284	—	0.01	1 ST	187
785 295	—	2.50	1 ST	183
785 298	—	2.85	1 ST	186
785 299	—	5.40	1 ST	183
785 301	1224	6.00	1 ST	166
785 310	—	12.70	1 ST	180
785 315	1379	0.63	1 ST	170
785 316	1379	0.10	1 ST	170
785 317	1379	0.13	1 ST	170
785 318	1379	0.15	1 ST	170
785 319	1379	0.25	1 ST	170
785 320	1379	0.09	1 ST	170
785 321	1379	0.10	1 ST	170
785 322	1379	0.13	1 ST	171
785 323	1379	0.19	1 ST	171
785 324	1379	0.09	1 ST	171
785 325	1508	0.62	1 ST	174
785 425	—	0.28	1 ST	191
785 426	—	0.34	1 ST	191
785 427	—	0.30	1 ST	191
785 428	—	0.01	1 ST	191
785 429	—	0.34	1 ST	191
785 436	—	0.34	1 ST	191
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785 506	1261	5.30	1 ST	161
785 515	1261	0.07	1 ST	163
785 520	1261	0.24	1 ST	161
785 521	1261	0.11	1 ST	162
785 522	1261	0.16	1 ST	162
785 523	1261	0.21	1 ST	162
785 530	1261	0.12	1 ST	162
785 540	1261	0.10	1 ST	162
785 541	1261	0.04	1 ST	162
785 542	1261	0.04	1 ST	162
785 543	1261	0.04	1 ST	162
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785 551	1508	33.50	1 ST	177
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785 560	1261	0.05	1 ST	162
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785 580	1261	0.05	1 ST	163
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785 590	1261	0.05	1 ST	162
785 591	1261	0.05	1 ST	162
785 592	1261	0.05	1 ST	181
785 595	1261	0.02	1 SA	163
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785 640	—	0.06	1 ST	196
785 641	—	0.06	1 ST	196
785 642	—	0.08	1 ST	196
785 643	—	0.08	1 ST	196
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785 647	—	0.07	1 ST	195
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785 649	—	0.01	1 ST	195
785 650	—	0.02	1 ST	196
785 652	—	0.09	1 ST	196
785 940	1379	8.20	1 ST	169
785 950	1508	27.30	1 ST	173
785 951	1508	21.20	1 ST	175
785 952	1508	1.43	1 ST	174
785 953	1508	0.12	1 ST	179
790 150	1011	0.45	1 ST	127
790 160	1011	0.74	1 ST	127
790 250	1018	0.19	1 ST	95
790 251	1018	0.25	1 ST	95
790 260	1018	0.18	1 ST	95
790 261	1018	0.28	1 ST	95
792 030	1011	0.61	1 ST	128
792 190	1011	1.20	1 ST	128
792 450	1011	2.95	1 ST	226
792 453	1011	2.95	1 ST	226
794 025	1011	4.17	1 ST	110
794 031	1011	4.62	1 ST	111
794 044	1011	4.29	1 ST	110
794 045	1011	4.26	1 ST	110
794 046	1011	4.35	1 ST	110
794 048	1011	4.75	1 ST	110
794 049	1011	4.21	1 ST	111
794 050	1011	4.36	1 ST	111
794 052	1011	4.75	1 ST	111
794 053	1011	4.30	1 ST	111
794 060	1011	4.35	1 ST	112
794 061	1011	4.45	1 ST	112
794 064	1011	4.36	1 ST	113
794 065	1011	4.45	1 ST	113
794 068	1011	4.38	1 ST	112
794 069	1011	4.38	1 ST	113
794 125	1011	4.80	1 ST	116
794 127	1011	4.84	1 ST	117
794 134	1011	5.28	1 ST	116
794 135	1011	4.68	1 ST	116
794 138	1011	5.30	1 ST	117
794 139	1011	4.71	1 ST	117
794 317	1011	6.10	1 ST	100
794 325	1011	4.25	1 ST	112
794 331	1011	4.26	1 ST	113
794 350	1011	6.04	1 ST	100
794 351	1011	6.08	1 ST	101
794 353	1011	6.31	1 ST	102
794 354	1011	6.35	1 ST	103
794 356	1011	6.27	1 ST	100
794 357	1011	6.40	1 ST	100
794 358	1011	6.46	1 ST	100
794 359	1011	6.37	1 ST	100
794 360	1011	6.36	1 ST	100
794 362	1011	6.00	1 ST	100
794 363	1011	6.10	1 ST	100
794 365	1011	6.09	1 ST	101
794 366	1011	6.30	1 ST	101
794 367	1011	6.52	1 ST	101
794 368	1011	6.50	1 ST	101
794 369	1011	6.40	1 ST	101
794 370	1011	6.38	1 ST	101
794 372	1011	6.04	1 ST	101
794 373	1011	6.10	1 ST	101
794 375	1011	6.32	1 ST	102
794 376	1011	6.54	1 ST	102
794 377	1011	6.65	1 ST	102
794 378	1011	6.72	1 ST	102
794 379	1011	6.63	1 ST	102
794 380	1011	6.62	1 ST	102
794 382	1011	6.27	1 ST	102
794 383	1011	6.33	1 ST	102
794 385	1011	6.35	1 ST	103
794 386	1011	6.56	1 ST	103
794 387	1011	6.68	1 ST	103
794 388	1011	6.75	1 ST	103
794 389	1011	6.65	1 ST	103
794 390	1011	6.65	1 ST	103
794 392	1011	6.30	1 ST	103
794 393	1011	6.36	1 ST	103
795 001	—	1.00	1 M	119
795 025	1011	4.69	1 ST	110
795 031	1011	4.70	1 ST	111
795 038	1011	4.70	1 ST	109
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795 043	1011	3.50	1 ST	109
795 044	1011	4.81	1 ST	110
795 045	1011	5.80	1 ST	109
795 046	1011	4.62	1 ST	110
795 048	1011	3.20	1 ST	109
795 049	1011	3.50	1 ST	109
795 050	1011	4.64	1 ST	111
795 053	1011	4.83	1 ST	111
795 060	1011	4.89	1 ST	112
795 061	1011	4.76	1 ST	112
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795 065	1011	4.79	1 ST	113
795 068	1011	4.95	1 ST	112
795 069	1011	4.98	1 ST	113
795 103	1011	4.36	1 ST	114
795 104	1011	5.05	1 ST	114
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795 114	1011	4.52	1 ST	115
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RSD 15104 Z MS	Sponge, 150x100x40 mm, serrated, FRS ZK MS	785 280	171
RSI 32	Reducing insert, 35/32, TRS MS	785 213	180
RSI 34	Reducing insert, 35/34, TRS MS	785 214	180
RSI 35	Reducing insert, 35/35, TRS MS	785 215	180
RSI 38	Reducing insert, 35/38, TRS MS	785 216	180
RSI 45	Reducing insert, 35/45, TRS MS	785 217	180
RSI 51	Reducing insert, 35/51, TRS MS	785 218	180
RSI 58	Reducing insert, 35/38, TRS MS	785 219	180
RST 36 1000	Rescue rod, 1000 mm	766 040	80
RST 36 1500	Rescue rod, 1500 mm	766 041	80
RST 36 2000	Rescue rod, 2000 mm	766 042	80
S 30 ZK MS	Scraper, gear coupling, FRS ZK MS	785 320	170
S60 PS PHE 285	PHE Test prod, S 60	767 760	44
S61 PS PHE 435	PHE Test prod,S 61	767 761	44
S62 PS PHE 620	PHE Test prod, S 62	767 762	44

Type / Product Index

Type / Product Index

Abbreviations	
SK	Hexagon shaft
SQ	T pin shaft
SQL	T pin shaft, long
FS	Wing screw
HG	Handle
SKN	Tommy bar
EH	Coupling aid
FV	Spring tension

Legal Notes

Sicne we perform no designing of systems or system components, the suggested applications of our products should be considered as product information and for advisory purposes only. Our oral and written advice on application is based on experience and given to the best of our knowledge. However, it must be also considered without obligation. This applies particularly to the different conditions of use which are beyond our control. We recommend to check whether or not the DEHN product chosen is suitable for the intended application. Application, use and processing of our products take place beyond our control. Therefore, the product is completely subject to the user's responsibility.

All items for transport and storage are delivered without equipment.

Abbreviations:

VPE	Packing unit
VME	Quantity per unit
Instr. No.	Instructions for use No.
ST	Weight per **unit**
M	Weight per **metre**
SA	Weight per **set**

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and our logos

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General Terms of Sale

1. General, Scope

1.1 All deliveries and services in business dealings with entrepreneurs take place eclusively under our general terms of sale (hereinafter "terms of sale"). We oppose deviating regulations, especially conflicting terms of purchase of the customer, unless we epressly agreed to the validity in writing. Our terms of sale apply even if we complete unconditional delivery to the customer while knowing that the terms of sale of the customer are in conflict with our own.

1.2 Our terms of sale apply to current business relationships and to all future transactions with the customer.

1.3 Collateral agreements must be made in writing.

2. Offer and Order, Reservation of Right of Modification and Copyright

2.1 Insofar as not epressly indicated by us as binding, documents such as diagrams, drawings, and measurements are only roughly binding.

2.2 Should our order confirmation contain reasonable epansions, limitations, or other modifications with respect to the order, then the customer's agreement is implied, if it does not immediately, at the latest however within 3 business days from receipt of the order confirmation, oppose it.

2.3 Our goods are only delivered in the packaging units indicated in the catalogs. If a different number of items is ordered, the amount and price of the net larger packaging unit is considered agreed upon.

2.4 We reserve the right to make technical modifications to our services, insofar as such modifications promote technical progress or are unavoidable based on other circumstances and are reasonable for the customer.

2.5 We reserve ownership and copyright rights to diagrams, drawings, calculations, and other documents; these may not be made available to third parties without our epress written consent.

3. Prices, Value-Added Ta, Packaging Costs

3.1 Our prices are subject to change without notice.

3.2 Prices include, insofar as nothing else is arranged, customary packaging from our plant without value-added ta. On the day of invoicing, the legally identified VAT amount is to be reimbursed to us.

3.3 The cost of non-customary packaging, e.g., collective or seaworthy packaging, is invoiced separately. The customer bears the cost of the disposal or return of packaging.

4. Passing of Risk, Optional Insurance

The risk of accidental loss, destruction, or deterioration passes to the customer upon dispatch to the customer from our plant, even if carriage-paid delivery is agreed upon. At the request and epense of the customer, we will insure the delivery against breakage, damage to goods in transit, and fire damage.

5. Payment Due Dates, Discounts, Right of Refusal, Default, Small Order Quantity Surcharge

5.1 Unless otherwise agreed, invoices are payable net 10 days. Purchaser shall pay the costs of payment. Discount amounts are deductible only if they have been agreed on with us and all accounts payable due have been paid.

5.2 If purchaser is in default with his payments, interest on the outstanding amount shall be payable at the rate of 8% above the base interest rate. We reserve the right to prove and allege higher default damages. We reserve the right to cause default by demanding early payment. If we are required to advance performance and, if after the execution of the contract, it becomes apparent that our claim, in particular for payment, may be jeopardized by purchaser´s inability to perform we may refuse performance.

5.3 The customer cannot charge counter-claims against our due payment claims or eercise a right of retention, unless the customer is entitled to a claim recognized by declaratory judgment that is not contested by us and if, while eercising the right of retention, the counter-claim from the customer is based on the same contractual relationship.

5.4 Orders, with the eception of cash sales, for which the net amount (invoiced amount without shipping costs and value-added ta) is less than € 75.00, a small order surcharge of € 25.00 will be charged.

6. Retention of Title, Assignment, Release of Securities

6.1 Delivered goods remain our property until the payment of all open business claims up to the point of invoicing. The claims of the customer including value-added ta from the resale of reserved goods, i.e., from a work performance using our goods, should already be transferred to us in the amount of the open invoice. In the case that the reserved goods from the customer are sold together with other goods that do not belong to us, whether it be without or after processing, or are delivered within the framework of a working contract, the assignment of the resulting claim of the reserve buyer is calculated in the amount of the value of the reserved goods.

6.2 Should the value of the granted securities eceed the claims by more than 20%, we are obliged to retransfer or release the securities upon request. We shall select the securities to be released.

6.3 Our goods may only be transferred within the framework of proper business activity. The customer is not allowed to pawn or transfer the ownership of goods that are still in our possession.

6.4 At our request, the customer is obliged to inform us of the purchaser and the arranged price and to show the assignment to its debtor.

7. Delivery Period and Appointment

7.1 The start of the delivery period presupposes the involvement of the customer for the clarification of all technical questions.

7.2 Delivery periods as well as delivery schedules will be appropriately etended if they cannot be adhered to as a result of military mobilization, war, uprising, strike or lockout, delayed delivery of raw and auiliary materials, late delivery by our suppliers, or similar circumstances beyond our control. A lasting obstruction under these circumstances gives us the right to withdraw from the contract without liability for damages.

8. Liability for Material and Title Defects

8.1 Insofar as there eists a defect of the contract subject that was beyond our control, we can choose to fi the defect or provide a defect-free contract subject (replacement).

8.2 Should the replacement (No. 8.1) not function properly, or should it be unreasonable to the customer, or should we seriously and conclusively refuse it or unreasonably delay it, or if other circumstances eist that, upon weighing mutual interests, justify immediate resignation or compensation, then the customer is entitled to choose to lower the contract price or to withdraw from the contract (No. 8.3) or demand compensation (No. 8.4). The customer is not entitled to withdraw from the contract if only insignificant contract inconformities eist, especially insignificant defects.

8.3 Insofar as the customer declares its withdrawal from the contract due to material or title defects after proper replacement (No. 8.2), it cannot also claim damages for the defect.

8.4 Insofar as the customer declares its withdrawal from the contract due to material or title defects after proper replacement (No. 8.2), it cannot also claim damages for the defect.

8.5 Material and title defect claims, including claims for compensation due to material and title defects, with the eception of claims under the Product Liability Act, lapse 12 months after delivery of the goods.

8.6 Numbers 8.1 through 8.5 do not impair the customer's rights if we maliciously concealed a defect or if we offered a quality guarantee.

9. Liability for Other Reasons

9.1 Our liability is ecluded for slightly negligent infringement of immaterial contractual obligations. Our liability is limited to the contractual, foreseeable damages for slightly negligent infringement of other obligations.

9.2 The above regulation does not apply to claims under the Product Liability Act. Insofar as the limitation on liability pursuant to No. 9.1 for claims from the producer's liability pursuant to § 823 of the German Civil Code does not interfere, our liability is limited to the replacement of the insurance. Insofar as this does not occur or does not occur in full, we are liable up to the insured amount.

9.3 Insofar as our liability is ecluded or limited, this also applies for the personal liability of all of our employees, representatives, and vicarious agents.

9.4 Our liability is unrestricted if the customer loses his/her life or suffers a bodily or health injury due to an action or failure attributable to us.

10. Return of Goods without Legal Liability

10.1 If no legal claim to return eists, delivered goods will be accepted only with previous written agreement from us as well as the issuance of a return number. Returns without a return number will be send back – postage-due – to the sender without inspection. The customer bears the shipping costs for the return delivery in No. 10.1.

10.2 The goods must still be in their original packaging. Special orders or deliveries, which date back more than three months or the net value of which is less than € 75.00, cannot be returned. A processing fee of 15% of the net value of the goods will be charged to cover the cost of the return. If the goods can no longer be resold at the list price at the time of the return, an additional deduction (old goods deduction) will be made in addition to the processing fee. If we make an eception and agree to accept the return of parts that are unpackaged or that are no longer in their original packaging, an epense remuneration of at least 15% will be charged for reworking and repackaging in addition to the processing fee and, if applicable, the old goods deduction.

10.3 Returned goods will only be credited to a new invoice. Credits cannot be used to clear invoices due at the time of the return.

11. Product Information, No Advisory Obligation

Our deliveries are intended only for specialty stores or skilled users. Our user information and instructions are limited to the details of each written product information (e.g., installation instructions, catalogs, data sheets). Further advisory obligations do not eist. Application, use, and processing of the products lie solely in the customer's realm of responsibility.

12. Use and Protectionof Customer Data

We use customer data, which concern the business dealings with the customer, in terms of the Federal Data Protection Act.

13. Applicable Law, Jurisdiction

13.1 German law applies to the mutual contractual obligations, their materialization, interpretation, and implementation as well as all resulting contractual and business relationships. The application of the UN Agreement on Contracts on the International Purchase of Goods and the thereafter-enacted laws of the Federal Republic of Germany is ecluded.

13.2 Place of performance and jurisdiction for delivery, payment, and for all obligations, including those from echange and check payments, is eclusively Nuremberg. We reserve the right to file a complaint against the customer at its official location.

14. VAT Identification Number

VAT ID No. DE 133251475

DEHN + SÖHNE GmbH + Co. KG.
Nürnberg – Neumarkt

Update October 2005

Template
for Insulating Protective Shutters acc. to DIN VDE 0682, Part 552 for Switchgear Installations with Voltages up to 36 kV
Material: Hard PVC

1 CUSTOMER:

Company: _____

Address: _____

Address, Country: _____

Person in charge: _____ Dept.: _____

Tel.: _____

JSP ____ / ____

For internal office use only
Please do not complete

SWITCHGEAR / INSTALLATION:

Type: _____ Nominal voltage: _____

☐ Request ☐ Order Quantity of protective shutters: _____

REMARK:

_____

_____

_____

_____

2 RECORDED BY:

Name: _____

Date/Signature: _____

Internal notes (please do not fill in)
Person in charge:

Dept.	Name	Date	Remark
Service			
Sales			
Purchases			Order No. EK4/

3 CONFIRMATION OF DELIVERY:

The protective shutter(s) has/have been delivered to the above mentioned customer in accordance with the requirements of the template on ..... (date).

This delivery has been subject to random tests in accordance with DIN VDE 0682 Part 552.

_____ / _____

Location, Date Stamp/Signature

DEHN + SÖHNE GMBH + CO. KG.
HANS-DEHN-STRASSE 1
P. O. Box 1640
92306 NEUMARKT
GERMANY
TEL. 09181 906-0
FAX 09181 906-100

Template
for Insulating Protective Shutters acc. to DIN VDE 0682 Part 552 for Switchgear Installations with Voltages up to 36 kV Material: Hard PVC

JSP___ / ____

Type of insulating protective shutter

Thickness:

_____ mm

Colour:

_____

Type/Application
- – with finger holes for operation by hand (A1) ☐
- – with finger holes for operation by hand (A4*) ☐
- – with 1 bayonet pin for working with operating rod (A3) ☐
- – with 2 bayonet pin for working with operating rod (A3) ☐
- – rotatable shutter for working with operating rod (A3) ☐
- – with handle (A2) ☐

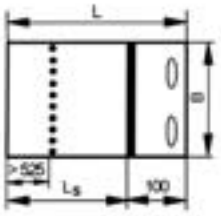
Type/Inserting
- – Standard type (insertable into guide rails, 9030) ☐
- – Insert allows for rotation of the shutter (by bearing pin guide) ☐

* Note:
Type A4 – For inserting and removing the shutter, the front of the switchgear installation itself protects the operator from electrical shocks!

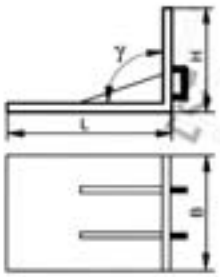
Shutter sizes exceeding 1 m² would require 2 persons for operation!

Type of insulating protective shutter

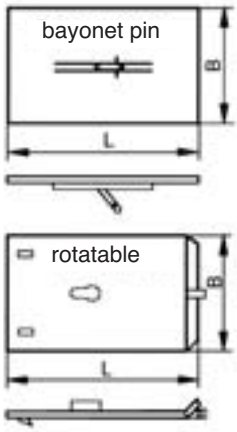
A1: 763 211



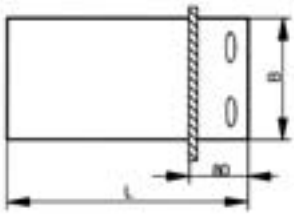
A2: 763 221



A3: 763 231



A4: 763 241



Dimension:

B _____ mm

L _____ mm

L_S _____ mm

H _____ mm

γ _____ The angle of the handle can be selected for angles between 70° to 290°.

Additional sketch for different types

x_1 Rear left corner (panel format)

x_2 Rear left corner (landscape format)

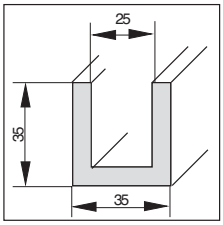
x_2

x_1

Template
for Insulating Protective Shutters acc. to DIN VDE 0682 Part 552 for Switchgear Installations with Voltages up to 36 kV
Material: Hard PVC

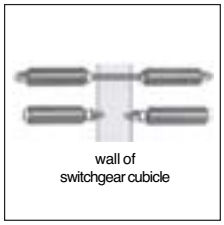
Accessories

Guide Rails 9030



Bayonet Pin 9040

Bearing Pin 9010 / 9020

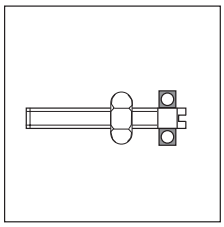


Magnetic Support 9060

Supporting Device 9070 / 9080

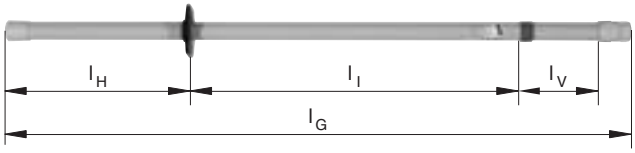
Handle 9050

Ball Bearing

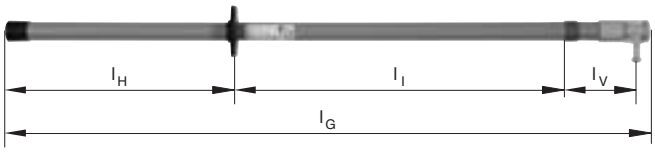


Type	Length (in mm)	Pieces

Insulating rod for voltages up to 36 kV
with cone coupling
for swivel pin



Switching rod for voltages up to 36 kV
for slotted shutters



Nominal voltage	l_G	l_I	l_H	l_V	Part No. of insulating rod	Part No. of switching rod
up to 36 kV	1028 mm	525 mm	350 mm	140 mm	**766 311**	
up to 36 kV	1528 mm	525 mm	500 mm	490 mm	**766 315**	
up to 36 kV	2028 mm	525 mm	600 mm	890 mm	**766 320**	
up to 36 kV	1030 mm	525 mm	370 mm	115 mm		**763 610**
up to 36 kV	1500 mm	525 mm	550 mm	395 mm		**763 611**
up to 36 kV	2000 mm	525 mm	700 mm	745 mm		**763 612**

Other lengths available on request!

Key Words

DEHN + SÖHNE

Lightning Protection
Surge Protection
Safety Equipment

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