PORTABLE EARTHING AND SAFETY EQUIPMENT

CONTENTS

* "Earthing and short-circuiting devices" abbreviated to "E. and s.-c. devices"

REGISTER OF TYPE NUMBERS

OUR PRODUCTS ARE DEVIDED INTO FOUR SEPARATE USER GROUPS:

UNDERGROUND CABLE CONNECTORS

- Cable branch terminals and cable branch ring connectors
- Cable connectors
- Connection terminals for flat and V-shaped conductors
- Transformer and switchgear connection terminals
- Tools and accessories

OVERHEAD LINE CONNECTORS

- Tap-off, termination and multi-purpose clamps
- Earth wire and earth strip clamps
- Surge arresters
- Tools and accessories

COMPRESSION CONNECTORS

- For cables and overhead lines:
- Compression cable lugs, compression links
- Compression connections for h.v. cables
- Compression tools and accessories

ELECTRICAL SAFETY EQUIPMENT

- Insulated tools, protection and safety equipment
- Current tapping devices
- High voltage live line testers, switching rods Fuse tongs
- Earthing and short-circuiting devices, earthing rods
- and lance earthing devices

General notes:

- All rights are reserved, especially those of photomechanical reproduction or reprints, of translations, microfilm, storage and processing in electronic systems, even in excerpts.
- This catalogue supersedes all previously published catalogue sheets on earthing and safety equipment which now become invalid.
- All information and illustrations refer to the publishing date of this brochure.
  We reserve the right to modify designs in the course of technical developments.
- All weights and dimensions are approximate values.
- During our 70 year-long experience in the field of safety equipment numerous specific solutions have been manufactured, e.g. for type-tested switchgear, airports, electrical railways, etc., which are not contained in this brochure.
  Ask for our capability in this respect !
- For quantity orders, special manufacture to customer's requirements can be considered (e.g. phase clamps with specific surface treatment).
- This catalogue contains among others complete earthing and short-circuiting devices.
  Because of space limitation it is not always possible to give a detailed description of all parts.
  For this reason all parts are summarized in a separate chapter.
  From these elements devices and rods can be assembled according to your specific requirements.

DELIVERY CONDITIONS

For all orders the "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry" of the Zentralverband Elektrotechnik and Elektronikindustrie (ZVEI) e.V. valid at the time of supply are applied, unless otherwise expressedly agreed.

This catalogue **"Portable Earthing and Safety Equipment"** was edited in the reversion time of the following VDE standards:

DIN VDE 0683: 1988 - 03 — *„Portable apparatus for earthing and short-circuiting",*
Part 1: Freely guided devices for earthing and short-circuiting
Part 2: Guided earth rods and short-circuiting devices

into the new european standards:

DIN EN 61230
VDE 0683 part 100: 1996 - 11 — *„Live working / Portable equipment for earthing or earthing and short circuiting"*
IEC 1230: 1993, modified
German edition EN 61230: 1995

DIN EN 61219
VDE 0683 part 200: 1995 - 01 — *„Live working / Earthing or earthing and short-circuiting equipment using lances as a short circuiting device - Lance earthing"*
IEC 1219: 1993
German edition EN 61219: 1993

Our products comply with the respective national standard **DIN VDE 0683** part 1 and part 2 / 03.88 and will be adjusted to the European Standard under consideration of the specified reversion deadline:

Material to **EN 61230 part 100** until 01 July 2001
Material to **EN 61219 part 200** until 01 October 1999.

The subject of this brochure is limited to *portable earthing and short-circuiting devices*.

For mobile l*ance earthing devices with restricted guidance* please ask for our **prospectus No.423/1997T1** .

Stationary lance earthing devices with restricted guidance are dimensioned according to the specific switchgear design.
Please include the full data of the switchgear with your enquiry.

When working under the absence of voltage VDE 0105 part 100: 1997 - 10 requires the working place first of all to be clearly defined.
Next the requirement to obtain and maintain a voltage-free state have to be fulfilled under the observance of the **5 safety rules:**

1. Switch off,
2. Ensure supply cannot be re-energized,
3. Verify the absence of voltage,
4. Apply earthing and short-circuiting device,
5. Apply cover or partition against neighbouring live sections.

Any deviation from these 5 rules must have a substantial cause.

When using earthing and short-circuiting devices the following must be observed:

- The devices must be thoroughly examined for perfect condition before use.
  Damaged cable insulation or protruding bare wires will exclude further usage.

- The devices must only be used in switchgear where their short circuit rating is not exceeded.
  The maximum s.c.current is given on the short circuit and earth leads and on each short circuit bar.

- Any devices which have been subjected to a full short circuit must not be re-used.

- Short-circuit devices, cables and bus bars are dimensioned to be short circuit proof. Earthing cables such as the mutual earth cable of a 3-phase earthing and short-circuiting device do not need to be short circuit proof in 3-phase balanced systems since they only divert residual currents.
  In accordance with the information on page 37 and 38 the cross section of the earth cable may be smaller than the one of the main phase leads.

- Connections on earthing and short circuiting devices are either compressed or bolted.
  Welding or soldering is no longer applied due to the possibility of hardening of the conductor wires.

- Uninsulated leads for 3-phase earthing and short circuiting devices must not be used, due to the danger of sintering if the leads are contacting parts of the switchgear in the case of a short circuit, due to electro dynamic forces.
  Leads are insulated with PVC, which has been found is the best compromise for cost and durability. Leads with Hypalon insulation are more flexible at low temperatures but they tend to fracture when hitting parts of metal framework. Furthermore they do not allow visual inspection of the copper wires due to the colouring.

- The length of cable between two connections must not be less than 1.2 times the distance between the two connections. Excessively long short circuit cable will cause unnecessary movements and unadmissibly high voltages. The dynamic force generated in case of a short circuit is considerable and must be taken into account.

- When connecting short circuiting devices with cables in parallel the following conditions must be fulfilled:

  1. Cables must be of identical length,
  2. Identical lead type (cross-section, stranding, material)
  3. Identical connection parts and pieces,
  4. Any devices inserted must be close to each other, leads in parallel,
  5. Loading capacity per lead must be reduced to 75% in the case of uncertainty as to current sharing.

Current rating and determination of cross-section

(to **DIN VDE 0683 part 1**: 1988 - 03)

The current rating of the short circuit cables and bars depends on the material, the cross-section A, and the short circuit time T_k .

Earthing and short circuiting devices must have a current rating according to the data in the following diagrams.

Depending on the material, short circuiting bars must meet the current rating according to the diagrams in figs. 4 and 5.

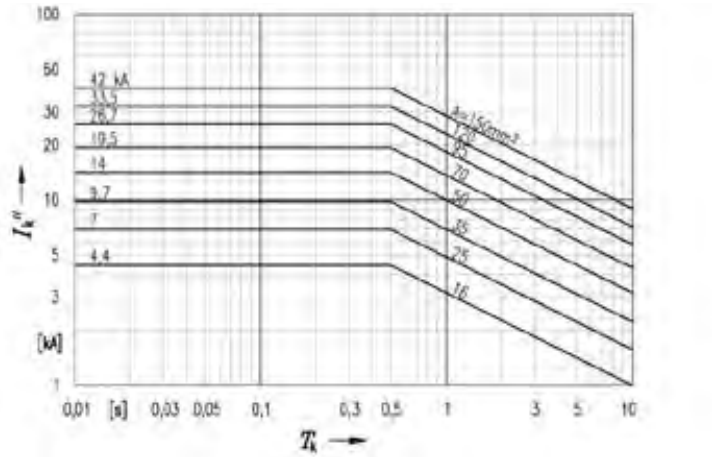
The formulae for calculation of minimum cross-sections A in sqmm are including each a numerical value (4.1/5.07/5.54/8.62), the maximum initial short circuit alternating current I_k" in kA and the short circuit time T_k in seconds.
The indicated rating allows for temperature reducing influences, and refers to lead end temperatures of 250°C or 400°C for devices for railway earthing.

In all calculation formulae the reference short circuit current is the initial short circuit alternating current I_k" which equals the sustained short circuit current I_k" resp. the disconnection alternating current I_a.
This complies with the most critical case, when the short circuit is most remote from the generator.
It is not permissible to reduce the minimum times T_k for the thermical rating of the leads or busbars stated in the tables as the dynamic effect of the instantaneous short circuit current must be considered. For this reason the curved shape in the diagrams for lower values is limited by horizontal lines.

The family of curves in the current load capacity diagrams is based on an initial short circuit alternating current I_k" in case of a short circuit most remote from the generator (κ =1.8).

The highest peak value of the instantaneous current I_s is calculated as follows:

$$I_s'' = \kappa \cdot \sqrt{2} \cdot I_k'' = 2{,}54 \cdot I_k''$$



Initial cable temperature: 20°C
Cable end temperature: 250°C

$$A = 5{,}07 \cdot I_k'' \cdot \sqrt{T_k}$$

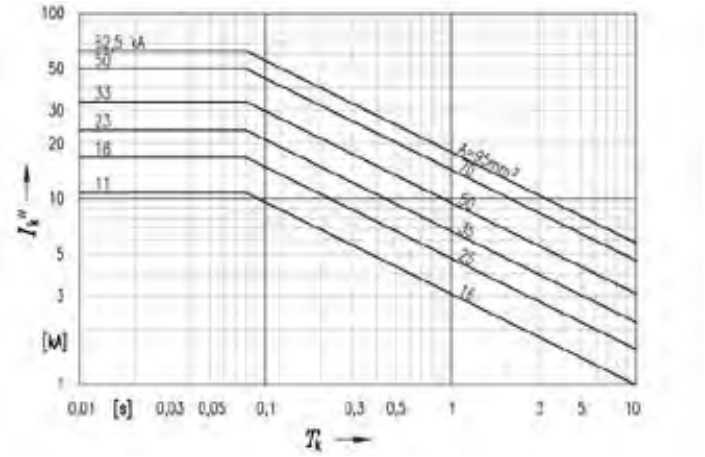
for

$$T_k \geq 0{,}5\,s$$

Explanation:

A : Cable cross section sqmm
I_k'' : Max.init.short circ.altern. current in kA (to **DIN VDE 0102 part 1**)
T_k : Short circuit time in seconds.

Fig. 1: Admissible current carrying capacity of short circuit cables made of Cu for use in installations with alternating and 3-phase current



Initial cable temperature: 20°C
Cable end temperature: 250°C

$$A = 5{,}07 \cdot I_k'' \cdot \sqrt{T_k}$$

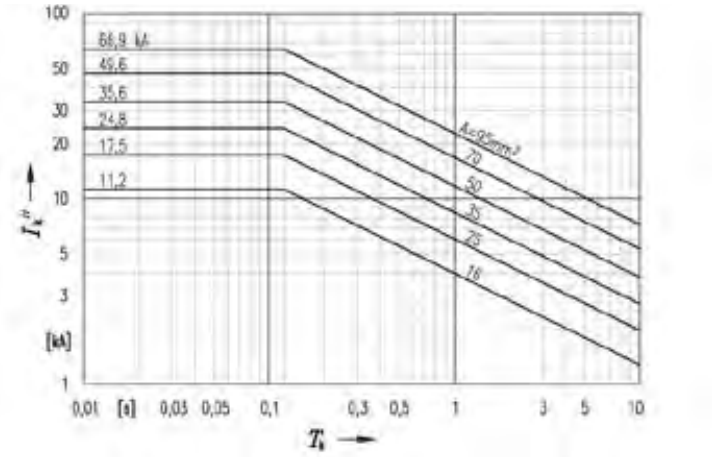
for

$$T_k \geq 0{,}08s$$

Explanation:

A : Cable cross section sqmm
I_k'' : Max.short circuit current in d.c.installations in kA
T_k : Short circuit time in seconds.

Fig. 2: Admissible current carrying capacity of short circuit cables made of Cu for use in d.c.installations



Initial cable temperature: 20°C
Cable end temperature: 400°C

$$A = 4{,}1 \cdot I_k'' \cdot \sqrt{T_k}$$

for

$$T_k \geq 0{,}12\,s$$

Explanation:

A : Cable cross section in sqmm
I_k'' : Max. initial short circuit a.c. current in kA (to **DIN VDE 0102 part 1**)
T_k : Short circuit time in seconds.

Fig. 3: Admissible current carrying capacity of short circuit cables made of Cu for use on overhead contact wires on electric railways

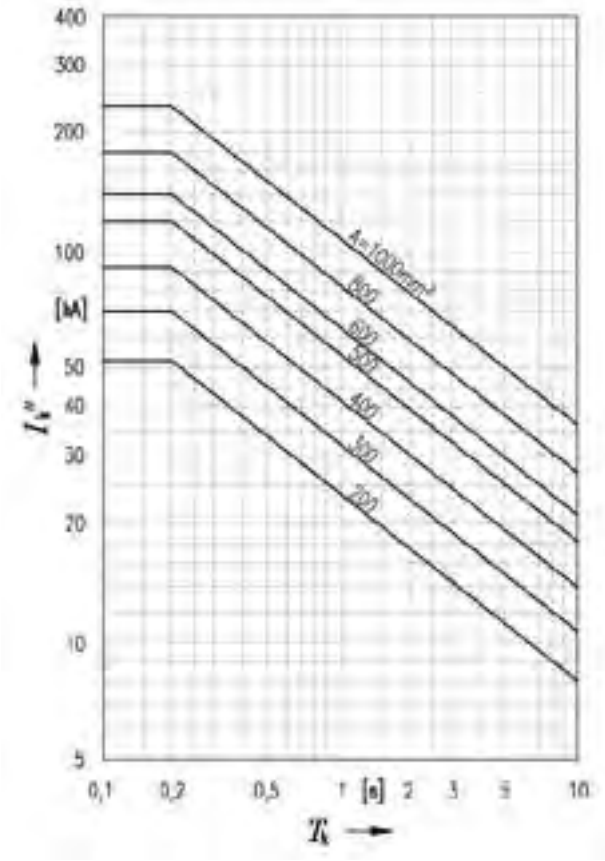


Fig. 4: Admissible current carrying capacity of short circuit bars made of pure aluminium E-Al F10

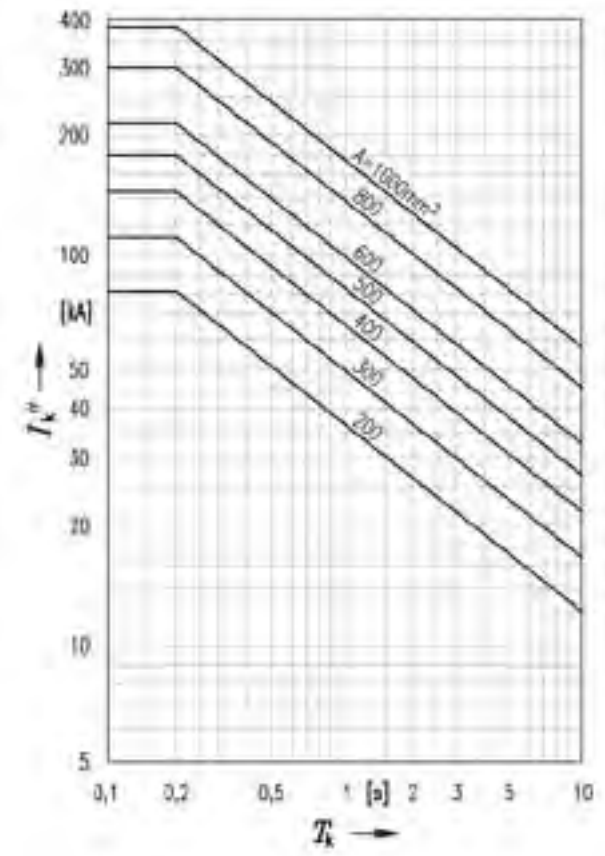


Fig. 5: Admissible current carrying capacity of short circuit bars made of electrolytic copper E-Cu 57 F20

Pure Aluminium E-Al F10

Initial temperature: 20°C
End temperature: 250°C

$$A = 8{,}62 \cdot I_k'' \cdot \sqrt{T_k}$$

for

$$T_k \geq 0{,}2\,s$$

Cross section of copper cable	Rated current (A) and rated time to EN 61230 VDE 0683, part 100			
sqmm	3s	2s	1s	0.5s
16	1850	2200	3200	4500
25	2800	3500	4900	7000
35	4000	4900	6900	10000
50	5700	7000	9900	14000
70	8000	9800	13800	19500
95	10800	13200	18700	26500
120	13700	16700	23700	33500
150	17000	20900	29600	42000

Electrolytic Copper E-Cu 57 F20

Initial temperature: 20°C
End temperature: 250°C

$$A = 5{,}54 \cdot I_k'' \cdot \sqrt{T_k}$$

Explanation:

A : Cable cross section in sqmm
I_k'': Max. initial short circuit a.c. current in (to **DIN VDE 0102 part 1**)
T_k : Short circuit time in seconds.

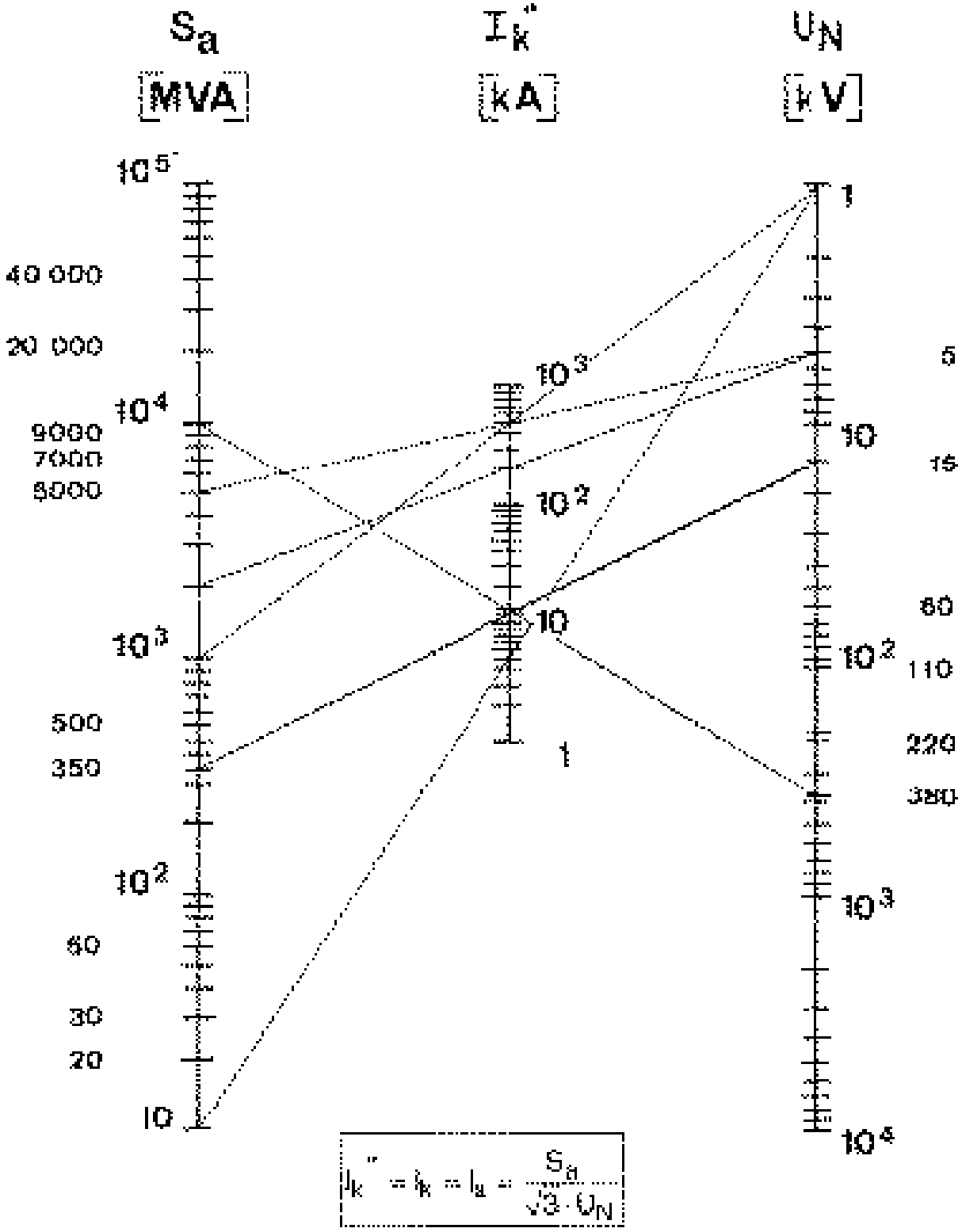


Fig. 6: Determination table short circuit current I_k'' of the mains breaking capacity S_a

Rated current I_r and rated time t_r

Each part of an earthing and short circuiting device which has to withstand a short circuit current is marked with the respective values I_r and t_r. These values state the highest effective value of the current and the highest Joule-integral ($I_r^2 \cdot t_r$)
The rated current I_r corresponds to the current I_k" in case of short circuits remote from the generator under observance of the d.c. aperiodic component (n = 2.5").

With total break times of ≥1s I_k" is approx. equal to I_r whilst with very low break times, e.g. 0.1 s, the additional heating of the earthing and short circuiting device by the d.c.component contained in I_k" has to be considered.

The rated times are standardized with 3s, 2s, 1s, 0.5s, 0.25s and 0.1s.*)

The rated current is stated as effective value in kA for one of these standardized times (p.e.:14 kA/0.5s).

Earthing and short circuiting devices must be loaded neither with higher currents than the rated current I_r nor with higher Joule-integrals than $I_r^2 \cdot t_r$.

The conversion of the electrical values must only be executed equivalent to the Joule rating at higher total break times.

European standard EN 61230 abandons the determination of temperature limits as per the cable end temperatures of 250°C or 400°C stated in the former DIN VDE 0683 part 1.

Consequently, short circuit cables can be exposed to higher loads resulting from an increased Joule-integral $I^2 \cdot t$.
Short circuit tests have confirmed this only within certain limits.An earthing and short circuiting device with a cable cross section of 70 sqmm according to its max. current carrying capacity to the old standard DIN VDE 0683 part 1, also in future will not be manufactured with a cross section of 50 sqmm.

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*) Conversion table on page 11

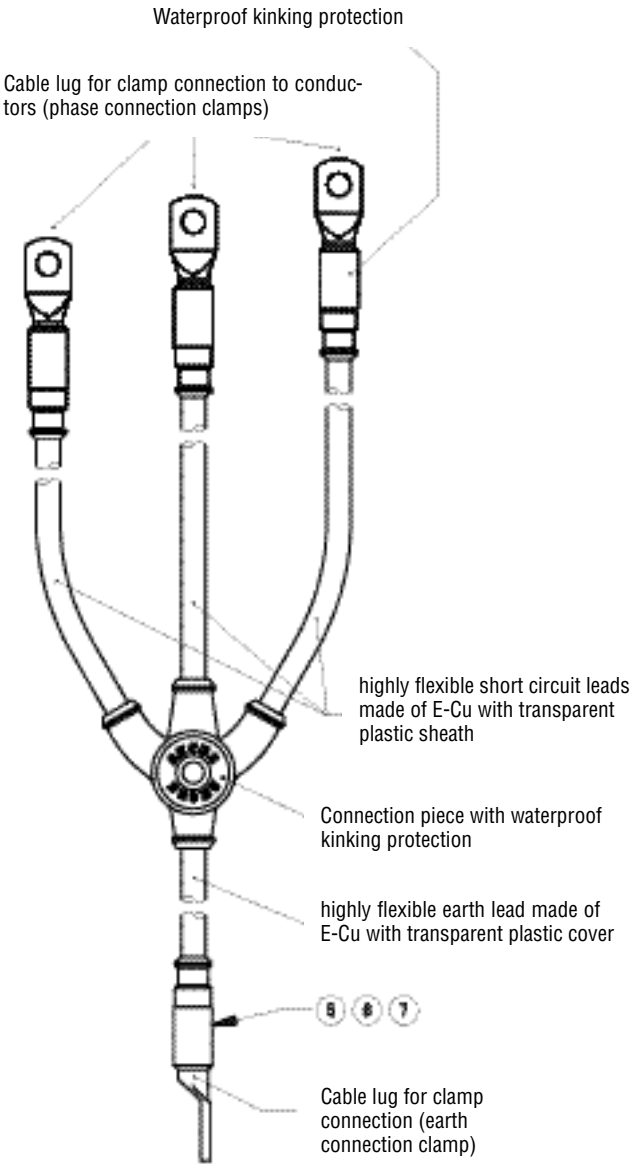


Fig. 1

Construction

All earthing and short circuiting devices are assembled from highly flexible copper leads with a transparent plastic insulation.

Connection pieces are compressed and aditionally bolted.

Joints from the connection piece or cable lug to the cable insulation are enclosed by a stabilized tenacious elastic and transparent sleeve.

This mechanical kinking protection guarantees reliable sealing against moisture ingress.

Transparent insulation of the copper cables allows permanent visual inspection. Any damaged strands are recognized immediately.

In order to protect the cable lugs against torsion and to reduce the dynamic forces in case of a short circuit, each cable lug sleeve is equipped with a shear pin.

Finally the light-weight construction of the connection piece (reduction of the accelerated mass during a short circuit) together with the soft kinking protection offers an improved protection for persons and installation.

All leads are processed under observation of the required pulling strength values to DIN EN 61230 part 100: 1996-11.

The devices are rated for a temperature range of -25°C up to +70°C. This corresponds to the usual usage to DIN EN 61230 part 100 as well as the category W.

Cable flexibility is slightly reduced at low temperatures.

Marking of the cables

according to **DIN VDE 0683 part 1: 1988 -03:**

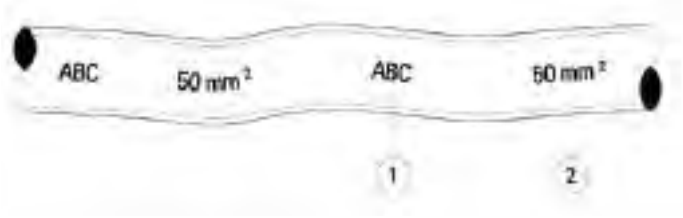


Fig.1

according to **DIN EN 61230 part 100: 1996-11:**

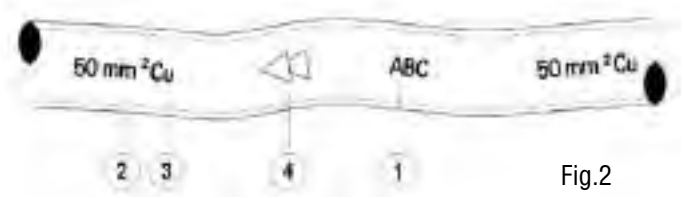


Fig.2

Marking of the earthing and shor t circuiting device

① Name and code of the cable manufacturer

② [1] Cross section in sqmm

③ [1] Conductor material

④ [1] Double triangle

⑤ Name or trademark of the manufacturer of the device (see page 14, Fig. 1)

⑥ Year of production of the device (see page 14, Fig. 1)

⑦ Type of device (see page 14, Fig. 1)

[1] to **DIN EN 61230 part 100: 1996-11** printing at intervals of approx. 1 m

Copper leads to EN 61230 used in the assembly of earthing and short circuiting devices

Type no. [1]	Cross section [sqmm]	Cond.resist. [Ω/km]	Strands	Cable diameter [mm]	Insulation thickness [mm]	Outer diameter [mm]
505 040	16	1,160	525	5,7 ± 0,2	1,3	8,4 ± 0,2
505 041	25	0,758	800	7,1 ± 0,2	1,3	9,8 ± 0,2
505 042	35	0,536	1120	8,6 ± 0,2	1,4	11,4 ± 0,3
505 043	50	0,379	1615	10,1 ± 0,3	1,8	13,8 ± 0,3
505 044	70	0,268	2250	12,2 ± 0,3	1,8	15,8 ± 0,4
505 045	95	0,198	3085	14,2 ± 0,3	2,0	18,2 ± 0,4
505 046	120	0,155	3820	16,0 ± 0,4	2,0	20,1 ± 0,5
505 047	150	0,125	4800	18,0 ± 0,4	2,0	22,0 ± 0,5

[1] Please state required length, when sending cables for repair.

Notes on application:

The plug-in blades are fitted with leashes for connection to DIN fuse grips or in covers for DIN-fuse holders and sockets. The metal contact of the blade must only be short circuited with disconnected spring contacts of fuse holders which have been tested for the absence of voltage.

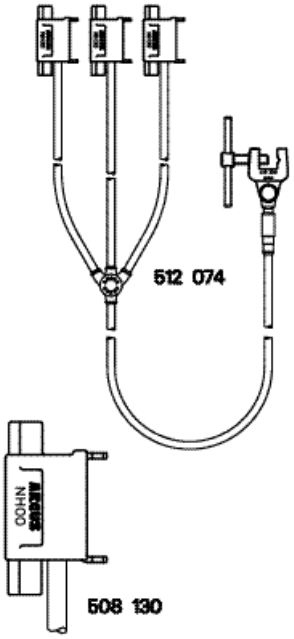


Fig. 1

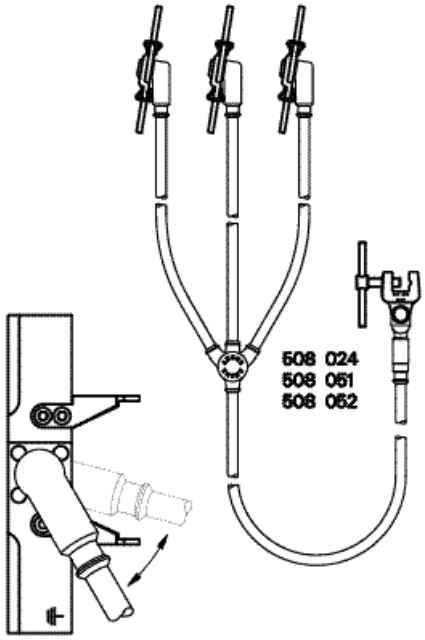


Fig. 2

Construction features:

Plug-in blade type 508 130 (red polyamide) with fixed cable connection.

Plug-in blade with fixed swivel cable connection, one half made of plastic material.

Short circuiting parts made of copper alloy tin -plated,
T-shaped parts for handle made of galvanized steel,
short circuiting cables graded to their lengths of 320, 520 and 720 mm,
earth cable 1200 mm long,
cables made of highly flexible copper cable with transparent insulation,
connection piece compressed, bolted and equipped with a moulded,
transparent and waterproof protection cover,
with earth connection clamp type 502 016 or as required *).

Type no.	fuse holder size HRC	Cable cross sect. sqmm	Ir / tr kA/s	Weight each appr. kgs
512 074	00	16	4.5 / 0.5	1.1
508 024	0-3	25	7.0 / 0.5	2.2
508 051	0-3	35	10 / 0.5	2.5
508 052	0-3	50	14 / 0.5	3.0

*) see page 39,42

3-phase earthing and short circuiting device

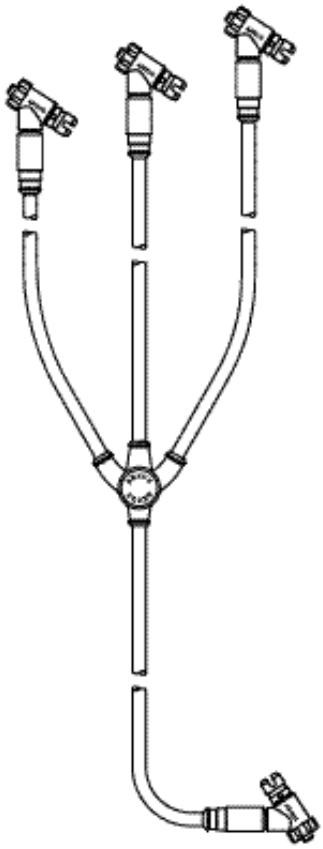


Fig. 1

Cables made of highly flexible copper leads, cross section 35 sqmm, with PVC-insulation.

Connection piece compressed, bolted and equipped with a moulded, transparent and waterproof protection cover.

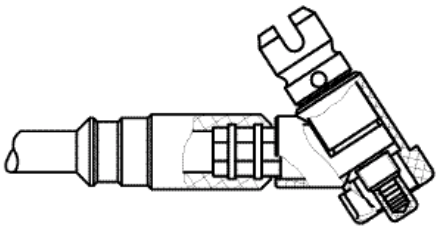
Fully insulated screw-in connection couplings to be fixed with the handle described on page 18.

Short circuiting cables supplied in lengths:
320 / 520 / 720 mm

Length of the earthing cable: 1000 mm.

Rated current and time (I_r / t_r): 10 kA / 0.5 s.

Type no. 512 257



Fully insulated connection coupling **Fig. 2**

Plug-in blades for DIN-fuse holders to DIN 43620

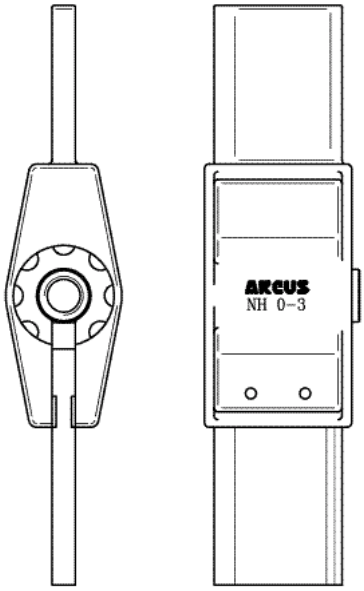


Fig. 3

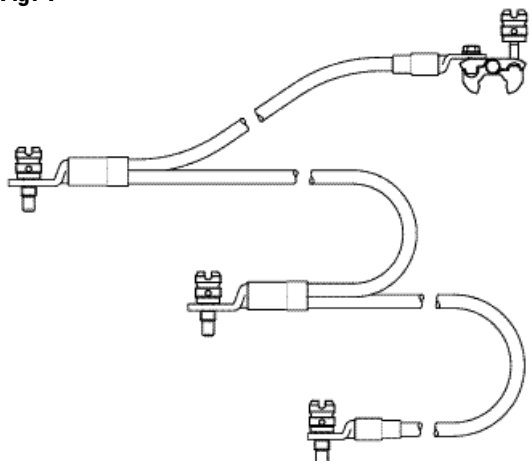
Plug-in blades made of red plastic material, metal part with threaded hole for torsion-safe connection to fully-insulated connection coupling, fitted using the earthing handle (see page 18).

Sizes of plug-in blades	
Type no.	**for HRC holder**
508 141[1)]	00
508 142	0-3
508 143	4a

[1)] Also suitable for earthing and short circuiting device for service boxes, type 512 258.

Earthing and short circuiting device for service boxes

Fig. 1



Type no.: 512 258

Cables made of highly flexible copper lead cross section 25 sqmm, with transparent PVC insulation.
Graded lengths of the cables 180 / 180 / 260 mm.
With partially insulated couplings for connection to plug-in blades
DIN 00 or threaded fuse-links E27 and E33 with earthing handle type 508 145.

The earth connection clamp type 502 067 is suitable for

flat conductors	from 9 to 18 mm,
round conductors	up to 18 mm diameter,
hexagon	SW17 and SW19 (M10, M12).

Rated current and time (I_r / t_r): 7 kA / 0.5s.

Earthing handle

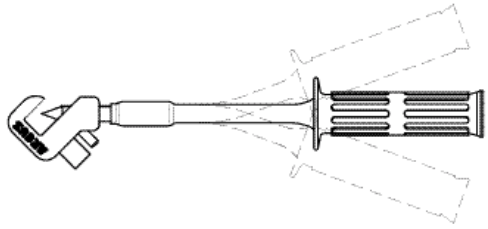
Fig. 2

Type no.: 508 145

Earthing handle, one end is used to insert the plug-in blades and on the other end to fix the earthing and short circuiting devices types 512 257 and 512 258.

Earth connection clamp for e. and s.-c. device type 512 257

Fig. 3



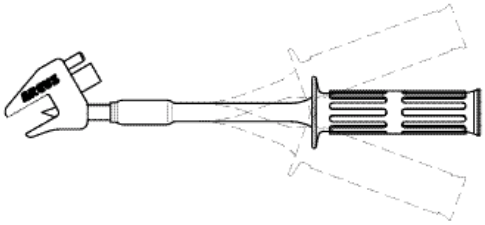
Type no.: 502 064

Insulated earth connection clamp with flexible handle for screwing onto flat bars (width 3-6 mm), to be clamped from below.

The flexible handle allows connections to be made when depth is limited.

Earth connection clamp for e. and s.-c. device type 512 257

Fig. 4



Type no.: 502 065

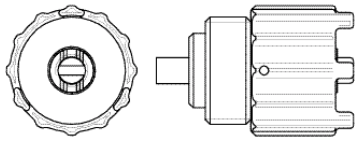
This earth connection clamp is similar to type 502 064. The clamping head is suitable for clamping onto PEN-bars (width 3-8mm) from the top side.

UNIVERSAL EARTHING AND SHORT CIRCUITING DEVICE

for distribution boards DIN and DIAZED fuse holders size 00 up to 0-4a, insulated systems and cable conductor ends

Threaded fuse-links for "DIAZED" elements for e. and s.-c. devices types 512257 and 512 258 fitted with earthing handle type 508 145

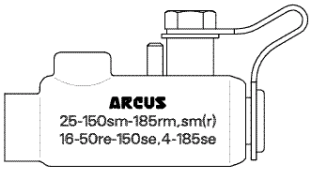
Fig. 1



Threaded fuse-link		with	
Type no.	Size	Pin earth	Ring earth
597 064	E27	X	
597 066	E27		X
597 063	E33	X	
597 065	E33		X

Cable end sleeve for e. and s.-c. device type 512 257 with earthing handle 508 145

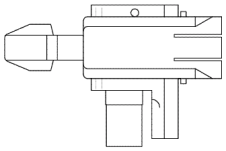
Fig. 2



Type no.: 508 147
insulated, suitable for cable cores
25-150 sect. stranded, -185 rd. str., sect.str.(rounded)
16-50 rd.sol. - 150 sect.sol., 4x185 sect.sol.
Application e.g. to earth disconnected cable loops.
Suitable T-box wrench SW6 (not shown).

Connection element for KKV for e. and s.-c. device type 512 257 with earthing handle type 508 145

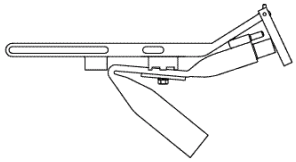
Fig. 3



Type no.: 508 144
Connection piece for plug-type cable distribution systems Jean Müller or equivalent.

Earth insert for e. and s.-c. device type 512 257 and earthing handle 508 145

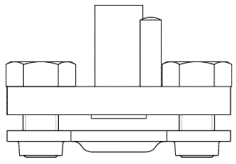
Fig. 4



Type no.: 508 148 (400 A), 508 149 (630 A)
Earth inserts for connecting blocks brand Driescher, system 403 for 400 A and 630 A with threaded connection for fully insulated couplings.

Earth connector with connection leash for additional stationar y installation in cable distribution boxes

Fig. 5

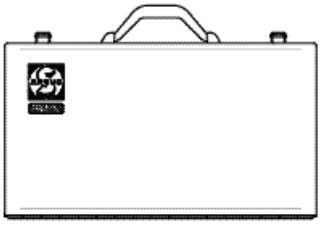


Type no.: 515 228
Earth connector tin plated, distorsion-safe, on galvanized steel connection grip with 2 mounting bolts M10.

Other connectors available on request!

Carrying & storage case

Fig. 6



(615 060)

Manufactured from steel plate, tough red varnish, with separations for earthing handle, e.and s.-c.device, plug-in blades, etc.

Type no.	Dimensions		
	W	H	D
615 053	440	330	130
615 059	390	245	110
615 060	450	250	190

Current tapping blades for DIN fuse holders size 00 to DIN 43 620

Fig. 1

Plug-in blade type 508 130 (page 16) is equipped with rubber-sheathed cable (length appr.200 mm, cross-section = 16 sqmm). The fully insulated and protected housing accepts threaded fuses up to 63 A max.

Conductor connection with separated clamping of the insulation, cross-section 10-25 sqmm, 4 x 35 sqmm, one-polar.

Weight: appr. 0.2 kgs
Type no.: 517 022

Plug-in cartridge for DIN fuse holders size 0-3 to DIN 43 620

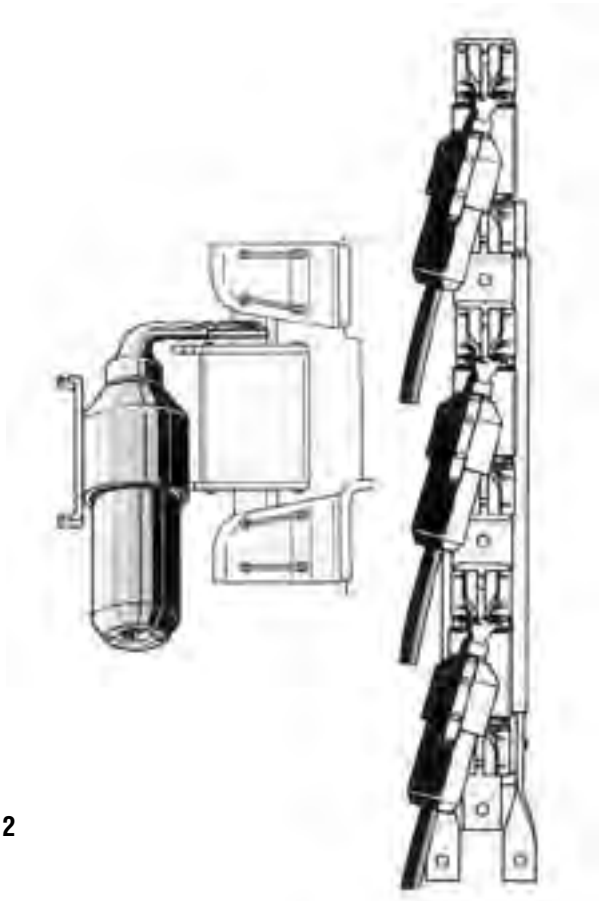


Fig. 2

The plug-in cartridge consists of a fully insulated housing for a threaded fuse up to max. 63 A and an angular expanding contact with external spring. The cartridge is inserted to an operating DIN fuse by means of a commercially available DIN handle.

Conductor connection with separate clamping of the insulation, cross-section 10-25 sqmm, 4 x 35 sqmm, single pole.

Weight: appr. 0.3 kgs
Type no.: 517 006
517 044 for DIN connection blocks

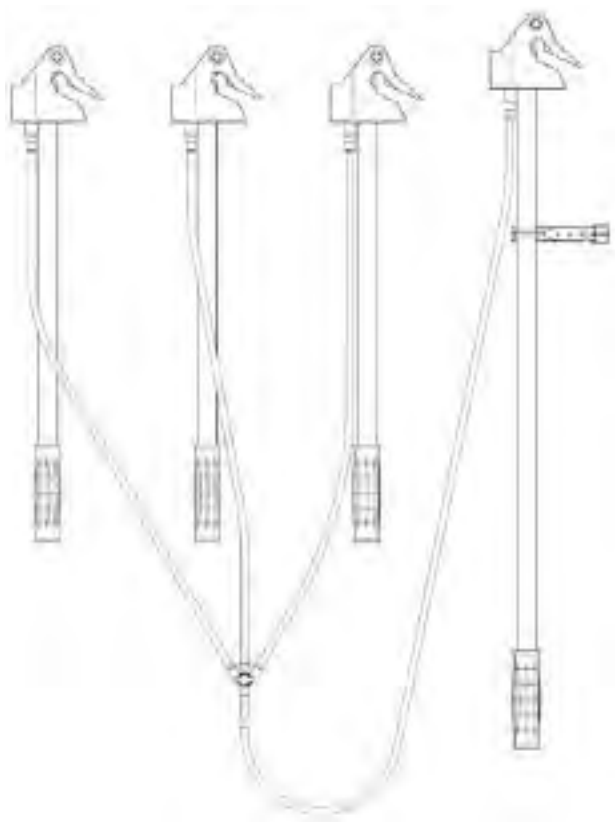


Fig. 1: 512 210

Application:

Urban networks with neutral conductor at top or bottom.

Suitable for Aluminium or Copper conductors,
3-14 mm dia.,
(6 sq.mm round solid to 120 sq.mm round stranded).

Rated current and time (I_r / t_r):
4.5 kA / 0.5 s.

Construction features:

Contact parts are totally insulated.

Permanent and firm contact provided by the spring mechanism.

Operating rods and covers made of impact-resistant plastic material.

Short circuiting rod type 508 117, length 600 mm
Short circuiting rod type 508 119, length 900 mm

Short circuiting rod with LED glow lamp type 508 120 upon request.

Short circuiting and earthing cables made of highly flexible copper lead 16 sqmm, with waterproof and transparent cover, length 600 mm.

Connection piece and kinking proctection made of transparent and waterproof plastic material.

Type no.	Connection rod per device appr. kgs	Weight
512 210	3 x 508 117 1 x 508 119	2.7
512 212	4 x 508 117	2.5

Short Circuiting Devices

with rods and spring-type clamps for low voltage overhead lines

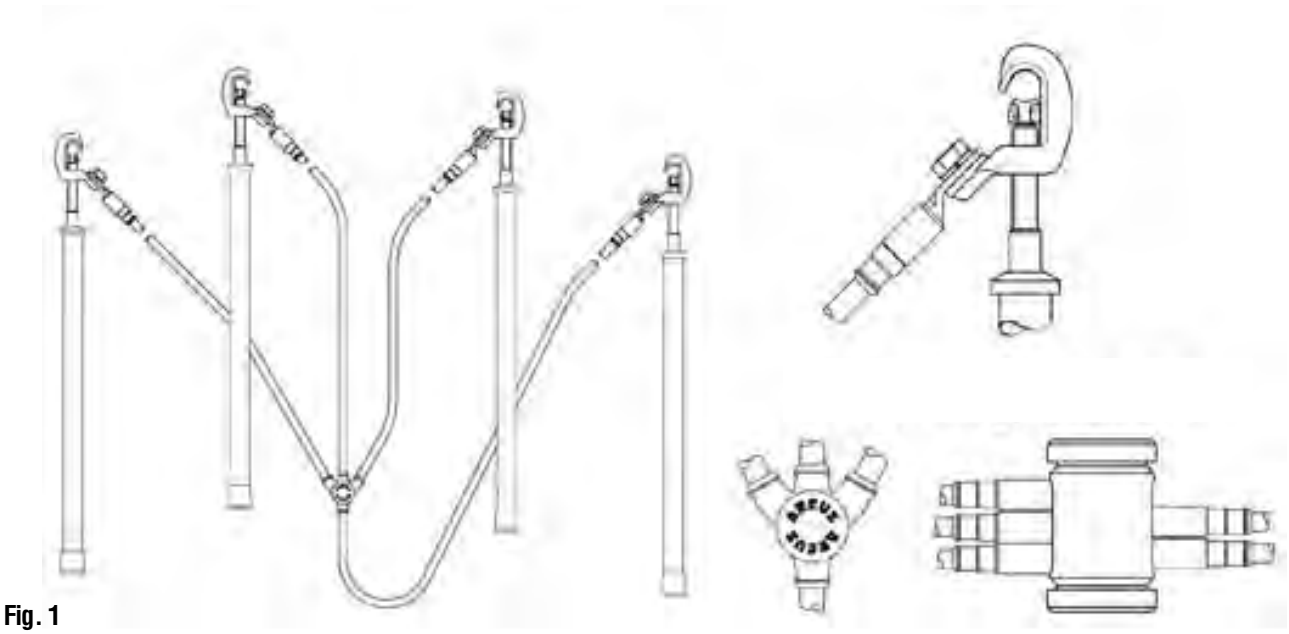


Fig. 1

Application:

Urban networks with neutral conductor at top or bottom.
Suitable for Aluminium or Copper conductors, 3-14 mm dia. (6 sq.mm round solid to 120 sq.mm round stranded).
Earthing and short circuiting cables 25 sqmm *)length 600 mm, made of copper, highly flexible and with a transparent cover.

Rated current and time (I_r / t_r): 7 kA / 0.5 s.

Construction features:

Connection rods with screw-type clamps made of tin-plated heavy duty copper alloy, type 507 050.
Clamping surfaces with transverse and longitudinal grooves for removal of foreign and oxide layers on the conductor.

Connection rods made of impact-proof PVC.
Devices 512 103 - 512 105 are equipped with connection rods type 507 032 (length 500 mm).
For urban networks with neutral conductor on the top side a connection rod type 507 033 with a length of 900 mm is available.

Type no.	No.of conn.rods	Length of conn.rods	Weight per device appr. kgs
512 103	4	4 x 500	3.2
512 104	5	5 x 500	4.0
512 105	6	6 x 500	4.7
512 106	4	1 x 900 + 3 x 500	3.4
512 107	5	1 x 900 + 4 x 500	4.2
512 108	6	1 x 900 + 5 x 500	4.9

*) Upon request also available with short circuiting cables 16, 35, 50 and 70 sqmm

Notes on application:

These rods can be installed on live lines to provide long-term power supply to building sites, etc.
The outgoing cables are to be attached to the pole so as to reduce vertical stress. For this purpose we recommend the use of the strain-relief bracket type 517 036 shown on page 24.

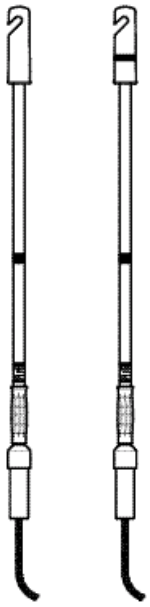


Fig. 1 **517 035 517 043**

517 042

517 035
517 041
517 043

Fig. 2

Application:

Aluminium and copper conductors 5-15 mm diameter (16 sq.mm round solid to 120 sq.mm round stranded).

Single phase current-tapping connections for rubber-sheathed cables H07RN-F (resp. AD7RN-F) to DIN VDE 0282 part 810 with cross-sections 10 to 25 sqmm, 4 x 35 sqmm.

Types 517 035, 517 043 and 517 041 for:
separately fused worksite distribution boards with max. 100 A and neutral conductor connections.

Type 517 042 for:
worksite distribution boards without fuse protection for max. 63 kA threaded fuses.

Construction features:

Contact-proof construction with a 1 m long insulated rod for safe attachment to lines.

Clamp made of tin-plated aluminium alloy.
Connection of the rubber-sheathed cables with separate clamping of conductor and insulation.

Threaded fuse and cable conductor socket are situated in a threaded housing to protection type IP54.

Type no.	for use to	colour marking	max. current (A)	for threaded fuses	Weight per rod in kgs
517 042	phase volt.	black	63	up to 63 A	1.2
517 035	phase volt.	black	100		
517 043	neutral	yellow/green	100		
517 041	neutral	blue	100		

STRAIN RELIEF SLEEVE

for various connections
to low voltage overhead lines

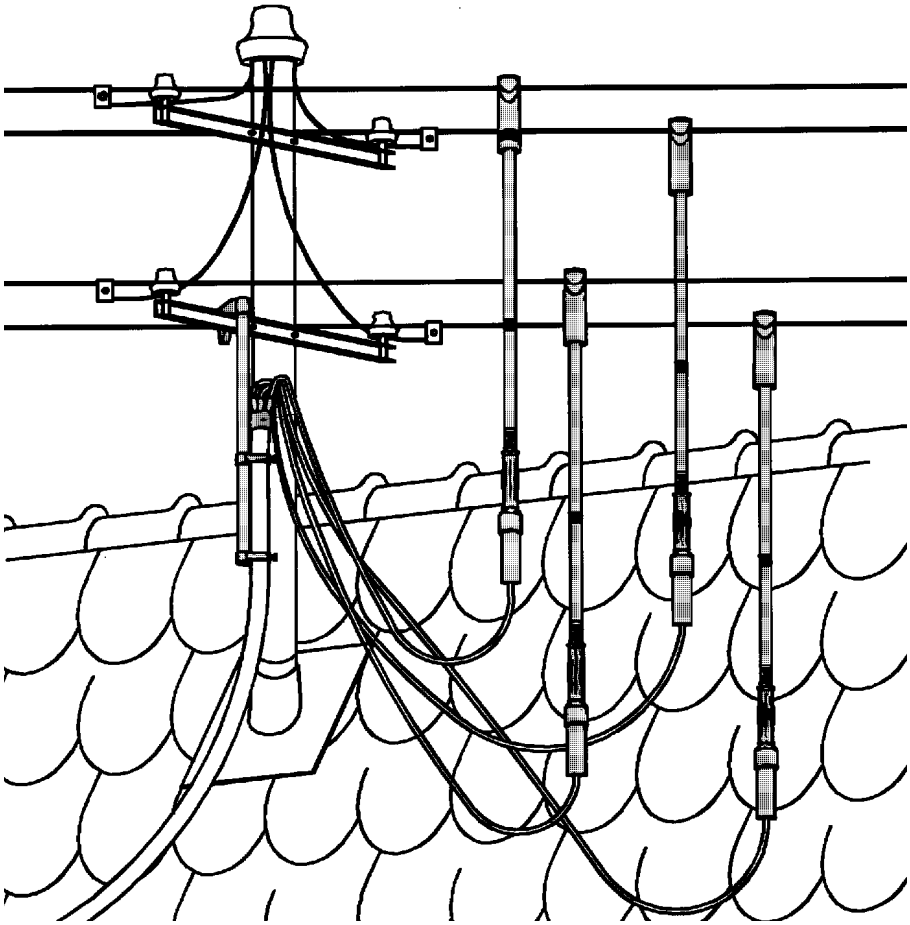


Fig. 1

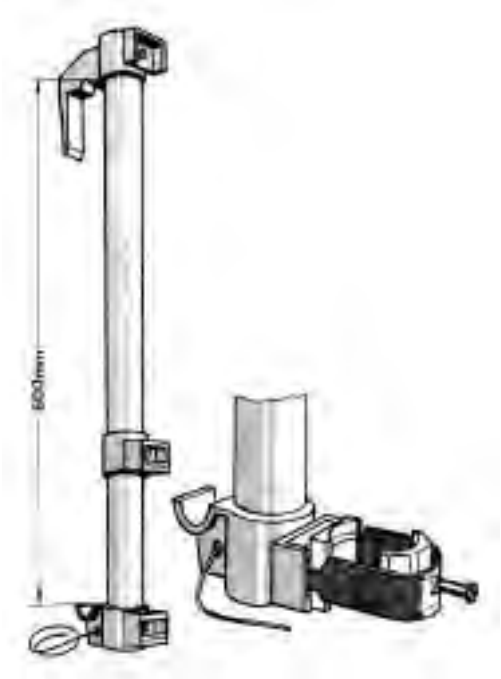


Fig. 2

Fully insulated construction made of plastic material resistant to ultraviolet light, equipped with 2 clamps made of galvanized steel for cables up to 42 mm.

The strain relief sleeve can be attached as illustrated or suspended from a hook.

Fixing can be reinforced at the mast with a nylon cord.

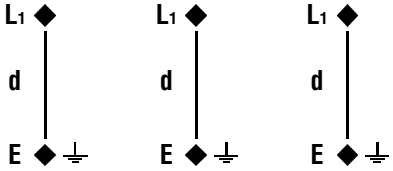
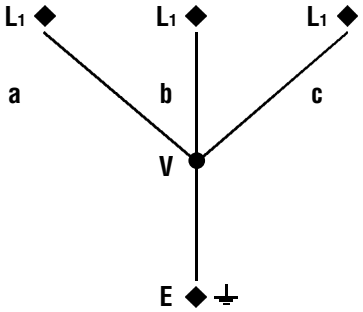
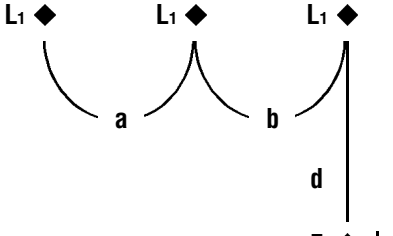
Tensile strength max. 1000 N

Weight appr. 0.75 kgs
Type no. 517 036

EARTHING AND SHORT CIRCUITING DEVICES WITH CABLES

Ordering information

Apart from the standard devices in the catalogue we supply devices for medium and high voltage installations made up to the customer's specification.

Components used in the device	Selection of parts assembly according to page	Data required	Example for order
Single phase e. and s.-c. **devices mainly for high voltage installations**			
	Page 43, 46, 47	Phase clamp no. ...	L_{1-3} = 507 006
	Page 8-15 and 35	Cable cross section Length [1]	a = 70 sqmm d = 5000 mm
	Page 39-43	Earth clamps no. ...	⏚ E = 502 019
Three-phase e. and s.-c. devices with connection piece **for indoor and outdoor medium voltage switchgear**			
	Page 43, 46, 47	Phase clamp no. ...	L_{1-3} = 507 006
	Page 8-15	Cable cross section Length [1]	a,b,c = 70 sqmm a,b,c = 800 mm
	Page 36-38	Connection piece no.	V = 504 162
	Page 8-15	Lead cross section Length [1]	d = 70 sqmm d = 2500 mm
	page 39-43	Earth clamp no. ...	⏚ E = 502 019
Three-phase e. and s.-c. devices without connection piece **mainly for indoor medium voltage switchgear**			
	Page 43, 46, 47	Phase clamp no. ...	L_{1-3} = 507 006
	Page 8-15 and 35	Cable cross section Length [1]	a,b = 120 sqmm a,b = 650 mm
	Page 8-15 and 35	Cable cross section Length [1]	d = 120 sqmm d = 3000 mm
	Page 39-43	Earth clamp no. ...	⏚ E = 502 019

1) The length of the lead must be determined according to the information on page 9.

In the order please also state the rated cur rent I_r (kA) and the rated time t_r (s).
Order example :

3 pieces of single phase e.and s.-c.device

L_{1-3} = 507 006
a = 70 sqmm
d = 5000 mm
E = 515 044

1 piece of three-phase e.and s.-c. device with connection piece

L_{1-3} = 507 003
a,b,c = 70 sqmm
a,b,c = 800 mm
V = 504 162
d = 70 sqmm
d = 2500 mm
E = 502 019

Apart from those devices assembled from single parts also the standard devices on pages 26,28,29 and 30 can be adapted to different requirements such as length of cable or clamps.

Application: Intended for outdoor medium voltage installations

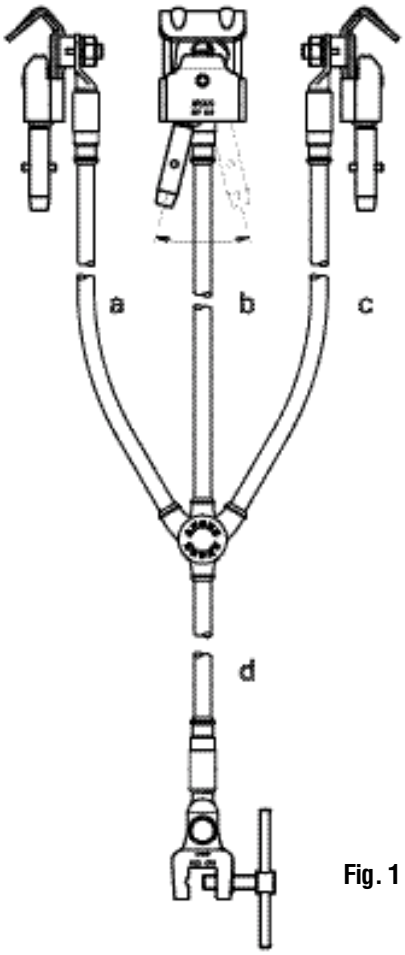


Fig. 1

This device is equipped with the well-proven phase clamps made of tin-plated copper alloy with large contact surfaces, type 507 003.
The swivel bayonet spindle is a particular advantage when mounting the clamp from an angular position.

Clamping range: Line 16 - 240 sqmm
round 4.5 - 20 mm
flat up to 20 mm,

aluminium and copper conductors.

The connection pieces are compressed, bolted and moulded with a transparent and waterproof protection cover.

The earth connection is made by means of a strap-type earth clamp type 502 016 made of high-quality copper alloy with a hand screw of galvanized steel.

Type no	Cable cross section	Ir /tr	Cable lengths [mm]		Weight per device
	[sqmm]	kA/s	a,b,c	d	kgs
512 148	25	7/0.5			6.5
512 149	35	10/0.5	2000	3000	7.6
512 150	50	14/0.5			8.8
512 151	70	19.5/0.5			12.2

For further details please see

Phase clamps: Page 46
Connection pieces: Page 37, 38
Earth clamps: Page 42
Earthing rods: Pages 63-66

Earth cable extensions for three-phase earthing and short-circuiting devices

(page 26)

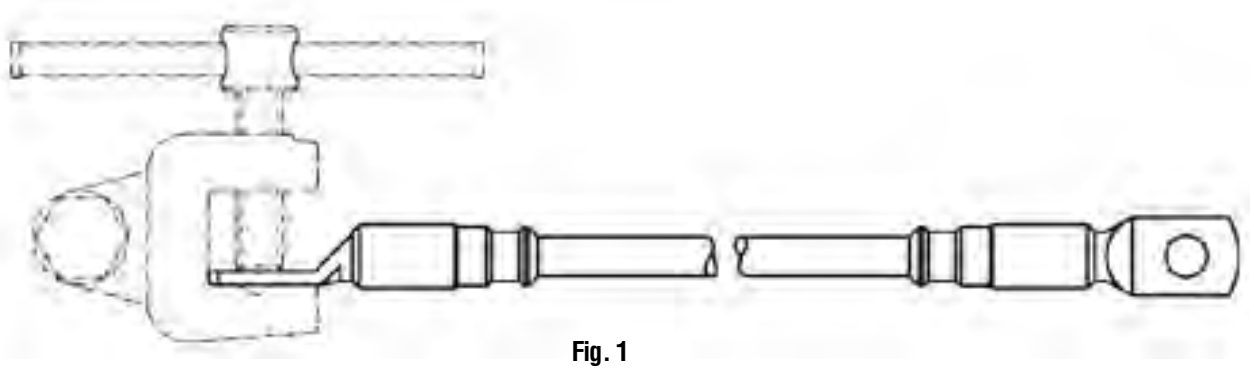


Fig. 1

Type no.	Cross sect.	Weight each appr. kgs
504 121	25	3.5
504 122	35	5.0
504 123	50	6.6

Construction:

Highly flexible copper lead with transparent insulation cover, at the earth side with compression cable lug for thread M12, on the phase side with counter-sunk cable lug which allows secure fastening to the hand screw of the earth clamp. Length of earth cable 10 m.

Earth spikes

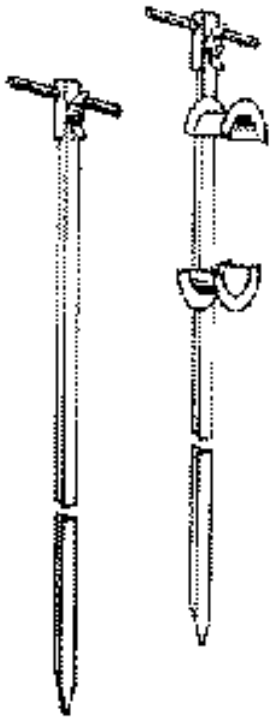


Fig. 2

Construction:

The spikes of T-iron have a solid driving head piece, cross-handle and wing screw M12 for connection to the earth cable.

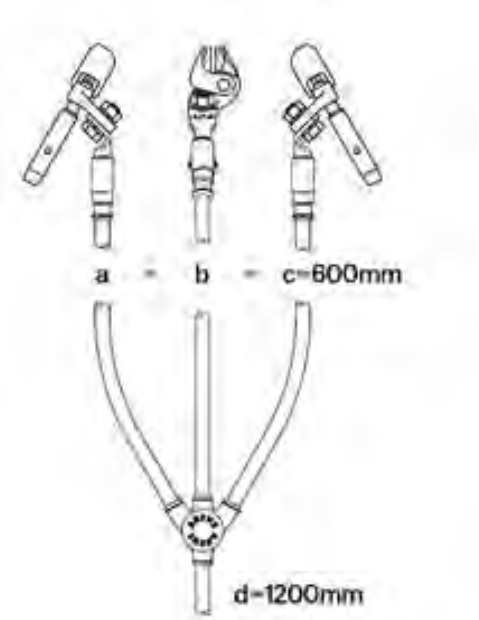
All parts are hot-dip galvanized.

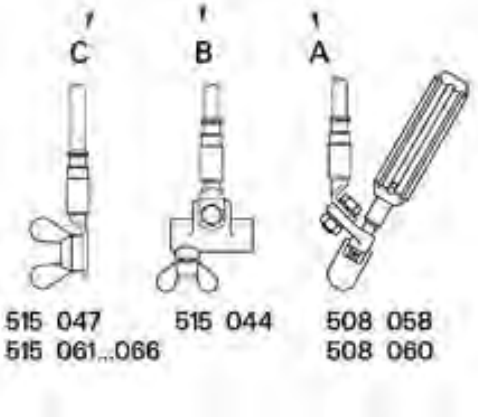
Type no.	Model	Length m	Weight each kgs
616 015	without take-up device		3.0
616 016	with take-up device for 10 m / 50 sqmm	1.3	4.0

THREE-PHASE EARTHING AND SHORT-CIRCUITING DEVICES

with spherical tongs

Application: for medium voltage switchgear





Type no.	Earth cable connection	Cable cross section [sqmm] Short circ. cable	Earth cable	I_r / t_r [kA/s]	Weight per device appr. [kgs]
Short circuiting device with spherical tong type 508 057 (∅20)					
512087	A(∅20)				1,7
512088	B	25	25	7 / 0,5	1,65
512089	C(M12)				1,45
512090	A(∅20)				1,9
512091	B	35	35	10 / 0,5	1,8
512092	C(M12)				1,6
512093	A(∅20)				2,8
512094	B	50	50	14 / 0,5	2,7
512095	C(M12)				2,5
512096	A(∅20)				3,8
512097	B	70	70	19,5 / 0,5	3,7
512111	C(M12)				3,6
512112	A(∅20)				5,1
512113	B	95	95	26,5 / 0,5	5,0
512114	C(M12)				4,9
Short circuiting device with spherical tong type 508 059 (∅25)					
512115	A(∅25)				5,4
512116	B	95	95	26,5 / 0,5	5,3
512117	C(M16)				5,2
512118	A(∅25)				7,1
512119	B	120	120	33,5 / 0,5	7,0
512120	C M16				6,9

For further details please see

Spherical tong for phase connection: Page 43
Connection pieces: Page 37,38
Earth clamps: A= page 43, B = page 41, C = page 40
Ball point connectors: pages 44, 45
Earthing rods: Pages 63-66

THREE-PHASE EARTHING AND SHORT-CIRCUITING DEVICES

with universal phase clamp

Application:

Use in medium and high voltage installations. Universal clamps are suitable for connection to flat and round conductors as well as T-bolts and ball point connectors.

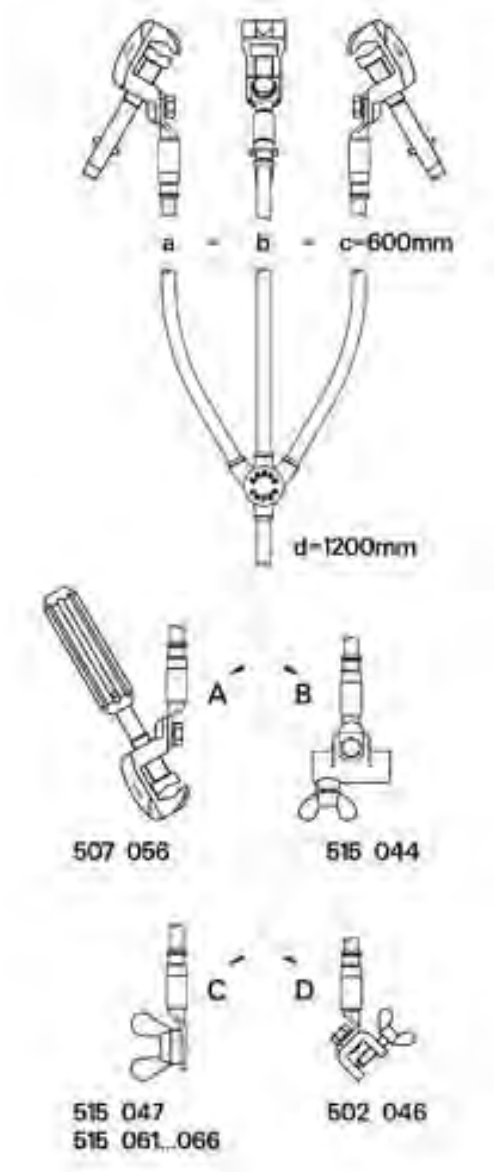


Fig. 1

Type no.	Earth connection	Cable cross section [sqmm] Short circ. cable	Earth cable	I_r / t_r kA/s	Weight per device appr. [kgs]
Device with universal clamp type 507 042 (ball ∅20)					
512156	A (∅20)				2,10
512157	B	25	25	7 / 0,5	1,80
512158	C(M12)				1,60
512159	D				1,60
512160	A (∅20)				2,50
512161	B	35	25	10 / 0,5	2,20
512162	C(M12)				2,0
512163	D				2,0
512164	A (∅20)				2,90
512165	B	50	25	14 / 0,5	2,70
512166	C(M12)				2,50
512167	D				2,50
512168	A (∅20)				3,90
512169	B	70	35	19,5 / 0,5	3,70
512170	C(M12)				3,50
512171	D				3,50
512187	A (∅20)				4,20
512 188	B	95	35	26,5 / 0,5	3,90
512189	C(M12)				3,80
512190	D				3,80
Device with universal clamp type 507 043 (ball ∅25)					
512172	A (∅25)[1]				4,80
512 173	B	95	35	26,5 / 0,5	4,50
512174	c(M12)[2]				4,40
512175	D				4,40
512176	A (∅25)[1]				5,70
512177	B	120	50	33,5 / 0,5	5,50
512178	C(M12)[2]				5,40
512179	D				5,40

[1] also available for ball point conn. 25 mm (507 057)
[2] also available for fixed points with thread M16 (515 132)

For further details please see

Universal phase clamps: Pages 46, 47
Connection pieces: Page 37,38
Earth clamps: A= page 43/47, B = page 41, C = page 40, D = page 42
Earthing rods: Pages 63-66

THREE-PHASE EARTHING AND SHORT-CIRCUITING DEVICES

with phase clamps for Top Hat contacts

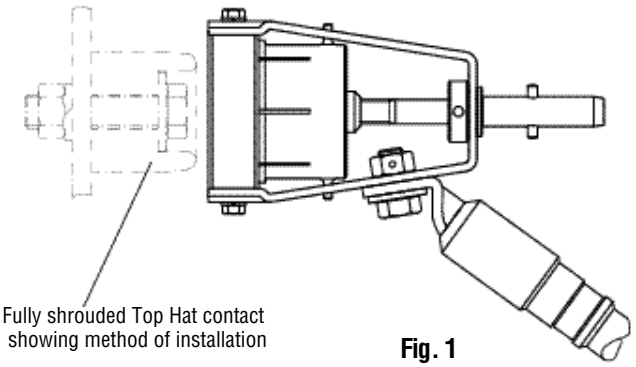


Fig. 1

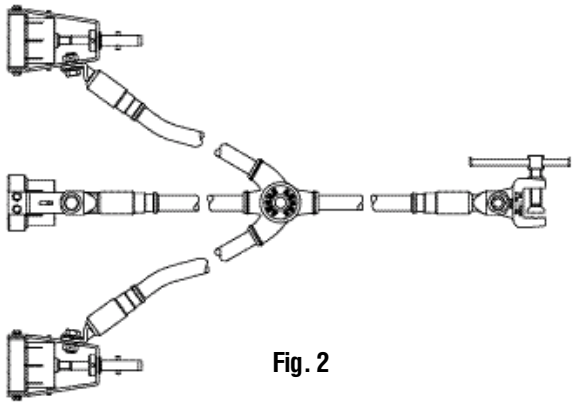


Fig. 2

Type no. 3-phase e.and s.-c. device	Phase connection clamp	Top-hat ∅ [mm]	I_r / t_r [kA/s]	Remark
512 260	**512 260 10**	60	26.0 / 1.0	Torque
512 181	**512 181 09**	45	28.0 / 1.0	
512 181 and 3x	**512 181 09 and 1x**	25	28.0 / 1.0	= 20 Nm[2)]
504 124 [1)]	**504 124** [1)]			

[1)] Reduction sleeve
[2)] Use earthing rod with cross pin, type 597 330 !

Application :
- Medium voltage switchgear with top-hat contacts
- Primary test of current transformers

Construction features:

Concentric phase clamp with slotted conical clamp sleeve and screw spindle.
Current carrying parts made of tin-plated copper alloy, mechanical parts made of galvanized steel.
3-phase device with short circuiting and earth cable cross section of 120 sqmm, short circuit cables 500 mm, earth cable 900 mm long.
Connection piece type 504 164 compressed, bolted and with transparent protection cover.

The earthing and short circuiting cables are made of highly flexible copper leads with transparent insulation. The transitions to cable lugs and connection piece are enclosed by a stabilized tenacious elastic and transparent sleeve.

For earth connection strap-type clamp type 502 022 with hand screw M16 was selected.

Earthing rod type 597 330 consists of an epoxy resin tube, glasfibre reinforced, with safety bayonet head and cross pin.
Length of the earthing rod = 1000 mm.

For further details please see:

E. and s.-c.device: Pages 7-15
Connection pieces: Page 37
Earth clamps: Page 42
Earthing rods: Pages 60, 61

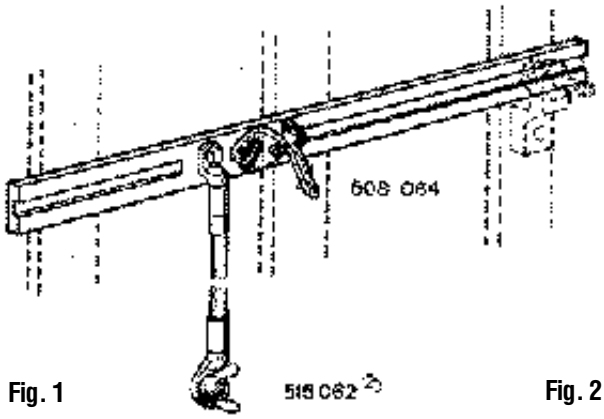


Fig. 1

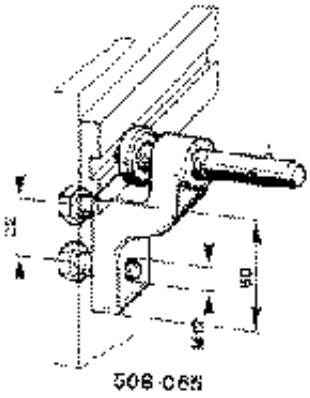


Fig. 2

In the case of extremely high short circuit currents rigid short circuiting bus bars are of advantage. They offer simple assembly, little floor space and high resistance to short circuit strength.

The bus bar is laid on the clamping pieces type 508 065 by means of an earthing rod (see page 63) and is tightened.

Feeding bolt 508 064 can be mounted horizontally or vertically and at any angle to the bus bar. The clamping pieces are securely tightened by fitting into a grooved slot on the bus bar.

The clamping pieces are made of galvanized steel and are equipped with a bayonet screw spindle and pressure plates.

Clamping piece Weight appr. 0.75 kgs
Type no. 508 065

Type no.	Cross sect. [mm]	Length [1)] [mm]	Material	I_r / t_r [3)] [kA/s]	Earth cable [2)]	Weight each appr. kgs
508 079	40 x 10		Copper	95 / 0.5	A = 50 sqmm	4.0
508 075	40 x 10	650	Aluminium	60 / 0.5	L = 2000 mm	2.3
508 076	60 x 10		Aluminium	85 / 0.5		2.7

[1)] the length refers to a distance between phases of 250 mm, please state other distances
[2)] other earth connections and cable lengths also available
[3)] the instantaneous short circuit current refers to Kappa $\kappa = 1.3$ ($I_S = 1.3 \sqrt{2} = 1.84$)

For further details please see

Earth clamps: Pages 40-42
Earthing rods: Pages 60, 63

SINGLE PHASE EARTHING AND SHORT-CIRCUITING DEVICES

for high voltage overhead lines with carrier frequency transmission

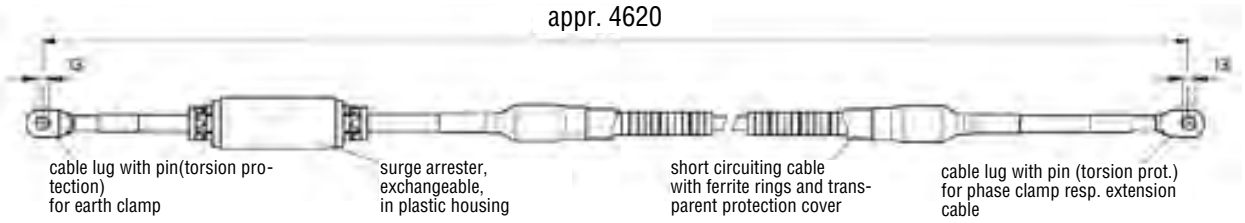


Fig. 1

Type no.:	**504 074**
Lead cross section:	70 sqmm
Rated current and time **(I_r / t_r)**:	19.5 kA / 0.5 s
Weight:	appr. 7.3 kgs.

Application:

The device will earth and short circuit without interruption of the carrier frequency which is transmitted along the phase conductor. The carrier frequency range permitted is 35 – 490 kHz.

Construction features:

The ferrite rings on the short circuiting cable have the function of a frequency interruptor. They provide an inductance "L" of appr.1 mH. Above 100 kHz the impedance is 600 Ohm. For the lower frequencies the effectiveness of the barrier should be checked since the impedance will be less.

With 5 to 10 A the ferrite rings reach their saturation and are no longer effective. This must be taken into consideration especially with induced currents from neighbouring live systems. In the event of a short circuit peak voltages occur on the earthing and short circuiting cables which are limited to 150 V by a surge arrester which is connected in parallel to the cable.

The length of the cable is determined by about 300 ferrite rings mounted on the earthing and short circuiting cable. If required an extension is possible by means of a cable of the same cross-section. For easy handling and in order to protect the ferrite rings against mechanical damage the short circuiting cable with carrier frequency barrier should be fixed to the earth end side.

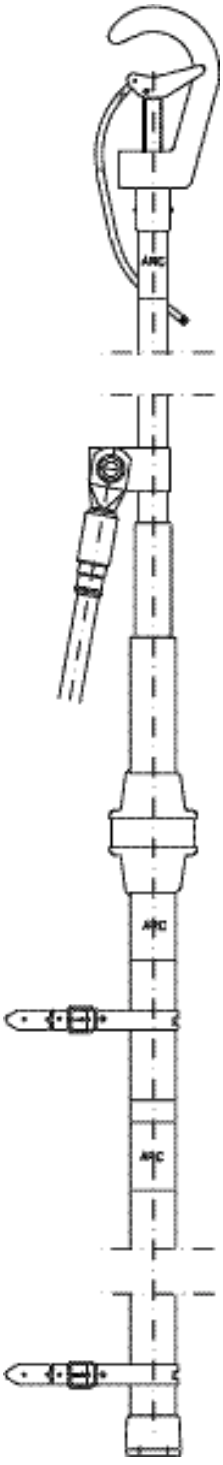
When extending and completing the carrier frequency device, the instruction for use no.22 which is enclosed with the equipment must be followed.

For further details please see:

E. and s.-c.devices:	Pages 7-15
Phase clamps:	Pages 46, 47
Earth clamps:	Pages 41-43
Earthing rods:	Pages 63-66.

SHORT-CIRCUITING DEVICE WITH EARTHING ROD

with conductive mid-section
for high voltage installations 220 kV



511 136 D

Fig. 1

General:

Manual earthing and short circuiting of high voltage installations with high short circuit currents is hindered by increased conductor heights and large cable cross sections.

In order to facilitate the installation, 2-section earthing rods are used. The conductive upper section is made of aluminium tubes and the lower section of epoxy-resin tubes glasfibre-reinforced.

The cable is connected to the lower part of the aluminium tube by means of a bracket.

The length of the earthing and short circuiting cable and the earth clamp must be ordered according to local requirements.

The rod is equipped with an aluminium phase clamp similar to type 507 040 (page 47) with an additional sliding strap made of stainless steel.

The earthing rod is supplied with 2 leather straps to bind the two rod parts together, during transport.

Clamping range: ∅10-65 mm.

Earthing rod with conductive mid-section					
Type no.	**max. cross sect. of earth.cable sqmm**	**I_r / t_r [kA/s]**	**Length max. [mm]**	**Transp.length [mm]**	**Rod weight [kgs]**
511 136 D	120	33.5 / 0.5	6000	3150	5.0

For further details please see:

Earth clamps: Pages 41-43

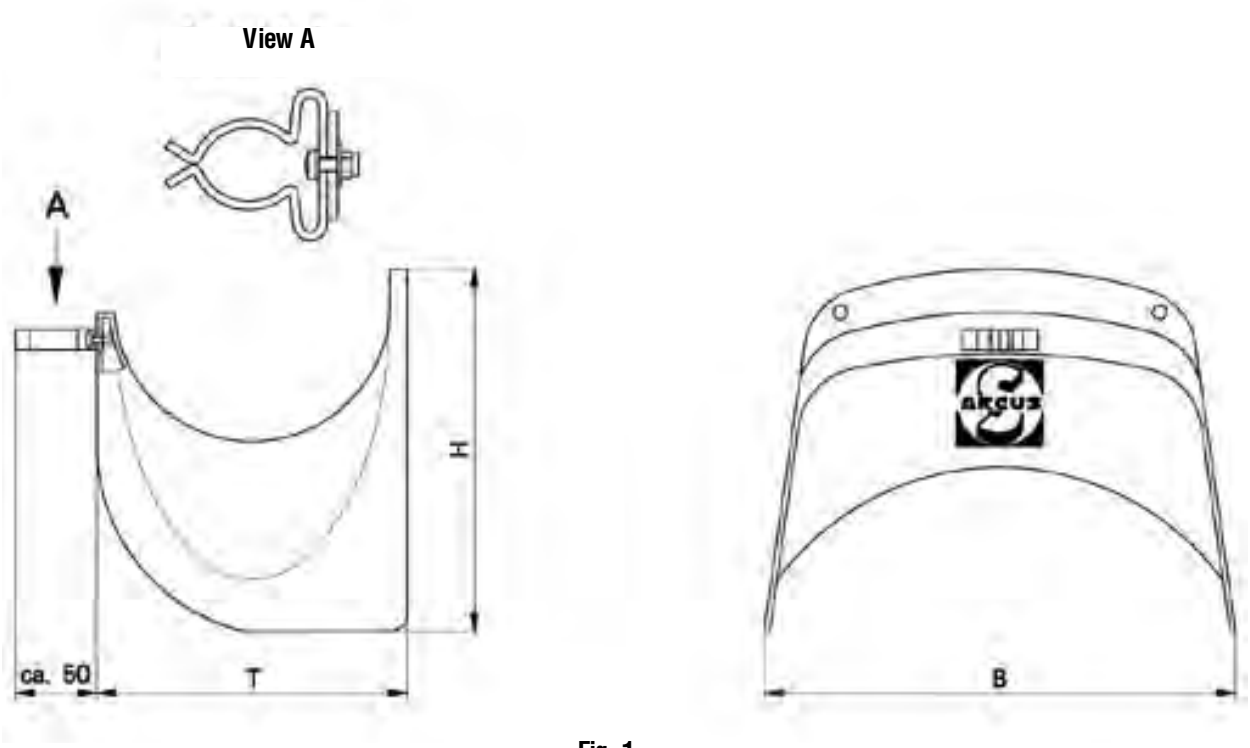


Fig. 1

Type no.	H [mm]	W [mm]	T [mm]	Material	with grip roller	without for earthing rod
615 057	215	273	185	Plastic	X	
615 058						X
615 009	140	280	127	Steel with plastic covering	X	
615 014						X

The storage brackets serve for the suitable storage of an earthing and short circuiting device and the earthing rod belonging to it.

The brackets are available either in plastic or steel plate.

In order to hold the earthing rod (tube ∅30-40 mm) a brace of spring steel is used.

In order to protect the highly flexible cables the load bearing-surface areas are specially rounded.

SINGLE PHASE EARTHING AND SHORT-CIRCUITING CABLES

with cable lugs

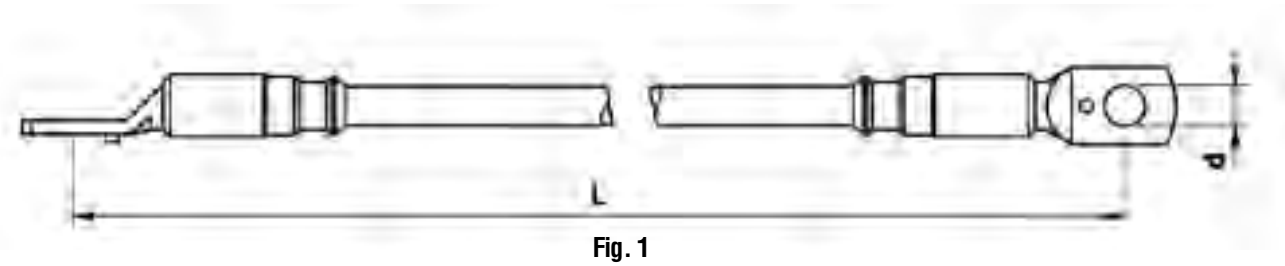


Fig. 1

Construction

All earthing and short circuiting cables are assembled from highly flexible copper leads and transparent plastic insulation. The transitions from cable lug towards lead cover are enclosed by a stabilized tenacious elastic transparent sleeve.

This mechanical kinking protection guarantees a reliable seal against the intrusion of moisture. Transparent insulation allows visual inspection of the lead right up to the copper sleeve. Consequently, damaged strands are easily recognised.

In order to protect the cable lugs against torsion and to reduce the dynamic forces in case of a short circuit each cable lug sleeve is equipped with a shear pin.

All leads are processed in accordance with the required pulling strength values to *DIN EN 61230 part 100: 1996-11.*

Type no.	cable cross section [sqmm]	I_r / t_r [kA/s]	Dimensions [1] L [mm]	∅ d [mm]	Weight each appr. kgs
504 097			2000		0,70
504 098	25	7/0,5	3000		1,0
504 099			4000		1,30
504 100			5000		1,60
504 101			2000		1,0
504 102	35	10/0,5	3000		1,50
504 103			4000		2,0
504 104			5000		2,40
504 105			2000	10,5	1,40
504 106	50	14/0,5	3000		2,0
504 107			4000		2,60
504 108			5000		3,20
504 109			2000		2,0
504 110	70	19,5/0,5	3000		3,0
504 111			4000		3,80
504 112			5000		4,70
504 113			2000		2,70
504 114	95	26,5/0,5	3000		3,90
504 115			4000		5,10
504 116			5000	13,0	6,30
504 117			2000		3,50
504 118	120	33,5/0,5	3000		5,20
504 119			4000		6,80
504 120			5000		8,40

[1] Other lengths and hole diameters possible on request.

CONNECTION PIECE WITH DETACHABLE CONNECTIONS

for earthing and short circuiting cables

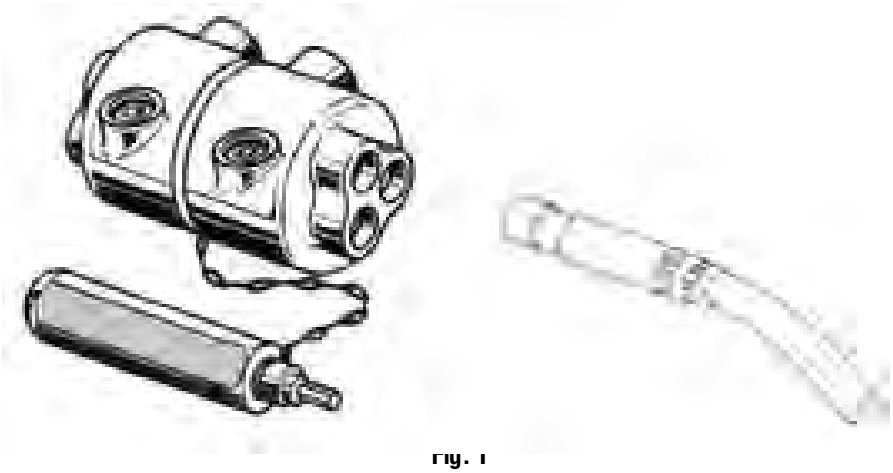


Fig. 1

Application:

The connection piece is intended for use in conjuction with earthing and short circuiting devices for low voltage overhead lines.

The cross section of connecting cables is 25 sqmm, rated current and time (I_r / t_r): 7 kA/0.5 s.

Construction features:

The connection piece is fully insulated.

Up to six earthing cables can be fed onto the connection piece and firmly attached by means of the insulated undetachable Allan key.

In this way the number of connecting clamps required for additional earthing and short circuiting of street lighting and control wires can be adjusted to practical needs.

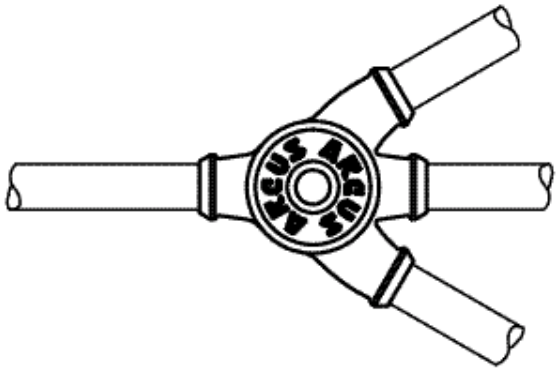
The cable ends are fitted with copper end sleeves. As a kinking protection, the passive part of the sleeve is moulded with a transparent, stabilized tenacious elastic and waterproof plastic sleeve.

The clamping body is of copper alloy, the Allen key of steel. The casing and the insulated grip are made of shock resistant plastic.

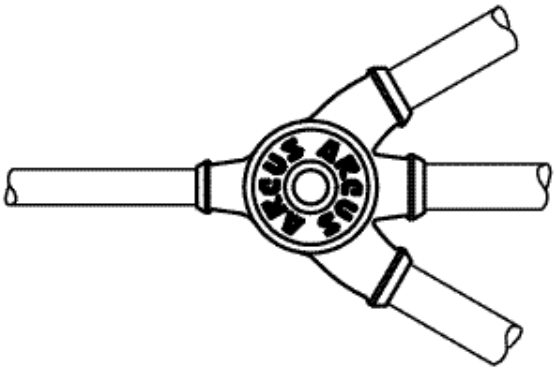
Type no.: 508 004

CONNECTION PIECE WITH UNDETACHABLE CONNECTIONS

for earthing and short circuiting devices with common earthing cable



Connection piece with equal cross sections		
Type no.	Lead cross section [sqmm]	(I_r / t_r) [kA/s]
504 158	4 x 16	4,5 / 0,5
504 159	4 x 25	7 / 0,5
504 160	4 x 35	10 / 0,5
504 161	4 x 50	14 / 0,5
504 162	4 x 70	19,5 / 0,5
504 163	4 x 95	26,5 / 0,5
504 164	4 x 120	33,5 / 0,5
504 165	4 x 150	42 / 0,5



Connection piece with reduced cross sections of earth cable		
Type no.	Lead cross section [sqmm]	(I_r / t_r) [kA/s]
504 181	3 x 35 +1 x 16	10 / 0,5
504 166	3 x 35 +1 x 25	10 / 0,5
504 167	3 x 50 +1 x 25	14 / 0,5
504 168	3 x 70 +1 x 35	19,5 / 0,5
504 169	3 x 95 +1 x 35	26,5 / 0,5
504 170	3 x 120 +1 x 50	33,5 / 0,5
504 171	3 x 150 +1 x 50	42 / 0,5

Construction

The connection pieces are compressed, bolted and coated with a transparent protection cover.

The transitions from the connection piece to the lead cover are enclosed by a stabilized tenacious elastic and transparent sleeve.

This mechanical kinking protection guarantees a reliable sealing against the intrusion of moisture.

Due to the transparent insulation the copper leads remain visible up to the copper sleeves. In this way damaged strands are quickly recognized.

In order to protect the cable lugs against torsion and to reduce the dynamic forces in case of a short circuit each cable lug sleeve is equipped with a shear pin.

Finally the lightweight construction of the connection piece (reduction of the accelerated mass in case of a short circuit) as well as the soft kinking protection offer an improved protection for personnel and installations.

All leads are processed in accordance with the required-values for tensile strength to DIN EN 61230 part 100: 1996-11.

Fully insulated connection pieces with leads of the same cross section:

All leads with equal cross sections are connected inside the connection piece uncut and short circuit-proof.

Fully insulated connection piece with reduced cross section of earth cable:

Earthing cables for use in three phase systems without neutral (no star point) may have a smaller cross-section than the phase cables.

When the length of earthing cable is reduced, the two outside phase cables are uncut and are bonded firmly into the connection piece with the separate middle phase cable and the earth cable.

Devices with reduced earth cable cross section offer good savings in weight to facilitate transportation - especially when long earthing cables are fitted.

CONNECTION PIECE WITH CABLE LUGS

for earthing and short circuiting devices with identical earthing cable

Construction features:

The connection consists of 4 copper compression cable lugs which are bolted together with a copper alloy high tensile bolt.

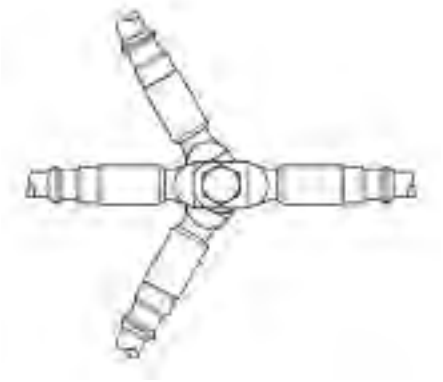


Fig. 1

The bolt is secured by a lock nut against accidental loosening.Bolt, lock nut and cable lug sleeve are uninsulated.

The transitions from the cable lugs to the lead are moulded with a transparent, stabilized tenacious elastic plastic material. This mechanical kinking protection seals against intrusion of moisture.

Connection piece with equal cross sections		
Type no.	Cable cross section [sqmm]	(I_r / t_r) [kA/s]
504 044	4 x 25	7 / 0,5
504 045	4 x 35	10 / 0,5
504 046	4 x 50	14 / 0,5
504 047	4 x 70	19,5 / 0,5
504 048	4 x 95	26,5 / 0,5
504 049	4 x 120	33,5 / 0,5
504 050	4 x 150	42 / 0,5

Connection piece with cable lugs for leads with identical cross section:

Short circuit cables and earth cable have leads with identical cross section.

Fig. 2

Connection piece with cable lugs for reduced cross section of earth cable:

3-pole earthing and short circuiting devices for use in three phase systems without neutral (no star point) may have earth cables with smaller lead cross section than the respective short circuit cables.
When the length of earth cables is reduced, the two outside phase cables are uncut and are bonded firmly into the connection piece with the separate middle phase cable and earth cable.

Connection piece with reduced cross sections of earth cable		
Type no.	Cable cross section [sqmm]	(I_r / t_r) [kA/s]
504 085	3x 35 +1 x 25	10 / 0,5
504 086	3x 50 +1 x 25	14 / 0,5
504 087	3x 70 +1 x 35	19,5 / 0,5
504 088	3x 95 +1 x 35	26,5 / 0,5
504 089	3x 120 +1 x 50	33,5 / 0,5
504 090	3x 150 +1 x 50	42 / 0,5

Devices with reduced earth cable cross-section offer good savings in weight to facilitate transportation - especially when long earthing cables are fitted.

The connection pieces are similar to the above mentioned types 504 044 - 504 050.

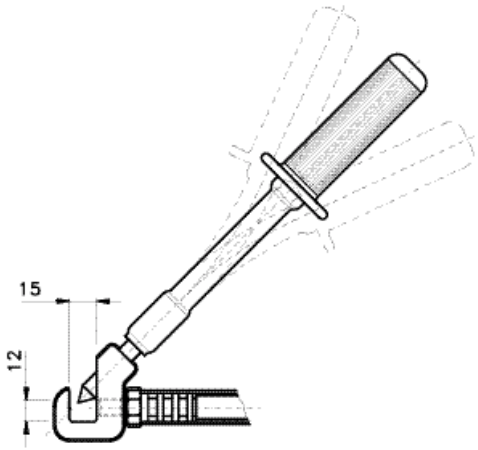


Fig. 1: 502 055 (with compressed connection)

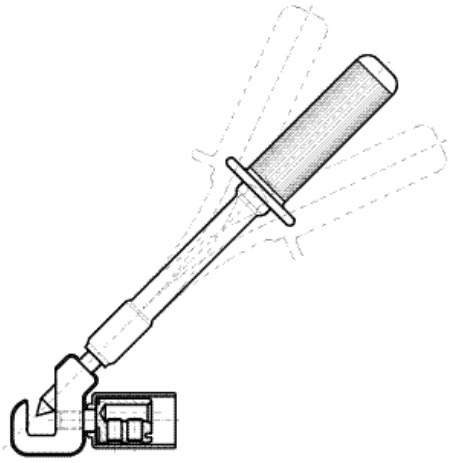


Fig. 2: 502 056 (with clamping connection)

Type no. earth conn.	for earth lead [sqmm]	Type no. compr.conn.
	16	**598 457 02**
502 055	25	**512 227 06**
	35	**512 228 03**

Type no. Earth conn.	Description
502 056	with clamping connection for 16-35 sqmm max. 1 x 35 sqmm H07RN-F

Suitable for:

Earth connections of single phase earthing and short circuiting devices with a cross section of max. 35 sqmm.

Earth connections of 3-phase earthing and short circuiting devices with short circuiting leads max. 95 sqmm and earth lead max. 35 sqmm.

The width of th clamp head of appr.20 mm only requires small space when clamping to the PEN bar.

Connections to earth bars with thickness of 3-8 mm.

Rated current and time (I_r / t_r): 10 kA / 0.5 s.

Construction features:

Clamp head, handle and lead connection are insulated, only the pressure bolt and the slot for the PEN-rail in the clamp head are bare.

The handle is flexible and can be bent when space is limited, e.g. when distribution boxes are closed.

The clamp head is of high quality copper alloy.The flexible handle is equipped with a threaded spindle of galvanized steel with a hardened cone shaped top.

Application note:

In the event of a short circuit the electro-dynamic forces will oppose the mechanical force which holds the clamp in position. Consequently it is essential that clamps are securely attached, especially for single phase earthing systems.

EARTH CONNECTION CABLE LUGS FOR FIXED POINT EARTHING

with threaded bolt

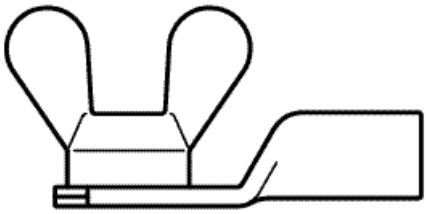


Fig. 1: 515 047, 515 061 - 515 066 515 132, 515 133, 598 335

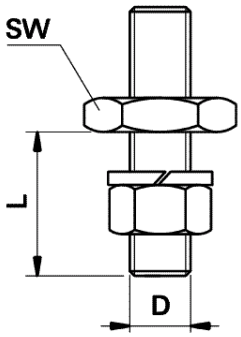


Fig. 2: 515 090, 515 091

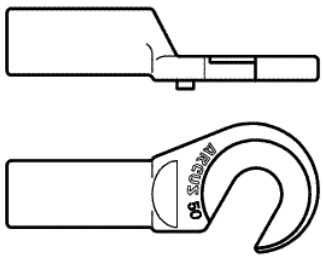


Fig. 3: 111 094 - 111 096

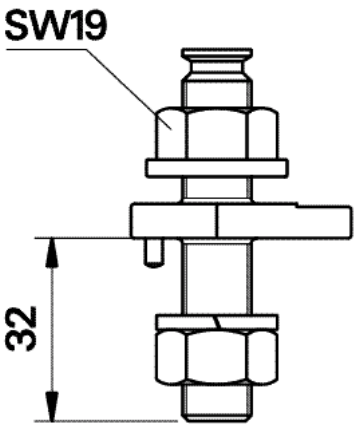


Fig. 4: 515 031

Construction features:

Connection part: copper compression cable lug with non-detachable wing nut[1] made of copper alloy.
Both parts are tin-plated.

[1] Also available with non-detachable wing bolt.

Type no.	Cross section of earth lead	Thread	Weight each appr. kgs
515 047	25		0,18
515 061	35		0,20
515 062	50	M12	0,22
515 063	70		0,23
515 066	95		0,24
515 132	35		024
515 133	50		0,25
598 335	70	M16	0,26
515 064	95		0,26
515 065	120		0,30

Fixed point: Threaded bolt of steel 8.8 with hexagonal brass disc of copper alloy, incl. nut and spring plate. All parts are tin-plated.

Type no.	Bolt dimensions			Weight each
	D	L	Key size (SW)	appr.[kgs]
515 090	M 12	28	30	0,07
515 091	M 16	38	36	0,07

Connection part: Copper grooved cable lug with torsion safety device (cross pin).

Type no.	Cross section of earth lead [sqmm]	Weight each appr. [kgs]
111 094	25	0,07
111 095	35	0,07
111 096	50	0,07

Fixed point: Disc with torsion safety device and threaded bolt M12 made of copper alloy, pressed, incl. non-detachable collar nut, nut and spring plate.

Weight: appr. 0.15 kgs
Type no.: **515 031**

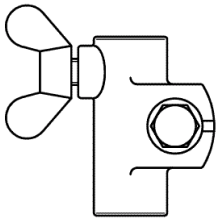


Fig. 1: 515 044

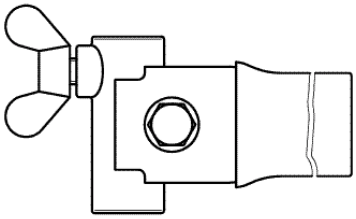


Fig. 2: 515 128

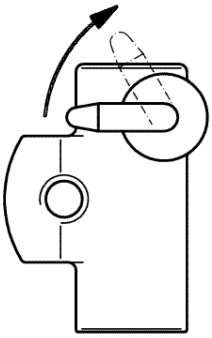


Fig. 3: 515 122

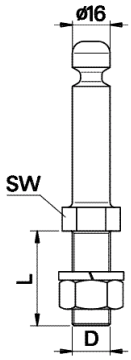


Fig. 4: 515 148, 515 149

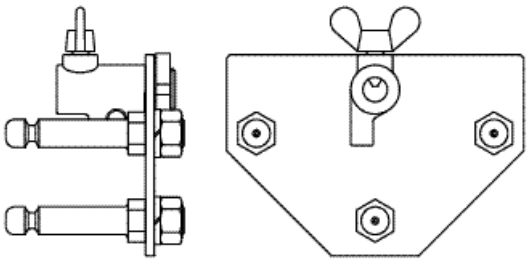


Fig. 5: 515 129
Weight: appr. 2.3 kgs

Construction features:

Connection parts:

Plug earth connection clamp with cable lug connection M12 and wing bolt for secure mounting on fixed point bolts. Plug clamp made of copper alloy, wing bolt of steel. All parts tin-plated or galvanized.

Type no.: 515 044

Plug earth connection clamp similar to type 515 044, but in addition with a C-shaped insulated handle in order to ensure an optical inspection of the copper lead.

Type no.: 515 128

Plug earth connection clamp with automatic locking catch mechanism. To remove the clamp from the fixed point the angle-lever is rotated in the required direction. Other features as type 515 044.

Type no.: 515 122

All plug clamps can be used with leads up to 120 sqmm cross section.
Rated current and time (I_r / t_r): 33.5 kA/ 0.5 s

Fixed points:

Cylindrical bolts with ring nut made of CuNiSi tin-plated, with nut and safety ring of galvanized steel. Rated current and time (I_r / t_r):

for cylindrical bolts M12: 33.5 kA / 0.5 s
and for cylindrical bolts M16: 41 kA / 0.5 s.

Type no.	Thread D x L	Key size SW	Weight each appr. [kgs]
515 148	M16 x 40	22	0,22
515 149	M16 x 40	22	0,20

Earth connection plate:
Plate made of tin-plated copper, thickness 5 mm, with modified plug clamp type 515 044 and 3 cylindrical bolts with ring nut. Suitable for earthing and short circuiting of 3 single phase short circuit cables with plug earth connection clamp.

Rated current and time (I_r /t_r):

for cylindrical bolts M12: 33.5 kA / 0.5 s
and for cylindrical bolts M16: 41 kA / 0.5 s.

Type no.: 515 129

Fig. 1

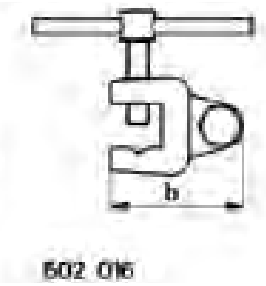


Fig. 2

Fig. 3

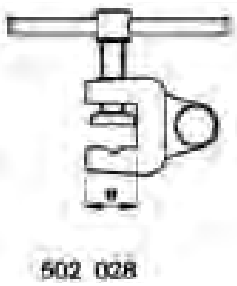


Fig. 4

Notched clamps may also be used on tubular or round conductors.

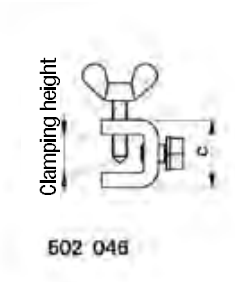


Fig. 5

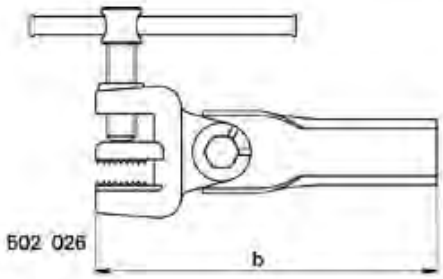


Fig. 6

Clamp type 502 026 is tightened to the earth connection and by means of the handle it can be rotated at an angular range of appr.20 °, tightening the hand screw repeatedly. After the serrated contact surfaces have removed paint or other insulating layers on both sides of the earth connection the hand screw can be tightened completely.

Application notes:

In the event of a short circuit the electrodynamic forces will oppose the mechanical force which is holding the clamp in position. Consequently it is essential that clamps are securely tightened, especially for single phase earthing and short circuiting devices.

Type no.	Cable cross section [sqmm]	(I_r / t_r) [kA/s] [2]	Clamping height [mm]	Thread size ∅	Clamping section [mm] a [3]	b	c	d	Weight/each appr. kgs
Description:	Wing nut with hardened conical top. Steel U-section. All part are galvanized.								
502 046 [1]	16 - 50	10 / 0,5	20	M 10	30	30	36	23	0,2
Description:	Galvanized steel hand screw with circular grooves. Copper alloy U-section with notched base.								
502 016	16 - 70	19,5 / 0,5	20	M 10	26	60	44	23	0,4
502 019	35 - 70	19,5 / 0,5	41	M 10	32	85	73	32	0,9
502 020	95 - 120	33,5 / 0,5	41	M 12	32	85	73	32	0,9
Description:	Galvanized steel hand screw with end pressure piece. Copper alloy U-section with notched base.								
502 028	16 - 70	19,5 / 0,5	15	M 10	26	60	44	23	0,4
502 021	35 - 70	19,5 / 0,5	31	M 10	32	85	73	32	0,9
502 022	95 - 120	33,5 / 0,5	31	M 12	32	85	73	32	0,9
Description:	Contacts with serrated steel surface, hardened and galvanized. Paint and oxyde layers can be removed by sliding the clamp whilst tightening it.								
502 026	35 - 120	33,5 / 0,5	24	M 12	32	185	73	32	1,1

1) For earth connection of 3-phase earthing and short-circuiting devices.
2) The listed rated values in each case refer to the maximum short circuit cable cross section.
For rated values for smaller cross sections please see table on page 11.
3) Clamp dimension “a“ refers to the width of the U-section.

SPHERICAL TONGS AND UNIVERSAL PHASE CONNECTION CLAMPS

for ball point connectors

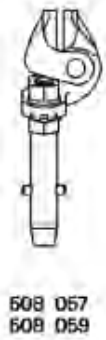


Fig. 1

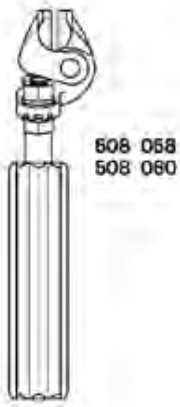


Fig. 2

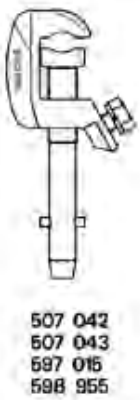


Fig. 3

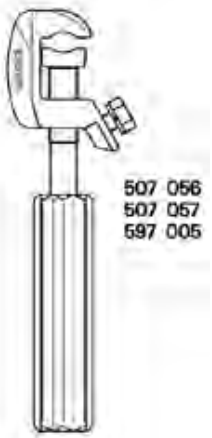


Fig. 4

Construction features:

Spherical tong

The compact construction allows installation under limited space conditions. Both clamping sections are equipped with large-area spherical caps.This avoids distortion or abrasion of the ball point connector. For connection, the opened spherical tong is placed onto the ball point connector and then tightened free from the weight of the device.

Universal phase clamp

The fork-shaped clamping piece ensures a connection to the ball point connector secure against the dynamic forces in case of a short circuit.The universal phase clamps are equipped with a pressure piece and are suitable for use with round and flat conductors as well as ball point connectors and T-bolts. The clamping surfaces are equipped with vertical grooves for use with flat and round conductors. The connection bolts for the cable lugs are notched to take up the cable lugs with pin against torsion.

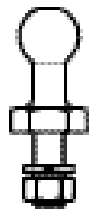
The earth connection clamps and tongs are provided with plastic handles. The clamping pieces are of a high-quality copper alloy, hand screw, bolt and spring plates are made of galvanized steel.

Type no.		Clamping range mm							Weight each [kgs]	
Clamp for connection to		Conductor		Fixed point		Cable cross sect.	I_r / t_r	Connection bolt	Clamp for connection to	
phase	earth	round	flat	Ball p.c.	T-bolt	[sqmm]	[kA/s]		phase	earth
Spherical tong										
508 057	508 058	-	-	20	-	max. 95	26,5/0,5	M10	0,40	0,50
508 059	508 060	-	-	25	-	max. 120	33,5/0,5	M12	0,50	0,60
Universal phase clamp										
507 042	507 056	9-22	up to 20	20	15	max. 70	19,5/0,5[1)]	M10	0,60	0,70
507 043	507 057	9-22	up to 20	25	20	max. 120	33,5/0,5	M12	0,80	0,90
597 166	-	9-22	up to 20	20/25	20	max. 95	24/0,5	M12	0,80	-
597 015	597 005	9-22	up to 20	25/30	20	max. 95	26,5/0,5	M12	0,80	0,90
598 955	-	9-22	up to 20	25/30	20	120	33,5/0,5	M12	0,80	-

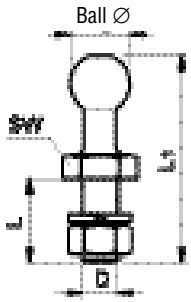
1) The high current test of the universal clamp type 507 042 with ball point connector type 515 076 resulted in 23 kA/1.3 s.

Advantages in use of fixed points:

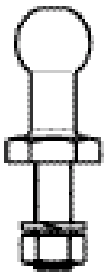
- Defined connections to conductor and earth installation for earthing and short circuiting.
- The secure connection between fixed point and connection clamp guarantees safety in case of high dynamic and thermal loads during a short circuit.



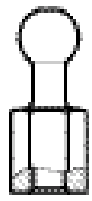
515 107
515 033



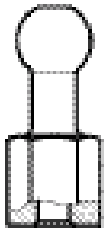
515 108



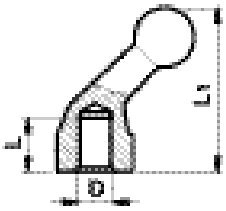
515 032
515 015
515 014



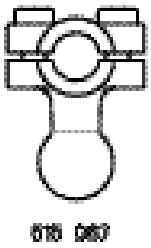
515 078



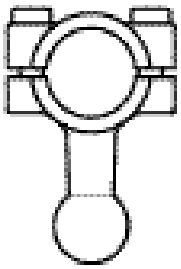
515 075
515 101



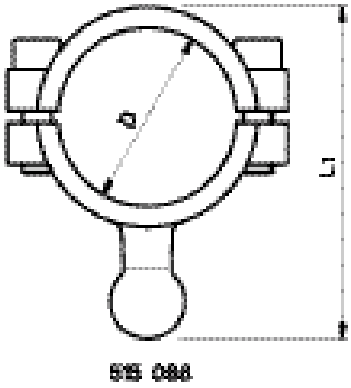
515 064
515 056
515 136



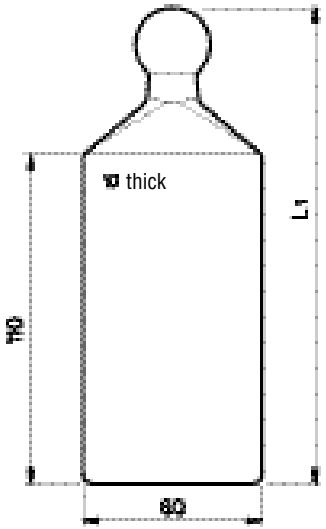
515 067



515 088
515 068
515 077



515 088



515 020

The spherical heads of the fixed points are manufactured with a very high-quality surface.

The threaded bolts are dimensioned for high dynamic forces.

Construction features/Type no.:

Type no.	Ball ∅ [mm]	I_r / t_r [kA / s]	Connection thread resp. hole ∅ [mm]	Fixed points: Length of thread L	Fixed points: Total length L_1	Fixed points: Key size SW	Weight each appr. kgs
Ball point connectors with threaded bolt in one piece, nut and spring washer							
515106	20	14 / 0,5	M 10	25	67	22	0,15
515107	20	26,5 / 0,5	M 12	28	70	22	0,20
515033	20	26,5 / 0,5	M 12	36	77	22	0,20
515032	25	33,5 / 0,5	M 12	36	88	27	0,40
515015	25	33,5 / 0,5	M 16	27	79	27	0,35
515014	25	33,5 / 0,5	M 16	47	99	27	0,40
Ball point connectors straight, with female thread (without bolt)							
515076	20	26,5 / 0,5	M 12	18	62	22	0,20
515075	25	33,5 / 0,5	M 12	18	74	27	0,35
515101	25	33,5 / 0,5	M 16	24	77	27	0,35
Ball point connectors angled at 45° with female thread (without bolt)							
515054	20	26,5 / 0,5	M 12	18	56	22	0,10
515136	25	33,5 / 0,5	M 12	24	76	27	0,20
515055	25	33,5 / 0,5	M 16	24	76	27	0,20
Ball point connectors for round conductors, conductor clamping piece retained by 2 screws							
515067[1]	25	33,5 / 0,5	to ∅16[2]	-	58	-	0,25
515068[1]	25	33,5 / 0,5	∅ 16-22[2]	-	75	-	0,35
515069[1]	25	33,5 / 0,5	∅ 22-30[2]	-	75	-	0,35
515077[1]	25	33,5 / 0,5	∅ 30-40[2]	-	85	-	0,45
515086[1]	25	33,5 / 0,5	∅ 50-60[2]	-	110	-	0,70
Ball point connector with lug for connection to busbar packages							
515020	25	33,5 / 0,5	Lug 60 x 10, Length: 110 mm			-	0,75

[1] Ball point connectors made of copper F20, tin plated
[2] Please state conductor diameter in your order.

Material:

Ball point connectors made of high-tensile copper alloy F65, tin plated, nuts and spring washers made of galvanized steel, bolts (in connectors for round conductors) made of stainless steel.

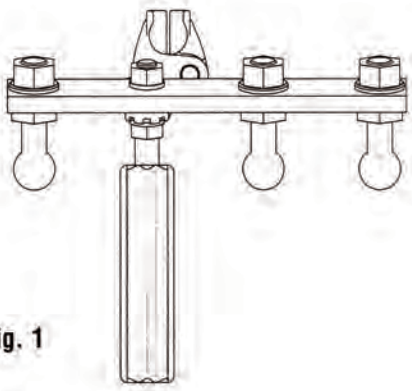


Fig. 1

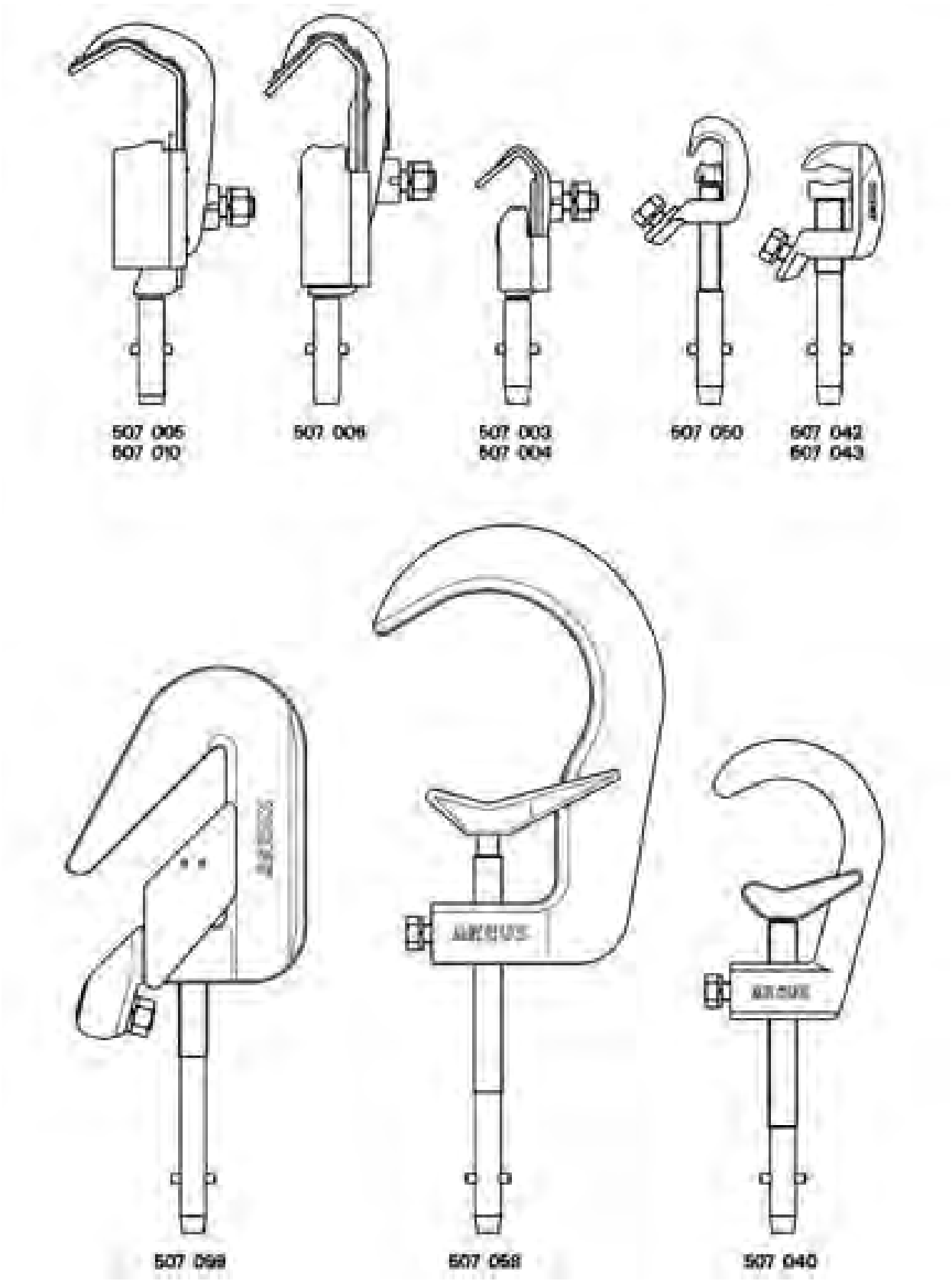
Multiple earth connection with ball point connectors

Bar for earth connection with 3 ball point connectors

The bar is equipped with 3 ball point connectors ∅ = 25 mm and one spherical tong with plastic handle, type 509 060. For connection to the earth installation there is one ball point connector ∅ = 25 mm.

Rated current and time (I_r / t_r): 33.5 kA / 0.5s

Weight: appr. 2.25 kgs
Type no. **515 134**


507 005
507 010
507 006
507 003
507 004
507 050
507 042
507 043
507 058
507 040

PHASE CONNECTION CLAMPS FOR AL AND CU / CONSTRUCTION

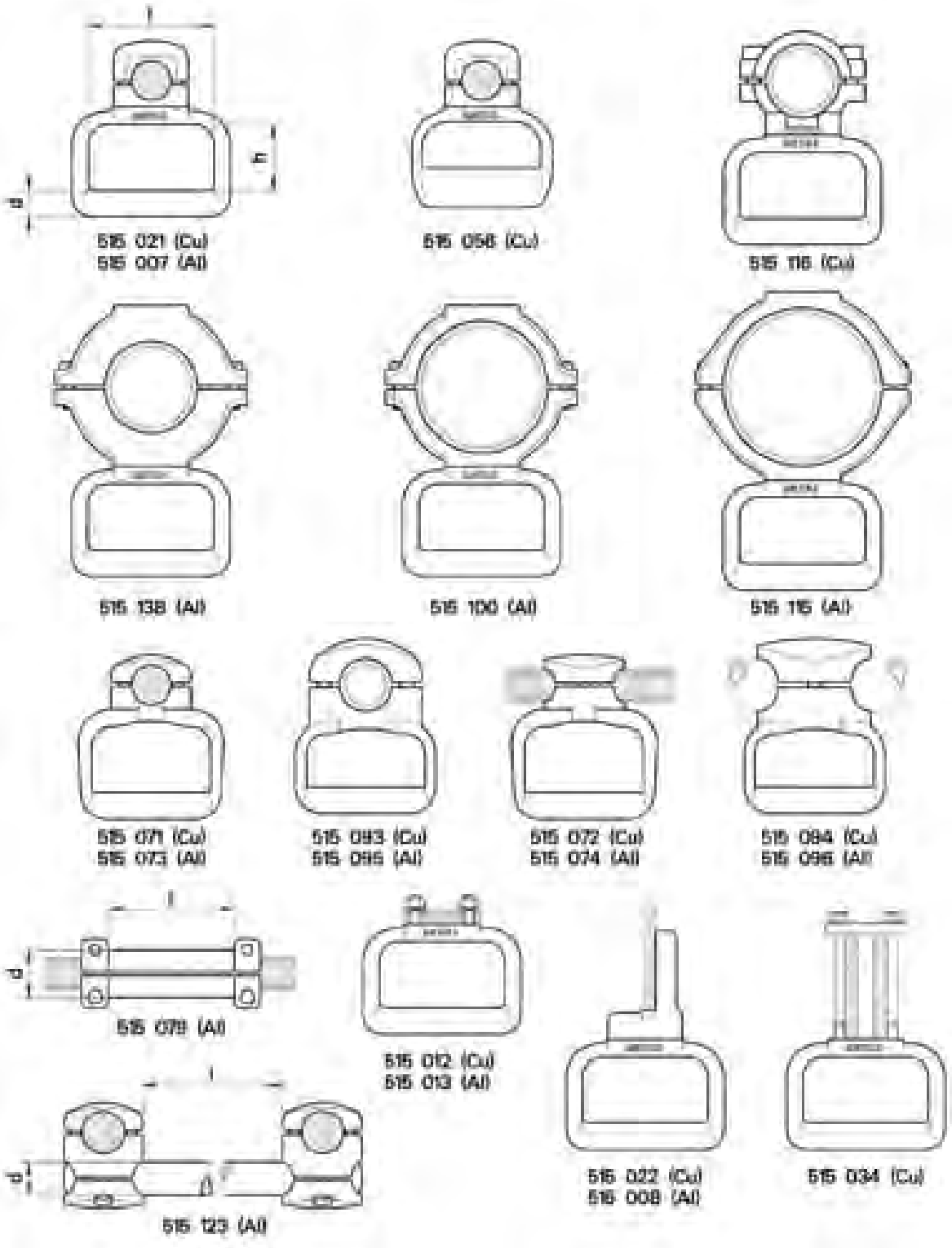
screw clamps especially for round conductors

Type no.	Clamping range [sqmm/mm]	Cable cross section max. [sqmm]	I_r / t_r [kA / s]	Connection bolt thread	Construction	Weight each appr. kgs
507 050 [1]	16-120² ∅ 4–14	95	26,5 / 0,5	M 10	Compact construction, contact surfaces finely grooved	0.35
507 004 [3]	10-150² Flat 15	95	26,5 / 0,5	M 10	High tensile sheet construction, large contact surfaces, swivel spindle	0.32
507 003 [2]	16 - 240² Flat 20	95	26,5 / 0,5	M 10	High tensile sheet construction, large contact surfaces, swivel spindle	0.55
507 042 [1]	∅9-22 Flat 20	70	19,5 / 0,5	M 10	Compact construction, also for use with ball point connectors 20 mm and T-bolts 15 mm	0.60
507 043 [1]	∅9-22 Flat 20	120	33,5 / 0,5	M 12	Compact construction, also for use with ball point connectors 25 mm and T-bolts 20 mm	0.80
507 006 [3]	∅6-35 Flat 30	120	33,5 / 0,5	M 12	High tensile sheet construction, large contact surfaces, swivel spindle	0.88
507 010 [3] **507 005** [2]	∅20-60	120	33,5 / 0,5	M 12	High tensile sheet construction, large contact surfaces, swivel spindle	0.87 1.60
507 099 [3]	∅5-35	150	42 / 0,5	M 12	Heavy section die cast	1.30
507 040 [3]	∅10-65	120	33,5 / 0,5	M 12	Heavy section die cast	0.95
507 058 [3]	∅50-120	120	33,5 / 0,5	M 12	Heavy section cast aluminium alloy	1.30

[1] Strap and pressure piece made of tin plated copper alloy, spindle galvanized steel
[2] Heavy duty copper alloy, tin plated, type 507 005 plain copper (only for copper conductors)
[3] Tempered aluminium alloy, type 507 040, 507 099 and 507 058 spindle of galvanized steel

Advantages in the use of fixed points:

- Defined connections for earthing and short circuiting on conductor and earth installation
- The secure connection between fixed point and connection clamp guarantees safety in case of high dynamic and thermal loads during a short circuit.



Construction features / Type no.

Cond.fixed point type no. Material Cu	Al	for cond.[1] ▮ or ● mm	Dimensions of fixed point in mm d	l	h	for phase connection clamp type no.	for nominal voltage max. kV	Weight each appr. kgs Cu	Al
Strap-type fixed points for round conductors parallel and transverse to the conductor									
515021	**515007**	∅10-30	20	95	50		220	1,80	0,65
515056	-	∅10-30	30	90	35			2,20	-
515116	-	∅60	20	95	50	507 005[2] 507 006 507 010		1,75	-
-	**515138**	∅60-95	20	95	50	507 040 507 042 507 043		-	1,40
-	**515100**	∅100	20	95	50	(fixed point 515 056 not suitable		-	1,10
-	**515115**	∅120	20	95	50	for 507 042 and 507 043)		-	1,20
Strap-type fixed points for round conductors transverse to the conductor									
515071	**515073**	∅10-30	20	90	50	507 005[2] 507 006 507 010	150	1,50	0,45
515093	**515095**	∅30-50	20	90	40	507 040 507 042 507 043	220	270	0,70
Strap-type fixed points for round conductors parallel to the conductor									
515072	**515074**	∅10-30	20	90	50	507 005[2] 507 006 507 010	220	1,50	0,45
515094	**515096**	∅30-50	20	90	40	507 040 507 042 507 043		2,70	0,70
Shell-type fixed points for round conductors									
	515079	∅20-28	35	95	-	507 006 507 010 507 040	220	-	0,35
Strap-type fixed points for flat conductors parallel and transverse to the conductor									
515012	**515 013**	flach 12 [3]	20	95	50	507 003 507 004 507 005[2] 507 006 507 010 507 040 507 042 507 043	220	1,70	0,55
Strap-type fixed points for flat conductors parallel and transverse to the conductor									
515022	**515008**	flach80x10	20	95	50	507 005[2] 507 006 507 010 507 040 507 042 507 043	220	2,30	0,75
Strap-type fixed points for 2 flat conductors parallel and transverse to the conductor									
515034	-	max. 2 x 80 x 10	20	95	50	507 005[2] 507 006 507 010 507 040 507 042 507 043	150	1,70	-
-	**515123**	∅10-30	25	-400[4]	-	507 006 507 010 507 040	220	-	1,50

[1] Please state the exact conductor-∅ in your order
[2] Phase connection clamp 507 005 only for use with copper fixed points
[3] Attached by drilling two 8.5 mm holes, 40 mm between centres
[4] Length of strap suitable for 2 phase connection clamps.

Material:

Cu: Straps made of copper and copper alloy (bare), bolts high-tensile copper alloy
Al: Straps made of high tensile aluminium alloy, bolts of stainless steel

Fig. 1: 507 009

Fig. 2: 507 037

Fig. 3: 507 077

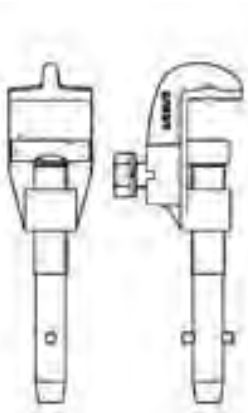


Fig. 4: 507 007

Construction features:

Pointed clamps 507 009, 507 037:
The clamping parts are closed by thightening the cone which is mounted on a threaded spindle.
One clamping part has fine cross grooves, whilst the second one has a flat surface which is angled to correspond with the swinging action as the cone is tightening.

Type 507 037 has a stud in the serrated clamping part. The bus bar to be clamped should have a hole of appr. 6,5 mm to accomodate this stud.

These clamps are especially designed for use on bus bars, flat switching contacts and disconnecting switches.

Pointed clamps for contact blades type 507 077:
This clamp is designed for use in encapsulated switchgear or on contacts with limited access space.

The compact construction is a specific feature of this clamp. It can be used in a bushing with dimensions 50 x 36 cm. Pointed clamps are suitable for vertical or horizontal bus bars (e.g. on isolators).

U-shaped clamp 507 007:
This type is mounted at right angles on flat conductors.

The contact surfaces in the strap are finely cross grooved.

The pressure piece pivots on the threaded spindle so as to adapt to possible surface irregularities without affecting the contact.

Type no.	Clamping range [mm]	Cable cross section max. [sqmm]	I_r / t_r [kA / s]	Connection bolt thread	Weight each appr. kgs
			Pointed clamps		
507 009	flat up to 12	70	19,5 / 0,5	M 10	0,50
507 037	flat up to 6 with boring	95	26,5 / 0,5	M 10	0,50
507 077	Contact blade 5-15	120	33,5 / 0,5	M 10	0,90
			U-shaped clamps		
507 007	flat up to 20	120	33,5 / 0,5	M 10	0,50

Clamping parts and bolts are made of high tensile copper alloy.

Application notes: In case of a short circuit dynamic forces are opposing the secure connection of the clamp to the conductor. For this reason ensure that the clamps are tightened properly.

These devices are fully approved by the Deutsche Bahn / DB (German Railway System)

Electrical load values for complete devices (according to the DB):

I_{sw} = 78 kA **I_k" = 35.6 kA** **t_k = 0.06 sec**

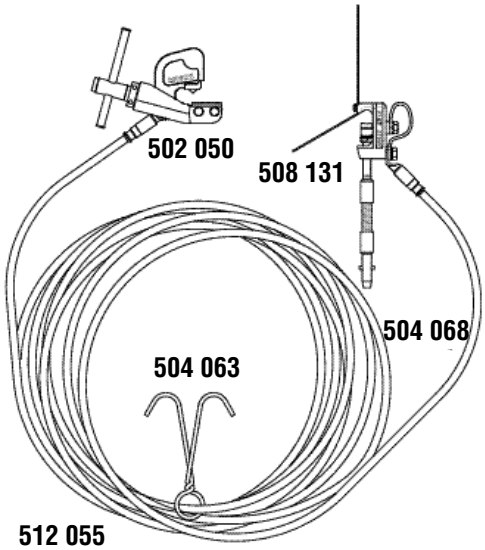


Fig. 1

Type no. clearing track-profile	Type no. not clearing track-profile	consisting of [1]		Weight each appr. kgs
for local storage				
512 055	**–**	**508 131** **504 063**	**502 050** **504 068**	12,5
–	**512 056**	**508 131**	**502 050** **504 153**	10,0
512 036	**–**	**512 055**	**511 188**	18,0
–	**512 034**	**512 056**	**511 188**	15,5
can be fitted on electrical track maintenance vans				
–	**512 042**	**512 056**	**511 130**	14,9

1) for parts please see page 53

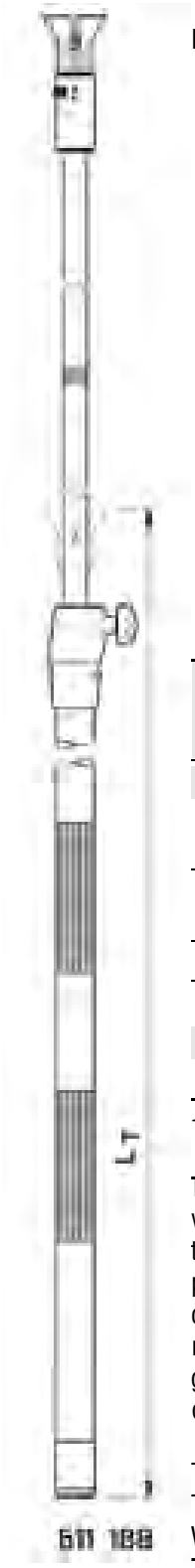


Fig. 2

Telescopic earthing rods in two sections
with securable locking head. Insulating tubes made of fibre glass reinforced polyester, inner tube square. Rod head, coupling and rod end cap are made of metal. The robust construction is designed to withstand occasional dropping onto the track without damage.

Total length (Lg):	5.0 m
Transport length (Lt):	2.9 m
Weight:	appr. 5.5 kgs
Type no.:	**511 188**

Telescopic earthing rod in three sections
with securable locking head, insulated tubes made of fibre glass reinforced polyester. Due to its reduced transport length this rod is specially suitable for transport on electrical trains.

Total length (Lg):	5.0 m
Transport length (Lt):	2.2 m
Weight:	appr. 4.9 kgs
Type no.:	**511 130**

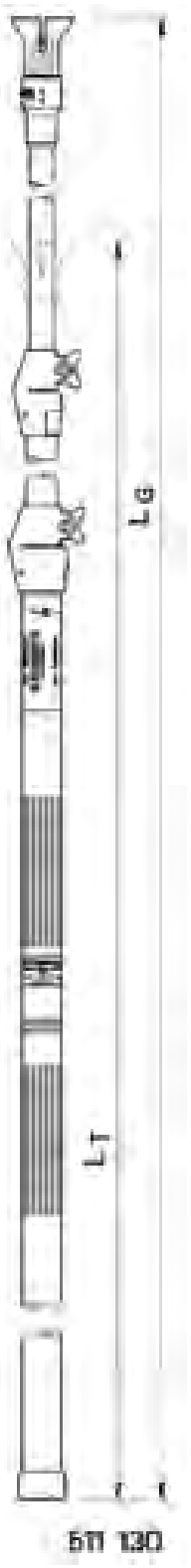


Fig. 3

EARTHING AND SHORT CIRCUITING DEVICES, FIXED POINTS EARTHING RODS

for feeder cables and contact wires of electric railways

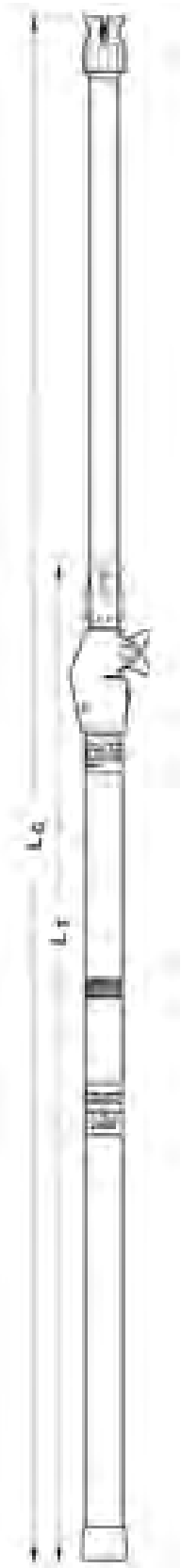


Fig. 4

These devices are fully approved by the Deutsche Bahn / DB (German Railway System)

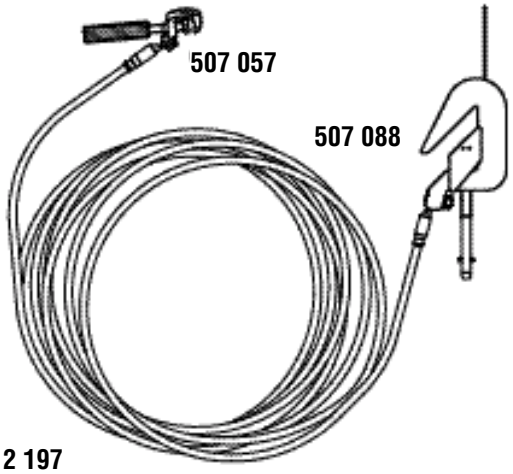


Fig. 1: 512 197

Fig. 2

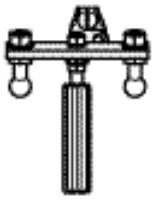


Fig. 3: 515 130

The earthing and short circuiting device consists of:

Phase connection clamp 507 086
with test strip, for conductors ∅6-35 mm.

Earthing and short circuiting cable 504 126
cross section 50 sqmm, length 4000 mm, made of highly flexible copper lead with transparent insulation cover.

Earth connection clamp 507 057 with handle
for ball point connectors ∅25 mm and flat conductors up to 20 mm.

Weight appr.	10.5 kgs
Type no.	**512 197**

Telescopic earthing rod in two sections
with safety bayonet head, insulated tube made of fibre glass reinforced epoxy resin.

Total length (Lg):	3.5 m
Transport length (Lt):	1.9 m
Weight:	appr. 3.0 kgs
Type no.:	**511 167**

Fixed points as required:

Ball ∅:	25 mm
Thread:	M16 x 47
Weight:	appr. 0.40 kgs
Type no.	**598 239**
Thread:	M16 x 27
Weight:	appr. 0.35 kgs
Type no.	**598 389**

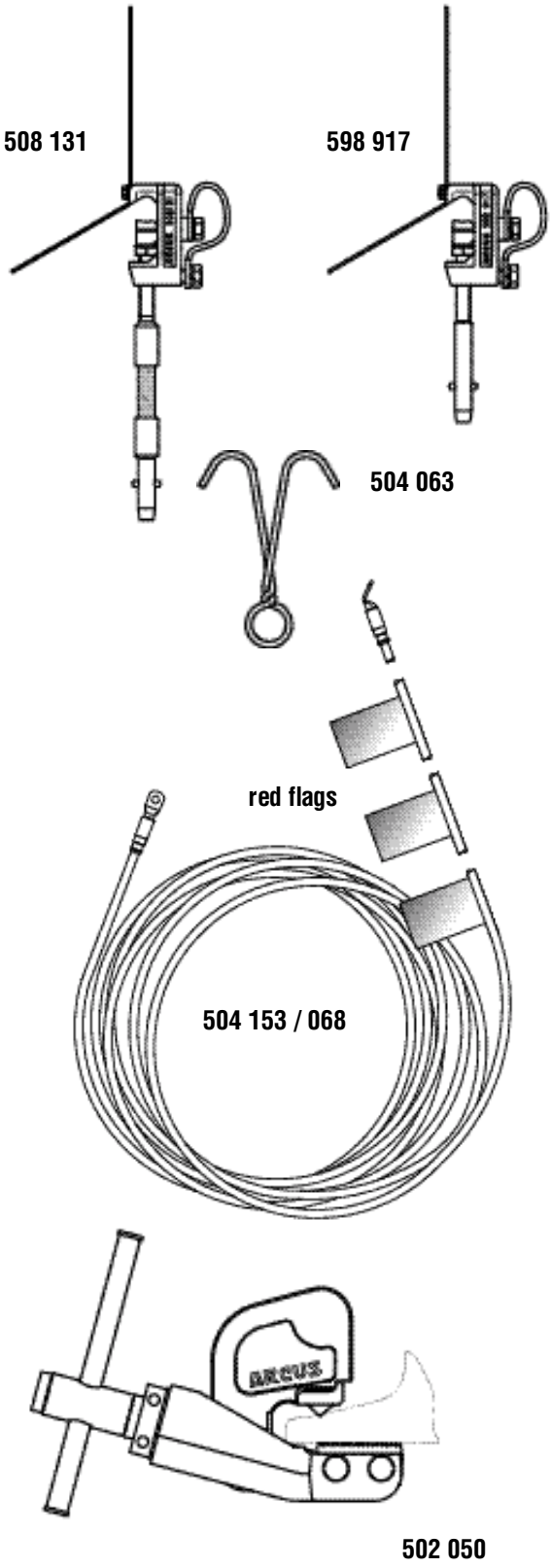
Multiple earth connection consisting of:

Star point bar made of copper, with 2ball point connectors ∅25 mm fixed to an earth connection clamp for ball point connectors ∅25 mm.

The multiple earth connection may be used with two single-phase short circuiting devices.

Weight:	appr. 1.75 kgs
Type no.:	**515 130**

These devices are fully approved by the Deutsche Bahn / DB (German Railway System)



Connection clamp for contact wires

with spring plates and direct cable connection to the clamp body and pressure plate.

For grooved contact wires Ri 80-120 to DIN 43141 and round contact wires ∅10.6 up to 13.2 mm.

Weight: appr. 1.25 kgs
Type no.: 508 131 with flexible bayonet spindle
598 917 with rigid bayonet spindle

Suspension hook

for earthing and short circuiting cables to obtain clearance-free fixing.

Weight: appr. 0.2 kgs
Type no.: 504 063

Earthing and short circuiting cable

highly flexible multi-stranded copper lead 50 sqmm, length 8.5 m, with transparent and waterproof insulation cover, compression cable lug on both sides, with 3 red flags. Not for clearance-free earthing.

Weight: appr. 5.4 kgs
Type no.: 504 153

Earthing and short circuiting cable

as above, length 12 m.
For clearance-free earthing.

Weight: appr. 7.6 kgs
Type no.: 504 068

Rail foot earthing clamp

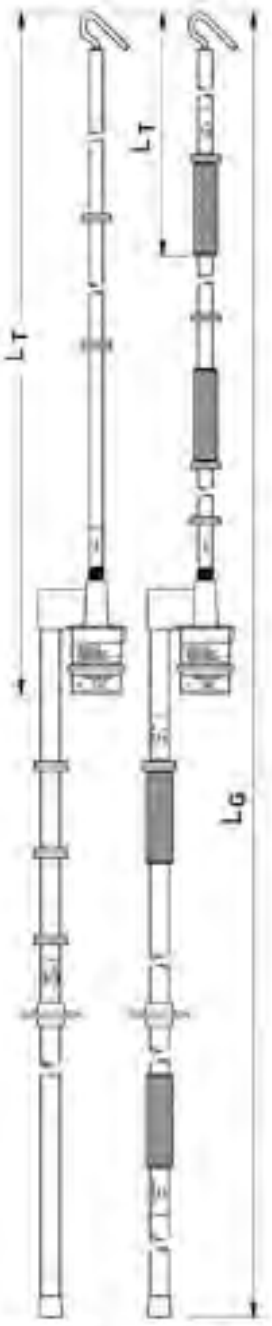
with replaceable contact cutting piece for penetration of foreign matter.
For rail profiles S 49, S 54, S 64, UIC 60.

Weight: Appr. 3.4 kgs
Type no.: 502 050 **with hand screw**
Type no.: 502 059 **with ratchet**

HIGH VOLTAGE LIVE LINE TESTERS AND EARTHING ROD, MULTI-SECTIONAL

for contact wires of electric railways

These devices are fully approved by the Deutsche Bahn / DB (German Railway System)



610 023 **698 698**

Fig. 1

Voltage tester ARCUSLIGHT CE
for 15 KV, 16 2/3 Hz, with optical indication, self-testing device, glasfibre-reinforced epoxy resin tubes with rain shields.

May be used in precipitation

Supplied in a tough woven plastic carrying bag, cold-resistant.

2-section type for contact and reeder wires

Total length (Lg):	4.6 m
Transport length (Lt):	2.4 m
Weight:	appr. 3.1 kgs
Type no.:	**610 023**

5-section type with sealed screw-type couplings

The reduced transport length makes his device ideal for fire brigades and emergency services.

Total length (Lg):	4.6 m
Transport length (Lt):	appr.1 m
Weight:	appr. 3.5 kgs
Type no.:	**698 698**

5-section telescopic earthing rod

with securable locking head, insulated fibre glass tubes, plug-in couplings with push-button locking.
Due to its reduced transport length this rod is especially useful on board electric trains and emergency accident vehicles.

Supplied in a tough woven plastic carrying bag, cold-resistant.

Total length (Lg):	5.0 m
Transport length (Lt):	appr. 1.05 m
Weight:	appr. 5.0 kgs
Type no.:	**511 189**

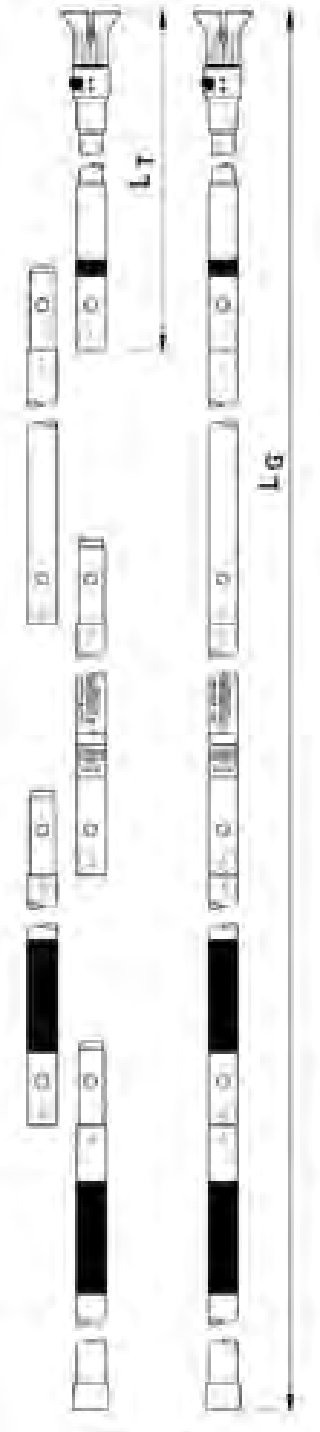


Fig. 2: 511 189

SHORT CIRCUIT DEVICE FOR THIRD RAIL SYSTEMS

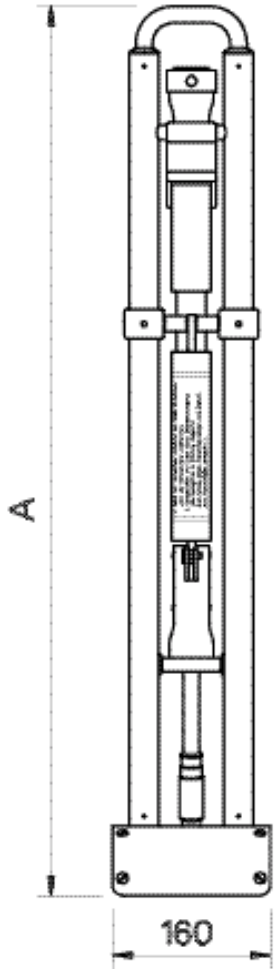


Fig. 1

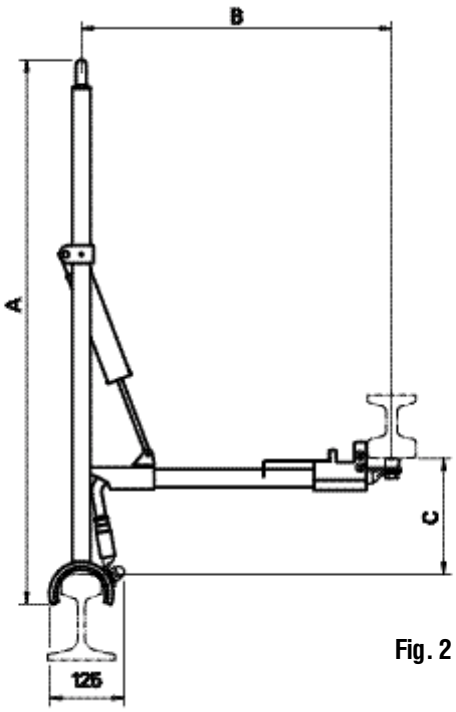


Fig. 2

This device is used for short circuiting tracks with a lateral contact rail.

It is attached to the running rail adjacent to the contact rail. The short-circuit is effected by swinging over the fully insulated handle. The fast-operating system may be used in an emergency to short circuit the live contact rail.

Short-circuit rating:

Up to 30 kA/ 0.025 s with 700 V d.c.

The compact construction of the earthing device allows it to be stored under the train driver's seat.

All electrical wearing parts are exchangeable.

References: Munich, Berlin, Hamburg, Vienna, London Docklands, Prague, Singapore and others.

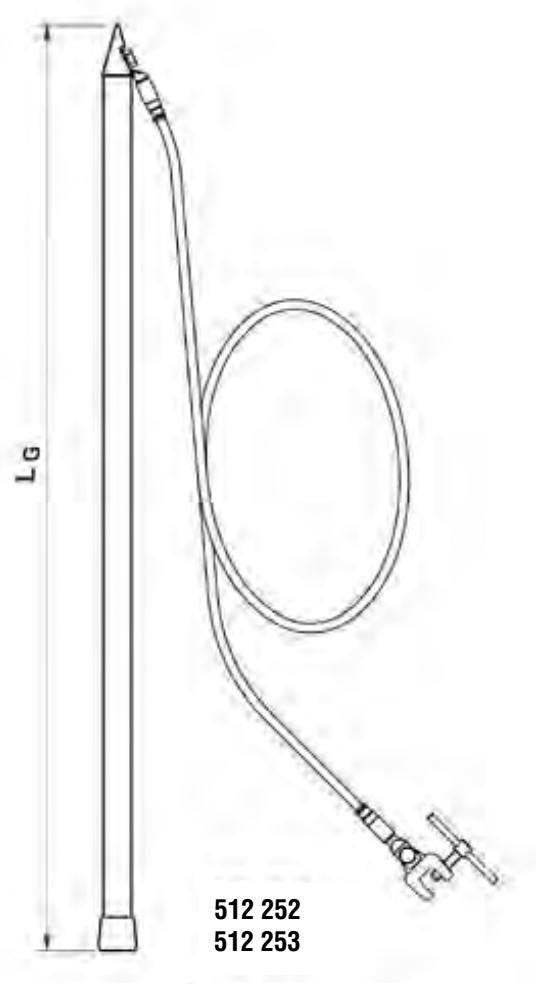
Please state the distance A and B (between the rails), according to picture 2.

Storage dimensions:

appr. ≤ 1100 x 160 x 125 mm

Weight:	appr. 5.0 kgs
Type no. for standard construction:	515 105

Short circuit devices for other rail configurations on request.



512 252
512 253

Fig. 1

These devices are designed to equalise for a short time differences in potentials.
For this purpose the earthed test tip is brought in contact with the part to be restored to earth potential.

The devices are firmly connected to the earthing rod:

Construction:

Earthing rod made of fibre glass reinforced epoxy resin tube, total length (L_g) = 1000 mm, firmly connected to test tip of aluminium.
Earth cable 25 sqmm, length 3000 mm, with earth connection clamp 502 016.

Weight: appr. 1.8 kgs
Type no.: 512 252

As above, but earthing rod with a total length of 1500 mm.

Weight: appr. 2.0 kgs
Type no.: 512 253

512 153

Fig. 2

Device for mounting to existing earthing rods:

Construction:

Test tip with screw-on quick fastening device to earthing rods 510 194 - 510 210, earth cable 25 sqmm, length 3000 mm, with earth connection clamp 502 016.

Weight: appr. 1.2 kgs
Type no: 512 153

For more information please see:

Earthing rods	page 63
Earth cables	page 35
Earth connection clamps	page 42

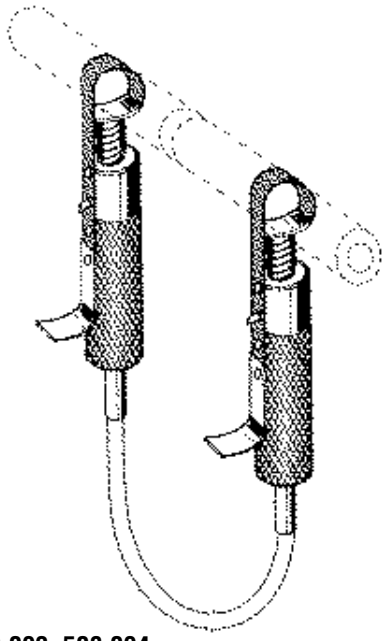


Fig. 1: 508 093, 508 094

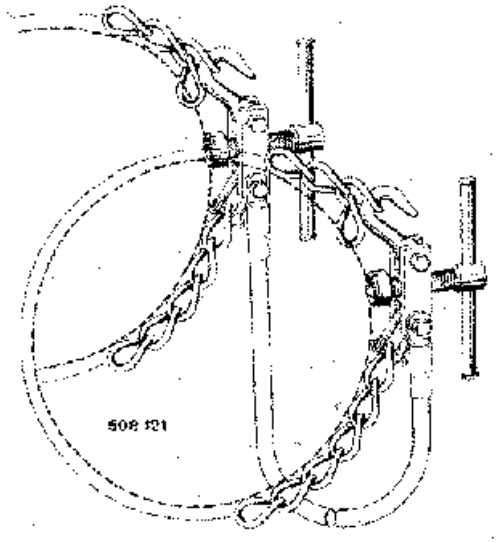


Fig. 2: 508 121

1.) Working on cable networks

Working on insulated metal sheathed cables which are influenced by adjacent strong a.c. current paths, or by earth-fault currents of high voltage lines with a star neutral earth point is highly dangerous.
According to DIN VDE 0105-100: 1997 - 10, para. 6.2.4.1.101, any insulated metal conductor under the electro-magnetic influence of an alternating current path, or a star neutral point of an h.v. network, must have a bridging electrical contact made of at least 16 sqmm before cutting.
Our devices types 508 093 and 508 094 are especially designed for this application and have been proven in practice to be highly effective.
Previous devices were either too heavy, caused deformations on the metal sheath of cables or worked loose during working. The ARCUS system fully overcomes these problems.

2.) Working on pipelines

Before the separation of electrically conductive house connection pipelines and pipelines in buildings, e.g. when exchanging fittings, meters, or in case of repair works, a provisional electrical bypass with 25 sqmm can be applied.

Jumper connection device type 508 121 is also suitable for coated pipes.

The clamps are connected by a highly flexible copper cable of 2500 mm length, with transparent insulation.

Type no.	Clamping range [mm]		Construction features	Weight per device
	Outer∅ of the cable screen	for bare and insulated pipes		appr. kgs
508 093	13,5 – 90	-	Flexible tin plated conductor band, stainless steel pressure spring, plastic handles	1,0
508 094	90 – 220	-		1,10
508 121	-	60 – 250	Pressure plate with circular grooves of hardened burnished steel, hand screw, chain and threaded section	3,7

PLASTIC SAFETY HOOKS

for rescue of accident victims

Fig. 1

S-shaped hook for the rescue of persons from l.v. current circuits, working machines, etc., for example by: pulling on arms, legs, arm pits, neck or ankle, etc.

Material:
Polyethylene-HD, highly heat-stable, good chemical resistivity.

Technical Data:

Density:		0,950 g/cm^3
Creep resistance:		600 V
Breaking stretch:		300 %
Bending e-module:		800 N/sqmm
Pulling e-module	>=	600 N/sqmm
Bending stress:	>=	15 N/sqmm
Inflamability	appr.	350 °C

Range of temperatures:

Permanent use: -50 up to +70°C

1 kV safety hook (509 048) with special stabilisation against ultraviolet light suitable for outside use.
Do not store under direct solar radiation.

Durability:

For safety reasons the safety hook should be exchanged after 10 years.
The year of production is marked on the hook.

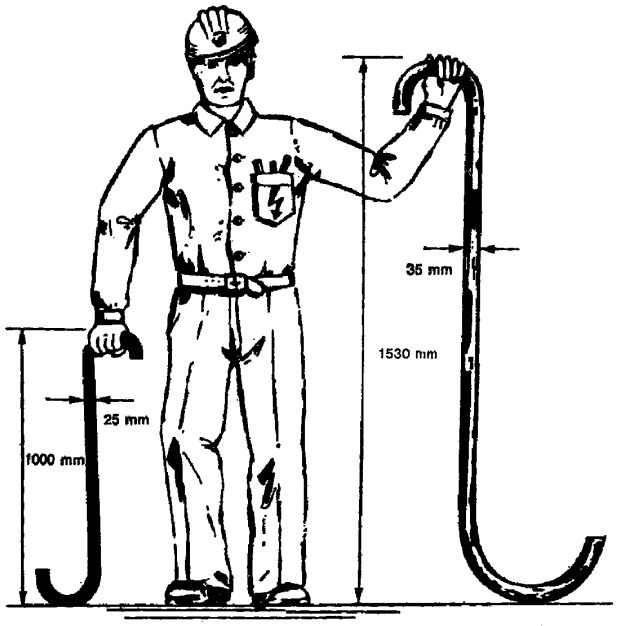


Fig. 2

For low voltage up to 1 kV :

Length:	1000 mm
Bar diameter:	25 mm
Colour:	black
Type no.:	**509 048**

For high voltage up to 60 kV

Length:	1530 mm
Bar diameter:	35 mm
Colour:	ivory
Type no.:	**509 049**

ELECTRICAL SAFETY GLOVES

made of latex

Fig. 1

Type no.	Class	Size	Length appr.[mm]	Strength appr. [mm]
622 006	00	10	360	0,5

Application:

Insulated safety gloves are suitable for live working up to 500 V.

They conform to DIN EN 60903, VDE 0682 part 311 of October 1994.

Material:

Special natural latex with good properties against tearing and abrasion and very good cold flexibility.

Resistant against acid and ozone.

Shape and properties:

Anatomical shape with good flexibility and good touching sensitivity.

Long-term skin protection due to antibacterial treatment.

Earthing rods

Earthing rods are used for the approach and connection of phase clamps to dead conductors.
Earthing rods are divided by the “black ring“ into the insulating section Li and the handle section Lh.
The length of the insulating section is ≥ 500 mm and is independent of the nominal voltage of the switchgear in which the earthing rod is to be used.

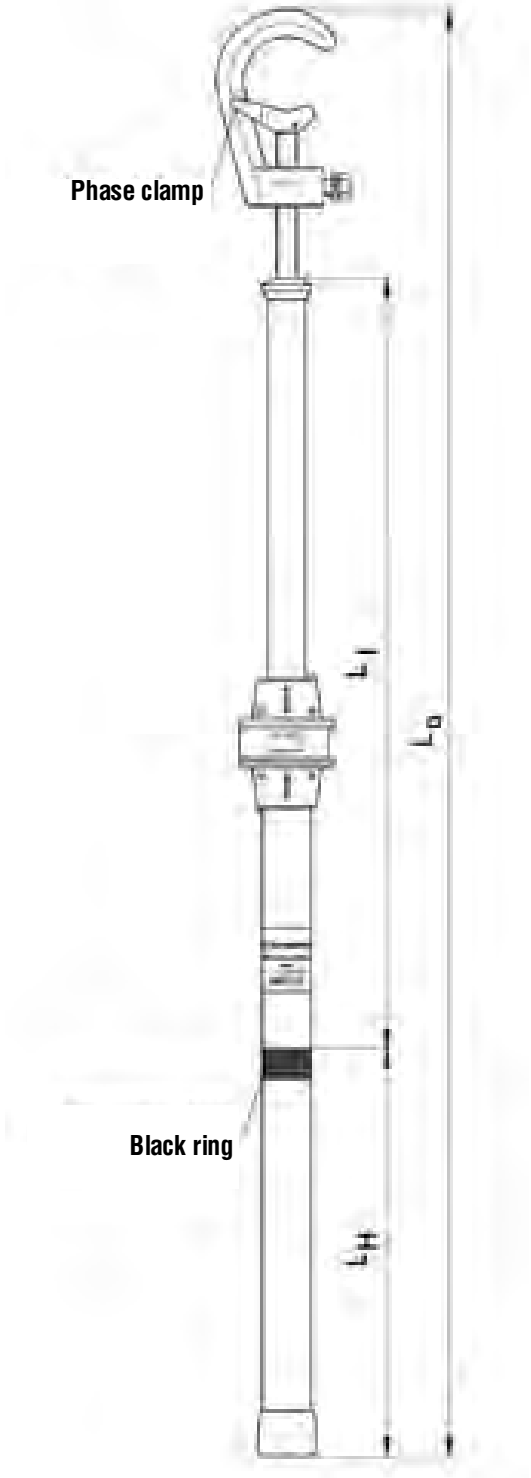


Fig. 1: Telescopic earthing rod

The length L_0 of an earthing rod is mainly not determined by the insulating properties but by the condition to keep the operator at the necessary distance from live parts of the installation.

Conductor connection
If the total length L_0 required for earthing and short circuiting is inconvenient for transport and storage, the use of telescopic or multi-sectional types is recommended.

Also the weight of the earthing rod together with the earthing and short circuiting device to be directed safely to the line influences the bending strength and flexibility of the earthing rods made of fibre glass reinforced epoxy resin.
To *EN 61230: 1996-11* they are divided into three cathegories:
Black ring

light (L)	**bending strength ≥ 25 N,**
normal (S)	**bending strength ≥ 50 N,**
reinforced (R)	**bending strength ≥ 100 N.**

This definition replaces the weight information on the type labels of the rods to the old standard.

In the chapter “earthing rods“ in this brochure (from page 63 on) you will find a large number of long-term approved earthing rods which fulfill all present demands.

From now on the labels on the earthing rods will show the marking according to the new European Standard, as the example below:

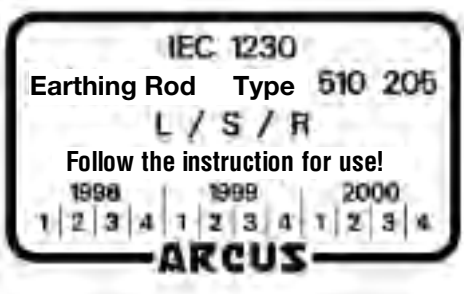


Fig. 2: Example of a label to *IEC 1230*

Coupling heads for earthing and operating rods [1)]

The working heads shown below are suitable for use with phase clamps, switching rod heads and other operating equipment with a spindle according to DIN 48 087.
A special feature of these heads is their fast and simple operation.

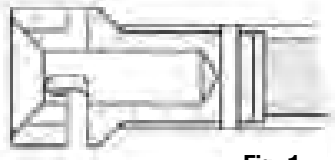


Fig. 1

Normal bayonet head (Fig. 1)

Protection with bayonet slot against accidental loosening.

Material: Impact resistant plastic material.

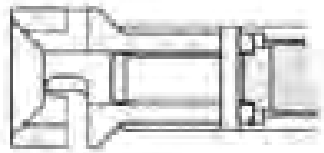


Fig. 2

Spring bayonet head (Fig. 2)

Protection against accidental loosening in addition with a spring.

Material: Impact resistant plastic material
Elastomere spring

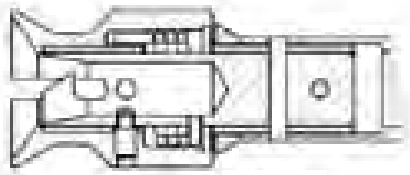


Fig. 3

Safety rod head (Fig. 3) [1)]

A plastic head which can be turned around a steel bayonet equipped with a spring control device prevents accidental loosening or detachment of the phase clamp.

Material: Impact resistant plastic material steel parts galvanized

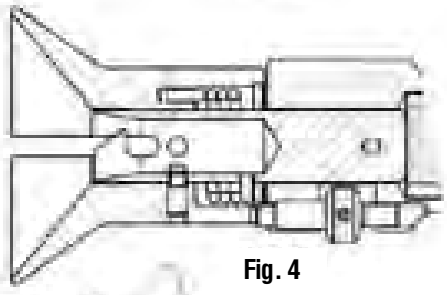


Fig. 4

Safety bayonet head with locking function (Fig. 4)[1)]

The function is the same as with the safety bayonet head. In addition the head can be locked by a threaded nut. This robust head is intended for rough handling as with railways or mining.

Material: All parts metal
steel parts galvanized

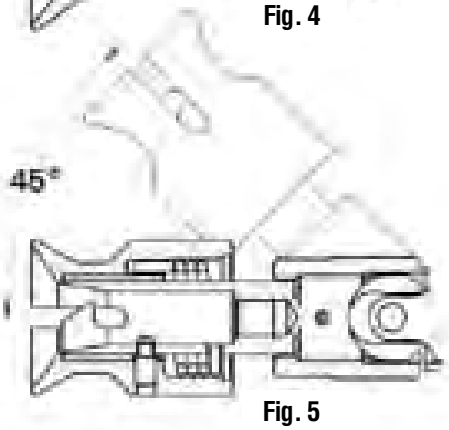


Fig. 5

Safety joint head (Fig. 5) [1)]

Construction as the safety bayonet head, but in addition with a steel joint and threaded ring to allow the head to swivel to all sides at an angle of 45°.

Material: Impact resistant plastic material
steel parts galvanized

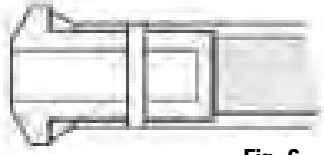


Fig. 6

Connection piece (Fig. 6)

For a non-detachable connection between insulated rod and phase clamp.

Material: Impact resistant plastic material

1) Due to the metal parts the safety bayonet heads may only be used with operating rods under certain conditions.

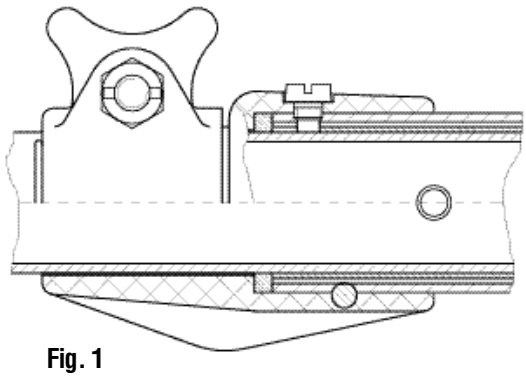


Fig. 1

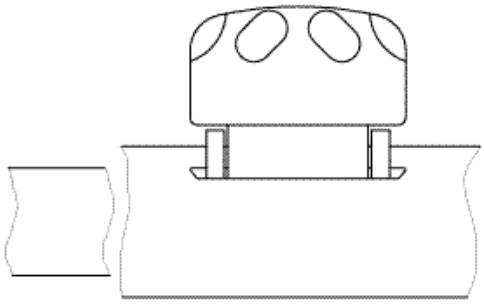


Fig. 2

Connection with slotted sleeve for telescopic rods (Fig. 1)

The inner rod is to be fully extended and is clamped into a slotted sleeve secured against torsion. The clamp screw is non-detachable.

Material: Sleeve and grip screw made of plastic material, bolted screw made of galvanized steel.

Clamping connection for telescopic rod type 511 188 (Fig. 2)

The inner rod can be fully extended up to the stop position and secured against torsion and tensile forces with the tightening strap and pressure screw.
All parts are covered with shock resistant material.

This clamping connection is suitable for earthing rods for use under rough conditions (railway tracks, mining).

Material: Hand knob of aluminium, all other parts of galvanized steel.

Locking connection for telescopic rods (Fig. 3)

Once the locking ring is slackened, the inner rod can be telescoped between 0,4 and 0,5 mtrs, and then locked to ensure it can neither rotate nor extend. The locking function is assisted by a spring. This feature enables different operating lengths to be safely achieved.

Material:

Locking pin and spring stainless steel.
Joint parts made of impact-resistant plastic material.

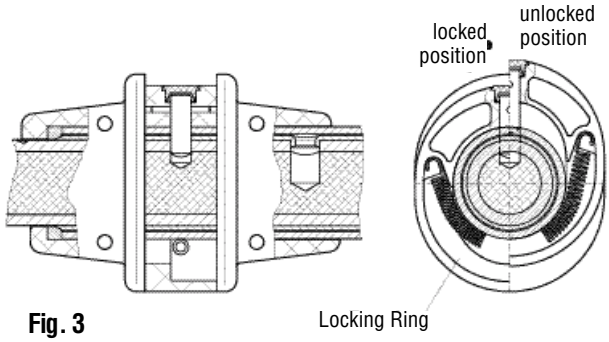


Fig. 3

Plug-in connection for multi-section rods (Fig. 4)

To connect separate rods these are inserted and locked by means of the locking ring, to secure against torsion and tensile forces. Foamed tubes with rain shields and multi-sectional operating rods for use in precipitation can be manufactured if required (see page 69).

Material:

Locking pin and spring stainless steel, joint parts made of impact-resistant plastic material.

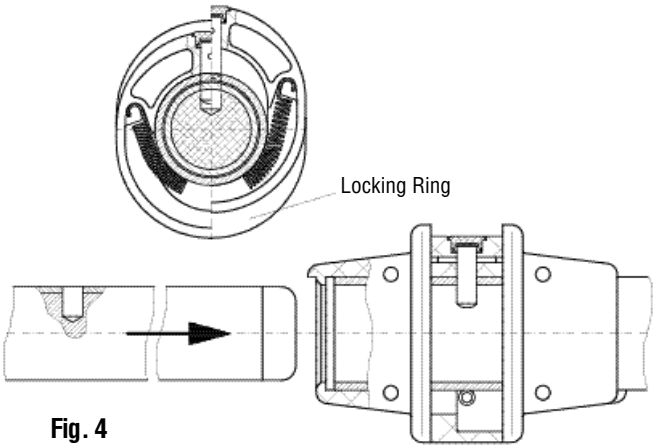


Fig. 4

Fig. 1

Coupling heads / construction:

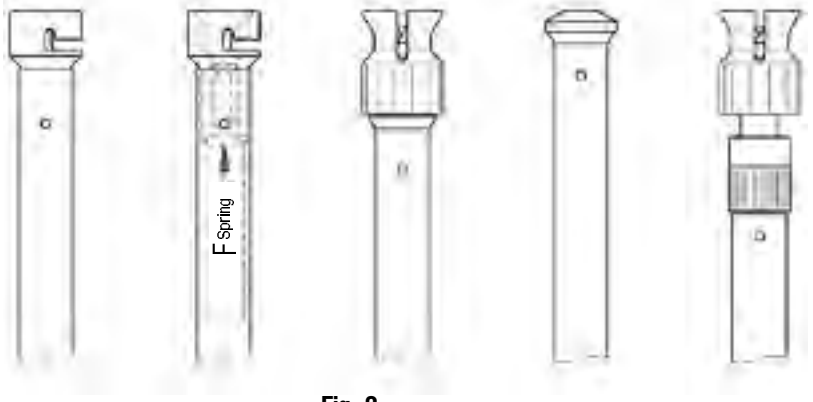


Fig. 2

Single section earthing rods								
Dimensions	L_G[mm]	1000	1500	1750	2000	2700	3500	4500
	L_H[mm]	440	940	1140	1440	2140	2940	3840
	D[mm]	30	30	30	30	40	40	40
Rod category	(VDE 0683 Part 100)	R	R	S	S	R	S	L
Weight [5]	[kgs / each]	0,8	1,0	0,9	1,1	2,0	2,5	3,1
Con-struc-tion	**with coupling head**	**Type no.**						
A	normal bayonet head	**510 194**	**510 195**	-	**510 196**	**510 197**	**510 198**	**510 199**
B	spring bayonet head	**510 205**	**510 206**	-	**510 207**	**510 208**	**510 209**	**510 210**
C	safety rod head	**510 216**	**510 217**	-	**510 218**	**510 219**	**510 220**	**510 221**
D	connection piece [1]	**510 238**	**510 239**	-	**510 240**	**510 241**	**510 242**	**510 243**
F	safety joint head	**510 244**	**510 245**	**510 246**	-	-	-	-

1) Please state type of phase clamp (page 47, 48) in your order.
2) Upon request the rod can be supplied with a hand protection disk instead of the black ring.
3) Label made of PVC, colour yellow, with abrasion resistant printing.
4) Rod end made of non-slip rubber with holes against condensation water.
5) The stated weights refer to those rods with safety rod head.

Material: Rods made of fibre glass reinforced epoxy resin, colour yellow, rod heads impact-resistant plastic material.

For earthing rod details please see pages 60-62.

TWO- AND THREE-SECTION TELESCOPIC EARTHING RODS

with slotted sleeves
for nominal voltages above 1 kV

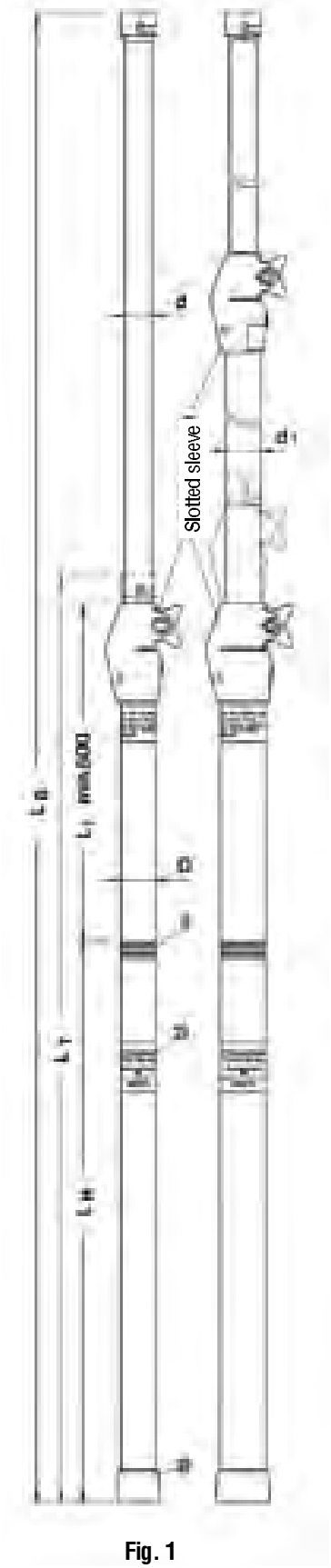


Fig. 1

Coupling heads / construction:

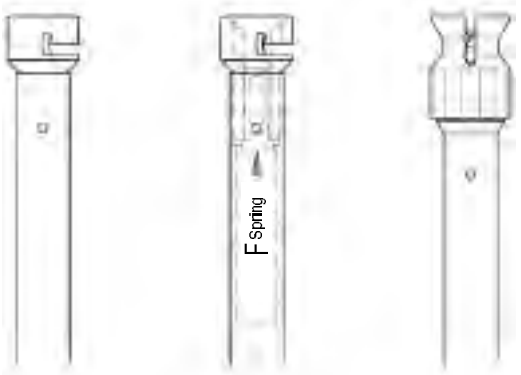


Fig. 2

Telescopic earthing rods with slotted sleeves						
		two-section type				
Dimensions	L_G [mm]	1500	2000	2700	3500	4500
	L_H [mm]	300	700	950	1350	1950
	L_T [mm]	900	1250	1500	1900	2500
	D/d [mm]	40/30	40/30	40/30	40/30	40/30
Rod category	(VDE 0683 Part 100)	R	R	S	S	L
Weight[4]	[kgs/each]	0,90	1,15	1,50	1,90	2,30
Con-struc-tion	**with coupling head**	**Type no.**				
A	Normal bayonet head	**511 140**	**511 141**	**511 142**	**511 143**	**511 144**
B	Spring bayonet head	**511 145**	**511 146**	**511 147**	**511 148**	**511 149**
C	Safety rod head	**511 150**	**511 151**	**511 152**	**511 153**	**511 154**
		three-section type				
Dimensions	L_G [mm]	3500	4500			
	L_H [mm]	750	1000			
	L_T [mm]	1400	1700			
	$D/d_1/d$ [mm]	50/40/30	50/40/30			
Rod category	(VDE 0683 Part 100)	S	L			
Weight[4]	[kgs/each]	2,20	2,80			
Con-struc-tion	**with coupling head**	**Type no.**				
A	Normal bayonet head	**511 155**	**511 156**			
B	Spring bayonet head	**511 157**	**511 158**			
C	Safety rod head	**511 159**	**511 160**			

1) Upon request the rod can be supplied with a hand protection disk instead of the black ring.
2) Label made of PVC, colour yellow, with abrasion resistant printing.
3) Rod end made of non-slip rubber with holes against condensation water.
4) The stated weights refer to those rods with safety rod head.

Material: Rods made of fibre glass reinforced epoxy resin, colour yellow, rod heads impact-resistant plastic material.

For earthing rod details please see pages 60 - 62.

TWO- AND THREE-SECTION TELESCOPIC EARTHING RODS

with locking connection
for nominal voltages above 1 kV

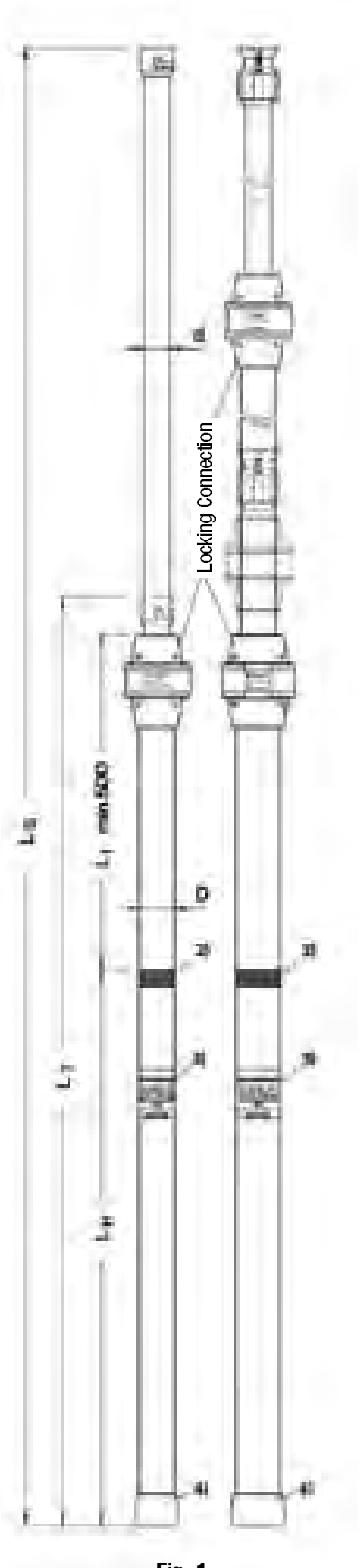


Fig. 1

Coupling heads / construction:

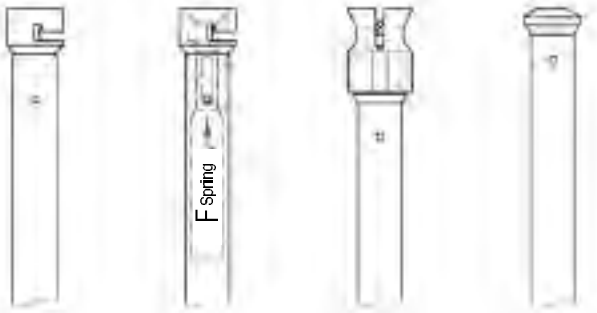


Fig. 2

Telescopic earthing rods with slotted sleeves						
		two-section type				
Dimensions	L_G [mm]	1800	2100	2700	3500	4500
	L_H [mm]	400	450	750	1150	1650
	L_T [mm]	1025	1175	1475	1875	2375
	D/d [mm]	40/30	40/30	40/30	40/30	40/30
Rod category	(VDE 0683 Part 100)	R	R	S	S	L
Weight[4]	[kgs/each]	0,90	1,20	1,50	1,90	2,30
Con-struc-tion	**with coupling head**	**Type no.**				
A	Normal bayonet head	**511 196**	**511 197**	**511 198**	**511 199**	**511 200**
B	Spring bayonet head	**511 201**	**511 202**	**511 203**	**511 204**	**511 205**
C	Safety rod head	**511 206**	**511 207**	**511 208**	**511 209**	**511 210**
D	Connection piece	**511 211**	**511 212**	**511 213**	**511 214**	**511 215**
		three-section type				
Dimensions	L_G [mm]	3500	4500			
	L_H [mm]	540	870			
	L_T [mm]	1345	1675			
	$D/d_1/d$ [mm]	50/40/30	50/40/30			
Rod category	(VDE 0683 Part 100)	S	L			
Weight[4]	[kgs/each]	2,20	2,80			
Con-struc-tion	**with coupling head**	**Type no.**				
A	Normal bayonet head	**511 216**	**511 217**			
B	Spring bayonet head	**511 218**	**511 219**			
C	Safety rod head	**511 220**	**511 221**			
D	Connection piece[1]	**511 222**	**511 223**			

1) Please state type of phase clamp (page 47, 48) in your order.
2) Upon request the rod can be supplied with a hand protection disk instead of the black ring.
3) Label made of PVC, colour yellow, with abrasion resistant printing.
4) Rod end made of non-slip rubber with holes against condensation water.
5) The stated weights refer to those rods with safety rod head.

Material: Rods made of fibre glass reinforced epoxy resin, colour yellow, rod heads impact-resistant plastic material.

For earthing rod details please see pages 60 - 62.

MULTI-SECTION EARTHING RODS, PLUG-IN TYPE

for nominal voltages above 1 kV

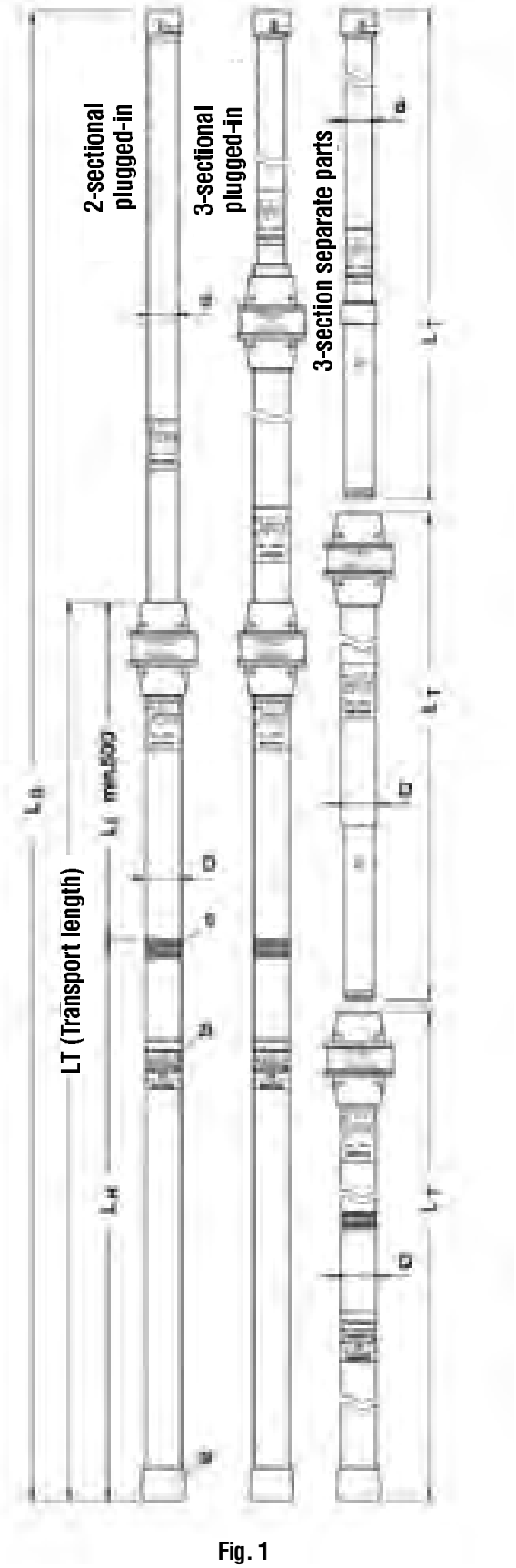


Fig. 1

Coupling heads / construction:

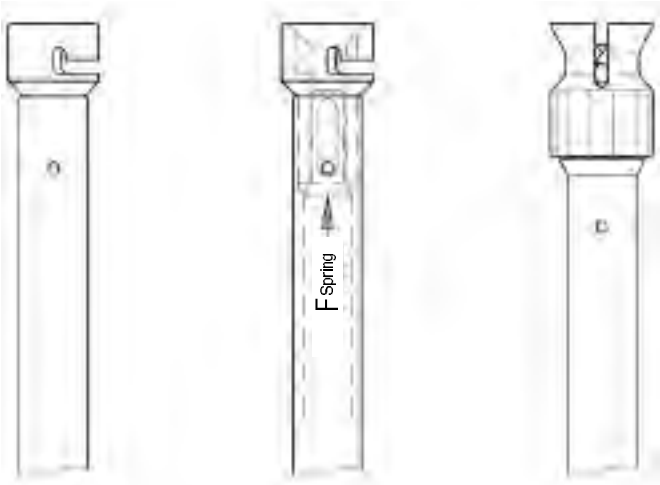


Fig. 2

Multi-section earthing rods, plug-in type			
Construction		**2-sect.**	**3-sect.**
Dimensions	L_G [mm]	3500	4500
	L_H [mm]	1200	985
	L_T [mm]	1860	1675
	D/d [mm]	40/30	40/40/30
Rod category	(VDE 0683 Part 100)	S	L
Weight[4]	[kgs/each]	3,00	3,60
Con-struc-tion	**with coupling head**	**Type no.**	
A	Normal bayonet head	**511 224**	**511 227**
B	Spring bayonet head	**511 225**	**511 228**
C	Safety rod head	**511 226**	**511 229**

1) Upon request the rod can be supplied with a hand protection disk instead of the black ring.
2) Label made of PVC, colour yellow, with abrasion resistant printing.
3) Rod end made of non-slip rubber with holes against condensation water.
4) The stated weights refer to those rods with safety rod head.

Material: Rods made of fibre glass reinforced epoxy resin, colour yellow, rod heads impact-resistant plastic material.

For earthing rod details please see pages 60 - 62.

Operating rods

Operating rods are devices for manual use for testing and operating live parts.
Construction of rods is as follows:

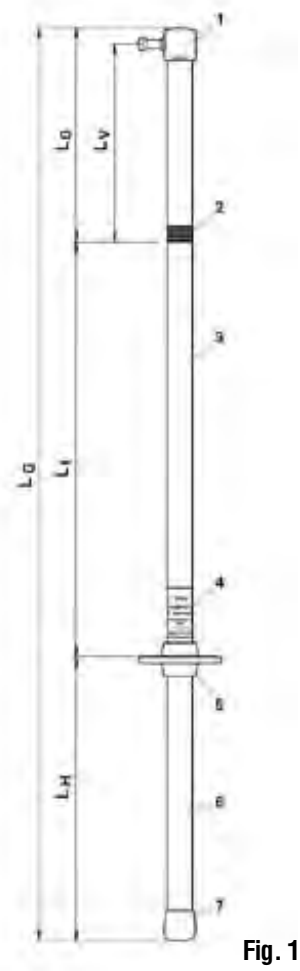


Fig. 1

1 Operating head
2 "Red ring"
3 Insulating section (length L_I)
4 Label with type indication
5 Hand protection disk
6 Length of handle (L_H)
7 Rod end cap
L_V Length of the extension section
L_O Length of the top section
L_G Total length of the operating rod
L_I Length of the insulating section

Between the hand protection disk and the "Red ring" the insulating section (L_I) is located which gives the operator the protective distance and sufficient length of insulation for safe handling. The minimum length of the insulating section is between 500 and 3200 mm and depends on the nominal voltage for which the operating rod is marked on the label. Discharge currents must not exceed 0.2 mA in dry conditions and 0.5 mA under precipitation.

The top section (L_O) is the rod section between the insulating section and upper end of the operating head.

The extension section (L_V) is located between the insulating section and the operating element. It enables the operator to reach distant parts of the installation. In this case it is permitted to reach with the operating head along live installation parts.

Operating rods are manufactured in 2 categories:

1.) For indoor and outdoor use but not with precipitation.
Label is marked: "Do not use with precipitation !".

2.) For use indoors and outdoors with any kind of weather.
Label is marked: "May be used in precipitation".

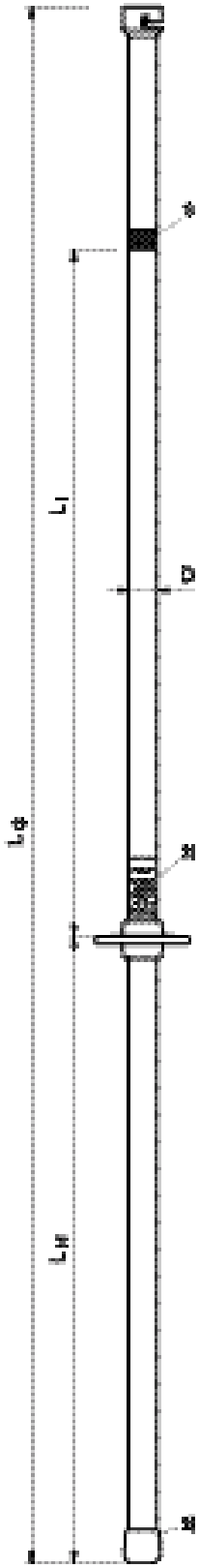
VDE standards:

DIN VDE 0681 part 1: 1986-10	Operating, testing and safe-guarding devices for work on electrically energised systems with rated voltages exceeding 1 kV - Part 1: General requirements for the part 2 to 4
DIN 57681 part 2/ **VDE 0681 part 2:** 1977-03	VDE-specification for operating, testing and safe-guarding devices used when carrying out live-line-work on equipment with rated voltages exceeding 1 kV - Part 2: Operating rods
DIN 57681 part 3/ **VDE 0681 part 3:** 1977-03	- Part 3: Fuse tongs
DIN VDE 0681 part 4: 1986-10	Operating, testing and safe-guarding devices for work on electrically energised systems with rated voltages exceeding 1 kV - Part 4: AC voltage detectors

The operating rods shown on the following pages are according to part 1 to 3 of the afore mentioned standards.
High voltage live line testers to VDE 0682 part 411 are described in a separate brochure.

SINGLE SECTION OPERATING RODS
SWITCHING ROD HEAD

Operating rods for nominal voltages above 1 kV
"not to be used with precipitation"



Construction and material:

Operating rods comply with DIN VDE 0681 part 1 / 10.86.
They are equipped with a normal bayonet head as described on page 61.
The rods are manufactured from fibre glass reinforced and smooth epoxy resin tubes.
The surface is protected by a yellow UV-resistant varnish.
The hand protection disk is made of black rubber material.
The rod end is sealed with a non-slip rubber cap.
Labels are made of PVC-material, colour yellow, with abrasion resistant printing.

Single section operating rods						
Nominal voltage	up to 30	up to 60	up to 110	up to 150[4]	up to 220[4]	up to 380[4]
L_G [mm]	1000	1500	2000	2700	3500	4500
L_H [mm]	350	450	550	800	900	1000
L_I [mm]	525	900	1300	1750	2400	3200
D [mm]	30	30	30	40	40	40
Weight [kg/each]	0,60	0,70	0,90	1,80	2,30	3,0
Type no.	**510 183**	**510 184**	**510 185**	**510 186**	**510 187**	**510 188**

1) "Red Ring"
2) Label
3) Rod end cap
4) Only for networks with effectively earthed star point.

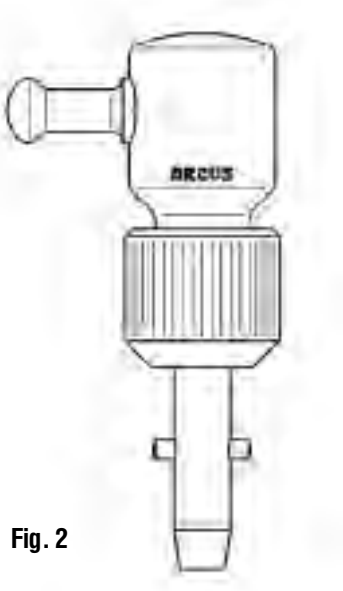


Fig. 2

Switching rod head

To DIN 57 681 part 2 / 3.77, can be quickly screwed onto the operating rod.

Material: Fibre glass reinforced polyamide, operating bolt made of solid glass polyester.

Type no.: **509 053**

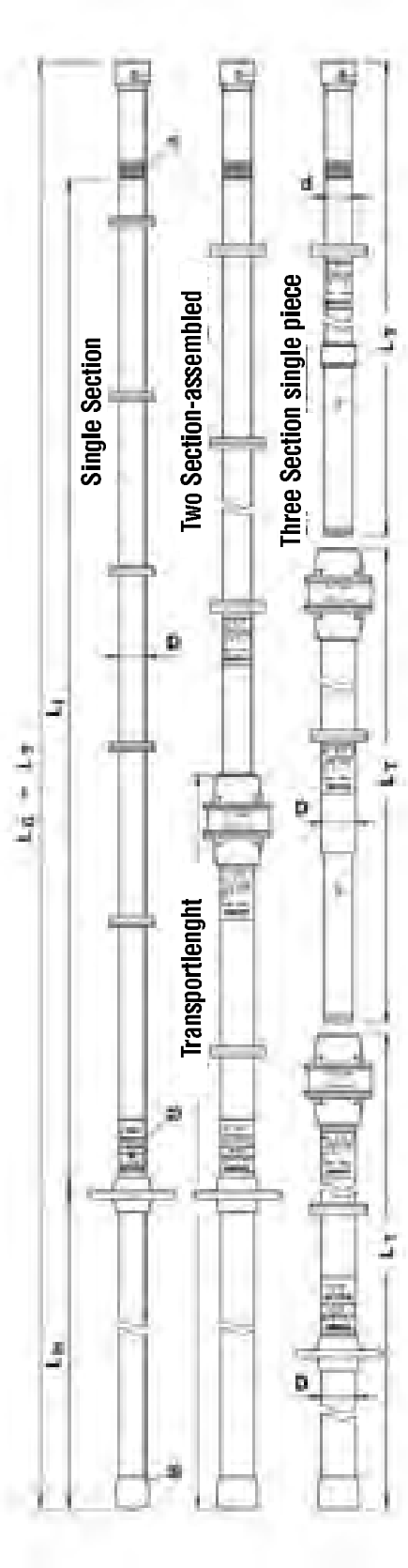
For further details about operating rods please see pages 61, 62 and 67.

The -test marks on this page were granted by the VDE Test Office.

SINGLE- AND MULTI-SECTION OPERATING RODS, PLUG-IN TYPE

for nominal voltages above 1 kV

"Can also be used with precipitation"



Construction and material:

Operating rods comply with DIN VDE 0681 part 1 / 10.86.and are equipped with a normal bayonet head as described on page 61. The rods are manufactured from fibre glass reinforced and smoothened epoxy resin tubes.
The surface is protected by a yellow UV-resistant varnish.
The inner tube is foamed with dense pores.
The hand protection disk is made of black rubber material.
The rod end is sealed with a non-slip rubber cap.
Labels are made of PVC-material, colour yellow, with abrasion resistant printing.
The rain insulators are made of impact-resistant plastic material, colour blue, and are glued to the tube unmovably.
For further details about operating rods please see pages 61, 62 and 67.

Operating rods						
Construction	**one-sectional**			**two-section plugged-in type**	**three-section plugged-in type**	
Nominal voltage [kV]	up to 30	up to 60	up to 110	up to 110	up to 150[4]	up to 220[4]
L_G [mm]	1800	2300	2800	2700	3500	4100
L_H [mm]	500	600	700	700	800	980
L_T [mm]		-	-	1455	1855	1500
L_I [mm]	1200	1600	2000	1900	2600	3000
D/D/d [mm]	30	30	30	40/30	40/30	40/40/30
Weight [kg/each]	2,0	2,4	2,8	3,0	3,5	4,0
Type-no.	**510 250**	**510 251**	**510 252**	**510 288**	**510 289**	**510 290**

1) "Red Ring"
2) Label
3) Rod end cap
4) Only for networks with effectively earthed star point.

SWITCHING RODS

for nominal voltages 10 kV to 110 kV
"Must not be used in precipitation"

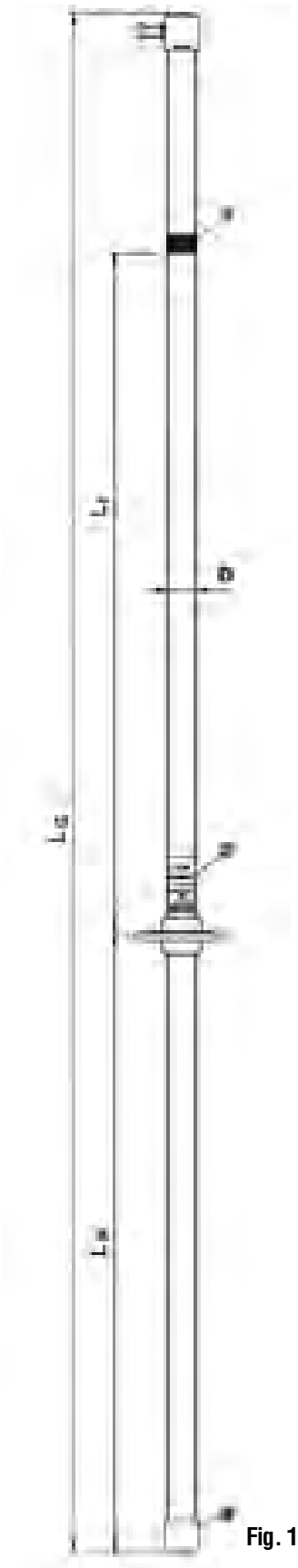


Fig. 1

Construction and material:

Switching rods comply with DIN VDE 0681 part 2 / 3.77.
Operating bolt and switching rod heads are made of high-quality plastic material.
The rods are manufactured from fibre glass reinforced and smoothened epoxy resin tubes. The surface is protected by a yellow UV-resistant varnish.
The hand protection disk is made of black rubber material.
The rod end is sealed with a non-slip rubber cap.
Labels are made of PVC-material, colour yellow, with special printing.

Switching rods							
Nominal voltage [kV]	up to 30	up to 30	up to 30	up to 30	up to 30	up to 30	up to 30
L_G [mm]	1000	1500	2000	2500	3000	3500	4000
L_H [mm]	350	450	550	700	850	900	950
L_I [mm]	525	525	525	525	525	525	525
D [mm]	30	30	30	30	30	30	40
Weight [kg/each]	0,60	0,70	0,90	1,10	1,30	1,50	1,90
Type no.	**510 227**	**510 264**	**510 265**	**510 266**	**510 267**	**510 268**	**510 269**

Switching rods		
Nominal voltage [kV]	up to 60	up to 110
L_G [mm]	1500	2000
L_H [mm]	450	550
L_I [mm]	900	1300
D [mm]	30	30
Weight [kg/each]	0,70	0,90
Type no.	**510 228**	**510 229**

1) "Red Ring"
2) Label
3) Rod end cap

For further details about switching rods and operating rods please see page 67.

The -test marks on this page were granted by the VDE Test Office.

FUSE TONGS

for nominal voltages 10 kV to 30 kV
“not to be used with precipitation“

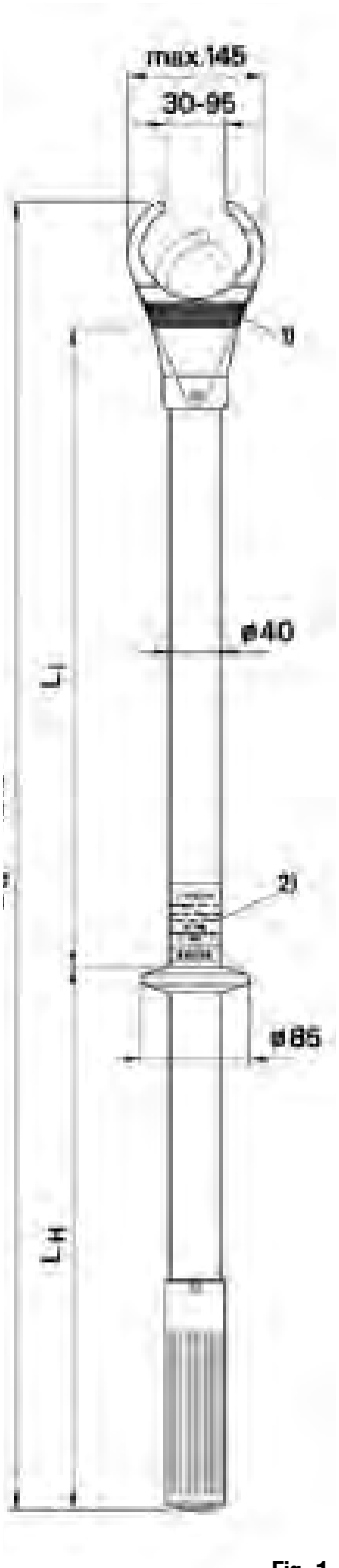


Fig. 1

The fuse tong is used to grip an HRC-fuse from the front. By rotating the handle the HRC-fuse is held tightly by the clamping part.
Little space is required by the fuse tong on each side. It is highly suitable for use in switching stations where space is limited.

Type no.	UN [kV]	LH [mm]	LI [mm]	Safety standard
514 007	10 - 20	425	500	GS
514 008	10 - 30	400	525	GS

Clamping range: 30 - 95 mm
Weight each: appr. 2 kgs

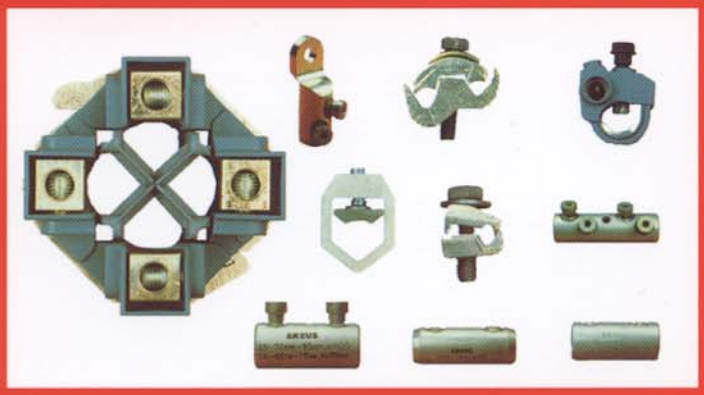
Material: Clamping head made of fibre glass reinforced plastic material, colour black.
Insulating tube fibre glass reinforced polyester, colour yellow.
Hand protection disk made of hardened rubber, colour black.
Label made of plastic material, with abrasion resistant printing, colour yellow.

The GS-test signs on this page were granted by the Technical Supervision Association (TÜV) Bavaria.

1) Red Ring

2) Label

Production programme

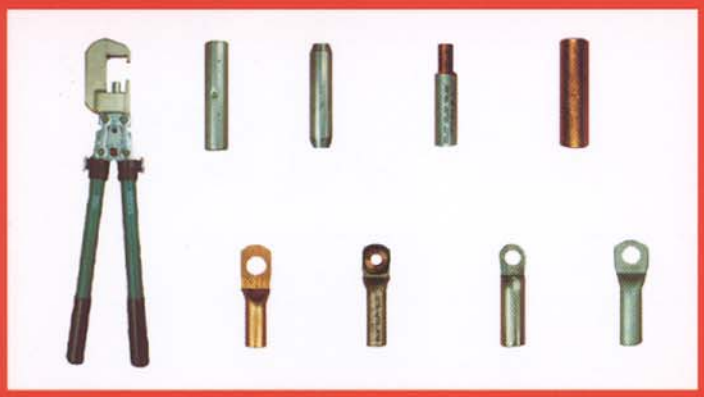


Cable Connection Technique

- Cable branching and ring connectors
- Cable connectors
- Connection terminals
- Transformer connection terminals
- Installation accessories

Overhead Line Clamps

- Tap-off and dead end clamps
- Earth wire and strip clamps
- Surge arresters
- Accessories



Compression Programme

- Compression cable lugs Al and Cu
- Compression links Al and Cu
- Compression material Al and Cu
- Compression tools

Safety Equipment

- High voltage live line testers 3-400 kV
- Earthing and short circuiting devices for low, medium and high voltage
- Earthing and switching rods
- Earth and phase fixed points
- Insulated tools

N 05.01

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