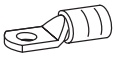
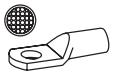
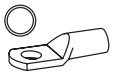
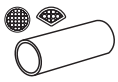
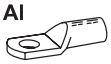
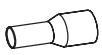
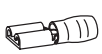
Technical Appendix

Technical notes on the various crimping types

	Crimping	Description	Range of application
	**Hexagonal crimping**	for crimping tubular copper cable lugs and compression joints "standard type", cable lugs for panels, compression cable lugs DIN 46235 and compression joints DIN 46267, aluminium cable lugs and compression joints.	6 – 1,000 mm^2
	**Indent crimping**	for crimping tubular copper cable lugs and compression joints ”standard type”, cable lugs for panels, terminals DIN 46234 and pin terminals DIN 46230, insulated terminals, tubular cable lugs and compression joints for fine stranded cables, tubular nickel cable lugs and compression joints, stainless steel tubular cable lugs and compression joints.	0.75 – 400 mm^2
	**oval crimping**	for crimping tubular double compression cable lugs, C-clamps, insulated tubular cable lugs and compression joints, insulated pin cable lugs and compression joints DIN 48217, compression dead ends, insulated cable connectors.	0.1 – 185 mm^2
	**Indent crimping**	for crimping tubular copper cable lugs and compression joints ”standard type”, cable lugs for panels, tubular cable lugs and compression joints for fine stranded cables.	6 – 400 mm^2
	**Indent crimping**	for crimping tubular copper cable lugs and compression "standard type" cable lugs for panels, tubular nickel cable lugs and compression joints, stainless steel tubular cable lugs and compression joints.	4 – 95 mm^2
	**Trapezoid crimping**	for crimping cable end-sleeves and twin cable end-sleeves.	0.14 – 240 mm^2
	**Indent crimping**	for crimping cable end-sleeves and twin cable end-sleeves.	0.5 – 35 mm^2
	**Square crimping**	for crimping cable end-sleeves and twin cable end-sleeves.	0.14 – 16 mm^2
	**Roll crimping**	for crimping non-insulated receptacles and cable end-sleeves DIN 46228, part 2.	0.1 – 6 mm^2
	**Round crimping**	for crimping cable end-sleeves and twin cable end-sleeves	0.14 – 16 mm^2
		of 90° and 120° sector shaped conductors	10 sm – 300 sm 35 se – 300 se
	**Quad-point indent crimping**	for crimping tubular copper cable lugs and compression joints "standard type", cable lugs for panels, tubular cable lugs and compression joints for fine stranded cables.	10 – 300 mm^2
	**Four point crimping**	for crimping turned pin receptacles and pin connectors.	0.1 – 4 mm^2
	**Special trapezoid crimping,**	particularly for crimping cable end sleeves for compacted fine stranded wires.	10 – 240 mm^2
	**Gas-tight oval crimping**	Crimp quality according to the automotive standard	

Legend of pictograms used for connecting materials

	Designation
	Copper tubular cable lugs and compression joints
	Insulated cable lugs and compression joints “standard type”
	Tubular cable lugs and compression joints for fine stranded conductors
	Tubular cable lugs and compression joints for solid conductors
VA 	Stainless steel tubular cable lugs and compression joints
Ni 	Nickel tubular cable lugs and compression joints
DIN 	Copper compression cable lugs and compression joints acc. to DIN
	Copper solderless terminals, compression joints and pin cable lugs acc. to DIN
	Insulated solderless terminals
	Copper sleeves for compacted conductors and sector shaped conductors
Al 	Aluminium compression cable lugs and compression joints acc. to DIN
Al/Cu 	Aluminium/copper compression cable lugs and compression joints
	C and H-shaped clamps
	Cable end-sleeves
	Insulated terminals
	Non-insulated receptacles

Material properties

Information on materials used for copper and aluminium cable lugs and compression joints

- All copper tubular cable lugs, terminals and pin terminals as well as relevant compression joints are manufactured from Cu to DIN 13600.
- Cable end-sleeves to DIN 46228 part 1 and part 4 are manufactured from Cu to DIN EN 13600.
- Aluminium compression cable lugs and compression joints are manufactured from E-Al 99.5 to DIN 1712.

Electrical properties

- The maximum permissible current load of our connecting material, in conjunction with insulated conductors is according to values in the following chart.

	Group 1 One or several single-core cables laid in conduits		**Group 2** Multi-core cables, e. g. plastic-sheathed cables, metal-sheathed cables, lead-sheathed cables, flat webbed cables, flexible cables		**Group 3** Overhead single-core cables with clearance between lines at least corresponding to cable diameter	
Nominal cross section mm²	**Cu (A)**	**Al (A)**	**Cu (A)**	**Al (A)**	**Cu (A)**	**Al (A)**
0.75	–	–	12	–	15	–
1	11	–	15	–	19	–
1.5	15	–	18	–	24	–
2.5	20	–	26	–	32	–
4	25	–	34	–	42	–
6	33	–	44	–	54	–
10	45	–	61	48	73	57
16	61	48	82	64	98	77
25	83	65	108	85	129	103
35	103	81	135	105	158	124
50	132	103	168	132	198	155
70	165	–	207	163	245	193
95	197	–	250	197	292	230
120	235	–	292	230	344	268
150	–	–	335	263	391	310
185	–	–	383	301	448	353
240	–	–	453	357	528	414
300	–	–	504	409	608	479
400	–	–	–	–	726	569
500	–	–	–	–	830	649

Values only valid at an ambient temperature of 30 °C

Mechanical properties

- The tensile strength of connections assembled in accordance with our assembly instructions and tools complies with DIN EN 61238-1.

Please note *that crimping of solderless cable connectors with tools from other manufactures will not guarantee proper and safe connection. We exclusively recommend the use of solderless cable connections* **Klauke®** *with tools from* **Klauke®***.*

Designation of cables and conductors

a) Copper

- Our copper cable lugs and compression joints are suitable for stranded copper conductors according to DIN 48201, part 1 and copper conductors according to DIN EN 60228 (see chart).

b) Aluminium

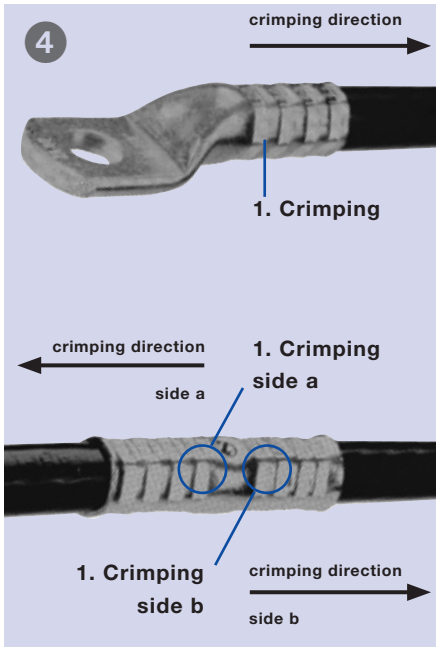
- Our aluminium cable lugs and compression joints are suitable for stranded aluminium conductors according to DIN 48201, part 1, DIN EN 50182 and aluminium conductors according to DIN EN 60228, (see chart).

Sector conductors must be rounded with crimping tools before assembly.

Cross section compatibility chart for cable lugs and compression joints to copper and aluminium conductors according to

- VDE 0250
- DIN 48200
- DIN 48201 part 1, DIN EN 50182
- DIN EN 60228

Cross section	Reference cross section	Cable Cu and Al		Stranded circular conductor	Compressed circular conductor		Solid conductor		Fine and finest stranded conductor
	DIN 48201 part 1, DIN EN 50182			VDE 0295, DIN EN 60228					
mm²	(mm²)	Number of wires	Cable Ø (mm)	Conductor Ø (mm)	Conductor Ø min. (mm)	Conductor Ø max. (mm)	Conductor Ø min. (mm)	Conductor Ø max. (mm)	Cable Ø max. (mm)
0.5	–	–	–	1.1	–	–	–	0.9	1.1
0.75	–	–	–	1.2	–	–	–	1	1.3
1	–	–	–	1.4	–	–	–	1.2	1.5
1.5	–	–	–	1.7	–	–	–	1.5	1.8
2.5	–	–	–	2.2	–	–	–	1.9	2.3
4	–	–	–	2.7	–	–	–	2.4	2.9
6	–	–	–	3.3	–	–	–	2.9	3.9
10	10.02	7	4.1	4.2	–	–	–	3.7	5.1
16	15.89	7	5.1	5.3	–	–	–	4.6	6.3
25	24.25	7	6.3	6.6	5.6	6.5	5.2	5.7	7.8
35	34.36	7	7.5	7.9	6.6	7.5	6.1	6.7	9.2
50	49.48	7	9	9.1	7.7	8.6	7.2	7.8	–
50	48.35	19	9	–	–	–	–	–	11
70	65.81	19	10.5	11	9.3	10.2	8.7	9.4	13.1
95	93.27	19	12.5	12.9	11	12	10.3	11	15.1
120	116.99	19	14	14.5	12.5	13.5	11.6	12.4	17
150	147.11	37	15.8	16.2	13.9	15	12.9	13.8	19
185	181.62	37	17.5	18	15.5	16.8	–	–	21
240	242.54	61	20.3	20.6	17.8	19.2	–	–	24
300	299.43	61	22.5	23.1	20	21.6	–	–	27
400	400.14	61	26	26.1	22.9	24.6	–	–	31
500	499.83	61	29.1	29.2	25.7	27.6	–	–	35
625	626.2	91	32.6	33.2	29.3	32.5	–	–	39
800	802.09	91	36.9	37.6	–	–	–	–	–
1000	999.71	91	41.1	42.2	–	–	–	–	–



Assembly instructions for cable lugs and compression joints

1. Strip conductor according to insertion depth (+ 10 % because of length changing of crimped sleeve).
2. Conductor ends must be cleaned with a cloth or brush before assembly.
3. Insert conductor fully into cable lug or compression joint.
4. Observing the crimping direction, crimp the cable lug or compression joint using the appropriate tools. The crimping direction for cable lug and compression joint is indicated in the illustration on the left.
5. After crimping, remove excess compound emerging from aluminium cable lugs and compression joints.

We recommend the following number of crimps for individual cross sections:

Cross section	Tubular cable lugs		Cable lugs DIN 46235		Aluminium cable lugs	
mm²	5 mm crimping dies	wide crimping dies	5 mm crimping dies	wide crimping dies	7 mm crimping dies	wide crimping dies
6	1		2			
10	1		2			
16	1	1	2	1	4	2
25	2	1	2	1	4	2
35	2	1	2	1	5	2
50	2	1	3	1	5	2
70	2	1	3	1	6	3
95	2	1	4	2	6	3
120	2	1	4	2	6	3
150	2	1	4	2	6	3
185	2	1*	4	2	6	3
240	4	2	5	2	8	3
300	4	2		2	8	3
400	4	2		3		4
500				3		4
625				3		
800				3		
1000				3		

* When operating the quad-point crimping tool (e. g. HK60VP, EK60VPFTPLUS, PK60VP), the recommended number of crimps is 2

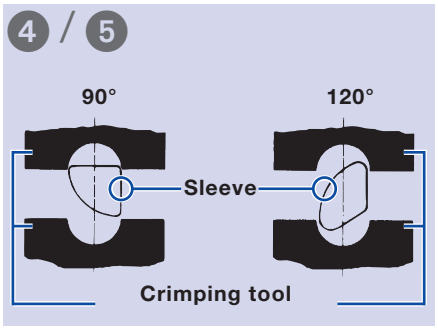
Assembly instructions for sleeves for type VHR and VHD compacted conductors

We recommend that additional VHR and VHD sleeves be used for compressed circular conductors in order to ensure that the tubular cable lugs and compression joints fit accurately.

In the case of sector-shaped conductors, we recommend that additional sector sleeves VHR 3 or VHR 4 and VHD 3 or VHD 4 be used to fit the Cu cable lugs and compression joints, as well as to prevent the end of the conductor from springing back when crimped. The sector sleeves are crimped with the aid of crimping tools.

Please note:

1. Ensure that the conductor is deformed as little as possible when cutting to length.
2. Strip the conductor insulation in accordance with the length to be inserted.
3. Slide the sleeve up to the front cut edge of the conductor.
4. Place the conductor and sleeve in the crimping tool as shown in the sketch.
5. Crimp the sleeve
   a) Crimp as illustrated (1st pre-compression)
   b) Crimp turned through 90° (2nd pre-compression)
   c) Crimp turned through 30° (final crimp)
   d) Crimp turned through 30° if necessary (final crimp)



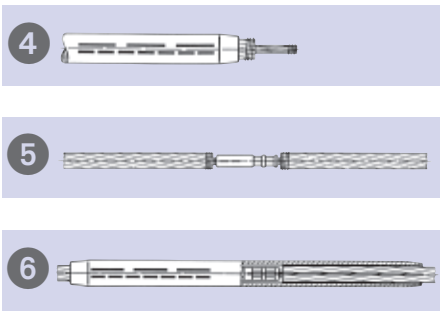
Assembly instructions for reduction sleeves

Only wide hydraulic crimping dies may be used when crimping more than two cross-sections.

Mounting instructions for full tension Al/steel compression joints DIN 48085, part 3

The compression joints consists of an aluminium bushing (E-Al 99.5) and a soft steel bushing (St 52).

1. Straighten cable ends and remove dirt and if necessary oxide layer.
2. Slip the Al-compression joint onto one of the cable ends.
3. Tie the cable end and strip the aluminium wires.
4. Tie aluminium and steel wires.
5. Slip on the steel bushing and crimp according to the crimping marks.
6. Push the aluminium bushing in the center over the assembled steel bushing and crimp according to the crimping marks.



Attention: *Do not crimp in the center around the steel joint. Do not crimp on the cone-shaped ends of the connector.*

7. Remove access compound after crimping the compression joint.

Attention: *Do not remove compound before the assembly.*

The allocation of the dies can be made either by the colour of the dies but preferably by looking at the code No. which is related to the cross-sections. The dies for the steel bushings have a black finish, the aluminium bushing is zinc-coated.

General information:
The crimping procedure has to be continued until the dies are completely closed.
If not, we cannot guarantee a proper crimp

General information

Crimping dies:

The outside dimensions of the dies in series K18, EK18PLUS, PK18, HK18 and THK18 as well as in series HK252, PK252, HK252EL are according to DIN 48083 part 1 and part 3.

The hexagon dimensions of all interchangeable dies for crimping tools and hydraulic tools of series D (i. e. for DIN cable lugs and compression joints 46235 and 46267) and A (aluminium cable lugs and compression joints, as well as Al-Cu cable lugs and compression joints) are according to DIN 48083 part 4.

Surfaces:

All dies are supplied "chrome-yellow" for copper and "galvanized" for aluminium and nickel.

Note the following maximum cross-sections when crimping connectors with crimping tools K18, PK18 and HK12025 and EK12025:

K18 / PK18 Type of compression joint / dies	max. cross-section mm^2	HK12025 and EK12025 Type of compression joint / dies	Max. cross section mm^2
Copper, standard version, R-series	95	Copper, standard version, R-series	185
Copper version to DIN for high tension stress, D-series	70	Copper version acc. to DIN, D-series	150
		Aluminium version, A-series	120
Aluminium version, A-series	70	for high tension stress, A-series	95

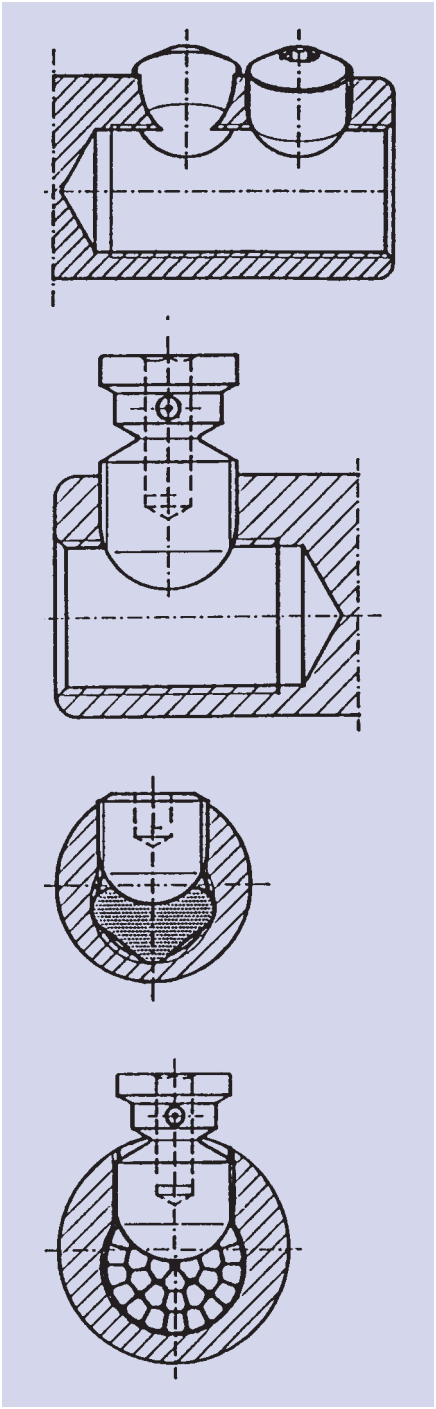
Following tools do not provide a code No. on crimps:

EK60VPPLUS, EK60VPFTPLUS, HK60VP, HK60VPFT, PK60VP und PK60VPFT.

The following tightening torques apply for screws and bolts of strength class 8.8 as specified by DIN EN 61238:

Size of thread	Tightening torque (Nm)	Size of thread	Tightening torque (Nm)
M 5	5	M 12	75
M 6	9	M 14	120
M 7	15	M 16	190
M 8	22	M 20	380
M 10	44		

Mounting instruction for screw connection clamps



Screw connection clamps are connecting elements which can be un-screwed and are preferably used for heat shrinking or cast resin technique. They also can be used in all other kinds of cable joints. Four screw connection clamps are especially suitable for fine stranded conductors as the great connector length increases the transverse conductance of the individual wires and the contact resistance falls accordingly. In addition higher pull-out values are achieved. Barrier type four screw connection clamps are suitable for cables with mass-impregnated paper insulation.

In an electrolyte free, e.g. dry environment, copper as well aluminium conductors can be combined. This also applies in combination with heat shrinks. When conductors of different material (e.g. Cu and Al cables) have to be combined, a barrier type connector is recommended.

While identical types of cables (e.g. NAYY-NAVY) can be used with non-barrier types of connectors, for dissimilar cables (e.g. NAYY-NAKBA), plastic or drained cables are recommended to be used with barrier type connectors as an oil stop.

Insertion depth of conductors is controlled either by the barrier or by inspection hole on connectors without barrier.

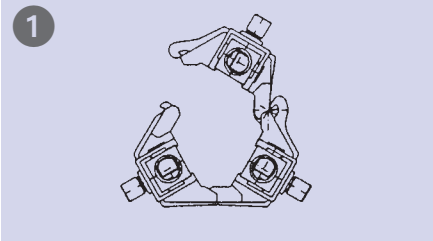
In addition to the traditional screw connection clamps we offer screw connection clamps with shearoff heads as well. The benefit of this version lies in the defined tightening torque, which depends on the maximum transferable torque at the predetermined breaking point. These defined torques set by the manufacturer guarantee maximum electrical properties and mechanical properties (DIN EN 61238). No torque wrenches are required for assembly of these compression joints.

With standard screw connection clamps, the required contact pressure is reached at approx. 80% of the given torque values. Torques higher than recommended are to be avoided.

The cross grooves on the conductor channels enable high tensile forces to be withstood. The tractive force of screw connectors correspond to compression joints DIN 46267, part 2, having identical cross sections.

The contact screws are treated with a highgliding lubricant based on molybdenum sulphide. This guarantees adequate contact pressure with low tightening torque.

Assembly instructions KSK1503



1 Bare cable acc. to DIN 47630.

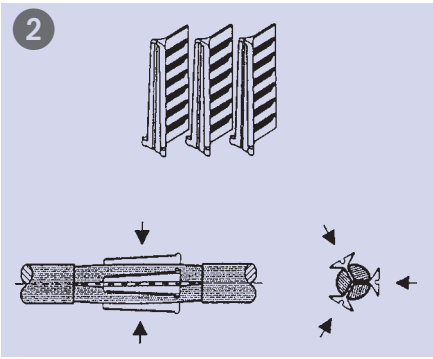
Delivered with open snap-closure.

If opening is required due to inadvertent closing, open ring parts by hand against snapping direction.

Three conductor cable

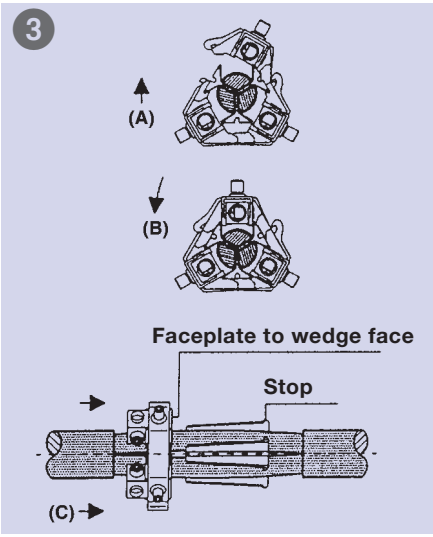
Cross section	recommended bare length*
50 – 95 mm²	200 mm
50 – 185 mm²	320 mm

* **Observe assembly instructions of gland manufacturer!** On sets with off-centre bulge (largest gland diameter) spacer wedges are also to be placed off-centre.



2 Spacer wedges to be placed between conductors.

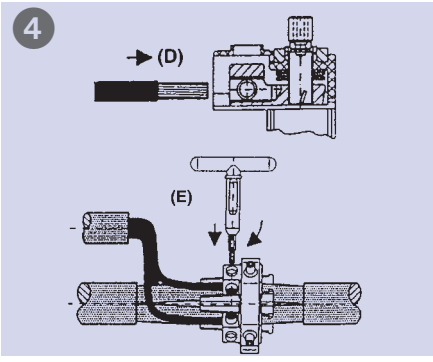
Expander wedges help to spread the conductors.



3 (A) Clamping ring to be placed on the main conductor.

(B) Press clamping halves tight next to wedges.

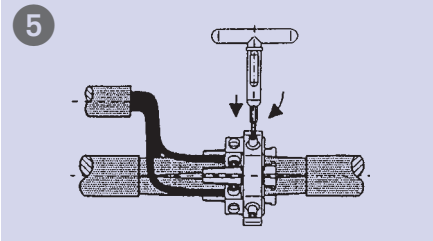
(C) Attach ring onto wedges. It does not have to be pushed until the stop.



4 (D) Bare tap conductor.

(E) Insert phase conductor into tap hole and tighten.

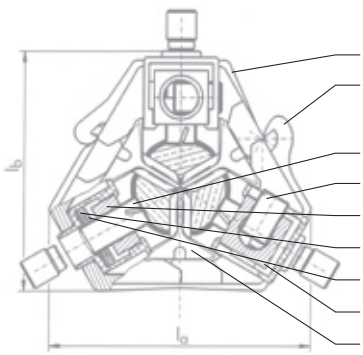
Attention! *Always insert wrench fully into hexagon screw. Tap conductors below 16 mm² are recommended to be clamped with kinked ends.*



5 Shear-off screws to be tightened until seated on insulation.

- Contact by alternate uniform tightening until heads shear off.
- Shear-off screws ease assembly operation. However they do not dispense need for careful assembly by alternate and uniform tightening of screws. Remove sheared-off heads from gland. Once sheared-off screws cannot be loosened.

View of the compact tap connector KSK1503 for three conductors



	View of	material
1.	**Ring:**	
1.1	Upper part	high-strength aluminium alloy
1.2	Lower Part	high-strength aluminium alloy
2.	**Contact block:**	
2.1	Threaded bolt (main conductor)	E-copper, tin plated
2.2	Pressure bolt (tap conductor)	steel, tin plated
2.3	Segment Housing	high-strength plastic
2.4	Washer,	steel
2.5	Spring support,	spring steel, finished
2.6	Contact segment	copper alloy
3.	Spacer wedge	high-strength plastic

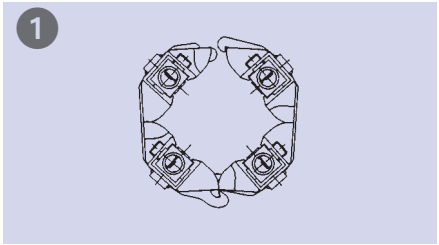
Assembly instructions KSK504

1 Bare conductor and insert wedge. Make sure that wires are tight to wedge.

Type	recommended bare length*
KSK504	90 mm

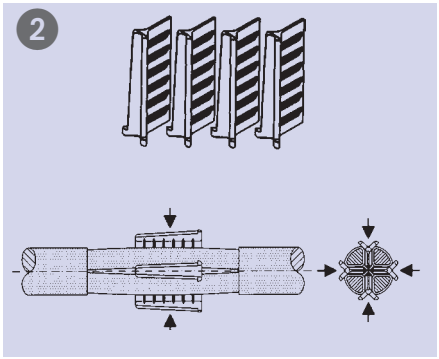
*** Observe assembly instructions of gland manufacturer!** Delivered with open snap-closure.

If opening is required due to inadvertent closing, open ring parts by hand against snapping direction.



2 Spacer wedges to be placed between conductors.

Expander wedges help to spread the conductors.



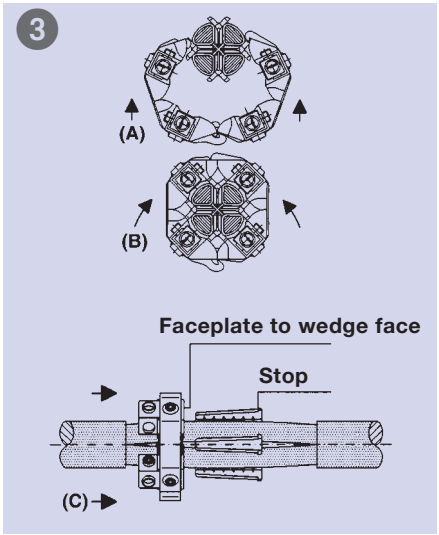
3 (A) Clamping ring to be placed on the main conductor.

(B) Press clamping halves tight next to wedges.

(C) Attach ring onto spacers. If wedges or two piece insulator are used, attach ring only hand-tight. It does not have to be pushed until the stop.

4 (D) Bare tap conductor.

(E) Insert phase conductor into tap hole and tighten.

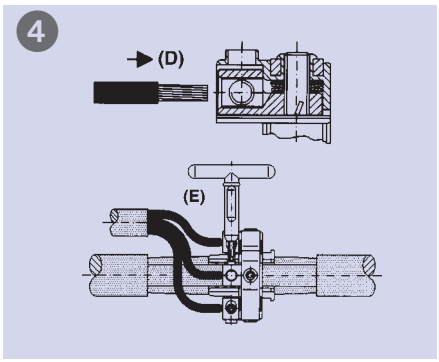


Attention! *Always insert wrench fully into hexagon screw. Tap conductors below 16 mm² are recommended to be clamped with kinked ends.*

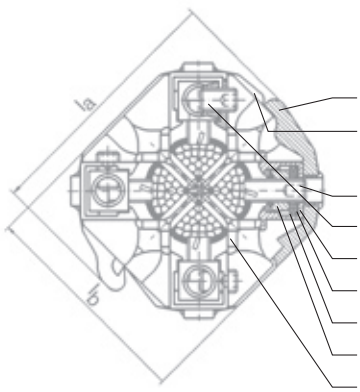
5 Shear-off screws to be tightened by alternate and uniform actions until seated on insulation.

Contact by alternate uniform tightening.

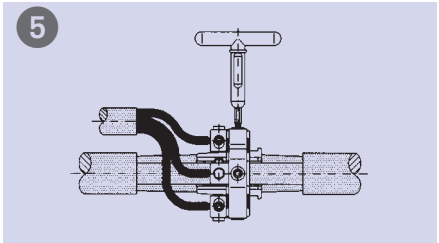
Maximum tightening force is achieved when a perceptible resistance is felt after cutting through insulation (stop), caused by penetration of bolt into conductor surface. Recommended tightening torque is approx. 15 Nm (1.5 kpm).



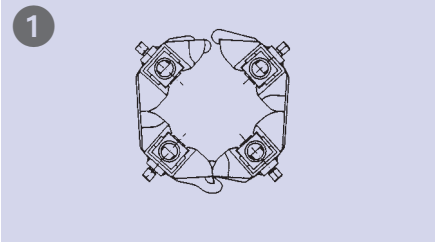
View of the compact tap connector KSK504 for four connector cables

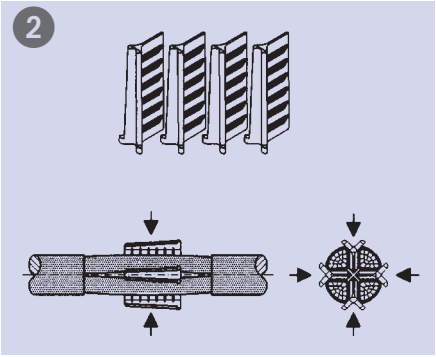


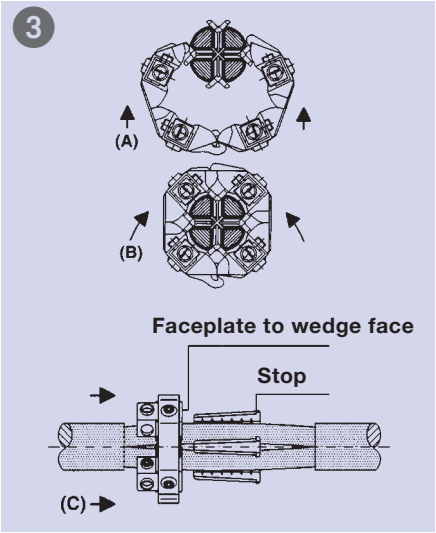
	View of	material
1.	Ring:	
1.1	Upper part	high-strength aluminium alloy
1.2	Lower Part	high-strength aluminium alloy
2.	**Contact block:**	
2.1	Threaded bolt (main conductor)	E-copper, tin plated
2.2	Pressure bolt (tap conductor)	steel, tin plated
2.3	Segment Housing	high-strength plastic
2.4	Washer,	steel
2.5	Spring support,	spring steel, finished
2.6	Contact segment	copper alloy
3.	Spacers	high-strength plastic

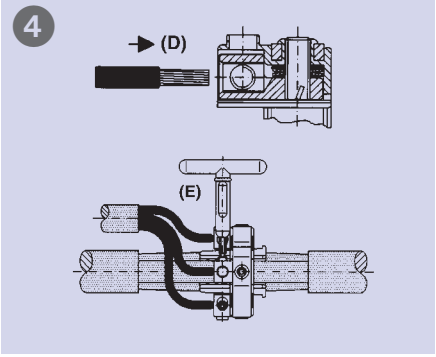


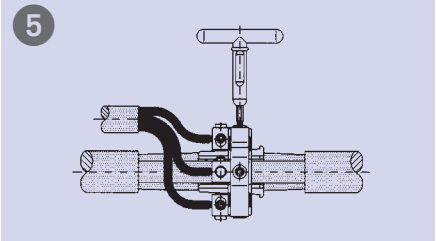
Assembly instructions for compact tap connectors











Assembly Instructions for: SKR1503 / SKR1204 / SKR1304 / SKR1504 / SKR150 / 1504 / SKR1854 / KSK1504 / KSK1854

1 Bare cable acc. to DIN 47630.

Delivered with open snap-closure.
If opening is required due to inadvertent closing, open ring parts by hand against snapping direction.

Three conductor cable

Cross section	recommended bare length*
50 – 95 mm²	200 mm
50 – 185 mm²	320 mm

Four conductor cable

Cross section	recommended bare length*
50 – 120 mm²	120 mm
50 – 185 mm²	160 mm

* **Observe assembly instructions of gland manufacturer!** On sets with off-centre bulge (largest gland diameter) spacer wedges are also to be placed off-centre.

2 Spacer wedges to be placed between conductors.
Expander wedges help to spread the conductors.

3 (A) Clamping ring to be placed on the main conductor.

(B) Press clamping halves tight next to wedges.

(C) Attach ring onto wedges.
It does not have to be pushed until the stop.

4 (D) Bare tap conductor.

(E) Insert phase conductor into tap hole and tighten.

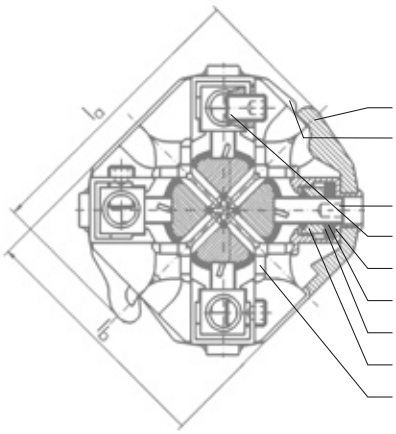
Attention! *Always insert wrench fully into hexagon screw. Tap conductors below 16 mm² are recommended to be clamped with kinked ends.*

5 Shear-off screws to be tightened by alternate and uniform actions until seated on insulation.

Contact by alternate uniform tightening.

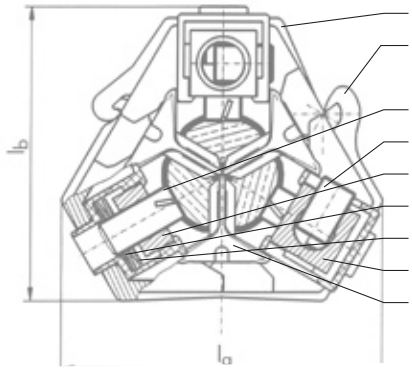
Maximum tightening force is achieved when a perceptible resistance is felt after cutting through insulation (stop), caused by penetration of bolt into conductor surface. Recommended tightening torque is approx. 20 Nm (2 kpm).

View of the compact tap connectors SKR1204, SKR150/504, SKR150/1504 und SKR1854 for four connector cables



View of	material
1. Ring:	
1.1 Upper part	high-strength aluminium alloy
1.2 Lower Part	high-strength aluminium alloy
2. Contact block:	
2.1 Threaded bolt (main conductor)	E-copper, tin plated
2.2 Pressure bolt (tap conductor)	steel, tin plated
2.3 Segment Housing	high-strength plastic
2.4 Washer,	steel
2.5 Spring support,	spring steel, finished
2.6 Contact segment	copper alloy
3. Spacer wedge	high-strength plastic

View of the compact tap connector SKR1503 for three connector cables



View of	material
1. Ring:	
1.1 Upper part	high-strength aluminium alloy
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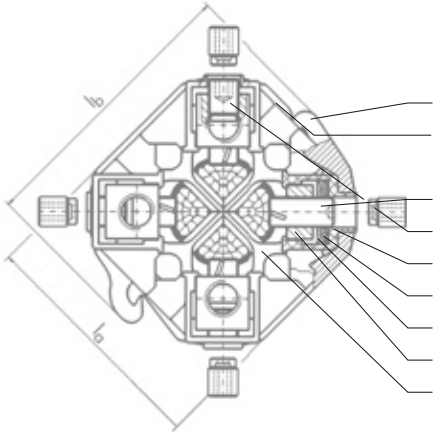
2. Contact block:	
2.1 Threaded bolt (main conductor)	E-copper, tin plated
2.2 Pressure bolt (tap conductor)	steel, tin plated
2.3 Segment Housing	high-strength plastic
2.4 Washer,	steel
2.5 Spring support,	spring steel, finished
2.6 Contact segment	copper alloy
3. Spacer wedge	high-strength plastic

View of the compact tap connector KSK1504 for four connector cables



View of	material
1. Ring:	
1.1 Upper part	high-strength aluminium alloy
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2.3 Segment Housing	high-strength plastic
2.4 Washer,	steel
2.5 Spring support,	spring steel, finished
2.6 Contact segment	copper alloy
3. Spacer wedge	high-strength plastic

Designation of conductor cross sections (AWG, MCM sizes to mm²)

AWG	metric conductor cross-section mm²	comparable conductor cross-section mm²	MCM	metric conductor cross-section mm²	comparable conductor cross-section mm²
27	0,102	–	250	127	120
26	0,128	0,14	300	152	150
25	0,163	–	350	177	185
24	0,205	0,2	400	203	–
23	0,259	0,25	500	253	240
22	0,325	0,34	600	304	300
21	0,412	–	700	355	–
20	0,519	0,5	800	405	400
19	0,653	–	900	456	–
18	0,823	0,75	1000	507	500
17	1,04	1	1250	633	625
16	1,31	–	1500	760	800
15	1,65	1,5	1750	887	–
14	2,08	–	2000	1010	1000
13	2,63	2,5			
12	3,31	–			
11	4,15	4			
10	5,27	6			
9	6,62	–			
8	8,35	–			
7	10,6	10			
6	13,3	–			
5	16,8	16			
4	21,2	–			
3	26,7	25			
2	33,6	35			
1	42,4	–			
1/0	53,4	50			
2/0	67,5	70			
3/0	85	95			
4/0	107,2	120			

British and American units of measurement

length		area		volume		fluid volume		weight	
1 mil	0.0254 mm	1 sq. in.	645.1 mm²	1 cu. in.	16.386 cm³	1 pint	0.568 l	1 grain	0.059 g
1 inch	25.4 mm	1 sq. ft.	0.093 m²	1 cu. ft.	0.028 m³	1 quart	1.136 l	1 ounce	28.349 g
30.48 cm	0.3048 m	1 sq. yd.	0.836 m²	1 cu. Yd.	0.764 m³	1 brit. gallon	4.554 l	1 pound (lb)	0.454 kg
0.91 m	0.9140 m					1 am gallon	3.785 l	1 brit. ton	1.016 t
1 mile	1.6090 km					1 quarter	290.790 l	1 am. ton	0.907 t
						1 bushel	36.350 l		

Check-list for special cable lugs and connectors

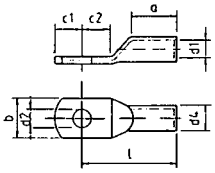
Customer / Company: . . . . . Customer No.: . . . . . .

Address: . . . . . Fax: . . . . . .

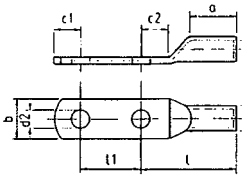
Contact person: . . . . . Phone: . . . . . .

Drawings and Dimensions: Please fill in all the required dimensions (see dimension chart) and the necessary data.

☐ Cable lug

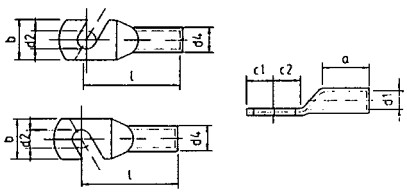


☐ Double hole cable lug

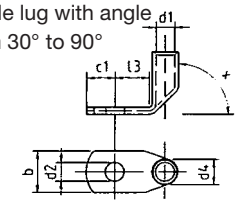


☐ Cable lug with hook
right

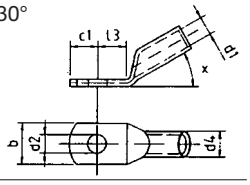
left



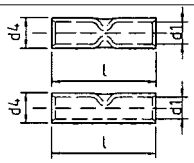
☐ Cable lug with angle from 30° to 90°



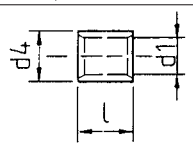
☐ Angled cable lug to 30°



☐ Butt splicer



☐ Parallel compression joint



Number of buttmarks: 0 / 1 / 2 / . . . . . .

Other types acc. to your sketches/Remarks:

Dimension chart (please state nominal dimensions in "mm"):

Dimension d1 . . . . . Dimension d1 . . . . .

Dimension d4 . . . . . Dimension l1 . . . . . .

Dimension d2 . . . . . Dimension l3 . . . . . .

Dimension a . . . . . .

Dimension b . . . . . .

Dimension c1. . . . . Angle x . . . . . .

Dimension c2. . . . . .

Technical Data

Type of conductor (if known): . . . . . .

Cross-section (cable): . . . . . .

Inspection hole (on cable lugs): ☐ Tubular cable lugs ☐ Tubular compression cable lugs

Surface: ☐ bright ☐ tin plated ☐ nickel-plated

others: . . . . . .

Material: ☐ Cu ☐ Al

others: . . . . . .

Commercial Data

Quantity / Annual requirement: . . . . . .

Requested delivery time:. . . . . .

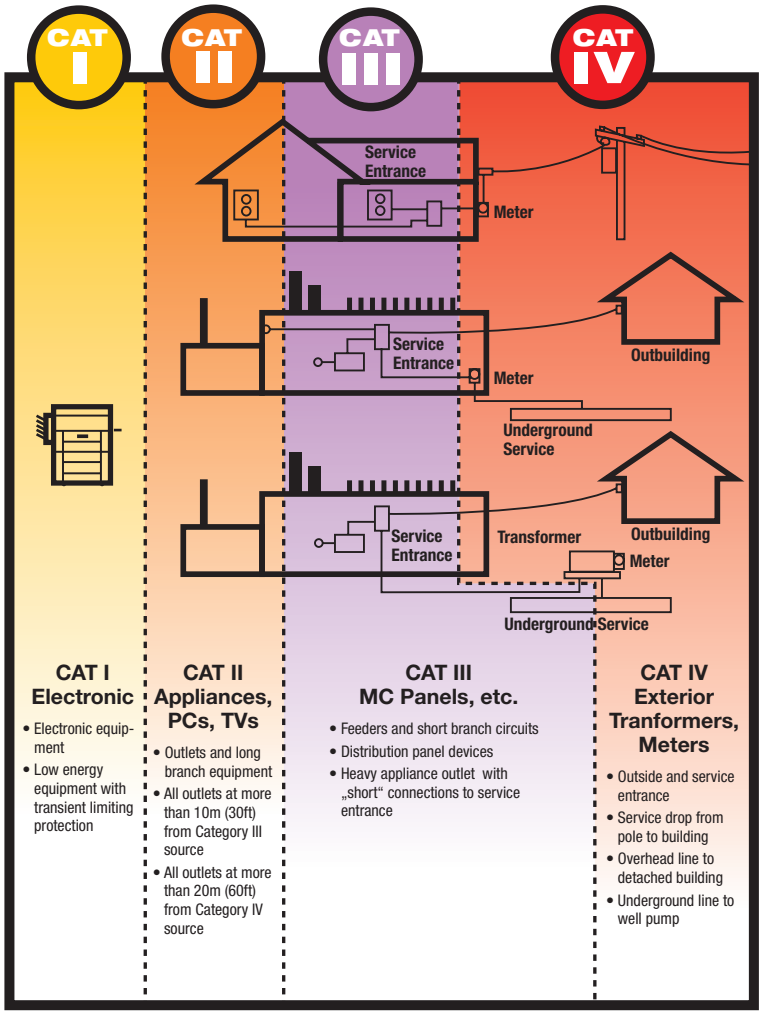
Sample: ☐ Yes ☐ No

Test report of first sample: ☐ Yes ☐ No

Additional Information:

Date: . . . . . Signature (Customer): . . . . . .

Measuring categories



Protective values which greatly exceed the nominal capacity of a system are stipulated in the standards of the IEC categories. Without this additional protection, transient overvoltages, which occur more and more frequently, may lead to serious or fatal injuries.

Measuring category I

is the signal level for telecommunications and electronic equipment.

Measuring category II

is the local level for permanently connected devices or devices not operated by means of a fixed connection – including all types of illumination from household devices to office equipment, such as copy machines. Can also be used in areas of Category I.

Measuring category III

is the distribution level for fixed main feed or bypass flow circuits. These electric circuits are usually separated by at least one level of transformer barrier of Category IV (public utility or other high-voltage power source). Can also be used in areas of Category II and Category I.

Measuring Category IV

is the main electric supply level. Greenlee is setting new standards by offering equipment that meets the highest protective values of the IEC standards and is respectively certified. Can be used in all category ranges.

Greenlee equipment – tested and certified for compliance with norms by an independent party. This catalogue states for many Greenlee devices the category indicating that these devices comply with the various IEC categories (II, III or IV). All these references represent the categories confirmed by independent testing organizations within the scope of actual tests – which means additional security for you.

The right type of protection for the task at hand. No matter which area in which you may need overvoltage protection – select a device which has at least the nominal capacity suitable for the work you are carrying out.

FAQ

The following questions on using holemaking tools are intended as general hints and are to be regarded as recommendations. Please fax any further specific questions you may have on this issue using the form below.

What does a punch unit include?
- Punch/die/draw stud and if required ball bearing nut and counter nut.

What causes damage to the draw studs?
- Normal usage over a certain period causes wear and tear. Punching through too thick or incorrect material will accelerate breakage. Lubricating the draw studs increases their service life.

Can holemaking tools be used with electrical pumps?
- The use of electrical pumps is not recommended.

When is the use of hydraulic punch drivers recommended?
- Hydraulic punch drivers save time and energy, so they always pay off when there is a large number of holes to be punched. The use of a hydraulic punch driver is mandatory for special shape holes of a certain size or generally with Greenlee Slug Splitters.

How many holes can I get with my punch?
- There is no set formula. It depends an many factors such as material thickness and type, drive method, care and maintenance of your punch.

Is Greenlee able to to produce special shape/size punches?
- In many cases we can produce a special size/shape punch unit.

How do I make pilot holes in stainless steel?
- Use the Greenlee Kwik Stepper™ step bit (page 588).

My question is:

_____

_____

_____

_____

Company / Address: _____

Contact person: _____

Tel / Fax: _____

Please send to:

Klauke domestic sales **Fax 0 21 91 / 907-201**
Klauke international sales **Fax +49 21 91 / 907-205**

Metric cable glands for electrical installations EN 50262

The new European standard EN 50262 defines conditions for all manufacturers of electrical appliance housings and all electrical installations.

It's scope includes cables and conductors for panels, enclosures, junction boxes, house service connections, electrical housings etc.

The EN 50262 supersedes all existing Pg sizes used for cable glands. The sizes Pg 7 to Pg 48 are being replaced by ISO M 6 to M75.

Greenlee holemaking tools in ISO sizes acc. to EN 50262

ISO sizes	mm	Slug-Buster® Punches	Slug-Splitter® Punches	HSS hole saws	Step bits	Kwik Change® carbide tipped cutters
12	12.5	✔				
16	16.5	✔	✔		✔	
20	20.5	✔	✔	✔	✔	✔
25	25.5	✔	✔	✔	✔	✔
32	32.5	✔	✔		✔	
40	40.5	✔	✔		✔	
50	50.5	✔	✔	✔		✔
63	63.5	✔	✔	✔		✔

Holemaking systems

	Operation	Capacity	Hole size
Slug-Buster®	Manual, hydraulic punch drivers	max. 3.0 mm in mild steel	12.5 to 64.0 mm
Slug-Splitter®	Hydraulic punch drivers	max. 3.5 mm in stainless steel	15.2 to 64.0 mm
Standard	Manual, hydraulic punch drivers	max. 3.0 mm in mild steel	66.7 to 143.7 mm
Special shaped punches	Manual, hydraulic punch drivers	max. 3.0 mm in mild steel or 1.5 mm in stainless steel	See data for the individual punch drivers

Hydraulic punch drivers

		Description
LS 60 Plus Battery operated hydraulic punch driver		– micro-processor controlled – 60 kN punching force – punches up to 3.0 mm mild steel and up to 2.5 mm stainless steel, depending on hole size
Quick Draw™ Hand hydraulic punch driver 7804E	50342916	– ideal for fast, straight-on front panel punching – 80 kN punching force – punches up to 3.0 mm mild steel and up to 3.5 mm stainless steel, depending on hole size
Quick Draw 90™ Hand hydraulic punch driver 7904E	50342991	– right angle driver head, rotates 180° – maximum flexibility in tight working areas – 80 kN punching force – punches up to 3.0 mm mild steel and up to 3.5 mm stainless steel, depending on hole size
Ram and hand pump hydraulic driver 7646	50159062	– compact design of punch, pump and cylinder – 110 kN punching force – punches up to 3.0 mm mild steel and up to 3.5 mm stainless steel, depending on hole size
Ram and foot pump hydraulic driver 7625	50250973	– Foot operation frees both hands to operate punch. – 110 kN punching force – punches up to 3.0 mm mild steel and up to 3.5 mm stainless steel, depending on hole size

Standards for cabling

Various standards bodies, whose role is to define the technical features of cabling systems, have been in existence since 1993. These directives must be observed when planning and setting up networks. Full volumes can be obtained from specialist bookshops.

International standards

International Standards are published by the ISO (International Standards Organisation). In Europe, these international directives are used for information purposes.

ISO/IEC IS 11801	Description of the performance requirements for a general cabling system
IEC 1156	Multi-core and symmetrical conductors for digital message transmission
IEC 1156-1	Basic specification
IEC 1156-2	Framework specification for service cables IEC1156-3 Framework specification for path and equipment connecting cables
IEC 1156-4	Framework specification for building connecting and rising cables

European standards

In collaboration with the national standards institute, the European Committee for Electrical Standardisation, the CENELEC (Comite Europeen de Normalisation Electrotechnique), has published European standards that are based on the international ISO/IEC 11801 and hence normative for Europe.

EN 50173	Description of the performance requirements for a general cabling system (EN 50173 also refers to HD 608 and also EN 55022)
608	General specification for symmetrical conductors for digital message transmission
EN 50167	Framework specification for service cables
EN 50168	Framework specification for patch and equipment connecting cables
EN 50169	Framework specification for building connection and rising cables
EN 55022	Framework specification for electromagnetic compatibility (EMC). This specification contains threshold values and measuring procedures for radio interference of data processing equipment.

American standards

The American standards are published by the EINTIA (Electronic Industries Association / Telecommunication Industries Association), an American Joint Venture.

TSB 36	Framework specification for symmetrical data cables (100 Ohm, unshielded)
TSB 40	Framework specification for passive components (100 Ohm, unshielded)
EIA/TIA 568	Framework specification for cabling systems

Glossary

Attenuation
The reduction in signal power along a line. Unit dB (decibel).

AWG
(American Wire Gauge) An American measuring unit that indicates the conductor cross-section.

Bandwidth
Bandwidth describes the frequency range over which a network (or a transmission medium) is able to operate. The greater the bandwidth, the higher the volume of information that can be transmitted over the network in one time unit.

Coating
Primary coating of optical fiber.

Core diameter
Expresses the light-conducting surface in the cross-section of fiber optic cables. It also has a higher refraction coefficient than the glass coating. The core diameter on gradient fibers (multi-mode) is 50 µm or 62.5 µm. The core diameter on single-mode fibers (mono-mode), by contrast, is only 9 µm.

d8
(Decibel) Unit of transmission amplification, attenuation and power level. See attenuation.

Dispersion
Dispersion of the signal runtime within an optical fiber.

EIA
(Electric Industries Association).

EN 50167
This European standard describes the design of tertiary cables with common shielding used in digital communication transmission.

EN 50168
Unlike EN 50167, this standard specifies the design of equipment connecting cables with common shielding used in digital communication transmission.

EN 50169
Design specification for distribution lines with common shielding used in digital communication.

EN 50173
European standard for general building cabling. EN 50173 has been taken almost in its entirety from international cabling standard ISO/IEC DIS 11/801. In terms of electromagnetic compatibility (EMC), however, the standard has been modified specifically to European requirements. All CENELEC members are required to grant the European standard national standard status.

EN 50222
European standard for electromagnetic compatibility (EMC).

Fiber optic
Very thin, flexible glass wires for transmitting digital or analog signals in the form of light pulses at high pulse rates (high bandwidth). Laser or light-emitting diodes (LEDs) send light pulses, which are transferred into the fiber through a process of total reflexion. One optical fiber consists of two layers surrounded for protection (primary and secondary coating).

Frequency
Number of oscillations of a signal per second at which an analog signal occurs.
Unit of measurement: Hertz (Hz).

Gradient fiber (multi-mode fibre)
Fiber optics with refraction coefficients decreasing outwards. The light pulses are reflected within the core fiber towards the centre of the core and can therefore pass more quickly through the fiber. Extremely low dispersion values and hence a correspondingly high transmission bandwidth of approx. 1 GHz are thus achieved.
See single-mode fiber.

Hertz (Hz)
Dimension of frequency or bandwidth. 1 Hz means 1 oscillation per second.
It is named after Heinrich Hertz.

Impedance
Wave resistance. A complex resistance with a real part and an imaginary part.
On a line, for example, at a certain frequency. Unit of measurement: Ohm.

Insertion loss
The loss of optical power caused by inserting an optical component, a connecting element, for example, into an optical transmission system.

LAN
(Local Area Network) A network within a geographical area, an office, building, building complex or on a factory complex. The local network features high bandwidth, cost-efficient data transmission technology that enables the connection of numerous nodes.

Loss
Attenuation, e.g. on a transmission route.

Modes
Possible dispersion paths of the light waves within an optic fiber. It is possible to visualise modes by assuming that light rays are injected into conductors at various angles. A ray that disperses parallel to the optical axis of the conductor, must never be reflected at the core/coating transition. It passes through the optical fiber cable using the shortest, and hence the fastest, route. Light that does not run parallel to the optical axis takes a zig-zag course through the optical fiber cable, therefore taking longer. The greater the angle, the longer the route and runtime.

Mono-mode fiber
See single-mode fiber.

Multi-mode fiber
See multi-mode fiber.

Multi-mode fiber
In contrast to the single-mode fiber, the multi-mode fiber enables several modes to disperse.

NVP

(Nominal velocity of propagation) Signals disperse in all data cables at a speed lower than the speed of light. The NVP value indicates the light dispersion speed ratio. It is also used to calculate the signal runtime.

Optical fiber

Optical transmission medium made from glass or plastic. The core, from optically transparent material with low attenuation, is surrounded by a coating that is also from optically transparent material with a lower refraction coefficient than that of the core. The optical fiber is used to transfer signals within the optical frequency range.

Primary cabling

The overall link between two buildings or their main distributor boxes.

Secondary cabling

The vertical link between the floor distributor boxes (flow area).

Single-mode fiber

With the single-mode fiber, also referred to as the mono-mode fiber, only one mode can disperse within the optic fiber. Dispersion in single-mode fibers is extremely low. A laser diode is used as a transmission element.

Tertiary cabling

The horizontal link between the floor distributor boxes and the workstations.

Twisted Pair

Pair of conductors that are twisted together (stranded).
A distinction is drawn between:
Unshielded Twisted, Pair = UTP,
Foiled Twisted Pair = FTP,
Shielded Foiled Twisted Pair = S/FTP,
Shielded Shielded Twisted Pair = S/STP.

Wavelength

The distance between the crests of a wave. The dispersion speed to frequency ratio of the wave.