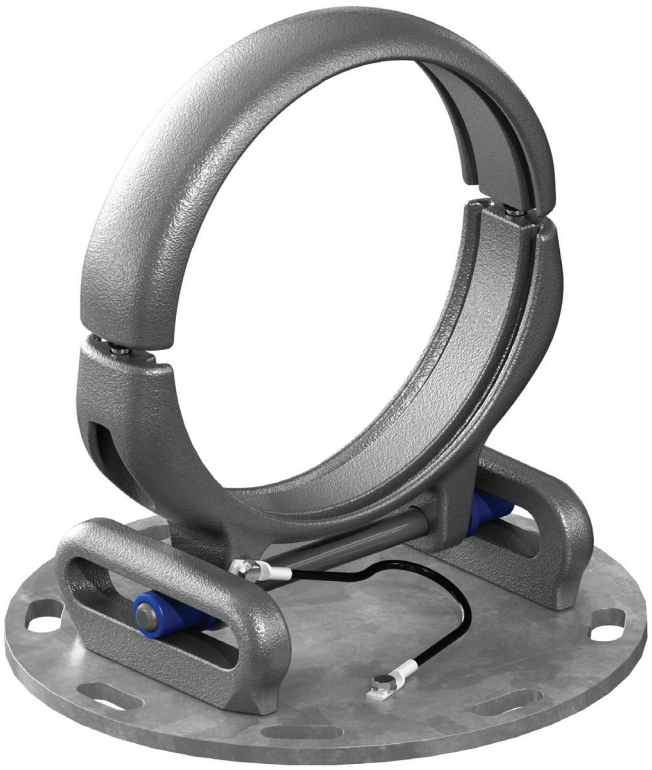
PRODUCT OVERVIEW



SUBCON SUBSTATION CONNECTORS

Single Conductor Clamps | Bundle Conductor Clamps | Busbar Clamps | Accessories

ABOUT PLP

Founded in 1947, PLP is a global designer, manufacturer, and supplier of high-quality products and services for the electric power industry. With 25 global locations and customers in more than 140 countries, PLP is recognized around the world as a market leader in developing innovative and dependable solutions for transmission, distribution, and substation systems. This combination of local presence and global reach enables PLP to provide superior customer service, timely product delivery, and unmatched technical support to all our customers and industry partners.

SUBCON

SubCon is PLP's product line of substation connectors, including designs for all voltage levels up to 1100 kV AC and DC. The SubCon product range includes standard connectors, busbar couplers, bimetallic and copper clamps, and insulator string sets for specialized connectors. In addition, a complete set of complementary accessories, including stranded and tubular conductors, insulators, and grounding materials is available. And with more than 4,000 existing products and 1,000 tailor-made products designed each year, SubCon offers customizable solutions for any application.

ADDING VALUE THROUGHOUT ALL PROJECT PHASES

Engineering

- Analysis and specification of required connectors
- Recommendation of optimal solutions and applications
- We take care of connector location plans and bill of quantities

Manufacturing & Testing

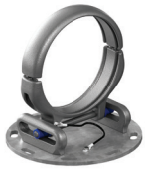
- Our manufacturing plants support multiple technologies like sand casting, die casting, welding, machining, forging, and others
- We perform and coordinate electrical and mechanical tests n independent laboratories

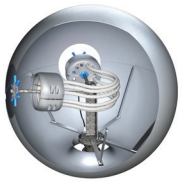
Product Development & Design

- Optimal design of connectors considering valid standards and requirements
- Detailed drawing documentation
- Creation and maintenance of manufacturing tool sets (including pattern making)

Quality Control & Logistics

- To ensure our high level of quality and our continuous improvement approach, we are certified with ISO 9001 Quality Management Systems
- Find quality control of checks are preformed on all executed orders in our quality and logistic center

Connector Bolted Type	Connector Bolted/ Compressed Type	Busbar Coupler	Busbar Support
			

Bimetallic Connector	Copper/Bimetallic Connector	Suspension String	Special HVDC Connector
			

SUBSTATION PROJECTS COMPLETED IN OVER 100 COUNTRIES WORLDWIDE

With 25 global locations, PLP is recognized around the world as a market leader in developing innovative and dependable solutions for electric power delivery systems.

Basslink HVDC
(Australia)
500 kV

UW Bisamberg
(Austria)
380 kV

Western Alberta
Transmission Line
HVDC (Canada)
500 kV

JinPing HVDC
(P.R. China)
800 kV

UPME (Colombia)
525 kV

(Finland - Estonia)
400 kV

SylWin (Germany)
330 kV

NEA 800 HVDC (India)
800 kV

Rahim Yar Khan
(Pakistan)
500 kV

Moyle HVDC
(Scotland - Northern Ireland)
420 kV

ESKOM (South Africa)
400 kV

Tha Tako (Thailand)
500 kV

Neptune HVDC (U.S.)
500 kV

Yaracuy - La Arenosa
(Venezuela)
765 kV

SALES CONTACTS

ELECTRIC UTILITY
SALES

CUSTOMER SUPPORT

U.S. SUPPORT

Tel: 440.461.5200

Fax: 440.442.8816

Email: info@plp.com

INTERNATIONAL SUPPORT

Tel: 440.473.9294

Fax: 440.461.2918

Email: international@plp.com

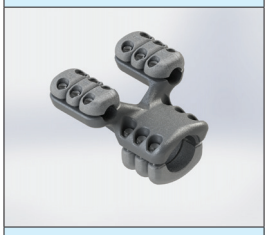
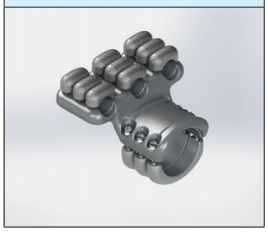
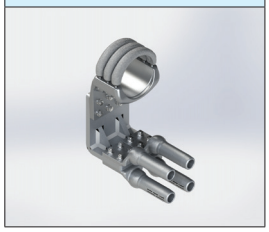
CONTENTS

SUBCON SUBSTATION CONNECTORS

PARALLEL CONNECTORS

Conductor to Conductor

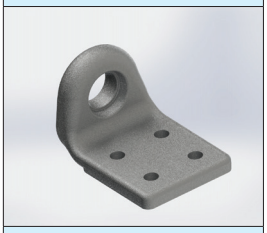
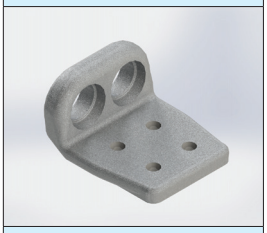
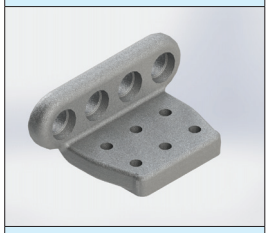
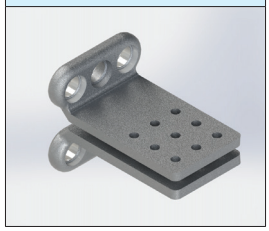
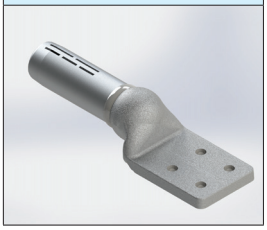
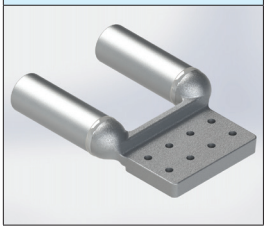
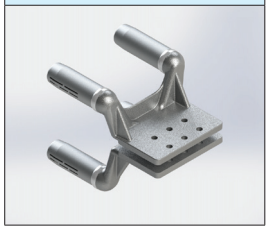
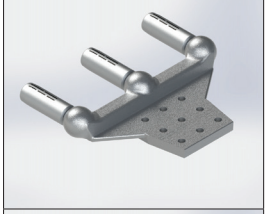
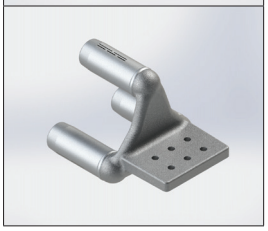
SubCon™

H21	H31	H41	H11	H22
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Compression Bolted (R)		Compression Bolted (R)		
			Compression Bolted (R)	
				

STRAIGHT CONNECTORS

Conductor to Terminal

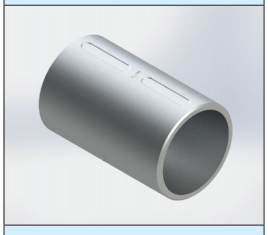
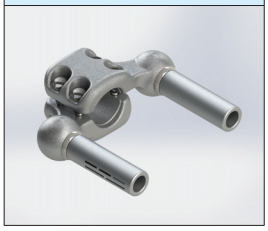
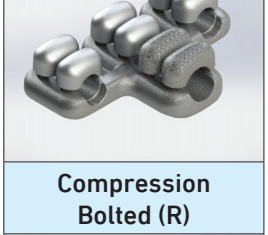
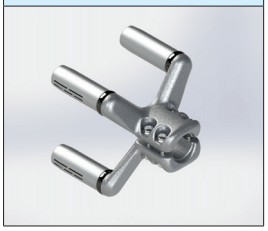
SubCon™

I1F	I2F	I3F	I4F	I6F
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Welded (W)	Welded (W)		Welded (W)	Welded (W)
		Welded (W)		
Compression (P/R)	Compression (P/R)		Compression (P/R)	
		Compression (P/R)		
				
				

STRAIGHT CONNECTORS

Conductor to Conductor

SubCon™

I11	I21	I31	I41	I61
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Welded (W)	Compression (P/R)	Compression Bolted (R)	Compression (P/R)	
				
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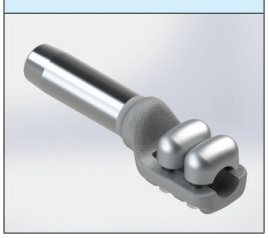
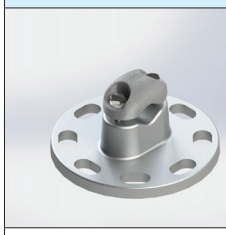
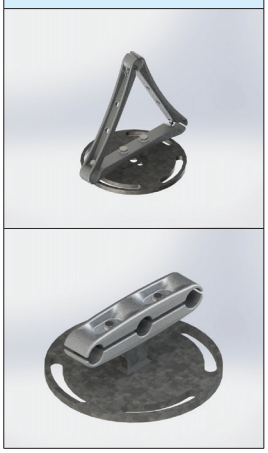
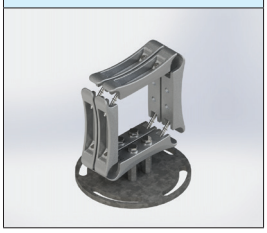
				

SUPPORTS

Straight through Conductor

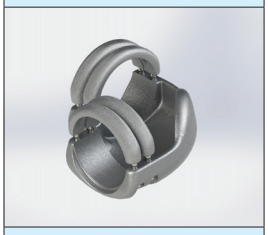
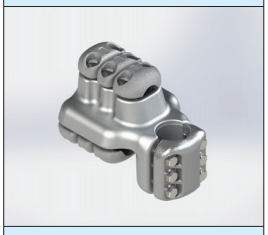
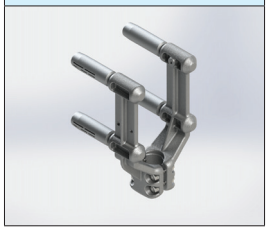
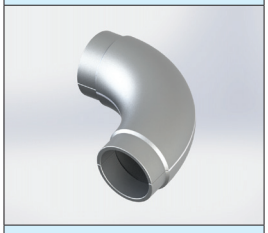
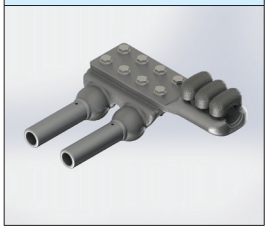
SubCon™

IJ0	IJ20	IJ30	IJ40	IJ60
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
				
Welded (W)				
				

ANGLE 90 DEGREES CONNECTORS

Conductor to Conductor

SubCon™

L11	L21	L31	L41
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
			
Welded (W)	Compression (P/R)	Compression (P/R)	
			
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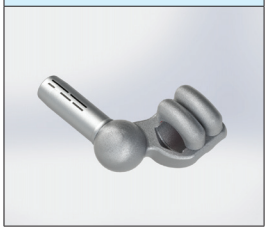
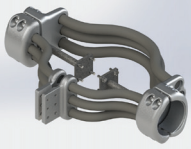
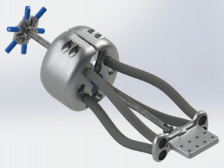
			

EXPANSION CONNECTORS

Conductor to Conductor

SubCon™

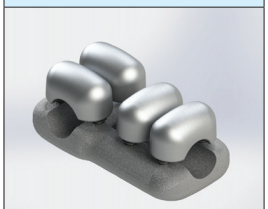
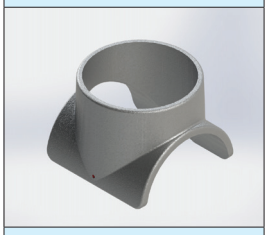
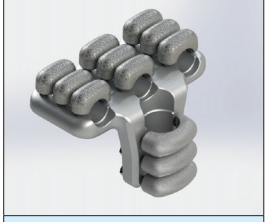
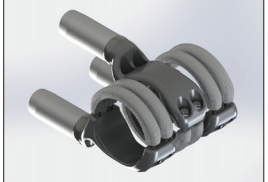
IXOX	LXOX	IX1	IXF	TX1
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Compression (P/R)	Compression (P/R)		Compression (P/R)	Compression (P/R)
				

TXFXF	TXF	WX1	WXF
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
			

TEE CONNECTORS

Conductor to Conductor

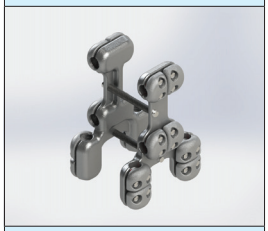
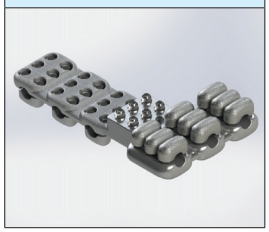
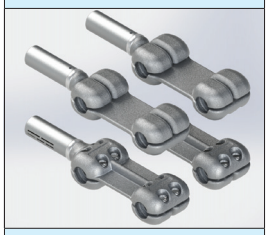
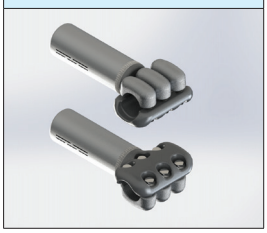
SubCon™

T11	T21	T31	T41	T61
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Welded (W)	Compression (R)	Compression (R)	Compression (R)	
				
Compression (R)				
				
Compession (P)				
				

TEE CONNECTORS CONTINUED

Conductor to Conductor

SubCon™

T44	T22	T33
Bolted (K)	Bolted (K)	Bolted (K)
		
Welded (W)	Welded (W)	
		
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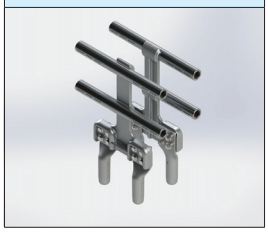
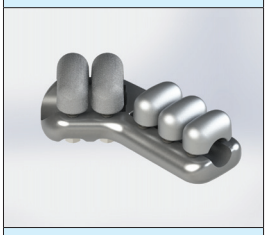
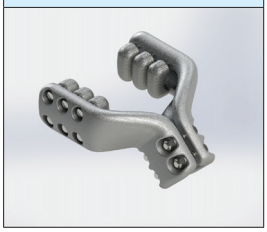
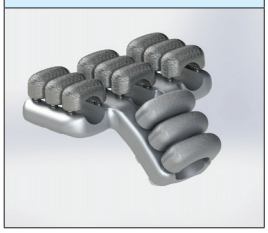
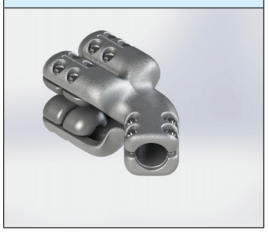
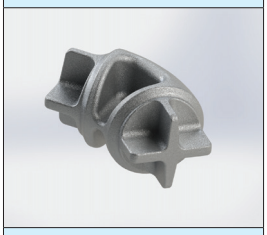
		

ANGLE 45 DEGREES CONNECTORS

Conductor to Conductor

SubCon™

V11	V21	V31	V41	V61
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Welded (W)				
				
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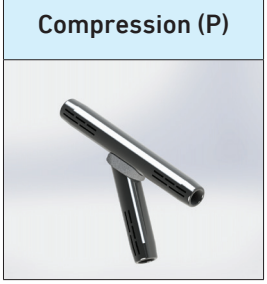
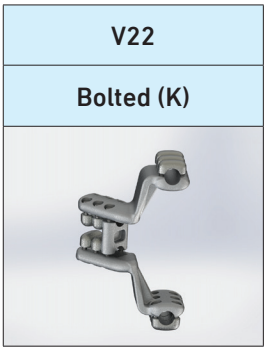
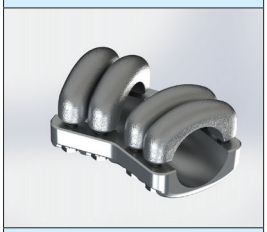
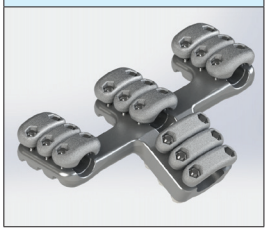
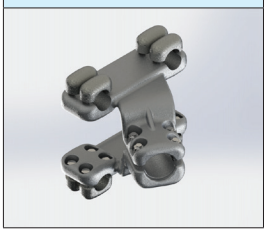
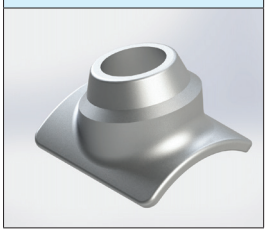
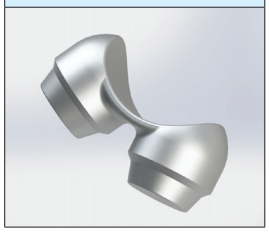
				

V22
Bolted (K)


ANGLE CONNECTORS

Conductor to Conductor

SubCon™

W11	W21	W31	W41	W61
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Welded (W)	Welded (W)			
				

BUSBAR SUPPORT WITH BASEPLATE T-TYPE

SubCon™

TJ0
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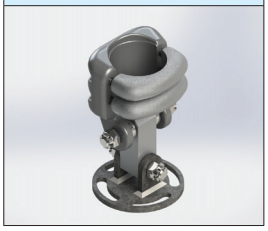


90 DEGREES EXPANSION

Flat Terminal

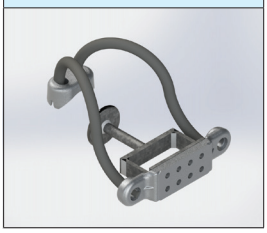
LXF
Bolted (K)

Welded (W)


90 DEGREES EXPANSION

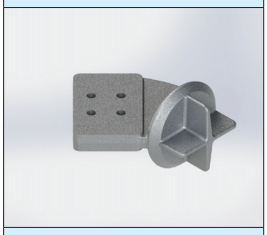
Bolt Coupler

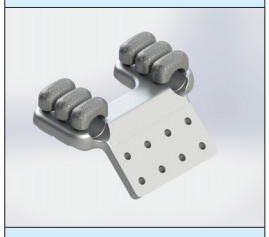
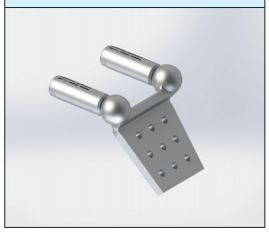
SubCon™

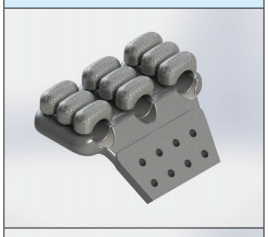
LX1
Bolted (K)


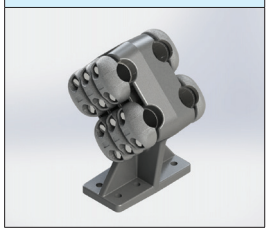
45 DEGREE FLAT TERMINAL CONNECTOR

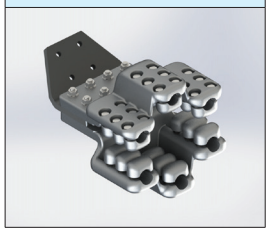
V1F
Bolted (K)

Welded (W)

Compression (P/R)


V2F
Bolted (K)

Compression (P/R)


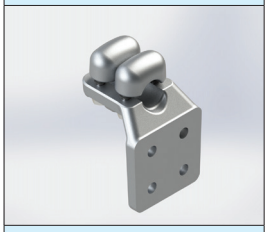
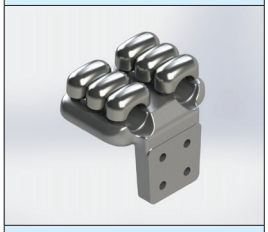
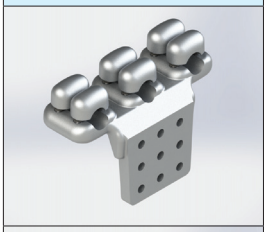
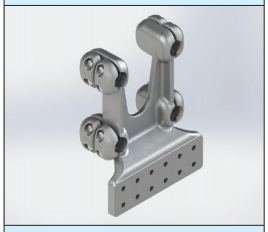
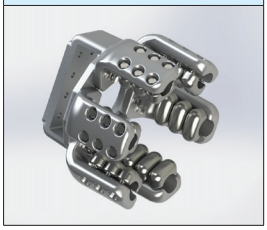
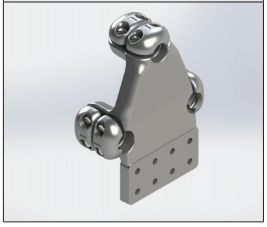
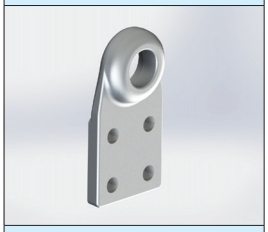
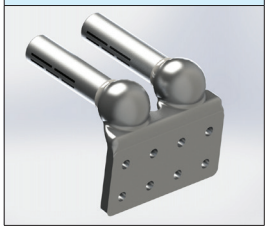
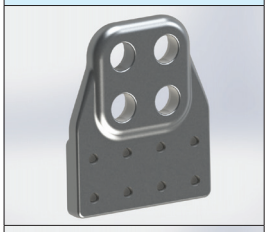
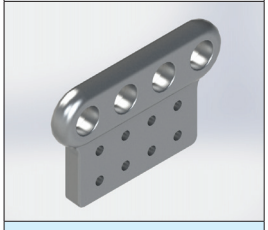
V3F
Bolted (K)



V4F
Bolted (K)


V6F
Bolted (K)


90 DEGREES FLAT TERMINAL CONNECTOR

SubCon™

L1F	L2F	L3F	L4F	L6F
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Welded (W)	Compression (P/R)		Welded (W)	
				
Compression (P/R)				
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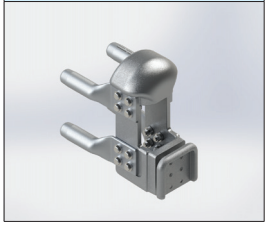
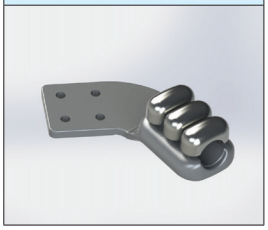
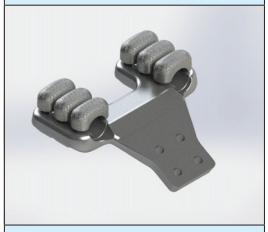
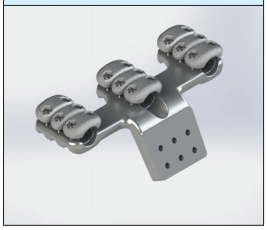
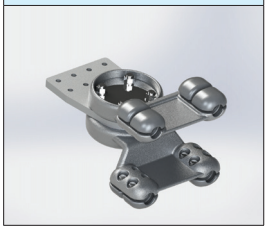
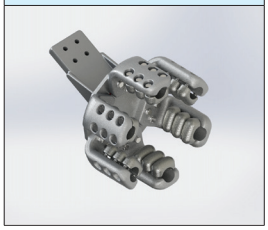
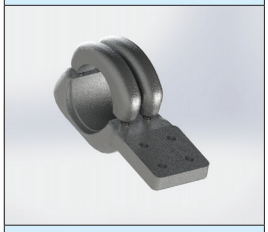
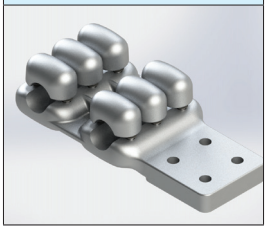
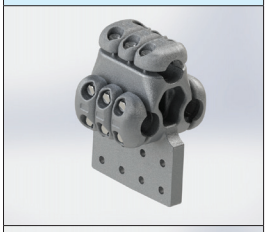
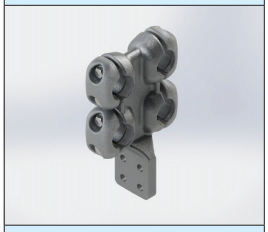
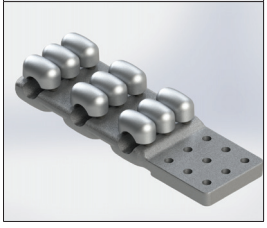
				

ANGLED FLAT TERMINAL CONNECTOR

SubCon™

W1F	W2F	W3F	W4F	W6F
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
	Compression (P/R)			
				

TEE FLAT TERMINAL CONNECTOR

T1F	T2F	T3F	T4F	T6F
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Compression (P/R)			Compression (P/R)	
				

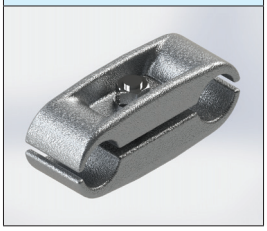
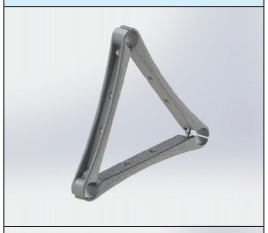
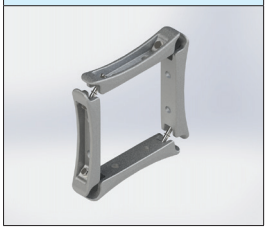
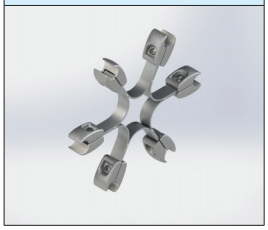
ACCESSORIES

SubCon™

Parallel Clamp

P11	P21	P22
Bolted (K)	Bolted (K)	Bolted (K)
		

Spacer

Q2	Q3	Q4	Q6
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
			
			

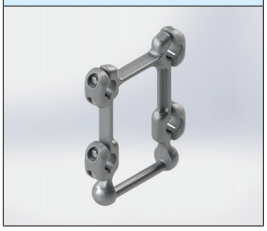
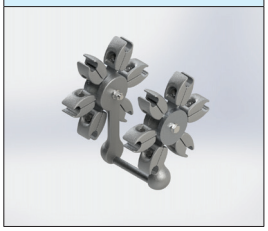
Cover Tension Clamp

DA11
Bolted (K)

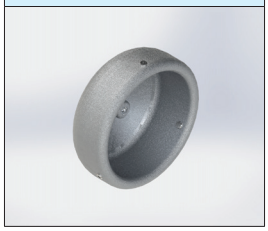
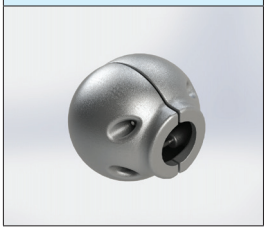
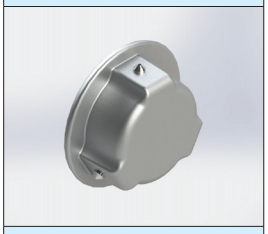

ACCESSORIES CONTINUED

SubCon™

Earthing Fixpoint

T31	Q3	Q3	P22	P22
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
				
Welded (W)				
				

Busbar Endcap

RAK	RBK	RCK	RDK	RRK Damping Wire Fixing
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
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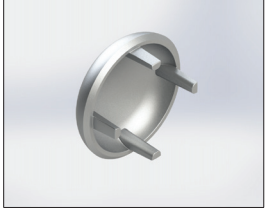
				

ACCESSORIES CONTINUED

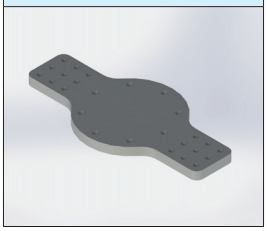
SubCon™

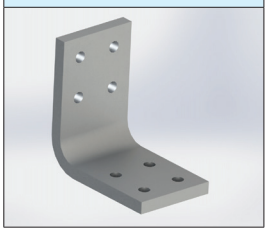
Cableloop for Pantograph

NJ
Bolted (K)


NJJ
Bolted (K)


Intermediate Plate

IF
Bolted (K)


LF
Bolted (K)


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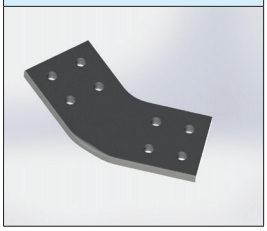
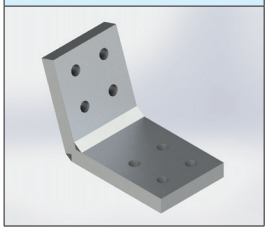
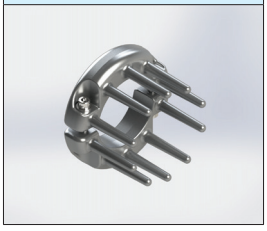
Bolted (K)


WF
Bolted (K)


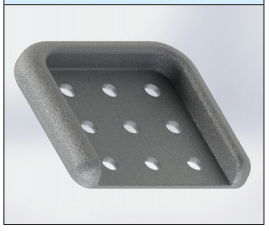
Ice Separation Clamp

TS
Bolted (K)


Corona Ring

TZ
Bolted (K)


Corona Pads

Bolted (K)


GENERAL INSTALLATION INSTRUCTIONS FOR SUBSTATION CONNECTORS BOLTED TYPE

SubCon™

The reliability and lifetime expectation of any electrical contact depends strongly on the preparation and installation accuracy.

1. Preparation of connectors before installation

1.1 Estimate the type and position of connector contact surfaces (typical arrangements, see Figure 1).

1.2 Wipe the contact surfaces of the connector body with a cleaning detergent and a clean cloth.

1.3 Brush all smooth contact surfaces using a clean steel brush (approximately 30 strokes, until the brush is "gripping").
Riffled contact surfaces in connector bodies may be brushed softly.
NOTE: For Aluminum and Copper materials, always use two different brushes with marking.

1.4 Apply a thin film of contact grease immediately after brushing the contact surfaces.
NOTE: Use only clearly marked contact grease for bolted type connectors. Never use other or unknown greases.

1.5 Proceed with the other steps in order to finish the installation within 30 minutes after the initial contact surfaces brushing.
DO NOT touch the prepared contact surfaces.

Drawing Number: **BA00193**
Revision: "L" 11.07.2018

Fig.1

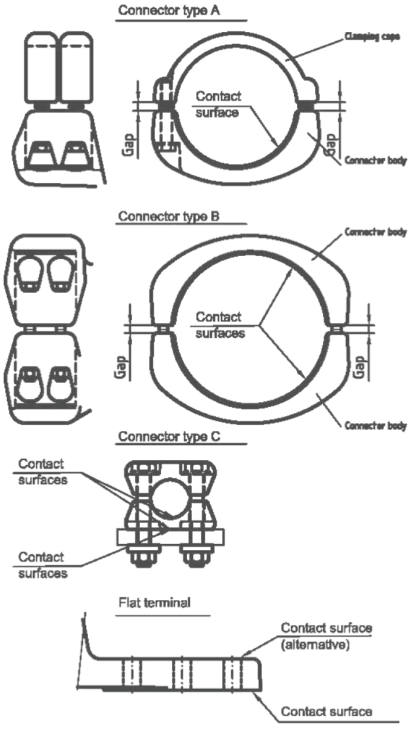
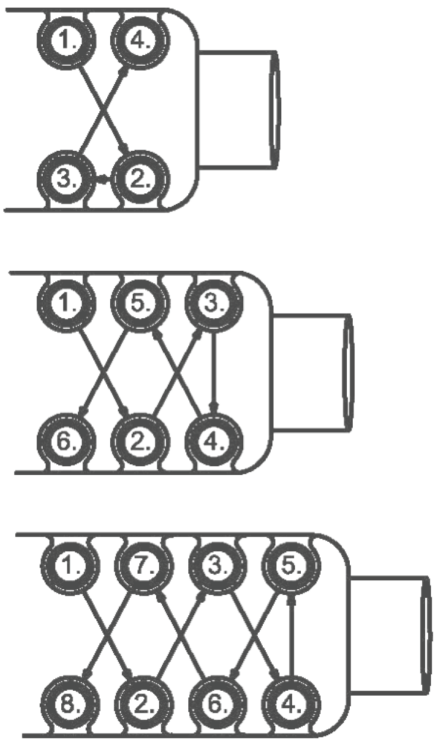


Fig.2: recommended torque settings for hex. bolts

Bolt material	M 8	M10	M12	M16	M20
A2f80 / 8.8	23Nm	46Nm	80Nm	190Nm	380Nm
A2f70	15Nm	29Nm	51Nm	120Nm	240Nm
CuNi1Si F59	20Nm	39Nm	68Nm	160Nm	

Fig.3 Alternating bolt tightening schema



GENERAL INSTALLATION INSTRUCTIONS FOR SUBSTATION CONNECTORS BOLTED TYPE CONTINUED

SubCon™

2. Preparation of conductors/terminals before installation

NOTE: This paragraph also applies for the preparation of the sleeves and shims (See Figure 3D).

2.1 Wipe the contact surfaces of the connector with cleaning detergent and a clean cloth.

2.2 Standard conductors: clean the contact surfaces of the conductor where the connector will be applied using a clean steel brush.

2.3 Tubular conductors/Flat terminals: clean the contact surfaces of the conductor where the connector will be applied using a clean steel brush or a clean emery cloth in the same manner as described in 1.3.

2.4 Proceed with the other steps in order to finish the installation within 30 minutes after the initial contact surfaces are brushed.

DO NOT touch the prepared contact surfaces

3. Installation of connectors and flat terminal connections

3.1 Bring together the connector and the conductor/terminal in the proper installation position. Follow Figure 3A for the installation of the conductor ends.

3.2 Tighten the bolts in a symmetrical way (check the equidistance gap according to Figure 1).

3.3 Alternate and apply crosswire the specified torque to the bolts using a torque wrench.

NOTE: For detailed explanation of crosswire tightening, see Figure 3.

NOTE: Follow the torque setting values engraved on the connector bodies and the general torque settings for hexagonal bolts and nuts in Figure 2.

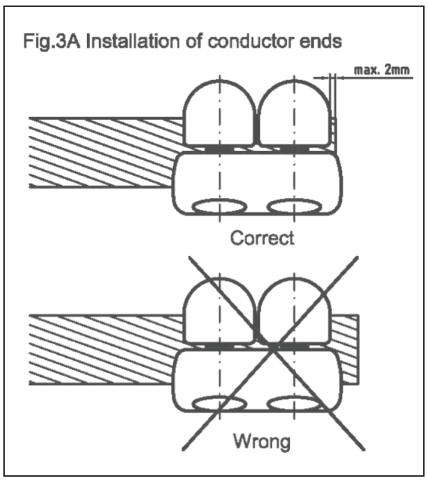
3.4 Check the installation and, if necessary, re-tighten the bolts (1x).

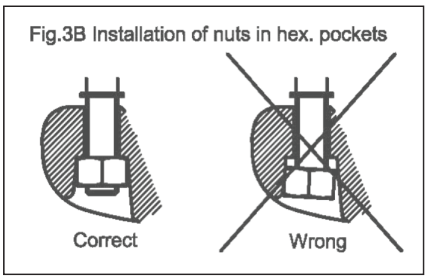
3.5 No additional maintenance and re-tightening is necessary.

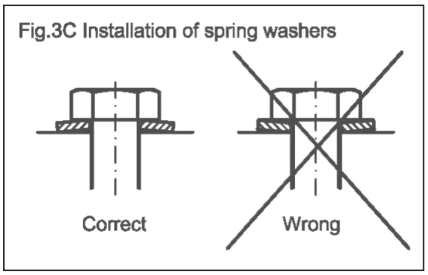
IMPORTANT NOTES:

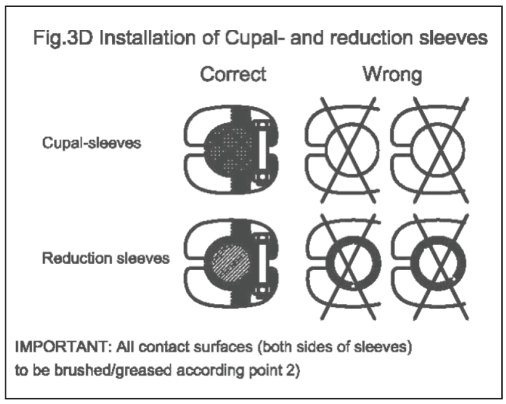
A. Store the connectors dry/clean before installation.

B. Standard connectors are not designed for re-installation or reopening. If re-installation required, contact the manufacturer.









GENERAL INSTALLATION INSTRUCTIONS FOR SUBSTATION CONNECTORS BOLTED TYPE CONTINUED

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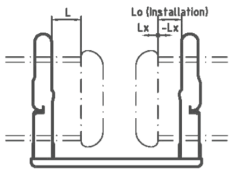
Fig.4 Busbar end installation position schema

Dimension " Lo " for installation at 20°C temperature is usually given in the expansion connector drawings

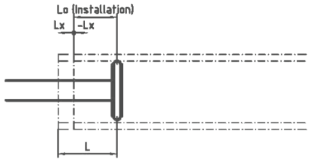
Corrective dimension " Lx " to be calculated acc. to Fig.5 depending on the actual temperature and busbar length

The effective installation position " L " to be calculated as L = Lo + Lx

Support type A (Outer bearing)



Support type B (Inner bearing)



Support type C (Roller bearing)

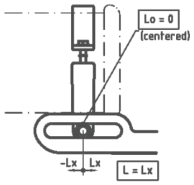


Fig.4A Installation of potential equalizer spring type

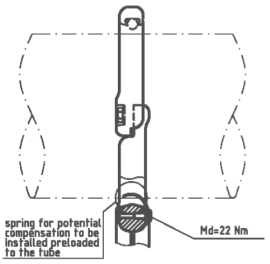
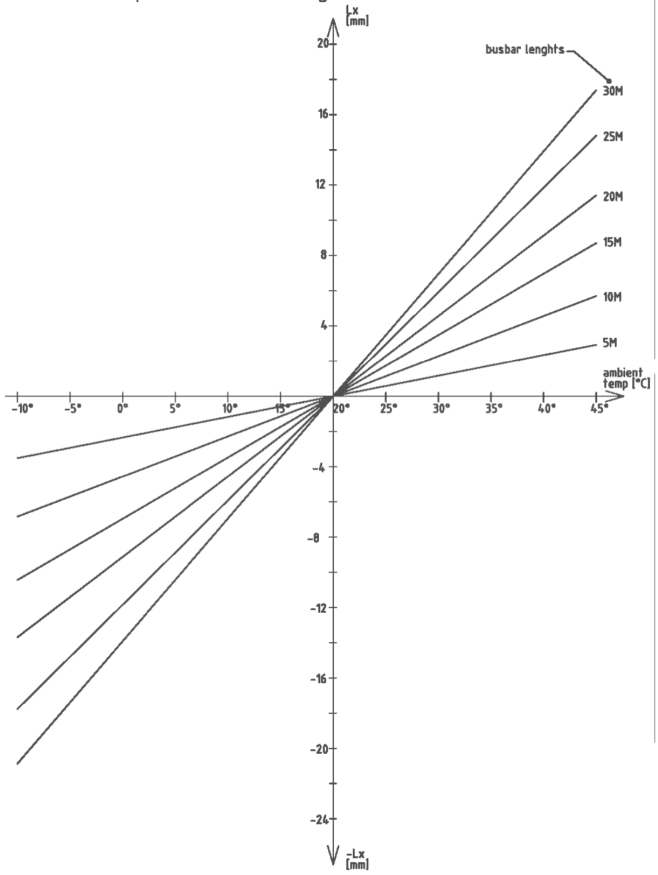


Fig.5: Corrective length " Lx " depending on installation temperature and busbar length



GENERAL INSTALLATION INSTRUCTIONS FOR SUBSTATION CONNECTORS BOLTED TYPE CONTINUED

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Assembly instructions for compression type connectors and dead end clamps for Aluminum Alloy (AAC, AAC) and Aluminum/Steel (ACSR) conductors.

NOTE: Points 3, 4, 5, 7, 8, 9, 10, and 11 are valid for dead-end clamps with separately compressed ACSR conductors steel core only.
NOTE: For compression joints, use clearly marked compression compound grease only. Never use unidentified or unknown greases.
NOTE: For installation of all flat terminal connections, use contact grease for bolted connections only.

1. Straighten the conductor.

2. Clean the conductor surface from dust and oxide at a length corresponding to that of the aluminum sleeve.

3. Mark the length to be stripped. The stripping length shall correspond to the length of the steel sleeve plus approximately 10 mm (Figure 6).

4. Bind the remaining aluminum strands, respectively, with an insulating tape close to the mark (Figure 6). Cut off the aluminum strands respectively perpendicular to the conductor axis using the shipping tool. When cutting off the aluminum layers of the conductor, take care of the strand of the last layer. This strand shall not be completely cut through. Rather, these strands have to be broken to avoid damaging the core layer of the steel core. If necessary, burr the sectional edges (Figure 7).

5. Clean the steel core with cotton pad.

6. Push the greased aluminum sleeve of the compression dead-end clamp with the conically shaped sleeve end over the end of the conductor (Figure 8).

7. Insert the core of the conductor into the steel sleeve and push in the core, until the gap between the edge of the steel sleeve and the aluminum strands is approximate 8-10 mm (Figure 9).

8. Compress the steel sleeve with die code confirmed by the manufacturer. The compressions shall be made in the order of the compression marks starting from the clamp fixing point side and going towards the end of the sleeve (Figure 10).

9. After completion of the steel compression, remove the PVC tape and push back the aluminum sleeve of the dead-end clamp to such an extent that a gap of 2-3 mm remains between the sleeve end and the metallic stop (Figure 11).

10. Align the clevis or eye connection to the jumper tongue (Figure 11).

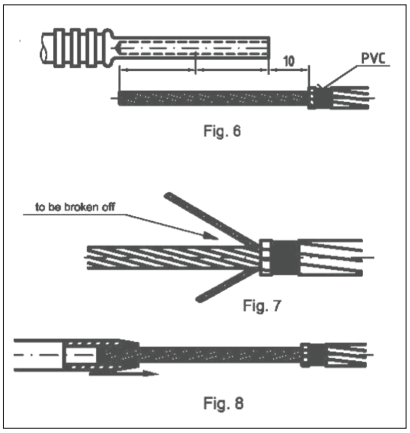
11. Compress the aluminum sleeve with the die code confirmed by the manufacturer. The section between the clevis connection and the jumper tongue shall be compressed continuously and overlapping as marked on the sleeve. The area between the jumper tongue towards the conductor shall be compressed in order starting from the tongue towards the front tube end according to existing compression marks on the aluminum sleeve (Figure 11).

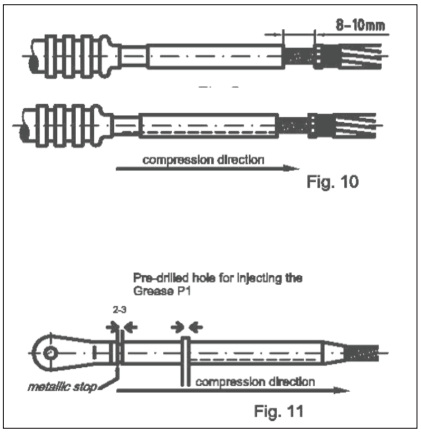
12. According to Item 11, compress the jumper terminal (i.e., aluminum tube with flat terminal) to the jumper conductor. For installation of bolted type flat terminal connections, follow the general instructions for bolted type connectors. Fill the hollow spaces with grease (if required).

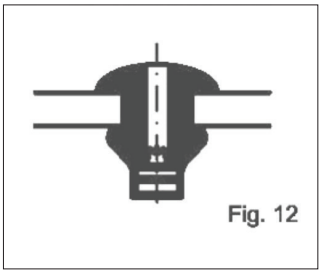
GENERAL INSTALLATION INSTRUCTIONS FOR SUBSTATION CONNECTORS BOLTED TYPE CONTINUED

13. Inject the grease P1 through the pre-drilled hole until the hollow space is completely filled (Figure 11).

14. Insert a POP IMEX. Revert into the hole and apply steady pressure to the handle of the riveting tool until the mandrel breaks and the hole is sealed (Figure 12).







CONNECTOR ARTICLE NUMBER EXPLANATIONS

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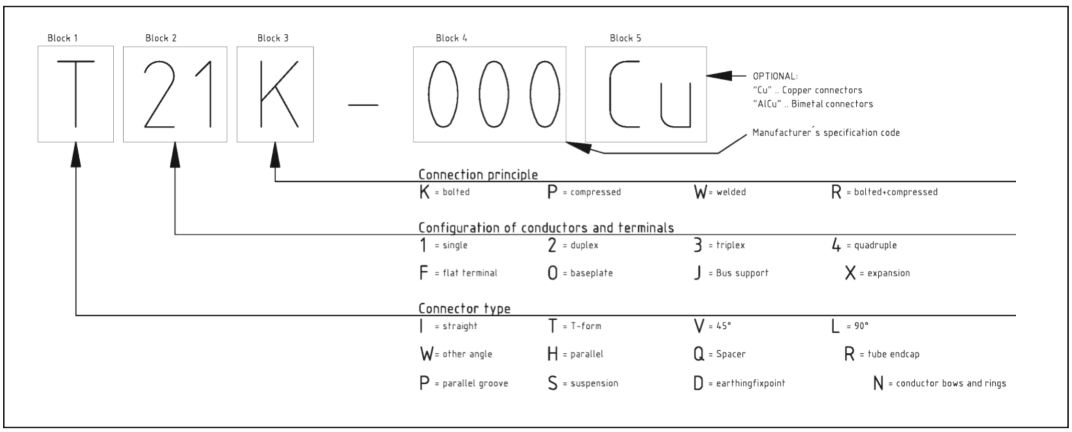
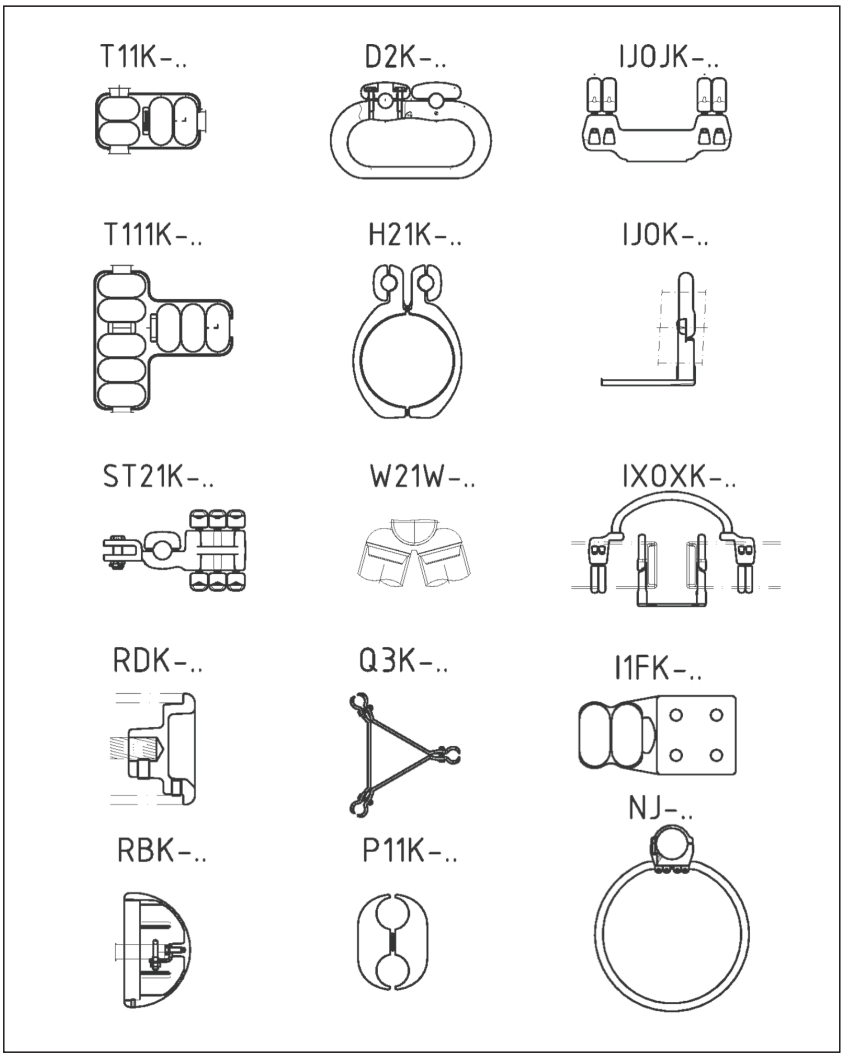


EXAMPLES



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