PREFORMED LINE PRODUCTS

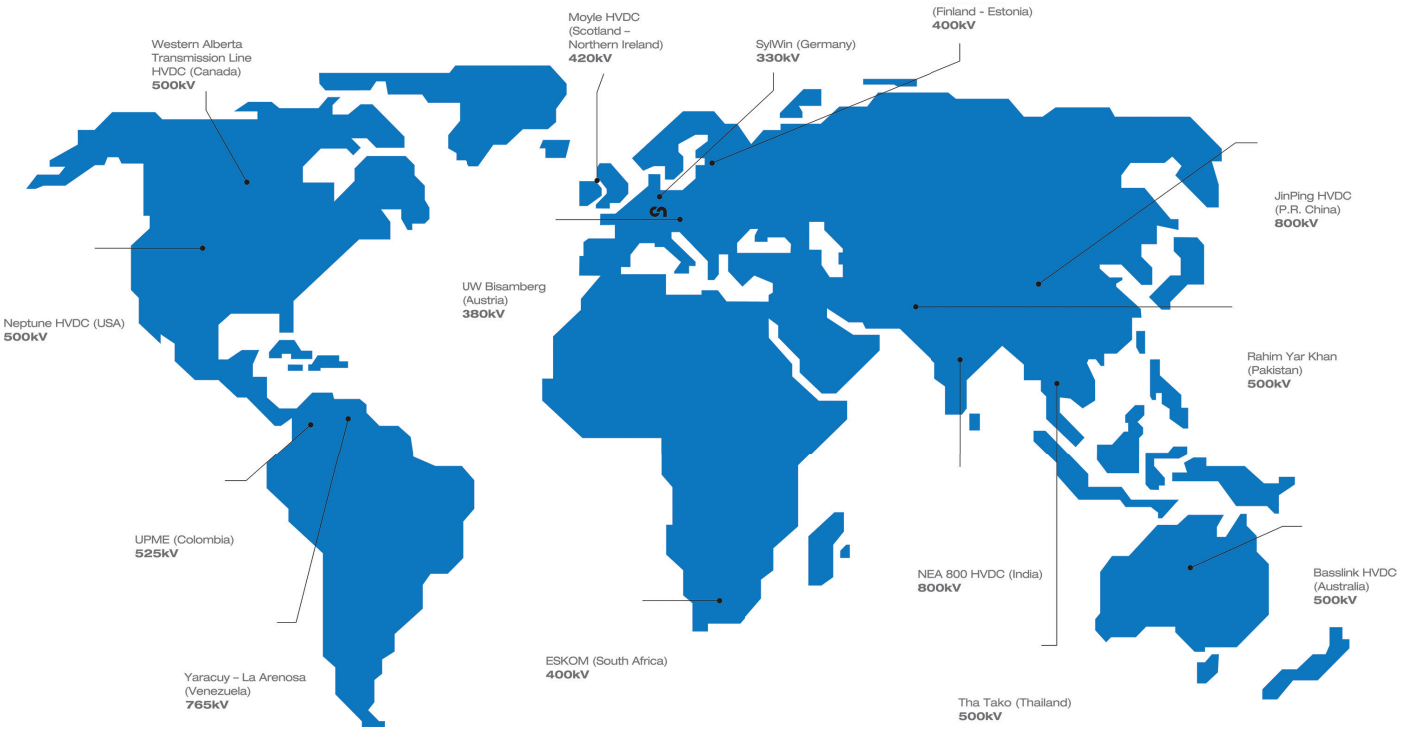
SubCon

SUBSTATION CONNECTORS PRODUCT OVERVIEW

Single Conductor Clamps | Bundle Conductor Clamps
Busbar Clamps | Accessories

Substation projects completed in over 100 countries worldwide

With 24 global locations, PLP is recognized around the world as a market leader in developing innovative and dependable solutions for electric power delivery systems.



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Preformed Line Products (PLP)

Founded in 1947, PLP is a global designer, manufacturer, and supplier of high-quality products and services for the electric power industry. With 24 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

SubCon

ENGINEERING

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

MANUFACTURING & TESTING

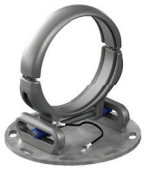
- Our manufacturing plants support multiple technologies like sand casting, die casting, welding, machining, forging, and others
- We perform and coordinate electrical and mechanical tests in independent laboratories

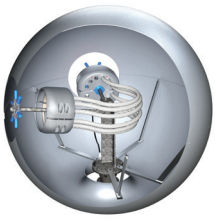
PRODUCT DEVELOPMENT & DESIGN

- 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 the ISO 9001 Quality Management System
- We guarantee the highest level of quality throughout all project phases
- Final quality control checks are performed on all executed orders in our quality and logistic center

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

Expansion Connector	Copper/Bimetallic Connector	Suspension String	Special HVDC Connector
			

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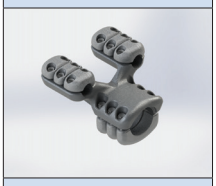
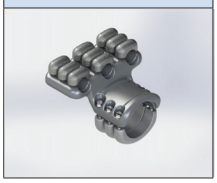
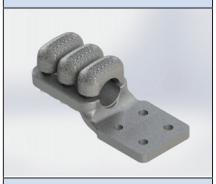
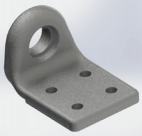
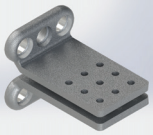
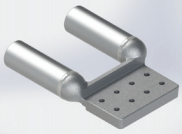
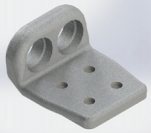
Parallel Connectors – Conductor to Conductor

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

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)	Welded (W)	Compression (P/R)	
				
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		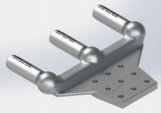		
				

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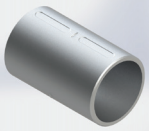
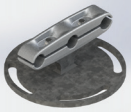
Straight Connectors – Conductor to Conductor

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

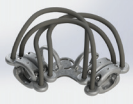
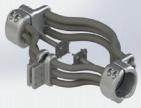
Supports – Straight through Conductor

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

Angle 90° Connectors – Conductor to Conductor

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

Expansion Connectors – Conductor to Conductor

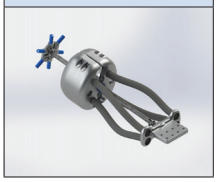
IXOX	LXOX	IX1	IXF	TX1	TXFXF
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
					
Welded (W)	Welded (W)		Welded (W)	Welded (W)	
					

Expansion Connectors – Conductor to Conductor

TXF
Bolted (K)

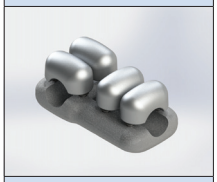
WX1
Bolted (K)

WXF
Bolted (K)

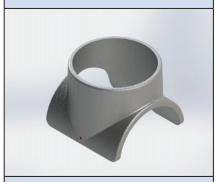


TEE Connectors – Conductor to Conductor

T11
Bolted (K)



Welded (W)

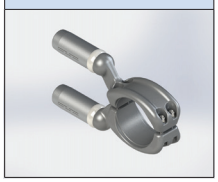


Compression (R)

Compression (P)

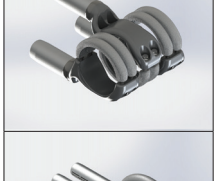
T21
Bolted (K)

Compression (R)



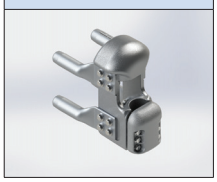
T31
Bolted (K)

Compression (R)



T41
Bolted (K)

Compression (R)

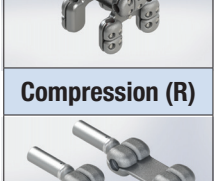


T33
Bolted (K)

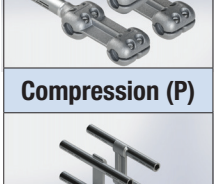
T61
Bolted (K)

T44
Bolted (K)

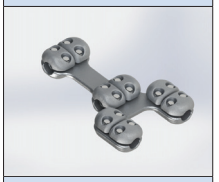
Compression (R)



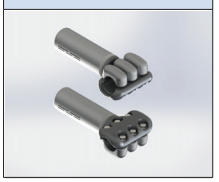
Compression (P)



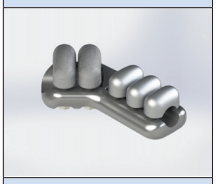
T22
Bolted (K)



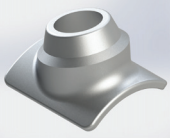
Compression (R)



Angle 45° Connectors – Conductor to Conductor

V11	V21	V31	V41	V61	V22
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
					
Welded (W)					
					
Compression (P)					
					

Angle Connectors – Conductor to Conductor

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

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Busbar Support with Baseplate T-type

TJO
Bolted (K)


90° Expansion - Flat Terminal

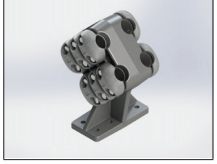
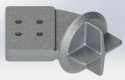
LXF
Bolted (K)

Welded (W)


90° Expansion - Bolt Coupler

LX1
Bolted (K)


45° Flat Terminal Connector

V1F	V2F	V3F	V4F	V6F
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Welded (W)	Compression (P/R)			
				
Compression (P/R)				
				

90° Flat Terminal Connector

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)				
			Compression (P/R)	
				

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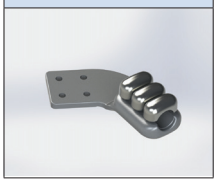
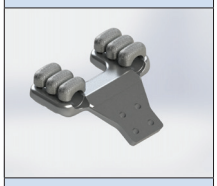
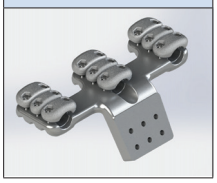
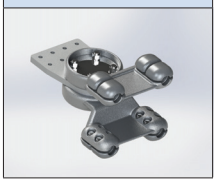
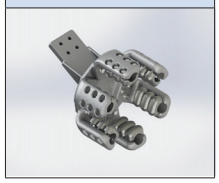
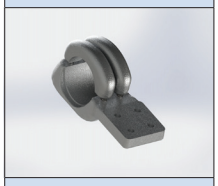
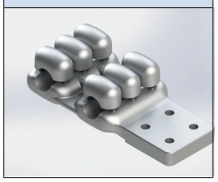
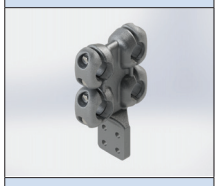
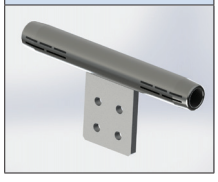
Angled Flat Terminal Connector

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

Tee Flat Terminal Connector

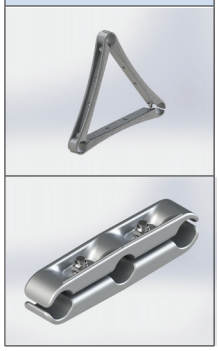
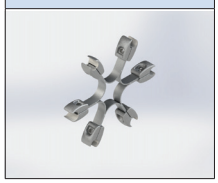
T1F	T2F	T3F	T4F	T6F
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
Compression (P/R)			Compression (P/R)	
				

Accessories

Parallel Clamp

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

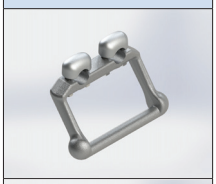
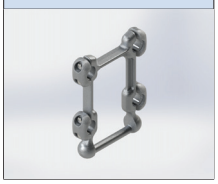
Spacer

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

Cover Tension Clamp

DA11
Bolted (K)


Earthing Fixpoint

D1	D2	D3	D4	D6
Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)	Bolted (K)
				
				
Welded (W)				
				

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Accessories

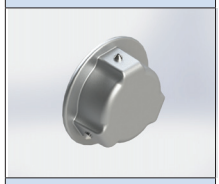
Busbar Endcap

RAK
Bolted (K)

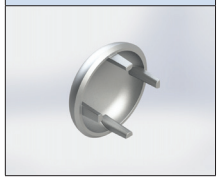
RBK
Bolted (K)

RCK
Bolted (K)

RDK
Bolted (K)



Welded (W)



RRK
Damping Wire Fixing

Bolted (K)

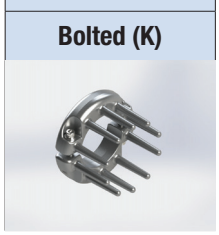
Cableloop for Pantograph

NJ
Bolted (K)

NJJ
Bolted (K)

ICE Separation Clamp

TS
Bolted (K)

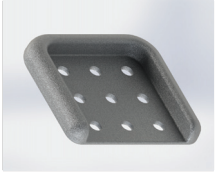


Coronaring

TZ
Bolted (K)

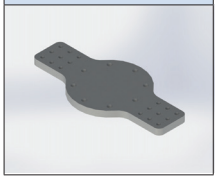
Corona Pads

Bolted (K)

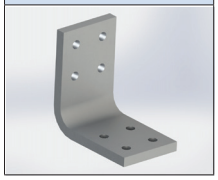


Intermediate Plate

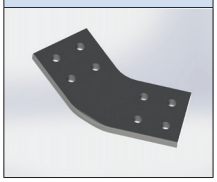
IF
Bolted (K)



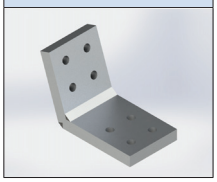
LF
Bolted (K)



VF
Bolted (K)



WF
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 Fig. 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 (approx. 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

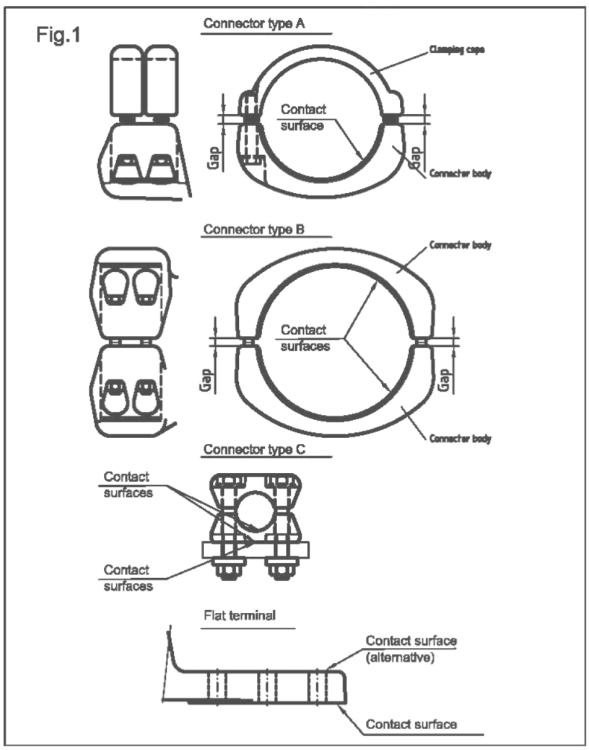
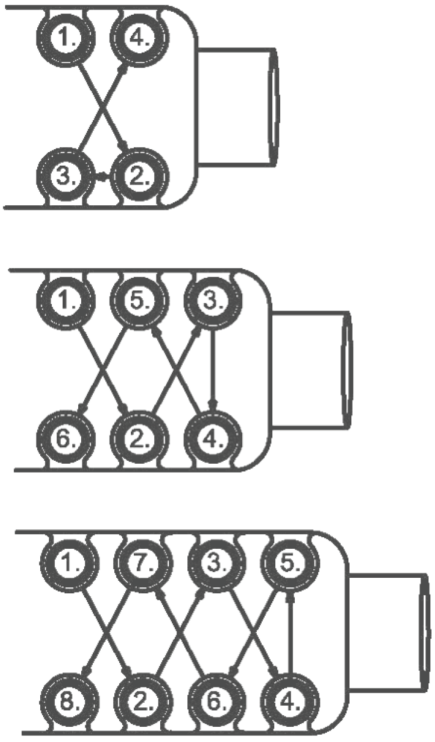


Fig.2: recommended torque settings for hex. bolts

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 (con't)

SubCon

2. Preparation of conductors/terminals before installation

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

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

2.2 Stranded 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 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 Fig. 3A for the installation of the conductor ends, Fig. 3B/C for eventual washer and nut installation. For detailed adjustment of the busbar position in expansion connectors, follow Fig. 4.

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

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

NOTE: For detailed explanation of crosswise tightening, see Fig. 3.

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

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

3.5 No additional maintenance and re-tightening is necessary.

Fig.3A Installation of conductor ends

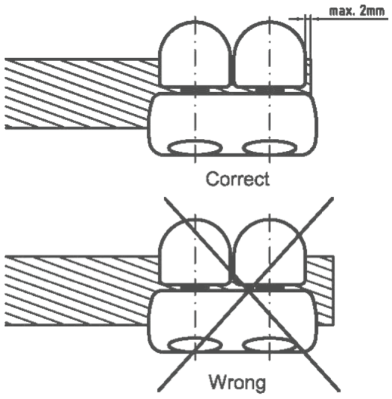


Fig.3B Installation of nuts in hex. pockets

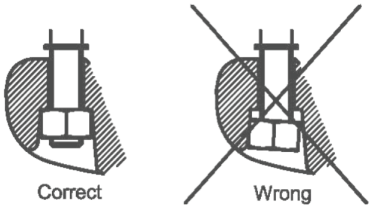


Fig.3C Installation of spring washers

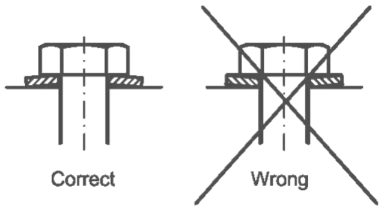
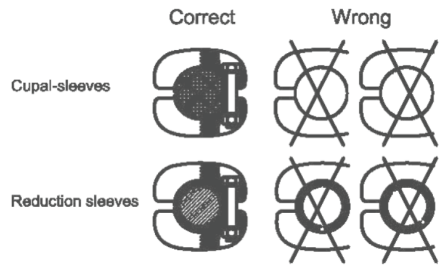


Fig.3D Installation of Cupal- and reduction sleeves



IMPORTANT: All contact surfaces (both sides of sleeves) to be brushed/greased according point 2)

IMPORTANT NOTES:

A. Store the connectors dry/clean before installation

B. Standard connectors are not designed for Reinstallation or Reopening!
If reinstallation required, contact the manufacturer!

General Installation Instructions for substation connectors bolted type (con't)

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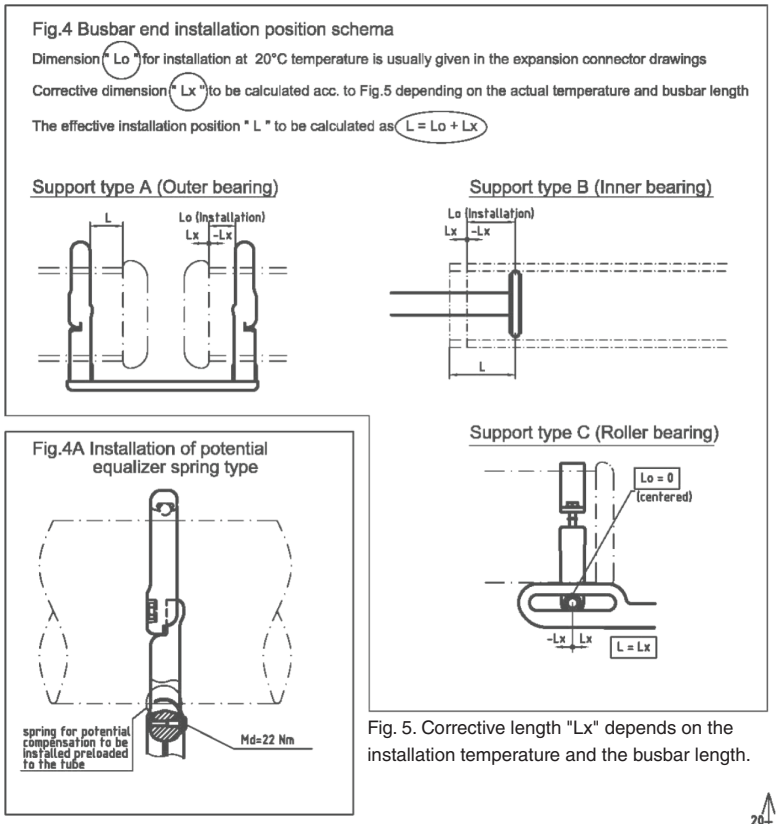
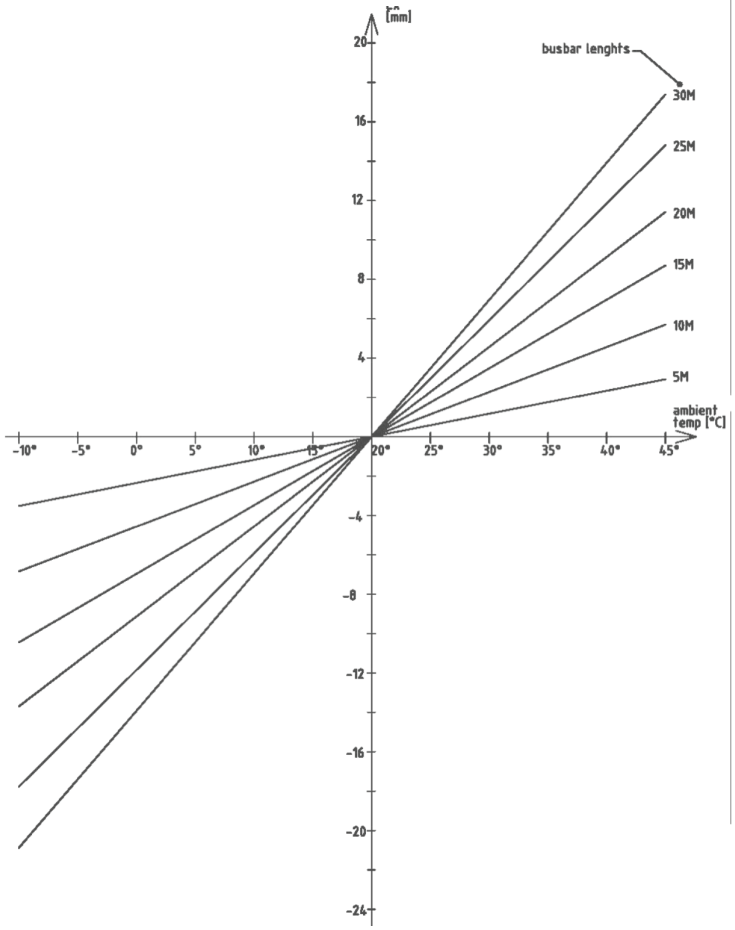


Fig. 5. Corrective length "Lx" depends on the installation temperature and the busbar length.



General Installation Instructions for substation connectors bolted type (con't)

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

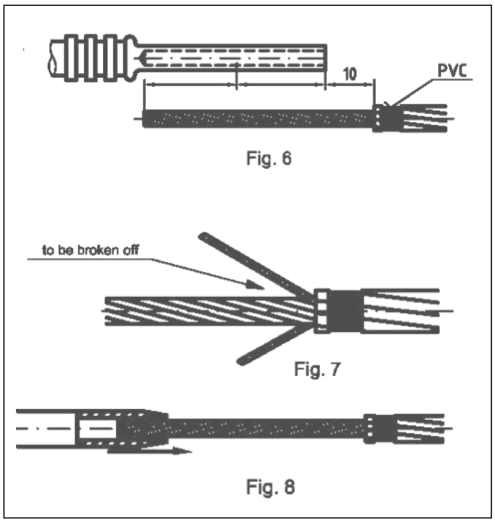
NOTE 1: Points 3, 4, 5, 7, 8, 9, 10, and 11, are valid for dead-end clamps with separately compressed ACSR conductors steel core only.

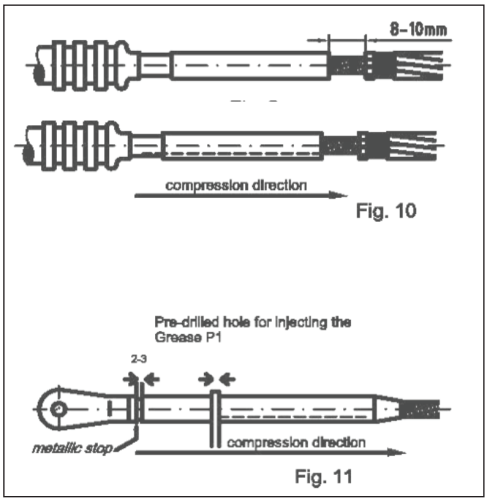
NOTE 2: For compression joints, use clearly marked compression compound grease only. Never use unidentified or unknown greases!

NOTE 3: 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 approx. 10 mm (Fig. 6).
4. Bind the remaining aluminum strands, respectively, with an insulating tape close to the mark (Fig. 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 off to avoid damaging the core layer or the steel core. If necessary, burr the sectional edges (Fig. 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 (Fig. 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 approx. 8-10 mm (Fig. 9).
8. Compress the steel sleeve with the 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 (Fig. 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 to 3 mm remains between the sleeve end and the metallic stop (Fig. 11).
10. Align the clevis or eye connection to the jumper tongue (Fig.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. (Fig.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

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13. Inject the grease P1 through the pre-drilled hole until the hollow space is completely filled (Fig.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 (Fig. 12).

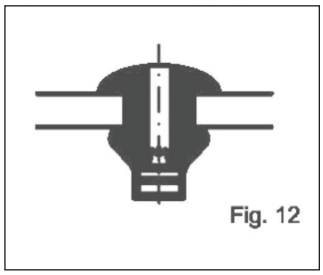

Fig. 12

Connector Article Number Explanations

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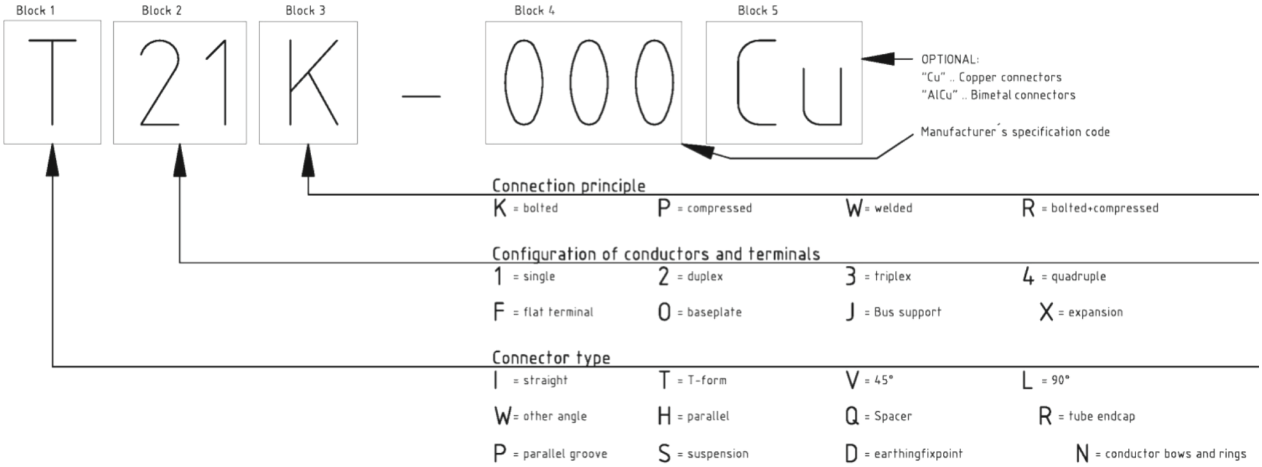
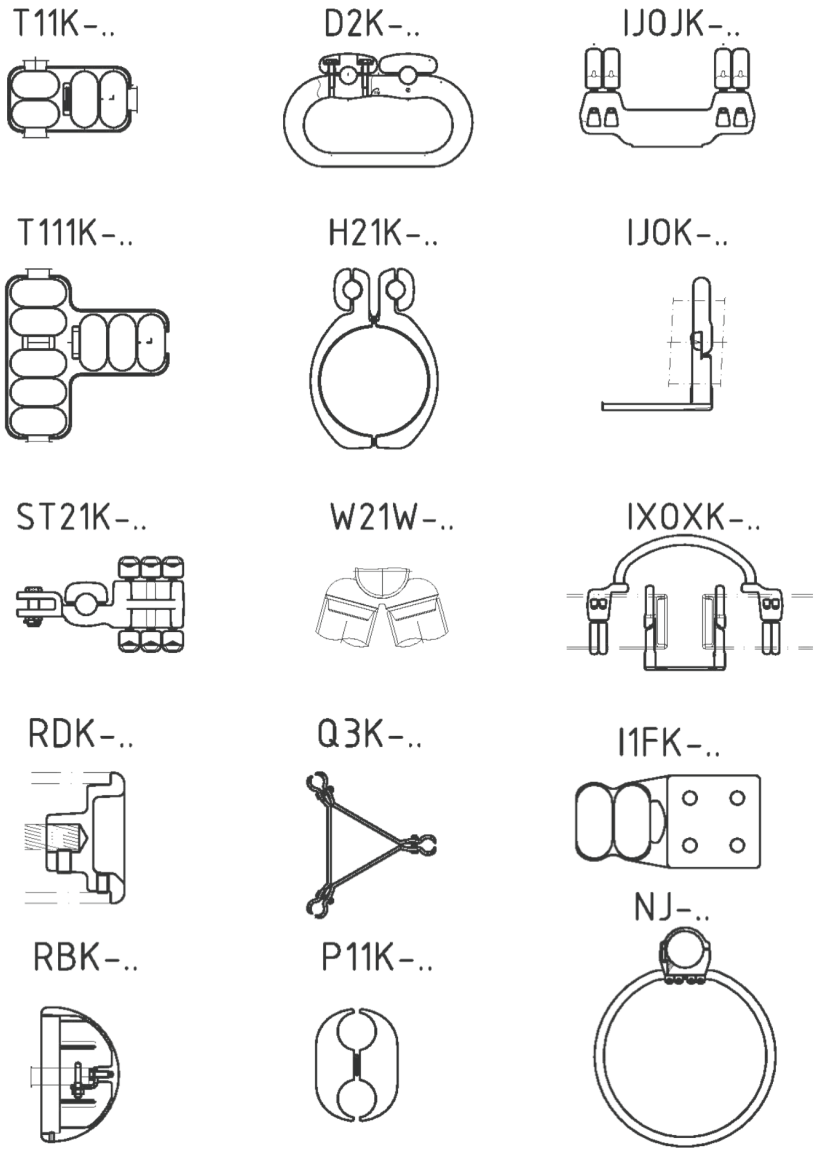


Examples:



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