

CADWELD®

Railway Earthing

CADWELD® – Earthing Bonds and Earthing Connections for Electrical Railways



ERICO®

Earthing Bonds

ERICO manufactures prefabricated Earthing Bonds to customized specifications. These bonds are made from galvanized or copper cables. The ERICO CADWELD exothermic connection process is employed to attach an earth plate on one end of the bond and a steel connection plate on the other end. The steel connection plate is welded on site to reinforcing bars or steel beams.

Low resistance to corrosion makes a permanently welded CADWELD bond the best solution for connections inside concrete structures. The property of low resistance is important for earthing and cathodic protection of reinforcing bars and steel beams in bridges and tunnels. However, other acceptable methods of connections are to combine a CADWELD connection and a mechanically crimped connection, or a mechanically crimped connection on both ends of the Earthing Bond.

An equipotential bond between all current carrying elements in a structure and earth is required for personnel safety in case of catenary failure.

A cathodic protection system prevents damage to steel work due to corrosion and reduces expensive maintenance.

How To

The connection is made to reinforcing bars prior to pouring the concrete. The steel connection plate is connected the steel reinforcing bars by welding in place. The earth plate is temporarily bolted or nailed to the internal surface of the formwork. When the formwork is removed only the connecting surface of the earth plate appears. The earth plate is equipped with a threaded hole in order to connect the standard lug of an earth cable. When the reinforcing bars are discontinuous (expansion joints for example), Earthing Bonds connect them electrically by means of prefabricated jumpers made from an insulated flexible cable equipped on each end with a standard lug.

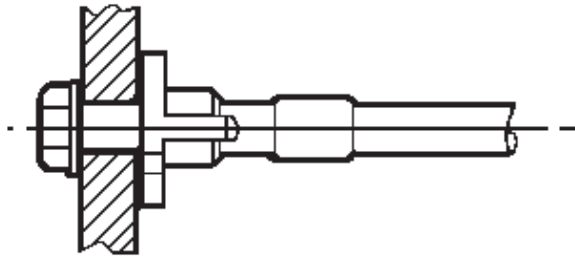
Benefits

- Earthing Bonds (CADWELD - CADWELD) can be custom manufactured according to your specifications.
- Earthing Bonds are available in 500 and 1000 mm lengths, and in 70 and 95 mm \leq diameters.
- ERICO offers three styles of construction:
 1. *CADWELD - CADWELD Earthing Bond.*
 2. *CADWELD - Mechanically Crimped Earthing Bond, earth plate welded with CADWELD, steel plate mechanically crimped.*
 3. *Crimped -Crimped Earthing Bond, earth plate and steel plate both mechanically crimped.*
- Increased resistance to corrosion with the use of the earthing bonds.
- Reduces expensive maintenance
- The use of Earthing Bonds provides increased safety to personnel.

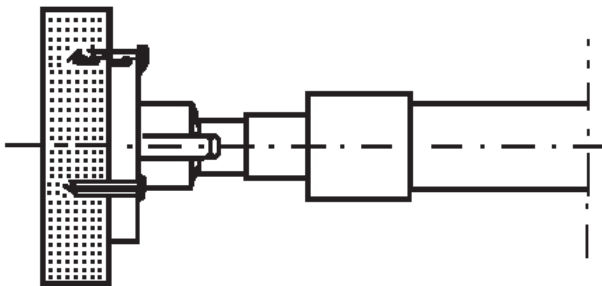
1. Assembly Instructions

1.1 Connection with the casing

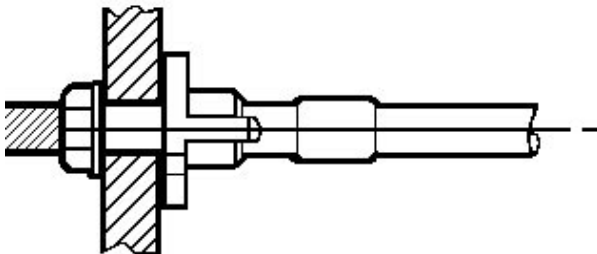
Earthing plates DB-16 can be fastened to the casing as shown in the following. It has to be ensured that the earthing plate and casing are connected as closely together as possible. This is achieved by pressing the connection surface of the earthing plate plane-parallel against the casing.



- 1.1.1** The casing is bored through and the earthing plate is drawn tight against the casing with an M16 bolt. This bolt is removed before removing the casing.



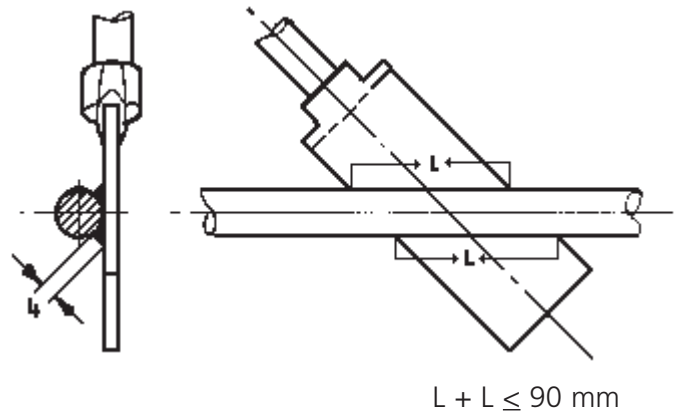
- 1.1.2** The earthing plate is connected to the casing with nails in the three indents. After removing the casing the three nail spikes are to be removed.



- 1.1.3** For an easy assembly, it is recommended to use a threaded rod with a nut and, depending on the casing material, with a washer. First, screw the threaded rod into the blind hole of the earthing plate by hand.

1.2. Connection with the reinforcement

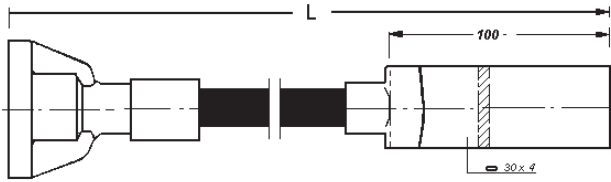
The electrically connected conducting rods of the reinforcement, designated as earthing conductor, should have a minimum diameter of 16 mm. The flat welding tongues are connected to these rods by arc welding. To avoid reduction of the cross sectional area, the root of the welding seam must be at least 4 mm.



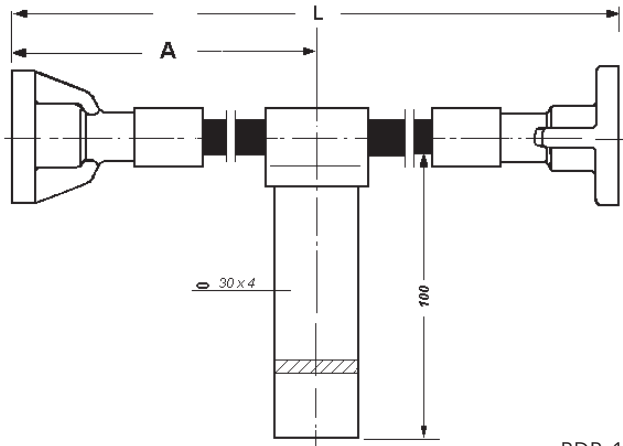
2. Summary of Types – Information

The following diagrams show a selection of the most common types. The identification of each type is given on the bottom right hand side.

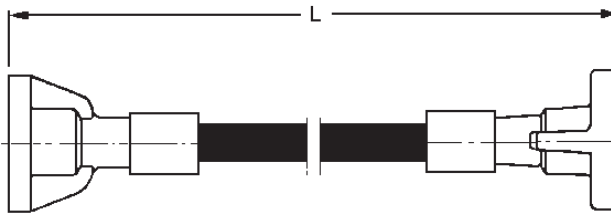
Linear design, flexible



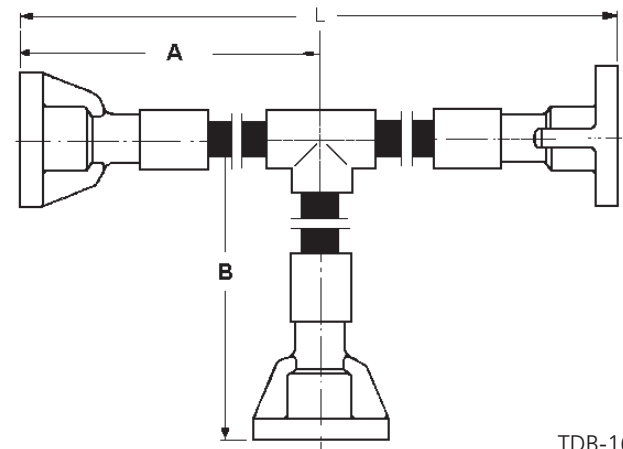
FDBS-16
FDBC-16
FDB-16



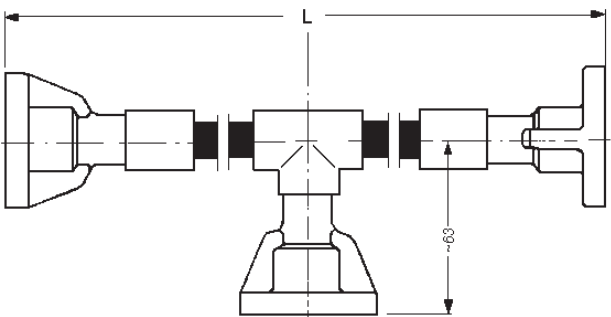
RDB-16



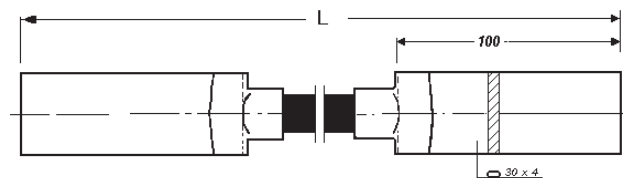
SDB-16



TDB-16



ADB-16

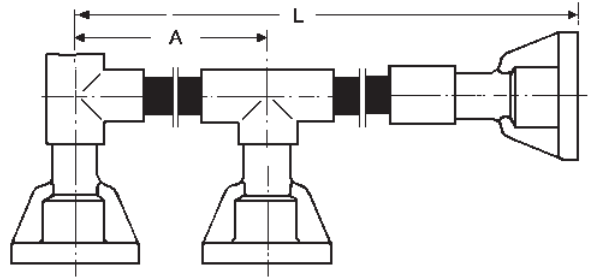


FDB-16

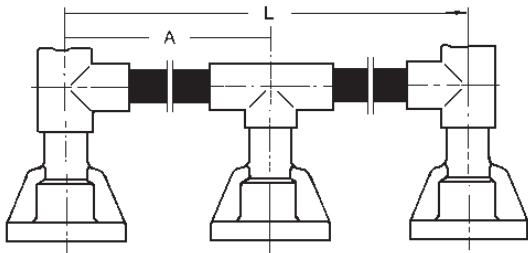
Right angular design, flexible type WDB-16



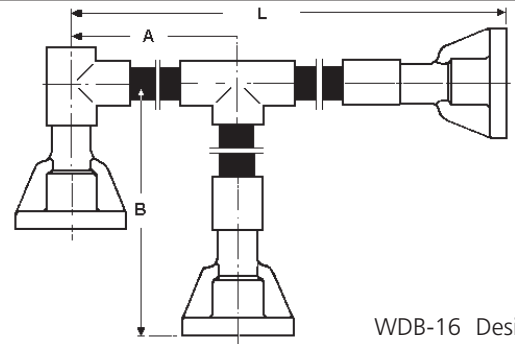
WDB-16 Design 1



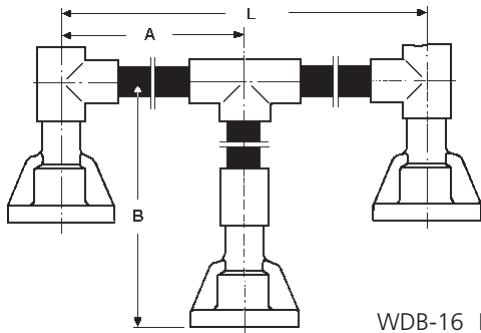
WDB-16 Design 5



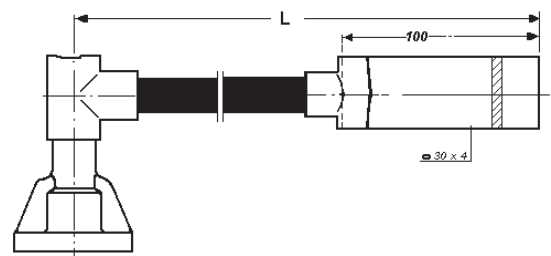
WDB-16 Design 2



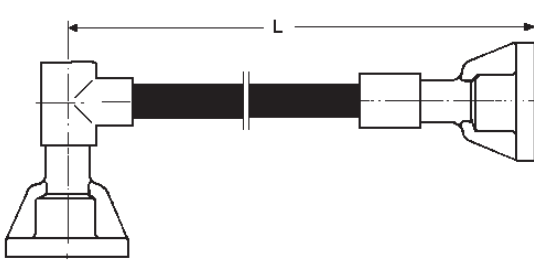
WDB-16 Design 6



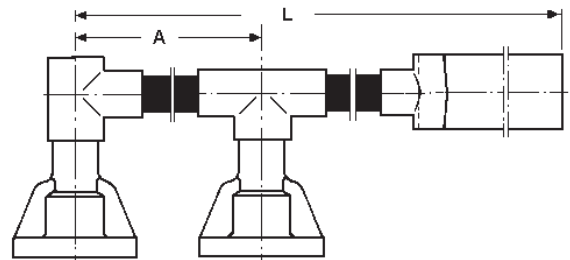
WDB-16 Design 3



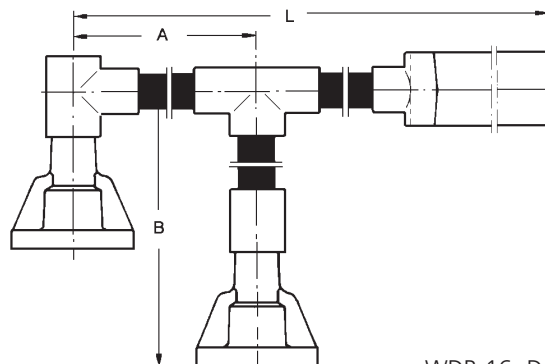
WDB-16 Design 7



WDB-16 Design 4



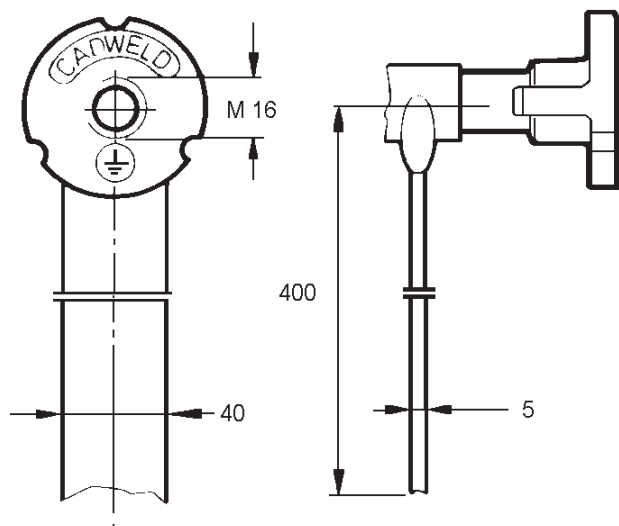
WDB-16 Design 8



WDB-16 Design 8

2.1 Design with solid conductor

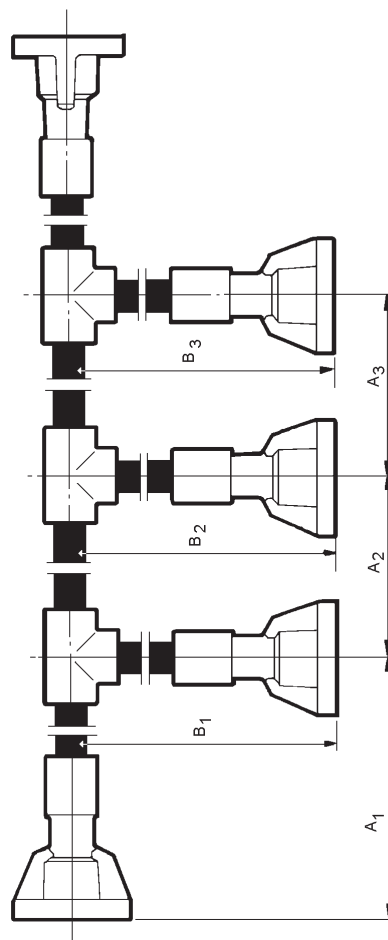
This type, KDB 16, is to be used on such concrete structures where flexible connections are not necessary (e.g. sound protection walls etc.). The standard length of the steel band is 400 mm, if required varying lengths can also be supplied.



Design with steel band KDB-16

2.3 Special designs

With a few structures, e.g. viaduct piers, mass-produced earthing bonds with several outputs have proven themselves. For orders of this kind, drawings or sketches should be provided to ERICO with all necessary information, such as spacing, lengths and connection pieces.



2.2 Standardized types

Standardized lengths 500 and 1000 mm

FDBC


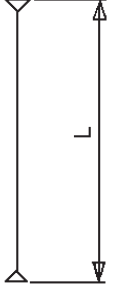

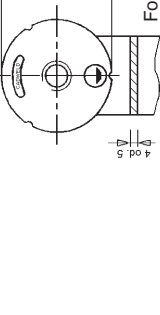
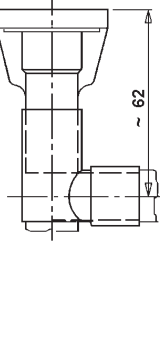
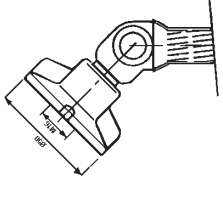
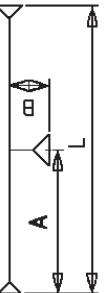

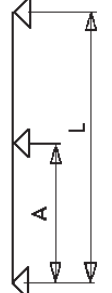
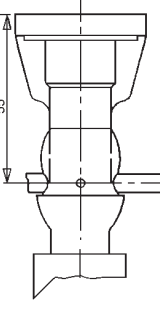
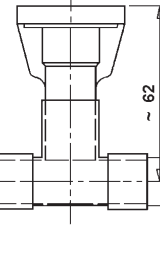
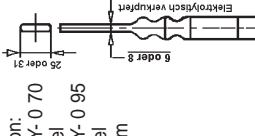
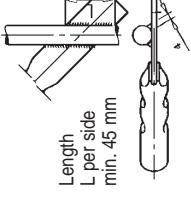
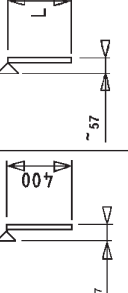
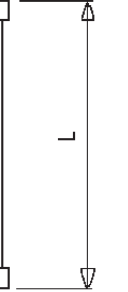
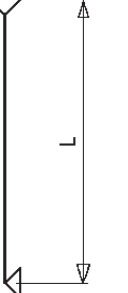
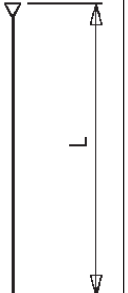
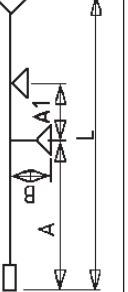
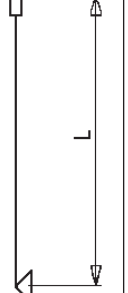
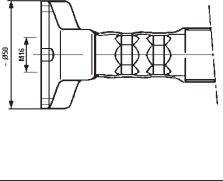
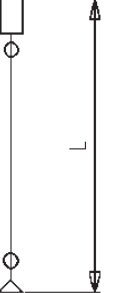
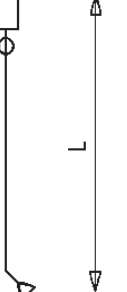
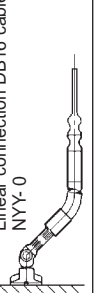

The solid deep-drawn copper earthing point is opened by boring. This makes a compressed joint possible according to DIN VDE 0220 part 2 in the factory. The coppered steel welding tongue is compressed onto the copper cable. This variation is only possible with straight designs.



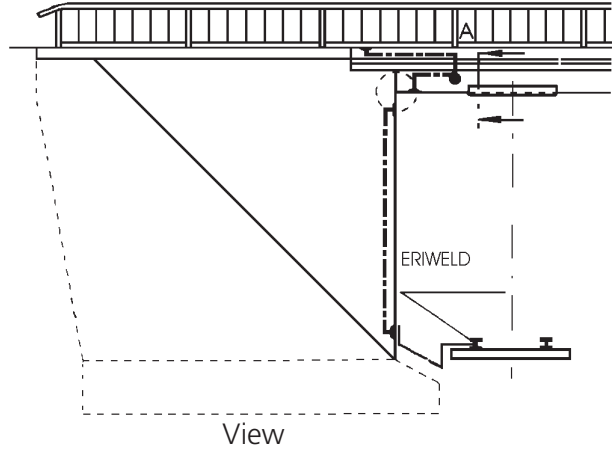
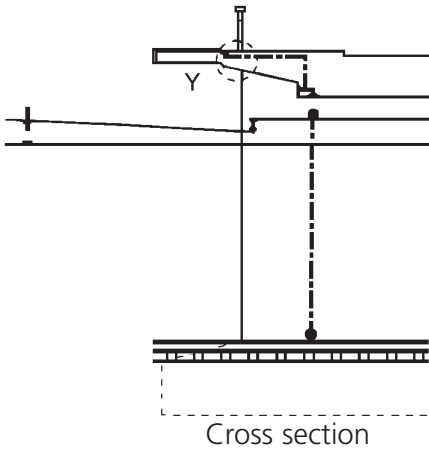
FDBS

The FDBS is a combination of the well-established CADWELD welding joint and the newly introduced compression technique. The solid deep-drawn copper earthing point is welded to the copper cable in the factory by means of a CADWELD welded electrical connection. The coppered steel welding tongue is compressed onto the copper cable.



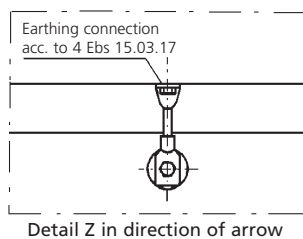
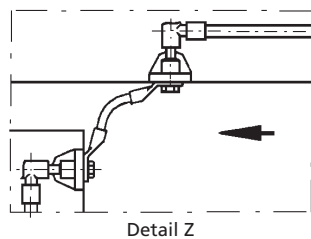
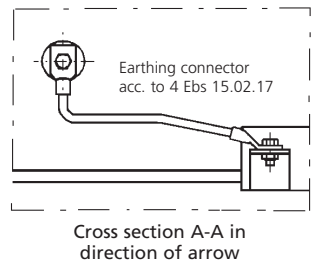
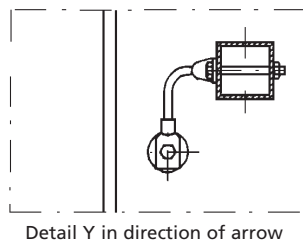
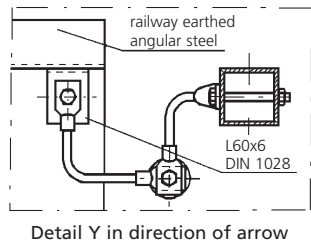
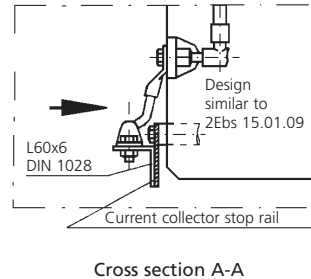
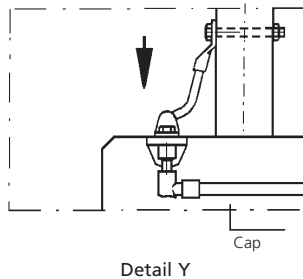
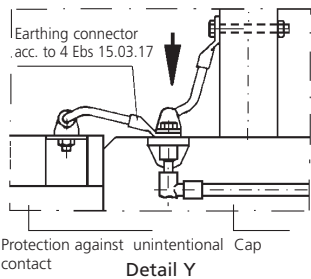
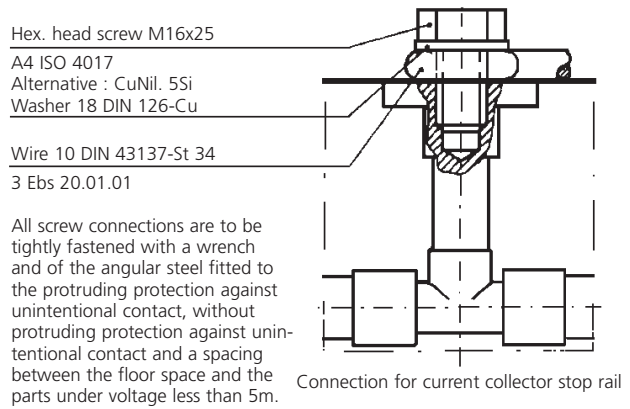
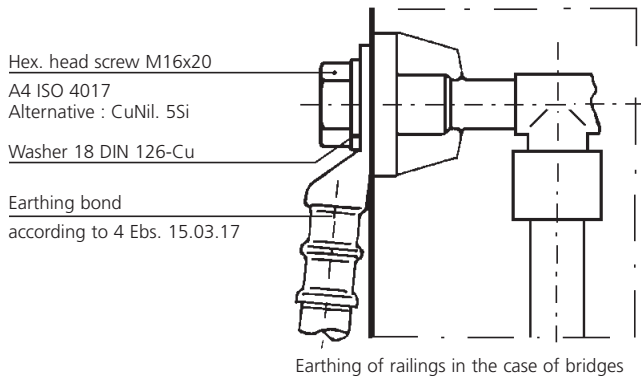
<p>FDB-16</p> 	<p>SDB-16</p> 	<p>WDB-16 Design 1</p> 	<p>Angular connection DB 16 with welding tongue</p>  <p>For construction 1 For construction 2</p> <p>Type KDB-16</p> <p>Angular connection DB 16 with cable NYY-0</p>  <p>Type WDB-16</p> <p>Connection DB16- cable NYY-0</p> 	<p>TDB-16</p> 	<p>EDB-16</p> 	<p>WDB-16 Design 2</p> 	<p>Linear connection DB 16 with cable NYY-0</p>  <p>Type FDB-16</p> <p>T-connection DB 16 with cable NYY-0</p>  <p>Type WDB-16 design</p> <p>Connection: cable NYY-0 70 cable NYY-0 95 8X31 steel Weld seam</p>  <p>Welding to steel reinforcement</p>  <p>Length L per side min. 45 mm</p>	<p>KDB-16</p> 	<p>KDB/FF-16</p> 	<p>WDB-16 Design 4</p> 	<p>Ordering example:</p> <p>... pieces TDB - 16 ... pieces SDB - 16 ... pieces FDBS - 16 ... pieces FDBSD - 16 ... Special designs only according to a sketch</p> <p>Construction 1 L = 2000 mm Construction 2 L = 500 mm</p> <p>A = 1000 mm B = 300 mm</p> <p>Usable for:</p> <p>Overhead line regulations of the DB</p>	<p>KDB-16</p> 	<p>Special Design</p> 	<p>WDB-16 Design 7</p> 	<p>Connection DB16- cable NYY-0</p> 	<p>FDBC-16</p> 	<p>FDBS-16</p> 	<p>Linear connection DB16 cable NYY-0</p>  <p>Angular connection DB16 cable NYY-0</p> 	<p>3 Ebs. 15.03.19 BL. 1</p> <p>Issue _____</p> <p>Date _____</p> <p>Scale _____</p> <p>Dimensions without reference to tolerance</p> <p>Summary of types of CADWELD Earthing Bonds</p>	<p>Symbol</p> <p>Designation</p> <p>Application</p> <p>Const. 1 (< 25 kA) Constr. 2 (> 25 kA)</p> <p>Earth bond construction 1 (l > 25kA) consisting of a cable NYY-0 1x70 mm</p> <p>Earth bond construction 2 (l < 25kA) with welded-on earthing plate DB 16 and or welding tongue</p> <p>With earthing links of construction 1 and 2 all earthing plate connections (welded on or pressed) and the compressed welding tongues are sheathed with heat-shrink sleeving</p>	<p>Seen Frankfurt/Main TZF 73 on</p> <p>Reviser _____</p> <p>Checked _____</p> <p>Standard _____</p> <p>Plan chk. _____</p> <p>Date 08-03-200</p> <p>Name Dingemans</p> <p>Revised 08-03-200 F. from Erip</p>	<p>1 Sheet</p> <p>Rep. for 3Ebs. 15.0319 / 07-99</p> <p>Repl. by B</p>
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Application Examples

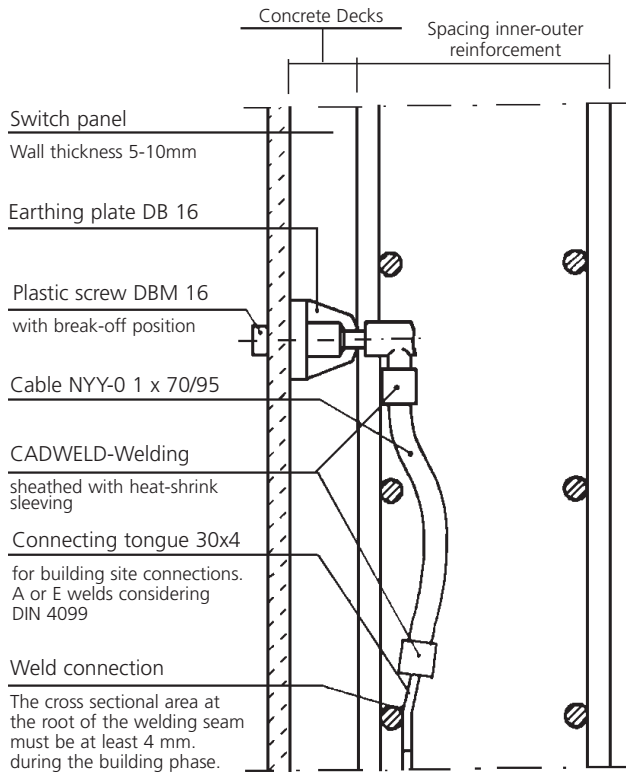


Example of a connection with an earthing connector

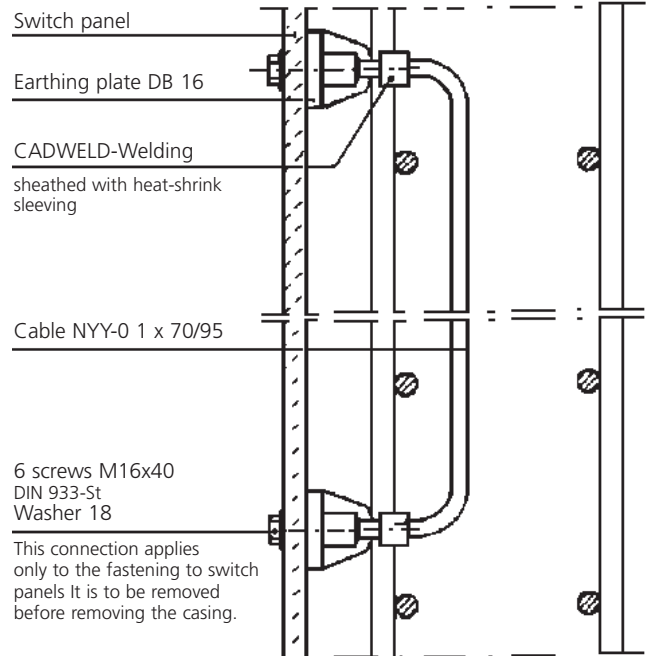
Example of a connection with wire 10 DIN 43 137-St34



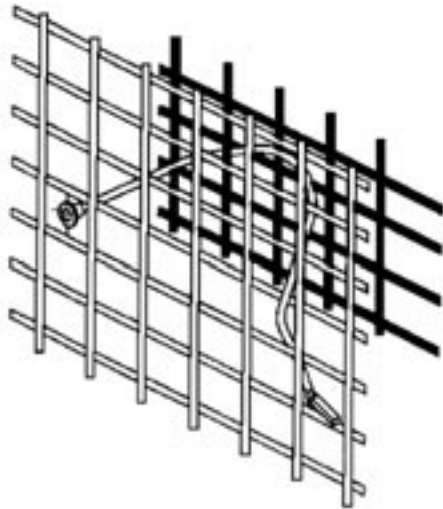
Measures to be taken for earthing when including slack reinforcement



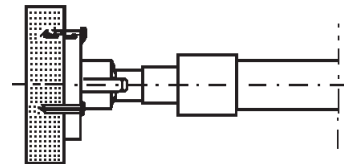
Measures to be taken for earthing without including slack reinforcement



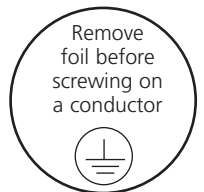
Assembly information



The fastening of the earthing plates to the switch panels can also be made with nails in the nail inserts. After removal of the casing the nail spikes that stick out are to be removed.



The protection foil stuck on the front side of the earthing plates serves as a protection to threads during the building phase. It is to be removed before screwing in a conductor.



Accompanying drawings:

- 2 Ebs 02.05.19 3 Ebs 02.05.34
- 2 Ebs 15.01.09 4 Ebs 15.03.17
- 3 Ebs 20.01.01

Source of supply for earthing bonds:
ERICO GmbH, 66851 Schwandenmühle

This connection applies to rods with a minimum diameter of 10 mm. For smaller diameters a longer terminal lug is to be selected which is to be welded on more often, as is appropriate.

By the use of a casing carriage the seating of the earthing plates is determined accurately by borings. This seating may not be obstructed by reinforcement rods. When pressing on the reinforcement, sufficient room must remain for the earthing bonds.

The earthing plate is to be fastened firmly to the casing carriage with the plastic screw DSM16. This screw is not to be removed before removing the casing. The head is to be knocked off with a hammer, the remaining part protects the threaded hole from of the subsequent damage and can be removed with a hexagonal socket key.

When fitting earthing bonds it has to be ensured through the use of spacers or transposition of conductors that the bonds do not contact the casing skin. Only an adequate concrete decking protects against consequential damage due to corrosion.

The vibrators are to be handled carefully during compacting of the concrete near the earthing plates. If struck directly there is a danger of breaking the plastic screw.

Usable for:		DB BZA Munich Jan. 1992		2 Ebs 15.01.20	
Overhead line regulations		Dimensions without reference to tolerance DIN		Issue	
				Date	
Drawing revised		1.93	1991	Date	Name
			Reviser	21.11.	Stein
			Checked	01.92	
			Standard		
			CD 101.179e		Information about the arrangement of railway earthing on buildings with CADWELD type earthing bonds
Changes		Date	Name	Orig. ERICO CD 101.143	Repl. for 2Ebs.15.01.20/05.85
					Repl. by
					Sheet 1
					1 Sheet

TEL Frankfurt/Main
TEL 2 Munich
TZF 73 Frankfurt/Main
ERICO GmbH

Technical Release

1. The present technical release applies to the company

ERICO GmbH
66851 Schwanemühle

2. The technical release applies to the supply of the following equipment to the DB AG:

FDBC-16 earthing bonds
FDBS-16 earthing bonds

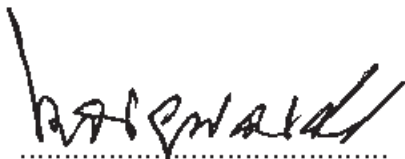
3. The following documentation, test certificates and other details were checked, and form the basis of the technical release:

- EBA authorization for electronic systems no.: 201090/8
- Investigation of the short circuit behavior, Report no.: 98471638.000-HVL 99-1322, of the KEMA Netherlands B.V.
- Separation testing by the company ERICO, Test report no.: PN0023T1
- Drawing 3 Ebs 15.03.19 Sht. 1

4. Additional condition:

5. The technical release presented is valid until revoked.

Frankfurt/Main, 05.09.2001


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(Dipl.-Ing. Borgwardt)



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