

## DEHN railway earthing

Expert solutions





## Contents



### **Railway earthing**

page 3

Basic knowledge



### **Notes**

page 4

Materials and cross-sections



### **DEHN railway earthing portfolio**

page 5

Earthing bridges / earthing connectors / accessories



### **Approvals**

page 13

from DB Netz AG<sup>1)</sup> by  
Ebs approval drawings



### **Selection matrix**

page 14

Dimensioning / design

<sup>1)</sup>DB Netz AG: rail infrastructure company of German railway

# Railway earthing - Protect people, ensure reliable rail traffic

Railway earthing protects people and equipment in the railway environment. It is necessary to prevent danger to people on the platform or damage to equipment in the event of an incident, e.g. if a contact wire of the catenary system breaks.

Railway earthing means a current-proof connection between all conductive components, the return circuit and the overall earth-termination system at the substation. This connection must be short-circuit-current-proof since operating currents and, in the event of a fault, also short-circuit currents flow through it.

In case of a short-circuit, the overhead contact line must be disconnected quickly. Railway earthing establishes a permanent connection with the return circuit (running rail or return wire) and also reduces the rail potential.

Railway earthing is therefore a fundamental requirement in the overhead contact line zone and current collector zone of tracks (break area).

EN 50122-1 is an important standard for railway earthing concepts. Requirements from this European standard can be found in the regulation "Bahn-Richtlinie RIL 997, Untergruppe 02" (RIL 997 guideline by German Railways, subgroup 02) entitled "Rückstromführung, Bahnerdung und Potentialausgleich" (return circuit, railway earthing and equipotential bonding).

## What must be earthed?

Primarily,

- catenary masts
- tracks
- steel and reinforced concrete bridges above tracks
- tunnels
- conductive components on and above platforms
- noise protection walls
- conductive fences (e.g. wire mesh)
- earth-termination systems for power supply, signalling and control and telecommunication systems

must be earthed.

The importance of railway earthing becomes clear if a contact wire breaks, putting lives at risk and having a negative effect on economic efficiency. Line closures, delays, loss of image – all of these should be avoided wherever possible.

Railway earthing reduces touch voltages, e.g. on railings, masts or ticket machines, thus ensuring uninterrupted railway traffic and protecting human life.

## Causes of a contact wire break:

- Fallen trees
- Construction site vehicles
- Material fatigue of overhead contact line components
- Faulty current collectors
- Individual vehicles, e.g. trucks with too high superstructures

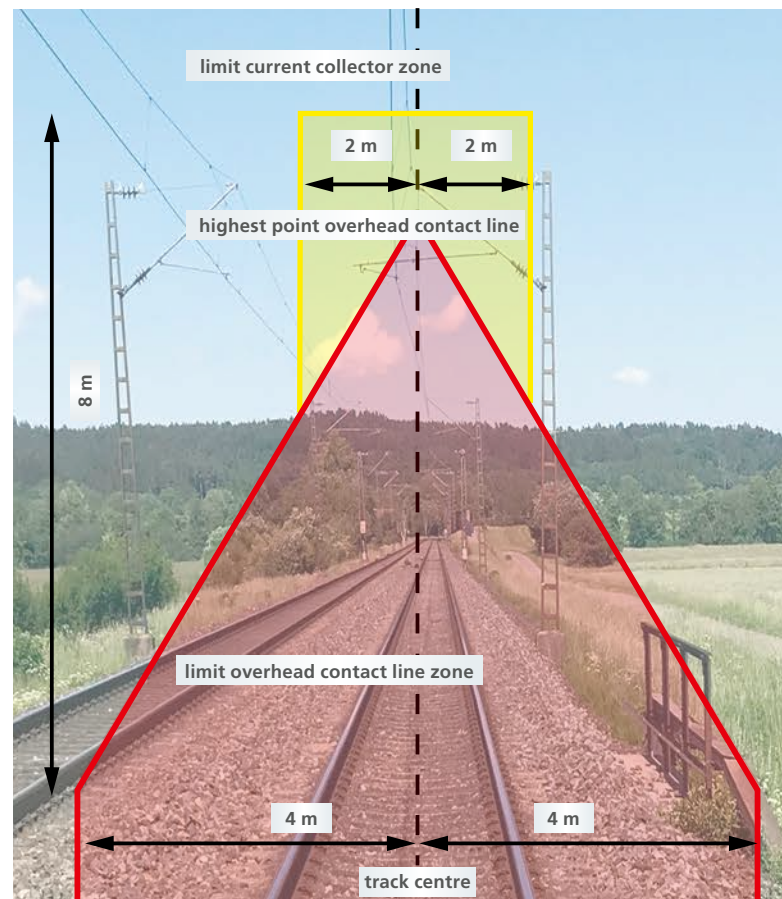


Fig. 1: Break area in the overhead contact line zone in Germany

Figure 1 shows the break area.

In the overhead contact line zone (red), the zones whose limits are in general not exceeded by a broken overhead contact line is marked as a triangle. The rectangle shows the current collector zone (yellow). This is the area not normally exceeded by a live current collector in case of a break or derailment.

# Which materials and cross-sections are sufficient?

To obtain approval from DB Netz AG, it must be proven that all railway earthing components are short-circuit-current-proof. This is specified in the RIL 997.0205A01 guideline „Elektrotechnische Anforderungen und Prüfbedingungen von Verbindungen“ (electrical requirements and test conditions for connections).

The following parameters are used:

$I_{k''} \leq 25 \text{ kA}$ : test current of 25 kA, duration of 100 ms  
 $I_{k''} > 25 \text{ kA}$ : test current of 40 kA, duration of 100 ms

| Short-circuit current                  | $\leq 25 \text{ kA}$                          |  | $> 25 \text{ kA}$                             |  |
|--|---|--|---|--|
| Earthing conductors laid in open space | Cu, 50 mm <sup>2</sup> <sup>1)</sup><br>NYY-O | Fe, 95 mm <sup>2</sup><br>Steel cable                        | Cu, 70 mm <sup>2</sup> <sup>1)</sup><br>NYY-O | Fe, 120 mm <sup>2</sup><br>Steel cable                       |
| Earthing conductors laid in concrete   | Cu, 70 mm <sup>2</sup><br>NYY-O or H07V-K     | Fe, 120 mm <sup>2</sup><br>No structural reinforcement steel | Cu, 95 mm <sup>2</sup><br>NYY-O or H07V-K     | Fe, 200 mm <sup>2</sup><br>No structural reinforcement steel |

<sup>1)</sup> To prevent theft, the use of copper cables in outdoor areas is generally not permitted at DB AG, therefore Fe versions, Al versions or mixed forms such as CuStAl are offered.

These points must be observed:

## Bare steel conductors, embedded in concrete

Structural reinforcement steels and statically required components must not be used as earthing conductors. Welding earthing parts to the structural reinforcement is not permitted.

## When laid in concrete

Parts of the earth-termination system must be checked before concreting. This is done by an approved inspector or qualified electrician. This partial acceptance must be documented.

For series-produced precast concrete parts, the check is carried out during technical acceptance.

In case of individual concrete production, the check is carried out directly at the manufacturer's premises before concreting.

## Concrete-embedded joints

Concrete-embedded joints must generally be welded to be short-circuit-current-proof. The defined welding seam lengths and thicknesses must be observed:

### Welding seam length

Defined weld seam lengths are required for welded joints.

In case of short-circuit currents  $\leq 25 \text{ kA}$  at the installation point, a length of at least  $2 \times 30 \text{ mm}$  is required - in case of short-circuit currents  $> 25 \text{ kA}$ , a length of at least  $2 \times 45 \text{ mm}$  is required.

### Welding seam thickness

To avoid a reduction in cross-section, an effective welding seam thickness of 4 mm is required.

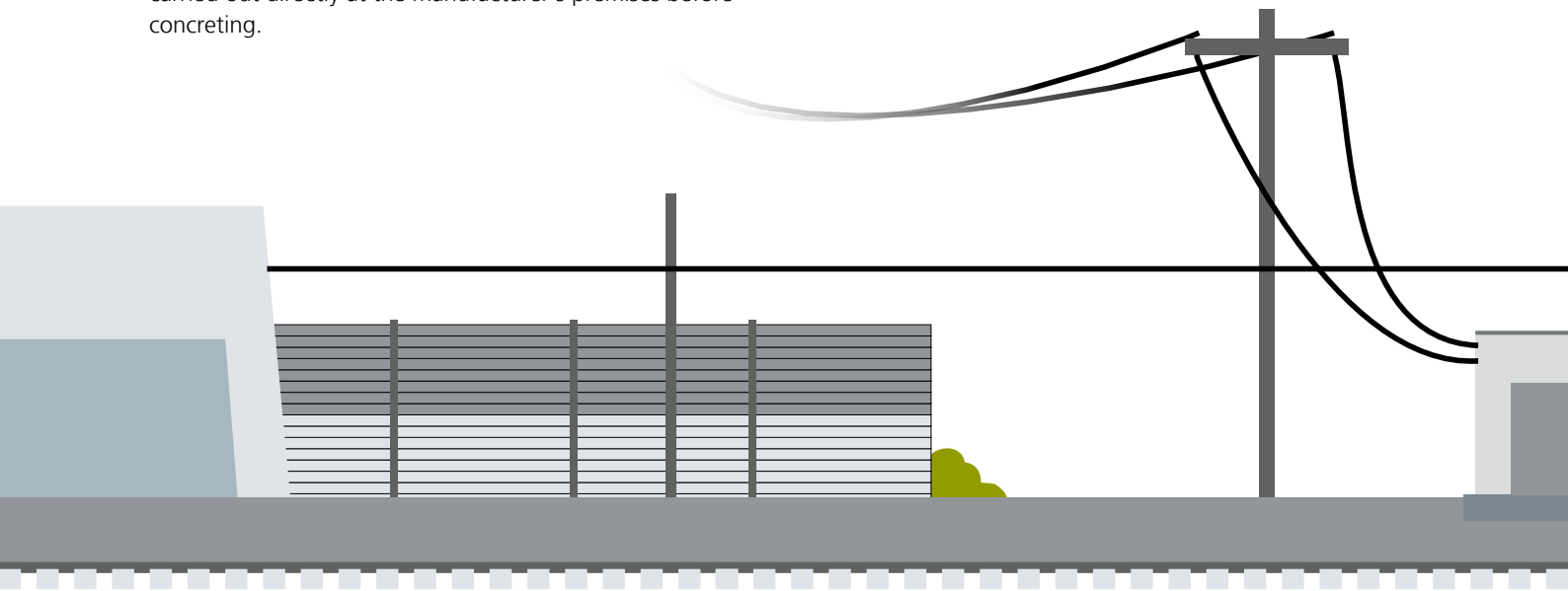


Fig. 2: 16.7 Hz traction power supply

# Earthing bridges and earthing connectors

The DEHN railway earthing portfolio is designed for use in railway transportation systems. It is used to connect electrically conductive metal parts such as noise protection walls, metal structures of tunnels or supporting walls and other structures in the vicinity of the railway line. The aim is to ensure personal and equipment protection in the overhead contact line and current collector zone, e.g. in the event of a contact wire break and to avoid impermissibly high rail potentials.

DEHN offers the user a range of earthing bridges and earthing connectors which, due to variable end caps and connection elements, make up a comprehensive modular system with various possible combinations.

Our DEHN railway earthing systems are approved by DB Netz AG.

## DEHN earthing bridges Internal, invisible connection

The concrete-embedded earthing bridges are designed for earthing, current return circuits and equipotential bonding. They are used to connect the internal and external earthing.

A connection plate serves as the intersection between the internal and external earthing and ensures ideal contact with the earthing connectors.

Connection to the internal, later no longer visible, railway earthing is ensured by a defined welded joint

## DEHN earthing connectors External, visible earthing

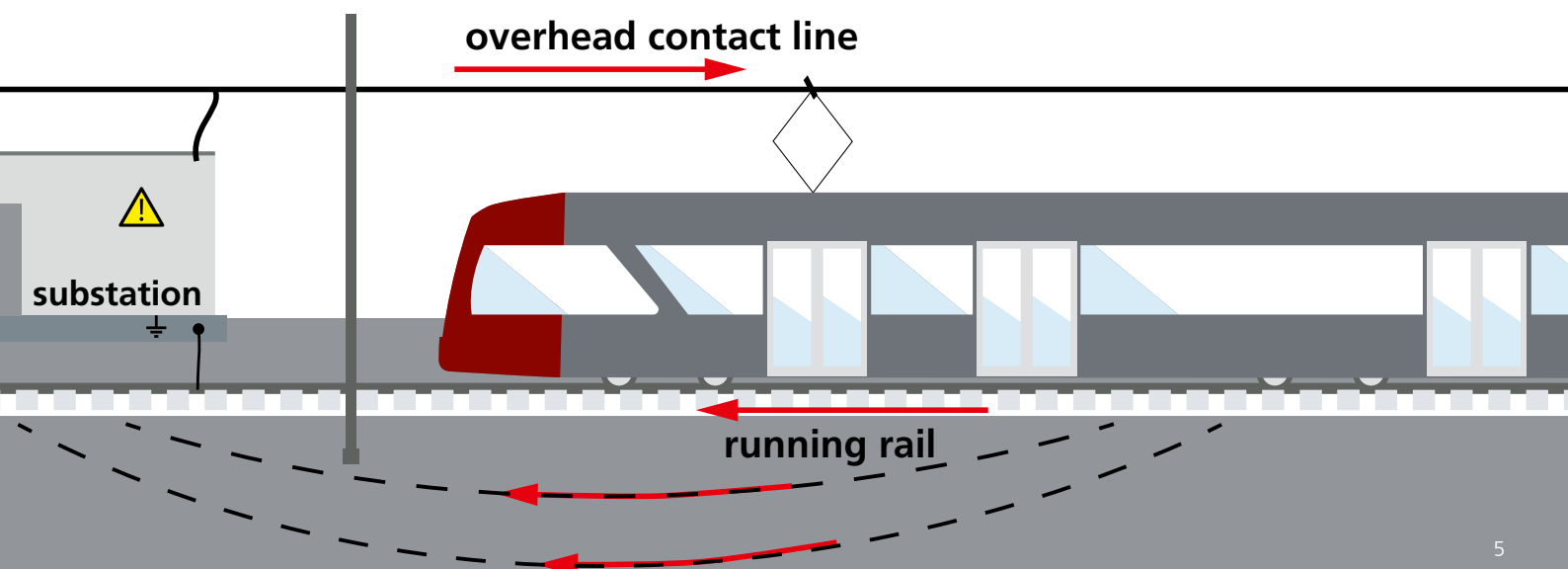
Earthing connectors are screwed to concrete-embedded earthing bridges. They continue the invisible, internal railway earthing. For inspection purposes, the screw connection must be accessible from the outside at all times. Steel or also CuStAl is particularly suitable for this purpose. Not least to prevent damage caused by theft, which unfortunately is quite common with copper components.



Fig. 3: Earthing connectors

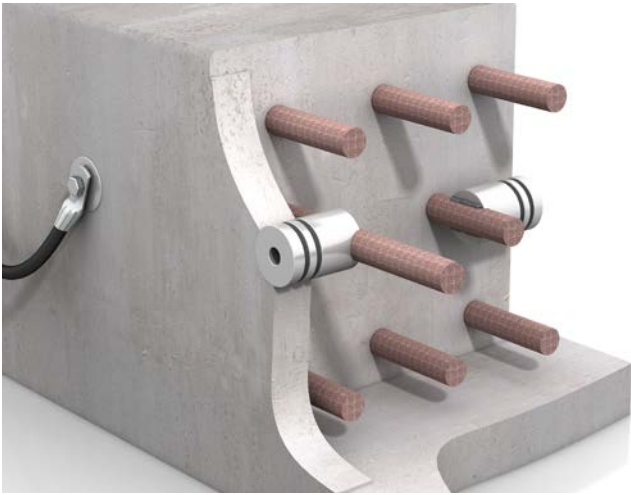
### Good to know:

The DEHN railway earthing portfolio also includes products for earthing large pipes - i.e. for partly visible and partly invisible connections.





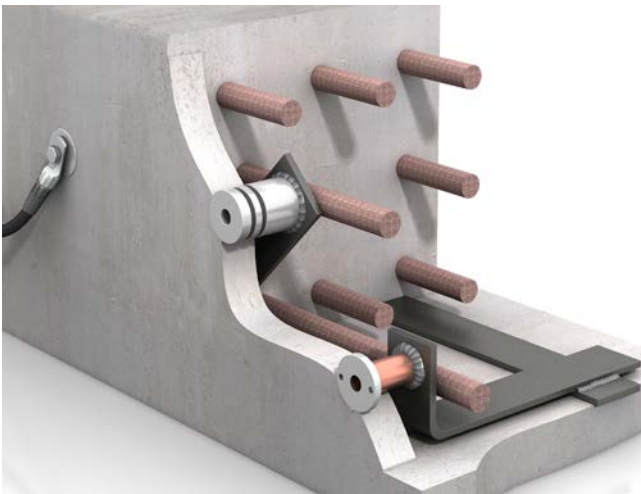
Railway earthing system



**Stainless steel earthing bridges**

The earthing bridges are designed for earthing, current return circuits and equipotential bonding in railway applications. The stainless steel earthing bridge ensures this via a defined welding seam to the earthing conductor. This earthing bridge also has a technical approval from DB Netz AG and can be reliably used in planning.

| Type                           | D BEB 0 - 63        | D BEB 0 - 70        | D BEB 0 - 77        |
|--------------------------------|---------------------|---------------------|---------------------|
| Part No.                       | 419 000             | 419 001             | 419 002             |
| Material of connection element | StSt                | StSt                | StSt                |
| Material No.                   | 1.4301              | 1.4301              | 1.4301              |
| Short-circuit current          | > 25 kA             | > 25 kA             | > 25 kA             |
| Test current                   | 40 kA / 100 ms      | 40 kA / 100 ms      | 40 kA / 100 ms      |
| Standard                       | Ril 997.0205A01     | Ril 997.0205A01     | Ril 997.0205A01     |
| Thread                         | M16                 | M16                 | M16                 |
| Diameter of connection plate   | 50 mm               | 50 mm               | 50 mm               |
| Total height                   | 63 mm               | 70 mm               | 77 mm               |
| Installation height            | 55 mm               | 62 mm               | 69 mm               |
| DB drawing No.                 | 3 Ebs 15.03.19 - 37 | 3 Ebs 15.03.19 - 37 | 3 Ebs 15.03.19 - 37 |
| PU                             | 1 pc(s)             | 1 pc(s)             | 1 pc(s)             |

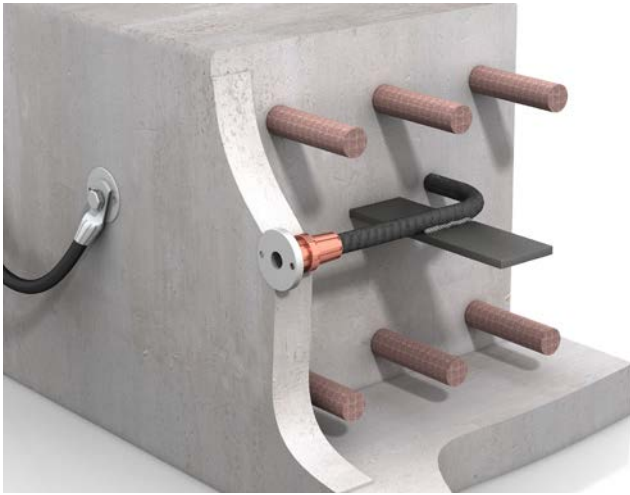


**Flat steel earthing bridges**

The earthing bridges are designed for earthing, current return circuits and equipotential bonding in railway applications. This version is installed flush with the surface and the flat steel is welded to the earthing reinforcement via a defined welding seam. This earthing bridge also has a technical approval from DB Netz AG and can therefore be reliably used in planning.

| Type                         | D BEB 1             | D BEB 1 - L100             | D BEB 1-L           | D BEB 1-NR          |
|------------------------------|---------------------|----------------------------|---------------------|---------------------|
| Part No.                     | 419 010             | 419 500 <small>NEW</small> | 419 011             | 419 012             |
| Material of plate            | StSt                | StSt                       | StSt                | StSt                |
| Material No.                 | 1.4301              | 1.4301                     | 1.4301              | 1.4301              |
| Material of socket           | St / Cu             | St / Cu                    | St / Cu             | –                   |
| Material of flat steel       | S235                | S235                       | S235                | S235                |
| Short-circuit current        | > 25 kA             | > 25 kA                    | > 25 kA             | > 25 kA             |
| Test current                 | 40 kA / 100 ms      | 40 kA / 100 ms             | 40 kA / 100 ms      | 40 kA / 100 ms      |
| Standard                     | Ril 997.0205A01     | Ril 997.0205A01            | Ril 997.0205A01     | Ril 997.0205A01     |
| Thread                       | M16                 | M16                        | M16                 | M16                 |
| Diameter of connection plate | 50 mm               | 50 mm                      | 50 mm               | 50 mm               |
| Dimensions of flat steel     | 400 x 40 x 5 mm     | 100 x 40 x 5 mm            | 402 x 40 x 5 mm     | 400 x 50 x 5 mm     |
| Total height                 | 58 mm               | 58 mm                      | 58 mm               | 63 mm               |
| Installation height          | –                   | –                          | 410 mm              | –                   |
| DB drawing No.               | 3 Ebs 15.03.19 - 30 | 3 Ebs 15.03.19 - 30        | 3 Ebs 15.03.19 - 30 | 3 Ebs 15.03.19 - 30 |
| PU                           | 1 pc(s)             | 1 pc(s)                    | 1 pc(s)             | 1 pc(s)             |





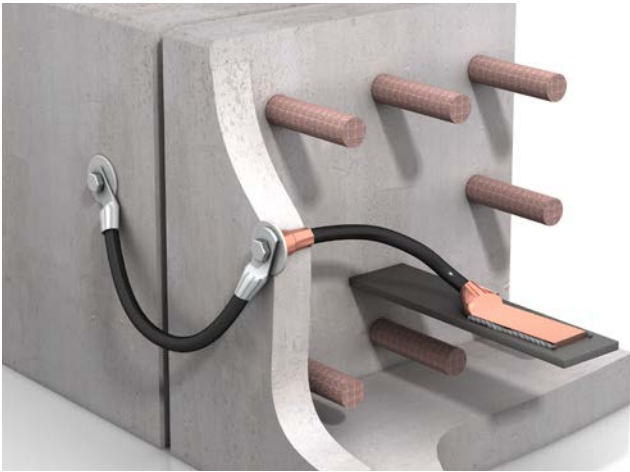
**Reinforcing steel earthing bridges**

The earthing bridges are designed for earthing, current return circuits and equipotential bonding in railway applications. This version is installed flush with the surface and welded to the earthing reinforcement with the angled reinforcing steel, particularly in installation situations where space is critical. This earthing bridge also has a technical approval from DB Netz AG and can therefore be reliably used in planning.



| Type                          | D BEB 2                 | D BEB 3                 | D BEB 8                 |
|-------------------------------|-------------------------|-------------------------|-------------------------|
| Part No.                      | 419 020                 | 419 030                 | 419 080                 |
| Material of plate             | StSt                    | StSt                    | StSt                    |
| Material No.                  | 1.4301                  | 1.4301                  | 1.4301                  |
| Material of socket            | St / Cu                 | St / Cu                 | St / Cu                 |
| Material of shaft             | reinforcing steel B500B | reinforcing steel B500B | reinforcing steel B500B |
| Short-circuit current         | > 25 kA                 | > 25 kA                 | > 25 kA                 |
| Test current                  | 40 kA / 100 ms          | 40 kA / 100 ms          | 40 kA / 100 ms          |
| Standard                      | Ril 997.0205A01         | Ril 997.0205A01         | Ril 997.0205A01         |
| Thread                        | M16                     | M16                     | M16                     |
| Diameter of connection plate  | 50 mm                   | 50 mm                   | 50 mm                   |
| Diameter of reinforcing steel | 16 mm                   | 16 mm                   | 16 mm                   |
| Installation height           | 160 mm                  | –                       | –                       |
| Length                        | 400 mm                  | 400 mm                  | 500 mm                  |
| DB drawing No.                | 3 Ebs 15.03.19 - 31     | 3 Ebs 15.03.19 - 31     | 3 Ebs 15.03.19 - 33     |
| PU                            | 1 pc(s)                 | 1 pc(s)                 | 1 pc(s)                 |

Railway earthing system



**Copper cable earthing bridges**

The earthing bridges are designed for earthing, current return circuits and equipotential bonding in railway applications. This version is installed flush with the surface. The copper-plated steel lug pressed onto the copper cable is welded to the earthing reinforcement. The flexibility of the cable makes installation in the reinforcement easier for the user. The special FLEX versions are particularly suited for installation situations where space is critical since extra-flexible, finely stranded copper cables are used. The earthing bridges also have technical approval from DB Netz AG and can be reliably used in planning.

| Type                         | D BEB 4             | D BEB 4-FLEX        | D BEB 5             | D BEB 5-FLEX        |
|------------------------------|---------------------|---------------------|---------------------|---------------------|
| Part No.                     | 419 040             | 419 041             | 419 050             | 419 051             |
| Material of plate            | StSt                | StSt                | StSt                | StSt                |
| Material No.                 | 1.4301              | 1.4301              | 1.4301              | 1.4301              |
| Material of socket           | St / Cu             | St / Cu             | St / Cu             | St / Cu             |
| Material of lug              | St / Cu             | St / Cu             | St / Cu             | St / Cu             |
| Material of cable            | Cu                  | Cu                  | Cu                  | Cu                  |
| Short-circuit current        | ≤ 25 kA             | ≤ 25 kA             | > 25 kA             | > 25 kA             |
| Test current                 | 25 kA / 100 ms      | 25 kA / 100 ms      | 40 kA / 100 ms      | 40 kA / 100 ms      |
| Standard                     | Ril 997.0205A01     | Ril 997.0205A01     | Ril 997.0205A01     | Ril 997.0205A01     |
| Thread                       | M16                 | M16                 | M16                 | M16                 |
| Diameter of connection plate | 50 mm               | 50 mm               | 50 mm               | 50 mm               |
| Cable                        | NYO                 | H07V-K              | NYO                 | H07V-K              |
| Cable cross-section          | 70 mm <sup>2</sup>  | 70 mm <sup>2</sup>  | 95 mm <sup>2</sup>  | 95 mm <sup>2</sup>  |
| Cable diameter               | 17 mm               | 17 mm               | 19 mm               | 19 mm               |
| Dimensions of lug            | 80 x 30 mm          | 80 x 30 mm          | 80 x 30 mm          | 80 x 30 mm          |
| Length                       | 500 mm              | 500 mm              | 500 mm              | 500 mm              |
| DB drawing No.               | 3 Ebs 15.03.19 - 32 | 3 Ebs 15.03.19 - 32 | 3 Ebs 15.03.19 - 32 | 3 Ebs 15.03.19 - 32 |
| PU                           | 1 pc(s)             | 1 pc(s)             | 1 pc(s)             | 1 pc(s)             |

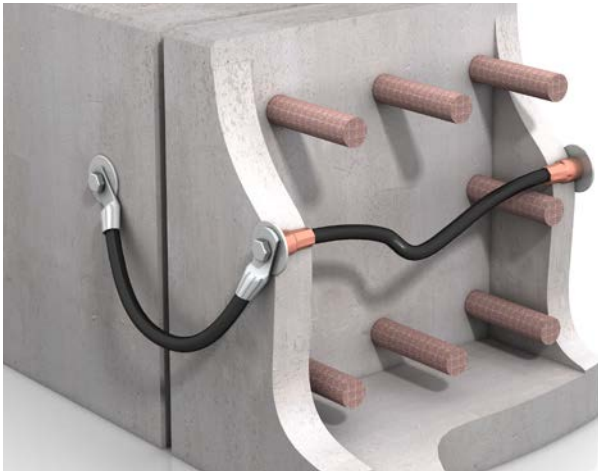


| Type                         | D BEB 5 - L700         | D BEB 5 - L1000        | D BEB 5 - L1500        | D BEB 5 - L2000        |
|------------------------------|------------------------|------------------------|------------------------|------------------------|
| Part No.                     | 419 501 <sup>NEW</sup> | 419 502 <sup>NEW</sup> | 419 503 <sup>NEW</sup> | 419 504 <sup>NEW</sup> |
| Material of plate            | StSt                   | StSt                   | StSt                   | StSt                   |
| Material No.                 | 1.4301                 | 1.4301                 | 1.4301                 | 1.4301                 |
| Material of socket           | St / Cu                | St / Cu                | St / Cu                | St / Cu                |
| Material of lug              | St / Cu                | St / Cu                | St / Cu                | St / Cu                |
| Material of cable            | Cu                     | Cu                     | Cu                     | Cu                     |
| Short-circuit current        | > 25 kA                | > 25 kA                | > 25 kA                | > 25 kA                |
| Test current                 | 40 kA / 100 ms         | 40 kA / 100 ms         | 40 kA / 100 ms         | 40 kA / 100 ms         |
| Standard                     | Ril 997.0205A01        | Ril 997.0205A01        | Ril 997.0205A01        | Ril 997.0205A01        |
| Thread                       | M16                    | M16                    | M16                    | M16                    |
| Diameter of connection plate | 50 mm                  | 50 mm                  | 50 mm                  | 50 mm                  |
| Cable                        | NYO                    | NYO                    | NYO                    | NYO                    |
| Cable cross-section          | 95 mm <sup>2</sup>     | 95 mm <sup>2</sup>     | 95 mm <sup>2</sup>     | 95 mm <sup>2</sup>     |
| Cable diameter               | 19 mm                  | 19 mm                  | 19 mm                  | 19 mm                  |
| Dimensions of lug            | 80 x 30 mm             | 80 x 30 mm             | 80 x 30 mm             | 80 x 30 mm             |
| Length                       | 700 mm                 | 1000 mm                | 1500 mm                | 2000 mm                |
| DB drawing No.               | 3 Ebs 15.03.19 - 32    | 3 Ebs 15.03.19 - 32    | 3 Ebs 15.03.19 - 32    | 3 Ebs 15.03.19 - 32    |
| PU                           | 1 pc(s)                | 1 pc(s)                | 1 pc(s)                | 1 pc(s)                |





Railway earthing system



**Copper cable earthing bridges**

The earthing bridges are designed for earthing, current return circuits and equipotential bonding in railway applications. This version is installed flush with the surface on both sides and allows the earthing to pass through structural elements. The flexibility of the cable makes installation in the reinforcement easier for the user. The special FLEX versions are particularly suited for installations where space is critical - extra-flexible, finely stranded copper cables are used here. The earthing bridges also have technical approval from DB Netz AG and can be reliably used in planning.

| Type                         | D BEB 6             | D BEB 6-FLEX        | D BEB 7             | D BEB 7-FLEX        |
|------------------------------|---------------------|---------------------|---------------------|---------------------|
| Part No.                     | 419 060             | 419 061             | 419 070             | 419 071             |
| Material of plate            | StSt                | StSt                | StSt                | StSt                |
| Material No.                 | 1.4301              | 1.4301              | 1.4301              | 1.4301              |
| Material of socket           | St / Cu             | St / Cu             | St / Cu             | St / Cu             |
| Material of cable            | Cu                  | Cu                  | Cu                  | Cu                  |
| Short-circuit current        | ≤ 25 kA             | ≤ 25 kA             | > 25 kA             | > 25 kA             |
| Test current                 | 25 kA / 100 ms      | 25 kA / 100 ms      | 40 kA / 100 ms      | 40 kA / 100 ms      |
| Standard                     | Ril 997.0205A01     | Ril 997.0205A01     | Ril 997.0205A01     | Ril 997.0205A01     |
| Thread                       | M16                 | M16                 | M16                 | M16                 |
| Diameter of connection plate | 50 mm               | 50 mm               | 50 mm               | 50 mm               |
| Cable                        | NYY-O               | H07V-K              | NYY-O               | H07V-K              |
| Cable cross-section          | 70 mm <sup>2</sup>  | 70 mm <sup>2</sup>  | 95 mm <sup>2</sup>  | 95 mm <sup>2</sup>  |
| Cable diameter               | 17 mm               | 17 mm               | 19 mm               | 19 mm               |
| Length                       | 500 mm              | 500 mm              | 500 mm              | 500 mm              |
| DB drawing No.               | 3 Ebs 15.03.19 - 33 | 3 Ebs 15.03.19 - 33 | 3 Ebs 15.03.19 - 33 | 3 Ebs 15.03.19 - 33 |
| PU                           | 1 pc(s)             | 1 pc(s)             | 1 pc(s)             | 1 pc(s)             |



**Copper cable earthing bridges**

The earthing bridges are designed for earthing, current return circuits and equipotential bonding in railway applications. This version establishes a non-visible connection within the concrete by welding the copper-plated steel lugs pressed onto the copper cable to the earthing reinforcement. The flexibility of the cable makes installation in the reinforcement easier for the user. The special FLEX versions are particularly suited for space-critical installation situations since extra-flexible, finely stranded copper cables are used. The earthing bridges also have technical approval from DB Netz AG and can be reliably used in planning.

| Type                  | D BEB 9             | D BEB 9-FLEX        | D BEB 10            | D BEB 10 - L800        | D BEB 10-FLEX       |
|-----------------------|---------------------|---------------------|---------------------|------------------------|---------------------|
| Part No.              | 419 090             | 419 091             | 419 100             | 419 505 <sup>NEW</sup> | 419 101             |
| Material of lug       | St / Cu             | St / Cu             | St / Cu             | St / Cu                | St / Cu             |
| Material of cable     | Cu                  | Cu                  | Cu                  | Cu                     | Cu                  |
| Short-circuit current | ≤ 25 kA             | ≤ 25 kA             | > 25 kA             | > 25 kA                | > 25 kA             |
| Test current          | 25 kA / 100 ms      | 25 kA / 100 ms      | 40 kA / 100 ms      | 40 kA / 100 ms         | 40 kA / 100 ms      |
| Standard              | Ril 997.0205A01     | Ril 997.0205A01     | Ril 997.0205A01     | Ril 997.0205A01        | Ril 997.0205A01     |
| Cable                 | NYY-O               | H07V-K              | NYY-O               | NYY-O                  | H07V-K              |
| Cable cross-section   | 70 mm <sup>2</sup>  | 70 mm <sup>2</sup>  | 95 mm <sup>2</sup>  | 95 mm <sup>2</sup>     | 95 mm <sup>2</sup>  |
| Cable diameter        | 17 mm               | 17 mm               | 19 mm               | 19 mm                  | 19 mm               |
| Dimensions of lug     | 80 x 30 mm          | 80 x 30 mm          | 80 x 30 mm          | 80 x 30 mm             | 80 x 30 mm          |
| Length                | 500 mm              | 500 mm              | 500 mm              | 800 mm                 | 500 mm              |
| DB drawing No.        | 3 Ebs 15.03.19 - 33 | 3 Ebs 15.03.19 - 33 | 3 Ebs 15.03.19 - 33 | 3 Ebs 15.03.19 - 33    | 3 Ebs 15.03.19 - 33 |
| PU                    | 1 pc(s)             | 1 pc(s)             | 1 pc(s)             | 1 pc(s)                | 1 pc(s)             |



Railway earthing system



**Earthing connector for earthing large pipes**

The earthing connectors are designed for earthing, current return circuits and equipotential bonding in railway applications. The version for earthing large pipes is designed for use with pile and large pipe foundations. The product consists of a steel cable with a copper-plated steel lug at one end and a cable lug at the other end. A heat shrinkable sleeve at the welding lug end prevents the ingress of water into the steel cable. The steel cable is therefore an anti-theft measure. The earthing connectors also have technical approval from DB Netz AG and can be reliably used in planning.

|                       |                    |
|-----------------------|--------------------|
| Type                  | D BEB 40           |
| Part No.              | 419 400            |
| Material of lug       | St / Cu            |
| Material of cable lug | Cu/gal Sn          |
| Material of rope      | St                 |
| Short-circuit current | ≤ 25 kA            |
| Test current          | 25 kA / 100 ms     |
| Standard              | Ril 997.0205A01    |
| Rope cross-section    | 95 mm <sup>2</sup> |
| Cable diameter        | 17 mm              |
| Dimensions of lug     | 80 x 30 mm         |
| Borehole cable lug    | 17 mm              |
| Length                | 500 mm             |
| DB drawing No.        | 4 Ebs 15.03.25 - 4 |
| PU                    | 1 pc(s)            |



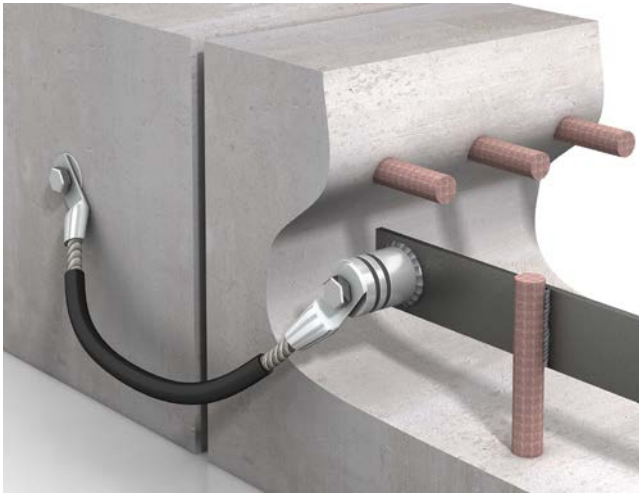
**Earthing bridge for earthing large pipes**

The earthing bridges are designed for earthing, current return circuits and equipotential bonding in railway applications. This version for earthing large pipes is designed for use with pile and large pipe foundations. The product consists of a copper cable with a pressed-on lug and a StSt connection plate with integrated boreholes for fixing to the formwork at one end and a cable lug at the other end. The cable lug is used to establish a short circuit current resistant connection to the pile or large pipe foundation. The flexibility of the cable makes installation in the reinforcement easier for the user. The earthing bridges also have technical approval from DB Netz AG and can be reliably used in planning.

| Type                         | D BEB 11           | D BEB 11 - L1000       |
|------------------------------|--------------------|------------------------|
| Part No.                     | 419 110            | 419 506 <sup>NEW</sup> |
| Material of plate            | StSt               | StSt                   |
| Material No.                 | 1.4301             | 1.4301                 |
| Material of socket           | St / Cu            | St / Cu                |
| Material of cable lug        | Cu/gal Sn          | Cu/gal Sn              |
| Material of cable            | Cu                 | Cu                     |
| Short-circuit current        | ≤ 25 kA            | ≤ 25 kA                |
| Test current                 | 25 kA / 100 ms     | 25 kA / 100 ms         |
| Standard                     | Ril 997.0205A01    | Ril 997.0205A01        |
| Thread                       | M16                | M16                    |
| Diameter of connection plate | 50 mm              | 50 mm                  |
| Cable                        | NYO                | NYO                    |
| Cable cross-section          | 70 mm <sup>2</sup> | 70 mm <sup>2</sup>     |
| Cable diameter               | 17 mm              | 17 mm                  |
| Borehole cable lug           | 13 mm              | 13 mm                  |
| Length                       | 500 mm             | 1000 mm                |
| DB drawing No.               | 4 Ebs 15.03.27 - 2 | 4 Ebs 15.03.27 - 2     |
| PU                           | 1 pc(s)            | 1 pc(s)                |



Railway earthing system



**Steel cable earthing connector**

The earthing connectors are designed for earthing, current return circuits and equipotential bonding in railway applications. The halogen-free (sheathed) version D BEB 26 – for external connection of earthing points or other parts to be earthed- consists of a steel cable as an earthing conductor and is thus a preventive anti-theft measure. The earthing connectors also have technical approval from DB Netz AG and can be reliably used in planning.

|                       |                      |
|-----------------------|----------------------|
| Type                  | D BEB 26             |
| Part No.              | 419 260              |
| Material of cable lug | Cu/gal Sn            |
| Material of rope      | St                   |
| Short-circuit current | ≤ 25 kA              |
| Test current          | 25 kA / 100 ms       |
| Standard              | Ril 997.0205A01      |
| Rope                  | 1-12-12 B 350 sZ PE  |
| Rope cross-section    | ≥ 95 mm <sup>2</sup> |
| Design                | halogen-free         |
| Cable diameter        | 17 mm                |
| Borehole cable lug    | 17 mm                |
| Length                | 500 mm               |
| DB drawing No.        | 3 Ebs 15.03.17 - 11  |
| PU                    | 1 pc(s)              |



**Copper-steel-aluminium cable earthing connector**

The earthing connectors are designed for earthing, current return circuits and equipotential bonding in railway applications. The halogen-free version D BEB 29 / the halogen-free and flame-retardant version D BEB 29-NF – for external connection of earthing points and other connection elements – is a cable lug version for M16 connections. This earthing connector consists of a copper, steel and aluminium cable and is thus a preventive anti-theft measure. The earthing connectors also have technical approval from DB Netz AG and can be reliably used in planning. The halogen-free and flame-retardant version can even be used in tunnels according to the EU regulation.

| Type                  | D BEB 29                   | D BEB 29 - L350            | D BEB 29 - L800            | D BEB 29-NF                      |
|-----------------------|----------------------------|----------------------------|----------------------------|----------------------------------|
| Part No.              | 419 290                    | 419 507 <sup>NEW</sup>     | 419 508 <sup>NEW</sup>     | 419 291                          |
| Material of cable lug | Cu/gal Sn                  | Cu/gal Sn                  | Cu/gal Sn                  | Cu/gal Sn                        |
| Material of cable     | CuStAl                     | CuStAl                     | CuStAl                     | CuStAl                           |
| Short-circuit current | > 25 kA                    | > 25 kA                    | > 25 kA                    | > 25 kA                          |
| Test current          | 40 kA / 100 ms             | 40 kA / 100 ms             | 40 kA / 100 ms             | 40 kA / 100 ms                   |
| Standard              | Ril 997.0205A01            | Ril 997.0205A01            | Ril 997.0205A01            | Ril 997.0205A01                  |
| Cable                 | (N)2X RF CuStAl            | (N)2X RF CuStAl            | (N)2X RF CuStAl            | B2ca RF CuStAl                   |
| Cable cross-section   | ≥ 70 mm <sup>2</sup>       | ≥ 70 mm <sup>2</sup>       | ≥ 70 mm <sup>2</sup>       | —                                |
| Rope cross-section    | —                          | —                          | —                          | ≥ 70 mm <sup>2</sup>             |
| Design                | halogen-free               | halogen-free               | halogen-free               | halogen-free and flame-retardant |
| Cable diameter        | 17 mm                      | 17 mm                      | 17 mm                      | 17 mm                            |
| Borehole cable lug    | 17 mm                      | 17 mm                      | 17 mm                      | 17 mm                            |
| Length                | 500 mm                     | 350 mm                     | 800 mm                     | 500 mm                           |
| DB drawing No.        | 4 Ebs 15.03.17 - 6 (Bayka) | 4 Ebs 15.03.17 - 6 (Bayka) | 4 Ebs 15.03.17 - 6 (Bayka) | 4 Ebs 15.03.17 - 6 (Bayka)       |
| PU                    | 1 pc(s)                    | 1 pc(s)                    | 1 pc(s)                    | 1 pc(s)                          |





**Railway earthing system**

**Adhesive pad**

The adhesive pad is used to fix railway earthing products to the formwork by means of an adhesive connection. The adhesive pad can be stuck to the StSt connection plate of D BEB 0 and is then connected to the formwork itself.

|          |               |
|----------|---------------|
| Type     | D KLP D50 BEB |
| Part No. | 419 900       |
| Diameter | 50 mm         |
| PU       | 1 pc(s)       |



**Earthing sticker**

The earthing sticker is a spare part for marking installed railway earthing products. It is simply stuck to the StSt connection plate. This kind of marking can be used for earthing bridges D BEB 1 to 8 as well as for the D BEB 11 version for earthing large pipes if the sticker applied in the factory has fallen off or is damaged.

|          |               |
|----------|---------------|
| Type     | D EAK D50 BEB |
| Part No. | 419 901       |
| Diameter | 50 mm         |
| PU       | 1 pc(s)       |



**Hexagon screw**

|          |                  |
|----------|------------------|
| Type     | D SKS M16X30 V4A |
| Part No. | 419 902          |
| Material | StSt A4-70       |
| Thread   | M16 x 30 mm      |
| PU       | 1 pc(s)          |



**Hexagon nut**

|          |               |
|----------|---------------|
| Type     | D SKM M16 V4A |
| Part No. | 419 903       |
| Material | StSt A4-70    |
| Thread   | M16           |
| PU       | 1 pc(s)       |



**Washer**

|                |               |
|----------------|---------------|
| Type           | D SCH A17 V4A |
| Part No.       | 419 904       |
| Material       | StSt A4-70    |
| Outer diameter | 30 mm         |
| Inner diameter | 17 mm         |
| PU             | 1 pc(s)       |



**Overview of Ebs regulations for earthing large pipes**

| Mast earthing at the large pipe for concrete masts and HE wide flange beams |                             |                         |
|---|-----------------------------|-------------------------|
| DEHN type   | Part No.                    | DB Ebs approval drawing |
| D BEB 40 / EBS 15-03-25 (welded)  | 419 400                     | 3 Ebs 15.01.50          |
| D BEB 26 / EBS 15-03-17 (screwed)   | 419 260                     | 3 Ebs 15.01.51          |
| D BEB 29 / EBS 15-03-17 (screwed)   | 419 290 / 419 507 / 419 508 | 3 Ebs 15.01.51          |

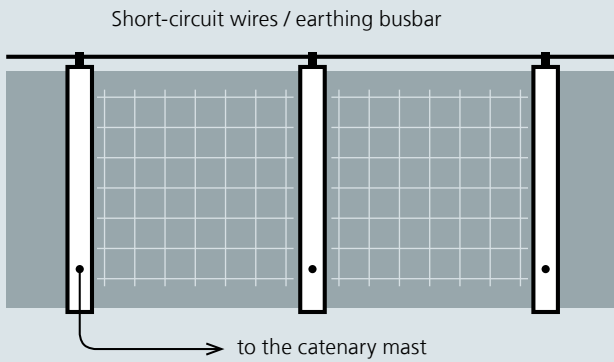
| Mast earthing at the pile and large pipe foundations for steel masts |   |                         |
|--|---|-------------------------|
| DEHN type  | Part No.  | DB Ebs approval drawing |
| D BEB 4 / EBS 15-03-19 (welded)                                      | 419 040   | 3 Ebs 15.01.55          |
| D BEB 4-FLEX / EBS 15-03-19 (welded)                                 | 419 041   | 3 Ebs 15.01.55          |
| D BEB 5 / EBS 15-03-19 (welded)                                      | 419 050 / 419 501 / 419 502 / 419 503 / 419 504 | 3 Ebs 15.01.55          |
| D BEB 5-FLEX / EBS 15-03-19 (welded)                                 | 419 051   | 3 Ebs 15.01.55          |
| D BEB 11 / EBS 15-03-27 (screwed)                                    | 419 110 / 419 506                               | 3 Ebs 15.01.56          |

# Approvals by DB Netz AG: Ebs approval drawings

All system components have been approved for use at Deutsche Bahn by Ebs drawings. The latest version of these drawings is available on the Internet at [www.dehn-international.com](http://www.dehn-international.com). The following table shows a list of approvals for the relevant products.

| Product with relevant Ebs approval drawing |          |                                  |
|--|----------|----------------------------------|
| DEHN type                                  | Part No. | DB Ebs approval drawing          |
| D BEB 0 - 63 / EBS 15-03-19                | 419 000  | 3 Ebs 15.03.19 - 37              |
| D BEB 0 - 70 / EBS 15-03-19                | 419 001  | 3 Ebs 15.03.19 - 37              |
| D BEB 0 - 77 / EBS 15-03-19                | 419 002  | 3 Ebs 15.03.19 - 37              |
| D BEB 1 / EBS 15-03-19                     | 419 010  | 3 Ebs 15.03.19 - 30              |
| D BEB 1 - L100 / EBS 15-03-1               | 419 500  | 3 Ebs 15.03.19 - 30              |
| D BEB 1-L / EBS 15-03-19                   | 419 011  | 3 Ebs 15.03.19 - 30              |
| D BEB 1 - NR / EBS 15-03-19                | 419 012  | 3 Ebs 15.03.19 - 36              |
| D BEB 2 / EBS 15-03-19                     | 419 020  | 3 Ebs 15.03.19 - 31              |
| D BEB 3 / EBS 15-03-19                     | 419 030  | 3 Ebs 15.03.19 - 31              |
| D BEB 4 / EBS 15-03-19                     | 419 040  | 3 Ebs 15.03.19 - 32              |
| D BEB 4-FLEX / EBS 15-03-19                | 419 041  | 3 Ebs 15.03.19 - 32              |
| D BEB 5 / EBS 15-03-19                     | 419 050  | 3 Ebs 15.03.19 - 32              |
| D BEB 5 - L700 / EBS 15-03-19              | 419 501  | 3 Ebs 15.03.19 - 32              |
| D BEB 5 - L1000 / EBS 15-03-19             | 419 502  | 3 Ebs 15.03.19 - 32              |
| D BEB 5 - L1500 / EBS 15-03-19             | 419 503  | 3 Ebs 15.03.19 - 32              |
| D BEB 5 - L2000 / EBS 15-03-19             | 419 504  | 3 Ebs 15.03.19 - 32              |
| D BEB 5-FLEX / EBS 15-03-19                | 419 051  | 3 Ebs 15.03.19 - 32              |
| D BEB 6 / EBS 15-03-19                     | 419 060  | 3 Ebs 15.03.19 - 33              |
| D BEB 6-FLEX / EBS 15-03-19                | 419 061  | 3 Ebs 15.03.19 - 33              |
| D BEB 7 / EBS 15-03-19                     | 419 070  | 3 Ebs 15.03.19 - 33              |
| D BEB 7-FLEX / EBS 15-03-19                | 419 071  | 3 Ebs 15.03.19 - 33              |
| D BEB 8 / EBS 15-03-19                     | 419 080  | 3 Ebs 15.03.19 - 33              |
| D BEB 9 / EBS 15-03-19                     | 419 090  | 3 Ebs 15.03.19 - 33              |
| D BEB 9-FLEX / EBS 15-03-19                | 419 091  | 3 Ebs 15.03.19 - 33              |
| D BEB 10 / EBS 15-03-19                    | 419 100  | 3 Ebs 15.03.19 - 33              |
| D BEB 10 - L800 / EBS 15-03-19             | 419 505  | 3 Ebs 15.03.19 - 33              |
| D BEB 10-FLEX / EBS 15-03-19               | 419 101  | 3 Ebs 15.03.19 - 33              |
| D BEB 11 / EBS 15-03-27                    | 419 110  | 4 Ebs 15.03.27 - 2               |
| D BEB 11 - L1000 / EBS 15-03-27            | 419 506  | 4 Ebs 15.03.27 - 2               |
| D BEB 26 / EBS 15-03-17                    | 419 260  | 3 Ebs 15.03.17 - 11              |
| D BEB 29 / EBS 15-03-17                    | 419 290  | Bayka drawing 4 Ebs 15.03.17 - 6 |
| D BEB 29 - L350 / EBS 15-03-17             | 419 507  | Bayka drawing 4 Ebs 15.03.17 - 6 |
| D BEB 29 - L800 / EBS 15-03-17             | 419 508  | Bayka drawing 4 Ebs 15.03.17 - 6 |
| D BEB 29-NF / EBS 15-03-17                 | 419 291  | Bayka drawing 4 Ebs 15.03.17 - 6 |
| D BEB 40 / EBS 15-03-25                    | 419 400  | 4 Ebs 15.03.25 - 4               |

**Note:** Please contact us for ÖBB and/or SBB approvals.



Short-circuit wire on a gabion or grating fence

## Short-circuit wire

Defined short-circuit in the event of a fault.

During the implementation of railway earthing projects, it has transpired that there are always objects on railway lines that cannot carry short-circuit currents in the event of an overhead contact line break. Objects in the area where the overhead contact line breaks that do not have sufficient short-circuit current carrying capacity put people and installations at risk. These conductive bodies, e.g., metal boundaries or fences, must be equipped with an additional, sufficiently dimensioned conductors. This is done using a short-circuit wire.

It is installed on fences or boundaries and triggers a defined short-circuit in the event of a broken overhead contact line. Short-circuit wires are also used in tunnel building and for noise barriers.

### When is a short-circuit wire required?




A short-circuit wire is always needed then when the conductive body (e.g. gabion baskets or grating fences as per 3 Ebs 15.03.48) cannot carry the required short-circuit current. The object is connected to the railway earthing according to the specifications of Ril 997.02 via a short-circuit wire with a suitable diameter. The dimensioning of the short-circuit wire depends on the short-circuit current that must be handled in the event of a fault.

### Dimensioning short-circuit wires – Calculation example for short-circuit currents

$I_{SC} \leq 15 \text{ kA}^*$  = short-circuit wire (round wire, St/tZn)  $\Rightarrow$  min.  $\varnothing 10 \text{ mm}$

$I_{SC} > 15 \text{ kA}^*$  = short-circuit wire (round wire, St/tZn)  $\Rightarrow$  min.  $\varnothing 16 \text{ mm}$

\* In this specific application, the  $I_{SC}$  limit of 25 kA commonly used in the railway sector was changed to a value of 15 kA, because standard steel wire variants are available from a diameter of  $\varnothing 10 \text{ mm}$  or  $\varnothing 16 \text{ mm}$ .

| Short-circuit wire  | Part No.   | EBS            |
|---|--|----------------|
|  <p><b>Angle bracket</b><br/>For attaching <math>\varnothing 16 \text{ mm}</math> short-circuit wires to gabions and fences</p>  | 419 750  | 3 Ebs 15.03.47 |
|  <p><b>Parallel connectors</b><br/>For attaching <math>\varnothing 10 \text{ mm}</math> and <math>\varnothing 16 \text{ mm}</math> short-circuit wires to grating fences</p> | S15 779  | 3 Ebs 15.03.44 |
|  <p><b>Short-circuit wire</b> (round steel)<br/>To discharge short-circuit current to the rail in the event of a fault, the short-circuit wire must be chamfered.</p>        | S16 033 ( $\varnothing 10 \text{ mm}$ )<br>483 200 ( $\varnothing 16 \text{ mm}$ ) | 3 Ebs 15.03.42 |

For enquiries about special numbers relating to railway earthing, please contact [railway.technology@dehn.de](mailto:railway.technology@dehn.de)












## Selection matrix – What should be considered?












Before selecting the right components for your purpose, you should answer the following questions:



1. What has to be earthed?
2. What is the maximum short-circuit current?
3. What type of connection is required (linear, angled)?

### Components for use with maximum short-circuit currents $\leq 25$ kA

| Earthing bridge (invisible, internal connection)  |                  |          |                      |          | Earthing connector (visible, external connection)  |              |          |
|--|------------------|----------|----------------------|----------|---|--------------|----------|
| Design   | Flexible type    |          | Highly flexible type |          | Design  | Halogen-free |          |
|  | DEHN type        | Part No. | DEHN type            | Part No. |   | DEHN type    | Part No. |
|   | D BEB 4          | 419 040  | D BEB 4-FLEX         | 419 041  |   | D BEB 26     | 419 260  |
|   | D BEB 6          | 419 060  | D BEB 6-FLEX         | 419 061  |   | D BEB 40     | 419 400  |
|   | D BEB 9          | 419 090  | D BEB 9-FLEX         | 419 091  |   |              |          |
|   | D BEB 11         | 419 110  |                      |          |   |              |          |
|   | D BEB 11 - L1000 | 419 506  |                      |          |   |              |          |

### Components for use with maximum short-circuit currents $> 25$ kA

| Earthing bridge (invisible, internal connection)  |                 |          |                      |          |
|--|-----------------|----------|----------------------|----------|
| Design   | Rigid type      |          |                      |          |
|  | DEHN type       | Part No. | DEHN type            | Part No. |
|   | D BEB 0 - 63    | 419 000  | D BEB 0 - 77         | 419 002  |
|  | D BEB 0 - 70    | 419 001  |                      |          |
|   | D BEB 1         |          |                      | 419 010  |
|   | D BEB 1-L       | 419 011  | D BEB 1 - L100       | 419 500  |
|   | D BEB 1-NR      |          |                      | 419 012  |
|   | D BEB 2         |          |                      | 419 020  |
|   | D BEB 3         |          |                      | 419 030  |
|   | D BEB 8         |          |                      | 419 080  |
| Design   | Flexible type   |          | Highly flexible type |          |
|  | DEHN type       | Part No. | DEHN type            | Part No. |
|   | D BEB 5         | 419 050  | D BEB 5-FLEX         | 419 051  |
|  | D BEB 5 - L700  | 419 501  |                      |          |
|  | D BEB 5 - L1000 | 419 502  |                      |          |
|  | D BEB 5 - L1500 | 419 503  |                      |          |
|  | D BEB 5 - L2000 | 419 504  |                      |          |
|   | D BEB 7         | 419 070  | D BEB 7-FLEX         | 419 071  |
|   | D BEB 10        | 419 100  | D BEB 10-FLEX        | 419 101  |
|  | D BEB 10 - L800 | 419 505  |                      |          |

| Earthing connector (visible, external connection)  |                 |          |   |          |
|---|-----------------|----------|---|----------|
| Design  | Flexible type   |          |   |          |
|   | Halogen-free    |          | Halogen-free and flame retardant (NF <sup>1)</sup> for use in tunnels |          |
|   | DEHN type       | Part No. | DEHN type   | Part No. |
|    | D BEB 29        | 419 290  | D BEB 29-NF   | 419 291  |
|   | D BEB 29 - L350 | 419 507  |   |          |
|   | D BEB 29 - L800 | 419 508  |   |          |

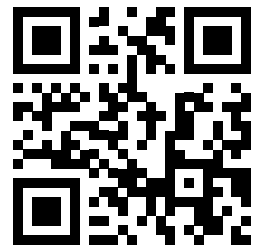
**Note:** The components are classified according to their short-circuit current resistance. Components which are suitable for use in case of maximum short-circuit currents  $> 25$  kA can, of course, also be used for lower short-circuit currents.

<sup>1)</sup> NF: non-fire

Surge Protection  
Lightning Protection  
Safety Equipment  
DEHN protects.

DEHN SE  
Hans-Dehn-Str. 1  
92318 Neumarkt  
Germany

Tel. +49 9181 906-0  
Fax +49 9181 906-1100  
info@dehn.de  
www.dehn-international.com



de.hn/6q2Z6

We accept no liability for technical modifications, misprints and errors.  
Illustrations are not binding.

DS681/EN/0822 © 2022 DEHN SE