1. Installation tools
Basic equipment:
Standard tools, drilling template BS 15
Additional equipment:
in case of large systems with arches and switches
Bending device BVU 15
Hand punch press HST 15

2. System diagram

3. Symbols in installation drawings

4. Support bracket
Attach the support bracket and align it in a horizontal position and at a right angle to the runway.
Hanger interval, see table or installation drawing.

Max. hanger interval

<table>
<thead>
<tr>
<th>Single current collector</th>
<th>1000 mm</th>
<th>500 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double collector</td>
<td>800 mm</td>
<td>400 mm</td>
</tr>
</tbody>
</table>
6.1. Installation of the powerails with the connectors
(Image 4 and 5)
– Slide the connectors half-way into the already installed section of the powerails.
– Press the next section into the rail holders (image 6). The claws have to span the rail profiles (audibly engage).
– Slide the powerail onto the free end of the connector up to the stop.
– Tighten the connector; max. tightening torque 4 Nm.
– From the side, position the joint cap halves against the butts of the rails so that the powerail is encompassed tightly. At the same time press the joint cap halves together until their latching lugs engage in the corresponding openings.

6.2. Preparation of the powerails for the connectors
If any shorter sections will have to be adjusted at the construction site, the ends of the powerails have to be prepared as follows for the connectors:
– Mark the track length, saw it off with a hacksaw and deburr it.
– Pull some of the insulation profile off the powerail profile, shorten it by 42 mm and deburr it.
– Slide the insulation profile on the powerail profile back to the point where the conductor profile protrudes by equal lengths on both ends (image 5).

6.3. Expansion sections
The expansion sections have been pre-installed at the factory. Length: 1000 mm.

The expansion sections are installed:
– For straight lengths exceeding 100 m.
– If the length of the conductor line between two bends, switches or other fixed points exceeds 20 m (drawing 1).

The expansion lengths have to be attached with locating clamps in the center between 2 expansion sections or between expansion sections and the end of the system (drawing 2).
The maximum length \( L \) of the expansion track for an expansion section depends on the max. temperature difference \( (\Delta t) \) (see table).

<table>
<thead>
<tr>
<th></th>
<th>up to ( \Delta t )</th>
<th>max. ( L )</th>
<th>up to ( \Delta t )</th>
<th>max. ( L )</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 °C</td>
<td>88 m</td>
<td>40 °C</td>
<td>44 m</td>
<td></td>
</tr>
<tr>
<td>30 °C</td>
<td>58 m</td>
<td>50 °C</td>
<td>35 m</td>
<td></td>
</tr>
</tbody>
</table>

**Maximum expansion path of an expansion section is 30 mm.**

Installation according to drawing 3:

a) Enter the lowest and highest operating temperature and connect them with a straight line.

b) Enter the installation temperature (temp. of the powerails) on this line and read measurement "a".

Example: max. operating temperature = 30 °C  
\( \Delta t = 40 °C \)
min. operating temperature = – 10 °C  
Installation temperature = 20 °C  
Measurement "a" = 8 mm

– Install expansion section with measurement "a" (image 7).

**7. Locating clamps**

Locating clamps are used to fix powerail sections to prevent the powerail from sliding in a longitudinal direction.

A fixed point is created with two locating clamps that are positioned to the left and right of a rail holder (see image 8).

Arrangement:

– For straight tracks, in the middle of the system (see drawing 4).
– Between two expansion sections (drawing 2) or an expansion section and powerail end.
– In bends (drawing 5).
If there are interruptions in the track, e.g. caused by switches or lifting stations (drawing 5).

Screw on the locating clamps.

After the installation, the opening of the powerail has to be checked. For straight transfers 6 mm and for slanted transfers 10 mm.

8. Feeds

If possible, feeds should be installed instead of the connectors near the supply cable. Prepare the contact surfaces as in item 6.

If the feed is not installed at the butt of the track, the plastic housing has to be modified (8.2).

Feeds in transition sections see 10.

For arrangements where the distance between the rails is 18 mm, the feeds have to be arranged offset for UEG.

The feed cable may not interfere with the clear passage of the current collectors and the powerail’s length expansion in case of temperature changes.

8.1 Arrangement instead of the connectors

The installation of the feed is possible in systems with connectors without additional modifications.

8.2 Arrangement on the section

– Mark the position of the feed on the section.

– Pull off the insulation profile, cut it at the marked position and shorten it by 42 mm.

– Slide a copper lug with connecting screws into the powerail profile up to this point.

– Slide the insulation profile back on.

8.3. Installation of the powerails with feeds

– Press the powerails into the holders (avoiding the area of the feed).

– For UE 15 K 4: Attach ring-shaped crimp cable shoes according to DIN 46234 for connection bolts M 5 on connecting cables (image 9). The max. connection diameter for each connections screw is 6 mm².

– For UEG 15 K 4, use the provided special cable shoe for two screw connections. Interior Ø for the cable connection is 8.2 mm.

– Plug the cable with the attached cable shoe on to connection bolts and screw on.

– Remove the cable transfer at the cover in the respective size.

– Place cap on top and press together.

– Also press the powerail into the rail holders in the feed area.

– Attach the strain relief for the feed cable.

9. Joints

The powerail is electrically isolated by means of the joints.

In front of and behind the joints, the powerail also has to be suspended with a max. distance of 200 mm from the center of the joint.

9.1. Isolated sections (image 10)

Installation according to the installation drawing at the factory or during the assembly:

– Mark the position of the joints on the powerail.

– Pull out the copper or stainless steel profile and separate it at the marked area.
– Shorten the copper or stainless steel profile and deburr it (see table).

<table>
<thead>
<tr>
<th>Name</th>
<th>Length of the joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT/U 15-5</td>
<td>5 mm</td>
</tr>
<tr>
<td>IT/U 15-15</td>
<td>15 mm</td>
</tr>
<tr>
<td>IT/U 15-30</td>
<td>30 mm</td>
</tr>
<tr>
<td>IT/U 15-90</td>
<td>90 mm</td>
</tr>
</tbody>
</table>

– Connect the copper or stainless steel profile with the joint and slide it into the PVC profile (image 10).

9.2. **Air joints** (image 11)
– Mark the position of the air joints on the conductor profile.
– Separate the powerail in this location and shorten it by a total of 43 mm.
– Process the powerail as described under 10.1.

After they are placed on the powerails, the air joints are connected with the additional lugs by pressing them together sideways (snap button principle).

**Combination options:**

- \( \text{LT/LF-} \) U 15 without feed
- \( \text{LT/LTE-} \) U 15 with feed, single-sided
- \( \text{LTE/LTE-} \) U 15 with feed, double-sided

10. **Transition sections**

Usage for switches, lifting stations and removable runway sections.

May also be used as a contact protection for rail ends ("end caps").

There are two types of transition sections:

a) Transition sections of the types US 15 T
   - US 15 T
   - USE 15 T
   - USE 15 TS

b) Transition sections of the types US 15
   - USE 15

– Usage: For straight tracks with arrangements that are lateral and suspended (a slanted design is possible after a modification during the installation).
– No simultaneous function as a fixed point.

10.1. **Transition sections US 15 T** (image 12)

Installation procedure:

1) Pull off the insulation profile by about 50 mm from the powerail profile and use the hand punch press HST 15 (image 13) to punch a rectangular recess into the insulation profile (image 14 and drawing 6a).

2) Position the head of a square screw into the insulation profile recess and slide in the powerail profile until it is flush with the insulation profile again.
3) Place the clamping bracket (copper) on top and tighten it with a washer and nut (image 15). Max. tightening torque 2 Nm. (Make sure that the powerail profile and insulation profile are exactly flush at the end.)

For transition sections with feeds or air joints with feeds, the provided flat connector (6.3 x 0.8 mm) has to be screwed on as well (image 16).

4) Slide on the transition section (until it audibly engages).

10.1.1. Arrangement of the transition sections (lateral arrangement)

The straight transition sections US 15 T and USE 15 T have to be used for straight runway sections; the slanted transition sections US 15 TS and USE 15 TS each have to be used in one part of the slanted section (drawings 6 b, 6 c).

10.1.2. Attachment for transition sections BFU

– Mark the through-holes for BFU on the attachment surface (see drawing 6 c).

ATTENTION: The transition sections may not protrude into the rail section under any circumstances...

– Drill the through-holes for M 5 into the attachment surface.

– Slide the transition sections onto the BFU attachment (image 17).

– Screw the BFU onto the attachment surface.

– Knock in the clamping pins to fixate the transition sections.

– In the case of slanted sections, make sure that the head of the fixing screw does not protrude into the cut of a runway profile.

When installing transitions, make sure that facing rail ends are exactly aligned to prevent interferences during the passage of the current collectors.

The max. vertical and lateral offset: ± 2 mm

Max. air joint: in straight transfers: 6 mm
for slanted transfers: 10 mm

EHB runways (switching and lifting stations) have to be aligned before installing the powerails.

10.2. Transition sections US 15, USE 15 (image 18)

– Powerail processing as described under 12.

For transition sections with feeds, connection for flat plugs 6.3 x 0.8 mm.

When installing transitions, make sure that facing rail ends are exactly aligned to prevent interferences during the passage of the current collectors.

The max. vertical and lateral offset: ± 2 mm

Max. Air gap: 6 mm
11. Transfer funnel
If the powerails are separated in long sections, the current collectors have to be inserted with the aid of a transfer funnel EFTU 15-... .

12. End caps
The end caps form the contact-protected terminals of the powerail and are generally attached on the corresponding powerail sections at the factory.

If the delivery is made in individual sections, proceed as follows:
– Slide drilling template BS 15 (image 19) on the end of the rail and hold it in place.
– Drill Ø 6.5 mm only in the back of the insulation profile (drawing 7). Use hole "B" in the drilling template.
– Drill Ø 3 mm cross-wise through the entire U-Rail (drawing 7). Use hole "D" in the drilling template. Then knock in the provided clamping pin Ø 3 mm according to DIN 1481 (length 12 mm).
– Slide the square of the drilling template head-first into the powerail profile to guide the clamping pin.
– Slide on the end cap until it audibly engages.
– The clamping pin has to be entirely covered by the end cap.

Transfer funnel for KSFU 25
for max. speed \( v = 100 \text{ m/min.} \)

<table>
<thead>
<tr>
<th>Type</th>
<th>A mm</th>
<th>B mm</th>
<th>C mm</th>
<th>D mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFT U 15-2 - KSFU</td>
<td>44</td>
<td>102</td>
<td>90</td>
<td>144</td>
</tr>
<tr>
<td>EFT U 15-3 - KSFU</td>
<td>62</td>
<td>120</td>
<td>108</td>
<td>162</td>
</tr>
<tr>
<td>EFT U 15-4 - KSFU</td>
<td>80</td>
<td>138</td>
<td>126</td>
<td>180</td>
</tr>
<tr>
<td>EFT U 15-5 - KSFU</td>
<td>98</td>
<td>156</td>
<td>144</td>
<td>198</td>
</tr>
<tr>
<td>EFT U 15-6 - KSFU</td>
<td>116</td>
<td>174</td>
<td>162</td>
<td>216</td>
</tr>
<tr>
<td>EFT U 15-7 - KSFU</td>
<td>134</td>
<td>192</td>
<td>180</td>
<td>234</td>
</tr>
<tr>
<td>EFT U 15-8 - KSFU</td>
<td>152</td>
<td>210</td>
<td>198</td>
<td>252</td>
</tr>
</tbody>
</table>

Transfer funnel for KSTU 30/55
for max. speed \( v = 120 \text{ m/min.} \)

<table>
<thead>
<tr>
<th>Type</th>
<th>A mm</th>
<th>B mm</th>
<th>C mm</th>
<th>D mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFT U 15-2 - KSTU</td>
<td>44</td>
<td>130</td>
<td>157</td>
<td>180</td>
</tr>
<tr>
<td>EFT U 15-3 - KSTU</td>
<td>62</td>
<td>148</td>
<td>175</td>
<td>198</td>
</tr>
<tr>
<td>EFT U 15-4 - KSTU</td>
<td>80</td>
<td>166</td>
<td>193</td>
<td>216</td>
</tr>
<tr>
<td>EFT U 15-5 - KSTU</td>
<td>98</td>
<td>184</td>
<td>211</td>
<td>234</td>
</tr>
<tr>
<td>EFT U 15-6 - KSTU</td>
<td>116</td>
<td>202</td>
<td>229</td>
<td>252</td>
</tr>
<tr>
<td>EFT U 15-7 - KSTU</td>
<td>134</td>
<td>220</td>
<td>247</td>
<td>270</td>
</tr>
<tr>
<td>EFT U 15-8 - KSTU</td>
<td>152</td>
<td>238</td>
<td>265</td>
<td>288</td>
</tr>
</tbody>
</table>
13. Bending the powerails
The bends can be manufactured with the bending device BVU 15 (drawing 8). The BVU 15 can be used to bend U15 powerails vertically and horizontally. The cross bars are provided.

Work procedure:
- To prepare the bend, open the desired radius on a flat surface.
- Determine the dimension of the bend (expanded length) of the powerails (possibly from the installation drawing) and mark it on the rail section.
- Saw off the powerail at a length that is about 0.5 m longer than the bend dimension.
- Insert the cross bar into the powerail.
- Twist up the adjustment roll and insert the rail section with the cross bar into the bending device, using a groove that corresponds to the profile.
- Slightly tension the adjustment roll and slide the rail section back and forth.
- To prevent the formation of a fold at the beginning of the radius, move the beginning section for the following bending process a few centimeters towards the inside.
- Repeat the procedure until the radius is bent.
- Remove the cross bar again.
- Saw off the powerail at the length of the bend. To guarantee a problem-free connection, a straight section of about 100 mm has to follow at the ends of the bend for a radius < 700 mm (drawing 9).

14. Current collector
The connecting cables of the current collectors have to be highly flexible and installed in such a way that they do not interfere with the full motion capacity of the current collectors!

14.1. Holders for current collectors in the series KST 20, KST 25, KST 2/40, KSF, KDS and KES
The attachment surface of the current collectors has to be exactly parallel to the crosswise and longitudinal direction of the powerails.

The installation height of the attachment surface for the current collector up to the powerails’ conductor surface is determined according to the following table:

<table>
<thead>
<tr>
<th>Current collector type</th>
<th>Installation height mm</th>
<th>perm. tolerance T for the operation mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>KST 15, KST 40, KST 60</td>
<td>65</td>
<td>± 20</td>
</tr>
<tr>
<td>KDST 30, KDST 80, KDST 120</td>
<td>65</td>
<td>± 20</td>
</tr>
<tr>
<td>KSTL 15, KSTL 40, KSTL 60</td>
<td>85</td>
<td>± 40</td>
</tr>
<tr>
<td>KDSTL 30, KDSTL 80, KDSTL 120</td>
<td>85</td>
<td>± 40</td>
</tr>
<tr>
<td>KSTLU 15, KSTLU 40, KSTLU 60</td>
<td>85</td>
<td>± 20/± 40 (1)</td>
</tr>
<tr>
<td>KDSTLU 30, KDSTLU 80, KDSTLU 120</td>
<td>85</td>
<td>± 20/± 40 (1)</td>
</tr>
<tr>
<td>KST 30, KST 55, KSTU 30, KSTU 55</td>
<td>85</td>
<td>± 20</td>
</tr>
<tr>
<td>KSTL 30, KSTL 55, KSTLU 30, KSTLU 55</td>
<td>95</td>
<td>± 30</td>
</tr>
</tbody>
</table>

– Slide the current collector onto the towing arm, align and tighten.

For the ground conductor, the towing arm of the current collector has been milled according to the attachment clamp.
– The installation height refers to the center of the square up to the conducting surface.
15. Completion of the installation
Once the installation has been completed, check all parts for functionality, perform a test run and make sure that the contact between the carbon brush and powerail is problem-free.

16. Activation
The powerail U 15 and its components are constructed according to VDE 0100 and designed according to VDE 0470 part 1 with shock hazard protection. The shock-hazard-protection may not be impacted after the completed installation (e.g. opening width of the powerails).
Perform a test run after proper installation. Pay attention to the following points:
Conduct first run at low speed.
Current collector must move on the rail without vibration.
No sparks may occur in the area of the carbon.
(Sparking indicates soiled or oxidized grinding surfaces; clean grinding surfaces).
Ensure the perfect intake and exit of the current collectors at the transfer funnels and transition sections in particular.

17. Maintenance
The insulated powerails require low maintenance.
However, the following tasks have to be completed regularly:
1.) Checking the powerails:
Visual inspection every 4 weeks. Also pay attention to the expansion of the powerails and to burn points.
Remove deposited carbon dust especially in the joints and transition sections.
At the transition sections for switches, lifting stations, etc., the max. vertical and lateral offset of 2 mm may not be exceeded.
The max. air gap between the facing transition sections is the following for these types:

<table>
<thead>
<tr>
<th>US 15</th>
<th>USE 15</th>
<th>image 18</th>
<th>6 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 15 T</td>
<td>USE 15 T</td>
<td>image 12/17</td>
<td>10 mm</td>
</tr>
<tr>
<td>US 15 TS</td>
<td>USE 15 TS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To ensure that the current collectors may pass without problems, it is better to keep these values as low as possible.
2.) Control of the current collectors every two months.
a) Mechanical control:
Check the flexibility of the joints, bearings and pivots. Check for mechanical damage.
b) Electrical control:
Check abrasion of the carbon brushes, firm seating of all contact screws and cable fastenings.
Replace the carbon brushes at such an early stage that the sockets of the carbon brushes do not drag on the conductor surface or touch the outer edges of the caps etc.
c) Contact check:
Pull the carbon brushes out of the powerail using a spring scale. The contact strength should be around 3.5 N per carbon brush (series KST 20, KST 25, KST 2/40 and KDS 2/40, KESR).
Approx. 9 N per carbon brush for series KST 15 to KDSTLU 120.
Approx. 5 N for series KST 30 - KSTU 55 and approx. 7 N for the series KESL.
Installation instructions for catalog no. 2c/E 2010