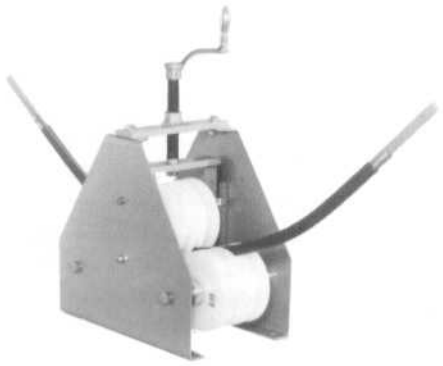


## Curve tool

Filler rod is to be ordered separately.

| Type | Weight kg | Cat.-No. |
|---|---|---|
| **BVU 10/15** | 10.000 | 165 090 |
| **FU 10** Filler rod, 4 m long | 0.340 | 165 234 |


## Table saw

| Type | Weight kg | Cat.-No. |
|---|---|---|
| **KS** | 6.500 | 165 276 |
| **SB** Spare blade | 0.070 | 165 263 |

## Conductor punch tool

| Type | Weight kg | Cat.-No. |
|---|---|---|
| **LZ 10** | 2.400 | 165 867 |

## Deburring tool

for inside of conductor

EGM

HRF

## Half-round file

for deburring and bevelling of conductor outside

| Type | Weight kg | Cat.-No. |
|---|---|---|
| **EGM** | 0.018 | 165 275 |
| **HRF** | 0.085 | 165 264 |

## Adjustment jig

| Type | Weight kg | Cat.-No. |
|---|---|---|
| **ST 10** | 0.150 | 165 091 |

## Conductor joint assembling tool

| Type | Weight kg | Cat.-No. |
|---|---|---|
| **MG-SW 10** | 0.125 | 165 093 |

## Locking pin driver

for BFU anchor bar

| Type | Weight kg | Cat.-No. |
|---|---|---|
| **ED 10** | 0.010 | 165 277 |

## Conductor dismantle tool

| Type | Weight kg | Cat.-No. |
|---|---|---|
| **DMW 10** | 0.039 | 165 119 |

## 1. Installation tools

No special tools are needed for simple systems; conductors will be supplied ready for installation.

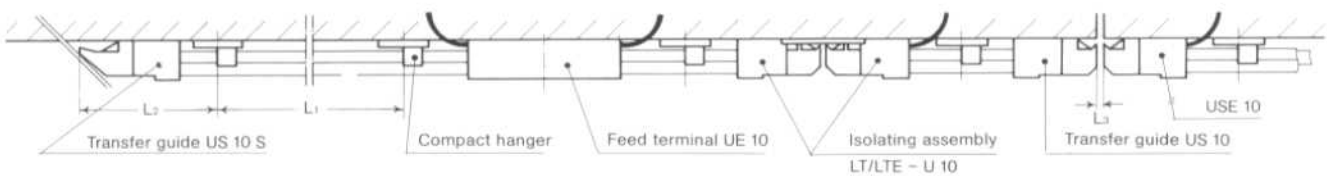
For complex layouts with switches and curves the following tools are required:

| | | |
|---|---|---|
| Curve tool<br>Filler rod | BVU 10/15<br>FU 10 | for making horizontal and vertical curves |
| Table saw | KS 10 | for cutting of conductors |
| Punch tool | LZ 10 | for punching square holes in conductor ends |
| Deburring tool<br>Half-round file | EGM<br>HRF | for burr removal on conductor cuts |
| Adjustment jig | ST 10 | for making short conductor sections, see 5.1 |
| Assembling tool | MG-SW 10 | combination tool for installing joint splice clips, joint covers and for checking/adjusting conductor slot width |
| Locking pin driver | ED 10 | for inserting locking pins into BFU alu anchor bar |
| Dismantle tool | DMW 10 | for dismantling conductor bars from supports |

## 2. Layout symbols

| | | |
|---|---|---|
| Support beam track (monorail) | | |
| Conductor rails | U 10/25 | |
| Joint splice | UV 10 | |
| Feed terminal | UE 10 | |
| Feed terminal | UES 10 | |
| Compact hanger | | |
| Compact hanger & locating clamps | | |
| Transfer guide, straight | US 10 | incl. BFU anchor bar |
| Transfer guide, oblique | US 10 S | |
| Transfer guide, straight w/feed | USE 10 | |
| Transfer guide, oblique w/feed | USE 10 S | |
| Isolating assembly | LT/LT-U 10 | |
| Isolating assembly w/one feed | LT/LTE-U 10 | |
| Isolating assembly w/two feeds | LTE/LTE-U 10 | |
| Expansion section | UDV 10/25 | |

## 3. System layout




| | | | |
|---|---|---|---|
| L = Standard lengths of conductor | 6 m | $L_2$ = permissible overhang | 0.2m |
| $L_1$ = max. support spacing<br>for straight runs<br>for curves | <br>0.6 m<br>0.3 m | $L_3$ = air gap between transfer guides at switches or drop sections | 3-6 mm |

## Installation procedure

## 4. Compact hanger

The compact hangers must be installed at exactly right angle with the track beam or hanger bracket.

### Compact hanger KA

Each compact hanger is supplied complete with two M 5 T- head bolts, nuts, washers and lock washers.
- Drill two holes for 5 mm bolts, hole centers can vary between 60-120 mm (see photo 1).
- Install compact hanger.

### Compact hanger KD, KK, KS

Compact hanger is designed to snap or to rotate into specific track beam profile.

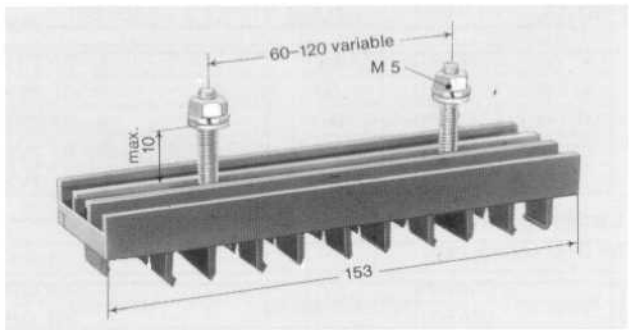



Photo 1: Compact hanger KA 10-10

## 5. Installation of conductors and joint splices

Conductor sections are connected with snap-in joint splices (photo 2). It is important for good electrical contact that the conductor ends are clean and free of residue and that any burrs are removed. The snap-in joint splices compensate for expansion and contraction of the conductors (see instructions 6 and photo 2). The joint splice is protected by an insulating cover.

Standard conductor sections are supplied ready for the installation of the joint splice. If a section has to be cut during installation, the end has to be prepared as shown under instructions 5.1.

Installation sequence, when conductor is installed starting on the left and progressing towards the right, is as follows:

- Start installation at an anchor point (switch or end of system, see instr. 8.1).
- Install standard length conductor sections; if curves are included install curve sections before cutting standard sections to fit.
- Make and install short conductor sections (see instr. 5.1).
- Maintain correct air gap between each conductor section (see instr. 6).
- Push joint splice cover onto the left end of the conductor bar. Push in splice cover far enough so that the conductor becomes accessible (see photo 3).
- Snap-in metal splice clip at the right end of the conductor (see photo 4).
- Install conductor section into compact hanger and use installation tool MG 10 to push left end of conductor into the splice clip of the already installed conductor section.
- Use installation tool MG 10 to push joint splice cover over joint splice, tap lightly if required (see photo 5).
- Maintain correct air gap between each conductor section (see instr. 6).

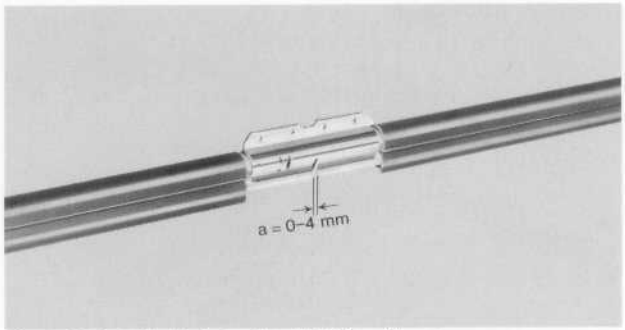


Photo 2: Installed joint splice UV 10, without cover

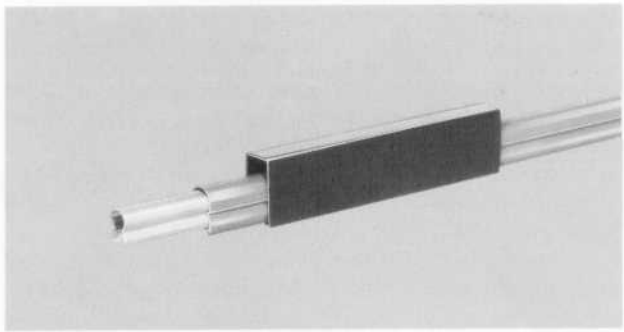


Photo 3: UV 10 joint splice cover

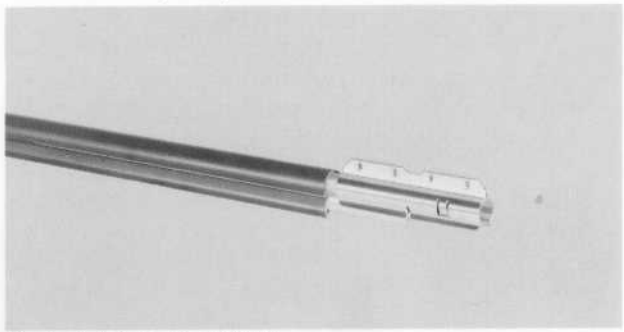


Photo 4: Joint splice UV 10

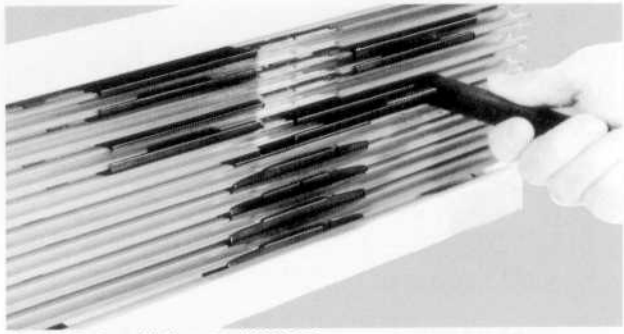


Photo 5: Installation tool MG 10

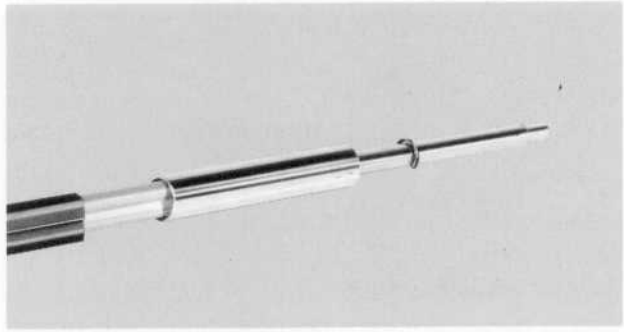


Photo 6: Adjustment jig ST 10

## 5.1 Preparing conductor end for joint splice

If a conductor section has to be cut on site, the conductor ends have to be prepared as follows (see fig. 3):

- Measure exact length required.
- Use adjustment jig ST 10 and pull conductor approx. 80-100 mm out of insulating shroud.
- Use hollow end of ST 10 and push back conductor to stop (70 mm, see photo 6).

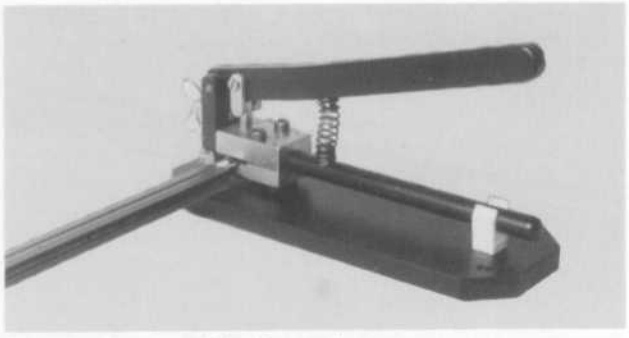


Photo 7a: Punch tool LZ 10 compl.

Photo 7b: LZ 10 pliers in operation

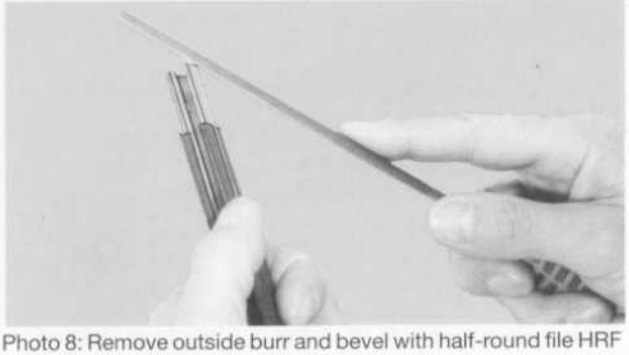


Photo 8: Remove outside burr and bevel with half-round file HRF

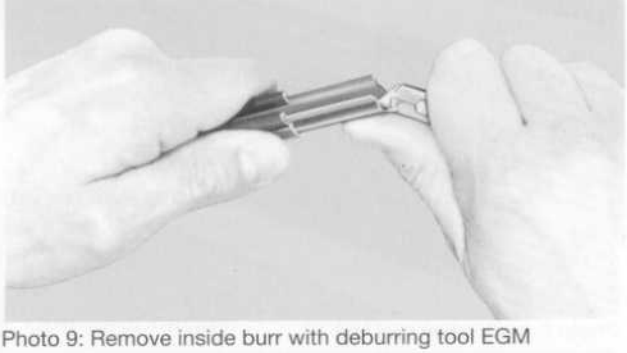


Photo 9: Remove inside burr with deburring tool EGM

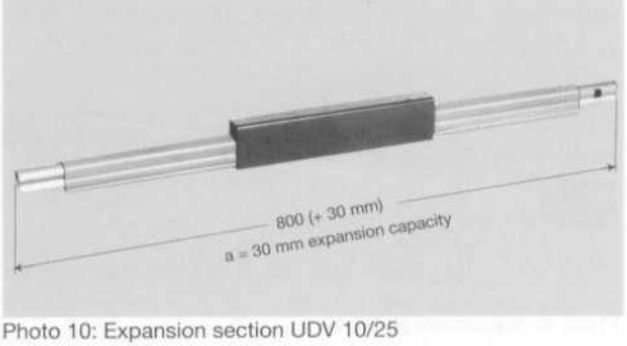



Photo 10: Expansion section UDV 10/25

- Cut conductor to exact length required; use hacksaw or table saw KS (fine teeth blades only).
- Use punch tool LZ 10 to punch square holes into each end of conductor (see photo 7 and fig. 2).

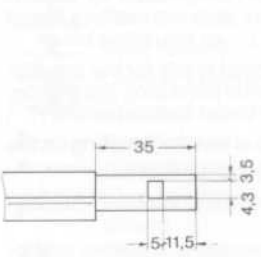



Fig. 2:

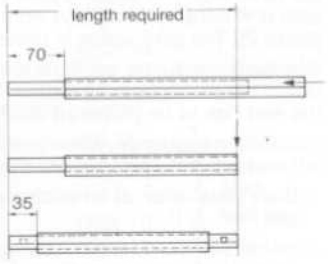



Fig. 3:

- Remove burr from cut, use half-round file HRF (see photo 8) for outside of conductor and deburring tool EGM (see photo 9) for inside of conductor; also sligthly bevel outside of conductor with half-round file.
- Use hollow end of ST 10, short setting, and push PVC shroud into center of conductor, conductor must extend 35 mm on each end (see fig. 3).

## 6. Conductor expansion and contraction

The special design of the joint splice UV 10 and feed terminal UE 10 compensates for expansion and contraction of the conductors due temperature difference.

The conductors have to be anchored with locating clamps USK 10 to assure controlled expansion and contraction and to avoid a push-along effect by dragging collectors. A fixpoint should be provided every 36 m (120') for long, straight systems (see instr. 10, case 2).

Expansion section UDV 10/25 (see photo 10) with expansion capability of max. 30 mm should be installed on systems with expansion joints in the track beam and/or in the building. Use locating clamps on each side of expansion section (see instr. 10, case 3).

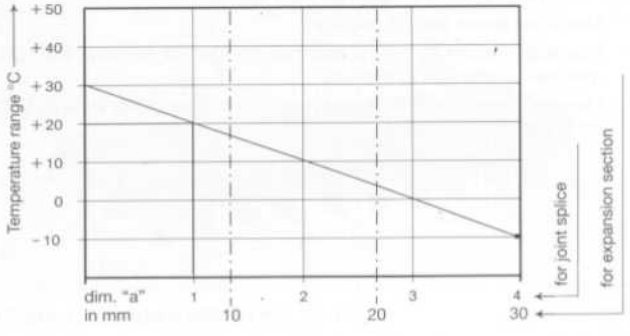
Dependent on the expected temperature difference ($\Delta$ t) an air gap "a" has to be set during installation (photo 2). Set air gap "a" according to the graph below.

**Example**

| | | |
|---|---|---|
| Max. expected temperature | = | 30° C |
| Min. expected temperature | = | −10° C |
| Temperature diff. $\Delta$ t | = | 40° C |
| Installation temperature | = | 20° C |
| Air gap "a" | = | 1 mm |

According to the expected temperature difference of the above example, conductor bars installed at 20° C (68° F) ambient temperature should have an air gap of 1 mm; expansion joints 8 mm. Use shims to maintain correct gap during installation. The graph below is based on the installation of standard conductor sections 6 m long. If a number of shorter sections are installed in a system more joint splices are available to compensate for expansion or contraction.

If a temperature difference of more than 40° C is expected, shorter (4 m) conductor sections or extra expansion sections UDV 10/25 should be installed.



## 7. Feed terminals

Feed terminal UE 10 (photo 11) may be installed between two conductor sections in place of a joint splice UV 10. If a feed terminal has to be installed anywhere else on the conductor bar use UES 10 feed terminal.

- If required, preparation of conductor bar as shown under instructions 5.1.
- Max. two cables can be connected, using a spade connector dim. 6.3 x 0.8 mm; (for installations requiring CSA approval use CSA approved SO cable, No. 10 AWG, connectors and crimping tool – CSA File No. LR 61839).
- Make certain that connecting cables do not restrict movement of condutors or collectors.

## 8. Transfer guide US 10 and USE 10

Transfer guides are used with switches, drop sections, turntables and air gaps; they are also used as end caps.

Installation procedure:

- Push prepared conductor bar into transfer guide, making sure they interlock.
- Secure BFU anchor bar on track beam, see fig. 5 and 6 for hole location and details under 8.3.
  (PVC-bar for single press locking, Alu-bar for locating group of transfers).

### 8.1 Placement of transfer guide

Straight transfer guide US 10 and USE 10 are used with straight track beam cuts. Oblique transfer guides US 10 S and USE 10 S are used on one side of an obliquely cut track beam (see fig. 4, 5 and 6).

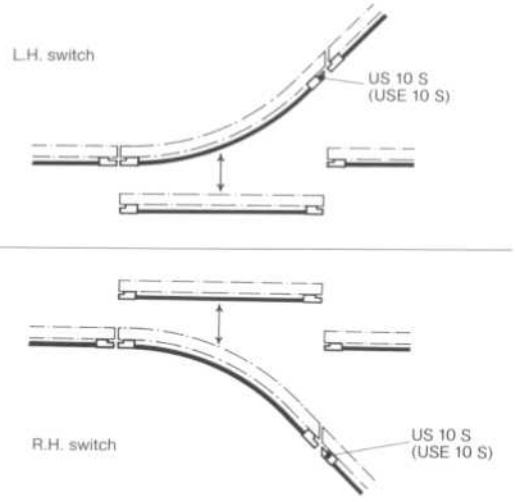



Fig. 4

### 8.2 Conductor bar preparation

- If required, preparation of conductor bar as shown under instructions 5.1.
- For USE 10 and USE 10 S push feed clip SE 10 onto conductor (photo 13), making sure that square hole remains accessible (see fig. 2).
- Push in transfer guide from front until it interlocks.
- Connect with spade connector, dim. 6.3 x 0.8 mm.

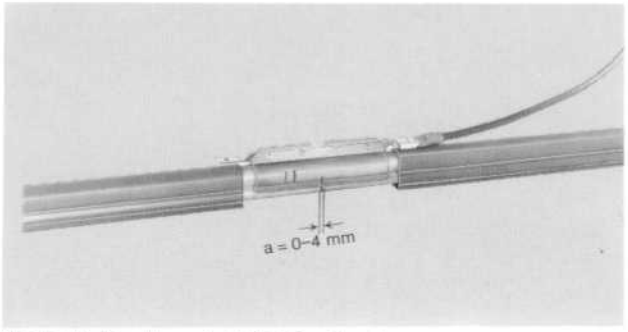



Photo 11: Feed terminal UE 10 without cover

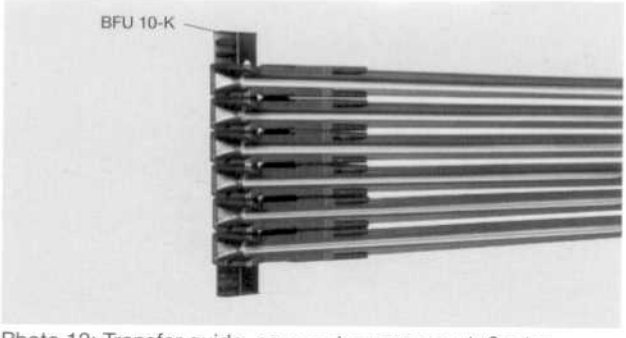



Photo 12: Transfer guide, compact arrangement, 6poles

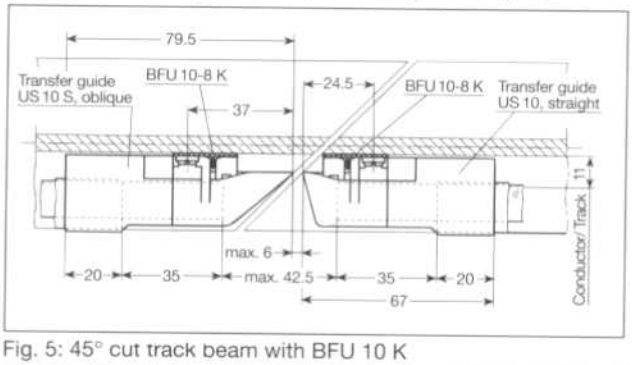



Fig. 5: 45° cut track beam with BFU 10 K

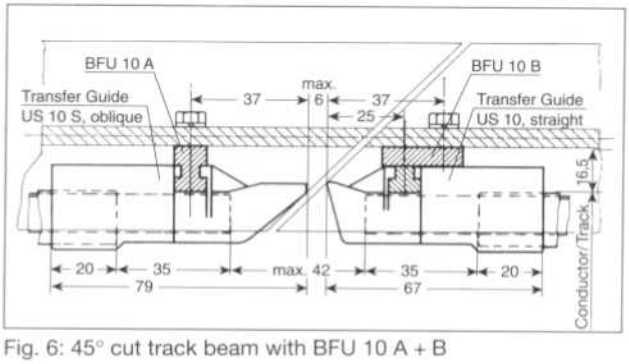



Fig. 6: 45° cut track beam with BFU 10 A + B

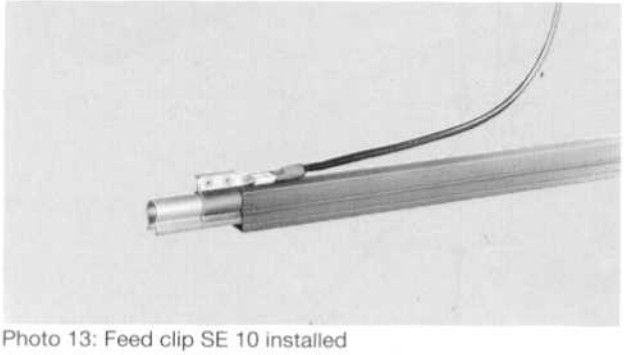


Photo 13: Feed clip SE 10 installed

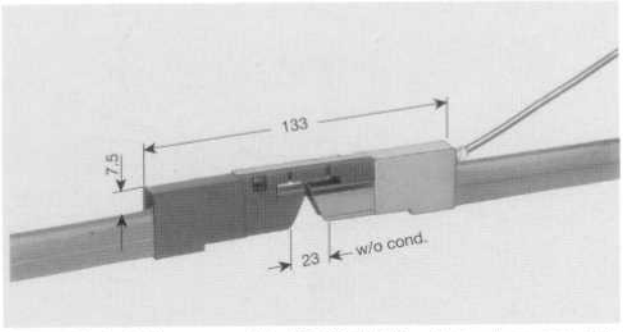



Photo 14: Isolating assembly LT/LTE-U 10 with feed on one side

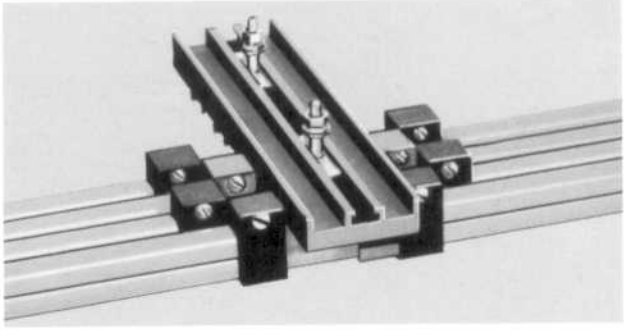


Photo 15: Compact hanger with staggered locating clamps USK 10

## 8.3 Installation of anchor bar

CAUTION! Make sure transfer guides have sufficient clearance when switch moves.

Drill holes for attachement screws; for location of holes see fig 5 and 6.

with PVC-bar:

- holes 3.4 mm in alu track, 3.5 mm in steel track for tapping screw M 4 x 8 (Cat.-No. 1011789)
- then press down (clip tight) the transfers.

with Alu-bar:

- Push transfer guides onto anchor bar.
- Fasten anchor bar securely on track beam in holes for M 5 screws.
- Use pin driver ED 10 to insert BFU locking pins.

To assure smooth collector passage, facing transfer guides must be accurately aligned with each other.

Permissible max. gap between transfer guides is 6 mm, max. offset in both directions is ± 3 mm.

## 9. Isolating assembly (photo 14)

Air gaps of 23 mm are used for isolating sections.

- Prepare conductor bar as shown under 5.1.

The following isolating/feed combinations are possible:

—||— = LT/LT- U 10 without feed terminals

—||ᵗ— = LT/LTE- U 10 with feed terminal on one side

ᵗ||ᵗ— = LTE/LTE- U 10 with feed terminals on both sides

After the two pieces have been pushed each onto a conductor they must be pressed together to interlock.

If system hangers do not permit the isolating assembly to support against the track beam (distance contact surface to track beam more then 10 mm), additional compact hangers must be installed at approx. 100 mm distance left and right of the isolating assembly for stabilization.

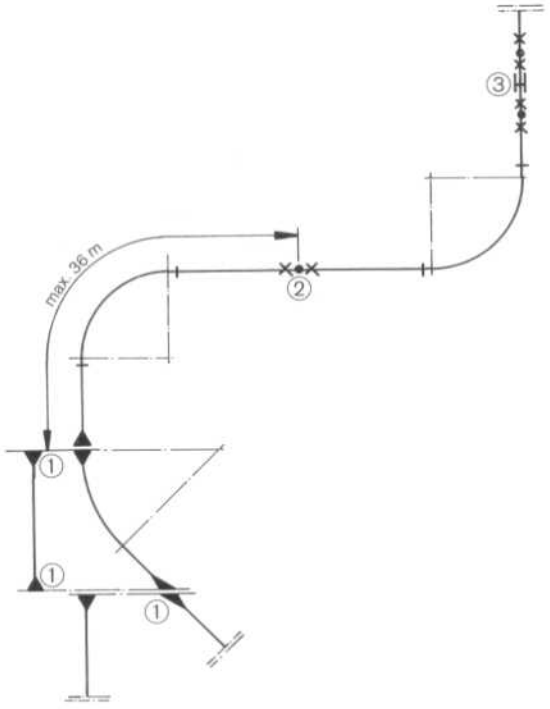



Fig. 7:

## 10. Anchor points (photo 15)

To prevent the conductor sections from sliding anchor points must be provided (see fig. 7).

| Case No. | Position | Consisting of |
|---|---|---|
| ① | Switches and drop sections | Transfer guide and BFU (see instructins 8.3) |
| ② | Continuous, long runs | USK 10 locating clamps left and right of bolted-on compact hanger |
| ③ | Expansion sections at building or track expansion joints | as under case No. 2 on adjacent hangers |

The distance between two anchor points should not exceed 36 m (120').

Installation of locating clamps USK 10

- Bolt-on compact hanger
- Install conductor bars, mark position of locating clamps before pushing conductor sections into compact hanger.
- Install locating clamps as marked on conductor sections and tighten securely; stagger locating clamps as shown in photo 15.
- Push conductor bars into compact hanger.

## 11. Bending of conductors

Horizontal or vertical curves can be supplied ready for installation. For curves to be made at the job site curve tool BVU 10/15 (photo 16) and filler rod FU 10 is required.

**Bending procedure:**

- Draw radius of curve on floor or flat surface (sheet of plywood etc., see fig. 8).
- Determine required length of conductor.
- Cut conductor section approx. 500 mm (± 20") longer as required.
- Insert filler rod FU 10 into conductor section, bevelled side of filler rod must be next to copper profile.
- Turn handle on curve tool to lift upper roller. Insert conductor section with filler rod into the correct groove of lower rollers.
- Slightly increase pressure with upper roller and push conductor back and forth.
- To avoid kinks, start each back-and-forth movement of the conductor an inch closer to the center of the curve.
- Repeat this procedure until the radius is obtained.
- Cut the conductor to the required length and prepare each end as shown under instructions 5.1.
- On curves with radii smaller than 700 mm a straight section of approx. 100 mm (4") on each end is required to assure a good splice (fig. 8).
- Check conductor slot width (5-5.5 mm) with installation tool MG-SW 10 and use test collector.

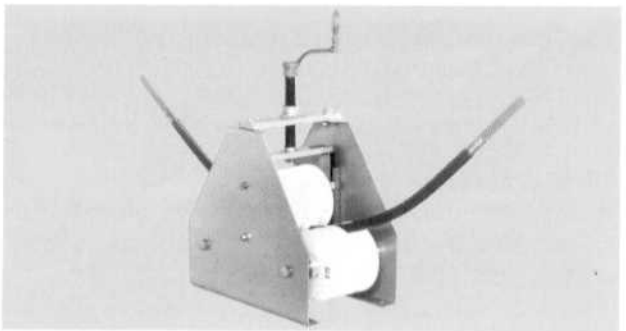


Photo 16: Curve tool BVU 10/15

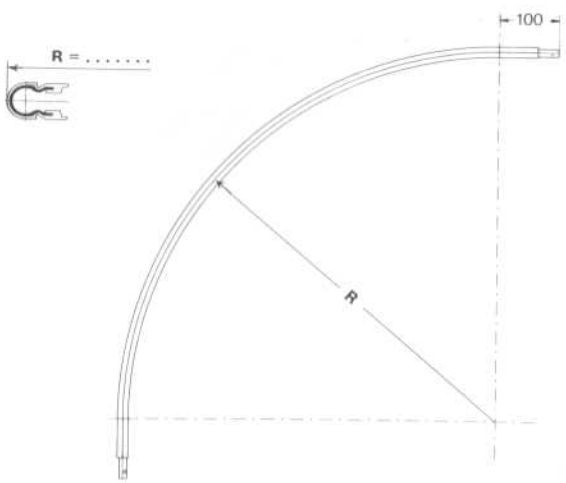



Fig. 8

## 12. Collectors

KDS collectors can be used for travel in both directions. If there is travel in one direction only, install respective collectors in dragging position (Photo 17).

(For installations requiring CSA approval use CSA approved SO cable No. 12 AWG and CSA approved connectors and crimping tool when making collector connections – CSA File No. LR 61839.)

### 12.1 Collector brackets

Collector brackets must be installed exactly parallel and at right angle to the conductor bars. Installation height from bracket to contact surface of the conductor is shown in the following table:

| Collector type | Bolt holes ∅ | Working height of collector |
|---|---|---|
| KDS 2/40-1-14 thru 12-14 | 2 slotted holes 7 x 15 mm | 98 mm |
| KSTF 2/40-2 thru 10 | 2 x for M 6 | 85 mm |
| KST 2/40 | phase 5.5 mm ground 6.5 mm | 80 mm |

Holes for single collector installation must be on 14 mm centers if standard compact hangers are used.

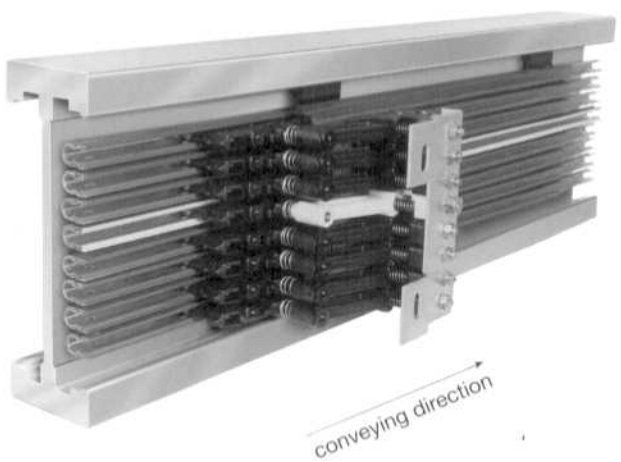



Photo 17

## 13. Installation inspection

**After installation has been completed inspect all components for correct fit, distance, line-up etc. Make trial runs and pay special attention to collector tracking.**

## 14. Commisioning and final check-up

Make test runs; start with low speed and inspect all components for proper function. Check positive contact between pick up shoes and conductors – no vibration of collectors and no sparking. In case of sparking clean conductor contact surface.

All transfer applications require special attention for proper passing over and re-tracking of collectors.

## 15. Maintenance instructions

Vahle unipole insulated conductor rail systems require a minimum of maintenance.

1. Check-up of conductor rails:
   Visual inspection in 4 weeks intervals. Control conductor expansion and look for burned spots.
   Remove carbon dust deposits especially in transfer guide and isolating assembly areas.
   Re-check the max. vertical and horizontal offset of 3 mm at switches, drop sections etc. Permissible max. gap between opposite transfer guides is 6 mm.
2. Check-up of current collectors:
   (in 2 months intervals)

a) Mechanical control:
   Flexiblility of links, bearings and support stems; check for mechanical wear and damages.

b) Electrical control:
   Brush wear test, tight fit of all contact screws and cable terminals.

c) Control of contact pressure:
   Use a spring-scale to pull the collectors out of the conductor bar. The contact pressure must be approx. 3.5 N per brush.

---

**Hints for the Installation Procedure:**

Proper and careful treatment of all materials, especially the non-metallic parts, keeping everything clean etc. is important. Make sure that joints and all other connecting points are clean of any residue. Tighten all hardware, using lockwashers etc. carefully. Take care of proper alignment between conductor rails and runway.

Install conductor rails in accordance to appertaining layout plans. Make sure that position of expansion joints and locating clamps is exactly per drawing and/or catalogue instructions.

---

**Safety Regulations for work with electrical equipment:**

1. Disconnect mains
2. Prevent reconnection
3. Test for absence of harmful voltages
4. Ground and short circuit
5. Cover or close off nearby live parts

To energize, apply in reverse order.