

Hevi-Bar II Manual Conductor Bar Systems



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SECTION 1 - SAFETY

Safety Information Responsibility

All owner, operator, and maintenance personnel must read and understand all manuals associated with this product before installation, operation, or maintenance.

The manual provides information on the recommended installation, operation, and maintenance of this product. Failure to read and follow the information provided could cause harm to yourself or others and/or cause product damage. No one should install, operate, or attempt maintenance of this product prior to familiarizing themselves with the information in this manual.

Safety Messages

The following safety messages are used in this manual to alert you to specific and important safety related information.

CAUTION

- CAUTION indicates unsafe actions or situations that have the potential to cause injury, and/or minor equipment or property damage.

DANGER

- DANGER indicates hazards that have the potential to cause severe personal injury or death.

WARNING

- WARNING indicates unsafe actions or situations that have the potential to cause severe injury, death, and/or major equipment or property damage.

NOTE

- NOTE is used to alert you to installation, operation, programming, or maintenance information that is important, but not hazard related.

SECTION 2 - OVERVIEW

Hevi-Bar II Familiarization

All personnel working on the conductor system should be familiar with this manual and regional, local, and install site health and safety standards, the guide way, the components, and the component location on the guide way.

To avoid problems during installation, the installer's personnel must become familiar with the notes on the component drawings. The drawings serve to identify the components and include notes on installation with torque values for fasteners. In the event of a conflict or question over installation procedure between the manual and the drawings, the drawing shall take precedence.

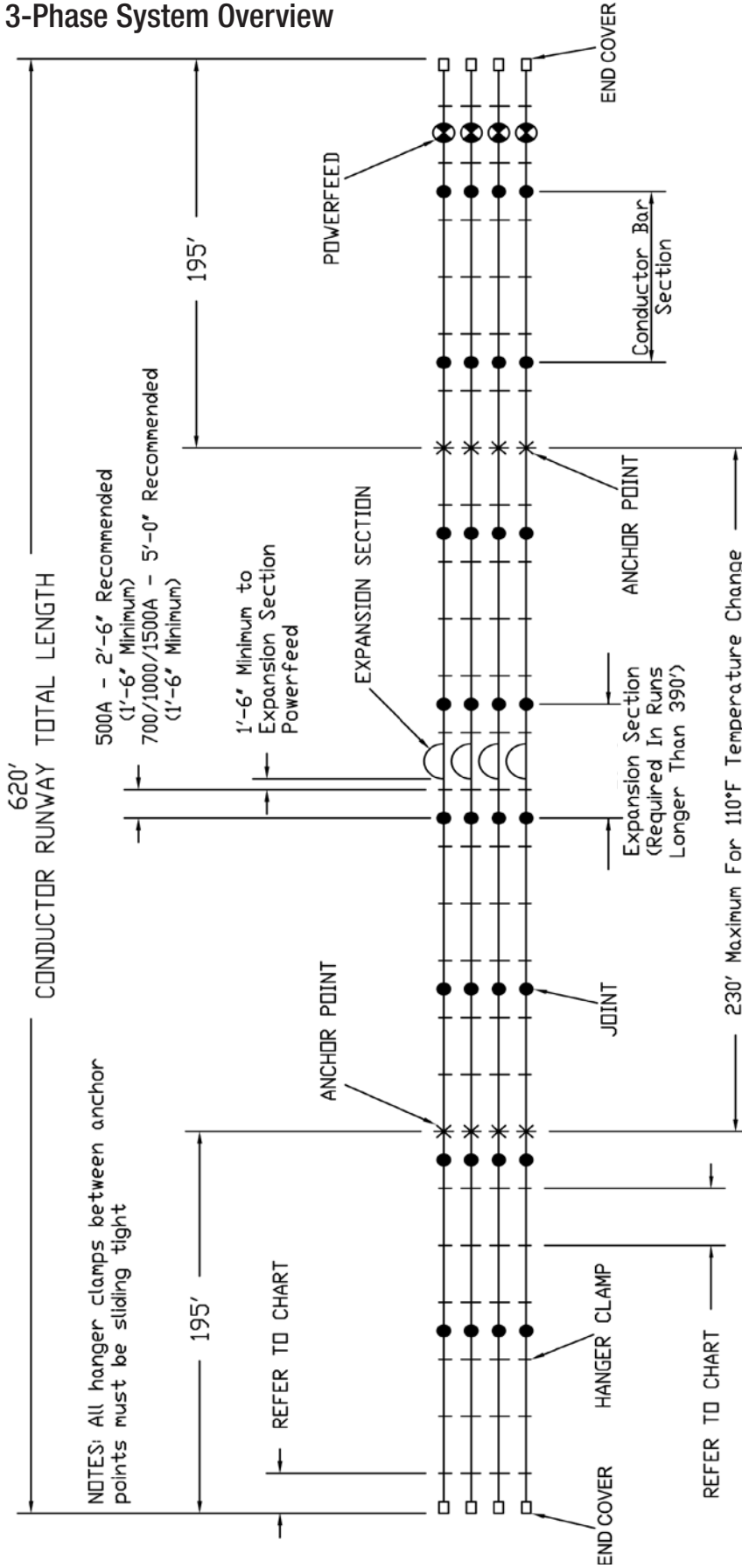
Due to the nature of this product as an electric conductor, all connections are critical. Mating surfaces must be cleaned of dirt and debris and aluminum oxide must be removed. Aluminum when exposed to air, builds up an oxide on the surface. This oxide is high in resistance. If the oxide is not removed prior to assembling the components, such as a splice, the current flow through the conductor system will be inhibited. It is critical that the resistance remain low for proper system performance. To remove the oxide, a wire brush must be used to clean all mating aluminum surfaces. Immediately after the oxide is removed, Aluma-Shield or No-Lox oxide inhibiting grease must be applied to the surface and then the components bolted together. The oxide inhibiting grease prevents oxide buildup and provides low-resistant connection.

Hevi-Bar II can be used indoor or outdoor with insulated hangers. The operating temperature range is -40°F to +250°F (up to +400°F with high-heat covers on 700A and 1000A Conductors Only).

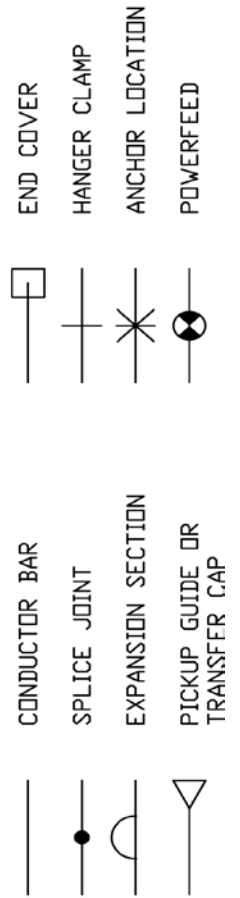
SECTION 2 - OVERVIEW

Typical 3-Phase System Overview

EXAMPLE OF 4 CONDUCTOR RUNWAY Hevi-Bar II (3 PHASE + 1 GROUND)



LEGEND:



HANGER SPACING CHART

| SYSTEM | FIRST HANGER | MAX.HANGER SPACING |
|----------|--------------|--------------------|
| 500 AMP | 2'-6" | 5'-0" |
| 700 AMP | 3'-9" | 7'-6" |
| 1000 AMP | 5'-0" | 10'-0" |
| 1500 AMP | 5'-0" | 10'-0" |

SECTION 2 - OVERVIEW

Environmental Considerations

- Standard Cover (PVC) is suitable up to 160°F.
- Medium Heat Cover (Polycarbonate) is suitable up to 250°F.
- High Heat Cover (Glass Filled Polyester) is suitable up to 400°F.

The following acidic or corrosive environments require the use of stainless steel hangers:

- Hydrochloric Acid
- Hydrofluoric Acid
- Sodium Hydrochloride
- Ammonium Chloride
- Chlorine Bleach
- Chloride Ions
- Fluoride Ions

Installation Tools

- Man lift or platform lift for access to the installation location (if required)
- A power drill, with drill bits ranging from 1/4" to 3/4", depending on system
- A hammer, to tap in anchor pins
- Two torque wrenches: one for ground use and one for runway level use. 7/16" to 3/4" sockets depending on system
- Two wire brushes, ground, and runway level
- Linoleum knife
- A measuring tape
- Scotch Brite Pads (or equivalent) to clean mating surfaces of bar
- Open end/box end combination 3/8", 7/16", and 1/2" wrenches

SECTION 2 - GENERAL ASSEMBLY INSTRUCTIONS



WARNING

- Always lock out/tag out all electrical power before starting work.

Installation Overview

This manual provides detailed instructions in the general order of system installation.

System installation consists of 4 phases:

1. Identifying and Organizing the Materials
2. Installation of Brackets Along the Runway
3. Pre-Install Assemblies on the Ground
4. Installation of Hangers and Conductors and Final Assembly Along the Runway

Identifying and Organizing the Materials

Check the pack list against the items received. Parts are labeled for your convenience. Review your specific installation layout drawing (if provided) or the typical layout diagram provided in this booklet to become familiar with the component location on the system. Note where the anchors, expansions, power feeds, and other assemblies will be located along the runway. Read through these instructions before starting work.

NOTE

- Make sure to check for smaller components that may be located inside the false bottom of the package.
- Do not remove shipping supports from expansion sections or power interrupting sections until they have been installed on the runway.

Installation of Brackets Along the Runway

Install brackets as shown in **Section 3 - Support Brackets**. Keep them as level and evenly spaced as possible. You may install the hangers on the brackets before or after they are mounted along the runway.

Assemble as much as possible on the ground. It's faster, easier, safer, and more convenient should you drop something.

1. Install end caps on the end conductors, keeping them separated from the main runway conductors.
2. Install isolation splices (if included) on the ends of the conductors in accordance with the installation layout drawing and the instructions found in the booklet.
3. Install end covers (transfer caps) on the conductor ends (if included) per this booklet.

Installation of Hangers and Conductors and Final Assembly Along the Runway

Final installation along the runway will most likely be accomplished from a lift or work platform.



WARNING

- Always lock out/tag out all electrical power before starting work.

1. Install the hangers, per this booklet.
2. Roll adjacent conductors into the hangers as shown in **Section 6 - Conductor Bars**. Follow the steps for the specific hanger that is being used, either snap in or cross bolt.
Conductix-Wampfler recommends the first accessible conductor being the ground conductor (if applicable).
3. Move down the runway, install the next inboard conductor and join it to the corresponding conductor installed in step 2.
4. Install the splice cover. Keep the splice assemblies at least 18.0" from the hanger brackets to allow for conductor movement from expansion. Repeat for the remaining phases and ground conductors.
5. When you get to where the expansion assemblies are to be installed, refer to the instructions found in **Section 8 - Expansion Section Kits**. Be sure to divide the total expansion gap distance (from chart) between the two air gap locations in the expansion assembly. (If the total gap setting = 1.85", each air gap will be .92").
6. Ensure the expansion assembly body is at least 18" from the nearest bracket.

8. If a conductor must be cut to a specific length, ensure that the cut end is square ± 1 degree and properly de-burred.
 - The conductor cover is always shorter than bar length. See **Figure 12-1**.
9. When you run the feed cable to the power feed assembly, ensure the cables have sufficient free length and are flexible enough to enable movement of the conductor due to expansion. Locating the power feed as close as possible to the anchors minimizes this concern. Do not support the weight of the feed cables with the conductors.
10. Install power feeds on conductor bars per layout and the instructions in **Section 9 - Power Feed Assembly Kits**.

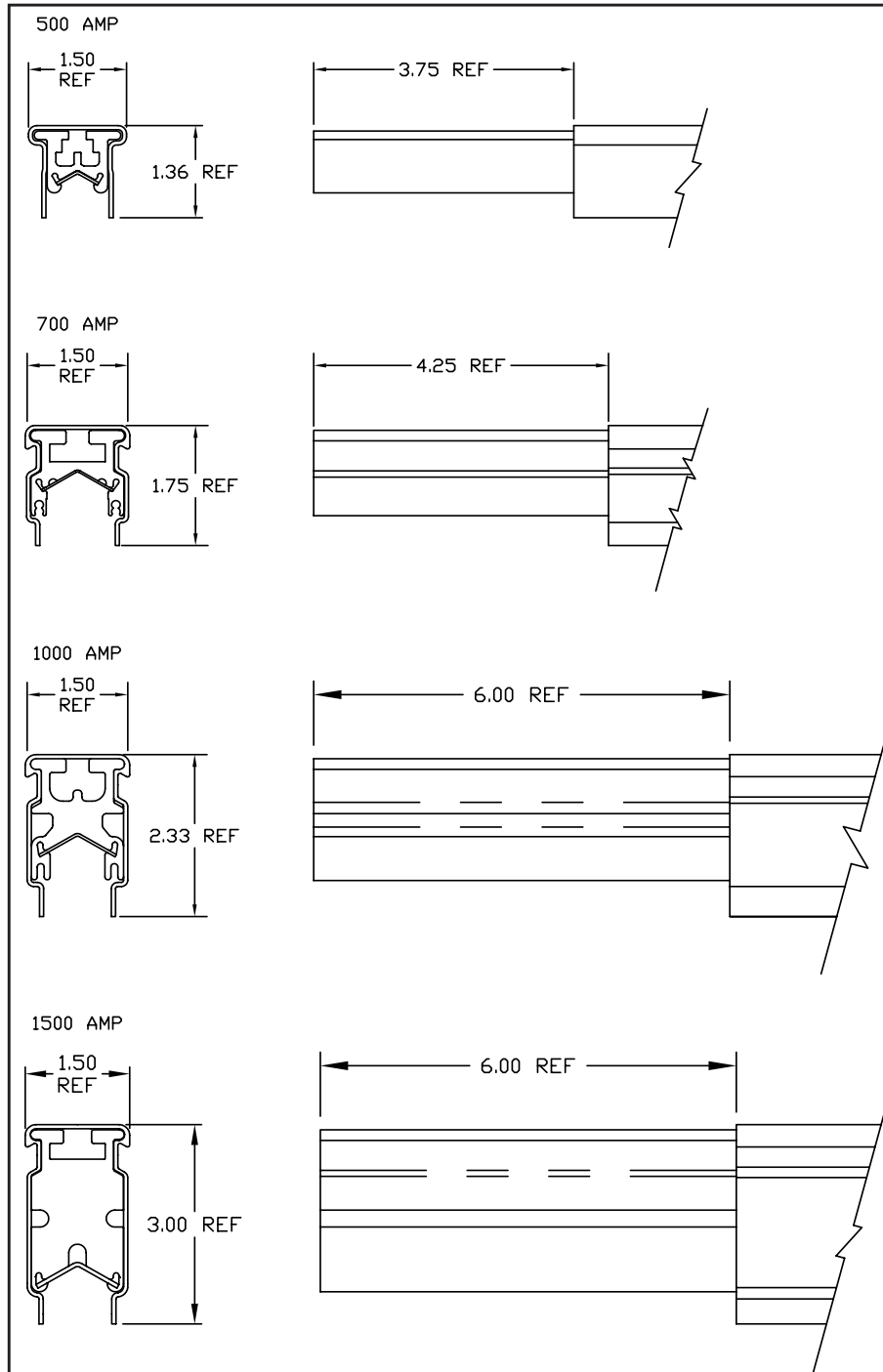


Figure 12-1 Cover Cutback Lengths

SECTION 3 - SUPPORT BRACKETS

Locations

Support brackets may be web, flange, brace web, or lateral. A drawing of each bracket can be seen in **Figure 13-1 to Figure 13-4**. The brackets are located at a maximum distance of 5 feet on a 500A system, 7.5 feet on a 700A system, and 10.0 feet on a 1000A-1500A system.

Tools Needed

- Drive torque wrench with standard sockets
- Welder (optional)

Support Bracket Installation

For ease of installation pre-install hangers to brackets on the ground following the steps described in **Section 4 - Hanger Clamps**.

When mounting web brackets, take special care in aligning the brackets at precisely the same height as to assure level travel of the system.

Web brackets may be mounted by bolting the bracket to the support structure or by welding the bracket in place.

Bolting the Bracket in Place

1. Drill 2 (two) 0.531" holes that match the mounting pattern of the web bracket being used.
2. Use 1/2" Grade 5 or higher hardware to mount the web bracket and I-beam hole with the bolt head on the web bracket side.
3. Place 1/2" bolt with washer on through the web bracket and I-beam hole with the bolt head on the web bracket side.
4. Place a 1/2" flat washer, lock-washer, and then nut on the bolt and tighten to 40 ft-lbs. (52.8 N-m).
5. Repeat for all mounting holes on web bracket.

Welding the Bracket in Place

1. To weld the web bracket to the support structure simply position the web bracket and tack weld to the beam.
2. After ensuring that the bracket is mounted at the correct height and level, proceed to fillet weld the bracket to the support structure.

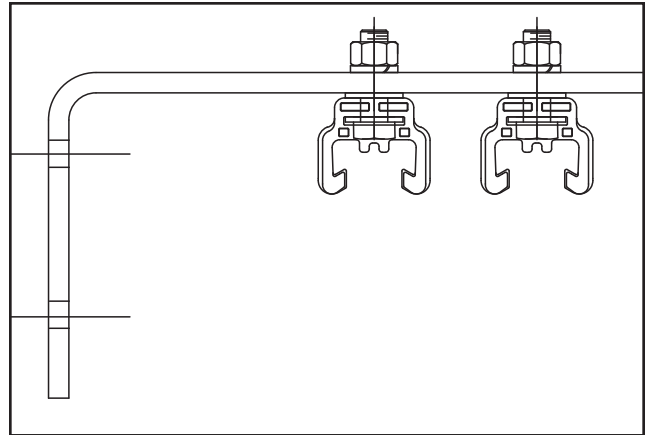


Figure 13-1 Web Support Brackets



Figure 13-2 Flange Support Brackets

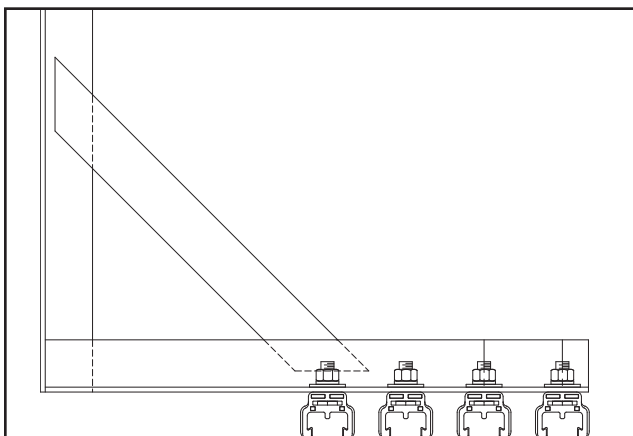


Figure 13-4 Braced Web Support Brackets

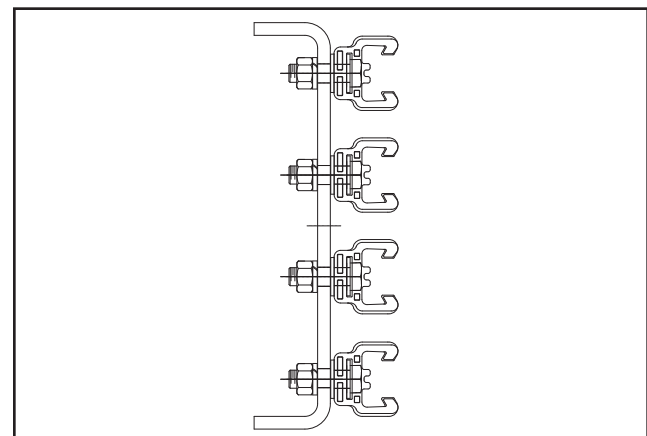


Figure 13-3 Lateral Support Brackets

SECTION 4 - HANGER CLAMPS

Locations

Hanger clamps are located at a maximum of 5 feet for 500A conductor bar, 7.5 feet for 700A conductor bar, and 10 feet for 1000 and 1500A conductor bar.

Tools Needed

- Drive torque wrench with standard sockets
- Welder (when mounting hanger directly to structure or when unable to use fasteners)

Hanger Clamp Kits Contents

- Hanger clamp body, bolts, washers, and lock washers. A reference drawing for both cross-bolt and snap-in hanger clamps can be seen in **Figure 14-1**.

Hanger Clamp Installation

Hanger clamps are most easily installed on brackets while on the ground, before the brackets are mounted to the runway.

1. Set the 1/2" hex-bolt head into the hole inside the top of the hanger clamp.
2. Place the bolt through the mounting hole on the bracket.
3. Attach a flat washer, lock washer, and nut and then torque to 40 ft-lb.
4. Weld or bolt brackets into place on the runway after checking to make sure that no splices will occur closer than 18 inches to a support bracket.
5. For systems using hanger clamps with cross bolts, tighten the nuts on the hanger clamp until .02 to .05 inch clearance remains between the hanger clamp and the conductor bar.

NOTE

- When using cross-bolt hangers they should not be tightened all the way. Doing so will prevent movement of the bar during thermal expansion and contraction causing the conductors to bind/snake, possibly causing damage to the system.

A drawing is shown below of the proper installation of each type of hanger clamp, snap-in or cross bolt, that is offered (conductor bar is shown only as a reference).

The distance from the bottom of the mounting surface to the contact surface of the bar is shown in **Table 14-1**.

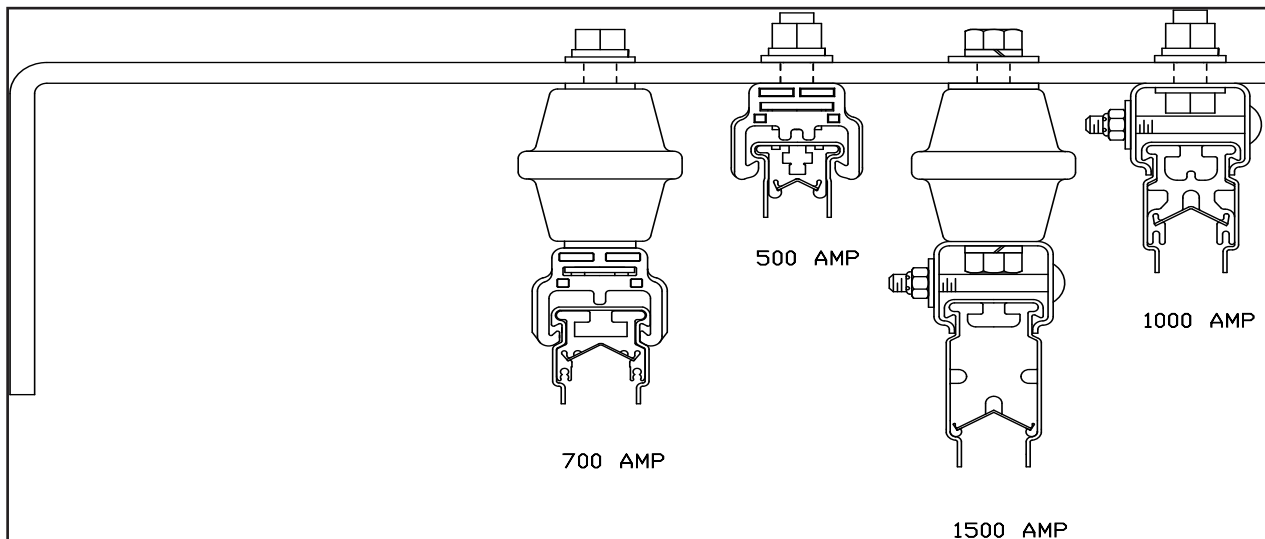


Figure 14-1 Cross-Bolt and Snap-In Hanger Clamps

| System | Distance to Contact Surface | With Insulator |
|----------|-----------------------------|----------------|
| 500 Amp | 1.63" | 4.50" |
| 700 Amp | 1.75" | 4.63" |
| 1000 Amp | 2.25" | 5.13" |
| 1500 Amp | 3.13" | 6.00" |

Table 14-1 Distance From Bottom of Mounting Surface Bar

SECTION 5 - ANCHOR CLAMPS

Purpose and Function

Anchor clamps control the expansion movement of the conductors. They fix or anchor the conductor to brackets at specified points along the runway.

WARNING

- Failure to properly install and locate the anchors could result in system malfunction and/or damage to the system components.

Locations

The first anchor point is nominally placed no more than 195 feet from the starting end, and succeeding anchor points will be made no more than 230 feet (distances will vary depending upon total system length and number of expansion zones). These values are based on 110°F maximum temperature change. For a greater maximum temperature change please consult the factory.

Tools Needed

- A power drill with a 0.247" or machinist "D" size drill bit
- A hammer
- RTV silicone
- 1/4" pin punch

Optional Tools (Not Required)

- For 500A bar (for use with snap-in-hanger clamps only) use drill fixture, PN XA-29855.
- For 700/1000/1500A bar (for use with snap-in hanger clamps only) use drill fixture, PN XA-30033.

Anchor Pin Installation

1. Mount anchor clamp to brackets using the same steps for mounting hanger clamps found in this manual.
2. Drill two (2) 0.247" (size "D") holes through the conductor rail and cover. Drill these holes as straight as possible, parallel to the top of the rail. See **Figure 15-1**.
3. Use anchor pin punch to insert the anchor pins through the conductor rail.
4. If pins are not a forced fit, an RTV type compound must be used to insure pin is properly secure and cannot fall out.

Anchor Clamp Installation

1. For systems using hanger clamps with cross bolts, torque the nuts on the hanger clamp to 60 in.-lbs at anchor locations only. Anchor pins are not required.

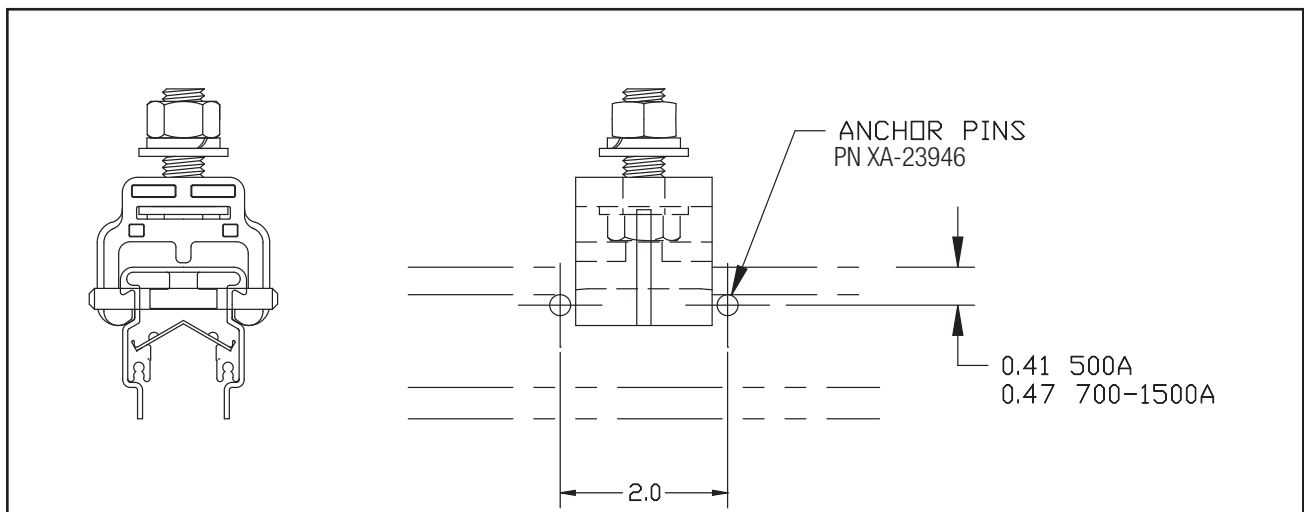


Figure 15-1 500A-1500A Pin Placement

SECTION 6 - CONDUCTOR BARS

Locations

Conductor bar spans the length of the entire system except where there are gaps in the span for the power interrupt sections and expansions.

Tools Needed

- Drive torque wrench with standard sockets
- Scotch Brite Pads (or equivalent) to clean mating surfaces of bars

Conductor Bar Kits Contents

- Conductor bar with insulating cover

Conductor Installation

Conductor bar is delivered from the factory with cover pre-installed. For information on installing cover over power feed connections, Power Interrupt Sections, and splice assemblies, please see the respective sections in this manual.

After brackets with hanger clamps are in place, installation of the bar may begin. Start at one end of the runway and work toward the other end.

1. Clean the contact surfaces with a Scotch Brite Pad or fine wire brush. See **Table 16-1** for distance.

NOTE

- If conductor has DURA-COAT, the surface must have all the coating removed before joint compound can be applied. Apply electrical joint compound (XA-15629) on cleaned contact surfaces.

| System | Distance Application for End of Bar |
|----------|-------------------------------------|
| 500 Amp | 3.00" |
| 700 Amp | 4.00" |
| 1000 Amp | 5.25" |
| 1500 Amp | 5.25" |

Table 16-1 Distance Application for End of Bar

2. Slide 3 bolt heads into the slot on the top of the bar and put the splice plate over the bolts.
3. Attach washer and nut, and tighten. DO NOT OVER TORQUE. One half of the splice plate, exposing three bolt holes, should be extended off the end of the conductor bar.
4. With three people at runway level (insure safety of the installers and proper handling of the conductor), raise the first bar up to position. It is best to hoist 30ft. lengths with three ropes.
5. Install the first section in the clamps nearest the web of the beam. One person should be handling the bar at each hanger clamp location.
6. Insert one lip of the covered bar into the clamp. Firmly rotate the bar until it snaps firmly into the other lip clamp. See **Figure 16-1**.

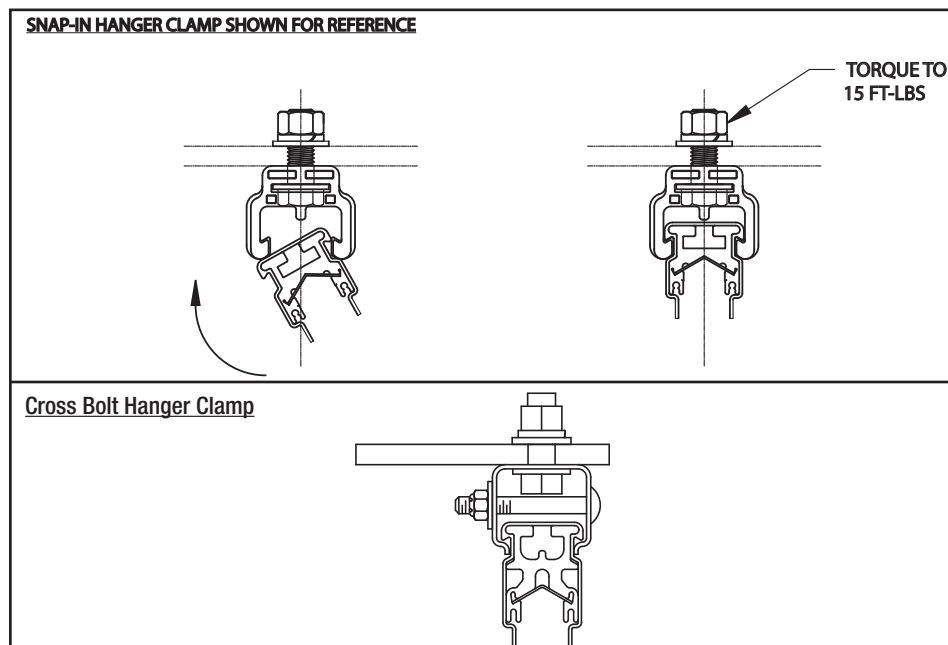


Figure 16-1 Cross Bolt Hanger Clamp Installation

SECTION 6 - CONDUCTOR BAR

7. For systems using hanger clamps with cross bolts, tighten the nuts on the hanger clamp until .02 to .05 inch clearance remains between the hanger clamp and the conductor bar. Do not over-tighten cross bolts on hangers.
8. Continue the same procedure for each phase of adjacent conductor bars.
9. The 30 foot length of bar is now suspended in 3 clamps. It is recommended that you snug each bar to 1 clamp with duct tape or a nylon tie TEMPORARILY, so that as you splice on successive bars down the runway you will not jar the first bars from their proper position. Hang a brightly colored streamer from the tie so that you will be reminded to come back and remove it as soon as you have installed the first set of anchors.
10. The bar and clamps have now been "seated". Tighten the nut on the top of each clamp to 15 ft-lbs. torque (snap-in hanger clamps only). DO NOT OVER TORQUE.
11. Check clamps to see that they have not rotated and that they are still square with the bar.

SECTION 7 - SPLICE ASSEMBLY KITS

Locations

Splice assemblies are used to join 2 pieces of bar together. They provide an electrical and mechanical connection.

Tools Needed

- Drive torque wrench with standard sockets
- Cable tie gun to tighten and cut cable ties
- Scotch Brite Pads (or equivalent) to clean mating surfaces of bars
- Electrical joint compound

Splice Kits Contents

- Aluminum splice plate, bolts, washers, nuts, cover, end caps and EJC (electrical joint compound).
- An example of a completed splice assembly is shown below in **Figure 18-1**.

Installation

1. You are now ready to install the second set of bars and make the first splice connection. If assembly has end caps slide end caps onto conductor bar far enough away to leave room to work. You may purchase additional splice kits for use during installation in case of dropping or misplacing any of the parts and pieces
2. Before splices can be assembled onto the conductor bar the mating surfaces of the conductor and splice need to be cleaned with Scotch Brite Pad (or equivalent).

NOTE

- If conductor has DURA-COAT, the surface must have all the coating removed before joint compound can be applied.

3. Apply joint compound to the top of the conductor bar end for approximately half of the splice length, and to the bottom of the splice plate. Apply joint compound to top surface of the second bar where splice plate will attach.
4. Slide 3 bolts into the slot in second bar, ease the bar downward slightly and slide the bar up to the next bar until bars butt together.
5. Maneuver the 3 bolts through the holes in the splice plate, attach washer and nut, and tighten to 6 ft-lbs. torque for 500 amp bar, 11 ft-lbs. for 700A-1500A. DO NOT OVER TORQUE.
6. Slide end plugs (if assembly has end plugs) onto conductor bars. Place overlap cover into position, centered over splice plate. Snap end plugs into the holes in the overlap cover. Ensure end plugs are seated correctly..

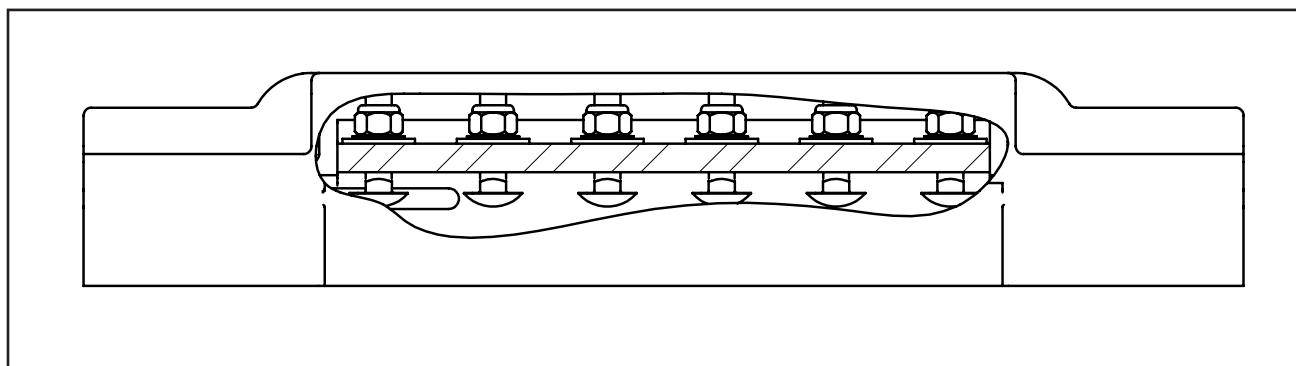


Figure 18-1 Completed Splice Assembly

SECTION 8 - EXPANSION SECTION KITS

Locations

Expansion assemblies can be placed in the span of any standard piece of bar. It is required that an expansion assembly be used if the span of the system exceeds 390 feet.

Tools Needed

- Drive torque wrench with standard sockets
- Scotch Brite Pads (or equivalent) to clean mating surfaces of bars
- Electrical joint compound

Expansion Assembly Kits Contents

- Conductor bar, conductor bar cover, slider assembly, overlap cover, and end plugs. A drawing of a 500A expansion assembly can be seen below in **Figure 19-1**.

NOTE

- Do not remove all shipping hardware until ready to set the gap. The hardware will keep the expansion from getting damaged during shipment.

Installation

1. Clean all surfaces to be joined with Scotch Brite Pads and apply electrical joint compound (XA-15629) to all mating surfaces.
2. Use same procedures for joint compound and splice plates on expansion sections as with standard bar section.
3. Install expansion section into clamps using same procedures as with standard bar. Use extra care as to not twist this section.
4. When conductor run has reached the next anchor point, adjust expansion gap per settings shown below. The standard temperature range is 0° to 110°F. For standard and medium heat see **Table 20-1**. For high heat see **Table 20-2**.
5. After the gap has been set, anchor the conductor.

NOTE

- For other temperature ranges see installation drawings or consult factory for gap settings.

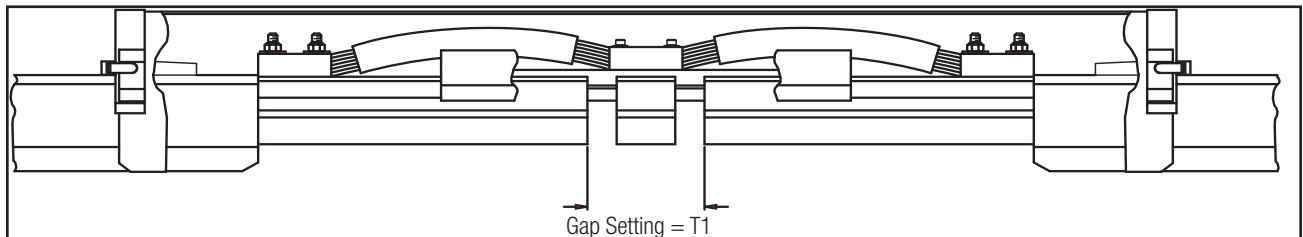


Figure 19-1

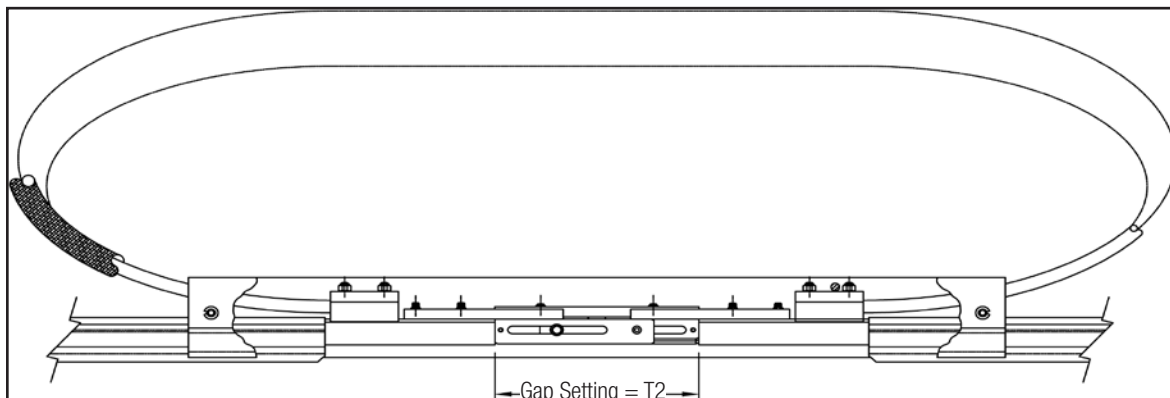


Figure 19-2

SECTION 8 - EXPANSION SECTION KITS

| Gap Setting Inches (mm) | Temperature Chart °F (°C) |
|----------------------------|------------------------------|
| | Chart 1 |
| 2.00 (50.8) | 120 (48.9) |
| 2.16 (54.9) | 115 (46.1) |
| 2.33 (59.2) | 110 (43.3) |
| 2.50 (63.5) | 105 (40.6) |
| 2.66 (67.6) | 100 (37.8) |
| 2.83 (71.9) | 95 (35.0) |
| 3.00 (76.2) | 90 (32.2) |
| 3.16 (80.3) | 85 (29.4) |
| 3.33 (84.6) | 80 (26.7) |
| 3.50 (88.9) | 75 (23.9) |
| 3.66 (93.0) | 70 (21.1) |
| 3.83 (97.3) | 65 (18.3) |
| 4.00 (101.6) | 60 (15.6) |
| 4.16 (105.7) | 55 (12.8) |
| 4.33 (110.0) | 50 (10.0) |
| 4.50 (114.3) | 45 (7.2) |
| 4.66 (118.4) | 40 (4.4) |
| 4.83 (122.7) | 35 (1.7) |
| 5.00 (127.0) | 30 (-1.1) |
| 5.16 (131.1) | 25 (-3.9) |
| 5.33 (135.4) | 20 (-6.7) |
| 5.50 (139.7) | 15 (-9.4) |
| 5.66 (143.8) | 10 (-12.2) |
| 5.83 (148.1) | 5 (-15.0) |
| 6.00 (152.4) | 0 (-17.8) |

Table 20-1 (T1) Standard and Medium Heat

| Rail Temp °F (°C) | Gap Settings (inches) with Anchors Located at Intervals of: | | | |
|----------------------|--|---------|---------|--------|
| | 230 ft. | 170 ft. | 140 ft. | 80 ft. |
| 300 (148) | ----- | ----- | ----- | 7.281 |
| 290 (143) | ----- | ----- | ----- | 7.406 |
| 280 (137) | ----- | ----- | ----- | 7.531 |
| 270 (132) | ----- | ----- | ----- | 7.656 |
| 260 (126) | ----- | ----- | ----- | 7.781 |
| 250 (121) | ----- | ----- | ----- | 7.906 |
| 240 (115) | ----- | ----- | ----- | 8.000 |
| 230 (110) | ----- | ----- | ----- | 8.125 |
| 220 (104) | ----- | ----- | ----- | 8.250 |
| 210 (98) | ----- | ----- | ----- | 8.375 |
| 200 (93) | ----- | ----- | ----- | 8.500 |
| 190 (87) | ----- | ----- | ----- | 8.625 |
| 180 (82) | ----- | ----- | 7.094 | 8.719 |
| 170 (76) | ----- | ----- | 7.313 | 8.844 |
| 160 (71) | ----- | ----- | 7.531 | 8.969 |
| 150 (65) | ----- | ----- | 7.750 | 9.094 |
| 140 (60) | ----- | 7.313 | 7.938 | 9.188 |
| 130 (54) | ----- | 7.594 | 8.156 | 9.313 |
| 120 (48) | ----- | 7.844 | 8.375 | 9.438 |
| 110 (43) | 7.094 | 8.094 | 5.594 | 9.563 |
| 100 (37) | 7.438 | 8.344 | 8.781 | 9.688 |
| 90 (32) | 7.781 | 8.594 | 9.000 | 9.813 |
| 80 (26) | 8.125 | 8.844 | 9.188 | 9.938 |
| 70 (21) | 8.469 | 9.094 | 9.406 | 10.031 |
| 60 (15) | 8.813 | 9.344 | 9.625 | 10.156 |
| 50 (10) | 9.156 | 9.625 | 9.844 | 10.281 |
| 40 (4) | 9.500 | 9.875 | 10.031 | 10.406 |
| 30 (-1) | 9.844 | 10.094 | 10.250 | 10.531 |
| 20 (-6) | 10.188 | 10.375 | 10.469 | 10.656 |
| 10 (-12) | 10.531 | 10.625 | 10.656 | 10.750 |
| 0 (-17) | 10.875 | 10.875 | 10.875 | 10.875 |
| -4 (-20) | 10.875 | 10.875 | 10.875 | 10.875 |

Table 20-2 (T2) High Heat

SECTION 9 - POWER FEED ASSEMBLY KITS

Locations

Power feed assemblies are typically installed in the center of a system, but can be placed anywhere along the system depending upon voltage drop, characteristics, and feed cable location. A minimum distance of 1-1/2 ft. to other components must be maintained.

Cable sizes range from 2/0 to 350 MCM for 500A and 2/0 to 500 MCM for 700A/1000A/1500A. Cable must be welding cable or as flexible as welding cable. Cable and lugs are to be supplied by customer.

Tools Needed

- Drive torque wrench with standard sockets
- Scotch Brite Pads (or equivalent) to clean mating surfaces of bars
- Electrical Joint Compound

Power Feed Kits Contents

- Power feed plate, bolts, washers, nuts, and insulating cover

NOTE

- Cable and lug are to be supplied by the customer.
- For maximum allowable cable diameter see **Table 21-1**.

500A Installation

1. If assembly has end plugs (refer to drawing supplied with power feed kits), slide end plugs onto conductor bar far enough away to leave room to work.
2. Cut top of cover to length (shown on installation instructions sent with power feed kit) where power feed is to be installed.
3. If conductor is DURA-COATED, coating must be removed prior to assembly of power feed plate.
4. Drill and deburr a 1/2" hole in the center of the slot in the top of the conductor (do not drill past slot).
5. Drop bolts head first into hole and slide into position.
6. If assembly has end plugs, cut grommet to accept feeder cable (1.25" max.), install in end plug, and insert power cable through grommet.
7. Clean mating surfaces (bar, power feed plate and lug) with wire brush or Scotch Brite Pads and apply electrical joint compound to cleaned surfaces.
8. Assemble power feed plate and cable on top of conductor using hardware provided. If hardware is stainless steel apply anti-seize to end of bolts before assembly of nuts. Torque to 6 ft-lbs.
9. Snap cover (centered) over power feed cable assembly, slide end plugs (if assembly has end plugs) into power feed cover.

NOTE

- An example of a 500A power feed assembled can be seen on the in **Figure 22-1**.

| Cover | Amperage | Max Cable Size | Part Number |
|-------------|----------|----------------|-------------|
| Standard | 500 | 350 MCM | XA-37674 |
| Standard | 700 | 500 MCM | XA-38117 |
| Standard | 1000 | 500 MCM | XA-38184 |
| Standard | 1500 | 500 MCM | XA-50227 |
| Medium Heat | 500 | 350 MCM | XA-32500 |
| Medium Heat | 700 | 500 MCM | XA-50067 |
| Medium Heat | 1000 | 500 MCM | XA-38184D |
| Medium Heat | 1500 | 500 MCM | XA-50227C |
| High Heat | 700 | 500 MCM | XA-24594 |
| High Heat | 1000 | 500 MCM | XA-23530 |

Table 21-1

SECTION 9 - POWER FEED ASSEMBLY KITS

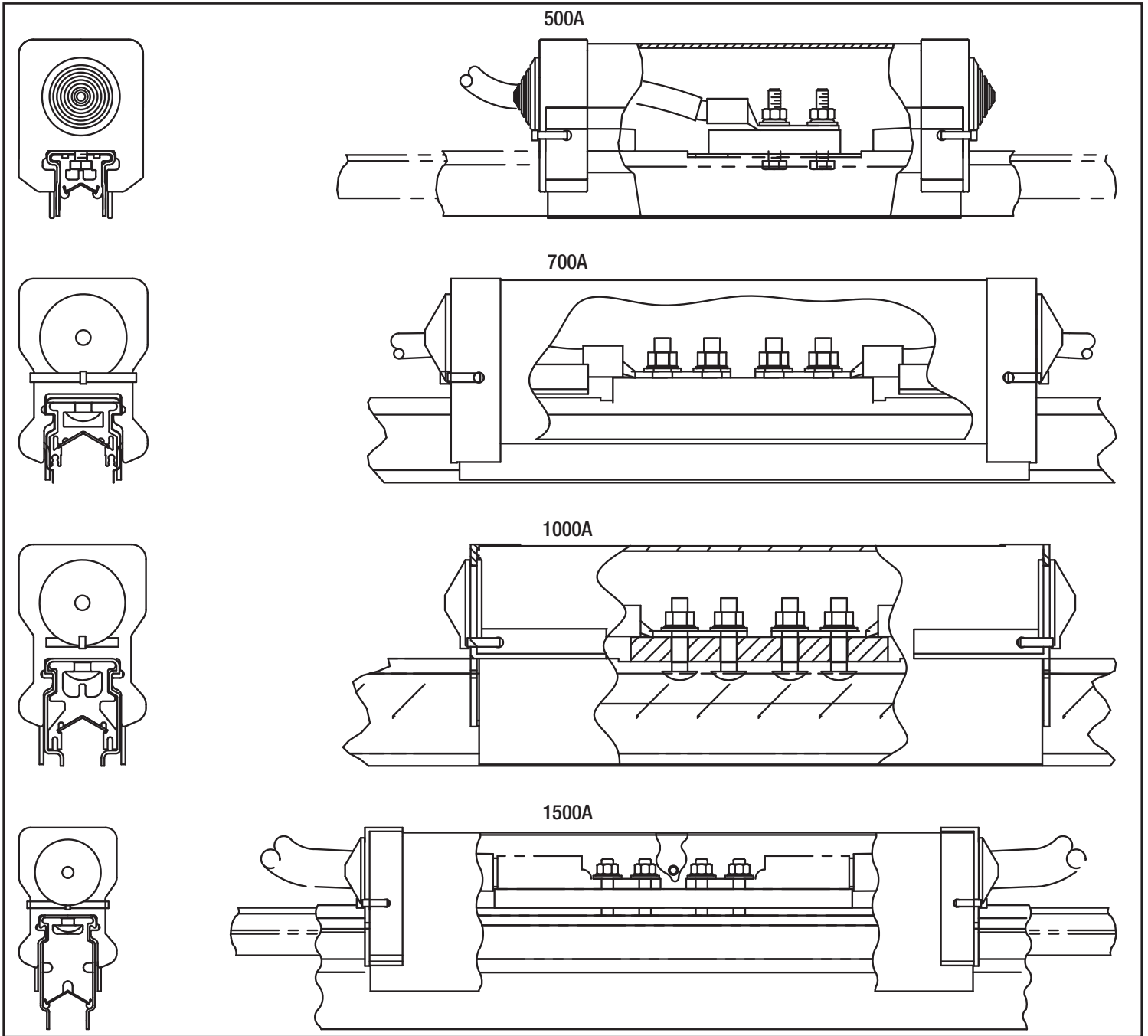


Figure 22-1 Power Feed Assemblies

SECTION 9 - POWER FEED ASSEMBLY KITS

700A/1000A/1500A Installation

1. If assembly has end plugs (refer to drawing supplied with power feed kit), slide end plugs onto conductor bar far enough away to leave room to work.
2. Cut top of cover to length (shown on installation instructions sent with power feed kit) where power feed is to be installed.
3. If conductor is DURA-COATED, coating must be removed prior to assembly of power feed plate.
4. Drill and deburr a 3/4" hole in the center of the slot in the top of the conductor (do not drill past slot).
5. Drop carriage bolts into hole head first and slide into position.
6. If assembly has end plugs, cut grommet to accept feed cable (1.25" max.), install in end plug, and insert power cable through grommet.
7. Clean mating surfaces (bar, power feed plate, and lug) with wire brush or Scotch Brite Pads and apply electrical joint compound to cleaned surfaces.
8. Assemble power feed plate and cable on the top of conductor using hardware provided. If hardware is stainless steel apply anti-seize to end of bolts before assembly of nuts. Torque to 10-11 ft-lbs.
9. Snap cover (centered) over power feed cable assembly, slide end plugs (if assembly has end plugs) into power feed cover.

SECTION 10 - POWER INTERRUPTING SECTION KITS

Locations

Power interrupting section kits are used so that a single power system may be broken into two separate power sections thus allowing one side to be shut off while the other is powered.

Tools Needed

- Drive torque wrench with standard sockets
- Scotch Brite Pads (or equivalent) to clean mating surfaces of bars
- Electrical joint compound

Power Interrupting Assembly Kits Contents

- Conductor bar, conductor bar cover, disconnect section, overlap cover, and end plugs.
- A detailed drawing of a power interrupt section is shown in **Figure 25-1**. The assembly displayed has a double 1.00" air gap setting for power interruption.

Installation

1. Clean all surfaces to be joined with Scotch Brite pads and apply electrical joint compound (XA-15629) to mating surfaces.
2. Use same procedures for joint compound and splice plates on power interrupting sections as with standard bar section.
3. Install power interrupt section into clamps using same procedures as with standard bar, but while using extra care as to not twist this section.

A detailed schematic can be seen in **Figure 26-1**.

NOTE

- The standard air gap for isolation is 1.0", it is recommended that a 2.0" air gap is used for outdoor and dusty / dirty environments.

SECTION 10 - POWER INTERRUPTING SECTION KITS

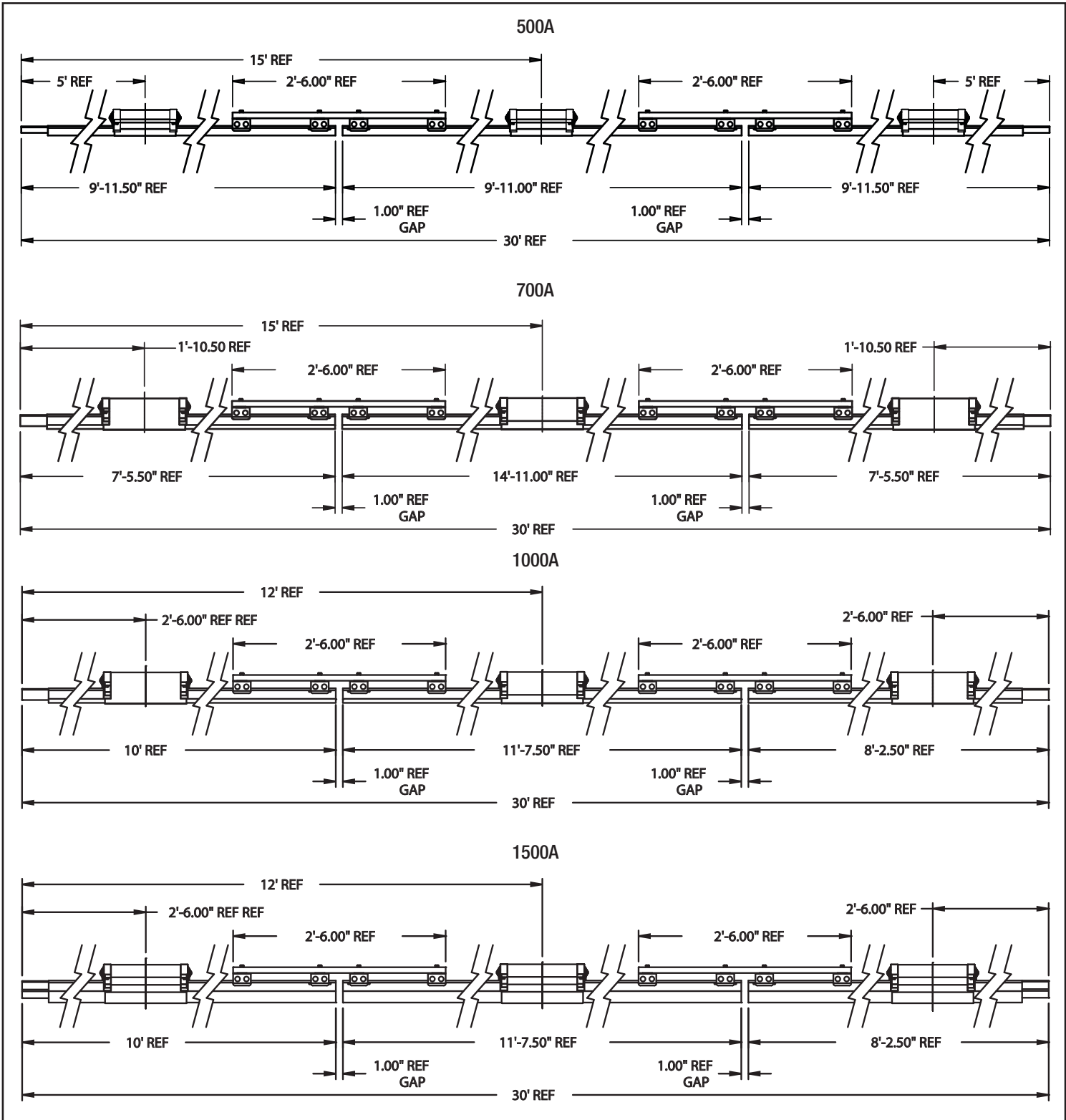


Figure 25-1 Power Interrupting Section Kits

SECTION 10 - POWER INTERRUPTING SECTION KITS

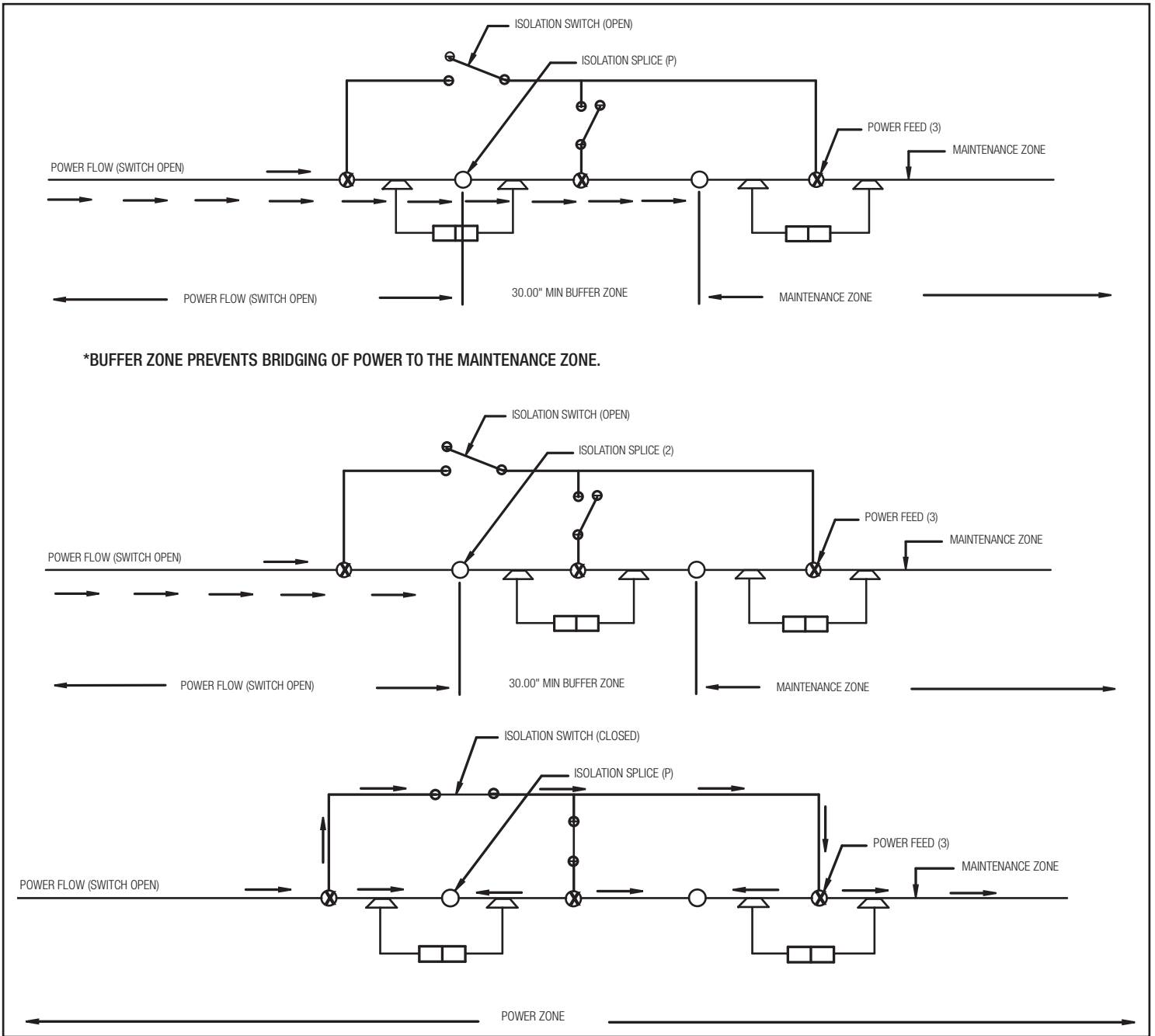


Figure 26-1 Power Interrupting Section Kits

SECTION 11 - STRONG BACK ASSEMBLIES

Locations

Strong back assemblies are used to protect and give extra support when needed for expansion gaps, isolation sections, and power interrupting sections. See **Figure 27-1**.

Tools Needed

- Drive torque wrench with standard sockets

Strong Back Assemblies Contents

- Hanger clamps, channel for required length, and mounting hardware

Installation

The strong back assembly is generally factory installed before shipment. The following must be checked prior to putting the system into use.

1. The top hanger mount must be checked for a max torque of 39 ft-lbs.
2. The cross bolts will be finger tight or max torque of 5 ft-lbs. depending on placement of strong back.

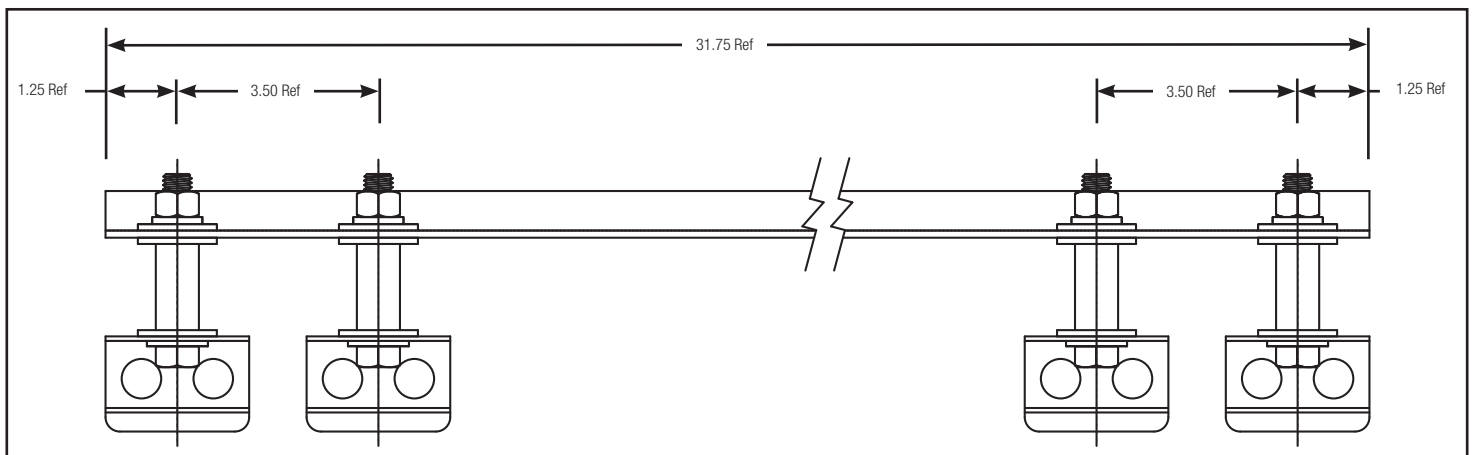


Figure 27-1 Strong Back Assemblies

SECTION 12 - COLLECTORS

Locations

Collectors run the length of the system traveling along the bar supplying power to the given machine. Collectors may be run single or tandem.

Tools Needed

- Drive torque wrench with standard 3/8" socket
- Open end/box end combination 3/8" wrench

Collector Kits Contents

- Collector assembly with all mounting hardware and pigtails

Installation

1. Mount the 1 inch square bar so that the center line is 6 inches from the contact surface of the bar. For 500A conductors, mount the 1 inch square bar so that the center line is 5.5 inches from the contact surface of the bar. For all other amperage conductors, mount the 1 inch square bar at 6 inches from the contact surface of the bar.
If there is any question to the mounting distance, please refer to the particular system layout drawing or consult the factory at (800) 521-4888.
2. Align the collectors on the square bar as shown in **Figure 31-1**. The typical phase-to-phase mounting distance between collectors is 3 inches. Please consult the specific layout drawing for exact values. Take special care as to align the collector arms so they run directly beneath the conductor bar. This will assure maximum shoe life and permit full articulation of the collector head.
3. Fasten the collector to the 1 inch square bar by tightening the mounting nuts according to **Table 28-1**. DO NOT OVER TORQUE.

NOTE

- For special collectors, refer to specific layout.
- For specific pigtail size see **Table 30-1**.

| Mounting Base Material | Torque Value |
|------------------------|--------------|
| Plastic | 8-10 Ft-Lbs |
| Aluminum | 18-20 Ft-Lbs |
| Stainless Steel | 18-20 Ft-Lbs |

Table 28-1

Leveling Spring Installation for Lateral Mount Collectors Overview

Install one collector at a time on the square mounting post and then install the leveling spring for that collector. If all collectors are installed before installing the springs, there is not enough space to insert the leveling springs.

Instructions are given looking down at the collector from above as viewed in **Figure 29-1**.

The body of the leveling spring is always installed on the top side of the collector so that it lifts the collector.

The angled end of the leveling spring is installed between the square mounting post and the mounting hardware and in the middle of the two collector bases.

The hook end of the spring will always wrap around the outside of the collector arms. The spring body should never be installed between the arms of the collectors.

Installation

1. Install the first collector on the square mounting post. Leaving mounting hardware slightly loose to ease installation of the leveling spring.
2. For the collector on the left, insert the angled end of the leveling spring on the bottom side of the square post in the space between the collector bases and the mounting hardware.
3. Wrap the hook end of the spring around the outside of the bottom collector arm and hook it to the inside of the arm.
4. For the collector on the right, insert the angled end of the leveling spring on the top side of the square post in the space between the collector bases and the mounting hardware.
5. Wrap the hook end of the spring around the outside of the top collector arm and hook it to the inside of the arm.
6. Tighten mounting hardware and torque to proper specifications.
7. For single collectors, the leveling spring installs exactly the same. The angled end of the spring is installed between the square mounting post and mounting hardware and in the middle of the collector base and back clamp.

NOTE

- See Figures on the following pages for reference.

SECTION 12 - COLLECTORS

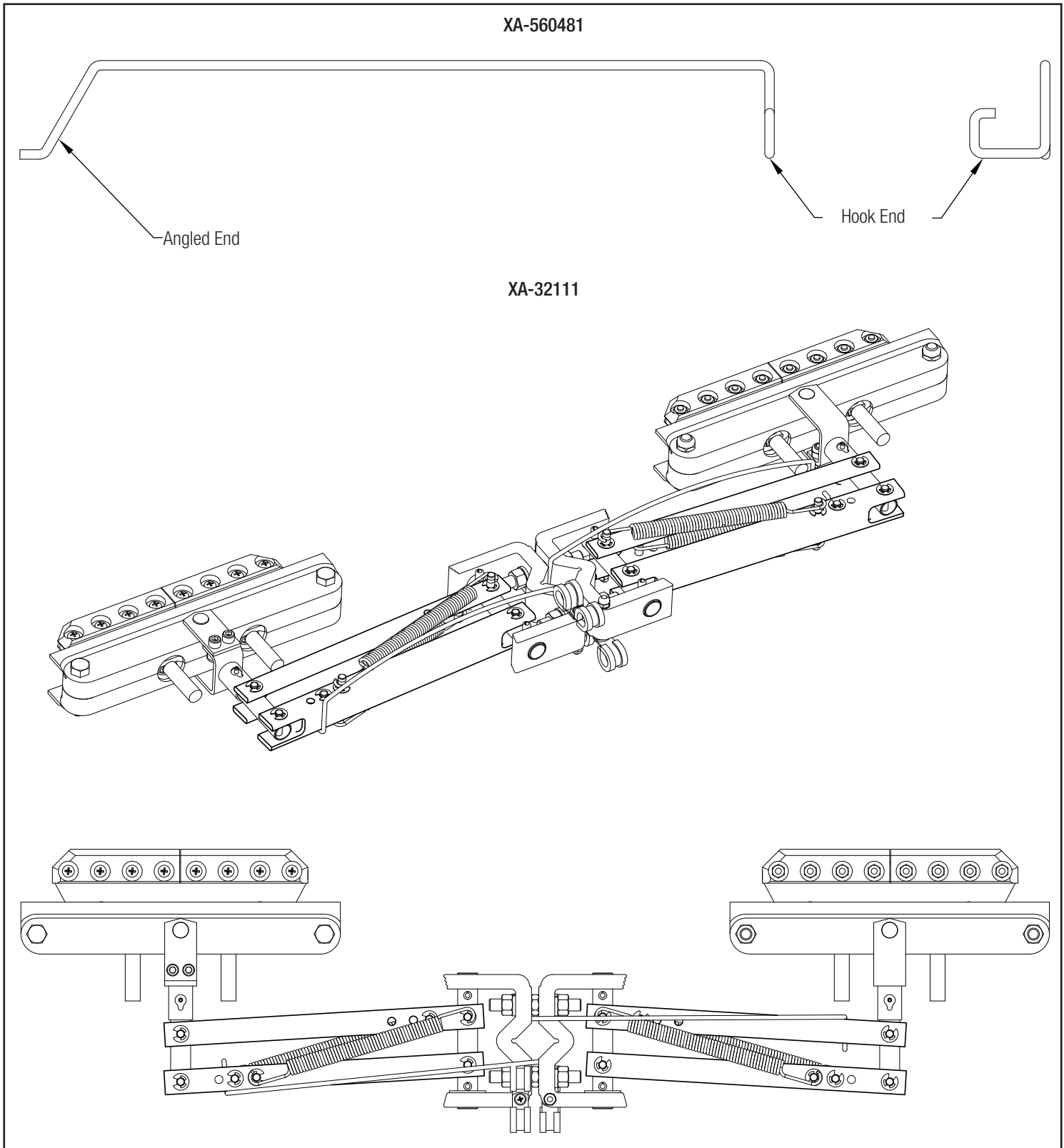


Figure 29-1

SECTION 12 - COLLECTORS

XA-31933

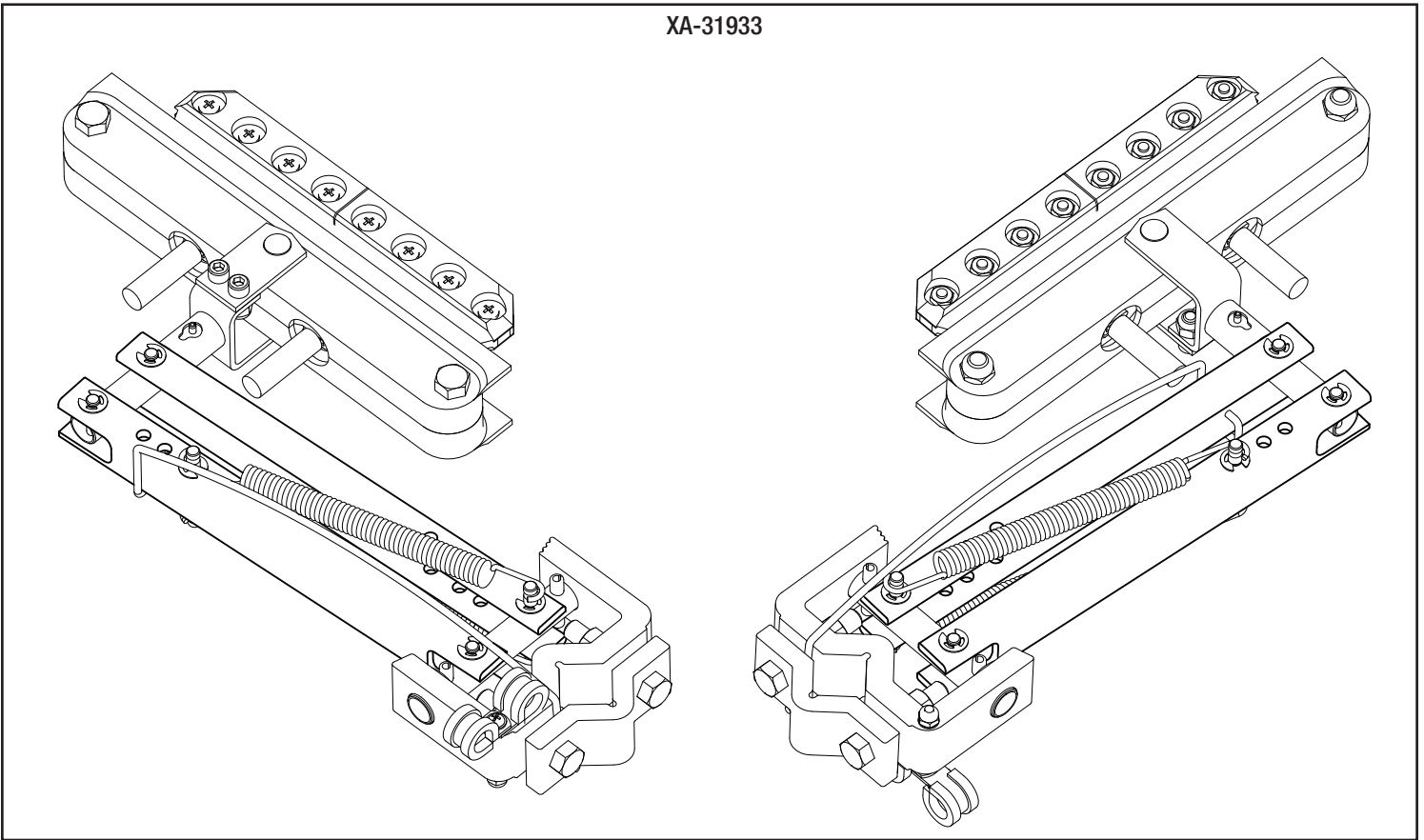


Figure 30-1

| Collector Part Number | Pigtail Part Number | Pigtail Gauge |
|-----------------------|---------------------|---------------|
| XA-24060 | XA-13696 | 2 AWG |
| XA-30388 | XA-28063 | 4 AWG |

Table 30-1

SECTION 12 - COLLECTORS

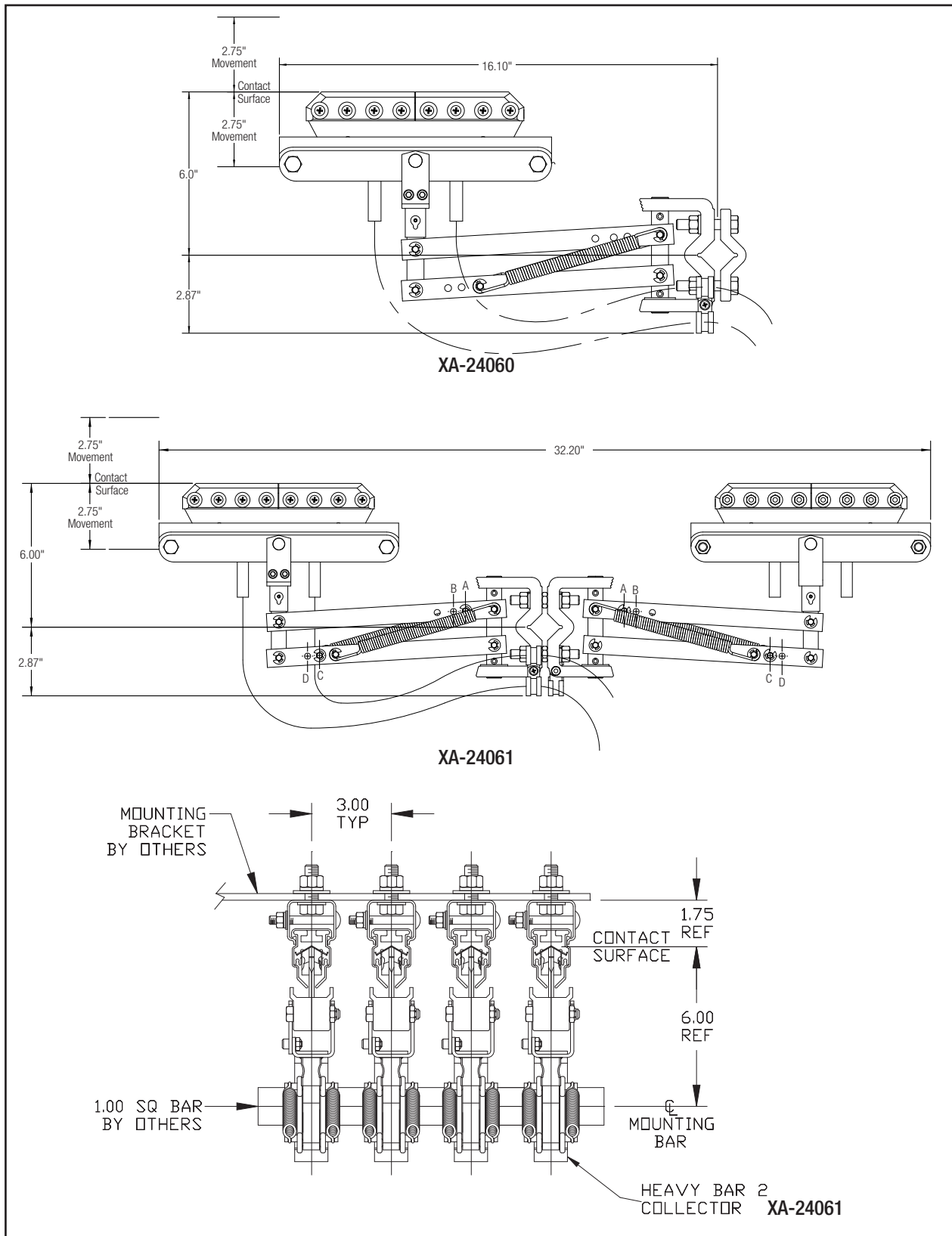


Figure 31-1

SECTION 13 - STANDARD HEAT END COVER KITS

500 Amp

Locations

End covers are used at runway ends to cover exposed conductor bar ends. The following covers are suitable up to medium heat applications up to 275°F (135°C).

Tools Needed

- 7/16" open end wrench
- Torque wrench with 7/16" socket
- Heat gun

End Cover Kits Contents

- Heat shrink tubing, bolt, and nut

Installation

1. With approximately 3.75" (95mm) bar exposed position 1/4" - 20UNC x 0.50" hex head bolt into top slot on bar approximately 3.13" (79mm) from end of bar.
2. Install 1/4" hex nut and tighten with a 7/16" open end wrench.
3. Torque nut with torque wrench to 4-5 ft-lbs.
4. Position heat shrink tubing over end of bar approximately 6.13" (156mm).
5. Using a heat gun shrink tubing over bar and cover.
6. While shrink tubing is warm, press and flatten the excess tubing starting approximately 0.75" (19mm) behind end of bar.
7. When tubing has cooled cutoff excess tubing, leaving approximately 0.75" (19mm) of flattened tubing.

SECTION 13 - STANDARD HEAT END COVER KITS

700 Amp

Locations

End covers are used at runway ends to cover exposed conductor bar ends. The following covers are suitable up to medium heat applications up to 275°F (135°C).

Tools Needed

- 1/2" open end wrench
- Torque wrench with 1/2" socket
- Heat gun

End Cover Kits Contents

- Heat shrink tubing, bolt, and nut

Installation

1. With approximately 4.25" (108mm) bar exposed position 5/16" - 18UNC x 0.75" carriage head bolt into top slot on bar approximately 3.00" (76mm) from end of bar.
2. Install 5/16" hex nut and tighten with a 1/2" open end wrench.
3. Torque nut with torque wrench to 10-11 ft-lbs.
4. Position heat shrink tubing over end of bar approximately 8.25" (209mm).
5. Using a heat gun shrink tubing over bar and cover.
6. While shrink tubing is warm, press and flatten the excess tubing starting approximately 0.75" (19mm) behind end of bar.
7. When tubing has cooled cutoff excess tubing, leaving approximately 0.75" (19mm) of flattened tubing.

SECTION 13 - STANDARD HEAT END COVER KITS

1000/1500 Amp

Locations

End covers are used at runway ends to cover exposed conductor bar ends. The following covers are suitable up to medium heat applications up to 275°F (135°C).

Tools Needed

- 1/2" open end wrench
- Torque wrench with 1/2" socket
- Heat gun

End Cover Kits Contents

- Heat shrink tubing, bolt, and nut
- A reference drawing of a standard heat end cover is shown in **Figure 34-1**.

Installation

1. With approximately 6.00" (140mm) bar exposed position 5/16" - 20UNC x 0.75" carriage head bolt into top slot on bar approximately 2.75" (70mm) from end of bar.
2. Install 1/4" hex nut and tighten with a 1/2" open end wrench.
3. Torque nut with torque wrench to 10-11 ft-lbs.
4. Position heat shrink tubing over end of bar approximately 9.50" (241 mm).
5. Using a heat gun shrink tubing over bar and cover.
6. While shrink tubing is warm, press and flatten the excess tubing starting approximately 0.75" (19mm) behind end of bar.
7. When tubing has cooled cutoff excess tubing, leaving approximately 0.75" (19mm) of flattened tubing.

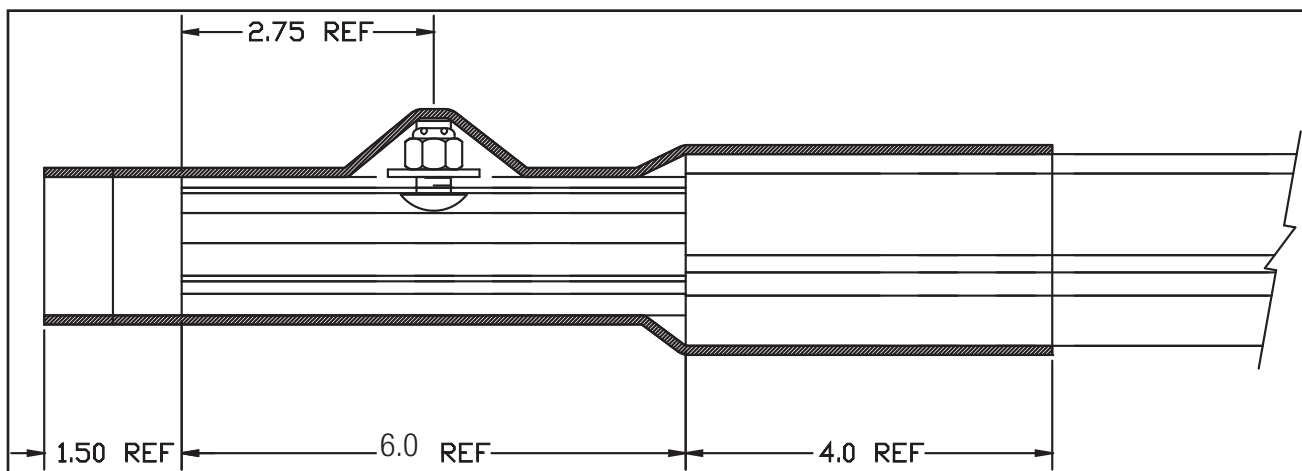


Figure 34-1 1500A Shown

SECTION 14 - HIGH HEAT END COVER KITS

700 Amp

Locations

End covers are used at runway end to cover exposed conductor bar ends. The high heat end covers are suitable up to 400°F (204°C).

Tools Needed

- 1/2" open end wrench

End Cover Kits Contents

- Insulating cover, insulating cover clamp, bolt, nut and washer
- A reference drawing of a high heat end cover is shown in **Figure 35-1**.

Installation

1. With approximately 4.25" (108mm) bar exposed slide a 10.0" (254mm) conductor bar cover on conductor bar bare end. Leave excess cover hang over the edge of bar.
2. Slide the overlap cover over bar and cover. Make sure the outer ends of the cover and overlap are even.
3. Install hardware into clamp using one 5/16"-18UNC x 2.75" carriage bolt, 5/16" flat washer, and 5/16" flexloc hex nut.
4. Position clamp underneath bar approximately 3.0" (76mm) from end and tighten 5/16" flexloc nut with a 1/2" open end wrench until cover is firm.

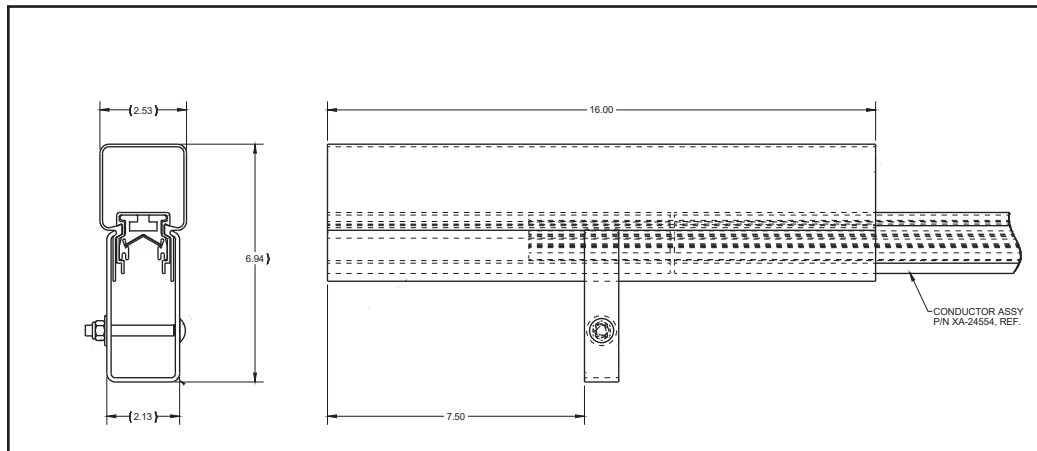


Figure 35-1

SECTION 14 - HIGH HEAT END COVER KITS

1000 Amp

Locations

End covers are used at runway ends to cover exposed conductor bar ends. The high heat end covers are suitable up to 400°F (204°C).

Tools Needed

- 1/2" open end wrench
- Torque wrench with 1/2" socket

End Cover Kits Contents

- Insulating cover, "L" shape clamp, bolt, nut, and washer

A reference drawing of a high heat cover is shown in **Figure 36-1**.

Installation

1. With approximately 6.00" (140mm) bar exposed position 5/16"-20UNC x 1.0" carriage head bolt into top slot on bar approximately 4.5" (114mm) from end of bar.
2. Install "L" shape clamp on carriage bolt with leg upward and slide toward conductor bar cover.
3. Install 5/16" hex nut and tighten with a 1/2" wrench.
4. Torque nut with torque wrench to 10-11 ft-lbs.
5. Snap overlap cover assembly, with short end toward conductor bar, over conductor bar and cover with "L" shape clamp positioned between overlap cover pins.

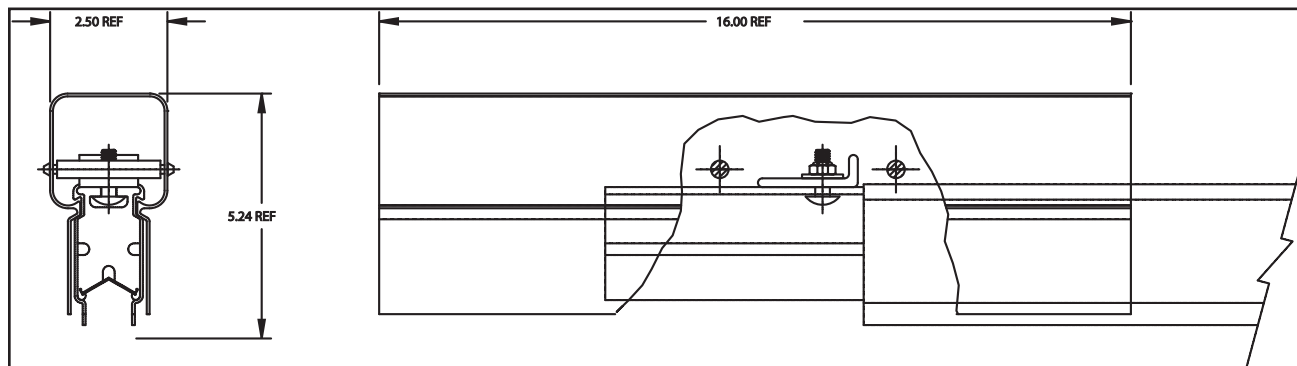


Figure 36-1

SECTION 15 - INSPECTION AND MAINTENANCE

Overview

Proper system performance and reliability require thorough periodic system maintenance. Each component of the system must be inspected, at a minimum annually. Many components require more frequent inspection and possibly maintenance, see **Table 37-1**. Bolt torque, cable connection integrity, insulating material integrity, and collector alignment and shoe wear are among the primary areas of concern.

WARNING

- All power must be disconnected from the conductor bar prior to performing any inspection or maintenance. Proper lockout/tag out procedures must be followed.
- Should questions or concerns arise regarding the condition of the system or its components, call Conductix-Wampfler Corporation at (800) 521-4888.

Frequency

| | Component | Frequency |
|---|----------------------|---|
| 1 | Covers | Semi-annually |
| 2 | Hanger Clamps | Semi-annually |
| 3 | Conductor | Semi-annually |
| 4 | Splice | Semi-annually |
| 5 | Anchor | Semi-annually |
| 6 | Expansion | Semi-annually |
| 7 | Power feed | Semi-annually |
| 8 | End Cap | Semi-annually |
| 9 | Collector Assemblies | 2 weeks after initial installation then Quarterly |

Table 37-1 Component Frequency

Covers

All covers (conductor and component overlap covers) shall be inspected semi-annually. The integrity of the cover is critical. Damage to the cover in the form of cracks, splits, or holes requires replacement.

Inspect the visible outside surfaces of the conductor and overlap covers for signs of damage. Replace as necessary.

Hanger Clamps

Check the hanger clamps to ensure there are no cracks or fractures in the molded plastic clamps. Replace components as necessary.

Check bolt torque per drawing. This can be a random sampling of 2 hanger clamps between each set of anchors (distance between anchors is approximately 195' from the starting end succeeding anchor points at 230' maximum). If the hardware is not a minimum of 15 ft-lbs, all the hardware between those 2 anchors must be checked and/or properly torqued.

For systems using hanger clamps with cross bolts, verify there is .02-.05 inch clearance between the hanger clamp and the conductor bar.

Conductors

All conductors shall be inspected semi-annually.

Inspect the contact surfaces and open area inside the cover for any debris and abnormal wear in 150 foot intervals (every 5th conductor). This will give a good overall indication of the degree of debris accumulation throughout the system.

SECTION 15 - INSPECTION AND MAINTENANCE

Splices

Remove covers and check bolt torque. Hardware must be 11 ft-lbs.

If bolts are loose, remove the splice plate and check for signs of burning or arcing between the conductor and splice plate. Replace damaged components as required following the installation instructions. Apply conductive grease when reinstalling splices.

Check overlap covers and end caps for signs of damage. Replace as required.

Anchor Clamps

Check the anchor clamps to ensure there are no cracks or fractures in the molded plastic clamps or damage to the stainless steel hangers. Replace components as necessary.

Check bolt torque per drawing. If the hardware is not at a minimum of 30 ft-lbs. all the hardware must be checked and/or properly torqued.

If system is equipped with anchor pins, check to insure pins are not missing or broken. If pins are found missing, insert new anchor pins. If the pins are not a force fit, use RTV sealant to insure the pin is properly secured.

For systems using hanger clamps with cross bolts, check torque at anchor locations is 60 in.-lbs.

Expansions

All expansions shall be inspected semi-annually.

Inspect the contact surfaces and open area inside the cover from any debris and abnormal wear. Verify there are no obstructions in the slots that will inhibit movement. Grab the block and determine if it is loose. Look for evidence of shoes hitting block. This could indicate that the block has come loose and will make shoes jump out of contact with conductor. The slider may have to be replaced.

Power Feeds

Remove covers and check bolt torque to ensure it is properly torqued to 11 ft-lbs. If bolts are loose, remove the powerfeed plate and check for signs of burning or arcing between the conductor and powerfeed plate. Replace damaged components as required following the installation instructions. Apply conductive grease when reinstalling powerfeeds. Check overlap covers and end caps for signs of damage. Replace as required. Check to ensure the grommets are located securely in the end plugs. Check cables for abrasion or damage to the jackets. Replace as required.

End Caps

Inspect the cover on the end cap for damage in the form of cracks, splits, or holes. Replace as necessary.

Collectors

Inspect quarterly for signs of cracks, wear, damage, dirt accumulation, or anything that would indicate an item or the assembly needs to be replaced. At a minimum, the inspection should include:

Collector Arms

Inspect for cracks, deformation, or any other evidence of damage. Collector arm should be replaced at least every 5 years.

Mounting Brackets and Bolts

Verify collector mounting base is square on the vehicle and it is aligned with the conductor.

Tension Springs

Spring is properly positioned on the pin in the collector arm. Check contact force and nominal distance between the mounting surface and contact surface (contact Conductix-Wampfler for force requirement). A "fish scale" may be used to check this. Hook the scale on the collector arm as close to the shoe-end of the collector. Pull the scale. The contact force is the force at which the arm begins moving away from the conductor. Replace if spring tension is not correct.

Spring Pins

Inspect for cracks, deformation, or any other evidence of damage. Verify all are in place.

Cables

Cable length between lug on shoe and cable clamp on arm is per the drawing. Cable routing to vehicle must allow free movement of collector throughout its complete range of motion. Check that cables are properly terminated to the vehicle (specification by others).

SECTION 15 - INSPECTION AND MAINTENANCE

Shoe Holders

Inspect for cracks, deformation, or any other evidence of damage.

Verify that all retaining rings and E-rings are securely in place.

Inspect the shoes weekly for wear and damage. Replace shoes when height, measured at any location along shoe, is 3/8" or less.

If a broken shoe is found, inspect the system for the cause. Broken shoes usually result from:

- Insufficient contact force causing the shoe to bounce excessively - replace the spring as required.
- Gaps at the splice joint - loosen splice hardware and butt conductors, tighten fasteners and torque to 11 ft-lbs.
- Misalignment between adjacent conductors - realign as required.
- Misalignment between the vehicle and conductor bar pulling the collector beyond its maximum horizontal and/or vertical envelope - this usually happens around curves in the conductor bar or in locations where hanger clamps and/or mounting brackets are not properly aligned. Realign as necessary.
- Inspect the shoes for uneven wear - uneven wear can be an indication of insufficient contact force or bias on a shoe due to cable routing, incorrect location of the tension spring, or misalignment. Uneven shoe wear, if not corrected, can wear the side of aluminum resulting in the stainless steel contact surface coming loose. Both ends of the shoe must be checked for uneven wear.

SECTION 15 - INSPECTION AND MAINTENANCE

Collector Shoe Replacement

Due to a wide variety of applications and environmental conditions, no time frame is given for shoe replacement. It is recommended however that the customer do periodic inspections of the collector heads to check for shoe wear. If the contact surface of the shoe reaches the wear-line the shoe should be replaced immediately. The shoe should also be replaced immediately if it shows signs of overheating, is pitted, cracked or chipped. If the wear pattern on the shoe is more than 10 degrees off even, the shoe should be replaced and the collector mounting position should be re-evaluated. A minimum of 0.18" (3/16") to the nearest cover component (including overlap covers) should always be maintained.

Several conditions may lead to accelerated shoe wear. The most common conditions are:

1. A loss of contact with the conductor surface creates an overheating situation which will cause pitting in the conductor surface. This pitting further reduces electrical contact, exacerbating the overheat condition and in turn, creates more pitting. Improper installation may prevent the collectors from maintaining adequate contact with the conductor contact surface along part or all of the complete length of the runway. This may be due to:
 - A. Poor alignment of the conductor mounting brackets in the vertical and horizontal planes - in this case the collectors do not have enough travel to maintain good contact because the conductors do not stay within the optimal contact range of the collector.
 - B. Improper location of the collector mounting bracket relative to the conductor (too close or too far away) - too far away creates too little contact pressure and too close may cause the shoe to nose or drag on the end.
 - C. Restricted movement of collector heads - it is essential that the collector pigtailed (feed cables) to the shoes have adequate free loop to allow rotation of the collector head throughout the full range of motion. Too-short pigtailed can prevent good shoe contact and cause loss of contact.
 - D. Loosening of conductor joints - when too few expansion sections are used or when anchor clamps are loose, the conductor joints may separate. The gaps in the conductor contact surface cause by this separation can shave the shoes down and cause premature wear. If not detected in time, poor contact may result, creating overheating, pitting of the conductor etc.
2. Contaminants in the environment may accumulate on the conductor contact surface. These contaminants need not be electrically insulating to cause problems; if they decrease the area of contact between the shoes and conductor, problems may arise with overheating, pitting, etc. Some contaminants may be abrasive, increasing the rate of wear on the shoes.
3. Corrosive elements may create deposits on the collector shoe and/or the conductor contact surface thus decreasing conductivity at the sliding contact surface. Under severely corrosive conditions, the copper graphite shoes may be corroded to the point where less than half of the shoe is remaining, decreasing the available contact surface area and causing overheating and pitting.
4. Infrequent maintenance of the collectors can lead to worn-out shoes, poor contact, pitting etc.

SECTION 16 - TROUBLESHOOTING

| Problem | Possible Cause(s) | Possible Solution(s) |
|--|---|--|
| Overheating/Burning Conductor | Loose splice | Disassemble component, clean mating surfaces, apply EJC, and re-torque hardware replacing Belleville washers and nuts. |
| | Loose power feed and/or lug(s) | |
| | Overloading | Check electrical loading by doing a load survey. Rectify if not according to system parameters. |
| Arcing/pitting on the stainless steel insert at the splice | Loose splice | Disassemble component, clean mating surfaces, apply EJC, and re-torque hardware replacing Belleville washers and nuts. |
| | Misaligned conductors resulting in the copper shoe losing contact | Disassemble component, clean mating surfaces, apply EJC, realign conductors, and re-torque hardware. |
| Arcing/pitting on the stainless steel insert | Collector not making good contact with conductor | <p>Check alignment of conductor with respect to vehicle. Adjust position of hanger clamp and/or hanger bracket.</p> <p>Verify contact force of collector is 17-23 lb. Replace tension spring on collector arm. Investigate stainless steel insert for debris and/or misaligned splice joints causing collector to bounce. Remove debris and/or align conductor in splice.</p> <p>Check vehicle's running surface for anything causing sudden lurch of the vehicle or excessive vibration. Adjust as necessary.</p> |
| Arcing/pitting on the stainless steel insert at an isolation | Large voltage potential between both side of the isolation | <p>Check for debris and/or misaligned isolation joint causing the collector to bounce. Remove debris and/or align conductors adjusting for a smooth transition of the collector shoe as required.</p> <p>Splice short pieces of conductor on either side of the isolation that can be easily replaced when worn out.</p> <p>Compare voltage drop from feed points on either side of the isolation. Adjust the location of the power feeds if possible.</p> |
| Conductor binding/snaking in between hanger clamps | Hanger clamp not "squared" with the conductor | Loosen hardware on hanger clamp, make square with conductor and re-torque. Check for debris and/or cracks in cover impeding expansion and contraction of conductor. Remove debris with compressed air and/or water. Replace cover if necessary. |
| | Expansion gap set incorrectly | Measure expansion gap and adjust according to the gap setting chart. |
| | Anchor clamp not tight | <p>Check torque of the hardware on the anchor. Re-torque as required.</p> <p>Check anchor clamps and verify none are cracked or fractured. Replace as necessary.</p> |

SECTION 16 - TROUBLESHOOTING

| | | |
|--|---|---|
| Shoe Chipping on leading edge | Misaligned splice, power feed, and/or isolation | Check alignment of conductor joints at splice, power feed, and isolations by running a shoe across the joint by hand. Adjust alignment of conductors as required. |
| | Insufficient contact force of shoe on conductor resulting in the shoe “tipping” up on the bar and impacting the leading edge | Verify correct position of collector base to contact surface then measure the contact force of the shoe on the conductor with a spring scale. Contact force should be 17-23 lbs. Replace spring if necessary. |
| Excessive shoe wear | Misaligned splice, power feed, and/or isolation | Check alignment of conductor joints at splice, power feed and isolations by running a shoe across the joint by hand. Adjust alignment of conductors as required. |
| | Arcing/pitting on the stainless steel creating a rough surface | See “arcing/pitting on the stainless steel insert” above. |
| Uneven shoe wear on leading edge vs. trailing edge | Insufficient contact force of shoe on conductor resulting in the shoe “tipping” up on the bar and impacting the leading edge. | Verify correct position of collector base to contact surface then measure the contact force of the shoe on the conductor with a spring scale. Contact force would be 17-23 lbs. Replace spring if necessary. |
| | Misaligned splice, power feed, and/or isolation impacting shoe in one direction | Check alignment of conductor joints at splice, power feed, and isolations by running a shoe across the joint by hand. Adjust alignment of conductors as required. |
| Uneven shoe wear on sides of shoe | Incorrect position of tension spring on collector | Position hook of spring in top slot of pin in base so spring is pulling the collector shoe into the conductor and “up” from the running surface (refer to collector drawing). |



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