Operating Instructions

Single-pole conductor-rail system
SingleFlexLine Program 0815

Order Number:
0815xx-...
Operating Instructions

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1 General notes

1.1 About this document

The information provided in this manual is designed to enable the conductor-rail system to be used safely and efficiently.

This document forms part of the conductor-rail system and must be kept accessible to personnel at all times and stored right by the device. Personnel must read this document carefully and understand it before starting any work. The basic prerequisite for safe work is compliance with all safety and operating guidelines in this document.

Local accident protection regulations and general safety guidelines for the area of use of the conductor-rail system also apply.

Illustrations in this document are provided for basic understanding and may deviate from the actual implementation of the system.

In addition to these operating instructions, the instructions located in the appendices for the individual assembled components also apply.

1.2 Limitation of liability

All data and information in these operating instructions have been compiled while taking the valid standards and regulations as well as the state-of-the-art and our many years of experience and knowledge into consideration.

The manufacturer is in no way liable for damages resulting from:

- Failure to comply with operating instructions
- Improper use
- Use by untrained personnel
- Unauthorized modifications
- Technical changes
- Use of unauthorized replacement parts and accessories

The actual scope of delivery may differ from the explanations and descriptions provided here if the model in question is a special one, if additional equipped has been ordered or due to recent technical changes.

The obligations agreed upon in the delivery agreement and our General Terms of Business apply, as do the delivery conditions of the manufacturer and all legal regulations applicable at the time the contract was concluded.

All products are subject to technical modifications in the context of improvement of function and further development.
1.3 Copyright

This document is subject to copyright, and is exclusively intended for internal use by customers. Provision of the operating instructions to third parties, reproductions in any form – even in part – as well as the reuse and/or disclosure of their content are not permitted without the written approval of the manufacturer, except for the customer's internal use.

Breach or infringement will result in liability for damages. This shall not affect our right to assert claims for further loss or damage.

1.4 Spare parts

**WARNING!**

Wrong spare parts are a safety hazard!

Wrong or faulty spare parts can result in damage, malfunctions, complete failure and affect safety.

→ Always use original spare parts from the manufacturer!

Order spare parts from your contracted dealer or directly from the manufacturer.
Contact details: See the last page of this document.
Replacement parts list: see chapter 12.1 Other applicable documents.

1.5 Material defects

The regulations about material defects are listed in the general terms and conditions of business.

1.6 Technical support

For technical support please contact our staff from the Customer Support Department.
Contact details: See the last page of this document.

Our employees are also always interested in new information and experience from the field that can be valuable for the improvement of our products.
2 Safety instructions

2.1 Explanation of symbols

Safety and hazard information is identified in these operating instructions by symbols. Safety instructions are introduced by signal words that indicate the scale of the hazard. Always observe safety and hazard instructions, and work carefully to avoid accidents, bodily injury and damage to property!

DANGER!

... indicates an immediately hazardous situation, which, if not avoided, may result in death or serious injury.

DANGER!

... indicates an immediately hazardous situation due to electricity, which, if not avoided, may result in death or serious injury.

WARNING!

... indicates a possibly hazardous situation, which, if not avoided, may result in death or serious injury.

WARNING!

... indicates a possibly hazardous situation due to electricity, which, if not avoided, may result in death or serious injury.

CAUTION!

... indicates a possibly hazardous situation, which, if not avoided, may result in minor or moderate injury.

Tips and recommendations:

... provides useful tips and recommendations as well as information for efficient and trouble-free operation.

ATTENTION!

... indicates actions that will help you prevent material damage.
2.2 Personnel requirements

2.2.1 Qualifications

**Persons who are not adequately trained are at risk of injury!**

Improper use can result in serious injury to persons and property.

→ All activities must only be performed by qualified personnel.

- Only those persons are authorized as personnel who can be expected to perform their work reliably. People whose capacity for reaction is influenced e.g. by drugs, alcohol, or medications are not authorized.
- When selecting personnel, all age- and occupation-specific guidelines applicable at the deployment site must be observed.

The following qualifications have been mentioned in these operating instructions for certain areas of operation:

- **Qualified specialists**
  
  are, due to their specialized training, knowledge, experience and knowledge of applicable regulations, capable of carrying out work assigned to them, while independently recognizing and avoiding possible risk.
  
  Personnel are considered qualified if they have successfully concluded training, for example, as electricians, master electricians, electrical engineers, or electrical technicians. Personnel are also considered qualified who have been employed correspondingly for several years, have been educated in theory and practice during that time, and have whose knowledge and skills in the trade required have been tested.

  The operator of the machine or system must document that the corresponding certification, or other documentation of qualification, is available or had been submitted previously.

  The installation, maintenance and commissioning of electrical equipment may only be carried out by qualified personnel (electricians) in accordance with local regulations. Work with higher installation positions usually requires additional qualifications and certificates for the use of lifting devices and protective equipment. On the part the manufacturer, professional and proper handling of components is required. It is recommended that the installation personnel be trained by the manufacturer or that accompaniment of the installation by specialist fitters/supervisor be scheduled.

- **Operators**

  have been instructed in an instruction session by the operator with respect to the tasks assigned to them and the potential dangers arising from improper actions.

  The operator of the machine or facility must document that the corresponding training has taken place.

- **Transport personnel**

  Trained person who transports the material indoors and outdoors in accordance with safety regulations.
2.2.2 Unauthorized personnel

**WARNING!**

Danger due to unauthorized personnel!

Unauthorized persons who do not meet the requirements described here are not acquainted with the dangers in the working area.

→ Keep unauthorized personnel out of the working area

→ In case of doubt, address such persons and direct them away from the working area

→ Stop work as long as unauthorized persons are in the working area

2.2.3 Training

Before commissioning the equipment, personnel must be trained by the operator. For better tracking, the implementation of the training must be logged as follows:

Example of an instruction log:

<table>
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<th>Date</th>
<th>Name</th>
<th>Type of training</th>
<th>Training given by</th>
<th>Signature</th>
</tr>
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<tr>
<td>11/5/2009</td>
<td>John Doe</td>
<td>First safety training for personnel</td>
<td>Horst Müller</td>
<td></td>
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2.3 Personal protective equipment

Always wear For all work

- **Protective headgear**
  For protection against falling or flying parts and materials.

- **Protective gloves**
  For the protection of hands against friction, scrapes, stabbing or deep wounds, as well as against contact with hot surfaces.

- **Protective clothing**
  Primarily for protection against entrapment by moving machine parts. Working clothes must be close fitting with a low resistance to tearing; they must have close-fitting sleeves and no protruding parts.

- **Protective footwear**
  For protection against heavy falling parts and slipping on slippery floors.
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2.4 Intended use

The equipment is exclusively designed and built for the use described here (its intended use).

Danger from improper use!

Any application that deviates from or goes beyond the intended use of the devices can result in hazardous situations.

→ Follow all information in these operating instructions strictly.
→ Prohibit any use of the system apart from its intended use!
→ Observe the information on improper use in chapter 2.5

We do not accept any liability for damage arising from improper use.
The operator bears sole liability for all damage that result from improper use.

Intended use

The SingleFlexLine 0815 conductor-rail system is an operating resource for customer construction of an electrical energy-supply system in indoor areas that are not accessible to the public. The conductor rail is an operational resource and thus has no actual operating mode, since this is determined by the application. Risks are limited only to the failure of mechanical components (e.g., falling components) and the danger from electrical current.

The SingleFlexLine 0815 conductor-rail system is used to supply electricity to mobile electrical consumers.

One of its typical applications is, for example, to supply power to logistics shuttles inside a warehouse with horizontal storage racks or electrical overhead monorail systems (EMS) (in German, Elektrohängebahnen [EHB]).

Use other than in the application approved by the manufacturer must be checked by the system engineer as part of a risk assessment for the final product and is under the responsibility of the system engineer.

An extended approval by the manufacturer for the application is possible in certain cases and requires written approval after examination of the use case and ambient conditions.
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The following technical requirements must always be strictly observed for the installation:

- The maximum permissible traversing speed of the consumer is up to 600 m/min depending on the system
- The conductor-rail must only be fitted horizontally

Electrical engineering operational requirements
- The electrical system must be secured in compliance with the locally applicable regulations

2.5 Use other than the intended use

Claims of any kind due to damage incurred during use that deviates from the intended use described above ("use other than the intended use") are excluded. The operator bears sole liability for all damage that result from improper use.

Uses other than the intended use particularly include the following types of use:

- Operating the system outside the specified operating conditions (see Chapter 3.3).
- Installation in an area accessible to the public.
- Operation within manual reach
- Use in non-industrial applications
- Overloading of the conductor-rails by excessive current or voltage
- Overloading of individual current collectors by excessive current or voltage
- Operation at excessively high or low temperatures
- Operating under ambient conditions that cause lasting damage to the materials used or drastically reduce insulating properties (e.g., chemical substances or gases)
- Operation under prohibited ambient conditions (see the prescribed ambient conditions depending on the product range)
- Operation in areas where flammable or explosive gases or dusts prevail
- Operation in areas that require a higher protection class than IP 2X
- Use as a walking or climbing aid
- Walking on the conductor-rail
- Use of unsuitable cleaning agents (e.g., silicone oils or aromatic compounds)
- Use of the system with accessories that have not been certified and have not been approved by the manufacturer.
- Operation of the system by untrained personnel.
- The conductor-rail system must only be operated under the environmental conditions detailed in chapter 3! Unsuitable ambient conditions are described in chapter 3.3
2.6 Protective measures to be taken by the operator/user

The device is designed for use in an industrial setting. The operator of the device is therefore subject to compliance with the relevant legal obligations concerning workplace safety. In addition to the safety instructions in these operating instruction, all safety, accident protection, and environmental regulations valid in the place of operation of the development must also be observed. This particularly includes:

- Work on electrical components of the system may only be carried out when disconnected from the power supply.
- The operator must inform him/herself of applicable workplace safety guidelines and identify any additional hazards that may arise under special working conditions at the deployment location of the device. This knowledge has to be expressed in the form of operating instructions for the operation of the device.
- During the entire time the device is in use, the operator must check that these operating instructions still correspond to the current state of regulations and adapt these as necessary.
- The operator must clearly manage and define responsibilities for installation, operation, troubleshooting and maintenance.
- The operator must ensure that all employees involved with the device have read and understood these operating instructions.
- The operator must provide personnel with all required protective equipment (work clothes, safety shoes, hearing protection, protective gloves, safety helmet, goggles, breathing mask).
- The operator must keep the keys for the switching cabinets in a safe place. "Safe" means that only explicitly authorized personnel may have access to the keys. The keys may only be issued to technical personnel as described in Chapter 2.2.1.
- The operator is furthermore responsible for ensuring that the device is always in perfect working order. The following thus applies:
  - The operator must ensure that the service intervals described in these operating instructions are observed.
  - The operator must get all safety systems regularly inspected for functionality and completeness. If possible, this inspection should be carried out once a year, but at least as often as required under the applicable national regulations.
  - If the device or system has been modified, the safety systems must be inspected again and adapted to the changed conditions in such a way that the device or system is safe again.

2.7 5 safety rules for working on electrical systems

Requirement:

Work on electrical systems must only be carried out when they are disconnected from the power supply. The 5 safety rules (see DIN VDE 0150-100:2009-10/EN 50110-1:2004-11) must always be followed before starting any work:

1. Disconnect the system from power using the main switch,
2. Secure the main switch against being turned back on
3. Verify the absence of a voltage by measuring
4. Ground and short-circuit parts of the system on which work will be done
5. Cover or block off neighboring parts which are still energized.

→ Only electricians or personnel trained in electrical work may disconnect power or approve reconnection of power after work carried out in the disconnected state!
2.8 Specific hazards

The following chapter lists residual risks, which were determined on the basis of a risk assessment.

→ Follow the safety instructions and the warnings in these operating instructions in order to reduce health hazards and avoid dangerous situations.

→ A detailed risk analysis must be prepared for the system in which the conductor rail is integrated. The resulting measures must be implemented by the system engineer.

→ PE and PEplus must always be designed redundantly. It must be monitored that both protective conductor connections are always engaged. For systems with transitions two current collectors with double heads must be used.

2.8.1 Electrical hazards and sources of danger

**Risk of death by electrocution!**

Contact with energized components can lead to death by electrocution or severe injury. There is also a risk of injury from a shock reaction, falling or being thrown across the room as a result of an electrical shock.

Work on the following components is dangerous:

- Main power supply
- Parts carrying electricity: Power feed, cables, connections, conductor-rail, connectors, current collectors, devices and connections within switching cabinets, control systems, etc.
- Parts that are carrying electricity due to a fault

**Before working on the parts listed above:**

→ Disconnect the conductor-rail system according to the 5 safety rules and secure it against being turned back on. For the 5 safety rules, see chapter 2.5.

**During work:**

→ Use insulated tools

**Before switching on:**

→ Every time before the device or system is started, test the insulation resistance according to locally applicable technical standards, directives and legal regulations.

→ Carry out locally required electrical tests

**Maintain electrical safety!**

→ Regularly test and maintain electrical equipment.

→ If dangerous deficiencies are identified, take measures to correct the deficiencies immediately. Inform the system operator immediately.

→ If it is not possible to correct a dangerous deficiency, block off the area in question or turn the equipment off, and secure it against being switched back on. Inform the system operator immediately.

→ Immediately secure loose cables and replace damaged cables.

→ Always replace blown fuses with fuses of the same rating
DANGER!

Fire hazard due to overload or sparking!
A fire hazard can occur due to overloads of the cable, electrical arcing, short circuits or the generation of sparks. Sparking can occur in poorly serviced, contaminated conductor-rails or if installation does not comply with the required tolerances.

→ Permissible current values must be observed.
→ Comply with tolerances during installation
→ Design and dimension systems in accordance with the permissible system load capacity and provide appropriate protection devices
→ Do not store inflammable and/or easily ignited materials near to conductor-rails.
→ Inspect, service, and clean conductor-rails regularly and in accordance with specifications. See chapters 8 and 9.

2.8.2 Mechanical hazards and sources of danger

Risk of injury due to grasping or impact!
Grasping and/or impact with moving conductor-rails (slip ring) or current collectors connected to the machine and other components must be prevented.

→ Cordon off the work area
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Caution when working in the vicinity of the danger zone, in particular below the conductor-rail
→ Use personal protective equipment!

Secure conductor-rails against falling
→ In application areas with personnel traffic and at an installation height of 3 m or more, conductor-rails must be secured against falling.

Risk of puncture wounds and cuts!
The packaging material can contain sharp objects such as nails and wood splinters that can cause injury to limbs.

→ Use personal protective equipment!
→ Cordon off the work area!
→ Caution when working in the vicinity, in particular below the conductor-rail
2.8.3 Danger due to dust and vapors

**WARNING!**

Danger of sensitization, irritation of the mucous membranes, and respiratory diseases due to dust!

Dust from the collector brushes collects in the conductor-rails and the guide profile. This dust is very fine and is categorized as a health risk. Frequent handling can result in sensitization. People who frequently spend longer periods of time in a heavily used plant without protective equipment must expect the following consequences:

- Irritations of the mucous membranes
- Respiratory diseases
- Cancer

These consequences must also be expected if accumulations of dust are handled without proper care (e.g., removal of dust using compressed air).

→ In workplaces with long-term exposure and heavily trafficked plants, take effective measures to protect employees from the dust.

→ During all work on the conductor-rail system in which collected dust can be stirred up, wear personal protective equipment. In particular wear personal protective equipment when cleaning the system

- Safety goggles
- Dust mask class FFP3
- Protective gloves
- Disposable coverall

→ Before starting work, clean the conductor-rail in accordance with regulations. There are special instructions for this task; see Chapter 9

→ Protect the surroundings during cleaning works, for instance by covering or removing warehouse goods and blocking access to those areas, in which dust could fall down on persons.

→ **Do not blow out dust with compressed air.** Instead, vacuum it up. The vacuum cleaner must be equipped with a Class H fine filter.

→ Do not eat, drink or smoke during work!

---

**DANGER!**

Poisonous gases in case of fire!

In case of fire in the facility, the plastic parts (PVC) of the conductor-rail system emit poisonous gases (HCL).

→ The building must be evacuated immediately.

→ The fire brigade must be informed.
2.8.4  Hazards arising from the operating environment

The following factors can give rise to hazards if the conductor-rail is installed in such an application environment:

- Dusts
- Gases
- Chemical substances
- Liquids
- Radiation
- Major temperature variations

The most important action for protection from these dangers is only to install the conductor-rail system in locations where suitable operating conditions prevail. See Chapter 2.4.

The system must be designed and operated in accordance with the prevailing ambient conditions.

Risk of components being damaged and losing functionality due to environmental influences!

Environmental influences (gases, substances, liquids, radiation, etc.) can damage the components, particularly the plastic parts. Hanger clamps can break and the conductor-rail system fall down, for example.

→ Check influences depending on temperature, time of action, concentration and interactions.
→ Use in chemical works, galvanizing plants, electroplating plants, composting plants or in warehouses or installations where chemical substances (e.g., aromatics, benzene) are stored or processed must be checked in advance by Conductix-Wampfler.

The resistance of plastic parts is critical in contact with oils, greases or various cleaning agents.

Major temperature variations can cause large expansions in the conductor-rail system, particularly for long systems. Hanger clamps can break and the conductor-rail system fall down, for example.

The system must be designed and operated in accordance with the prevailing ambient conditions as part of the permissible operating conditions!

Risk of fire due to sparking!

Highly flammable dusts, substances or gases in the vicinity of the conductor-rail can be ignited by sparks! These substances must not be present in the vicinity of the conductor-rail.
2.9 Conduct in the event of accidents and malfunctions

Measures to take in the event of accidents:
- Shut down the system and secure it against unauthorized, unintentional and/or erroneous activation.
- Secure the danger zone
- Remove persons from the danger zone.
- Initiate first-aid measures
- Alert the rescue services
- Inform responsible parties at the operating site
- Make access available for rescue vehicles.

Measures to take in the event of malfunctions:
- Shut down the system and secure it against unauthorized, unintentional, and/or erroneous reactivation
- Secure the work area against entry
- Consult qualified personnel when analyzing the fault
- Check for disconnection from power
- Remove the device and replace it with a new device.
- Determine the cause of error and repair the device.
### 3 Technical specifications

#### 3.1 Electrical

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current for the overall system</td>
<td>10–54 A as an overall system with expansion elements; (conductor-rails: 10–100 A)</td>
</tr>
<tr>
<td>Rated current for current collectors*</td>
<td></td>
</tr>
<tr>
<td>Single current collector</td>
<td>Pure carbon: max. 16 A</td>
</tr>
<tr>
<td></td>
<td>Copper–graphite: max. 35 A</td>
</tr>
<tr>
<td>Dual current collector</td>
<td>Pure carbon: 2 x 16 A</td>
</tr>
<tr>
<td></td>
<td>Copper–graphite: max. 2 x 25 A</td>
</tr>
<tr>
<td>Nominal voltage</td>
<td></td>
</tr>
<tr>
<td>without protective earth</td>
<td>max. 48 V AC/DC</td>
</tr>
<tr>
<td>with protective earth (PE)</td>
<td>max. 500 V AC</td>
</tr>
<tr>
<td>Ohmic resistance at 35°C</td>
<td>0.745 Ω/1000 m</td>
</tr>
<tr>
<td>Impedance at 14 mm pin spacing</td>
<td>0.748 Ω/1000 m</td>
</tr>
<tr>
<td>Number of pins</td>
<td>Any (EMS system holder 2, 4, 6, 8, 10 pin)</td>
</tr>
<tr>
<td>Assignment</td>
<td>Protective earth (PE) 4. Pin from above</td>
</tr>
<tr>
<td>Conductor-rail cross chapter</td>
<td>25 mm²</td>
</tr>
<tr>
<td>Conductor material</td>
<td>Copper</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 2X contact protected to IEC 60529</td>
</tr>
</tbody>
</table>

*Current-carrying capacity depending on the current-collector type! The current-carrying capacity is defined by the connected cable and is generally lower (see catalog)! Ambient temperatures and operating modes result in reduced current-carrying capacity (e.g., operating at a standstill, operating at elevated temperature).

#### 3.2 Mechanical

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. travel speed</td>
<td>Uninterrupted linear track 400 m/min</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>−5°C to +55°C</td>
</tr>
<tr>
<td>Maximum air humidity at +40°C</td>
<td>50 % RH</td>
</tr>
<tr>
<td>Max. operating temperature difference</td>
<td>40 K (in the ambient temperature range)</td>
</tr>
<tr>
<td>Altitude above sea level</td>
<td>≤ 2000 m</td>
</tr>
<tr>
<td>Installation situation/environment</td>
<td>Horizontal rail alignment/ interior (not vertical)</td>
</tr>
<tr>
<td>Direction of travel</td>
<td>Forwards and backwards (reversing)</td>
</tr>
<tr>
<td></td>
<td>Engagement of the current collector from the bottom or from the side</td>
</tr>
<tr>
<td>Pin spacing</td>
<td>14 mm</td>
</tr>
</tbody>
</table>

#### 3.2.1 Lengths

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length of the installed conductor-rail</td>
<td>Any, depending on the power feed design</td>
</tr>
<tr>
<td>Power rails</td>
<td>max. 4000 mm (standard), 6000 mm and short lengths on request</td>
</tr>
<tr>
<td>Min. permissible power rail length</td>
<td>300 mm</td>
</tr>
<tr>
<td>Supplementary length per connection point</td>
<td>10 mm</td>
</tr>
</tbody>
</table>
3.2.2 Installation orientation

**WARNING!**

Danger due to increased wear or damage!
→ Install the current collector with its central axis exactly on the central axis of the conductor-rail
→ The mean distance between the outrigger axis and the contact surface must be precisely complied with

**WARNING!**

Loss of contact or increased heating!
Risk due to loss of contact or increased warming if the current collector is operated outside the permissible installation position.

3.2.3 Tolerances

The conductor-rail must be installed within the following tolerances. Conductix-Wampfler does not accept any responsibility for the conductor-rail's correct functioning if these tolerances are not observed. In such a case, Conductix-Wampfler does not accept any liability for problems that arise if the conductor-rail system is not functioning correctly.

<table>
<thead>
<tr>
<th>Component</th>
<th>X Tolerance</th>
<th>Y Tolerance</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor-rails</td>
<td>±3 mm</td>
<td>±1 mm</td>
<td>(see Fig. 1)</td>
</tr>
<tr>
<td>Current collector*</td>
<td>±10 mm</td>
<td>±10 mm</td>
<td>(X: ±15 mm, Y: ±15 mm)</td>
</tr>
<tr>
<td>Force with which the current collector contacts the rail</td>
<td>approx. 9 N</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*depending on the current-collector type

Fig. 1: Power rail 0815 coordinate system
3.3 Unsuitable environmental conditions

The conductor-rail must **not be installed** and **not be operated** under these environmental conditions (see also Chapter 2.5, Chapter 2.8.4 and Chapter 3):

- In environments containing chemical substances or gases that can potentially permanently damage the conductor-rail’s materials (corrosion) or drastically impact on the insulation
- In ambient air that contains solvent vapors or aromatic compounds
- In ambient air that contains flammable or explosive gases or dusts
- In dusty environments
- Outside closed rooms
- In environments with relative humidity of more than 85%
- In close proximity to splashing water
- In environments that require a higher protection class than IP 2X

**Faults due to incorrect operating conditions!**

If the operating conditions change or are no longer within the specified range, the conductor-rails can malfunction due to short circuits, premature aging and damage to electrical and mechanical components.

→ The conductor-rail must be switched off if the operating conditions are no longer within the permissible range described above.
→ The conductor-rail must be switched off if it gets wet or is dirty. Cleaning or drying as prescribed
→ Take the relevant measures to restore suitable operating conditions.
4 Product description and method of functioning

4.1 Brief description

Single-pole insulated conductor-rails consist of individual conductor-rails firmly fixed on a guideway. One or more current collectors fastened to one or more mobile consumers engage with the conductor-rails with their current-collecting heads. The mobile consumers move along the guideway in a linear, track-guided manner. The current collector follows the movement of the mobile consumer and compensates for guideway deviations between the mobile consumer and the conductor-rails (horizontally and vertically). The electrical energy is transmitted into the conductor-rail through power feeds and then fed to the current collector. The current-collecting head of the current collector is pressed against the conductor-rail with a permanently present contact force. The electrical energy is transferred to the current-collecting head through the contact point and to the mobile consumer through a connecting cable on the current collector.

The SingleFlexLine 0815 conductor-rail system is a modular conductor-rail system for customer installation of an electrical power supply for moving, rail-guided parts or ring arrangements. Any number of poles can be combined in conductor-rail systems. The conductor-rails can be adapted to the route of the road guideway profile using a bending tool.

Examples of applications are:

- Electrical monorail systems (EMSs)
- Logistics shuttles
- Packaging Machines
- Small-parts warehouses
Fig. 2: System layout

*The installation spacing depends on the current-collector type (65 mm, 80 mm, 92 mm)

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>End cap</td>
</tr>
<tr>
<td>2</td>
<td>Connectors</td>
</tr>
<tr>
<td>3</td>
<td>Hanger clamp</td>
</tr>
<tr>
<td>4</td>
<td>Power feed</td>
</tr>
<tr>
<td>5</td>
<td>Air gap insulation section with expansion travel</td>
</tr>
<tr>
<td>6</td>
<td>Transition caps/&quot;long&quot; end caps</td>
</tr>
<tr>
<td>7</td>
<td>Current collector</td>
</tr>
<tr>
<td>8</td>
<td>Hanger clamp with anchor point caps</td>
</tr>
<tr>
<td>9</td>
<td>Air gap insulation section without expansion travel</td>
</tr>
</tbody>
</table>

Fig. 3: Outside/inside bends and horizontal bend

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inside bend</td>
</tr>
<tr>
<td>2</td>
<td>Outside bend</td>
</tr>
<tr>
<td>3</td>
<td>Horizontal bend</td>
</tr>
</tbody>
</table>
Operating Instructions

Single-pole conductor-rail system
SingleFlexLine Program 0815

Use of bends in horizontal and vertical curves

<table>
<thead>
<tr>
<th>Engagement direction of the current collector</th>
<th>Vertical (from below)</th>
<th>Horizontal (from the side)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal bend</td>
<td></td>
<td>Internal/external bend</td>
</tr>
<tr>
<td>suspension interval: 400 mm</td>
<td></td>
<td>suspension interval: 250 mm</td>
</tr>
<tr>
<td>bend radius: 1000 mm to ( \infty )</td>
<td></td>
<td>bend radius: 450 mm to ( \infty )</td>
</tr>
<tr>
<td>Internal/external bend</td>
<td></td>
<td>Horizontal bend</td>
</tr>
<tr>
<td>suspension interval: 250 mm</td>
<td></td>
<td>suspension interval: 400 mm</td>
</tr>
<tr>
<td>Bend radius: 450 mm to ( \infty )</td>
<td></td>
<td>bend radius: 1000 mm to ( \infty )</td>
</tr>
</tbody>
</table>

a = standard rail length
b = max. suspension interval: in straight sections 500 mm
   for horizontal bends 400 mm
   for internal/external bends 250 mm

The SingleFlexLine conductor-rail system consists of:
- Current collector (interface to the system engineer/operator’s machine)
- Conductor-rails
- Connectors
- Expansion element
- Anchor point
- Hanger clamp (interface to the system engineer/operator’s machine)
- Power feeds (interface to the system engineer/operator’s machine)
- End caps/transition caps for conductor-rails
- Air gap insulation section
- Accessories (cross arms, cross-arm brackets, clamping brackets, outriggers) depending on the product range

The conductor-rails are fastened to a straight, smooth surface provided by the customer using hanger clamps. The conductor-rails are electrically and mechanically coupled using connectors. The conductor-rail is supplied through power feeds with electrical energy that mobile consumers can tap continuously using current collectors.

Use the QR code ("click" or “scan”), to watch our animation
SingleFlexLine 0815 Overview.
4.2 Interfaces

All details are in the catalog, the installation instructions and possibly in the system-specific layout.

Mechanical interfaces:

- The current collector must be fastened to the mobile consumer of the machine. The manufacturer/operator of the machine/system must comply with the required installation clearances and tolerances over the whole guideway. The fastenings are generally secured by screws.
- The hanger clamp must be fastened to the supporting structure/substructure of the machine. The manufacturer/operator of the machine/system must take into account the required suspension intervals, the fastening positions and the loads. The fastenings are generally secured by screws or snap-fit connections.

Electrical interfaces:

- The head of the current collector is connected to the electrical system of the mobile consumer via a flexible connecting cable. The connecting cable can be supplied. The manufacturer/operator of the machine/system must observe the required conductor cross sections and possibly the design of the cable and ensure that it is installed flexibly and free of directional forces. The electrical design and integration into the overall electrical network is the responsibility of the plant manufacturer/operator. The connections are made via screw terminals or plug connectors.
- The conductor-rail is fed with electrical energy from the network or from the machine/system via the power feed. A single-core cable is connected in the power feed. Fastening is done via cable lugs and screw connections, and sometimes via plugs. The connecting cable is not included in this delivery. The electrical design and integration into the overall electrical network is the responsibility of the plant manufacturer/operator.

4.3 Description of the components

- **Hanger clamps 0815**
  Hanger clamps for supporting the conductor-rail. The hanger clamps listed in the catalog are screwable. In many cases, customer-specific hanger clamps that engage in the support profile or are screwed into it are used. The conductor-rails slide into the hanger clamps longitudinally.

- **Conductor-rail**
  Copper rail with PVC insulation as PH and PE as well as PEplus rails can be supplied in 4000 mm and special 6000 mm lengths on request. PE and PEplus rails are marked in green/yellow. Phase rails are yellow. Two protective conductor versions—PE and PEplus—are available for the conductor-rail system. For new systems, the
PEplus variant is used with error prevention. For PEplus rails the insulation is opened wider for a broader PEplus brush. The wider PEplus collector brushes mostly prevent (without use of force or crash) the dip of the collector brush in a phase rail. PEplus end caps are also wider open and recognizable by their green color.

PH = phase conductor
PE = Protective conductor
PEplus = protective conductor with error prevention

---

**Fixed point cap**

For mechanical fixing of the conductor-rail to the installation structure. Use of mechanical fixing on expanding sections with long systems.

1 = Engagement cam
2 = Anchor point cap
3 = Hanger clamp
4 = Guideway profile
5 = Screw

The fixed-point caps must be used with a hanger clamp screwed to the guideway profile.
Fig. 9: Screwable connector

Connectors
For mechanically and electrically connecting the individual rail sections (plug or quick-screw technology). The connectors are easily accessible from the front of the conductor-rail. Each connection point is protected against contact by a plastic connector cap.

Fig. 10: Power feed connector

Power feed
Power is supplied through a connector or end-cap power feed. With the connector power feed, the energy can be supplied by replacing a connector at any point. The connection is established through crimping cable lugs for 1.5 mm²–10 mm² conductor cross sections.

Another power feed option is via the end cap for a transition or gap (max. 6 mm²). For phases, doubly insulated cables must be provided for voltages > 48 V.

Fig. 11: End cap with power feed

End caps/end-cap units/power feed
These are used as insulating termination of rails and as guides for the collector brush at a transition. At a transition, the current collector is guided from one rail section to the following section. The end-cap unit consists of several end caps and a mounting plate or a mounting bar for multi-pole arrangements.

End caps and connectors are available as passive components and as power feeds. These components are similar to the passive components, but they have the option of connecting an electrical supply cable. The clamping unit for power feed modules differs from the passive components.

1 = End cap bar
2 = Clamping unit with crimping cable lug and connecting cable
3 = Crimping cable lug for connecting cable
4 = Clamping unit without crimping cable lug and connecting cable

The connection is established through crimping cable lugs for 1.5 mm²–6 mm² conductor cross sections. For phases, doubly insulated connecting cables must be provided for voltages > 48 V.
Operating Instructions

Single-pole conductor-rail system
SingleFlexLine Program 0815

- **Expansion element**
  The expansion element is used to compensate for the thermal expansion of the installation structure/EMS rail and conductor-rail.
  Building expansion points must be taken into account in the installation of the conductor-rail system.
  Observe the separate installation instructions MV0815-0005 for the installation.

Fig. 13: Expansion element

**ATTENTION!**

Expansion elements reduce the system load capacity of the overall system!
See Chapter 3.1

- **Air gap insulation section**
  The air gap insulation sections are used for the electrical isolation of the conductor-rail. The air gap insulation section consists of 2 opposing end caps and a lower part that connects the two end caps. The air gap insulation sections, like the end caps, provide a power feed option (see End caps/end-cap units/power feed)

Fig. 14: Air gap insulation section
4.4 Accessories

The following accessory parts are specific, special components and can be additionally ordered from the manufacturer (see manufacturer catalog):

- **Current collector**
  Current collector as a sliding electrical connection between conductor-rail and the moving consumer. Usually designed as a multiple-pole unit.

- **Collector brush sensor unit**
  A collector brush sensor unit is available for checking for the presence of the brushes and conditional wear measurement, which can check the status of the collector brushes in conjunction with control/evaluation logic provided by the customer (see BAL0815-0001).
Operating Instructions

Single-pole conductor-rail system
SingleFlexLine Program 0815

- Suction head/conductor-rail-cleaning unit

Various solutions are available for removing loose buildup and deposits on conductor-rails and EMS rails. Technical design and application details are available on request.

Fig. 18: Rail cleaner

4.4.1 Tools and materials

- Dismantling tool (081092)
- Drilling jig (see Chapter 6.3.3.4)
- Bending device (081091)
5 Transport, packaging and storage

5.1 Safety

Required protective equipment:

⚠️ **WARNING!**

**Risk of death due to suspended loads!**

Falling parts or uncontrolled swinging loads can lead to severe injury or even death.

→ Never walk under suspended loads.
→ Only use the attachment points provided; do not fasten lifting accessories to projecting machine parts or to eyelets on components.
→ Be sure the lashing elements are firmly seated.
→ Use only authorized lifting accessories and lashing elements with sufficient load capacity.
→ Do not use torn or damaged ropes or straps, but replace them with new ones.
→ Do not attach ropes or straps at sharp corners and edges, and do not knot or twist them.
→ Only move loads under supervision.
→ Set down the load when leaving the workplace.
→ Cordon off the work area.
→ Work carefully when working in the vicinity, especially below the conductor-rail system.

⚠️ **DANGER!**

**Risk of injury by crushing skin and limbs!**

Skin and limbs can be crushed:

- when packing components and handling long loads
- if transport crates are dropped
- with incorrect suspension points for transport crates
- with incorrect and unauthorized loading of transport crates

→ Wear protective gloves!
DANGER!
Risk of injury from cuts and cutting!
Cuts and amputations can occur:
- on packaging material (such as cartons, tapes, etc.)
- on sharp edges of the conductor-rail

→ Use personal protective equipment!

CAUTION!
Risk of puncture wounds and cuts!
The packaging material can contain sharp objects such as nails and wood splinters that can cause injury to limbs. Danger of conductor-rails sliding out if the packaging units are held at an angle.

→ Use personal protective equipment!
→ Cordon off the work area!
→ Caution when working in the vicinity, in particular below the conductor-rail

WARNING!
Damage from improper transport!
Improper transport can result in substantial property damage.

→ When unloading packaged parts upon delivery and during internal transport, proceed with caution and observe the symbols and information on the packaging.

→ Use only the provided attachment points.

→ Only remove packaging just before installation.

DANGER!
Risk of injury due to conductor-rails sliding out!
Risk of injury due to conductor-rails sliding out when the packaging units are held at an angle or carelessness with long loads.

→ Use personal protective equipment!
→ Cordon off the work area!

5.2 Transport
Check the delivery for completeness and transport damage immediately on receipt.
If transport damage is externally visible, proceed as follows:

- Do not accept delivery, or accept it only with reservations.
- Note the scope of damage on the transport documents, or on the transporter’s delivery note.
- File a complaint

ATTENTION!
File a complaint on every defect, as soon as it is detected. Damage compensation claims may only be made within the applicable claim periods.
5.3 Packaging

The individually packaged parts have been packed in accordance with the anticipated transport conditions. Only environmentally friendly materials have been used for packaging.

The packaging is designed to protect the individual components from transport damage, corrosion and other damage until installation. As a result, do not destroy the packaging and remove it only shortly before installation.

Handling packaging materials:
Dispose of packaging material according to valid legal regulations and local guidelines.

WARNING!
Environmental damage due to improper disposal!
Packaging materials are valuable resources and can be reused or usefully processed or recycled in many cases.
→ Dispose of packaging materials in an environmentally appropriate manner.
→ Comply with locally applicable disposal guidelines; if necessary, engage a specialist to handle disposal.

5.4 Storage of packaged parts

Packaged parts must be stored under the following conditions:

- Do not store outdoors
- Store in a dry, dust-free place
- Do not expose to aggressive media
- Protect from direct sunlight
- Avoid mechanical vibrations.
- Storage temperature: −30°C to +55°C
- Relative air humidity: Maximum 60% without condensation
- When storing for more than 3 months, check the general condition of all parts and the packaging at regular intervals. If necessary, refresh or replace the preservative

ATTENTION!
In some cases, there may be instructions for storage on the packaged parts that go beyond the requirements listed here.
→ Follow the instructions accordingly
6 Assembly

6.1 Safety

Installation and initial commissioning may only be carried out by specially trained technicians.

Required protective equipment:

![Pictograms for protective gear]

**Risk of death due to suspended loads!**
Falling loads can lead to severe injuries or even death.
→ Never walk under suspended loads.
→ Only move loads under supervision.
→ Set down the load when leaving the workplace.
→ Use personal protective equipment!

**Injury due to improper installation and initial commissioning!**
Improper installation and initial commissioning can result in serious injury to persons and/or material damage.
→ Before starting work, make sure there is sufficient space for assembly.
→ Handle open, sharp-edged components carefully
→ Make sure the installation area is tidy and clean! Loosely stacked or scattered components and tools are a source of hazards
→ Install components properly. Comply with the specified screw tightening torques

**Poisonous gases in case of fire!**
In case of fire in the facility, the plastic parts (PVC) of the conductor-rail system emit poisonous gases (HCL).
→ The system operator must take this into account accordingly when planning and take the appropriate protective measures
→ The building must be evacuated immediately.
→ The fire brigade must be informed.
DANGER!
Risk of injury by crushing skin and limbs!
There is a danger of crushing of skin and limbs due to:
- Spring force/gravity (stored energy)
- Current collector (spring force) during installation, dismantling and maintenance
- Falling conductor-rail system components if they have not been properly installed or if operated in inappropriate operating conditions (e.g. environment that contains solvents)

→ Have installation done only by trained technicians
→ When working on the conductor-rail system, wear safety boots, safety gloves, and a safety helmet
→ When changing the collector brush, follow the separate instructions for this task. See chapter 12.1
→ Only install the conductor-rail system where suitable operating conditions prevail. See chapter 3.3

DANGER!
Risk of injury due to grasping or impact!
Grasping and/or impact with moving conductor-rails (slip ring) or current collectors connected to the machine and other components must be prevented.

→ Cordon off the work area
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Caution when working in the vicinity of the danger zone, in particular below the conductor-rail
→ Falling conductor-rail system components if they have not been properly installed or if operated in inappropriate operating conditions (e.g. environment that contains solvents)
→ Use personal protective equipment!

DANGER!
Risk of injury from cuts and cutting!
Cuts and amputations can occur:
- on sharp edges of the general components
- on sharp edges of the conductor-rails
- on cut edges when trimming the conductor-rails
- on packaging materials (cartons, tapes, etc.)

→ Use personal protective equipment!
Risk of puncture wounds and cuts!
The packaging material can contain sharp objects such as nails and wood splinters that can cause injury to limbs.
→ Use personal protective equipment!
→ Cordon off the work area!
→ Caution when working in the vicinity, in particular below the conductor-rail

Risk of injury due to conductor-rails sliding out!
Risk of injury due to conductor-rails sliding out when the packaging units are held at an angle or carelessness with long loads.
→ Use personal protective equipment!
→ Cordon off the work area!

Risk of death by electrocution!
Contact with components carrying electrical power can lead to death by electrocution or severe injury. Danger of injury due to shock reactions, falling or being thrown across the room due to electrical shock.
→ The main power supply (from the building) must be disconnected in the installation area and secured against switching on again
→ Disconnect all electricity-supply power feeds
→ Check whether a voltage is still present in the components and take measures where necessary
→ Install the conductor-rail out of manual reach
→ Attach a sign saying "Risk of death by electrocution" with the relevant hazard symbol in all areas with live components
→ The customer must ground metallic components
→ The customer must provide protective devices
→ Make sure there is sufficient stability in the area

The system must be designed and operated in accordance with the prevailing ambient conditions!

Secure conductor-rails against falling
→ In application areas with personnel traffic and at an installation height of 3 m or more, conductor-rails must be secured against falling!
ATTENTION!

To the side of the conductor-rail there must, a clearance of at least 4 mm from metal components must be maintained (see Fig. 19) to prevent mechanical collisions and guarantee sufficient electrical insulation distances!

Fig. 19: Side clearance of at least 4 mm

6.2 Providing additional protection against accidental contact at the conductor-rail end

An end cap is attached to the conductor-rail end as protection against accidental contact. When using dual current collectors, one of the collector brushes, which will be live, might protrude from the end of the conductor-rail. Touching this collector brush might cause injury from an electric shock, as a result of falling or being thrown across the room. The system operator must ensure that the current collector does not project, instead remaining within the conductor-rails, or must make the danger area inaccessible (e.g. by providing protection against accidental contact).

Take structural protective measures!

→ Use control technology to ensure that the current collector never travels beyond the end of the conductor-rail.

→ Also fit a contact guard that will safely cover the collector brush if it leaves the conductor-rail!

Alert personnel to the hazard!

→ Attach a sign saying "Risk of death by electrocution" with the relevant hazard symbol in all areas with live components
6.3 Procedure

6.3.1 Required tools

- **Standard tool:**
  - Measuring tape
  - Calipers
  - Scribe
  - Allen key (3 mm)
  - Cutting tool (e.g. cordless angle grinder) For producing short lengths
  - File for deburring cut edges after trimming
  - Cordless drill and countersink bit
  - Screwdriver set

- **Special tool:**
  - Bending device (081091)
  - Rail-dismantling tool
  - Drilling jig for transition units
  - Torque wrench (2 Nm) with 3mm Allen key for rail connector

**Personnel:**

- Installation by technical personnel only
- At least two people

6.3.2 Customizing components

The customization of components is limited to the bending and trimming of the conductor-rail.

**ATTENTION!**

The trimming of the conductor-rail must be done away from the installation area!

6.3.2.1 Trimming conductor-rail

The conductor-rails have a standard length of 4000 mm. Shorter lengths can be supplied but are generally produced at the building site.

**Required tools:**

- Cutting tool, preferably a battery angle grinder with 1 mm cutting disc
- Print cutter

**Work steps:**

- Cut the conductor material and insulation to the same length.
- Saw off the metal rail and PVC insulation away from the contact area using a cutting tool.
- Deburr the sawed end with a smooth file. Chamfer the contact surface in the whole rail base by 0.3–0.4 mm by 15° to guarantee a problem-free passage of the collector brushes over the rail joint.
CAUTION!

Sharp edges and burrs result in increased wear of the collector brushes!
A sharp edge and/or burr can rapidly wear away the carbon of the collector brushes.

→ Deburr the sawed end with a smooth file

→ Clean the profile well and remove sawing debris

Fig. 20: Deburr the conductor-rail with a smooth file

Fig. 21: PEplus rail without end machining
ATTENTION!

The PE_{plus} rail has a plastic bar in the insulating profile!

→ Remove the plastic bar at each end using a print cutter or other suitable tool so that the connector or the end cap can be fitted

→ The cutting tool 08-W100-0603 can be used for producing the end machining

Use the QR code ("click" or "scan"), to watch our animation Cutting Phased Rail and PE_{plus} Rail, Notching for PE_{plus} Rail.
6.3.2.2 Making a bend in the conductor rail

Read and respect the additional operating instructions!
You can find additional information on the making a bend in a conductor rail in BAL0800-0004.

Conductor-rail bends can be fabricated in the factory or on site. They are prepared using the bending device 081091. For large installations, electrically driven bending devices available upon request.

---

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inside bend</td>
</tr>
<tr>
<td>2</td>
<td>Outside bend</td>
</tr>
<tr>
<td>3</td>
<td>Horizontal bend</td>
</tr>
</tbody>
</table>

---

Fig. 24: Outside/inside bends and horizontal bend

**Use of bends in horizontal and vertical curves**

<table>
<thead>
<tr>
<th></th>
<th>Engagement direction of the current collector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vertical (from below)</td>
</tr>
<tr>
<td><strong>Horizontal curve</strong></td>
<td>Horizontal curve</td>
</tr>
<tr>
<td></td>
<td>suspension interval: 400 mm</td>
</tr>
<tr>
<td></td>
<td>bend radius: 1000 mm to ∞</td>
</tr>
<tr>
<td><strong>Vertical curve</strong></td>
<td>Internal/external bend</td>
</tr>
<tr>
<td></td>
<td>suspension interval: 250 mm</td>
</tr>
<tr>
<td></td>
<td>Bend radius: 450 mm to ∞</td>
</tr>
</tbody>
</table>
Operating Instructions

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To avoid undesired deformations of the conductor-rail, the plastic insert supplied must be inserted in the slit in the contact surface before forming the bend and the removed once the bending process is complete.

---

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upper bending roller</td>
</tr>
<tr>
<td>2</td>
<td>Lower bending roller</td>
</tr>
<tr>
<td>3</td>
<td>Horizontal bend</td>
</tr>
<tr>
<td>4</td>
<td>Plastic insert 4x6 mm (white)</td>
</tr>
<tr>
<td>5</td>
<td>Insert PE plus for bending device 5.3x5 mm (black)</td>
</tr>
</tbody>
</table>

---

ATTENTION!

Ensure that the insert PE plus is installed in the correct position!

→ When bending the PE plus rail, make sure that the installation position is correct.
→ If necessary, re-measure (cut surfaces 5.3 mm or see surface A in Fig. 26)

---

Required tools:

- Bending device 081091

Work steps:

→ Scribe the required bend on a flat surface (e.g., the floor).
→ When making horizontal bends: Insert the plastic insert in the slot on the conductor-rail contact surface with the insulating profile slid open.
Using the setting spindle, move the upper bending roller upwards until the rail section can be inserted into the cutout provided in the bending device.

Adjust the position of the bending roller downwards and move the rail section back and forth.

Bend the rail section by progressively advancing the central pressure roller.

Repeat this process until the required radius is achieved.

All subsequent rail sections that are to be formed to the same radius can now be bent using the existing setting.

The rollers are designed for the various bends (horizontal/vertical, see BAL0800-0004 for the bending device for product ranges 0811 and 0815).

ATTENTION!

Use modified PE_{plus} rails for conductor-rail bends with radii < 1500 mm!

Use modified PE_{plus} rails (order no.: 081516-4x15) for preparing conductor-rail bends with radii < 1500 mm.

These rails are slotted on the rear side and can be bent without deformation of the insulation.

Fig. 27: Slotted PE_{plus} rail

Fig. 28: Bending device (081091)

Use the QR code ("click" or "scan"), to watch our animation Bending Rail.
6.3.3 Assembling the conductor-rail system

ATTENTION!

To the side of the conductor-rail there must, a clearance of at least 4 mm from metal components must be maintained (see Fig. 29) to prevent mechanical collisions and guarantee sufficient electrical insulation distances!

ATTENTION!

![Diagram showing side clearance of at least 4 mm](image)

Fig. 29: Side clearance of at least 4 mm

Procedure during installation:

It makes sense to start the assembly at one end cap and to assemble the conductor-rail along the route.

Work steps:

→ Indicate the positions/installation locations for power feed, customer's fixed points, junction boxes, expansion elements, isolating gaps and the guideway profile on the installation structure in accordance with the layout and allocation plan.

→ Prepare the power feed and section transitions.

→ Assembling the conductor-rail (see chapter 6.3.3.1).

→ Install conductor-rail sections including cut sections, lifter, conductor-rail bends and fixed points.

→ Prepare the cut sections and conductor-rail bends in the switches.

→ Check the mechanical installation.

Test steps to be performed during installation:

→ Check the design against the layout and allocation plan.

→ Maintain the hanger-clamp intervals; the rails must be properly engaged in the hanger clamp.

→ All screw connections for the power feeds, connectors and end caps must be tightened to 2 Nm.

→ All transitions and bends must be tested for functionality. Current collectors must not jam when passing through. Check for free passage with a single current collector.

→ The cabling must be checked (routing, labeling, etc.).

→ Conduct a continuity and insulation check.

→ Check the set dimension of the expansion element.
6.3.3.1 Setting the hanger clamps

The following must be observed when setting the hanger clamps:

→ Set the hanger clamps at intervals of approx. 500 mm and at intervals of 400 mm and 250 mm respectively for internal and external horizontal bends. Mount the hanger clamps at a distance of 100 mm – 150 mm from the end cap (see Fig. 31).

→ At transitions and connection points, a minimum distance to end caps, connectors and expansion elements of at least 200 mm must be maintained. Here, the hanger clamps must be set such that collisions of hanger clamps with other components of the system are avoided on expansion of the system.

Hanger clamps are screwed or snapped into customer-specific guideway profiles. When installing, ensure that the pretensioning is not too great. Excessive pretensioning will distort the hanger clamp. There is a risk that the hanger clamp will no longer rest flat on the central bar of the EMS rails.

Nevertheless, the hanger clamp must be so firmly seated in its position that it cannot dislocate freely in the guideway profile.

Frequently, the hanger clamps only become firmly seated in the EMS rail when the conductor-rails have been installed.

→ Provide additional fixing for clip-in hanger clamps that do not remain in their positions.

Fig. 30: Hanger clamp in EMS rail

Fig. 31: Distance of the hanger clamp to the end cap
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Fig. 32: Comparison of correctly and incorrectly engaged rail

Fig. 33: Clip the hanger clamp into the conductor-rail

Standard hanger clamp for screwing on:

To fasten the standard hanger clamps, drill holes must be made in the EMS rail. The drilling jig for support profile height 180 mm (Material-Nr. 2: 08-V015-0474-001) and the drilling jig for support profile 240 mm (Material-Nr. 2: 08-V015-0474-002) are available to set the drill holes quickly and easily.

The holes for the hanger clamps are placed via the row of the female connector (1). The row of the female connector has markings (2 and 3 see Fig. 33 and Fig. 34) indicating the distance between the drill holes of the hanger clamps (detail C). The drill hole distance depends on the number of poles. The position of the holes can be adjusted in y-direction via the slotted holes (4).

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Guideway rail</td>
</tr>
<tr>
<td>2</td>
<td>Hanger clamp</td>
</tr>
</tbody>
</table>
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Fig. 34: Drilling jig for hanger clamp

Fig. 35: Drill hole distance of the female connectors

Fig. 36: Drill hole distance of the female connectors (detail C)

Use the QR code ("click" or "scan"), to watch our animation
Mounting Hanger Clamps (clip-in, screwable and turnable).
6.3.3.2 Installing conductor-rail and connectors

→ After installation of the hanger clamps and preparations of the transitions and power feed points, push the conductor-rails into the hanger clamps. Make sure that the conductor-rails engage correctly and the hanger clamp covers the insulation above and below (see Fig. 32).

→ To simplify the installation of the subsequent conductor-rail, it makes sense not to engage the final meter of the current conductor-rail. This provides better accessibility of the conductor-rail joint (EMS).

According to the guidelines of the automotive industry, the protective conductor (PE) is provided as the 4th pole counted from above. This also corresponds to the standards of conductor-rail manufacturers.

![Diagram of connector and conductor-rails]

Fig. 37: Connector and 2 conductor-rails

Screw connections are used to connect 2 conductor-rails. The connectors have a contact part and a rear clamping part.

→ Push the connector into the conductor-rail such that the contact part sits in the interior of the conductor-rail and the clamping part engages between the conductor-rail and the rear insulation (see Fig. 39 and Fig. 40).

A light pressure on both sides of the side surface of the conductor-rail may make it easier to push the connector in.

→ Push the connector into the two conductor-rails as far as the stops and then lightly tighten the connector from the front. Then tighten the connector to 2 Nm with a torque wrench (see Fig. 41).

→ Put the insulating cap on from the back, engage it and check for secure hold.

→ Push the conductor-rail into the hanger clamp next to the connection point until it engages.

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
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<tbody>
<tr>
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<tr>
<td>2</td>
<td>Connectors</td>
</tr>
<tr>
<td>3</td>
<td>Conductor-rail</td>
</tr>
</tbody>
</table>
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Fig. 38: Push the rails onto the connector

Fig. 39: Correct position of the clamp

ATTENTION!
Make sure that the connector cap is completely engaged on both sides of the insulating profile!

→ Attach the connector cap centrally from behind clip it into the insulating profile.

→ Engage the conductor-rails in the hanger clamps (see Fig. 43).

Fig. 40: Incorrect position of the clamp

Tighten the connector with a 3-mm hex screwdriver to 2 Nm.

Fig. 41: Tighten the connector

Fig. 42: Slide the connector cap over the rail connection
**CAUTION!**

Conductor-rails can become deformed when bent!

→ Check conductor-rail bends for the correct profile, because conductor-rails can deform when bent in the area of the insulation

→ Push a current collector through the conductor-rail by hand. The current collector must slide through the conductor-rail bend without jamming.

→ For a PE<sub>plus</sub> rail use a PE<sub>plus</sub> current collector with a broader brush

→ If the connector cap cannot rest on the guideway profile, hanger clamps must be placed at maximum distances of 200 mm on both sides of the connector position (see Fig. 44).

---

**Fig. 43: Support profile with a conductor-rail installed**

Use the QR code ("click" or "scan"), to watch our animation Connecting Rails.
During installation, it can happen that a conductor-rail has to be taken out of a hanger clamp again. There is a dismantling tool for this (order no.: 081092). This is used to dismantle the conductor-rail fixed in the hanger clamp and end caps bars (see Fig. 45–Fig. 47; see chapter 11.2).

![Dismantling tool](image1)

Fig. 45: Dismantling tool

![Dismantling tool (side view)](image2)

Fig. 46: Dismantling tool (side view)

![Dismantling tool in use (side view)](image3)

Fig. 47: Dismantling tool in use (side view)

![Dismantling tool in use (front view)](image4)

Fig. 48: Dismantling tool in use (front view)

Use the QR code (“click” or “scan”), to watch our animation Using Dismantling Tool.
6.3.3.3 Installing a section power feed

The section power feed is installed instead of a connector. Here, a different clamping part and a power feed cap with room for a connecting cable to run out of it are used.

Fig. 49: Correct position of the clamping unit

Fig. 50: Incorrect position of the clamping unit

Fig. 51: Slightly loosen the screw connection with a screwdriver (½ turn), locking the square nut to facilitate loosening if necessary

Fig. 52: Push the rail section into the free end of the section power feed as far as the stop

Fig. 53: Slide the power feed cover over the preassembled rail connector.

Fig. 54: Tighten the hexagonal screw to 2 Nm
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By using a section power feed, power can be supplied at any connection point in the route. The connection is made using a crimping cable lug of 1,5 mm² to 10 mm² max. For phases, doubly insulated connecting cables must be provided for voltages > 48 V (max conductor diameter 7 mm, see Fig. 55). Basically, use connecting cables only with copper conductors.

→ Trim the feed cable and strip the insulation to the desired length.
→ Crimp the crimping cable lug of the section power feed onto the end of the cable. Do **not** remove the crimping cable lug from the connector for this. Use a suitable crimping tool to connect the cable and cable lug.
→ Loosen the screw with an SW-3 hexagonal screwdriver and insert the connector parts into the installed rail with insulation profile (see Fig. 51).
→ Push the next rail section into the free end of the section power feed as far as the stop (see Fig. 52).
→ Tighten the hexagonal-socket-headed screw to 2 Nm (see Fig. 53).
→ Slide the contact-preventing power feed cap over the preassembled rail connector. Make sure that the square nut is aligned in the recess of the connector cap. Engage the power feed cap on both sides of the insulating profile (see Fig. 54).

**ATTENTION!**

Make sure that the connector cap is completely engaged on both sides of the insulating profile!

→ Provide a constructional strain relief for the feed cable.
If needed, any connector can be replaced by a power feed. If a power feed has to be introduced into the route after completion of the installation, a 10-mm gap is cut into the rail. Then proceed as described above.

Fig. 55: Power feed cover

If the power feed cover cannot rest on the guideway profile, hanger clamps must be placed at maximum distances of 200 mm on both sides of the power feed position.

Preassembled power feed cables with clamping units installed can be ordered as a unit!
6.3.3.4 Installing end caps and end power feeds

Drill the guideway profile in accordance with the layout and allocation plan. The use of a drilling jig is recommended in order to ensure the exact position of the end caps. The drilling jig can be used both for straight transitions (e.g., entry into a lifter) and for angled cuts (e.g., switches). For further information see MV0815-0006.

Tools:

- Self-tapping screws DIN 7500-1 M4, length \( \geq \) profile bar width
- Drill diam. 3.6 mm

After installation of the end-cap bar (existing systems) or the retaining plate (new systems) for the transition caps, the end caps (with or without power feed) are installed.

**CAUTION!**

Ensure the correct positioning of the clamping unit!

Push the clamping unit of the end cap into the conductor-rail such the contact part sits in the interior of the conductor-rail and the clamping part engages between the conductor-rail and the rear insulation (see Fig. 58 and Fig. 59).
For end power feeds, the power can be supplied at the end of the route. An end power feed consists of an end cap with a power feed clamping unit. The connection is made using a crimping cable lug with a conductor cross section of 1.5 mm² to 6 mm². For phases, doubly insulated connecting cables must be provided for voltages > 48 V. Basically, use connecting cables only with copper conductors.

→ Only for end power feeds:

- Trim the feed cable and strip the insulation to the desired length.
- Crimp the crimping cable lug of the end power feed onto the end of the cable. Do not remove the crimping cable lug from the connector for this.

Fig. 60: Mounting of the end cap

→ Tighten the hexagonal-socket-headed screw to 2 Nm (see Fig. 60).
→ Provide a constructional strain relief for the end power feed cable.
→ For power feed with preassembled cable part, push the clamping unit onto the end of the rail. Possibly loosen the clamping screw somewhat and push the end cap onto the clamping part and the conductor-rail.

ATTENTION!

→ Engage the end cap/end power feed into the retaining plate (see Fig. 61).
6.3.3.5 Mounting the fixed point

A fixed point consists of a hanger clamp and 2 fixed point clamps per pole. The positions of the fixed points are determined when planning the system. The correct positioning of the fixed points is crucial for the thermal expansion behavior of the conductor-rail system.

Establishing a fixed point:

→ Install a fixed point left and right of a hanger clamp per conductor-rail pole. The fixed-point cap is secured by an engagement cam in a hole in the side wall of the conductor-rail.

→ Scribe the position on the conductor-rail before installation.

→ Put the fixed-point cap on the conductor-rail as a drilling jig and drill a 3-mm hole through the insulation and copper profile on one side.

→ Remove the fixed-point cap and replace it after rotating through 180° and insert an engagement cam into the hole.

![Fig. 62: Drill the hole for the engagement cam, insulating profile and copper element](image1)

![Fig. 63: Rotate the fixed-point cap through 180°.](image2)
**Operating Instructions**

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---

**Fig. 64:** Insert the engagement cam into the hole

**Fig. 65:** Fully assembled fixed point

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engagement cam</td>
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<td>2</td>
<td>Fixed-point cap</td>
</tr>
<tr>
<td>3</td>
<td>Hanger clamp</td>
</tr>
<tr>
<td>4</td>
<td>Track profile</td>
</tr>
<tr>
<td>5</td>
<td>Screw</td>
</tr>
</tbody>
</table>

---

**CAUTION!**

Additional fixing of the hanger clamp is required for clip-in hanger clamps!

For clip-in hanger clamps, the hanger clamp that is to be used as the fixed point must be additionally secured to the support profile/building structure with a screw.
6.3.4 Installing the current collector

Different current collectors are used for existing and new systems:

**Legacy systems**

<table>
<thead>
<tr>
<th>Number of Poles</th>
<th>b</th>
<th>B</th>
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</thead>
<tbody>
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<td>54</td>
</tr>
<tr>
<td>6</td>
<td>70</td>
<td>82</td>
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<td>8</td>
<td>70</td>
<td>110</td>
</tr>
<tr>
<td>10</td>
<td>70</td>
<td>120</td>
</tr>
</tbody>
</table>

Tolerances in the X-axis and Y-axis: ± 10 mm
1 = strain relief (optional)

- Fig. 66: Single current collector (081506…, 081507…)

- Fig. 67: Dual current collectors (081508…, 081509…)

**Figures**

- Single current collector (081506…, 081507…)
- Dual current collectors (081508…, 081509…)

Use the QR code ("click" or "scan"), to watch our animation Mounting Fixed Point.
New systems

Fig. 68: EMS current collector (08150A / B…)

*The screw is not part of the scope of supply. It must be ordered separately.

<table>
<thead>
<tr>
<th>Number of Poles</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
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<tr>
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<tr>
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<tr>
<td>8</td>
<td>112</td>
</tr>
<tr>
<td>10</td>
<td>140</td>
</tr>
</tbody>
</table>

Tolerances in the X-axis and Y-axis: ± 15 mm

1 = Hexagon screw M5 DIN EN 4017 (DIN 933)*

2 = integrated cable

Use the QR code ("click” or “scan”), to watch our animation EMS Current Collector Tolerances.

The single current collectors are mounted on base plates:

Fig. 69: Mount the single current collector (081506…, 081507…, 081508…, 081509…) on base plate
Fig. 70: Mount the EMS current collector (08150A / B…) on a base plate

ATTENTION!

One screw can be put on each pole at the EMS current collector!
The screw heads are be covered by the current collectors!

ATTENTION!

→ When installing current collectors, make sure the installation position is correct.

→ For types without an integrated cable guide, take care with the selection of the connecting cable and ensure the connecting cables are installed without tensile or directional forces:
  → Use only highly flexible Conductix-Wampfler cables! Basically, use connecting cables only with copper conductors.
  → Use wire end ferrule with plastic sleeve for the flexible connecting cables.
  → For phases, doubly insulated connecting cables must be provided for voltages > 48 V.
  → Do not bundle, fix or attach identification signs to the current-collector-connecting cable!
  → Do not allow foreign objects to protrude into the moving range of the current collector and connecting cables!

→ For systems with curves/bends, make sure that the current collector is installed in the pivot or steering axis—only by doing this can it be ensured that the correct contact pressure is maintained when passing through (inside/outside) curves.

Danger of electric shock!
Always protect unoccupied sockets on the current-collecting heads with protective caps!
The open connection must always be protected with a protective cap. This must also be observed when changing current-collecting heads (see Fig. 71).
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WARNING!

Risk of wear and damage!
The distance from the securing base surface of the current collector to the running surface of the conductor-rail is an important functional dimension. This dimension changes in curves if the current collector is not installed directly under the wheel contact point of the EMS hanger. If the distance from the wheel contact point is too great, the permissible tolerances may be exceeded in tighter curves. Result: Damage, high wear

→ Compliance with the installation tolerances must therefore be checked in the tightest curved section!

---

ATTENTION!
The protective cap is supplied pre-installed on the current collector. A replacement protective cap can be ordered as a packing unit with material number 08-A025-0080!
Install all current-collector cables highly flexibly and without tensile or directional forces!

---

Fig. 71: Protect unoccupied current-collector-connecting cable with the protective cap provided (08150A / B…; 08150x…)

Fig. 72: Comparison of the correct and incorrect position of the socket sleeve
**Operating Instructions**

**Single-pole conductor-rail system**

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---

**WARNING!**

**Bending up of the socket sleeve!**
If the socket sleeve is placed incorrectly on the collector brush, the socket sleeve bends up, the socket sleeve is damaged and the contact with the brush is minimized.

→ Ensure the socket is correctly positioned to prevent the socket sleeve from bending up!

---

**CAUTION!**

**Contact problems or increased heating!**
→ Clean the collector brush before commissioning and remove dirt, oxidation, pitting corrosion and other impurities by means of a brass brush or abrasive paper (320 grit).

---

**DANGER!**

**Risk of damage when cleaning the conductor-rail!**
When cleaning, only loose or lightly adhering dust or foreign substances may be removed.

→ Do not use contact spray (formation of silicon carbide/abrasive and/or damage of plastic parts)

→ Only use abrasives or brushes as tools for removing heavy build-ups at minor burns under supervision.

→ Persistent use with removal of the lubricant layer or running surface damages the rail (see also WV0800-0001 and WV0800-0004)

---

**Typical installation errors that have a negative affect on the running behavior of the current collectors:**

- Conductor-rails are not correctly engaged in the hanger clamp
- Rail bends are tapered due to progressive bending
- Switches and lifters are incorrectly set (end positions, dimensional tolerances) or yielding
- Incorrect current-collector-connecting cable
- Current-collector-connecting cable not used as (not free of directional and tensile forces)
- Installation positions are not within specification Permissible tolerances exceeded in bends and curves
- Rail joints and transitions have not been deburred

---

Use the QR code ("click" or "scan"), to watch our animation

**Mounting EMS Current Collector on Base Plate.**
6.4 Additional documents

Read and respect the additional operating instructions!
You can find further information on the installation of conductor-rail systems in the following instructions:
- MV0815-0005 Expansion module and expansion element
- MV0815-0006 Transitions
- MV0815-0007 Installation instructions for conductor-rail system 0815
- BAL0815-0001 Carbon-brush sensor unit
- BAL0800-0004 Bending device for product ranges 0811 and 0815
7 Commissioning

7.1 Safety

Personnel:

- The conductor-rail system must only be commissioned and operated for the first time after a repair by qualified electricians!
- The qualified electricians must meet the requirements described in Chapter 2.2.1.

Required protective equipment:

Requirement:

**WARNING!**

Only operate the conductor-rail system in areas inaccessible to the public!
Operation is only permitted in areas inaccessible to the public and out of manual reach.

→ The hazard zone must be enclosed by the customer or protection ensured by distance!

**WARNING!**

Risk of injury due to improper commissioning!
Improperly performed commissioning can lead to dangerous situations for personnel (see chapter 7.2.1).

→ Before commissioning, carry out the inspections on the inspection list of the manufacturer.

→ Always measure the insulation resistance before commissioning the system. This must be done in compliance with the local technical standards, guidelines and legislation

→ Always make sure that all of the assembly and installation work has been fully completed before commissioning the system

→ Always make sure that all of the components have been properly installed before commissioning the system
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Risk of injury by crushing skin and limbs!
There is a danger of crushing of skin and limbs due to:
- Spring force/gravity (stored energy)
- Current collectors (spring force) during preassembly, installation, operation, maintenance and dismantling (e.g., crushing of limbs between the current-collecting head and general components)
- Moving parts, when the system is in operation
→ Do not stand directly below the conductor-rail system
→ Do not enter the danger zones of the system during operation. The operator/system manufacturer must ensure the technical protective measures are taken (covers, protection by distance, control technology, etc.)

Fire hazard due to overload or sparking!
A fire hazard can occur due to overloads of the cable, electrical arcing, short circuits or the generation of sparks. Sparking can occur in poorly serviced, contaminated conductor-rails or if installation does not comply with the required tolerances.
Take the following measures:
→ Conduct electrical testing as prescribed
→ Permissible current values must be observed.
→ Maintain tolerances during operation
→ Do not remove the prescribed electrical safety devices and protective devices
→ Do not store easily ignited materials near to conductor-rails.
→ Inspect, service, and clean conductor-rails regularly and in accordance with specifications see chapter 12
→ Dimensioning according to permissible system load capacity and provide for appropriate electrical protective devices

Risk of injury due to grasping or impact!
Grasping and/or impact with moving conductor-rails (slip ring) or current collectors connected to the machine and other components must be prevented.
→ Cordon off the work area
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Caution when working in the vicinity of the danger zone, in particular below the conductor-rail
→ Falling conductor-rail system components if they have not been properly installed or if operated in inappropriate operating conditions (e.g. environment that contains solvents)
→ Use personal protective equipment!
Risk due to sensitizing material and dust!
Dust from the collector brushes collects in the conductor-rails and the guide profile. This dust is very fine and is categorized as a health risk. Working a lot with the conductor-rail system and/or not applying the requisite level of care when handling accumulated dust (e.g. cleaning the system with compressed air) can lead to sensitization.
→ Do not eat and/or drink in the workplace
→ Use personal protective equipment

Before switching the system on!
→ Ensure that all installation work has been completed and all the components have been properly installed
→ Every time before the device or system is started, measure the insulation resistance according to locally applicable technical standards, directives and legal regulations.
→ Carry out locally required electrical tests
→ Ensure adequate stability on the device/system for the commissioning engineer

Before working on these components!
→ Disconnect the conductor-rail system from the power supply according to the 5 safety rules and secure it against being switched back on. For the 5 safety rules, see chapter 2.5.

The system must be designed and operated in accordance with the prevailing ambient conditions!

Secure conductor-rails against falling
→ In application areas with personnel traffic and at an installation height of 3 m or more, conductor-rails must be secured against falling

Risk of injury due to hot components!
Components can get hot during operation.
→ Operation is only permitted in areas inaccessible to the public and out of manual reach.
→ The hazard zone must be enclosed by the customer or protection ensured by distance
→ Cordon off the work area
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Use personal protective equipment!
# 7.2 Testing and initial commissioning

## 7.2.1 Inspection list

**WARNING!** Danger of death by electrocution!

<table>
<thead>
<tr>
<th>Check</th>
<th>Checked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation height as per specifications (see chapter 3)</td>
<td></td>
</tr>
<tr>
<td>All installed components are clean, dry and undamaged.</td>
<td></td>
</tr>
<tr>
<td>Installation clearances of the current collectors are as specified</td>
<td></td>
</tr>
<tr>
<td>Have the contact surfaces of the collector brush been cleaned before commissioning and dirt, oxidation, pitting corrosion and other impurities removed by means of a brass brush or abrasive paper (320 grit)?</td>
<td></td>
</tr>
<tr>
<td>Are the connecting cables installed without directional and tensile forces? The connecting cables must not pull on, press against or cause the current collectors to twist.</td>
<td></td>
</tr>
<tr>
<td>Are the hanger-clamp spaces as specified? (see chapter 6.3.3.1)</td>
<td></td>
</tr>
<tr>
<td>Have the end caps been fitted correctly and to the first and end section?</td>
<td></td>
</tr>
<tr>
<td>Are the end-cap bars and fixed-points properly installed as specified?</td>
<td></td>
</tr>
<tr>
<td>Are the insulation profiles properly engaged in all hanger clamps?</td>
<td></td>
</tr>
<tr>
<td>Are the rail joints at the connection points and the end caps deburred and correctly aligned?</td>
<td></td>
</tr>
<tr>
<td>Are all electrical protection devices installed, tested and functioning? Are covers and barriers in place?</td>
<td></td>
</tr>
<tr>
<td>Is the power feed properly connected?</td>
<td></td>
</tr>
<tr>
<td>Are all metallic components (such as substructures/supporting structure) grounded as specified?</td>
<td></td>
</tr>
<tr>
<td>Are all screws tightened to the specified tightening torque?</td>
<td></td>
</tr>
<tr>
<td>Is the operating area tidy (no parts or tools)?</td>
<td></td>
</tr>
<tr>
<td>Has the operating personnel been trained?</td>
<td></td>
</tr>
<tr>
<td>All poles of the conductor-rail system have been run through with a loose current collector. The current collector may not stick and must slide in the rail without hindrance</td>
<td></td>
</tr>
<tr>
<td>Warning symbol “Electrical Shock” and type plate are installed by the manufacturer at a suitable location.</td>
<td></td>
</tr>
</tbody>
</table>

……………………………………………………………………………………………………

Date  Signature

7.2.2 Initial start-up of the conductor-rail system

1. Every time before the machine/system is started, measure the insulation resistance of the conductor-rail system according to locally applicable technical standards, directives and legal regulations.
2. Carry out locally required electrical tests.
3. Perform a complete run along the conductor-rail (walking pace).

Remark: Insulation resistance test according to EN 60204-1: 2006 ≥ 1 MΩ at a measuring voltage of 500 VDC. Exception for busbars, conductor-rails and slip rings ≥ 50 kΩ (EN 60204-1/18.3: 2006)

ATTENTION!
The current collectors must not become caught, stick or scrape!

where necessary, repair any faults and perform setting tasks.

4. Visual inspection of the device/system:
   → Current collector undamaged and without signs of heavy wear
   → Conductor-rail components undamaged and in the proper location. No displacements or distortions. Check hanger clamps, end caps and fixed points in particular!
   → Check that there are no visible signs of heavy wear (chips, plastic parts, etc.). Signs of heavy wear indicate that installation clearances and their tolerances are not complied with. This can sometimes also be the case for individual sections of the route.
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8 Operation

The only operations required to operate the conductor-rail system are switching the power supply on and off to stop/activate the system, see chapter 8.2. The safety information in chapter 8.1 must be observed to guarantee safety during operation.

8.1 Safety

ATTENTION!
The system must only be operated by trained personnel!

WARNING!
Danger for unauthorized personnel!
Unauthorized personnel are not familiar with the hazards in the working area.
→ Keep unauthorized personnel out of the working area
→ In case of doubt, address such persons and direct them away from the working area
→ Stop work as long as unauthorized persons are in the working area

Requirement:

WARNING!
Risk of injury due to entrapment!
There is a risk of being trapped by moving parts when the system is in operation.
→ Do not enter the danger zones of the system during operation

In order to comply with the most important measures for protection against hazards, the measures specified in chapters 2 and 3 must be observed. For information on foreseeable incorrect applications or unsuitable ambient conditions see especially chapters 2.5 and 3.3.
Risk of injuries from falling conductor-rails!
The mountings of the conductor-rail can fail and the conductor-rail fall down. Components can be damaged if the following or similar materials are stored in the vicinity of the conductor-rail:

- Solvents that contain aromatic compounds and evaporate
- Coating products and paints
- Separating agents or coolants and lubricants
- See Chapters 3.3 and 2.8.4.

→ Do not store any of the above or similar substances near the conductor-rails.
→ In application areas with personnel traffic and at an installation height of 3 m or more, conductor-rails must be secured against falling.

Risk of death by electrocution!
Contact with components carrying electrical power can lead to death by electrocution or severe injury. Danger of injury due to shock reactions, falling, or being thrown across the room due to electrical shock.
The conductor-rail must not be operated under the following circumstances:

→ If the conductor-rail is very dirty
→ If the conductor-rail becomes wet
→ If electrically live parts are exposed (insulating profile or the insulation of the connection cable are damaged)
→ If the hanger clamp or insulation profile fail
→ If the power rail falls down and contacts a conductive material

Take the following measures:

→ Install the conductor-rail out of manual reach
→ Attach a sign saying "Risk of death by electrocution" with the relevant hazard symbol in all areas with access to live parts
→ Secure the electrical system according to regulations
→ The customer must ground metallic components
→ The customer must provide protective devices
→ Install the conductor-rail as described in the installation manual
→ Take environmental conditions into account, perform regular checks, maintain and clean as detailed in the instructions
→ Regularly clean the conductor-rail and repair it if necessary
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DANGER!

Fire hazard due to overload or sparking!
A fire hazard can occur due to overloads of the cable, electrical arcing, short circuits or the generation of sparks. Sparking can occur in poorly serviced, contaminated conductor rails or if installation does not comply with the required tolerances.

Take the following measures:

→ Conduct electrical testing as prescribed before commissioning
→ Permissible current values must be observed.
→ Maintain tolerances during operation
→ Do not remove the prescribed electrical safety devices and protective devices
→ Do not store easily ignited materials near to conductor rails.
→ Inspect, service, and clean conductor rails regularly and in accordance with specifications see chapter 12
→ Dimensioning according to permissible system load capacity and provide for appropriate electrical protective devices

WARNING!

Risk of injury due to hot components!
Components can get hot during operation.

→ Operation is only permitted in areas inaccessible to the public and out of manual reach.
→ The hazard zone must be enclosed by the customer or protection ensured by distance
→ Cordon off the work area
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Use personal protective equipment!

WARNING!

Risk of health issues due to respirable dust!
Airborne dust can cause respiratory complaints and eye irritation.

→ Clean regularly
→ One result may be cancer

8.2 Normal operation

Conductor-rail system 0815 is protected against accidental contact and suitable for use in indoor operations such as for electric monorail systems (EMSs) or slip-ring assemblies.

WARNING!

Only operate the conductor-rail system in areas inaccessible to the public!
Operation is only permitted in areas inaccessible to the public and out of manual reach.

→ The hazard zone must be enclosed by the customer or protection ensured by distance!
8.3 Stopping the system

Requirement:

DANGER!

Risk of injury due to electric shock!
→ Disconnect the conductor-rail system from the power supply according to the 5 safety rules and secure it against being switched back on. For the 5 safety rules, see Chapter 2.5.

8.4 Continuing operation

WARNING!

Risk of injury if safety equipment and protective devices are disabled!
→ Before switching the system back on, make sure that all covers, safety systems and protective devices are installed and working properly

Before switching the system back on, make sure that:

- The current-collecting heads must lie within the conductor-rail for the whole length and the prescribed contact pressure must be applied
- There is no coarse dirt or objects in the conductor-rails
→ Visually inspect the system
- The insulation resistance corresponds to the locally applicable technical guidelines
→ Every time before the device or system is started, measure the insulation resistance according to locally applicable technical standards, directives and legal regulations.

8.5 Perform regular maintenance and servicing

Perform regular maintenance and servicing in accordance with chapter 9.

WARNING!

Risk of malfunctions!
Lack of maintenance and servicing can cause malfunctions significant damage.
9 Maintenance and servicing

9.1 Safety

The system must only be serviced and maintained by specialist personnel!

Requirement:

Disconnect the system from power and secure against being switched on again.

Required protective equipment:

Risk of injury due to improperly executed maintenance and/or servicing tasks!

Improper or omitted maintenance or servicing work can result in serious injury to persons and/or material damage. Loosely stacked or components and tools that are left lying around are a source of danger. They are a trip hazards and improperly stored components can fall over or fall to the ground.

→ Before starting work, make sure there is sufficient space for assembly.
→ Make sure the installation area is tidy and clean!
→ If components have been removed, be careful to reinstall them properly, replace all fastening elements and comply with screw tightening torques

Risk of injury due to dust!

Dust due to abrasion (collector brushes, copper rails, plastic) can cause respiratory complaints, choking and eye irritation.

→ Clean the system before starting work
→ Use personal protective equipment.
   → Safety goggles
   → Dust mask class FFP3
   → Protective gloves
   → Disposable coverall
→ Prevent contamination of the environment (e.g., people, goods, production facilities etc.) while cleaning by taking appropriate measures (use covers, barriers, filter systems)
Risk of injury due to materials and substances!
Respiratory complaints and eye irritation may occur due to airborne dust. There is a health hazard due to airborne respirable dust. One result may be cancer.
→ Clean regularly! Before starting work, clean the conductor-rail in accordance with regulations. See Chapter 12.1
→ Clean the system before starting work!
→ Use personal protective equipment
→ Prevent contamination of the environment (e.g., people, goods, production facilities etc.) by taking appropriate measures (use covers, barriers, filter systems)
→ Do not blow out dust with compressed air. Instead, vacuum it up. The vacuum cleaner must be equipped with a Class H fine filter
→ Eating and/or drinking at the workplace is prohibited!
→ Do not smoke while cleaning!
→ See chapter 2.8.3 for further information

Risk of injury due to entrapment!
Grasping and/or impact with moving conductor-rails (slip ring) or current collectors connected to the machine and other components must be prevented.
→ Cordon off the work area!
→ Caution when working in the vicinity of the source of danger
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Use personal protective equipment!

Risk of impact, puncture wounds and cuts!
Hazard due to moving or falling parts during maintenance/servicing.
→ Use personal protective equipment!
→ Cordon off the work area!
→ Caution when working in the vicinity, in particular below the conductor-rail
Risk of injury by crushing skin and limbs!
Skin and limbs can be crushed:
- when packing components and handling long loads
- if transport crates are dropped
- with incorrect suspension points for transport crates
- with incorrect and unauthorized loading of transport crates

→ Wear protective gloves!

Risk of death by electrocution!
Contact with components carrying electrical power can lead to death by electrocution or severe injury. Danger of injury due to shock reactions, falling, or being thrown across the room due to electrical shock.

→ The main power supply (from the building) must be disconnected in the maintenance/servicing area and secured against switching on again
→ Disconnect all electricity-supply power feeds
→ Check whether a voltage is still present in the components and take measures where necessary
→ The customer must ground metallic components
→ The customer must provide protective devices

Fire hazard due to overload or sparking!
A fire hazard can occur due to overloads of the cable, electrical arcing, or short-circuits.

→ Before recommissioning, ensure that all work has been completed and all components have been properly installed
→ Conduct electrical testing as prescribed
→ Permissible current values must be observed.
→ Electrical fuses must be installed in accordance with regulations.
→ Warn against misuse
→ Do not store easily ignited materials near to conductor-rails.
→ Dimensioning according to permissible system load capacity and provide for appropriate electrical protective devices
WARNING!
Risk of injury due to hot components!
Components can get hot during operation.
→ Operation is only permitted in areas inaccessible to the public and out of manual reach.
→ The hazard zone must be enclosed by the customer or protection ensured by distance
→ Cordon off the work area
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Use personal protective equipment!

CAUTION!
Alert personnel to the hazard!
→ Attach a sign saying “Risk of death by electrocution” with the relevant hazard symbol in all areas with access to live components for specialist personnel, for example

CAUTION!
Before working on these components!
→ Disconnect the conductor-rail system from the power supply according to the 5 safety rules and secure it against being switched back on. For the 5 safety rules, see chapter 2.5.

WARNING!
Risk of injury if safety equipment is switched off!
→ Never switch off safety equipment
Performing maintenance work on the current collectors

Risk of injury by crushing skin and limbs!
There is a danger of crushing of skin and limbs due to:

- Spring force/gravity (stored energy)
- Current collector (spring force) during installation, dismantling and maintenance
- Falling conductor-rail system components if they have not been properly installed or if operated in inappropriate operating conditions (e.g. environment that contains solvents)
- Moving parts, when the system is in operation

→ Have work done only by trained technicians
→ When working on the conductor-rail system, wear safety boots, safety gloves, and a safety helmet
→ When changing the collector brush, follow the separate instructions for this task. See chapter 12.1
→ Only install the conductor-rail system where suitable operating conditions prevail. See chapter 3.3

Replacing conductor-rails

Required protective equipment:

Risk of injury from cuts and cutting!
The ends of the power rails can have sharp edges, especially if they were cut to size at the construction site and have not been deburred.

→ Wear protective gloves and protective footwear.
→ During installation: Carefully deburr the insulation profile and power rails after sawing.
→ During dismantling: Handle cut, removed conductor-rails with care and store them properly (transport or other container)
→ Be on the lookout for sharp edges in the surroundings of the installation surface and avoid contact.

9.2 Tools and materials

The maintenance work on the conductor-rail must be performed using commercially available metric tools.

<table>
<thead>
<tr>
<th>Maintenance work</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure the height of the collector brushes</td>
<td>Calipers</td>
</tr>
<tr>
<td>Measure the contact force of the collector brushes</td>
<td>Spring balance with a measuring range of 0 to 20 N</td>
</tr>
</tbody>
</table>
9.3 Maintenance plan

The following tasks fall under the category “Servicing”:

- Inspection
- Checks
- Measurements
- Testing
- Maintenance
- Cleaning
- Washing
- Resetting
- Repair
- Replacement
- Readjusting

The next sections describe the maintenance tasks required for optimal and trouble-free operation. The tasks specified and performed as per the maintenance plan must be logged. If regular inspections reveal increased wear, the corresponding maintenance intervals should be shortened in accordance with the actual signs of wear.

Contact the manufacturer in case of any questions regarding maintenance tasks and intervals—see the service address on the last page. The operator must take responsibility for organizing the following maintenance measures in order to comply with warranty requirements and for general prevention of damage.

→ Inspection, maintenance, and repair work must only be carried out by trained, qualified technicians!
→ Inspection, maintenance, and repair measures must always be documented!

Maintenance instructions WV0800-0002 contain more detailed descriptions of the maintenance work.

ATTENTION!

The functioning and availability of the conductor-rail system are dependent on the quality of the contact surface!

Copper conductor-rails are dependent on a lubricant-patina running surface that builds up during operation and should not be removed (no sanding or brushing off). Follow the instructions in WV0800-0004.
Required protective equipment:

DANGER!

Danger of sensitization, irritation of the mucous membranes, and respiratory diseases due to dust!

Dust from the collector brushes collects in the conductor-rails and the guide profile. This dust is very fine and is categorized as a health risk. Working a lot with the conductor-rail system and/or not applying the requisite level of care when handling accumulated dust (e.g. cleaning the system with compressed air) can lead to sensitization. People who frequently spend longer periods of time in a heavily used plant without protective equipment must expect the following consequences:

- Irritations of the mucous membranes
- Respiratory diseases
- Cancer

→ In workplaces with long-term exposure and heavily trafficked plants, take effective measures to protect employees from the dust.

→ Personal protective equipment must be worn during all works on the conductor-rail system during which accumulated dust is disturbed.

→ The following personal protective equipment must be worn during cleaning operations:

- Safety goggles
- Dust mask class FFP3
- Protective gloves
- Disposable coverall

→ Before starting work, clean the conductor-rail in accordance with regulations (see WV0800-0001)

→ Protect the surroundings during cleaning work, for instance by covering or removing warehouse goods and blocking access to those areas in which dust could fall down on persons.

→ Do not blow out dust with compressed air. Instead, vacuum it up. The vacuum cleaner must be equipped with a Class H fine filter.

→ Do not eat and/or drink while cleaning!

→ Do not smoke while cleaning!

ATTENTION!

Risk of explosion!

Airborne dust, open flames or other sources of ignition create result in explosion.

The following table covers the most usual test steps. You can find details for cleaning and maintenance in WV0800-0001 and WV0800-0002. The cleaning interval is individual and depends on the degree of contamination and the intensity of the use of the system. Do not remove the patina under any circumstances! You can find details on the use of copper rails in WV0800-0004.
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Interval | Servicing task | To be performed
---|---|---
Daily | Visual inspection
- Are there coarse dirt or objects in the conductor-rail? | Operators

4 weeks after commissioning/500 km | Visual inspection:
- Check whether the contact areas of the collector brushes are worn
  → If the wear limit “a” (ratio between carbon insulation and collector brush) has been reached or exceeded, replace the current collector | Technician

Thereafter: Quarterly/semannually

Fig. 73: Collector brush wear limit

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Wear Limit “a”</th>
<th>Type of Current Collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contact surface of the conductor-rail</td>
<td>1 mm</td>
<td>Phase</td>
</tr>
<tr>
<td>2</td>
<td>Middle joint</td>
<td>2 mm</td>
<td>PE²</td>
</tr>
<tr>
<td>3</td>
<td>Spring</td>
<td>² The wear limit of PE equals 2 mm to ensure the PE function, especially at PEplus.</td>
<td></td>
</tr>
</tbody>
</table>

1 The tolerance varies according to the current-collector type (see chapter 6.3.4):

<table>
<thead>
<tr>
<th>Current Collector Type</th>
<th>Distance</th>
<th>Axis</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>081506... 081507...</td>
<td>65 mm</td>
<td>X</td>
<td>±10 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y</td>
<td>±10 mm</td>
</tr>
<tr>
<td>081508... 081509...</td>
<td>80 mm</td>
<td>X</td>
<td>±10 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y</td>
<td>±10 mm</td>
</tr>
<tr>
<td>08150A... 08150B...</td>
<td>92 mm</td>
<td>X</td>
<td>±15 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y</td>
<td>±15 mm</td>
</tr>
</tbody>
</table>

- Check the carbon insulation for cracks and abrasion.
  → replace the current collector if the brush insulation is damaged or cracked
**Operating Instructions**

**Single-pole conductor-rail system**

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<table>
<thead>
<tr>
<th>Interval</th>
<th>Servicing task</th>
<th>To be performed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Check the insulation for wear, dirt and burn marks</td>
<td>→ If necessary, clean insulation profile or repair the site of damage</td>
</tr>
<tr>
<td></td>
<td>Make sure that there are no constrictions inside the individual poles of the insulation profile (dust or adhering dirt).</td>
<td>→ Clean the insulation profile with a vacuum cleaner or brush or replace</td>
</tr>
<tr>
<td></td>
<td>Make sure that the insulation is not affected by foreign bodies (shavings, fluids, contamination, etc.; risk of short circuit).</td>
<td>→ Clean or replace components, if it is not possible to fully restore the insulating properties.</td>
</tr>
</tbody>
</table>

**Functional test:**

→ Check for the presence of springs

→ Check the correct installation position of the current collector (see chapter 6.3.4)

→ Change the fastening position in the event of deviation

→ The required contact force is ensured by the correct fastening position of the current collector

→ However, if measurement of the contact force is required, the following steps must be followed:

→ Attach a suitable spring balance to the current collector arm as close as possible to the middle joint of the two current collector heads. Pull the current collector head vertically away from the power rail using the spring balance.

→ Reading the measured value: Check the value measured by the spring balance when the collector brush lifts off the sliding surface! The contact force has to be 9 ± 0.5 N.

→ Check the freedom of motion of each individual current-collector arm

→ If necessary, clean or replace entire current collector

→ Check the vertical and lateral tolerance of the current collectors relative to the conductor-rail

→ If necessary, correct the mounting position

→ Ensure that the connecting cable is not twisted at the current-collecting head and that the cable loop is not exerting directional forces on the current-collecting head. This must apply in every position of the current-collecting arm

→ If necessary, clean insulation profile or repair defect
10 Troubleshooting

Danger of injury due to improper troubleshooting!
Improper troubleshooting can result in serious injury to person and property.
→ Contact the manufacturer in case of malfunction
→ Allow troubleshooting to be carried out only by personnel from or authorized by the manufacturer

The faults that, to Conductix-Wampfler's best knowledge, tend to arise are listed in the following table (see chapter 10.1) together with their corresponding remedial measures.

Required protective equipment:

Requirement:

Faults must only be repaired by qualified personnel!

Risk of injury by crushing skin and limbs!
There is a danger of crushing of skin and limbs due to:
- Spring force/gravity (stored energy)
- Current collector (spring force) during installation, dismantling and maintenance
- Falling conductor-rail system components if they have not been properly installed or if operated in inappropriate operating conditions (e.g. environment that contains solvents)
- Moving parts, when the system is in operation

→ Do not enter the danger zones of the system during operation
→ Have installation done only by trained technicians
→ When working on the conductor-rail system, wear safety boots, safety gloves, and a safety helmet
→ When changing the collector brush, follow the separate instructions for this task. See chapter 12.1
→ Only install the conductor-rail system where suitable operating conditions prevail. See chapter 3.3
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Only operate the conductor-rail system in areas inaccessible to the public!
Operation is only permitted in areas inaccessible to the public and out of manual reach.
→ The hazard zone must be enclosed by the customer or protection ensured by distance!

Risk of injury due to dust!
Dust due to abrasion (collector brushes, copper rails, plastic) can cause respiratory complaints, choking and eye irritation.
→ Clean the system before starting work
→ Use personal protective equipment.
  → Safety goggles
  → Dust mask class FFP3
  → Protective gloves
  → Disposable coverall
→ Prevent contamination of the environment (e.g., people, goods, production facilities etc.) while cleaning by taking appropriate measures (use covers, barriers, filter systems)

Risk of injury due to materials and substances!
Respiratory complaints and eye irritation may occur due to airborne dust. There is a health hazard due to airborne respirable dust. One result may be cancer.
→ Clean regularly! Before starting work, clean the conductor-rail in accordance with regulations. See chapter 12.1
→ Clean the system before starting work!
→ Use personal protective equipment
→ Prevent contamination of the environment (e.g., people, goods, production facilities etc.) by taking appropriate measures (use covers, barriers, filter systems)
→ Do not blow out dust with compressed air. Instead, vacuum it up. The vacuum cleaner must be equipped with a Class H fine filter
→ Do not eat and/or drink while cleaning!
→ Do not smoke while cleaning!
→ See chapter 2.8.3 for further information

Risk of injury from cuts and cutting!
Cuts and amputations can occur on:
■ sharp edges of the general components
■ sharp edges of the conductor-rails
■ cut edges when trimming the conductor-rails
■ packaging materials (cartons, tapes, etc.)
→ Use personal protective equipment!
Risk of injury due to grasping or impact!
Grasping and/or impact with moving conductor-rails (slip ring) or current collectors connected to the machine and other components must be prevented.

→ Cordon off the work area
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Use personal protective equipment!

Risk of puncture wounds and cuts!
The packaging material can contain sharp objects such as nails and wood splinters that can cause injury to limbs.

→ Use personal protective equipment!
→ Cordon off the work area!
→ Caution when working in the vicinity, in particular below the conductor-rail

Risk of death by electrocution!
Contact with components carrying electrical power can lead to death by electrocution or severe injury. Danger of injury due to shock reactions, falling or being thrown across the room due to electrical shock.

→ The main power supply (from the building) must be disconnected in the installation area and secured against switching on again
→ Disconnect all electricity-supply power feeds
→ When decommissioning, check whether a voltage is still present in the components and take measures where necessary
→ The hazard zone must be enclosed by the customer or protection ensured by distance
→ The customer must ground metallic components
→ The customer must provide protective devices
→ Make sure there is sufficient stability in the area

Before working on these components!

→ Disconnect the conductor-rail system from the power supply according to the 5 safety rules and secure it against being switched back on. For the 5 safety rules, see chapter 2.5.

Before switching the system on!

→ Every time before the device or system is started, measure the insulation resistance according to locally applicable technical standards, directives and legal regulations.
→ Carry out locally required electrical tests
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Alert personnel to the hazard!
→ Attach a sign saying "Risk of death by electrocution" with the relevant hazard symbol in all areas with access to live components

Fire hazard due to overload or sparking!
A fire hazard can occur due to overloads of the cable, electrical arcing, or short-circuits.
→ Before recommissioning, ensure that all work has been completed and all components have been properly installed
→ Conduct electrical testing as prescribed
→ Permissible current values must be observed.
→ Electrical fuses must be installed in accordance with regulations.
→ Warn against misuse
→ Do not store easily ignited materials near to conductor-rails.
→ Dimensioning according to permissible system load capacity and provide for appropriate electrical protective devices

Risk of injury due to hot components!
Components can get hot during operation.
→ Operation is only permitted in areas inaccessible to the public and out of manual reach.
→ The hazard zone must be enclosed by the customer or protection ensured by distance
→ Cordon off the work area
→ Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
→ Use personal protective equipment!
## 10.1 Fault remedy table

<table>
<thead>
<tr>
<th>Fault</th>
<th>Cause</th>
<th>Corrective measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>The collector brushes are unevenly worn.</td>
<td>The current collector heads' range of movement is restricted.</td>
<td>Only use original Conductix-Wampfler current-collecting heads, check cable position (make sure cables can move freely). Install current collector as specified in chapter 6.3.4. Check the installation position at various points in the system.</td>
</tr>
<tr>
<td>Contact pressure is too high or low.</td>
<td></td>
<td>Install current collector as specified in chapter 6.3.4; use superfine-stranded class-6 connecting cables (in accordance with ICE 602228).</td>
</tr>
<tr>
<td>The carbon insulation on the side has been worn away down to the collector brush.</td>
<td>If installed horizontally: The current collector's height is not correctly adjusted.</td>
<td>Replace current collector heads; correctly adjust the height of the current collector.</td>
</tr>
<tr>
<td>The collector brushes are wearing too fast.</td>
<td>Sharp edges on the power terminal, conductor-rails, connections between the conductor-rails</td>
<td>Smoothen sharp edges with a file, compressed-air grinder or sanding paper.</td>
</tr>
<tr>
<td>Conductor-rails dirty or scorched in places.</td>
<td></td>
<td>Check current values; clean rails as specified in maintenance instruction WV0880-0001; if necessary, replace conductor-rails.</td>
</tr>
<tr>
<td>Contact pressure too high.</td>
<td></td>
<td>Install current collector as specified in chapter 6.3.4. Check the installation position at various points in the system.</td>
</tr>
<tr>
<td>End segment and power terminal are not properly connected.</td>
<td></td>
<td>Tighten all screws to the specified torque, see 6.3.2.1; If necessary, recrimp and reinstall the crimping cable lug.</td>
</tr>
<tr>
<td>The power supply gets interrupted, the contact is disrupted.</td>
<td>Current collector not properly connected.</td>
<td>Install current collector as specified in chapter 6.3.4; correct connecting cable, replace if necessary.</td>
</tr>
<tr>
<td></td>
<td>Contact pressure too low.</td>
<td>Only use original Conductix-Wampfler current collectors, check cable position (make sure cables can move freely). Install current collector as specified in chapter 6.3.4; correct connecting</td>
</tr>
</tbody>
</table>
## Faults and Corrective Measures

<table>
<thead>
<tr>
<th>Fault</th>
<th>Cause</th>
<th>Corrective measures</th>
</tr>
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<tbody>
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<td>Cause</td>
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</tr>
<tr>
<td>Fault</td>
<td>Cause</td>
<td>Corrective measures</td>
</tr>
</tbody>
</table>

- **Fault:** Cable, replace if necessary. Check the installation position at various points in the system.
- **Cause:** Collision with system components
- **Corrective measures:** Check the system's layout, fasten the affected components in such a way that they cannot be collided with, replace damaged components.

- **Fault:** Abrasive dust has collected at one of the more frequently used transfer points (where the direction of travel is reversed).
- **Corrective measures:** Adjust the consumer's movement profile. Move over the end position to push the collected abrasive dust out of the power rail. Clean the power rail.

- **Fault:** Insulating profile is not engaged in the hanger clamp.
- **Corrective measures:** Snap in the insulation profile, check components, replace if necessary.

- **Fault:** Use of damaged components.
- **Corrective measures:** Replace damaged components.
11 Dismantling and disposal

11.1 Safety

Personnel:

- Must only be performed by trained technicians At least 2 people

Requirement:

- Disconnect the system from power and secure against being switched on again.

Required protective equipment:

- ![PPE Icons]

**WARNING!**

Danger of injury due to improper disassembly!

- Stored residual energy, sharp components, sharp points, and edges on and in the device or the required tools can cause injury.
- Make sure there is sufficient space before starting work
- Handle open, sharp-edged components carefully
- Make sure the workplace is tidy and clean! Loosely stacked or scattered components and tools are a source of hazards
- Dismount components properly. Be aware of the dead weights of the components. If necessary, use lifting gear.
- Secure components so that they cannot fall or fall over.
- Consult the manufacturer in case of doubt.

**DANGER!**

Risk of injury due to grasping or impact!

- Grasping and/or impact with moving conductor-rails (slip ring) or current collectors connected to the machine and other components must be prevented.
- Cordon off the work area
- Caution when working in the vicinity of the danger zone, in particular if protective devices (covers, enclosures, control devices) have been removed or disabled
- Use personal protective equipment!
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Risk of injury from cuts and cutting!
Cuts and amputations can occur on the:
- sharp edges of the conductor-rails
- cut edges when trimming rails

→ Use personal protective equipment!
→ Cordon off the work area!
→ Caution when working in the vicinity, in particular below the conductor-rail

Risk of injury by crushing skin and limbs!
There is a danger of crushing of skin and limbs due to:
- Spring force/gravity (stored energy)
- Current collector (spring force) during installation, dismantling and maintenance
- Falling parts of the conductor-rail system in the case of improper dismantling
- Moving parts, when the system is in operation

→ Do not enter the danger zones of the system during operation
→ When working on the conductor-rail system, wear safety boots, safety gloves, and a safety helmet

Risk of death by electrocution!
Contact with components carrying electrical power can lead to death by electrocution or severe injury. Danger of injury due to shock reactions, falling, or being thrown across the room due to electrical shock.

→ The main power supply (from the building) must be disconnected in the dismantling area and secured against switching on again
→ Disconnect all electricity-supply power feeds
→ When decommissioning, check whether a voltage is still present in the components and take measures where necessary
Risk of injury due to dust!

Dust due to abrasion (collector brushes, copper rails, plastic) can cause respiratory complaints, choking and eye irritation.

→ Clean the system before starting work

→ Use personal protective equipment.
   → Safety goggles
   → Dust mask class FFP3
   → Safety glasses
   → Disposable coverall

→ Prevent contamination of the environment (e.g., people, goods, production facilities etc.) while cleaning by taking appropriate measures (use covers, barriers, filter systems)

Risk of injury due to materials and substances!

Respiratory complaints and eye irritation may occur due to airborne dust. There is a health hazard due to airborne respirable dust. One result may be cancer.

→ Clean the system before starting work!

→ Use personal protective equipment

→ Prevent contamination of the environment (e.g., people, goods, production facilities etc.) by taking appropriate measures (use covers, barriers, filter systems)

→ Do not blow out dust with compressed air. Instead, vacuum it up. The vacuum cleaner must be equipped with a Class H fine filter

→ Do not eat and/or drink while cleaning!

→ Do not smoke while cleaning!

→ See chapter 2.8.3 for further information
11.2 Dismantling

After the system is no longer in use, the device must be disassembled and environmentally friendly disposal carried out.

Before starting disassembly:

- **DANGER!** Risk of injury due to conductor-rails sliding out!
  - Risk of injury due to conductor-rails sliding out when the packaging units are held at an angle or carelessness with long loads.
  - Use personal protective equipment!
  - Cordon off the work area!

- Remove operating and auxiliary materials as well as residual processing material, and dispose of them in an environmentally appropriate manner.

- **WARNING!** Be aware of dangers due to electric shock, harmful dusts, sharp edges, and moving parts!

- Clean the subassemblies and components properly and dismantle them under observation of applicable local occupational safety and environmental protection regulations.

11.2.1 Disassemble the conductor-rails

- **WARNING!** Danger of injury due to improper disassembly!
  - Stored residual energy, sharp components, sharp points, and edges on and in the device or the required tools can cause injury.
  - Make sure there is sufficient space before starting work
  - Handle open, sharp-edged components carefully
  - Make sure the workplace is tidy and clean!
  - Disassemble components properly
  - Consult the manufacturer in case of doubt.

**Personnel**

- May only be carried out by trained technicians
- At least two people

**Required tools**

- Dismantling tool (see chapter 6.3.3.2 and page 50)
- Hexagonal screwdriver SW 2.5
- Hexagonal screwdriver SW 3
- Spanner SW 7
- Flat-head screwdriver 1.2 x 6.5x150 mm
- Cutting tool (e.g. jigsaw)
- Tools for securing
CAUTION!

Risk of injury when removing the connector!
The connector is very large compared to the insulation profile and the power rail and a e.g. saw blade could easily become trapped in it. The saw could also jump and injure the installer.

→ When separating the 4-m rail segments, keep at a distance of at least 100 mm from the end of the insulation profile

CAUTION!

Reusing disposable components can give rise to hazards!
Reusing a connector or expanding rivet can give rise to the following hazards:

- The connection is not perfect and reliable
- Expanding rivet: There is a risk that conductor-rails may come loose, become quickly worn or destroyed
- Connectors: High-resistance connection, heating, fire hazard, reduced performance

→ Dispose of disassembled connectors and expanding rivets and replace with new ones. Do not re-use!

11.3 Disposal

DANGER!

Risk of death by electrocution!
Contact with components carrying electrical power can lead to death by electrocution or severe injury. Danger of injury due to shock reactions, falling, or being thrown across the room due to electrical shock.

→ The main power supply (from the building) must be disconnected in the dismantling area and secured against switching on again
→ Disconnect all electricity-supply power feeds
→ When decommissioning, check whether a voltage is still present in the components and take measures where necessary

In the absence of a return or disposal agreement, dismantled components must be recycled as follows:

- All metal parts must be scrapped
- Plastic components must be sent for recycling
- The other components are to be disposed of according to their material composition.

Environmental damage due to improper disposal!
Electrical waste, electronic components, lubricants, and other auxiliary materials are subject to hazardous-waste disposal regulations and may only be disposed of by authorized specialists

CAUTION!

Local authorities or special disposal companies can provide information about environmentally appropriate disposal.
### 12 Additional documents

#### 12.1 Other applicable documents

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<th>México</th>
<th>Brazil</th>
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<td>10102 F Street, Omaha, NE 68127</td>
<td>1435 Norjohn Court, Unit 5, Burlington, ON L7L 0E6</td>
<td>Calle Treviño 983-C, Zona Centro, Apodaca, NL México 66600</td>
<td>Rua Luiz Pionti, 110, Vila Progresso, Itu, São Paulo, Brasil CEP: 13313-534</td>
</tr>
<tr>
<td><strong>Customer Support</strong></td>
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<td><strong>Customer Support</strong></td>
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</tr>
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