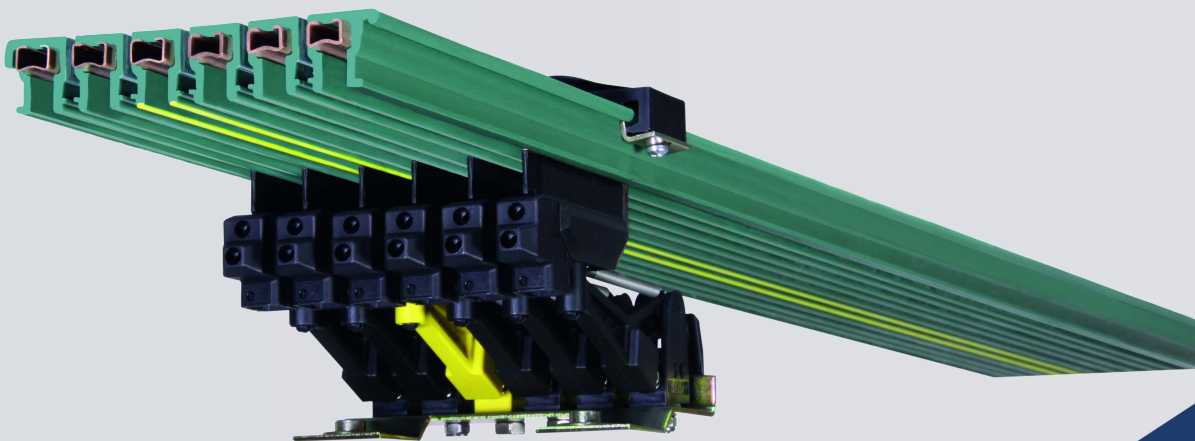




TRANSLATION OF THE ORIGINAL GERMAN OPERATING INSTRUCTIONS

VKS
COMPACT CONDUCTOR SYSTEM



**INSTALLATION MANUAL
SYSTEM MANUAL
MAINTENANCE MANUAL
EN V 1.01**

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1 GENERAL

1.1 About these instructions

These operating instructions enable the safe and efficient handling of our VAHLE products. This document is an integral part of the installation and must be kept accessible to operating and maintenance personnel in the immediate vicinity. The basic requirement for safe working is compliance with all specified safety instructions and instructions. This documentation does not give instructions for operating the plant/machine in which our system is integrated. In addition, the local accident prevention regulations and general safety regulations for the use of the system apply. Diagrams serve the basic understanding and may deviate from the actual version.

1.2 Symbols

Safety instructions in this manual are identified by symbols. Each safety instruction begins with signal word that indicates the severity of the hazard. The various types of warnings and safety instructions and their structure are explained below.



DANGER!

The source of the hazard is described here.

This combination of a symbol and a signal word indicates an immediately dangerous situation that will result in death or serious injury unless avoided.

► The actions to prevent the hazard are identified here.



DANGER!

The source of an electrical hazard is described here.

This combination of a symbol and a signal word indicates an immediately dangerous situation related to electricity that will result in death or serious injury unless avoided.

► The actions to prevent the hazard are identified here.



WARNING!

The source of the hazard is described here.

This combination of a symbol and a signal word indicates a potentially dangerous situation that may result in death or serious injury unless avoided.

► The actions to prevent the hazard are identified here.



CAUTION!

The source of the hazard is described here.

This combination of a symbol and a signal word indicates a potentially dangerous situation that may result in light or moderate injury unless avoided.

► The actions to prevent the hazard are identified here.

**NOTICE!**

The source of the hazard is described here.

This combination of a symbol and a signal word indicates a potentially dangerous situation that may result in property or environmental damage unless avoided.

- ▶ The actions to prevent the hazard are identified here.

**NOTICE!**

This indicates a reference to another place in this text or another document.

This combination of a symbol and a signal word indicates a reference to another place in this text or in a different document.

- ▶ The places in the text or references to other documents are identified here.

**TIPS AND RECOMMENDATIONS!**

- ▶ Simple tips and recommendations from our long years of experience are provided here.

1.3 Copyright protection

The contents of this manual are protected by copyright. Their use is permitted within the scope of the use of the installation. No further use is permitted without the written permission of the manufacturer. This manual may not be copied, given to any third party, reproduced in any form or by any means, including, but not limited to, exploitation and / or communication of the contents without the written permission of the manufacturer, except for internal purposes.

1.4 Disclaimer

The information in this document has been compiled in consideration of applicable standards and regulations, accepted rules of engineering, as well as our years of knowledge and experience.

The manufacturer shall not be liable for damages resulting from:

- Failure to observe the technical documentation
- Uses other than the intended use
- Use by personnel without the required training
- Unauthorized modifications or technical changes
- Use of non-approved spare parts or accessories

The actual scope of delivery may vary from the descriptions and images in this document in case of custom versions, the selection of additional order options, or due to latest technical changes.

The obligations agreed in the supply contract, the general terms and conditions and the terms and conditions of delivery, and the laws and regulations applicable at the time the contract was signed all apply.

We reserve the right to make technical changes to improve the usability and for further development.

1.5 Customer service

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Country of origin: Germany

1.6 Warranty

1.6.1 Warranty terms and conditions

The information in this document has been compiled in consideration of applicable standards and regulations, accepted rules of engineering, as well as our accumulated years of knowledge and experience.

The warranty period and the scope of the warranty are defined in the terms of the contract and the general terms and conditions of delivery of Vahle GmbH & Co. KG.

Our general terms of warranty and delivery are published on our website. www.vahle.de



WARNING!

No liability in case of unauthorized changes, modifications, or accessories!

Changes or modifications to the delivered product require the permission of the manufacturer. Genuine spare parts and manufacturer-approved accessories provide safety. The use of non-approved parts voids any liability of the manufacturer.

► Always consult the manufacturer first!

The warranty immediately expires if one or several of the following situations arise(s):

- If the product is modified without permission from Vahle.
- If the operator independently performs repairs during the warranty period or has repairs performed by third parties.
- If the product has been handled or maintained inappropriately.
- If parts are used that are not original parts approved by Vahle.
- If the information in this documentation is not observed.

2 SAFETY INSTRUCTIONS

2.1 Safety

This section gives an overview of all important safety aspects relating to the protection of personnel as well as the safe use and fault-free operation. Other, task-specific safety instructions can be found in the sections on the individual phases of the product's life.



DANGER!

Failure to observe the safety instructions may result in risks to life and health!

2.2 Intended use

Safety conductor systems (VKS type) are compact and contact-protected safety conductor systems. The minimal space required enables direct installation in track supports and special track profiles. The VKS conductor system is only to be used in indoor or covered outdoor installations and is suitable for suspended or lateral arrangements on straight and curved tracks.

Appropriate use also includes observance of all information provided in these instructions.

Any use beyond or other than the appropriate use, conversion or other modification is to be considered misuse and prohibited.



WARNING!

Danger in case of improper use!

Improper use may give rise to hazardous situations.

- ▶ Only ever use the system for its intended purpose.
 - ▶ Never let untrained personnel operate the system.
 - ▶ Never modify or alter the system improperly.
 - ▶ Never operate the system in ways that contradict the safety instructions.
 - ▶ Never use the system for outdoor applications.
 - ▶ Never operate the system at higher than specified currents or voltages.
 - ▶ Never operate the system with carbon brushes made by other manufacturers.
 - ▶ Never expose the system to large amounts of water.
-

Claims for damages resulting from improper use shall be invalid.

2.3 General risks

The following section describes residual risks that arise even if the product is used as intended. Observe the safety instructions listed here in the other sections of these instructions to reduce the risk of injuries or damage to property and equipment and to avoid dangerous situations.

Do not change or modify the system inappropriately!



WARNING!

Risk of death from improper replacement or removal!

Errors during the removal or replacement of components may cause life-threatening situations or significant property damage

- ▶ Observe the safety instructions before beginning any removal work.

2.3.1 Danger from electrical energy

Perform the following safety work according to VDE 0105-100 (this work must be carried out by a qualified electrician, see chapter: "2 security").

Activate

The required separation distances must be established.

Secure against restart

During work, a prohibition sign must be attached reliably on switching handles or drives of switches, control units, pressure and sensing devices, safety parts, circuitry breakers that have been used to unlock a system part or that can be used to connect electricity. If this is not possible, then the clearly associated prohibition sign must be nearby. Existing mechanical interlocking devices against restart must be used for manually operated switches.

Determine absence of voltage

Absence of voltage is to be determined at or as close as possible to the work site at all poles. Absence of voltage must be checked with a voltage tester immediately before and after use.

Grounding and short-circuiting

Parts on which work will be performed at the work place must first be grounded and then short circuited. Grounding and short-circuiting must be visible from the workplace. Deviating from the above, it is permitted to ground and short-circuit near the work place if this is required due to local conditions or for safety reasons. Devices for grounding and short-circuiting must always first be connected with the grounding system or the ground electrode and afterwards with the parts to be grounded. Grounding and short circuiting may be waived in certain low-voltage systems (see VDE 0100-100).

Cover adjacent, live parts or isolate them

Before starting work, check whether it is appropriate to make adjacent parts voltage-free.



 **DANGER!**

Danger of life due to electrical current!

Contact with live parts can result in life-threatening injuries.

- ▶ Make sure that the components are not live or in tension unauthorized approximation.
-

2.3.2 Risks from hazardous materials



 **WARNING!**

Danger to health from hazardous materials!

Improper use of hazardous materials may cause damage to health.

- ▶ Observe the manufacturer safety data sheets for hazardous materials used.
-

2.4 Responsibilities of the operating company

Definition of the operating company

The owner is listed in the order confirmation and has the following owner obligations:

Owner obligations

The system is put to commercial use. The owner of the system is therefore subject to laws and regulations on workplace health and safety. In addition to the safety instructions in this document, the safety, accident prevention, and environmental regulations for the system's field of application must be followed. The following applies in particular:

- The owner ensures protection against electric shock (contact protection).
- The owner must inform himself about applicable workplace health and safety regulations and conduct a risk assessment for additional hazards that may arise from the special operating conditions at the installation site. These must be implemented as facility instructions for the operation of the system.
- Over the entire time, the owner has to verify that the instructions drafted by him for the operation of the system conform to the current state of applicable regulations and adapt the instructions as necessary.
- The owner must clearly define responsibilities for the installation, operation, maintenance, and cleaning of the system.
- The owner must ensure that all employees who handle the system have read and understood the operating instructions. The owner is also required to provide training periodically and instruct personnel about the risks.

The owner is also responsible for ensuring that the system is always in good technical condition. The following therefore applies:

- The owner must ensure that the maintenance intervals described in this documentation are observed.
- Control and safety devices provided by the owner for the operation of the system must be checked for completeness and functional safety.
- The owner must ensure that assembly and installation comply with EN 60204.
- The owner must ensure that all components are de-energized in the event of an emergency off. This applies in particular to the parallel busbar.

2.5 Personnel requirements

2.5.1 Qualifications

The tasks described in this manual present various requirements to the qualifications of the persons performing them.



WARNING!

Hazard in case of insufficient qualification of personnel!

Insufficiently qualified persons are unable to judge the risks when working on the system, which puts them and others at risk if severe or fatal injuries.

- ▶ All work must be performed by qualified personnel only.
- ▶ Insufficiently qualified personnel must stay out of the work area.

Operator

The operator has been instructed by the owner about the tasks assigned to him and the risks of inappropriate actions. An operator may perform tasks that go beyond normal operation only if this is indicated in the instructions and the owner has expressly assigned him with such a task.

Electrically qualified person (see VDE 0105-100)

Due to their professional training, knowledge, experience, and knowledge of the relevant standards and regulations, professional electricians are able to carry out work on electrical installations and to independently recognize and avoid possible hazards. The professional electrician has been specifically trained for his/her professional working environment and is conversant with the relevant standards and regulations.

Qualified personnel

Qualified personnel are able, based on their technical training, knowledge, experience, and familiarity with applicable regulations, to perform the assigned tasks and independently detect and avoid potential hazards.

Instructed personnel

The instructed person has been instructed by the owner about the assigned tasks and the risks of inappropriate actions. Such persons must also have read and understood these safety instructions and observe them during their work.

This may need to be confirmed by the customer/user with a signature.

2.6 Personal protective equipment

Every person who is instructed to work on the system or in the vicinity of the system (support personnel) must wear personal protective clothing/equipment for the suitable type of their work. Personal protective equipment has the purpose of protecting personnel against hazards to their health and safety at work. The owner is responsible to ensure that protective equipment is worn.

Personal protective equipment is described below:



Safety shoes

Safety shoes protect against falling parts as well as against slipping.



Protective goggles

Protective goggles protect against flying particles and liquid sprays.



Helmet

Helmets protect against falling or flying parts and materials.



Gloves

Gloves protect hands against chafing and abrasion, cuts and punctures, as well as against contact with hot surfaces.



Protective work clothes

Work clothing is close fitting and resistant to tearing, with close-fitting sleeves and without any projecting parts. It is designed to protect against being caught by moving parts of machinery. However, it must not reduce mobility. Do not wear rings, necklaces, or other jewelry. Long hair must be covered (cap, hat, hairnet or similar). Fall-arrest equipment, face and hearing protection acc. to DGUV Regulation 112-189.



Hearing protection

To protect against severe and permanent hearing loss.



Breathing protection

To protect against severe and chronic conditions of the airways.

2.7 Safety devices



WARNING!

Danger from non-functional safety devices!

Non-functional or disabled safety devices cause a risk of severe injuries or even death.

- ▶ Before beginning any work, verify that all safety devices are functional and installed properly.
- ▶ Never disable or override safety devices.

In addition to locally applicable safety regulations, the following safety instructions must be observed.

The following accident prevention regulations (UUV; Germany), respectively the new Accident Prevention Regulations – Principles of Prevention (DGUV Regulation 1; Germany) must always be observed.

2.8 Conduct in case of danger or accident

Precautions:

- Have first-aid equipment (first-aid kit, blankets etc.) and fire extinguisher ready.
- Maintain free access for emergency services vehicles.

Conduct in case of accident:

- Secure site of accident and call first aid personnel.
- Alert emergency services.
- Provide first aid

2.9 Signage

The following symbols and instruction signs are located in the work area. They relate to the immediate environment in which they are installed.



DANGER!

Danger of life due to electrical current!

Contact with live parts can result in life-threatening injuries.

- ▶ Make sure that the components are not live or in tension unauthorized approximation.



WARNING!

Danger from illegible signs!

Over time, labels and signs can get dirty or can become unreadable in other ways, which means that the dangers are not identified and that operating instructions cannot be followed.

- ▶ Always keep all safety, warning and operating instructions in a legible condition.



NOTICE!

Follow instructions!

Only use the designated product after this documentation has been completely read and understood.



3 TECHNICAL DATA

Technical specifications - electrical					
Conductor cross section	[mm ²]	16	25	30	35
Resistance	[Ω/1000 m]	1.102	0.723	0.595	0.510
Impedance	[Ω/1000 m]	1.107	0.730	0.603	0.520
Nominal voltage with ground conductor (PE)	[V]	690 (UL 600)			
Number of pins		3 - 6			
Conductor material		Copper			
Protection class		IP21			
Dielectric strength according to DIN 53481	[kV/mm]	> 25			
Volume resistivity according to IEC 60093	[Ω x cm]	1 x 10 ¹⁴			
Surface resistance according to IEC 60093	[Ω x cm]	2.1 x 10 ¹³			
Comparative tracking index according to IEC 60093		CTI > 400			

Technical specifications - mechanical	
Travel direction	Suitable for closed loop and reverse operation
Traveling speed KESR/KESL	[m/min] 450 ⁽¹⁾
Traveling speed KSTU	[m/min] 300 ⁽¹⁾
Distance between pins	[mm] 18
Max. hanger spacing	[m] 1
Conductor rail tolerances	[mm] ± 5 in all directions (support brackets parallel and at right angles to the guide rail)

⁽¹⁾ Higher speeds on request

Technical specifications - operating conditions	
Operating temperature for delivery lengths < 4 m	[°C] -30 ⁽²⁾ up to +55
Operating temperature for delivery lengths > 4 m	[°C] 0 to +40
Max. air humidity at ambient temperature 10°C to 40°C	[%] 98, non-condensing
Max. deviation of operating temperature	[°C] 50
Flammability (insulating housing)	flame-retardant, self-extinguishing, UL 94 V0
Application	Indoor installations, covered outdoor installations

⁽²⁾ For applications permanently below 0 °C (cold storage) please consult with the manufacturer.



NOTICE!

UL certification

► For design with UL certification, please consult the manufacturer.



4 LAYOUT AND FUNCTION

4.1 System description VKS

VAHLE safety conductor system VKS is a compact and contact-protected safety conductor system. It consists of a flat insulating housing into which the conductor rails are drawn. These rails are contact-protected in accordance with DN VDE 0470 Part 1 (corresponds to European Standard EN 60529). They comply with accident and VDE regulations in the electrical, mechanical and fire engineering sense and are designed according to protection class IP 21. The current collectors are protected against contact only if the carbon brushes are fully within the conductor rails. For conductor rail systems located at arm's length, where under normal operation the current collectors leave the conductor rails, contact protection must be provided on site, e.g. by means of barriers or by switching off. This, however, only applies to voltages above 25 volts AC or 60 volts DC. The creepage distance between the rails of the VKS conductor system is 30 mm. The various insulating housing allows the installation of 3 to 6 rails in one profile. By combining two or more profiles, multi-pin conductor systems can be created with any number of pin. The minimal space required enables direct installation in track supports and special track profiles. VKS conductor systems are only to be used in indoor or rain-covered outdoor installations and are suitable for suspended or lateral arrangements on straight and curved tracks. Approvals: UL-approved.



4.2 Device overview VKS

4.2.1 Straight section

The insulating housings can hold 3 to 6 conductor rail profiles and provide reliable insulation. The ends of the sections are milled in a comb shape to maintain the necessary creepage distance. The standard length is 4 m or 6 m, shorter lengths can be supplied. The ground conductor is marked with a continuous yellow stripe. The conductor system for control current has no PE marking. The asymmetrical construction type reliably prevents phase reversal during installation.



VKS		
Standard lengths	[m]	4 and 6
Air gap, min.	[mm]	7 mm
Material		Plastic
Conductor rail profile		Cu
Conductor rail protrusion 6 mm at 20° C UT		
In the 5-pin version the conductor rail profile 6 is omitted; however the housing is as for the 6-pin version		
For delivery lengths over 4 m, please note the restricted ambient temperature (see 3 Technical data).		
Connecting material, see 4.2.3 Connecting material.		

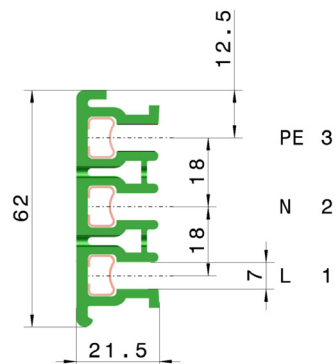
For the following tables the types must be added:

e.g. VKS 4/120 -2 HS for 2 m with PE (HS = with PE) ID no. 154 012

The last figure in the ID no. • specifies the individual length in meters. Please add 1, 2, 3, 4, 5 or 6 to the ID no. Shorter lengths are created from the next larger section.



Straight section, 3-pin



Type	Weight	Nominal current ⁽¹⁾	Nominal current ⁽²⁾	Voltage drop ⁽³⁾	Conductor cross section ⁽⁴⁾		ID no.
					N, L/1, 2 PE/3		
	[kg/m]	[A]	[V]	[V]	[mm ²]	[mm ²]	
VKS 3/ 63 HS	1.221	63	690	11.5	2x16	1x16	153 89 •
VKS 3/ 63 SS	1.221	63	690	11.5	2x16	1x16	153 94 •
VKS 3/ 100 HS	1.454	100	690	12.6	2x25	1x25	153 90 •
VKS 3/ 100 SS	1.454	100	690	12.6	2x25	1x25	153 95 •
VKS 3/ 120 HS	1.589	120	690	12.5	2x30	1x30	153 91 •
VKS 3/ 120 SS	1.589	120	690	12.5	2x30	1x30	153 96 •
VKS 3/ 140 HS	1.724	140 ⁽⁵⁾	690	11.3	2x35	1x35	154 96 •
VKS 3/ 140 SS	1.724	140 ⁽⁵⁾	690	11.3	2x35	1x35	156 08 •

⁽¹⁾ at max. nominal current 100 % duty cycle at (35 °C)

⁽²⁾ In the case of UL approval U applies_{UL} = 600 V

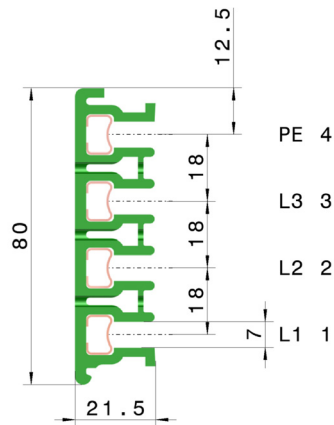
⁽³⁾ at max. nominal current 100 % duty cycle to 100 m

⁽⁴⁾ Conductor cross sections for conductor systems with PE also apply to conductor systems without PE. Other cross section combinations are possible.

⁽⁵⁾ At 80 % duty cycle



Straight section, 4-pin



Type	Weight	Nominal current ⁽¹⁾	Nominal voltage ⁽²⁾	Voltage drop ⁽³⁾	Conductor cross section ⁽⁴⁾		ID no.
					L1-L3/1-3 PE/4		
	[kg/m]	[A]	[V]	[V]	[mm ²]	[mm ²]	
VKS 4/ 63 HS	1.459	63	690	11.5	3x16	1x16	153 99 •
VKS 4/ 63 SS	1.459	63	690	11.5	3x16	1x16	154 04 •
VKS 4/ 100 HS	1.693	100	690	12.6	3x25	1x16	154 00 •
VKS 4/ 100 SS	1.693	100	690	12.6	3x25	1x16	154 05 •
VKS 4/ 120 HS	1.828	120	690	12.5	3x30	1x16	154 01 •
VKS 4/ 120 SS	1.828	120	690	12.5	3x30	1x16	154 06 •
VKS 4/ 140 HS	1.956	140 ⁽⁵⁾	690	11.3	3x35	1x16	154 31 •
VKS 4/ 140 SS	1.956	140 ⁽⁵⁾	690	11.3	3x35	1x16	156 54 •

⁽¹⁾ at max. nominal current 100 % duty cycle at (35 °C)

⁽²⁾ In the case of UL approval U applies_{UL} = 600 V

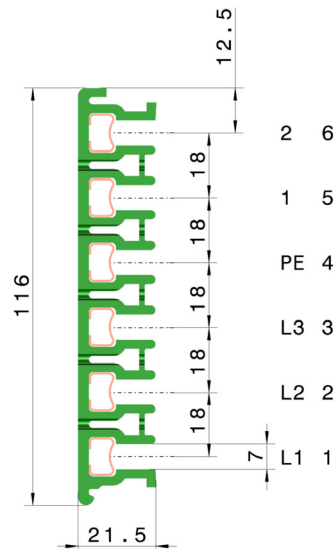
⁽³⁾ at max. nominal current 100 % duty cycle to 100 m

⁽⁴⁾ Conductor cross sections for conductor systems with PE also apply to conductor systems without PE. Other cross section combinations are possible.

⁽⁵⁾ At 80 % duty cycle



Straight section, 5-pin/6-pin



Type	Weight	Nominal current ⁽¹⁾	Nominal voltage ⁽²⁾	Voltage drop ⁽³⁾	Conductor cross section ⁽⁴⁾			ID no.
					L1-L3/1-3	PE /4	1,2/5,6	
	[kg/m]	[A]	[V]	[V]	[mm ²]	[mm ²]	[mm ²]	
VKS 5/ 63 HS	2.058	63	690	11.5	3x16	1x16	1x16	154 09•
VKS 5/ 63 SS	2.058	63	690	11.5	3x16	1x16	1x16	154 14•
VKS 5/ 100 HS	2.292	100	690	12.6	3x25	1x16	1x16	154 10•
VKS 5/ 100 SS	2.292	100	690	12.6	3x25	1x16	1x16	154 15•
VKS 5/ 120 HS	2.427	120	690	12.5	3x30	1x16	1x16	154 11•
VKS 5/ 120 SS	2.427	120	690	12.5	3x30	1x16	1x16	154 16•
VKS 5/ 140 HS	2.549	140 ⁽⁵⁾	690	11.3	3x35	1x16	1x16	154 87•
VKS 5/ 140 SS	2.549	140 ⁽⁵⁾	690	11.3	3x35	1x16	1x16	156 55•
VKS 6/ 63 HS	2.202	63	690	11.5	3x16	1x16	2x16	154 19•
VKS 6/ 63 SS	2.202	63	690	11.5	3x16	1x16	2x16	154 24•
VKS 6/ 100 HS	2.436	100	690	12.6	3x25	1x16	2x16	154 20•
VKS 6/ 100 SS	2.436	100	690	12.6	3x25	1x16	2x16	154 25•
VKS 6/ 120 HS	2.571	120	690	12.5	3x30	1x16	2x16	154 21•
VKS 6/ 120 SS	2.571	120	690	12.5	3x30	1x16	2x16	154 26•
VKS 6/ 140 HS	2.693	140 ⁽⁵⁾	690	11.3	3x35	1x16	2x16	152 60•
VKS 6/ 140 SS	2.693	140 ⁽⁵⁾	690	11.3	3x35	1x16	2x16	156 56•

⁽¹⁾ at max. nominal current 100 % duty cycle at (35 °C)

⁽²⁾ In the case of UL approval U applies_{UL} = 600 V

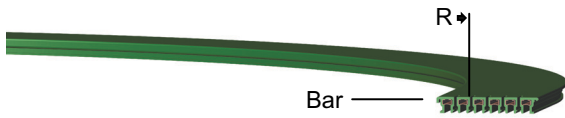
⁽³⁾ at max. nominal current 100 % duty cycle to 100 m

⁽⁴⁾ Conductor cross sections for conductor systems with PE also apply to conductor systems without PE. Other cross section combinations are possible.

⁽⁵⁾ At 80 % duty cycle



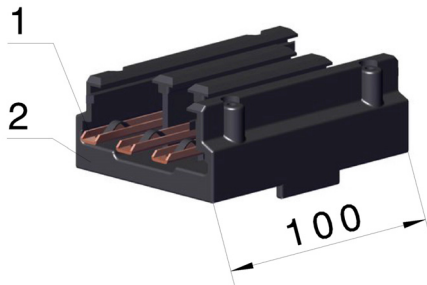
4.2.2 Curved section



Curved section		
Curve length, max.	[m]	3.6
Hanger spacing	[m]	~ 0.5
Angle, max.		180°

Type	Structure	R [mm]	ID no.			
			3-pin	4-pin	5-pin	6-pin
Horizontal curve, right	Outer bar	400 - 900	150 385	150 389	150 394	150 398
Horizontal curve, left	Inner bar	400 - 900	150 386	150 391	150 395	150 399
Horizontal curve, right	Outer bar	> 900	153 120	153 717	153 719	153 721
Horizontal curve, left	Inner bar	> 900	153 130	150 110	152 090	152 110
Inner curve	Inner conductor	200 - 800	150 387	150 392	150 396	150 401
Inner curve	Inner conductor	> 800	153 040	153 718	153 720	153 722
Outer curve	Outer conductor	200 - 800	150 388	150 393	150 397	150 402
Outer curve	Outer conductor	> 800	153 050	150 100	152 080	152 100

4.2.3 Connecting material



Connecting material	
1	Spring-loaded connector VM-STV-100-SLSM
2	Connector cover cap

The insulating housings are connected with one-piece connector cover caps, the conductor rail profiles are connected with spring-loaded copper plug connectors.

Type	Number of pins	Weight [kg]	ID no.
SVN 3/ 63 - 100	3	0.112	156 533
SVN 3/120 - 140	3	0.112	156 534
SVN 4/ 63 - 100	4	0.136	156 535
SVN 4/120 - 140	4	0.136	156 536
SVN 5/ 63 - 100	5	0.180	156 537
SVN 5/120 - 140	5	0.180	156 538
SVN 6/ 63 - 100	6	0.180	156 539
SVN 6/120 - 140	6	0.180	156 540



4.2.4 Fixed hangers/sliding hangers

All straight sections must be fastened at least once, with the maximum hanger spacing of 1000 m (or 800 mm), depending on the current collector, being observed (see 6.5.1 Contact line). The plastic hanger brackets, designed as sliding hangers, are fitted with M 6 screws and can be screwed directly onto brackets, track supports or special track profiles. The conductor system is clipped into the hangers. Removal is only possible with a tool.

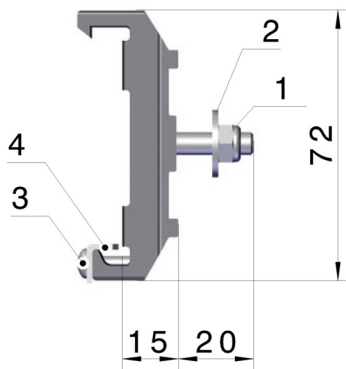


NOTICE!

- ▶ The conductor system can slide in the hangers in the event of longitudinal expansion. It is secured in the hanger by an additional screw at fixed points. A distance of max. 6 m (4 m in the cold storage area) between two fixed points must be observed.
- ▶ Other connections (e.g. S-rail) available upon request.

Fixed hanger

with hanger bracket and fixed point screw



Fixed hanger

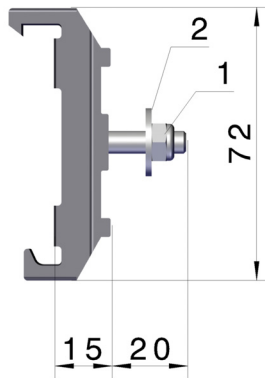
1	Nut and screw, M6
2	3D washer
3	Fixed point screw
4	Hanger bracket

Hanger spacing see section 6.5.1 Contact line.

Type	For number of pins	Width [mm]	Weight [kg]	ID no.
VEPS 3	3	30	0.042	153 070
VEPS 4	4	30	0.046	150 120
VEPS 6	5/6	30	0.062	152 120



Sliding hanger



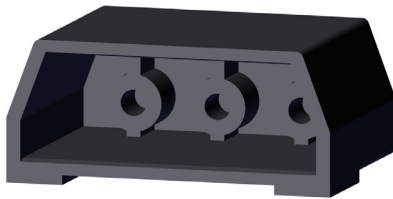
Sliding hanger

1	Nut and screw, M6
2	3D washer

Hanger spacing see section 3 Technical data.

Type	For number of pins	Width [mm]	Weight [kg]	ID no.
VAS 3	3	30	0.036	153 060
VAS 4	4	30	0.040	150 130
VAS 6	5/6	30	0.056	152 130

4.2.5 End cap



End caps

can be used left or right

Projection [mm] 13

L = supplied loose as individual part with fixing screws.

M = install at the factory according to the installation plan.

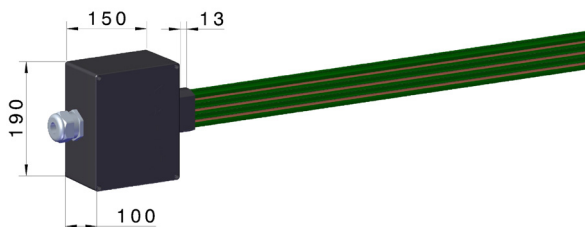
Type	For number of pins	Weight [kg]	ID no.
VES 3 - L	3	0.033	153 080
VES 3 - M	3	0.033	152 023
VES 4 - L	4	0.039	150 140
VES 4 - M	4	0.039	152 022
VES 6 - L	5/6	0.051	152 140
VES 6 - M	5/6	0.051	152 021



4.2.6 Feed terminal

End feed

Terminal box with terminal blocks



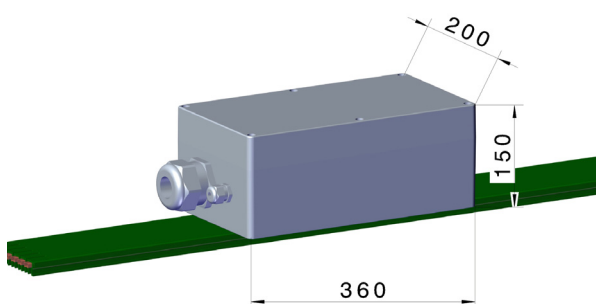
End feed	
Cable gland	ST - M40 x 1.5 for $\varnothing = 19-28$ mm ST - M20 x 1.5 for $\varnothing = 7-13$ mm
Connection cross section for terminal blocks	Phase = 35 mm^2 PE = 35 mm^2
Current [A]	63 - 120

End feeds are supplied loose as individual parts.

Type	Number of pins	Cable gland	Weight [kg]	ID no.
VEKS 3/63 - 120 L	3	ST - M40 x 1.5 for $\varnothing = 19-28$ mm	1.150	156 422
VEKS 4/63 - 120 L	4	ST - M40 x 1.5 for $\varnothing = 19-28$ mm	1.230	156 421
VEKS 5/63 - 120 L	5	ST - M40 x 1.5 for $\varnothing = 19-28$ mm ST - M20 x 1.5 for $\varnothing = 7-13$ mm	1.380	156 420
VEKS 6/63 - 120 L	6	ST - M40 x 1.5 for $\varnothing = 19-28$ mm ST - M20 x 1.5 for $\varnothing = 7-13$ mm	1.460	156 419
Installation at the factory				156 423

Line feed VNS

Line feeds are usually supplied mounted on a 1 m straight section.



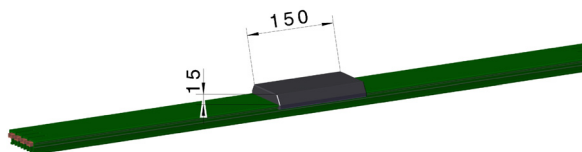
Line feed	
Cable gland	STR - M63 x 1.5 for $\varnothing = 28-45$ mm STR - M20 x 1.5 for $\varnothing = 5-13$ mm
Cable connection	M10 main current M5 control current
Current [A]	63 - 140

Type	Number of pins	Cable glands	Weight [kg]	ID no.
VNS 3/63-140	3	STR-M63 x 1.5	1.876	157 147
VNS 4/63-140	4	STR-M63 x 1.5 for $\varnothing = 28-45$ mm STR-M20 x 1.5 for $\varnothing = 5-13$ mm	1.982	157 146
VNS 5/63-140	5	STR-M63 x 1.5 for $\varnothing = 28-45$ mm STR-M20 x 1.5 for $\varnothing = 5-13$ mm	2.080	157 145
VNS 6/63-140	6	STR-M63 x 1.5 for $\varnothing = 28-45$ mm STR-M20 x 1.5 for $\varnothing = 5-13$ mm	2.200	157 144



Line feed VLS

Line feeds are usually mounted on a 1 m straight section.



Line feed	
Current [A]	63 - 140
No power cable, cable connection M 6	

Type	Number of pins	Current [A]	Tubular cable lug [mm ²]	Weight [kg]	ID no.
VLS 3/63	3	63	-	0.071	156 948
VLS 3/100-120 ⁽¹⁾	3	100-120	25	0.137	156 944
VLS 3/140 ⁽¹⁾	3	140	35	0.173	156 958
VLS 4/63	4	63	-	0.091	156 947
VLS 4/100-120 ⁽¹⁾	4	100-120	25	0.179	156 943
VLS 4/140 ⁽¹⁾	4	140	35	0.227	156 957
VLS 5/63	5	63	-	0.115	156 946
VLS 5/100-120 ⁽¹⁾	5	100-120	25	0.225	156 942
VLS 5/140 ⁽¹⁾	5	140	35	0.285	156 956
VLS 6/63	6	63	-	0.123	156 945
VLS 6/100-120 ⁽¹⁾	6	100-120	25	0.255	156 941
VLS 6/140 ⁽¹⁾	6	140	35	0.327	156 955

⁽¹⁾ Cable connection with enclosed special cable lugs for single wires. 35mm² (up to conductor Ø 8.5 mm) for 140 A. 25 mm² (up to conductor Ø 8.2 mm) for 100-120 A

4.2.7 Transfer guide

Straight transfer guides



Straight transfer guides	
Max. vertical offset [mm]	± 2
max. lateral offset [mm]	± 2
Application	Straight sections Diagonal cuts with lateral arrangement
for transitions, switches, dead sections	

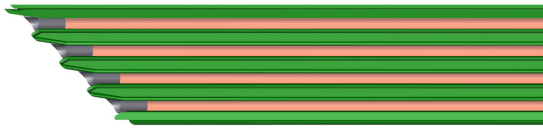
Type -M: Install at the factory according to the installation plan

Type -L: supplied loose as individual part, complete with accessory, select according to the type of conductor system. End finishing of the conductor system done by the customer.

Type	for number of pins	Length of the currentless section [mm]	ID no. Left version	ID no. Right version
VU 3 S-M	3	25	150191	150192
VU 3 S-L	3	25	150188	-
VU 4	4	30	150160	150390
VU 6 S-M	6	20	153801	153802
VU 6 S-L	6	20	153215	-



Diagonal transfer guides



Diagonal transfer guides

Application	Diagonal cuts with hanging arrangement
Protection class	IP 21 at a max. angle of 45°
for switches and turntables	

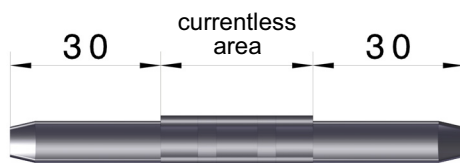
H = for hanging arrangement

S = side arrangement

Type	for number of pins	Length of the currentless section [mm]	ID no. Left version	ID no. Right version
VUS 3 H	3	30	150410	150420
VUS 4 H	4	30	150170	150400
VUS 4 S	4	30	153564	153565
VUS 5 H	5	30	152170	152300
VUS 6 H	6	30	152310	152320

4.2.8 Rail separation

Rail separations are electrical interruptions of the conductors. Operational overrunning of the current collectors with the aim of switching the voltage off or on is only permissible at low energies (control currents). Rail separations can be installed in accordance with your specifications. They are inserted into the conductor rail profile with pins on the right and left, thereby ensuring a smooth transition of the grinding surfaces.



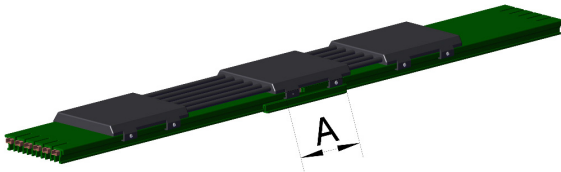
Rail separation	
Color	black
Currentless area [mm]	30

Type -M = installed at the factory

Type	Weight [kg]	ID no.
VSTS 1/63 M	0.006	156 933
VSTS 1/100 M	0.004	150 150
VSTS 1/120 M	0.004	151 674
VSTS 1/140 M	0.004	156 335



4.2.9 Expansion Joint



Expansion joint		
Length	[mm]	1000 ± 25
Expansion distance A	[mm]	0 - 50

The expansion section is used in building and track expansion joints. The expansion distance here is a maximum of 50 mm. For expansion joints > 50 mm, the number of expansion sections increases accordingly. Additional feed terminals are not required, as there is no electrical interruption.

Type	Weight [kg]	ID no. HS (with PE)	ID no. (without PE)
DVKS 3/ 63	1.900	153 230	153 240
DVKS 3/100	2.090	153 250	150 551
DVKS 3/120	2.215	153 623	150 552
DVKS 3/140	2.346	156 588	156 589
DVKS 4/63	2.412	150 480	150 510
DVKS 4/100	2.662	150 490	150 516
DVKS 4/120	2.852	153 538	150 553
DVKS 4/140	3.027	156 590	156 595
DVKS 5/63	3.266	152 340	152 380
DVKS 5/100	3.586	152 350	150 554
DVKS 5/120	3.811	153 633	150 555
DVKS 5/140	4.030	156 596	156 597
DVKS 6/63	3.582	152 360	152 390
DVKS 6/100	3.962	152 370	150 556
DVKS 6/120	4.242	153 638	150 557
DVKS 6/140	4.504	156 598	156 599



4.2.10 Transfer funnel

Transfer funnel for KSTU 30/55

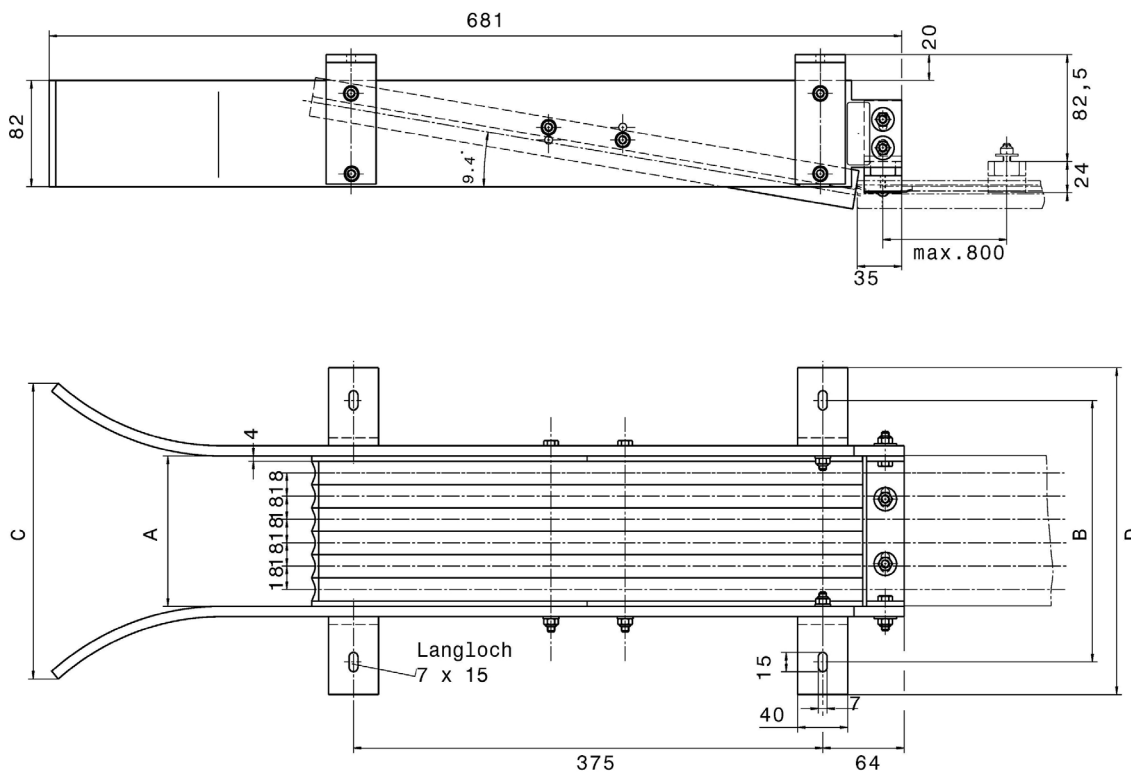


Transfer funnel		
Speed ⁽¹⁾ , max.	[m/min]	100

Type	A [mm]	B [mm]	C [mm]	D [mm]	Weight [kg]	ID no.	VU...L ⁽²⁾	VU...R ⁽²⁾
EFT V3 - KSTU	62	148	175	198	3.140	156 144	150 370	150 380
EFT V4 - KSTU	80	166	193	216	3.320	156 145	150 160	150 390
EFT V6 - KSTU	116	202	229	252	3.680	156 146	152 280	152 290

(1) Higher speeds on request.

(2) Conductor system section must be prepared for the funnel construction. For attachment on the left, VU...L, for attachment on the right VU...R.





Transfer funnel for KSFU25

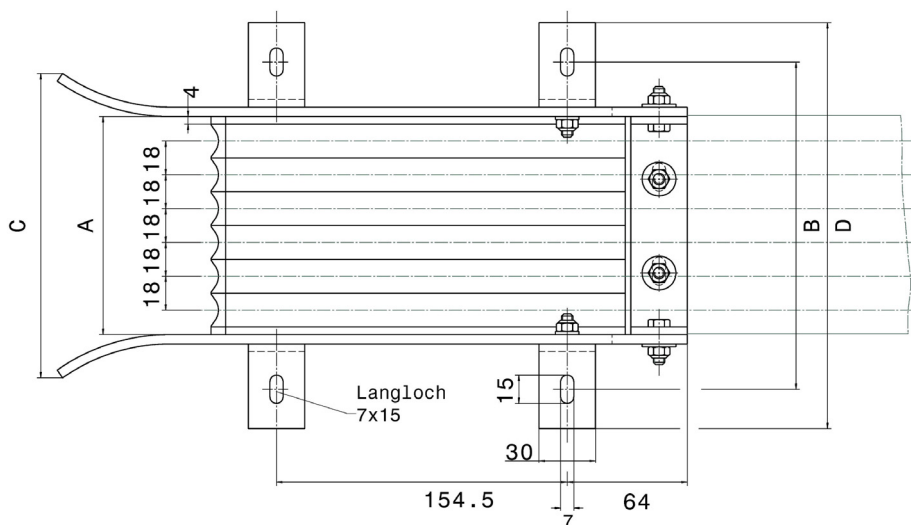
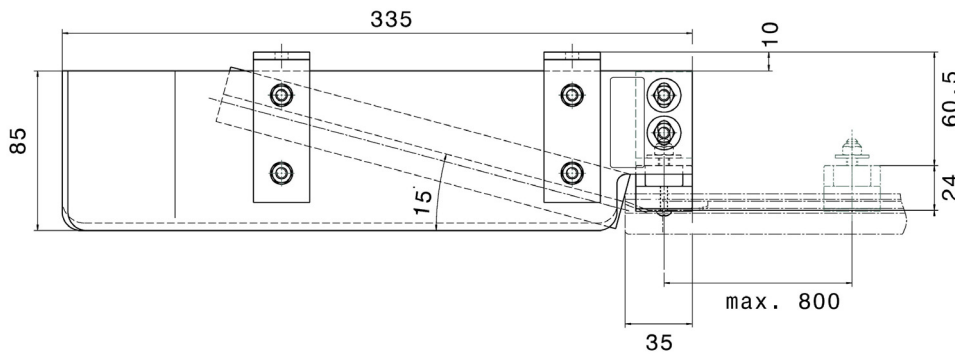


Transfer funnel		
Speed ⁽¹⁾ , max.	[m/min]	100

Type	A [mm]	B [mm]	C [mm]	D [mm]	Weight [kg]	ID no.	VU...L ⁽²⁾	VU...R ⁽²⁾
EFT V3 - KSFU 25	62	120	108	162	1.400	153 337	150 370	150 380
EFT V4 - KSFU 25	80	138	126	180	1.520	153 336	150 160	150 390
EFT V5 - KSFU 25	98	156	144	198	1.640	156 132	152 160	152 270
EFT V6 - KSFU 25	116	174	162	216	1.760	153 335	152 280	152 290

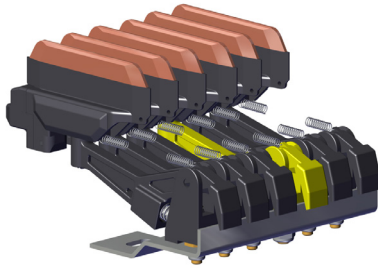
(1) Higher speeds on request.

(2) Conductor system section must be prepared for the funnel construction. For attachment on the left, VU...L, for attachment on the right VU...R.



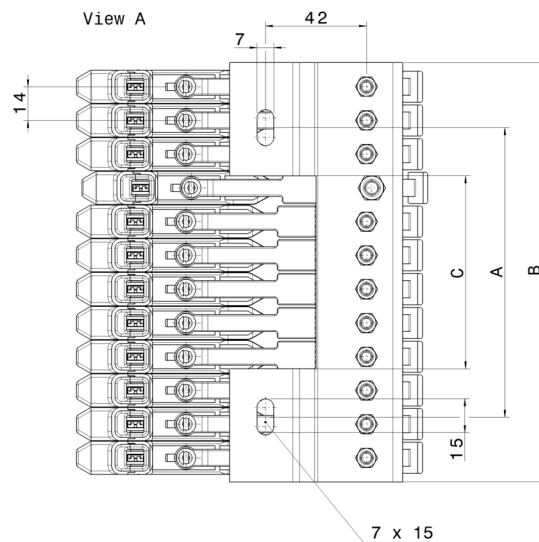
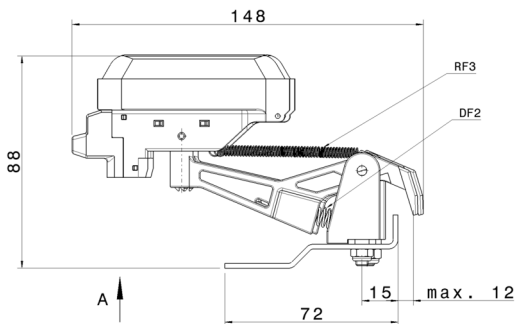


4.2.12 Compact current collector KESR 32-55



KESR 32-55		
Reversing operation		
Phase spacing	[mm]	18
Stroke and lateral deflection	[mm]	± 15
Contact pressure per carbon brush, approx.	[N]	3.5
PE (green) on no. 4 (other configuration possible)		
PE moves forward when folding into the conductor system		

max. current [A]	Flat plug	Screw connection
32	FLA 2.5	AEA 2.5
40	FLA 4.0	AEA 4.0
55	FLA 6.0	AEA 6.0





KESR-S

for connection cable with screw connection

Type ¹	Weight [kg]	A [mm]	B [mm]	C [mm]	Number of pins	Base plate	ID no. with PE HS	ID no. without PE ST
KESR 32-55 S- 3-18	0.405	54	79	-	3	4-pin (no. 4 = free)	157 220	157 225
KESR 32-55 S- 4-18	0.476	54	79	-	4	4-pin	157 221	157 226
KESR 32-55 S- 5-18	0.547	80	115	53	5	6-pin (no. 6 = free)	157 222	157 227
KESR 32-55 S- 6-18	0.618	80	115	53	6	6-pin	157 223	157 228

¹ max. current: 1 screw connection 32 A – AEA 2.5 | 40 A – AEA 4.0 | 55 A – AEA 6.0

Spare parts

Type	Description	ID no.
SK-MK63S/18.31	Carbon brush	157 309
SA-KESR32-55S/18PH-31-0	Current collector PH	157 294
SA-KESR32-55S/18PE31-0	Current collector PE	157 295

KESR-F

for connection cable with flat plug

Type ¹	Weight [kg]	A [mm]	B [mm]	C [mm]	pins	Base plate	ID no. with PE HS	ID no. without PE ST
KESR 32-55 F- 3-18	0.393	54	79	-	3	4-pin (no. 4 = free)	157 285	157 290
KESR 32-55 F- 4-18	0.457	54	79	-	4	4-pin	157 286	157 291
KESR 32-55 F- 5-18	0.521	80	115	53	5	6-pin (no. 6 = free)	157 287	157 292
KESR 32-55 F- 6-18	0.585	80	115	53	6	6-pin	157 288	157 293

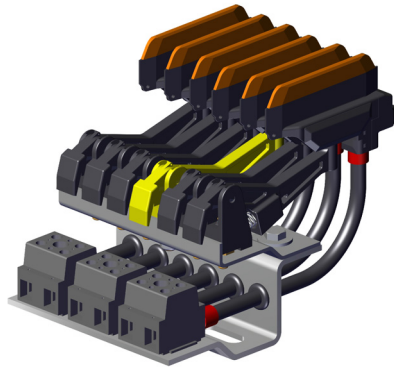
¹ max. current: 1 screw connection 32 A – AEA 2.5 | 40 A – AEA 4.0 | 55 A – AEA 6.0

Spare parts

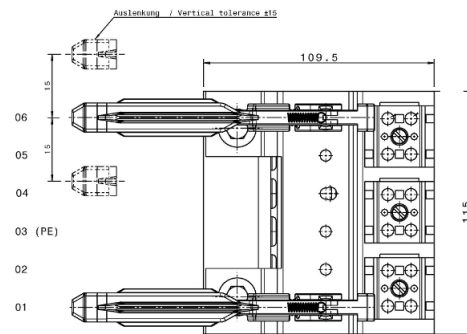
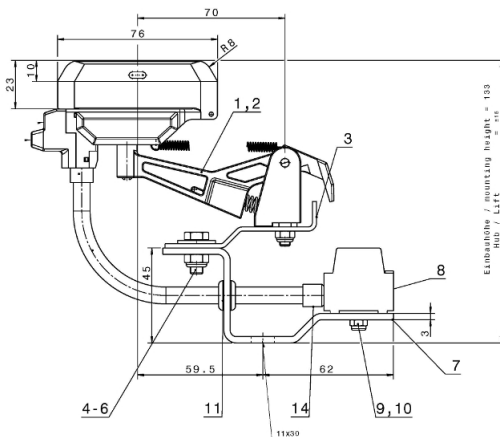
Type	Description	ID no.
SK-MK55F/18.31	Carbon brush	157 308
SA-KESR32-55F/18PH-31-0	Current collector PH	157 274
SA-KESR32-55F/18PE-31-0	Current collector PE	157 275



4.2.13 Compact current collector trolley KESR 63S



KESR 63S	
Reversing operation	
Adapter plate and terminal block	
Phase spacing	[mm] 18
Stroke and lateral deflection	[mm] ± 15
Contact pressure per carbon brush, approx.	[N] 7
For L (left) version PE (yellow) at no. 3	
For R (right) version PE at no. 4	
PE moves forward when folding into the system	



Left version

PE at no. 3

Type	Number of pins	ID no.
SA-KESR-63S-4-18-HS-KBL-01-04	4	10006549
SA-KESR-63S-5-18-HS-KBL-03-06-01	5	10006562
SA-KESR-63S-6-18-HS-KBL-03-06	6	10006591

Right version

PE at no. 4

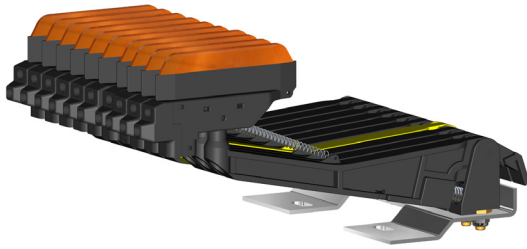
Type	Number of pins	ID no.
SA-KESR-63S-4-18-HS-KBR-04-04	4	10006550
SA-KESR-63S-5-18-HS-KBR-04-06-06	5	10006563
SA-KESR-63S-6-18-HS-KBR-04-06	6	10006592

Spare parts

Type	Description	ID no.
SK-MK63S/18.31	Carbon brush	157 309
SA-KESR32-63S/18PE-31-0	Current collector PE	157 295
SA-KESR32-63S/18PH-31-0	Current collector PH	157 294

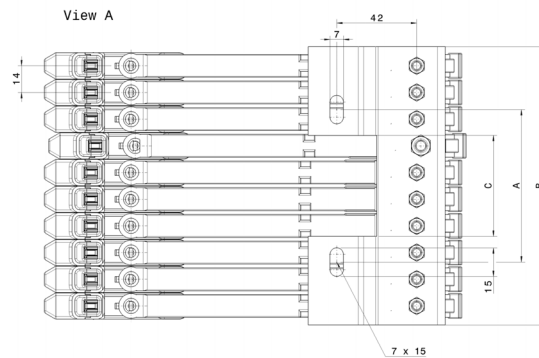
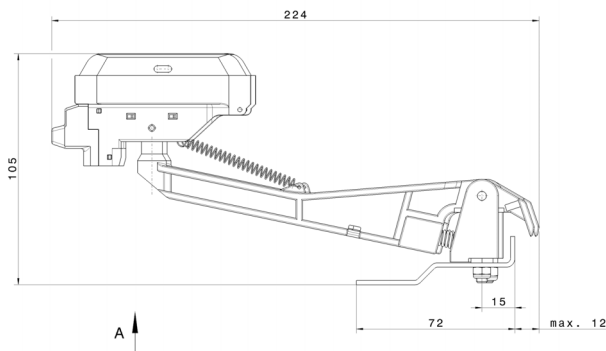


4.2.14 Compact current collector KESL 32-55



KESL 32-63		
Reversing operation		
Phase spacing	[mm]	18
Stroke and lateral deflection	[mm]	± 30
Contact pressure per carbon brush, approx.	[N]	7
PE (green) on no. 4 (other configuration possible)		
PE moves forward when folding into the conductor system		

max. current [A]	Flat plug	Screw connection
32	FLA 2.5	AEA 2.5
40	FLA 4.0	AEA 4.0
55	FLA 6.0	AEA 6.0





KESL-S

for connection cable with screw connection

Type ¹	Weight [kg]	A [mm]	B [mm]	C [mm]	Pins	Base plate	ID no.with PE HS	ID no.with-out PE ST
KESL 32-63 S- 3-18	0.451	54	79	-	3	4-pin (no. 4 = free)	157 190	157 296
KESL 32-63 S- 4-18	0.537	54	79	-	4	4-pin	157 191	157 297
KESL 32-63 S- 5-18	0.623	80	115	53	5	6-pin (no. 6 = free)	157 192	157 298
KESL 32-63 S- 6-18	0.709	80	115	53	6	6-pin	157 193	157 299

¹ max. current: 1 screw connection 32 A – AEA 2.5 | 40 A – AEA 4.0 | 55 A – AEA 6.0

Spare parts

Type	Description	ID no.
SK-MK63S/18.31	Carbon brush	157 309
SA-KESL 32-63 S/18 PE	Current collector PE	157 187
SA-KESL 32-63 S/18 PEH	Current collector PH	157 186

KESL-F

for connection cable with flat plug

Type ¹	Weight [kg]	A [mm]	B [mm]	C [mm]	Pins	Base plate	ID no.with PE HS	ID no.with-out PE ST
KESL 32-55 F- 3-18	0.438	54	79	-	3	4-pin (no. 4 = free)	157 199	157 300
KESL 32-55 F- 4-18	0.517	54	79	-	4	4-pin	157 200	157 301
KESL 32-55 F- 5-18	0.596	80	115	53	5	6-pin (no. 6 = free)	157 201	157 302
KESL 32-55 F- 6-18	0.675	80	115	53	6	6-pin	157 202	157 303

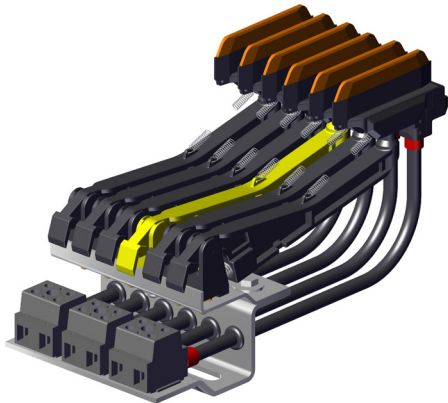
¹ max. current: 1 screw connection 32 A – AEA 2.5 | 40 A – AEA 4.0 | 55 A – AEA 6.0

Spare parts

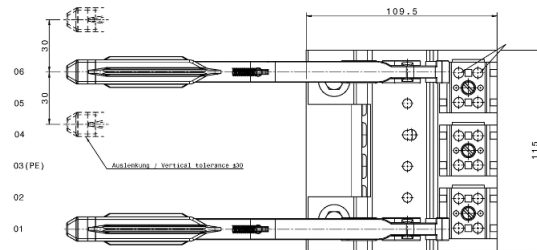
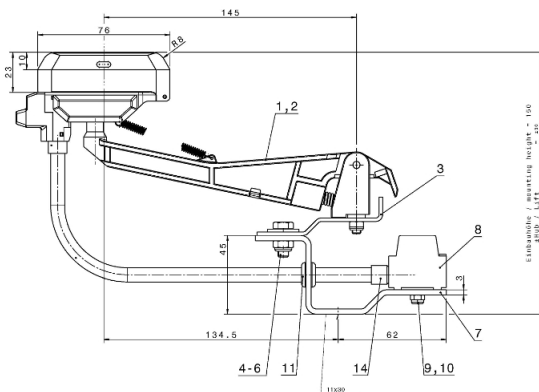
Type	Description	ID no.
SK-MK55F/18.31	Carbon brush	157 308
SA-KESL32-55F/18PE-31-0	Current collector PE	157 189
SA-KESL32-55F/18PH-31-0	Current collector PH	157 188



4.2.15 Compact current collector trolley KESL 63S



KESL 63S	
Reversing operation	
Adapter plate and terminal block	
Phase spacing [mm]	18
Stroke and lateral deflection [mm]	± 15
Contact pressure per carbon brush, approx. [N]	7
For L (left) version PE (yellow) at no. 3	
For R (right) version PE at no. 4	
PE moves forward when folding into the conductor system	



Left version

PE at no. 3

Type	Number of pins	ID no.
SA-KESL-63S-4-18-HS-KBL-01-04	4	10006553
SA-KESL-63S-5-18-HS-KBL-03-06-01	5	10006564
SA-KESL-63S-6-18-HS-KBL-03-06	6	10006594

Right version

PE at no. 4

Type	Number of pins	ID no.
SA-KESL-63S-4-18-HS-KBR-04-04	4	10006554
SA-KESL-63S-5-18-HS-KBR-04-06-06	5	10006565
SA-KESL-63S-6-18-HS-KBR-04-06	6	10006595

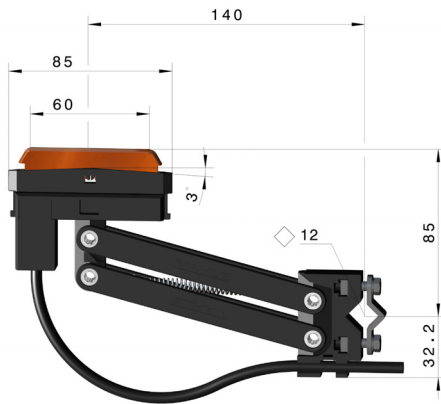
Spare parts

Type	Description	ID no.
SK-MK63S/18.31	Carbon brush	157 309
SA-KESL32-63S/18PE-31-0	Current collector PE	157 187
SA-KESL32-63S/18PH-31-0	Current collector PH	157 186



4.2.16 Single current collector

KSTU 30 / KSTU 55

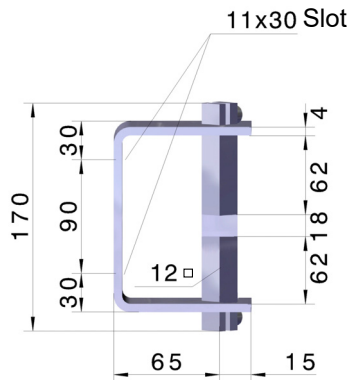


Current collector		
Connection cable	[m]	2
Stroke and lateral deflection	[mm]	± 20
In the funnel area	[mm]	± 10
Contact pressure, approx.	[N]	5
For transitions, switches, turntables etc. two current collectors or a double current collector must be used for each pin.		
for transfer funnel KSTU (section Transfer funnel for KSTU 30/55)		

Type	Current		Connection cable		Weight [kg]	ID no.	
	[A]	[A/mm ²]	[d max./mm]	Phase black		PE yellow	
KSTU 30	30	2.50	5	0.240	152 087	152 088	
KSTU 55	55	6.00	11	0.368	154 441	154 442	

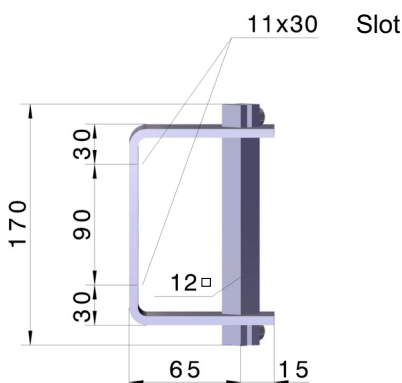
4.2.17 Driver

Driver for current collector set with PE



UMAS 12 HS-B	
ID no.	152 232
Weight [kg]	0.6
for KSTU 30/55	

Driver for current collector set without PE (control cables)



UMAS 12 ST	
ID no.	152 234
Weight [kg]	0.6
for KSTU 30/55	



4.2.18 Connecting cables

4.2.18.1 Connecting cable FLA

Connecting cable FLA



FLA	
highly flexible for current collector with flat plug connection "F"	
Observe assignment to current collectors	
Length [m]	1
with female spade connector 6.3 mm x 0.8 mm	
Longer connecting cable available	
Temperature range [°C]	-10 to +70

Type	Weight [kg]	A [mm ²]	∅ _{max.} [mm]	ID no. Phase black	PE yellow
AL-FLA2.5PE1-6.3	0.080	2.50	4.00	-	165 050
AL-FLA2.5PH1-6.3	0.100	2.50	4.00	165 049	-
AL-FLA4PE1-6.3	0.100	4.00	6.00	-	165 052
AL-FLA4PH1-6.3	0.150	4.00	6.00	165 051	-
AL-FLA6PE1-6.3	0.150	6.00	7.00	-	166 369
AL-FLA6PH1-6.3	0.080	6.00	7.00	166 369	-

4.2.18.2 Connecting cable AEA

Connection cable AEA



AEA	
highly flexible for current collector with screw connection "S"	
Length [m]	1
Longer connection cable available	
Temperature range [°C]	-10 to +70

Type	Weight [kg]	A [mm ²]	∅ _{max.} [mm]	ID no. Phase black	PE yellow
AL-AEA2.5PE-32-3.7-1000-D	0.038	2.50	3.90	-	143 079
AL-AEA2.5PH-32-4-1000-A	0.038	2.50	3.90	143 080	-
AL-AEA4PE-40-4.4-1000-D	0.063	4.00	5.40	-	143 077
AL-AEA4PH-40-5.6-1000-A	0.063	4.00	5.40	143 078	-
AL-AEA6PE-55-5.5-1000-D	0.085	6.00	5.70	-	143 075
AL-AEA6PH-55-5.9-1000-A	0.085	6.00	5.70	143 076	-
AL-AEA10PE-63-8.2-1000-D	0.160	10.00	8.20	-	143 073
AL-AEA10PH-63-8.4-1000-A	0.160	10.00	8.20	143 074	-

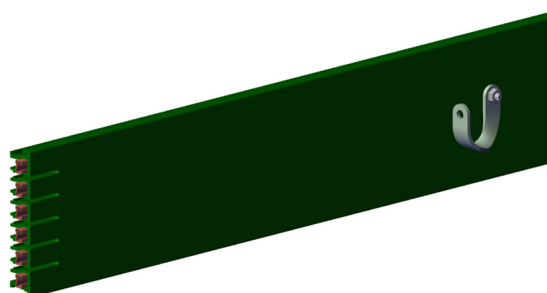


4.2.19 Equipotential bonding

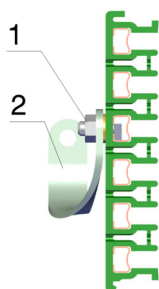
VKS equipotential bonding to the VMT - end cap

Type	Description	Weight [kg]	ID no.
VSPA-VMT-200-VKS4-R	Equipotential bonding connection set VKS4 (right)	0.443	171564
VSPA-VMT-200-VKS4-L	Equipotential bonding connection set VKS4 (left)	0.443	171566
VSPA-VMT-200-VKS5+6-R	Equipotential bonding connection set VKS5/6 (right)	0.457	171565
VSPA-VMT-200-VKS5+6-L	Equipotential bonding connection set VKS5/6 (left)	0.457	171567

VKS grounding - section



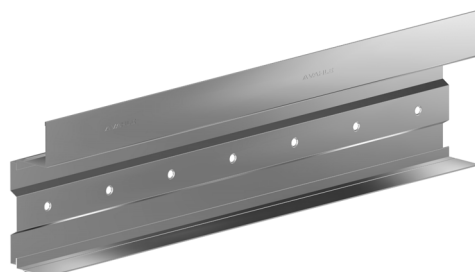
Grounding PE conductor rail VKS without VMT	
ID no.	157 800
Weight	[kg] 0.073
1	Terminal stud
2	Ground strap





4.3 System description VMT

With the new VAHLE multi-bearer, VAHLE has developed a product that is specially tailored to the many requirements of floor-guided storage and conveyor systems, such as storage and retrieval systems and transfer carriages. Please contact us in the case of other applications, e.g. in crane technology. Displacement and positioning systems can of course also be used in parallel. A further plus for the user are the large hanger distances, which enable quick and cost-effective installation.



System features

- Supports several standard conductor systems
- Hanger spacing up to 3.5 meters
- Quick and easy installation using plug and clamping systems
- Mechanical protection of the conductor rail system
- Temperature-independent system rigidity
- Trade-association compliant design of the support profile
- Integration of optical travel sensor and positioning systems
- Universal hangers for all common upright profiles
- 4- to 6-pin; 63–140 A with identical installation space
- 12 to 690 V
- IP2X contact protection
- Electrical protection through equipotential bonding
- Easy replacement of partial sections or individual sections



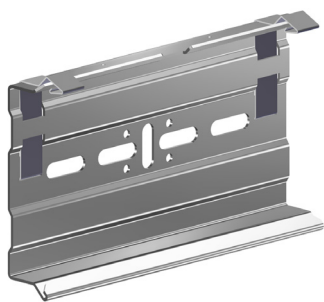
4.4 Device overview VMT

4.4.1 Profile



Profile		
VMT-6000		0171546/01
Weight	[kg]	12,336
Delivery length [mm]		6000

4.4.2 Terminal connector



Terminal connector		
KV-VMT		0171536/00
Weight	[kg]	0,845

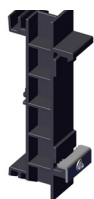
4.4.3 Hanger bracket

Sliding hanger VKS in VMT



Type	For number of pins	Weight [kg]	ID no.
VAS4-VMT	4	0.036	171526
VAS6-VMT	5/6	0.036	171525

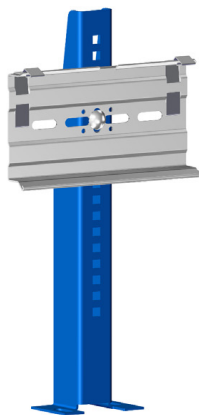
Fixed hanger VKS in VMT



Type	For number of pins	Weight [kg]	ID no.
VEPS4-VMT	4	0.042	171527
VEPS6-VMT	5/6	0.042	171528



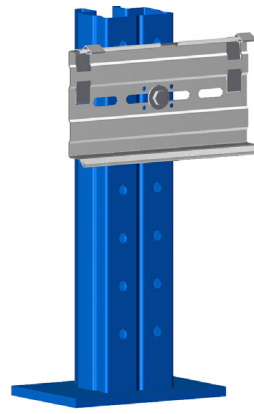
4.4.4 Single hangers



1



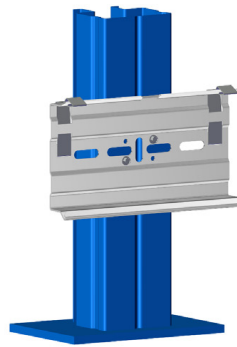
2



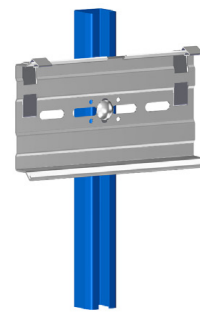
3



4



5



6

Position	Type	Description	Tightening torque [Nm]	Clamping area [mm]	Weight [kg]	Ident-No.
1	VMT-HS-S	Screw console (for auxiliary support HSE)	15		0,882	0171839/00
2	VMT-SPW	Clamping console (for auxiliary support HST)	15		1,062	0171539/00
3	VMT-S	Screw console	15		0,902	0171547/00
4	VMT 55 -125	Clamping console	15	55 to 65	1,600	0171552/00
				65 to 75	1,590	0171553/00
				75 to 85	1,610	0171554/00
				85 to 95	1,588	0171555/00
				95 to 105	1,620	0171556/00
				105 to 115	1,656	0171537/00
				115 to 125	1,638	0171538/00
5	VMT-BS	Screw console	7		0,848	0171540/00
6	VMT S1/2	Clamping console with insert nut	15		0,909	0171578/00

⁴ VMT 55-125: Larger clamping area on request



4.4.5 Auxillary supports

Auxiliary support HSE



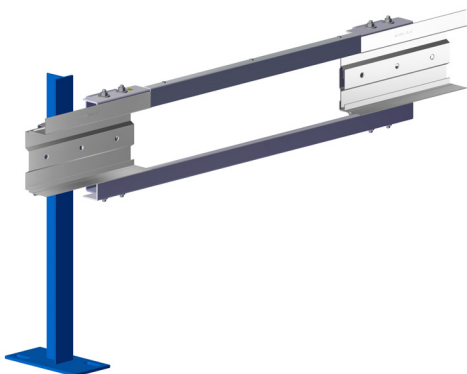
Type	Height [mm]	Ident-No.
HRL-HSE-300	300	0781697/00
HRL-HSE-350	350	0781758/00
HRL-HSE-400	400	0781710/00
HRL-HSE-450	450	0781694/00
HRL-HSE-500	500	0781677/00

Auxiliary support HST



Type	Height [mm]	Ident-No.
HRL-HST-50-250	250	0157172/00
HRL-HST-50-300	300	0152804/00
HRL-HST-50-350	350	0156393/00
HRL-HST-50-400	400	0152661/00
HRL-HST-50-450	450	0156492/00
HRL-HST-50-500	500	0152662/00
HRL-HST-50-550	550	0153246/00
HRL-HST-50-600	600	0152663/00
HRL-HST-50-650	650	0157183/00
HRL-HST-50-700	700	0152664/00

4.4.6 Connection for BCB feed terminal



VMTB900-ESST - on the line	
ID no.	171548
Weight [kg]	10.517
VMTB900-ESAE - at the lane end	
ID no.	171549
Weight [kg]	11.120



4.5 Installation plan

An installation plan is created for each system and enclosed with the documentation. The overview and location of individual components and assembly is also included here. The shorter lengths are given the item number from the order confirmation.

4.6 Interfaces

The conductor systems is supplied complete. The conductive components of the conductor system are contained in an insulating profile.

- Customer-side steel structure
- Perfectly aligned, profile upright or (VAHLE) auxiliary support
- On the vehicle side, there is a support bracket for the current collectors which is aligned to the conductor rail system.
- Please refer to the installation plan for the required system dimensions and tolerances.
- Rubber hose line for VLS infeed
- Customer-side line for VNS infeed
- Tubular cable lug M6 for VLS and M5 + M10 for VNS infeed
- The electrical connection of the feed terminals and current collectors is carried out on site.



5 TRANSPORT AND STORAGE

5.1 Safety instructions for transport and storage



NOTICE!

Damage due to improper transport or storage. Improper transport or storage may cause significant property damage!

- ▶ Storage temperature: 0 °C to +45 °C
- ▶ Storage location: Indoors, dry, no exposure to chemicals.
- ▶ Do not expose to direct sunlight.
- ▶ Exercise caution and observe the symbols on the packaging while unloading the pieces at delivery or during transport on the facilities.

5.2 Transport inspection

Check the delivery for completeness and transport damage upon receipt!

If any external damage is found:

- Refuse delivery or accept delivery only conditionally.
- Note the scope of the damage in the transport documents or on the carrier's delivery note.



NOTICE!

The delivery may be damaged during transport!

Report all defects as soon as they are found. Claims for damages can only be made during the applicable period.

- ▶ Document and report the defects found.

5.3 Conductor system

Conductor rail

- Transport and storage in wooden crates.
- Transport by truck



NOTICE!

Incorrect unpacking can lead to damage!

Improper unpacking may lead to property damage and personal injury.

- ▶ Only handle sections using lifting equipment which allows full-surface support or at least a three-point support, for example by using a lifting traverse.

5.4 Assemblies and individual parts

All units and separate parts are packaged in cardboard boxes for transport and storage.



6 COMMISSIONING

6.1 Safety instructions for commissioning



WARNING!

Risk of injury in case of improper operation!

Improper operation may result in serious injury or property damage.

- ▶ Observe the safety instructions from chapter “2 Safety instructions.”
- ▶ Are all acceptance reports available? (initial startup)
- ▶ Are there no people in the danger zones?
- ▶ Was the assembly performed completely according to instructions?
- ▶ Have excess materials, tools and auxiliary devices been cleared from the danger zones?
- ▶ Have the electrical system powered up by an authorized electrically trained person (see chapter “2 Safety instructions”)



WARNING!

Danger to unauthorized persons!

Unauthorized persons who do not meet the requirements described here do not know the dangers in the respective work area.

- ▶ Keep unauthorized persons away from the work area.
- ▶ If in doubt, speak to people and expel them from the work area.
- ▶ Interrupt the work as long as the unauthorized persons are in the work area.



WARNING!

Hazard in case of insufficient qualification of personnel!

Insufficiently qualified persons are unable to judge the risks when working on the system, which puts them and others at risk if severe or fatal injuries.

- ▶ All work must be performed by qualified personnel only.
- ▶ Insufficiently qualified personnel must stay out of the work area.



WARNING!

Risk of injury from falling parts!

In case of improper use (faulty assembly, misuse, failure to perform maintenance, etc.), there is a risk of parts falling down.

- ▶ Wear a helmet
- ▶ Perform regular maintenance



⚠ CAUTION!

Danger of crushing between the individual components!

During assembly there is a risk of crushing of the extremities between the individual components.

- ▶ Take care of your extremities.
- ▶ Wear personal protective equipment. (see Chapter: 2)



NOTICE!

The conductor rail material is susceptible to corrosion.

Corrosion can occur when working on the conductor rail with tools.

- ▶ Only tools that have not previously been used for ferritic materials may be used.
- ▶ Use own tools for the different materials (aluminum, copper, stainless steel).
- ▶ Chip-forming work (grinding etc.) must not be performed in the vicinity of the conductor rail system.



NOTICE!

The following points have to be strictly observed during assembly!

- ▶ Appropriate handling of materials.
- ▶ Clean and metallic bright surfaces on all contact points.
- ▶ Smooth crossovers, free of burrs, of the conductor rail profiles at the ends in order to avoid breakdowns and a high carbon brush wear.
- ▶ Firm tightening of all screws using the screw lock provided and observing the stated tightening torques.
- ▶ Exact alignment of the conductor rail to the guide system.
- ▶ Damaged materials must not be installed.
- ▶ Observe all applicable regulations governing installation of the plant.

6.2 Operation/decommissioning

6.2.1 Operation

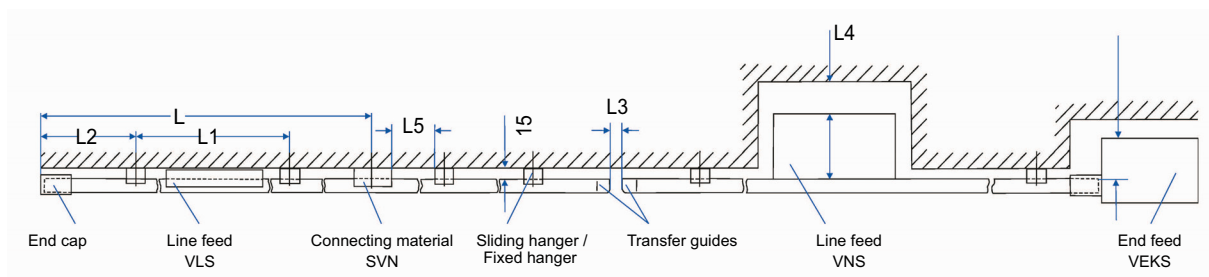
Operation is understood to be trouble-free, normal operation. Check intervals as per the maintenance schedule in Chapter: „8 “. If defects occur, stop using the system to prevent damage.

6.2.2 Decommissioning

Switch off the system and secure it against restarting. Disconnect the entire power supply from the system physically.



6.3 System diagram



Detail	Meaning
L	Length of the conductor system
L1	Hanger spacing (see section 6.5.1 / Hanging spacings)
L2	Overhang (max. 200 mm)
L3	Air gap during transitions, e.g. for switches and lifting stations (3–5 mm)
L4	Where applicable, space to lift the cover
L5	Safety distance for expansion of the conductor system (min. 50 mm)

6.4 Assembly tools

The following devices, tools and measuring equipment are necessary for assembly of the conductor rails with accessories:

- Suitable means of transport for bringing the conductor rails to the installation site (full-area support of the conductor rails).
- adjustable torque wrench for 5 Nm, 7 Nm and 44 Nm
- ½" reversible ratchet with extension and nut, size 17, 13, and 8
- Steel tape measure
- Contact angle
- Hacksaw
- Soft-face hammer, head Ø approx. 50 mm
- Screwdriver set

6.5 Installation of VKS

6.5.1 Contact line

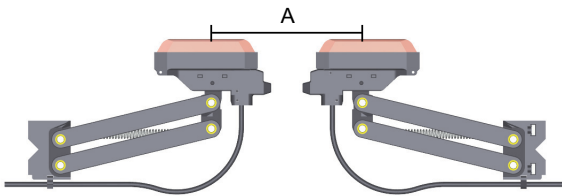
Prerequisites:

- ✓ Before installation, observe the system-specific installation plan and the applicable system documentation.
- ✓ If specified in the system-specific installation plan, always install curved sections and track switches of the conductor system first.
- ✓ The hanger spacings for curved sections and track switches are listed in the system-specific installation plan.
- ✓ Insert the feed terminal near the mains connection
- ✓ The connection lines must not impede the expansion of the conductor line.



Hanging spacings

Observe the following hanging spacings:



Maximum hanging spacing (A)	Straight [mm]	Curved [mm]
Compact current collector KSFU 25	1000	500
Compact current collector KESR 32-55	1000	500
Compact current collector KESR 63S	1000	500
Compact current collector KESL 32-55	1000	500
Compact current collector KESL 63S	1000	500
KSTU 30-55 if A > 300	1000	400
KSTU 30-55 if A < 300	800	400

Place the first hanger no more than 200 mm from the straight section.

NOTICE!

Range of application - 30 ° C to + 55 ° C

For applications permanently below 0 ° C (cold storage) please inquire separately.

- ▶ Operating temperature for delivery lengths < 4 m: -30 to + 55 ° C
- ▶ Operating temperature for delivery lengths > 4 m: 0 to + 40 ° C
- ▶ Restricted temperature range for 6 m lengths: $\Delta T \leq 50$ ° C

Installing support brackets

The support brackets are required for mounting the VKS hangers. The implementation is carried out by the customer. The use of special structures is possible.

Assembly steps:

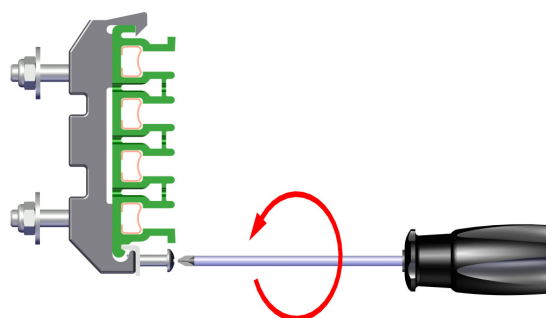
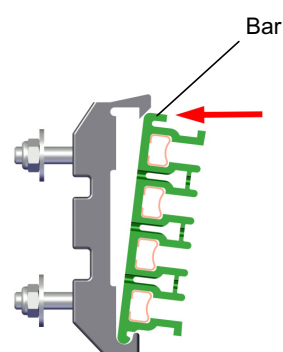
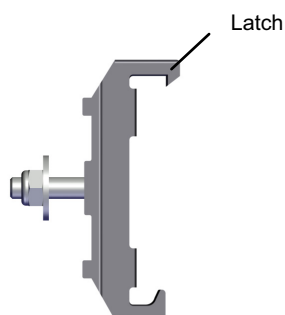
1. Mount the support brackets parallel and at right angles to the guide rail.



Mounting conductor system and adjusting connection joint

Install the conductor system straight and parallel to the crane runway.

The conductor system must be attached to each straight section with at least one hanger.



Hangers at support brackets

Prerequisites:

- ✓ The latch for the continuous bar of the conductor system must always be up for a side arrangement, or must always be facing outwards for a hanging arrangement.

Required tools:

- ✂ Screwdriver for countersunk screw M6

Assembly steps:

1. Attach the hanger to the support brackets by clipping or screwing (M6).

Inserting the conductor system

Prerequisites:

- ✓ Ensure that for a side arrangement, the bar of the conductor system is always up, and for a hanging arrangement it must always be facing outwards.

Assembly steps:

1. Insert the conductor system section into the hanger from the front and then snap it into place.

Securing the conductor system

Assembly tools:

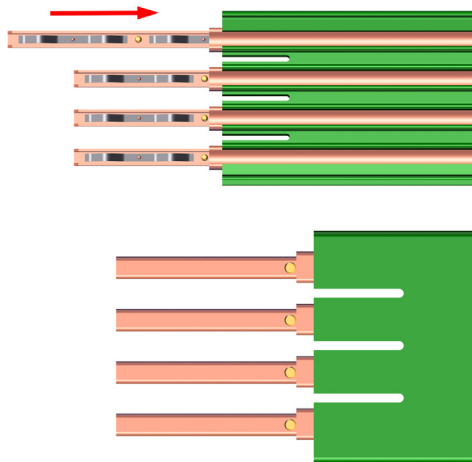
- ✂ Screwdriver

Assembly steps:

1. Screw the section to the intended fixed hanger with 12 Nm.

NOTICE!

- ▶ Each section must be fitted with a fixed hanger. The distance between two fixed hangers must not exceed 4 m (for delivery lengths of 4 m) or 6 m (for delivery lengths of more than 4 m).



Plug connector

Prerequisites:

- ✓ Before inserting, the springs must be checked for proper contact with the connector rail.
- ✓ During insertion, the springs must point towards the curvature of the conductor rail profile.

Required tools:

- ✂ Tape measure

Assembly steps:

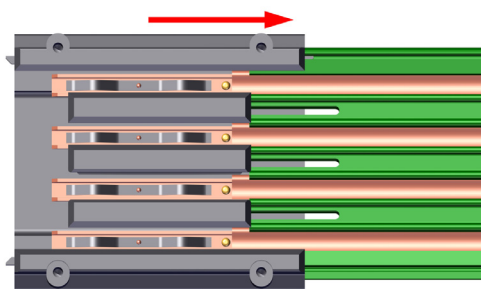
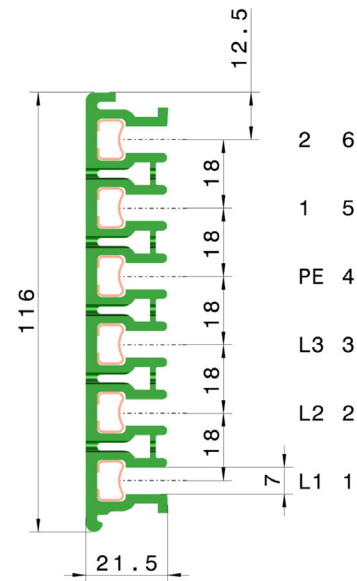
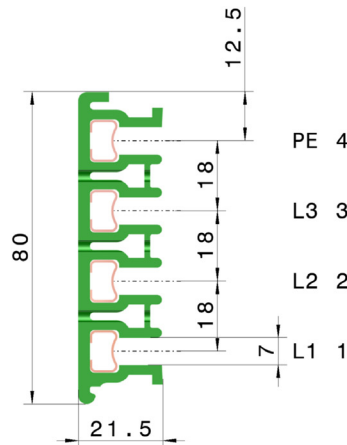
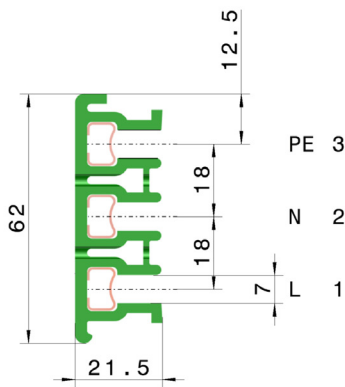
1. Slide the connectors on the section into the conductor rail profiles with an even projection of 66 mm.



NOTICE!

Risk of damage to the conductor rail.

- ▶ The connectors are assigned as shown in the diagram on the left and in the table on page 52.



Cover cap

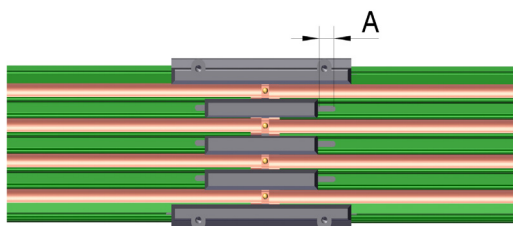
Assembly steps:

1. Push the connector cover cap on one side of the section as far as it will go.

Snap the section into place

Assembly steps:

1. Insert the next section from the front into the hanger and snap it into place.



Push sections together

Assembly steps:

1. Push the two sections together until the connectors are plugged in. To do this, cover the free end of the conductor system with an impact protection and drive the sections together using a hammer to setting dimension "A" (table page 53).

NOTICE!

- ▶ The adjustment dimensions according to 53 must only be strictly observed if the maximum temperature range is to be expected for the relevant conductor system. At lower temperature differences (20 °C / standard 4m=15 °C), to simplify installation the conductor system can be pushed together so that a closed copper joint is created. The air gap at the insulating housings then adjusts itself automatically.

Step 10

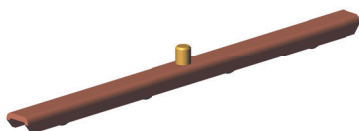
Assembly steps:

1. Install the other sections as per the previous steps.

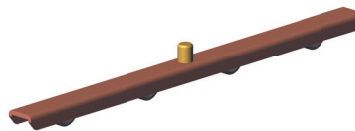
NOTICE!

- ▶ The distance between the hangers and the connecting caps, feed terminals must be at least 50 mm so as not to hinder expansion.

Table of plug connector assignments



Plug connector 63 A - 100 A

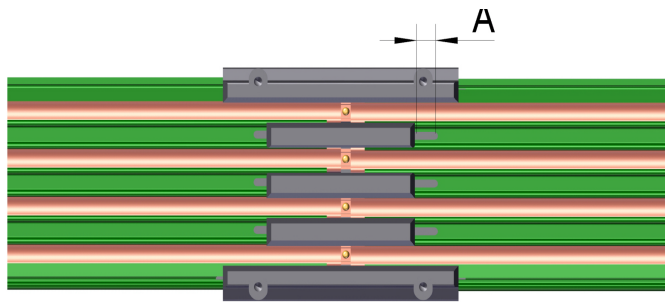


Plug connector 120 A - 140 A

Conductor system types	Plug connector (copper)	
	63-100 A	120-140 A
HS+SS	63-100 A	120-140 A
VKS3/63-100	L;N;PE or 1;2;3	-
VKS3/120-140	-	L;N;PE or 1;2;3
VKS4/63-100	L1; L2; L3; PE or 1; 2; 3; 4	-
VKS4/120-140	PE or 4	L1; L2; L3 or 1; 2; 3
VKS5/63-100	L1; L2; L3; PE; 1 or 1; 2; 3; 4; 5	-
VKS5/120-140	PE; 1 or 4; 5	L1; L2; L3 or 1; 2; 3
VKS6/63-100	L1; L2; L3; PE; 1: 2 or 1; 2; 3; 4; 5; 6	-
VKS6/120-140	PE; 1; 2 or 4; 5; 6	L1; L2; L3 or 1; 2; 3



Table, air gap "A"



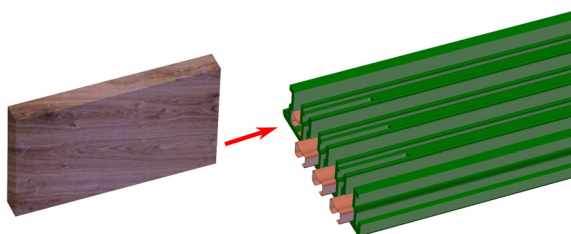
Installation temperature [° C]	-20	-15	-10	5	0	5	10	15	20	25	30	35	40	45	50	55
Air gap "A" [mm] 6 m straight sections	24	22.5	21	19.5	18	16.5	15	13.5	12	10.5	9	7.5	6	4.5	3	1.5
Air gap "A" [mm] 4 m straight sections	-	-	-	-	22	19.5	17	14.5	12	9.5	7	4.5	2	-	-	-

Shorter lengths

We manufacture shorter lengths at our factory according to your specifications. If shorter lengths still need to be adapted on site, modify the conductor system as follows.

NOTICE!

- ▶ The left side of the conductor rails has been widened at the factory to prevent it from moving inside the plastic housing. Therefore only ever shorten the right side.



Step 1

Required tools:

- ✂ Wooden board

Assembly steps:

1. Push in the conductor rails on the right side using a wooden board until they are flush with the insulation housing.

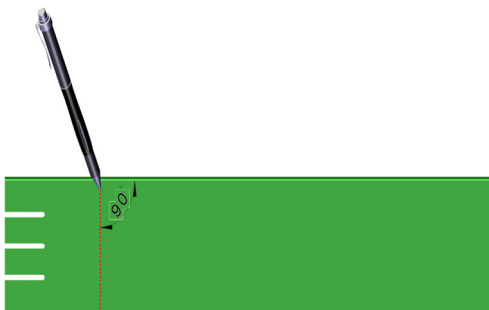
Step 2

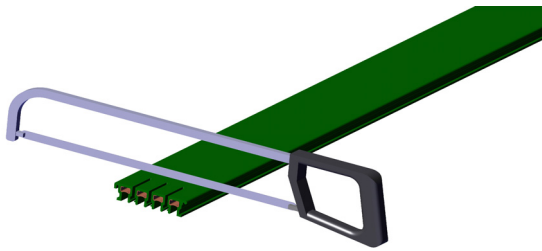
Required tools:

- ✂ Contact angle

Assembly steps:

1. Mark the new section length at right angles.

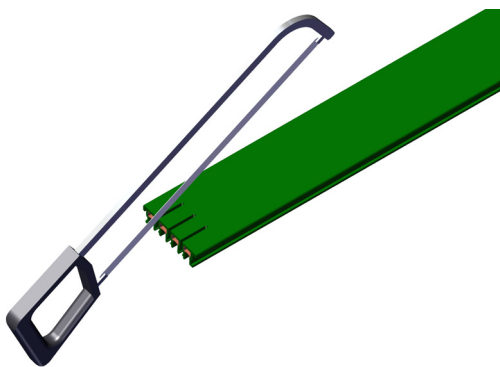


**Step 3***Required tools:*

✂ Hacksaw

Assembly steps:

1. Saw off the conductor line at the marking.

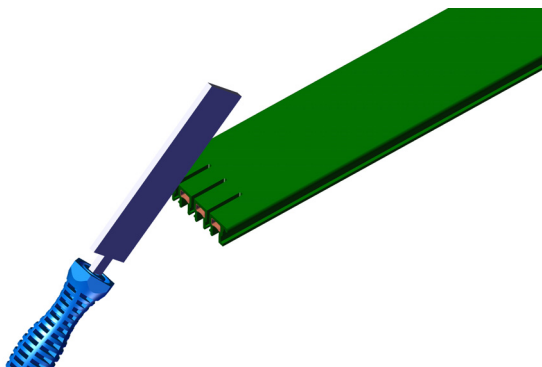
**Step 4***Required tools:*

✂ Tape measure

✂ Hacksaw

Assembly steps:

1. To extend the creepage distance, saw slots with a hand-held hacksaw 31 mm deep between the phases at the insulating housing.

**Step 5***Required tools:*

✂ Tape measure

✂ File

Assembly steps:

1. Widen the slots with a file to 3 mm.
2. Push the conductor line back until the same projection is achieved on both sides.
3. Deburr the slots and the copper at the shortened conductor line ends.

Bending the conductor system

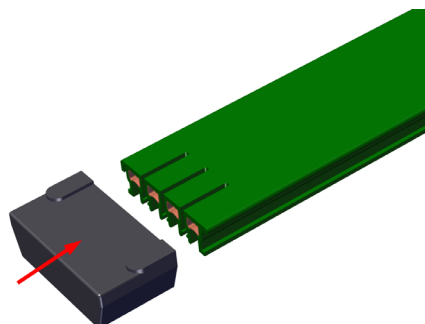
The conductor systems are only bent at the factory.

Minimum radius	R [mm]
Inner/outer curves	200
Horizontal curves	400



End caps

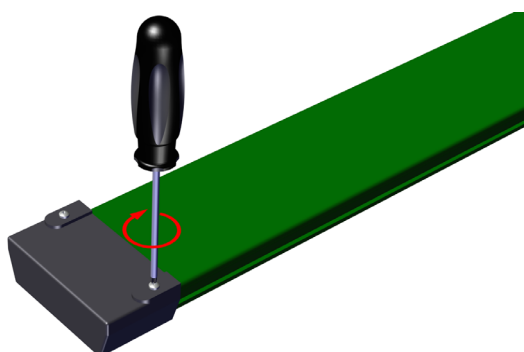
End caps form the contact-protected end of the conductor system.



Step 1

Assembly steps:

1. Push the end caps onto the conductor system ends.



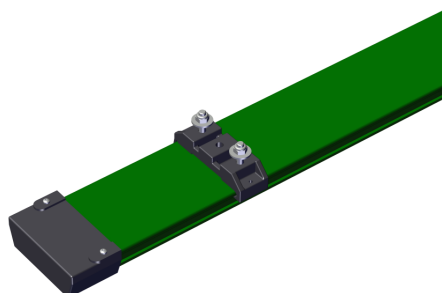
Step 2

Required tools:

- ✂ Screwdriver

Assembly steps:

1. Screw the end caps to the conductor system.



NOTICE!

- The overhang to the first or last hanger must not exceed 200 mm.



6.5.2 Feed terminal



DANGER!

Danger of life due to electrical current!

Contact with live parts can result in life-threatening injuries.

- ▶ Make sure that the components are not live or in tension unauthorized approximation.



CAUTION!

Danger of crushing between the individual components!

During assembly there is a risk of crushing of the extremities between the individual components.

- ▶ Take care of your extremities.
- ▶ Wear personal protective equipment. (see Chapter: 2.6)



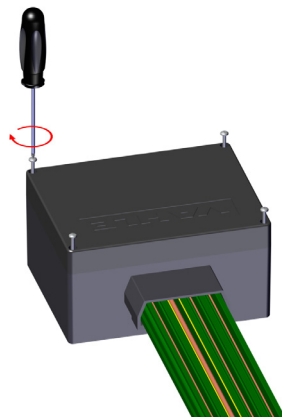
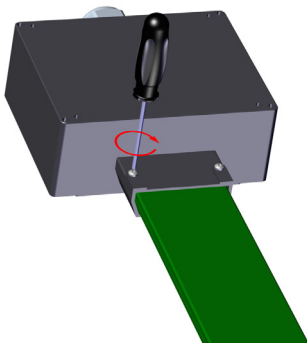
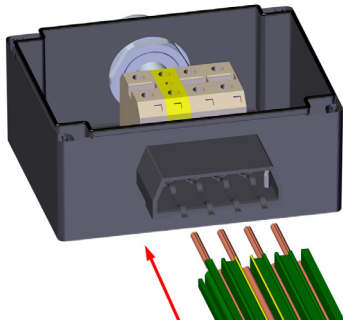
NOTICE!

- ▶ The line feeds are installed on a conductor system section as standard. The end feed is supplied without a section.
- ▶ Place the feed terminal as close as possible to the supply line.



End feed VEKS 10

The end feed consists of a connection box and the VLS feed (see Line feed VLS)



Step 1

Assembly steps:

1. Slide the end feed to the left or right onto one of the conductor system ends.

Step 2

Required tools:

- ✂ Screwdriver

Assembly steps:

1. Secure the box with two screws. The screws are included in the packaging unit.
2. Strip and cut the connecting wires as required.
3. Attach the cable lugs to the single wires and pass the connecting cable through the cable gland.

NOTICE!

- ▶ The cables are connected at terminal blocks.

Step 3

Required tools:

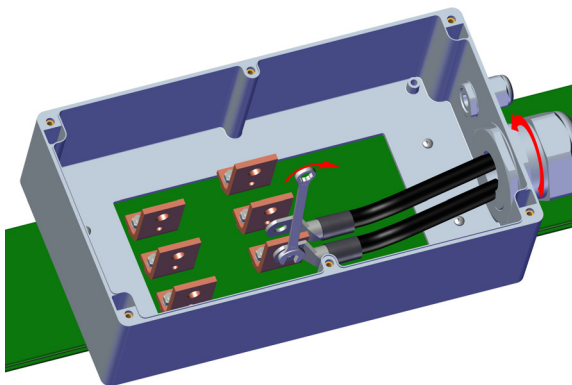
- ✂ Screwdriver

Assembly steps:

1. Tighten the cable gland until it is sealed against the connecting cable.
2. Replace the cover with the seal and close the connection box.



Line feed VNS

**Step 1**

Required tools:

- ✂ Screwdriver
- ✂ Torque wrench

Assembly steps:

1. Open the cover on the installed line feed
2. Strip and cut the connecting wires as required.
3. Attach the cable lugs to the single wires and pass the connecting cable through the cable gland.
4. Screw the cable lugs to the connecting lugs with the hexagon screws (M10, M5), lock washers and hexagon nuts.

NOTICE!

Tightening torques in accordance with DIN VDE 0220 T2

- ▶ M10 = 44 Nm
- ▶ M5 = 5 Nm

Step 2

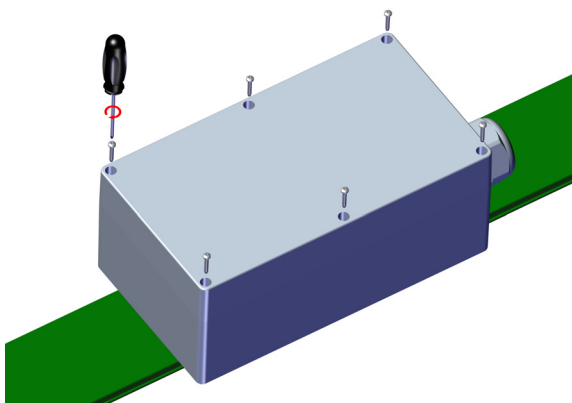
Assembly steps:

1. Tighten the cable gland until it is sealed against the connecting cable.

Step 3

Assembly steps:

1. Replace the cover and close the connection box.





Line feed VLS

Step 1

Required tools:

✂ Screwdriver

Assembly steps:

1. Remove the cover caps from the installed line feed.
2. Strip and cut the connecting cable as required.

NOTICE!

- ▶ From 100 A and above, use the double hole tubular cable lug.

Step 2

Required tools:

✂ Wrench

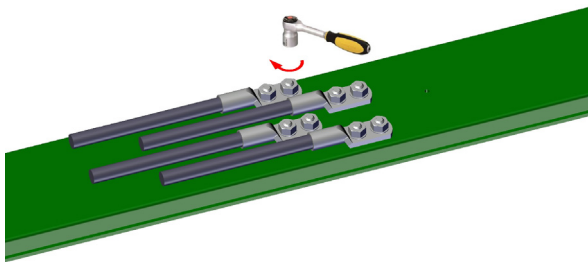
✂ Torque wrench

Assembly steps:

1. Attach the cable lugs to the single wires.
2. Place the terminal studs and spacers in the holes provided for them in the conductor system.
3. Screw the cable lugs to the terminal studs with the hexagon screws (M6), spring washers and hexagon nuts.

NOTICE!

- ▶ Tightening torque M6 = 7 Nm. Standard cable outlet on left, right also possible.

**Step 3**

Assembly steps:

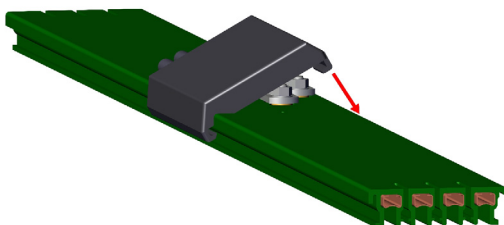
1. Assemble the cable routing on the predetermined breaking point of the cover cap.

The diameter of the through hole is 11 mm.

Step 4

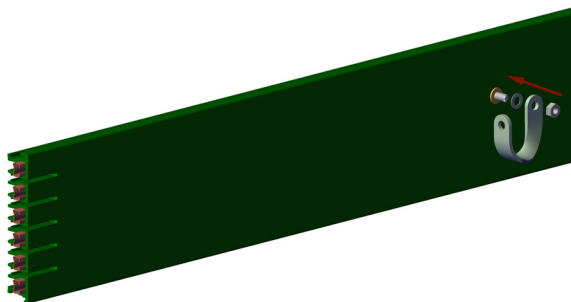
Assembly steps:

1. Place the cover cap on the conductor system and pay attention to cable routing.





6.5.3 Equipotential bonding



⚠ CAUTION!

To guarantee the protective measures, a low impedance connection including protective-/equipotential bonding conductor is essential!

See IEC 60364-4-41.

Equipotential bonding

Required tools:

⌘ Wrench M6

Assembly steps:

1. Loosen the nut on the pre-assembled terminal studs.
2. Secure the ground strap on the terminal studs.
3. Tighten the nut with 5 Nm.
4. Attach the other side of the ground strap to the supporting structure.

6.5.4 Collector

NOTICE!

Risk of damage by polarity reversal

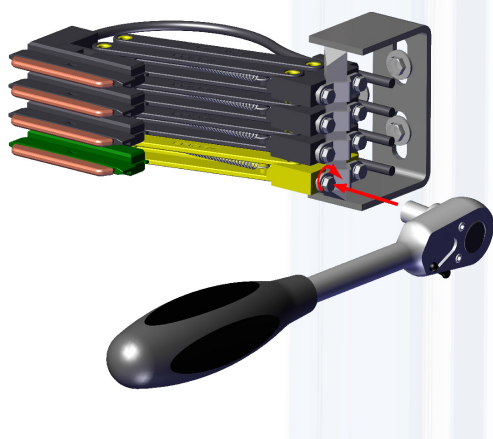
- ▶ Observe the correct pole configuration of the current collector.

Holder for current collector

For the current collectors, fastening must be parallel to the longitudinal direction of the conductor system and at a right angle to the contact surface.

NOTICE!

- ▶ The installation height "H" is shown in the table on page 61.



Current collector

Required tools:

⌘ Tape measure

Assembly steps:

1. Attach the current collectors in the intended position.
2. Slide the current collectors into the intended position.
3. Align the current collector with the phase center. For the ground conductor current collector, the collector is machined accordingly.



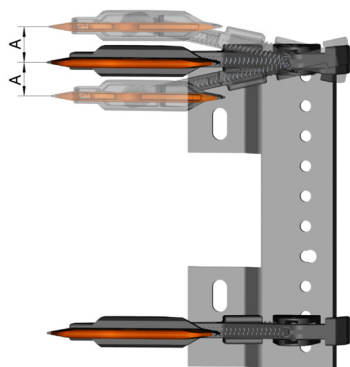
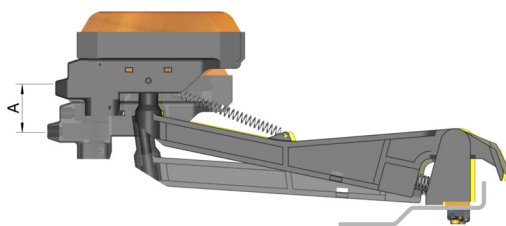
4. Attach the current collector with the fastening clip.
5. Install the freely hanging part of the connecting cable with a minimum bending radius of 10 x cable diameter.

NOTICE!

Risk of damage to the current collectors

- ▶ The connection lines must not impede the mobility of the current collectors.

Tolerances



NOTICE!

- ▶ The permissible operational tolerances "A" for the stroke and deflection apply for current collectors and conductor system together. They compensate for the difference that results from imprecisions in the movement of the vehicle and possible installation offset at the conductor system.

Current collector types	Installation height "H" [mm]	Stroke and lateral deflection "A" [mm]	Tightening torque MA for connection cable [Nm]
KSTU 30/55	85	± 20 / ± 15 ⁽¹⁾	5
KSFU 25	88	± 15 / ± 10 ⁽¹⁾	-
KESR 32-55 F	88	± 15	-
KESR 32-55 S	88	± 15 / ± 10 ⁽¹⁾	1.2
KESL 32-55 F	105	± 30	-
KESL 32-63 S	105	± 30	1.2
KESR 63S	133	± 15	1.2
KESL 63S	133	± 15	1.2

⁽¹⁾ First value is the standard, second value for the funnel area



Connecting the power supply



DANGER!

Risk of fatal injuries from electrical current!

Contact with electrically live components may result in fatal injuries.

- ▶ De-energize the system before making any electrical connections.

Assembly steps:

1. Connect the feed terminal to the power supply (see Feed terminal 6.5.2).
2. Wire the current collectors to the consumers.

NOTICE!

Risk of damage by polarity reversal

- ▶ Observe the correct pole configuration of the current collector.

NOTICE!

- ▶ Switches, fuses and cables for wiring must be provided and installed by the customer.



6.5.5 Transfer guides

Transfer guides are used for transitions, switches and dead sections. They separate the conductor system mechanically and electrically. There are left and right versions. The arrangement to the left or right side is determined by looking at the contact surface, for which the bar of the conductor system must be up. The transfer guides are fitted to VKS sections at the factory.

NOTICE!

At each transfer guide, the conductor system must be prevented from expanding with a fixed hanger.

NOTICE!

Risk of damage to the current collectors and transfer guides

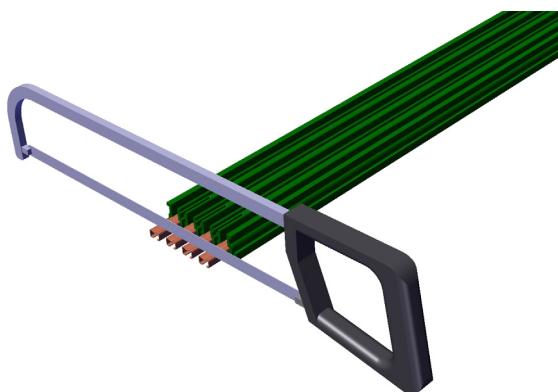
The air gap between the transfer guides must not exceed 5 mm. The maximum height and side offset of opposite rail transfer guides is ± 2 mm.

Transfer guide VU

Step 1

Assembly steps:

1. Push the conductor rails on one side into the plastic profile until a projection of 15 mm is achieved on the other side.



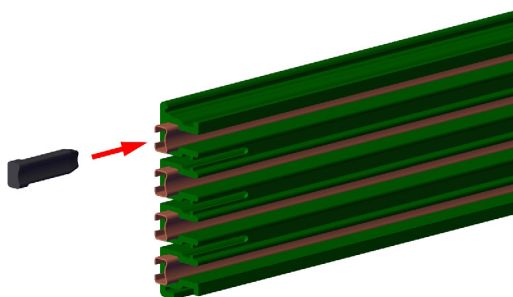
Step 2

Assembly tools:

- ✂ File

Assembly steps:

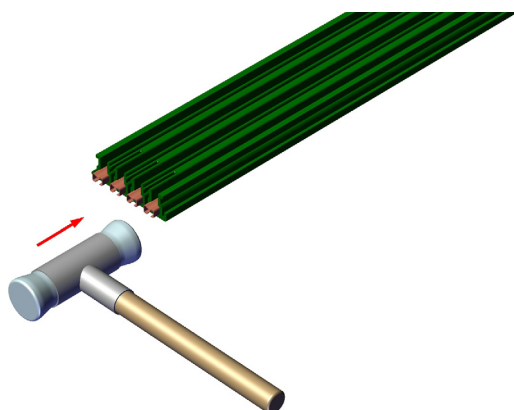
1. Shorten the conductor rail by 15 mm.
2. Deburr the end worked on.



Step 3

Assembly steps:

1. Push the insulating pieces onto the conductor rail ends.



Step 4

Assembly tools:

- ⌘ Rubber mallet

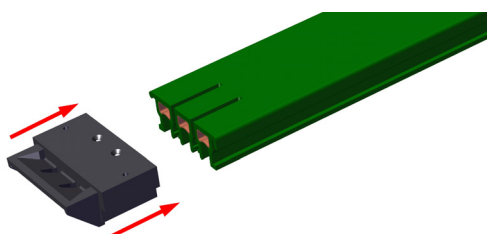
Assembly steps:

1. Drive the conductor rails into the plastic profile with a hammer until they are flush.



NOTICE!

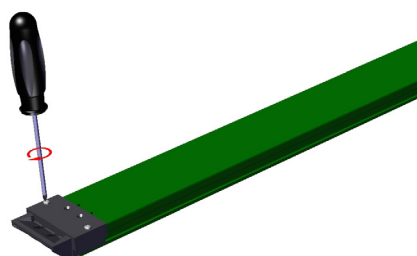
After the conductor rails have been pushed back into the plastic profile, there must be a protrusion on the other side of approx. 6 mm.



Step 5

Assembly steps:

1. Slide the transfer guide onto end worked on.



Step 6

Assembly tools:

- ⌘ Screwdriver

Assembly steps:

1. Secure the transfer guide with the screws.



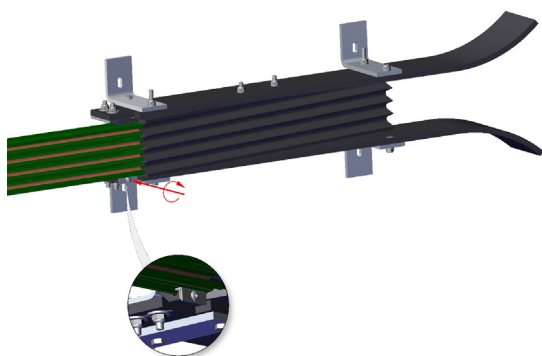
6.5.6 Transfer funnel

The transfer funnels are supplied pre-assembled but without conductor system sections. The transfer funnel can be mounted on the left and right of prepared VKS straight sections.

NOTICE!

Risk of damage to the current collectors and transfer funnels.

- ▶ The stroke and deflection tolerances of the current collectors in the entrance area of the transfer funnels are limited to max. 15 mm in all directions (KSFU 25 = 10 mm). The entry speed is max. 100 m/min



Step 1

Assembly steps:

1. Slide the transfer funnel onto the prepared section at the corresponding side.

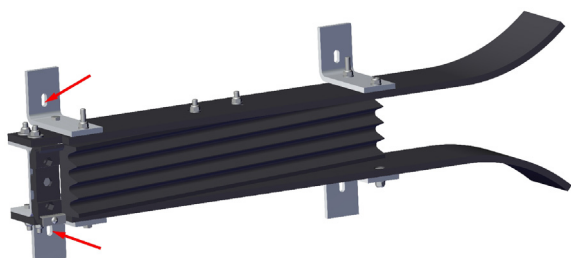
Step 2

Assembly steps:

1. Fix the funnel to the section with the retaining claw of the hanger.

NOTICE!

The offset between the transfer funnel and the conductor rail can be compensated for via the slotted holes of the lateral fastening.



Step 3

Assembly steps:

1. Secure the entire unit with the four brackets on the vibration-free support brackets (see section Installing support brackets).

NOTICE!

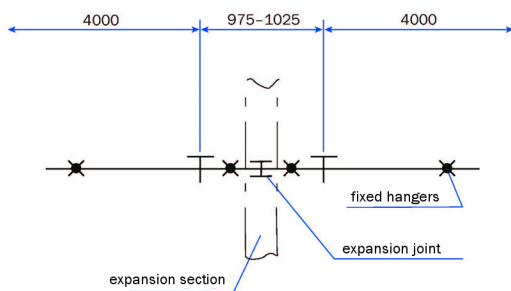
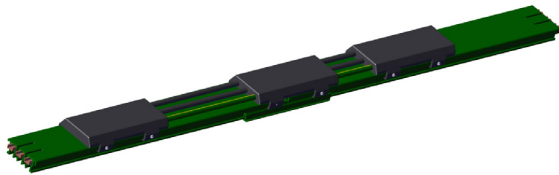
In the case of opposite transfer funnels, the air gap must be at least large enough to allow the current collectors to slacken.





6.5.7 Expansion Joint

The expansion section is fitted centrally in the area of the expansion joint, which is limited by 2 fixed points.



Step 1

Assembly steps:

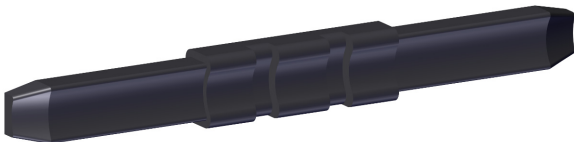
1. Fit the expansion section as described in section Mounting conductor system and adjusting connection joint in the center of an expansion joint.
2. Set the gap opening according to the expansion distance.
3. Limit the expansion area with two fixed hangers.

NOTICE!

The gap opening corresponds to the opening in the building or track expansion joint.

6.5.8 Rail separation

The rail separation electrically separates the conductor system. Installation is carried out at the factory in the VKS section.



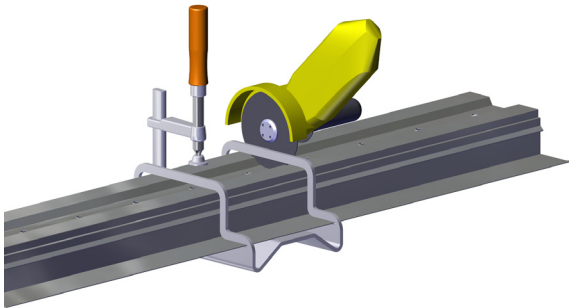
NOTICE!

The rail separations have a corresponding stamp imprint.

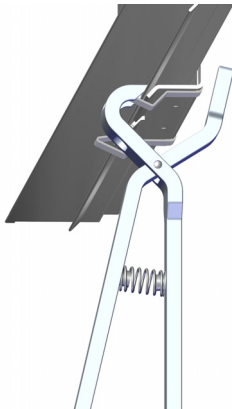


6.6 Installation VMT

6.6.1 Installation aids VMT



Sawing device	
ID no.	0171561/01
Weight [kg]	2.570

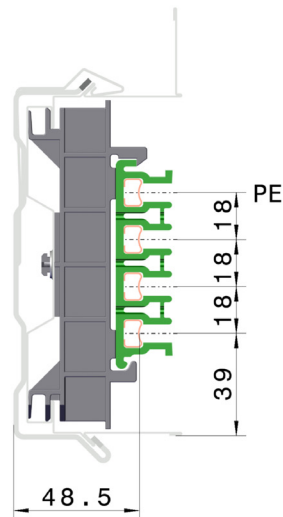


Installation pliers	
ID no.	0171533/00
Weight [kg]	0.700



6.6.2 Arrangement VKS In the VMT

(Sliding) fixed hanger
VAS4-VMT / VEPS4-VMT



(Sliding) fixed hanger
VAS6-VMT / VEPS6-VMT



6.6.3 Installation VMT profile



CAUTION!

When the VMT is hanging, i.e. the opening is facing downwards, the following restrictions apply:

- ▶ Hanging spacing: max. 3 meters
- ▶ The VMT hangers are installed in staggered arrangement. This means that the clamping springs are arranged alternately on the left or right
- ▶ In the case of hanging spaces of less than 2 meters, the alternate fixing of the hangers is not required.



NOTICE!

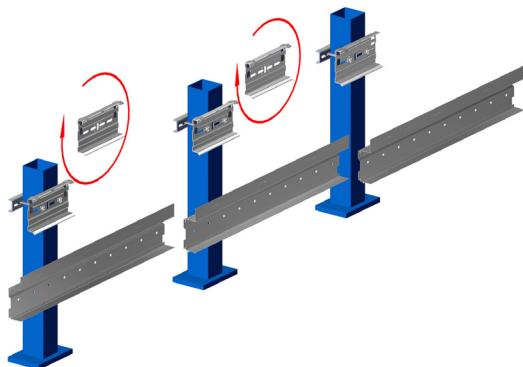
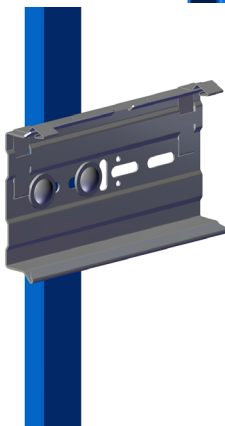
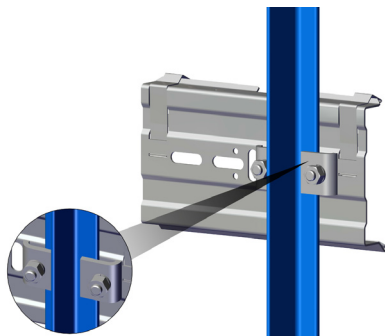
- ▶ Please observe the following torques regarding the different hangers:
- ▶ The AV-VMT-BS hangers are fixated with drill screws

**NOTICE!****Observe the following installation distances**

- ▶ Hanging spacing: max. 3.5 meters
- ▶ The first and last hanger have to be max. 500 mm from the end of the VMT.
- ▶ The distance of the hangers to the connecting material must be min. 350 mm.
- ▶ The hangers must be mounted parallel and at right angles to the guide rail.

Position	Type	Description	Tightening torque [Nm]	Clamping area [mm]	Weight [kg]	Ident-No.
1	VMT-HS-S	Screw console (for auxiliary support HSE)	15		0,882	0171839/00
2	VMT-SPW	Clamping console (for auxiliary support HST)	15		1,062	0171539/00
3	VMT-S	Screw console	15		0,902	0171547/00
4	VMT 55 -125	Clamping console	15	55 to 65	1,600	0171552/00
				65 to 75	1,590	0171553/00
				75 to 85	1,610	0171554/00
				85 to 95	1,588	0171555/00
				95 to 105	1,620	0171556/00
				105 to 115	1,656	0171537/00
				115 to 125	1,638	0171538/00
5	VMT-BS	Screw console	7		0,848	0171540/00
6	VMT S1/2	Clamping console	15		0,909	0171578/00

⁴ VMT 55-125: Larger clamping area on request



Step 1

Prerequisites:

- ✓ Upright must be installed correctly and straight.

Required tools:

- ⌘ Wrench/ reversible ratchet

Assembly instructions:

NOTICE!

The installation of the clamping console AH-VMT-SPW is shown as an example. Except for the AV-VMT-BS console, all consoles are installed similarly as shown.

- ▶ The AV-VMT-BS clamping console is fixated with drill screws (ST 5.5 = 7Nm).

1. Attach the clamping consoles or the screw consoles (dependent on the selected type). Tighten the M10 screws to a **torque of 15 Nm**. Ensure that the clamping springs always face upwards. For other clamping springs, please use the torques specified in the table above.

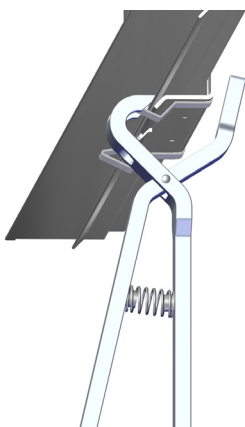
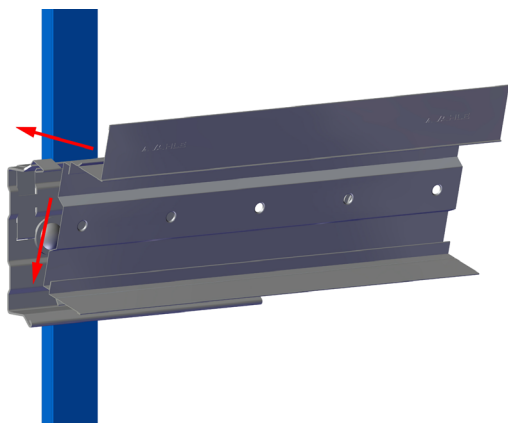
Step 2

Assembly instructions:

1. Lay out the VMT sections at the approximate position according to the installation plan, and then hang them in the mounted hangers.

NOTICE!

The connectors must be turned before assembly so that the clamping springs face downwards.



Step 3

Assembly instructions:

1. Insert the profiles as shown into the hangers and lock the clamping springs using the installation pliers (next illustration). Make sure that the springs have properly snapped in place.



CAUTION!

Danger of crushing between the individual components!

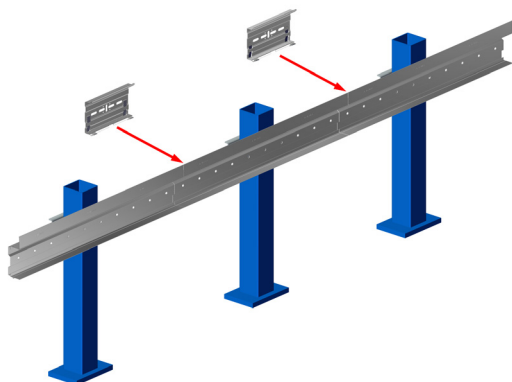
During assembly there is a risk of crushing of the extremities between the individual components.

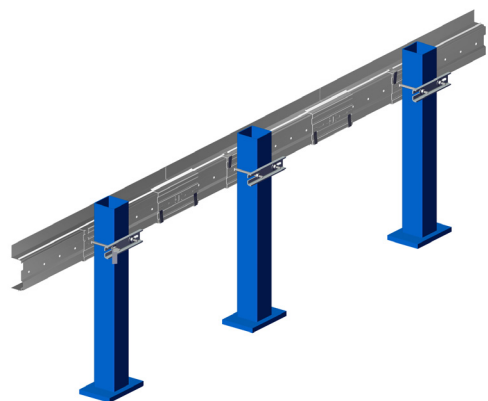
- ▶ Take care of your extremities.
- ▶ Wear personal protective equipment. (see Chapter: 2)

Step 4

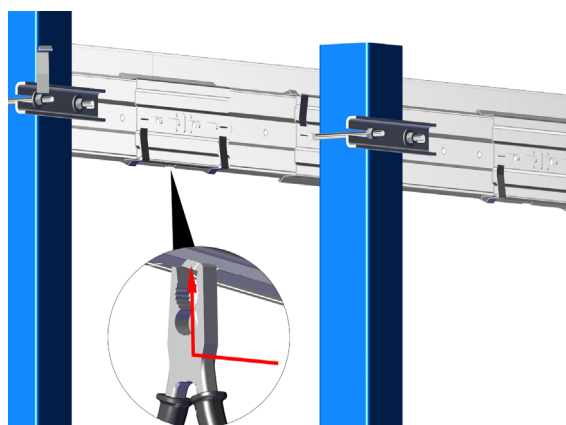
Assembly instructions:

1. Attach the connection sections and lock them using the installation pliers (as shown in Step 3).



**NOTICE!**

- ▶ Install the VMT sections with a **max. air gap of 0 to 2 mm** to one another.

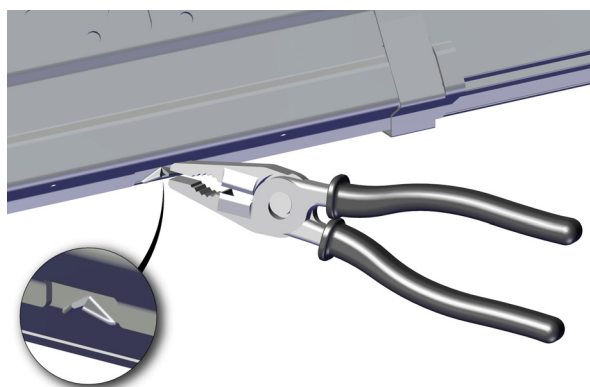
**Step 5**

Required tools:

- ✂ Combination or pipe wrench

Assembly instructions:

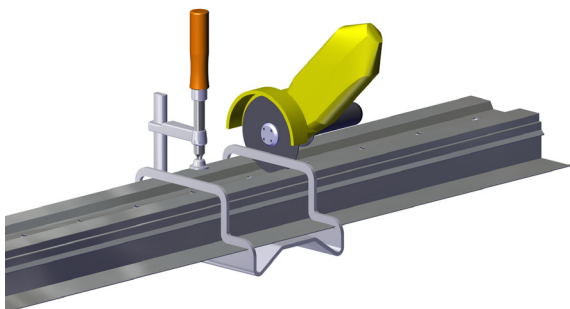
1. When all VMT sections and connectors are installed, slightly interlock the VMT ends at the connector using a combination or pipe wrench.

**NOTICE!**

This interlocking (approx. 30° downwards) prevents unintentional shifting of the connector onto the VMT profile.



6.6.4 Creating VMT shorter lengths



Step 6

Required tools:

- ✂ Sawing device SV-VMT

Assembly instructions:

1. If required, you can create shorter lengths on the construction side using the SV-VMT sawing device.
2. Deburr the cut edges.

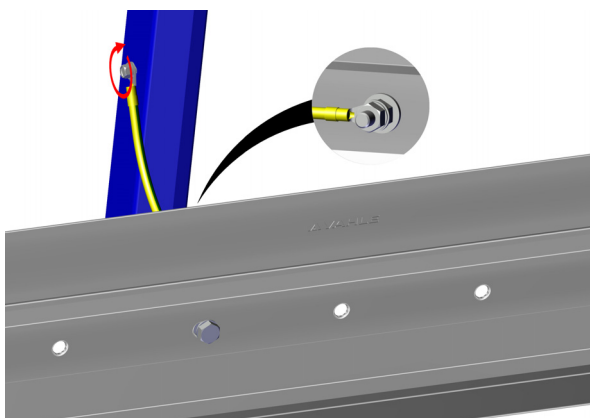
⚠ CAUTION!

Danger of injury!

Serious cutting injuries can occur if the cut edge is not deburred.

- ▶ Ensure that the cut edge is properly deburred.

6.6.5 Equipotential bonding



⚠ CAUTION!

To guarantee the protective measures, a low impedance connection including protective-/equipotential bonding conductor is essential!

See IEC 60364-4-41.

Step 1

Required tools:

- ✂ Wrench
- ✂ Electric drill

Assembly instructions:

1. Screw the equipotential bonding cable, as shown, to a point on the steel framework and the back of the VMT profile.

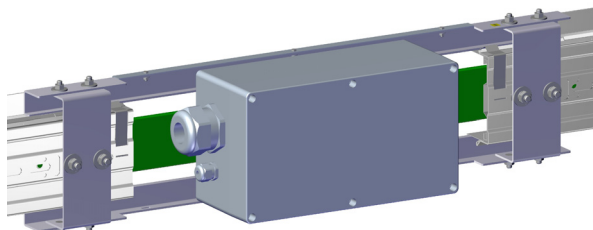
NOTICE!

The equipotential bonding between the conductor system and the VMT must be created as described in 6.5.3 Equipotential bonding .



6.6.6 Feed terminal Installation with VMT

Feed terminal installation

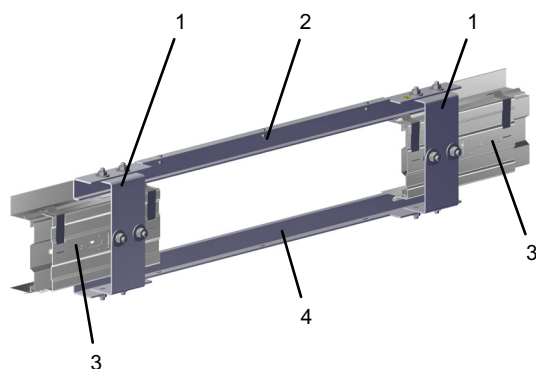


NOTICE!

The installation of the feed terminal is described in section 6.5.2 Feed terminal .

- ▶ In the VMT, the installation of the feed terminal must take place at a connection for BCB feed terminal (6.6.7 Connection for BCB feed terminal).

6.6.7 Connection for BCB feed terminal



Pre-assembly of connectors

Prerequisites:

- ✓ For the installation of the connection for the BCB feed terminal, there must be a distance of 600 mm between the VMT profiles.
- ✓ The distance to the next shelf upright or to the next auxiliary support must not exceed 1500 mm.

Required tools:

- ⌘ Wrench

Assembly instructions:

1. Secure the spacer bracket for the BCB (2) with four screws (M9, 9 Nm) at both U profiles (1).
2. Secure the connection profile for the BCB (4) with four screws (M9, 9 Nm) at both U profiles (1).
3. Secure both terminal connectors (3) with two screws each (M10, 15 Nm) at both U profiles (1).

Securing connectors to the auxiliary support

Prerequisites:

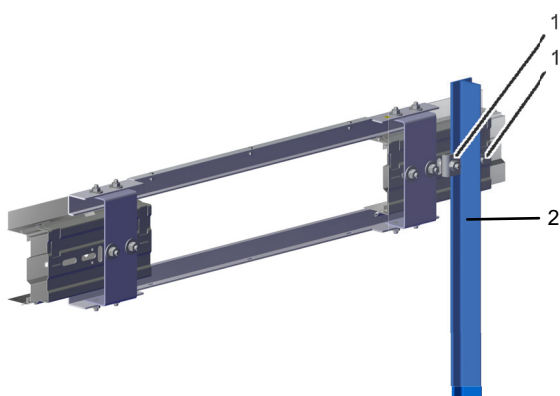
- ✓ Connector has been pre-assembled.

Required tools:

- ⌘ Wrench

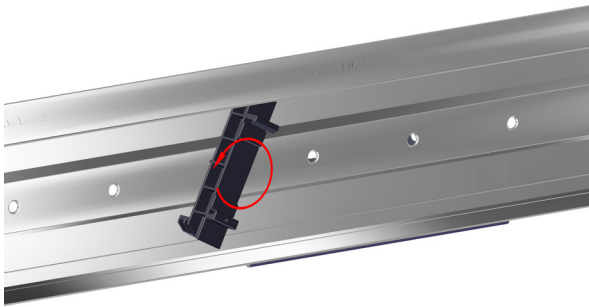
Assembly instructions:

1. Secure the connector with the clamping brackets (1) (M10, 15 Nm) to the auxiliary support (2) or the shelf upright.





6.6.8 Installation of VKS profile In the VMT



Step 1

Required tools:

✂ None

Assembly instructions:

1. Turn the holders into the corresponding bore-holes. (Grid dimension 100 mm).

NOTICE!

Observe the hanger distances from the supplied system or installation plan!

Step 2

Assembly instructions:

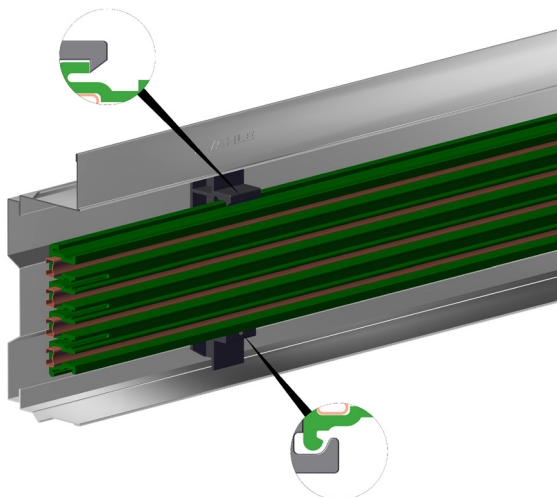
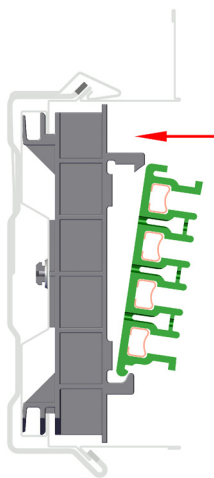
1. Click the remaining conductor rails into the profiles. Make sure that the lugs of the holders are properly snapped in place and the bar is pointing upwards.

NOTICE!

The profile connectors should be mounted outside the VMT profile, as in section Table of plug connector assignments !

NOTICE!

The poles are arranged in accordance with the Mounting conductor system and adjusting connection joint.





6.7 Condition after the installation



WARNING!

Risk of injury in case of improper operation!

- ▶ Before the initial start-up, verify that all acceptance reports have been submitted.
 - ▶ Ensure that no people are in danger zones.
 - ▶ Ensure that the system has been fully assembled.
 - ▶ Remove excess materials, tools and aids from dangerous locations.
 - ▶ The electrical system must be installed by a an authorized electrically trained person.
 - ▶ Perform a trial run after proper installation/maintenance.
Observe the following:
Perform the first trial run at reduced speed.
The graphite contacts must run in the rail without vibration.
-

6.8 Installation completion

After completing the assembly work, the plant is to be checked for functionality.

Commissioning

Perform a trial run after proper installation. The following points must be observed:

- Perform the first run at reduced speed.
- The carbon brushes must run in the conductor rail without vibration
- Formation of sparks on the carbon brush must not occur (formation of sparks indicates a dirty or oxidized contact surface; clean the contact surface).
- In particular, ensure smooth entry and exit at the transfer funnels and transfer guides. Transfer funnels are run with the current collectors intended for this purpose. The current collectors are fitted with height and lateral locks.



7 MALFUNCTIONS

7.1 Safety information about malfunctions



⚠ DANGER!

Electrical voltage on the system

Death or serious injury from electric shock.

- ▶ Before beginning any work, ensure that the system is free of voltage and remains so for the duration of the work. Observe the safety instructions!



⚠ WARNING!

Risk of injury in case of improper troubleshooting!

Improper troubleshooting may cause serious injuries or property damage.

- ▶ Ensure sufficient installation space before beginning any work.
- ▶ Switch off power supply, verify that the system is free of voltage, and secure against switching back on.

7.2 Conduct in case of malfunction

General principle:

- If case of malfunctions that present an immediate hazard to persons or property, immediately activate the safety devices.
- Determine the cause of the fault.
- Notify the person in charge at the place of operation.



NOTICE!

The inspection and maintenance tasks listed in the technical documentation must be performed and documented regularly:

(location, spare part, task performed, date, name of inspector).

- ▶ Only persons with the required training, qualification and authorization may perform troubleshooting work on the system.



7.3 Troubleshooting table

Fault	Cause	Remedy
Conductor system transmits no/ too little current.	No supply voltage	Check voltage supply on site.
Conductor system burnt.	Current collector position on rail in- correct	Check current collector on site.



NOTICE!

Improper troubleshooting

Non-functional system

- ▶ In the event of faults and malfunctions, the cause of the fault must be determined and the damaged components must be replaced. After a fault has occurred and components have been replaced, an insulation resistance measurement in accordance with EN 60204-32 (Section 18.3) must be carried out and a condition in compliance with the relevant standards must be restored before restarting.



8.1 Safety information about repairs



⚠ DANGER!

Before beginning any work, ensure that the system is free of voltage and remains so for the duration of the work. Observe the safety instructions from chapter “Safety”!



⚠ WARNING!

Risk of injury due to improperly performed maintenance work!

Improper maintenance can result in serious personal injury or property damage.

- ▶ Ensure that there is sufficient clearance before starting work.
- ▶ Pay attention to order and cleanliness in the workplace!
- ▶ Follow the procedure according to 2 Safety instructions before starting work.



⚠ WARNING!

Danger due to insufficiently qualified persons!

Insufficiently qualified persons cannot assess the risks involved in operating the system and expose themselves and others to the risk of serious or fatal injuries.

- ▶ Have all work performed only by persons qualified for the task.
- ▶ Inadequately qualified persons should be kept away from the work area.



⚠ CAUTION!

Tripping hazard due to protruding parts

There is a tripping hazard during the work.

- ▶ Watch out for steps and holes in the floor when walking inside the work area and the danger zone. There must be no loose objects in the work area.



⚠ CAUTION!

For maintenance and cleaning work where graphite contact dust may get into the ambient air, breathing protection must be used:

- ▶ Wear breathing protection mask acc. to EN 149, min. protection level FFP3. Vahle ID no.: 10017880
- ▶ Never blow out the mask with compressed air.

The general safety instructions in the operating instructions of the conductor system have to be read and obeyed!



NOTICE!

The following service and maintenance tasks must be performed to maintain the warranty and avoid damage to the system in general. These must be performed by the owner.

- ▶ Contact the manufacturer for questions about service and maintenance work.
- ▶ The intervals indicated below depend on the conditions under which the system is operated. This is why only average intervals are given.

8.2 Conductor system

For normal use, the conductor system requires only light maintenance. The following tasks should be performed periodically however.

Interval	Service/monitoring	Personnel
Daily	<ul style="list-style-type: none"> • Check safety equipment and operating behavior. 	Operator
Monthly	<ul style="list-style-type: none"> • Visual inspection of general condition. Replace damaged/defective parts. • Check mechanical and electrical connections, especially at the feed terminals; re-tighten if necessary. • Remove small burns or discolorations on the contact surface by scouring with an abrasive pad (min. grit size 400). Do not use a powered brush. If removing the burns is not possible, then replace the relevant section of the conductor system. • On transfer guides for track switches, the lifting station etc., the max. vertical offset of ± 2 mm must not be exceeded. • The max. air gap between opposite transfer guides is 5 mm. 	Technician/electrically qualified person
Quarterly	<ul style="list-style-type: none"> • Vacuum off any dust deposits (e.g. from carbon brushes) and other particles. Cleaning according to section 3.4. 	Qualified persons

In case of damage to the conductor system, the associated components such as current collectors must be inspected for damage.

Replacing the conductor system

Usually, the wear of the conductor system cannot be measured. If maintenance intervals are kept, then lifetimes of 15-20 years and more can be achieved.



8.3 Collector

Interval	Service/monitoring	Personnel
Daily	<ul style="list-style-type: none"> Check safety equipment and operating behavior. 	Operator
Monthly	<p>Visual inspection of general condition. Replace damaged/defective parts.</p> <p>Mechanical checks:</p> <ul style="list-style-type: none"> Check mobility of joints, bearings, and hinge pins. Inspection for mechanical damage of any type. Inspection of connecting cables for damage and correct installation. The connecting cables must not impede the mobility of the current collectors. Carbon brushes should be replaced in good time so that the mounts of the carbon brushes do not touch the outer edges of the connecting caps. For carbon brushes to be installed, observe the residual height "RH" of the carbon brush (see section 8.3 / Replacement intervals). <p>Electrical check:</p> <ul style="list-style-type: none"> Check for wear of carbon brushes, tight fit of all contact screws and cable attachments. Check residual height of the carbon brushes (see section 8.3 / Replacement intervals). <p>Check contact pressure:</p> <ul style="list-style-type: none"> Use a spring scale to pull the carbon brushes from the conductor system. The contact pressure must be approx. 5-7 N per carbon brush. If a check with a spring scale is not possible for design reasons, perform a visual check of the springs and verify that the contact force is even by individually lifting the carbon brush sockets. <p>Tightening torque:</p> <ul style="list-style-type: none"> The tightening torque of the contact screw (version for screw connection) is 1.2 Nm. 	Technician/electrically qualified person

In case of damage to the current collectors, inspect the conductor system for damage.



Service life

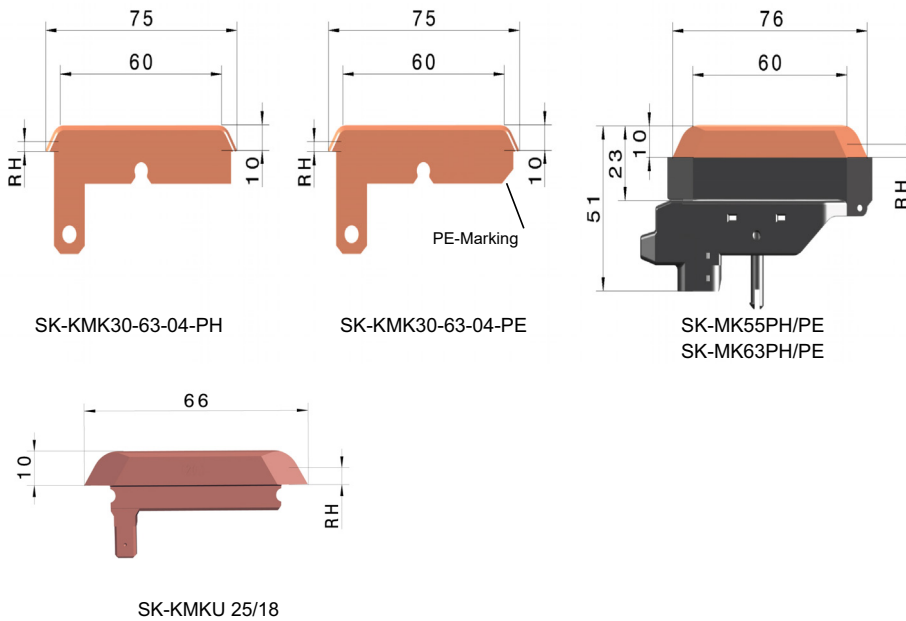
The wear of current collectors and carbon brushes depends on many different factors. These include temperature, humidity, current density, patination, and the amount of dirt and contamination of the application, especially the influence of foreign particles.

Until an optimal layer of patina is formed on the copper conductor systems, the first set of carbon brushes (initial delivery) usually has a somewhat shorter lifetime than subsequent sets.

Replacement intervals

Carbon brushes must be replaced in time so that the sockets of the graphite contacts cannot scrape on the conductor system housing or make contact with the edges of the connecting caps.

The residual heights of the carbon brushes are:



Type	for current collector	Width of the carbon brush [mm]	Residual height RH [mm]	ID no.
KMK 30-55 PH	KSTU 30-55	4.4	4	154 440
KMK 30-55 PE	KSTU 30-55	4.4	4	154 453
KMKU 25/18	KSFU 25	4.2	3.5	155 002
MK 55 F/18	KESR 32-55 F, KESL 32-55 F	4.2	3.5	157 308
MK 63 S/18	KESR 32-55 S, KESL 32-63 S, KESR 63S, KESL 63S	4.2	3.5	157 309

It is recommended to replace the complete current collector units with every third change of carbon brushes.



NOTICE!

Based on experience, the carbon brushes wear by one millimeter for up to 1000 km distance traveled.



9 DISASSEMBLY AND DISPOSAL

9.1 Preparation for disassembly

- Switch off the system and secure it against switching back on.
- Physically disconnect the entire power supply from the system.
- Loosen and remove all screws.



DANGER!

Danger of life due to electrical current!

Contact with live parts can result in life-threatening injuries.

- ▶ Make sure that the components are not live or in tension unauthorized approximation.

9.1.1 Disassembly

During disassembly, always observe the information in chapter 2.3.1 .



WARNING!

Risk of death from improper replacement or removal!

Errors during the removal or replacement of components may cause life-threatening situations or significant property damage

- ▶ Observe the safety instructions before beginning any removal work.



CAUTION!

All accessories must be checked for wear.

Only defect-free parts may be reused.

- ▶ Use only genuine VAHLE spare parts.

9.2 Disposal

When the system reaches the end of its useful life, the system must be dismantled and disposed of in an environmentally sound manner in accordance with the valid local regulations and laws.



NOTICE!

Electronic scrap is hazardous waste. For the disposal, please observe the local valid regulation and relevant laws in the respective country.

10 PROTECTIVE MEASURES

10.1 EU conformity declaration



EU - Declaration of conformity

Paul Vahle GmbH & Co. KG, Westicker Str. 52, D-59174 Kamen (Germany)

We herewith declare that the products specified hereafter conform to the relevant EU regulations. This declaration will be void when amendments not approved by us will be made to the products.

Product Group	34
Product	PVC Enclosed Conductor System
Type	VKS, VKL incl. accessories
Relevant EU Regulation	2014 / 35 / EU (Low Voltage Directive)
Placement of CE-marking	96

The following harmonized standards respectively other technical norms and Specifications have been applied:

EN 60204-1:	2006/AC:2010
EN 60204-32:	2008
EN 60529:	1991 / AC:1993

This declaration is not an assurance of properties.

The safety hints mentioned in the product documentation must be followed.

Kamen, 02.03.2018

Michael Heitmann
Manager Testing & Services

10.2 UKCA



UKCA - Declaration of conformity

Paul Vahle GmbH & Co. KG, Westicker Str. 52, D-59174 Kamen (Germany)

We herewith declare that the products specified hereafter conform to the relevant UK regulations. This declaration will be void when amendments not approved by us.

Product Group	34
Product	PVC Enclosed Conductor System
Type	VKS, VKL incl. accessories
Relevant UK Regulation	Electrical Equipment (Safety) Regulation 2016
First CE / UKCA - marking	1996 / 2022

The following harmonized standards respectively other technical norms and Specifications have been applied:

EN 60204-1:	2018
EN 60204-32:	2008

This declaration is not an assurance of properties.

The safety hints mentioned in the product documentation must be followed.

Kamen, 21.10.2022

Michael Heitmann
Director Quality Management

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Technical Documentation