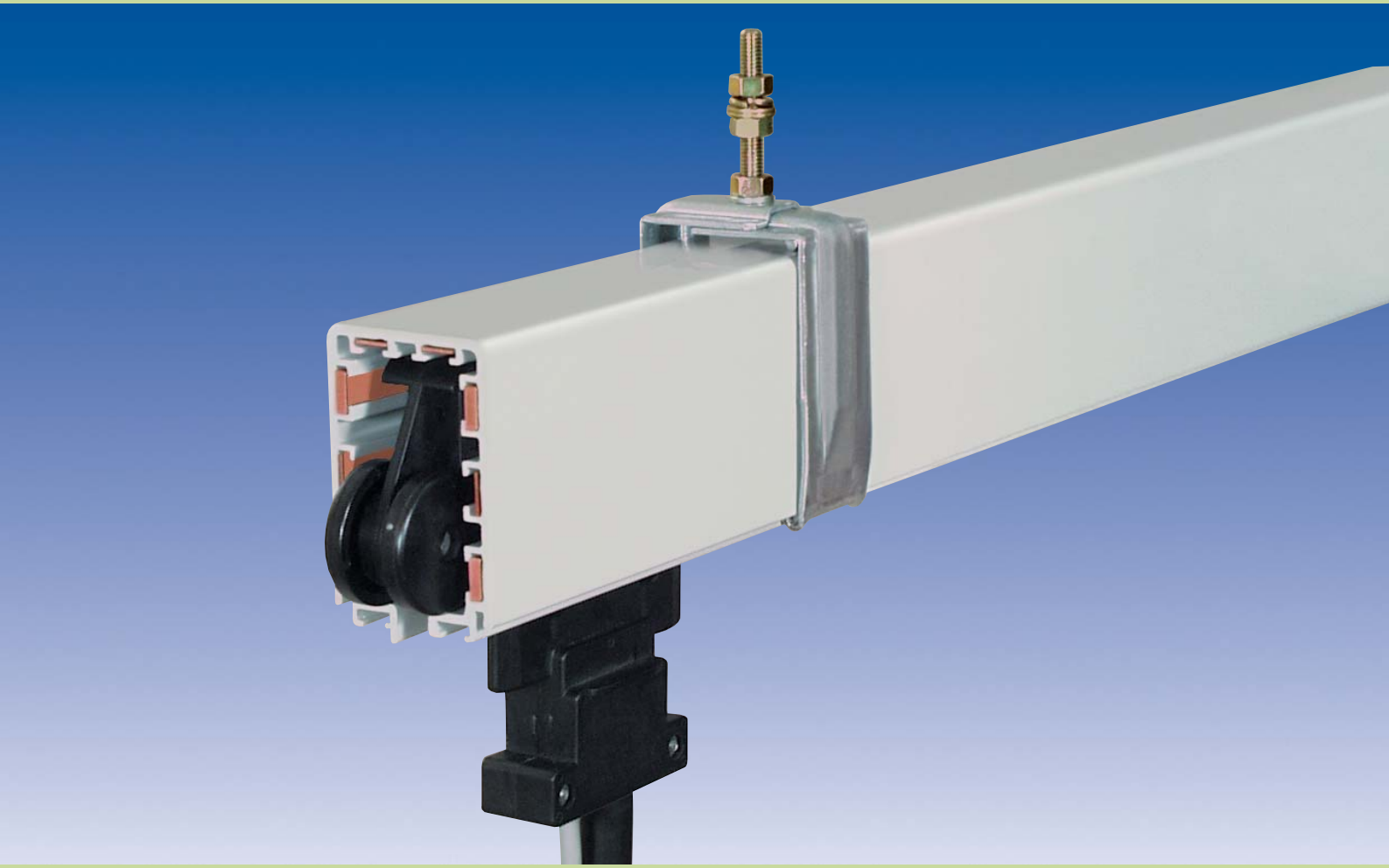


POWERAIL CONDUCTOR SYSTEMS

MKLD – MKLF – MKLS

VAHLE

ELECTRIFICATION SYSTEMS

INDEX Page

VAHLE-Powerail MKL…

Powerail MKL… is a totally enclosed conductor system for indoor and outdoor use. The insulated housing can accommodate different copper sections

Typ MKLD from 6 to 10 copper conductors
continuous copper strips 40 - 200 A
copper strips come as separate items as coils.

Typ MKLF from 6 to 10 copper conductors
with factory-assembled plug-in joints 40 - 100 A.

Typ MKLS from 6 to 10 copper conductors
with factory-assembled bolted joints 40 - 200 A.

MKL… Powerails require the minimum of space, are easy to install and cannot corrode.

They meet all national and international safety requirements. MKL… can be equipped with neoprene sealing strips and with a heating system.

Standard configurations are listed on page 5. Other configurations are possible.

Applications
Mobile power feeding of overhead cranes, monorail systems, electric hoists, electric power tools, machine tools, automated storage and retrieval systems, assembly and test lines, hangar doors, studio & station lighting systems and many others.

Housing
Gray colored, fully insulated, for 6 to 10 copper conductors.
Standard sections are 1, 2, 3 or 4 m long.
Specific lengths and curves are available.
Ground conductor identified by international color code.
Long and short lip housing profiles and collector safety keys avoid phase reversing.
Any number of conductors can be accomplished by installing several Powerails side by side.

Couplings of Housing
By fully insulated joint caps.

Feed sets
End feeds or line feeds are available.

End caps/sections
MKLD uses end sections.
MKLF & MKLS use end caps

Hangers
Standard brackets for Powerail attachment to crane girder are available (see page 8).

Fixpoint and sliding hangers for Powerail.
Max. support spacing is 2000 mm.

Expansion sections
Expansion sections for length compensation are available and do not interrupt electric conductors.

Anti-condensation sections
For combined indoor/outdoor applications use anti-condensation sections. They do not interrupt electric conductors.

Contact sections, turntables, switches
Powerail for working areas and transfer applications see pages 12 & 13.

Sectionalizing
Factory-assembled conductor dead sections are available for MKLF & MKLS in the air gap and insulating piece version.

Collectors
The current collectors are made of impact-resistant polyamide. Spring loaded carbon brushes maintain uniform contact. Connecting cables, hinged or flexible towing arms are included.
Double collectors to be used for transfer applications and higher amperage.

To speed up quotations and order processing, we would appreciate receiving your drawings or sketches for Powerail systems with curves, dead sections, turntables, switches, etc. Please use our questionnaire, page 22/23.

Please consult the factory for low voltage applications and data transmission, indicating special environmental conditions. Stainless steel conductors are available (see page 18).

Technical Data of Powerail MKL…

Electrical properties:			**Mechanical properties:**		
Dielectric strength	DIN 53481	30–40 KV/mm	Flexible strength		75N/mm² ± 10 %
Specific resistance	DIN 53482	5 x 10^{15} Ohm/cm	Tensile strength		40 N/mm² ± 10 %
Surface resistance	DIN 53482	10^{13} Ohm			
Leakage resistance	IEC 112/VDE 0303	CTI 600–2.7	**Temperature range (ambient):**		– 30 °C up to + 60 °C
Flame test proof:			**Resistance to chemicals:** at + 45 °C	Gasoline Mineral Oil Grease	Sulphuric acid 50 % Caustic soda 25 % & 50 % Hydro-chloric acid, concentrated
no flaming particles, self extinguishing	DIN 41 02 – Part 1	Class B 1			

Consider the voltage drop calculation to maintain the limits established by the motor manufacturers:

Formulas:

AC: $\Delta U = \sqrt{3} \times I \times \ell \times Z$

DC: $\Delta U_1 = 2 \ell \times I \times R$

$$\Delta U_2 = \frac{\Delta U_1 \cdot 100}{V}$$

ΔU_1 = Voltage drop [V]
ΔU_2 = Voltage drop [%]
I = Ampere load [A]
R = Resistence [Ohm/km]
ℓ = Power feed length [m]
L = System length [m]

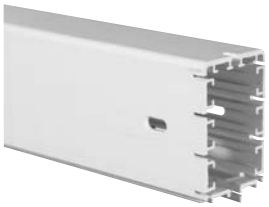
Effective length:
$l = L$ power feed located at the end of the system
$l = L/2$ power feed located at the mid-point of the system
$l = L/4$ power feed located at both ends of the system
$l = L/6$ power feed located at $L/6$ from each end of the system

Z = Impedance [Ohm/km]
V = Voltage rating [V]

The total ampere load is determined from the nominal rated current of all motors working simultaneously on the same feed section of your electrification system. A diversity factor of 0.5 – 0.9 can be considered.
The conductor size and/or number of feed points should be increased or booster cables should be used in parallel in case the drop is exceeding the limitations.
See page 5 for resistance and impedance values.

POWERAIL TYPES AND CAT.-NOS.

MKLD



Type MKLD
with continuous copper strips,
to be drawn in during installation.

Type* **HS** c/w PE **SS** w/o PE	Weight kg/m	Cat. No.
Housing only (Copper strips to be drawn in during installation, see page 18. Configurations on page 5).		
MKLD- ... HS	1,533	235 10**
MKLD- ... SS	1,533	235 04**

MKLF

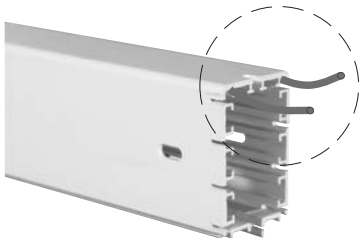
Type MKLF
with factory assembled copper strips
and plug-in joints,
(40 – 100 A)

Housing with factory assembled copper strips ans plug-in joints		
MKLF 6/ 40- ... HS	2,122	234 84**
MKLF 6/ 40- ... SS	2,122	234 83**
MKLF 6/ 60- ... HS	2,354	234 85**
MKLF 6/100- ... HS	2,612	234 86**
MKLF 7/ 40- ... HS	2,232	234 88**
MKLF 7/ 40- ... SS	2,232	234 87**
MKLF 7/ 60- ... HS	2,463	234 89**
MKLF 7/100- ... HS	2,707	234 90**
MKLF 8/ 40- ... HS	2,342	234 92**
MKLF 8/ 40- ... SS	2,342	234 91**
MKLF 8/ 60- ... HS	2,573	234 93**
MKLF 8/100- ... HS	2,816	234 94**

MKLS

Type MKLS
with factory assembled copper strips
and bolted joints,
(40 – 200 A)

Housing with factory assembled copper strips and bolted joints		
MKLS 6/ 40- ... HS	2,166	234 72**
MKLS 6/ 40- ... SS	2,166	234 71**
MKLS 6/ 60- ... HS	2,395	234 73**
MKLS 6/100- ... HS	2,635	234 74**
MKLS 6/140- ... HS	2,809	234 95**
MKLS 6/160- ... HS	3,138	234 96**
MKLS 6/200- ... HS	3,381	234 97**
MKLS 7/ 40- ... HS	2,282	234 76**
MKLS 7/ 40- ... SS	2,282	234 75**
MKLS 7/ 60- ... HS	2,513	234 77**
MKLS 7/100- ... HS	2,760	234 78**
MKLS 7/140- ... HS	2,931	234 98**
MKLS 7/160- ... HS	3,254	234 99**
MKLS 7/200- ... HS	3,450	235 00**
MKLS 8/ 40- ... HS	2,399	234 80**
MKLS 8/ 40- ... SS	2,399	234 79**
MKLS 8/ 60- ... HS	2,631	234 81**
MKLS 8/100- ... HS	2,874	234 82**
MKLS 8/140- ... HS	3,047	235 01**
MKLS 8/160- ... HS	3,371	235 02**
MKLS 8/200- ... HS	3,614	235 03**

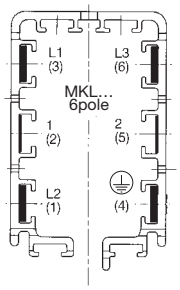


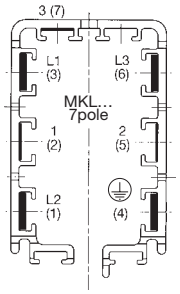
Types MKLD, MKLF and MKLS
with heating system

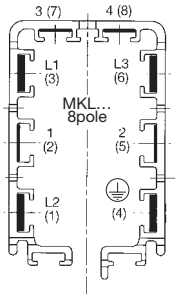
*** ... Complete types e.g. MKLD-4 HS for 4 m MKLD with Cat.-No. 235 104**
MKLF 8/40 -4 HS for 4 m MKLF 8/40 with PE Cat.-No. 234 924

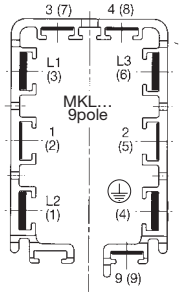
**** Add last number (1,2,3,4 length suffix) in accordance to bars required**

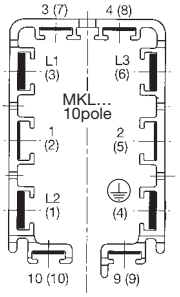
Type **HS** c/w PE **SS** w/o PE	No. of Con-duc-tors	Copper cross section mm² Phase L1, L2, L3	⏚	Control-line	Ampere-rating L1, L2, L3 Phases 100 % A	max. Voltage Rating V	Impedance at 50 Hz 20° C Ω/1000 m	Resis-tance at 20° C Ω/1000 m	Leakage Distance mm	configurations **
MKL ... 6/ 40 HS	6	3 x 10	10	2 x 10	40	600	1,73	1,72	30	
MKL ... 6/ 40 SS	6	–	–	6 x 10	40	600	1,73	1,72	30	
MKL ... 6/ 60 HS	6	3 x 17	17	2 x 10	60	600	1,07	1,06	30	
MKL ... 6/100 HS	6	3 x 26	17	2 x 10	100	600	0,71	0,69	30	
MKL ... 6/140 HS	6	3 x 33	17	2 x 10	140 *	600	0,57	0,55	30	
MKL ... 6/160 HS	6	3 x 42	26	2 x 10	160 *	600	0,46	0,43	30	
MKL ... 6/200 HS	6	3 x 51	26	2 x 10	200 *	600	0,39	0,35	30	
MKL ... 7/ 40 HS	7	3 x 10	10	2 x 10 1 x 11	40	600	1,73	1,72	30	
MKL ... 7/ 40 SS	7	–	–	6 x 10 1 x 11	40	600	1,73	1,72	30	
MKL ... 7/ 60 HS	7	3 x 17	17	2 x 10 1 x 11	60	600	1,07	1,06	30	
MKL ... 7/100 HS	7	3 x 26	17	2 x 10 1 x 11	100	600	0,71	0,69	30	
MKL ... 7/140 HS	7	3 x 33	17	2 x 10 1 x 11	140 *	600	0,57	0,55	30	
MKL ... 7/160 HS	7	3 x 42	26	2 x 10 1 x 11	160 *	600	0,46	0,43	30	
MKL ... 7/200 HS	7	3 x 51	26	2 x 10 1 x 11	200 *	600	0,39	0,35	30	
MKL ... 8/ 40 HS	8	3 x 10	10	2 x 10 2 x 11	40	600	1,73	1,72	30	
MKL ... 8/ 40 SS	8	–	–	6 x 10 2 x 11	40	600	1,73	1,72	30	
MKL ... 8/ 60 HS	8	3 x 17	17	2 x 10 2 x 11	60	600	1,07	1,06	30	
MKL ... 8/100 HS	8	3 x 26	17	2 x 10 2 x 11	100	600	0,71	0,69	30	
MKL ... 8/140 HS	8	3 x 33	17	2 x 10 2 x 11	140 *	600	0,57	0,55	30	
MKL ... 8/160 HS	8	3 x 42	26	2 x 10 2 x 11	160 *	600	0,46	0,43	30	
MKL ... 8/200 HS	8	3 x 51	26	2 x 10 2 x 11	200 *	600	0,39	0,35	30	
MKLD 9/ 40 HS	9	3 x 10	10	2 x 10 3 x 11	40	600	1,73	1,72	30	
MKLD 9/ 40 SS	9	–	–	6 x 10 3 x 11	40	600	1,73	1,72	30	
MKLD 9/ 60 HS	9	3 x 17	17	2 x 10 3 x 11	60	600	1,07	1,06	30	
MKLD 9/100 HS	9	3 x 26	17	2 x 10 3 x 11	100	600	0,71	0,69	30	
MKLD 9/140 HS	9	3 x 33	17	2 x 10 3 x 11	140 *	600	0,57	0,55	30	
MKLD 9/160 HS	9	3 x 42	26	2 x 10 3 x 11	160 *	600	0,46	0,43	30	
MKLD 9/200 HS	9	3 x 51	26	2 x 10 3 x 11	200 *	600	0,39	0,35	30	
MKLD 10/ 40 HS	10	3 x 10	10	2 x 10 4 x 11	40	600	1,73	1,72	30	
MKLD 10/ 40 SS	10	–	–	6 x 11 4 x 11	40	600	1,73	1,72	30	
MKLD 10/ 60 HS	10	3 x 17	17	2 x 10 4 x 11	60	600	1,07	1,06	30	
MKLD 10/100 HS	10	3 x 26	17	2 x 10 4 x 11	100	600	0,71	0,69	30	
MKLD 10/140 HS	10	3 x 33	17	2 x 10 4 x 11	140 *	600	0,57	0,55	30	
MKLD 10/160 HS	10	3 x 42	26	2 x 10 4 x 11	160 *	600	0,46	0,43	30	
MKLD 10/200 HS	10	3 x 51	26	2 x 10 4 x 11	200 *	600	0,39	0,35	30	











Conductors 9 & 10 for max. 24 V AC or 60 V DC.

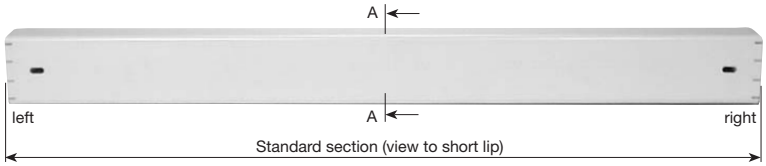
* 80% E.D.
... Complete types e.g. MKLS 7/60 HS for 7 poles with bolted joints
In case of using a neutral conductor copper pos.1 will be taken.
layout of the sytem on request (please see page 3)

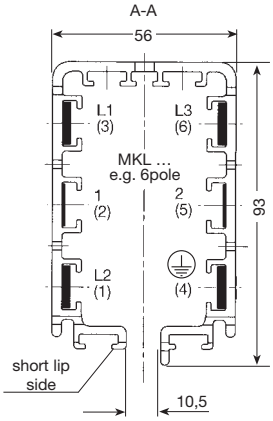
** Numbers in paranthesis apply to control line.

MKLD
MKLF
MKLS

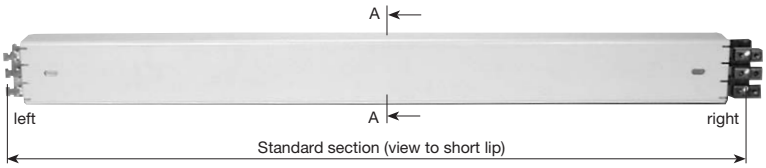
Standard sections

Type MKLD for continuous copper strips.

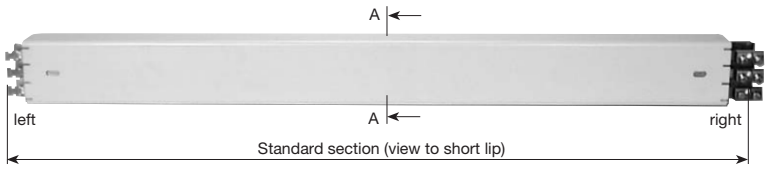




Type MKLF with plug-in joints, factory assembled.



Type MKLS with bolted joints, factory assembled.



Straight standard sections have no stiffener clamps. Stiffener clamps can be supplied loose or assembled each meter.

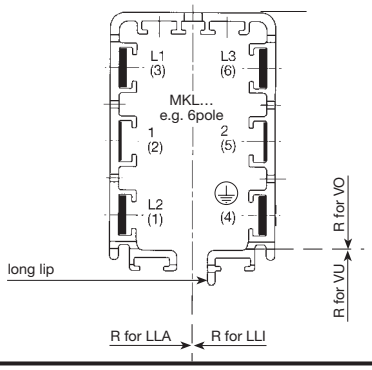
Stiffener clamps (paire)	Cat.-No.
loose, galvanized steel	234 017
loose, stainless steel	234 018

Stiffener clamps (piece)	Cat.-No.
factory assembled, galvanized steel	234 587
factory assembled, stainless steel	234 588

Curves

Min. bending radius, horizontal = 1100 mm
Max. length L = 3600 mm
Max. ∡ 120 °

Surcharge on request (piece)	Cat.-No.
Horizontal curve LLI and LLA*	234 547
Vertical curve VO and VU**	234 620



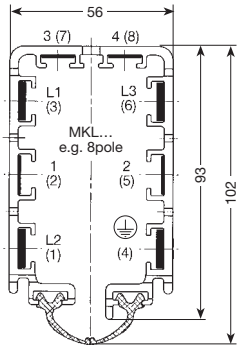
* LLI = long lip inside
* LLA = long lip outside
** VO = vertical curve upwards
** VU = vertical curve downwards

Long lip side of Powerails should always be mounted facing the machinery track.

Sealing strip with accessories

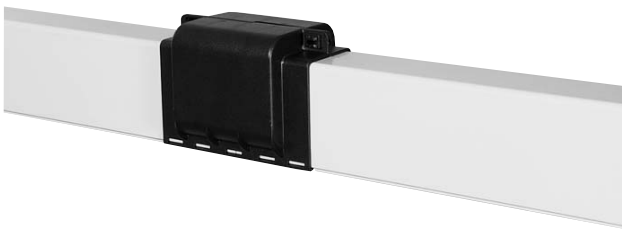
Type	Cat.-No.
Sealing strip, p. pair (max. length 50 m)	234 794
Fastener (2 per end)	258 432
Joint (2 per joint)	258 300

Not available for 9- and 10-pole systems.

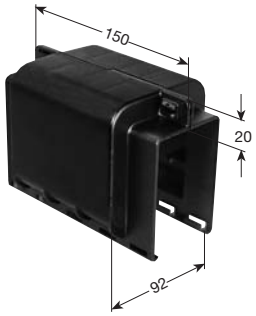


MKLD

Joint cap, self-locking



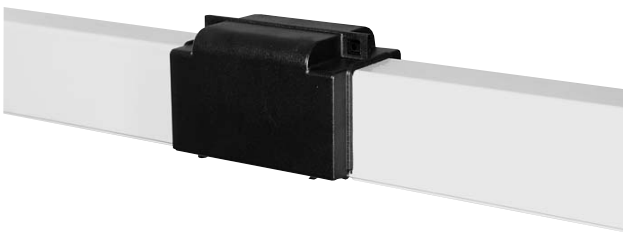
Ready installed



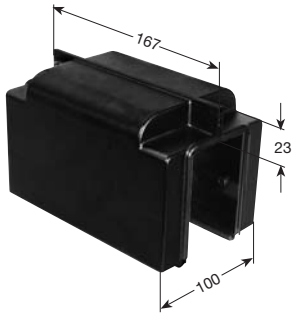
Type	Weight kg	Cat.-No.
MVMD	0,16	234 678

MKLF
MKLS

Joint cap, self-locking



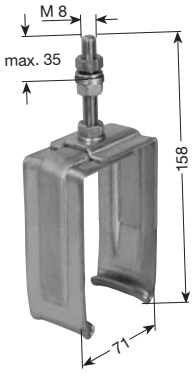
Ready installed

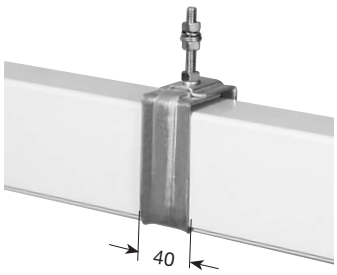


Type	Weight kg	Cat.-No.
MVMS	0,240	234 585

MKLD
MKLF
MKLS

Sliding hanger

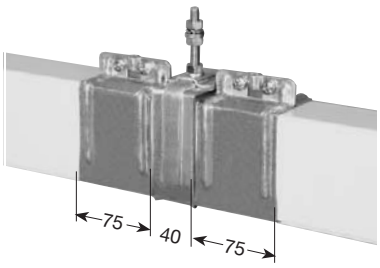


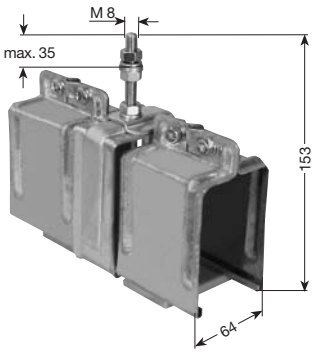


Sliding hanger mounted to Powerail section

Type	Weight kg	Cat.-No.
MGA	0,220	234 013

Fixpoint hanger



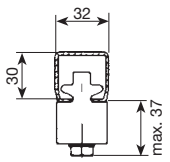


Fixpoint hanger mounted to Powerail section

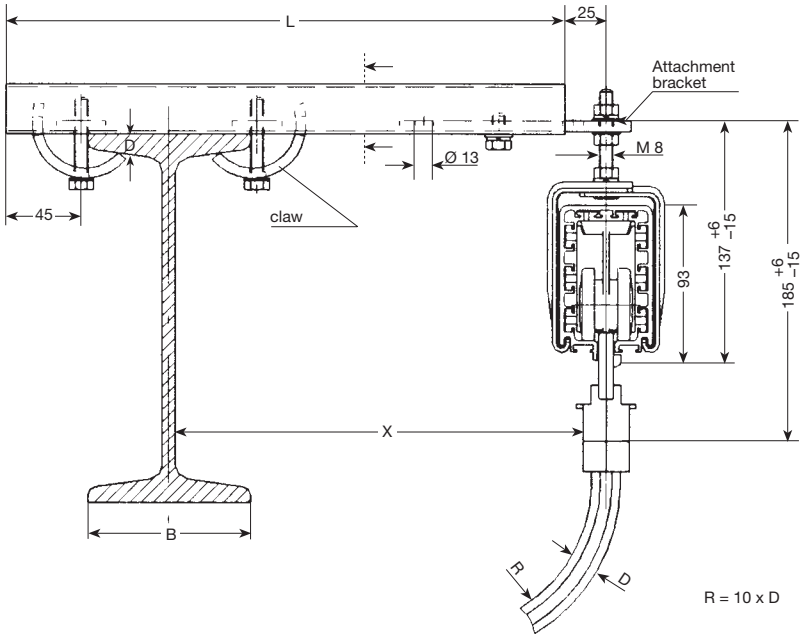
Type	Weight kg	Cat.-No.
MFN	0,275	235 142

EHK standard version

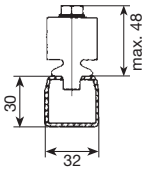
View w/o I-beam



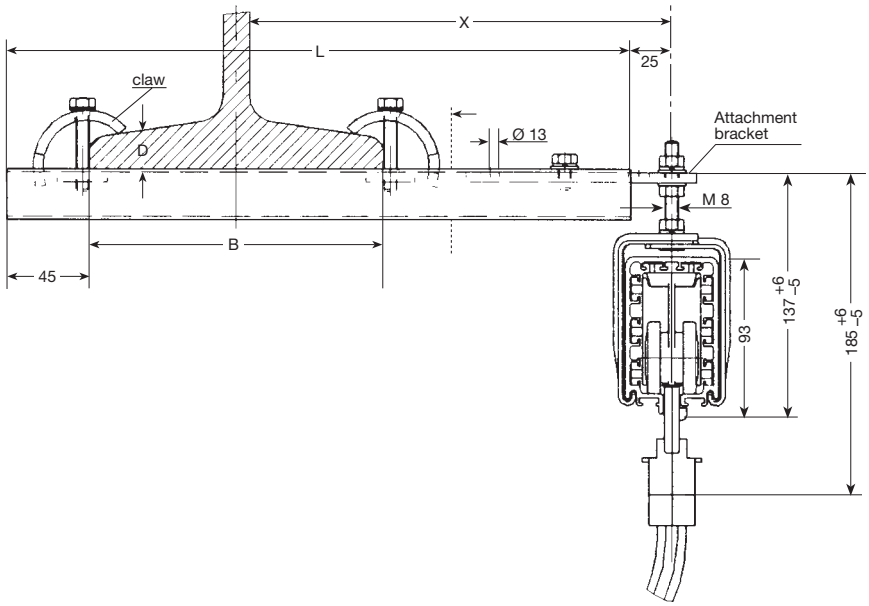
Claw suitable
for D = 6-15 mm



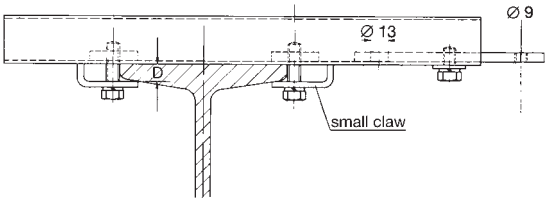
View w/o I-beam



Claw suitable
for D = 15-25 mm



EHK small claw version, D = max. 10 mm



Attention:
Make sure that hoist wheels have enough clearance. Use small claw if necessary. Check I-beam dimension D.

▭ rail of EHK is identical to type S 1, Cat. 8a.

Type	X mm	L mm	B max mm	Weight kg	Cat.-No. for standard version	Cat.-No. with small claw version
EHK 250	250	350	170	1.070	251 600	251 720
EHK 300	300	400	170	1.150	251 610	251 730
EHK 400	400	500	170	1.300	251 620	251 740
EHK 500	500	600	170	1.450	251 630	251 750
EHK 600	600	700	170	1.600	251 640	251 760
EHK 700	700	800	170	1.750	251 650	251 770
EHK 750	750	850	170	1.820	251 660	251 780
EHK 800	800	900	170	1.900	251 670	251 790

Select next larger size bracket when your I-beam dimension B is more than 170 mm.

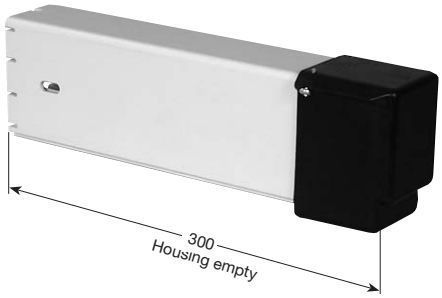
END SECTIONS

END FEEDS

MKLD

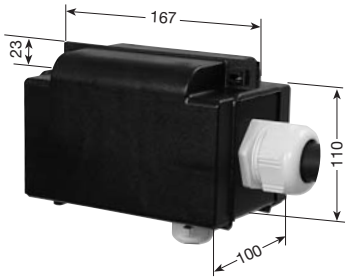
End sections

0,3 m long

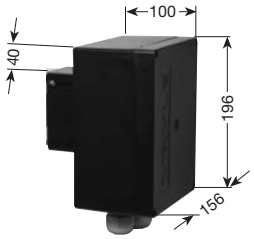


Type	Execution	Weight kg	Cat.-No.
MSED/L	left	0,550	235 144
MSED/R	right	0,550	235 145

End feeds



6 - 8 pole



9 - 10 pole

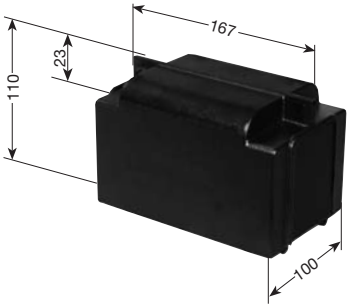
End feeds come loose w/o Powerail.
They can be mounted at either end.

Termination by others, using cable lugs and M 5 studs.

Type	Cable gland dimensions see p. 18	Weight kg	Cat.-No.
MKED 6-8/ 40-60 HS	M 25 & M 40	0,580	235 152
MKED 9-10/ 40-60 HS		1,040	235 155
MKED 6-8/ 40 SS	M 25	0,520	235 157
MKED 9-10/ 40 SS		0,980	235 160

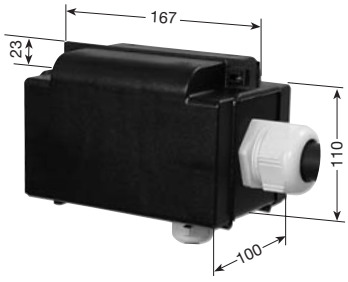
MKLF
MKLS

End cap



Type	Execution	Weight kg	Cat.-No.
MSES	left & right	0,286	235 141

End feeds



End feeds come loose w/o Powerail.
They can be mounted at either end.

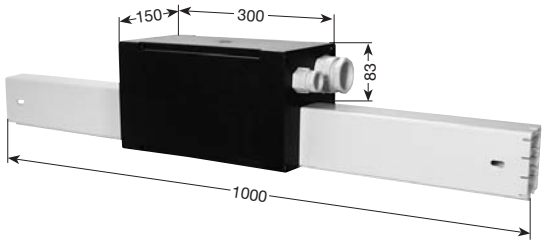
Termination by others, using cable lugs and M 5 studs.

Type	Cable gland dimensions see p. 18	Weight kg	Cat.-No.
MKES 6-8/ 40-60 HS	M 25 and M 40	0,580	235 230
MKES 6-8/ 40 SS	M 25	0,520	235 233

LINE FEEDS

with terminal box; incl. 1 m Powerail

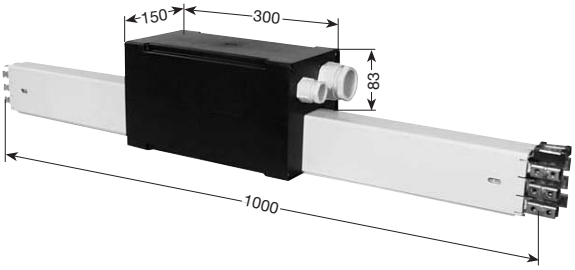
MKLD



Termination by others using cable lugs and M 8 studs.

Type	Cable gland (dim. see p. 18)	Weight kg	Cat.-No.
MNGD 6/ 40-100 HS	M 50 and M 25	2,740	235 055
MNGD 7/ 40-100 HS		2,817	235 056
MNGD 8/ 40-100 HS		2,894	235 057
MNGD 9/ 40-100 HS		2,954	235 058
MNGD 10/ 40-100 HS		2,994	235 059
MNGD 6/140-200 HS	M 50 and M 25	2,744	235 060
MNGD 7/140-200 HS		2,821	235 061
MNGD 8/140-200 HS		2,898	235 062
MNGD 9/140-200 HS		2,958	235 063
MNGD 10/140-200 HS		2,998	235 064
MNGD 6/ 40 SS	M 25	2,667	235 050
MNGD 7/ 40 SS		2,744	235 051
MNGD 8/ 40 SS		2,826	235 052
MNGD 9/ 40 SS		2,886	235 053
MNGD 10/ 40 SS		2,926	235 054

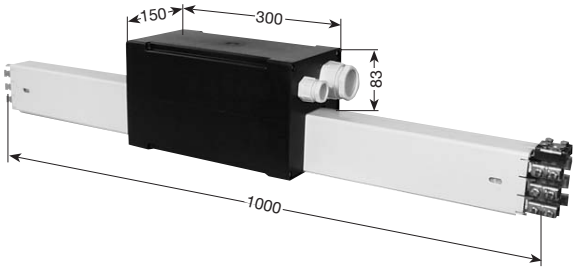
MKLF



Termination by others using cable lugs and M 8 studs.

Type	Cable gland (dim. see p. 18)	Weight kg	Cat.-No.
MNGF 6/ 40 HS	M 50 and M 25	3,367	235 089
MNGF 7/ 40 HS		3,566	235 090
MNGF 8/ 40 HS		3,763	235 091
MNGF 6/ 60 HS		3,598	235 092
MNGF 7/ 60 HS		3,797	235 093
MNGF 8/ 60 HS		3,994	235 094
MNGF 6/100 HS		3,841	235 095
MNGF 7/100 HS		4,040	235 096
MNGF 8/100 HS		4,237	235 097
MNGF 6/ 40 SS	M 25	3,299	235 086
MNGF 7/ 40 SS		3,498	235 087
MNGF 8/ 40 SS		3,695	235 088

MKLS

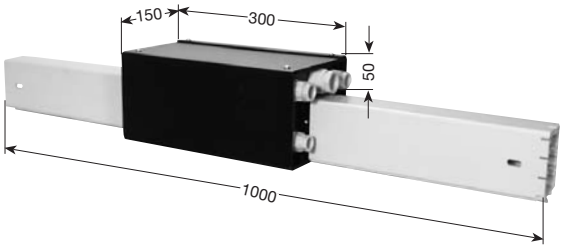


Termination by others using cable lugs and M 8 studs.

Type	Cable gland (dim. see p. 18)	Weight kg	Cat.-No.
MNGS 6/ 40 HS	M 50 and M 25	3,451	235 068
MNGS 7/ 40 HS		3,662	235 069
MNGS 8/ 40 HS		3,873	235 070
MNGS 6/ 60 HS		3,682	235 071
MNGS 7/ 60 HS		3,893	235 072
MNGS 8/ 60 HS		4,104	235 073
MNGS 6/100 HS		3,925	235 074
MNGS 7/100 HS		4,136	235 075
MNGS 8/100 HS		4,347	235 076
MNGS 6/140 HS	M 50 and M 25	4,103	235 077
MNGS 7/140 HS		4,314	235 078
MNGS 8/140 HS		4,525	235 079
MNGS 6/160 HS		3,427	235 080
MNGS 7/160 HS		4,638	235 081
MNGS 8/160 HS		4,849	235 082
MNGS 6/200 HS		4,670	235 083
MNGS 7/200 HS		4,881	235 084
MNGS 8/200 HS		5,092	235 085
MNGS 6/ 40 SS	M 25	3,383	235 065
MNGS 7/ 40 SS		3,394	235 066
MNGS 8/ 40 SS		3,805	235 067

MKLD

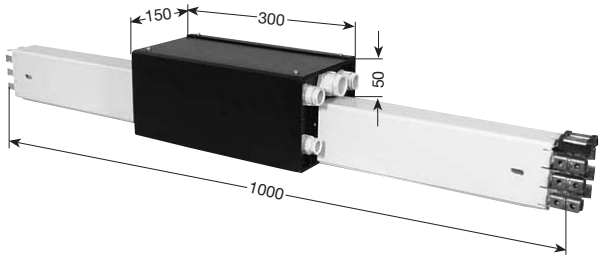
Type	Cable gland (dim. see p. 18)	Weight kg	Cat.-No.
MNLD 6/ 40-100 HS	M 25 for PE, L1, L2, L3, M 25 for 1-4 M 25 for 9/10	2,432	234 740
MNLD 7/ 40-100 HS		2,509	234 745
MNLD 8/ 40-100 HS		2,586	234 746
MNLD 9/ 40-100 HS		2,657	234 747
MNLD 10/ 40-100 HS		2,697	234 748
MNLD 6/140-200 HS	M 25 for PE, L1, L2, L3, M 25 for 1-4 M 25 for 9/10	2,447	234 749
MNLD 7/140-200 HS		2,524	234 750
MNLD 8/140-200 HS		2,601	234 755
MNLD 9/140-200 HS		2,672	234 756
MNLD 10/140-200 HS		2,712	234 757
MNLD 6/ 40 SS	1 x M 25	2,374	234 735
MNLD 7/ 40 SS		2,451	234 736
MNLD 8/ 40 SS		2,533	234 737
MNLD 9/ 40 SS	2 x M 25	2,612	234 738
MNLD 10/ 40 SS		2,652	234 739



Termination by others using cable lugs and M 8 studs.

MKLF

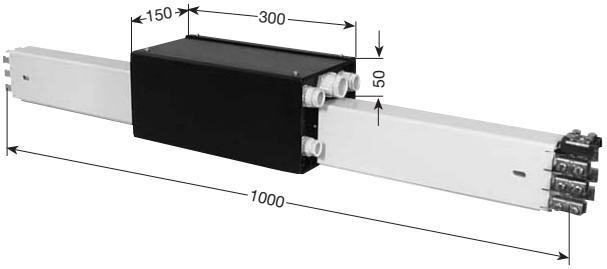
Type	Cable gland (dim. see p. 18)	Weight kg	Cat.-No.
MNLF 6/ 40 HS	M 25 for PE, L1, L2, L3, M 25 for 1-4	3,059	235 131
MNLF 7/ 40 HS		3,258	235 132
MNLF 8/ 40 HS		3,455	235 133
MNLF 6/ 60 HS		3,290	235 134
MNLF 7/ 60 HS		3,489	235 105
MNLF 8/ 60 HS		3,686	235 106
MNLF 6/100 HS		3,533	235 107
MNLF 7/100 HS		3,732	235 108
MNLF 8/100 HS		3,929	235 109
MNLF 6/ 40 SS	M 25	3,006	235 098
MNLF 7/ 40 SS		3,205	235 099
MNLF 8/ 40 SS		3,402	235 100



Termination by others using cable lugs and M 8 studs.

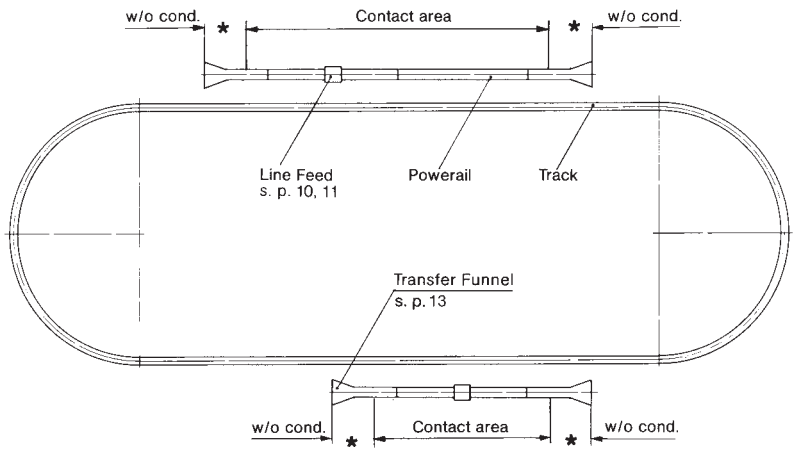
MKLS

Type	Cable gland (dim. see p. 18)	Weight kg	Cat.-No.
MNLS 6/ 40 HS	M 25 for PE, L1, L2, L3, M 25 for 1-4	3,143	235 113
MNLS 7/ 40 HS		3,345	235 114
MNLS 8/ 40 HS		3,565	235 115
MNLS 6/ 60 HS		3,374	235 116
MNLS 7/ 60 HS		3,585	235 117
MNLS 8/ 60 HS		3,796	235 118
MNLS 6/100 HS		3,617	235 119
MNLS 7/100 HS		3,828	235 120
MNLS 8/100 HS		4,039	235 121
MNLS 6/140 HS	M 25 for PE, L1, L2, L3, M 25 for 1-4	3,806	235 122
MNLS 7/140 HS		4,017	235 123
MNLS 8/140 HS		4,228	235 124
MNLS 6/160 HS		4,119	235 125
MNLS 7/160 HS		4,341	235 126
MNLS 8/160 HS		4,552	235 127
MNLS 6/200 HS		4,373	235 128
MNLS 7/200 HS		4,584	235 129
MNLS 8/200 HS		4,795	235 130
MNLS 6/ 40 SS	M 25	3,090	235 110
MNLS 7/ 40 SS		3,301	235 111
MNLS 8/ 40 SS		3,512	235 112

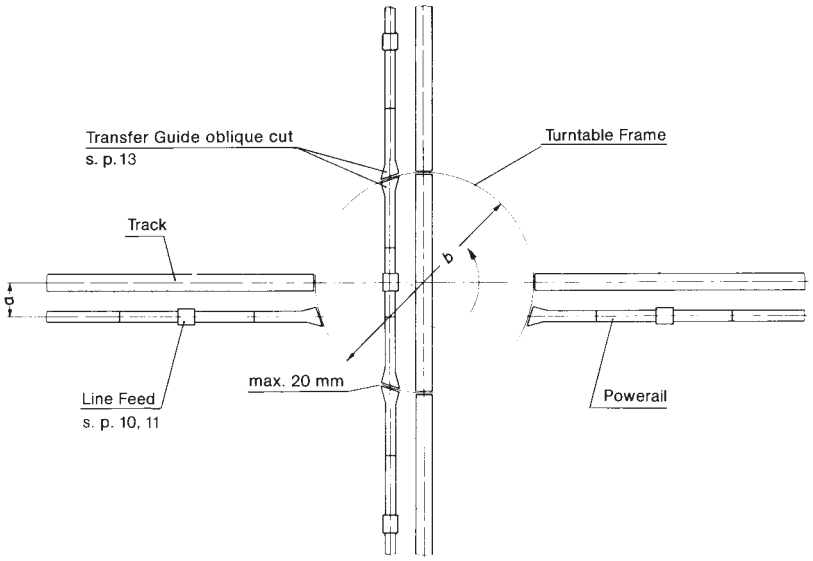


Termination by others using cable lugs and M 8 studs.

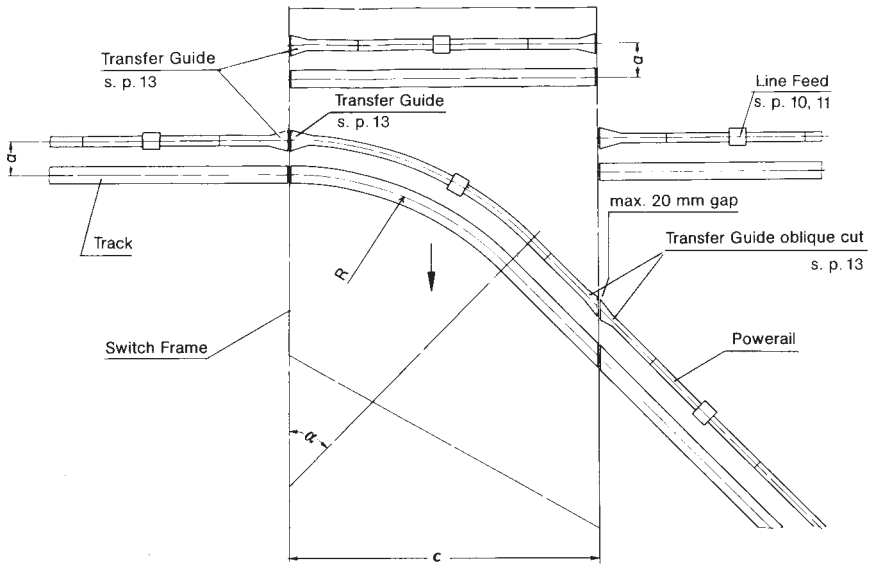
Contact section*



Turntable



Sliding switch



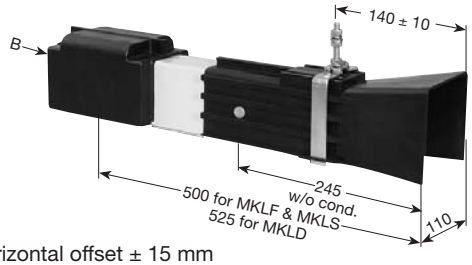
Please submit drawings of transfer applications. Specify dimensions a, b, c, R and angle α. (α max. 50°).

* Contact sections must not be activated before collectors are fully engaged.
Flexible support type tow arms MFM (see page 17) for collectors are essential with contact sections.

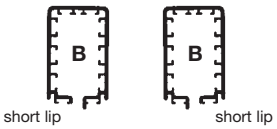
Transfer funnels

Energize Powerail only after current collector brushes have full contact with copper conductors. Do not use transfer funnel like a switch.

Type*	Weight kg	Cat.-No. L.H. version	Cat.-No. R.H. version
MTN 6/ 40-200 ... HS	2,201	235 162	235 172
MTN 7/ 40-200 ... HS	2,265	235 163	235 173
MTN 8/ 40-200 ... HS	2,528	235 164	235 174
MTN 9/ 40-200 ... HS	2,581	235 165	235 175
MTN 10/ 40-200 ... HS	2,634	235 166	235 176
MTN 6/ 40 ... SS	2,201	235 167	235 177
MTN 7/ 40 ... SS	2,265	235 168	235 178
MTN 8/ 40 ... SS	2,528	235 169	235 179
MTN 9/ 40 ... SS	2,581	235 170	235 180
MTN 10/ 40 ... SS	2,634	235 171	235 181

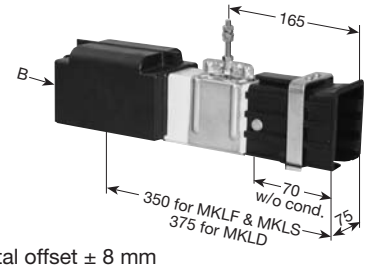


horizontal offset ± 15 mm
vertical offset + 10 mm

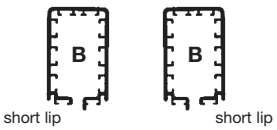


Transfer guides, straight

Type*	Weight kg	Cat.-No. L.H. version	Cat.-No. R.H. version
MUN 6/ 40-200 ... HS	2,155	235 182	235 192
MUN 7/ 40-200 ... HS	2,219	235 183	235 193
MUN 8/ 40-200 ... HS	2,482	235 184	235 194
MUN 9/ 40-200 ... HS	2,535	235 185	235 195
MUN 10/ 40-200 ... HS	2,588	235 186	235 196
MUN 6/ 40 ... SS	2,155	235 187	235 197
MUN 7/ 40 ... SS	2,219	235 188	235 198
MUN 8/ 40 ... SS	2,482	235 189	235 199
MUN 9/ 40 ... SS	2,535	235 190	235 200
MUN 10/ 40 ... SS	2,588	235 191	235 201

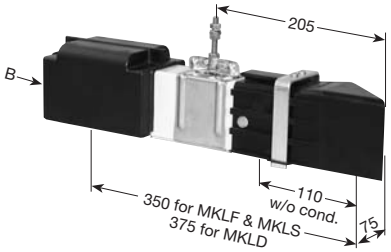


horizontal offset ± 8 mm
vertical offset ± 3 mm

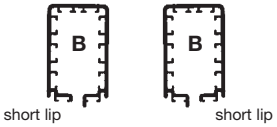


Transfer guides, oblique

Type*	Weight kg	Cat.-No. L.H. version	Cat.-No. R.H. version
MUNS 6/ 40-200 ... HS	2,185	235 202	235 212
MUNS 7/ 40-200 ... HS	2,249	235 203	235 213
MUNS 8/ 40-200 ... HS	2,512	235 204	235 214
MUNS 9/ 40-200 ... HS	2,565	235 205	235 215
MUNS 10/ 40-200 ... HS	2,618	235 206	235 216
MUNS 6/ 40 ... SS	2,185	235 207	235 217
MUNS 7/ 40 ... SS	2,249	235 208	235 218
MUNS 8/ 40 ... SS	2,512	235 209	235 219
MUNS 9/ 40 ... SS	2,565	235 210	235 220
MUNS 10/ 40 ... SS	2,618	235 211	235 221



horizontal offset ± 8 mm
vertical offset ± 3 mm



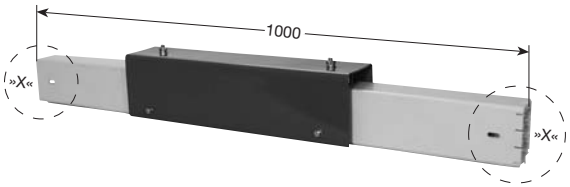
Details of oblique cut
per system layout.

*** Complete types e.g. MUN 6/40-200... HS**
L.H.-version: MUN 6/40-200 L HS Cat.-No. 235 182

ANTI-CONDENSATION SECTIONS

incl. 1 m section

MKLD



Type	Weight kg	Cat.-No.
MBD- HS	2,520	235 223
MBD- SS	2,520	235 222

MKLF

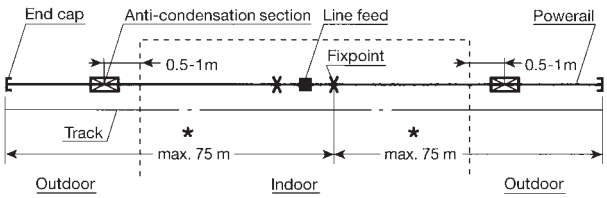
X: See page 2 for different versions of Powerail ends

The anti-condensation section consists of 1 m Powerail with air circulation holes, covered by a protection hood.

The anti-condensation section is to be used where Powerails are passing from indoor to outdoor, preventing condensation of hot air, escaping from the indoor section, in the cooler outdoor section.

Type	Weight kg	Cat.-No.
MBF- 6/ 40 HS	3,034	235 236
MBF- 7/ 40 HS	3,156	235 237
MBF- 8/ 40 HS	3,276	235 238
MBF- 6/ 60 HS	3,266	235 239
MBF- 7/ 60 HS	3,388	235 240
MBF- 8/ 60 HS	3,508	235 241
MBF- 6/100 HS	3,509	235 242
MBF- 7/100 HS	3,631	235 243
MBF- 8/100 HS	3,750	235 244
MBF- 6/ 40 SS	3,034	235 245
MBF- 7/ 40 SS	3,156	235 246
MBF- 8/ 40 SS	3,276	235 247

MKLS



Type	Weight kg	Cat.-No.
MBS- 6/ 40 HS	3,118	235 260
MBS- 7/ 40 HS	3,252	235 261
MBS- 8/ 40 HS	3,386	235 262
MBS- 6/ 60 HS	3,350	235 263
MBS- 7/ 60 HS	3,484	235 264
MBS- 8/ 60 HS	3,618	235 265
MBS- 6/100 HS	3,593	235 266
MBS- 7/100 HS	3,727	235 267
MBS- 8/100 HS	3,861	235 268
MBS- 6/140 HS	3,767	235 269
MBS- 7/140 HS	3,901	235 270
MBS- 8/140 HS	4,035	235 271
MBS- 6/160 HS	4,091	235 272
MBS- 7/160 HS	4,225	235 273
MBS- 8/160 HS	4,358	235 274
MBS- 6/200 HS	4,334	235 275
MBS- 7/200 HS	4,468	235 276
MBS- 8/200 HS	4,601	235 277
MBS- 6/ 40 SS	3,118	235 278
MBS- 7/ 40 SS	3,252	235 279
MBS- 8/ 40 SS	3,868	235 280

Feeding

No extra feeds required as the Powerail is not interrupted.

Collectors

No extra collectors required.

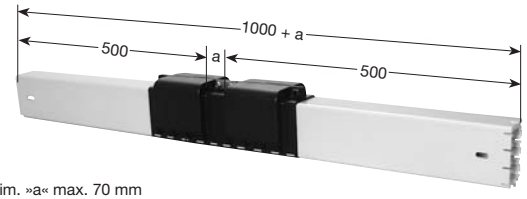
Installation

The anti-condensation section is to be placed outdoors, close to the transfer point.

* For longer runs use expansion joint section (see page 15)

MKLD

Type	Weight kg	Cat.-No.
MDD- 6-8 HS	1,890	235 224
MDD- 9 HS	1,883	235 225
MDD- 10 HS	1,877	235 226
MDD- 6-8 SS	1,890	235 227
MDD- 9 SS	1,883	235 228
MDD- 10 SS	1,877	235 229



Dim. »a« max. 70 mm

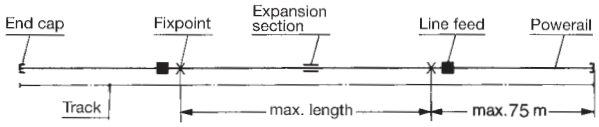
Expansion section **Typ MDD** is required to compensate difference in expansion between insulated housing and copper conductors.

The expansion joints are used if the Powerail length between feeds, curves, transfer guides and other fix points is exceeding 10 m.

Max. length to temperature differences

Δ t 20° C = 70 m Δ t 40° C = 35 m Δ t 80° C = 17 m
Δ t 30° C = 45 m Δ t 60° C = 23 m

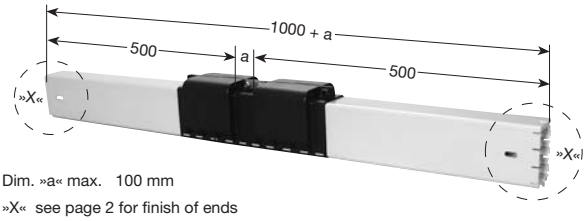
Longer runs or higher differences in temperature require several expansion joints.



Additional feed points and collectors are not necessary as the conductor rail is not electrically separated.

MKLF
MKLS

Type	Weight kg	Cat.-No.
MDS- 6/ 40-100 HS	5,400	235 395
MDS- 7/ 40-100 HS	5,520	235 396
MDS- 8/ 40-100 HS	5,640	235 397
MDS- 6/140-200 HS	5,900	235 398
MDS- 7/140-200 HS	6,020	235 399
MDS- 8/140-200 HS	6,140	235 400
MDS- 6/ 40 SS	5,400	235 401
MDS- 7/ 40 SS	5,520	235 402
MDS- 8/ 40 SS	5,620	235 403



Dim. »a« max. 100 mm

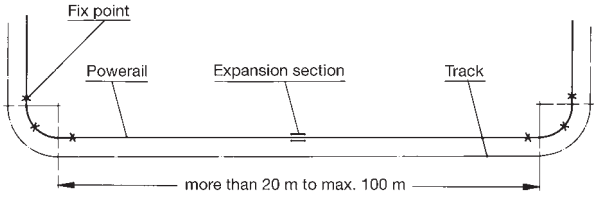
»X« see page 2 for finish of ends

Expansion joint section Type **MDS** is required to compensate difference in expansion between insulated housing and supporting structure:

The expansion joints are used if the powerail length between feeds, curves, transfer guides and other fix points is exceeding 20 m.

Max. length to temperature differences:

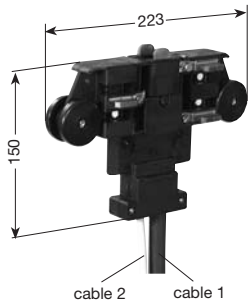
Δ t 90° C (–30° C to + 60° C) one expansion joint section per 100 m, and so on each 100 m.



Additional feed points and collectors are not necessary as the conductor rail is not electrically separated.

MKLD
MKLF
MKLS

Collectors



Connecting cables:

for power line: cable 1 → 4 x 6 mm²
cable 2 → ... x 1,5 mm²

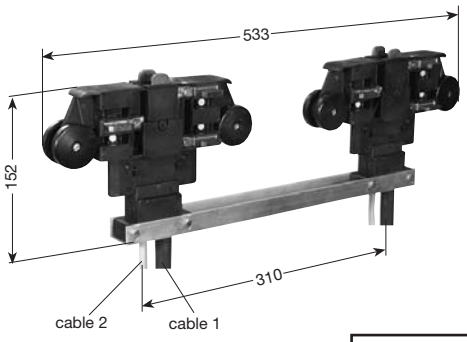
for control line: cable 1 → ... x 2,5 mm²
(two cables for 8-pole and more)

Type	Ampacity at 60% ED A	No. of poles	ø of connecting cables mm cable 1	cable 2	Travelling speed normal m/min.	Transfer m/min.	Weight kg	Cat.-No.
MSW 6/50-1 HS	50	6	≈17,0	≈ 7,0	180	100	1,150	234 118
MSW 7/50-1 HS	50	7	≈17,0	≈ 7,5	180	100	1,185	235 146
MSW 8/50-1 HS	50	8	≈17,0	≈ 8,0	180	100	1,220	234 120
MSW 9/50-1 HS	50	9	≈17,0	≈ 9,0	180	100	1,259	235 147
MSW 10/50-1 HS	50	10	≈17,0	≈10,0	180	100	1,298	235 148
MSW 6/25-1 ST	25	6	≈13,5	–	180	100	0,850	234 121
MSW 7/25-1 ST	25	7	≈13,5	–	180	100	0,880	235 149
MSW 8/25-1 ST	25	8	≈11,0	≈11,0	180	100	0,910	234 123
MSW 9/25-1 ST	25	9	≈12,0	≈11,0	180	100	0,949	235 150
MSW 10/25-1 ST	25	10	≈13,0	≈11,0	180	100	0,988	235 151

Collectors for higher speeds on request.
For curves use single collectors only.
Connecting cable 1 m, longer cable available.

Example of ordering collector with 2 m cable
Cat.-No. 234 118-2
for collector **MSW 6/50-2 HS**

Double collectors



Connecting cables:

for power line: cable 1 → 4 x 6 mm²
cable 2 → ... x 1,5 mm²

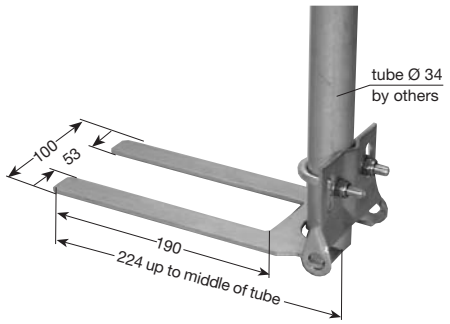
for control line: cable 1 → ... x 2,5 mm²
(two cables for 8-pole and more)

Type	Ampacity at 60% ED A	No. of poles	ø of connecting cables mm cable 1	cable 2	Travelling speed normal m/min.	Transfer m/min.	Weight kg	Cat.-No.
DMSW 6/100 S-1 HS	100	6	≈17,0	≈ 7,0	180	100	2,440	234 160
DMSW 7/100 S-1 HS	100	7	≈17,0	≈ 7,5	180	100	2,510	234 758
DMSW 8/100 S-1 HS	100	8	≈17,0	≈ 8,0	180	100	2,580	234 162
DMSW 9/100 S-1 HS	100	9	≈17,0	≈ 9,0	180	100	2,658	234 759
DMSW 10/100 S-1 HS	100	10	≈17,0	≈10,0	180	100	2,736	234 760
DMSW 6/50 S-1 ST	50	6	≈13,5	–	180	100	1,830	234 163
DMSW 7/50 S-1 ST	50	7	≈13,5	–	180	100	1,990	234 765
DMSW 8/50 S-1 ST	50	8	≈11,0	≈11,0	180	100	2,160	234 165
DMSW 9/50 S-1 ST	50	9	≈12,0	≈11,0	180	100	2,238	234 766
DMSW 10/50 S-1 ST	50	10	≈13,0	≈11,0	180	100	2,316	234 767

Connecting cable 1 m, longer cables available.

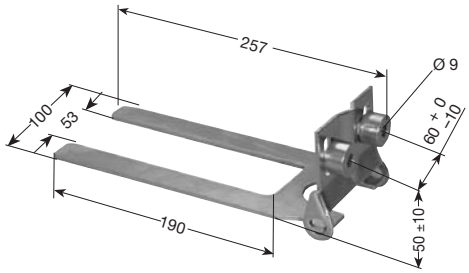
Example of ordering double collectors with 2 m cable
Cat.-No. 234 160-2
for collector **DMSW 6/100-2 HS**

Installation to tube
for single and double collectors



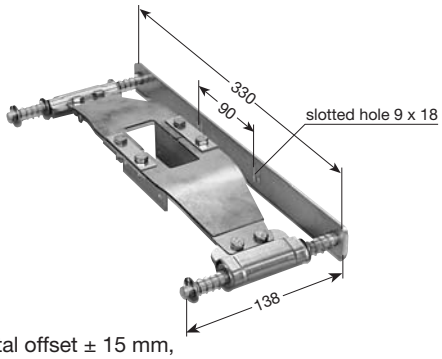
Type	Weight kg	Cat.-No.
MGR	0,560	234 015
MGR/K	0,560	234 021

Installation to plain surface
for single and double collectors



Type	Weight kg	Cat.-No.
MGF	0,590	234 016
MGF/K	0,590	234 022

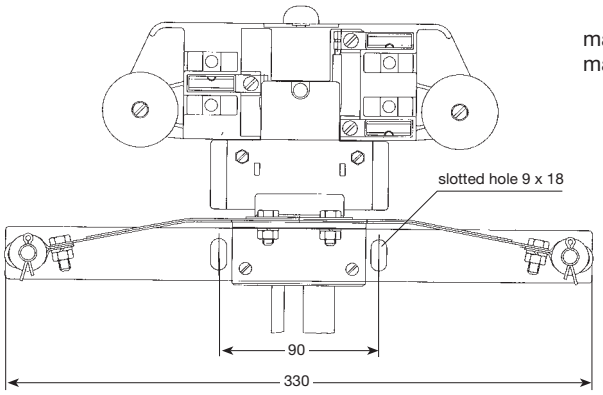
For single collectors – flexible support type
for systems with transfer funnels MTN



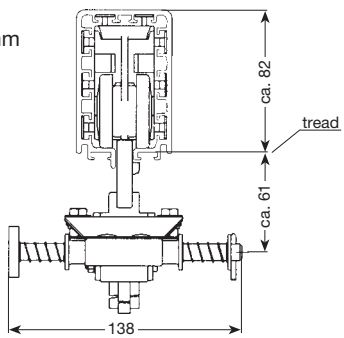
Type	Weight kg	Cat.-No.
MFM	1,120	234 211

max. horizontal offset ± 15 mm,
max. vertical offset ± 10 mm.

Flexible tow arm configuration



max. horizontal offset ±15 mm
max. vertical offset ±10 mm

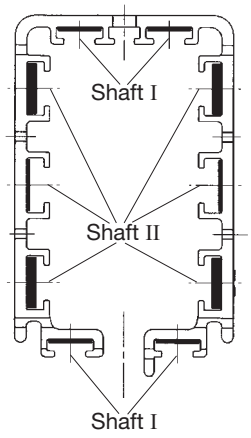


FLAT COPPER AND STAINLESS STEEL STRIPS

MKLD

Max. length of 11 mm wide strips*		for shaft I			Weight kg/m	Cu Cat.-No.	Weightt kg/m	Inox Cat.-No..
11 mm²	max. length (m)	90	260	300	0,10	234 198	0,09	234 384
11 x 1 mm (40 A)	Type of cassette	A	B	C				

Max. length of 13 mm wide strips*		for shaft II			Weight kg	Cu Cat.-No.	Weight kg	Inox Cat.-No..
10 mm²	max. length (m)	115	300	–	0,09	234 197	–	–
13 x 0,8 mm (40 A)	Type of cassette	A	B	C				
17 mm²	max. length (m)	65	200	300	0,15	234 199	0,13	234 383
13 x 1,3 mm (60 A)	Type of cassette	A	B	C				
26 mm²	max. length (m)	45	130	200	0,23	234 200	–	–
13 x 2 mm (100 A)*	Type of cassette	A	B	C				
33 mm²	max. length (m)	35	100	160	0,29	234 201	–	–
13 x 2,5 mm (140 A)*	Type of cassette	A	B	C				
42 mm²	max. length (m)	25	60(80)	(120)	0,37	234 202	–	–
13 x 3,2 mm (160 A)*	Type of cassette	A	B	C				
51 mm²	max. length (m)	22	50(65)	(100)	0,45	234 203	–	–
13 x 3,9 mm (200 A)*	Type of cassette	A	B	C				



*Longer lengths to be connected with bolted joints.

Use bolted joints and possibly expansion sections for bigger lengths than shown in the table. In this case installation by Vahle experts is recommended, especially for copper cross section of 42 mm² and 51 mm².

Consult factory for proper layout.

* With straightening tool (see page 19).

MKLD
MKLF
MKLS

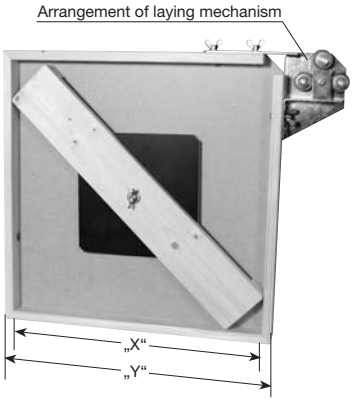
Cable glands for feeds

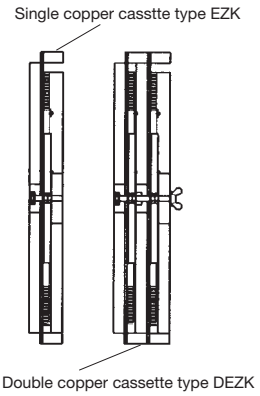
Cable glands	for cable-Ø in mm	capacity A execution: D/F/S	page
M 25 and M 40	9 – 19 and 17 – 26	40 – 60 HS	9
M 25	9 – 19	40 SS	9
M 25 and M 50	9 – 19 and 23 – 34	40 – 100 HS	10
M 25 and M 50	9 – 19 and 29 – 40	140 – 200 HS	10
M 25	9 – 19	40 SS	10
M 25 for PE and L1/L2/L3	6 – 15	40 – 200 HS	11
M 25 for 1 – 4 and 9/10	9 – 19	40 – 200 HS	11
M 25 6 – 10pole	9 – 19	40 SS	11

Copper cassettes

Execution of cassette	Type	Dim. »X«	Dim. »Y«	Weight kg	Cat.-No.
A	**EZK 1 single**	462	500	3,500	234 219
B	**EZK 2 single**	662	700	4,450	234 220
C	**EZK 3 single**	862	900	5,400	234 250
A	**DEZK 1 double**	462	500	6,500	234 221
B	**DEZK 2 double**	662	700	8,200	234 222
C	**DEZK 3 double**	862	900	9,900	234 251

Type of copper cassette depends on copper cross section and system length (see page 18).

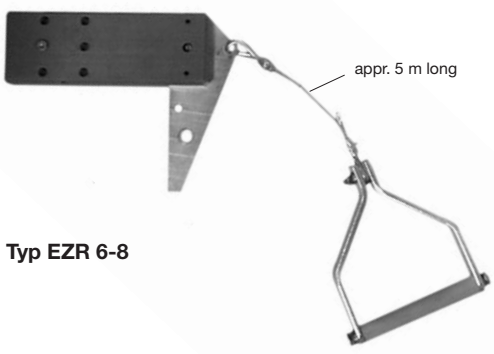




Straightening tool (required from strip sections 26 mm² upwards)

Type	Weight kg	Cat.-No.
RV	1,610	234 218

Conductor threading tools and installation carrier



Typ EZR 6-8

Type	Weight kg	Cat.-No.
EZR 6-8 for conductors inside housing, shafts I & II	1.450	234 204
EZR 9/10 for conductors outside housing, shafts I (not shown)	0.170	234 730
Installation carrier (for sealing strip; not shown)	1.620	234 376

MKLD
MKLF
MKLS

Sectionalizing

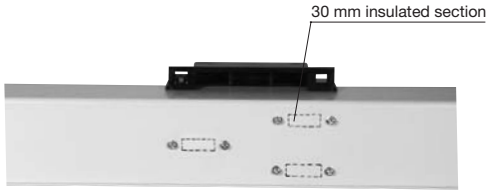


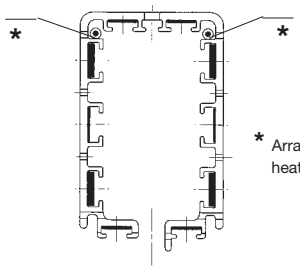
Illustration shows insulated section

Please indicate which conductors are to be interrupted (see page 4). Factory assembled.

5 mm air gap **30 mm insulated section**

Type	Cat.-No.	Type	Cat.-No.
MSTL 1	235 302	**MSTI 1**	235 312
MSTL 2	235 303	**MSTI 2**	235 313
MSTL 3	235 304	**MSTI 3**	235 314
MSTL 4	235 305	**MSTI 4**	235 315
MSTL 5	235 306	**MSTI 5**	235 316
MSTL 6	235 307	**MSTI 6**	235 317
MSTL 7	235 308	**MSTI 7**	235 318
MSTL 8	235 309	**MSTI 8**	235 319
MSTL 9	235 310	**MSTI 9**	235 320
MSTL 10	235 311	**MSTI 10**	235 321

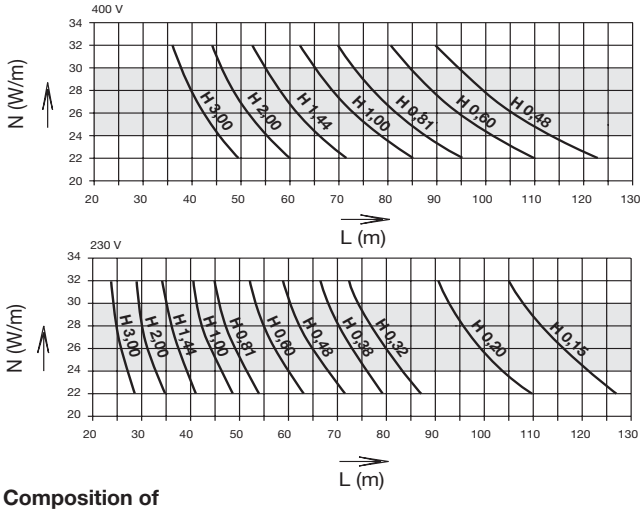
Heating system



Heating systems are recommended for outdoor Powerail installations with icing conditions and for extremely humid environments. The heating is accomplished by heating conductors being arranged inside the Powerail housing as shown in the adjacent drawing.

Attention! Heating system to be used only when temperature is + 5° C or lower.

Selection of heating cables



Determine a heating cable between **24 and 30 watt/m** capacity.

For longer runs, not covered by the adjacent diagrams, divide the length of the system into two or more heating sections.

Supply lower voltage via a transformer in case of shorter heating sections.

$$\text{Heating capacity [Watt/m]: } N' = \frac{U^2}{R \cdot L^2}$$

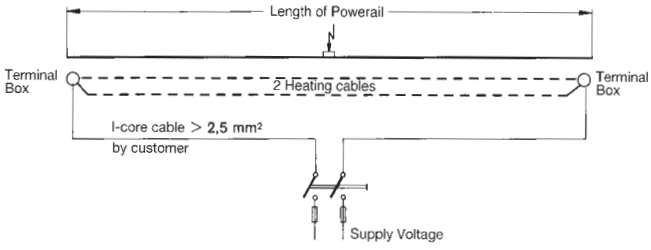
U = supply voltage [Volt]
R = resistance of heating cable [Ohm/m]
L = length of heating section [m]

Composition of heating cable:

Conductor: material resistor CrNi, stranded
Insulation: PTFE-(Teflon)
tinned copper braid
Sheath: PTFE-insulation
OD: 3,7 mm - 4,3 mm

Wire resistance data:
heating cable: H 0,15 → 0,15 Ohm/m
heating cable: H 0,20 → 0,20 Ohm/m
heating cable: H 0,32 → 0,32 Ohm/m
heating cable: H 0,38 → 0,38 Ohm/m
heating cable: H 0,48 → 0,48 Ohm/m
heating cable: H 0,60 → 0,60 Ohm/m
heating cable: H 0,81 → 0,81 Ohm/m
heating cable: H 1,00 → 1,00 Ohm/m
heating cable: H 1,44 → 1,44 Ohm/m
heating cable: H 2,00 → 2,00 Ohm/m
heating cable: H 3,00 → 3,00 Ohm/m
tolerance ± 2,5 %

Layout of one heating section with feeder boxes at both ends

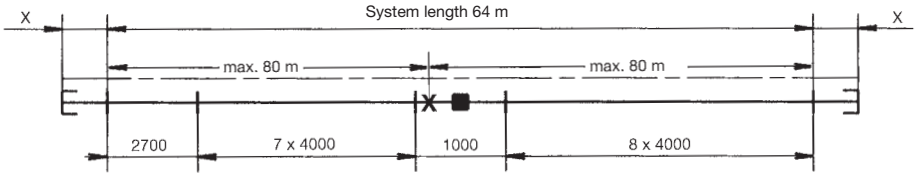


Example for ordering heating system for 60 m Powerail

1) 122 m heating cable type H 1,44
(incl. safety lengths)
Supply voltage 400 V, 2 heating sections
Heating capacity per above diagram approx. 2 x 31 W/m
with 60 m 2 x 31 W/m approx. 3720 W = 3,72 kW.
2) Two terminal boxes for heating system
3) Four sets of connecting material
4) Threading tool for heating cable

All switches, fuses, cable etc. by others!

Temperature control units on request.



X = 300 mm end section = expansion section for copper conductor for MKLD (w/o cond.). Not for MKLF and MKLS.

Example for ordering

System length 64 m MKL…8/100-HS (see page 5)

Qty.	Description	MKLD		MKLF		MKLS	
		Type	Cat.-No.	Type	Cat.-No.	Type	Cat.-No.
15	Flat copper strip 4 m	MKLD-4 **HS**	235 104	–	–	–	–
1	Flat copper strip 3 m	MKLD-3 **HS**	235 103	–	–	–	–
15	Powerail 4 m	–	–	MKLF 8/100-4 **HS**	234 944	MKLS 8/100-4 **HS**	234 824
1	Powerail 3 m	–	–	MKLF 8/100-3 **HS**	234 943	MKLS 8/100-4 **HS**	234 823
1	Line feed	MNGD 8/40-100 **HS**	235 057	MNGF 8/100-**HS**	235 097	MNGS 8/100-**HS**	235 076
1	End section, right	MSED/R	235 145	–	–	–	–
1	End section, left	MSED/L	235 144	–	–	–	–
2	End caps	–	–	MSES	235 141	MSES	235 141
18	Joint caps	MVMD	234 678	–	–	–	–
16	Joint caps	–	–	MVMS	234 585	MVMS	234 585
1	Fixpoint hanger	MFN	235 142	MFN	235 142	MFN	235 142
30	Sliding hangers	MGA	234 013	MGA	234 013	MGA	234 013
195 m	Flat copper strip, 3 coils à 65 m	26 mm²	234 200	–	–	–	–
65 m	Flat copper strip, 1 coil à 65 m	17 mm²	234 199	–	–	–	–
130 m	Flat copper strip, 2 coils à 65 m	10 mm²	234 197	–	–	–	–
130 m	Flat copper strip, 2 coils à 65 m	11 mm²	234 198	–	–	–	–
1	Collector	MSW 8/50-1 **HS**	234 120	MSW 8/50-1 **HS**	234 120	MSW 8/50-1 **HS**	234 120
1	Tow arm	MGR	234 015	MGR	234 015	MGR	234 015
1	Copper cassette	EZK 2	234 220	–	–	–	–
1	Laying mechanism	RV	234 218	–	–	–	–
1	Conductor threading tool	EZR 6-8	234 204	–	–	–	–

Spare parts for Powerail

	Cat.-No.
Plug in joint for MKLF (11 mm Cu; 40 A)	234 688
Plug in joint for MKLF (13 mm Cu; 40–100 A)	234 687
Bolted joint for MKLS (11 mm Cu; 40 A)	234 686
Bolted joint for MKLS (13 mm Cu; 40–200 A)	234 685
Joint Cap for transfer guide and transfer funnel, pair (MKLD, MKLF and MKLS)	234 779
Sealing strip	235 794

Spare parts for collectors

	Cat.-No.
Carbon brush phase, incl. brush holder (lateral)	230 199
Carbon brush PE, incl. brush holder (lateral)	230 200
Carbon brush 7th and 8th pole (above)	234 158
Carbon brush 9th and 10th pole (below)	234 370
Carbon pressure spring, standard for phase and PE	258 757
Carbon pressure spring, reinforced for phase and PE	238 760
Throat part	234 154
Trolley wheel	234 155
Connecting bar for double collector	234 515

QUESTIONNAIRE

CUSTOMER _____ ATTENTION OF _____

ADDRESS _____

TELEPHONE _____ TELEFAX _____

E-MAIL _____ INTERNET _____

1. Type of crane/machine to be electrified _____
2. Voltage _____ Volts~/=: _____ Phases, _____ c/s
3. Length of conductor system _____
4. Number of power conductors: _____ control lines: _____ ground: _____ neutral: _____
5. Indoor ☐ Outdoor ☐
6. Special site conditions (humidity, dust, chemical influences etc.) _____
7. Temperature conditions _____ °C min. _____ °C max.
8. Number of cranes/machines supplied by the one system _____
9. Ampere load of each crane/machine _____
   (use table on page 30)
10. Permissible voltage drop _____
11. Number and position of feed points* _____
12. Number and position of isolating sections* _____
13. Installation position envisaged* _____
14. Brackets required (see page 8) yes ☐ no ☐ c/c distance beam/Powerail: _____
15. Max. travelling speed of machinery _____
16. Other important data: _____

_____

_____

_____

_____

_____

* Please submit prints or sketches, also for curved tracks.

To the nearest local VAHLE agency:

Date:

Motordata	Crane 1							Crane 2						
	Power kW	Nominal current A	cos φ_N	% ED	Starting current A	cos φ_A	Type of motor**	Power kW	Nominal current A	cos φ_N	% ED	Starting current A	cos φ_A	Type of motor**
Hoist motor														
Auxiliary hoist														
Long travel														
Cross travel														

Motordata	Crane 3							Crane 4						
	Power kW	Nominal current A	cos φ_N	% ED	Starting current A	cos φ_A	Type of motor**	Power kW	Nominal current A	cos φ_N	% ED	Starting current A	cos φ_A	Type of motor**
Hoist motor														
Auxiliary hoist														
Long travel														
Cross travel														

Mark motors* which can operate simultaneously.

Mark motors Δ which can start simultaneously.

**Use K for squirrel cage motor

S for slipring motor

F for frequency controlled motor

Further remarks: _____

_____

_____

_____

Signature: _____

Catalog No. 4c/E 2005

MANAGEMENTSYSTEM

DQS certified in accordance with DIN EN ISO 9001:2000
OHSAS 18001 (Reg. no. 003140 QM OH)

	Catalog No.
Copperhead Conductor Systems	1 a
Battery Charging Systems	1 b
Insulated Conductor Systems U 10	2 a
Insulated Conductor Systems U 20 – U 30 – U 40	2 b
Insulated Conductor Systems U 15 – U 25 – U 35	2 c
Aluminium Enclosed Conductor Systems LSV – LSVG	3 a
Powerail Enclosed Conductor Systems KBSL – KSL – KSLT	4 a
Powerail Enclosed Conductor Systems VKS – VKL	4 b
Powerail Enclosed Conductor System MKLD – MKLF – MKLS	4 c
Powerail Enclosed Conductor System KS–10	4 d
Powerail Enclosed Conductor System KBH	4 e
Heavy Enclosed Conductor Systems	5
Trolley Wire and Accessories	6
Cable Tenders	7
Cable Carriers for ▢-tracks	8 a
Cable Carriers for Flatform Cable on I-beams	8 bF
Cable Carriers for Round Cable on I-beams	8 bR
Cable Carriers for ◇-tracks	8 c
Conductor Cables and Fittings	8 L
Spring Operated Cable Reels	9 a
VAHLE POWERCOM® – Data Transmission Systems	9 c
CPS® – Contactless Power Supply	9 d
SMG – Slotted Microwave Guide	9 e
WCS – Position Encoding System	9 f
Motor Powered Cable Reels	10

VAHLE 19 12
ELECTRIFICATION SYSTEMS

PAUL VAHLE GMBH & CO. KG • WESTICKER STRASSE 52 • D 59174 KAMEN/GERMANY • TEL. (+49) 23 07/70 40
Internet: www.vahle.de • e-mail: postmaster@vahle.de • FAX (+49) 23 07/70 44 44

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