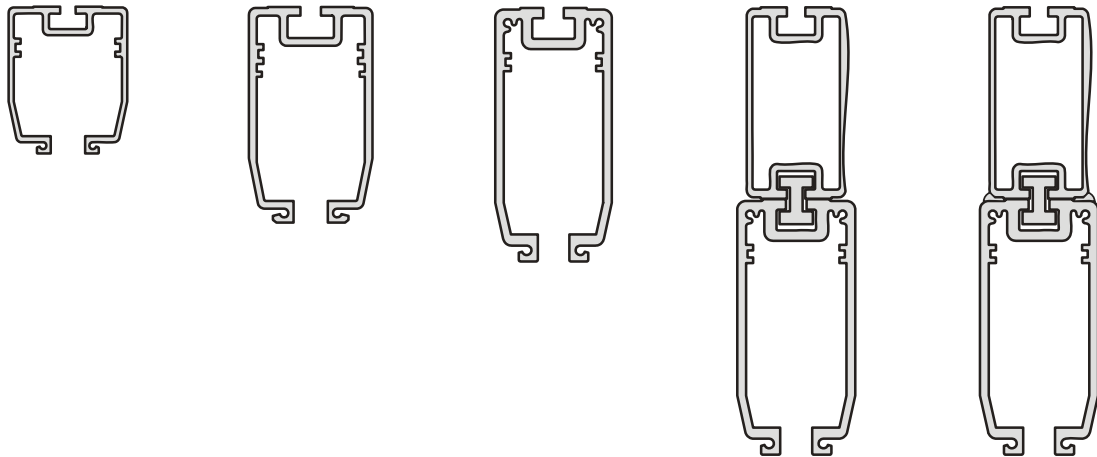
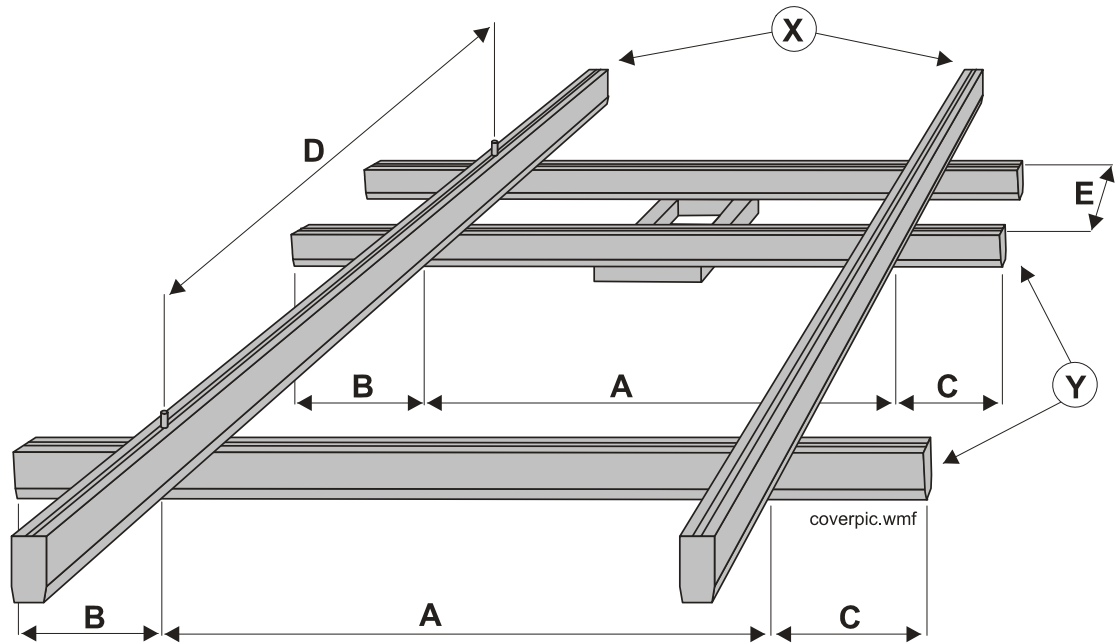


Movorail



Installation Manual
Edition: 4
DW110410gb-0710

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1	n.a.	manual created
2	n.a.	Changed content
3	2005-02-18	Changed content and new style
4	2007-03-09	Added instruction for adjustment of bogie trolleys

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1. Introduction

Thomson Movorail is a light weight rail system made of extruded aluminium profiles for loads up to 600 kg which is designed and manufactured by Danaher Motion to meet the latest national and international standards. Product quality is assured by our ISO 9001 certified quality system.

Read through this manual carefully and study all the instructions supplied with the delivery of the components before starting the installation work.

Do not hesitate to contact us for more information.

Important!

- Read through all installation instructions and all other diagrams and documents supplied with the delivery before commencing the installation in order to ensure that the work is carried out in a safe manner.
- No mechanical, electrical or pneumatic equipment delivered by Danaher Motion may be modified or be used in any other way than what is described in this manual without the written permission from Danaher Motion.
- Never walk or stand under a hanging load.
- Ensure that all ladders, lifting and climbing aids used during the installation are in good condition and that they are securely fastened.
- Make sure that only authorised people enter the working area.
- Never use any components that appear to be faulty or damaged. Replace them immediately with the components of the same make and type.
- The system must be labelled with a clearly visible max. load sign.
- All operators of the system should be instructed in using the system safely before using it.
- Never work with any electricity or compressed air switched on during the installation.
- The Movorail system may not be used before it complies with the EEC Machinery Directive (89/392/EEC) with valid amendments if it is to be used within the EEC area. In such cases electrical equipment is a part of the system the system also must comply with the demands in the Low Voltage Directive (72/23/EEC) and the directive for Electromagnetic Compatibility (89/336/EEC) with valid amendments.
- All equipment, work and documentation must, for both the electrical, mechanical and pneumatic areas, comply with all relevant national and international regulations, standards and EEC directives.
- Regular maintenance is necessary in order to obtain long life and to maintain a high safety level. Service instructions can be found in the "Movorail Service Manual" which is included in the delivery.
- Do not hesitate to contact Danaher Motion if you have any questions.

2. The components of the Movorail system

2.1 System with main girder rails

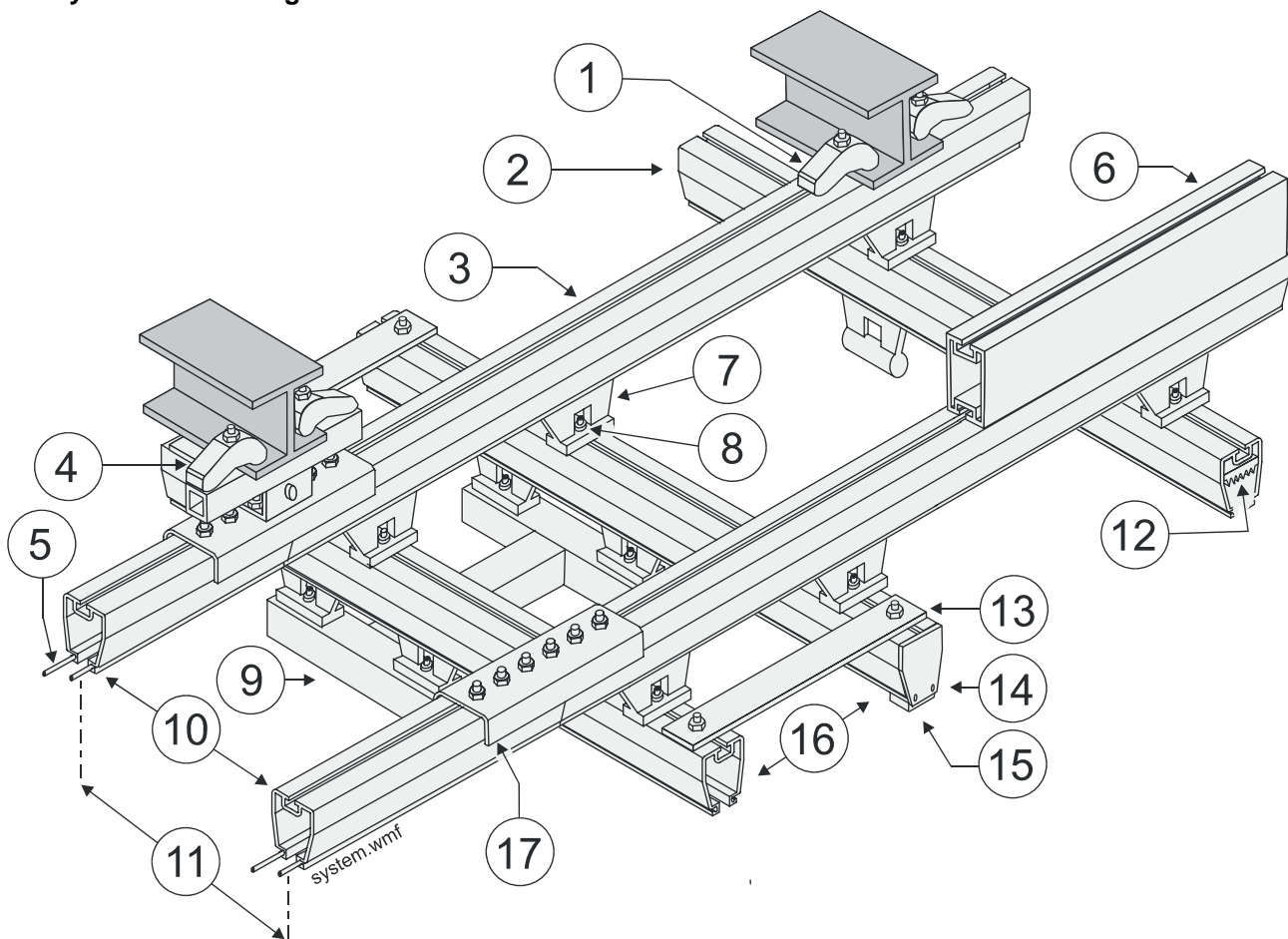


Figure 1: system with main girder rails

1. **I-beam clamps type VBKLA:** used to suspend a rail directly to an I-beam.
2. **Single main girder rail**
3. **Movorail rail:** load carrying profile which comes in five sizes: SPR 85, SPR 125, SPR 160A, SPR 295B and SPR 295W.
4. **Flexible suspension type DBSU:** suspension type that allows some misalignment between the I-beam and the rail.
5. **Locating pin:** a pin that guides the rails at connections.
6. **Reinforcement profile:** a profile that is used to reinforce profile SPR 160A.
7. **Bogie trolley:** trolley with horizontal wheels for guidance that is used for hanging loads.
8. **BUB:** attachment between bogie trolleys, distance girders and rails.
9. **Yoke:** frame in which a hoist or other loads can be suspended.
10. **Down shop rails:** the non-moving rails to which the suspensions are attached.
11. **Span:** the c/c distance between two down shop rails.
12. **Current track:** rail with copper conductors installed inside of the Movorail profile.
13. **Distance girder:** two types exist, flexible or rigid.
14. **End plate**
15. **End stop**
16. **Double main girder rails**
17. **Connection**

2.2 Single down shop rail

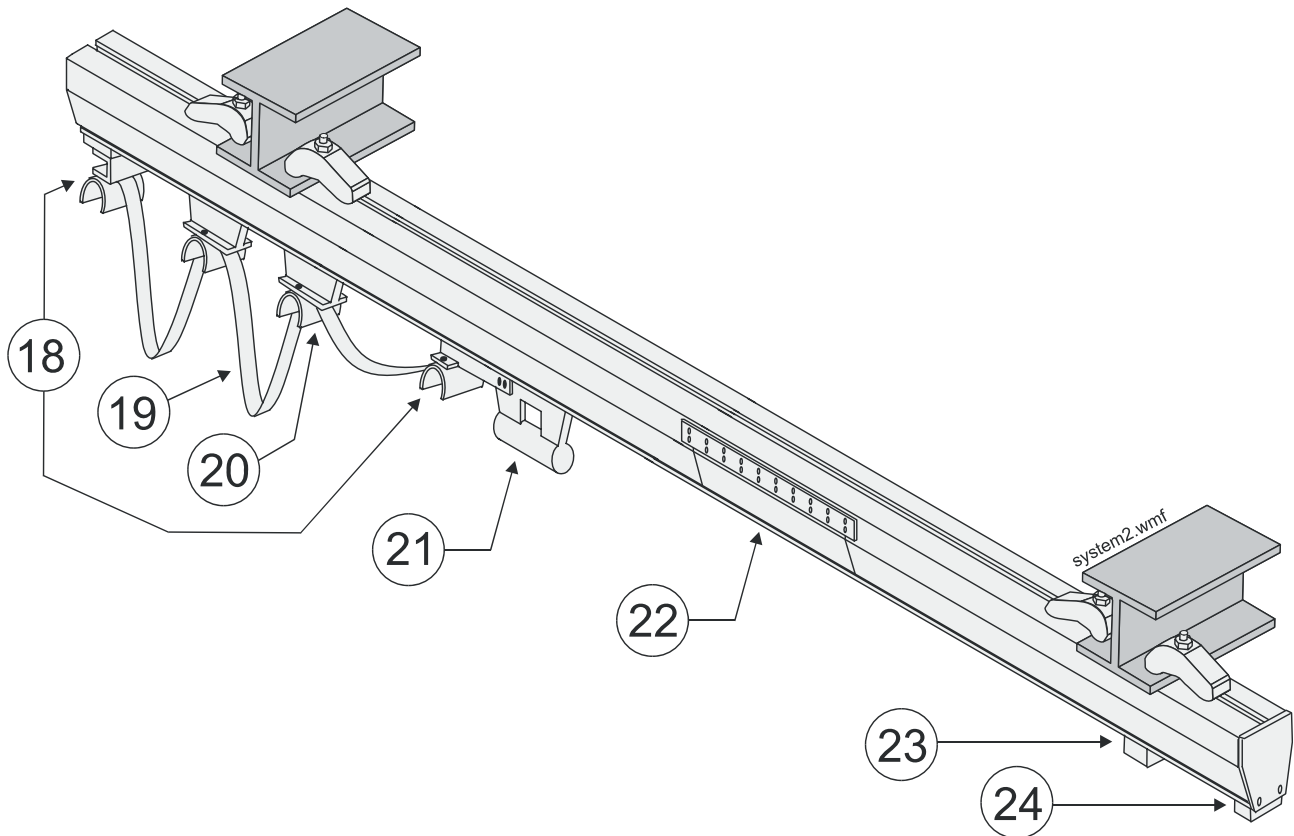


Figure 2: single down shop rail system

- 18. Rail and trolley cable attachment (kit):** components that fix cables to the end of a rail and a trolley.
- 19. Cable:** the type of cable/hose determines the type of cable trolley.
- 20. Cable trolley**
- 21. Crab trolley**
- 22. Service section:** a hatch that facilitates the service of trolleys and other components at long rails.
- 23. End stop**
- 24. End plate support:** a component used to attach the end plate to when the end stop is not placed in the end of the rail.

3. The Movorail rails

3.1 Rails

There are five different straight rail sizes, SPR 85, SPR 125, SPR160A, SPR295B (with reinforcement profile) and SPR295W (with welded reinforcement profile). Further to this sizes 85, 125 and 160A also comes in a curved versions (SPB). The reinforcement profile SPF 135 can also be delivered separately and be installed afterwards on top of a SPR 160A with the aid of the T-slot profile TSS to create a rail of type SPR295B. The max. allowed load for each profile depends on the distance between the suspensions, see point 18.3.

For installations to the T-slots of the rails there is a series of T-slot bolts in different lengths. Size TBM 8 is used for SPR 85 while TBM 12 is used for the others. Note! Only this type of bolt may be used for attachments to the rail T-slots.

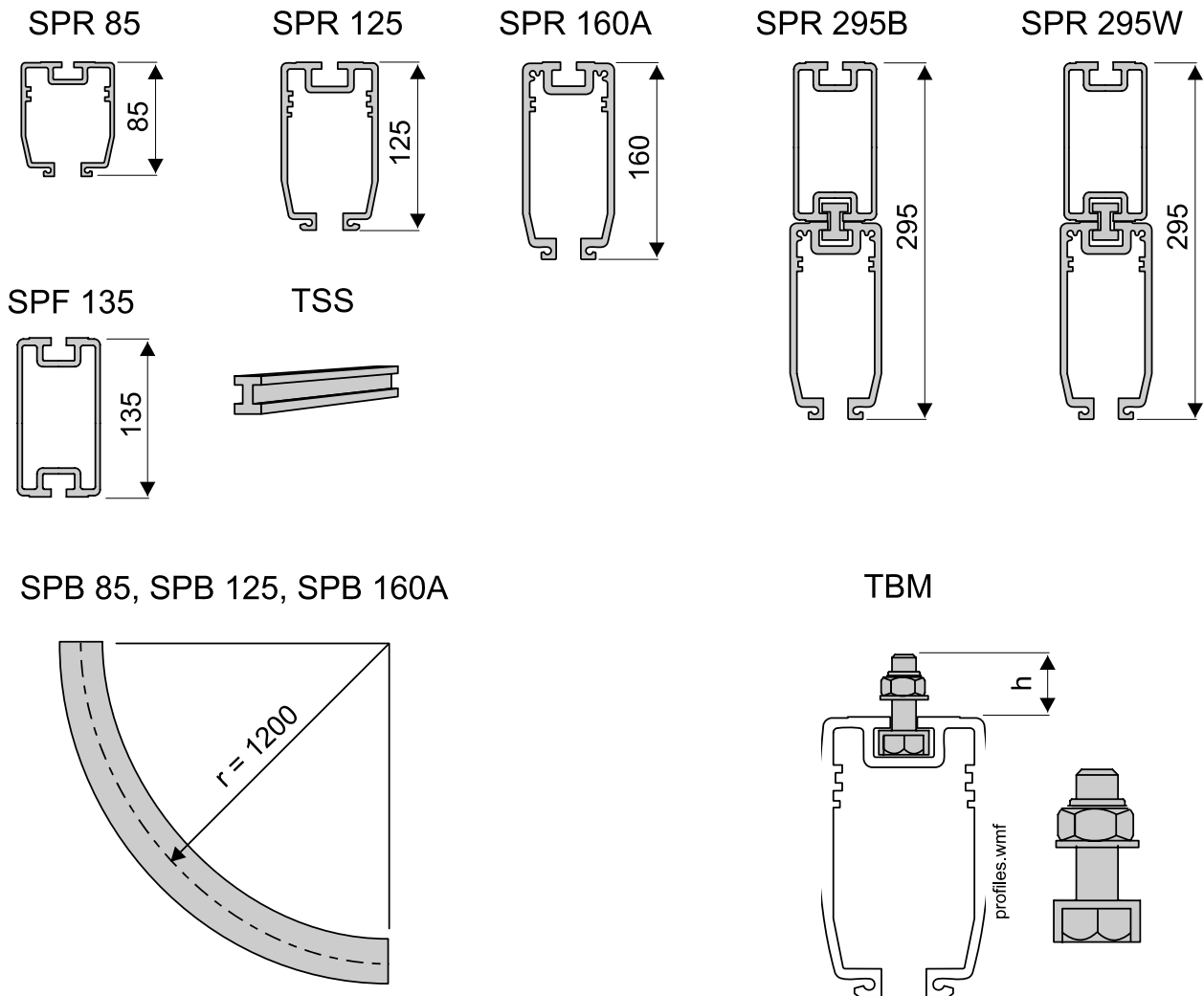


Figure 3: profiles and T-slot bolts

3.2 Attachment of reinforcement profile type SPF 135

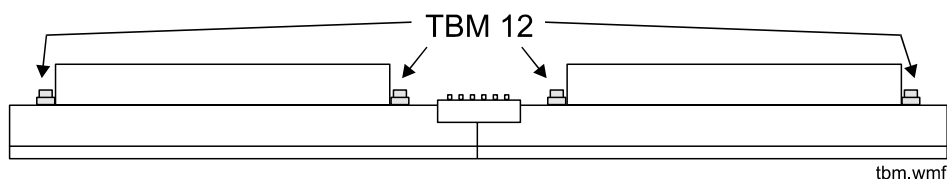


Figure 4: how to secure the T-slot profile

At SPR295B or at installation of reinforcement profile in the reinforcement profile must be fixed so that it can not move. Installing T-slot bolts on both sides of the reinforcement profile prevents it from moving.

4. Connection of rails

4.1 Connection of straight rails type SPR

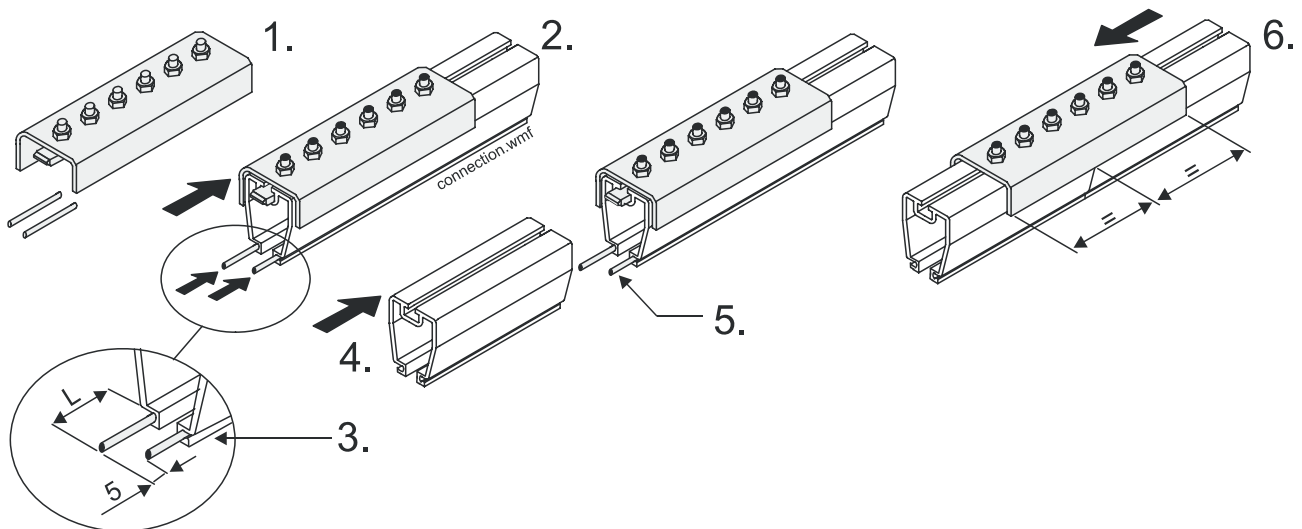


Figure 5: connection of straight rails

1. Assemble the connection.
2. Push the connection on to the rail.
3. Glue the locating pins to the rail using the glue supplied with the connection. Also see below table.
4. Push the other rail on to the locating pins.
5. Do not glue the locating pins in this end!
6. Pull over the connection (6) from the first rail to the other until the connection is exactly in the middle and then tighten all bolts according to the table in point 18.2. Note! Keep in mind that each connection must be supported by a suspension.

	SPR 85	SPR 125 / SPR 160A / SPR 295B / SPR 295W
L (mm)	30	40

Table 1: projecting length of the locating pins

4.2 Connection of curves type SPB

Connection of curves is done the same way as for straight but with special curve connections (SK 85R/B and SK 125/160AR/B). Note! Keep in mind that both the connections and the curve must be supported by a suspension. This means that at least three suspensions must be used per curve.

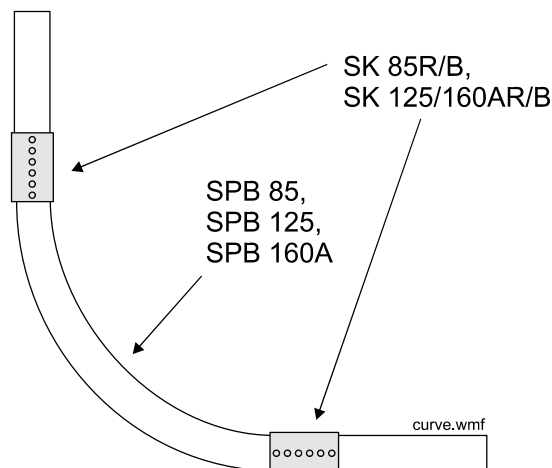


Figure 6: connection of curved rails

5. Service sections

5.1 Installation and inspection of service sections type SSKT

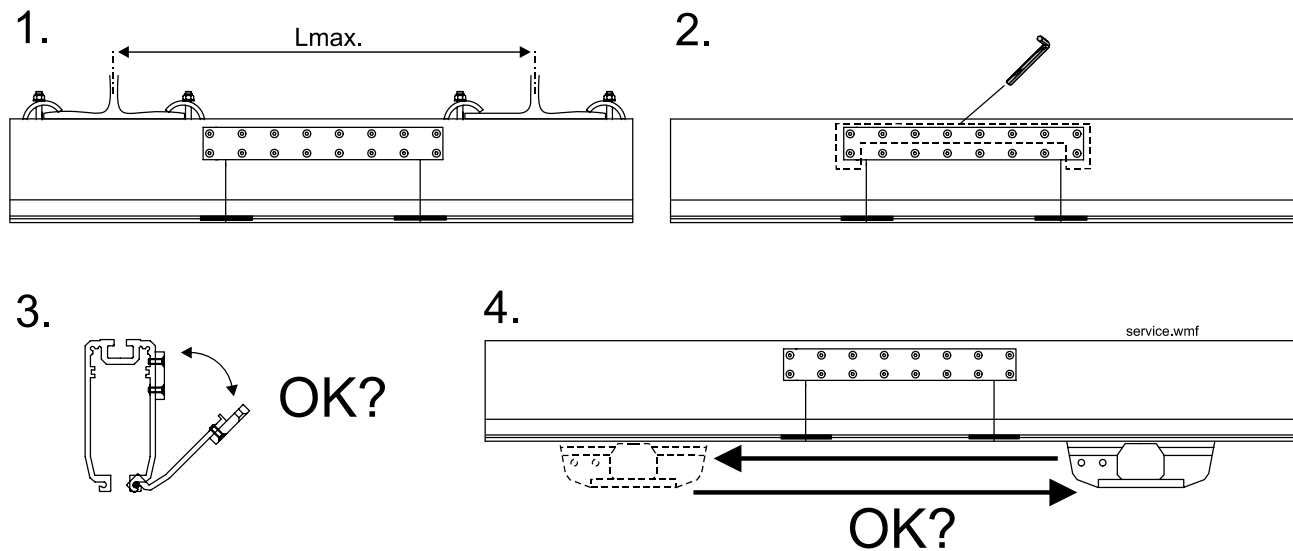


Figure 7: installation of service section

1. Suspend the service section using one suspension on each side. Maximum allowed distance (Lmax.) is 400 mm for SPR 85 and 500 mm for SPR 125 / SPR 160A.
2. Remove the indicated socket head cap screws.
3. Test the function of the hatch. Adjust if necessary. Put back the socket head cap screws.
4. Test the function of the section by running the types of trolleys that will be used trough the section.
5. The hatch can, when it is open, be completely removed by knocking out the hinge pins from the hatch to the sides of the hatch.

6. Trolleys and accessories for trolleys

6.1 Trolleys

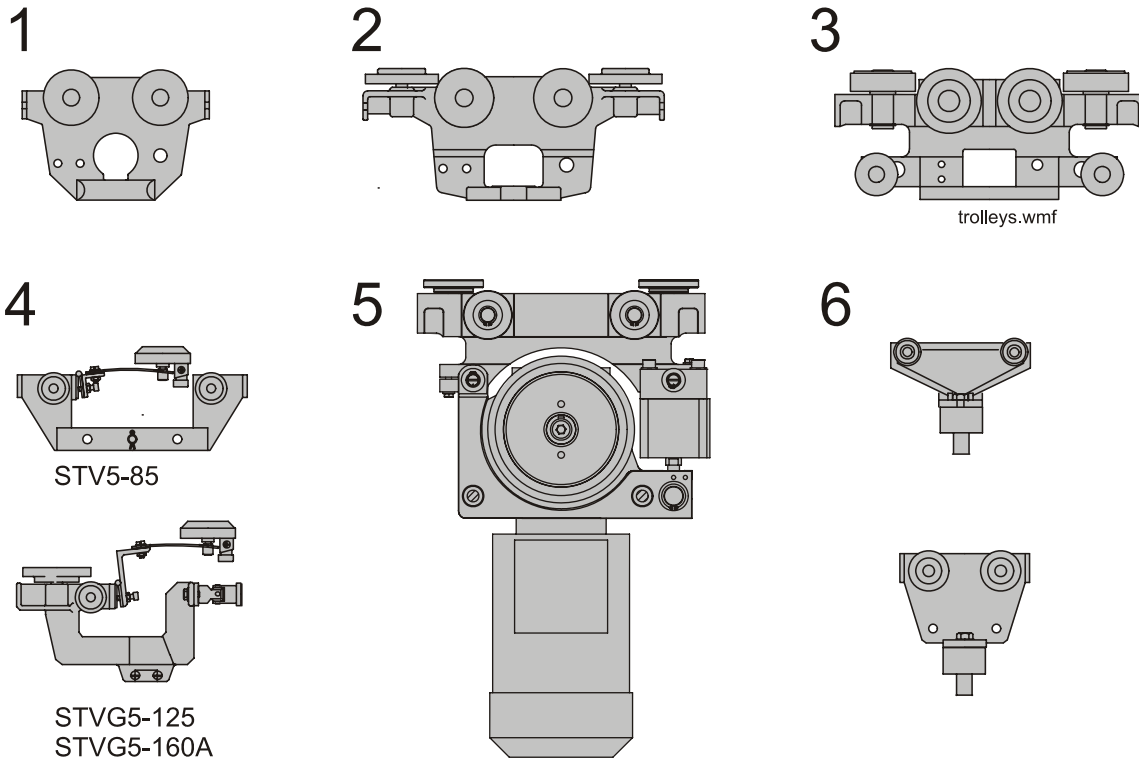


Figure 8: trolleys

1. **Crab trolleys:** this type of trolley is used when only hanging loads (the force pointing downwards) shall be moved i.e. as for hoists.
2. **Bogie trolleys:** this type of trolley is used when both hanging loads and lateral forces can be present, i.e. as for crane rails or systems with curves.
3. **Bogie trolleys with lower support rollers:** this type of trolley can manage hanging loads, lateral forces and upward forces.
4. **Pick up trolleys:** this type of trolley is used when a rail is equipped with current track. STV5 can be used alone while STVG5 must be connected to another trolley with the help of the cardan joint, see point 6.4.
5. **Motor trolleys:** this type of trolley is used to motorise the movement in X or Y direction and is available in several speed versions.
6. **Cable trolley:** this type of trolley is used to move cables along a rail. The cable trolley is at the delivery equipped with a cable clamp, a strap or a cable tie for round cables, flat cables or hoses.

6.2 Installation of rail and trolley attachments type KFFB, KFKK, KFVS and KFSB

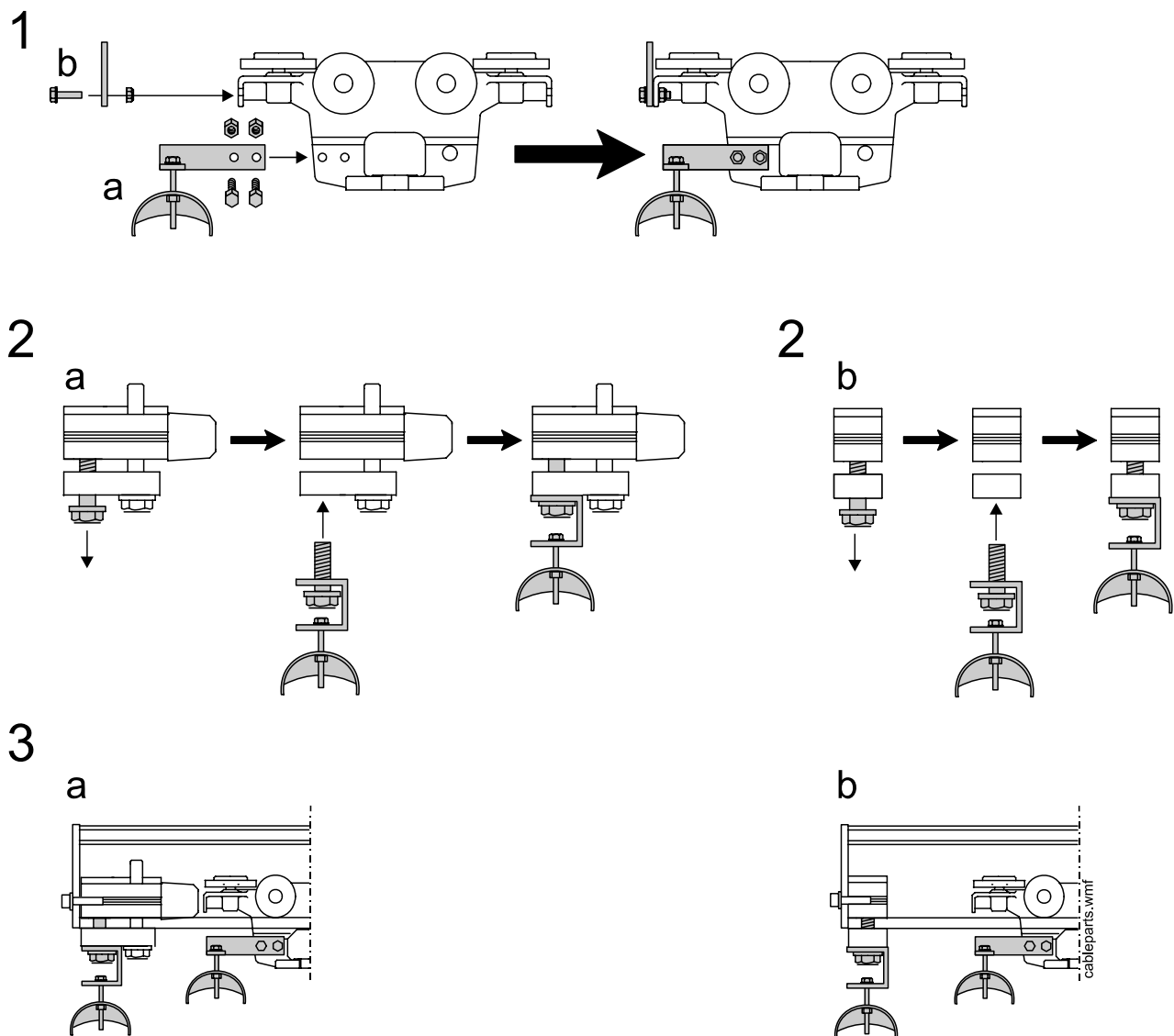


Figure 9: installation of rail and trolley attachments

1. Install the trolley cable attachment (a) to the installation holes of the trolley. The picture shows a cable attachment with a flat cable clamp. Cable attachments with other clamp types exist, however, they are all installed in the same way. Also install the motion limiter plate (b) to the trolley if a motion limiter will be used (see point 7.2).
2. The rail cable attachment is installed on the end stop (a) or to the end plate support (b) depending on how the rail is equipped.
3. Examples of complete installations. Also see point 7.1 and 7.2 for instructions on the installation of end stops, end plate supports and motion limiters.

6.3 Adjustment of bogie trolley type BGV 300 HSE with support rollers

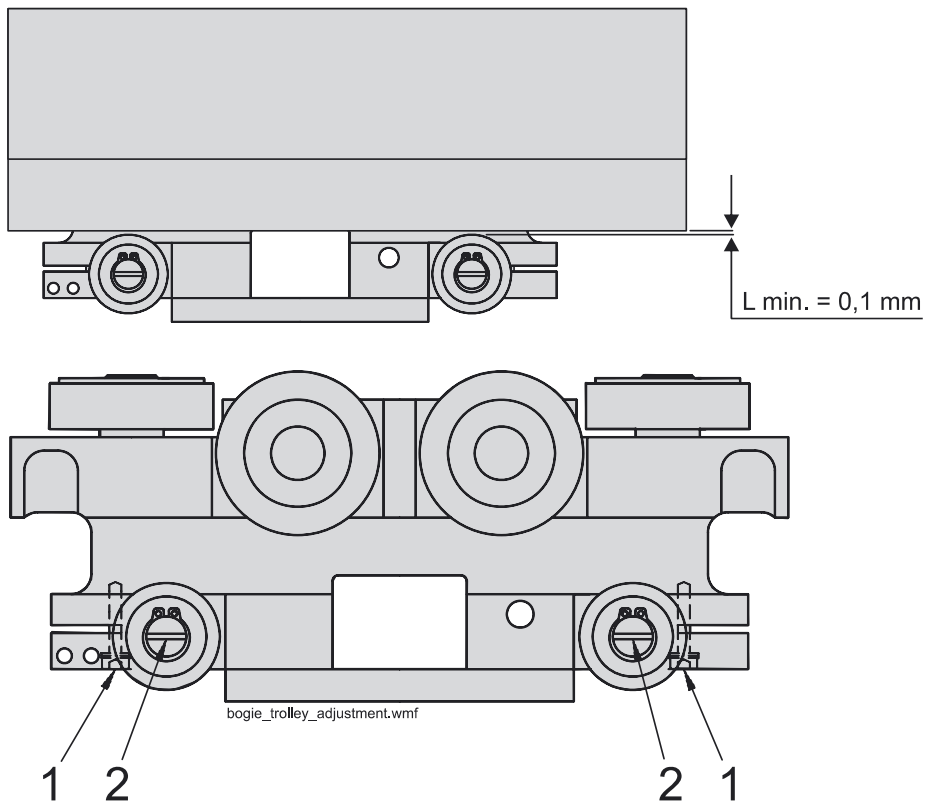


Figure 10: adjustment of bogie trolley support rollers

The position of the support rollers on bogie trolleys type BGV 300 HSE must be checked after installation. If the distance between the support rollers is less than 0,1 mm anywhere along the entire length of the rail the roller positions must be adjusted. To adjust, loosen the lock screws (1) and turn the eccentric shaft of the rollers (2) until the distance between the rollers is within the limit all along the rail. Tighten the lock screw when the adjustment is done. The tightening torque of the lock screws should be 5 Nm.

6.4 Cable trolleys type KBV, KBVA and KBVS

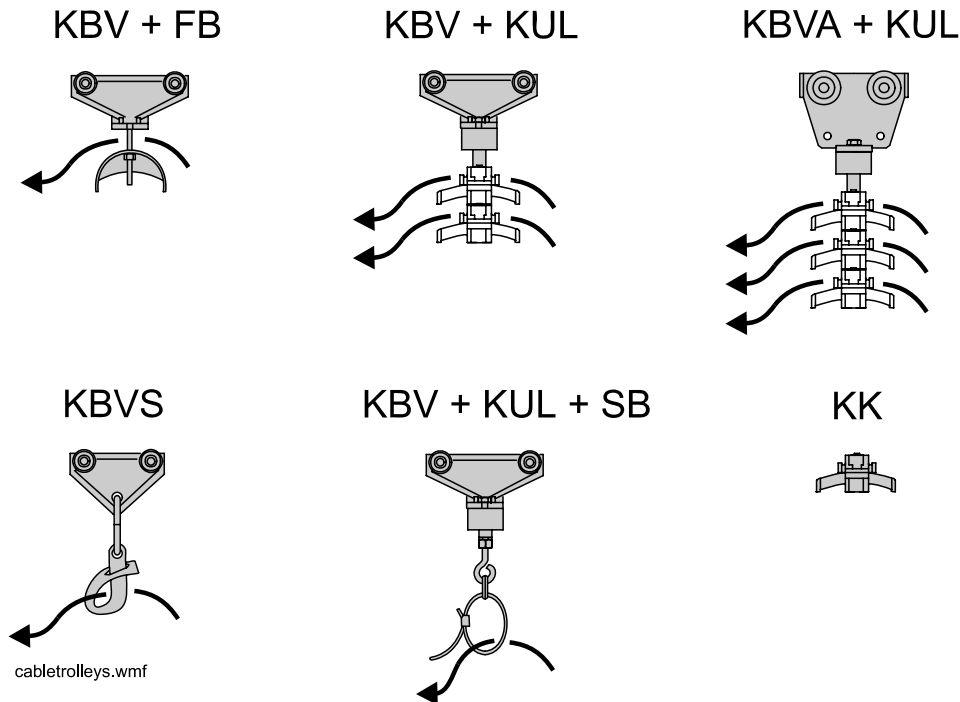


Figure 11: cable trolleys

Cable trolley type KBV + FB

Cable trolley type KBV + FB is intended to be used to flat cables.

Cable trolley type KBV + KUL

Cable trolley type KBV + KUL is intended to be used to round cables. The trolley must be completed with cable clamps of type KK in suitable dimension. A maximum of two cable clamps can be installed to the trolley.

Cable trolley type KBVA + KUL

Cable trolley type KBVA + KUL is intended to be used to round cables. The trolley must be completed with cable clamps of type KK in suitable dimension. As many cable clamps as needed can be installed to the trolley as long as the load do not exceed 50 kg.

Cable trolley type KBVS

Cable trolley type KBVS is intended to be used to round cables which is fixed by the strap.

Cable trolley type KBV + KUL + SB

Cable trolley type KBV + KUL + SB is intended to be used to hoses that are fixed with the cable tie. The cable tie accepts hoses with a diameter of 30 – 80 mm.

Cable clamps type KK

Cable clamps type KK are available in three sizes, for cables with a diameter of 10 – 16 mm, 17 – 25 mm and 26 – 36 mm. The clamps are installed on top of each other in the maximum amount that the trolley type accepts.

6.5 Pick up trolleys type STV5 and STVG5

STV5 is intended for rail SPR 85 and can carry loads up to 50 kg. STV5 can be connected to other trolley if needed. STVG5 comes in two versions, STVG5-125 for rail SPR 125 and STVG5-160A for SPR 160A, SPR 295 B and SPR 295W. This trolley must always be connected to another trolley via the cardan joint, which is included in the delivery. Never exceed the current limits of the pick up brushes/current track, see point 18.4.

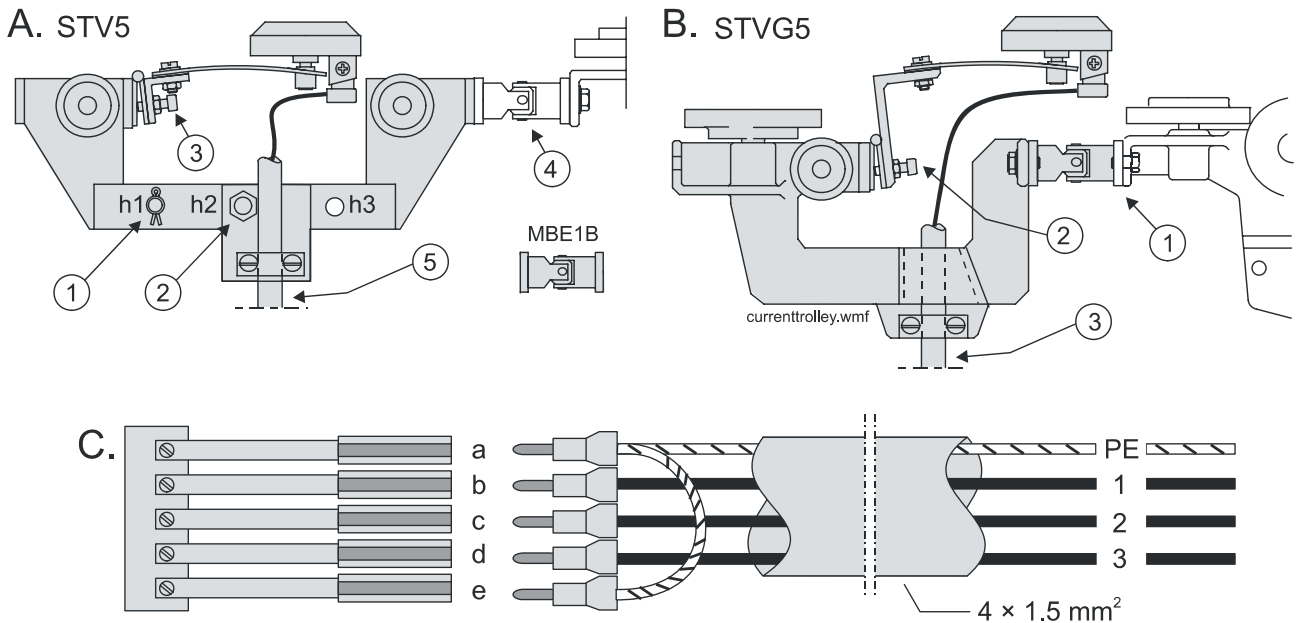


Figure 12: connection of pick up trolley

A. STV5

1. The load-carrying pin can be placed in any of the holes (h1, h2, or h3). Max. load = 50 kg.
2. The strain relief plate can be placed in any of the holes (h1, h2 or h3).
3. Adjustment screw for the contact pressure of the brushes. Adjust the brushes to ensure good contact. Clean if necessary the brushes from any oxide. Connect the cable according to the below table.
4. If needed, connect STV5 to another trolley by means of the cardan joint MBE1B (not included in STV5).
5. Cable 4 x 1,5 mm².

B. STVG5

1. Connect STVG5 to the load carrying trolley.
2. Adjustment screw for the contact pressure of the brushes. Adjust the brushes to ensure good contact. Clean if necessary the brushes from any oxide. Connect the cable according to the below table.
3. Cable 4 x 1,5 mm².

C. Connection of cable to pick up trolley

	a	b	c	d	e
1 x 230 VAC	Earth (PE)	L1	N	L1	Earth (PE)
3 x 400 VAC	Earth (PE)	L1	L2	L3	Earth (PE)
Cable lead	Yellow / green	1	2	3	-

Table 2: connection of cable on pick up trolley

6.6 Installation of motor trolleys type TMT

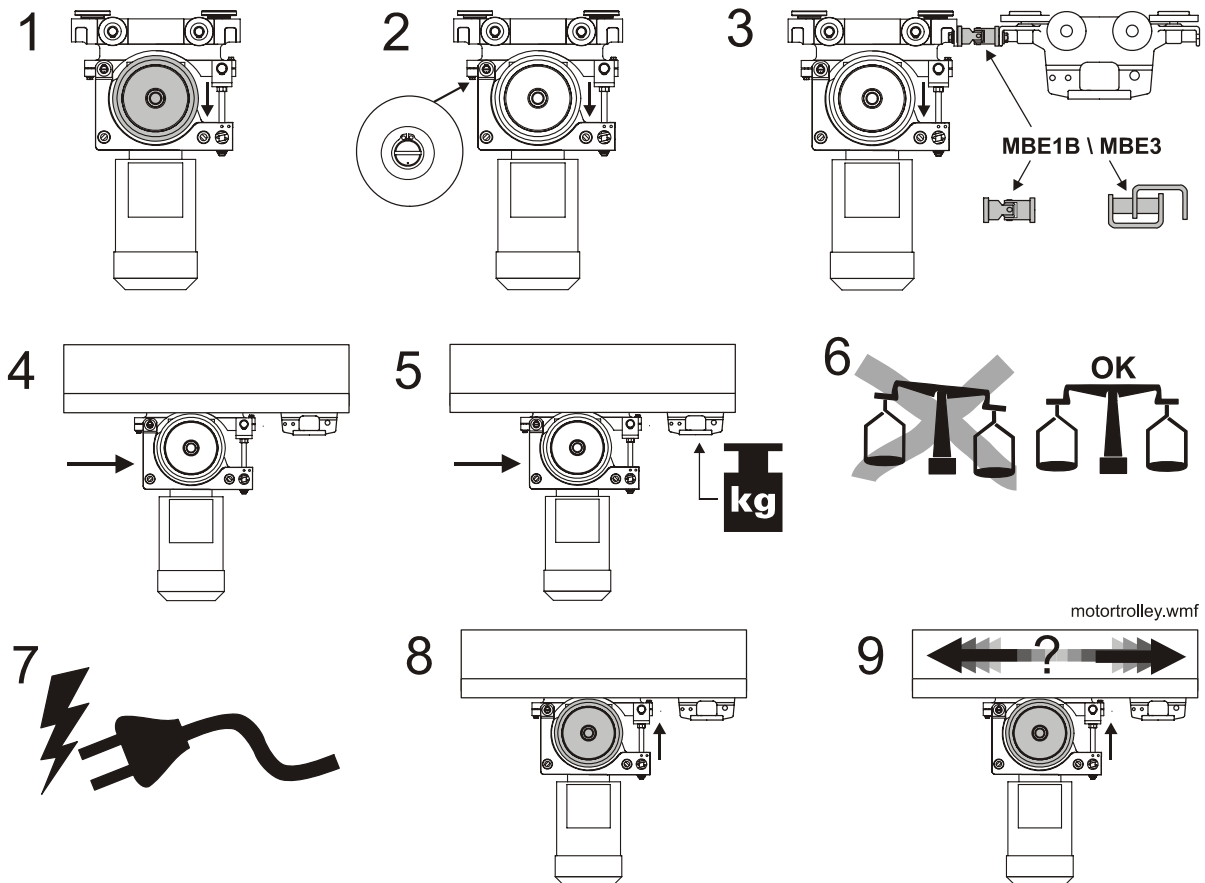


Figure 13: installation of motor trolleys

Installation order for motor trolleys.

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Lower the drive wheel, see point 6.8. 2. Set the correct profile size, see point 6,8. 3. Connect possible trolley to the motor trolley using the cardan joint. Use MBE1B if curved rails are used and MBE3 if only straight rails are used. 4. Insert the motor trolley into the rail. | <ol style="list-style-type: none"> 5. Attach the load to the trolley (never attach any load to the motor trolley itself). 6. Check the centre of gravity, see point 6.7. 7. Connect the supply and the motor. 8. Adjust the drive wheel contact pressure, see point 6.7. 9. Test run, see point 6.8. |
|--|---|

6.7 Adjustment of centre of gravity on motor trolley type TMT

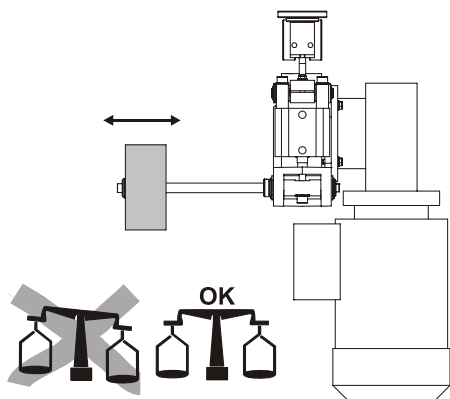


Figure 14: centre of gravity adjustment

Adjust the counter weight so that the trolley hangs perpendicular.

6.8 Electrical connection and adjustment of motor trolleys type TMT

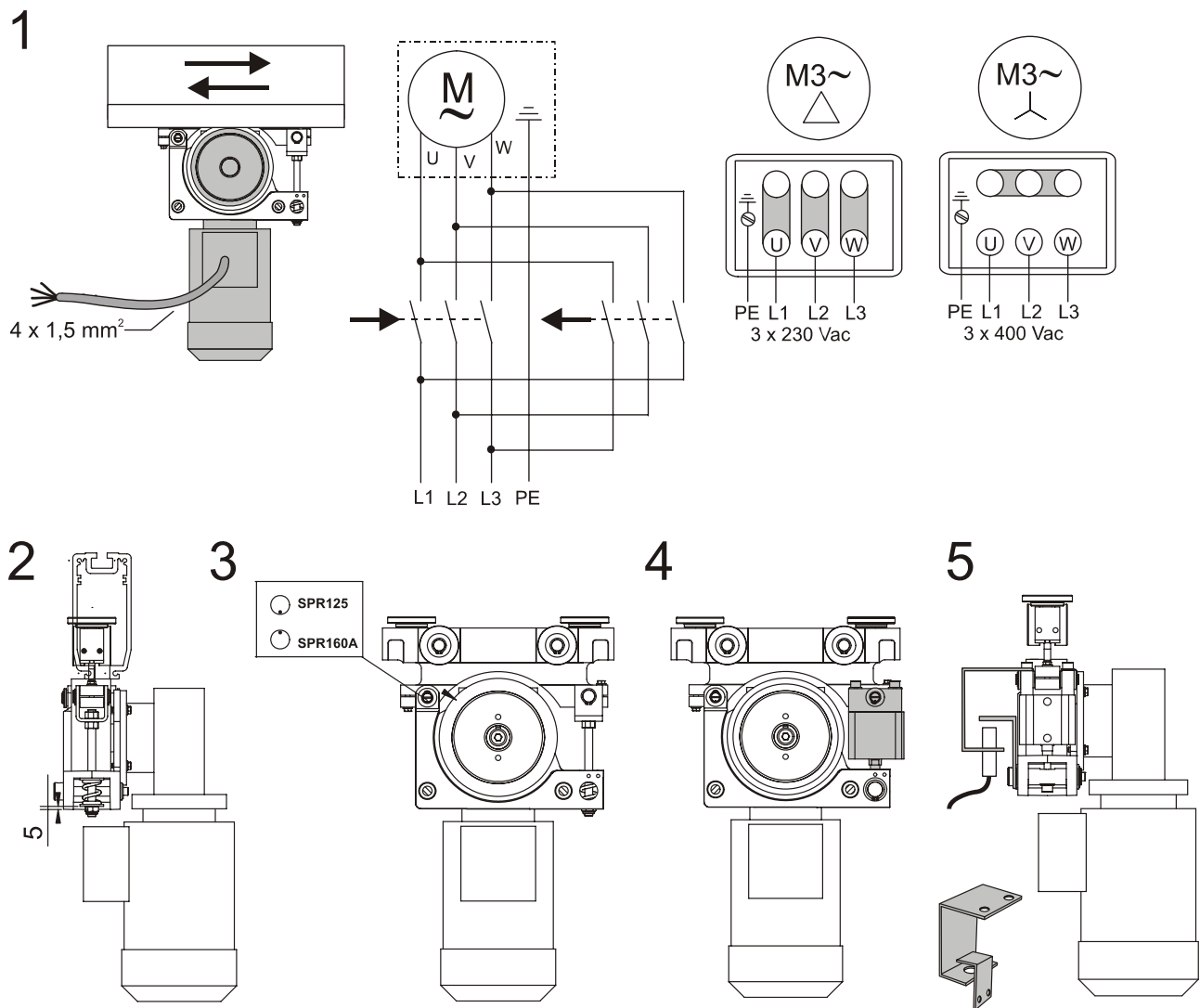


Figure 15: connection and adjustment

1. Connect the motor cable.
2. Adjust the spring pressure to obtain slip free drive wheel operation.
3. Set the eccentric screw to the correct position for the profile size being used.
4. If pneumatic release is being used, make sure the operating pressure is max. 5 bar.
5. Install the pneumatic release cylinder sensor bracket as shown.

7. End plates, end stops, motion limiters and Walter bolts

7.1 End stops type STP, end plates type TPL and end plate supports type EPF

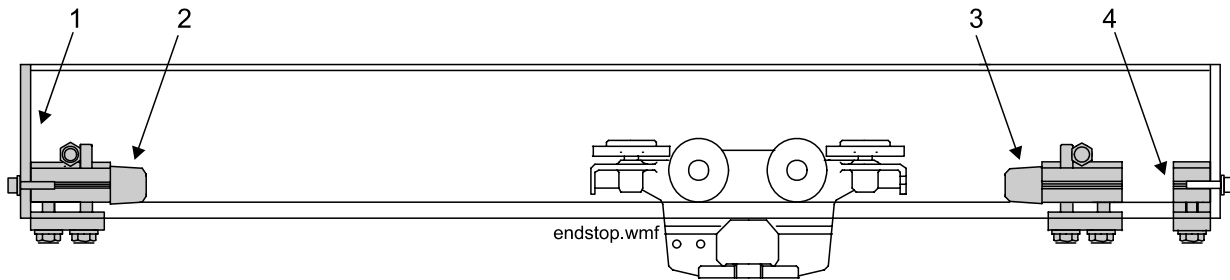


Figure 16: installation of end stop, end plate and end plate support

All rails should be equipped with end plates (1) and end stops (2) in both ends. If the end stop is installed a bit from the end (3) an end plate support (4) can be installed in the rail as a support for the end plate.

7.2 Motion limiter type BGR

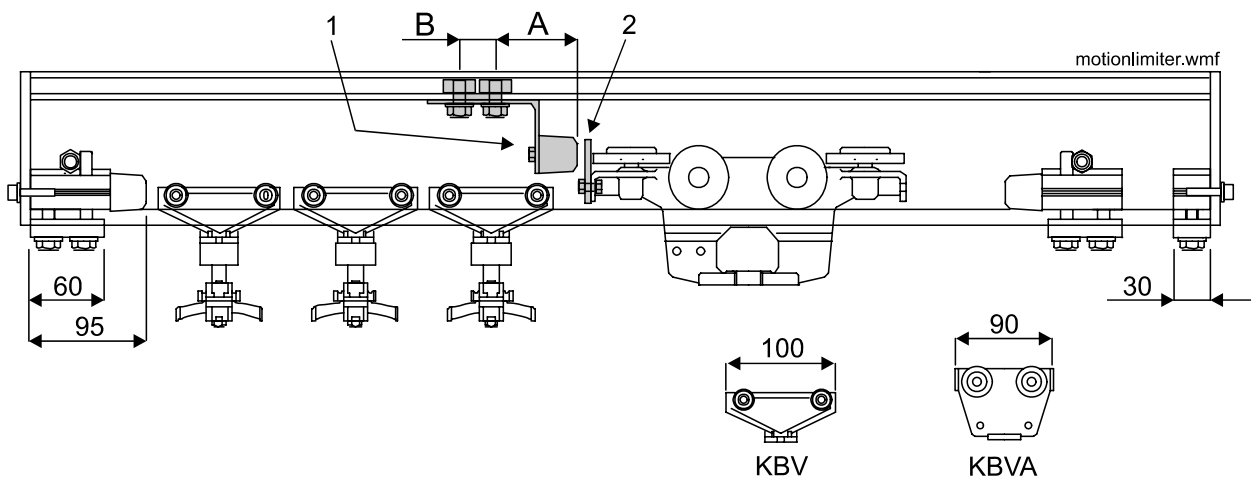


Figure 17: installation of motion limiter

Motion limiters (1) are used to create a buffer zone for cable trolleys in a rail end. How long the buffer zone needs to be depends on the number and type of cable trolley being used. For information on how to calculate the number of cable trolleys, see point 15.1.

One or two holes needs to be drilled (the number of holes depends on the rail type) in the centre of the T-slot of the rail to be able to install the motion limiter. For drilling data, see the table below. On trolleys that will work against a motion limiter there must be a motion limiter plate (2) installed. Also see point 6.2. Check that no suspension bolts will be located at the same place as the motion limiter.

	BGR 85	BGR 125 / BGR 160A
A	38 mm	60 mm
B	–	36 mm
∅	1 × 9 mm	2 × 13 mm

Table 3: drill measures for motion limiters

7.3 Walter bolt type WBM

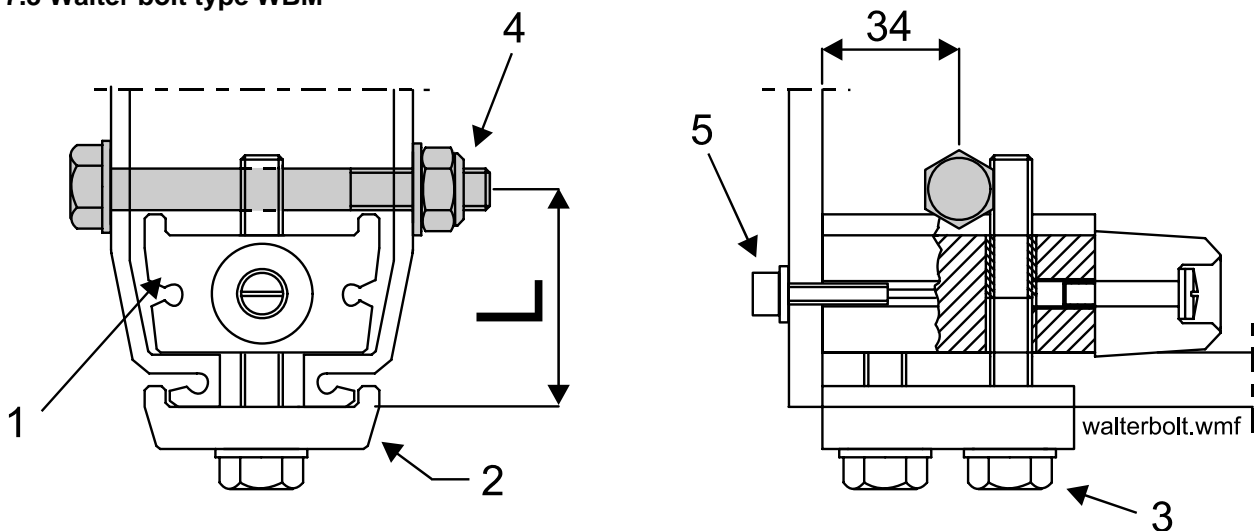


Figure 18: installation of Walter bolt and end stop

- 1. Holder for the rubber bumper
- 2. Lock plate
- 3. Bolt
- 4. Walter bolt (bolt, washer and nut)
- 5. End plate screws (2x)

The Walter bolt is used to enhance the safety of the system, as it will make it impossible to push the end stop out of the rail. See the table below for the position and the diameter of the hole. Do not deform the rail when tightening the bolt.

	SPR 85	SPR 125	SPR 160A / SPR 295B / SPR 295W
L (mm)	49	52	56
Ø (mm)	12,5	12,5	12,5

Table 4: drilling position of the hole for Walter bolts

8. Location of suspensions

9.1 Location of suspensions

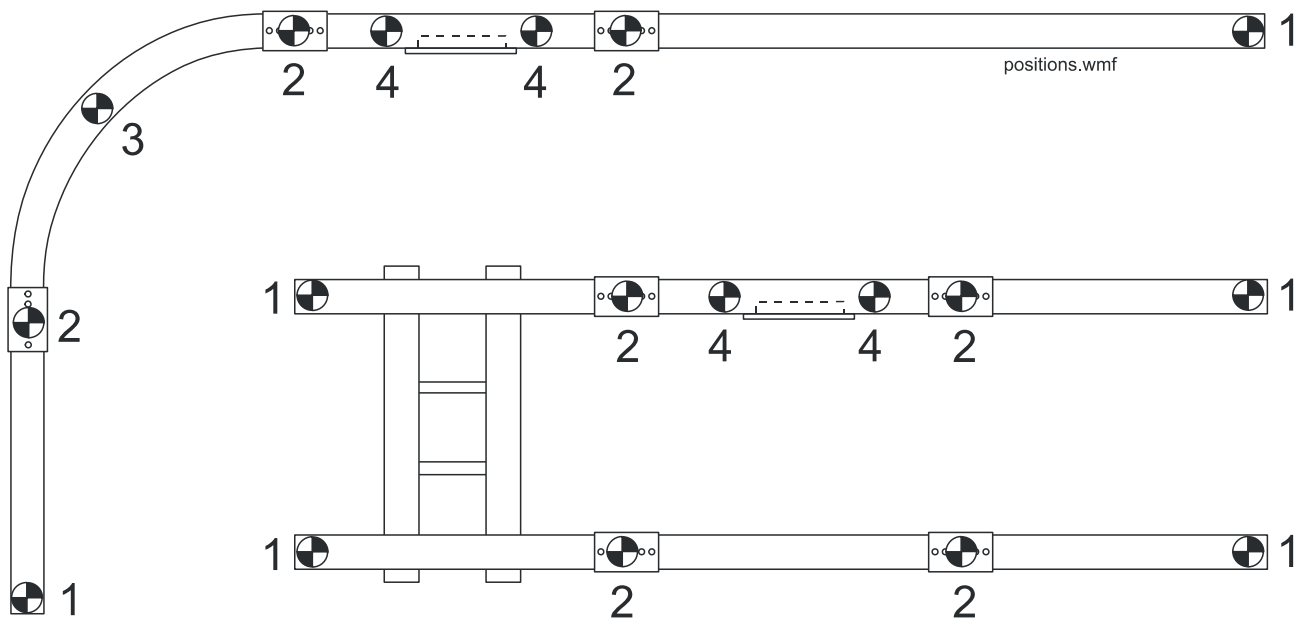


Figure 19: suspension points

The above figure shows at which points it is necessary to install suspensions for different types of systems. It may also be necessary to use more suspensions in order to keep the deflection of the rails within the permissible limits. See the diagram in point 18.3.

1. **Rail ends:** always install a suspension at the ends of each rail.
2. **Connections:** each connection must be supported by a suspension placed directly on to the connection.
3. **Curves:** each curve must be suspended by at least one suspension in the centre of the curve.
4. **Service sections:** each service section must be suspended by at least two suspensions, one on each side of the hatch. Also see point 5.1.

9. Suspensions

9.1 General about suspensions

Never use any suspensions or fixing material in any other way than recommended in this manual. Check that the beams and suspension points that will be used can carry the maximum load of the system (max. load to lift + weight of system). Furthermore may no suspension be exposed to higher side forces than 10 % of the permissible max. load. Tighten all bolts according to the table in point 18.2.

We recommend that each suspension and its attachments should be thoroughly inspected by someone with adequate knowledge before the system is tested or used.

9.2 Z-suspension type DZ

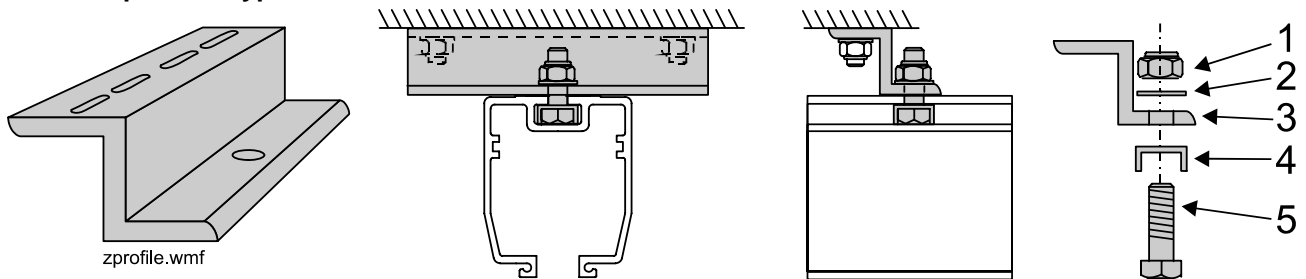


Figure 20: installation of DZ

1. Nut
2. Washer
3. Z-profile
4. Clamp
5. Bolt

Z-suspensions are installed directly to the T-slot in the rail and is attached to the roof or a roof beam. Max. load for DZ 85 is 1000 N while DZ 125/160A manage 6000 N.

9.3 I-beam clamps typ VBKLA

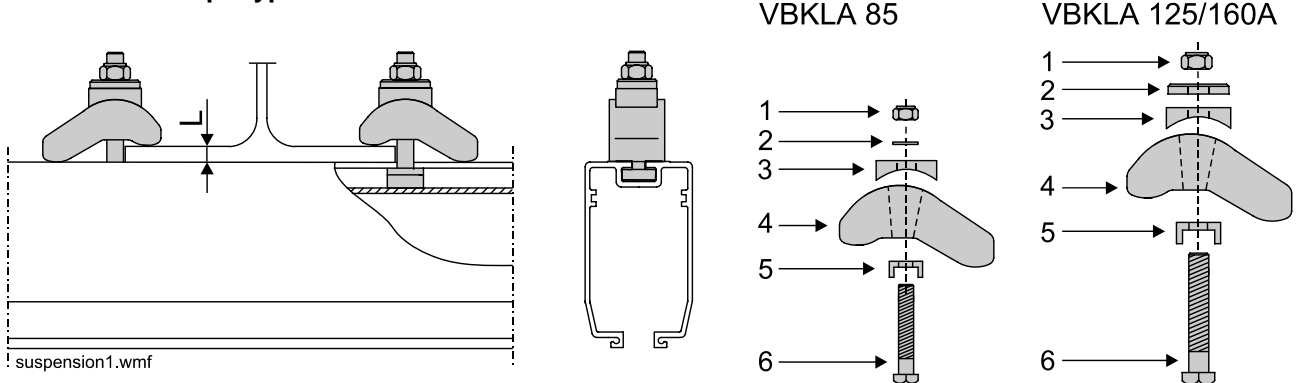


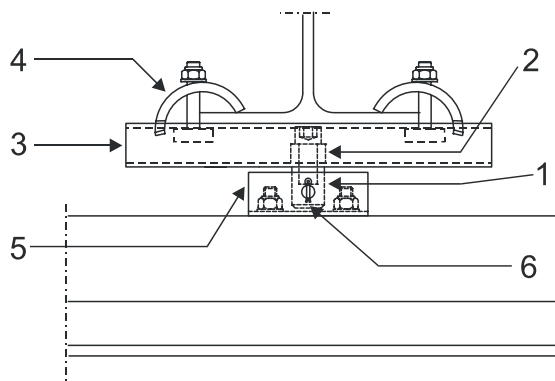
Figure 21: installation of VBKLA

1. Nut
2. Washer
3. Sliding washer
4. Clamp
5. T-slot profile
6. Bolt

I-beam clamps are installed directly to the T-slot in the rail and are attached to a beam flange. Max. load for VBKLA 85 is 1000 N while VBKLA 125/160A manage 6000 N. I beam clamps type VBKLA accepts a beam flange thickness (L) from 5 – 20 mm. I-beam clamps type VBKLA can not be installed on a connection.

9.4 Flexible suspensions type DBSU

DBSU 85-100



DBSU 125/160A-600

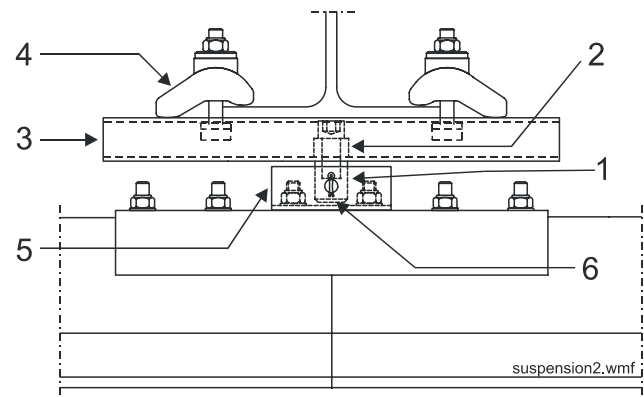


Figure 22: installation of DBSU

Flexible suspensions are installed either to the T-slot of the rail (as shown for DBSU 85-100) or on a connection (as shown for DBSU 125/160A-600). Two of the bolts of the connection are used in the later case to fit the bracket to the connection. The suspension is then attached to a beam flange. This type of suspension can be installed in any angle in relation to the rail. Max. load for DBSU 85-100 is 1000 N while it for DBSU 125/160A –600 is 6000 N.

Fit the cube (1) and the spacer sleeve (2) to the suspension profile (3). Then fit the I-beam clamps (4) to the suspension profile. Attach the suspension profile to the beam flange with the I-beam clamps. Fit the bracket (5) to the Movorail profile or to the connection. Fit the bracket to the cube with the aid of the cylindrical pin (6). Secure the pin with the split cotter pins.

If this type of suspension is installed both directly on to the rail and on connections in the same system, the supplied washers must be placed between the rail and the bracket on those suspensions installed directly on the rail to keep the rail horizontally aligned over the whole length.

9.5 Adjustable suspensions type ASU

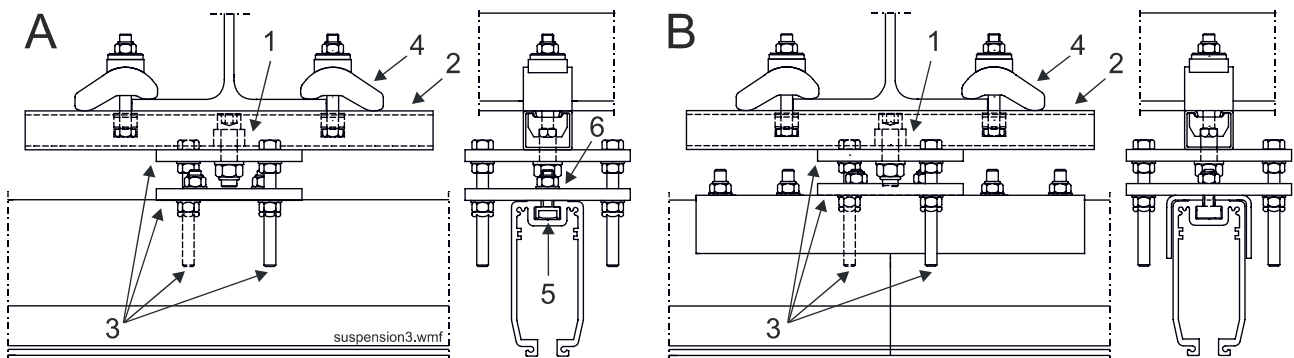


Figure 23: installation of ASU

Adjustable suspensions are installed either to the T-slot of the rail (A) or on a connection (B). Two of the T-slot bolts of the connection are used in the later case to fit the plate to the connection. The suspension is then attached to a beam flange. This type of suspension can be installed in any angle in relation to the rail and be adjusted 50 mm in height. Max. load is 6000 N.

Fit the socket head cap screw and the sleeve (1) to the suspension profile (2). Fit the two plates and the adjustment screws (3) to the suspension profile. Then fit the I-beam clamps (4) to the suspension profile. Attach the suspension profile to the beam flange with the I-beam clamps. At installations directly on the rail the two T-slot bolts (5), which is supplied with the suspension, must be used to attach the rail to the suspension. There must also be a washer (6) between the nuts and the lower plate. At installations on a connection the two bolts in the centre of the connection are used instead and no washer should be installed between the nuts and the lower plate.

10. Safety cables for suspensions

10.1 Safety cable type SLU

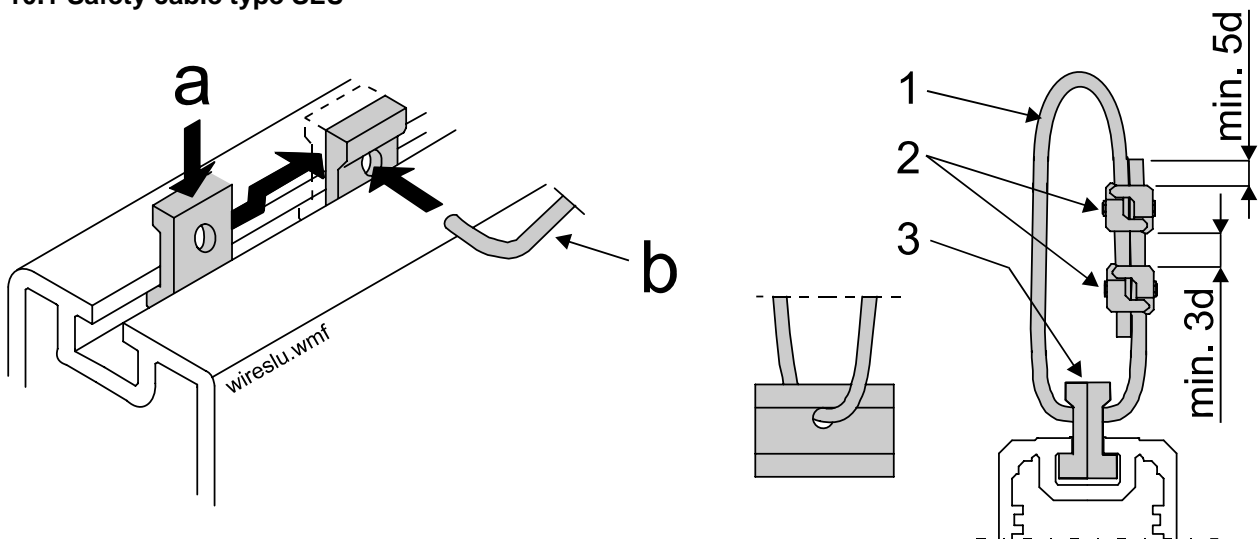


Figure 24: installation of safety cable type universal

Safety cables type SLU are used to enhance the safety of suspensions. The safety cable is put around any safe point that can support the load, such as a roof beam. The L-profiles makes it possible to add safety cables to a system at any time without any disassembly. The cable is 1,5 m long and is cut to fit the application. The cable should be installed with a minimum of slack so that the fall height is minimised.

Insert the L-profiles (a) one by one in to the T-slot of the profile. Then put the cable (b) trough the holes in the L-profiles and put the cable around the safe point (beam, roof beam etc.) Connect the ends of the cable using the cable locks. Install the cable locks with a distance between them and with a length of the projecting ends corresponding at least to the figure above.

1. Cable
2. Cable locks (a minimum of two locks must be used)
3. L-profiles

Rail	Cable designation	Cable diameter (d)
SPR 85	SLU4	4 mm
SPR 125 / SPR 160A / SPR 295B / SPR 295W	SLU6	6 mm

Table 5: cable diameter

11. Installation of current track

11.1 General about current track

The current track is installed in the Movorail rails. The supply to the current track is connected to the power supply track that is installed in one of the rail ends. Sometimes, however, it may be necessary to install power supply tracks in both ends of the current track, due to the power required. See below figure.

Carry out the electrical connections to the current track as described in point 11.5. Make sure that the voltage and current that will be transmitted in the current track lies within the permissible limits. See table in point 18.4. A qualified electrician must carry out all electrical connections.

11.2 Installation of current track type SB

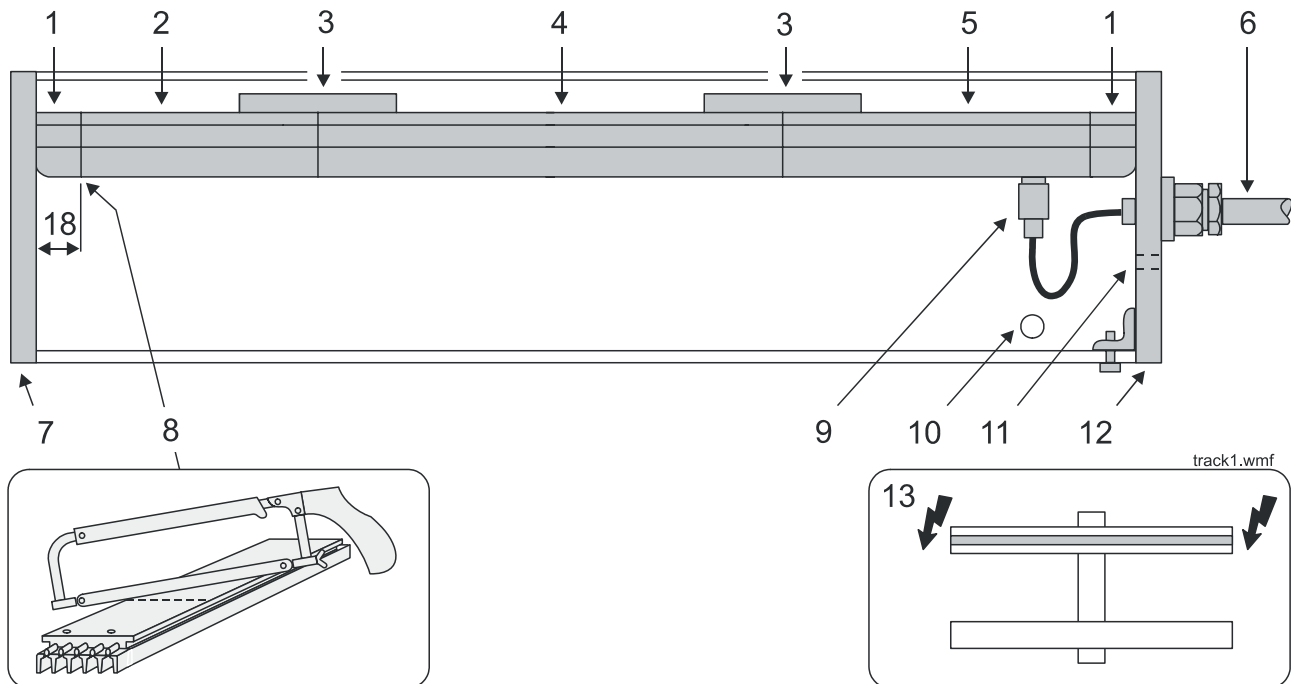


Figure 25: components to current track

If the current track is not delivered from factory cut to fit the total length of the rails, it may be necessary to cut one of the current tracks to make the total track length the same as the total rail length. This operation is also necessary as the track ends only can be fitted to a straight track end and not to a track end used for track connections, see point 11.4. Never cut a power supply track. Also drill a hole in the aluminium profile at the power supply track to be used for earthing of the Movorail profile. Also see point 11.5.

1. Track end type EST 5 + LED 5
2. Current tracks type SB, cut
3. Track connection type ATSK 5
4. Current track type SB, uncut
5. Power supply track type ATSA 5
6. Cable
7. End plate type TPL
8. Place of cut
9. Cable clip, see point 11.5
10. Hole for earthing of the rail, see point 11.5
11. Hole for earthing of the end plate, see point 11.5
12. End plate type TPLH with cable gland PG16
13. Example of power supply at both ends

11.3 Insertion of current track in to the Movorail profile

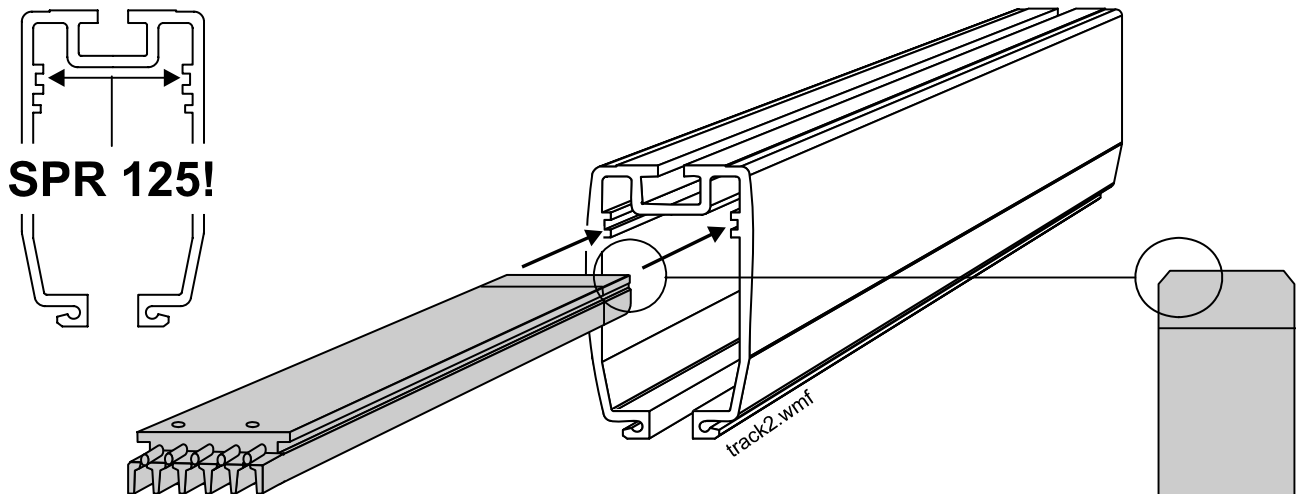


Figure 26: insertion of current track

The current track is inserted in to the grooves in the profile. Use the top grooves in SPR 125! Install the current tracks before any trolleys are inserted into the profile. The track end of the first current track can be slightly chamfered to simplify the insertion. Chalk can be used as lubricant to reduce the friction. Never use any oil or silicone based products as lubricants.

11.4 Connection of current tracks with current track connection type ATSK 5

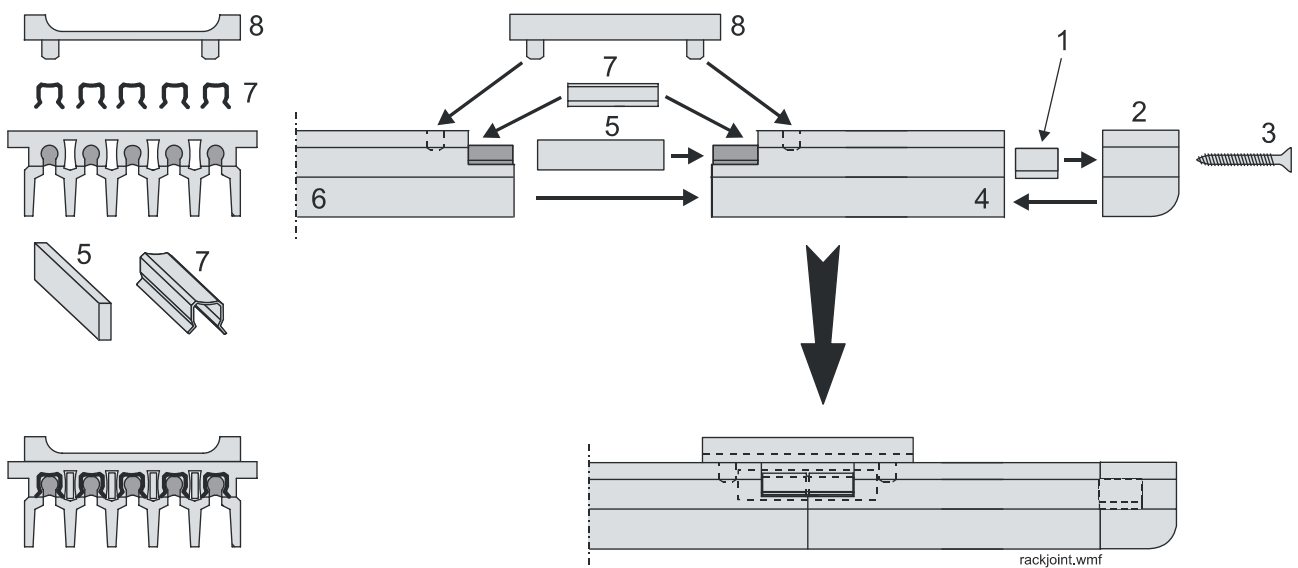


Figure 27: connection of current tracks

Insert the plastic pins LED 5 (1) in the track end (2). Attach the track end with the aid of the two screws (3) to the end of the first current track / power supply track (4) and then insert the track into the profile until the first connection. Insert the four insulation pieces (5) in to the first current track and put together the next current track (6) with the first so that the insulation pieces enter both tracks. Snap on the five collars (7) over the copper conductors and snap on the track connection plate (8) so that rails gets connected. Insert the connection and the current track until the next connection and repeat the procedure until the whole current track is installed. At last, install a track end on the finishing current track / power supply track.

11.5 Electrical connection of current tracks with power supply track type ATSA 5

ATSA 5

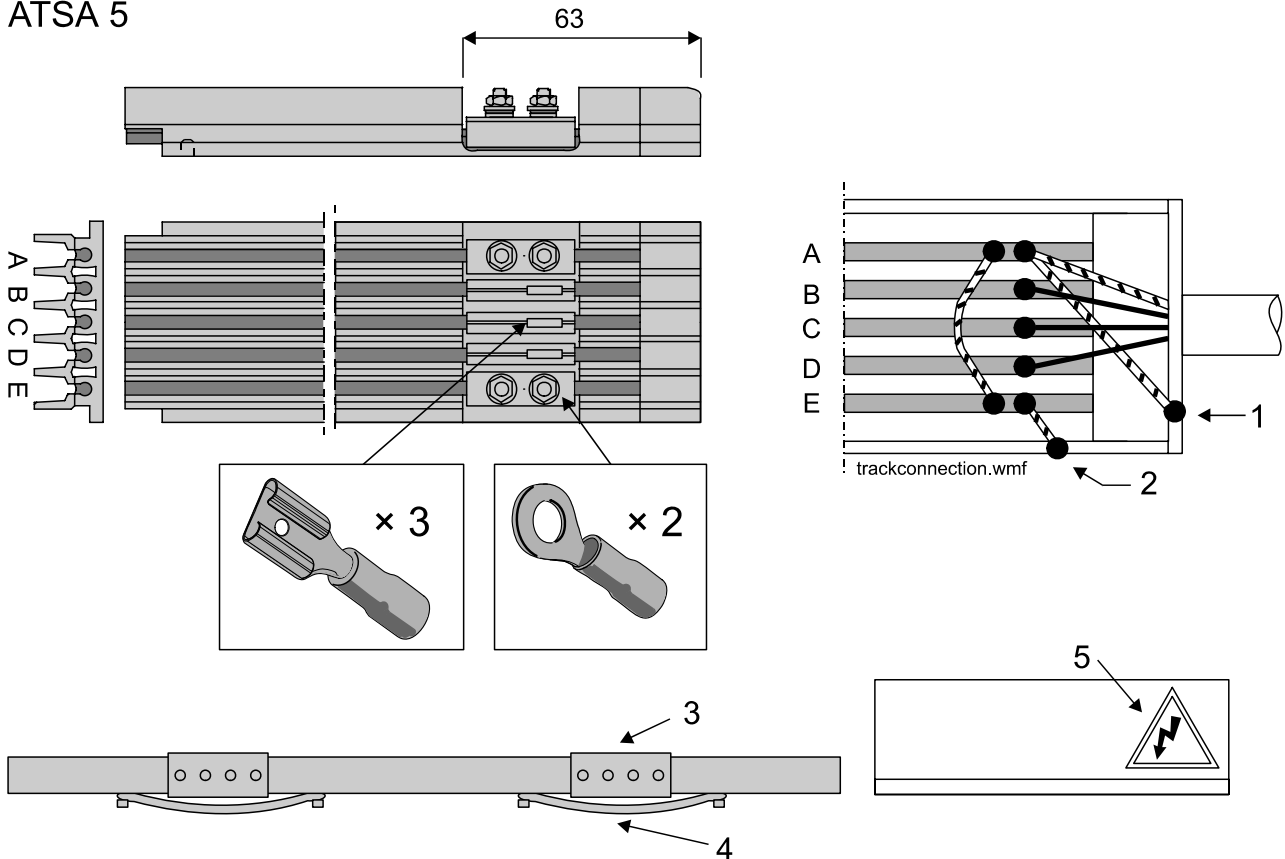


Figure 28: electrical connection of current track

The power supply track ATSA 5 has five connection points for cable clips. The two outer are for screw connection while the three in the centre are for pin connection.

Proper earthing is important for the safety. Connect earth to the pre-drilled M3 Hole in the end plate (1) and to the profile (2). At every connection (3) an earth cable (4) should be installed over the connection in order to earth the whole rail. This requires the drilling of a hole in the beginning of each rail and at each side of a connection. Clean the end plate and the profile from any oxide and anodising before the earth leads are connected to ensure good contact. Carry out the connections to the current track according to the figure and the table. At last, affix a warning sign (5) at both ends of the rail.

If the track has been stored before it is installed, it may be need to be cleaned from oxide before it is used. Spray along the track with a contact spray, e.g. Electrolube SOB, Scotch 1607 or equivalent. Let the spray work for a while before using the track. Never spray with the power on.

	A	B	C	D	E
Supply 1 x 230 VAC	PE	L1	N	L1	PE
Supply 3 x 400 VAC	PE	L1	L2	L3	PE
Cable with number leads	Yellow/green	1	2	3	Yellow/green
Cable with colour leads	Yellow/green	Brown	Black	Black/white	Yellow/green

Table 6: connection of power supply track

12. Flexible bolt connection for trolleys and trolley safety cable

12.1 Installation of flexible bolt connections type BUB between trolleys and crane rail

BUB 85

BUB 125/160A

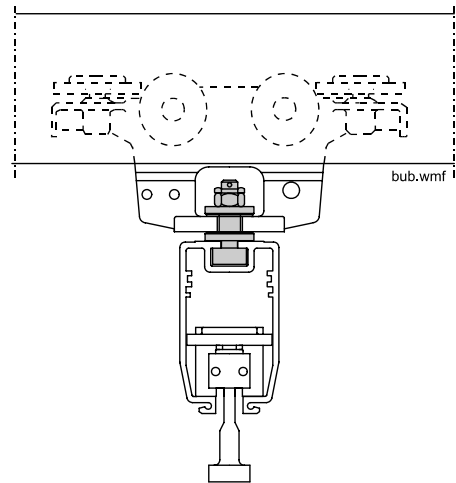
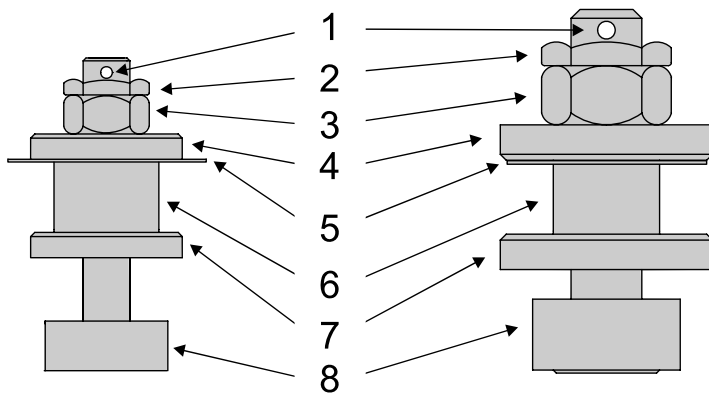


Figure 29: flexible bolt connections type BUB

- | | |
|--|------------------------------|
| 1. Split cotter pin | 5. Plastic washer |
| 2. Lock nut | 6. Distance sleeve |
| 3. Nut | 7. Lower washer (chamfer up) |
| 4. Upper washer (BUB 85 = chamfer up, BUB 125/160A = chamfer down) | 8. T-slot bolt |

BUB:s should always be used to attach a trolley to a rail, never replace them by another component. Also always install the safety cable supplied with the BUB, see below. Note! Check so that the chamfer of the washers are correctly positioned and that the plastic washer is not stuck between the upper washer and the distance sleeve! Use the correct tightening torque. See table 7 below.

Tightening torque		BUB 85	BUB 125/160A
Dry threads	(Nm)	23,0	77,8
Oiled threads	(Nm)	20,6	69,7

Table 7: BUB tightening torque

12.2 Installation of trolley safety cable type SLV

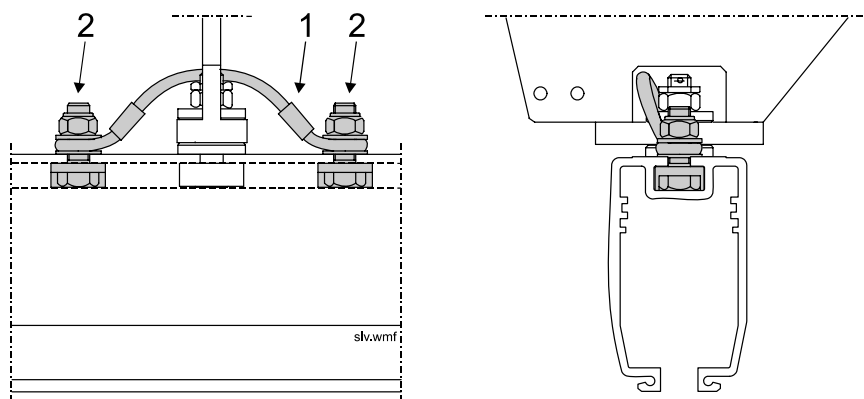


Figure 30: safety cable type SLV

A trolley safety cable type SLV is supplied with each BUB and shall be installed together with it. Two sizes exist, SLV4 for rail SPR 85 and SLV6 for SPR 125, SPR 160A, SPR 295B and SPR 295W. Install the cable (1) trough the trolley and attach it to the rail using its loops and the two T-slot bolts (2).

12.3 Installation of flexible bolt connections type TBUB between trolleys and crane rail

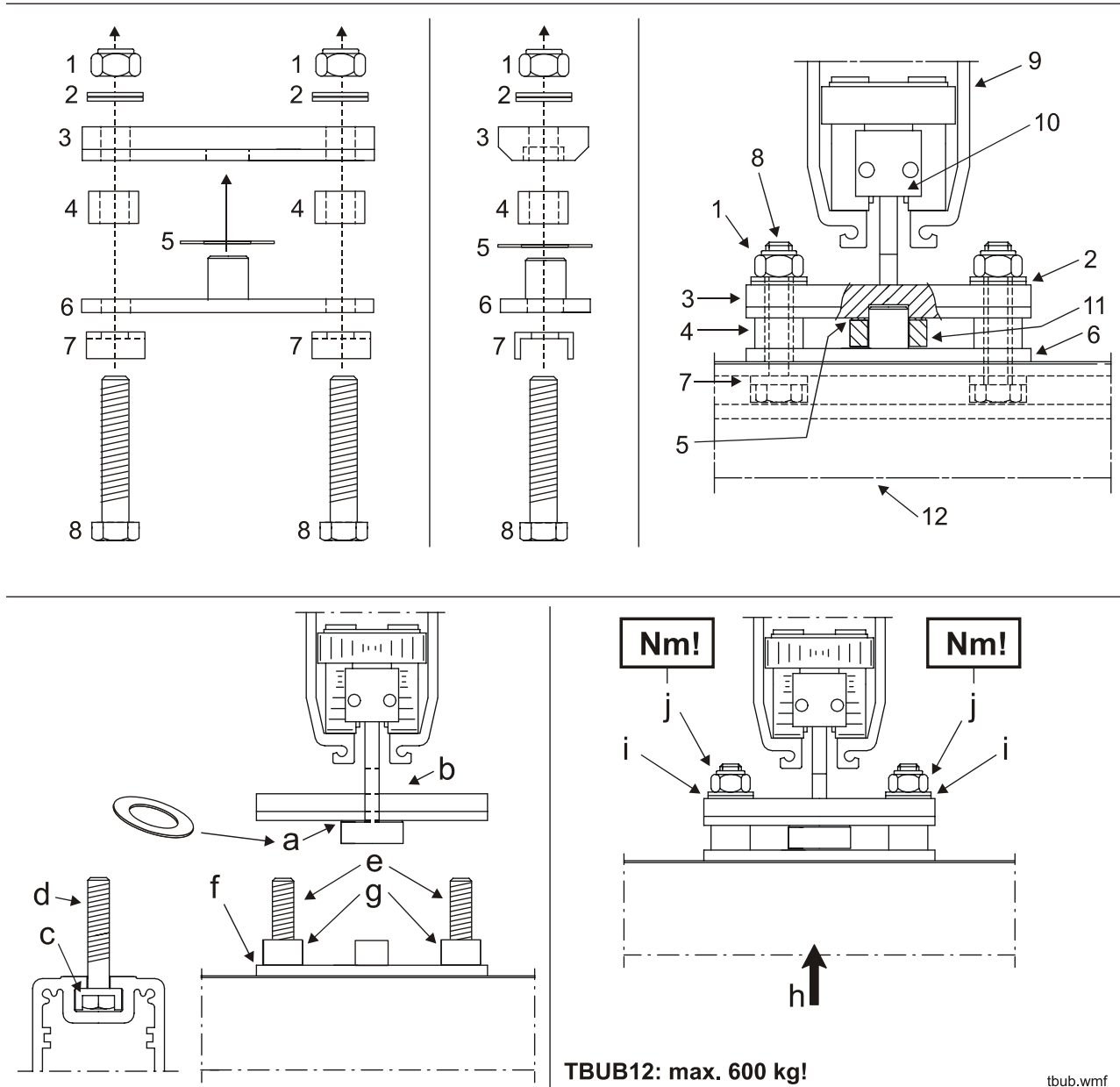


Figure 31: flexible bolt connection type TBUB

- | | | |
|--------------------|-------------------|----------------------------------|
| 1. Nut | 5. Plastic washer | 9. Movorail profile |
| 2. Washer 2 x | 6. Beam with pin | 10. Trolley |
| 3. Upper beam | 7. T-slot profile | 11. Trolley load attachment beam |
| 4. Distance sleeve | 8. Bolt | 12. Movorail profile |

TBUB:s are used to connect a trolley to a rail. Put the plastic washer (a) on to the trolley load attachment and put the upper beam (b) in place. Then insert the T-slot profiles (c) which are put on the bolts (d) in to the Movorail profile. Adjust the bolts (e) so that the beam with the pin (f) and the distance sleeve can be placed on the bolts. Push up the Movorail profile and fix it to the trolley by means of the washers (i) and nuts (j). Tighten the bolts with the correct torque. For dry bolts use 77,8 Nm and for oiled 69.7 Nm.

13. Crane distance trolley and distance girders

13.1 Flexible distance girder type DNS

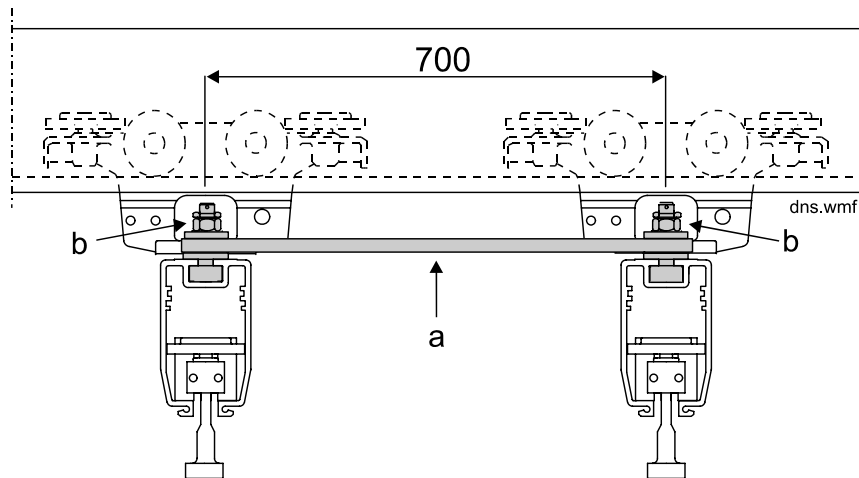


Figure 32: flexible distance girder type DNS

The flexible type of distance girder separates two crane rails of type SPR 125, SPR 160A, SPR 295B or SPR 295W. The rails may move around the BUB. The distance girder (a) is attached by two BUB:s 125/160A (b). For installation of BUB 125/160A, see point 12.1.

13.2 Rigid distance girder type SD

The rigid type of distance girder separates two crane rails of type SPR 125, SPR 160A, SPR 295B or SPR 295W. The rails are fixed in relation to each other. Except from this the rigid type of distance girder is installed and functioning in the same way as the flexible with the exception that four T-slot bolts are used for the attachment instead for two BUB:s.

14. Switches and turntables

14.1 General about switches and turntables

Switches and turntables are delivered completely assembled. If a current track kit is ordered to the switch (SBHX or SBVX) or the turntable (SBVS), then this is installed as well.

Switches and turntables are operated pneumatically. The air pressure must be at least 6 bar. We recommend only using filtered air.

When a switch or a turntable is installed it is important to adjust them so that the trolleys can pass them without problems.

14.2 Switches type HXL and VXL

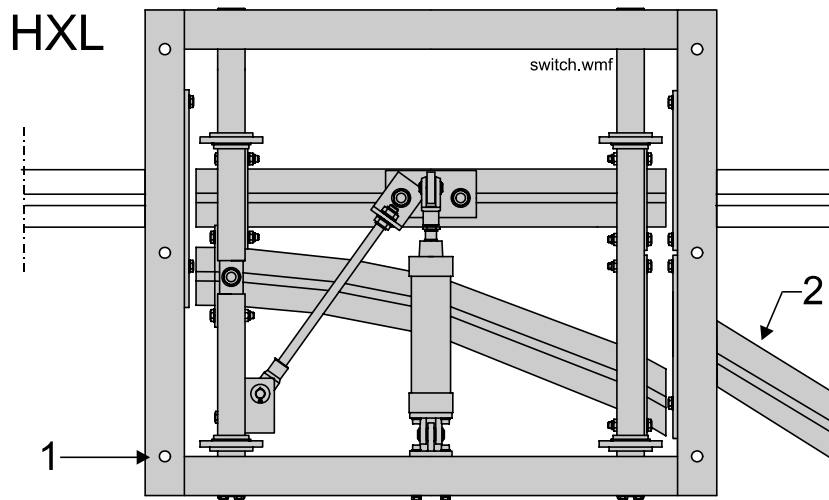


Figure 33: installation of switch (seen from above)

Switches come in a right (HXL) and a left (VXL) version. The switches are suspended from the six suspension holes (1). The connection rail (2) must be used in order to connect the rail system to the curved rail section in the switch. This rail is 1000 mm long and is included in the switch delivery.

14.3 Turntables type VSL

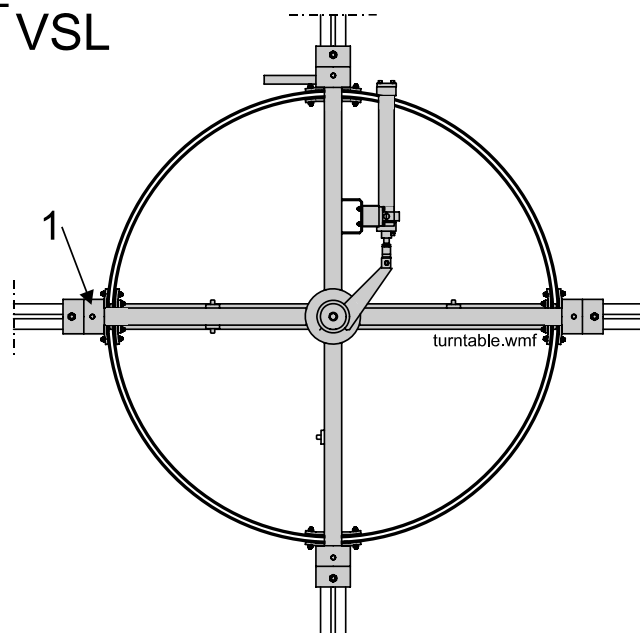


Figure 34: installation of turntables

Turntables are suspended from the four suspension holes (1).

15. Cable loop

15.1 Installation of cable loop

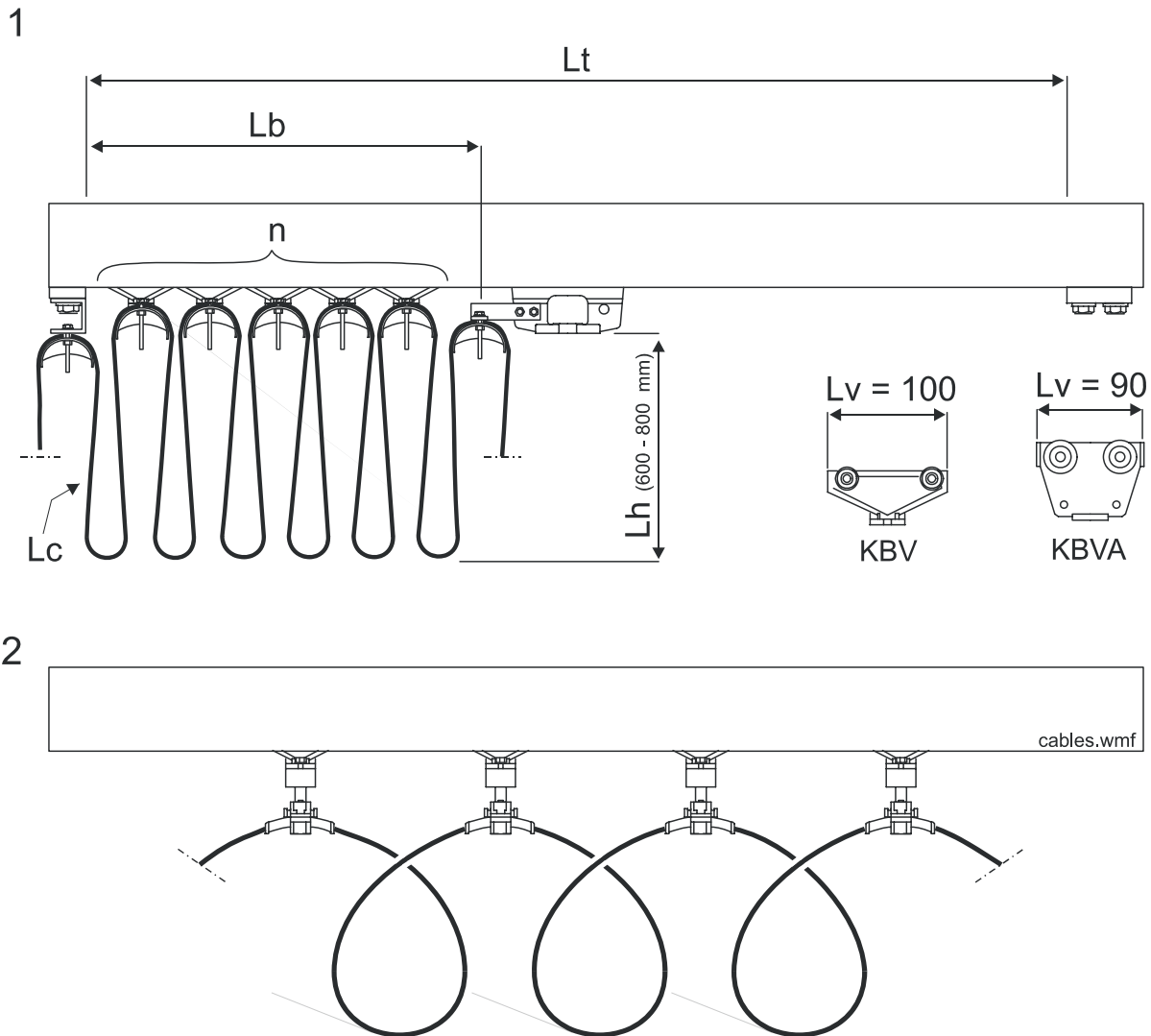


Figure 35: cable loop

Cable loop can be done with flat cable (1), round cable (2) or hose (2). The same calculations are used for all types of cables and hoses to calculate the necessary number of trolleys, the buffer zone length and the length of the cables.

Always check so that the trolleys roll on their wheels and not are lifted up in the rail by the cables or the hose. Always use flexible cables or hoses which are made for continuous motion and that can withstand the environment in question. If in doubt, contact your cable or hose supplier.

Select the conductor cross-section area with respect to the power that will be transmitted. Keep in mind that long cables may result in a voltage drop that necessitates the use of a greater conductor cross-section. See point 18.6. Avoid using cables with less conductor cross-section than 1 mm² as they may break due to the forces acting on the cable.

Number of trolleys	Length of buffer zone	Length of cables
$n = L_t / (L_h \times 2)$	$L_b = n \times L_v$	$L_c = L_t + L_b \times 1,15$

L_t = total length of travel for cables

L_b = length of buffer zone

n = necessary trolley quantity

L_c = length of cables (hoses) in the loop

L_h = loop height (600 – 800 mm is recommended)

L_v = length of cable trolley being used

16. Testing the Movorail system

16.1 General about testing of the Movorail system

The system must be tested when the installation is completed. Follow all applicable instructions below. Please note that national and international regulations may call for further tests. The test area should be closed during all tests, only persons who are involved in the testing procedures may enter the area.

16.2 Inspection points at a test of a Movorail system

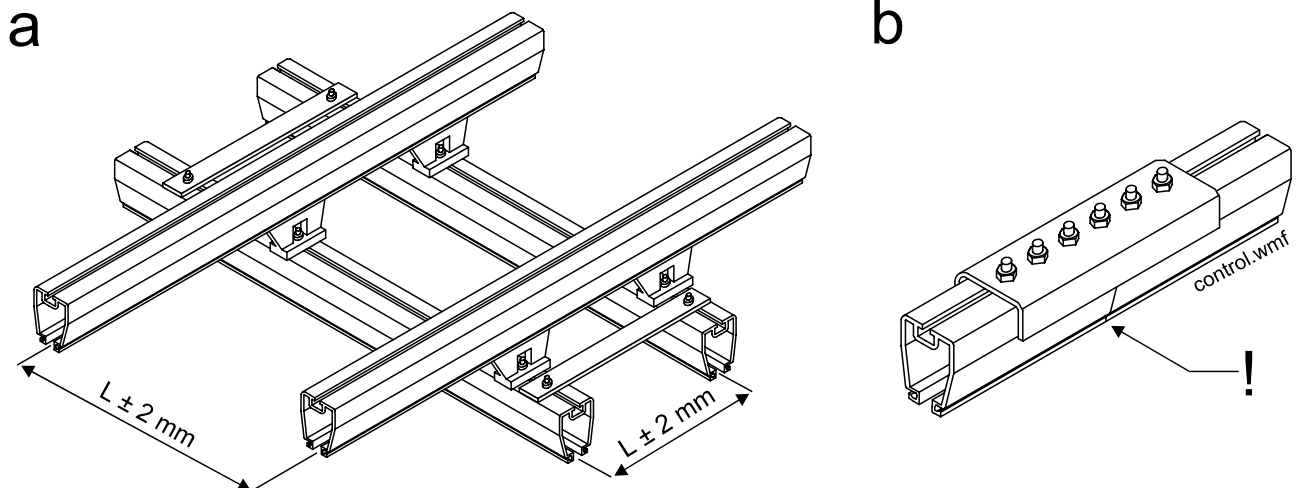


Figure 36: inspection of the system

1. Check the system against the drawing, if any is available.
2. Make sure the system is marked with an adequate number of max. load sign.
3. Check the span (a). Max. permissible parallel deviation between the rails is ± 2 mm.
4. Check so that there is no gap between the rails at the connections (b).
5. Check so that no rails are deformed or that they are subjected to any twisting or bending forces.
6. Check the tightening torque for all bolt connections, BUB;s, suspensions, connections and safety cables.
7. Test any electrical systems. Perform at least a continuity check of the bonding circuit, an insulation resistance test and a voltage test. Also make sure that the system is equipped with a lockable main switch placed beside it and that warning signs for electrical equipment are applied.
8. Run the system without load. Check all functions. Adjust.
9. Run the system with 25 % overload. Check all functions. Check all critical components after the test, especially bolt connections.
10. If rails of type SPR 295W are used, check so that there is no cracks in the weldings between the upper and the lower rail.
11. At last, check all rail and trolley tolerances again. Adjust if necessary.

17. Training and user instructions

17.1 General about training

All operators should have the sufficient training before the equipment is taken into use. The training required depends on the type of equipment and has to be defined on a case to case basis. The following instructions, however, apply to most types of equipment and are the basic information all users should be given. Also make sure that all users fulfil the requirements below.

1. Only those who are at least 18 years old may use the equipment.
2. Only those who are authorised by their superiors may use the equipment.
3. Only those who have been trained may use the equipment.
4. Only those who know all safety devices and operating controls of the system may use the equipment.

17.2 User instructions

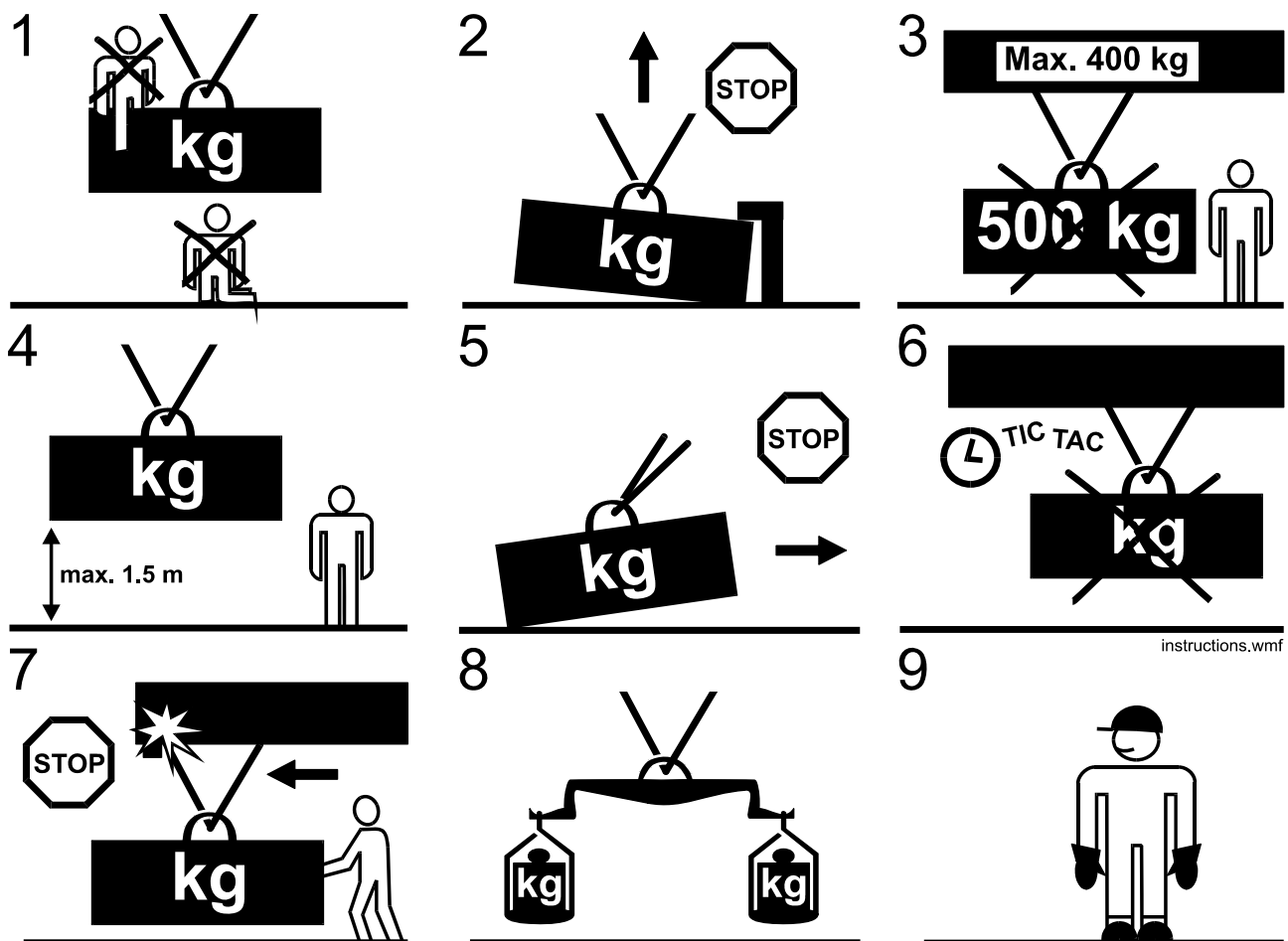


Figure 37: user instructions

1. Never move people with the system. Never lift loads above people.
2. Never force loads that are stuck or jammed, to move.
3. Never apply overload to the system.
4. Avoid lifting loads higher than 1,5 m above floor level.
5. Never pull loads along the floor.
6. Never leave hanging loads unattended at any time.
7. Never push loads intentionally into the end stops.
8. Always try to lift loads from their centre of gravity.
9. Wear hard hat, safety shoes and protective gloves at all times.

18. Technical data

18.1 Data for the Movorail profiles

	SPR 85	SPR 125	SPR 160A	SPR 295B	SPR 295W	SPF 135
Material	Anodised extruded aluminium					
Colour	Natural aluminium					
X (mm)	85	125	160	295	295	135
C (mm)	68,8	71,5	73,5	73,5	73,5	70
Standard profile lengths (m)	4 / 5 / 6 / 8	4 / 5 / 6 / 8	4 / 5 / 6 / 8	4 / 5 / 6 / 8	4 / 5 / 6 / 8	3,6 / 4,6 / 5,6
Inertia (cm ⁴)	97	333	812	1368	3700	556
Weight / meter (kg/m)	3	5	7,8	14	14,1	6,2
Profile area (cm ²)	11	18,6	28,7	51,5	51,5	22,8
Modulus of elasticity (N/mm ²)	70 000	70 000	70 000	70 000	70 000	70 000

Table 8: profile data

SPR 85, SPR 125, SPR 160A

SPR 295B, SPR 295W

SPF 135

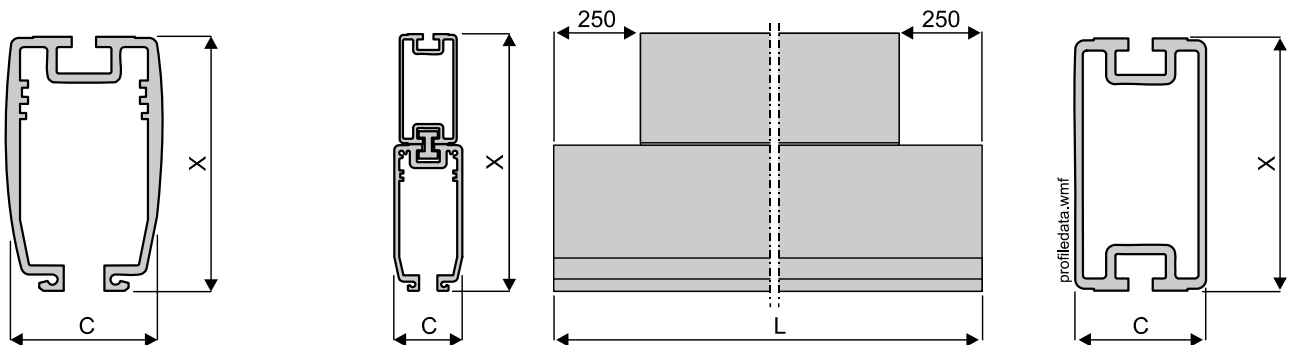


Figure 38: profile dimensions

18.2 Tightening torque for bolts

The table is valid for both normal bolts and T-slot bolts. The bolt grade is normally embossed on the bolt heads, see the figure below. We recommend using at least bolt grade 8.8. Use a calibrated torque wrench to gauge the torque.

Bolt dimension	Grade	Zinc-pl. dry	Zinc-pl. oiled
M6	8.8	9,4 Nm	8,4 Nm
M8	8.8	23,0 Nm	20,6 Nm
M10	8.8	45,1 Nm	40,4 Nm
M12	8.8	77,8 Nm	69,7 Nm
M16	12.9	319,6 Nm	286,3 Nm

Table 9: tightening torque for bolts

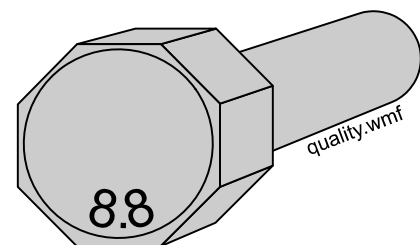


Figure 39: bolt grade

18.3 Load diagram for a rail with a single load

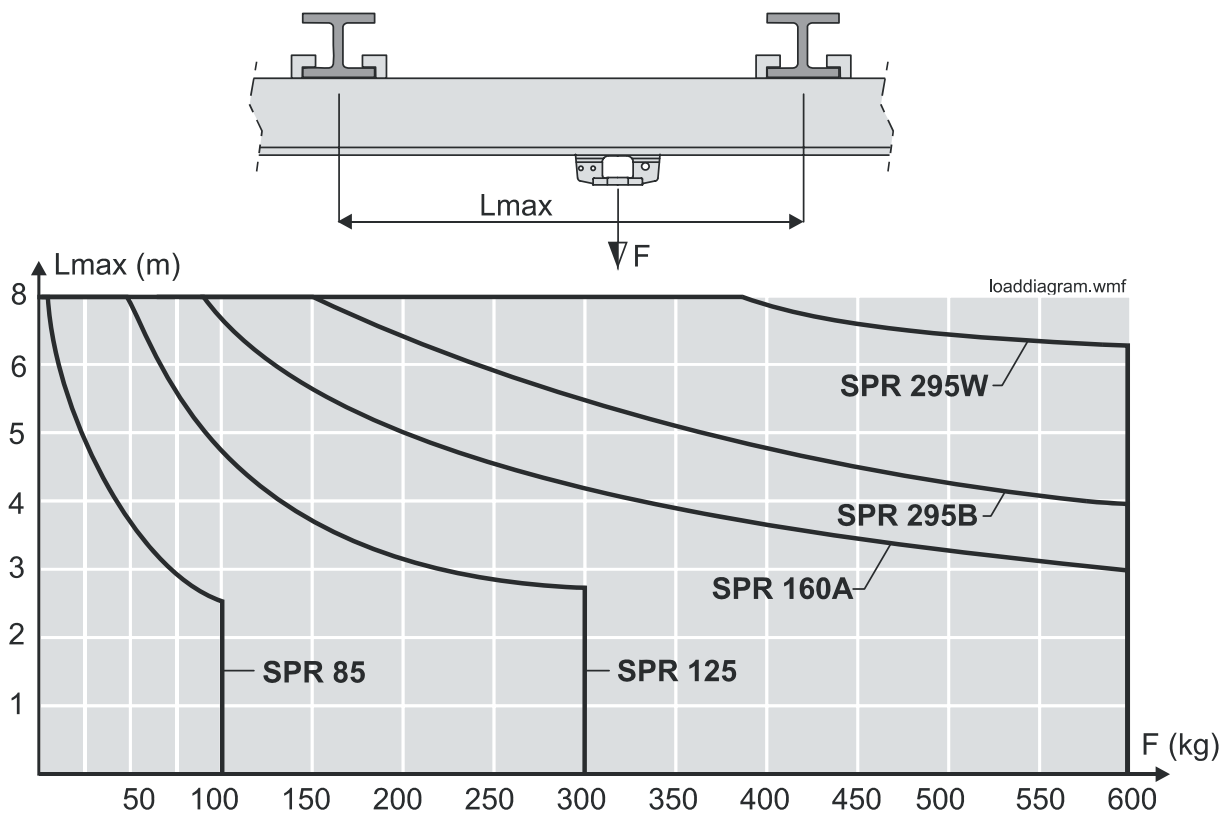


Figure 40: diagram for max. recommended distance between suspensions at a single load

The diagram is based on a maximum deflection of 1/500 of the distance between the suspensions (L_{max}) and shows the maximum recommended distance between the suspensions at a given load.

18.4 Technical data for current track type SB

Max. voltage	400 V	Current track conductor cross-section	9 mm ²
Protection class	IP 21	Max. current track	55 A
Ambient temperature	-20°C – + 55°C	Max. current connection	25 A
Voltage drop	0,103 V / m @ 25 A	Max. current power supply track	25 A
Max. speed straight rails	2 m/s	Max. current pick up @ 60 % ED	10 A
Max. speed curved rails	0,5 m/s	Max. current pick up @ 100 % ED	6A

Table 10: technical data for current track

18.5 Voltage drop in cables

Long cables may lead to a significant voltage drop that may lead to malfunctioning. To avoid this it may be necessary to increase the conductor cross-section. The formulas below can be used to calculate the voltage drop. If the voltage drop exceeds 5 % (Ufactor less than 0,95) of the nominal voltage, a larger cross-sectional area is necessary.

Formula 1. $U_{end} = U_{start} - (2 \times L \times R \times I_{max})$

Formula 2. $U_{end} / U_{start} = U_{factor}$

**Formula 3. $U_{factor} > 0,95 = OK$
 $U_{factor} < 0,95 = \text{not OK}$**

I_{max} = max. current to be transmitted in cable

U_{factor} = voltage drop coefficient

U_{end} = voltage at the end of the cable

U_{start} = voltage at the start of the cable

L = length of cable

R = resistance per meter (see table below)

Conductor area	Resistance / meter (R)
1 mm ²	0,0175
1,5 mm ²	0,0116
2,5 mm ²	0,0070

Table 11: resistivity

Example:

If: $U_{start} = 24 \text{ V}$, $L = 40 \text{ m}$, conductor area = 1,5 mm², $I_{max} = 1,5 \text{ A}$

Then: $U_{end} = 24 - (2 \times 40 \times 0,0116 \times 1,5) = 22,608 \text{ V}$

$U_{factor} = 22,608 / 24 = 0,94$

$0,94 < 0,95 = \text{not OK}$, the voltage drop is too large

Conclusion: a larger conductor cross-section is necessary, e.g. try with 2,5 mm².

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