



Manual

for the design and assembly
of cable drag chain systems



Version 1.2

Foreword

These “installation and assembly instructions” are intended as a handy and concise reference resource to enable cable drag systems to be assembled properly and as easily as possible.

They both provide the designer with fundamental information about the various applications of cable drag chains and facilitate the work of the mechanics installing systems on site.

In line with these tasks, the technical features of cable drag systems and the associated details are given with the necessary accuracy and precision. The drawings and the relevant explanations offer a rapid overview of the technology and specifications.

If you have any queries or require further information, please do not hesitate to contact Technical Support at our head office or in our overseas branches.

We hope that this manual is a useful and reliable resource with regard to cable drag systems and their applications. It does not claim to cover all possible installation variants but instead deals with the most frequent uses and cases.

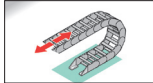
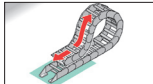





If you have any ideas on how we can improve and complement the manual in the next edition, we would be pleased to hear from you.

With that in mind, I would like to express my thanks for the many interesting discussions we have had with our customers that inspired us to publish this manual.

Helmut Jostmeier
Product Manager



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1.1 Unsupported arrangement

Case example: unsupported arrangement in a Trumpf laser machine.





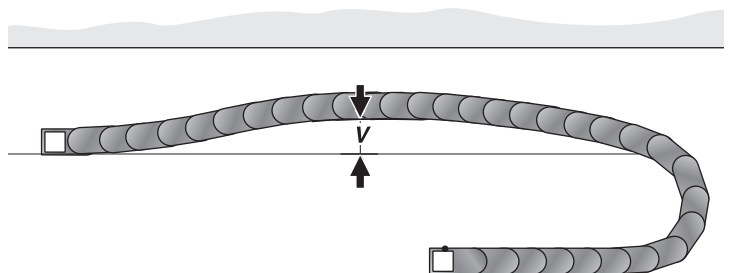
1.1 Unsupported arrangement

Definition: If the upper run of a cable drag chain (called CDC for short) does not touch the lower run over the entire travel distance (stroke), we talk of an “unsupported arrangement”.

Application: This form of CDC is the most common of all types of installation. This arrangement should be applied wherever high dynamic stresses and long life are required.

Specification: Where possible, biased CDC's ($RV = \text{radius with bias}$) must be chosen for this arrangement. CDC's of smaller sizes are only produced in a version with a moderate bias (R). This identification letter along with the radius (e.g. $RV\ 250$) is shown on the chain link. For more information about the available radius combinations, please refer to our current cable drag chain catalogue or the data sheets on the Internet.

Bias V : The bias V makes the upper run arch up slightly when unladen. It then sinks to the horizontal as it is loaded with cables. This ensures an optimal flow of forces in the chain links. The value for the bias V is indicated in mm/m. These data can be obtained from the current data sheet on the Internet.

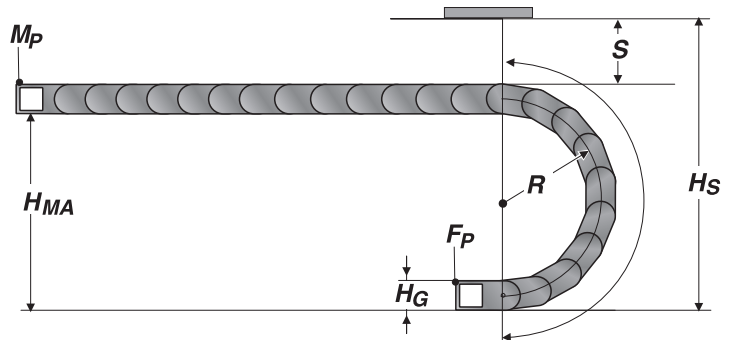


1.1 Unsupported arrangement

Moving end height: The moving end height (H_{MA}) must always be double the chain radius R so that the unsupported chain section (the upper run) and the horizontal chain section (the lower run) run parallel to each other. The upper run is the part that moves and has the moving end connection (M_p) at the chain end, while the fixed chain bracket (F_p) is located at the end of the lower run.

Altezza di montaggio: The required installation height (H_S) is obtained from the calculated height ($2 * R + H_G$) plus a safety distance S to allow for the arching produced by the bias. The figures for the above values that are specific to each type (see data sheet diagram) relate to a maximum possible bias and do not take the loading into account.

Assembly dimensions for an unsupported arrangement:





1.1 Unsupported arrangement

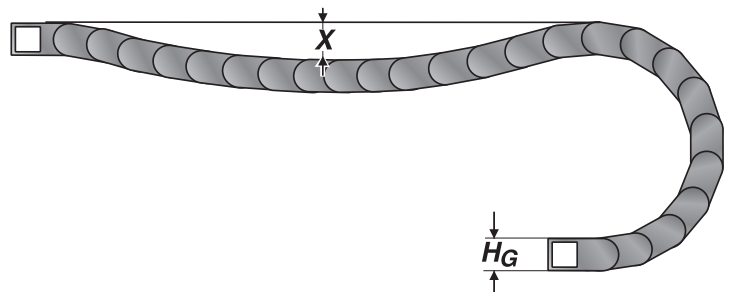
Sag X:

In the installed condition the unsupported section can arch slightly up or down. An arch upwards results from the bias of the chain. This bias is essential in order to counteract the weight of the load. Depending on the load, the arching produced by the bias then goes horizontal or arches downwards – this is known as the sag X.

The approximate value for the maximum sag is roughly the chain link height H_G . Please refer to the data sheet or catalogue for the exact values.

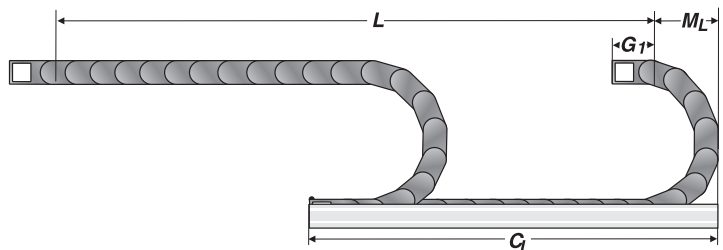
We differentiate between the optimal condition, with a very slight sag FL_g (this range is optimal in terms of service life and unrolling), and the range FL_b with a maximum permitted sag. The latter condition is perfectly acceptable in the vast majority of cases, but it can lead to problems with very great acceleration $a > 15 \text{ m/s}^2$ (1.5 g) and high travel frequencies. If the sag is greater than FL_b , the arrangement is critical and should be avoided. The flow of forces in the side links is not optimal and failure cannot be ruled out. In this case support should be provided for the unsupported section or a gliding arrangement should be chosen.

Should a chain exceed the maximum permitted sag after a very long period of use, replacement is strongly advised.



1.1 Unsupported arrangement

- Load:** The permitted unsupported length (F_L) must be chosen as a function of the travel distance and load in accordance with the type-specific diagrams. The individual product data sheets and the current edition of the cable drag chain catalogue contain extensive tables and diagrams.
- Configuration:** The cables in the chain must be configured in such a way that the centre of gravity of the load is exactly halfway across the width of the chain window (symmetric distribution of weight).
Please contact our support team if you have any questions about the layout of the chain.
- Strain relief:** The energy lines (cables, conduits etc.) must be strain-relieved in or immediately behind both chain brackets.
For more information about strain relief, please refer to page 34 and following.
- Channel length:** The use of a guide channel is essential in order to ensure that the CDC functions smoothly.
The channel length C_L is determined by half the travel distance $L/2$, the length of the chain bracket G_1 and the arc projection M_L .
Please refer to the current catalogue or the data sheets on the Internet for these figures.



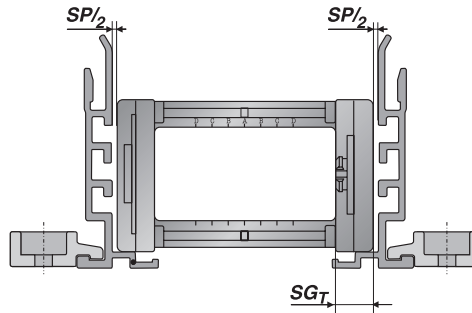


1.1 Unsupported arrangement

Guide channel:

The guide channel must be installed with a lateral clearance (SP) from the CDC over the entire length. The clearance per side ($SP/2$) is determined by the thickness of the side link. It is at least 1 mm and no more than 30 % of the thickness of the side link SG_T . The height of the guide channel should equal the height of the side link H_G if possible. A table giving a comprehensive selection of Murrplastik guide channel systems (referred to below as VAW) can be found in the VAW section of the CDC catalogue.

Cross-section of guide channel with CDC:



Screw connection:

All screw connections of the chain brackets as well as the linkage between the metal angle and the plastic part of the chain bracket, and the linkage between the metal angle or KA-F and the machine must be secured against coming loose by means of special paint (e.g. LOCTITE) or self-locking nuts or bolts..

The use of serrated lock washers, snap rings and other locking means is not permitted!

Tightening torques:

Please refer to the information in Appendix VI (page 55) for the tightening torques required for assembling the chain brackets on the machine/system.

Attention!

The tightening torque on fastening screws and strain relief plates (type ZL) must be checked after about 500 cycles and corrected where necessary. Type RS-ZL strain relief plates and integrated C-profiles are permanently fixed in position after installation and are not subject to this inspection.

1.2 Gliding arrangement

Case example: Lowered moving end connection with back chain links on a BMW engine production line in Birmingham (GB).



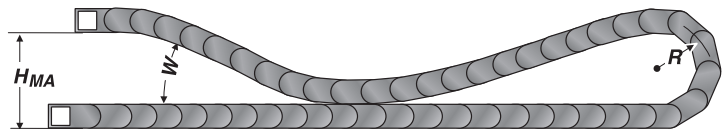
Definition: If the upper run of a cable drag chain glides along the lower run, we talk of a “gliding arrangement”.

Application: This form of a CDC can be found wherever long travel distances have to be covered. The friction that occurs between the upper and the lower run over the travel distance means that the high speeds and accelerations possible in the unsupported arrangement are not possible here.



1.2 Gliding arrangement

- Specification:** Where possible, non-biased CDC's (RK = radius without bias) must be chosen for this arrangement. CDC's of smaller sizes are only produced in a version with a moderate bias. This identification letter along with the radius (e.g. RK 150) is shown on the chain link. For more information about the available radius combinations, please refer to our current CDC catalogue or the data sheets on the Internet.
- Bending radius:** The bending radius for a gliding arrangement should be as small as possible, but the minimum bending radius of the cables to be installed (lines, hoses etc.) must be taken into account. The minimum bending radius should not be less!
- Moving end height:
($R \leq 150$ mm)** The connection height of the moving end connection (H_{MA}) should be no more than double the radius if the bending radius is less than or equal to R 150 mm. ($H_{MA} = 2 \times R$) (height, moving end connection). Angle W must not exceed 15° ($W \leq 15^\circ$).



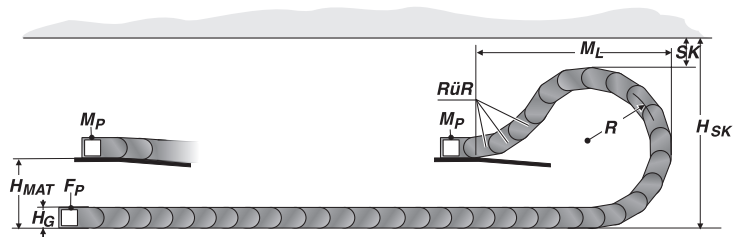
1.2 Gliding arrangement

Gliding arrangement with lowered chain bracket ($R > 150\text{mm}$):

If the chain radius is greater than 150 mm, the moving end connection should be lowered so that the upper run can lie down and start gliding as soon as possible. This considerably reduces the following stresses:

- Internal strains in the chain link that result from excessively long sag until contact is made with the lower run.
- Internal strains caused by oscillation in the area of the sag.

The moving end connection (H_{MAT}) is lowered by means of backward-pivoting chain links (RüR) which are located immediately after the chain bracket. H_{MAT} (height, moving end connection) and the required number of back chain links can be referred to in the table in Appendix I (page 48).



Gliding arrangement of closed cable drag chains:

Closed cable drag chains can be easily used, even in gliding applications. As with open cable drag chains, here, too, the basic conditions for easy use must be observed.

The optimal height of moving end connection H_{MA} must be selected as is the case with open chains. If the moving end connection is to be lowered, chain links with back radii must be used. Back radii are not available for closed cable drag chains. As such, the initial links downstream of the moving end connection must be open versions in this case.



1.2 Gliding arrangement

Installation options: Backward-pivoting chain links (RüR) must be supported by means of a fixed bottom plate/moving end connection plate. This support allows the occurring forces to be transmitted stress-free into the chain bracket via the chain links. Service life in this particularly sensitive area is thus considerably improved.

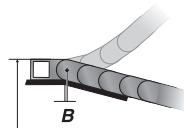
Support with parallel positioning of the chain brackets at the moving end and at the fixed point: The moving end connection plate must be designed in such a way that the chain bracket is parallel to the moving axis. The moving end can be connected “above”, “below” or “face on”. The following explanations apply both to chain brackets with type KA metal angles and to the flexible version of type KA-F.

Connection “below”: You must take the following into account if fixing the chain bracket “below” or “face on” and locating the moving end connection plate “below”:

- the supported chain links must lie completely on the support
- the first link after the chain bracket must not be able to press “down” against the edge of the plate during rotation or movement
- dimension B = 5 mm must always be observed.

1.2 Gliding arrangement

Moving end connection



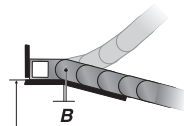
Fixed-point connection



Fastening the chain bracket “below”

Support is provided by a plate bent at right angles underneath the chain run for fixing the chain bracket and supporting the back radii. At least 3 chain links or all chain links with back radii must be supported.

Moving end connection



Fixed-point connection



Fastening the chain bracket “face on”

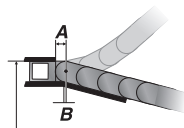
Support is provided by a plate bent at right angles underneath the chain run for fixing the chain bracket and supporting the back radii. At least 3 chain links or all chain links with back radii must be supported.

Connection “above”:

You must take the following into account if fixing the chain bracket “above” and locating the moving end connection plate “below”:

- the supported chain links must lie completely on the support
- the first link after the chain bracket must not be able to press “up” or “down” against the edges of the plate during rotation or movement
- dimension $B = 5 \text{ mm}$ must always be observed
- dimension A must always be observed – see table below.

Moving end connection



Fixed-point connection



Fastening the chain bracket “above”

Support is provided by a plate bent at right angles underneath the chain run for fixing the chain bracket and supporting the back radii. At least 3 chain links or all chain links with back radii must be supported.



1.2 Gliding arrangement

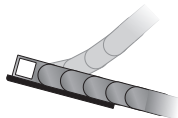
Table:	Chain type	Distance A	Chain type	Distance A
	MP 14	5 mm	MP 42	10 mm
	MP 15	5 mm	MP 44	10 mm
	MP 18	5 mm	MP 52	10 mm
	MP 26	5 mm	MP 62	15 mm
	MP 3000	5 mm	MP 66	15 mm
	MP 32	10 mm	MP 72	15 mm
	MP 35	10 mm	MP 82	15 mm
	MP 41	10 mm	MP 102	20 mm

Support when the moving end chain bracket is positioned at an angle:

If the moving end connection plate is designed in such a way that the chain bracket is not fixed parallel to the lower run but instead forms a line with the next chain links, you must note the following:

- the chain links immediately behind the chain bracket must have a back radius.

Moving end connection



Fastening the chain bracket “below”

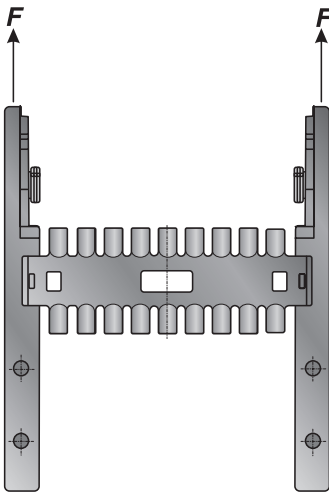
Support is provided by a plate bent at right angles underneath the chain run for fixing the chain bracket and supporting the back radii.

At least 3 chain links or all chain links with back radii must be supported.

Fixed-point connection



1.2 Gliding arrangement

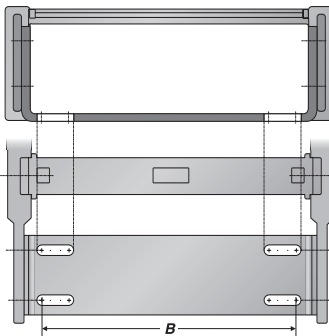


Type KA-F chain bracket for long travel distances:

If the chain is longer than 20 m (corresponds to a total travel distance of about 40 m with central entry), the friction of the chain produces high to very high tensile forces. The part under the greatest strain is the chain bracket at the moving end (M_p).

To enable these strains to be easily absorbed, flexible chain brackets of type KA-FB or type KA-FG must be used at this end (M_p) since fixing takes place in the extension of the side band so that no torque occurs between the fixing point and the side run. This type of connection ensures the optimal transmission of loads.

Type KA chain bracket with U-profile for long travel distances:



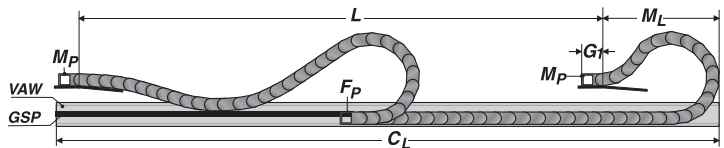
If connection is only possible using mounting brackets (type KA), U-profiles (special articles which are not listed in the catalogue) must be used instead of the standard metal angles in order to ensure stability and permanent absorption of the torques. Please contact us.

Dimension B corresponds exactly to the connection size of the metal angle. This makes exchanges straightforward. Please refer to the catalogue or data sheet for details.



1.2 Gliding arrangement

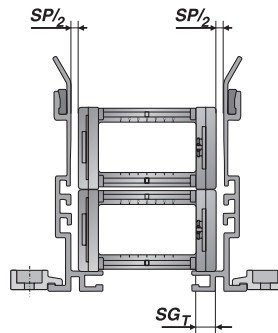
- Configuration:** The cables in the chain must be configured in such a way, that the centre of gravity of the load is exactly halfway across the width of the chain window (symmetric distribution of weight). Please contact our support team if you have any questions about the layout of the chain.
- Strain relief:** The energy lines (cables, conduits) must be strain-relieved in or immediately behind the moving end connection (M_P). Regular inspection of correct placement of the cables in the CDC (especially in radius arches) and possible readjustment are recommended. There must be no strain relief at the end of the fixed chain bracket (F_P). Please refer to page 34 and following for more information about strain relief.
- Cables:** Cables in this arrangement are subject to longitudinal expansion as a result of their own weight (due to the length of the cables and the friction at the CDC), which can lead to incorrect positioning in the radius arch as well as wear on the outer jacket (see “Strain relief”).
- Channel length:** The use of a guide channel is essential in order to ensure that the CDC functions smoothly. The channel length C_L depends on the travel distance L , the length of the chain bracket G_1 and the arc projection M_L . Please refer to the current catalogue or the data sheets on the Internet for these figures.



1.2 Gliding arrangement

Vano guida: The guide channel must be installed with a lateral clearance (SP) from the CDC over the entire length. The clearance per side $SP/2$ is determined by the thickness of the side link and is at least 1 mm and no more than 30 % of the thickness of the side link SG_T . The height of the guide channel must be at least double the height of the side link H_G . A table giving a comprehensive selection of Murrplastik guide channel systems can be found in the VAW section of the CDC catalogue.

Cross-section of guide channel with CDC:



Screw connection: All screw connections of the chain brackets as well as the linkage between the metal angle and the plastic part at the chain bracket, and the linkage between the metal angle or KA-F and the machine must be secured against coming loose by means of special paint (e.g. LOCTITE) or self-locking nuts or bolts.

The use of serrated lock washers, snap rings and other locking means is not permitted!

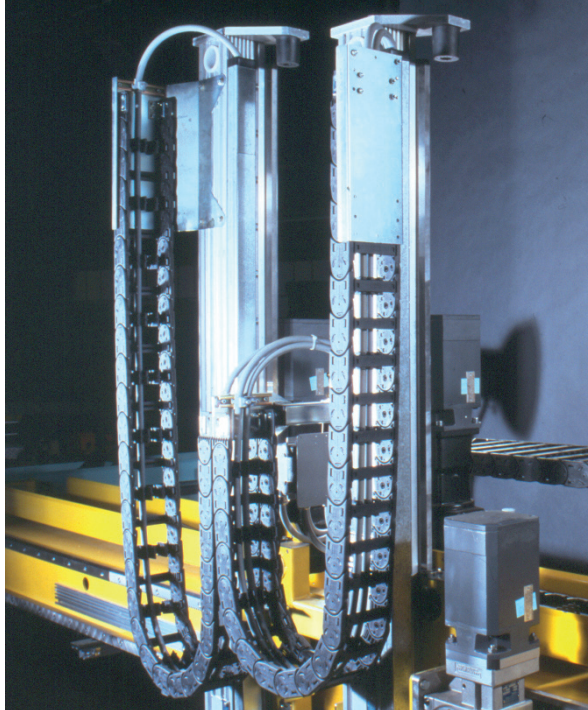
Tightening torques: Please refer to the information in Appendix VI (page 55) for the tightening torques required for assembling the chain brackets on the machine/system.

Attention! The tightening torque on fastening screws and strain relief plates (type ZL) must be checked after about 500 cycles and corrected where necessary. Type RS-ZL strain relief plates and integrated C-profiles are permanently fixed in position after installation and are not subject to this inspection.



1.3 Hanging arrangement

Case example: Hanging chain arrangement in a handling gantry of Bleichert, Osterburken.



Definition: When the radius arch of a cable drag chain hangs down with a vertical movement direction, we refer to a “hanging” arrangement.

Use: Wherever cables guided by a cable drag chain pass through a vertical movement direction, a “hanging” arrangement should be used. In this arrangement it is possible to realise travel distances – or in this case installation heights – of over 100 m.

Material flow technology – particularly in high-bay warehouses with storage and retrieval units – is exactly the area in which CDC’s arranged in this way allow long-term and controlled infeed of different cables.

1.3 Hanging arrangement

- Installation advantages:** The advantage as compared to a vertically “standing” arrangement has to do with the lower stress placed on the cable drag chain. In the “standing” arrangement, the routed cables lie in contact on the radius arch. The additional weight places stress not only on the chain links but in particular also on the chain brackets that must constantly transfer the entire load (CDC + load).
- Specification:** Where possible, non-biased CDC’s (RK = radius without bias) must be chosen for this arrangement. This identification (e.g. RK 150) can be found in the chain link. CDC’s of smaller series are only produced in a version (e.g. R 50) with a moderate bias. For more information about the available radius combinations, please refer to our current cable drag chain catalogue or the data sheets on the Internet.
- Bending radius:** The very small bending radius for a “hanging” arrangement is selected in most cases, with it being necessary to take into account and not fall below the minimum bending radius of the cables being routed (cables, conduits etc.).
- Vertical movement without lateral acceleration:** With this type of application, there is never a need for a side guide. However, even without lateral acceleration there can be oscillation of the cable drag chain system if the moving end connection is moved with travel cycles in rapid succession combined with high acceleration and speed. This oscillation places stress on both the articulated joints in the chain links and the chain brackets. In addition to heavy signs of wear, the chain parts can also break. A side guide is also advisable in this case.



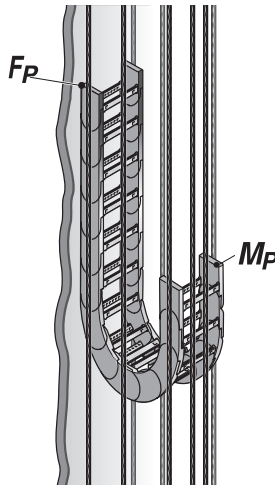
1.3 Hanging arrangement

Vertical movement with lateral acceleration:

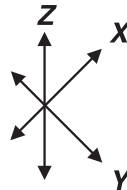
If, in addition to the vertical movement, lateral acceleration acts on the system – for example on storage and retrieval units (RGBs) – always guide the hanging CDC at the side. In the project planning stage of such an application – movement in the X and Z axes – the CDC should always be arranged such that the direction of action is transverse to the CDC (X-direction). This enables the forces to be absorbed in the best way.

Guide channel:

Both hanging chain runs must be guided at the sides. However, this guide does not have to be always along the entire travel distance. When placing the fixed point (FP = immobile chain bracket) in the centre of the stroke, a side guide is only required “downwards”. The run of the moving end connection (MP = movable chain bracket) must be guided across the entire travel distance, if necessary with interruptions. The height of the guide channel should correspond as close as possible to the chain link height (H_G). The guide channel must be installed with a lateral clearance (SP) from the CDC over the entire length. The clearance per side (SP/2) is determined by the thickness of the side link. It is at least 1 mm and no more than 30 % of the thickness of side link SG_T .



Tensioned and precisely positioned steel ropes are suitable as a guidance possibility for the hanging arrangement.

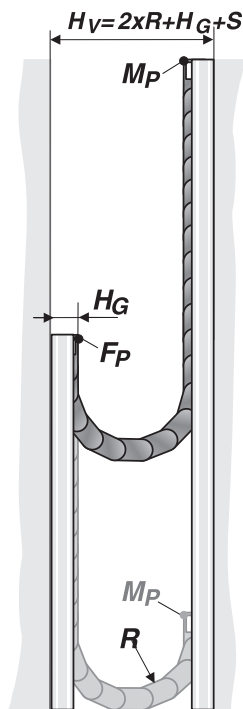


1.3 Hanging arrangement

Installation dimensions: The required installation dimension for positioning a vertically hanging arrangement corresponds to double the chain radius plus the height of the chain link and safety S.

$$H_V = 2 \times R + H_G + S$$

Please refer to the table in our main catalogue or the Internet for the exact installation dimension. The installation dimension corresponds to dimension HSK.



Both hanging cable runs must be guided so that they run parallel to each other

Loading:

With a vertically hanging arrangement, we cannot refer to loading in the sense of weight loading. If the cables guided in the CDC have been correctly placed and strain-relieved, the chain brackets are loaded only by the CDC's own weight. In this case, the weight of the cable hangs only on the strain relief. The possible travel distances in this arrangement can be found in the technical data of the current CDC catalogue or the data sheets on the Internet.



1.3 Hanging arrangement

- Configuration:** The cables in the chain must be configured in such a way that the centre of gravity of the load is exactly halfway across the width of the chain window (symmetric distribution of weight). Please contact our support team if you have any questions about the layout of the chain.
- Strain relief:** The energy lines (cables, conduits etc.) must be strain-relieved in or immediately behind the two chain brackets and placed in the CDC so that they hang free in the radius arch. Supporting the cables in the inside flexure curve of the radius is not permissible, since the weight load of the CDC would otherwise increase greatly and could extremely shorten the service life. Regular inspection of correct placement and possible readjustment are recommended.
- Cables:** Cables in this arrangement are subject to longitudinal expansion as a result of their own weight. Even with initial correct placement in the CDC, this results in supporting on the inside of the chain of the outside flexure curve. As an alternative to conventional flexible lines of the type usually used in CDC's, we recommend the use of special "hanging lines". The feature of these lines is that they have a special carrier element for absorbing the weight forces integrated, which means that the possibility of elongation can be almost excluded.
- Screw connection** All screw connections of the chain brackets as well as the linkage between the metal angle and the plastic part at the chain bracket, and the linkage between the metal angle or KA-F and the machine must be secured against coming loose by means of special paint (e.g. LOCTITE) or self-locking nuts or bolts.
The use of serrated lock washers, snap rings and other locking means is not permitted!

1.3 Hanging arrangement

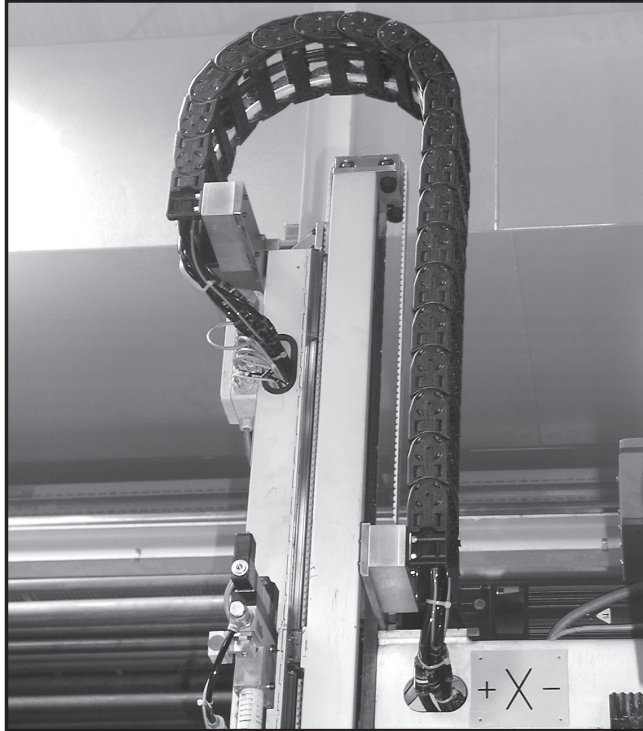
Tightening torques: Please refer to the information in Appendix VI (page 55) for the tightening torques required for assembling the chain brackets on the machine/system.

Attention! The tightening torque on fastening screws and strain relief plates (type ZL) must be checked after about 500 cycles and corrected where necessary. Type RS-ZL strain relief plates and integrated C-profiles are permanently fixed in position after installation and are not subject to this inspection



1.4 Standing arrangement

Case example: Standing chain arrangement at a configuration portal of TDK, Belgium.



Definition: When the radius arch of a cable drag chain with a vertical movement direction is up, this is referred to as a “standing” chain application.

Application: A “standing” chain application is used wherever cables guided by a cable drag chain pass through a vertical movement direction and a hanging chain arrangement cannot be realised for space reasons.

In contrast to a vertically hanging arrangement (chapter 1.3), here travel distances (or in this case, installation heights) spanning just a few meters can be achieved.

1.4 Standing arrangement

- Example:** Especially in the areas of machine tools and handling machines, cable drag chains arranged in this way allow for controlled vertical infeed of cables, even in very restricted available space.
- Installation situation:** Unlike a vertically hanging installation arrangement, with a vertically standing cable drag chain, the guided cables always lie in contact on the radius arch.
- The additional weight places stress not only on the chain links, but in particular also on the chain brackets, which must constantly transfer the entire load (CDC + load).
- Specification:** Where possible, non-biased cable drag chains (RK = radius without bias) must be chosen for this arrangement. This identification (e.g. RK 150) can be found in the chain link. Cable drag chains of smaller series are only produced in a version (e.g. R 50) with moderate bias. For more information about the available radius combinations, please refer to our current cable drag chain catalogue or the data sheets on the Internet.
- Bending radius:** The very small bending radius for a “standing” arrangement is selected in most cases, with it being necessary to take into account and not fall below the minimum bending radius of the cables being routed (cables, conduits etc.).

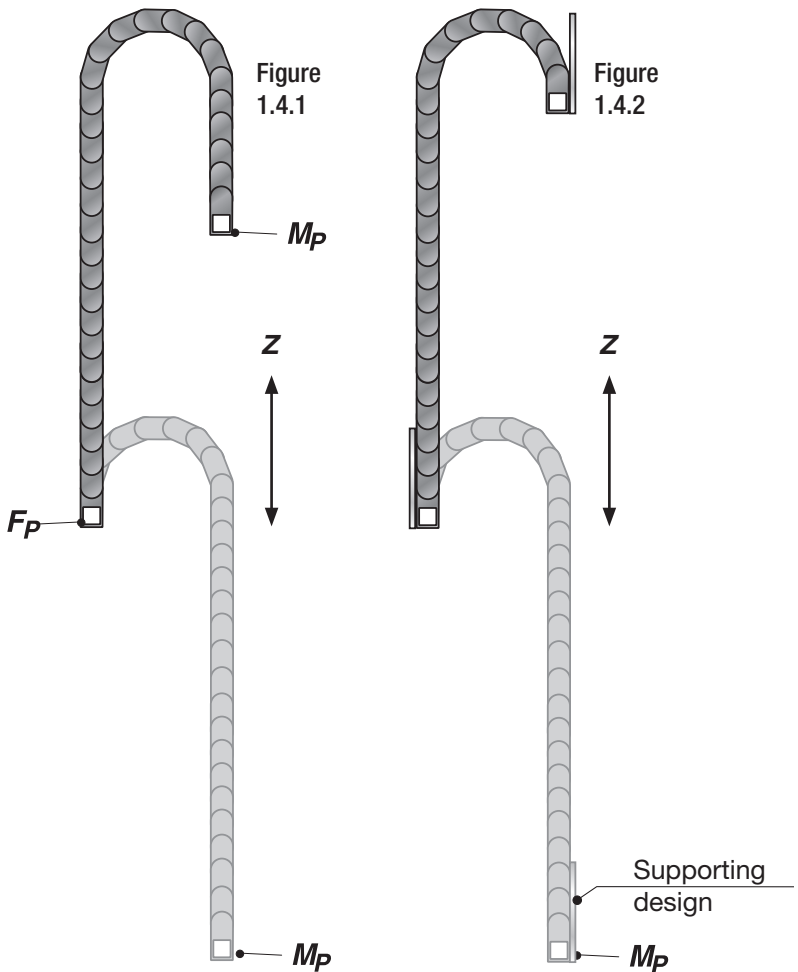


1.4 Standing arrangement

Vertical movement without lateral acceleration:

With this type of movement (movement direction of moving end connection MP occurs exclusively in the Z-direction), there is never a need for a side guide (Figure 1.4.1).

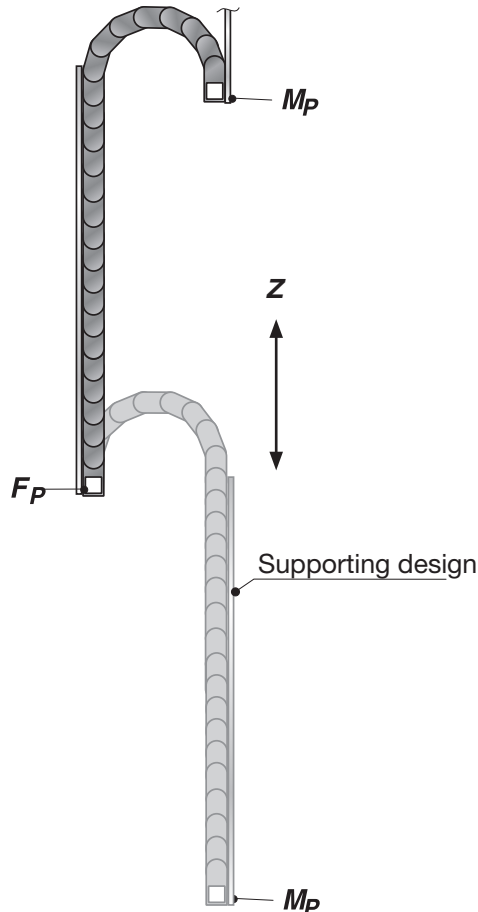
However, in order to increase the service life of the system, we recommend providing support for the first 500 mm after the chain bracket (or at least the first two links) (Figure 1.4.2).



1.4 Standing arrangement

The standing chain arch (incl. the strain relief) can oscillate when subjected to travel cycles in rapid succession in conjunction with high travel parameters.

In order to reduce this high load placed on the chain links as well as on the chain brackets and to increase the service life of the system, we recommend providing support for as much of the entire travel distance as possible in the outside flexure curve.





1.4 Standing arrangement

**Vertical movement
with lateral accelera-
tion:**

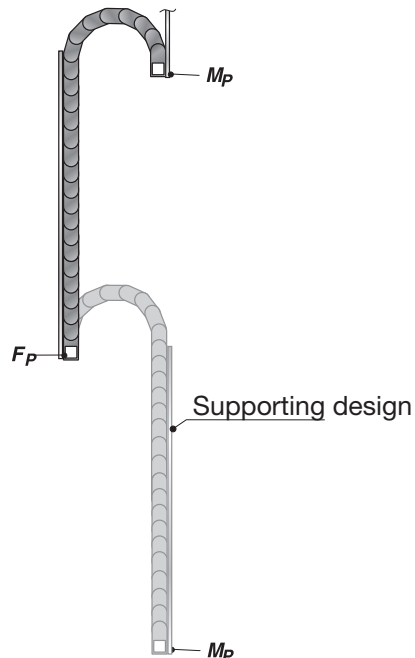
For a vertically standing application with additional lateral acceleration acting on the system (which is frequently the case with machine tools), a side guide must always be provided.

We make a distinction between the following system movements and their guidance options:

a) The entire cable system is moved. In this case, the cable drag chain executes only a vertical movement, however the entire system is positioned on the plant/machine such that it can also travel in the Y- and/or X-directions.

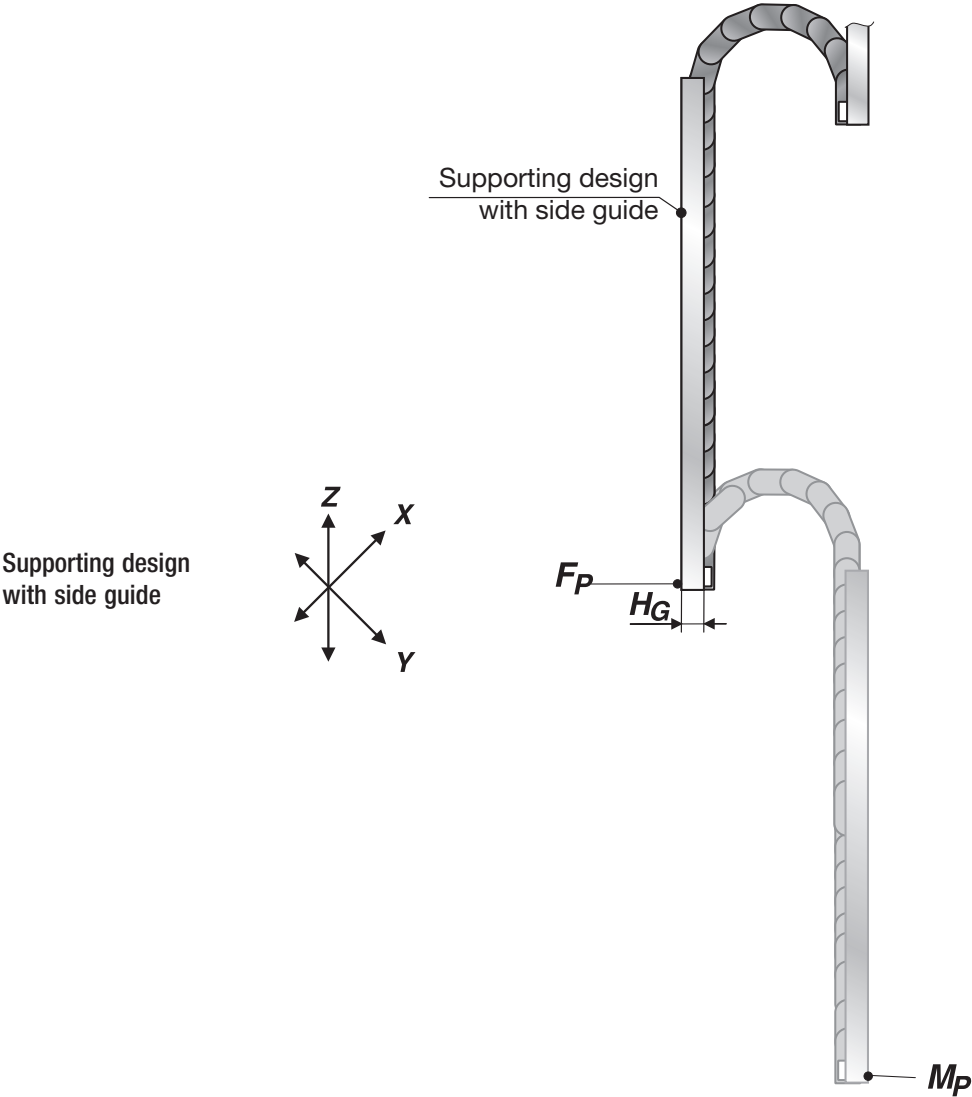
With an additional movement in the Y-direction only, a single support for both standing chain runs is sufficient. This support should cover the entire length of travel. If this is not possible, the chain's service life can be reduced when subjected to high travel parameters.

Vertical movement



1.4 Standing arrangement

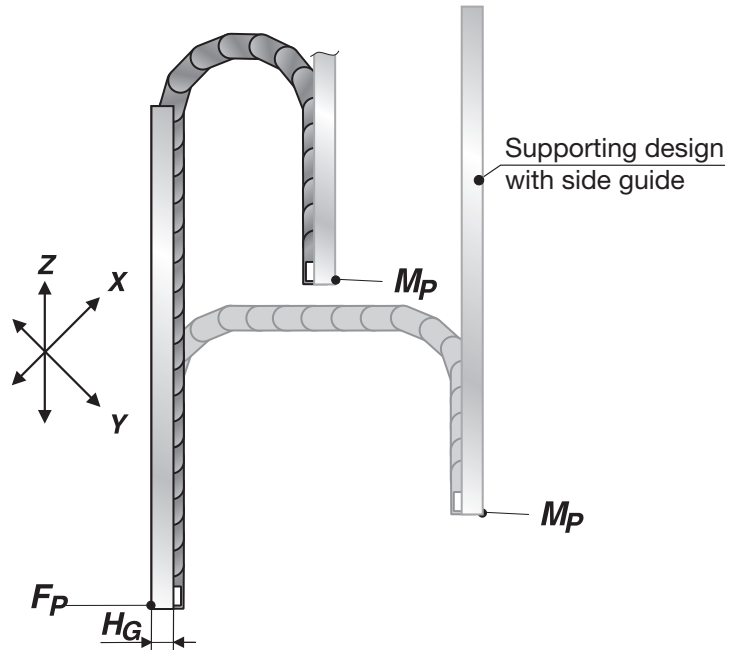
A second side guide must be provided for additional movement in the Y- and X-directions in addition to the support described above.





1.4 Standing arrangement

b) The entire cable drag system is positioned on the plant/machine such that it moves in the X-direction.



The moving end connection moves in the Y- and Z-directions. The entire system additionally is moved in the X-direction. A lateral guide spanning the entire travel distance is absolutely necessary.

Guide channel:

It is recommended that you provide support (incl. a side guide) for both chain runs and across the entire travel distance in order to ensure optimal service life of the cable drag systems.

Exact specifications are listed under the individual attachment versions (see above).

Installation dimensions:

The required installation dimension for positioning a vertically hanging arrangement corresponds to double the chain radius plus the height of the chain link and required safety S.

1.4 Standing arrangement

Only cable drag chains without bias should be used for the standing application. Please refer to the installation dimensions table in our main catalogue or the Internet for the exact dimension. The required installation dimension corresponds to dimension H_{SK} .

- Configurazione:** The cables in the chain must be configured in such a way that the centre of gravity of the load is exactly halfway across the width of the chain window (symmetric distribution of weight). Please contact our support team at any time if you have any questions on this topic.
- Strain relief:** The energy lines (cables, conduits etc.) must be strain-relieved in or immediately behind both chain brackets. For more information on this topic, please refer to the section entitled “Strain relief systems”.
- Screw connection:** All screw connections of the chain brackets as well as the linkage between the metal angle and the plastic part at the chain bracket, and the linkage between the metal angle or KA-F and the machine must be secured against coming loose by means of special paint (e.g. LOCTITE) or self-locking nuts or bolts.
The use of serrated lock washers, snap rings and other locking means is not permitted!
- Tightening torques:** Please refer to the information in Appendix VI for the tightening torques required for assembling the chain brackets on the machine/plant.
- Attention!** The tightening torque on fastening screws and strain relief plates (type ZL) must be checked after about 500 cycles and corrected where necessary. Type RS-ZL strain relief plates and C-profiles are permanently fixed in position after installation and are not subject to this inspection.

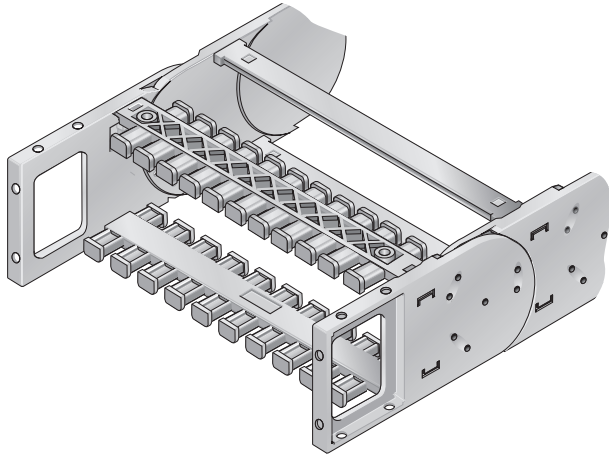


2. Strain relief systems ZL / RS-ZL

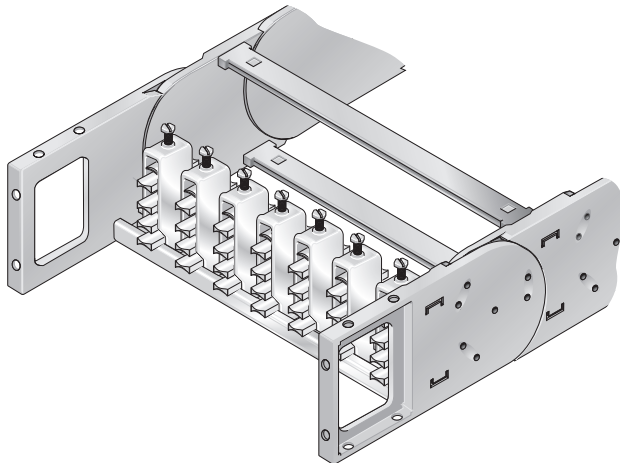
RS-ZL/C-profile:

Ideally, frame bridge strain relief plates of type RS-ZL or alternatively C-profile rails with hooped clamps are fixed in the CDC. The possible positioning of these strain relief plates in the chain bracket in both the inside bend and the outside bend means that two strain relief plates can be permanently integrated at each end of the CDC. This makes it possible to fix a large number of energy lines in position quickly and reliably.

KA-F with RS-ZL



KA-F with C-profile and hooped clamps:

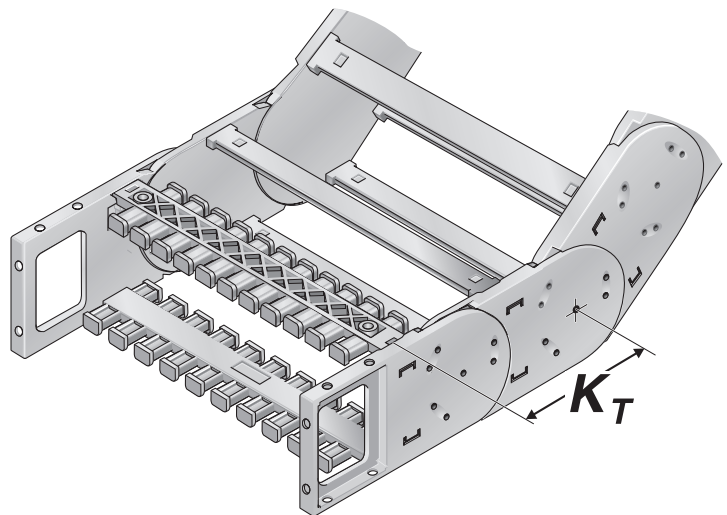


2. Strain relief systems ZL / RS-ZL

Chain extension:

Should the distance between the integrated strain relief (see above) and the last moving point of the CDC not be sufficient for the integrated energy lines (approximate values for this dimension are in the range of the minimum bending radius of the energy lines), the CDC can be extended by one chain link at each end. This chain link increases the distance between the strain relief and the moving point (K_T) of the CDC by the chain link pitch (T), since it is not required directly for the travel distance and thus does not move.

In this case, however, it must be remembered that the arc projection (M_I) increases by the chain link pitch.



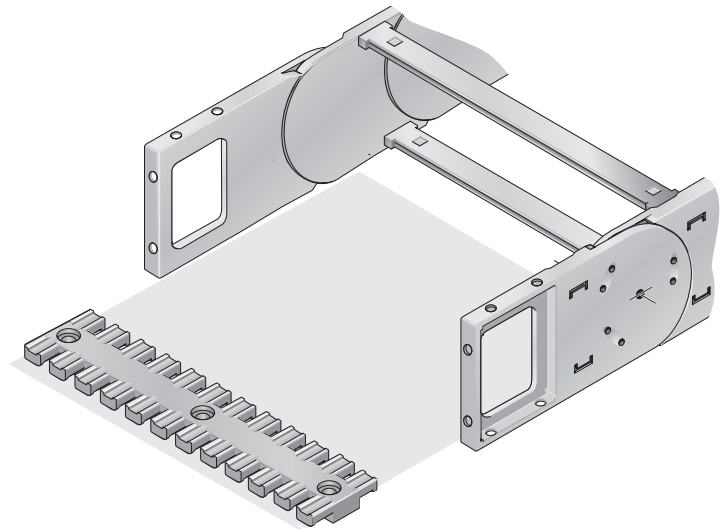


2. Strain relief systems ZL / RS-ZL

ZL:

Should the extremely convenient method of integrated strain relief – as described above – be restricted because a very confined space does not permit the arc projection (M_1) to be extended, it is absolutely essential that the strain relief plate is positioned before the chain bracket. In this case screw-on strain relief plates of type ZL must be used. These strain-relief plates can also be “double-decked” by means of spacers to allow a larger number of energy lines to be fixed.

KA-F with ZL in front:



3. Variable guide channel system VAW

Definition:

Guide channel systems for CDC serve to accommodate and laterally guide the lower run of unsupported arrangements if the travel distance is short. In the case of long travel distances and gliding arrangement, a channel also acts as an instrument for guiding the upper run as it sets down. If no guide channel system is used, it cannot be guaranteed that the upper and lower runs will set down and glide properly. This is especially true for large radii as there is no lateral guidance here. The energy lines are usually fed in at the middle of the travel distance so that the chain is kept as short as possible. However, with a gliding arrangement this requires a glide rail profile (GSP) over that half of the travel distance in which there is no lower run setting down (see drawing of VAW 248).

Assembly:

Assembly of the VAW requires that the foundation is level on all sides. The channel elements are arranged one after the other on one side lengthwise and connected to each other on the outside contour by means of longitudinal connectors (see page 53). Sizes 177 and 248 require 2 longitudinal connectors and 2 clamping pieces per joint and side (see page 52). It must be ensured that the guide channel systems used to guide the CDC are positioned at an angle of 90° to the foundation. This eliminates any offset and impact. This method of assembly prevents any “deformation” of the channel caused by temperature fluctuations, for instance. Once the correct channel internal width (see above) has been set, the channel profiles are secured to the foundation by means of the clamping pieces or cross ties. Using cross ties to assist clamping has the advantage that the correct internal width is set automatically.

Clamping pieces should be clamped from the inside of the channel, and from the outside as well if required. The glide rail profiles required for gliding arrangements do not require any extensive screwing or adjustment. The glide rail profile is simply pushed into the slot in the channel that corresponds to the chain in use.



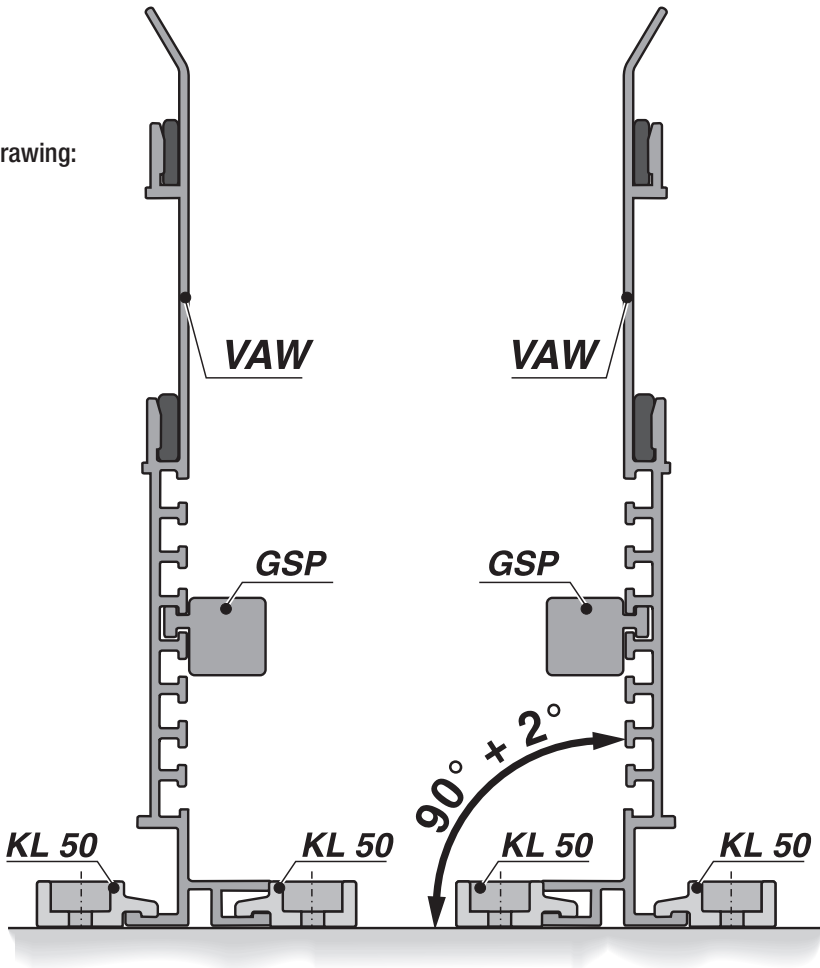
3. Variable guide channel system VAW

Available VAW lengths: 2,000 mm or 5,000 mm

Available GSP lengths: 2,000 mm

Our current CDC catalogue gives a detailed description of how to match CDC, guide channels (VAW) and glide rail profiles (GSP).

VAW 248 drawing:



3. Variable guide channel system VAW

Temperature influences: Having the channel side sections “floating” by using a clamping piece (KL) or cross tie (QV) compensates for possible length stretching caused by temperature fluctuations. The channel sections can move slightly in the longitudinal direction.

If there are very great temperature differences between the time of assembly and possible operation – e.g. outdoor assembly in winter, operation in summer in direct sunlight – and/or on very long channel systems, the above-mentioned play-free type of assembly is no longer sufficient for distortion-free operation.

The channel sections must be assembled with a gap to allow for deformation (see drawing on Page 52/53).

Refer to the table below for the necessary gap size as a function of the possible temperature difference.

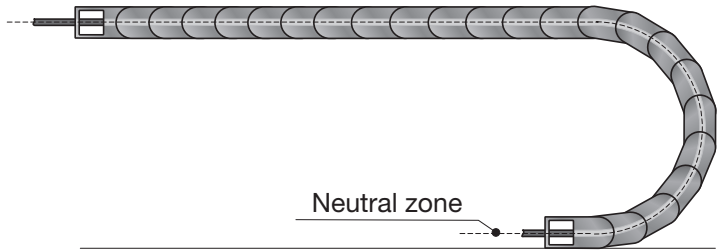
Length of the side sections used (mm)	Temperature difference (°K)	Gap size SPL (mm)
2000	30	1.8
	40	2.4
	50	3.0
	60	3.6
	70	4.2
	80	4.8
5000	30	4.5
	40	6.0
	50	7.4
	60	8.9
	70	10.4
	80	11.9



4. Guidelines for laying cables to be installed

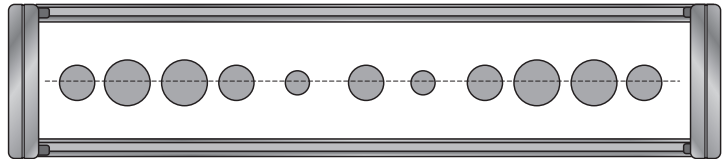
Principles:

Cables and conduits laid in cable drag chains only have optimum conditions if they run in the “neutral zone”. This means that ideally, the centre line of the cable or conduit would have to run through the rotation points of the individual chain links.



Only with this arrangement is it possible to exclude relative movement between the cables and conduits and the cable drag chain.

In terms of construction, this optimum solution would produce a cable drag chain with a low internal height and a partly enormous width so that all energy cables etc. can run next to each other in the “Neutral Zone”

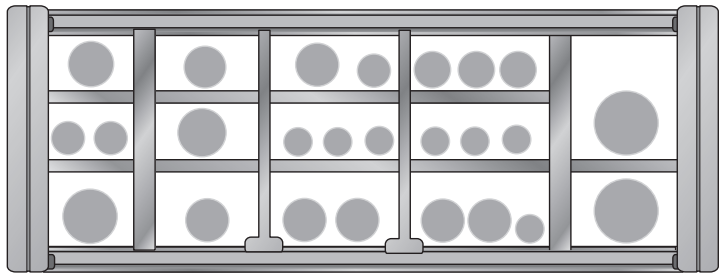


However, this optimum arrangement of cables is, in reality, almost never achievable, because the space required is extremely unfavourable (very great width) and a cable drag chain with a low height also possesses only low intrinsic strength. The permissible sag X (see Page 8) would be exceeded very quickly.

4. Guidelines for laying cables to be installed

In order to still obtain a good combination of extremely low wear – caused by the relative movement – and therefore a long service life of cables and conduits combined at the same time with high rigidity of the cable drag chain, a multi-layer fabrication with components designed specially for the purpose such as shelving systems or separators has become established.

Example: Multi-layer internal chain compartment



In order to obtain the longest possible service life in this sensitive area however, it is essential to follow the guidelines below.

Bending radii:

Cables to be installed (cables, conduits) for dynamic use have a minimum bending radius defined by the manufacturer. This radius is directly related to the structural design of these components that can withstand dynamic stress.

In general, the construction work involved and therefore also the price is greatest for the smallest bending radii.

The sizes given for the minimum bending radii are in most cases given as a function of the outside diameter, for example $10 \times D$ in mm (D = outside diameter, cable).

These bending radii must not be fallen below so that the service life defined by the manufacturer is realised.

This means that the smallest possible chain radius is defined by the choice of quality and size of the cables.



4. Guidelines for laying cables to be installed

In order to minimize the bending radii, it is appropriate to divide lines with a large number of wires (> 18 wires) or conduits with a large cross section (> 50 mm) into two or more units.

Due to the large number of possible uses and the complexity of this subject, we recommend that you use our free project planning service. State the cables you require and we will send you a detailed recommendation.

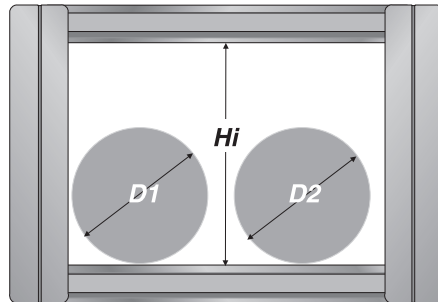
A prepared questionnaire with the information we require can be found in the current CDC catalogue or on the Internet under www.murrplastik.eu

Fabrication:

Cables (flat or round, as well as conduits) should, if possible, be laid individually next to each other.

It must be ensured that these lines cannot move on top of each other. The clear internal height (H_i) of the cable drag chain must be smaller than the sum of two adjacent lines (D_1 , D_2 = outside diameter of the lines).

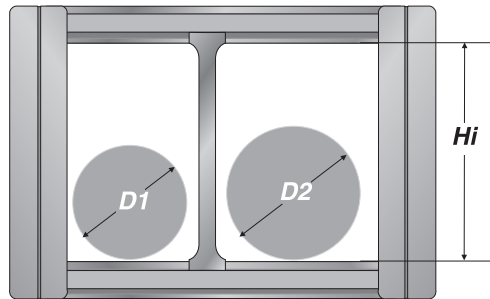
Expressed as a formula: $H_i < D_1 + D_2$



4. Guidelines for laying cables to be installed

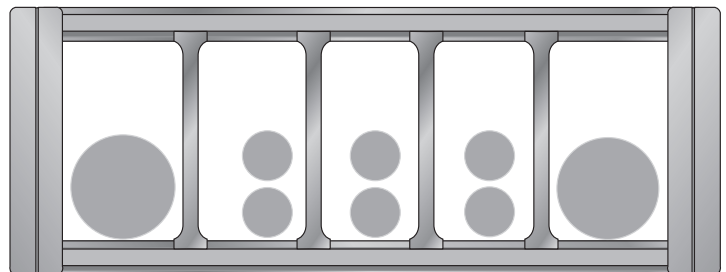
Adjacent lines that can move on top of each other must be separated from each other by separators, because the sum of the outside diameters is smaller than the internal height of the chain H_i .

Expressed as a formula: $H_i > D_1 + D_2$



The laying of numerous cables on top of each other or numerous cables or conduits of greatly differing diameters next to each other is only recommended when separators are used.

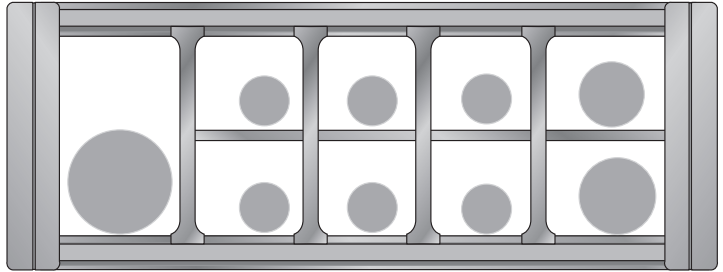
It is not recommended that more than three layers lie on top of each other.



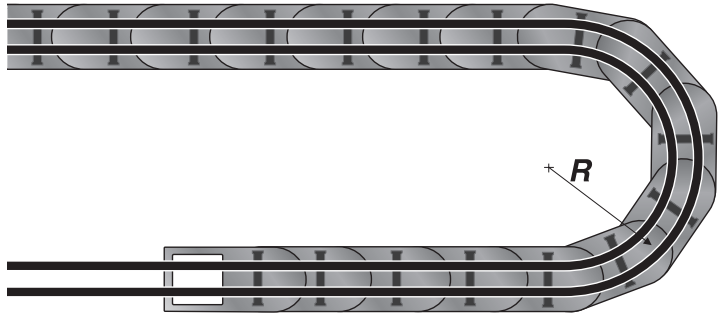


4. Guidelines for laying cables to be installed

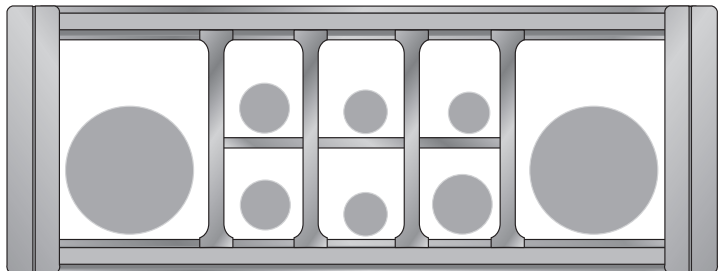
Horizontal separations are recommended for multi-layer laying. The cables must be able to move freely in the shelving system.



The cables and conduits must pass round the bending radius without any strain.



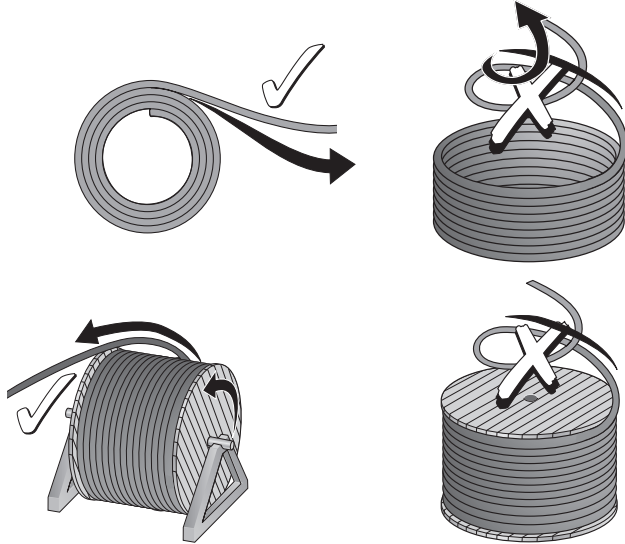
The weight distribution in the chain link should be as symmetrical as possible, i.e. heavy cables/conduits must be laid outwards, with light ones inwards.



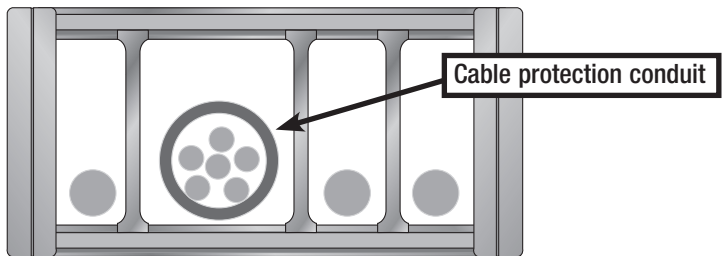
4. Guidelines for laying cables to be installed

Cables:

Cables delivered or stored on drums or in rings must be unrolled correctly and laid in the cable drag chain without being twisted. The cables may not be lifted in loops



Highly-flexible cables or individual wires with a diameter of up to 6 mm should be combined loose and laid slightly twisted in a cable protection conduit.



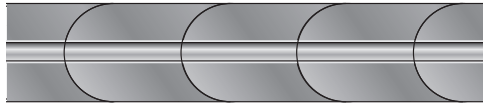
The cable protection conduits must be able to move freely in the frame bridge. A much larger conduit cross section must be selected than the sum of the individual cross sections (max. filling approx. 50 %).



4. Guidelines for laying cables to be installed

Pressure hoses:

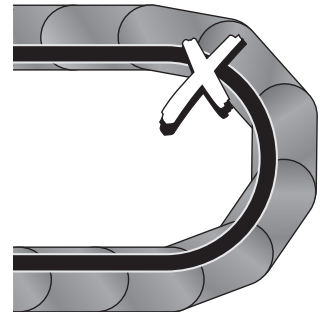
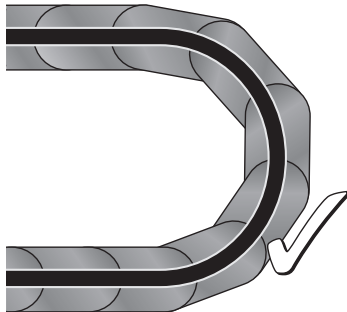
Pressure hoses, e.g. hydraulic or water hoses must be able to move freely in the chain ridge, because they can become shorter or longer as the pressure increases or decreases.



under pressure



no pressure



Information about the length changes of hoses can be found in the hose manufacturers' catalogues.

4. Guidelines for laying cables to be installed

Reserves for different energy cables (% of outside diameter)

To optimally fill a cable drag chain, the required space reserve must be maintained around every energy cable.

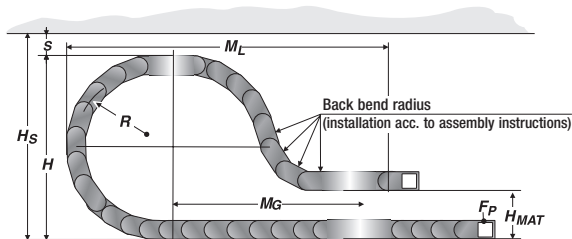
Depending on the quality of the components, the dynamics of the system and the required service life, we obtain the following guideline values:

Type of loading	Reserve all round (% of outside Ø)
Electr. round cable	10 %
Electr. flat cable	10 %
Pneumatico	5 to 10 %
Hydraulic	20 %
Media hoses	15 to 20 %
Cable protection conduit	10 %

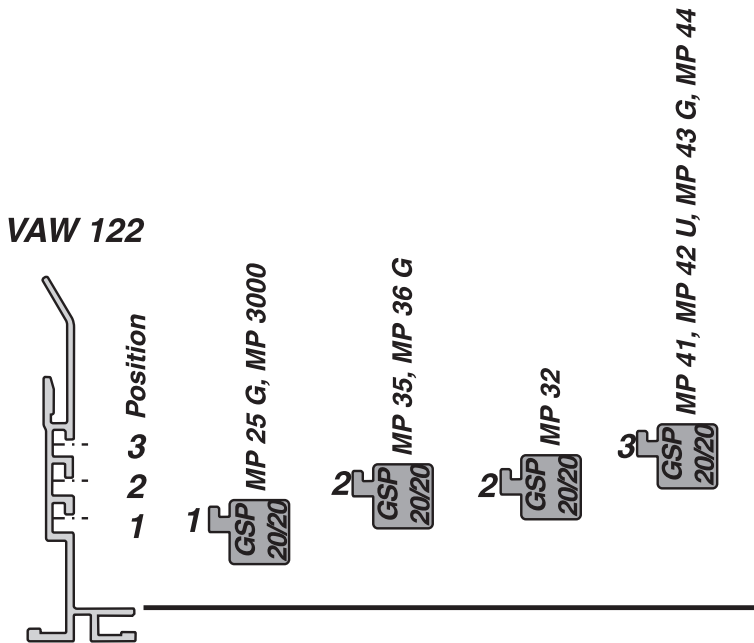
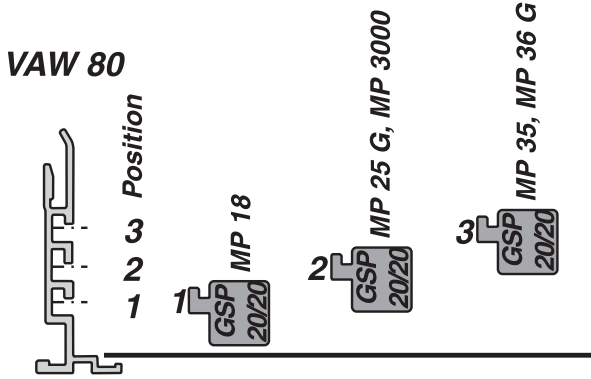


Appendix I: Lowered chain bracket

All figures in mm	Radius R	Height of moving end connection (H_{MAT})	Safety margin S	Install. height inc. safety margin(H_S)	Projection (M_L)	Additional links	of which additional back chain links
MP 32 / MP 32.2	200	210	50	523	720	14	3
	250	230	50	623	880	17	3
MP 41 / MP 41.2	200	190	50	522	770	13	2
	250	220	50	622	910	15	2
	300	280	50	722	1180	19	2
	350	320	50	822	1140	19	3
MP 52.1 / MP 52.2	200	210	50	565	830	10	3
	250	250	50	665	990	13	3
	300	300	50	765	900	14	3
	350	330	50	865	1180	16	3
MP 62 / MP 62.2	200	230	60	564	850	11	2
	250	270	60	664	990	12	2
	300	320	60	764	1060	12	3
	400	380	60	964	1060	14	3
	500	440	60	1164	1520	17	3
MP 72	200	240	60	580	850	9	2
	250	260	60	680	1010	12	3
	300	290	60	780	1150	13	3
	400	350	60	980	1360	16	3
	500	400	60	1180	1620	20	3
MP 82.2	200	240	60	582	900	8	2
	250	260	60	682	1050	10	2
	300	290	60	782	1130	11	2
	400	420	60	982	1340	13	2
	500	400	60	1182	1620	16	4
MP 102.2	250	250	60	695	880	9	3
	300	270	60	795	1020	10	3
	400	390	60	995	1220	12	3
	500	420	60	1200	1490	15	3

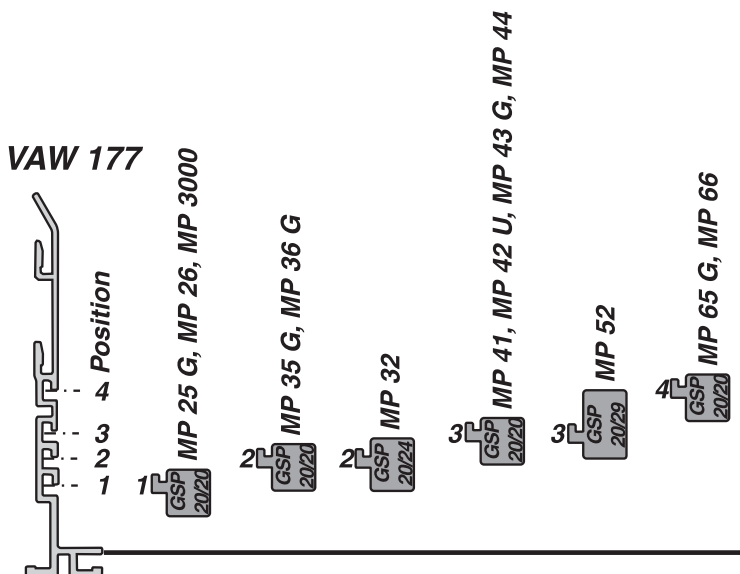
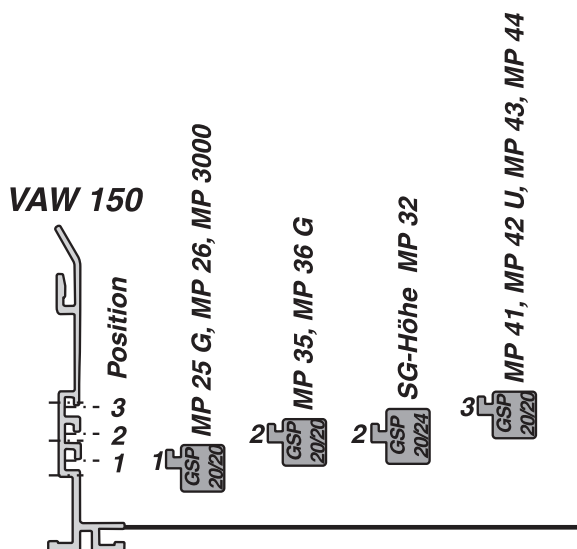


Appendix II: Assignment of glide rail profiles to guide channels

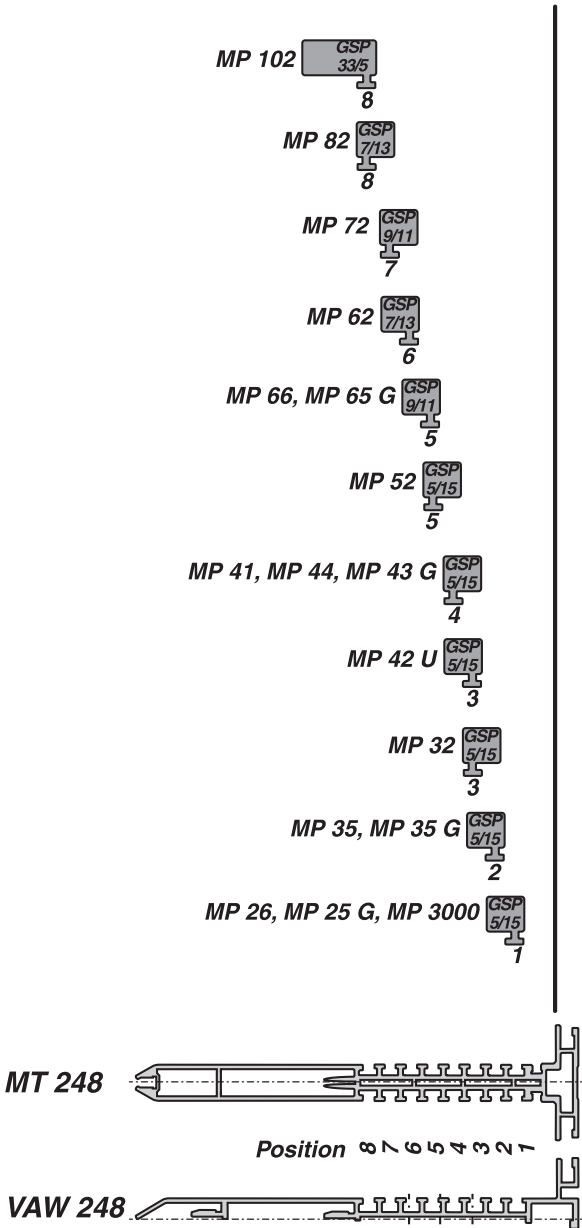




Appendix II: Assignment of glide rail profiles to guide channels



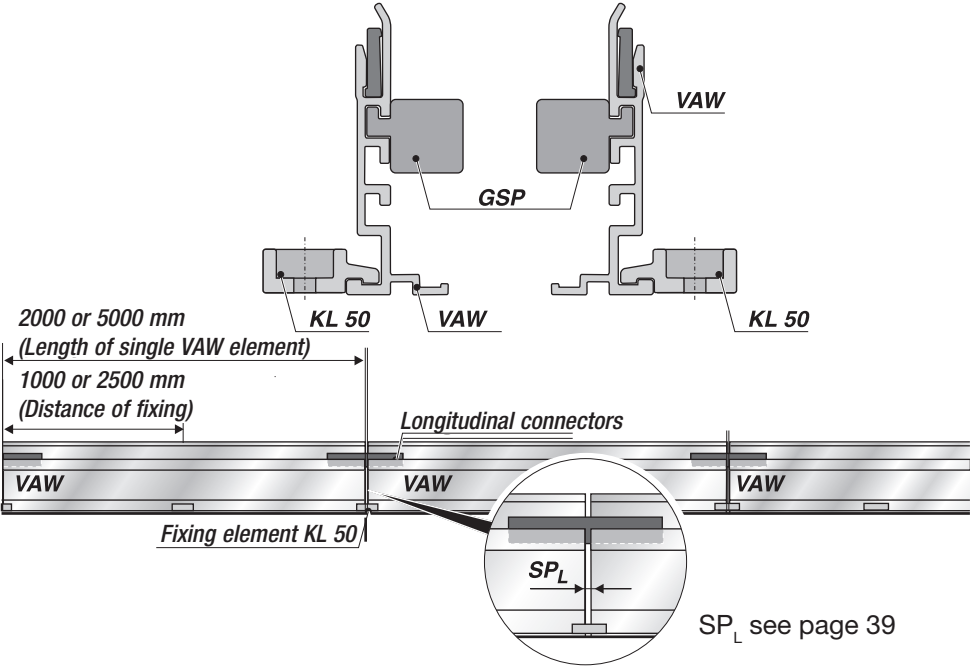
Appendix II: Assignment of glide rail profiles to guide channels





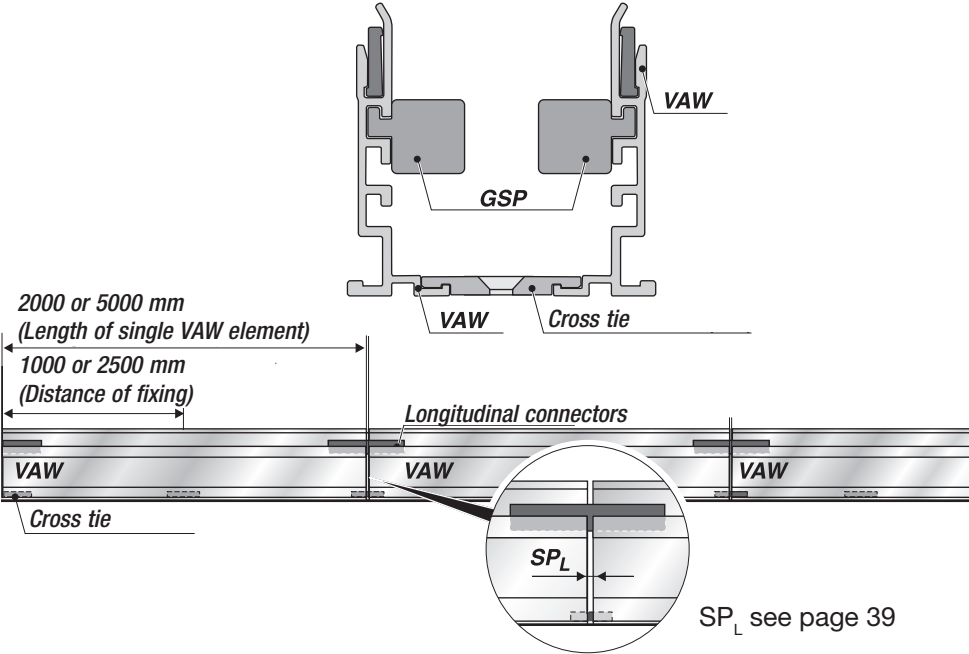
Appendix III: Assembly of guide channel with clamping pieces

VAW mounted with clamping pieces



Appendix IV: Assembly of guide channel with cross ties

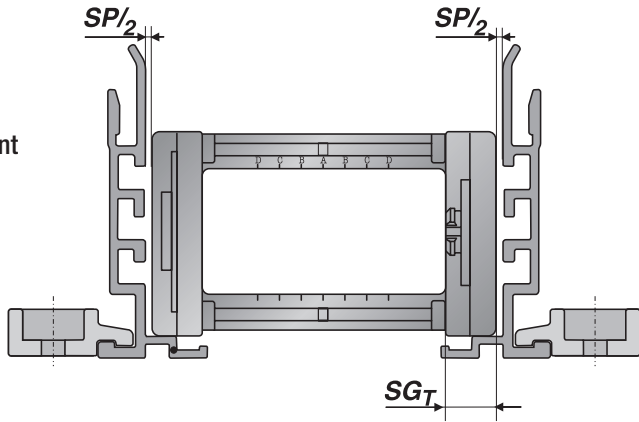
VAW
mounted with cross ties





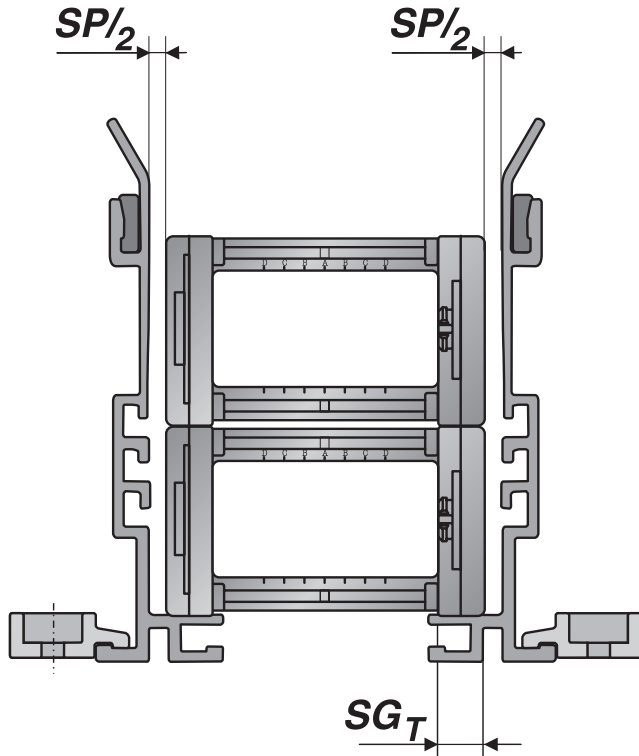
Appendix V: Clearance SP between guide channel and chain

Unsupported arrangement



#

Gliding arrangement



Appendix VI: Tightening torques

Thread size	Property classes				
	5.6	6.8	8.8	10.9	12.9
M3	0.7 Nm	0.9 Nm	1.2 Nm	1.7 Nm	2.0 Nm
M4	1.7 Nm	2.1 Nm	2.8 Nm	4.1 Nm	4.8 Nm
M5	3.4 Nm	4.3 Nm	5.5 Nm	8.1 Nm	9.5 Nm
M6	5.9 Nm	7.3 Nm	9.6 Nm	14.0 Nm	16.0 Nm
M8	14.3 Nm	17.8 Nm	23.0 Nm	34.0 Nm	40.0 Nm
M10	28.3 Nm	35.4 Nm	46.0 Nm	67.0 Nm	79.0 Nm
M12	49.6 Nm	62.1 Nm	79.0 Nm	115.0 Nm	135.0 Nm

Attention:

All screw connections of the chain brackets as well as the linkage between the metal angle and the plastic part at the chain bracket, and the linkage between the metal angle or KA-F and the machine must be secured against coming loose by means of special paint (e.g. LOCTITE) or self-locking nuts or bolts.

The use of serrated lock washers, snap rings and other locking means is not permitted!

The tightening torque for chain brackets and strain relief plates of type ZL must be checked after about 500 cycles and corrected where necessary. Type RS-ZL strain relief plates and C-profiles are permanently fixed in position after installation and are not subject to this inspection.



Appendix VII: Acceptance report for a complete cable drag chain system

Acceptance report for a complete cable drag chain system for:

Company: _____

Street: _____

City/State/Post code: _____

Contact person: _____ Department: _____

Tel: _____ Fax: _____

Com. / Project: _____ Cust. no.: _____

Technical data:

Chain type: _____ Width: _____ mm Length: _____ m

Radius: _____ mm Chain bracket KA KA-F

Travel distance: _____ m Speed: _____ m/s Acceleration: _____ m/s²

Installation position: _____

Type of VAW: _____ Length w. GSP: _____ m Length exc. GSP: _____ m

Chain configuration:

1.) Configuration: _____ Ø: _____ mm minimum bending radius: _____ mm

2.) Configuration: _____ Ø: _____ mm minimum bending radius: _____ mm

3.) Configuration: _____ Ø: _____ mm minimum bending radius: _____ mm

4.) Configuration: _____ Ø: _____ mm minimum bending radius: _____ mm

5.) Configuration: _____ Ø: _____ mm minimum bending radius: _____ mm

6.) Configuration: _____ Ø: _____ mm minimum bending radius: _____ mm

7.) Configuration: _____ Ø: _____ mm minimum bending radius: _____ mm

8.) Configuration: _____ Ø: _____ mm minimum bending radius: _____ mm

Additional weight of chain configuration: _____ kg/m

Height of moving end connection (H_{MA}): _____ mm

Distance between bottom edge of lower run and top edge of upper run: _____ mm

Appendix VII: Acceptance report for a complete cable drag chain system

Line inspection:

All lines in the radius can be moved lengthways?	yes/no
Line clearance in both end positions of the travel distance checked?	yes/no
Line clearance in end positions after approx. 4 weeks of operation checked?	yes/no
Strain relief present at moving end?	yes/no
Strain relief present at fixed point in unsupported arrangement?	yes/no
Is the clearance of the cables in the chain at least 10 % of the cable diameter?	yes/no

Cable drag chain inspection:

All frame bridges closed?	yes/no
Internal separation executed and fixed as prescribed?	yes/no
Receiving point at moving end flush with guide channel?	yes/no
Chain brackets tightened as prescribed and secured by means of a screw locking device? (e.g. LOCTITE)	yes/no
At least one chain link reserve present in the mechanical limit position?	yes/no
Back radii with support plate and correctly arranged?	yes/no

Guide channel inspection:

Guide channel free of foreign objects?	yes/no
Channel internal width > 2 mm and < 6 mm chain outside width?	yes/no
Transition of glide rail to chain lower run at same height?	yes/no
Channel joints arranged flush and unobstructed?	yes/no
Strain relief located in the guide channel below the glide rail?	yes/no
Guide channel running parallel to the moving end guide?	yes/no

ATTENTION:

If the answer to any of the above questions is no, please comment under “Remarks” on page 3.



Appendix VII: Acceptance report for a complete cable drag chain system

Chain window (sketch):

Remarks:

This is to confirm the accuracy of the information.

Place, date: _____

Customer: _____

Murrplastik Systemtechnik _____

Appendix VIII: Manufacturer's Declaration

Herstellererklärung / Manufacturer's Declaration / Déclaration du fabricant /Declaración del fabricante/ Dichiarazione del produttore

Gemäß Anhang IIB nach Maschinenrichtlinie 98/37/EG bestätigen wir
As per appendix IIB in accordance with Machine Directive 98/37/EC, we hereby confirm
En conformité avec l'annexe IIB de la directive Machines 98/37/CE, nous
En conformidad con lo establecido en la parte B del anexo II de la Directiva sobre máquinas 98/37/CE
Come per l'appendice IIB in accordo con la direttiva macchine 98/37/EC noi dichiariamo

Murrplastik Systemtechnik GmbH
Fabrikstr. 10
D-71570 Oppenweiler

das unsere Produktfamilien
that our product lines
attestons que nos gammes de produits
certifica que su familia de productos
Che le nostre linee prodotto

Energieführungsketten und -systeme
Cable drag chains and systems
Systèmes et chaînes porte-câbles
Sistemas de cadenas portacables
Sistemi di catene portacavi

folgende Richtlinien und Normen einhält:
are in compliance with the following guidelines and standards:
répondent aux directives et normes suivantes :
cumple las siguientes directrices y normas:
Sono conformi con le seguenti linee guida:

EN 292
Maschinensicherheit / Safety of machinery / Sécurité des machines
Seguridad de las máquinas / Sicurezza della macchina
EN 1050

Leitsätze zur Risikobeurteilung / Principles for risk assessment / Principes pour l'appréciation du risque / Principios
para la evaluación del riesgo / Principi per la valutazione del rischio

Die Inbetriebnahme ist solange untersagt, bis die Maschine, in die oben genanntes Produkt eingebaut wurde, den wesentlichen Anforderungen der Richtlinien entspricht.
Commissioning is prohibited until the machine, in which the above mentioned product has been installed, is in compliance with the essential requirements stated in the guidelines.
En cas d'incorporation dans une machine, leur mise en service est interdite tant que la conformité de la machine avec les principales dispositions des directives n'a pas été vérifiée.
Se prohíbe la puesta en marcha de la máquina hasta que se haya montado en el producto arriba mencionado, que cumple los requisitos esenciales de las directrices.
La messa in opera è vietata fintantoché la macchina, sulla quale va installata la catena, è in accordo con le linee guida essenziali della direttiva



Lutz Scharf-Martini
Leiter Technologie-Center
Director, Technology Centre
Directeur du Centre technologique
Direttore del centro tecnico

Revisione 00

22/4/2004 Lutz Scharf-Martini

All details given in our prospectuses and catalogues as well as the information available online are based on our current knowledge of the products described.

The electronic data and files made available by Murrplastik, particularly CAD files are based on our current knowledge of the product described.

A legally binding assurance of certain properties or the suitability for a certain purpose can not be determined from this information.

All information on the chemical and physical properties of our products as well as application-technical advice in word, writing and via tests is given to the best of our knowledge.

This does not free the purchaser of carrying out their own inspections and tests in order to determine the suitability of a product for a specific purpose.

Murrplastik accepts no responsibility for the available information being up-to-date, correct or complete. Neither do we accept responsibility for the quality of this information or for any damages that may occur for use of our products.

Murrplastik reserves the right to make technical changes and improvements through constant further development of products and services.

Furthermore, our General Terms of Sale apply.

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