



---

## Welcome to CHAIN-SeleCalc

CHAIN-SeleCalc is a module of a family of Habasit calculation programs created by the Habasit application engineering team.

The transition to an internet based calculation tool ensures that you will always calculate with most up to date data.

Please enjoy the CHAIN-SeleCalc tool.

## Internet online version

Online SeleCalc tools are continuously kept updated. It assures that the latest belt types and material combinations can be calculated. Complex version releases are not needed. It ensures that you will always calculate with the latest version.

CHAIN-SeleCalc is an online program that allows calculating chain tensile strength utilization for straight and radius applications. It will indicate if the selected chain can run within the specified application parameters. It will provide additional information like pressure speed (PV) utilization, shaft torque, shaft rotation and drive shaft power.

The program is optimized to run on Internet Explorer 9 and higher but will run on other browsers like Chrome or Firefox although appearance and performance might be slightly different.

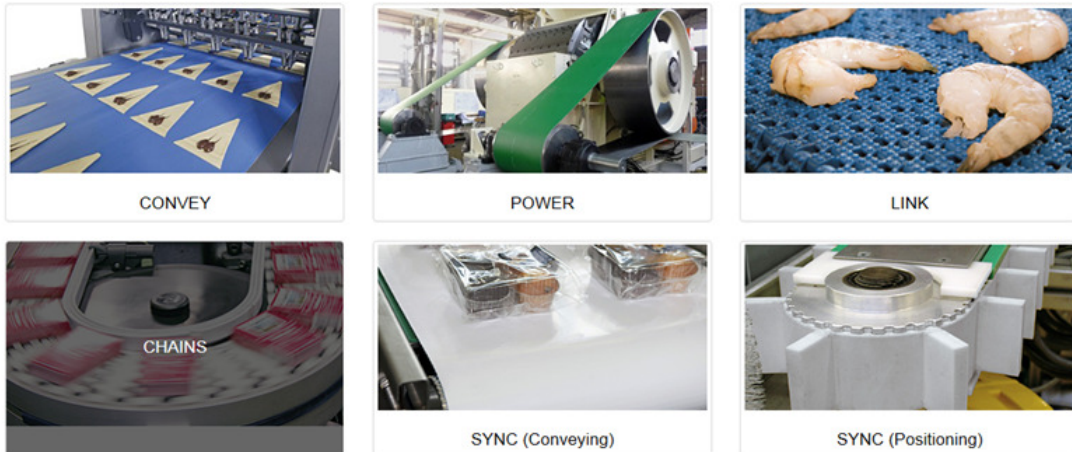
The program PRO version allows changing parameters and is reserved for product specialists.

## Contents

First registration and settings.....	3
Getting started.....	4
Calculation example.....	5
Tips and hints.....	12
Chain selection.....	13
Chain materials.....	14
Pin materials.....	17
Sprocket materials.....	18
Material selection.....	19
Low temperature applications.....	20
Radius configuration.....	21
Friction in radius section.....	22
Accumulation on radius chains.....	23
Incline decline conveyors.....	24
Conveyor configurations with chain back bending (back flexing).....	26
Calculation for conveyors with chain back bending (back flexing).....	27
Speed limits for conveyors with chain back bending (back flexing).....	28
Service factors for conveyors with chain back bending (back flexing).....	28
Conveying length.....	29
Accumulation length.....	30
Maximum speeds.....	31
Drive configurations.....	32
Frequent start stop.....	37
Temperature.....	38
Load.....	39
Accumulation load.....	40
Friction chain to slider.....	41
Friction chain to product.....	41
Sprocket selection.....	42
Admissible sprocket load.....	44
Shaft type.....	45
Shaft material.....	46
Nominal tensile strength.....	47
Service factor.....	48
Temperature factor.....	49
Speed factor.....	50
Effective tensile force.....	51
Adjusted tensile force.....	52
Admissible tensile force.....	53
Adjusted tensile force utilized.....	54
Result torque.....	55
Result shaft power (motor power).....	56
Contact.....	57
Legal disclaimer.....	58

## First registration

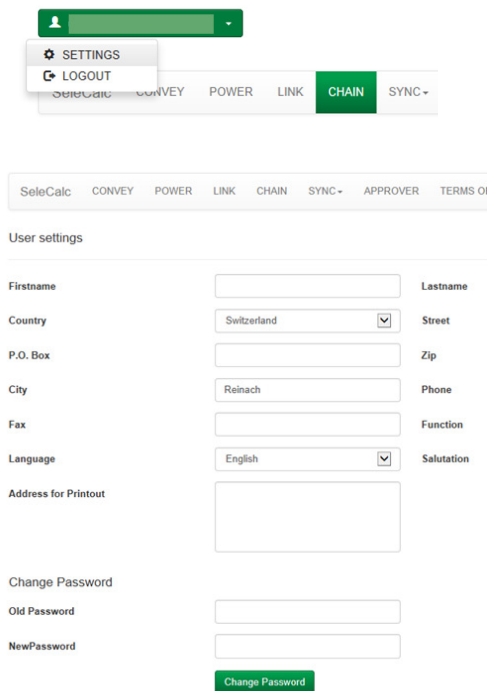
Please register as per website on: <https://selecalc.habasit.com/Link.aspx> for access. You will be approved by a local Habasit approver and will receive a confirmation.



Select CHAIN-SeleCalc from the menu.

## Settings

Use this function to get to your personal settings for all SeleCalc tools. You can enter or modify your personal information and to manage your password. The information on this page are used as contact information on the calculation report.



SETTINGS  
LOGOUT

SeleCalc CONVEY POWER LINK CHAIN SYNC-

SeleCalc CONVEY POWER LINK CHAIN SYNC- APPROVER TERMS OF

User settings

Firstname  Lastname

Country  Street

P.O. Box  Zip

City  Phone

Fax  Function

Language  Salutation

Address for Printout

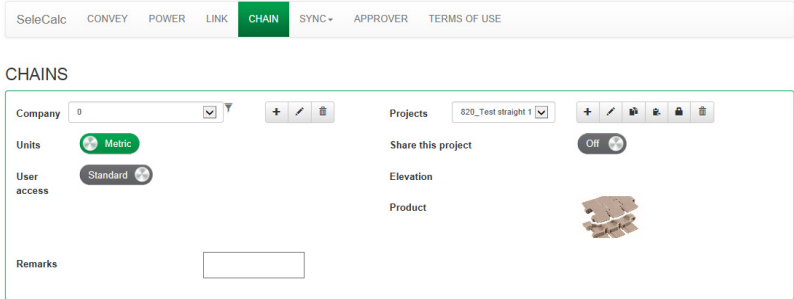
Change Password

Old Password

NewPassword


Change Password

# Getting started





Icon explanation:

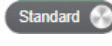
Company  : Select an existing company name

 : Add, edit or delete a company name.

Projects  : Select an existing project name

 : Add, edit, copy, send by email, lock project or delete a project name.

Share this project  : Projects can be shared with colleagues. All member of a group can share their projects. The group is specified by the approver (Habasit) but is usually the company name that allows all users within the same company to share projects.

User  : Most of the users calculate in Standard mode. Pro uses can change certain parameters directly in the program but this calculation mode is reserved for product specialists.

Remarks:

In the text box you can enter comments for your own use about the project. Remarks will be printed on the report file.

Remarks

Product:

In the header you can find a picture of the belt that is selected. If you click on this picture the product date (PDS) sheet will appear.

Metric / Imperial: You can change the current project from metric to imperial and vice-versa. All values will be converted.

Units 

Always **reselect the sprocket** after changing the unit system.

# Calculation example

To start with your first calculation:

1. Enter a company name
2. Enter a project name.

The program loads the Graphical User Interface (GUI)



the rotating arrows icon top left on the screen indicates the program is in contact with the server. Please always wait until this icon disappeared.

Please use the tab key or click with the mouse cursor into the next field rather than pressing the Enter Key.

**Chain selection** C0820K0325DPAA

**Straight**  **Radius**

Chain series: Slat top chains (straight)

Chain type: 820

Chain width: 82.60

Chain material: DP

Pin material: SS 430 / SS 431

C0820K0325DPAA

Edit Product

**Properties**

Chain weight: 0.85 kg/m

**Dimensions**

Conveying length: 10.000 m

Chain length at ambient temp.: 20.57 m

Chain length at process temp.: 20.59 m

Elevation height: m

Elevation angle: °

Accumulation length: 5.00 m

**Calc Area**

Service factor: 1.20 -

Temperature factor: 0.99 -

Calculation of speed factor: 0.87 -

Admissible tensile force utilised: 13 %

Drive shaft torque: 11 Nm

Shaftrotation: 84.1 RPM

Required shaft power: 0.094 kW

Required power on drive shaft: 0.094 kW

The motor power does vary dependent on gear box type. Please contact your gearmotor supplier for required power.


3. Select Straight (default) or Radius application (radio button)

Note: Radius chains can run in straight or radius applications

4. Select chain series, type, width, material and rod material

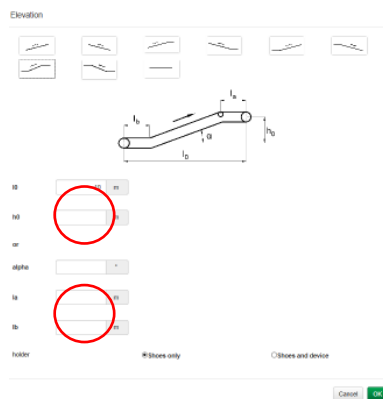
The chain article (code with chain and rod material) will be uploaded into the header of the belt selection **C0820K0325DPAA**

5. Enter dimensions in white fields (gray fields are calculations and cannot be edited). In case of radius chain the conveyor configuration will be defined in Radius sections (see point 7)

6. Elevation: In case it concerns an elevation configuration click on  in the elevation height line and a sub menu will open:



Click on the icon indicating required elevating configuration. A sub menu will open:




Enter values required and click OK button. The values will be taken into the GUI.

7. If you select calculation of a radius run, the choice of chain types is reduced to radius chains.

Straight       Radius

Unlike for straight chains there is not a direct input filed for radius applications.

For radius application the section lengths need to be defined.

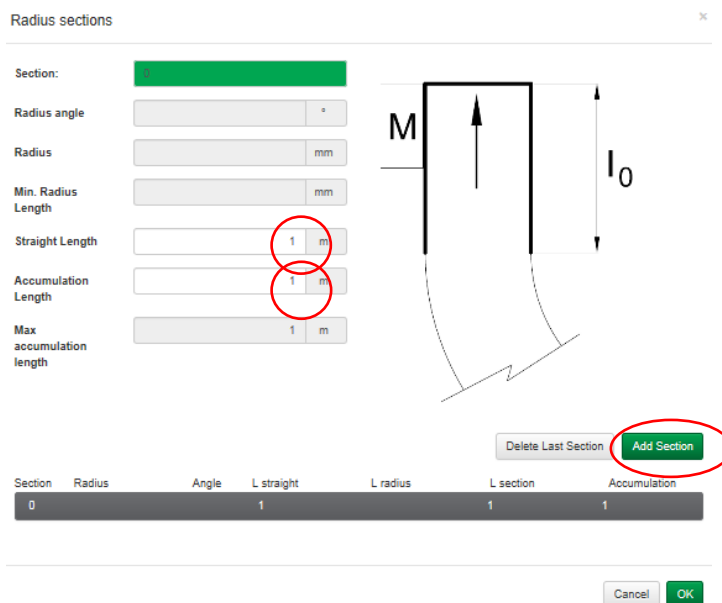
For radius configuration click on  in the Radius section:



In case the conveyor is equipped with turndiscs in the radius sections, select turndisc yes. The friction force for the radius section will decrease.

A sub menu will appear.

Enter required value for Straight length  $l_0$  (section 0) in the menu. If required enter Accumulation length.



Press button Add Section:

A new menu for section 1 will appear. For section 1,2,3 etc. always a radius and a straight part needs to be defined. Enter radius angle, straight length  $l$ , accumulation length (if required) and inside radius if larger than the minimum that is indicated.

Radius sections x

Section: 1

Radius angle:

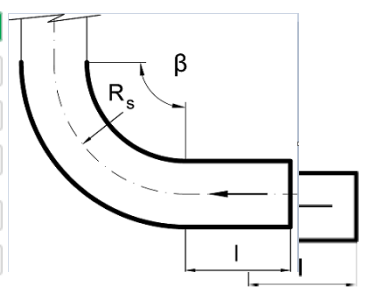
Radius:  mm

Min. Radius Length:  mm

Straight Length:  m

Accumulation Length:  m

Max accumulation length:  m



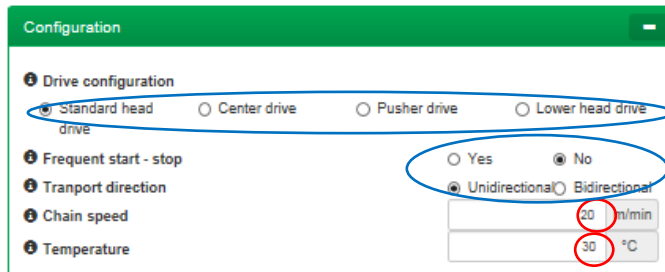
Section	Radius	Angle	L straight	L radius	L section	Accumulation
0			1		1	1
1	457	90	1	0.72	1.72	1.2

Add additional sections if needed.

If accumulation over the whole section is planned, insert the maximal accumulation length into the accumulation length field. The length of straight part plus outer length of the curve is indicated in the max. accumulation field.

Check if all values have been loaded and press OK

8. Select or enter configuration parameters:



The Configuration window includes the following settings:

- Drive configuration:**  Standard head drive,  Center drive,  Pusher drive,  Lower head drive
- Frequent start - stop:**  Yes,  No
- Transport direction:**  Unidirectional,  Bidirectional
- Chain speed:** 20 m/min
- Temperature:** 30 °C

9. Enter load conveyed and load accumulated (if there is any accumulation):

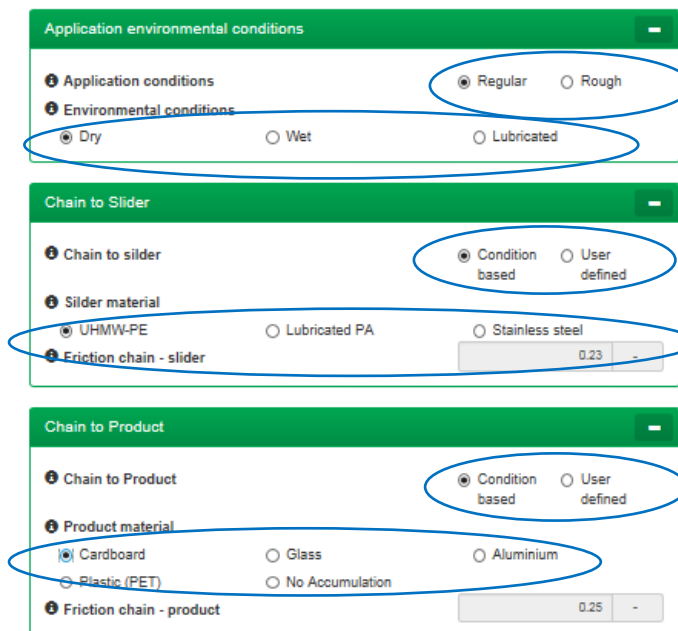


The Chain load window shows the following values:

- Load conveyed:** 10.0 kg/m
- Load accumulated:** 20.0 kg/m

Note: The accumulation load is usually higher than the standard load because there is no room between products.


10. Environment and friction:



The settings are organized into three sections:

- Application environmental conditions:**
  - Application conditions:**  Regular,  Rough
  - Environmental conditions:**  Dry,  Wet,  Lubricated
- Chain to Slider:**
  - Chain to slider:**  Condition based,  User defined
  - Slider material:**  UHMW-PE,  Lubricated PA,  Stainless steel
  - Friction chain - slider:** 0.23
- Chain to Product:**
  - Chain to Product:**  Condition based,  User defined
  - Product material:**  Cardboard,  Glass,  Aluminium,  Plastic (PET),  No Accumulation
  - Friction chain - product:** 0.25

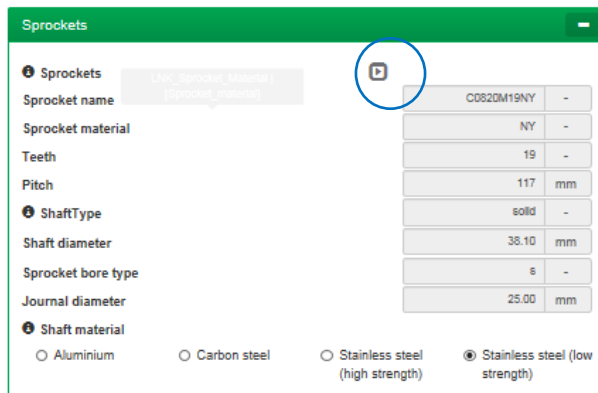
Select conditions. If not known, select tough condition.

Friction can be selected by support material or user defined that requires to enter a friction value. By pressing the arrows  one can change the selected friction value in 0.01

steps. For radius application, the selected friction value will be used (and indicated) for the radius friction as well (see point 7).


Friction for chain to product is required for product accumulation only.

### 11. Sprocket selection:



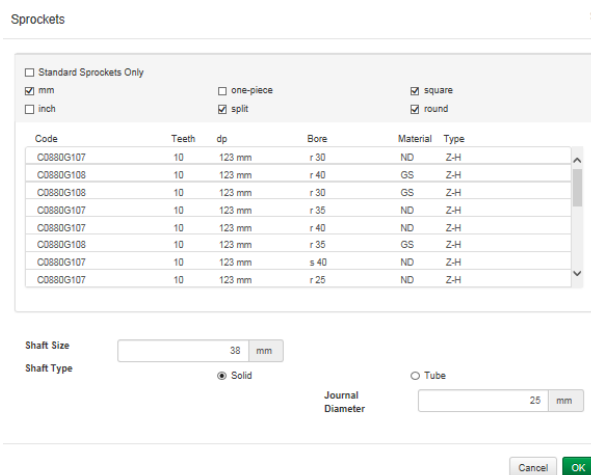
The screenshot shows the 'Sprockets' configuration window with the following fields and values:

- Sprocket name: C0820M19NY
- Sprocket material: NY
- Teeth: 19
- Pitch: 117 mm
- ShaftType: solid
- Shaft diameter: 38.10 mm
- Sprocket bore type: 8
- Journal diameter: 25.00 mm
- Shaft material:  Stainless steel (low strength)

Press  to open the sub menu to select a sprocket.

Filter in the light gray field for standard or non standard, metric or imperial size.

Select a sprocket in the selection field. For sprockets with a bore range, enter a shaft size within its range. For standard sprockets the bore size will be taken into the shaft size field that turns to gray. For shafts made of a tube, select Tube and enter the wall thickness into the field Wall Thickness. Enter a journal diameter (connection to motor) that must be smaller or equal to the shaft size. Press tab for selection and as soon rotating arrow disappeared press OK.



The screenshot shows the 'Sprockets' selection sub-menu with the following configuration fields:



- Standard Sprockets Only:
- mm:  inch:
- one-piece:  split:
- square:  round:

Code	Teeth	dp	Bore	Material	Type
C0880G107	10	123 mm	r 30	ND	Z-H
C0880G108	10	123 mm	r 40	GS	Z-H
C0880G108	10	123 mm	r 30	GS	Z-H
C0880G107	10	123 mm	r 35	ND	Z-H
C0880G107	10	123 mm	r 40	ND	Z-H
C0880G108	10	123 mm	r 35	GS	Z-H
C0880G107	10	123 mm	s 40	ND	Z-H
C0880G107	10	123 mm	r 25	ND	Z-H

Configuration fields:

- Shaft Size: 38 mm
- Shaft Type:  Solid  Tube
- Journal Diameter: 25 mm

The sprocket parameters will be taken into the GUI. Please check values in the GUI.

12. Press . Note: As long as the save button is not pressed the data is not stored and will be lost if program is closed or with the program timeout. Press  to receive a result pdf file.

## Tips and hints

The web based CHAIN-SeleCalc needs to transmit the data via internet. The program shows the connection to server by a rotation arrow on the top left of the screen. Please wait until the rotating arrows disappear for intermediate and final calculations.



**Please** use tab button or click with cursor into next field instead the enter button. Sub menus need intermediate calculation.



OK is light green, press tab button or wait until the button turns dark green.



OK is dark green, press tab or click with cursor on button.

**For radius** applications check if the radius sections are filled.



**If** you stop working with the program it will run into a timeout. The data entered will NOT be stored automatically. Please press the save button to store data.



**If** an internet connection is not available it is possible to work via mobile phone net. But it requires a smart phone that is able to be a Hot Spot. You can find on YouTube several tutorials how to generate a Hot Spot for specific smart phones.

For Samsung S3: <https://www.youtube.com/watch?v=yYbNgyJnOIs>

For iPhone S5: <https://www.youtube.com/watch?v=-BiWUEtM9Us>

After Hot Spot is active on your smart phone and selected by your device (tablet or labtop) it is possible to do CHAIN-SeleCalc calculation just as you are used to do. Don't forget to switch off Hot Spot after you have finished the calculation.

## CHAIN selection

For a Chain overview please consult: <http://www.habasit.com/en/cha-chain-types-and-data-sheet.htm>

For Chain per application consult our Engineering Guide 6017 in the download section of our website:

<http://www.habasit.com/en/download.htm#Chains>

## Material

### Chain material

The following standard materials are used for Chains.

Plastic chains – Standard chain materials				
Material	Description	Density [g/cm <sup>3</sup> ]	Temperature range	Standard color
DP	Standard POM (Acetal) <sup>1)</sup> with good strength and good coefficient of friction. Entry level material for standard or low speed applications.	1.42	Dry conditions: -40 °C to +93 °C (-40 °F to +200 °F) Wet conditions: -40 °C to +60 °C (-40 °F to +140 °F)	Gray
LF	Low-friction POM (Acetal) <sup>1)</sup> with high strength and good abrasion resistance. Suitable for high speed applications. Food contact approved.	1.42	Dry conditions: -40 °C to +93 °C (-40 °F to +200 °F) Wet conditions: -40 °C to +60 °C (-40 °F to +140 °F)	Light brown  for Flexi Chains: White
PT	Low-friction POM (Acetal) <sup>1)</sup> The material shows a low coefficient of friction, high strength and good abrasion resistance. Suitable for high speed applications with reduced lubrication	1.43	Dry conditions: -40 °C to +93 °C (-40 °F to +200 °F) Wet conditions: -40 °C to +60 °C (-40 °F to +140 °F)	Gray-brown  for Flexi Chains: White
TS	Extra low-friction POM (Acetal) <sup>1)</sup> with special self-lubricating agents. This material has the lowest friction values and highest P×V (load and speed) limit.	1.43	Dry conditions: -40 °C to +93 °C (-40 °F to +200 °F) Wet conditions: -40 °C to +60 °C (-40 °F to +140 °F)	Silver
NG	Extra low friction PBT material with good strength and very good abrasion resistance. Suitable for high speed, dry running applications. Should be used in combination with a high performance corner track.	1.34	Dry conditions: -40 °C to +120 °C (-40 °F to +248 °F) Wet conditions: -40 °C to +50 °C (-40 °F to +122 °F)	Gray

### Special chain materials:

Plastic chains – Special chain materials				
Material	Description	Density [g/cm <sup>3</sup> ]	Temperature range	Standard color
For special materials, strength reduction and dimensional variation to be expected. Please consult with Habasit Engineering.				
PK	Extra wear-resistant aramid fiber-filled POM (Acetal) <sup>1)</sup> . The special formulation ensures good wear resistance and a low coefficient of friction, especially for abrasive, wet or dry running applications.	1.41	Dry conditions: -40 °C to +93 °C (-40 °F to +200 °F) Wet conditions: -40 °C to +66 °C (-40 °F to +151 °F)	Dark gray
EC	POM (Acetal) <sup>1)</sup> with an electrical surface resistivity below 50.000 Ohm/sq (DIN/EN 1637). Material has high strength and a good coefficient of friction. Especially for applications where chain charge-up must be avoided. To be used with a conductive wear strip.	1.42	Dry conditions: -40 °C to +93 °C (-40 °F to +200 °F)	Black

Plastic chains – Special chain materials				
Material	Description	Density [g/cm <sup>3</sup> ]	Temperature range	Standard color
DE	POM (Acetal) <sup>11</sup> with a special additive to ensure the material is detectable for metal and X-ray systems.	1.67	Dry conditions: -40 °C to +93 °C (-40 °F to +200 °F) Wet conditions: -40 °C to +66 °C (-40 °F to +151 °F)	Blue
NY	PA with high strength and abrasion resistance. Material has very good long-term heat resistance. Suitable for high load, dry conditions and elevated temperatures. Flammability rating UL94 V2	1.14	Dry conditions: -46 °C to +118 °C short-term +135 °C (-50 °F to +245 °F short-term +275 °F) Wet conditions: not recommended	Dark gray
WR	Extra wear-resistant PA for dry and abrasive applications (glass). Higher wear resistance than NY with a low coefficient of friction. When using this material, it is necessary to use a synthetic lubricating agent (no water).	1.35	Dry conditions: -18 °C to +82 °C (0 °F to +180 °F) Wet conditions: not recommended	Black
HT	Reinforced PA with very high strength and toughness. Suitable for high loads, dry conditions, at elevated temperatures. Flammability rating UL94 HB.	1.37	Dry conditions: -40 °C to +145 °C short-term +175 °C (-40 °F to +293 °F short-term +347 °F) Wet conditions: not recommended	Black
NP	PBT with good strength and low coefficient of friction. Developed for conveying applications in the tobacco industry.	1.30	Dry conditions: -40 °C to +120 °C (-40 °F to +248 °F) Wet conditions: -40 °C to +50 °C (-40 °F to +122 °F)	Natural white
PP	Glass fiber reinforced PP designed for demanding applications where a high level of chemical resistance is required.	1.13	+5 °C to +105 °C (+40 °F to +220 °F)	Natural white
CR	Extremely chemical resistant fluorinated thermoplastic material. Good strength, low friction and good abrasion resistance. Especially for applications with high demands for chemical or hot water resistance.	1.78	Dry conditions: +5 °C to +115 °C (+40 °F to +239 °F) Wet conditions: +5 °C to +115 °C (+40 °F to +239 °F)	White

## Steel chain materials:

Steel chains				
Material	Description	Density [g/cm <sup>3</sup> ]	Temperature range	Standard color
CS	Carbon steel – 43 HRC	7.85	Wet conditions: not recommended Dry conditions: -40 °C to +180 °C (-40 °F to +355 °F)	Black
SS	Inox for standard applications – Ferritic stainless steel, magnetic qualities, and good chemical resistance. Suitable for most applications and environments.	7.90	Dry conditions: -40 °C to +260 °C (-40 °F to +500 °F) Wet conditions: -40 °C to +120 °C (-40 °F to +248 °F)	Gray
SH	Hard Inox for high strength applications – Martensitic stainless steel, magnetic qualities, better mechanical resistance and less chemical resistance, Ra < 0.3	7.70	Dry conditions: -40 °C to +260 °C (-40 °F to + 500 °F) Wet conditions: -40 °C to +120 °C (-40 °F to +248 °F)	Gray
SA	18/8 SS with high chemical resistance – Austenitic stainless steel, non-magnetic, with better chemical resistance and wear resistance, but less mechanical strength. Used in tough environments or for esthetic reasons.	7.90	Dry conditions: -40 °C to +400 °C (-40 °F to +752 °F) Wet conditions: -40 °C to +120 °C (-40 °F to +248 °F)	Gray

## Pin materials:

Pins				
Material	Description	Density [g/cm <sup>3</sup> ]	Temperature range	Standard color
J	Case hardened carbon steel (steel chains only)	7.85	Wet conditions: not recommended Dry conditions: -40 °C to +180 °C (-40 °F to +355 °F)	Gray
K	Standard applications - Ferritic stainless steel, magnetic qualities, and good chemical resistance. Suitable for most applications and environments. Standard pin for plastic and steel chains. AISI 430 for plastic chains, and AISI 431 for steel chains (Previous code SS).	7.90	Dry conditions: -40 °C to +260 °C (-40 °F to +500 °F) Wet conditions: -40 °C to +120 °C (-40 °F to +248 °F)	Gray
P	High chemical resistance - Austenitic stainless steel, non-magnetic, with better chemical resistance and wear resistance, but less mechanical strength. Used in tough environments or for esthetic reasons. AISI 304 (Previous code SA)	7.90	Dry conditions: -40 °C to +400 °C (-40 °F to +752 °F) Wet conditions: -40 °C to +120 °C (-40 °F to +248 °F)	Gray
Q	High chemical resistance - Austenitic stainless steel, non-magnetic with increased resistance to chloride corrosion. AISI 316 (Previous code IN)	7.90	Dry conditions: -40 °C to +400 °C (-40 °F to +752 °F) Wet conditions: -40 °C to +120 °C (-40 °F to +248 °F)	Gray

Pins				
Material	Description	Density [g/cm <sup>3</sup> ]	Temperature range	Standard color
L	Wear and fatigue resistant highly reinforced Polyamide. Easy to recycle option for plastic chains. (Previous code PA)	1.55	Dry conditions: -40° C to +145 °C short-term +175 °C (-40°F to +293 °F short-term +347 °F) Wet conditions: not recommended	Natural beige
N	Extra low friction PBT material with good strength and very good abrasion resistance. Easy to recycle for selected plastic chains. (Previous code NG)	1.30	Dry conditions: -40 °C to +120 °C (-40 °F to +248 °F) Wet conditions: -40 °C to +50 °C (-40 °F to +122 °F)	Natural white

### Sprocket materials:

Sprockets				
Material	Description	Density [g/cm <sup>3</sup> ]	Temperature range	Standard color
GS	Reinforced polyamide with high strength and wear resistance for long life Multi-Hub sprockets.	1.37	Dry conditions: -46 °C to +118 °C (-50 °F to +245 °F) Wet conditions: -40 °C to +50 °C (-40 °F to +122 °F)	Black
ND	Tough, wear resistant and noise dampening material for Multi-Hub sprockets.	1.24	-20 °C to +50 °C (-4 °F to + 120 °F)	Dark gray
PE	Tough, wear resistant and noise dampening UHMWPE. Not suitable for abrasive applications. For machined sprockets.	0.94	-70 °C to +65 °C (-94 °F to +150 °F)	Natural white
NY	High heat resistant, good abrasion resistant polyamide sprocket material. For machined sprockets.	1.14	Dry conditions: -46 °C to +118 °C short-term +135 °C (-50 °F to +245 °F short-term +275 °F) Wet conditions: not recommended	Natural white
L	Extra low friction POM (Acetal) with self-lubricating agent for Multi-Hub idler and molded sprockets.	1.41	Dry conditions: -40 °C to +93 °C (-40 °F to +200 °F) Wet conditions: -40 °C to +60 °C (-40 °F to +140 °F)	Black
CI	Cast iron for solid sprockets. Suitable in non-corrosive, abrasive environments, such as glass conveying.	7.85	Dry conditions: -40 °C to +180 °C (-40 °F to +355 °F) Wet conditions: not recommended	Black

For further detailed material properties and food approvals, please contact Habasit.

## **Material selection**

The suitable material combination has to be selected depending on the actual application and environment.

Always check the chemical resistance of the material selected (see Engineering Guide).

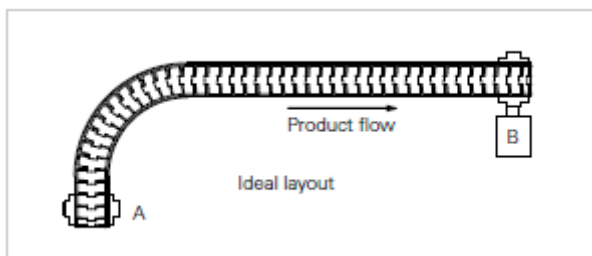
## **Low temperature applications**

Applications below  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) have to be analysed carefully. Since the belts are shrinking at low temperature, the sprockets will no more properly engage. This is particularly the case, if the sprockets stay warmer than the belt. This can be the case if the belt is passing through a cooling tunnel and the sprockets are positioned outside in warmer environment. For applications below  $-40^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$ ) it is recommended to contact Habasit.

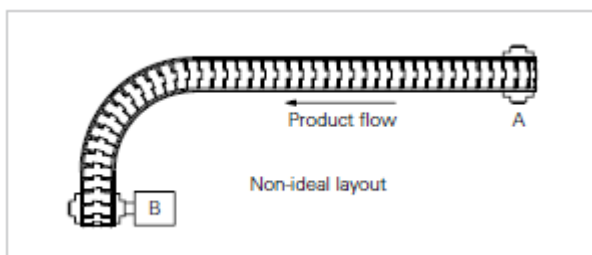
## Radius configuration

A conveying system may not always use straight conveyors due to the process flow or obstructions, a radius conveyor can be utilized.

Location of the curve section in relation to the drive end [B] is critical to keep tensions lower. To reduce the tension in the system, the curve section should be located as close as possible to the idle end [A] of the conveyor. The ideal diagram below shows the curve section close to the idle end which minimizes the tension increase through the curve.



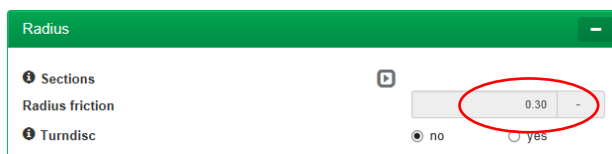
The non ideal diagram below shows the curve close to the drive end [B]. This layout will significantly increase the tension in the system and should be avoided if possible.



The number of curves and the angle of each curve should be minimized in each conveyor section to keep the tension in the system within limits. The CHAIN-SeleCalc is a tool that can be used to calculate the tensions.

## Friction in radius section

For corner tracks or wear strips the coefficient of friction for the radius section is equal to the selected friction value between chain and slider support:



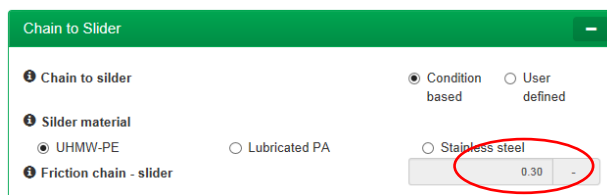
Radius

Sections

Radius friction: 0.30

Turndisc:  no  yes

equal



Chain to Slider

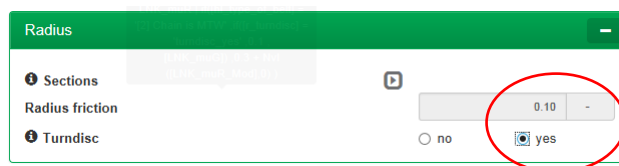
Chain to silder:  Condition based  User defined

Slider material:  UHMW-PE  Lubricated PA  Stainless steel

Friction chain - slider: 0.30

## Turndisc

In case Turndisc is selected the coefficient of friction for the radius sections is set to 0.10 on carryway as well as on the returnway for all curves.



Radius

Sections

Radius friction: 0.10

Turndisc:  no  yes

## Accumulation on Radius Chains

Accumulation can be applied on any section of the conveyor. It is assumed that the accumulation starts at the front end of a section. For the calculation, insert the accumulation length requested for a section into the respective accumulation fields. This value must be smaller than or equal to the maximum possible accumulation length indicated for this section.

Length of a section (i.e. section 1) = length of the curve plus length of the following straight part (view from front (motor) to back).

It is advisable to start the accumulation at the head end (drive) of the conveyor and if possible, to limit it to the straight section only. If accumulation in the curve is necessary, keep it as short as possible.

If accumulation over a whole section is planned, insert the maximal accumulation length indicated.

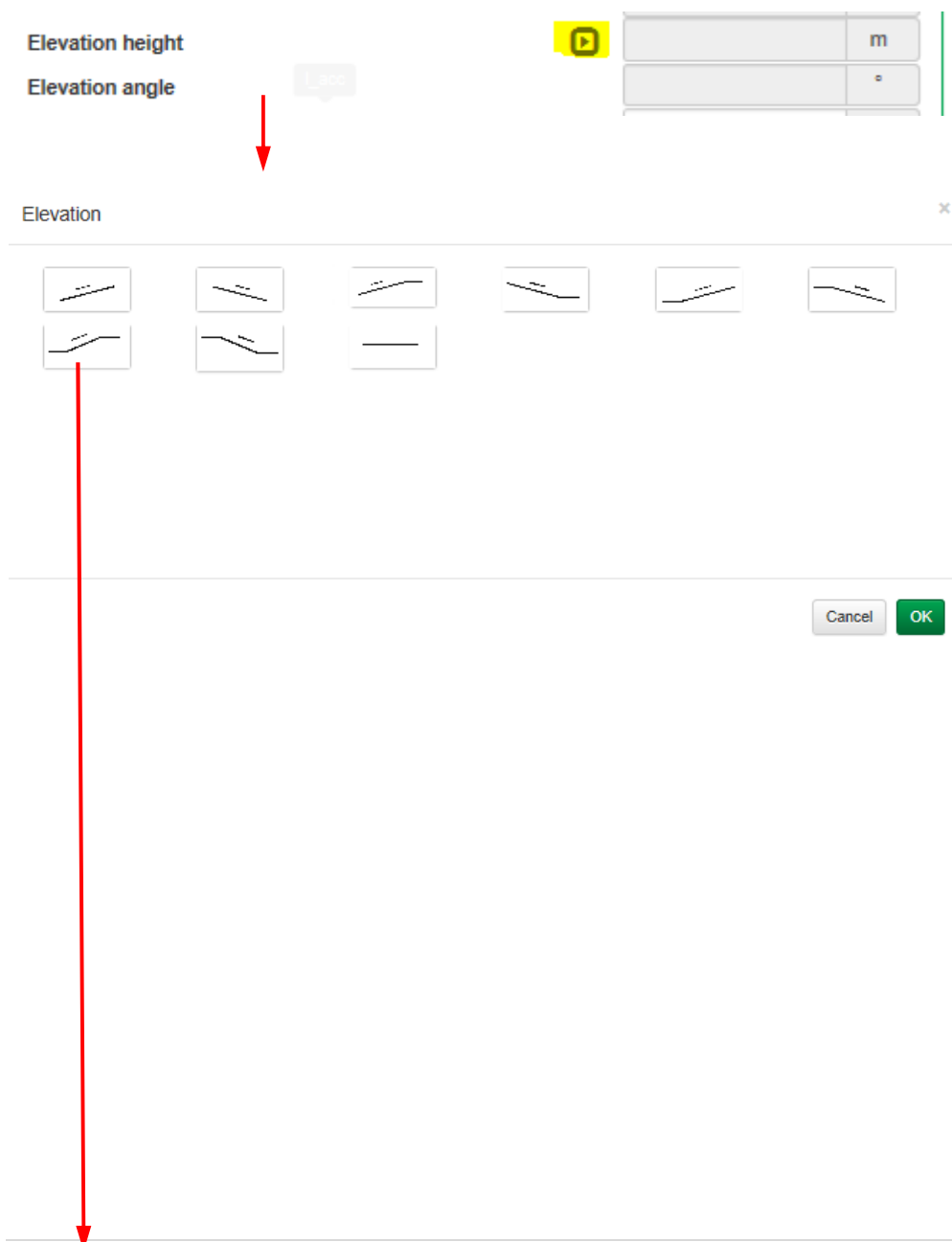
For smaller radius applications with 1 curve only, accumulation may be possible over the total length of the conveyor. In this case insert the maximum possible accumulation length as indicated for each individual section.

## Elevation

### Incline / decline conveyors

The program does have a sub menu containing 8 configurations for inclined and declined conveyors.

For chains in radius application the configurations 1 and 5 are applicable.



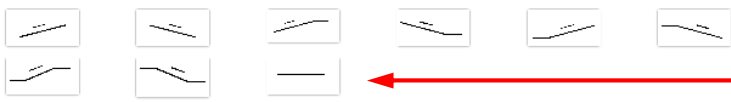
Elevation height  m

Elevation angle  °

Elevation ×

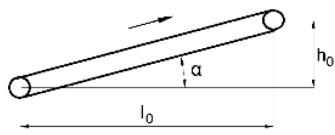
Cancel OK

Elevation ×



← Change configuration

← Back to horizontal



$l_0$   m

$h_0$   m

or

alpha  °

### Down-going elevators (declined)

Insert the height as a positive value in meters or feet.

At a certain height (inclination angle) the utilized % of belt strength becomes 0. This means that the product pulling the belt down the inclination compensates for the belt friction against the base and consequently the motor does not need to drive anymore. Above this height the product load will begin to drive the belt and the motor brakes it (torque negative).

### Combined up- and down-going conveyors (incline / decline)







For the conveying length insert the distance between the shaft centers at the very ends of the conveyor (horizontal projection)  $l_0$  in meters or feet. Further insert the difference between the up- and down-going heights (sum of all up-going heights minus the sum of all down-going heights).


[Inclined radius belts](#)

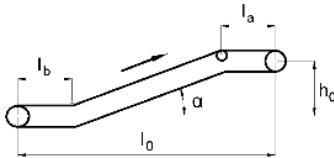
## Conveyor configurations with chain back bending

Configurations 3, 4, 6, 8 include **at least 1 belt backbend** (special case)

Elevation x


back to horizontal



$l_0$   m

$h_0$   m

or

alpha  °

$l_a$   m

$l_b$   m

holder  Shoes only  Shoes and device

## **Calculation for conveyors with back bending**

To provide an exact calculation for conveyors with chain backbend it is necessary to have all the conveyor data including length of horizontal sections, friction of hold down shoes, etc. In practice these values are often unknown. For this reason the calculation is simplified.

A higher inclination influences the friction force in the hold down devices and the chain tensile force will increase.

A loaded long straight section  $l_b$  increases the friction forces in the hold down devices and leads to a higher belt tensile force. For this reason long straight sections  $l_b$  in front of the inclination should be avoided.

## Speed limit for conveyors with chain back bending

For conveyors with belt back bending the speed is limited to 30 m/min (98ft/min.) due to increased friction. It is possible to over write it. Please contact Habasit.

[Incline / decline conveyors](#)

[Incline radius belts](#)

## Service factor

Service factors take into account the impact of stress conditions that reduce the belt life.

Z-conveyors include all elevators with at least 1 backbend.

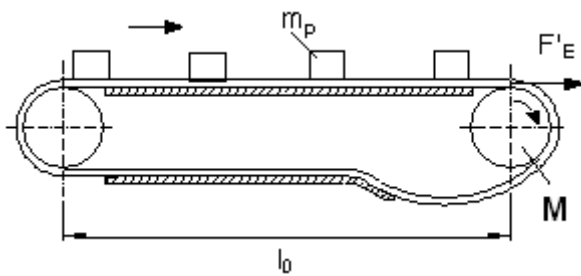
Service factors for Z-conveyors consider additional friction in the backbend.

Values:

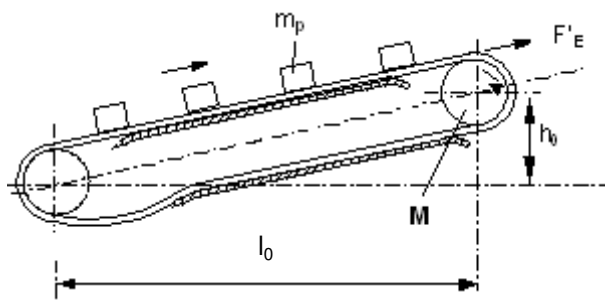
- Inclination  $>20^{\circ}$  = + 0.2
- Inclination  $20^{\circ}$ - $50^{\circ}$  = + 0.4
- Inclination  $50^{\circ}$ - $70^{\circ}$  = + 1.1
- Inclination  $70^{\circ}$ - $90^{\circ}$  = + 1.8

## Conveying length

The **conveying length** is identical to the **horizontal shaft center distance**. Please insert the conveying length  $l_0$  in meters or feet.



For the conveying length of elevators (inclined or declined conveyors, Z-conveyors) insert the **horizontal projection**  $l_0$ .



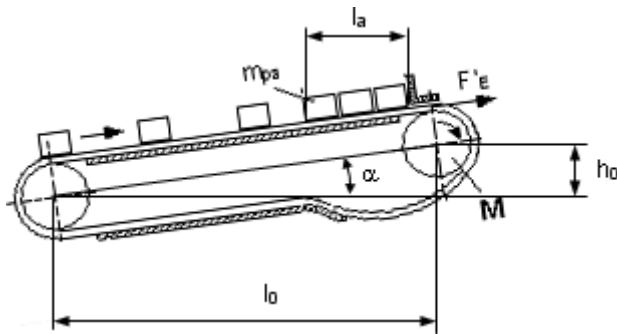
### Remarks

For inclination angles  $< 12^\circ$  the catenary sag is normally positioned at the upper end of the conveyor.

The chain length needed to produce the conveyor is called the **total geometric belt length**. The calculated geometrical chain length ( $l_g$ ) is equal to the length of the transport side plus return side and sprocket circumference plus the excessive length of the catenary sag ( $l_c$ ). The length of the chain must be finally adjusted on the machine. It is important to order sufficient material, since re-order is costly for all parties involved. In addition, extra material also helps in emergency cases. Due to the hinge clearance, the effective chain length is always slightly longer than the calculated geometrical length. For applications in cold environments (e.g. freezers) the belt shortening due to temperature differences between the installation temperature and the lowest service temperature must be considered. For most other cases the catenary sag length calculation can be ignored. For conveyors shorter than 5 meters (15 feet) it is advisable to add 50 mm (2") to the calculated length.

The total chain length indicated in the print-out includes an additional 1% of the calculated geometric belt length (at least an extra 100 mm), for the catenary sag.

## Accumulation length



Accumulation only works for horizontal and lightly inclined conveyors. The limit is reached when the friction force and gravity force are equal and the product starts to slide backwards. The limit of the inclination angle is reached when the back-up pressure of the accumulation is near to 0.

$$h_0 \leq 0.8 \cdot l_0 \cdot \mu_{pa}$$

Please note that the defined limit is only valid for inclined conveyors with just one inclination over the whole length. It is not valid for Z-conveyors and conveyors with multiple inclinations and declinations.

Accumulation length should not exceed conveying length.

# Configuration

## Maximum speeds

Insert the speed in **m/min** (or ft/min)

Admissible speeds of long conveyors:

Length	Max. speed
up to 15 m (45 ft)	50 m/min (150 ft/min)
15 - 25 m (45 - 75 ft)	30 m/min (90 ft/min)
over 25 m (75 ft)	15 m/min (45 ft/min)

Applications exceeding 50 m/min (150 ft/min) negatively affect the life expectancy of the belt. For speeds higher than 50 m/min always consult a Habasit specialist.

**Polygon effect:** Chain links moving around a sprocket cause the belt speed to vary. The pin travels on the pitch diameter of the sprocket, while the middle of the chain moves through the smaller chordal radius. This polygon effect is also called **chordal action**. The magnitude of speed variation depends entirely on the number of sprocket teeth. The higher the number of teeth the smaller the speed variation.

[Speed factor](#)

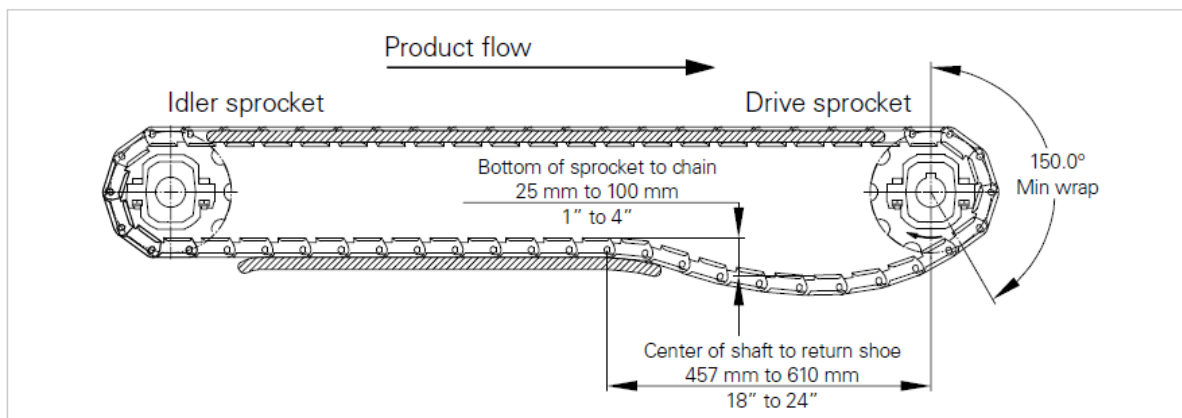
## Drive configurations

For all chain applications soft start drive controls should be used. Sudden starts reduce the chain lifetime.

### Drive and tensioning construction

#### Standard end drive

The motor is normally at the discharge of the conveyor. This drive system is unidirectional in which the chain is always pulled towards the discharge. A catenary sag is used to tension the chain. Please see sections below on catenary sag and return way entry for proper design details. Catenary sag is an unsupported length of chain for absorbing changes in chain length caused by thermal expansion, thermal contraction, load changes, and wear of the chain. Catenary sag is measured when the conveyor is running. If the catenary sag is greater than the recommendations, chain needs to be removed and catenary sag corrected. The catenary sag needs to be as close as possible to the drive. See diagram for proper dimensions.

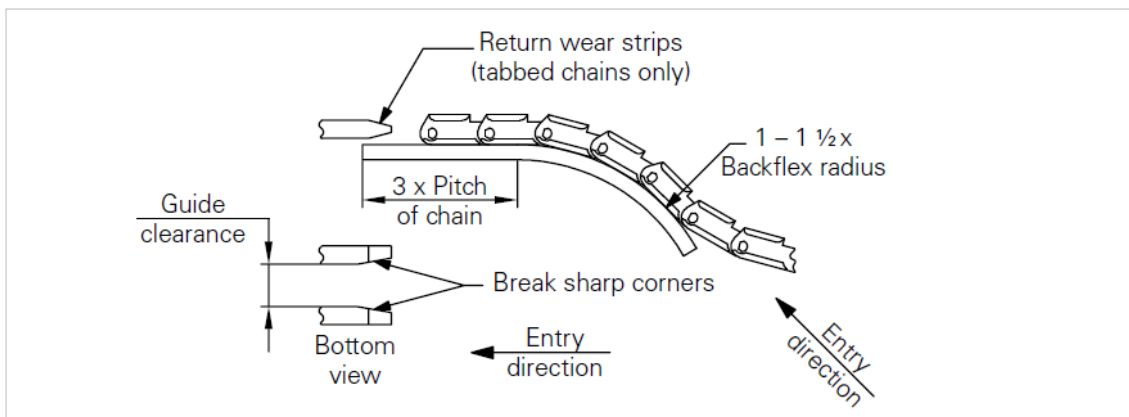


The catenary sag area needs to be free of obstruction including cross members, drive components, supports, and fasteners that can damage the chain. It is not recommended to run the chain tight and in most cases, takeups are not typically used. For heavily loaded conveyors, a gravity tensioning device may be required to keep proper tension on chain.

## Return way entry radius

For smooth transition of the chain from the catenary sag to the return, a return shoe is required with a radius of 1 – 1.5 times the back flex radius.

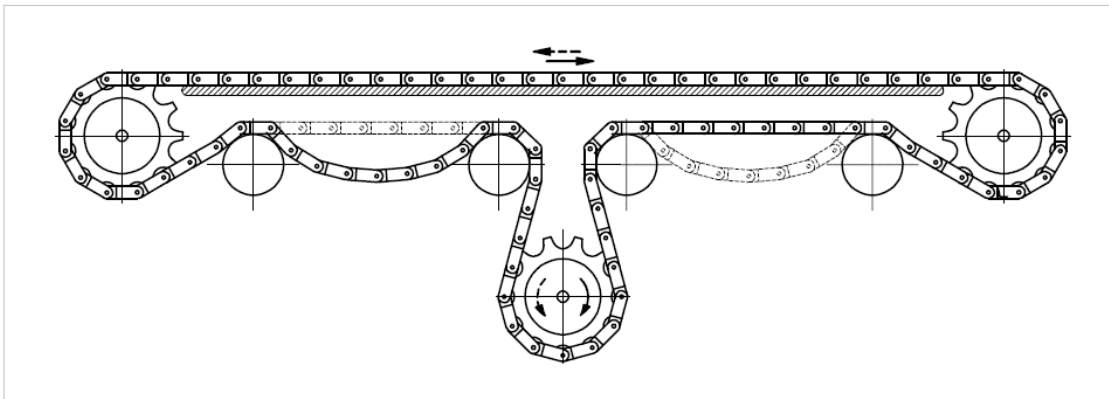
For a tab return system, the return shoe needs to have a tangent of 3 times the pitch of the chain prior to the start of the wear strips that will hold the tabs. This will ensure the chain is flat and the tabs are in the same location for ease of entry in to the return wear strips.



The wear strips need to be chamfered so the chain has additional clearance when entering the return wear strips to prevent catching of the chain. The width between the two return wear strips must follow the guide clearance recommendations for the chain that is used.

### Center drive

The motor is located on the return side as close to center as possible. This drive system can be unidirectional or bi-directional. A catenary sag is used to tension the chain. In this case, the catenary sag is between the support rollers. Please note the diameter of the support rollers needs to be two times the back flex radius of the chain. The catenary sag will switch locations depending on the direction the chain is traveling. This is noted in the drawing below.



Belt wrap on drive sprockets 190 - 210°

Catenary sags must have sufficient length to provide a back-tension at sprockets

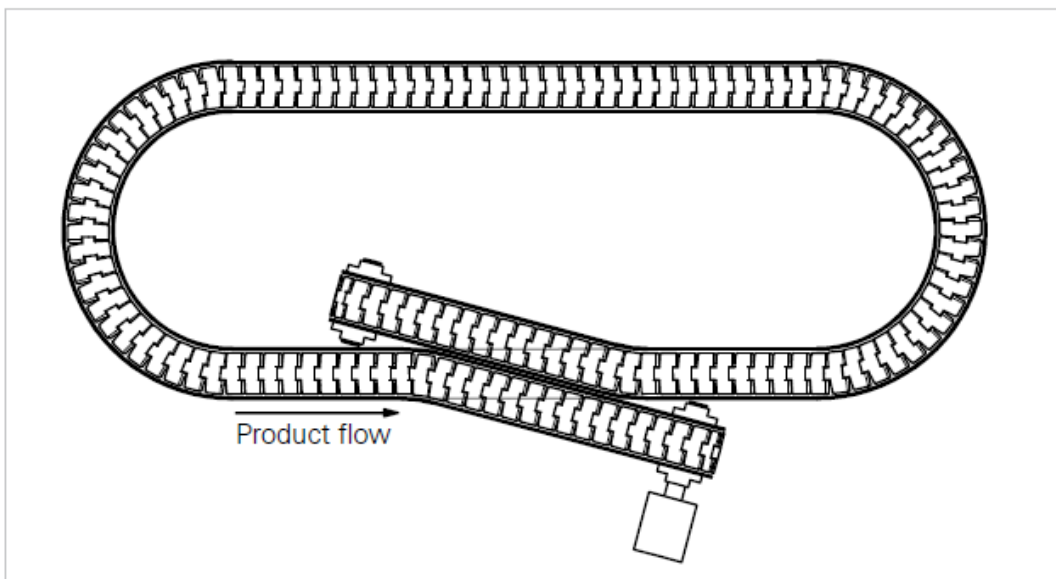
Use large back flexing rollers

This drive system is not valid for all chain types and is not recommended for long conveyors or conveyors with a curve.

## Offset Drive

Similar to standard end drive except the chain is guided (offset), through the catenary to the idle sprocket. This is a unidirectional drive.

Most of the return chain is eliminated, less chain in the system. The chain must be a side flexing type.



## Pusher drive

**Pusher drives are not recommended.** In this case the chain needs to be tensioned. The shaft load is doubled, wear increases, and the lifetime is reduced.

## Frequent start/stop

Definition: Frequent start/stop = more than one start per hour

The service factor for frequent start/stop is based **on soft start drives**. Use soft start drive controls for all chain applications. Sudden starts reduce the belt lifetime.

## Temperature

Insert the temperature of the chain material near the drive. This temperature may be different from the temperature of the environment (heat transfer from product to belt, cooling effects, etc.).

### [Temperature factor](#)

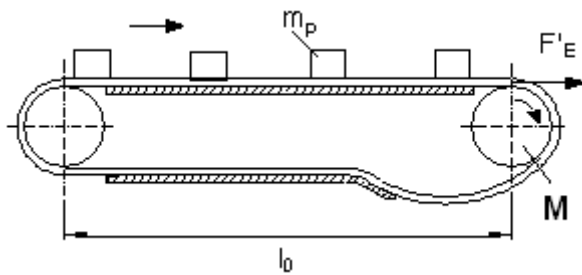
#### **Low temperature applications**

At very low temperatures (< -40 °C, -40 °F) sprocket engagement may be affected!

For maximum allowed temperatures refer to chapter chain material.

## Load

### Conveyed load



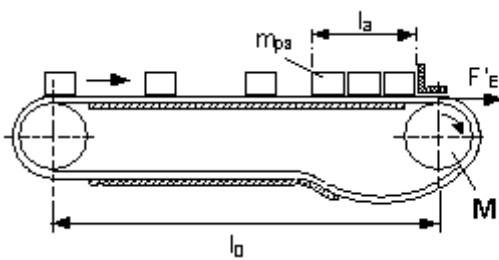
The conveyed load  $m_p$  has to be inserted in **kg/m (lb/ft)**.

Note: For radius applications the radius sections must be defined in the sub menu Radius in order a calculation can be performed.

## Accumulation load

The accumulation has to be inserted in **kg/m (lb/ft)**.

Take into account the density of the accumulated product on the belt, which is normally higher than the conveyed load.



## **Friction chain to slider support**

### **Friction chain to product**

Due to the fact that the calculations strongly depend on the coefficient of friction, this has to be defined carefully according to the application.

In case the friction value is unknown choose values on the safe side (tough conditions).

The effective friction values may be 2-3 times higher than the value evaluated by tests in the laboratory. In case of uncertainty we recommend that you evaluate the effective value on site.

Condition-based coefficients of friction

Regular conditions: Clean conditions or application with regular cleaning


Tough conditions: Dirty industrial or abrasive applications, e.g. applications where paper dust, sand or sticky contaminants are involved

# Sprocket


## Sprocket selection

For sprocket code explanation please consult sprocket product data sheet on:

<http://www.habasit.com/en/sprockets.htm>

Open the submenu by pressing the  button:

### Sprockets

**i Sprockets** 

Sprocket name	C0880M09NY	-
Sprocket material	NY	-
Teeth	9	-
Pitch	111	mm
<b>i ShaftType</b>	solid	-
Shaft diameter	40.00	mm
Sprocket bore type	r	-
Journal diameter	30.00	mm

**i Shaft material**

Aluminium     Carbon steel     Stainless steel (high strength)     Stainless steel (low strength)

Mark check boxes according to your interest to limit the sprocket choice.

Sprockets ✕

---

Standard Sprockets Only

mm                       one-piece                       square  
 inch                       split                       round

Code	Teeth	dp	Bore	Material	Type
C0880M09NY	9	111 mm	r 40	NY	C1
C0880M09NY	9	111 mm	s 25	NY	C1
C0880M09NY	9	111 mm	s 40	NY	C1
C0880M10NY	10	123 mm	s 25	NY	C1
C0880M10NY	10	123 mm	s 40	NY	C1
C0880M11NY	11	135 mm	s 25	NY	C1
C0880M11NY	11	135 mm	s 40	NY	C1
C0880M12NY	12	147 mm	s 40	NY	C1

**Shaft Size**  mm  
**Shaft Type**  Solid  Tube  
**Journal Diameter**  mm

Select appropriate size by clicking on the sprocket code.

Bore type:

r.. = round bore

s.. = square bore

Type of sprockets:

S = Molded sprocket

C1 = Machined sprocket

Z-C1 = Machined split sprocket

Z-H = Multi hub molded type

Molded and Multihub sprockets have a defined bore (shaft) size. Shaft size field is filled by the defined shaft size and can't be changed, field is gray.

Enter a journal diameter. This diameter is the connection to Motor and is usually slightly smaller than the shaft size.

In case the shaft is made of a tube, select Tube and enter wall thickness of the tube.

## **Admissible sprocket load**

Admissible sprocket loads depend on sprocket type, sprocket size, shaft size and sprocket material, and are defined individually for each sprocket.

Large sprockets with small shaft bores may have lower admissible sprocket loads.

The compliance of admissible sprocket loads is taken into consideration in the CHAIN-SeleCalc program.

General rules:

Nylon sprockets do have a higher admissible strength compared to sprockets made of Polyethylene. Square shafts allow a 4 times higher torques transmission compared to round shaft with one key way.

## Shaft type

You can select solid or tube shafts.

Please consider that it may be difficult to fix sprockets properly to tubes dependent on tube size tolerance. Joining the tubular drive shaft to the solid journal (shaft end for drive connection) is critical and needs to be well engineered to guarantee torque transmission. The calculation does not take into account shaft strength reduction due to welding or notches.

A common shaft design may also be a combination of a round shaft with a square tube which is shifted over the round shaft and joined by welding. In this case we recommend selecting a solid square shaft for calculation.

### Wall thickness

Wall thickness is used for calculating the shaft deflection.

### Journal diameter

The journal diameter is the diameter of the driven shaft end connected to the motor or gear shaft. It may be smaller than the shaft itself, but cannot be bigger. The selected journal diameter is validated by strength calculation, assuming a solid cylindrical journal. If the shaft is found to be insufficiently strong to transmit the torque, the display of the calculated torque value will turn red.

## Shaft material

The following average values are used for the calculation of bending and torque:

Shaft material offered for selection (pop-up menu)	Modulus of elasticity E	Shearing strength	Possible material specifications
Carbon Steel	206'000 N/mm <sup>2</sup>	60 N/mm <sup>2</sup>	St 37-2 , KG-37
Stainless Steel (low strength)	195'000 N/mm <sup>2</sup>	60 N/mm <sup>2</sup>	X5CrNi18 10, AISI 316, 304
Stainless Steel (high strength)	195'000 N/mm <sup>2</sup>	90 N/mm <sup>2</sup>	X12CrNi 17 7, AISI 301
Aluminum	70'000 N/mm <sup>2</sup>	40 N/mm <sup>2</sup>	AlMg3, AA 5052

## **Nominal tensile strength**

The nominal chain strength is set at approximately 30% of the breaking strength at standard conditions for temperature and humidity and is indicated on the product data sheet.

## Result: Factors

### Service factor

The service factor  $C_s$  takes into account specific conveyor conditions (higher friction and stress due to backbending, nosebars, etc.).

The service factor takes into account the impact of stress conditions that reduce the chains life. Z-conveyors include all elevators with at least 1 backbend. The service factor for Z-conveyors considers additional friction in the backbend.

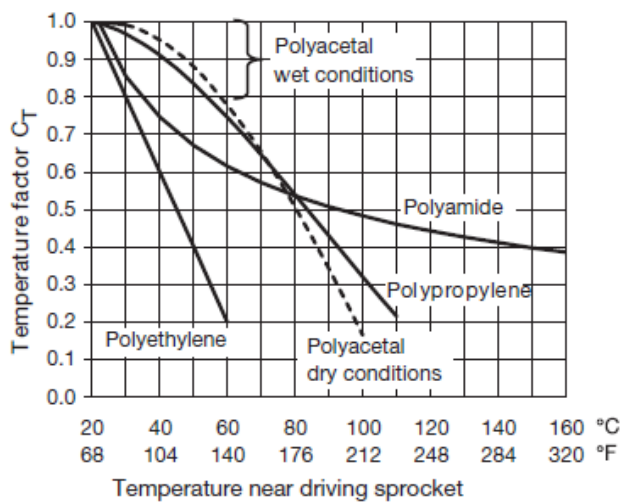
Typical service factors are:

- Frequent start/stop +0.2
- Lower head drive +0.1
- Center drive +0.2
- Pusher drive +0.4
- Inclined conveyor with chain back-bending +0.2 to +1.8 dependent on incline angle and chain strength utilization.

## Temperature factor

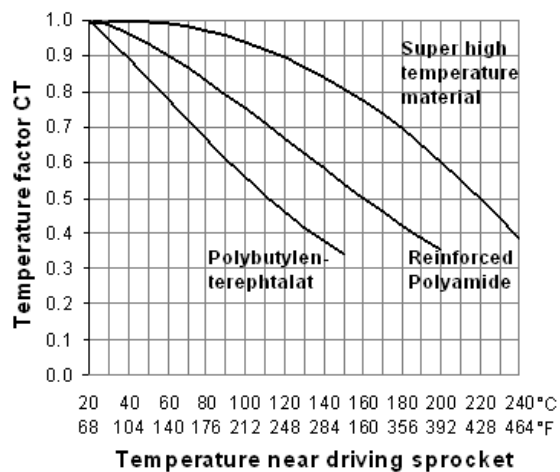
The temperature factor  $C_T$  takes into account the reduction in the belt strength at higher temperatures.

[Admissible tensile force utilized](#)



Temperature factor for special materials

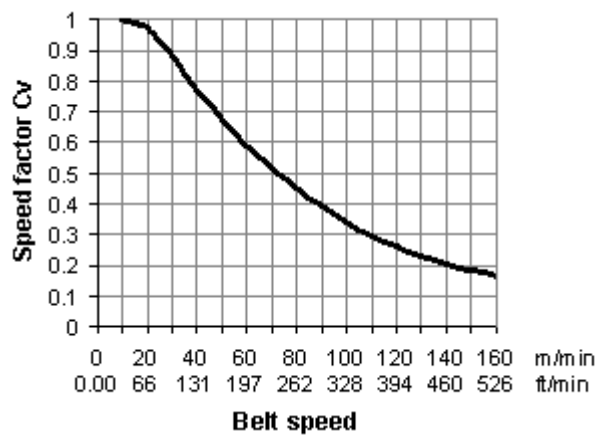
### Special materials



## Speed factor

The speed factor  $C_v$  takes into account the increased stresses on the belt at higher speeds due to dynamic forces and increased friction.

### [Admissible tensile force utilized](#)



## **Result: Force**

### **Effective tensile force**

Effective tensile force (N or lbs) is calculated near the drive shaft, where it reaches its maximum.

## Adjusted tensile force

Adjusted tensile force = effective tensile force multiplied by the **service factor Cs**. This factor takes into account the **operational conditions** such as:

- Conveyor system (elevator, radius)
- Type of drive (head, center, pusher)
- Running conditions (frequent start/stop)

## Admissible tensile force

Admissible tensile force = nominal tensile strength of the belt multiplied by the **temperature factor CT** and **speed factor Cv**. These factors take into account the **process conditions**.

## **Admissible tensile force utilized**

100% utilized tensile force is only acceptable for well defined and stable process and service conditions. The percentage of utilized tensile force cannot be  $> 100\%$ . Above 70% we recommend that you carefully study the conditions. Friction values in particular have a great influence on the calculation results!

## Result: Torque (journal diameter)

The calculated torque is compared with the admissible torque for the selected journal diameter (end of drive shaft connected to the motor- or gear shaft). If the calculated torque is bigger than the admissible journal torque, the torque value displayed will turn red.

Please note that no strength calculation is made for the shaft itself (solid or tube). It is the responsibility of the machine producer to calculate the specific shaft size. This is of particular importance if tubes are used with welded journals at the drive end.

## Result: Required shaft power

The displayed value "Required power on drive shaft" relates to the friction forces belt/guides and belt/product and indicates the power needed at the sprocket shaft considering a high efficiency  $\eta$  for the shaft bearings.

### Required motor power

Since several machine components may be installed between the motor and the drive shaft of a conveyor, the energy loss of those elements (gear boxes, transmissions, etc.) has to be considered when specifying the required motor power. Due to its 90° in/out gear shape worm gears are regularly used. But such gears can have a very low efficiency  $\eta$  that requires more motor power. Depending on these losses in the drive system, **drive efficiency  $\eta$  even lower than 50% is possible!**

**Please contact your drive system supplier to specify the motor power required.**



## Contact

You can reach a Habasit expert at the following e-mail address:

[info@habasit.com](mailto:info@habasit.com)

## Legal disclaimer

“This disclaimer is made by and on behalf of Habasit and its affiliated companies, directors, employees, agents and contractors (hereinafter collectively "HABASIT".) with respect to the products referred to herein (the "Products"). SAFETY WARNINGS SHOULD BE READ CAREFULLY AND ANY RECOMMENDED SAFETY PRECAUTIONS BE FOLLOWED TRICTLY! Please refer to the Safety Warnings herein, in the Habasit catalogue as well as installation and operating manuals. All indications / information as to the application, use and performance of the Products are recommendations provided with due diligence and care, but no representations or warranties of any kind are made as to their completeness, accuracy or suitability for a particular purpose. The data provided herein are based on laboratory application with small-scale test equipment, running at standard conditions, and do not necessarily match product performance in industrial use. New knowledge and experience may lead to re-assessments and modifications within a short period of time and without prior notice.

EXCEPT AS EXPLICITLY WARRANTED BY HABASIT, WHICH ARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, THE PRODUCTS ARE PROVIDED “AS IS”. HABASIT DISCLAIMS ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE, ALL OF WHICH ARE HEREBY EXCLUDED TO THE EXTENT ALLOWED BY APPLICABLE LAW. BECAUSE CONDITIONS OF USE IN INDUSTRIAL APPLICATION ARE OUTSIDE OF HABASIT'S CONTROL, HABASIT DOES NOT ASSUME ANY LIABILITY CONCERNING THE SUITABILITY AND PROCESS ABILITY OF THE PRODUCTS, INCLUDING INDICATIONS ON PROCESS RESULTS AND OUTPUT.”