ROLLCO

TECHNICAL INFORMATION
TIMING BELT CONVEYORS

Index

Product overview

The main purpose of our timing belt conveyor systems is to solve two typical requirements:

- Sideways transportation of slender objects such as boards, lists, tubes, and rods
- 100 % synchronized motion, both between individual parallel belt units and relative to the drive source.

The timing belt conveyor comes in two sizes, TB40 and TB80, and consists of one timing belt unit or several parallel synchronously driven timing belt units. The conveyor is designed to be driven by a geared 3-phase asynchronous motor. What size and how many synchronously driven timing belts are needed is determined by the weight, size, and amount of goods to be transported.

Design

Both TB40 and TB80 have a base of a modular aluminum profile 40 mm wide and use a 32 mm wide timing belt. What differs is the height of the aluminum profile (40 or 80 mm) and the diameter of the timing belt wheel. The benefits of the TB80 are higher load capacity and possibility for thicker topside covers on the belt.

The timing belt runs in a plastic profile, which ensures good guiding and low friction for the belt during operation. Due to the use of AT10 belt profile, false teeth and screwed cleats can be used on both TB40 and TB80.

Synchronized drive

For a 2-units system, the units are simply connected by lateral cross bars, forming a ladder frame, and the legs are fixed directly to the profiles of the belt units.

For systems having 3 or more parallel belt units, the legs are fixed to the crossbars. The crossbars run as continuous profiles over the full system width. The belt units are connected to the crossbars via short vertical profiles.

TB Multisystem

TB Double

Proven performance

TB40 and TB80 have been extensively tested over its full performance range of speeds, loads, and lengths, together with our standard drive units. It is possible to go beyond the standard drive unit performance by using alternative drive systems.

Operating and environmental conditions and properties

- Conveyor system TB is designed for indoor, clean, and dry conditions.
- Operative temperature range:+10 to +40 °C
- Relative humidity range: 30 – 70%
- Heavy dust and particle contamination to be avoided
- Not intended to withstand liquids and wet contaminations
- Not for handling of unprotected food
- Not suitable for handling of ESD-sensitive components or assemblies
- Not to be used in explosive (ATEX) environments
- Noise emissions with Standard drive units: < 70 dB(A) at 1 m (typical value, noise created by transported goods excluded)

More details about proper use, cleaning, and maintenance will be provided with each deliveries Assembly Instruction.

Technical information

System

The individual system properties and performance will vary a lot depending on system size and configuration. This technical information document will give an overview of what is constant and what is configuration dependent. The fastest way to find out the capacity of a desired configuration is to run our web-based interactive CAD- and configuration tool.

General system maximal ratings

Table 1

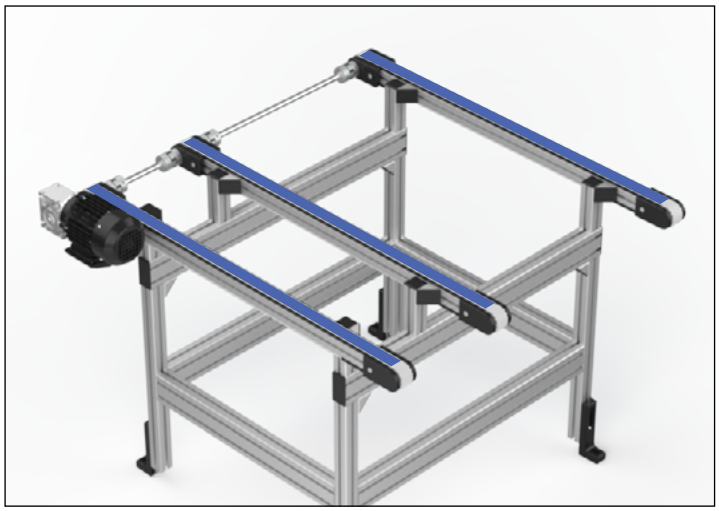
Conveyor model	System load (kg)	Load/belt unit (kg)	Load/meter, /belt unit (kg)	Single tooth load (kg)
TB40	150	75	25	5
TB80	400	100	100	5

Conveyor model	Speed (m/min)	Length (m)	Width (m)	No. of parallel units	CC conveyors (mm)
TB40	32	6	6	10	200-1500
TB80	54	6	6	10	200-2000

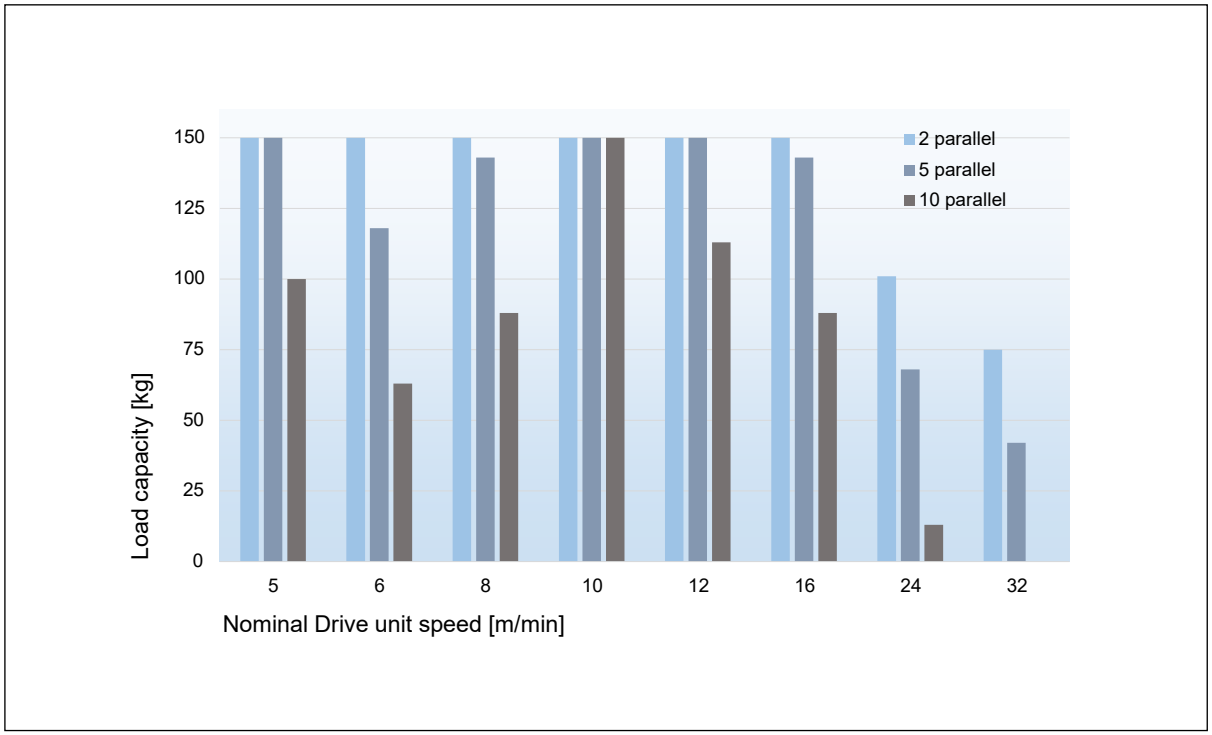
The above general maximal ratings are validated independently and cannot always be utilized simultaneously in an arbitrary configured system. The limitations are valid in combination with the use of standard drive units at their respectively nominal speed. The values are valid for horizontal systems (inclination 0°).

Load and speed

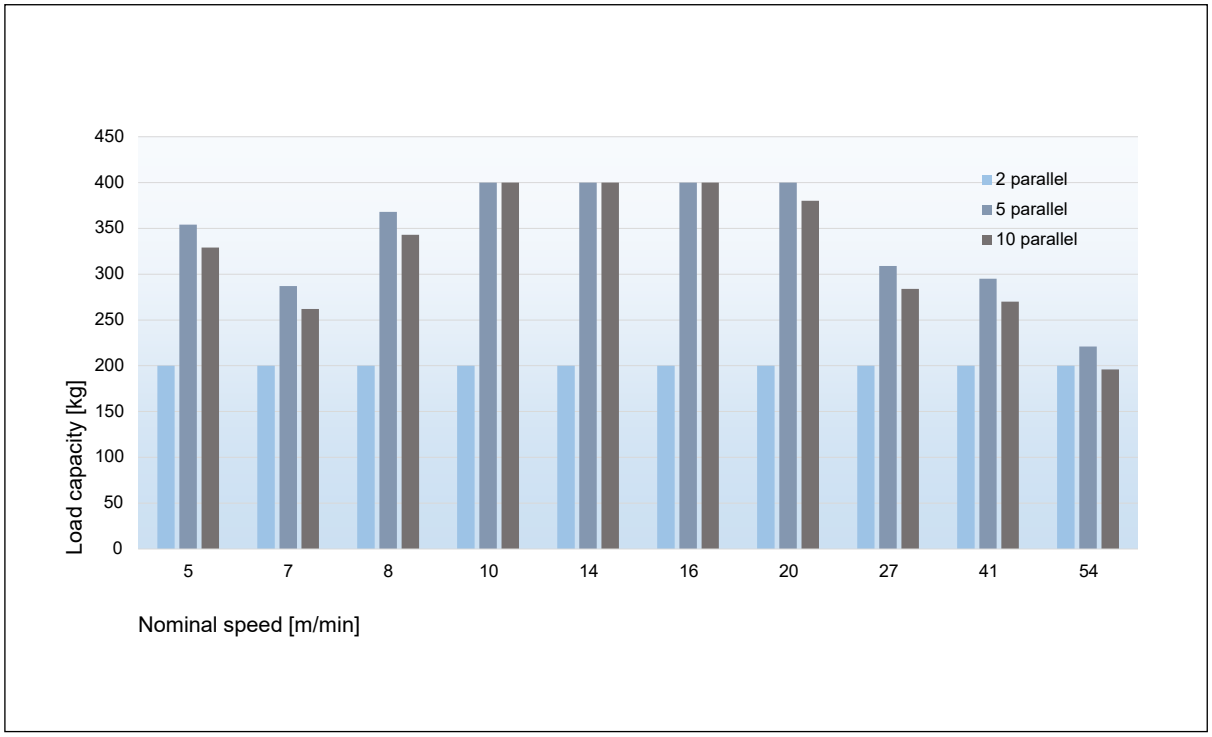
System Load



TB 40 system load [standard drives @ 50 Hz]



TB 80 system load [standard drives @ 50 Hz]



The following factors sets the maximal system load:

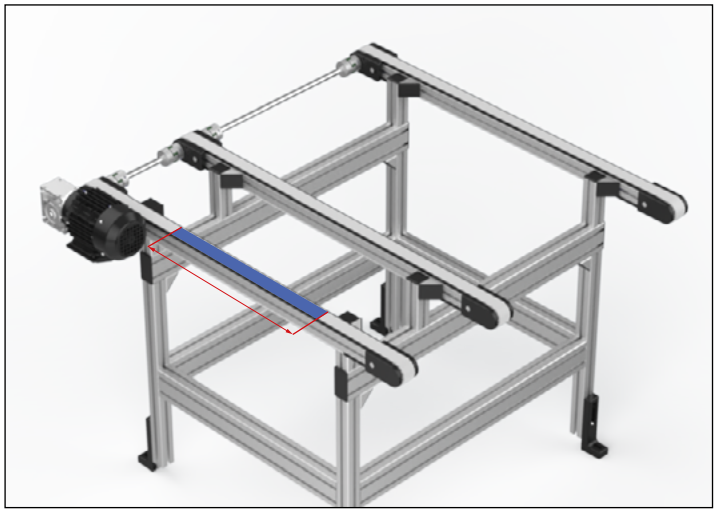
- Model size of conveyors (TB40, TB80)
- No of parallel conveyors
- Length of conveyors
- Inclination of the system
- Drive torque limit
- Selected standard drive unit

Each standard drive unit result in an individual nominal conveyor speed and load capacity. See more under section "*Calculations and formulas*".

Load on a single conveyor

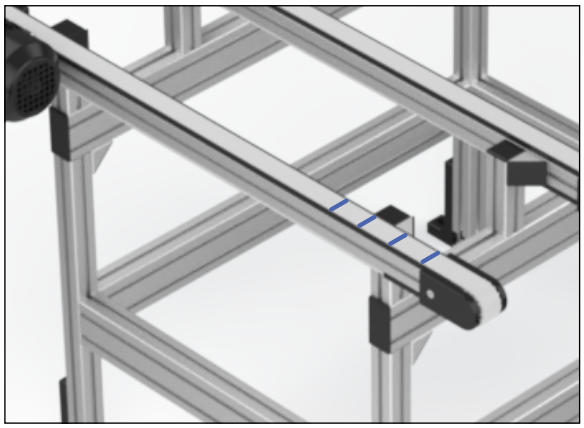
Single conveyor general load limits depend on the maximal torque the drive shaft can transfer to the drive wheel. For short conveyors, the load per meter may be the effective limit. See *Table 1* and *Table 2*.

Load distribution on a single conveyor



A short single conveyor will be limited in load per unit length. The limitation depends on the structural strength and stiffness of conveyor body. See *Table 1*.

Single tooth load

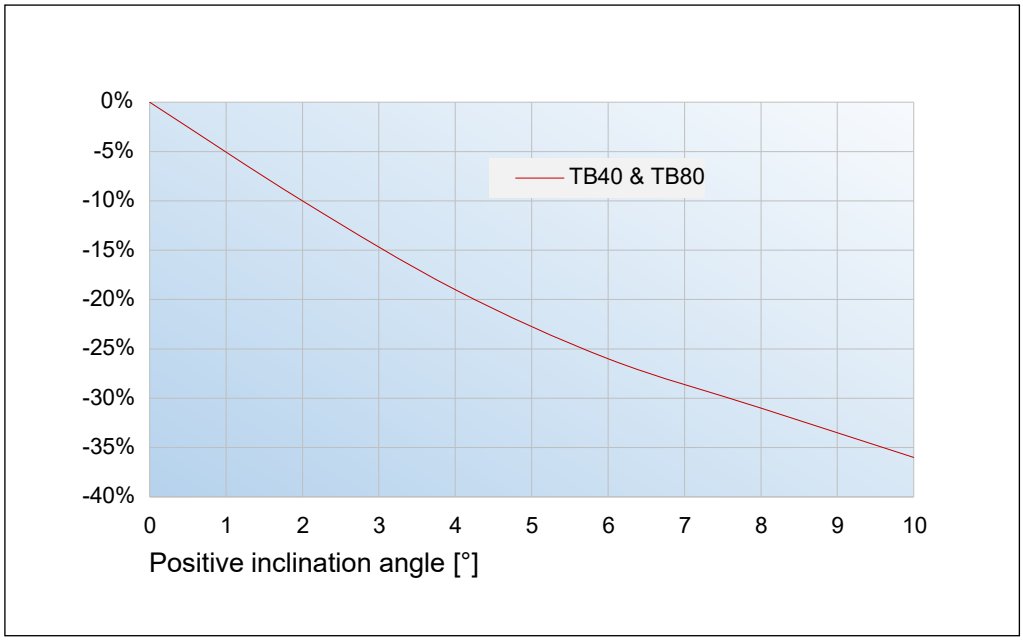


Heavy objects with small contact surface may create high loads on a very short portion of the belt. The smallest unit defined is the load per belt tooth. Exceeding this load concentration level may lead to excessive wear of both the belt and the guiding profile. See *Table 1*.

Inclined conveyors

Up to 10° inclination can be configured. A positive (rising) inclination will reduce the load capacity in relation to a horizontal installation. Inclination greater than +/- 10° requires additional engineering and calculations. Please contact Rollco.

TB40 & TB80 load reduction at inclination [%]



To configure with inclination, a stand must be included. The inclination angle comes as result of the length and the height difference between the ends of the conveyor. The resulting load capacity will also be calculated in the configurator.

Speed

The speed limits for TB40 and TB80 are tested and based on the Standar drive units running at their nominal speeds (50 Hz current). See Table 1. There is no definitive upper speed limit evaluated for TB40 or TB 80. Please contact Rollco if higher speeds than the Standard drive units offer at 50 Hz is required.

Table 2

Conveyor model	Feed constant, fc, per revolution (mm)	Speed per rpm (m/minute)	Speed per rpm (mm/second)
TB40	170	0,17	2,83
TB80	290	0,29	4,83

Synchronicity

Multiple belts in a conveyor are synchronously driven via shafts and couplings. The shafts and couplings will flex torsional under load and cause a position deviation between individual belts. The deviation depends on system width, number of conveyors and the load.

Worst case TB40 system

- System width 6000 mm
- System length 6000 mm
- 10 parallel belts
- Equal distance between belts
- System load 150 kg, evenly distributed between the belts

Above system consists of 9 sync shafts of about 600 mm length and a total of 18 couplings. In this example, the position lag of the belt most far away from the drive unit will accumulate to about 4,5 mm and 0,5 mm between each belt.

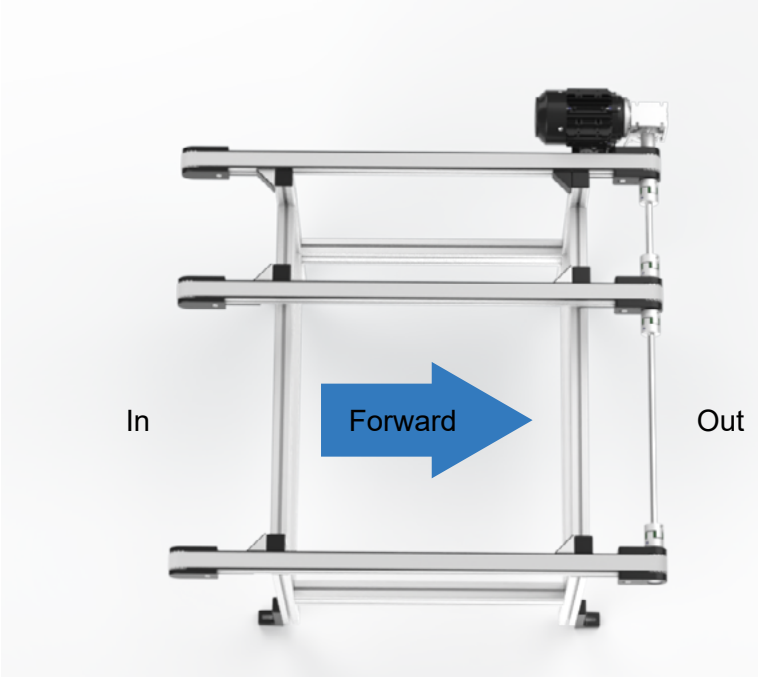
Worst case TB80 system

- System width 6000 mm
- System length 6000 mm
- 10 parallel belts
- Equal distance between belts
- System load 400 kg, evenly distributed between the belts

Above system consists of 9 sync shafts of about 600 mm length and a total of 18 couplings. In this example, the position lag of the belt most far away from the drive unit will accumulate to barely 7 mm and < 0,8 mm between each belt.

Direction of feed

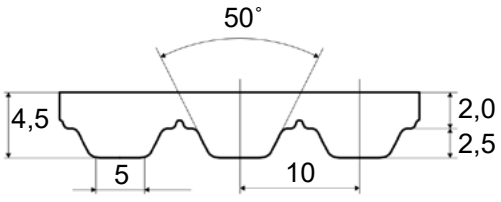
Timing belt conveyor TB can operate in both directions without any restrictions. To establish a reference, the forward direction has been defined to be when the goods are fed from the non-driven end to the drive end. When operating in the opposite direction, TB is working in reverse direction.



Belt

The timing belt used is as standard white TPU with steel cord. The profile is the well proven AT10. As standard, the belt is covered on the tooth side with a polyamide fabric to reduce noise and friction.

At delivery, the belt of TB40 and TB80 are pre-tensioned 0,05 to 0,1% (0,5-1 mm per meter). Higher pre-tension may increase noise and bearing wear. Lower pre-tension might cause excessive sag and unreliable tracking of the belt. In special cases, with long lengths and a lot of heavy cleats/false teeth, a somewhat higher pre-tension may be required. It is recommended to use TB80 in those cases as TB80 comes with higher capacity bearings.



Belt data

Table 3

Belt data	Value	Note
Profile	AT10	
Tooth pitch	10 (mm)	
Width	32 (mm)	
Weight	0,192 (kg/m)	Plain belt w/o coating
Maximal working force	2240 (N)	Reduced 38 % for false teeth
Breaking strength (cord)	19456 (N)	Reduced 38 % for false teeth
Strength of joining	9728 (N)	Flexproof welded
Length of joint	80 (mm)	
Force for 1% elongation	11200 N	Reduced 38 % for false teeth
Hardness elastomer matrix	92 (Shore A)	
Temperature range	-20 to +80°C	

Belt top coatings

Top coating of the belt is possible and used when the belt core material does not offer the desired characteristics. As standard, we offer the well-known Linatex HMTM natural rubber coating as alternative to the plain belt. A top-coat may reduce the load capacity slightly by making the belt stiffer, hence increasing the losses when bending over the belt wheels. *Table 4* summarize the main differences between Linatex HMTM and a plain belt.

Table 4

Belt type	Material	Hardness	Friction	Abrasion resistance	Oil/grease resistance	Hydrolysis resistance	Temperature range
Plain belt (no coating)	TPU	Shore 92A	Low	Good	Excellent	Excellent	-20 to +80°C
Linatex HM^{tm}	Natural rubber	Shore 38A	High	Excellent	Limited exposure only	Good	-40 to +70°C

For special needs, some +90 alternative top cover materials are possible on request.

Cleats and false teeth

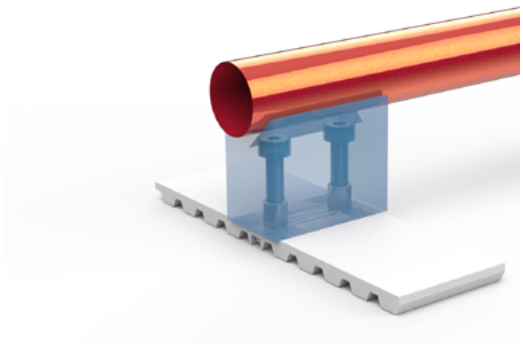
Standard cleats are made of solid 4 mm thick TPU of same composition as the belt matrix. They are bonded to the top surface of the belt. They can not be combined with coating.

Standard TPU with cleats

For more robust or specially shaped cleats, the false teeth interface can be used. The false teeth offer a mechanical interface comprised of two short circular studs with internal threads. The anchor is embedded in the TPU matrix, hence keeping the noise level as low as possible.

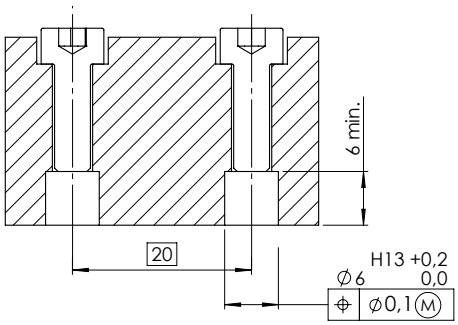
Standard TPU with false teeth

Typical use of screwed cleats is for transport of heavy objects on inclined conveyors. In such case, a simple rectangular block can be used. Another use is to better hold and locate for example round bars. By making a block with a v-groove, the bar will be elevated above the belt. That makes it possible to convey objects that may be too hot to be in direct contact with the timing belt.



Rollco do not design and produce custom cleats for false teeth. When you make your design, keep in mind that the weight of the cleats will cause increased belt sag that may require additional side guiding on the return path. It is ok to make the cleats wider than the belt but not more than 36 mm, this to avoid having interference with the stand in the return path.

For design of your own cleats for false teeth, follow the interface dimensions in below drawing.

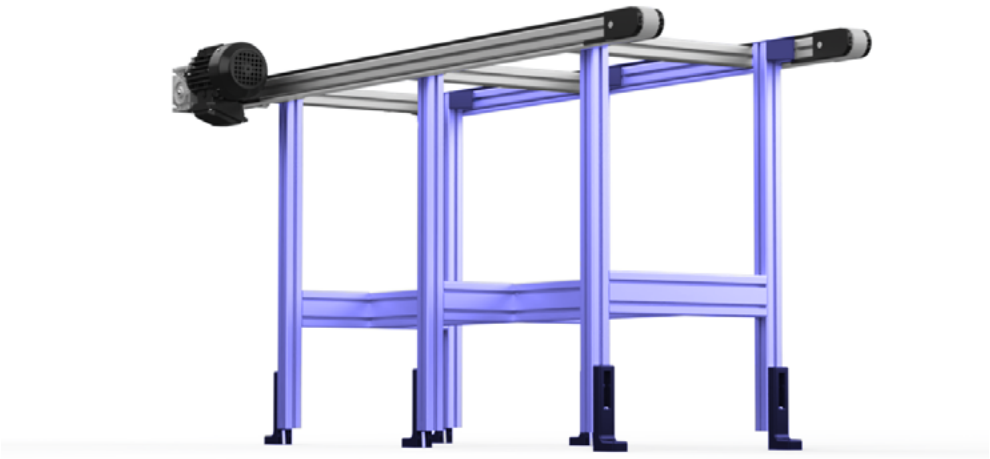


Stand

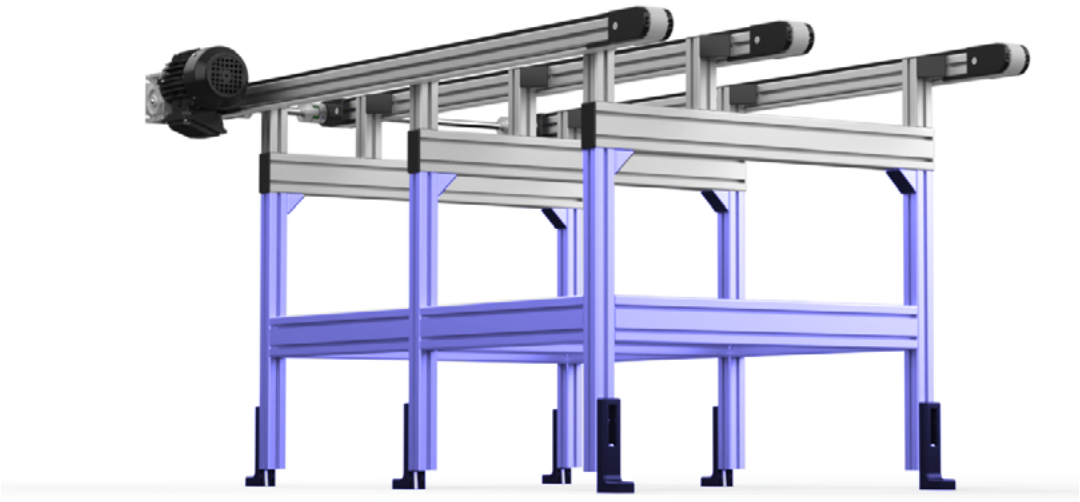
Conveyor system TB may include a floor stand made of aluminum profiles. For a 2-units system, the units are simply connected by lateral cross bars, forming a ladder frame, and the legs are fixed directly to the profiles of the belt units.

For systems having 3 or more parallel belt units, the legs are fixed to the crossbars. The crossbars run as continuous profiles over the full system width. The belt units are connected to the crossbars via short vertical profiles.

Our web-configurator handles all the rules of the stand and the crossbars.



TB40 2-units system

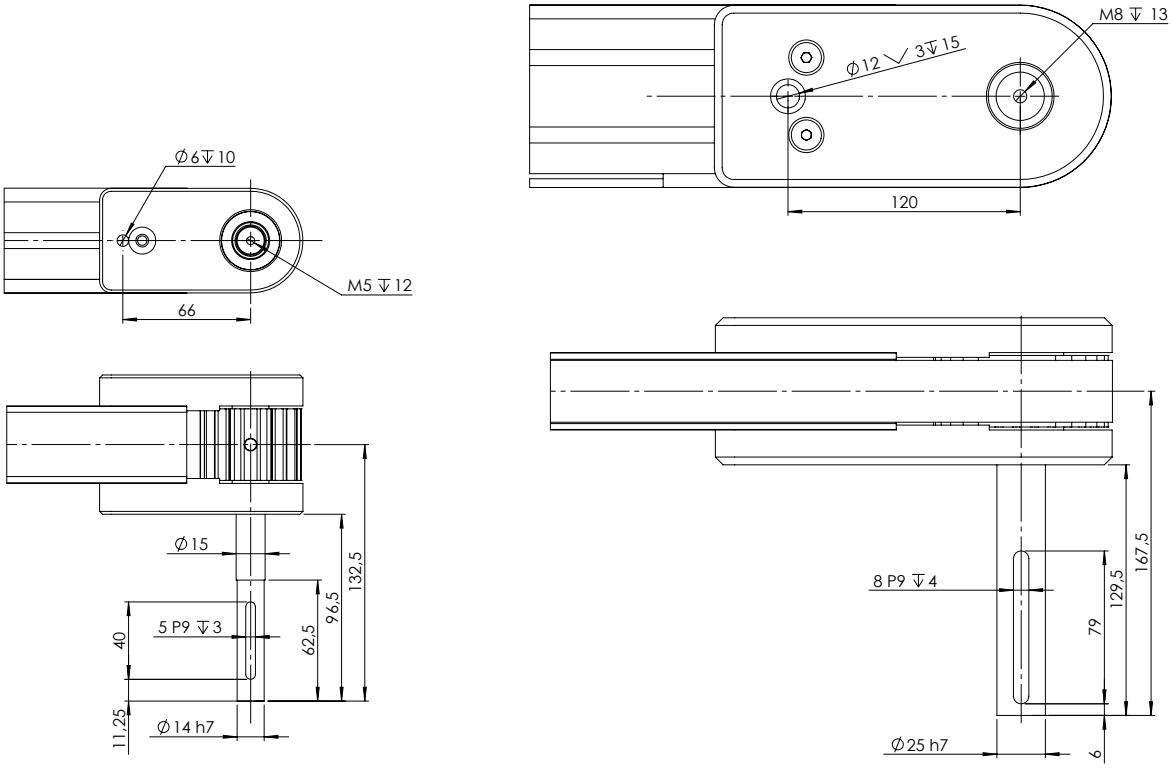


TB40 3-units system

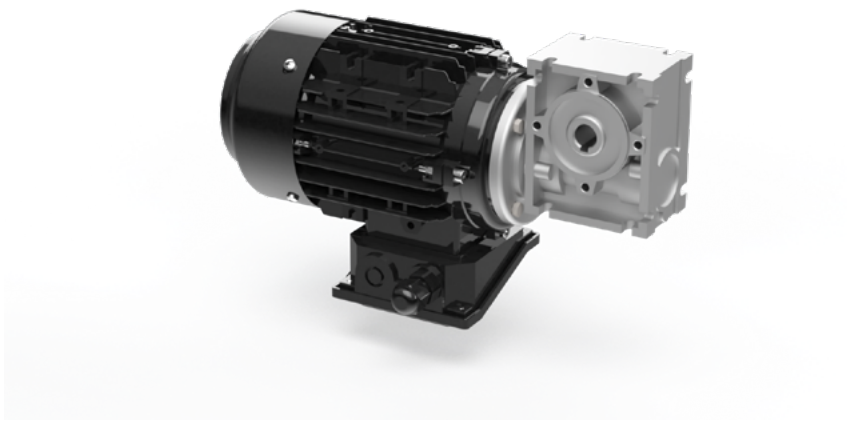
Drive system and interface

Direct drive-standard interface

The drive shaft shown is designed for our standard drive unit. A hollow shaft gearbox is carried by the shaft and is locked in rotation with a torque rod attached to a pin (FRP ISO 8752 type recommended) inserted in the Ø6 or Ø12 hole shown in the drawings. It is possible to use other hollow shaft drive units having the same dimensions.



Standard drive units



Proven and cost effective 3-phase asynchronous motors with a worm gear.
The standard drive units are named after what size of conveyor size and the resulting conveyor speed you get.
The standard drive units are part of the order code but are always delivered unassembled to the conveyor.

Driveunit-40-12

- 40: for conveyor size TB40
- 12: nominal speed 12 m/min

The drive units are preferable electrically powered via a frequency inverter. This enables soft start and stop, less heat generation at frequent starts and stops and gives a possibility to adjust the speed. Our general recommendation is to stay within 20 to 80 Hz frequency. Lower frequency may lead to insufficient cooling of the motor. At frequencies above 50 Hz, the load capacity of the conveyor will always be reduced.
Please contact Rollco if your application requirements calls for continous use of drive frequencies deviating from 50 Hz.

Under drive option

A ratio 1:1 timing belt gear that moves the position of the standard drive system down below the top of the conveyor, making it possible to transport objects stretching outside of the system width in both directions. The under drive will reduce the load capacity, see section ”*Calculations and formulas*”.

**The under-drive option is not yet integrated in the web-configurator and only available upon request.*

Custom drive interface

It is possible to power the conveyor with alternative motors and drive systems. There are a number of customization levels possible on request:

- Alternative shaft dimensions of the direct drive standard interface. Used if you want to put on a different type of hollow shaft gear. There will be a weight limit to consider, based on the shaft diameter required and the bearings of the drive end of the conveyor.

- Direct drive via shaft coupling. The same coupling as used for the sync shafts for each model is recommended. Used if you have a gear with shaft output. The gearbox must be fixed and aligned separately by the user.

- Fitted with in-line or angled planetary gear for servo motor drive. Suitable for more accurate positioning and if frequent start-stop and a wide speed-range is required. Designed on request.

Calculations and formulas

Load capacity

Formula for load capacity for a horizontal conveyor as function of drive torque and numbers of parallel belt units.

$$m_{l\_hor} = TB_{size} \cdot (T_2 - n_{bu} \cdot TB_{par})$$

Alternatively, you can calculate the required drive torque (T2) for a given horizontal load.

$$T_2 = \frac{m_{l\_hor}}{TB_{size}} + (n_{bu} \cdot TB_{par})$$

m_{l_hor} = system load, horizontal (kg)
n_{bu} = number of parallel belt units
T_2 = input torque (Nm)
TB_{size} = factor depending on conveyor model
TB_{par} = factor depending on number of parallel belt units and conveyor model

Table 7

Conveyor model	Factor TB_{size}	Factor TB_{par}
TB40	12,55	0,9
TB80	7,35	0,73

Nominal output torque and speed from standard drive units, 50 Hz

Table 6

Drive unit model	Useful output torque T_2 (Nm)	Output speed n_2 (rpm)
Driveunit-40-5	17	28
Driveunit-40-6	14	35
Driveunit-40-8	16	47
Driveunit-40-10	21	56
Driveunit-40-12	18	70
Driveunit-40-16	14	93
Driveunit-40-24	10	140
Driveunit-40-32	7,8	187
Driveunit-80-5	52	17,5
Driveunit-80-7	60	23,3
Driveunit-80-8	54	28
Driveunit-80-10	62 (68)*	35
Driveunit-80-14	62 (81)*	47
Driveunit-80-16	62 (71)*	56
Driveunit-80-20	59	70
Driveunit-80-27	46	93
Driveunit-80-41	44	140
Driveunit-80-54	34	187

*Some drive units have more capacity than TB can utilize

Table 8, absolute drive torque limitations

Conveyor model	Max. allowed input torque on drive shaft (Nm)	Max. transferred torque to slave conveyors (Nm)	Max. torque used per single conveyor (Nm)
TB40	21	21	7
TB80	62	62	14

Note that some combinations of Drive units and conveyor configurations will result in very small or even negative load capacity! Those are of course not useful.

Capacity reduction for inclined conveyor

At positive (rising) inclination, the capacity m_{L_con} will be reduced according to formula and table to the right.

$$m_{l\_inc} = m_{l\_hor} \cdot f_{\alpha}$$

Table 9

Inclination (°)	f_{α}
1	0,95
2	0,9
3	0,85
4	0,81
5	0,78
6	0,74
7	0,71
8	0,69
9	0,66
10	0,64

Speed

Formulas for conveyor speed:

$$v_m = \frac{n_2 \cdot fc}{1000}$$

$$v_s = \frac{n_2 \cdot fc}{60}$$

v_m = speed (meter/min)
v_s = speed (mm/s)
f_c = feed constant (mm/revolution) (see *Table 2*)
n_2 = input speed in rpm on the drive shaft (equal to Drive unit output rpm)

Belt sag

Formula for belt sag (horizontal conveyor):

$$h = \frac{Q \bullet L^2}{8 \bullet F_{belt}}$$

h = belt sag (meter)
Q = weight of belt and cleats (N/meter)
L = length of free belt length (meter), (equal to conveyor nominal length)
F_{belt} = 560 to 1120 N (0,05 to 0,1% pre-tension)

The formula gives the theoretical sag at stand-still. The stretching of the upper belt part due to load and friction under motion will increase the sag up to some 20%. Conclusive, the sag due to conveyor load have marginal influence but the weight per meter belt has a great influence on long conveyors. Recommendation is to avoid adding more than 1 kg of cleats per meter for conveyors of length up to 4 meter and 0,5 kg per meter for conveyors of length above 4 and up to 6 meters.

Nominal life

Conveyor
The only components of the timing belt conveyor which are reliably calculable for life are the bearings in the end units. Due to most of the component loads comes from the pre-tension of the belt and the weight of the drive unit, the lifetime of the conveyor does not vary a lot with load.

Standard drive unit
The nominal life at full load and 50 Hz is 10000 hours of operation. Using partial load will increase the life but rarely to more than 30000 h. Overloads, frequent and aggressive starts and stops, over- or under- speed may decrease the lifetime rapidly and well below the nominal 10000 h.

Conveyor model	Standard drive unit, no load	Standard drive unit, full load	Under drive, no load	Under drive, full load
TB40	47000	36000	40000	13000
TB80	> 100000	> 100000	> 100000	39000

Rated conveyor bearing life in kilometers depending on load and drive system.

Timing belt

32AT10 -L4170 - B - CL - 30

Belt width
32 mm wide (AT10 tooth profile)

Length
(mm)

Belt type
A = Plain PU on top, PA fabric on teeth
B = Linatex 2 mm on top, PA fabric on teeth
C = Linatex 4 mm on top, PA fabric on teeth (only for TB80)

Belt cleats
0 = w/o cleats
FT = False teeth
CL = Bonded PU 10x32x4
CM = Bonded PU 20x32x4
CH = Bonded PU 30x32x4

Cleat c/c
0 = w/o cleats
Min. 10 mm interval for bonded (CL, CM, CH)
Min. 100 mm interval for false teeth (FT)

Timing belt conveyor with stand

TB40 - E 40 - L1000 - 5 - (200) - 20 - L H3 - A - 0 - 10 - A200 - B200 - D400 - E450 - A

Height
TB40
TB80

Drive
E = Direct drive w/ geared motor
U = Under drive w/ geared motor
E0 = Direct drive w/o motor
U0 = Under drive w/o motor

Width
40 mm profile width

Length
300 ≥ 6000 mm (5 mm interval)

No of parallel units
1-10

Conveyor c/c
Distance between units (only applicable for ≥2 units)

Speed
5, 6, 7, 8, 10, 12, 14, 16, 20, 24, 27, 32, 41, 48
(m/min at 50 Hz with standard drive)

Drive position
R = Right
L = Left

Drive orientation
See drawing on next page
H1
H2
H3
H4
V1
V2
V3
V4

Belt type
A = Plain PU on top, PA fabric on teeth
B = Linatex 2 mm on top, PA fabric on teeth
C = Linatex 4 mm (only for TB80) on top, PA fabric on teeth

Belt cleats
0 = w/o cleats
FT = False teeth
CL = Bonded PU 10x32x4
CM = Bonded PU 20x32x4
CH = Bonded PU 30x32x4

Cleat c/c
Min. 10 mm interval for bonded (CL, CM, CH)
Min. 100 mm interval for false teeth (FT)

First crossbar distance (A)
(mm)

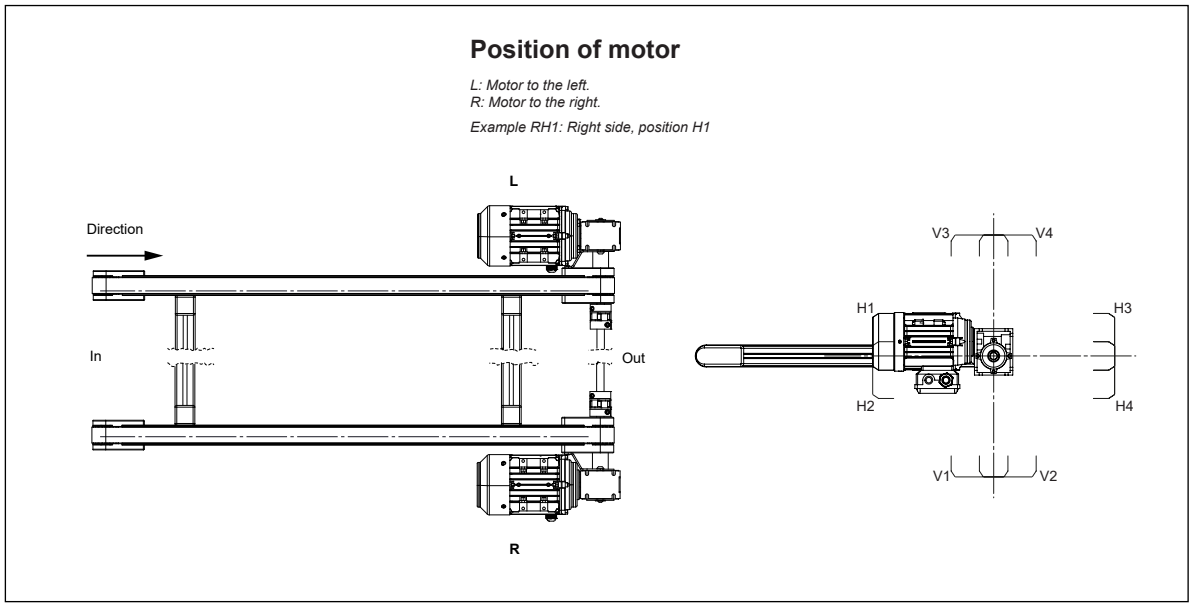
Last crossbar distance (B)
(mm)

Start height (D)
(mm)

End height (E)
(mm)

Feet
A = L-feet

Drive orientation



Note:
All our conveyors are skillfully adjusted and tested on our factory floor before delivery. After delivery and placement however we cannot guarantee perfect running and strongly recommend final adjustments to be made. Please see the documentation provided with the conveyor for more information on how best to do this. Note that most tracking problems occur from uneven assembly of conveyor bases or flooring and that belt tension should be maintained when adjustments made.
Motors are not individully tested and not assembled to the unit during transport.

ALWAYS THE RIGHT SOLUTION AT THE RIGHT TIME.

With reliability, competence and commitment Rollco rapidly delivers the right solutions and components to create safe and cost-effective automation and linear movement.

ROLLCO

LINEAR SOLUTIONS **YOUR** WAY

Rollco AB
Box 22234
Ekvändan 17
250 24 Helsingborg
Sweden
Tel. +46 42 15 00 40
www.rollco.se

Rollco A/S
Skomagervej 13 E
7100 Vejle
Denmark
Tel. +45 75 52 26 66
www.rollco.dk

Rollco Oy
Sarankulmankatu 12
33900 Tampere
Finland
Tel. +358 207 57 97 90
www.rollco.fi

Rollco Norge AS
Industrigata 6
3414 Lierstrada
Norway
Tel. +47 32 84 00 34
www.rollco.no

Technical Information Timing Belt Conveyor English 202401 Art.no. P7200ENTI