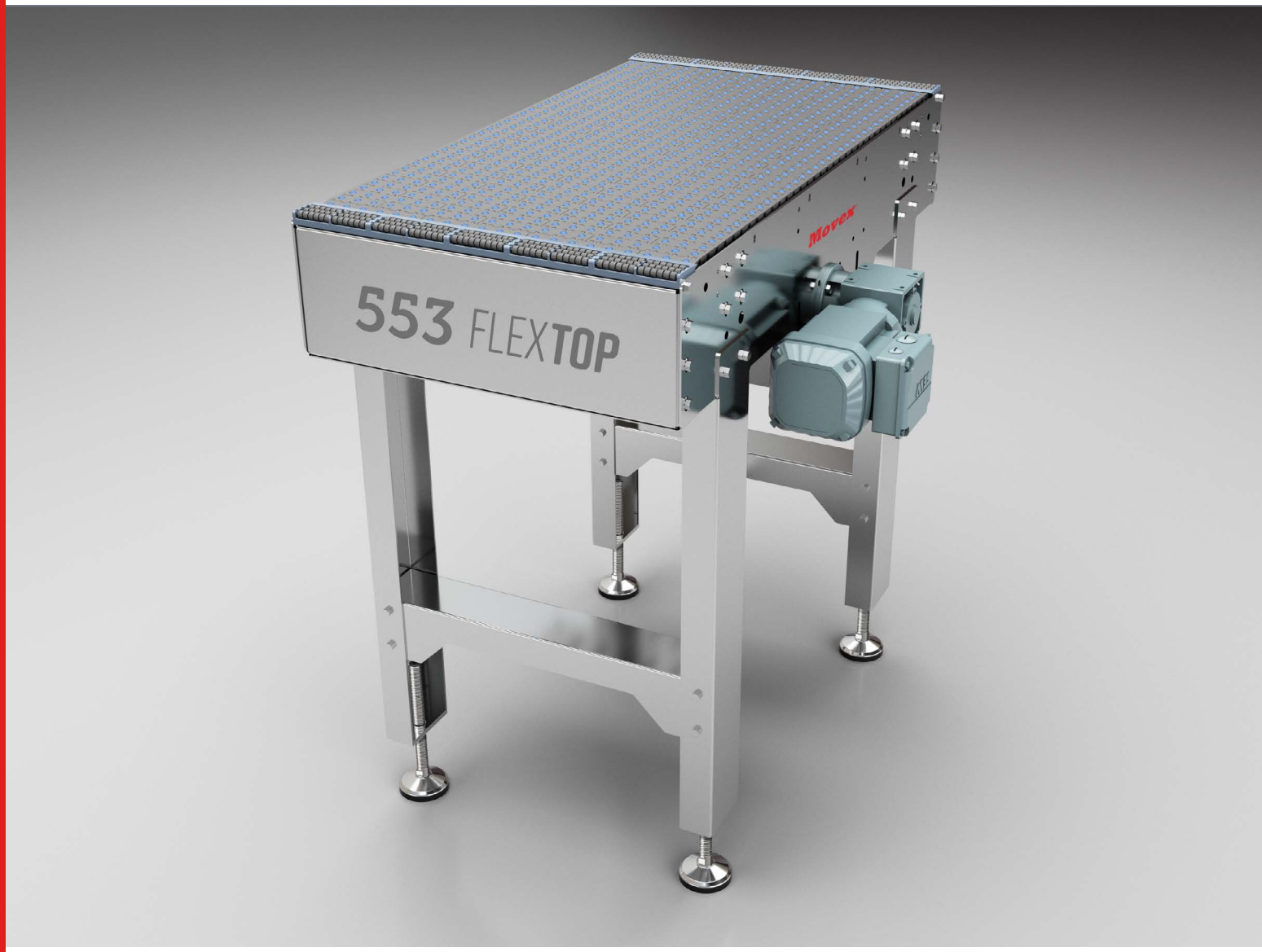
PATENT PENDING

553 FLEXTOP

Multidirectional Modular Belt

ENGINEERING MANUAL



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REFERENCE YEAR 2018

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Creating value through innovative development of ideas, supporting our partners with professionalism, flexibility and effectiveness.

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In the new headquarters **Movex** designs and manufactures high quality components for the food, beverage, packaging, automotive and automation industries.

Movex meets your needs for standard and custom products in a dynamic and responsive way ensuring the best performance product with an attractive market price.

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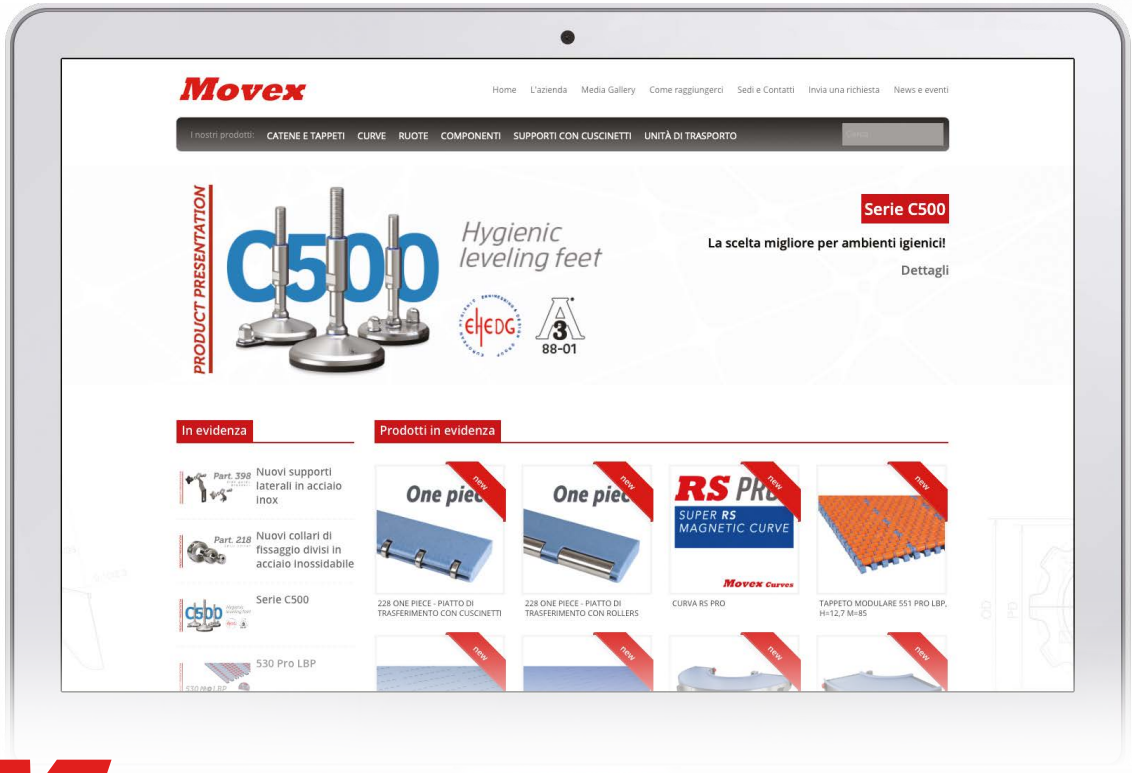

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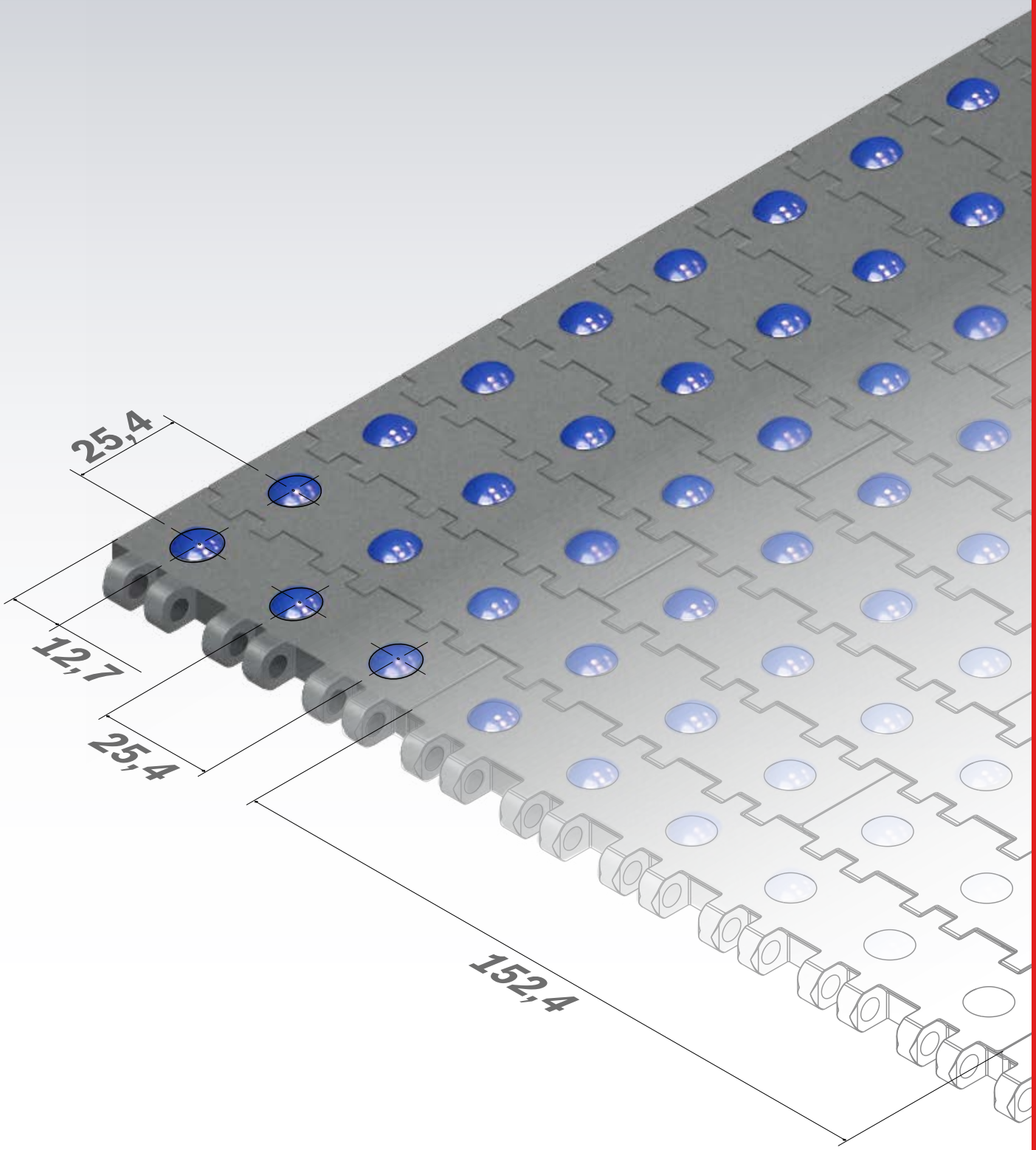
553 FLEXTOP

Multidirectional Modular Belt



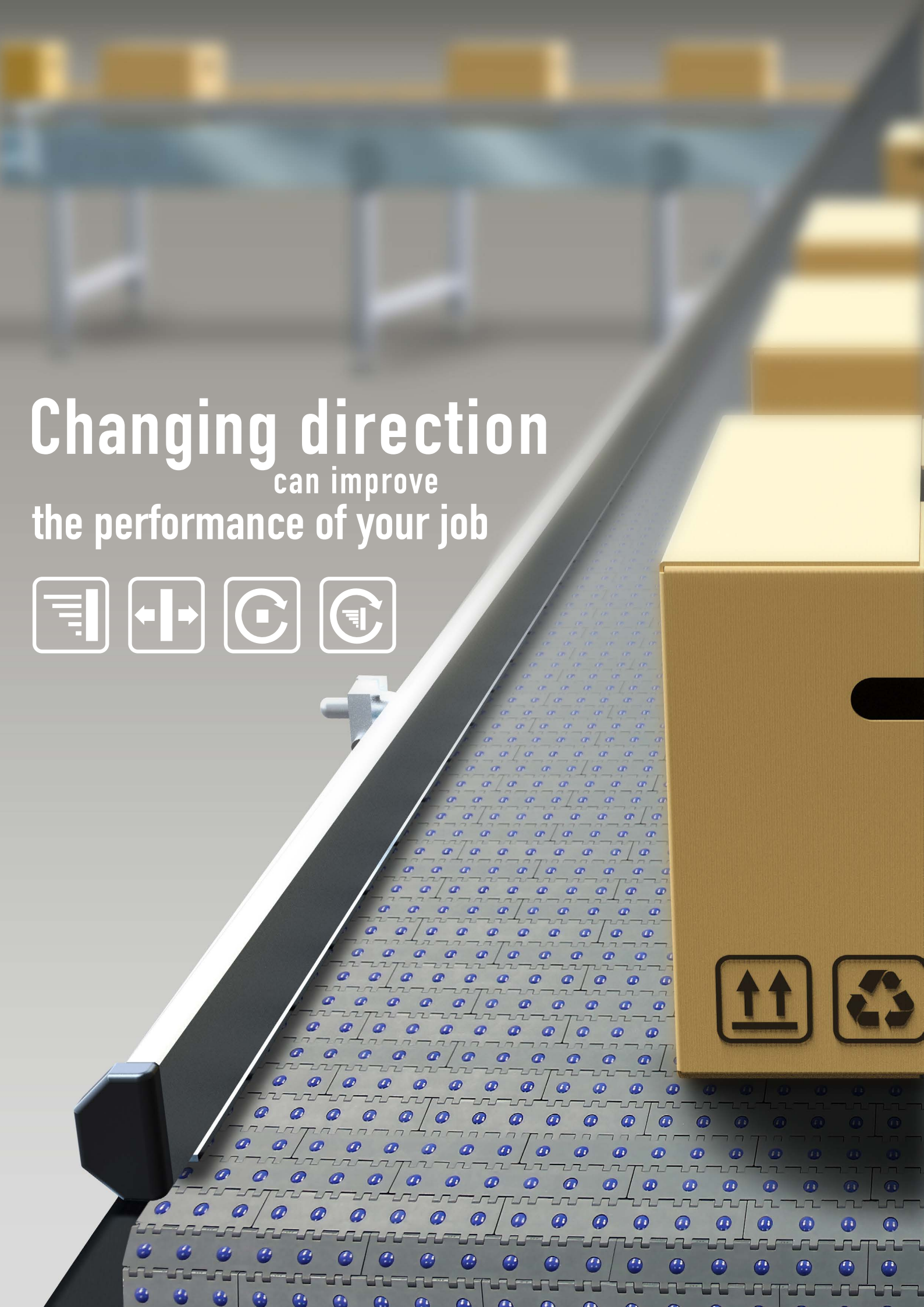
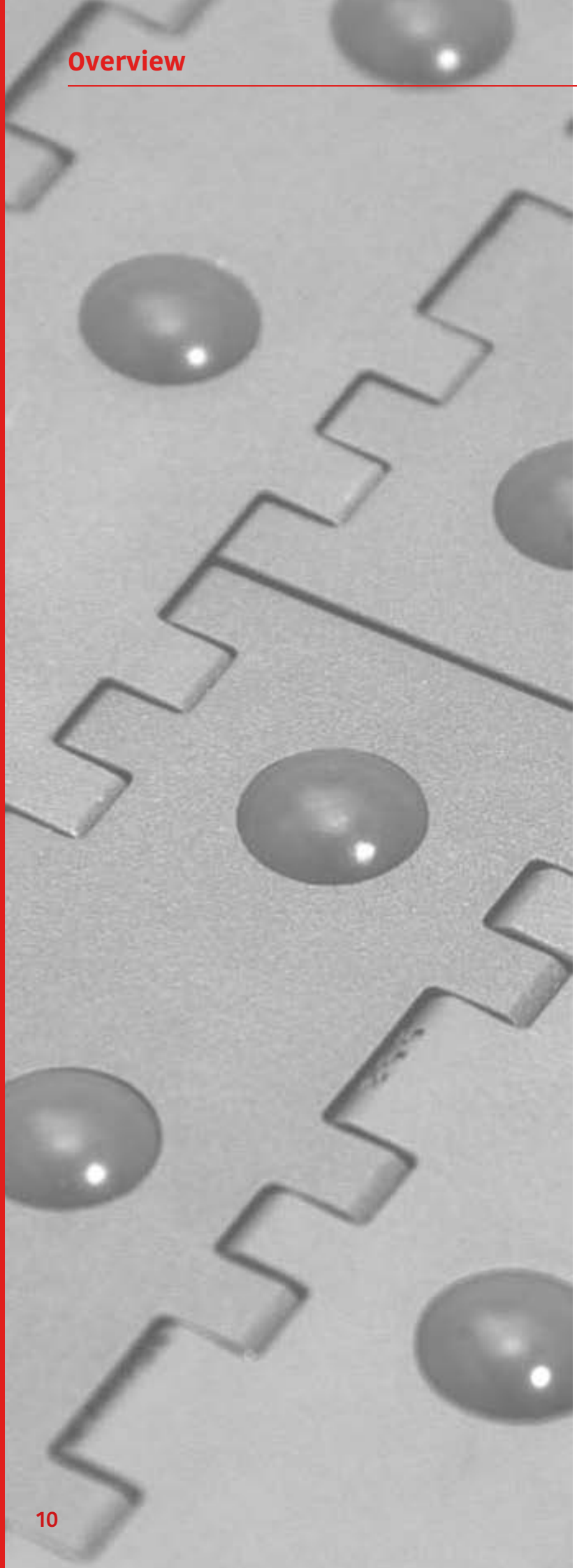

Changing direction
can improve
the performance of your job

TABLE OF CONTENTS

553 FLEXTOP

Multidirectional Modular Belt

Overview



The new **Movex® 553 FlexTop** modular belt with self-locking spheres is specifically designed for high-precision material handling, suitable for several applications like logistic centers, packaging stations (food and beverage) and corrugated industries, easily to be integrated into existing systems.

The **360° movement** possibility makes the belt suitable for diverting, rotating, accumulation and acceleration applications and minimize required maintenance and downtimes.

The **small pitch** between the spheres (diameter 12,7 mm and pitch 25,4 mm) allows every type of good transfer and is ideal for small and light packages, unlike traditional roller conveyors.
Density: 1.600 spheres/m².

The complete **closed sliding** belt surface is the perfect solution to carry carton boxes, crates, cans and bottles shrink-wrap packaging and any kind of polybag with Top-Accuracy package control.

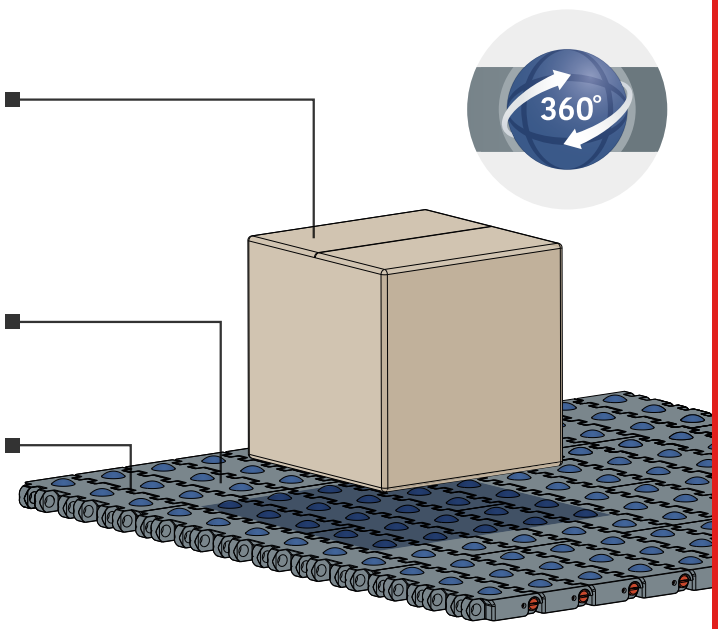
Features

High strength	Perfect good control	Self cleaning	Great versatility	Long durability	Reduced downtimes

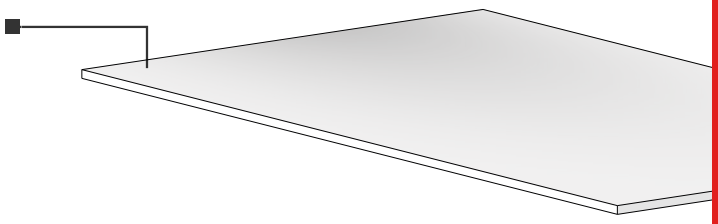
Design and features of 553 FlexTop make it ideal for the transport of several type of **goods** ***(e.g. polybags, shrink-wrap packaging).***

The small pitch between the **spheres** allows for a great goods control.

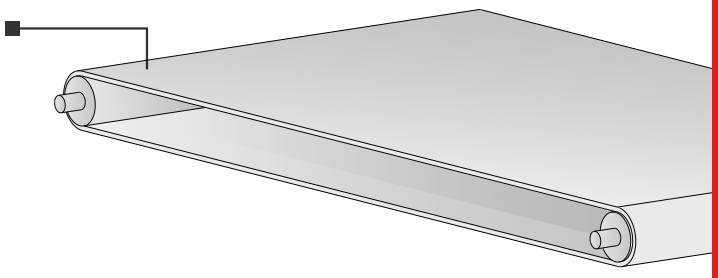
A complete closed sliding surface , in combination with self-locking spheres, makes the **belt** design flexible and robust.



553 FlexTop belt can be used **over a fixed support area to accelerate transport speed** or with additional belts and rotating plates to fully express its potential.

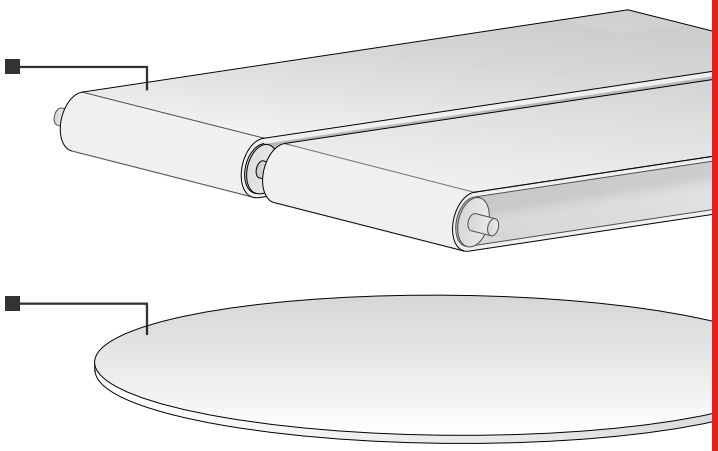


With a directional belt underneath the FlexTop belt **you can control the direction and more precisely the speed of the spheres**, making this belt 100% versatile.
This function is very useful when goods must be separated from each other but also to transfer your package laterally without external guides and pushers. This scenario is ideal for several applications requiring **rapid 90° transfer** of the conveyed items.



Using two parallel running belts positioned underneath 553 Flextop belt, and running in opposite directions, **goods in the middle of the belt will rotate quickly** without interrupting the main transport movement (rotation with good moving).

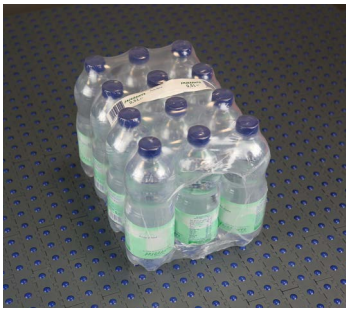
553 FlexTop belt can also be **used in combination with a rotating plate to have an optimum control of the rotation of the good** (rotation with item stopped).



In this manual, you will find more details for each option.

Suitable goods

VERSATILITY



The main advantage of the Movex® 553 FlexTop modular belt is its maximum flexibility to meet your needs.

Ideal to transport cardboard boxes and small packages, the 553 FlexTop belt is also the right solution when you have to transport **polybags, papers, plastic cases, containers, rubber parts (tires), shrink packs of bottles and cans, etc...**

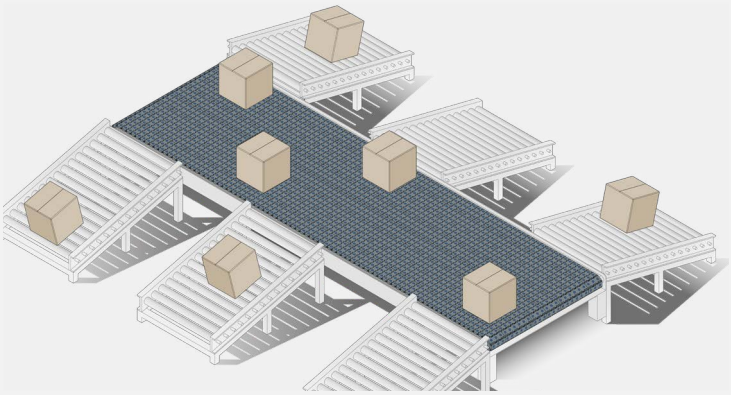
What's important is understanding if the good sliding surface is suitable with the 553 FlexTop surface, because that will determine the success of the application.

To do this, the goods bottom surface must have flat parts able to run completely on at least one sphere with a minimum of 6 spheres per good.

Another important aspect is the total weight of the good: most of the times is suitable with the max working load of the belt, especially of the spheres. Anyway, we always suggest to double check that the total weight of the good does not exceed the max load of the spheres, **15N/ea.**

We have several machines in our showroom that can be used for testing your goods with all the type of movements available with 553 FlexTop belt (sorting and rotation).

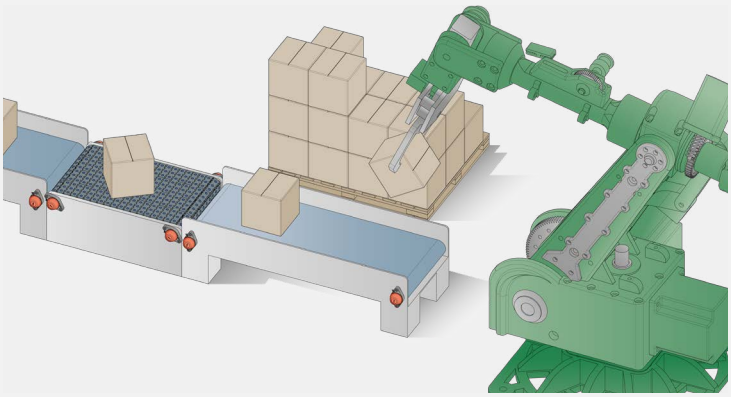
Application examples and Industries



AUTOMATIC STORAGE SYSTEM

- Distribution system
- Sorting
- Lane divider

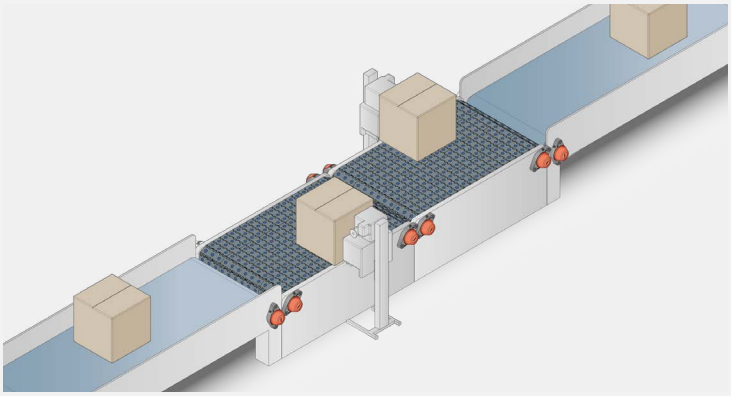
The goods can be guided over the 553 Flextop in 3 different directions: straight, left or right, bases on the correct exit to be taken.



GOOD ORIENTATION

- Casing machines
- Palletizers

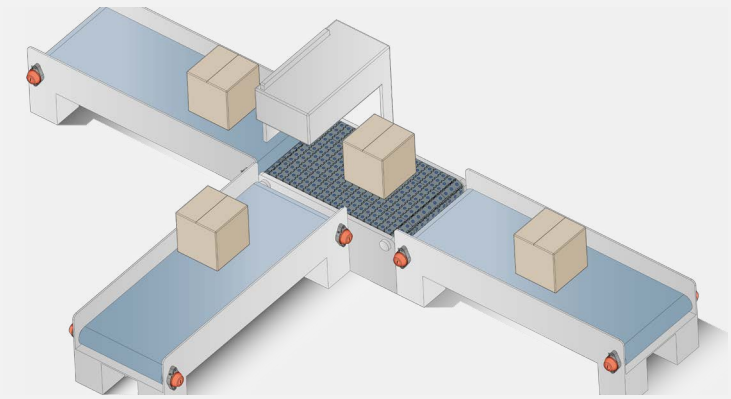
The goods can be oriented on the right side. This can be done by static rotation or dynamic rotation, based on the required quality output and the process speed.



GOOD POSITIONING

- Labelling
- Printing
- Barcodes Reading

The goods needs to be guided first on the right and then on the left. This can be done by using two separate modules or one single solution.



REJECT STATION

- Inspection equipment
- Measuring devices

The goods can be rejected on its left/right.

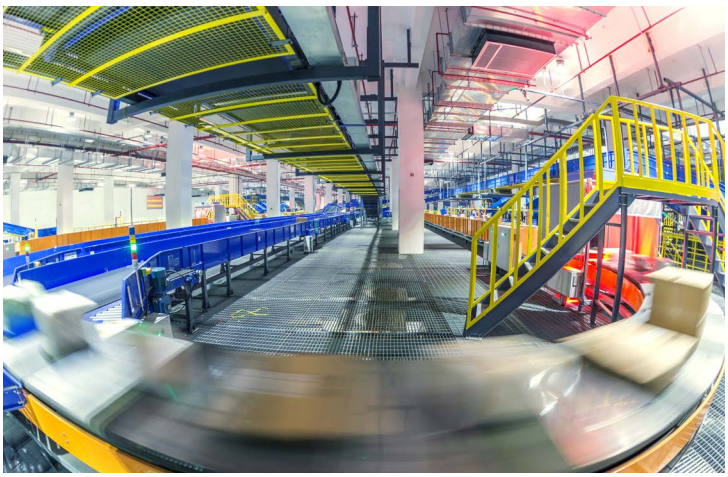
Application examples and Industries

The 553 FlexTop modular belt is ideal for all those applications where a dedicated movement is required.

Its versatility with different movements offer great use in different application areas.

The most used are logistic and distribution centers, food and beverage and corrugated.

At the same time, whevener a dedicated movement is required and the good sliding surface is suitable to the 553 FlexTop belt, it can be used as well.



Logistic and distribution centers

With more and more consumers buying from the web, logistics and distribution centers are becoming more efficient. The 553 FlexTop modular belt is ideal when different product sizes and sliding surface are running over, keeping the efficiency at the maximum value and avoiding machines and robots which may result very expensive.

Safe design, very high speed, low noise.

Food and beverage

In the packaging area of the food and beverage industries, the 553 FlexTop modular belt can help creating different actions with one machine only: orientate the package to the right side, align with the group, reject in case of non-conformity, move side to side, everything done by keeping always one eye on safety aspect.

Safe design, high speed, high working load.

Corrugated

The corrugated industry is the most traditional system where the 553 FlexTop can be used. With this belt all type of stack of cardboards can be easily handled and with only one machine the good can have 3 different exit directions: straight, left or right, without the needs of having different conveyors, head to tail transfers and the risk of downtimes.

Safe design, low speed, very high working load.

Belt and Sprockets specification

CODE STRUCTURE GUIDE (Example)			
5530	27	0042	A
Series	*Material	Width	Version

Backflex radius min.: 25 mm

Material

LFG - Code 27
Low friction Acetal

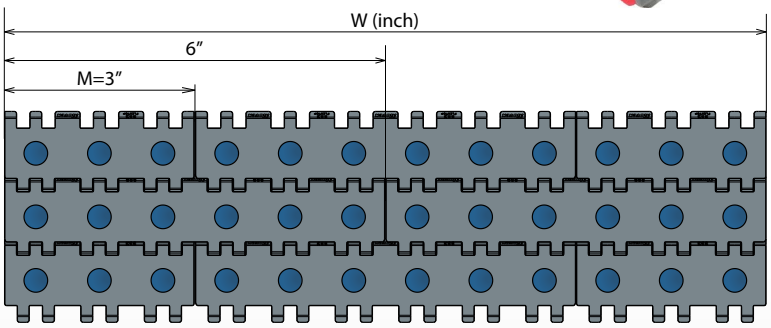
Max working load: 27500 N/m (1850 lbs/ft)
Weight: 10 Kg/m² (2.04 lbs/ft²)
Temp. range dry: -40÷80 °C (-40÷176°F)
Temp. range wet: -0÷65 °C (+32÷149°F)
Pin material: PBT white

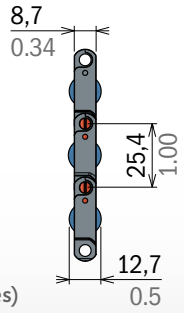
Belt available also in RAL 5005 (Blue)

Sphere material

High-tech Polyamide

Max working load: 15 N (3.37" lbs)
Sphere Diameter: 12,7 mm (0.50")





Supplied coil length: Width ≤ 30" : 1.524 m (60 pitches) - Width > 30" : 1.016 m (40 pitches)
On request wider belts are available with 3" increments.

Version A - Standard

Series	Material	Width	Version
5530	27	0003	A
5530	27	0006	A
5530	27	0009	A
5530	27	0012	A
5530	27	0015	A
5530	27	0018	A
5530	27	0021	A
5530	27	0024	A
5530	27	0027	A
5530	27	0030	A
5530	27	0033	A

Continue >>

Series	Material	Width	Version
5530	27	0036	A
5530	27	0039	A
5530	27	0042	A
5530	27	0045	A
5530	27	0048	A
5530	27	0051	A
5530	27	0054	A
5530	27	0057	A
5530	27	0060	A
5530	27	0063	A
5530	27	0066	A

Continue >>

Series	Material	Width	Version
5530	27	0069	A
5530	27	0072	A
5530	27	0075	A
5530	27	0078	A
5530	27	0081	A
5530	27	0084	A
5530	27	0087	A
5530	27	0090	A
5530	27	0093	A
5530	27	0096	A
5530	27	0099	A

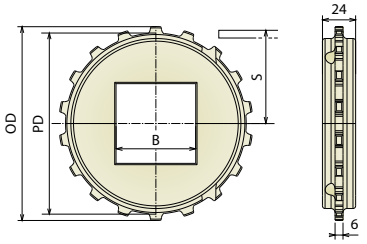
Continue >>

Series	Material	Width	Version
5530	27	0102	A
5530	27	0105	A
5530	27	0108	A
5530	27	0111	A
5530	27	0114	A
5530	27	0117	A
5530	27	0108	A
5530	27	0111	A
5530	27	0114	A
5530	27	0117	A

Drive split sprockets - Machined and molded

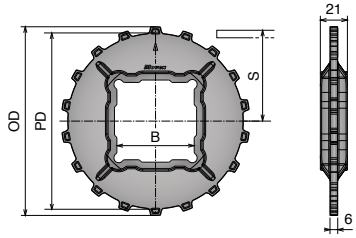
- *Easy clean and installation*
- *Heavy duty design*

- *Optimized hygenic*
- *Quick replacement*



Art-Nr.	Z-	Bore (mm-in)	PD (mm-in)	OD (mm-in)	S (mm-in)
166108	12	40x40 1.57x1.57	98,1 3.86	97,6 3.84	44,5 1.75
166208	15	40x40 1.57x1.57	122,2 4.81	121,9 4.80	56,5 2.22
166210		60x60 2.36x2.36			
166308	18	40x40 1.57x1.57	146,3 5.76	146,0 5.75	68,5 2.70
166310		60x60 2.36x2.36			
166311		65x65 2.56x2.56			

Material: Polyamide
Screws: Stainless steel Nuts: Zinc plated steel



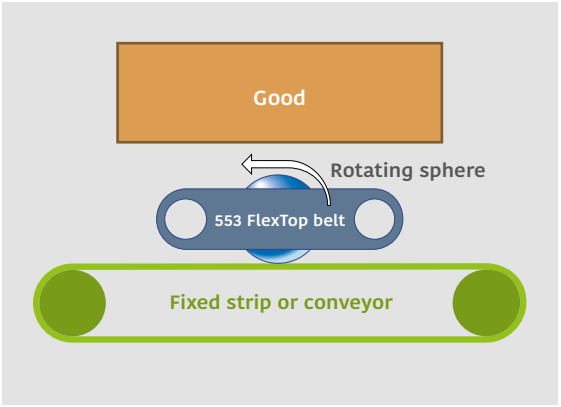
Art-Nr.	Z-	Bore (mm-in)	PD (mm-in)	OD (mm-in)	S (mm-in)
166511	18	40x40 1.57x1.57	146,3 5.76	146,0 5.75	68,5 2.70
166510		60x60 2.36x2.36			

Material: Reinforced polyamide

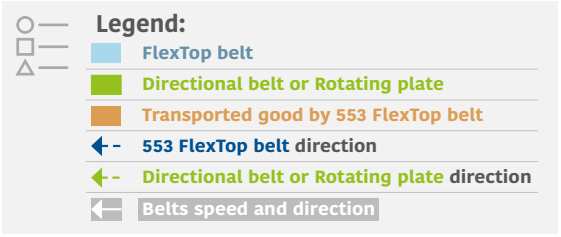
Machined sprockets with round bore are available on request.

Basic controls

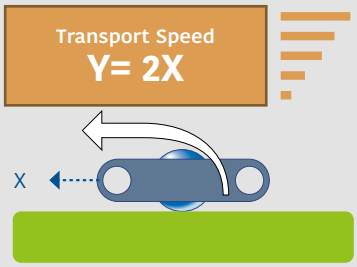
When the 553 FlexTop modular belt is running over a static support, directional belt or rotating plate, its spheres start changing direction and speed. It is very important to give enough friction to the spheres to better control them.
In case of acceleration, 553 FlexTop belt spheres can run on a Polyethylene support plate (wear strips or machined plate, **min 15mm thickness**). **In case of lateral movements**, 553 FlexTop belt spheres can run on a PVC or Polyurethane coating **belt with hardness of 60-70ShA**.
To guarantee the same speed of the spheres (then of the goods), **it is always suggested to cover the support plate with the same material of the directional belt** (different friction may cause different goods speeds).



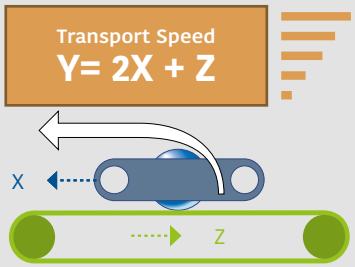
For a better indication of possible directional belts, their performances (maximum speed), as well as minimum thickness of the coating, please enquire your belting supplier.



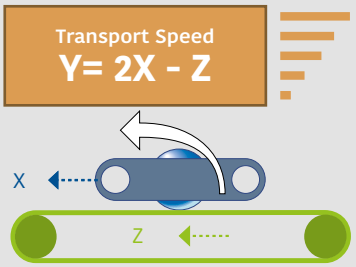
Basic formulas to control goods speed/direction



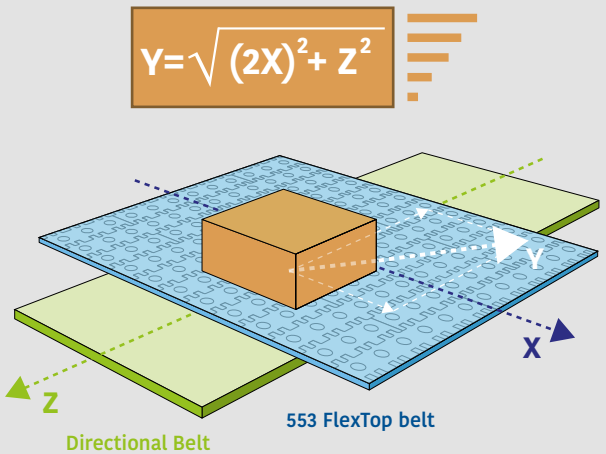
553 FlexTop belt running over fixed surface.



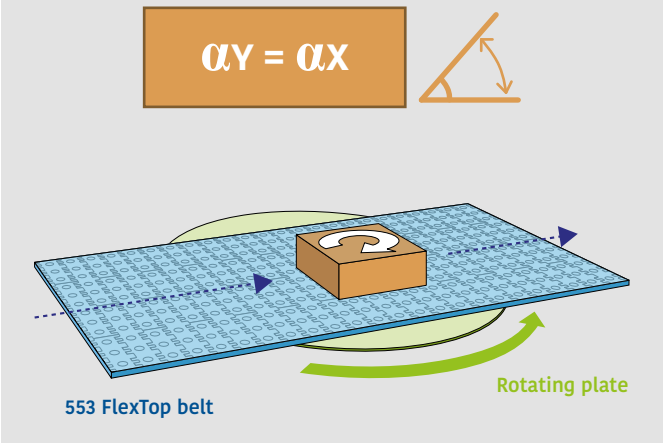
553 FlexTop belt mounted over a longitudinal conveyor running in opposite direction.



553 FlexTop belt mounted over a longitudinal conveyor running in the same direction.



553 FlexTop belt with directional belt mounted perpendicularly
The difference in speed between the 553 FlexTop belt and the directional belt determines the direction angle of the good.



553 FlexTop belt with a 360° rotating plate underneath
Useful option used to easily positioning the good.

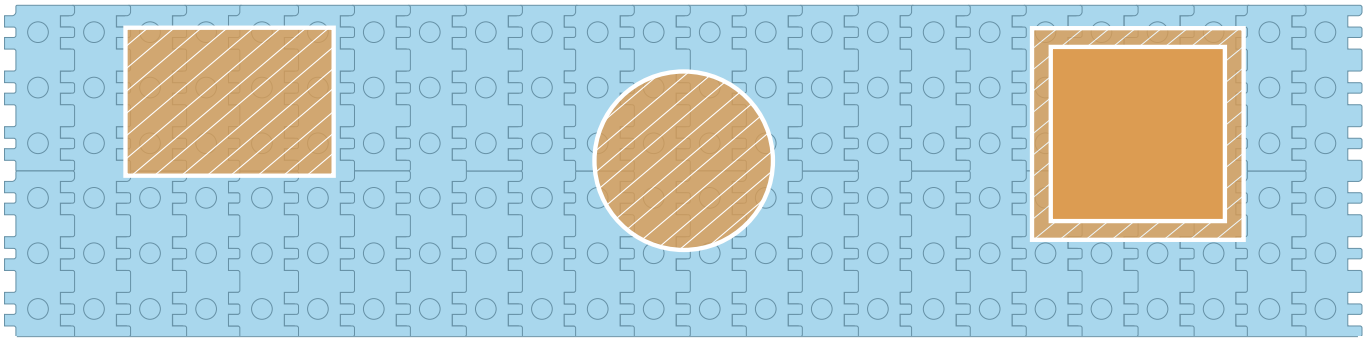
<u>Belt spheres run in the opposite direction of the directional belt</u> (to go on the left the directional belt must run on the right) and of the rotating plate (to go clockwise the rotating plate must turn counter clockwise).

Combine different movements to get the required direction for your business!

Goods dimensioning

The type of the goods to be transported over the 553 FlexTop belt must be checked carefully.
In general, there are a few recommendations need to be followed to check if the good can be transported:

- **Bottom surface** of the goods – **relatively flat**
- **Center of gravity** of the goods – **relatively distributed** (+/-20% around the nominal one)
- **Weight** – suitable with spheres – maximum **15N per sphere**
- **Contact –** goods running on **at least 6 spheres**



Goods contact surface

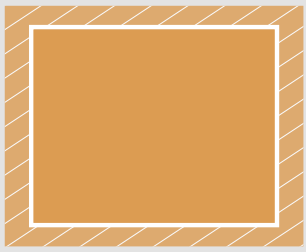
Contact with the spheres is a necessary condition

As a rule, there must be at least **6 spheres in contact with the good surface at the same time**, so almost 6in² (38cm²) ➜ 1in² per sphere (6,4cm² per sphere).

To guarantee sliding properties, it is very important to calculate the sliding contact surface of the good. It must be bigger than 38cm².

Example:

Good suitability assessment of a polystyrene box weight 18kg with bottom surface – external contact.



- External Length ➜ 10cm
- Internal Length ➜ 8cm
- External width ➜ 16cm
- Internal width ➜ 13cm

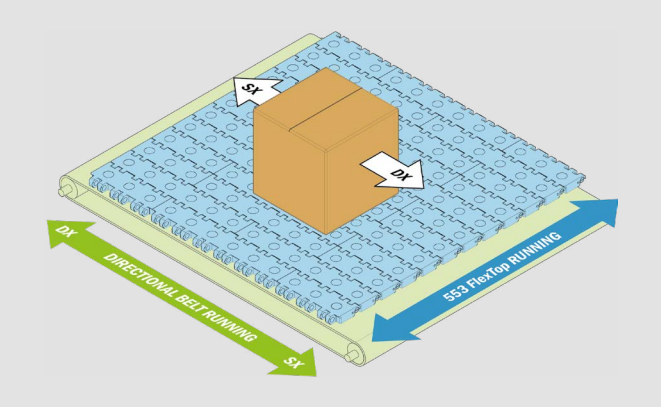
Calculation:
Surface in contact: (10x16) - (8x13) = 56cm² > 38cm² ➜ **OK**
This can be transformed in N° of spheres in contact ➜ 56/6,4=8,75 ➜ 8 spheres (would result 8 full sphere in contact)
Weight: 18Kg * 9,81= 176,6N ➜ 176,6/15=11,77 ➜ minimun 12 spheres required

Output:
⚠ This type of goods can't be transported.

Because of the weight, this box cannot be transported. You have two options to solve the problem:

Possible solutions to meet the requirements:
- Increase the dimension of the box to achieve 76,8 cm² sliding surface (12 spheres x 6,4 cm²).
- Reduce the box weight to maximum 120N (8 spheres x 15N).

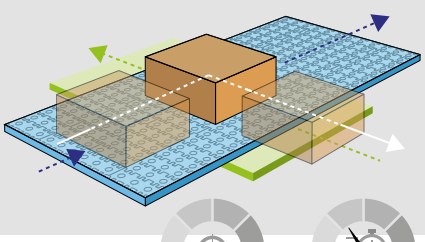
For more support or particular applications you can contact our engineering department.



Divert – lateral movement

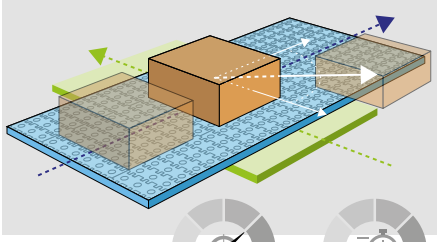
By using a directional belt underneath the 553 FlexTop belt, running square to the travel direction, the goods can be transferred left and right.

The combination of the speed of modular belt and directional belt will determine the direction of the exit.



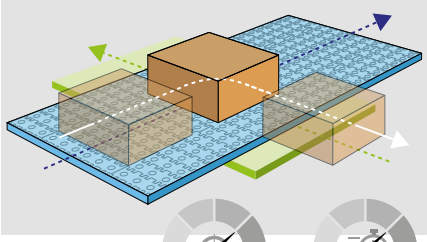
Straight exit PRECISION SPEED

To get a completely straight exit, **the directional belt must be activated when 553 FlexTop is not running**.



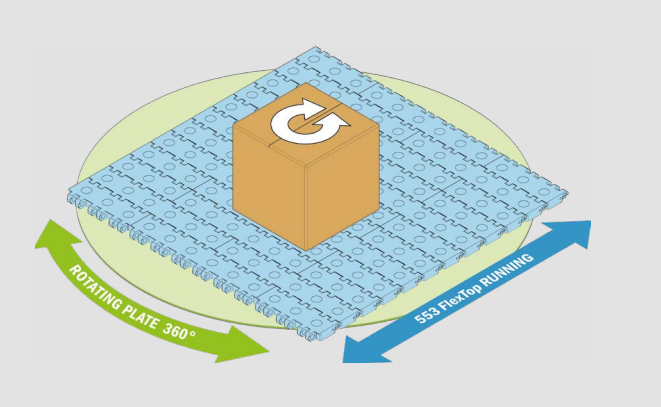
Inclined exit PRECISION SPEED

To get a 45° inclined direction, the **speed of the directional belt must be the same** as the speed of the 553 FlexTop and they have to work contemporary.



Curved exit PRECISION SPEED

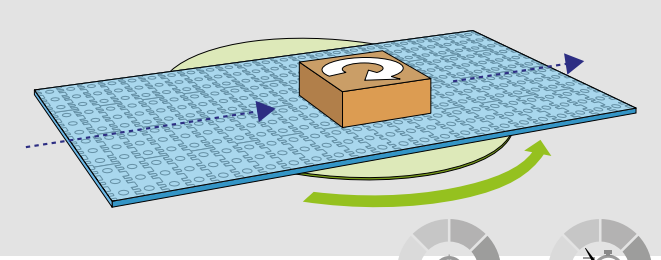
To get a straight exit without loosing relatively too much time, the **directional belt can be activated** also **when the 553 FlexTop is running, while is reducing speed**.
The combination of the two speeds will determine the exit curve dimension.



Static Rotation

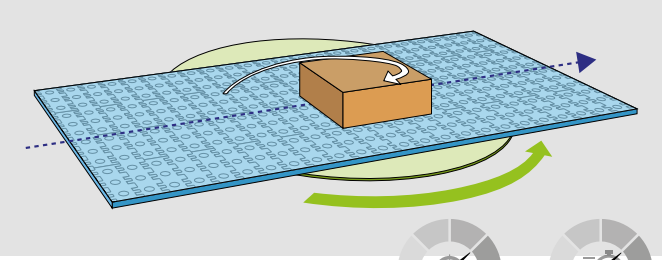
By using a **rotating plate underneath the 553 Flextop belt**, the goods will start rotating.

Such a movement can be done by having a Rotating Plate turning at the opposite direction than what has to be the good direction. **For a high-precision rotation, it is suggested to active the Rotating Plate when the modular belt is stopped.**



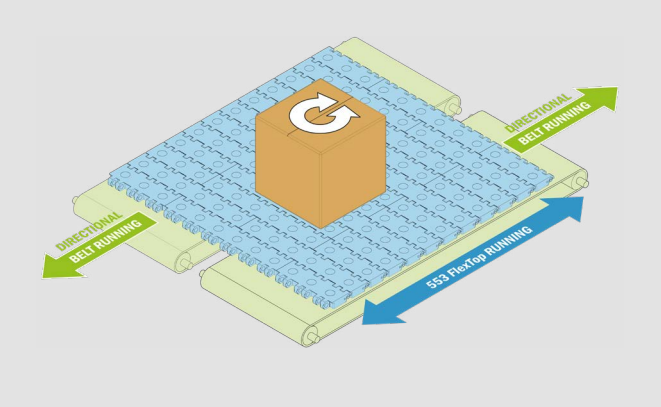
Controlled rotation PRECISION SPEED

To get a controlled roation, the rotating plate must be activated **when 553 FlexTop is not running.**



Uncontrolled rotation PRECISION SPEED

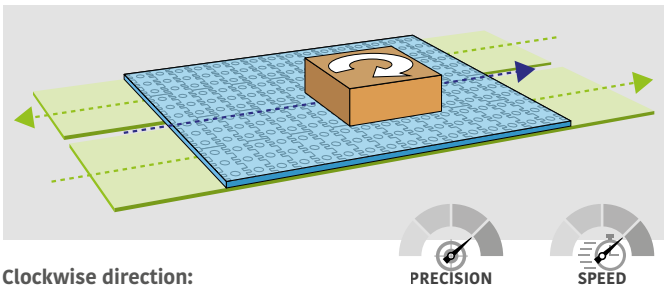
If the rotating plate get activated while the modular belt is running, the **good will rotate in more space.**
Be sure the product is running over the plate till its rotation is completed.



Dynamic Rotation

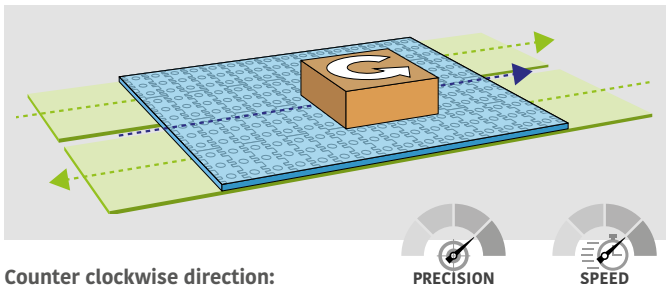
By **using two directional belts underneath the 553 Flextop belt**, running at **opposite direction**, the **good will start rotating**.

This option is **ideal for high speed lines**, while the goods needs to be rotated **to correct sides without slowing down the production line**. Based on the combination of speeds between the 3 belts, the good will rotate in a different distance. It is suggested to keep the directional belts speed always the same.



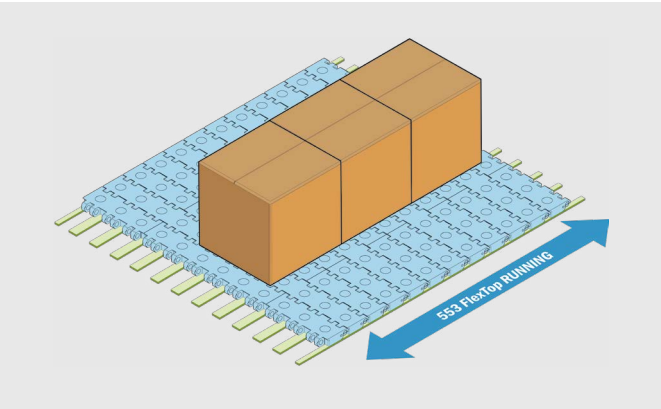
Clockwise direction:

To get a **dynamic rotation to the right**, the two directional belts must run like the picture.



Counter clockwise direction:

To get a **dynamic rotation to the left**, the two directional belts must run like the picture.

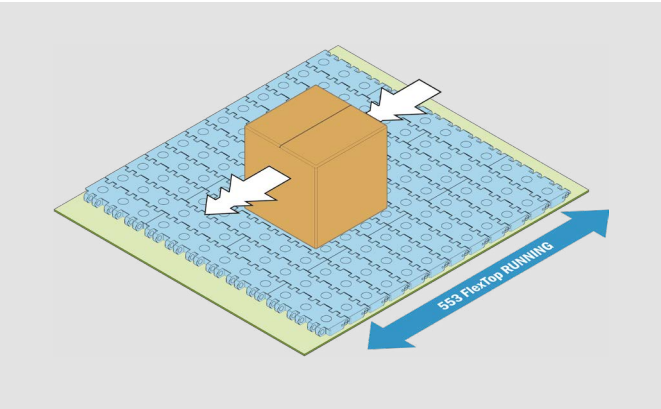


Accumulation

For a limited time, in case of needs or special application (e.g. rejected table), the 553 FlexTop belt can work as accumulation.

In that case **spheres must be free to run,** so the belt has to be supported by wear-strips positioned between spheres (see page 29).

Maximum wear-strip width 8mm.



Acceleration/Deceleration

By using a static plate or a directional belt underneath the 553 FlexTop belt, the good can accelerate or decelerate.

Static plate

By using a static plate, the good **speed will result double** than the 553 FlexTop belt speed.

Directional belt

By using a directional belt, the good speed can be **accelerated or decelerated independently from the 553 FlexTop belt speed**.

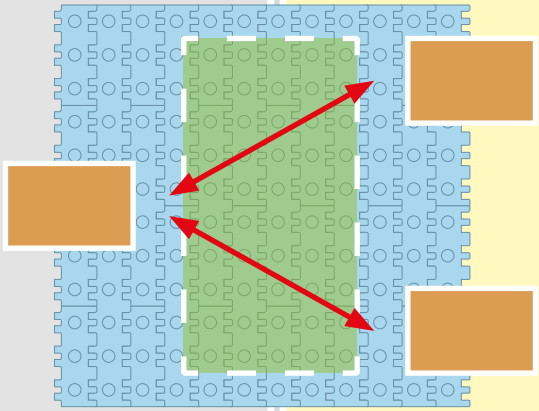
DIVIDER - MERGER

Below sketch of the **typical schemes** can be done with the 553 FlexTop belt.

In case of different movement required, please provide information to your sales representative and you will receive required support.

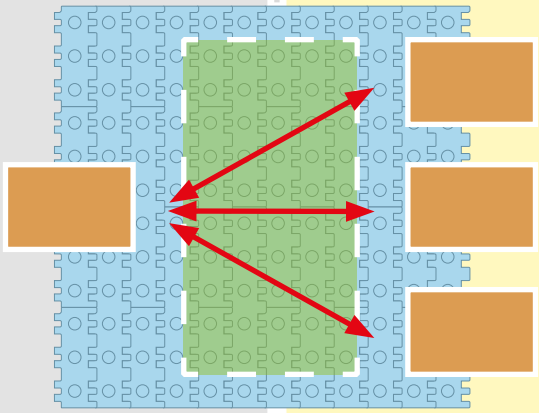
DIVIDER → MERGER ←

1 to 2 - centered



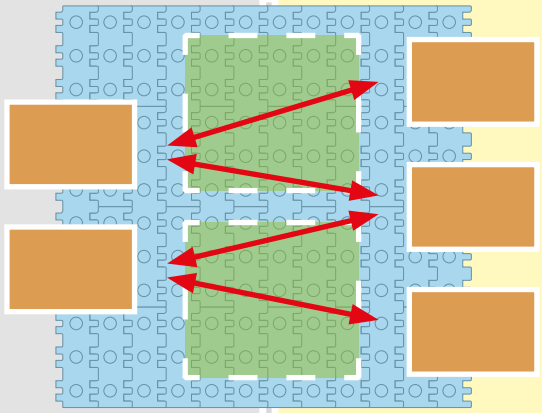
1 553 FlexTop belt - **1** Directional belt

1 to 3 - centered



1 553 FlexTop belt - **1** Directional belt

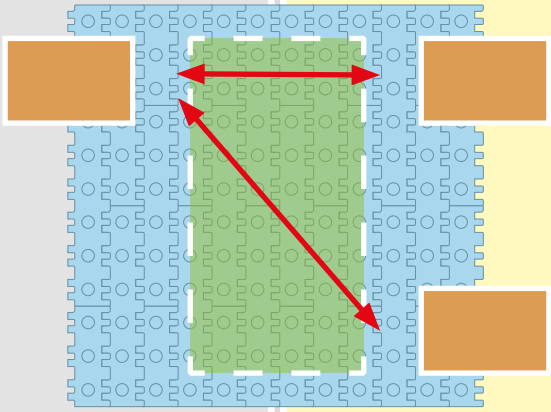
2 to 3 - centered



1 553 FlexTop belt - **2** Directional belts

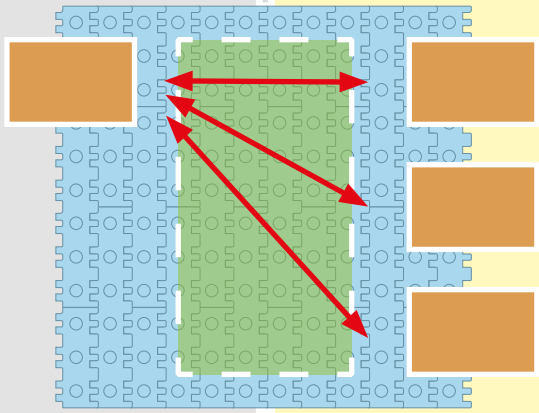
DIVIDER → MERGER ←

1 to 2 - aside



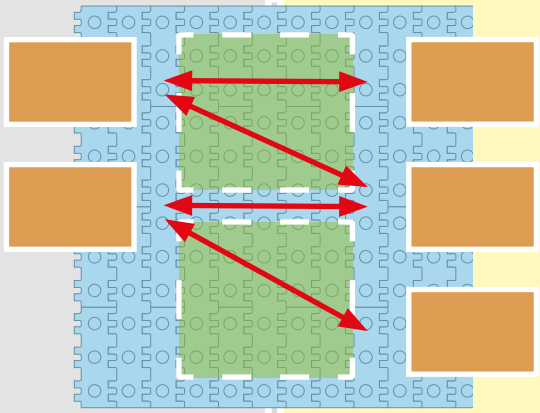
1 553 FlexTop belt - **1** Directional belt

1 to 3 - aside



1 553 FlexTop belt - **1** Directional belt

2 to 3 - aside



1 553 FlexTop belt - **2** Directional belts

SORTER

Below sketch of the **typical schemes** can be done with the 553 FlexTop belt.

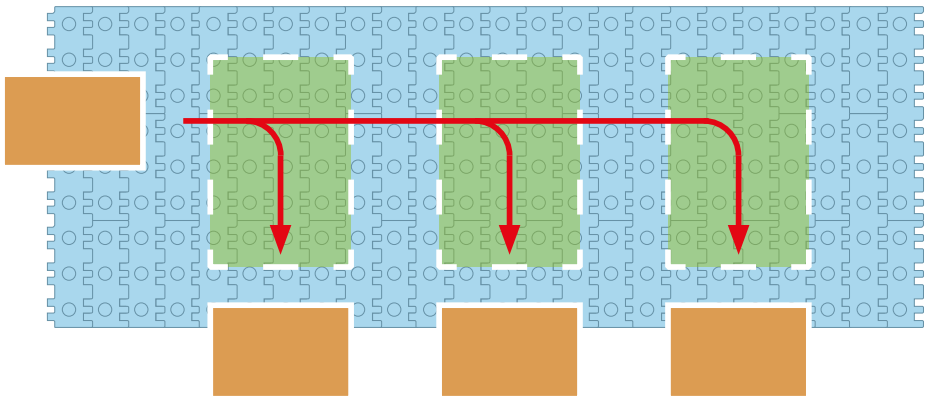
In case of different movement required, please provide information to your sales representative and you will receive required support.

More bays can be created in **two different ways**:

- **Single unit – more directional belts**
- **Single unit – single directional belt**

Both will have related advantages, the single unit with more directional belts results easier to program and handle; the single unit with single directional belt results quicker from maintenance point of view (easy to replace and avoid downtimes).

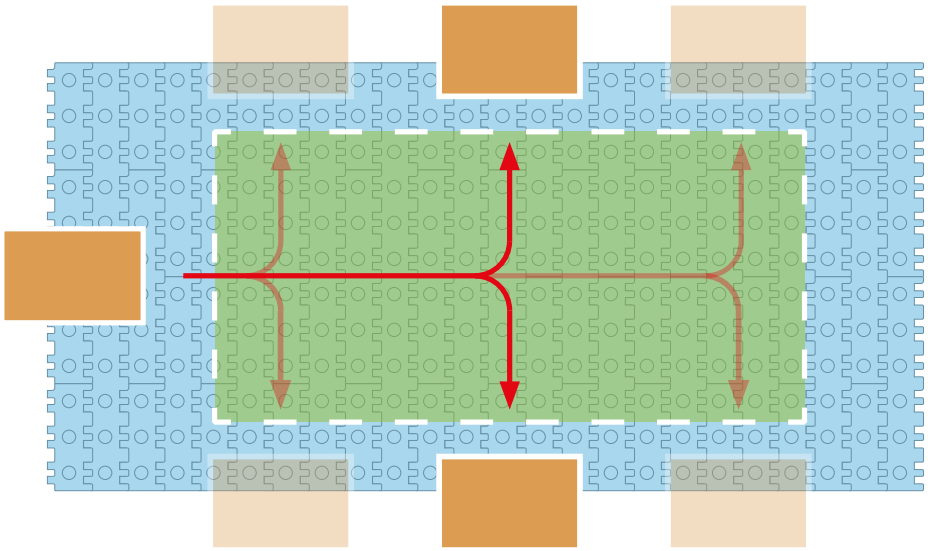
90° SORTING - One side - more directional belts



1 553 FlexTop belt - **3** Directional belts

One side sorting can also be done with single directional belt (see the example below)

90° SORTING - Two sides - single directional belt



1 553 FlexTop belt - **1** Directional belt

Two sides sorting can also be done with more directional belts (see the example above)

When using a single directional belt, goods can take the exit only one by one and the next good can't run over the directional belt if the previous one is on its exiting direction (that will compromise its direction).

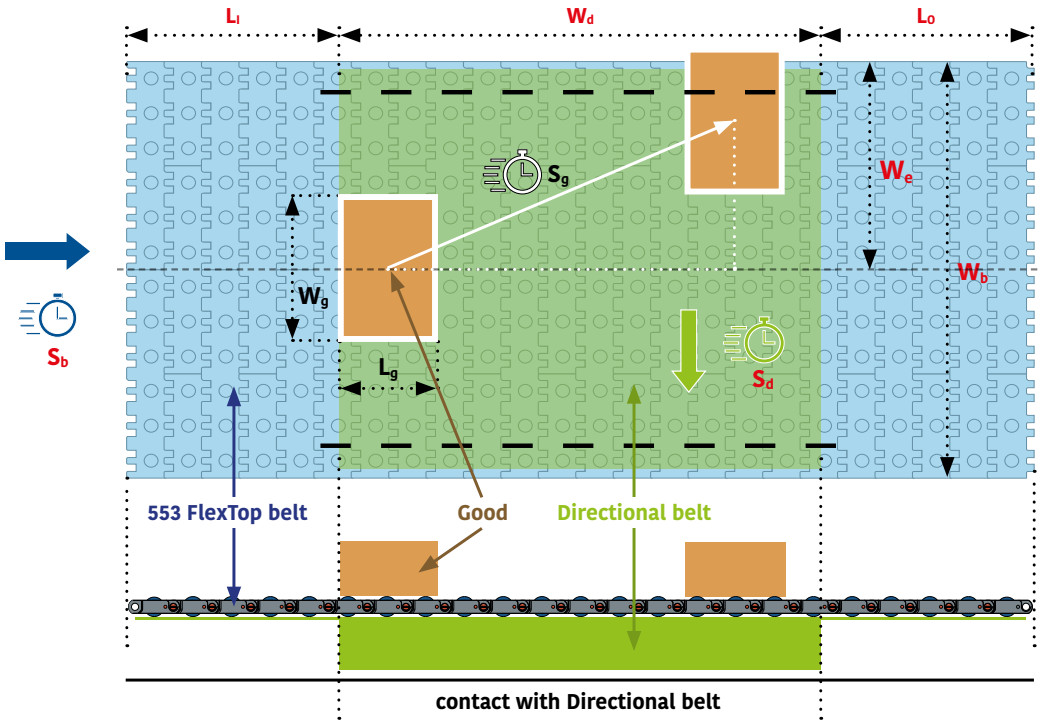
Divider - Merger - Sorter - Complete dimensioning solution

Below sketch of the **typical schemes** can be done with the 553 FlexTop belt.

In case of different movement required, please provide information to your sales representative and you will receive required support.

Complete dimensioning solution

Below the main functional scheme for a typical application of product lateral movements.
Shown formulas help calculating main information to create a complete unit.
In **black** are indicated required **input**, in **red** are indicated **output** that can be calculated with the following formulas:



Legend:

- L_g Good length
- W_g Good width
- W_b FlexTop belt width
- W_d Directional belt width
- S_d Directional belt speed
- S_g Good speed
- S_b FlexTop belt speed

L_g

Goods length corresponds to **the running side,** not always to the longer side of the goods!

Inputs:

- L_g Goods length (mm)
- W_g Goods width (mm)
- C Capacity - n° of goods per minute (N°/min) (or S_g goods speed m/min)
- P_g Goods pitch (mm)

Outputs:

- W_b FlexTop belt width
- W_d Directional belt width
- S_d Directional belt speed
- S_b FlexTop belt speed
- T_{c1} Climbing time
- T_{c2} Crossing time
- T_u Useful time
- W_e Exit width
- L_I Infeed length
- L_o Outfeed length
- L_{tot} Total conveyor length
- W_e Exit width

Formulas:

- FlexTop belt width (bigger than goods width, multiple of 3" standard measure):

$$W_b \geq \frac{W_g}{76,2} \text{ to catalog width}$$

- Directional belt width (at least 1,5 times the goods length): $W_d = 1,5 * L_g$
- Goods pitch (if not provided as input, at least long as Wd): $P_g = W_d$
- Goods speed (if not provided as input, can be calculated from capacity): $S_g = \frac{P_g}{1000} * C$
- FlexTop belt speed (considering all spheres running on a flat plate): $S_b = \frac{1}{2} * S_g$
- Climbing time: $T_{c1} = \frac{L_g}{S_g}$
- Crossing time: $T_{c2} = \frac{W_d}{S_g}$
- Useful time (net available time for directioning): $T_u = T_{c2} - T_{c1}$
- Exit width (considering the good coming in the middle of the FlexTop belt): $W_e = \frac{W_b}{2}$
- Directional belt speed: $S_d = \frac{[W_e + (W_g / 2)]}{T_u * 1000}$
- Infeed length (mandatory): $L_i \geq L_g$
- Outfeed length (optional): $L_o = \frac{L_i}{2}$
- Total conveyor length: $L_{tot} = L_i + L_o + W_d$

Sorter - Complete dimensioning solution - EXAMPLE

Inputs:

- L_g Goods length (mm) = **380mm**
- W_g Goods width (mm) = **420mm**
- C Capacity - n° of goods per minute (N°/min) = **25pcs/min** (or S_g goods speed)
- P_g Goods pitch (mm) = **n.a.**

Don't forget to check if the goods weight and dimensions are suitable: **maximum weight 15N per sphere and minimum 6 spheres fully in contact.**

Outputs:

- W_b FlexTop belt width:

$W_b \geq \frac{W_g}{76,2}$ to catalog width → $\frac{420}{76,2} = 5,51$ → 6 * 76,2 = 457,2mm (**Belt width 18"** – Art. Nr 5530270018A)

- W_d Directional belt width: $W_d = 1,5 * L_g$ → 1,5 * 380 = **525mm**

The wider is the directional belt, the more will be the time available for the goods to be moved.

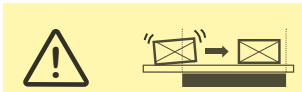
- P_g Goods pitch (mm): $P_g = W_d > 525$ → **600mm**

The pitch between goods is very important to give enough time to a goods to realize the right movement

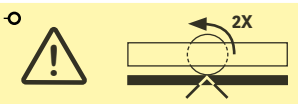
- S_g Goods speed: $S_g = \frac{P_g}{1000} * C$ → $\frac{600}{1000} * 25 = 15$ m/min
- S_b FlexTop belt speed: $S_b = \frac{1}{2} * S_g$ → $\frac{1}{2} * 15 = 7,5$ m/min
- T_{c1} Climbing time: $T_{c1} = \frac{L_g}{S_g}$ → $\frac{380}{15} * \frac{60}{1000} = 1,5$ s
- T_{c2} Crossing time: $T_{c2} = \frac{W_d}{S_g}$ → $\frac{525}{15}$ → $\frac{60}{1000} = 2,1$ s

Fig. A

- T_u Useful time: $T_u = T_{c2} - T_{c1}$ → 1,5-1,08 = 0,6 s
- W_e Exit width: $W_e = \frac{W_b}{2}$ → $\frac{457,2}{2}$ = 228,6mm Fig. B
- S_d Directional belt speed: $S_d = \frac{W_e + (W_g/2)}{T_u * 1000}$ → $\frac{228,6 + (420/2)}{0,6 * 1000} = 0,7$ m/s → **44 m/min**
- L_i Infeed length: $L_i \geq L_g$ → 380 mm
- L_o Outfeed length: $L_o = \frac{L_i}{2}$ → $\frac{380}{2} = 190$ mm
- L_{tot} Total conveyor length: $L_{tot} = L_i + L_o + W_d$ → 380 + 190 + 525 = **1.095 mm**



If the next good is running over the directional belt before the first one is already out, it will start rotating and then the final position won't be as programmed.



If the spheres are touching a static support (strips or plate) their speed will result double than the speed of the FlexTop belt.
That's why the FlexTop belt speed (S_b) results half of the goods speed (S_g).

Fig. A

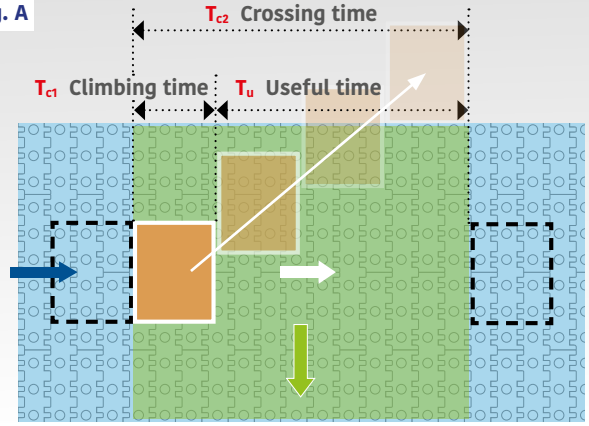
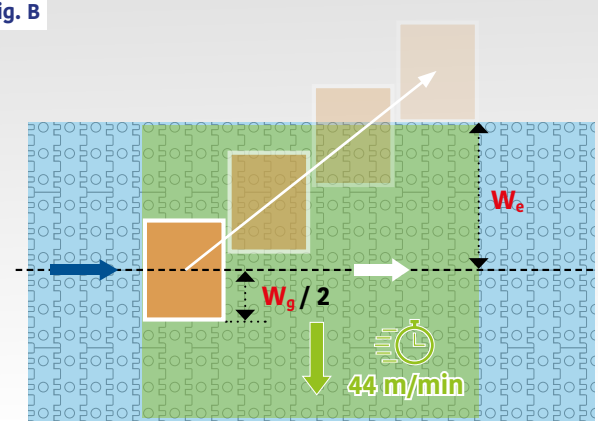
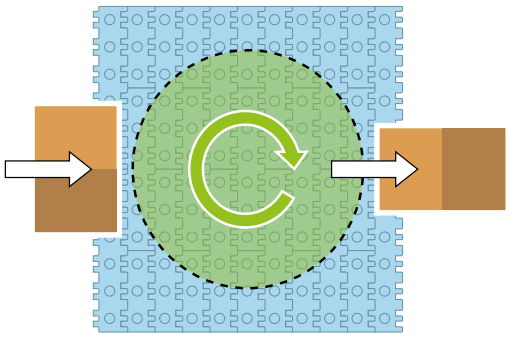


Fig. B



Static Rotation - Complete dimensioning solution

Below sketch of the **typical schemes** can be done with the 553 FlexTop belt.

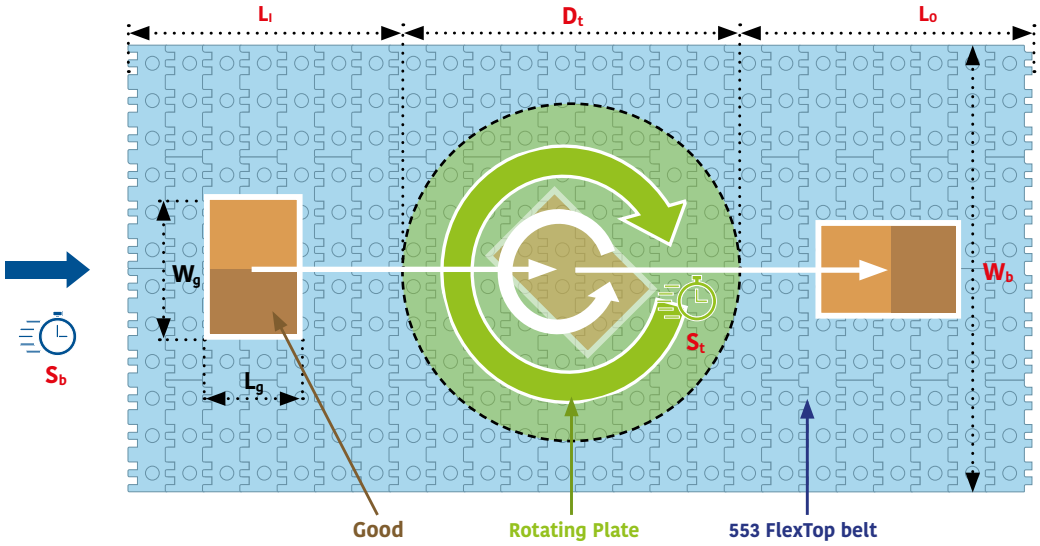


In case of different movement required, please provide information to your sales representative and you will receive required support.

For a movement completely under control, the static rotation is the best way to rotate a product. Obviously, this is also the slower solution, because **the goods needs to arrive in the middle of the disc, stop, turn and start again**.

Complete dimensioning solution

Below the main functional scheme for a typical application of goods rotation.
Shown formulas help calculating main information to create a complete unit.
In **black** are indicated required **input**, in **red** are indicated **output** that can be calculated with the following formulas:



Legend:

L_g	Goods length
W_g	Goods width
W_b	FlexTop belt width
D_t	Rotating plate diameter
S_t	Rotating Plate speed
S_b	FlexTop belt speed

L_g

Goods length corresponds to **the running side,** not always to the longer side of the goods!

Inputs:

- L_g Goods length (mm)
- W_g Goods width (mm)
- C Capacity - n° of goods per minute (N°/min) (or S_g Goods speed m/min)
- P_g Goods pitch (mm)
- α Rotation angle

Outputs:

- W_b FlexTop belt width
- D_t Rotating Plate diameter
- S_b FlexTop belt speed
- T_u Useful time
- S_t Rotating Plate speed
- L_i Infeed length
- L_o Outfeed length
- L_{tot} Total conveyor length

Formulas:

- FlexTop belt width (bigger than goods width, multiple of 3" standard measure):

$$W_b \geq \frac{W_g}{76,2} \text{ to catalog width}$$

- Rotating Plate diameter: $D_t \geq \sqrt{L_g^2 + W_g^2}$
- Goods pitch (if not provided as input, at least long as D_t): $P_g = D_t$
- Goods speed (if not provided as input, can be calculated from capacity): $S_g = \frac{P_g}{1000} * C$
- FlexTop belt speed (considering all spheres running on a flat plate): $S_b = \frac{1}{2} * S_g$
- Useful time (net available time for rotation): $T_u = \frac{P_g}{1000 * S_g}$
- Rotating Plate speed: $S_t = \frac{\alpha}{T_u}$
- Infeed length (optional): $L_i = L_g$
- Outfeed length (optional): $L_o = \frac{L_i}{2}$
- Total conveyor length: $L_{tot} = L_i + L_o + D_t$

Static Rotation - Example

Complete dimensioning solution - EXAMPLE

Inputs:

- L_g Goods length (mm) = **380mm**
- W_g Goods width (mm) = **420mm**
- C Capacity - n° of goods per minute (N°/min) = **25pcs/min** (or S_g Goods speed)
- P_g Goods pitch (mm) = **n.a.**
- α Rotation angle = **90°**

Don't forget to check if the goods weight and dimensions are suitable: **maximum weight 15N per sphere and minimum 6 spheres fully in contact.**

Outputs:

- W_b FlexTop belt width:

$W_b \geq \frac{W_g}{76,2}$ **to catalog width** ➜ $\frac{420}{76,2} = 5,51$ ➜ **6 * 76,2 = 457,2mm** (**Belt width 18"** – Art. Nr 5530270018A)

- D_t Rotating Plate diameter: $D_t = D_t \geq \sqrt{L_g^2 + W_g^2}$ ➜ $\sqrt{380^2 + 420^2} = 566,4$ ➜ **600mm**

The wider is the Rotating Plate diameter, the easier will be that the goods is perfectly center on it.

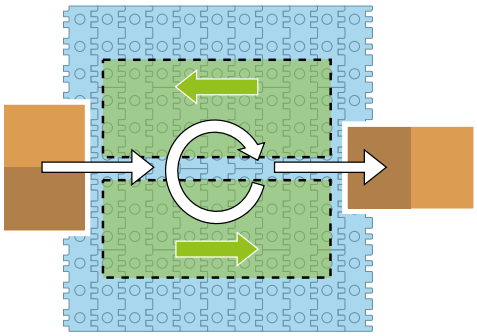
- P_g Goods pitch (mm): $P_g = D_t$ ➜ **600mm**
- S_g Goods speed: $S_g = \frac{P_g}{1000} * C$ ➜ $\frac{600}{1000} * 25 = 15$ m/min
- S_b FlexTop belt speed: $S_b = \frac{1}{2} * S_g * 15 = 7,5$ m/min
- T_u Useful time: $T_u = \frac{P_g}{1000 * S_g}$ ➜ $\frac{600}{1000 * 15} = 0,04$ min * 60 ➜ 2,4 s
- S_t Rotating Plate speed: $S_t = \frac{\alpha}{T_u}$ ➜ $\frac{\frac{\pi}{2}}{2,4} = 0,65$ rad/s = 39 rad/min
- L_i Infeed length: $L_i = L_g$ ➜ 380 mm
- L_o Outfeed length: $L_o = \frac{L_i}{2}$ ➜ 380 / 2 = 190 mm
- L_{tot} Total conveyor: $L_i + L_o + D_t$ ➜ 380 + 190 + 600 = **1.170 mm**

If the next goods is running over the directional belt before the first one is already out, it will start rotating and then the final position won't be as programmed.

If the spheres are touching a static support (strips or plate) their speed will result double than the speed of the FlexTop belt.
That's why the FlexTop belt speed (S_b) results half of the goods speed (S_g).

Dynamic Rotation - Complete dimensioning solution

Below sketch of the **typical schemes** can be done with the 553 FlexTop belt.

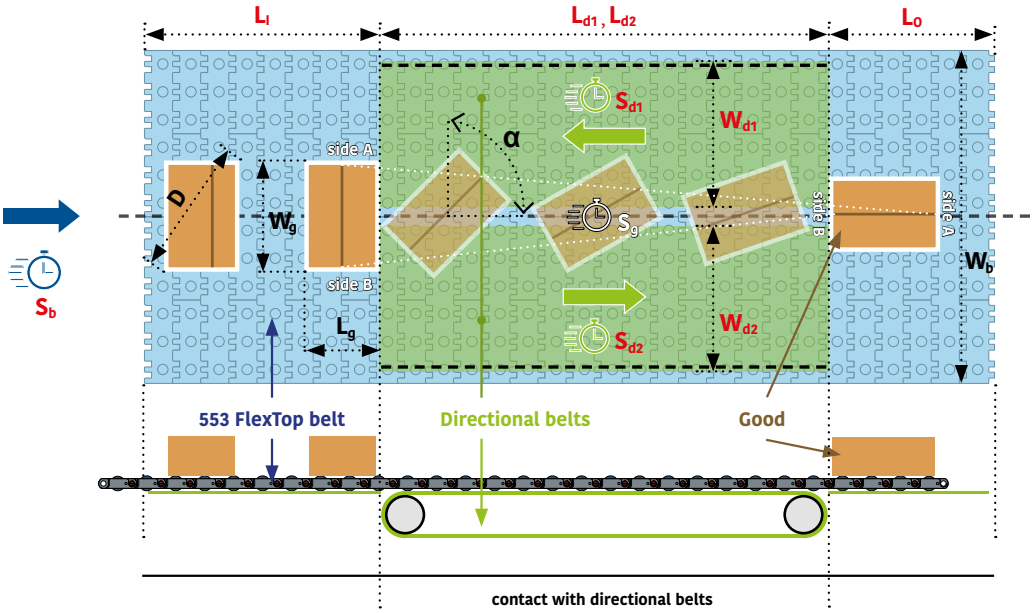


In case of different movement required, please provide information to your sales representative and you will receive required support.

For a faster rotation of the goods, the two parallel belts can be activated while the goods is still running on the 553 FlexTop belt.
This will result to be faster than the static one, but the rotation precision won't be as high as the first solution, for obvious reasons.

Complete dimensioning solution

Below the main functional scheme for a typical application of goods rotation.
Shown formulas help calculating main information to create a complete unit.
In **black** are indicated required **input**, in **red** are indicated **output** that can be calculated with the following formulas:



Legend:

L_g	Goods length
L_{d1}	Directional belt length
L_{d2}	Directional belt length
W_g	Goods width
W_b	FlexTop belt width
W_{d1}	Directional belt width
W_{d2}	Directional belt width
S_{d1}	Directional belt speed
S_{d2}	Directional belt speed
S_b	FlexTop belt speed

L_g
Goods length corresponds to **the running side,** not always to the longer side of the goods!

Inputs:

- L_g Goods length (mm)
- W_g Goods width (mm)
- C Capacity - n° of goods per minute (N°/min) (or S_g Goods speed m/min)
- P_g Goods pitch (mm)
- α Rotation angle

Outputs:

- W_b FlexTop belt width
- W_{d1}, W_{d2} Directional belt width
- L_{d1}, L_{d2} Directional belt length
- S_{d1}, S_{d2} Directional belt speed
- S_{s1}, S_{s2} Sphere belt speed
- S_b FlexTop belt speed
- T_u Useful time
- Ω Turning goods speed
- L_i Infeed length
- L_o Outfeed length
- L_{tot} Total conveyor length

Formulas:

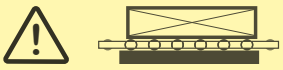
- FlexTop belt width (bigger than good swidth, multiple of 3" standard measure): $W_b \geq \frac{W_g}{76,2}$ to catalog width
- Goods pitch (if not provided as input, at least long as goods diagonal D): $P_g \geq \sqrt{L_g^2 + W_g^2}$
- Directional belt widths: Wd_1 and $Wd_2 < \frac{Wb}{2}$
- Directional belt lengths: Ld_1 and $Ld_2 = 1,5 * D$
- Goods speed (if not provided as input, can be calculated from capacity): $S_g = \frac{P_g}{1000} * C$
- FlexTop belt speed (considering all spheres running on a flat plate): $S_b = \frac{1}{2} * S_g$
- Useful time (net available time for directioning): $T_u = \frac{L_d}{1000 * S_g}$
- Turning goods speed: $\Omega = \frac{\alpha}{T_u}$
- Speed to rotate goods: $(S_{s1} - S_{s2}) = \Omega * \frac{P_g}{2}$
- Sphere belt speed: $S_{s1} = 2 * S_g + S_{d1}$ $S_{s2} = 2 * S_g + S_{d2}$
- Infeed length (mandatory): $L_i \geq L_g$
- Outfeed length (optional): $L_o \geq W_g$
- Total conveyor length: $L_{tot} = L_i + L_o + L_d$

Dynamic Rotation - Example

Complete dimensioning solution - EXAMPLE

Inputs:

- L_g Goods length (mm) = **380mm**
- W_g Goods width (mm) = **420mm**
- C Capacity - n° of goods per minute (N°/min) = **25pcs/min** (or S_g Goods speed)
- P_g Goods pitch (mm) = **n.a.**
- α Rotation angle = **90°**



Don't forget to check if the goods weight and dimensions are suitable: **maximum weight 15N per sphere and minimum 6 spheres fully in contact.**

Outputs:

- W_b FlexTop belt width:

$W_b \geq \frac{W_g}{76,2}$ **to catalog width** ➜ $\frac{420}{76,2} = 5,51$ ➜ **6 * 76,2 = 457,2mm (Belt width 18" – Art. Nr 5530270018A)**

- P_g Goods pitch (mm):

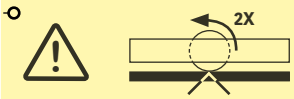
$$P_g = \sqrt{L_g^2 + W_g^2} \rightarrow \sqrt{380^2 + 420^2} = 566,4 \rightarrow \textbf{600mm}$$

The pitch between goods is very important to give enough time to a goods to realize the right movement

Pay attention: if the pitch is not correct, the goods may be touch each other and then comprosime a controlled rotation.

- S_g Goods speed: $S_g = \frac{P_g}{1000} * C \rightarrow \frac{600}{1000} * 25 = 15$ m/min

- S_b FlexTop belt speed: $S_b = \frac{1}{2} * S_g \rightarrow \frac{1}{2} * 15 = 7,5$ m/min



If the spheres are touching a static support (strips or plate) their speed will result double than the speed of the FlexTop belt.
That's why the FlexTop belt speed (S_b) results half of the goods speed (S_g).

- L_{d1}, L_{d2} Directional belt length: $L_{d1}, L_{d2} = 1,5 * D \rightarrow 1,5 * 600 = 900$mm

- T_u Useful time: $T_u = \frac{L_d}{1000 * S_g} \rightarrow \frac{900}{1000 * 15} = 0,06$ min $* 60 \rightarrow 3,6$ s

- Ω Turning goods speed: $\Omega = \frac{\alpha}{T_u} \rightarrow \frac{\frac{\pi}{2}}{3,6} = 0,44$ rad/s = 26 rad/min

- $(S_{s1} - S_{s2})$ Required different speed to rotate goods:

$$(S_{s1} - S_{s2}) = \Omega * \frac{P_g}{2} \rightarrow 0,44 * \frac{\frac{900}{2}}{1000} = 0,2 \text{ m/s} = 12 \text{ m/min}$$

From the relation of the speeds:

$(S_{s1} - S_{s2}) = 2 * S_g + S_{d1} - (2 * S_g + S_{d2}) = S_{d1} + S_{d2} = 12$ m/min

$S_{s1} = 20$ m/min (decided value, in case the calculated speed results too high or too low, recalculate it)

$S_{s2} = S_{s1} + 12$ m/min $= 20 + 12 = 32$ m/min

- S_{d1} Directional belt speed:

$S_{s1} = 2 * S_g + S_{d1} \rightarrow S_{d1} = S_{s1} - 2 * S_g \rightarrow 20 - (2 * 7,5) = 5$ m/min

- S_{d2} Directional belt speed:

$S_{s2} = 2 * S_g - S_{d2} \rightarrow S_{d2} = S_{s2} - 2 * S_g \rightarrow 32 - (2 * 7,5) = 17$ m/min

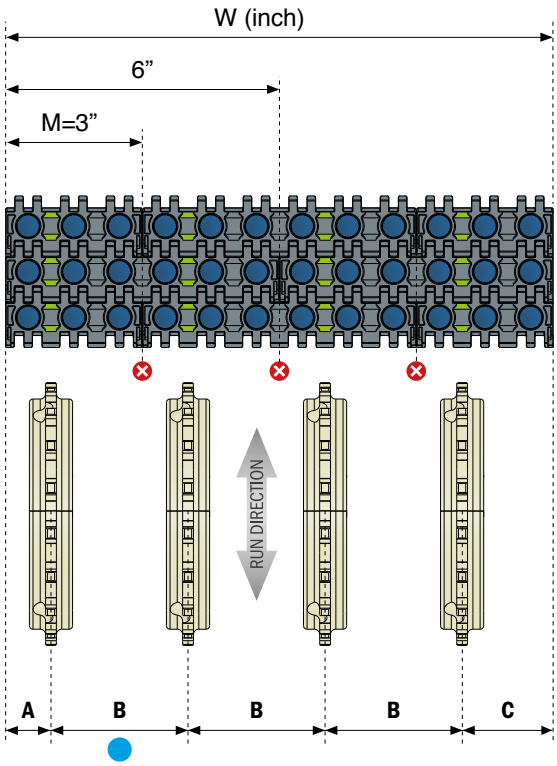
- L_i Infeed length: $L_i = L_g \rightarrow 380$ mm

- L_o Outfeed length: $L_o = W_g \rightarrow 420$ mm

- L_{tot} Total conveyor: $L_{tot} = L_i + L_o + L_d \rightarrow 380 + 420 + 900 =$ **1.700 mm**

Sprockets Position

Standard

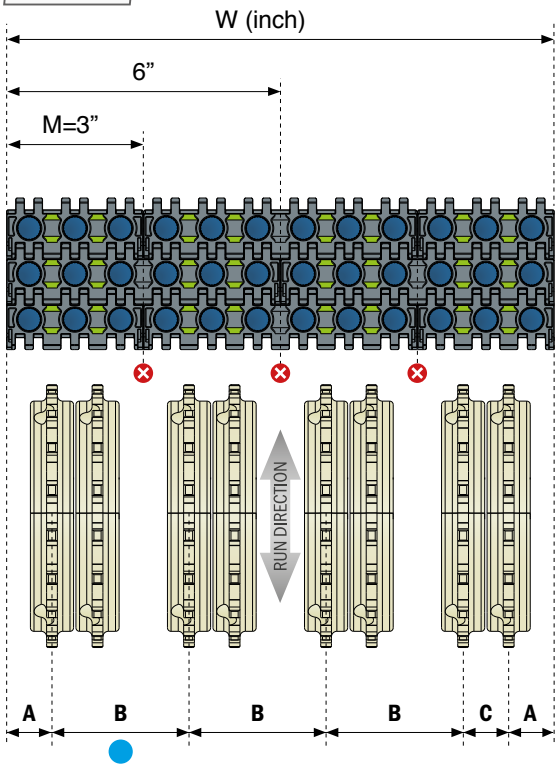


BOTTOM VIEW
Contact point

A: *0,99” (25,2 mm)*
B: *3” (76,2 mm)*
C: *2” (50,6 mm)*

Belt width (in/mm)	Recommended n° of sprockets
3 / 76.2	1
6 / 152.4	2
9 / 228.6	3
12 / 304.5	4
15 / 381.0	5
18 / 457.2	6
21 / 533.4	7
24 / 609.6	8
27 / 685.8	9
30 / 762.0	10
33 / 838.2	11
36 / 914.4	12
39 / 990.6	13
42 / 1066.8	14
45 / 1143.0	15
48 / 1219.2	16
51 / 1295.4	17
54 / 1371.6	18

HEAVY DUTY



A: *0,99” (25,2 mm)*
B: *3” (76,2 mm)*
C: *1” (25,4 mm)*

IMPORTANT

Add sprocket positions every 76,2 mm according to 76,2 mm width increments of the belt corresponding with 76,2 mm conveyor track pitch system.

*It’s **NOT** possible to place the sprockets in this position.*

If more sprockets are required the Heavy duty position can be followed.

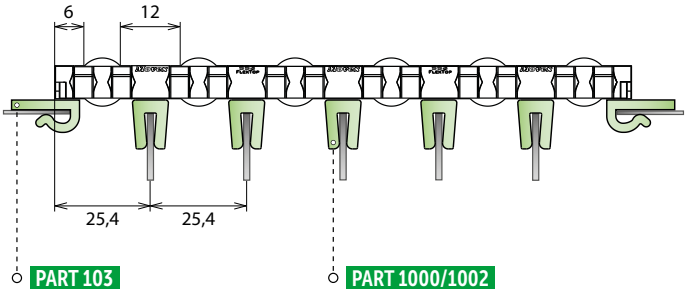
HEAVY DUTY position is ideal in case the load of the application is close to the belt limit or in case there is an high number of starts/stops during production.

Wear Strips and Machined Plates

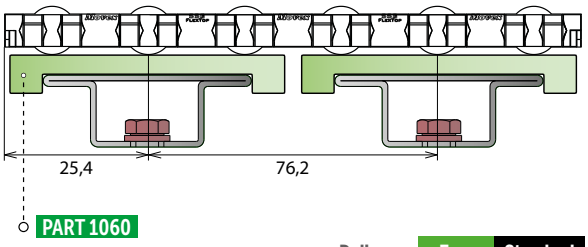
Wear strips

Wearstrips are **ideal to guide the 553 FlexTop** belt as well as create a stable sliding support.
They **can be installed in 2 different positions, for accumulation or driven**. Below only an example of wearstrips that can be used: for the complete product range, please refer to the Movex general catalogue.

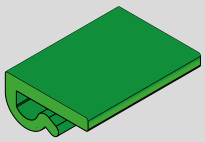
Position scheme for accumulation



Position scheme for driven



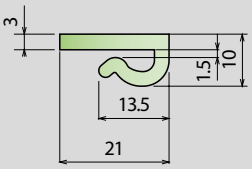
Delivery: Easy | Standard

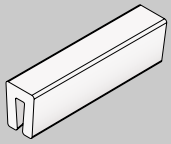


PART 103

Z-clip profile without nose — Fit on 2,5 to 3,5 mm

Part	Article-Nr.	Colour	Availability	Supply
103	10301	black	Stock item	60 m coils
103	10302	green	Stock item	60 m coils
103	10303	white	Stock item	60 m coils
103	10300B-30	BluLub	Stock item	30 m coils

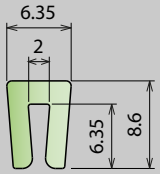


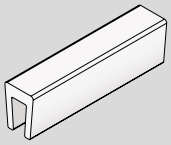


PART 1000

Bar cap 1.5 mm — Fit on 1.5 mm

Part	Article-Nr.	L	Colour	Availability	Supply
1000	100003-30	30 m	white	On request	30 m coils

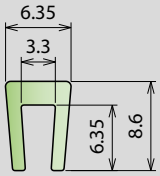


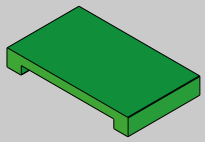


PART 1002

Bar cap 3 mm — Fit on 3 mm

Part	Article-Nr.	L	Colour	Availability	Supply
1002	100203-30	30 m	white	On request	30 m coils

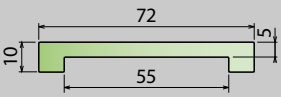




PART 1060

U-profile — On request available in white color

Part	Article-Nr.	L	Colour	Availability	Supply
1060	106001C	3 m	black	Stock item	3 m bars
1060	106001	6 m	black	On request	6 m bars
1060	106002C	3 m	green	Stock item	3 m bars
1060	106002	6 m	green	On request	6 m bars

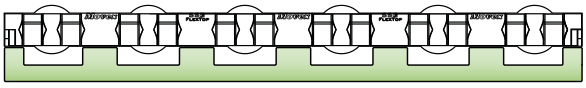


For the complete profile range, please see the Movex general catalogue.

Machined plates

Machined plastic plate can be used to support spheres. They can be machined with grooves (accumulation) or flat (driven). In the both case we suggest to have a minimum thickness of 15mm to guarantee minimum required flatness. **Movex can machine these plates based on your inputs.**

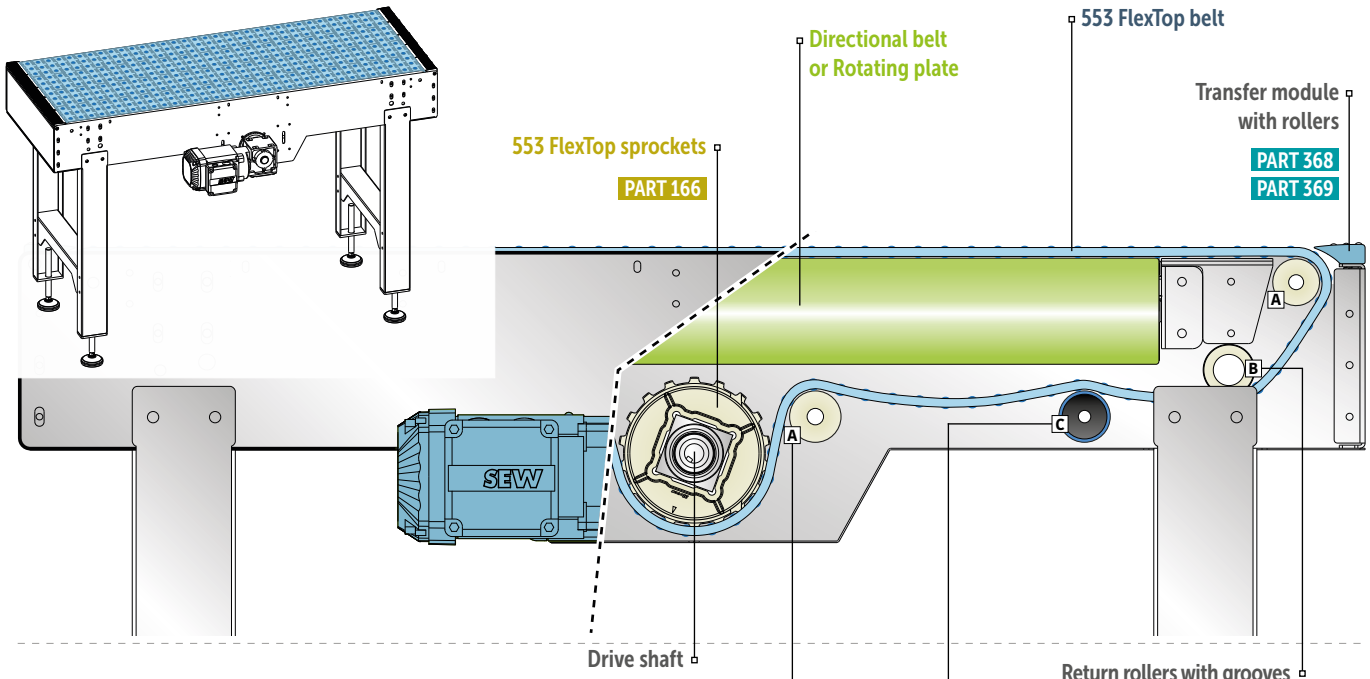
Position scheme for accumulation



Position scheme for driven

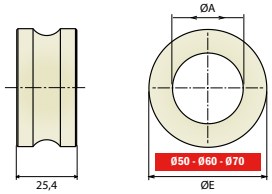
Pay attention: *different sliding material (directional belt and support plate) may have differences in friction, therefor spheres may run with different speeds. To keep the same speed, it is suggested to use the same material (same hardness).*

Return rollers



Return rollers with grooves

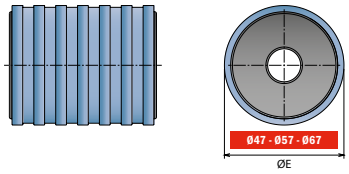
Part	Article	ØE	ØA
236	23601	50	25
236	23602	50	30
236	23603	60	25
236	23604	60	30
236	23605	70	25
236	23606	70	30



Return rollers with rubber

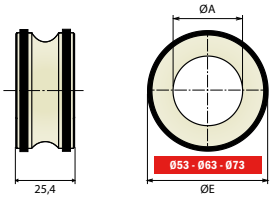
Part	ØE
220	47
203	57
204	67

See Movex General Catalog to find the article number that meets your needs.



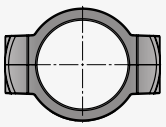
Return rollers with grooves and seals

Part	Article	ØE	ØA
237	23701	53	25
237	23702	53	30
237	23703	63	25
237	23704	63	30
237	23705	73	25
237	23706	73	30

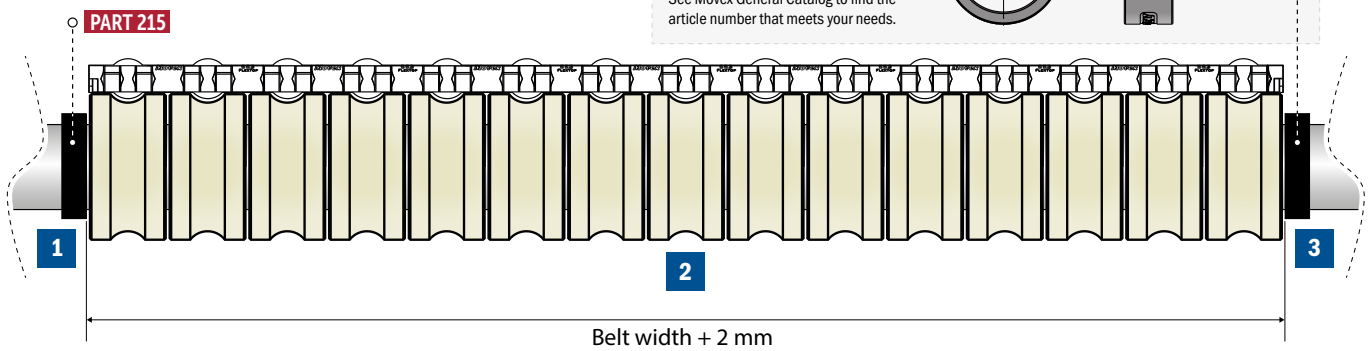


Return rollers fixation

See Movex General Catalog to find the article number that meets your needs.



PART 215



1 Fix the first split collar on the shaft.

2 Slide in the shaft required number of Return Rollers (e.g. for belt width 15", 15 rollers are required).

3 Fix the second split collar at a distance of "Belt width +2mm" (this will guarantee enough play between rollers and belt spheres).

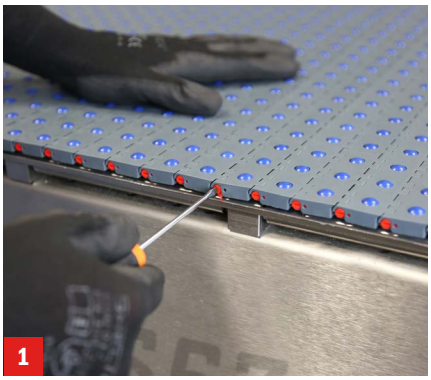
For our 553 FlexTop Conveyor solution, contact your sales representative.

Maintenance

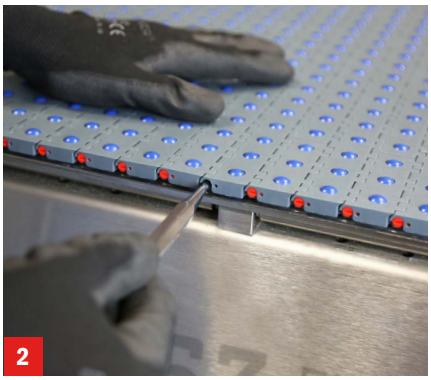
Assembling/Disassembling

Below the main steps required to mount and dismount 553 FlexTop modular belt.

Sequence for disassembling the 553 belt. To disassemble it, follow the instructions in reverse order.



Insert a flat screw driver into the red clip mounted at the sides of the belt, turn it by 90° to leave it from the clip fixation and remove it.



Insert a pin punch and push to extract the white rod from the opposite side.

Once the white rod is removed, the belt can be opened easily.

Before proceeding to remove the rod, ensure that the belt ends cannot slip away due to its weight.

Cleaning

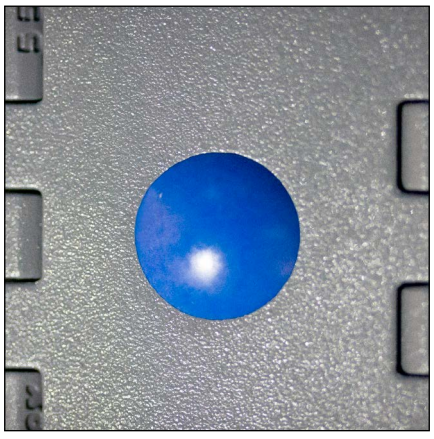
To guarantee the belt functionality and then the rotational properties of the sphere, clean condition must be respected.

If the belt is mounted on the conveyor system, the best choice is to use compressed air or damp cloth, acting with a soft brush on the spheres if required. Try to avoid pressure water since it could compromise internal electronical parts.

In case the belt results still uncleaned, then we suggest to dismount it, lay out on the floor and clean with water and soap (also with high pressure jet, keeping at safety distance) and let it completely dry (with the help of compressed air).

In case of residual dirt still visible on the spheres, repeat the operation with the help of a soft brush.

PATENTED
CLOSED GAP



Patented closed gap helps reducing maintenance frequency and increasing productivity.

Pay attention: a non-dry belt housing will compromise the belt functionality and non-cleaned belt housing spheres will not guarantee correct performances of the required movement.

Minimize Downtime and increase Productivity thanks to the patented system.

Notes

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553 FLEXTOP ENGINEERING MANUAL

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