

Food Belt Conveyor Design Guideline Index

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Food Belt Conveyor Design Guidelines

DRIVE CONFIGURATION

Head Drive Configuration (pull)

- Most common configuration.
- The conveying side of the belt is traveling (pulled) toward the drive (powered) sprockets. See Figure 1.

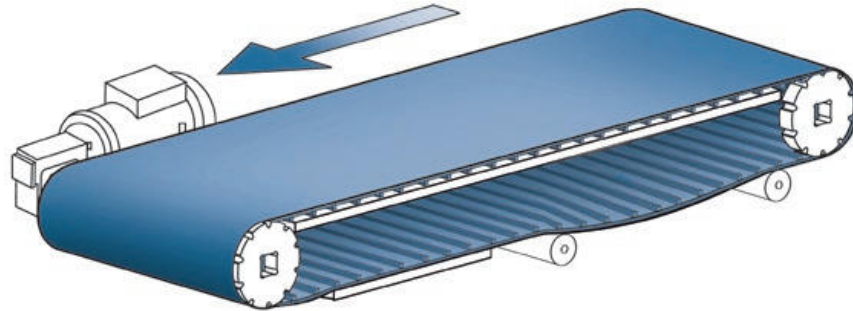


Figure 1

Tail Drive Configuration (push)

- The conveying side of the belt is traveling (pushed) away from the drive (powered) sprockets. See Figure 2
- Belt needs to be under tension at all times to prevent it from jumping the drive sprocket grooves.
- Maximum recommend conveyor length: 15 feet (4.6 m).

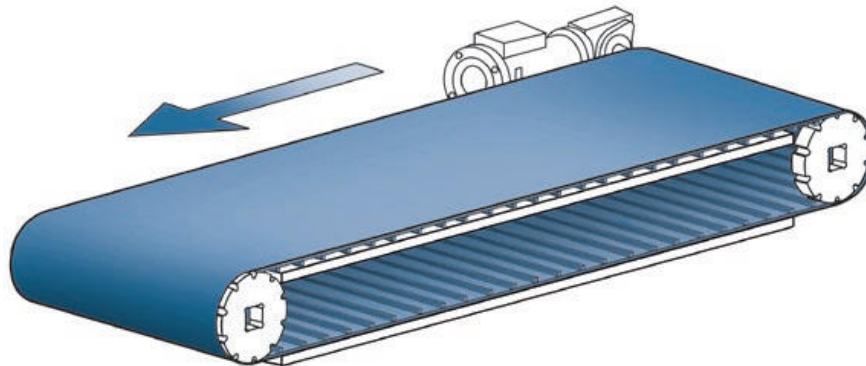


Figure 2

Food Belt Conveyor Design Guidelines

Center Drive Configuration

- Gates Mectrol does not recommend this drive configuration because belt tracking can be difficult.
- The drive sprockets in this configuration are not placed at the conveyor ends but within the conveyor span length. See Figure 3. It is used typically for bi-directional conveyors.
- Back bend rollers need to be flanged to assist belt tracking.
- Carryway support, see Basic Straight Line Conveyor guidelines
- This configuration is not suitable for belts with cleats and/or corrugated side walls.

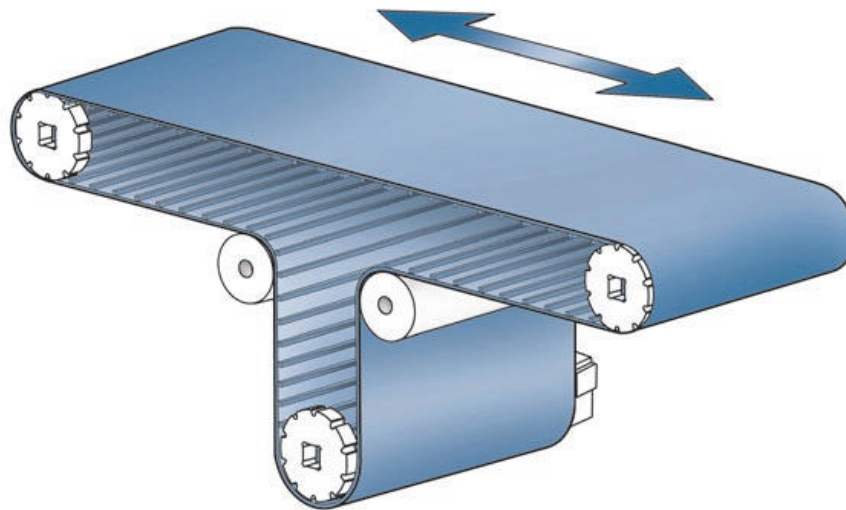


Figure 3

Food Belt Conveyor Design Guidelines

Center Drive Configuration Specifications

	PC10	PC20	CC40
Drive sprocket - Minimum diameter	12 Tooth 3.8" (97 mm)	10 Tooth 6.2" (158 mm)	12 Tooth 5.9" (150 mm)
Back-bending roller - Minimum diameter <25°C (77°F)	3.5" (89 mm)	6" (150 mm)	6" (150 mm)
Back-bending roller - Minimum diameter >25°C (77°F)	5" (125 mm)	8" (200 mm)	8" (200 mm)
Minimum Flange Height	0.375" (10 mm)	0.500" (13 mm)	0.375" (10 mm)*

* If the drive pulley does not capture the belt teeth laterally

DRUM MOTOR (MOTORIZED PULLEY)

- Motorized pulleys, designed for Gates Mectrol Food Grade Belts, are available from major manufacturers of these conveyor drives.
- Motorized pulleys, by the nature of their design, are well suited for meeting conveyor sanitation requirements.

BASIC STRAIGHT LINE (HORIZONTAL OR INCLINE) CONVEYOR

Components

1. Drive Sprocket
2. Idler (Tail) Sprocket
3. Carryway Support
4. Returnway Support Rail
5. Returnway Support Roller

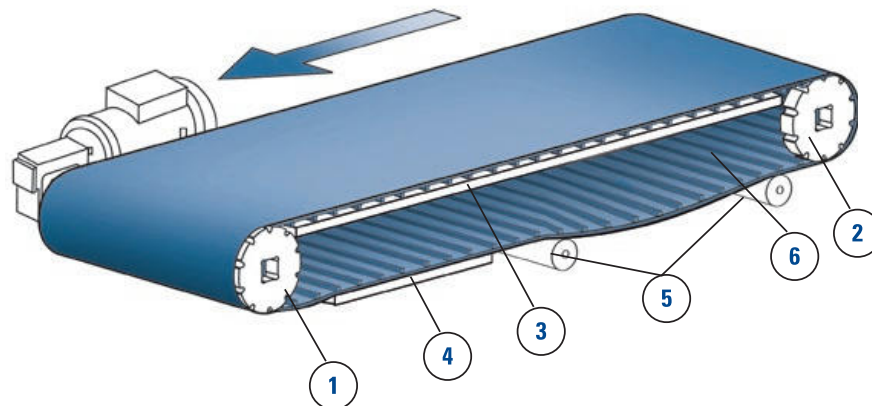


Figure 4

Food Belt Conveyor Design Guidelines

Belt Guiding and Tracking

- The conveyor frame must be rigid, square and aligned in all planes for the Gates Mectrol food grade belts to track properly.
- PosiClean
 - PosiClean belts are not self-tracking designs. External guides along the belt edges are required. Guides can be stationary or rollers. Surfaces on stationary guides that contact the belt should be made of UHMW-PE. Conveyor side rails or frames can serve as stationary guides.
 - Minimum heights of guides or roller flanges, Dim. A
 - PC10: .375" (9.5 mm) (~1.5x belt thickness)
 - PC20: .500" (12.7 mm)
- Minimum recommended gap between belt edge and conveyor sidewall, 0.125"

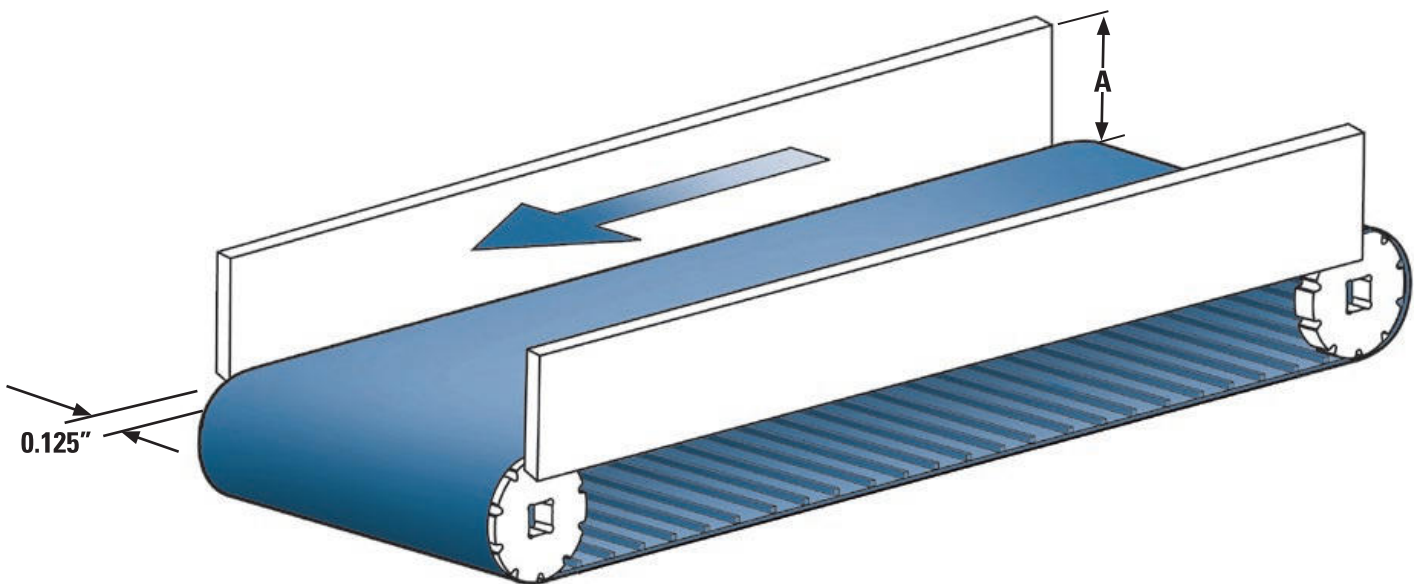


Figure 5

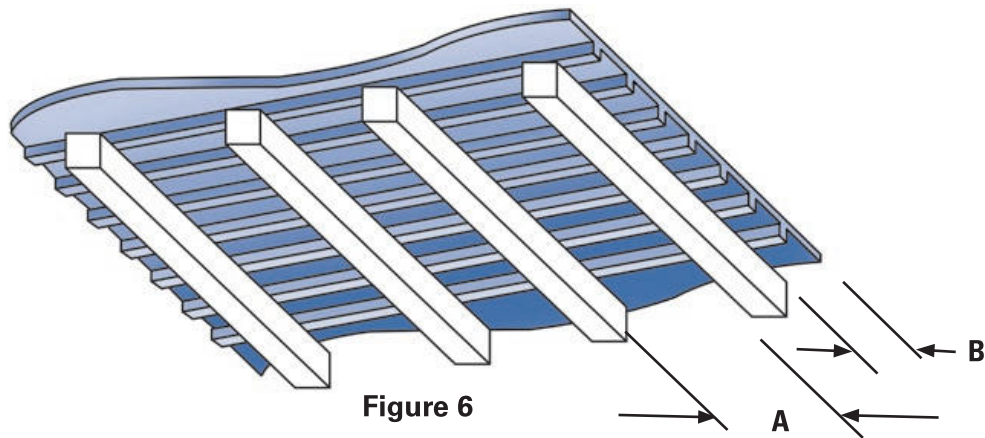
- CenterClean
 - CenterClean is guided by the belt teeth by the carryway support. See dimension C in Figure 7
- FlatClean
 - V-Guides: See page 25 for available V-guides and minimum recommended pulley diameters.

Food Belt Conveyor Design Guidelines

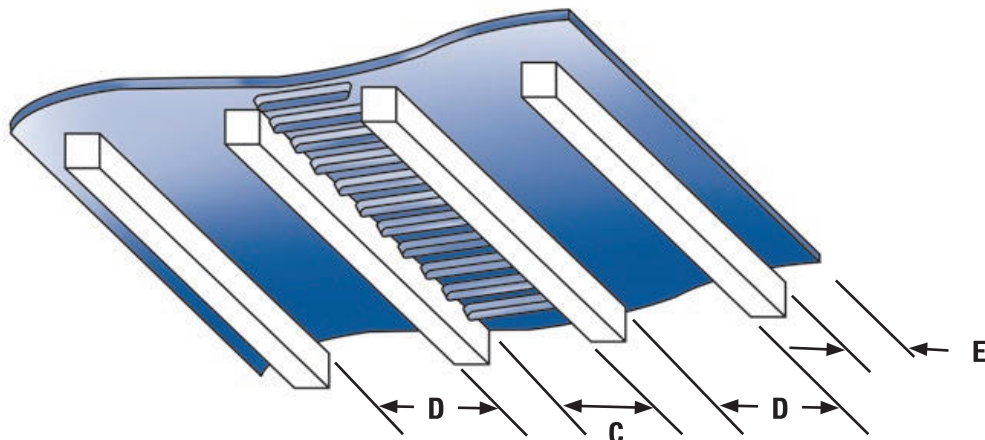
Belt Guiding and Tracking (continued)

Carryway Support

- Continuous support rails, parallel to the belt length, made of UHMW-PE or acetal (POM), is the preferred carryway support for PosiClean, CenterClean and FlatClean belts. Gates does not recommend stainless steel support rails.
- Joints in support rails: downstream rail should be slightly lower than the joining upstream rail or have a beveled end to prevent damage to belt teeth or underside of the belt.
- Rail width minimum: 1.25" (32 mm)
- Spacing recommended for parallel support rails:
 - PosiClean, PC10 and PC20, Figure 6
 - Distance between rails, Dim. A: 4" - 6" (100 - 150 mm)
 - Distance from belt edge to outer rail, Dim. B: 0.5" - 2" (15 - 50 mm)



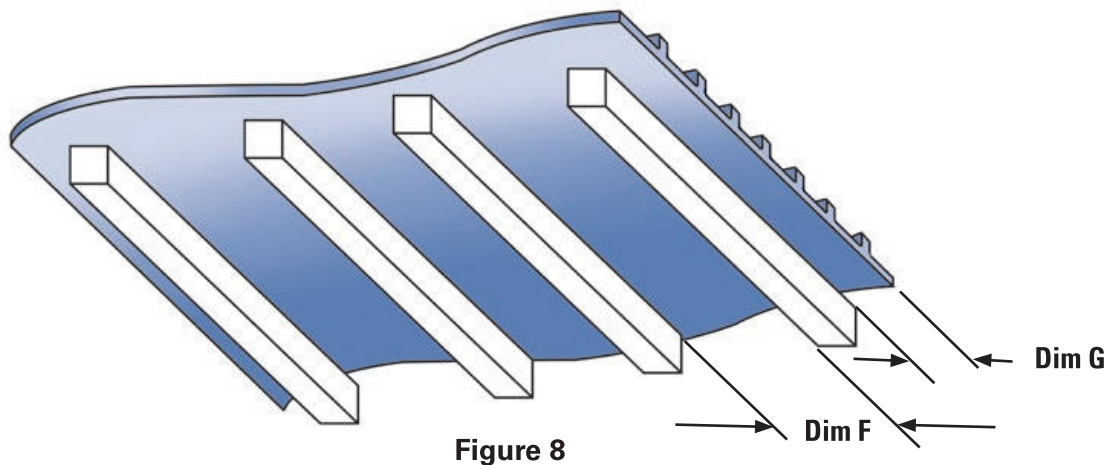
- Spacing recommended for parallel support rails:
 - CenterClean, CC40, Figure 7
 - Distance between rails guiding belt teeth, Dim C: 3.15" (80.0 mm)
 - Distance between rails not guiding belt teeth, Dim D: 4" - 6" (100 - 150 mm)
 - Distance from belt edge to outer rail, Dim E: 0.5" - 2" (15 - 50 mm)
 - FlatClean, FC12
 - Distance between rails: 4 - 6" (100 - 150 mm)
 - Distance from belt edge to outer rail: 0.5 - 2" (15 - 50 mm)



Food Belt Conveyor Design Guidelines

Returnway Support

- Returnway supports can be continuous rails that are parallel to the belt length (reference figure 7), intermittent supports such as rollers or stationary bars that are perpendicular to the belt length, or a combination of both. The belt contact surfaces of stationary supports should be made of UHMW-PE or acetal (POM).
- Continuous rails
 - Rail width: 1" – 2" (25 – 50 mm)
 - Joints in support rails: downstream rail should be slightly lower than the joining upstream rail to prevent damage to belt teeth or underside of the belt.
 - Rail Spacing, Figure 8
 - Distance between rails, Dim. F : 6" - 12" (150 - 300 mm)
 - Distance from belt edge to outer rail, Dim. G: 2" – 3" (50 – 75 mm)



- Support rollers or stationary bars
 - Width: same width as the belt
 - Minimum radius:
 - PC10, FC12: 1" (25 mm)
 - PC20, CC40: 1.5" (37 mm)
 - Typical spacing of roller shafts or stationary bars: 36" – 60" (1 - 1.5 meters)
 - Typical catenary sag between supports: 2" - 5" (50 – 125 mm)

Food Belt Conveyor Design Guidelines

Snub roller

- Belt manufacturers that don't embed cord tension members in their belt look to reduce belt stretch by using a higher durometer resin. These harder, stiffer urethane grades make it more difficult to achieve the proper wrap around the drive sprocket and improving the wrap angle is important because it increases the drive torque and prevents ratcheting or skipping teeth. These same belt manufacturers often recommend positioning a snub roller up against the drive sprocket to overcome the belt stiffness. Gates Mectrol believes putting a roller against the drive sprocket unnecessarily creates a dangerous pinch point and compromises belt sanitation. Such a roller only needs to aid the belt in wrapping the drive sprockets 180° or more and should be positioned away from the drive sprocket.
- We recommend the use of snub rollers at the drive sprockets for:
 - Applications involving both heavy loads with little or no belt pretension. Loads are considered heavy if the calculated belt tensions at 50% or more of the belt rating.
 - Applications utilizing the minimum recommended sprocket diameter with little or no belt pretension.

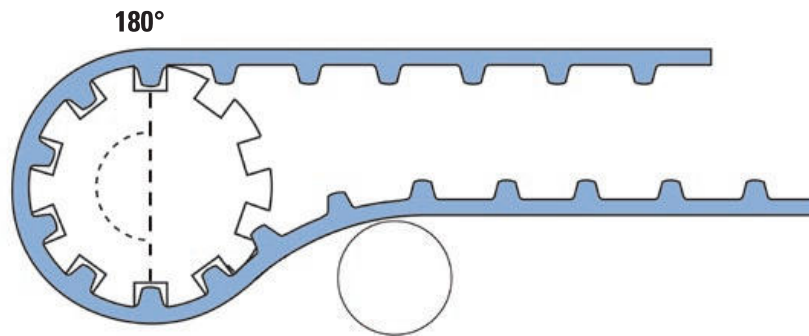


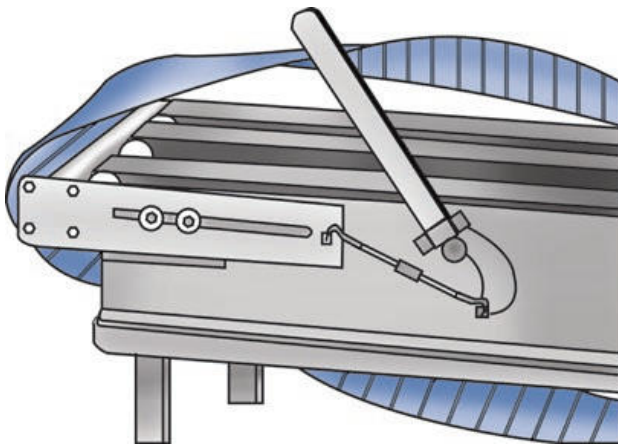
Figure 9

- Snub roller dimensions:
 - Width: same width as the belt
 - Minimum diameter:
 - PC10
 - above 25°F (-4°C): 3.5" (89 mm)
 - at or below 25°F (-4°C): 5" (125 mm)
 - PC20, CC40
 - above 25°F (-4°C) : 6" (150 mm)
 - at or below 25°F: 10" (250 mm)
 - FC12
 - above 25°F (-4°C): 3" (75 mm)
 - at or below 25°F: 4.5" (114 mm)

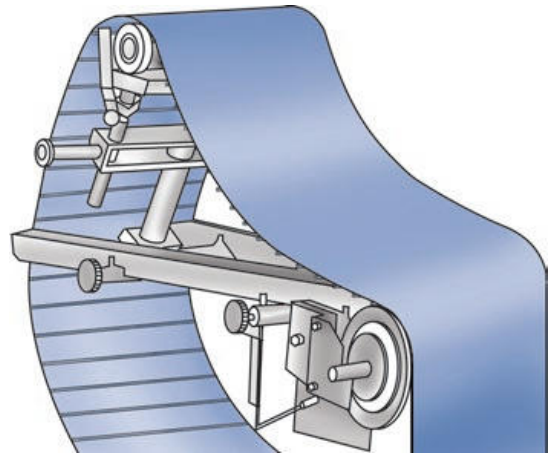
Food Belt Conveyor Design Guidelines

Tensioning Device (Tensioner/Take- Up)

- Gates Mectrol recommends that conveyors be installed with quick release tensioners or pivot arm to allow the belt to be cleaned on the conveyor thus eliminating the need for belt removal during the cleaning process. Such tensioners allow the belt to be quickly slacked off in order that it can be lifted in order to clean the underside of the belt and the conveyor carryway.
 - A tensioning device or tensioner allows the belt to be slack while it is installed onto the conveyor. It is also necessary for adjusting the belt tracking.
 - Recommended minimum take-up travel: 5" – 8" (125 – 200 mm)



Quick Release
Tensioner



Pivot Arm

Food Belt Conveyor Design Guidelines

STRAIGHT LINE (HORIZONTAL OR INCLINE) CONVEYOR WITH CLEATS

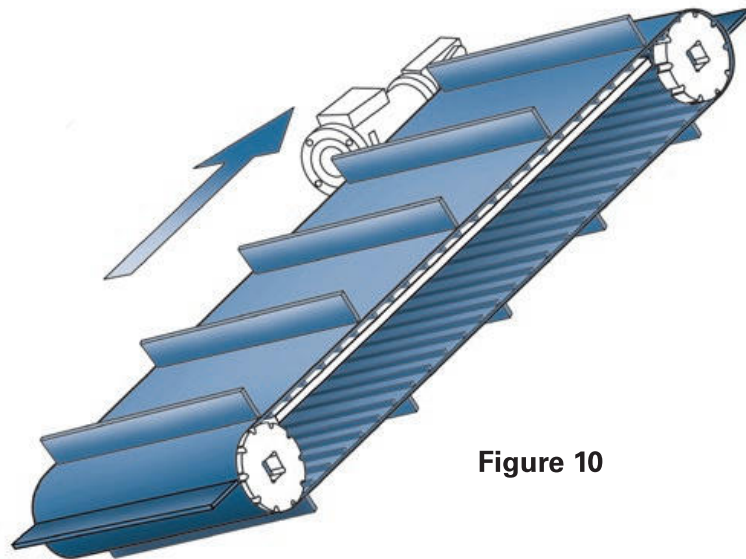


Figure 10

General

- Cleat geometries and specifications
 - See pages 21 and 22.
- Minimum Drive and Idler Sprocket Diameters
 - See belt and mechanical splice data found on pages 11, 14, 18, 19 and 29 .

Carryway Support

- See Horizontal Basic Conveyor Construction on pages 34 and 35.

Returnway Support

- **Maximum recommended belt width without center support: 18"**
- Returnway support can be continuous rails that are parallel to the belt length, support rollers, or a combination of both.
- Conveyors with center returnway supports require split cleats, see Figures 11 and 12.
- Continuous rails
 - Recommend that continuous support rails contact the belt conveying surface and not the top of the cleats and be made of UHMW-PE or acetal (POM). See Figure 11
 - Minimum width for outer rails: 1.25" (32 mm)
 - Recommended distance from rails to cleat, 0.25" (6 mm). Guides return side of belt without binding.

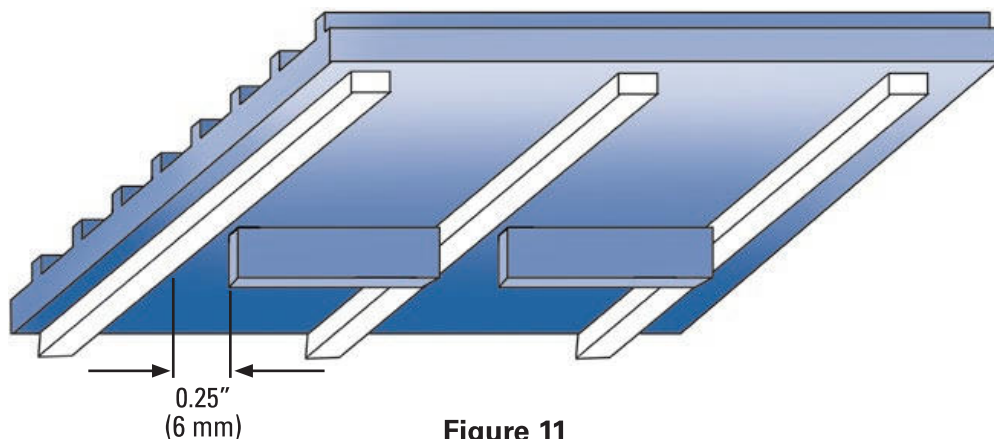


Figure 11

Food Belt Conveyor Design Guidelines

- Support Rollers

- Dynamic support rollers can be used if conveyor has center returnway rollers. See Figure 12
- Roller Width: 1" minimum (25 mm)
- Minimum roller diameter:
 - PC10, FC12 : 2" (50 mm)
 - PC20, CC40: 3" (75 mm)
 - Large enough so cleats can clear roller shaft
- Recommended clearances, Figure 13
 - Recommended distance from rollers to cleat, 0.25" (6 mm). Prevents belt and cleats from binding on support rollers.
- Typical spacing along belt length: 36" – 60" (1 - 1.5 meters)
- Typical catenary sag between supports: 2" - 5" (50 – 125 mm)

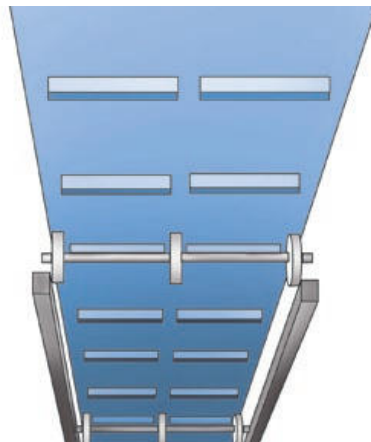


Figure 12

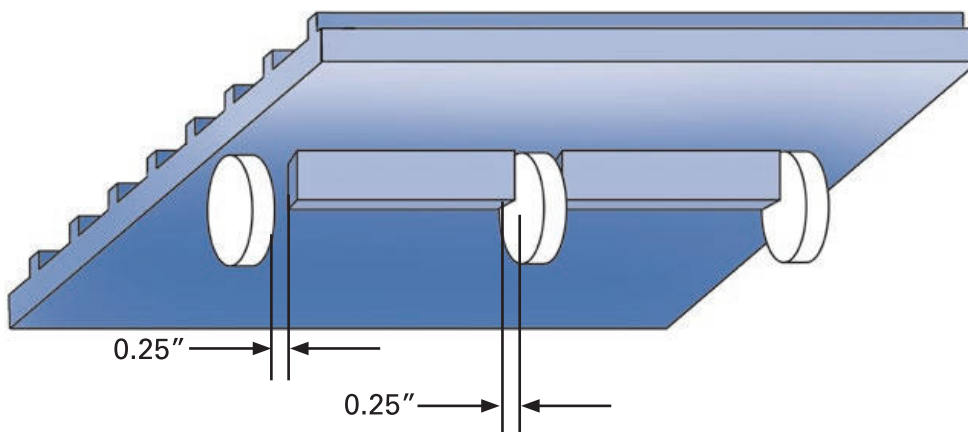
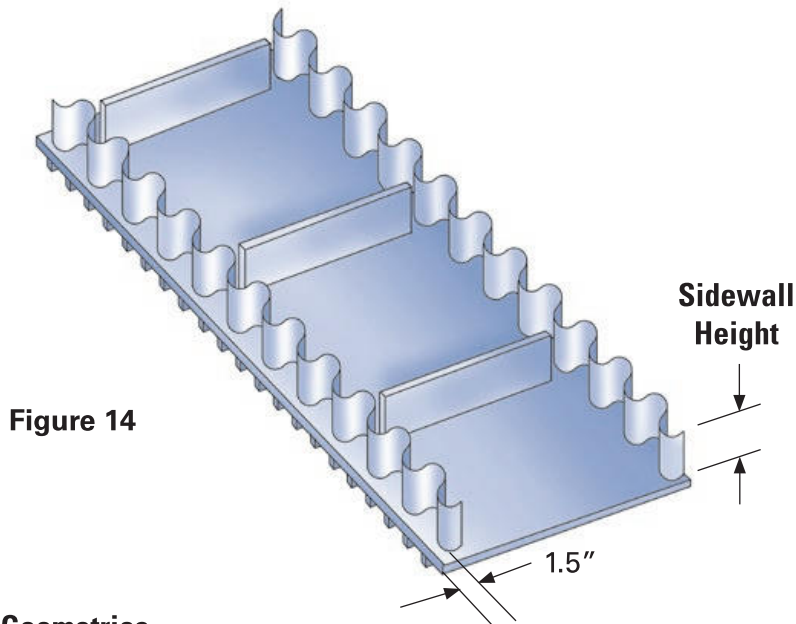


Figure 13

Food Belt Conveyor Design Guidelines

STRAIGHT LINE CONVEYOR WITH CORRUGATED SIDEWALLS



Corrugated Sidewall Geometries

- See page 23 for sidewall specifications
 - Note: Sidewall loops will not necessarily line up.
- Suggested corrugated sidewall height: 0.5" above height of cleats.

Minimum Sprocket/Pulley Diameter

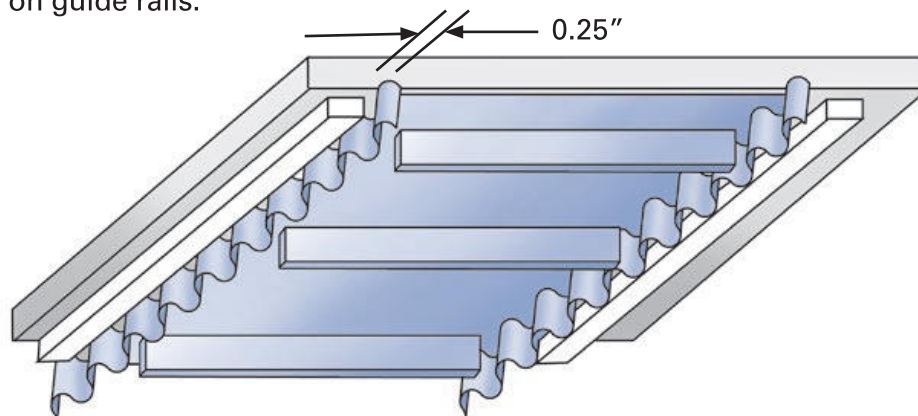
- Minimum sprocket diameter = $2.5 \times \text{Sidewall Height}$ or minimum diameter recommendation for belt and fastener type, whichever is greater.
- Minimum back bend diameter = $1.5 \times \text{Sidewall Height}$ or minimum diameter recommendation for belt type, whichever is greater.

Carryway Support

- See Horizontal Basic Conveyor Construction, pages 38 and 39.

Returnway Support

- Recommended 1.5" sidewall indent.
- Recommend continuous support rails: contacting the base belt and not the top of the cleats, arranged parallel to the belt length, and made of UHMW-PE or acetal (POM). See Figure 15.
- Minimum width for outer rails: 1.25" (32 mm)
- Recommended distance from outer rails to sidewall: 0.25" (6 mm). Prevents belt and sidewall from binding on guide rails.



Food Belt Conveyor Design Guidelines

- Dynamic rollers can be used in place of stationary rails provided the belt has sufficient stiffness across its width.
 - Roller Width: 1" minimum (25 mm)
 - Minimum roller diameter:
 - Large enough so corrugated sidewalls and cleats can clear roller shaft
 - PC10, FC12: 2" (50 mm)
 - PC20, CC40: 3" (75 mm)
 - Recommended clearances
 - Recommended distance from outer rollers to corrugated sidewall: 0.25" (6 mm).
 - Typical spacing along belt length: 36" – 60" (1 - 1.5 meters)
 - Typical catenary sag between supports: 2" - 5" (50 – 125 mm)

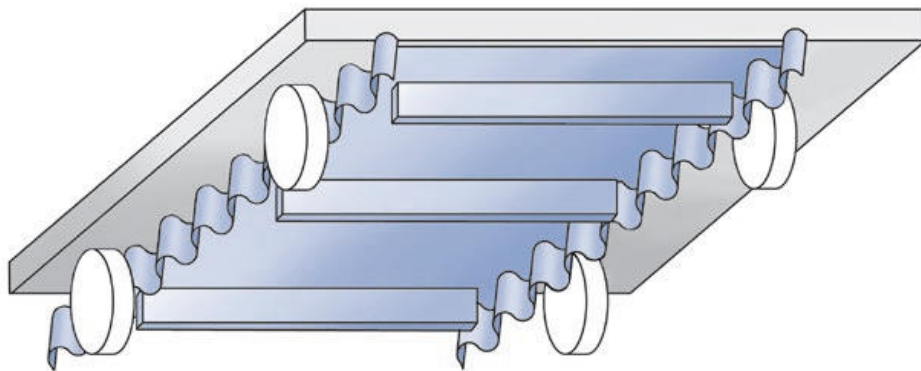


Figure 16

Food Belt Conveyor Design Guidelines

Z-CONVEYOR (GOOSE NECK)

We strongly **recommend using PosiClean PC20** for Z-conveyors. PosiClean's greater lateral stiffness and its distribution of loads across the full belt width help minimize the tendency of the belt to pull out from under the hold downs in the carryway transition areas. We **do not recommended CenterClean** for Z-conveyors.

Components

1. Drive sprockets
2. Transition sprockets
3. Transition hold down rollers
4. Transition rollers
5. Idler tail sprockets with take-up
6. Carryway support rails
7. Returnway support rails
8. Transition hold down
9. Transition support rail

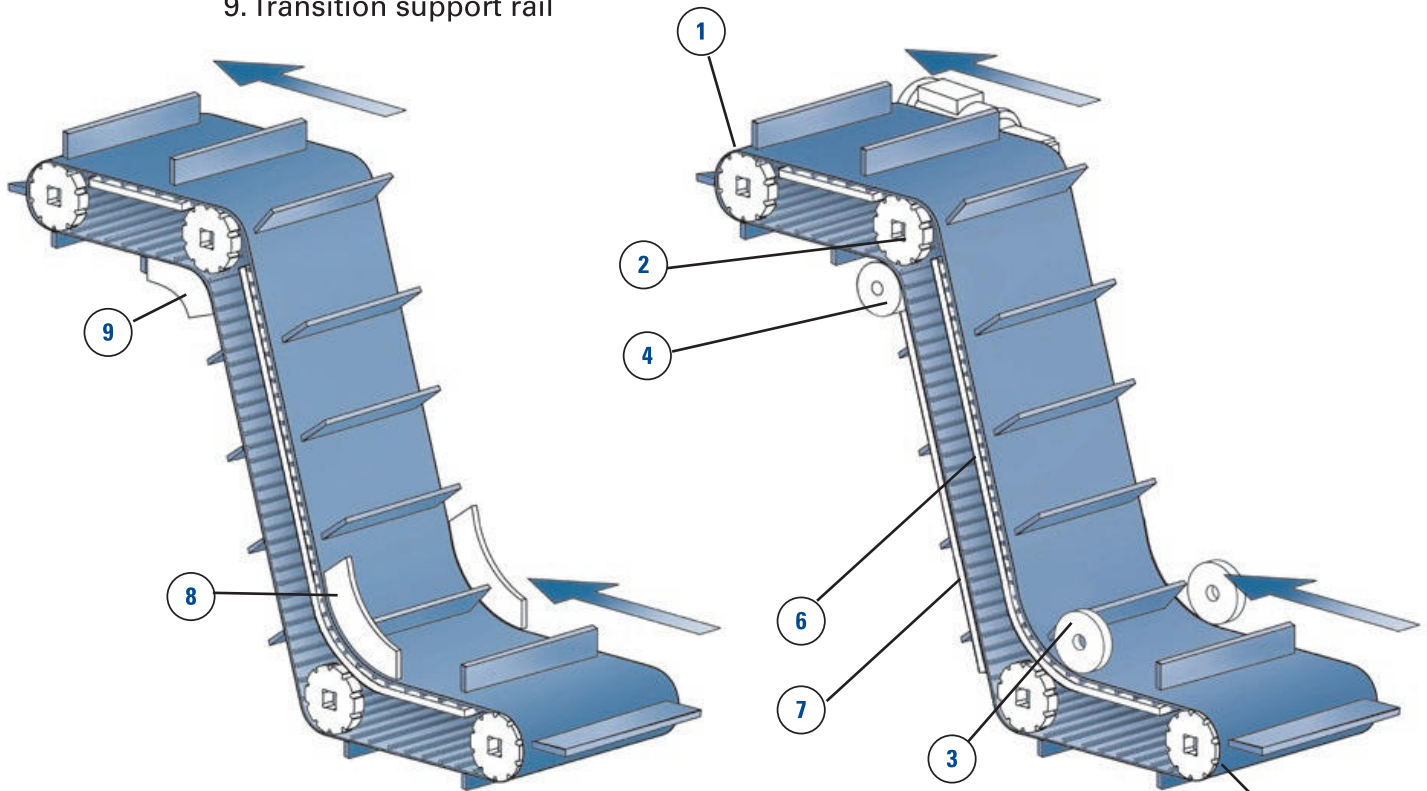
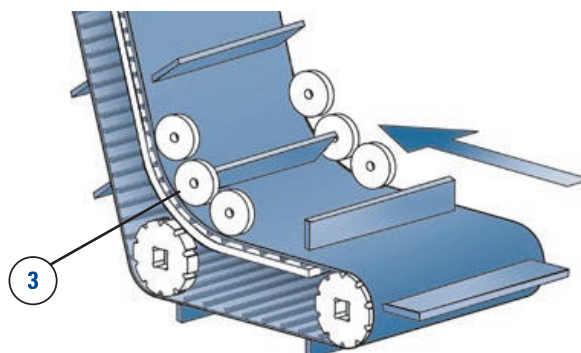


Figure 17

Figure 18



Food Belt Conveyor Design Guidelines

Carryway Transition - Horizontal to Incline

- **Gates Mectrol strongly recommends dynamic rollers as hold downs in the carryway transition area, especially for dry applications.**
- Hold Down Rollers
 - Roller minimum width: 1.5" (38 mm)
 - Rollers minimum diameter **without** corrugated belt sidewalls
 - PC10
 - above 25°F: 3.5" (89 mm)
 - at or below 25°F: 5" (125 mm)
 - PC20
 - above 25°F : 6" (150 mm)
 - at or below 25°F: 10" (250 mm)
 - Rollers minimum diameter **with** corrugated belt sidewalls:
 - Minimum diameter = 1.5 x Sidewall Height or minimum diameter recommendation for belt type without sidewalls listed above, whichever is greater.
 - Recommended clearance between roller and cleat or corrugated sidewall: 0.25" (6 mm)
- Hold Down Shoes
 - **Gates Mectrol does not recommend the use of hold down shoes.**
 - Hold Down Shoes are only to be used if the interface between shoe and belt is lubricated (e.g. wet) and the conveyance loads are light.
 - Hold down shoe minimum radius: 6" (150 mm)
 - Minimum width: 1.5" (38 mm)
 - Clearances
 - Clearance between shoe and cleats or side walls, Figure 19, Dim. O: 0.25" (6 mm)
 - Clearance between base of shoe and belt conveying surface, Fig. 19, Dim. P: .063" (1.5 mm)

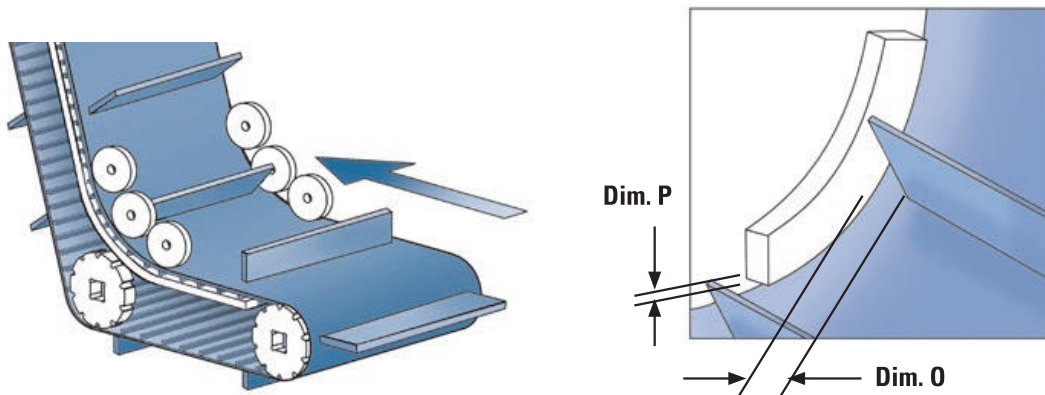


Figure 19

Food Belt Conveyor Design Guidelines

Carryway Transition- Incline to Horizontal

- **Gates Mectrol strongly recommends sprockets in this transition area to reduce the frictional drag and belt wear, especially for dry applications.**
 - Transitions sprockets
 - Minimum sprocket diameters: see belt data on pages 12,15 and 20.
 - Maximum sprocket spacing: see PosiClean Sprocket and Support Guidelines on page 12.
 - Transition rails are only to be used if the interface between the rails and belt is lubricated (e.g. wet) and the conveyance loads are light.
 - Minimum radius: 6" (150 mm)
 - Minimum width: 1.25" (32 mm)
 - Maximum rail spacing: 6" (150 mm)

Returnway Transition – Horizontal to Decline

- **Gates Mectrol strongly recommends dynamic rollers in this transition area to reduce the frictional drag and belt wear, especially for dry applications.**
- Transition Roller design guidelines: see Hold Down Rollers, page 47.
- Transition Support Rail Transition rails are only to be used if the interface between the rails and belt is lubricated (e.g. wet) and the conveyance loads are light.
 - Minimum radius: 6" (150 mm)
 - Minimum width: 1.5" (38 mm)
 - Clearance between rail and cleats or side walls: .25" (6 mm)
 - For clarification see Figure 11 for cleats and Figure 15 for corrugated belt sidewalls.

Returnway Transition – Decline to Horizontal

- **Gates Mectrol strongly recommends sprockets in this transition area to reduce the frictional drag and belt wear, especially for dry applications.**
- Transitions sprockets
 - Minimum sprocket diameters: see belt data on pages 10, 14, 17 and 19.
 - Number of drive sprockets: see PosiClean Sprocket and Support Guidelines on page 12.
- Transition rails are only to be used if the interface between the rails and belt is lubricated (e.g. wet) and the conveyance loads are light.
 - Minimum radius: 6" (150 mm)
 - Minimum width: 1.25" (32 mm)
 - Maximum rail spacing: 6" (150 mm)

Carryway Support

- See Basic Straight Line Conveyor guidelines, page 36.

Returnway Support

- See Straight Line Conveyor with Cleats pages 42 and 43. For Straight Line Conveyor with Corrugated Sidewalls, see pages 44 and 45.

Food Belt Conveyor Design Guidelines

Drive Sprockets

- Gates strongly recommends that drive sprockets are located at the discharge end of the conveyor, i.e., the conveyor is a head drive configuration.
- Minimum diameter to ensure sufficient torque transmission
 - PC10: number of teeth – 12, diameter - 3.8" (97 mm)
 - PC20: number of teeth – 10, diameter – 6.2" (157 mm)
- Maximum sprocket spacing: see PosiClean Sprocket and Support Guidelines on page 12.

Tail Sprockets

- Minimum Idler Sprocket Diameters: see pages 10,14, 17 and 19.
- Maximum sprocket spacing: 6" (152 mm).

Conveyor Sidewalls (fixed to conveyor frame) acting as hold downs

- Thickness, minimum: 1" (25 mm)
- Clearances: see hold down shoe dimensions on page 47.

RECIPROCATING CONVEYOR (TELESCOPING , SHUTTLE OR RETRACTABLE)

This design is **not recommended for belts with cleats or corrugated sided walls**. Experience has shown that the belt performs best with a full width back bend roller.

- Gates Mectrol recommends using PosiClean for reciprocating conveyors. We do not recommend CenterClean.
- Follow the guidelines in the section on Basic Horizontal Straight Line Conveyor for this conveyor design. Below are some additional guidelines for the reciprocating section of the conveyor.

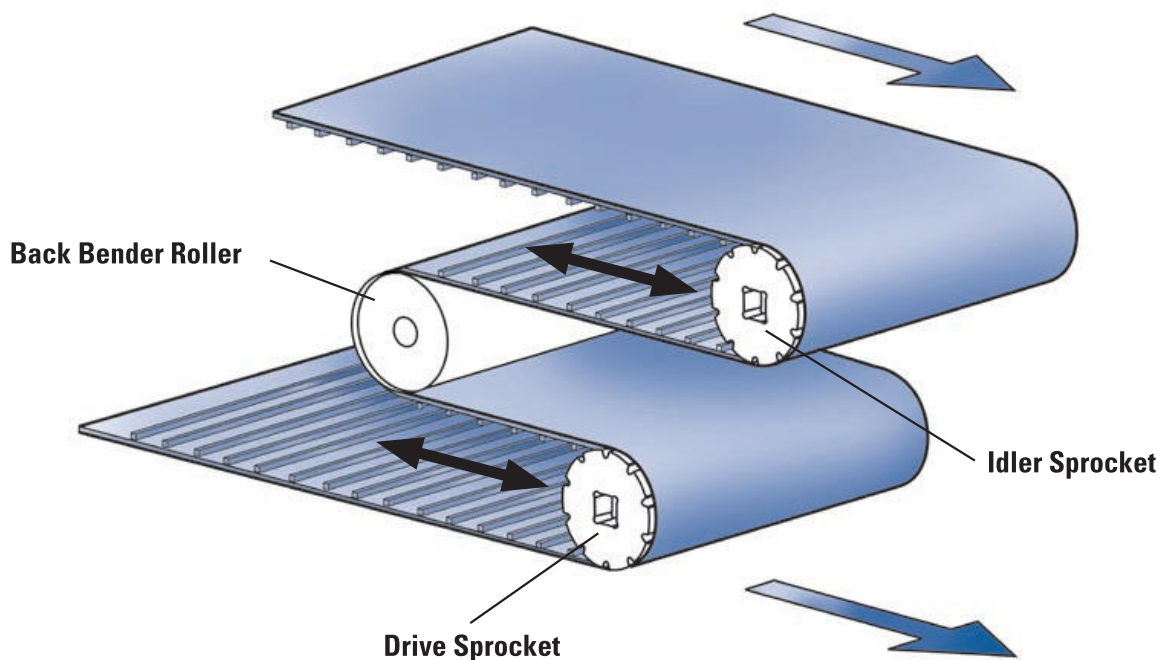


Figure 20

Food Belt Conveyor Design Guidelines

Belt Tracking

- The belt will not track properly in the reciprocating section if the shafts are not parallel to each other and perpendicular to the belt travel.
- We recommend that the back bend idler have flanges or guides are placed along the belt edges between the idler sprockets and back bend roller or placed between the back bend roller and the drive sprockets.
- Surfaces on stationary guides that contact the belt edges should be made of UHMW-PE or acetal (POM).

Back Bend Roller

- Minimum diameter:
 - PC10
 - above 25°F (-4°C): 3.5" (89 mm)
 - at or below 25°F (-4°C): 5" (125 mm)
 - PC20
 - above 25°F (-4°C): min 6" (150 mm)
 - at or below 25°F (-4°C): 10" or 8" (250 or 200 mm)
- Minimum flange heights:
 - PC10: 0.375" (10 mm)
 - PC20: 0.500" (13 mm)

Sprockets

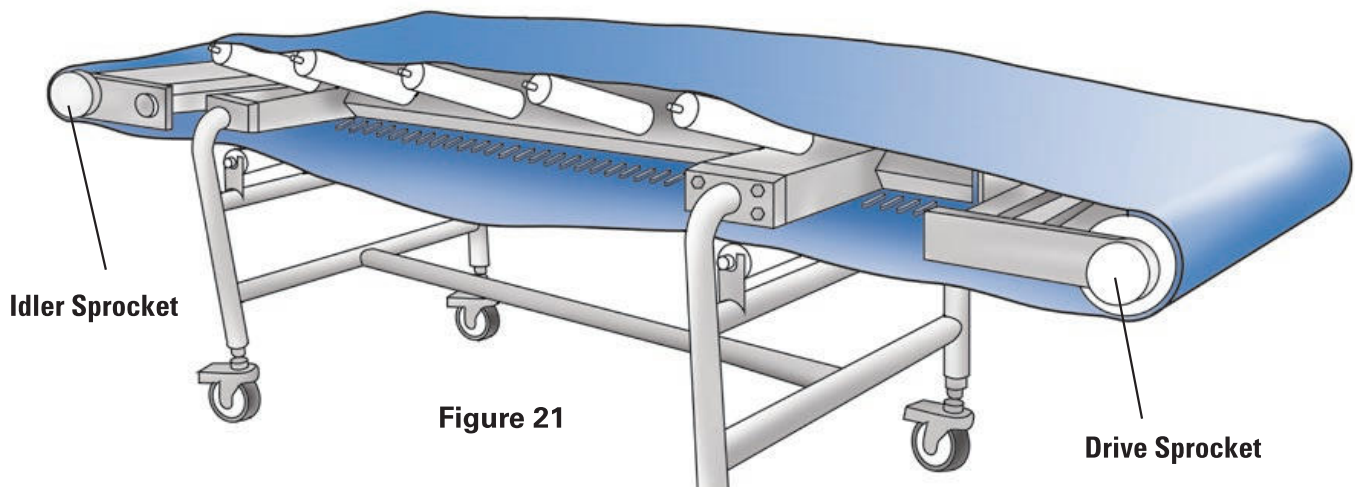
- Minimum Drive and Idler Sprocket Diameters: see pages 10, 14, 17 and 19.
- Number of Drive and Idler Sprockets: on 3" (76 mm) centers. This ensures even distribution of the belt load.

Tension

- Reciprocating conveyors work best with some pre-tension. Gates Mectrol Kevlar® reinforced belts are ideally suited for working under tension.
 - Tensioning Device (Take-Up): see page 41.

TROUGHED CONVEYORS

- Conveyor must be at least 5 feet long for troughing applications
- We only recommend using CenterClean for troughing applications.
- The belt needs to be pre-tensioned to trough and transmit torque properly. This requires that the conveyor have a tensioning device. A quick tensioning system is recommended.



Food Belt Conveyor Design Guidelines

Carryway Support

- The center of the belt, in the area of the teeth, must be firmly supported with a slider bed or support rails on either side of the belt teeth. Slider bed and support rails should be made of UHMW-PE or acetal (POM).
- The center of the belt on either side of the belt teeth must be supported.
- Support rollers are recommended to reduce the belt drag, particularly in dry applications. Support roller options include 2 angled rollers ('rabbit ears') with UHMW-PE center support rails, see Figure 22. We do not recommend 2 angle rollers without any center support, see Figure 23

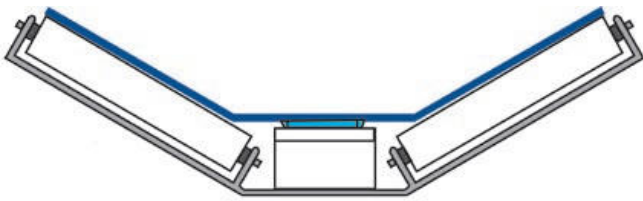


Figure 22

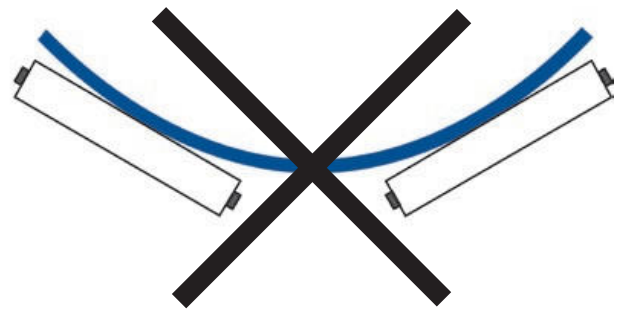


Figure 23

- Minimum Roller Diameter: 4" (100 mm)
- Roller length: extend beyond the belt edges
- Typical spacing of roller shafts: 16" – 28" (406 – 711 mm)
- Guidelines for transitioning the belt from flat to trough shape see Transition Length section below.
- Support rails can be used for wet applications but the belt contact surfaces must be made of UHMW-PE or acetal (POM). Rails with round belt contact surfaces are not recommended.
 - Rail faces must be tangent or conform to trough shape to minimize belt abrasion. Figure 24 shows a support rail that pivots to conform to the trough shape. Figure 25 shows rail surfaces tangent to the troughing belt.

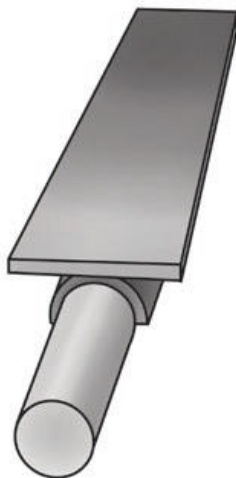


Figure 24

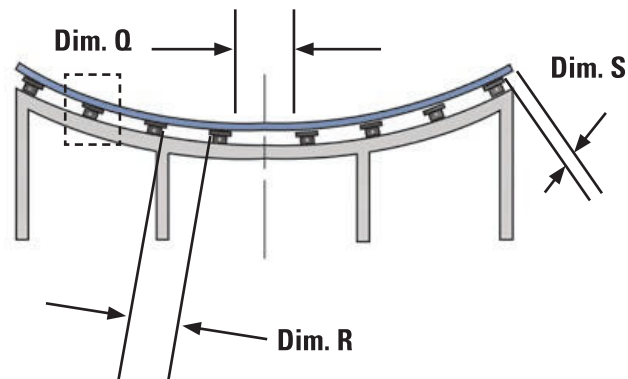


Figure 25

Food Belt Conveyor Design Guidelines

- Rail width, minimum: 1.25" (32 mm)
- Spacing, see Figure 25.
 - Distance between rails guiding belt teeth 3.15" (80.0 mm), Dim. Q.
 - Distance between rails not guiding belt teeth 3" – 4" (75 – 100 mm), Dim. R.
 - Distance from belt edge to outer rail 0.5" – 1" (15 – 25 mm), Dim. S.
- Guidelines for transitioning the belt from flat to trough shape see Transition Length section below.

Transition Length (L) – distance for transitioning the belt from flat to trough shape, typically between the pulleys (drive/idler) and the beginning of the trough.

- Minimum transition length for a given trough (β) is:

$$L = T_c \times W$$

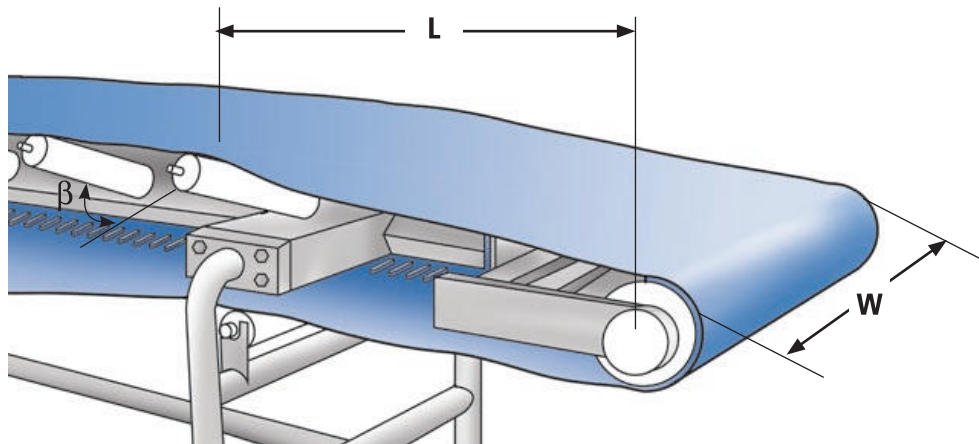


Figure 26

- Where W = Belt Width
- T_c = Troughing Constant
- β = Troughing Angle

Troughing Angle β	10° - 20°	>20° - 40°
Troughing Constant T _c	1.5	2

Table 1

Note: Maximum recommended trough angle: (β) 40°.

Belt Width

- Widths less than 12" (300 mm) are not recommended because they will not easily form the trough shape.
- Widths less than 20" (500 mm) will not easily trough more than 30° per side (see trough angle β in Figure 26).

Returnway Support

- See Basic Straight Line Conveyor page 36.

Food Belt Conveyor Design Guidelines

Pulleys

- At least 80% of the belt width must be directly supported by the driver and idler pulley assemblies, because of the high tension in the belt sides and edges that result from troughing.
 - One piece full width pulleys that fully support the belt edges (see Figure 27) are ideal for these applications.
 - Pulley assemblies with individual support rollers and drive/idler pulley (see Figure 28) can also be used.
 - The outer support rollers must support the belt edges.
 - The sum of the roller and pulley widths for a pulley assembly must be 80% or more of the belt width.

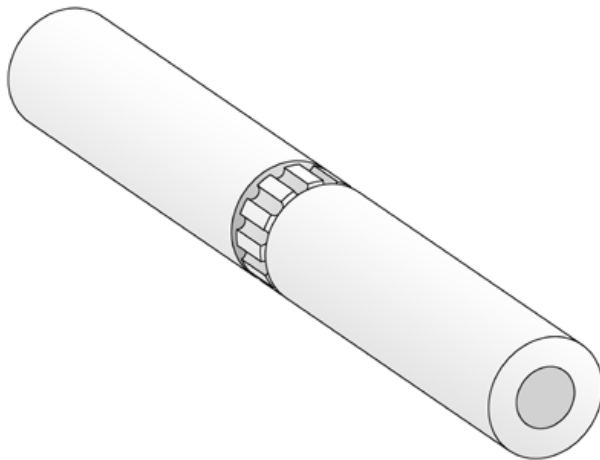


Figure 27

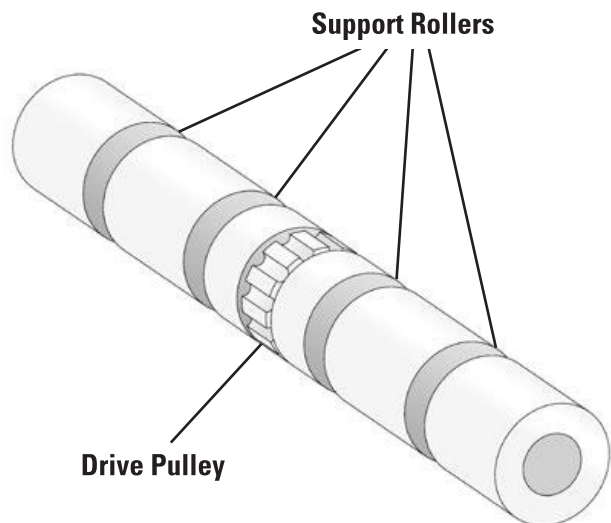


Figure 28