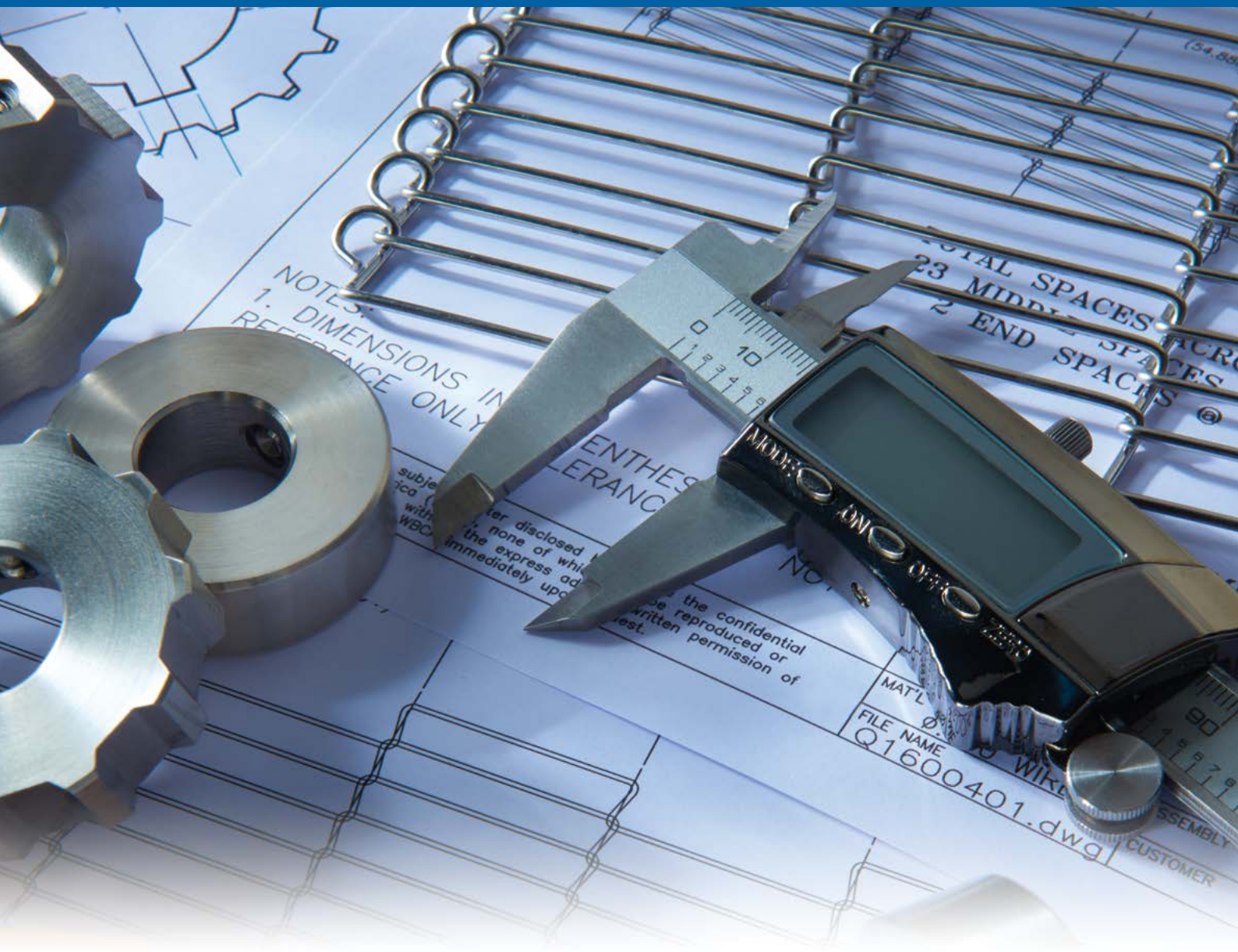
wirebelt®

The Trusted Metal Conveyor Belt Manufacturer™



Flat-Flex® conveyor belts

Engineering Guide

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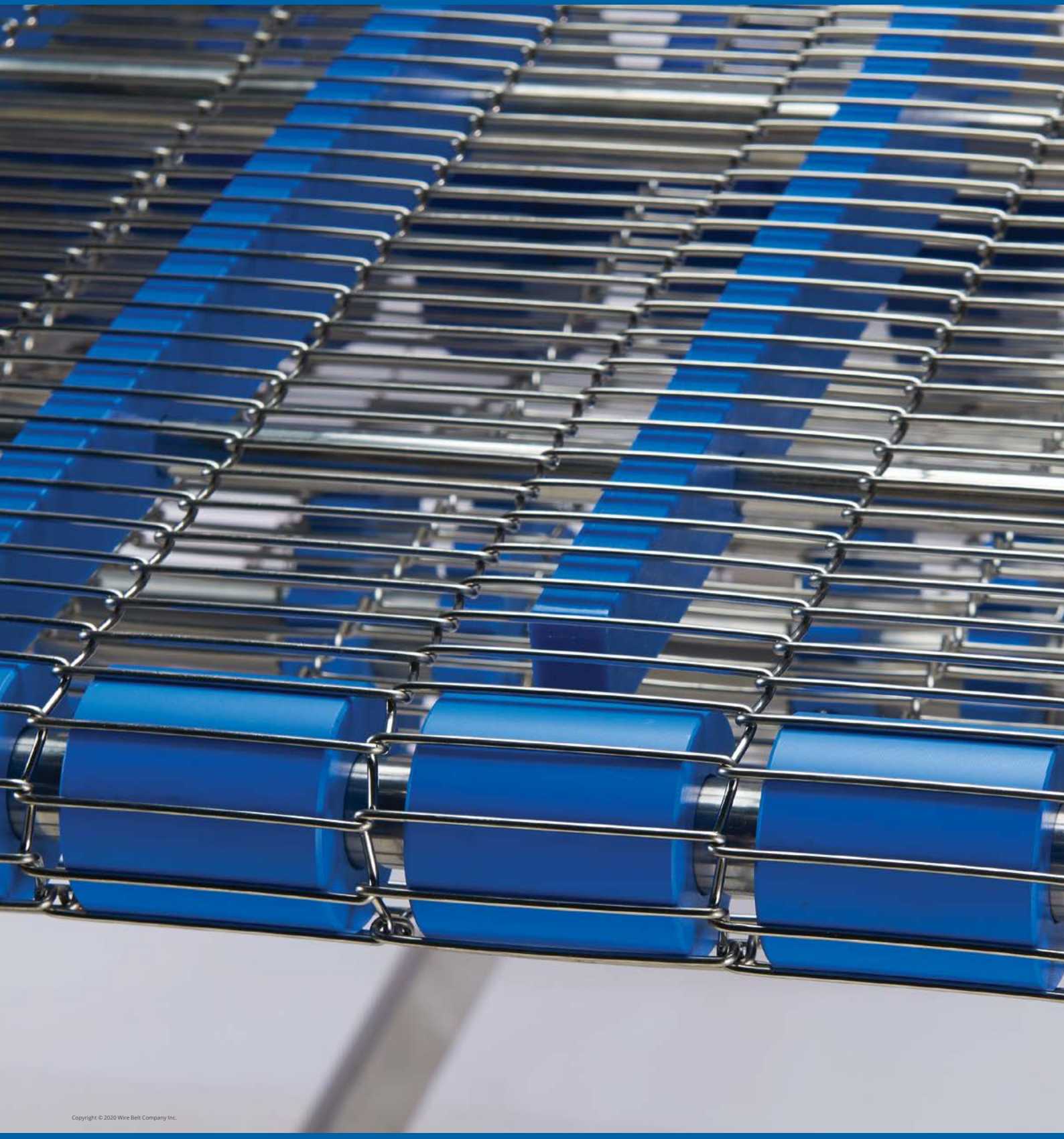

Flat-Flex® conveyor belt

Engineering Guide

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Overview of Conveyor System and Design

Flat-Flex® Belts: Solutions to the entire range of conveyor needs

Versatile Flat-Flex® belting technology is preferred in many industries such as food processing, electronics, baking, pharmaceutical, confectionery, automotive, veneer and textiles. Original equipment manufacturers (OEMs) specify our Flat-Flex® product as the belting component in their processing equipment for a wide variety of applications in these industries.

The unique features of Flat-Flex® conveyor belting offer numerous benefits that increase productivity, help contain costs and improve overall product quality. Here are just a few of the reasons to consider Flat-Flex® conveyor belting in your OEM equipment designs.

- Largest proportion of open mesh area available in any belt, up to 85%, greatly improves efficiency in cooling, coating, draining, heating and drying applications.
- Amongst the smallest transfer roller and drive sprocket diameters in the processing belt industry, down to 12mm diameter transfer rollers and 32mm diameter drive sprockets means even your most delicate products are handled gently and easily with extremely tight transfers.
- A non-slip, positive drive engages the entire width of the belt, distributing load evenly, minimising belt tension and eliminating the need for complicated tracking mechanisms.
- USDA approved for direct food contact; no hidden crevices make our belts easier to clean and maintain.
- Very low belt mass means easier handling and reduced power to drive the belt, resulting in lower operating costs
- Reduced thermal transference during operations, increasing the efficiency of both heating and cooling applications

Parts of the Conveyor System

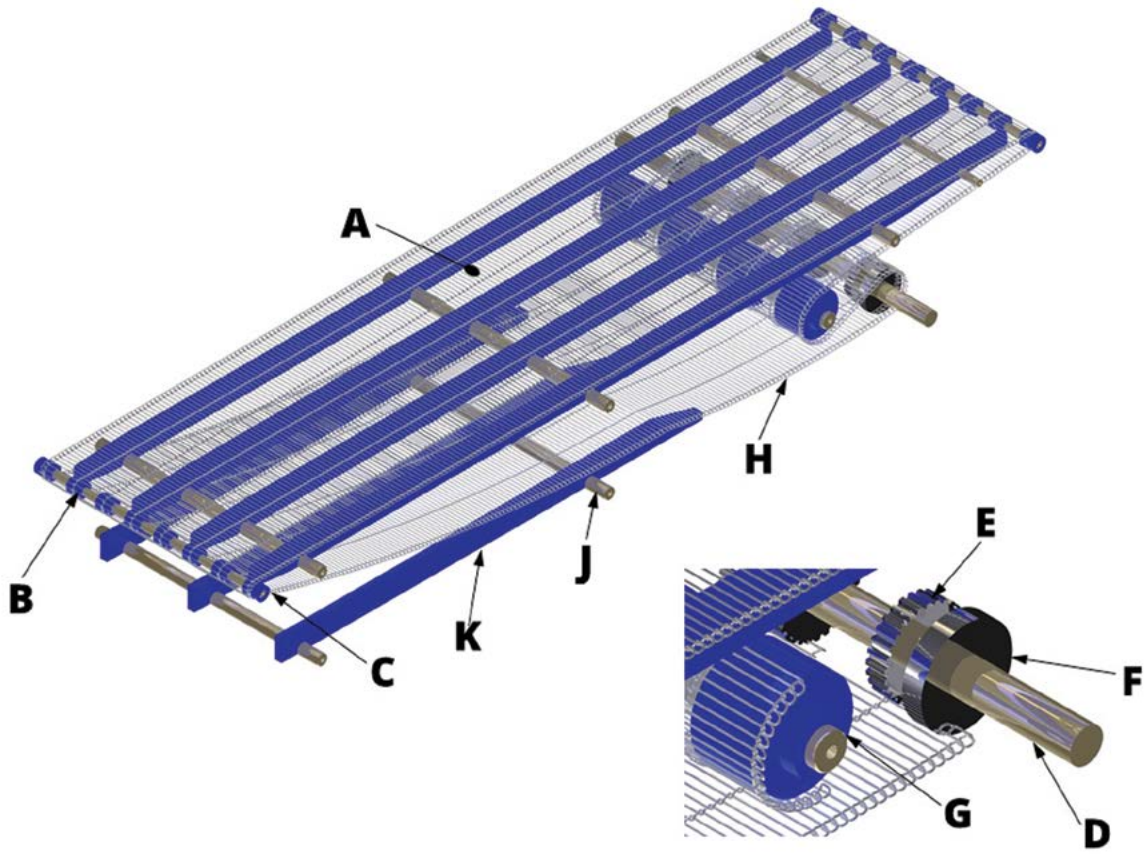


DIAGRAM KEY

A - Flat-Flex® Belt	**E** - Sprocket	**J** - Cross Tie Rod
B - Transfer Rollers	**F** - Blank	**K** - Wear Strip
C - Transfer Roll Shaft	**G** - Reverse Bend	
D - Drive Shaft	**H** - Catenary Take-up	

Design Considerations

Looking at the entire conveyor system, key issues in the areas of Product, Process, Application and Maintenance must be addressed. These include;

PRODUCT

- Size, shape, weight, need for support. These issues define belt requirements and prevent the product falling through the mesh. Each belt also has a limitation on the load that can be conveyed with normal reliability.

PROCESS

- Draining, cooking, cooling, coating, curing and drying processes often have requirements for minimal contact, better spray through, heat penetration or reduced shadowing effect.
- Temperature exposure. You should always consider the effects of temperature variations in the conveyor circuit; such as the coefficients of thermal expansion for dissimilar materials.

APPLICATION

- Safe Operation. C-CureEdge® available to reduce risk of snagging and entanglement.
- Transfer needs. The product may require a very tight transfer. This influences the type of transfer design you choose.
- Throughput speeds. A belt should be selected with regard to its recommended maximum speed.
- Throughput requirements. This defines the width and length of processing conveyors, and load on the belt.
- Special requirements. Inclines/declines, product separation, elevating the product, will require specially designed belts.

MAINTENANCE

- Cleanability. Compliance with USDA regulations is a major factor for food processing applications.
- Accessibility. Easier belt replacement, repair or adjustment will save costly production down-time. Use of EZSplice® strands enable a belt to be joined in as little as 30 seconds.

Belt Selection Criteria

PITCH AND WIRE DIAMETER

Flat-Flex® conveyor belting is available in wire sizes 0.90mm to 4mm and in pitch sizes from 4mm to 25mm. Your application determines the choice of belt.

The first consideration in selecting the specification of belt to use is the pitch. This needs to provide proper support to the product carried, having regard for its shape, size and nature. A wire diameter will also need to be selected. Larger wire diameters generally increase the overall strength of the belt, however this will also increase the mass of the belt and decrease flow-through, a consideration for cooling and coating operations.

TECH TIP	To maximise belt life and reduce maintenance select the largest diameter wire that meets your requirements.

BELT SIZE

Flat-Flex® is available in widths ranging from 28mm to 4.5 metres. In determining belt width, allow sufficient clearance within the inside of the conveyor frame – 6mm to 12mm on each side for belts up to 900mm wide and 20mm for wider belts. In determining belt length, remember to consider the complete circuit, including reverse bends.

BELT MATERIAL

Flat-Flex® belts are available in a wide variety of materials; the standard is 1.4310 (302) stainless steel. Other materials available include: 1.4404 (316L) stainless steel, various carbon steels, and specialist materials suitable for high temperature applications.

Flat-Flex® can be supplied with a PTFE-coating for applications requiring a non-stick surface. High friction finishes are also available.

BELT OPERATING TEMPERATURE

Our standard 1.4310 (302) stainless steel can accommodate temperatures up to 370°C. Specialty materials can be used for higher temperature applications, please contact Technical Sales with your requirements.

EDGE CONSIDERATIONS

Single Loop Edges are the most common belt edge finish and are a default standard for all wire diameters.

C-CureEdge™ Single Loop Edge technology eliminates the possibility of the belt edge catching and tangling. They are an available option for a selected range of Flat-Flex® belts.

Double Loop Edges (also referred to as “Gear Wheel Edge”) can also be supplied to suit existing enrober belts and reinforces the outside edge of the belt (available only on belting using 0.90mm to 1.27mm diameter wire).

STRENGTH CONSIDERATIONS

To determine whether the belt selected has suitable strength for the application you must first establish the following information:

- Nature of process.
- Product type, nominal size & temperature.
- Product loading (kgs/m²)
- Overall conveyor length.
- Overall required belt width.
- Conveyor aspect (Horizontal/Incline/Decline) – if Incline or Decline confirm the differential height.
- Belt speed.
- Maximum belt operating temperature.
- Belt support type & material for both carry way and return way.
- Belt circuit arrangement.

With this information contact our Technical Sales Engineers to check and confirm belt suitability for the application.

TECH TIP	To maximise belt strength, increase the number of joints – the more spaces the stronger the belt.

Positive Drive for Flat-Flex Belts

DRIVING THE BELT

Flat-Flex® belts are designed to be positively driven by our specially designed sprockets. Whenever possible the drive should be positioned so the loaded portion of the belt is pulled, particularly with longer conveyors. The belt should wrap the drive sprockets through 180° of the sprocket circumference. Use of a single drive shaft per belt circuit is recommended.

DRIVE COMPONENT SELECTION

Only Wire Belt manufactured Flat-Flex® sprockets should be used to drive Flat-Flex® belting. Our sprockets are the culmination of decades of development work carried out to ensure smooth engagement with the belt at all available sprocket diameters. Sprockets not specifically designed for Flat-Flex® should be avoided as they may cause the belt to surge, jump teeth, and result in premature failure.

Correct sprocket selection is a function of: amount of room available for the drive; speed requirements; the length, width and loading of the conveyor belt. Larger sprockets are needed for more demanding applications.

Clean-Sweep™ sprockets can be chosen if there is build-up of product. Clean-Sweep™ sprockets have been designed to deflect the amount of product build-up accumulated on your conveyor drive.

TECH TIP	Selecting the largest practical standard size sprocket provides positive drive and longer belt life.

Blanks are used to complement sprockets and as belt supports. When used on the same shaft with sprockets, blanks must be the same diameter as the root diameter of the sprockets.

DRIVE COMPONENT MATERIALS

When choosing the most appropriate sprocket material for your application, it is important to look at the conditions under which the belt will operate. Conditions such as abrasion, corrosion, high/low temperature variations, surrounding temperature, type of process performed, etc. all have an impact on sprocket selection.

Available material types include:

Type 1.4305 (303) stainless steel - which is highly recommended for all applications, especially in food processing industries as it is FDA approved for direct contact with food.

Type 1.4404 (316) stainless steel – which is recommended for applications in corrosive environments, i.e. exposure to saltwater. FDA approved for direct contact with food.

POM (PolyOxyMethylene) plastic, otherwise known as Acetal - usually preferred for light loads, where the operating temperature range is limited to between -20°C to +80°C, and is also FDA approved for food processing applications.

PEEK (PolyEtherEther-Ketone), a high performance engineered thermoplastic that can operate at high temperatures and is less abrasive on your stainless steel belts than metal drive components. PEEK can be used continuously to 250°C and in hot water or steam without permanent loss in physical properties.

SHAFT SELECTION

Shaft deflection should be less than 1.5mm on all shafts to prevent undue belt strain. When in doubt contact a Wire Belt engineer to determine correct shaft size.

Note: If you have a very wide conveyor, Wire Belt can manufacture sprockets with a bore to accommodate a larger diameter shaft.

SPROCKET PLACEMENT AND DRIVE SHAFT ASSEMBLY

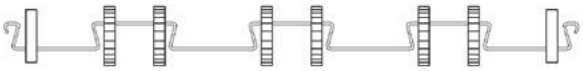
In order to drive the belt with even tension, all sprockets must support the same strand. A keyed shaft assists greatly in lining up the teeth of the sprocket and is capable of handling greater loads. These sprockets are arranged in pairs as shown in the diagrams.

Sprockets are usually placed in odd numbered spaces to allow use of splicing clips without interfering with sprockets. If clips are never used, placing sprockets in even numbered spaces ('Alternative' style) is acceptable. However you should never mix the two arrangements.

Sprocket Arrangement

Standard

Sprocket Arrangement



Alternative

To establish the correct number of sprockets and blanks required for the belt drive shaft the following rules applies:

Standard Flat-Flex® belts require one less sprocket than the total number of spaces across the belt, plus 2 blanks.

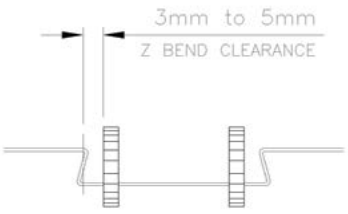
Note: There are two exceptions to this rule:

A) a single space belt uses only two (2) sprockets

B) a three space belt requires four (4) drive sprockets and no blanks – pairs of sprockets in each outside space only

3 Space Sprocket Arrangement

TECH TIP	On wider conveyors, use keyed sprockets to help maintain sprocket alignment across the entire belt width.

TECH TIP	For good belt life it is critical that sprocket teeth are aligned across the width of the belt, and also that drive components be positioned 3-5mm away from each Z-bend to allow the belt some side-to-side motion. When using EZSplice™ please consult our Technical Sales Engineers for the correct clearances.	

Transfers and Support Considerations

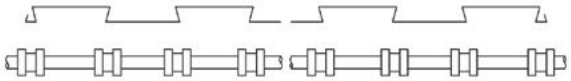
TRANSFER END ARRANGEMENTS

To facilitate transfer of product to and from other machinery, rollers may be used at each end of the conveyor. Rotating end rolls are preferred due to reduced friction and associated belt wear. Grooved end rolls (see diagram) or free turning transfer rolls (see diagram) should be used where possible to ensure positive tracking and minimise wear at the belt joints.

Smaller rolls should be braced or supported to prevent deflection.

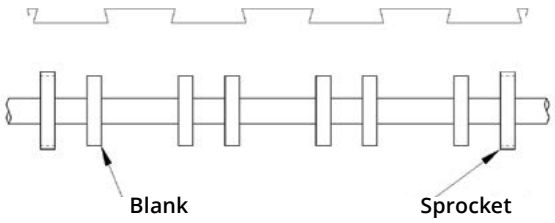
Blank type end rolls may use one or two pairs or sprockets along with blanks to assist the roll in turning and to provide belt alignment. Belts wider than 1200mm should use extra sprockets in the centre. Any extra sprockets added should be evenly distributed across the width of the belt.

Free turning transfer roll



Grooved end roll

Blank type end roll



BELT SUPPORTS FOR CONVEYING SURFACE

Support required for Flat-Flex® conveyor belts depends upon the load carried, type of product conveyed, and the application (ie transport/coating/cooling)

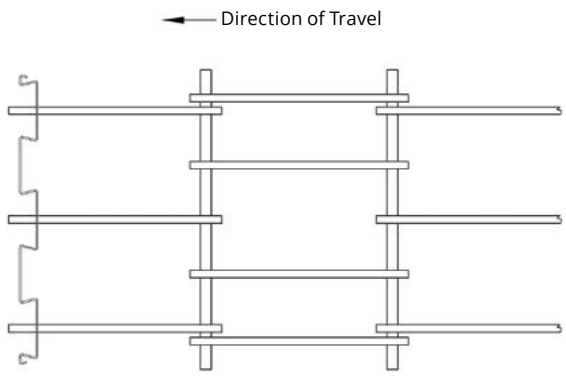
If the belt needs to be fully supported, use a slider bed of longitudinal rails centred in each or every other space across the belt width. Always support the outside spaces of the belt to minimise metal fatigue.

To reduce friction and prevent surging in the belt circuit, be sure the wear strip surface is smooth. Also, the end of the wear strips should be rounded to prevent the belt wires from catching. Angle the supports in a modified herringbone pattern or staggered pattern to provide even wear.

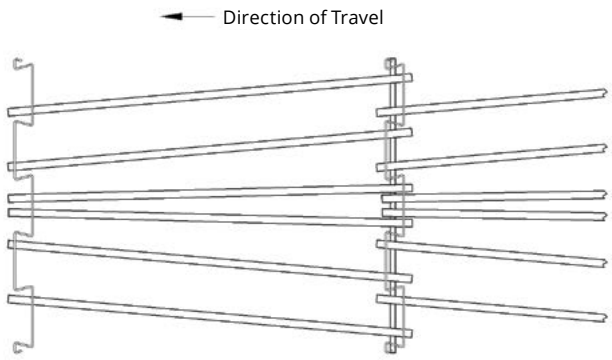
BELT SUPPORTS FOR RETURN PATH

The return or slack side of the belt can be supported on freely turning smooth rolls spaced at 0.6m to 1.2m intervals or with longitudinal strips.

For situations where the belt changes direction (e.g. transition from flat to an incline) use UHMW-PE hold downs to assist in tracking.



Staggered pattern



Herringbone pattern

BELT SUPPORT MATERIALS

Ultra-High Molecular Weight Polyethylene (UHMW-PE) bars work well for temperatures up to 80°C; otherwise stainless steel rods or high temperature plastics such as PTFE or PEEK are needed.

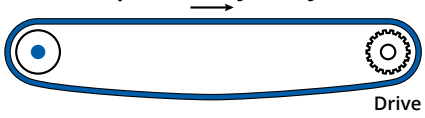
Conveyor Layouts and Tensioning Techniques

BELT CIRCUIT

The belt circuit is a major design consideration for your conveyor. Generally a simpler circuit means longer belt life. Some conveyor layouts are illustrated below.

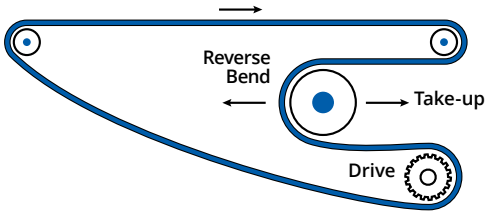
A simple conveyor layout can be used if discharge of products over the drive sprockets is acceptable

Simple conveyor layout

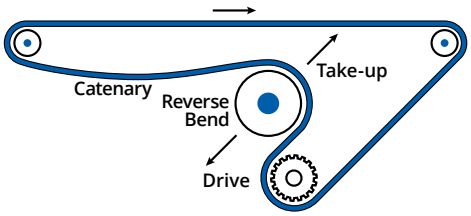


An "S" Drive conveyor layout can be used to obtain a smaller transfer diameter at the discharge or where discharge of products over the drive sprockets is **not** desired

"S" Drive conveyor layout



Alternate "S" Drive conveyor layout



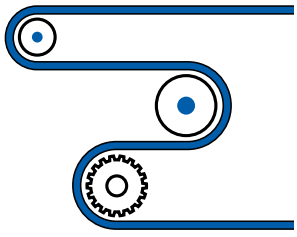
DRIVE LOCATION

Whenever possible the drive should be positioned so that the loaded portion of the belt is pulled, particularly with longer conveyors.

REVERSE BEND – TAKE-UP ROLLERS

Several of the typical conveyor layouts include one or more reverse bends. A reverse bend occurs when the belt flexes in the opposite direction from a transfer. This is normally for take-ups or to increase wrap around a drive shaft. It is good engineering practice to use the largest diameter possible for all changes in direction of belt path. This will decrease flexing of the wire strands and help prolong belt life. So, if a reverse bend must be used we recommend the reverse bend diameter be at least 10 times the pitch.

Simple reverse bend



TECH TIP	Design using the largest size possible in all end rolls, drives and reverse bends for maximum belt life.

REVERSE BEND - SPROCKETS

Wire Belt Company standard sprockets are not designed to run in a reverse bend condition. The pitch of the belt changes in a reverse bend, so the belt mesh will not be properly engaged unless specially designed sprockets are used. If your application gives you no alternative but to drive the belts at a reverse bend, special sprockets must be specified by Wire Belt Technical Sales department.

TENSIONING

Flat-Flex is a low tension belt and control of belt length is vital to maintain correct tension.

TECH TIP	Never over-tension your belt. Too much tension will inevitably cause premature belt failure.

Use only the lowest tension needed to engage the drive sprockets properly.

All conveyor circuits should have provision for adjusting belt tension and to facilitate installation of the belt. If excess belt length accumulates loosely on the return path the belt may slip or jump off the drive sprockets.

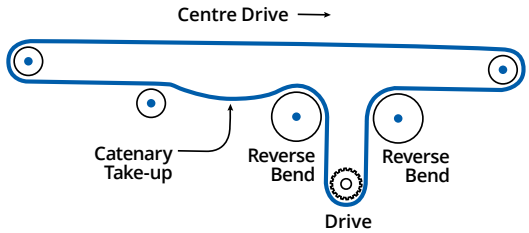
Take-up of slack can be done in several ways:

- The simplest method is to allow the belt to sag on the return side of the belt circuit (called a catenary). The weight of the belt itself keeps the needed tension on the drive shaft. This is the preferred approach for tensioning Flat-Flex.

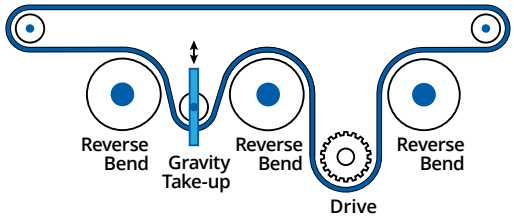
TECH TIP	Rule of thumb: catenary sag should be 50-100mm for 900mm between support rolls.

- For the applications where catenary is not practical, we recommend 'gravity' take up. This is the case especially if the belt will be subjected to considerable variations in temperature. (Temperature affects belt length – if a belt goes through an oven or fryer, its length is extended).
- Manual or 'screw' take ups provide easy tensioning adjustment for short conveyors.
- For long conveyors, with appropriate drive arrangements, 'spring', 'hydraulic' or 'pneumatic' type tension adjustment are sometimes used.

Catenary Take-up



Gravity Take-up



TENSION ADJUSTMENT

The following guidelines may help you determine the correct tension:

1. Use the minimum amount of tension which allows the drive sprockets to smoothly engage the belt strands. The belt should neither slip nor jump off the drive sprockets. (This can happen if excess belt length accumulates loosely on the return path).

2. Understand your conveyors tensioning mechanisms. All conveyors should have some provision for adjusting the belt tension and to facilitate installation of new belts. However, different machines use different tensioning methods. The simplest is the catenary take up. Conveyors longer than 8 metres may use gravity, spring, and hydraulic or pneumatic type tension adjustments. Consult the manufacturer's documentation or their customer service department for more information on the tensioning mechanisms and their adjustment.

3. Always check for 'sag' in the return path. Whatever the tensioning method designed into your conveyor by its manufacturer, there should always be some 'sag' in the belt take up. Be sure to check under the conveyor for this 'sag' whenever you adjust the tension.

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Our policy is one of continuous improvement and we reserve the right to change specifications at any time and without notice, or modify these to suit manufacturing processes

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