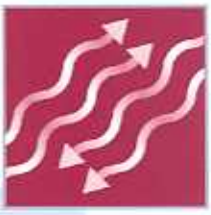
wirebelt™

Specifiers Guide



NQA ISO 9002 REGISTERED COMPANY

UKAS QUALITY MANAGEMENT

Manufacturers of Flat-Flex® belting since 1947

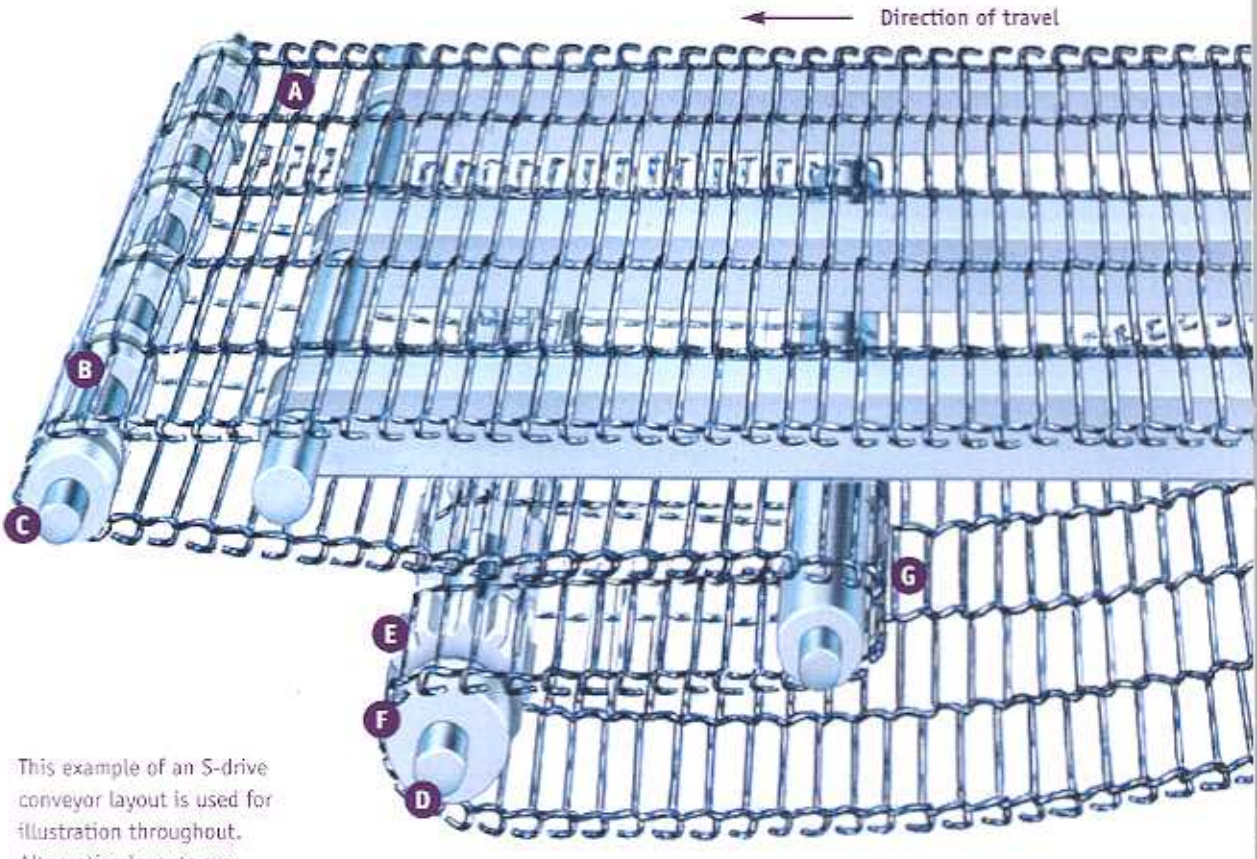
Overview of Conveyor System Design

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.
- Smallest diameter end-rolls and drive rolls in the processing belt industry - down to 12mm diameter end rolls and 32mm diameter drive rolls (See Table 1) - means even your most delicate products are handled gently and easily with extremely **tight transfers.**
- A no-slip, **positive drive** engages the entire width of the belt, 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, plus the belt absorbs less heat during operations.



This example of an S-drive conveyor layout is used for illustration throughout. Alternative layouts are covered on page 10.

Major 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

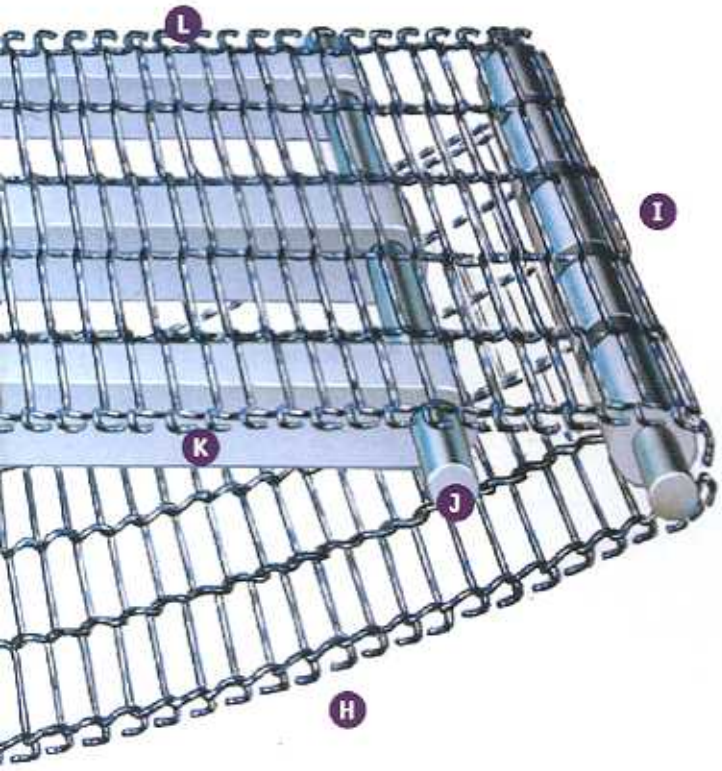
- **Draining, cooking, cooling, coating, curing, drying** processes often have requirements for minimum contact, better spray-through, heat penetration, or reduced shadowing effect.
- **Temperature exposure** You should always consider the effects of temperature variations in the conveyor circuit; such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

Application

- **Safe Operation** Smaller pitches will help avoid trapping fingers.
- **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 (See Table 1)
- **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.



A Flat-Flex Belt
B Transfer Rollers
C Transfer Roll Shaft
D Drive Shaft
E Sprocket
F Blank
G Reverse Bend
H Catenary Take-up
I Grooved End Roll
J Cross Tie Rod
K Wear Strip
L Single Loop Edge

Belt Selection Criteria

Pitch and Wire Diameter

Flat-Flex conveyor belting is available in wire sizes **0.89mm to 4mm** and in pitch sizes from **3.5mm to 25mm.** Your application determines the choice of belt.

Strength Considerations

Determine product load on the belt in kg/m² and also the maximum tension per joint (see Table 1 for maximum load and tension for each belt specification).

HOT 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 with side frame - 6mm to 12mm on each side for belts up to 900mm wide; 20mm for wider belts. In determining belt length, remember to consider the complete circuit, including reverse bends.

Belt Material

HOT TIP:
To maximise belt strength, increase the number of joints - the more spaces the stronger the belt.

Flat-flex belts are produced in **1.4310 stainless steel** (popular because it is FDA approved for direct food contact), **music wire** (high tensile strength carbon steel) or **high carbon steel.**

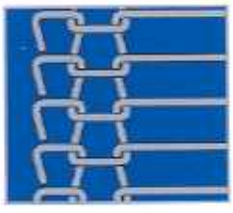
Belt Operating Temperature

Temperatures up to 400°C may be accommodated depending upon conditions.

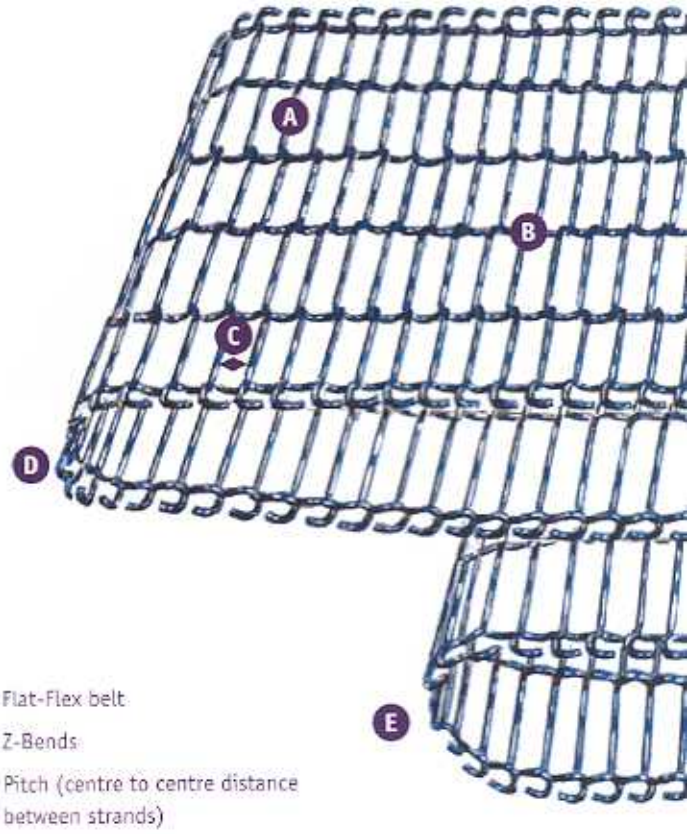
Edge Considerations

Standard edge configuration is a single loop edge. For demanding applications, a double loop edge option reinforces the outside edge of the belt (available only on belting using 0.89mm to 1.27mm diameter wire).

Single loop edge



Double loop edge



A Flat-Flex belt

B Z-Bends

C Pitch (centre to centre distance between strands)

D Forward Bend/Transfer

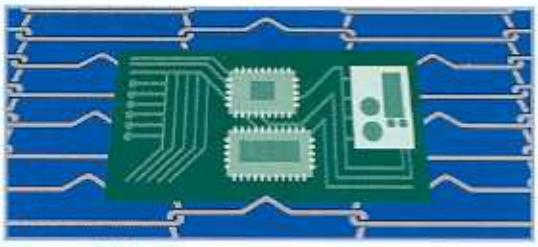
Special Belt Requirements

Wire Belt engineers can help you with special applications - conveying up inclines, maintaining product separation, minimising point contact or keeping product in line.

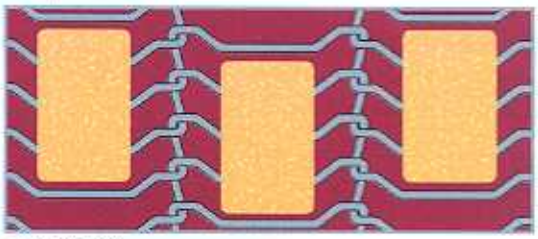
Compound belts incorporate specially formed strands in predetermined locations in the belt. 'Flights' are available in standard and custom shapes. Different shapes can be mixed to create guides or 'pockets' that isolate easily damaged products.

Aligned belts are used to convey products in specific rows.

Crowned belts: Since belts may curl under high heat, belts can be pre-stressed in the opposite direction to maintain a flat surface during operation. Reverse crowns are used for "hold down" applications, such as the conveyorised frying process preventing belt 'sag'.



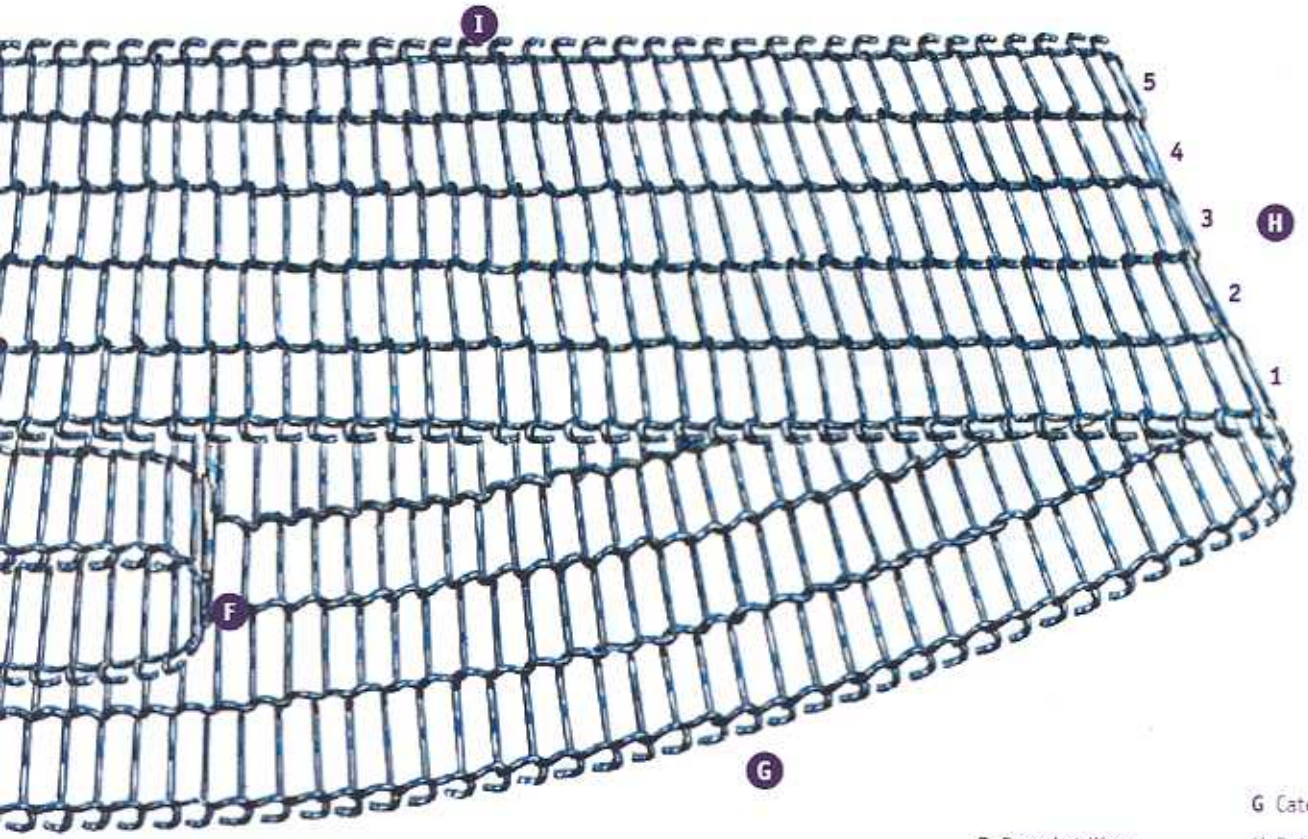
compound belt



aligned belt

crowned belt

reverse crown belt



E Sprocket Wrap
F Reverse Bend
G Catenary Take-up
H Belt Spaces (1-5)
I Single Loop Edge

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.

Sprocket Selection

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

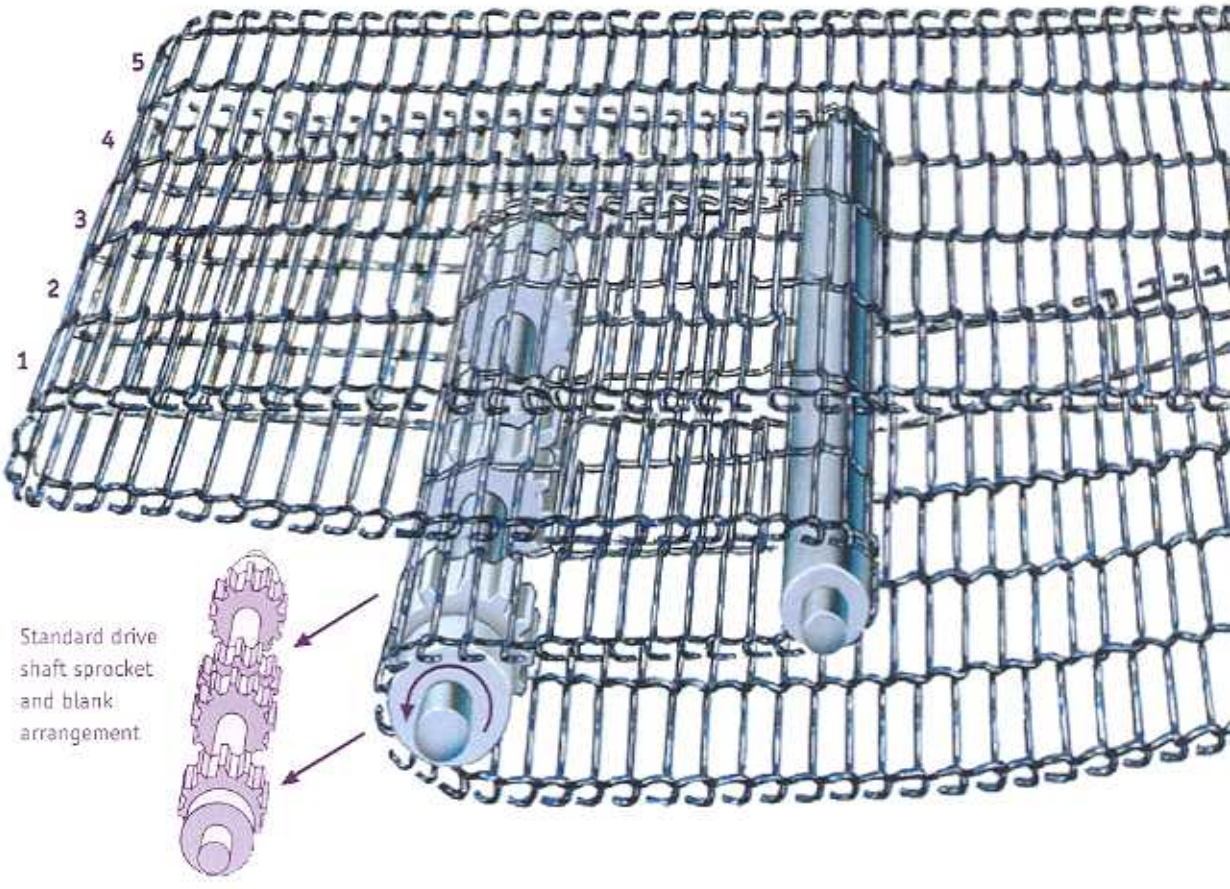
Wire Belt manufactures a wide range of drive sprockets. Wire belt standard sprockets (see Table 2) are designed specifically to drive Flat-Flex belts smoothly and efficiently. Sprockets not specifically designed for Flat-Flex should not be used as they may cause the belt to surge, jump teeth, and result 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.

Sprocket Materials

1.4305 stainless steel is highly recommended for all applications. It is FDA approved.

Polyacetal Plastic is usually preferred for light loads, is limited to operating temperature range (-40°C to 65°C), and is FDA approved.



Standard drive shaft sprocket and blank arrangement

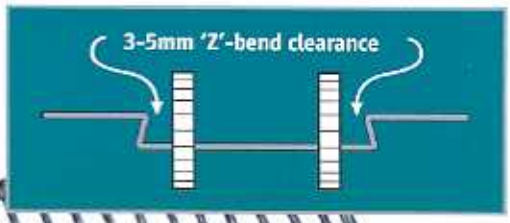
Blanks are used to complement sprockets and as belt supports. When used on the same shaft with sprockets, blanks must be the same diameter as the root diameter of the sprockets (see Table 2)

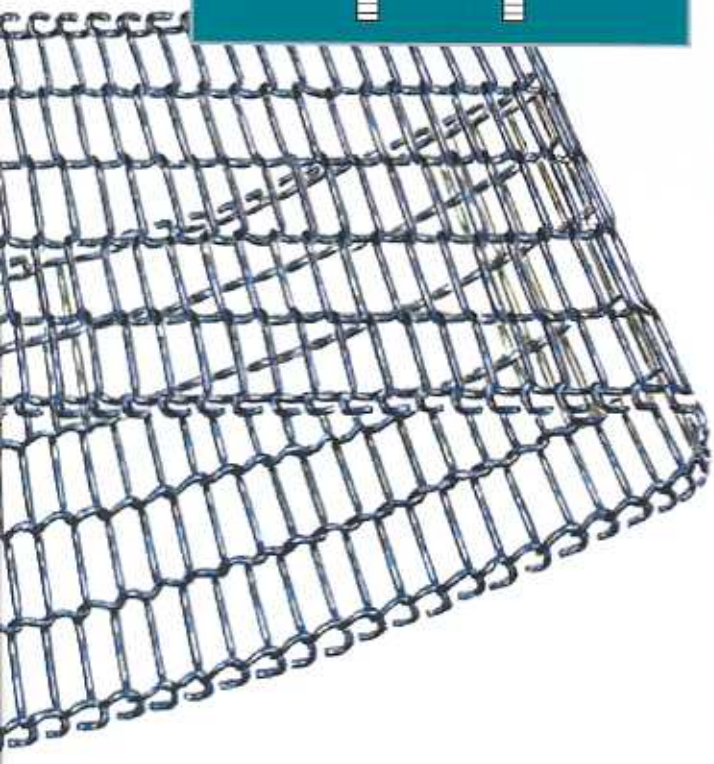
HOT TIP:
For good belt life it is critical that teeth be lined up across the width of the belt, and also that drive components be positioned 3-5mm away from each 'z' joint to allow the belt some side-to-side motion.

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 bore out sprockets to accommodate a larger diameter shaft.*



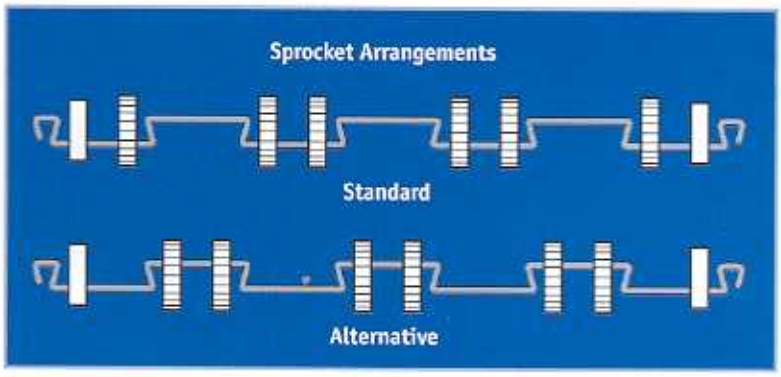


Sprocket Placement and Drive Shaft Assembly

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 the sprockets. If clips are never used, placing sprockets in even numbered spaces ('Alternative' Style) is acceptable. However, you should never mix the two arrangements.

HOT TIP:
Drive sprockets may be keyed – especially for wider conveyors.



Calculating the number of sprockets

The number of sprockets required to drive your belt depends on the number of spaces across the belt. Here's how to calculate it:

1. Belts with a single loop edge need one less sprocket than the number of belt spaces, plus two blanks.
2. Drive shafts for double loop edge belts should be set up 'Alternative' style.
3. **Note:** Two exceptions to these rules: A) a single space belt uses only two (2) sprockets; B) a three space belt requires four (4) drive sprockets and no blanks.

Transfers and Support Considerations

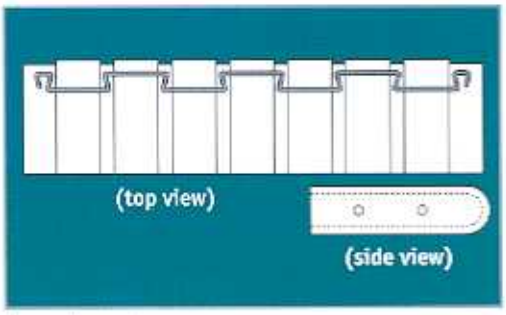
Transfer End Arrangements

To facilitate transfer of product to/from other process machinery, rollers may be used at each end of the conveyor. Rotating end rolls are preferred because belt wear is less. Grooved end rolls (see E below) or free turning transfer rolls (see B below) should be used where possible to ensure positive tracking and minimise wear at the belt joints.

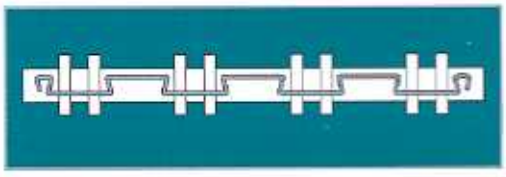
Smaller rolls should be braced or supported to prevent deflection.

Blank type end rolls may use one or two pairs of 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.

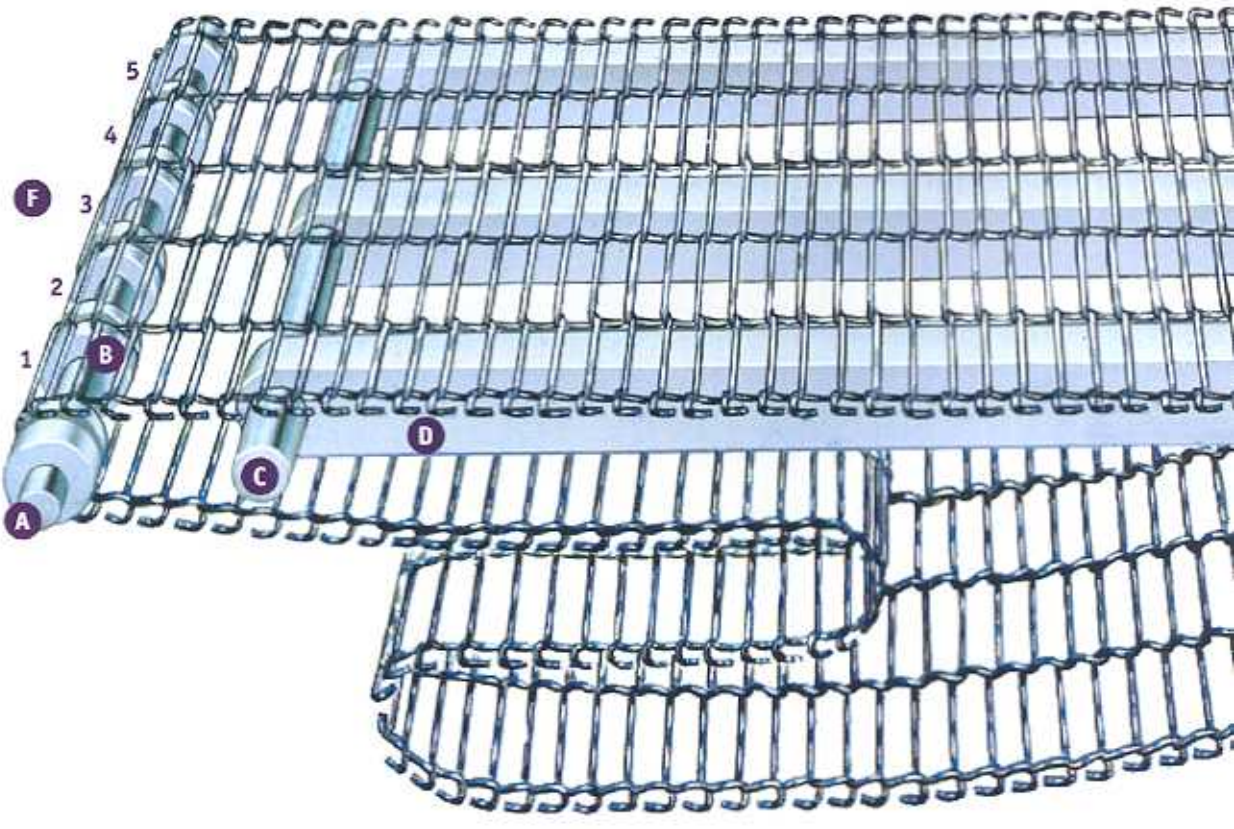
For the tightest transfer requirements, a **grooved nosebar** may be used to keep the belt tracking properly.
(See Table 1 for minimum diameters)



Grooved nosebar



Blank type end roll



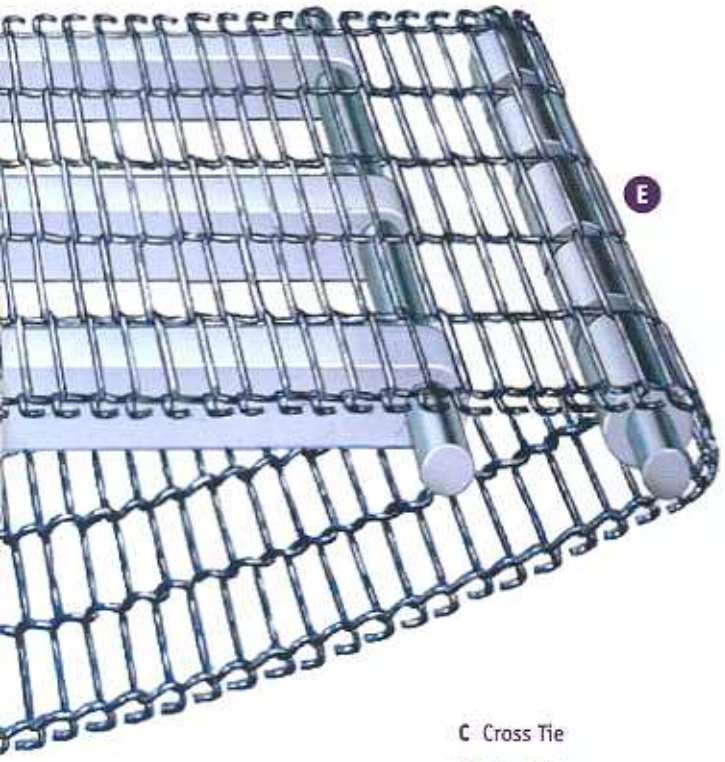
Belt Supports for Conveying Surface

HOT TIP:
Never drive belts at reverse bend because the pitch of the belt is different than the forward side—belt will not mesh correctly with sprockets.

Support required for Flat-Flex wire belts depends upon the load carried, type of product conveyed, and the process.

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. Ultra-High Molecular Weight (UHMW) polyethylene bars work well for temperatures up to about 50°C; otherwise stainless steel rods or high temperature plastics are needed. 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.



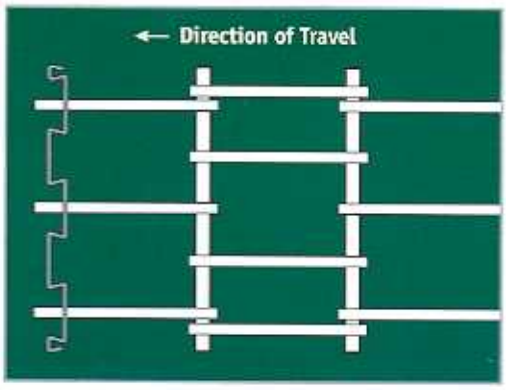
A Transfer Roll Shaft
B Transfer Rollers
C Cross Tie
D Wear Strips
E Grooved End Roll
F Belt Spaces (1–5)

Belt Supports for Return Path

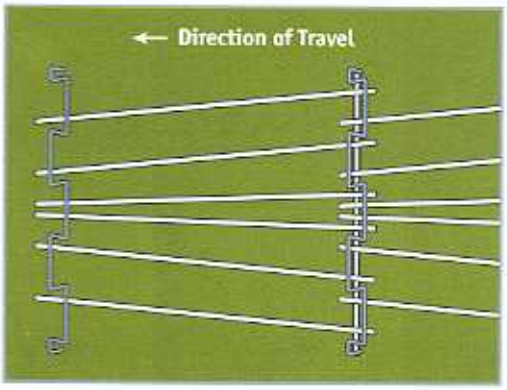
HOT TIP:
Never put supports under the Z-bends; wear strips should be placed between belt joints to minimise wear and to assist tracking.

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. a transition from flat to an incline) use UHMW hold downs to assist in tracking.



Staggered pattern



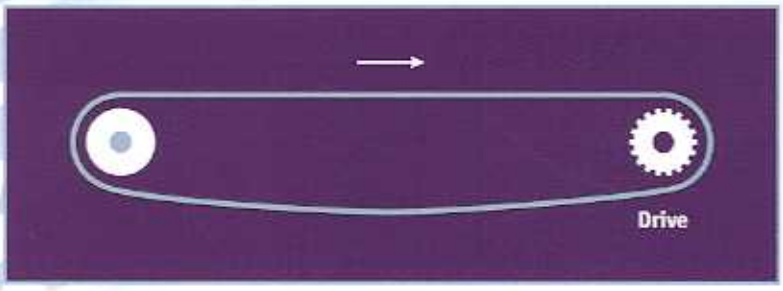
Herringbone Pattern

Conveyor Layouts and Tensioning Techniques

Drive Location

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.

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

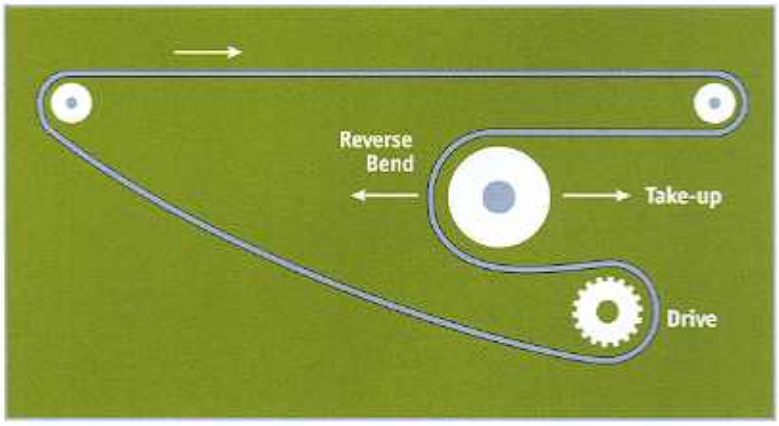


Simple conveyor layout

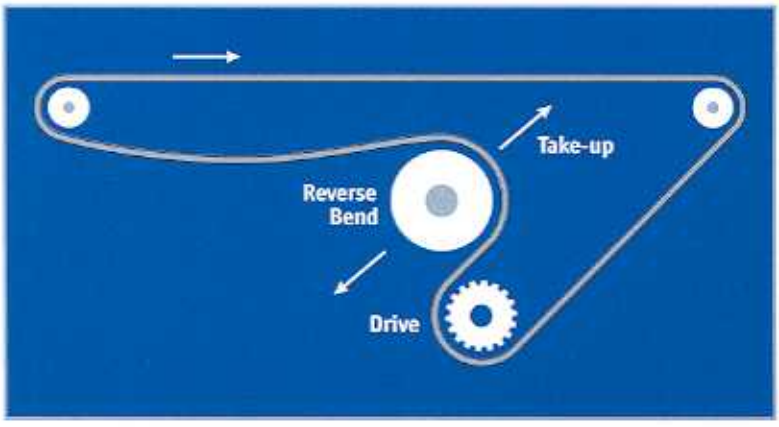
Reverse Bends

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

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. The reverse bend diameter is normally 10 times pitch.



Preferred "S" drive conveyor layout



Optional "S" drive conveyor layout

Tensioning

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

HOT TIP:
Never over-tension your belt (see Table 1 for maximum tension force per joint for your belt size)

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:

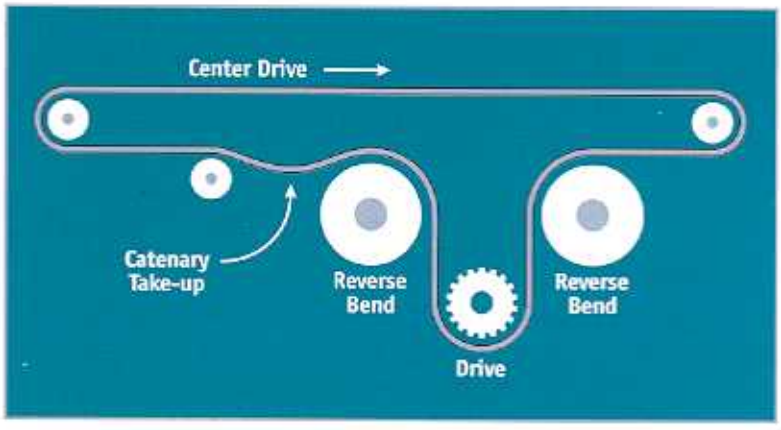
- The simplest method is to allow the belt to sag on the return side of the belt circuit (called a 'catenary'). The weight of the belt itself keeps the needed tension on the drive shaft. This is the preferred approach for tensioning Flat-Flex.

HOT TIP:
Rule of Thumb: Catenary sag should be 50-100mm for 900mm between support rolls.

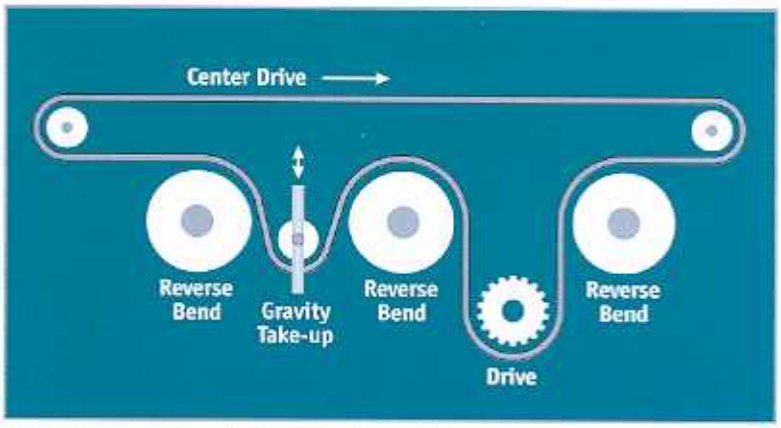
- For the applications where a catenary is not practical, we recommend a 'gravity' take up. This is the case especially if the belt will be subjected to considerable variations in temperature. (Temperature affects belt length - if a belt goes through an oven or fryer, its length is extended).

- 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 (No more than 180° wrap)



Gravity take-up with weighted roller for varying temperature applications.

Table 1: Standard Belt Data

This is an extract from our full range of Flat-Flex® belting

Pitch & Wire Diameter	Nominal belt thickness at joint (mm)	Average weight per sq. metre (kg.)	Max. belt load per sq. metre (kg.)*	Max. belt tension per space (Newtons)	Grooved Transfer		Min. reverse bend diameter (mm) **	Speed range for optimum belt life (m.p.m)	Typical open area (%)
					Min. roll diameter (mm)	Groove Depth (mm) (Includes Clearance)			
4.24 x 0.89	2.4	1.3	2.4	13.4	12	3.0	43	0-5	77
4.30 x 1.27	3.2	2.6	7.3	44.5	12	3.0	43	0-10	67
5.64 x 0.89	2.4	1.0	1.7	13.4	12	3.5	57	0-5	82
6.0 x 1.27	3.2	1.9	4.9	44.5	16	4	60	0-10	76
6.35 x 1.27	3.2	2.0	4.9	44.5	16	4	64	0-10	77
6.40 x 1.40	3.6	2.7	7.0	55.0	20	4	64	0-10	76
7.26 x 1.27	3.2	1.6	4.9	44.5	16	4	73	0-10	80
7.26 x 1.57	4.1	2.5	11.0	66.7	19	4	73	0-15	75
9.60 x 2.08	5.2	3.5	48.8	97.8	25	5	96	0-25	75
12.0 x 1.83	4.5	2.3	29.3	80.0	29	6.5	120	0-20	81
12.7 x 1.83	4.5	2.2	29.3	80.0	29	6.5	127	0-20	82
12.7 x 2.34	4.8	3.6	48.0	133.4	38	6.5	127	0-25	78
20.32 x 2.34	4.8	2.6	39.0	133.4	38	6.5	203	0-25	85

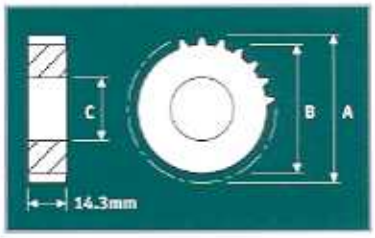
* Assuming correct belt support and subject to limiting belt tension

** Recommended for optimum belt life Note: Belt Width available up to 4.5 metres

Other beltings also available - Contact Sales Dept. 01795 421771

Table 2: Selection of stock sprockets & blanks for Flat-Flex® belts

Pitch (mm)	Wire Dia. (mm)	Outside Dia. (A) (mm)	Root Dia. (B) (mm)	Bore Dia. (C) (mm) *	No. of Teeth
4.24 4.30 4.30	0.89 1.00 1.27	50.80	46.99	20	34
5.64	0.89 1.00	50.80 76.20 76.20	45.72 70.00 70.00	20 20 25	25 39 39
6.35	0.89 1.00 1.27	50.80 76.20 76.20	44.19 71.12 71.12	20 20 25	22 35 35
7.26	1.27 1.57	31.75 50.80 50.80 57.15 76.20 76.20	27.43 45.72 45.72 50.80 68.58 68.58	16 20 25 20 20 25	12 20 20 22 29 29
12.70	1.83 2.34	50.80 50.80 76.20 76.20	44.95 44.95 68.58 68.58	20 25 20 25	11 11 17 17
20.32	2.34	76.20 76.20	65.53 65.53	20 25	10 10



*Imperial equivalent also stocked

Outside diameter of blank = Root diameter of sprocket

Standard Material Available:
(1) Polyacetal
(2) Stainless Steel

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