



POLYSUR® FERRO
Steel cord reinforced elevator belt

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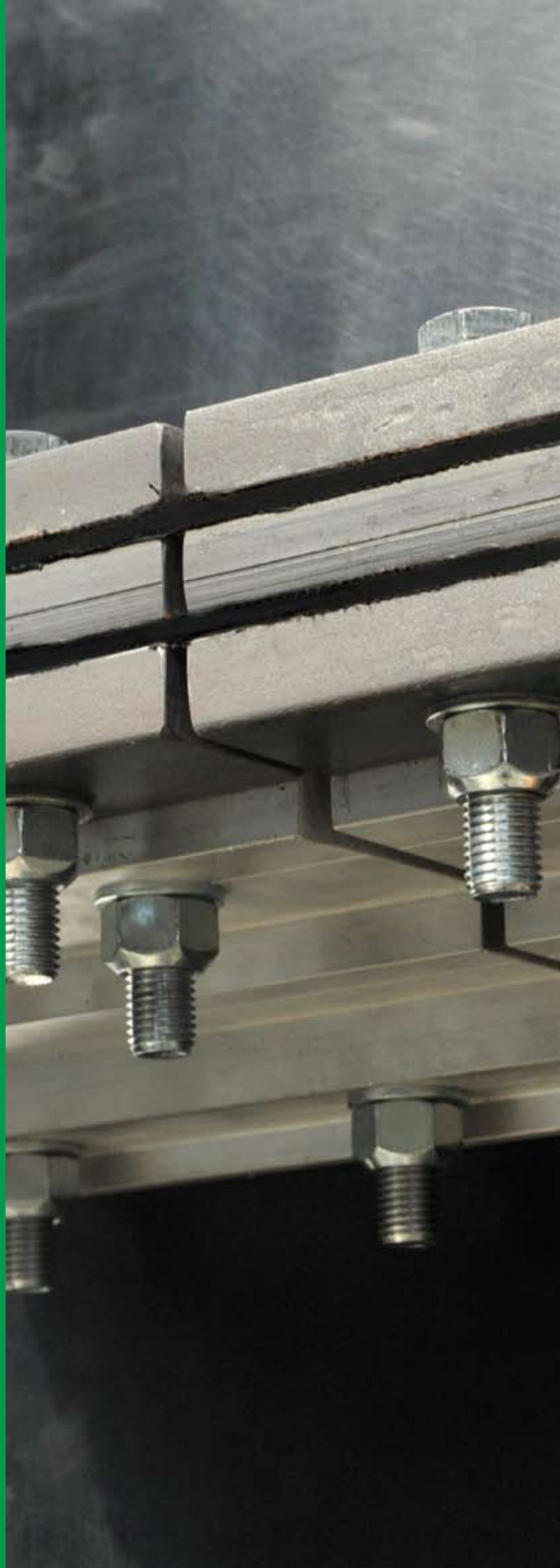
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polysur®

Steel cord reinforced elevator belt



*“Polysur[®] Ferro”
steel cord reinforced
elevator belt,
modern technology
for bucket elevators*





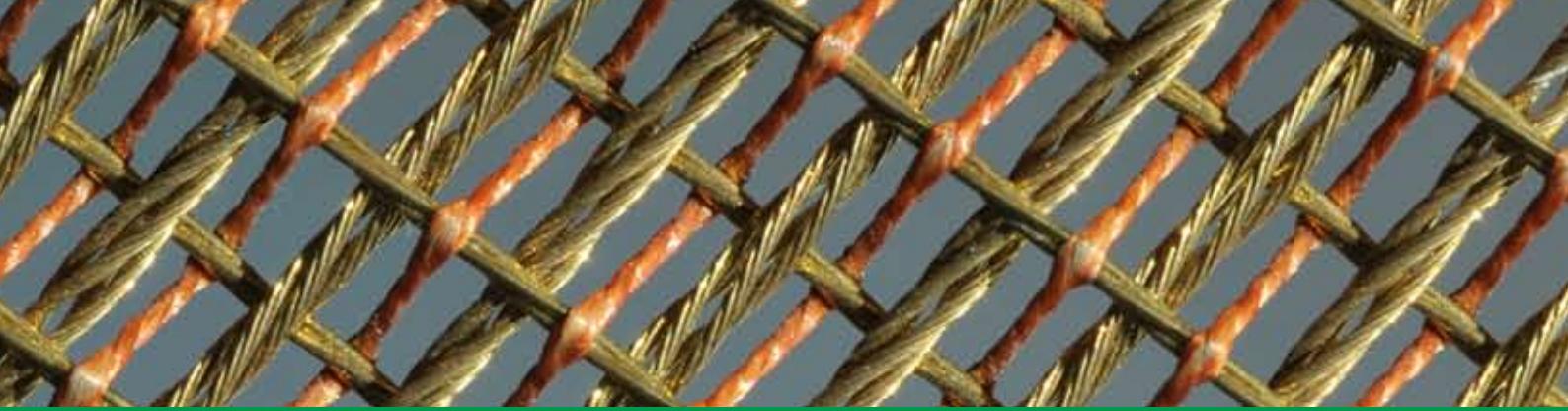
POLYSUR® FERRO STEEL CORD BELT FOR BUCKET ELEVATORS

Polysur® Ferro steel cord elevator belts are designed for heavy duty industrial applications with long centre distances, requiring straight running and reliability with high safety factors. Their construction and characteristics differ from those of traditional steel cable belts. Their steel cord carcass consists of low elongation, yet high elasticity steel cords in the length and cross rigid cables in the width all embedded in a solid rubber mass that cannot delaminate. The built-in elasticity allows running over lightly crowned pulleys while the rigid weft construction warrants excellent straight tracking. Manufacturing norms: DIN 22102 and ISO Norms.

Polysur® Ferro elevator belts are available in normal and high temperature resistant qualities and offer excellent life in the most arduous applications.

Based on know-how and vast field experience the Polysur® Ferro programme offers following belt qualities:

- **Polysur® Ferro T 60** a very good abrasion resistant quality, based on SBR rubber for use at ambient temperature of 60°C.
- **Polysur® Ferro T100** an improved version of the above suitable for product temperature of 90 - 100°C and very short peaks up to 120°C.
- **Polysur® Ferro T130** based on EPDM rubber, suitable for product temperature up to 130°C. and short peaks up to 150°C.
- **Polysur® Ferro T150** based on EPM rubber, suitable for product temperatures up to 150°C. and short peaks up to 180°C.
- **Polysur® Ferro G** suitable for handling oily and fatty product at ambient temperatures up to 80°C.
- **Polysur® Ferro ALE** white rubber food quality suitable for non-fat food products at ambient temperatures. Also available in non fat resistant quality.



BELTING TECHNOLOGY

Heat resistant conveyor belts in general

Heat resistant belts are widely in use handling hot materials in steel factories, foundries, cement factories and power stations on overland belt conveyers. In these belt conveyor systems the belt is usually running in the open air at ambient temperatures and it can cool down in the return part after the load has been discharged.

As a result, when loaded with very hot materials, the inner core of the belt seldom reaches temperatures as high as the temperature of the product carried. In fact, as an example, over a conveying length of 60 metres and product up to 200°C the inner core of the belt measured at discharge point may not even reach 80°C. and the belt can cool down again in the return part.

Heat resistant belts in bucket elevators

In bucket elevators handling hot product the belt can hardly cool down in the return part, because the ambient temperature in the elevator casing often approaches the product temperature. Significant cooling airflow inside

the casing is not always possible, especially not when handling dusty products, as it may cause turbulence and spillage of product from the buckets.

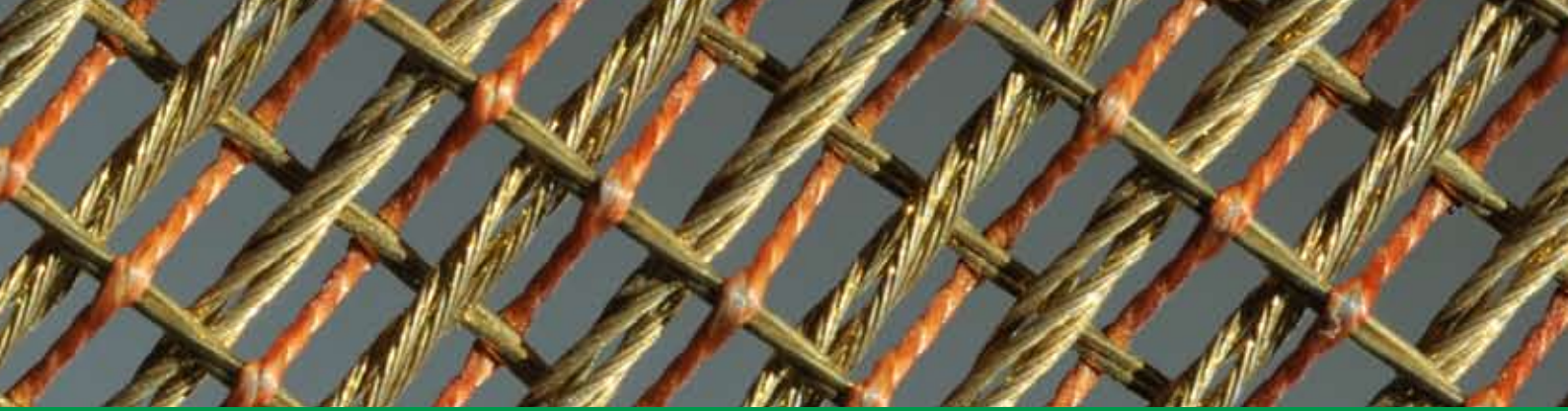
Metal buckets and bucket attachments will partly retain their heat in the return belt part and will therefore have a continuous effect on the belt's aging process.

Belts will age during sustained prolonged and continuous exposure to high heat. Aging means that the rubber hardens, loses its breaking strength and elasticity and the wear resistance is reduced. The covers will develop cracks and they will separate from the belt carcass.

Heat resistant rubber compounds

Rubber compound qualities commonly used in heat resistant belting are: BUTYL, EPDM and EPM. Lab tests during 4 months at a constant temperature of 150°C in an oven (no mechanical load or friction) shows following results:

	Original			60 days exposure			120 days exposure		
	EPM	EPDM	Butyl	EPM	EPDM	Butyl	EPM	EPDM	Butyl
Hardness °A shore	75	72	74	81	87	89	82	94	-
Tensile strength (N/mm ²)	167	191	123	70	91	-	46	118	-
Elongation at break %	378	680	330	197	93	-	55	13	-

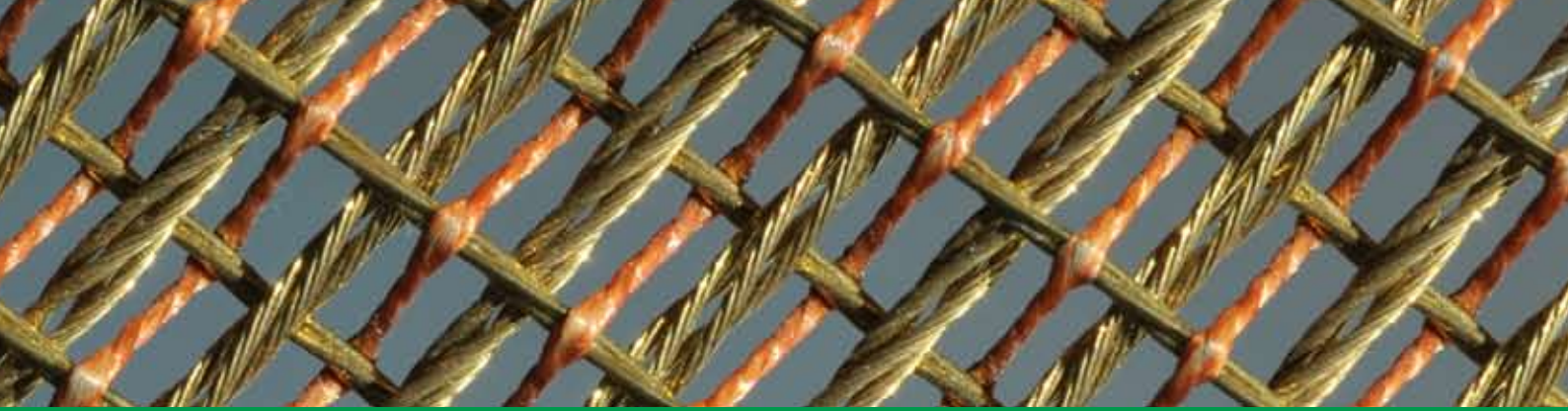


Conclusion:

1. EPM shows little hardening 9% from 75°A - 82°A shore, loses strength but retains a fair percentage of elasticity at break 55% thereby avoiding cracking. EPM is the base compound for **Polysur® Ferro T150** and is very suitable for operating temperatures 130°C - 150°C.
2. EPDM hardens 25% from 75°A to 94° shore A but loses only 38% strength, however loses elasticity leading to the potential development of cracks. EPDM is the base compound for **Polysur® Ferro T130** and is very suitable for operating temperatures up to 130°C.
3. BUTYL hardens the most from 74°A to 94°A shore and loses all strength and flexibility after 2 months already. It is not recommended for use in high heat elevators.



On site inspection and consultation.



POLYSUR® FERRO TECHNICAL INFORMATION

Standard belt constructions

Strength	Construction	Belt thickness	Min. pulley	Appr. weight
SW 630	3+3 mm	11 mm	Ø 400 mm	15,21 kg/m ²
SW 800	3+3 mm	12 mm	Ø 500 mm	17,20 kg/m ²
SW1000	3+3 mm	13 mm	Ø 500 mm	17,93 kg/m ²
SW1250	4+4 mm	14 mm	Ø 630 mm	22,37 kg/m ²
SW1400	4+4 mm	14 mm	Ø 630 mm	23,12 kg/m ²
SW1600	4+4 mm	14 mm	Ø 630 mm	23,97 kg/m ²
SW1800	4+4 mm	14 mm	Ø 630 mm	24,67 kg/m ²
SW2000	4+4 mm	14 mm	Ø 800 mm	25,17 kg/m ²
SW2500	5+5 mm	17 mm	Ø 1000 mm	27,71 kg/m ²

Recommended minimum covers, other combinations are possible. Thicknesses and weights are approximate.

Roll diameter shipping dimensions:

Belt thickness	Belt length in meters				
	75	100	125	150	
12 mm	1.09	1.25	1.40	1.55	■ min. width 250 mm
13 mm	1.13	1.30	1.45	1.59	■ min. width without steel weft 150 mm
14 mm	1.21	1.40	1.56	1.70	■ max. width 2000 mm
					■ max. length depending on coil weight

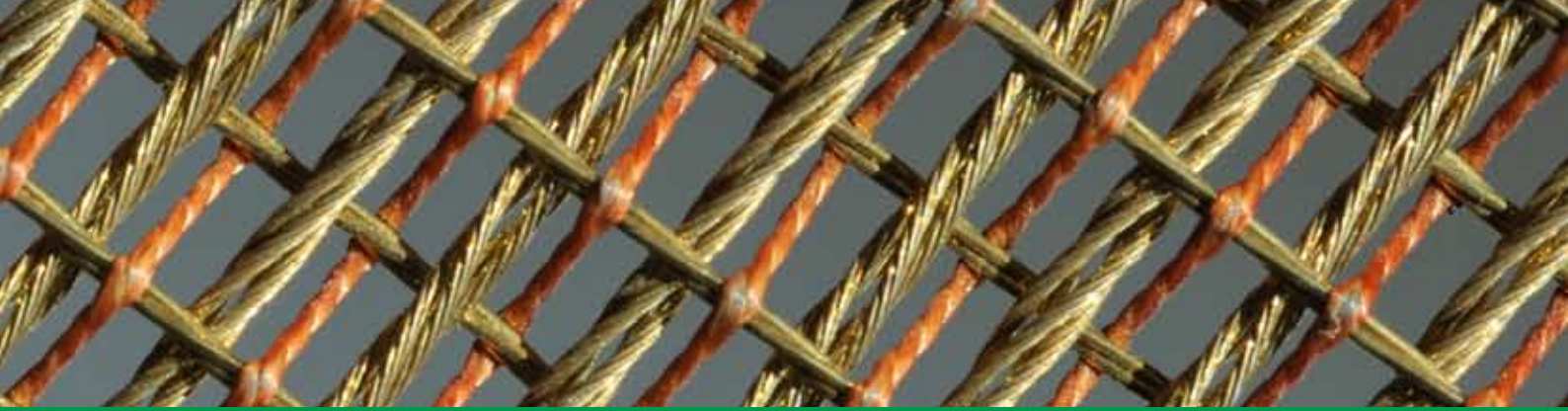
THE CONSTRUCTION OF THE STEEL CARCASS

Polysur® Ferro belts are constructed with Fleximat® E-cords, flexible, specially designed straight warp, open type steel cords with built-in elasticity in the warp direction, onto which rigid weft cords are tied using a special weaving technique.

This special weaving technique means that neither warp nor weft cords are in any way deformed, but both lay perfectly straight all over the belt length resulting in maximum strength performance and high resistance to damage.

Advantages of the open E-cords in belt length (warp):

- highly flexible;
- low permanent elongation max. 0.35% at 10-safety factor;
- unique elastic elongation 0.15%;
- improved shock resistance;
- improved compression behaviour;
- allows maximum rubber penetration;
- minimising corrosion risk in case of belt damage;
- very high rubber to steel adhesion.



Belt carcass construction

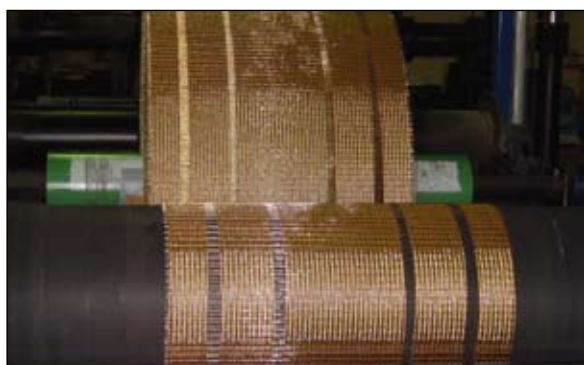
Strength	Warp cords	pitch	Weft cords	pitch
SW 630	Ø 2.00 mm	4.63 mm	Ø 1.29	6.67 mm
SW 800	Ø 2.85 mm	6.67 mm	Ø 1.29	6.67 mm
SW1000	Ø 2.85 mm	5.38 mm	Ø 1.29	6.67 mm
SW1250	Ø 3.90 mm	7.04 mm	Ø 1.29	6.67 mm
SW1400	Ø 3.90 mm	6.25 mm	Ø 1.29	6.67 mm
SW1600	Ø 3.90 mm	5.50 mm	Ø 1.29	6.67 mm
SW1800	Ø 3.90 mm	5.00 mm	Ø 1.29	6.67 mm
SW2000	Ø 3.90 mm	4.65 mm	Ø 1.29	6.67 mm
SW2500	Ø 4.50 mm	5.71 mm	Ø 1.29	6.67 mm

Polysur® Ferro elevator belts display only max. 0.35% permanent elongation at maximum permissible working load (at safety factor 10), ensuring constant belt tension even at long centre distances. As an unique feature these E-cords show an elastic elongation of 0.15%, increasing shock resistance and allowing the belts to run over lightly crowned pulleys.

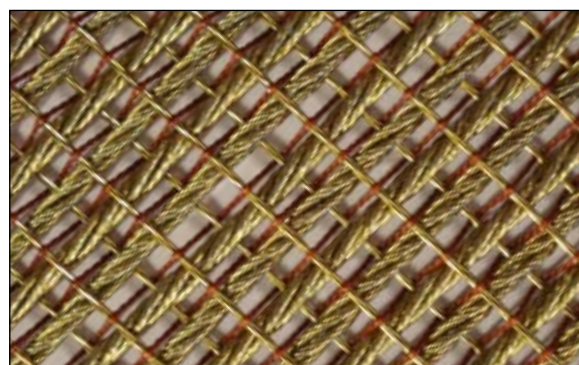
The elastic elongation is the “give” in the belt, the variation in length when subjected to a load variation between 20% and 100% of the maximum permissible load at 10-fold safety factor.

Advantages of the rigid cords in belt width (weft):

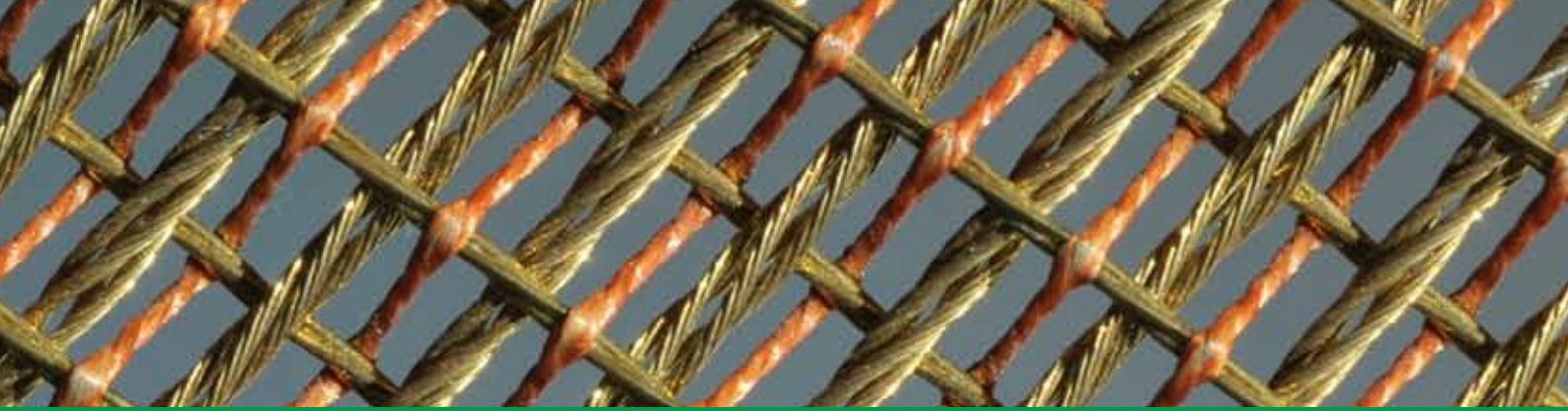
- very cross rigid and dense weft construction with cords of 1.29 mm diam at 6.67 mm pitch;
- acts as a barrier to ripping and tearing;
- increases bucket bolt holding ability;
- minimises risk of bucket bolts slitting through the belt;
- produces a very cross rigid belt that offers excellent straight running abilities;
- allows light pulley crown further improving straight running.



Polysur® Ferro carcass during production.



Polysur® Ferro SW1250 carcass.

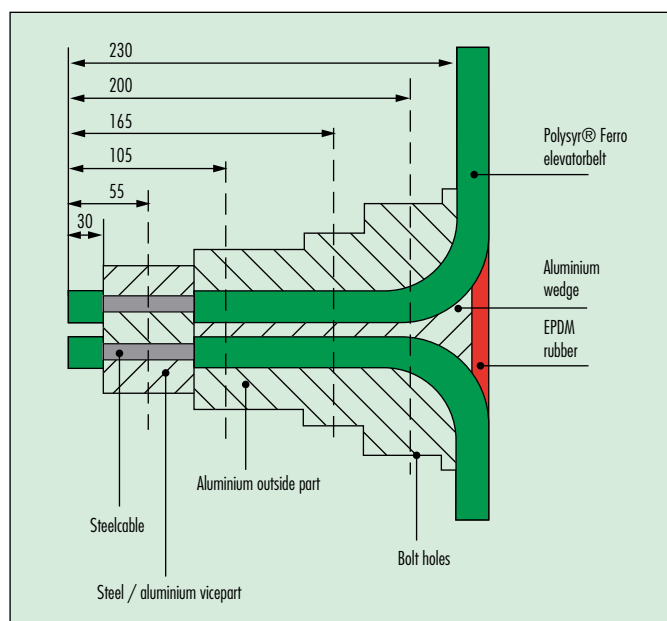


THE BELT CLAMP AND BUCKETS

The belt clamp and the buckets, attached to the belt, are in a sense foreign objects that do injury to the belt due to the pressure these parts exercise onto the belt while running over the pulleys. Every elevator belt will first develop wear and tear in those areas where these foreign objects are attached to the belt, whether the application is hot or cold. To avoid such premature wear, in particular in the cement industry, the belt should have maximum temperature resistance and the attachments should be as light as possible.

THE BELT CLAMP

Polysur® Ferro belts are preferably made endless with the standard MB SOLID clamp. This is a heavy duty mechanical clamping device with a three piece construction made of high quality aluminium and an additional steel vice-grip section.



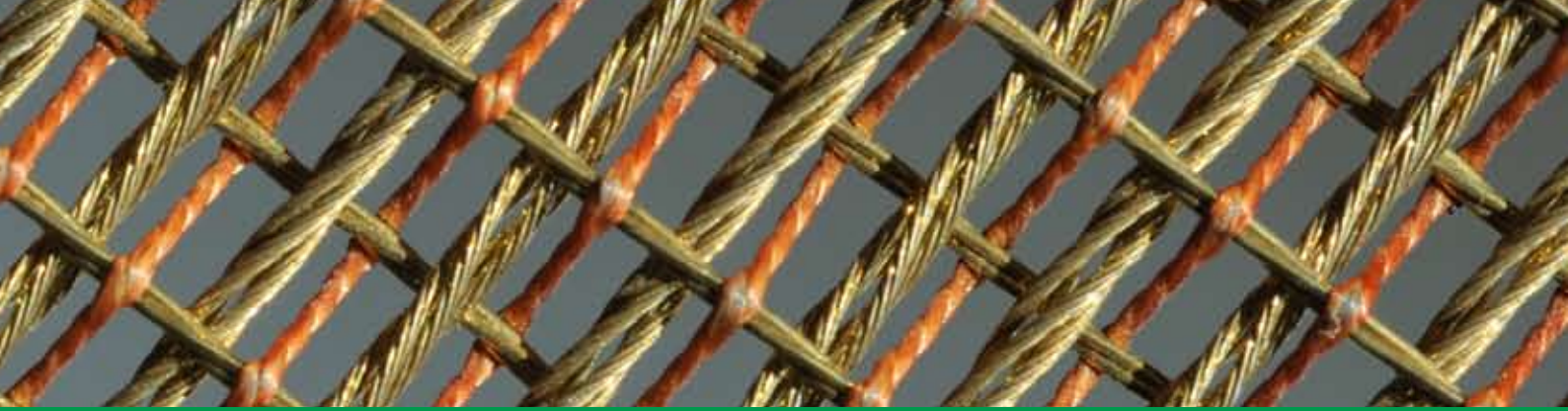
Sketch of MB Solid belt clamp.

The working is based on clamping forces and friction. The belt ends are bend off around a 75 mm radius and 90° angle. A central wedge part supports the clamp when riding over the pulleys. This central wedge part is equipped with a rubber section on the pulley side intended to prevent wear of the belt due to the pressure and friction when running over the pulleys.

Clamp information:

- Rubberised wedge section suitable for use up to 130°C.
- For temperatures exceeding 130°C the rubber segment is replaced by an available aluminium part.
- Clamp is supplied with two or three rows of M16 bolts depending on belt strength.
- MB Solid clamps are made of special aluminium and are noncorroding in normal operating conditions, and non-sparking.
- Clamps are individually designed and the pitch of the bolt holes in the clamp is intended to match as much as possible the pitch of the bolt holes in the buckets, so as to avoid loss of belt strength.
- Templates required to drill clamp bolt holes in a belt end during fitting on site are included.
- Special drilling tools required to cut bolt holes for clamps or bucket bolts on site are available
- Electrical cutting tool required to prepare the belt end on site for fitting the vice-grip section of the clamp can be offered.

In certain markets a supervisor can be made available at cost to guide local technicians in fitting a belt and clamp.



MB Solid belt clamp.



MB Solid belt clamp pulley side.



Clamp holes drilled and drilling tool.



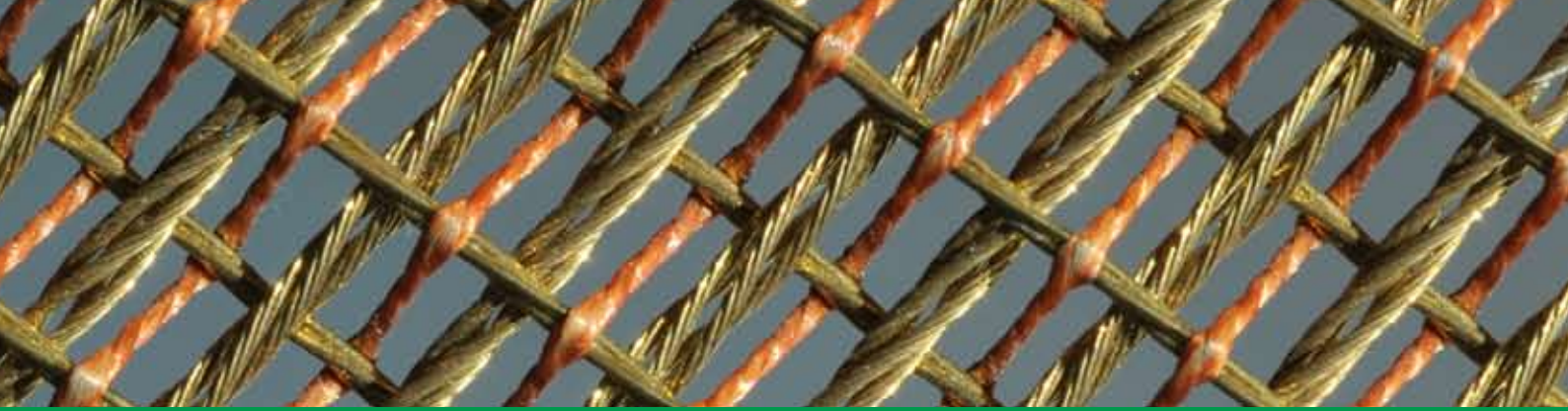
Preparing groove in belt end to fit vice-grip.



Electric groove cutting tool.



Belt end ready to fit clamp.



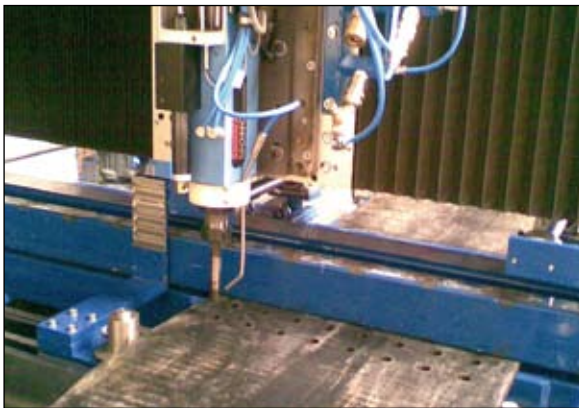
BUCKET BOLT HOLES IN POLYSUR® FERRO BELTS

Automatic hole cutting machine

Polysur® Ferro belts are usually supplied complete with bucket bolt holes. Holes for bucket bolts are cut through full warp and weft cord carcass on an automatic cutting machine suitable for handling belts up to 2000 mm width. To order, bolt holes for the clamp fasteners can be cut into one belt end, or if exact belt working length is known, holes for clamp bolts can be cut into both belt ends.

Cable free zones optional

Although **Polysur® Ferro** belts are recommended and usually supplied with full cord carcass, thus without cable free zones, and bolt holes are cut through the full warp and weft carcass construction, it is possible on special request to supply belts with cable free zones. However the maximum bucket bolt pull-out strength is obtained with full warp and weft cord construction.



1. Cutting bolt holes in Polysur® Ferro belt.



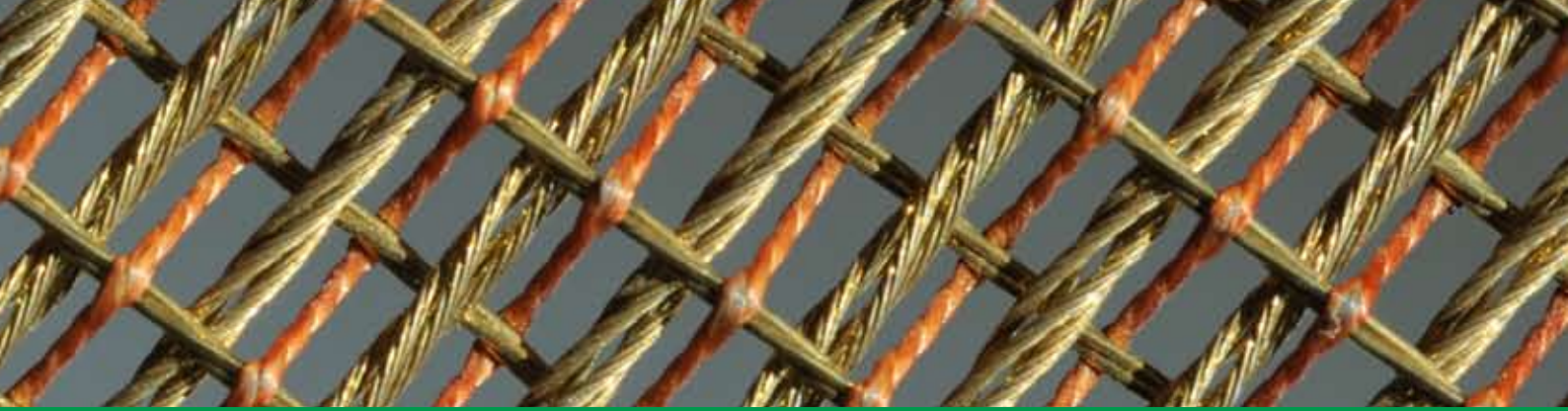
2. Automatic bolt hole punching machine.



3. Maximum working width 2000 mm.



4. To order special carcass with cable free zones.



BUCKET BOLTS

To fit elevator buckets standard DIN 15237 bolts are available in zinc or black quality, or stainless quality A4, quality choice depending on type of material conveyed.

Available sizes DIN 15237:

M8 : 28 mm head diam

M10 : 35 mm head diam

M12 : 42 mm head diam

M12 : 50 mm head diam (special)

Standard Grade 4.6 ex stock, to order in Grade 8.8

All sizes are available in various lengths and are preferably to be used with an allen key in the head, facilitating fitting and undoing, and with a locknut or lock washer.

Bolts are supplied standard with concave washer and standard hex nut. On request lock nuts are available also in heat resistant quality type 980V, or lock washers. The special M12 bolts with 50 mm head diameter will provide 20-25% increased holding ability compared to the standard M12 bolt with 42 mm head.



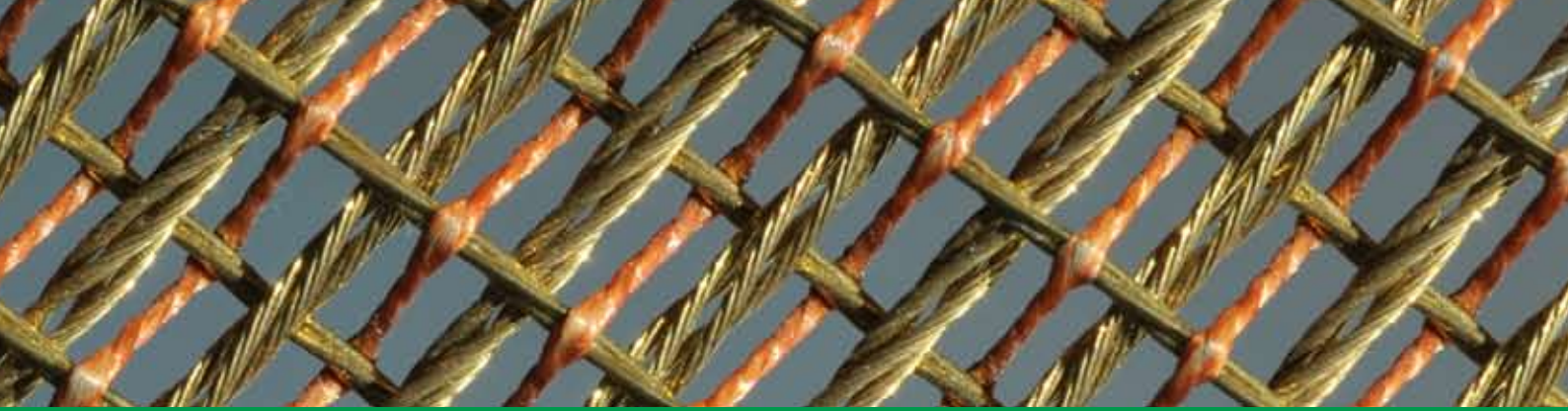
Bolt DIN 15237 M10 zinc.



Bolt DIN 15237 M12 with allen key.



Bolt M12 with 50 mm head diam covers 25% more warp and weft cables than standard 42 mm head diameter resulting in stronger bucket to belt attachment.



ELEVATOR BUCKETS

Buckets are foreign objects to the belt and the weight of buckets plays a role in the degree of injury they do to the belt. Also the method of attachment of buckets to belt is important as this also may cause damage to the belt. The lighter a bucket the less pressure it exercises on the belt and the least wear a bucket causes to the belt.

We offer all types of fabricated buckets as per various DIN specifications 15233, 15234 and 15235 or as per customer drawing. Besides the above well-known types, often used in rather heavy construction, and fitted at relatively large pitch, we have available light weight buckets that allow closer stacking on the belt, resulting in high capacities.

These smaller and lighter buckets are often suitable to replace heavy existing buckets fitted at larger pitch. Please consult our technical department for recommendations.

Advantages of light weight buckets:

- Fitted at shorter pitch reduce digging resistance in the boot.
- Reduces wear to the belt.
- Buckets cool down quicker.
- Buckets are easier to replace, lighter to handle.
- Less dead weight on the belt.
- More flexible will bend before being torn off the belt.

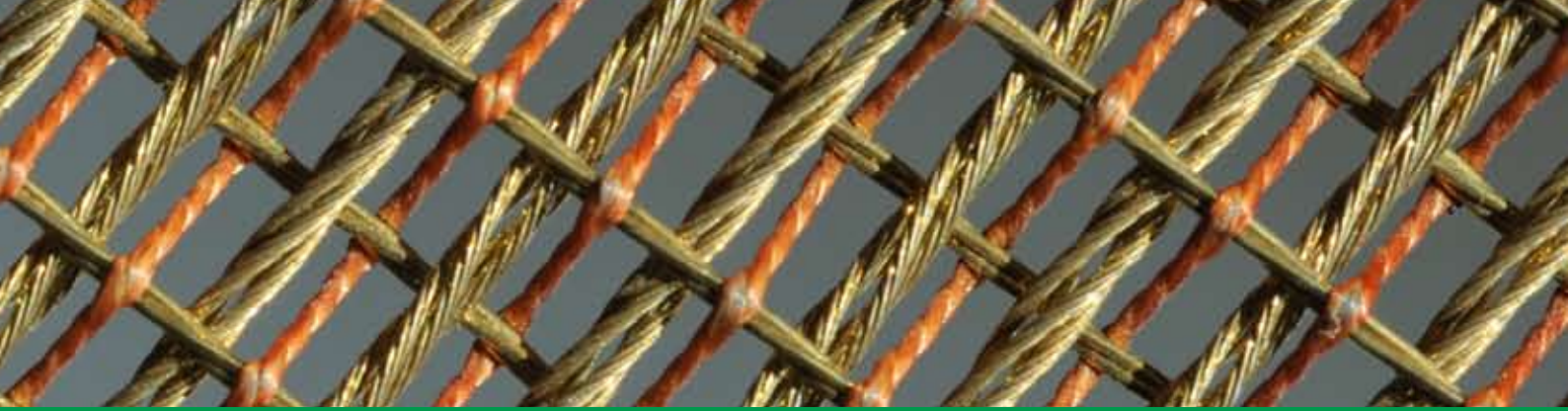
Ideally, to assure long belt life, light weight and flexible buckets made of high grade engineering plastic would improve belt life. Plastic buckets are available in polyethylene, polyurethane and polyamide (nylon) however plastic buckets have a temperature limitation of approx. 100°C and can only be used for cold product in handling sand and gravel, minerals, wood chips, fertilisers, grain and cereals. They are very abrasion resistant, non stick, relatively flexible and light weight and offer high capacities.



Light weight buckets in 2 rows handling 250 T/h cement on 850 mm wide belt.



Synthetic buckets handling wood chips.



CROWNED PULLEYS

Generally, steel cable belts should run over cylindrical pulleys. Crowned pulleys cause the cables in the centre of the belt to overstretch and break, and broken cables cause internal damage to the belt.

Polysur® Ferro belts are manufactured with unique E-cords showing 0.15% elastic elongation, besides the 0.35% permanent elongation, and therefore they allow a low crown on the pulleys to assist the straight tracking of the belts.

On a 1000 mm pulley diameter e.g. Polysur Ferro belts with E-cords accept a crown on radius of 2 mm maximum.

The construction of **Polysur® Ferro** belts is already very cross rigid, thanks to the 1.29 mm diameter weft cables at 6.67 mm pitch, alternating on both belt faces, which in itself already warrants straight running.

Consult our technical department for crown recommendations.

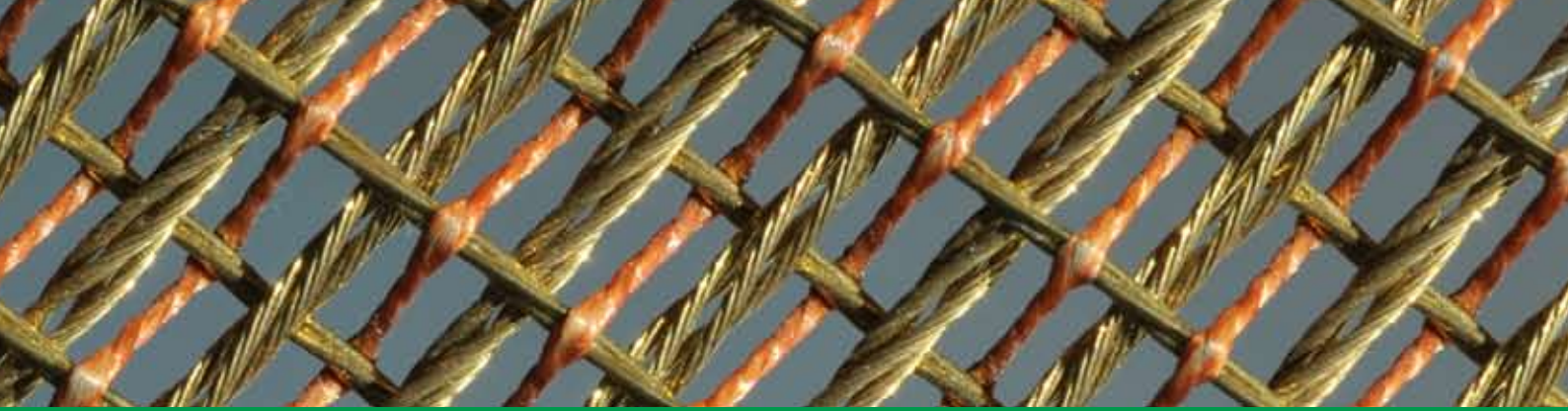


Preparing a belt for dragging into the elevator casing.



Fitting a Polysur® Ferro belt.





PULLEYS AND PULLEY LAGGINGS

Pulley laggings are often a “must” to ensure that the drive pulley can exercise a positive grip on the belt due to friction.

In some high heat product handling elevators, the drive pulleys are lagged with rubber slip preventing lagging. These laggings are also exposed to the high ambient temperature present in the elevator casing and they will suffer deterioration.

Ceramic/rubber laggings are available which show the same limitations due to the low temperature resistant rubber compound used. Moreover both types are usually glued to the steel pulley face and the glue also has a temperature limitation. As part of the **Polysur® Ferro** programme we offer special pulley laggings for low and high heat applications, or fat and oily operating conditions.

Various types of lagging are available:

- Diamond profile rubber sheet glued onto the pulley face, available in normal rubber or in oil resistant quality.
- Slide-Lag type consisting of rubber bonded to metal segments fitting in between retainer strips welded to the pulley surface, available in normal, and oil resistant quality however with a temperature limitation of 90°C.
- Ceramics or rubber/ceramics on preformed metal segments bolted to the rim of the pulley face, temperature limitation 90°C.
- Preformed metal segments with sintered all metal surface layer that are bolted to the rim of the pulley face, no temperature limitation and recommended for high heat applications.



Diamond shaped rubber lagging.



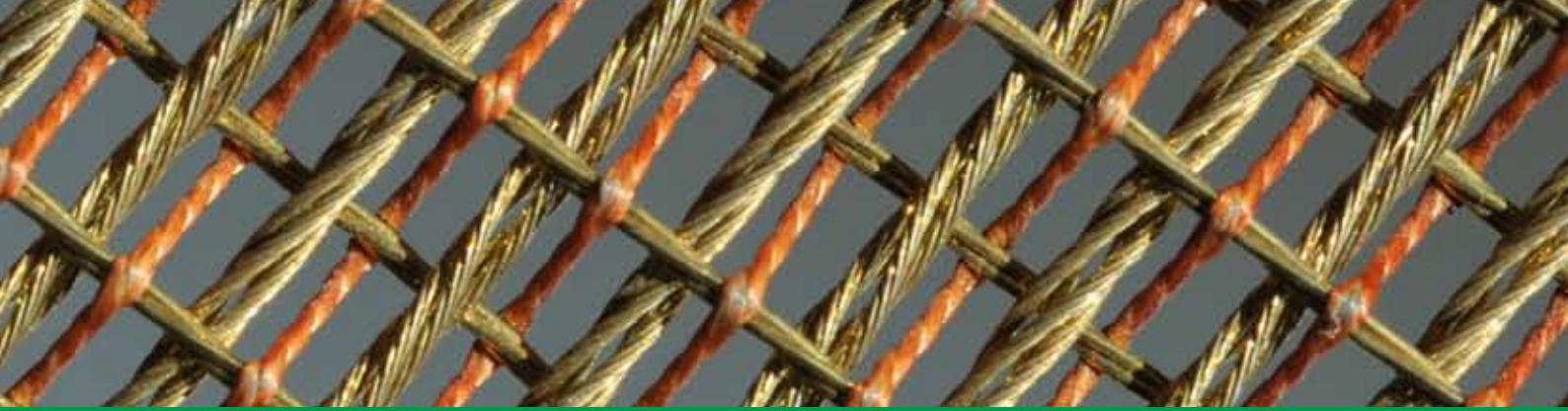
Slide-Lag rubber/steel lagging.



Ceramic/rubber lagging on preformed steel plates.



Sintered metal segments preformed to pulley face.



REPLACE PULLEYS

We offer a range of pulleys made to individual order specifications, as spare parts for elevators, whereby special attention will be given to details such as product size handled and crowning in order to avoid belt damage or excessive stresses on buckets.



Replace dust-free elevator boot.



Replace slatted boot pulley.



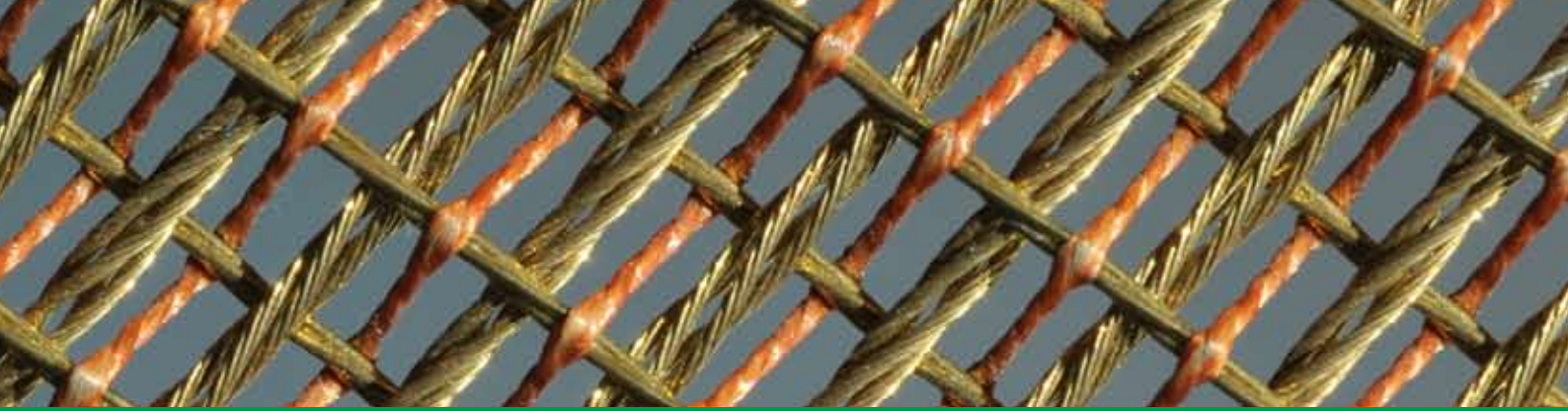
Special replace boot pulley.



Replace boot pulley for lumpy material.



Replace drive pulleys.



BUCKET ELEVATOR ENGINEERING

We offer a full service in providing capacity calculations and engineered “most economical” design recommendations for upgrading existing bucket elevators or constructing new elevators.

For an engineering proposal for existing elevators, please provide us with the following information:

- Product type being transported;
- Product density;
- Product temperature;
- Type of elevator bucket used;
- Elevator height;
- Belt speed or pulley RPM;
- Width of the elevator belt;
- Pulley diameter and face width;
- Motor capacity (kW);
- Capacity (tons per hour).

For new elevators please advise following details:

- Product type being transported;
- Product density;
- Capacity (tons per hour);
- Elevator height.



A close-up photograph of industrial machinery. The image features a prominent blue cylindrical component in the foreground, which is secured with several silver-colored bolts. Above this, a green component is visible, also featuring multiple bolts. The background is a blurred green surface. The lighting is bright, highlighting the metallic textures and the precision of the assembly.

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