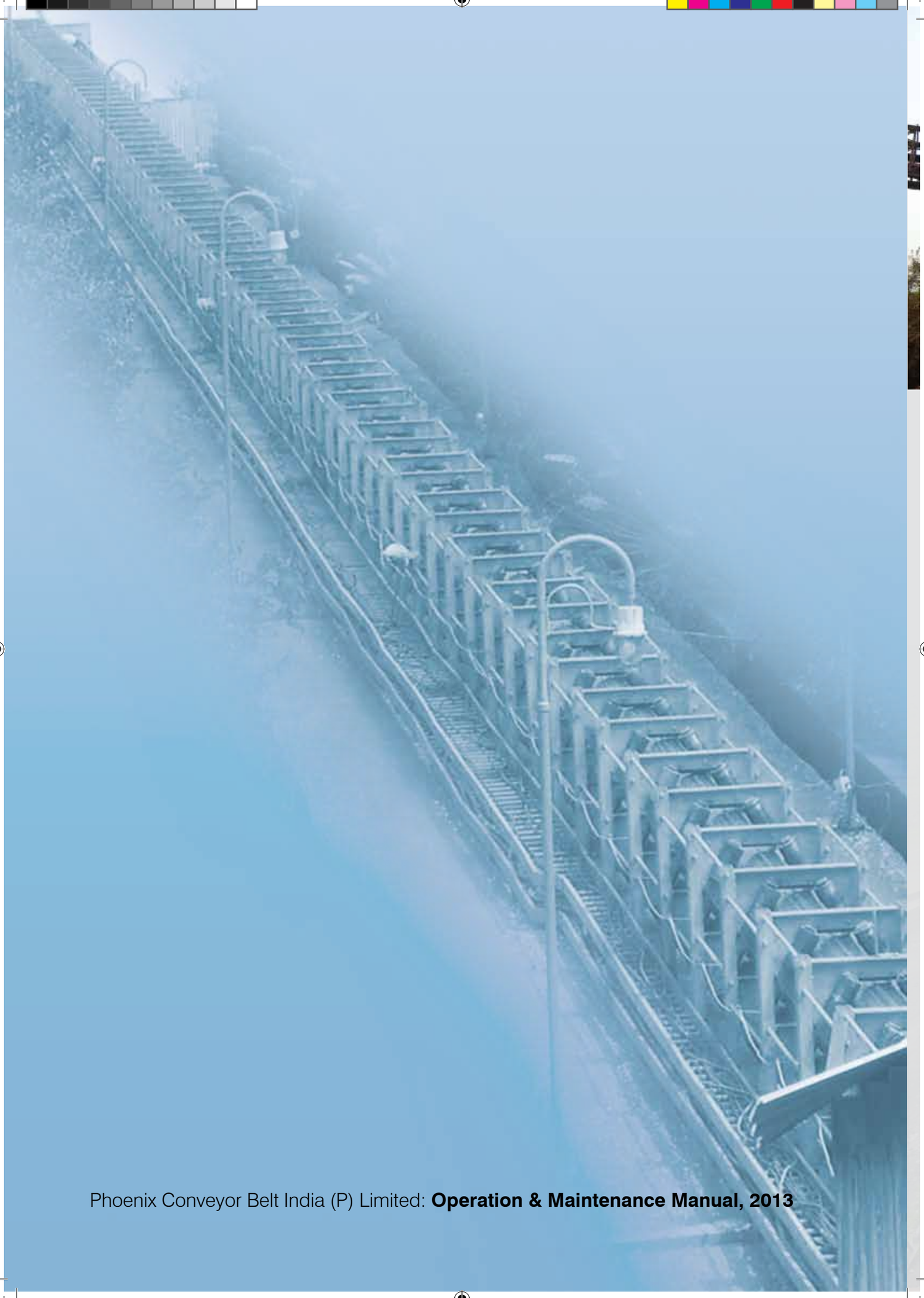
Operation & Maintenance Manual

PHOENIX
Conveyor Belt India



Phoenix Conveyor Belt India (P) Limited: **Operation & Maintenance Manual, 2013**

PHOENIX CONVEYOR BELT SYSTEMS

Phoenix Conveyor Belt Systems (PCBS), the Germany - based conglomerate has grown to emerge as the world‘s leading solution provider and technology leader in areas as diverse as bulk solid handling, fluid transmission, transport technology and vibra-acoustics.

During 100 years of conveyor belt production, Phoenix has always being the pioneer in the development, construction and supply of highest efficiency conveyor belt.

The emergence of PCBS as the world leader, through numerous enviable milestones, places Phoenix in the unique position of having unrestricted access to the finest of technologies available worldwide.

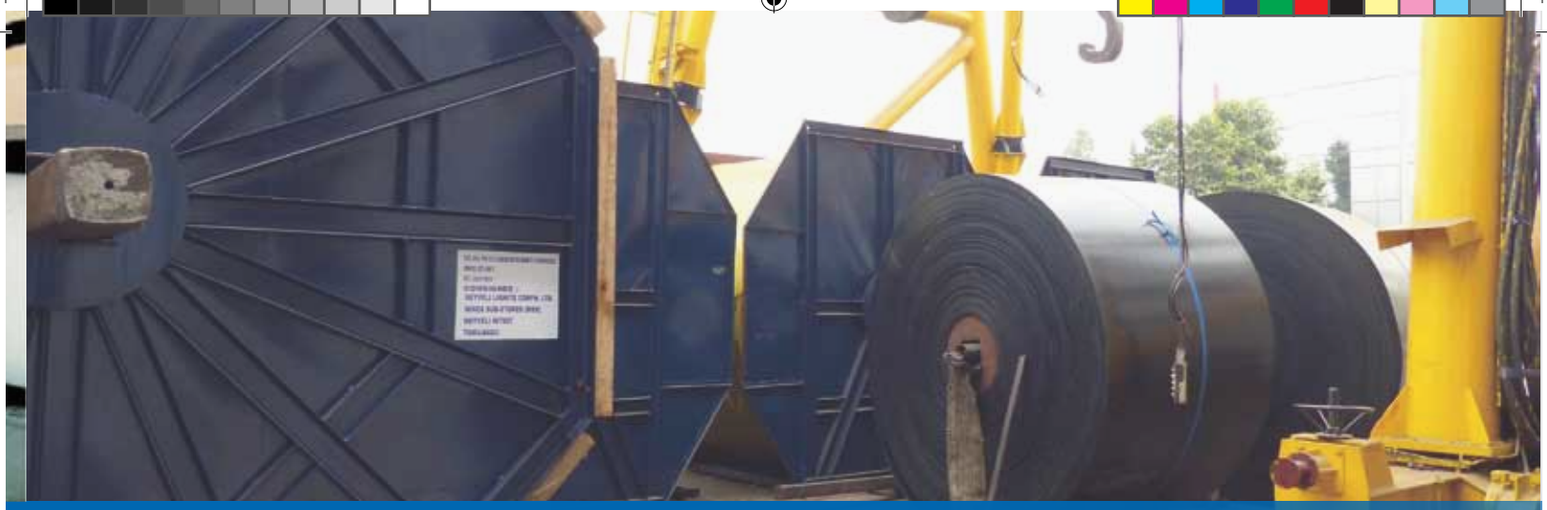
Some of the world records attained by PCBS include:

- the world‘s strongest belt ST 7800 at Los Pelambres, Chile
- the heaviest belt in the world, weighing 233 kg/m

PHOENIX Conveyor Belt Systems, Germany is the world’s leader in high-technology conveyor belts having a field experience of over 100 years

- the longest steel cord conveyor belt carrying limestone from Meghalaya of India to a cement plant in Sylhet of Bangladesh, having single flight of 17 km long incorporating 34.5 km long belting
- the strongest belt installed underground, a ST 7500 carrying material on forward and return runs at the DSKAG (Deutsche StelnkohlaAG) in Germany
- the steepest conveyor system conveying gold ore at 18° incline at Pierina, Peru
- the first self extinguishing steel cord belt in the world
- the longest pipe conveyor belt world wide at Peru having a belt length of 16.4 km

This manual is intended to serve as a guide to help customers optimally harness the belts created with such technology and establish new performance benchmarks at their own workplace.



Transportation, handling & storage

At Phoenix Conveyor Belt India (P) Ltd., we are committed to offer to our clients and users, various guidelines, for storing, installing, splicing, commissioning and maintenance of conveyor belts. Transportation, storing and maintenance exert fundamental influences on the performance of conveyor belts. These are important pre-requisites to achieving long life, reduced downtime and low maintenance costs. With this objective in mind, we have consolidated our global knowledge and experience into this operation and maintenance manual.

Shipping and transportation

Depending on transportation facilities, the conveyor belts which are wound up on wooden cores or drums, are shipped either by rail or by road transport to the customer. A framing is built of squared timber on which the conveyor belt reel are fixed. The frame is then lifted to the transportation facility by means of a crane. The frame is built in such a manner that the conveyor belt reel has a firm hold inside the framing thus providing for better distribution of its weight. The wooden frame secures the belt reel from vehicle movements. In addition to this, the conveyor belt is secured in both directions by means of tightening straps or chain hoists.

As far as shipping and transportation are concerned, the following details have to be ensured :

a. During lifting the conveyor belts, the belt edges have to be specially protected by using appropriate stoppers such as cross bars.

b. When setting down, the conveyor belt reels have to be placed on a clean surface which is free from greases, oils, nails, stones or sharp-edged materials.

c. Conveyor belt reels are to be properly fastened during transportation by rail and truck. This is especially important for conveyor belts of large diameters and considerable weight, and also for narrow belts supplied in moderately long rolls.

Handling

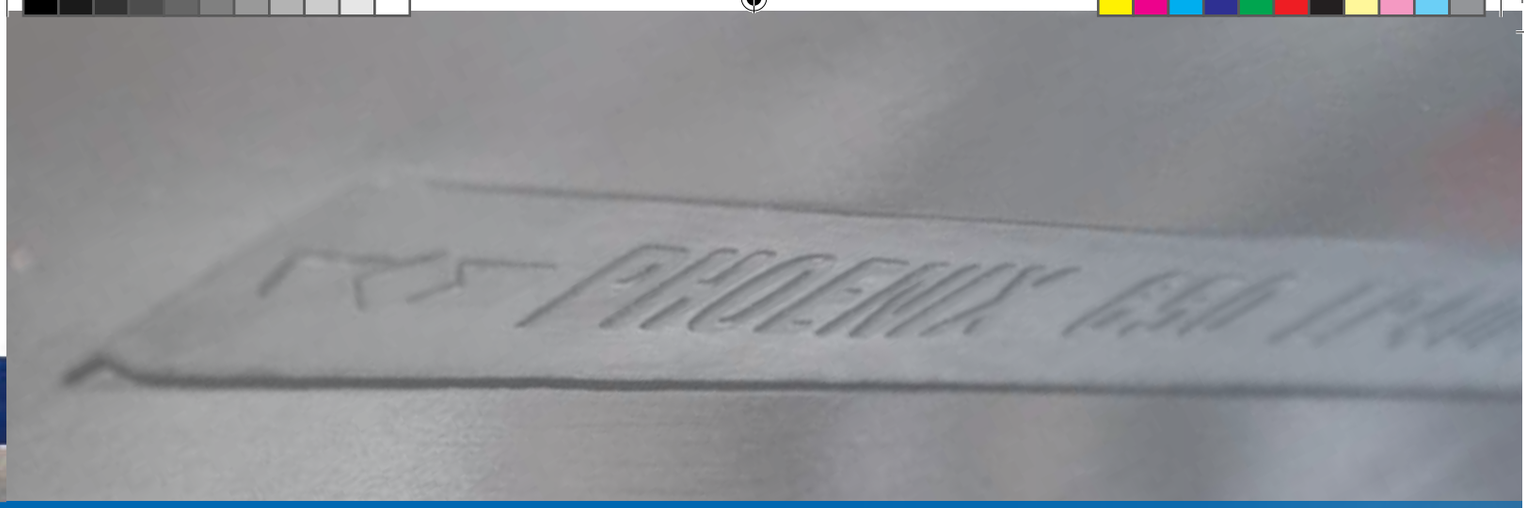
In order to lift the conveyor belt reels by a crane, a suitable weight-carrying tool (steel rod or steel square) has to be pushed through the inside square of the drum core. With the aid of two rope slings or chains over a cross bar this can be lifted. The cross bar should be sufficiently longer than the width of the reel in order to avoid damage to the conveyor belt edge attributable to the ropes or chains. Steel chains or steel ropes must not be used for lifting without a cross bar of the appropriate length in order to avoid any contact between the chains or ropes with the conveyor belt edges. Uneven load distribution may cause the reel to slip out sideways and cause an accident.

Storage

Conveyor belt laying

To avoid negative influences of extended storage (3 months & more) on the serviceability of conveyor belts, emphasis should be placed on the following details:

- Conveyor belts should be kept in an upright position until they are being commissioned. They are to be stored in a cool, dry, covered and well ventilated place away from direct sunlight. Exposure to ozone in seaside location, contact with any type of solvent, oil, grease, heat and moisture as well as other substances that may have detrimental effect on rubber should be avoided.
- Conveyor belts weighing over 1,500 kg. should be supported off the ground on 'A' frames. Conveyor belts kept as spares should be stored off the ground and rotated ¼ turn every three months. Whenever lengths are cut off from the belting roll, the end should be sealed with conveyor belting repair solution to prevent ingress of moisture into the carcass.
- The drums in storage should be examined once every three months to ensure that the packing has not been attacked by white ants and similar insects.
- For conveyor belts which have not been stored in good condition, it is advisable to test a sample to ascertain deterioration of the properties, before commissioning.



Installation

Conveyor belt laying

Unrolling of the conveyor belt should be done with care so as to avoid any damage. The drum should be hoisted after placement of the bar through the centre. The edges of conveyor belt should be properly protected. During drawing of the conveyor belt for unrolling, care should be taken that undesired additional rotation does not loosen the residual remains of belts in drum. The end of the conveyor belt should be protected from moisture or foreign material whenever any part of the length is cut from roll.

Conveyor belts are generally marked on the carry cover along one edge of the belt. It is always advisable to lay the conveyor belts in such a way so that the markings on the belts come along the same edge of the conveyor throughout the entire length.

The following procedure is commonly applied during installation of conveyor belt:

a. Replacing textile conveyor belt with steel cord conveyor belt

Cutting the old conveyor belt at tail end and then fixing the new steel cord conveyor belt with the old conveyor belt by clamping at three positions in the troughing zone with metal plate & bolt. During fixing this nut/bolt, cover rubber has to be removed in that area so that exposed nut/bolt will not damage pulley or idler during pulling the conveyor belt. Then the old conveyor belt is to be pulled with the help of a winch from bottom side of tail pulley and coiled in reels. After insertion of first roll, splicing is to be carried out with the subsequent roll & then finally the last joint is to be carried out on the conveyor structure.

b. Replacing textile conveyor belt with textile conveyor belt

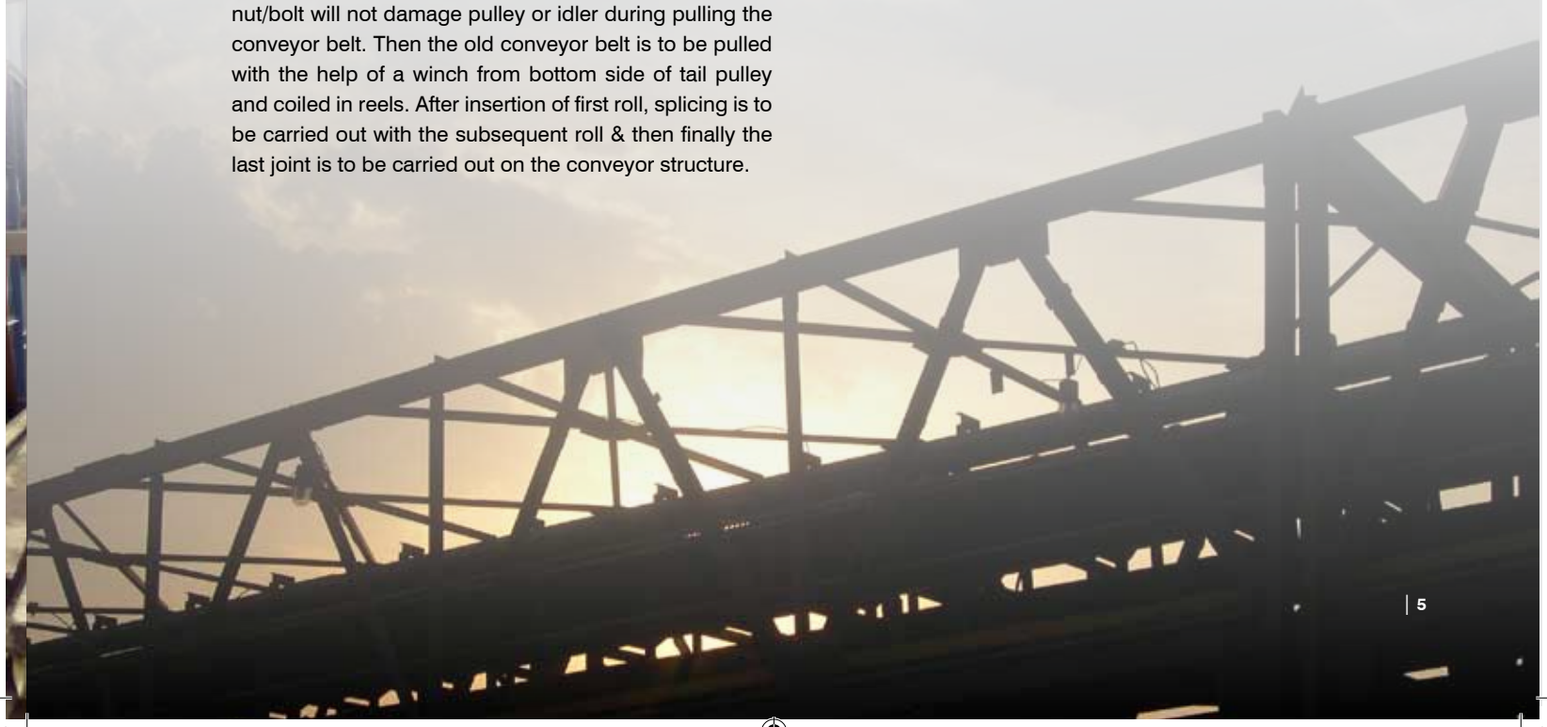
The old conveyor belt is cut at the tail pulley and the new conveyor belt is clamped with it. The other end of the old conveyor belt is then pulled by a winch or hydra.

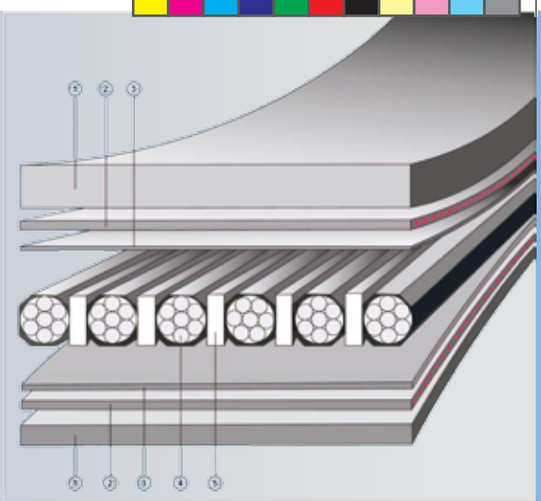
c. Replacing steel cord conveyor belt with steel cord conveyor belt

Cutting the belt at tail pulley, temporary splice joint is to be carried out with new conveyor belt. The old conveyor belt is pulled by a rope with the help of a winch or hydra.

d. New Installation

Inserting new conveyor belt can be done at tail end top side and pulling it around the pulley at head end through bottom run with the help of winch/hydra. Initial joints (splicing) can be done on ground but final joint is to be done on the conveyor structure.





Steel cord conveyor belt splices

1. Cover
2. Transverse reinforcement
3. Intermediate sheet
4. Steel cord with residual core rubber
5. Inter cord strips

Preparation for the splice

1. Working place

In order to ensure quality and durability of splicing, a clean working place is essential. The working place must be easily accessible. There should be power supply for lighting and other machine tools. The working place must be properly ventilated.

2. Splicing materials

Good quality splicing material should be used ensuring compatibility with the main belts to be jointed. The splicing materials must be stored in a cool and dry place at a temperature around 18 °C.

For best results it is always advisable to use splicing compound manufactured by the manufacturer of the conveyor belt, particularly for high heat resistant, oil resistant and other special grade conveyor belts. Before use, the date of expiry should be checked.

3. Preparation

3.1. Splicing should be done preferably on a horizontal run rather than on an incline. If splicing is restricted to an incline, it should be done at the lower end where the conveyor belt can be handled easily.

3.2. Construct a flat working table of double the splice length before and behind the press at the level of the lower heating plates.

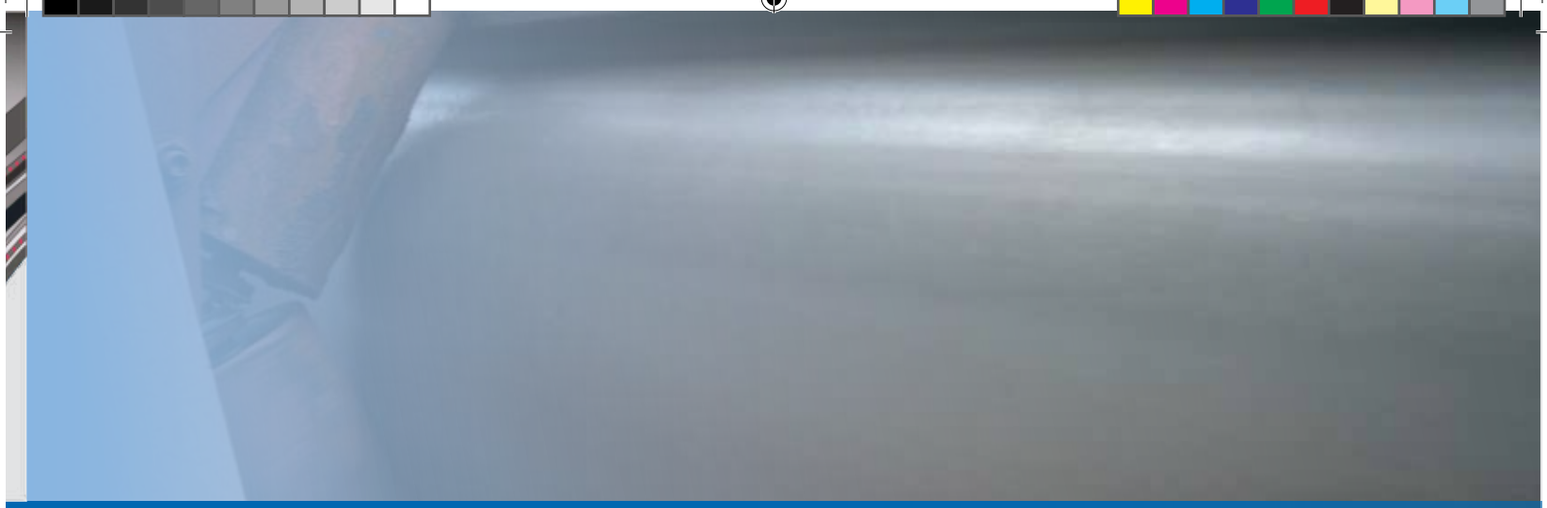
3.3. If the splicing is required to be done in an open area, construct a temporary shed to protect the splice from dust and rain.

3.4. When the conveyor is above the ground level, it is preferable to make all the splice on the ground level, except the last one. The last or final splice is carried out at a convenient place on conveyor deck after proper tensioning of the belt to eliminate sag and after positioning the take up pulley.

3.5. In case of conveyors, where take-up movement space is insufficient, leave one mechanical splice in the conveyor belt until the initial stretch is removed. This may take several weeks of normal operation. Afterwards, the mechanical splice can be replaced by a vulcanized splice.

4. Tools for splicing

- Grinding machine
- Grooved wire brushes for grinding machines (steel cord belt)
- Scissors
- Needles for pricking
- Paintbrushes
- Blacksmiths hammer
- Measuring chalk lines (and yellow chalk in spare)
- Whetstones
- Vice grips (parallel closing system)
- Clamps
- Marking numbers and letters for splice marking
- Marking crayon
- Chain hoist
- Foil (width 2000 mm)
- Stanley knives and spare blades
- Ply knives (textile belts)
- Turn round idlers
- Thickness gauge
- Measuring tape
- Marking tape (steel cord belt)
- “Don Carlos”-knives
- Fibre discs for grinding machines
- 2 ton winch (2 speed)
- Mechanical cable
- Cutter (steel cord belt)
- Angle grinder (steel cord belt)
- Edge bars (1-2 mm thinner than belt)
- Cord stripper (steel cord belt> ST 3000)



Splicing of steel cord conveyor belt

The steel cord belts are spliced or made endless by stepped joints and hot vulcanization method. The splice geometry and length of splice are dependent on the cord breaking strength, cord pull out strength, cord diameter, number of cords etc. Generally oblique joints (0.3 x belt width) are made, but perpendicular joints are also permissible.

1. Technical parameters

The strength of the joint evolves from the pull out force between the steel cord and surrounding rubber matrix in the splice.

In the splice geometry, the gap (S) between two parallel cords coming from the opposite end, should be sufficient, to achieve a good pull out force.

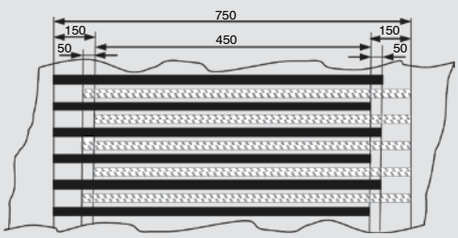
It will not always be possible to carry out a single step splice, because of insufficient gap between the cords. In such case, multistep splices are carried out. Different splice schemes as per DIN 22131 are shown below:

Splice dimensions as per DIN 22131 Part 4, is given in the following table. Please refer to Phoenix for belt construction other than DIN, FR under round belts and other special grade belts.

Splice dimension (DIN 221311 Part 4)

Belt rating	No. of steps	Minimum step length (l_{st})	Minimum joint length (l_v in mm)
Upto ST-1000	1	300	600
ST-1250	1	350	650
ST-1600	1	450	750
ST-2000	2	400	1150
ST-2500	2	500	1350
ST-3150	2	650	1650
ST-3500	3	650	2350
ST-4000	3	750	2650
ST-4500	3	800	2800
ST-5000	4	900	4050
ST-5400	4	1000	4450

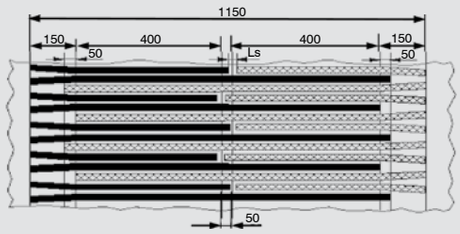
Splicing scheme Type I



Cord diameter : 4.9 mm
Cord pitch : 14.0 mm
No of cords : 84

Sketch not true to scale

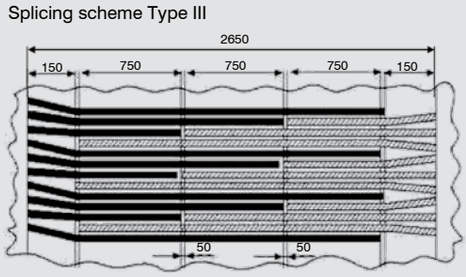
Splicing scheme Type II



Cord diameter : 5.2 mm
Cord pitch : 12.0 mm
No of cords : 97
Ls : Min 3 × cord diameter

Sketch not true to scale

Splicing scheme Type III



Cord diameter : 8.6 mm
Cord pitch : 15.0 mm
No of cords : 77
Ls : Min 3 × cord diameter

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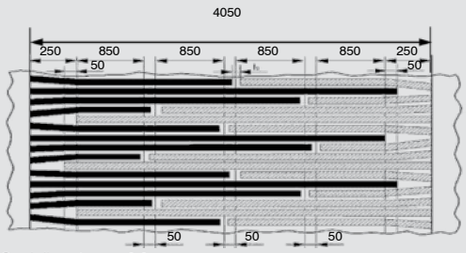
Splicing scheme Type IV



Cord diameter : 9.6 mm
Cord pitch : 12.7 mm
No. of cords : 92
Ls : Min 3 × cord diameter

Sketch not true to scale

Splicing of steel cord conveyor belt

2. Checklist for splicing works

1. **Vulcanization press**
   a) Manufacturer
   b) Length: (Splice length + 300 mm, min)
   c) Width: (Belt width + 100 mm, min)
   d) Temperature range: 0 - 200 °C
   e) Pressure range: 0 - 12 bar
   f) Type of pressurization

2. **Tables (at level of press)**
   a) Length: 2 × splice length before and behind the press
   b) Width: Belt width + 200 mm

3. **Tools (as per list)**

4. **Working tent**
   a) Length: 5 × press length
   b) Width: Belt width + 1500 mm
   c) Height: Height of lower platen of press +1.8 m
   d) Climatic conditions on site
   e) Storage of splicing material

5. **Electric current**
   a) available voltage
   b) Electrician on site during heating
   c) Types of plugs
   d) Light available (night shift)

6. **Water cooling**
   a) Water for cooling of splice available

7. **Splicing team**
   a) Numbers of skilled splicers available
   b) Shift times
   c) Transportation

Curing plates are required if the press to be used is made up of several platens. Their function is to bridge the gap between adjoining platens and restrict the rubber flow which would otherwise occur causing defects and low pressure points on the splice. They are made from one piece sheet of mild steel having a 2 mm nominal thickness.

3. Miscellaneous items

a) Electrical extension leads, suitable plugs and sockets for power tools, press, etc.

b) Ropes and wire lashings, snatch blocks of wood suitable for use as packing.

c) Spare blades and any necessary spare parts for tools and press e.g. fuses, bolts and bulbs.

d) First aid box.

4. Splicing material

Splice kits for each conveyor belt is tailor-made and consists of the following materials, quantity and dimension of which are calculated through a software programme.

a) Top cover plate
b) Back cover plate
c) Intermediate rubber strips
d) Intermediate rubber
e) Edge rubber sheet
f) Bonder solution
g) Vulcanization cloth

5. Curing conditions

a) **Curing temperature:** 150 °C ±5 °C

b) **Curing time:**

Belt thickness (mm)	Hold time (mins)
Upto 24	60
26	65
28	70
30	75
32	80
34	85

N.B.: For special grade belts, consult PCBI

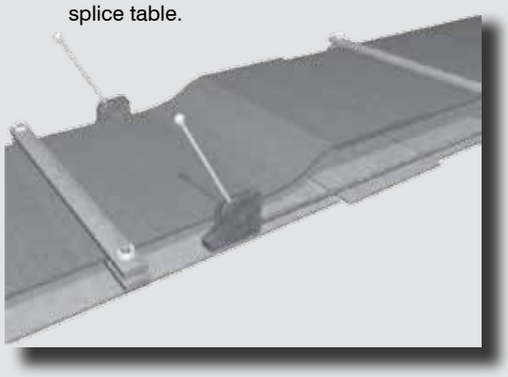
c) **Hydraulic pressure (specific):** Apply a specific pressure of around 10 bar -12 bar.

Specific pressure = (Total no. of cylinder in press × Area of each cylinder × Line pressure) / Platen area

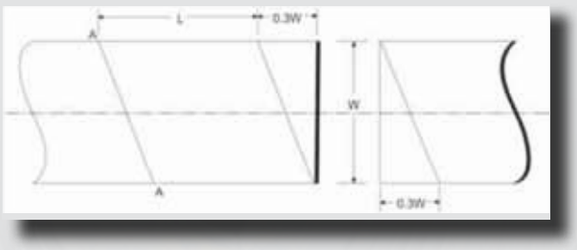
d) **Post cure cooling:** Cool down the splice to at least 70 °C before releasing the hydraulic pressure

6. Splicing procedure

6.1 Both belt ends are aligned roughly on the splice table.

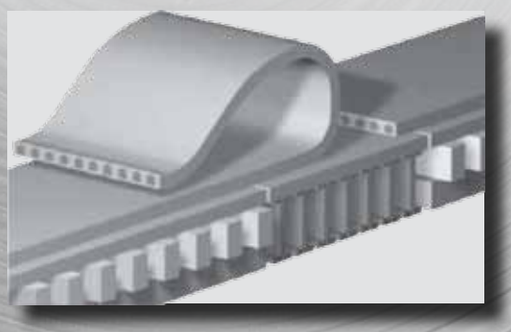


6.2 On both belt ends the complete splice dimensions are marked. In case of an oblique splice, the overlap length of the splice extends itself by about 0.3 × belt width.

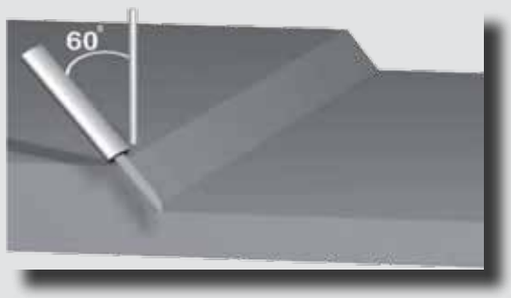


6.3 Within the splice length, the edge rubber is cut off up to the outer steel cords. This has to be done on both belt ends.

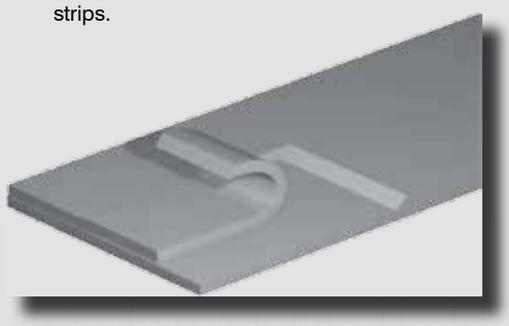
6.4 One belt end is flipped back onto the working table to allow parallel working.



6.5 Along the marking the belt cover lying on top is cut with a “Don Carlos”-knife under an angle of approx. 45 up to the steel cords.



6.6 The cover rubber is peeled off under tension up to the steel cords in approx. 500 mm wide strips.

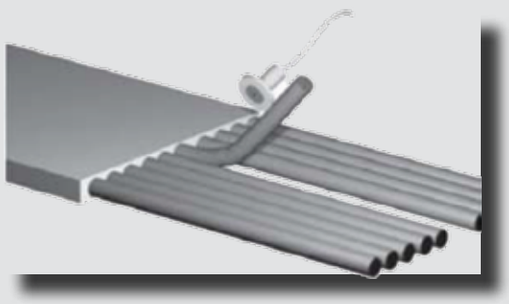


6.7 After folding the belt ends the belt cover plates lying below are peeled off in accordance with points 6.5 and 6.6.

6.8 At both belt ends the rubber between the steel cords is cut out up to the crosswise oblique cut (“outfingering” of the steel cords). The steel cord profile has to be cut in a way that the metallic surface is visible.

6.9 The cords are roughened with grooved out wire buff wheels.

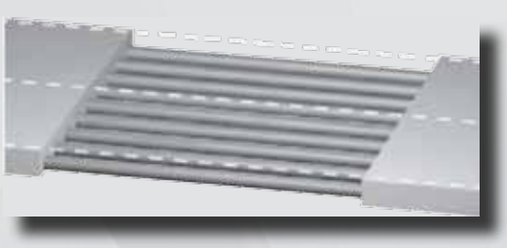
6.10 Behind the oblique cut, the exact belt center line is marked on both belt ends. Three dot marks (reference points) in steps of approx. 1.5m, which are measured on each belt end, are necessary and helpful to align the center line.



6.11 The belt ends must be aligned exactly, which includes the following processes:

- Observing and keeping the dictated splice length.
- Observing and keeping the minimum covering of the heating elements, both in width and length.
- The center line dots on both belt ends (reference points) are kept under true alignment.

  This is checked with a tensioned and chalked string line.



6.12 Both belt ends are clamped in a way that a slipping out of the true alignment is impossible.

6.13 The splice ramps lying above are roughened with rotating wire buff wheels. The arising rubber dust is removed with a soft brush.

6.14 The belt ends with the “outfingered” steel cords are folded back and the steel cords are arranged in a parallel way.

6.15 The splice ramps formerly lying below and now lying above are also roughened.

6.16 The splice ramps lying above and the “outfingered” steel cords of both belt ends are cleaned, specially from rubber dust and other impurities. Cleaning solvent is to be avoided.

6.17 The steel cords of both belt ends are coated with bonder rubber solution thinly. Before continuing with the processing at the cords it is essential that the solution has completely evaporated (checking with hand test).

6.18 The Phoenix cover tissue is laid out evenly on the lower heating elements. The tissue must cover the total heating element length with a surplus of 300 mm in longitudinal direction.

6.19 The cover plate, temporarily cut in width and length, is laid on the tissue.

6.20 The intermediate plate is laid on the roughly spread raw rubber cover plate. Afterwards the intermediate plate is pressed by applying a hand roller. If necessary the synthetic Phoenix reinforcement breaker is laid between the cover and the intermediate plate and pressed with a hand roller.

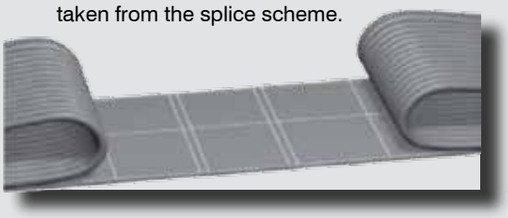
6.21 The ramps of the folded back belt ends lying above are thinly coated with the rubber solution.

6.22 The length and width of the prepared raw rubber package consisting of cover and intermediate plate (respectively cover plate, reinforcement breaker and intermediate plate) are cut in such a way that the ramp of the folded back belt end overlaps approx. 10 mm with the ramp of the raw rubber package. Also the distance between the ramps of both belt ends has to correspond to the splice length. Before turning over the belt ends the ramps of the raw rubber package are thinly coated with the bonder rubber solution.

6.23 The belt ends are turned over and the raw rubber package becomes a unit with the vulcanized ramps. This unit is realized by hitting this area with a hammer.

6.24 On both belt ends the steel cords are counted and the middle cord is determined on both ends.

6.25 On the surface of the raw rubber package all the support lines which are necessary for the splice manufacturing are marked with a chalk dusted string line. The dimensions of the support lines are taken from the splice scheme.

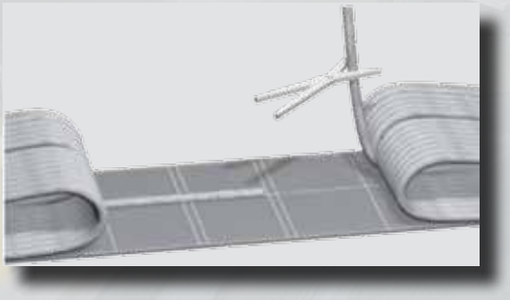


6.26 Marking of the exact belt center line is carried out on the raw rubber package using the dot marks (reference points) on both belt ends.

6.27 To keep the marked chalk lines visible they are dragged along with a pair of scissors or a knife before they are coated with the bonder rubber solution.

6.28 The surface of the raw rubber package is lightly freshened with the bonder rubber solution whereby the chalk lines are removed.

6.29 In accordance to the given splice scheme the steel cords are laid onto the raw rubber package, beginning with the middle cords (the intermediate plate is laying on the top) and pressed against each other. A special pair of cord scissors are used to cut the cords. Between the cords, a strip of intermediate rubber (called “noodle” or “intercord strip”) is put in.



6.30 Any still existing gaps between the cords (e.g. in the cord transition zone and the gaps between the cord tails) are filled out properly with intermediate rubber according to the cord height on the package.

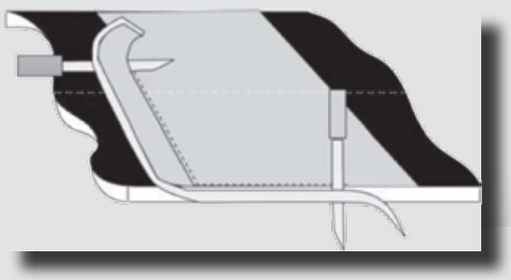
6.31 Next to the two edge cords an edge rubber strip of intermediate plate quality is inserted. The thickness of this rubber strip is in accordance to the cord height as well as the cord diameter. The edge rubber strips should be so wide that the splice width matches the belt width.

6.32 The entire splice area and both ramps are coated with the bonder rubber solution thinly. The bonder rubber solution has to be applied very thinly and it is necessary to wait until the solution has completely evaporated (checking with hand test).

6.33 The upper intermediate plate is laid on and pressed with a hand roller. If necessary the Phoenix reinforcement breaker is laid on the intermediate plate and hand roller is applied on it.

6.34 The upper raw rubber cover plate, temporarily cut in width and length, is laid on the package. After this procedure it is cut to the exact distance, skive to skive (with 10 mm overlapping). With hammer hits or a pressing roll, a unit within the skive areas is produced between the raw and the vulcanized rubber.

6.35 Both splice edges are marked with a chalk dusted string line. Surplus material i.e. rubber from the raw rubber package is cut off.



6.36 The edge bars corresponding to the belt thickness (bar thickness = belt thickness minus 2mm) enclose the splice package.

6.37 Using bar stretchers (e.g. made of chains) or screw platens the edge bars are prestressed outside the heating elements or within the bolts.

6.38 The splice alignment as well as the straightness is checked with a string line, which is laid over the middle dot marks. If necessary the splice is to be realigned.

6.39 The upper tissue is laid upon the raw rubber cover plate smoothly. The tissue must cover the total heating element length, each side more than about 300 mm. In cross direction the tissue passes straightaway to the edges. The heating tins, upper heating elements and press tie-bars are built up. Be alert that the outer pairs of press tie-bars are positioned outside of the splice zone and that they are spread regularly over the heating element area. This is required for an even pressure allocation. Afterwards the edge bars are stretched again and the bolts are put into the tiebars. The connection between the tie-bars allows the pressurization according to the mechanical principle of the press.

6.40 The necessary specific vulcanization pressure of min. 10 bar/145 psi is built up gradually along with rise in temperature of the heating platens. Full pressure is applied when heating platen temperature reaches 100°C. The curing time starts as soon as the temperature reaches 145°C. The vulcanization temperature has to be maintained for a certain period of time in accordance with the belt thickness (see table).

6.41 When the vulcanizing time is completed the heating elements are cooled down to 70°C.

6.42 Dismounting and taking down of the vulcanization equipment is then carried out.

Splicing Record

Assembling Site :

Conveyor System :

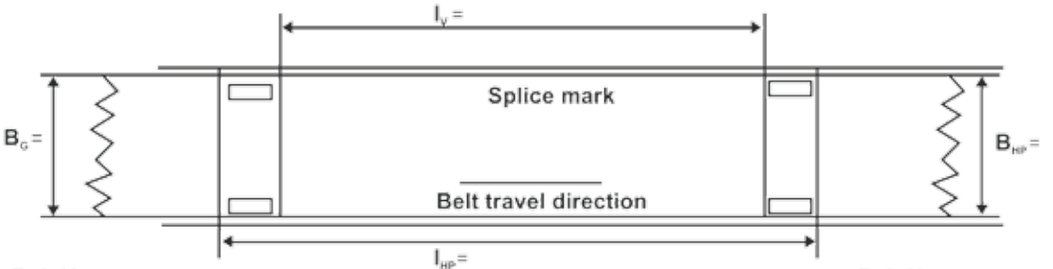
Belt Construction :

Date of Splice manufacture : _____ Belt thickness : _____

Current splice number : _____ Edge bar thickness : _____

Length of splice l_v : _____

Length of step l_s : _____



Belt No. ---------- Direction of Pulling - in ---------- Belt No.

Top Cover at splicing manufacture ☐ above/ ☐ below

Number of heating plates : _____

Number of tie-bars : _____

Heating time/temperature/pressure : _____

Temperature record during vulcanization (in min.) Top / Bottom

5	10	15	20	25	30	35	40	45	50
°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
55	60	65	70	75	80	85	90	95	100
°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
105	110	115	120	125	130	135	140	145	150
°C	°C	°C	°C	°C	°C	°C	°C	°C	°C

Events during splicing manufacture :

Assessment of splice and comments :

Shore Hardness :

Signatures :

1. After placement of cords

2. After completion of splice

Date : Exec. Firm PHX Others

Splicing of textile conveyor belt

1. Selection of technical parameters

1.1 Overlap splice

Overlap splices can be made for mono and two ply belts.

1.2 Step splice

Step splice is applicable for multiply belts.

1.3 Step direction

For conveyors where scrapers are fitted, the splice should be in such a way that it runs against conveying direction.

1.4 Step length

Selection of the step length can be done with the following table. If the belt rating can not be found in this table, the necessary splicing length can be calculated in the following way:

Calculate the breaking strength of one ply. For this value the necessary step length can be taken from the table. This length is multiplied with the possible number of steps (n-1) which is the splice length.

Example: One ply of a 1000/3 has a breaking strength of approx. 333 N/mm (1000:3=333.3). The step length for this value is 300 mm, therefore the splice length is 300 mm x (3-1) = 600mm.

1.5 Additional length

The additional length of belting required for splicing can be calculated from following formula.

$$\text{Additional Length} = 0.3w + l \cdot (N-1) + 50\text{mm}$$

where, w = Belt width in mm.
N = No. of piles.
l = Step length in mm.

For the ramp strip, a surplus of 50 mm as above must be taken into account for the splice length.

1.6 Specific pressure

Recommended specific pressure during Hot splicing of textile conveyor belt is approximately 8 bar.

1.7 Vulcanizing temperature

Vulcanising temperature should be controlled within 150°C ± 5°C.

Selection of step length DIN 22102 - Part 3

Belt rating	Breaking stress of one ply (N/mm)	Step length l_v (mm)	Splice length l_s (mm)	Number of steps
315/3	80-100	150	300	2
400/3	125-160	200	400	2
500/3			400	2
630/4			600	3
800/4	200-250	250	750	3
1000/5			1000	4
1250/5			1000	4
1600/5	315-400	300	1200	4
2000/5				
2500/5	500-630	350	1400	4
3150/5			1400	4

1.8 Valcanising time

Belt thickness (mm)	Time (min.)	Cooling up to (°C)
Up to 10	25	70
Over 10 up to 12	30	
Over 12 up to 15	36	
Over 15 up to 17	42	
Over 17 up to 20	48	
Over 20 up to 22	53	
Over 22 up to 25	60	
Over 25 up to 30	70	

1.9 Magma plus and Magma

Belt thickness (mm)	Time (min.)	Cooling up to (°C)
Super grade belt minimum vulcanising time	60	70

2. Splicing material (for one kit)

2.1 Cover rubber

Grade of belting	Dimension	Quantity
General purpose & HR (except Magma plus)	1.6 mm x 175 mm x 4.5 m	1.5 kg
FR	1.6 mm x 175 mm x 4.5 m	1.5 kg

2.2 Intermediate rubber

Grade of belting	Dimension	Quantity
General purpose & HR (except Magma Plus)	0.8 mm x 175 mm x 8 m	1.5 kg
FR	0.8 mm x 175 mm x 8 m	1.5 kg

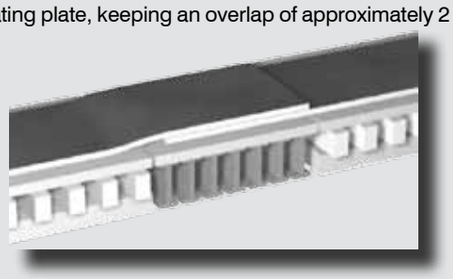
2.3 Solution

Grade of belting	Quantity
General purpose, HR (except Magma Plus)	2 lt.
FR	2 lt.

Remarks: Two intermediate rubber kits may be required for belt width above 1200 mm

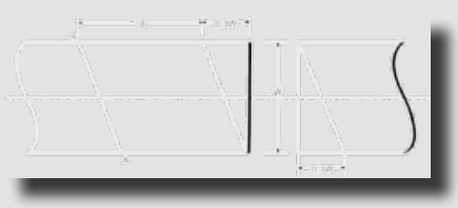
3. Splicing the belt

1. Pull both ends of the conveyor belt on the bottom heating plate, keeping an overlap of approximately 2 m.

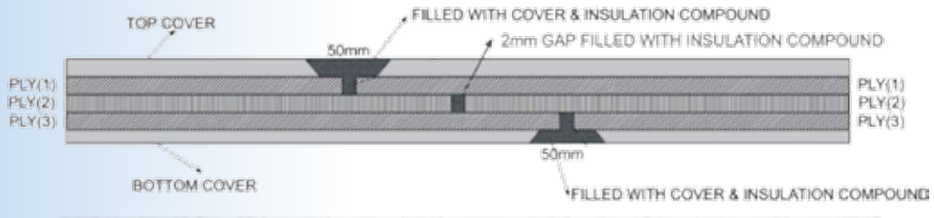


2. Align the conveyor belts centrally and arrest the belt ends near the working platforms, so that it cannot roll back.
3. Draw the centerline extending up to 2-3 m on each belt end.

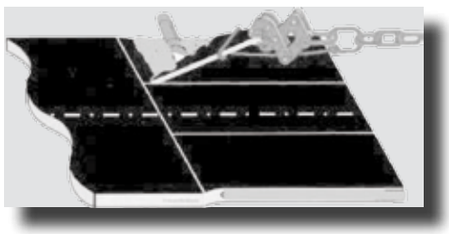
4. Draw a right angle at the belt end with respect to the centerline.
5. Mark the bias length at one edge and draw the bias angle from the other edge.



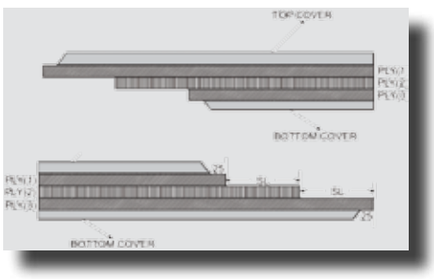
6. Cut the conveyor belt along the bias angle.
7. Fold back the belt and mark the bottom cover to be stripped off.
8. Pull off the strip from the bottom cover. Buff the cut edge of the cover gently with a wire brush.
9. Fold back the belt again and mark the splice length (l_v) at both edges of the conveyor belt.
10. Join these two marks on the top cover and draw a line parallel to this at a distance of 25 mm.



11. Remove the 25 mm cover strip from this area.
12. Mark the step length (ls) on both edges. Join them.
13. Cut the first fabric ply along with the cover in 500 mm (approx.) wide longitudinal strips without damaging the second fabric ply.
14. Remove the cover and ply by pulling with a pulling lifting machine (hook chook) in 500 mm (approx.) wide longitudinal strips.
15. Mark the next fabric step. Cut it longitudinally and remove the strips by pulling with a hook chook.



16. Prepare the subsequent fabric steps in the same way.
17. Remove the excess rubber from the exposed surface by means of a prodder.
18. Clean the rubber dust with a soft brush. Do not use any solvent.
19. Prepare the other end of the conveyor belt correspondingly.



4. Matching the splice

1. Place two ends of the splice, one over the other and check the alignment and accuracy of splice dimensions.
2. Apply two coats of splicing cement on the prepared surface, after cleaning them with a soft brush. The second coat should be applied after the first coat is completely dried.
3. Apply 0.8 mm thick intermediate rubber on the coated surface. Remove the foil.
4. Put two additional layers of intermediate rubber to build up the edges.
5. Match the two ends of the belt accurately and ensure that each fabric step butt precisely.
6. Stitch down firmly with a hand roller starting from the center towards the edge of the conveyor belt.
7. Apply one coat of spicing cement on the ramp.
8. Mount the 50 mm wide ramp strip.

5. Vulcanization of the splice

5.1 Check the alignment of bottom traverses and heating platens (which constitute the work-bench).

5.2 If more than one pair of platens is used, place a metal sheet between the bottom paltens and the conveyor belts.

5.3 Align the splice once more with respect to the press platens.

5.4 Place the edge bar at both edges of the splice, which must be approximately 1-2- mm thinner than the belt.

5.5 Ensure proper contact between the belt and the edge bar by carpenter's clamp or through wedges.

5.6 Place metal sheet followed by the top heating platen on the belt. Set down the top traverses on them and join firmly to the bottom traverses by clamping bolts.

5.7 Apply pressure gradually and switch on the heating platens.

5.8 Apply full pressure when the platen temperature reaches 100 °C.

5.9 Switch off the heating platens when the temperature reached 145 °C. If the temperature drops down to 143 °C, switch it once again. Curing time starts as soon as the temperature reaches 142 °C.

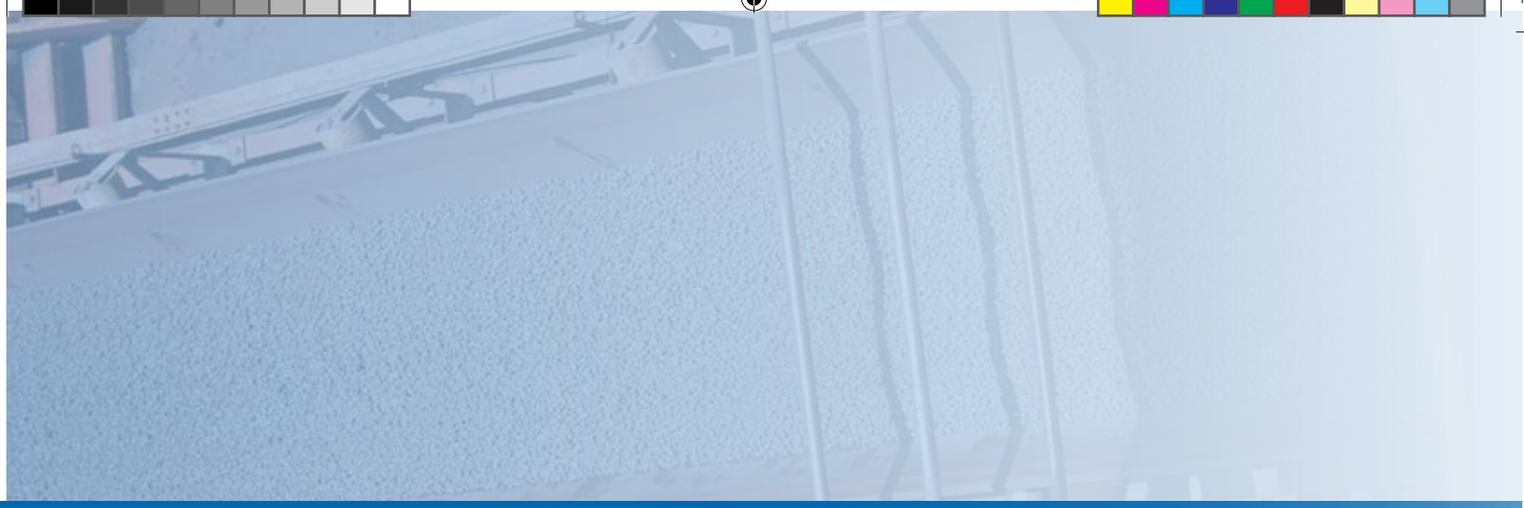
5.10 Check the hydraulic pressure continuously during the curing period.

5.11 After full time cure, cool down the press to 70 °C.

5.12 Dismount the top platen. Check the splice visually and trim the overflow in the ramp and edge area. Put the belt into operation.

6. Records

Maintain records of vulcanization in the enclosed splicing record form.



Maintenance

When installing conveyors, primary importance should be attached to their largely maintenance-free running. The following points are to be followed to maintain trouble free running of conveyor belts.

a) Responsible personnel should monitor the belt and the conveyor systems on a regular basis. The belt should be specially checked for possible damages to the covers, edges or carcass.

b) The return run should be examined at regular intervals in order to detect and remove sources of troubles on time.

c) To avoid excessive wear, the scrapers should not exert too much pressure on the belt.

d) All idlers, drive and return pulleys as well as the belt should move freely. Jamming and worn out idlers must be replaced by spare idlers promptly.

e) The belt tension should be checked at regular intervals. “Slipping” of the belt round the drive pulley/pulleys and too much belt sag between the idlers indicate a lack of belt tension. Especially in case of take up stations with fixed take up pulleys, the take up pulley has to be adjusted. If a new conveyor belt is employed, the belt tension has to be examined even after a considerable period of operation.

f) The conveyed material should be loaded centrally on to the belt at a velocity ideally matching that of the belt. Depositing the material from one side will cause of track movement of the belt and will thus lead to damaging the conveyor belt. At the discharge zone, a free trajectory is recommended.

g) Heaped up debris can result in very extensive wear of the belt. Bulky materials, which are prevented from leaving the belt may, in extreme cases, cause belt slitting.

h) In case of abrasive materials (large), screening them inside the chute may provide bed of small lumps.

i) Spacing of impact idlers should be such that most of the material fall on impact idler and not between them.

j) Slope of chute should be such that material cannot fall directly on to the belt under gravity. In ideal case, material, at the time of touching the belt, has the same velocity as that of the belt.

k) The skirt board should have a clearance at an angle upward the belt travel.

l) Ensure that delivery chute is not choked.

m) Emergency stops of the conveyor should be checked for their proper functioning at regular intervals when carrying out work on the conveyor. Make sure that all starters are protected adequately.

n) When carrying out lubrication as well as during operations, be careful not to bring oil or grease in contact with the belt, as usually the rubber cover has not been designed to cope with this kind of stress and could therefore get damaged.

o) Cleanliness especially in the conveyor area is of utmost importance. Any sticky material being conveyed may adhere after discharging which may result in:
   i) Excessive wear
   ii) Build-up of materials
   iii) Misalignment of belt

p) The material should be cleaned before it reaches snub pulley or return idler. Cleaning can be done by,
   i) Single or multiple scraper
   ii) Rotary belt cleaner
   iii) Water spray and wipers

q) It must be ensured that the material does not get entrapped between the belt and the pulley through the return run. This can be achieved by fitting a V-type return belt scraper.

Common problems in conveyor belts and their causes

	Problem	Causes	Corrective actions
1.	Faster wear of carry cover	a) Scrapper/skirt rubber is hardly pressed on belt b) Material deposition on return idlers c) Return belt rubbing with deck plate and material d) Ceased idler on return run e) Material entrapped between skirt rubber and belt	a) Position the scrapper correctly. Do not use old belt as scrapper. Reduce the length of skirt rubber. b) Use cleaning device. Use some disc type return idlers. c) Maintain the clearance of skit board at an angle upward the belt travel
2.	Faster wear of pulley cover	a) Ceased idlers on top b) Belt slippage on drive pulley c) Material slippage between belt and pulley	a) Improve maintenance and lubrication b) Increase belt tension. Lag driver pulley. Increase arc of contact. c) Improve loading conditions. Install deck plate between top and bottom run. Install plows or scrapper before the tail pulley.
3.	Opening up of the joint	a) Cover channnel if the splice area is hitting the scraper/skirt board	a) Change the direction of the splice in such a way that it runs against the conveying direction.
4.	Transverse break in the carcass	a) Entrapment of material between pulley and belt.	a) See corrective action 2(c)
5.	Excessive edge wear	a) The belt is running off center and rubbing with conveyor frame on the return side.	a) Realign the idlers. Use aligning idlers.
6.	Gouging of cover	a) Entrapment of material between skirt and belt or scrapper and belt. b) Big lumps are falling from a great height.	a) See corrective action 1(c) b) Install impact idlers. c) Reduce the gap between impact idlers. d) Redesign the chute to avoid direct fall on the conveyor belt.
7.	Ply seperation at the edge	a) Belt is running off center and rubbing with conveyor frame on the return side.	a) See corrective action 5(a) b) Use moulded edge belt.
8.	Small cuts in the cover throughout the entire length	a) Severe impact damage b) Impact idlers are missing	a) See corrective action 6(b) and 6(c)
9.	Belt catches fire	a) Generation of spark or flame due to jamming of belt. b) Belt has come in contact with flame by some other means.	a) Use fire reterdant belt
10.	Reverse troughing of belt	a) Material being carried contains some oil	a) Use oil resistant belt
11.	Heat cracks on carry cover	a) Material temperature is too high	a) Use heat resistant belt Magmas

Remarks: Corrective action is obvious, which requires elimination of the cause of the problem.

Repair of steel cord conveyor belts

Conveyor belts play a very important role in bulk conveying system. It is of utmost importance to ensure the proper use of the conveyor belt on a well-maintained conveyor. However, if any damage occurs on the conveyor belt, the same should be attended immediately and repair work should be undertaken as soon as possible. Repairs should be carried with hot vulcanization method, wherever possible.

Typical damages

The following types of damages are generally observed in steel cord belts:

a) Cover damage caused by skirt boards or mechanical influence.

b) Edge damage due to off center running/rubbing with frames.

c) Damage of steel cable by penetration.

d) Longitudinal rip

Method of repair

i) Cover damage

a) Mark the cover keeping a distance of approximately 30 mm from the damage. The shape of the repair should preferably be rhombic.

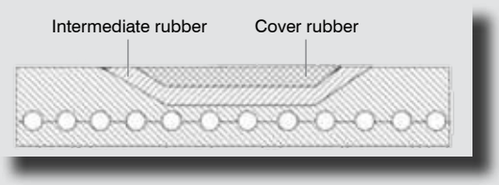
b) Cut out the cover rubber at an angle of about 45° to the belt surface.

c) Grind the area including the ramp with a rotating wire brush.

d) Apply soft brush and then put thin coat of repair cement. Dry it.

e) Apply 2 mm thick intermediate layer, followed by cover rubber.

f) Vulcanise and cool down to 70 °C

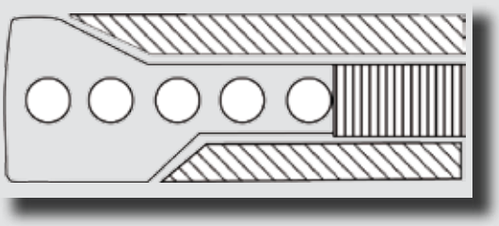


g) For vulcanising conditions see relevant pages of splicing of steel cord conveyor belt.

ii) Edge damage

a) Please see the sketch.

b) Edge building is necessary on this case. Principle of repair is similar to that of cover damage.



iii) Damage of steel cable

Less than 150 mm

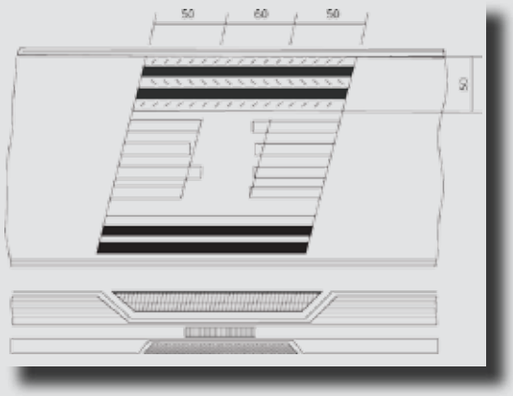
a) If the extent of damage is small, i.e. less than 150 mm width, replacement of cord is not necessary.

b) Broken cords are cleaned from soil, rust, etc.

c) Apply repair cement.

d) Void space is filled with intermediate rubber strips.

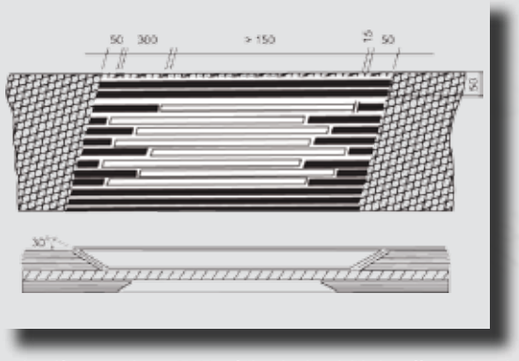
e) Common principle of repair is followed for other steps.



Above 150 mm

a) cut the cords as shown in sketch.

b) Replace with new cords/rubberized cord of same diameter from other belt. In case of rubberized cords buff them with rotating wire brush.



Remarks: If more than 25% of the belt width is affected, take new slice.

c) Follow the common principles of steel cord conveyor belt repair.

iv) Longitudinal rip

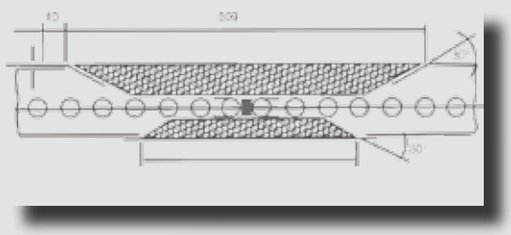
a) Skive the cover rubber on top and bottom side as shown in sketch.

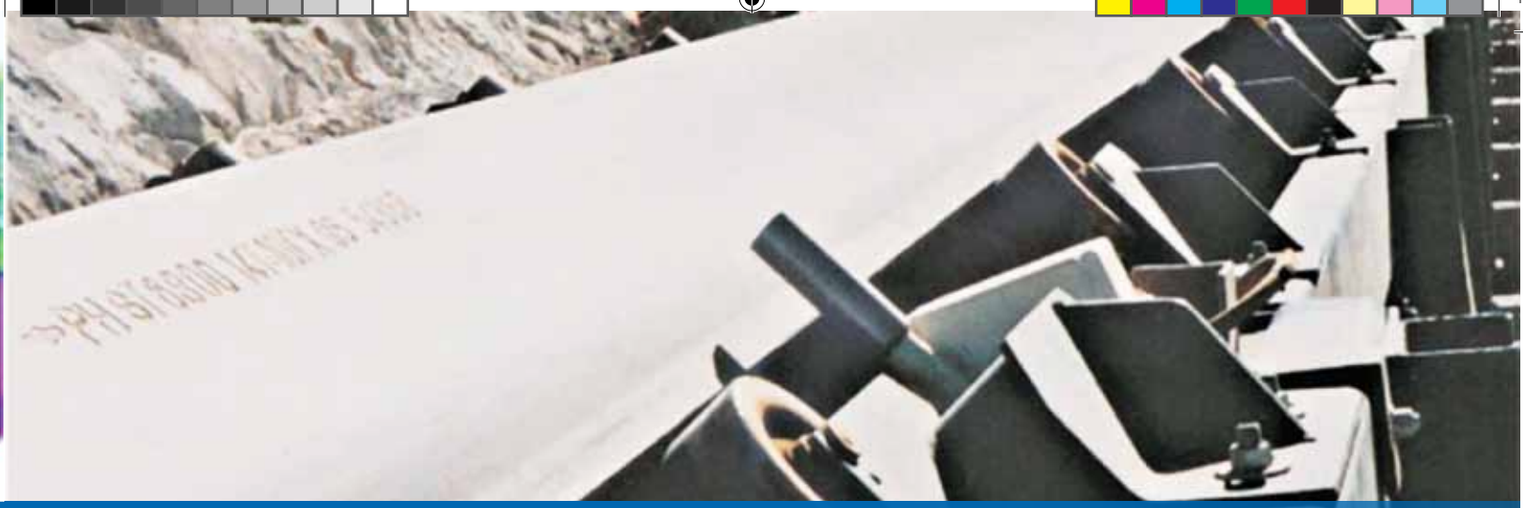
b) Clean and apply repair cement.

c) Put 2 mm thick intermediate rubber between two separated cords.

d) Hold the two separated parts together with a carpenter's clamp.

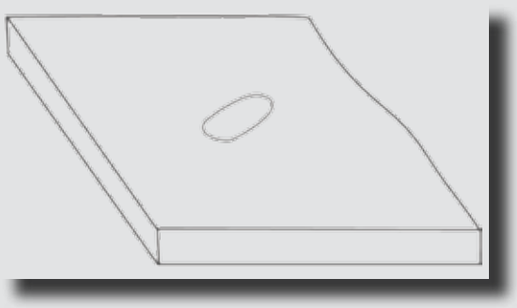
e) Follow common principles of steel cord belt repair process.



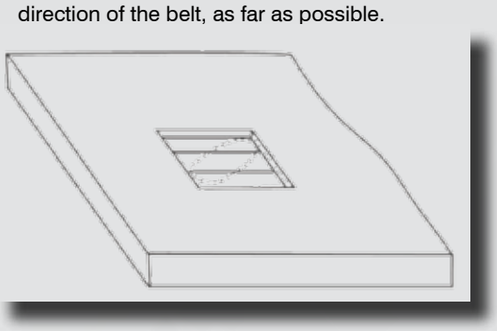


Repairing textile conveyor belts

a) Mark the area surrounding the damage.



b) Cut out the cover rubber up to the ply level with a rubber-cutting knife, taking care not to damage the ply. The shape of the area will depend on the extent of damage, but it is recommended that no line of the cut should be in perpendicular to the longitudinal direction of the belt, as far as possible.



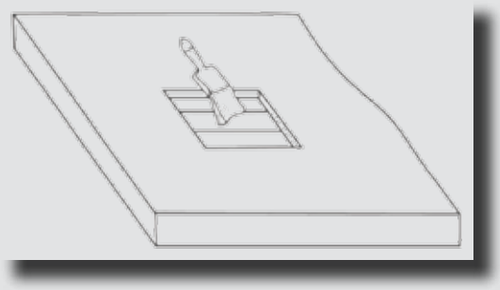
Ensure that no sharp corners are formed as a result of cutting the cover. Make sure that there is no dirt, grease oil or moisture in the damaged surface.

c) Roughen the exposed carcass surface and cut edge by means of a wire brush.

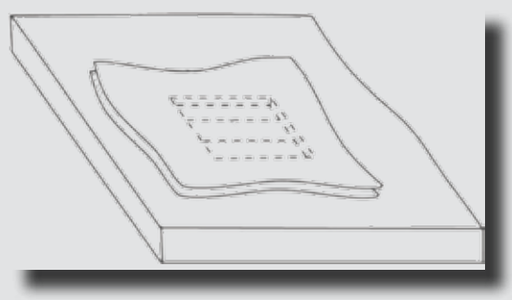
d) Clean the area thoroughly.

Conditions for vulcanizing			
Thickness of cover	**Pressure (bar)**	**Vulcanizing time (min)**	**Vulcanizing temp. (°C)**
≤ 6 mm	8	30	150
6 mm	8	40	150

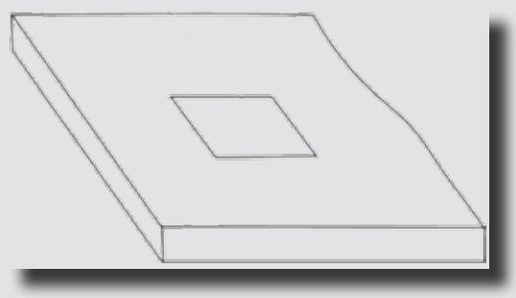
e) Apply a thin coat of rubber cement on the prepared surface. Allow it to dry.



f) Apply 0.8 mm thick intermediate rubber. Stitch it well.



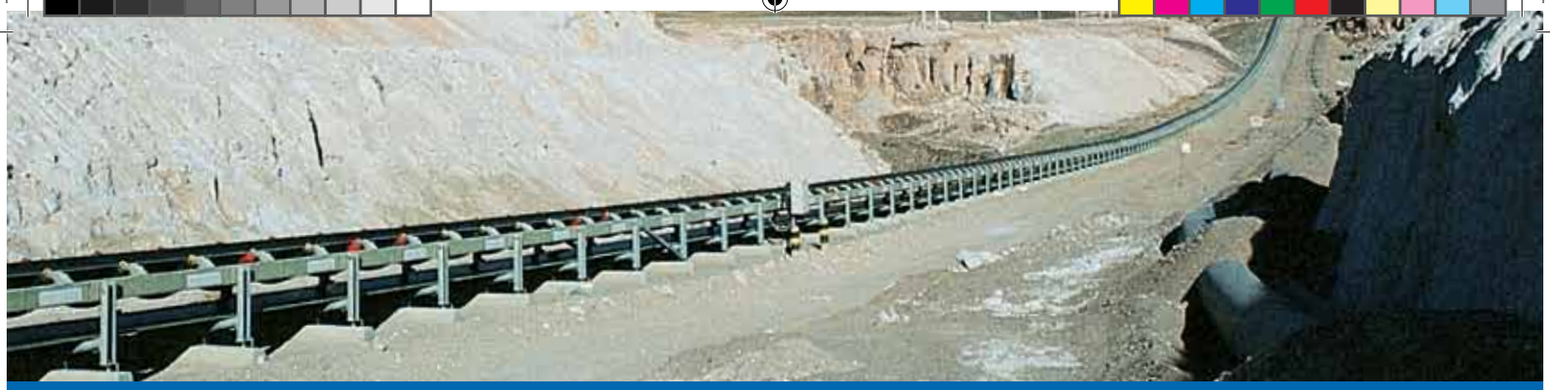
g) Apply cover rubber of required thickness. Stitch it well.



h) Trim off the excess rubber.

i) Vulcanize the repaired area in a vulcanizing press as per the condition given in the adjacent table.

j) Cool down to 70 °C, before releasing the pressure.



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We believe in excellence in the management of environment, right from concept to commissioning of belt.

We are proud winner of Environment Excellence Award instituted by ICC & WBPCB and also winner of universally acknowledged Greentech Award for environmental excellence.

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