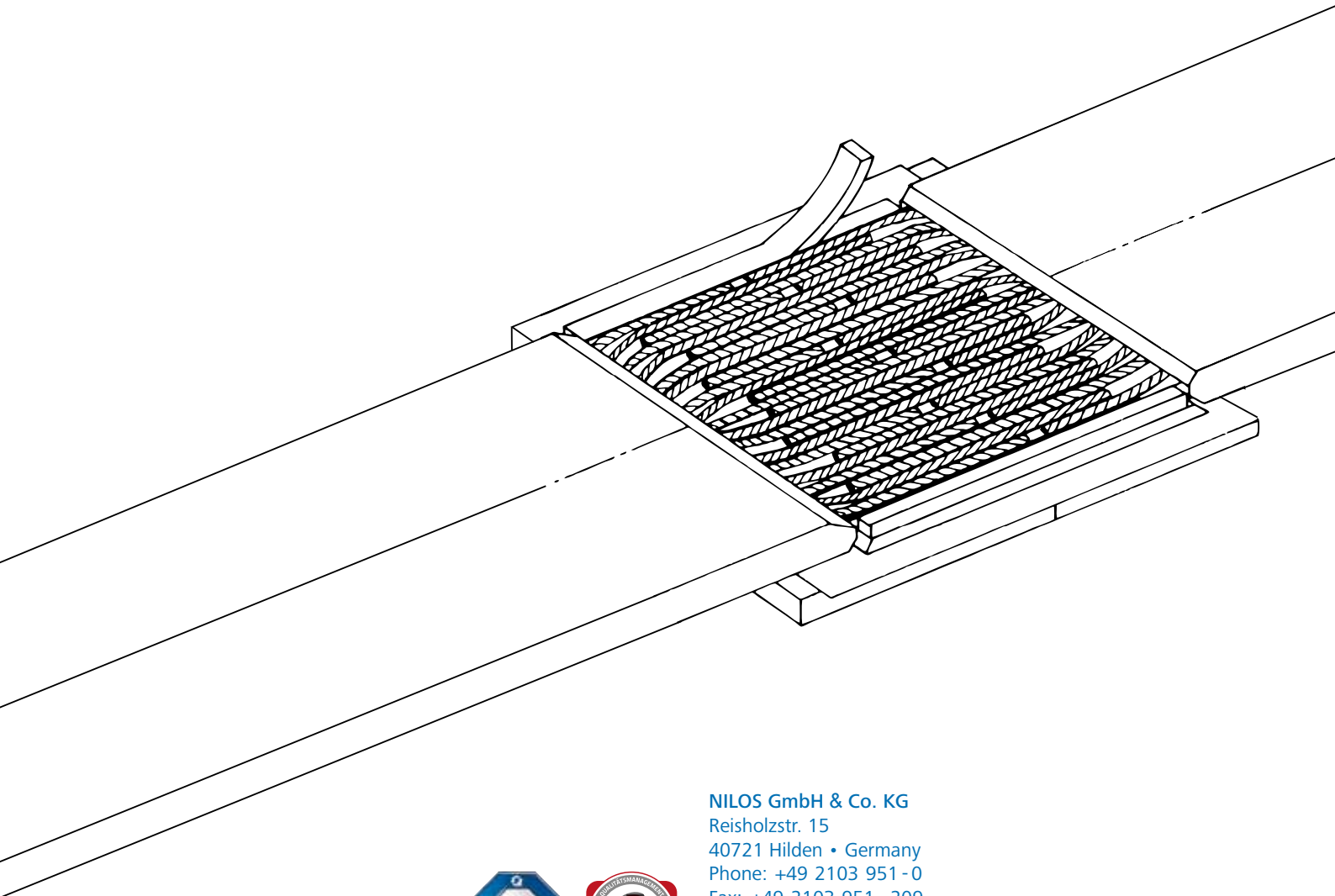




NILOS

Instructions for splicing steel cord belts



NILOS GmbH & Co. KG
Reisholzstr. 15
40721 Hilden • Germany
Phone: +49 2103 951 - 0
Fax: +49 2103 951 - 209
info@nilos.de
www.nilos.de



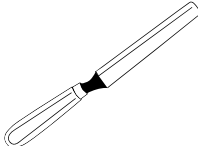
Contents

4 - 5	Material requirements and legend
6	Safety instructions
7	1. Preparations
8 - 9	2. Preparing the workstation
	3. Splicing
10	3.1 Requirements and working conditions
10	3.2 Splicing guidelines
11	3.3 Aligning and bracing the belt ends
11	3.4 Cutting the cover plates
12	3.5 Exposing the steel cords
12	3.6 Splitting the cords
13	3.7 Stripping the steel cords using a cord stripper
13	3.8 Splicing preparation
14	3.9 Setting up the bottom cover plate
15	3.10 Preparing the vulcanisation solution
15	3.11 Coating the splice
16	3.12 Laying the cords
17	3.13 Closing the press
17	3.14 Cooling down the splice
18	3.15 Dismantling the press and final steps
18	3.16 Splicing report
19 - 20	4. Splicing report

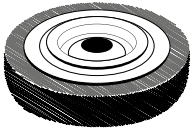
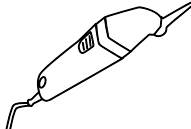
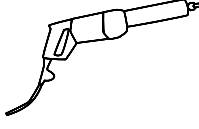
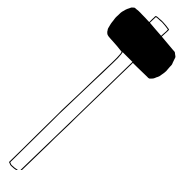
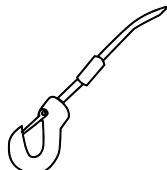

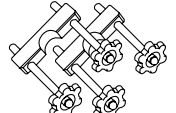
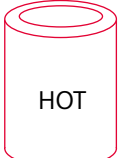
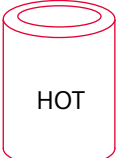
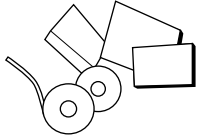
Instructions for splicing steel cord belts




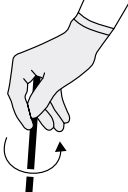

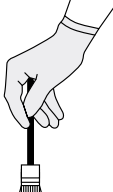
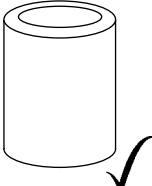
Material requirements and legend

Material	Item no.	Material	Item no.	Material	Item no.
	K 0605 Cobbler's knife		K 0604 Saddler knife		K 0482 Stop bracket
	K 0661 + K 0661A Chalked string with powder		K 0745 Pliers		K 0772 / 0638 Wire cable scissors
	K 0646 Wire grip		K 0609 Angled blade		K 0634 Whetstone with wooden handle
	K 0792-A / K 0731 Rotary sander for processing rubber + fibre discs		K 0624 Folding rule		K 0626 Brush, size 12
	H 0612 Knurled roller		K 0615 Flat roller		K 0613 Piercing roller
	K 0627 Hand brush		K 0620 Rubber scissors		K 0654 Screw clamp
	K 0658 Safety goggles		K 0662 Protective gloves		K 0740 + k 0748 Sanding machine, flexible shaft
	H 0317-C Silicon paper (disposable)		H 0316 Shirting roll (multiple use)		H 0318 Printing blanket (multiple use)

Instructions for splicing steel cord belts

Material	Item no.	Material	Item no.	Material	Item no.
	K 0747 / 62 / 61 Wheel wire brush		K 0781 Easy cut		K 0669 Hand extruder
	K 0628 Rubber hammer		E 0190 / 0190-1 Cable pull electr./mech.		Cord stripper system
	J 0600 Edge bar tensioner		H 0312 STG-B, 650 g tin vulcanisation solution benzine based		H 0313 STG-FW, 1000 g tin vulcanisation solution dichlormethane based
	On request Splicing kits (Cover plate core plate STG strips)				

Legend

	Processing time		Stir		Test on back of hand
	Brush on thinly and evenly		Ready for processing		

Instructions for splicing steel cord belts



Emergency information
Phone: +49 173 5306827



Poison Control Center Berlin
Phone: +49 30 19240

Vulcanisation solution STG-B

Safety instructions:

P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking. **P243:** Take precautionary measures against static discharge. **P261:** Avoid breathing mist/vapours/spray. **P280:** Wear protective gloves/protective clothing/eye protection/face protection. **P273:** Avoid release to the environment. **P301+P310:** IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. **P303+P361+P353:** IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. **P305+P351+P338:** IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. **P304+P340:** IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. **P331:** Do NOT induce vomiting.

Danger instructions:

H225: Highly flammable liquid and vapour. **H315:** Causes skin irritation. **H336:** May cause drowsiness or dizziness. **H304:** May be fatal if swallowed and enters airways. **H411:** Toxic to aquatic life with long lasting effects.



Danger



Vulcanisation solution STG-FW

Safety instructions:

P101: If medical advice is needed, have product container or label at hand. **P102:** Keep out of reach of children. **P261:** Avoid breathing dust/fume/gas/mist/vapours/spray. **P280:** Wear protective gloves/protective clothing/eye protection/face protection. **P273:** Avoid release to the environment. **P302+P352:** IF ON SKIN: Wash with plenty of soap and water. **P305+P351+P338:** IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. **P308+P313:** IF exposed or concerned: Get medical advice/attention. **P391:** Collect spillage. **P405:** Store locked up.

Danger instructions:

H302+H312+H332: Harmful if swallowed, in contact with skin, if inhaled. **H 315:** Skin irritation possible. **H317:** May cause an allergic skin reaction. **H 319:** Provoke strong irritation of eyes. **H336:** Can bring sleepiness and numbness. **H341:** Suspected of causing genetic defects. **H350:** May cause cancer. **H373:** May cause damage to organs (or state all organs affected, if known) through prolonged or repeated exposure. **H412:** Harmful to aquatic life with long lasting effects.



Danger





1. Preparations

1.1 Belt transport

For transportation, conveyer belts are usually wound onto wooden cores or, in the case of higher loads, steel cores. (Steel cores are however only used in the case of excess stress and multiple-use.) In order to protect the belt edges and cover plates from excessive sun exposure, you can wrap up the entire belt coil in a film that will protect the belt from transport damage at the same time. The belts are often dispatched on drums with flanged pulleys. This applies specifically to dispatches overseas, as special protection and added security are often desired for the belt edges in transport coils. The belt is then secured against slipping out of place too.

1.2 Loading and unloading

Avoid damaging the belt edges and cover plates when loading and unloading using forklifts, cranes, fixings etc. Remember before unloading that the belt must be rolled counter to the winding directions. This saves you from having to reposition the belt. If the belt is especially heavy, use distancing beams between the cords and place old belt material or something similar underneath the coil if the surface is sharp-edged.

1.3 Storage

In order to prevent premature ageing, the formation of cracks, hardening and swelling, protect the belt from the following during storage:

1. heat and sun exposure
2. mechanical damage
3. contact with chemical, grease or oil
4. moisture (especially if storing outdoors)

Please comply with ISO 5285 when it comes to storage and handling.

1.4 Planning the vulcanisation

Set out the work sequence in a preliminary

assembly talk:

1. What personnel do I require?
2. How will the areas of responsibility be divided up?
3. What is the timeline for the assembly process?
4. What auxiliary equipment is required?
5. Where will the belt reel be jacked up?
6. Where will the belt be fed in? (Exact position)
7. Where will the vulcanisation area be set up?
8. How to power supply?
9. Is full occupational safety guaranteed?

1.5 Jacking up the belt coil

Belt reels and winding shafts should be selected according to the belt weights and coil diameters. Determine the position of the belt reel depending on the feed-in method. Mount the belt coil onto the belt reel, ensuring that the running side is facing the conveyer rollers of the upper run when the belt is being fed in.

1.6 Feeding in the belt

To prevent the belt from bumping against anything while being fed in, cut back the belt edges at the start of the belt. Tension straps should be used to fasten the pull cord in the case of heavy belts in particular. Lightweight and short belts can be fed in using hand winches. Otherwise motorised winches or tractor units such as caterpillars or wheel loaders should be used.

Safety instructions for falling or rising system sections:

Install a retaining device. If the brakes should fail or the cord should rupture during the feed-in process, significant damage and safety risks could occur. Therefore use a belt clamp system.

Instructions for splicing steel cord belts

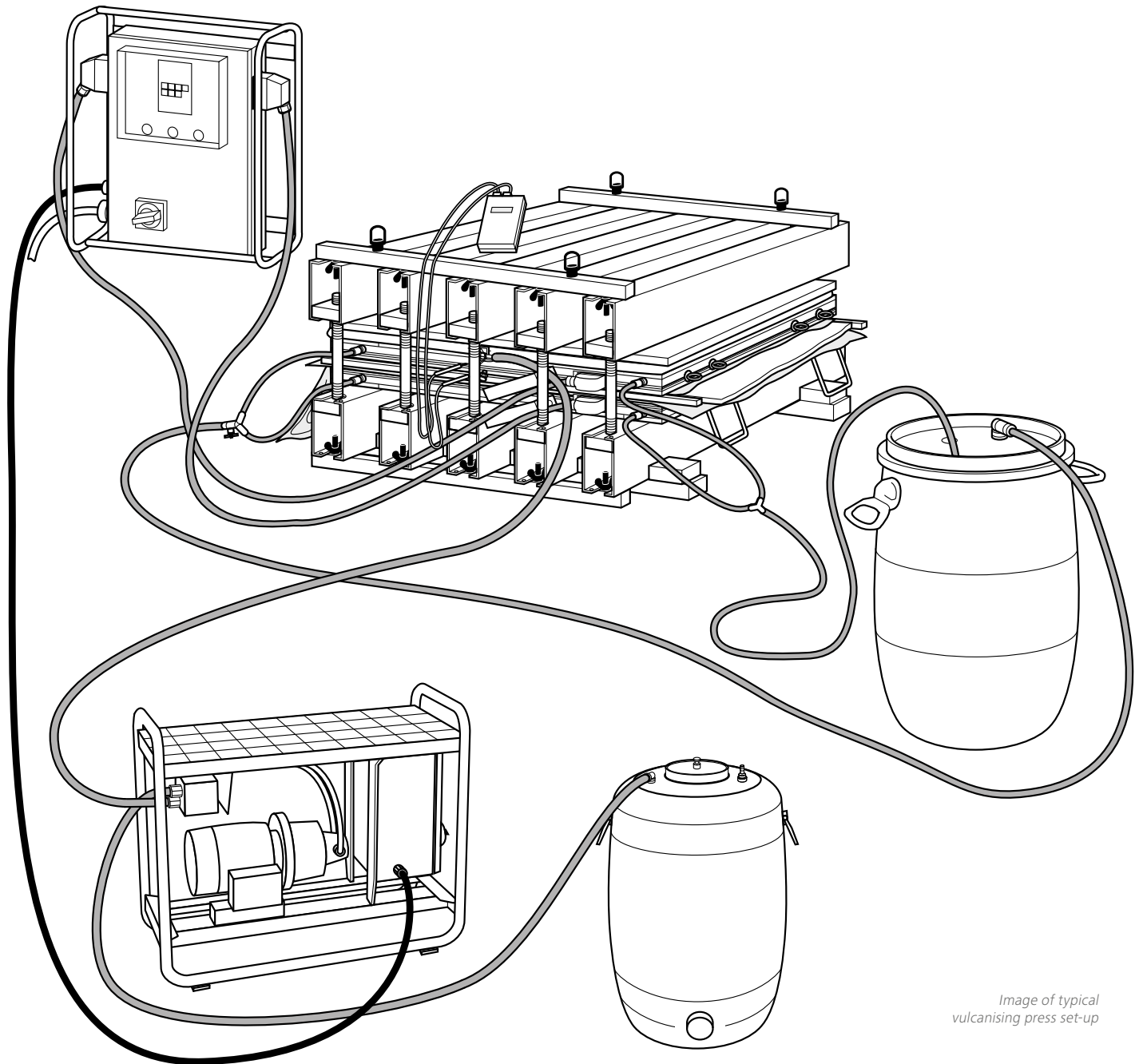


Image of typical vulcanising press set-up

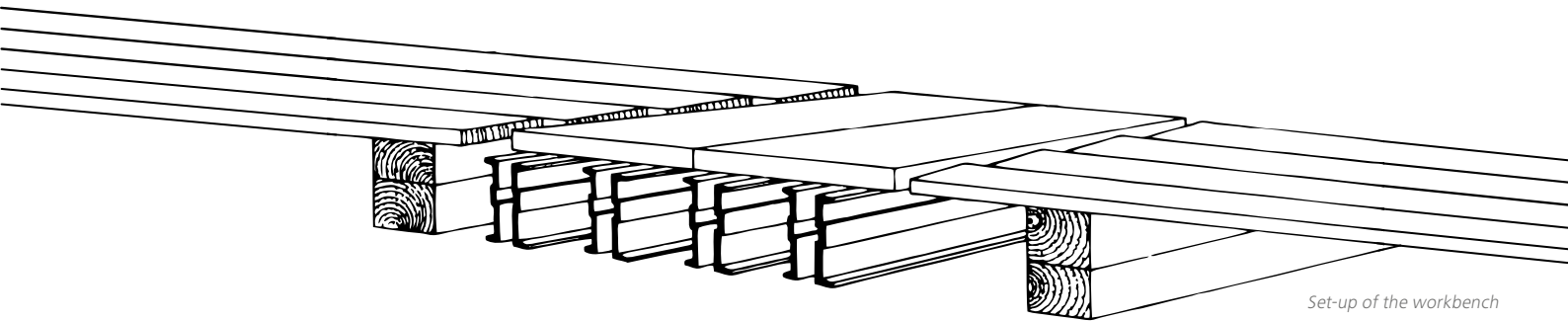
2. Preparing the workstation

2.1 The vulcanisation area

When deciding on your vulcanisation point, ensure that there is enough space, taking into consideration the size of the belt, even ground and adequate protection against weather conditions. Ensure there is sufficient space for a tent if need be.

2.2 Setting up the workbench

The materials needed to erect a workbench include squared timber and planks. Set up your workbenches in front of and behind the lower part of the vulcanising press; this is the only way the belt heads can be properly worked on and aligned. The workbenches must be the same height as the sub-structure of your vulcanising press. The total length of the workbenches must be at least triple that of the splice length.



Set-up of the workbench

2.3 Setting up the press

Observe the respective manufacturer's instructions when setting up the press.

The heating surfaces can be built from several heating surfaces positioned next to each other lengthwise or crosswise. You can use right angle splicing or rhombic splicing depending on the press you have at your disposal. The heating plates must protrude a minimum of 200 mm lengthwise over the splice on each side so that the belt ends to be linked can be fixed during the cooling down process. The heating plates must each protrude a minimum of 75 mm over the sides of the splice.

When lateral interception are min. 60 mm wide edge rails appear. Make sure that the edge rails 1 - 2 mm thinner than the belt to be vulcanized. Fix the edge rails with edge rail clamps.

2 - 3 mm Heating sheets are laid between the splice and heating plate. The sheets should be measured such that they fit the heating surface at the sides and protrude by approx. 100 mm lengthwise on each side. Heating plate joints and sheet joints must not lie on top of one another. The press beams should be evenly distributed across the heating surface. Heating plate joints must be positioned directly on top of the beam surface area.

Instructions for splicing steel cord belts

3. Splicing

3.1 Requirements and working conditions

Observe the safety regulations and hazard warnings for the tools and materials. Wear the prescribed personal protective equipment. Keep your workstation clean before starting and during the work. Protect the workplace and the materials used against environmental influences (rain, direct sun exposure, heat, the cold, strong wind, dust etc.). A tent or an enclosure for the working area may be necessary. Avoid the formation of condensation. Clean and dry the belt ends before starting the connecting work and use calibrated measuring tools. You must note the storage and use-by date of the connection materials.

3.2 Splicing guidelines

Please observe the respective instructions of the belt manufacturer. Steel cord belts are usually joined using a so-called stepped splice.

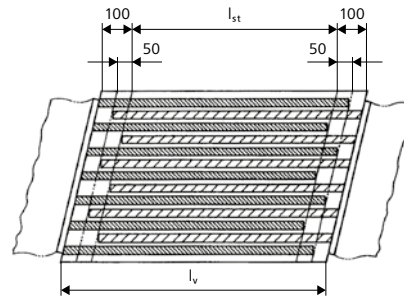
We recommend applying the following standards:

- DIN 22129 Section 4
- DIN 22131 Section 4
- DIN EN ISO 15263-4

DIN belt type	Step number	Minimum step length ¹	Splice length ¹	STG rubber strips (W x H ¹)
ST 1.000 ²				2 x 6
ST 1.250 ²	1	600	800	2 x 7
ST 1.600 ²				2 x 7
ST 2.000	2	500	1,150	2.5 x 7
ST 2.500				2.5 x 10
ST 3.150				2 x 10
ST 3.500	3	650	2,450	2.5 x 11
ST 4.000				2.5 x 11
ST 4.500				2 x 13
ST 5.000	4	900	4,250	2.5 x 13
ST 5.400				1,000

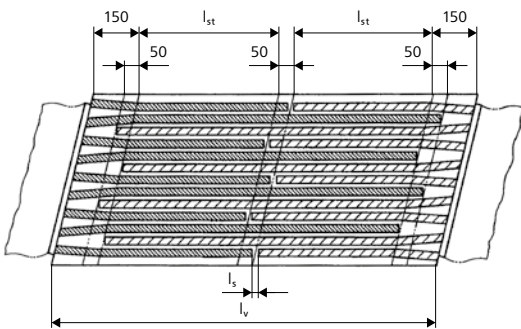
1-step splices¹

Refer to belt types ST 1000 to ST 1600



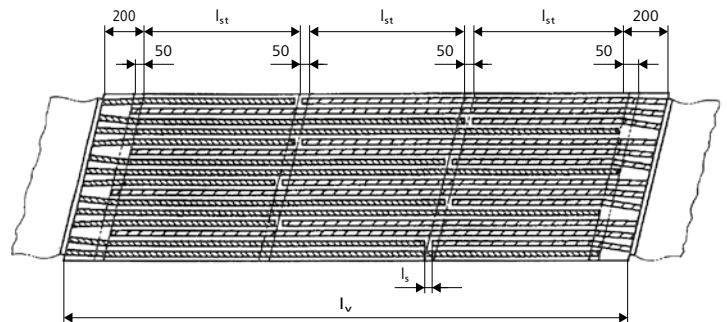
2-step splices¹

Refer to belt types ST 2000 to ST 3150



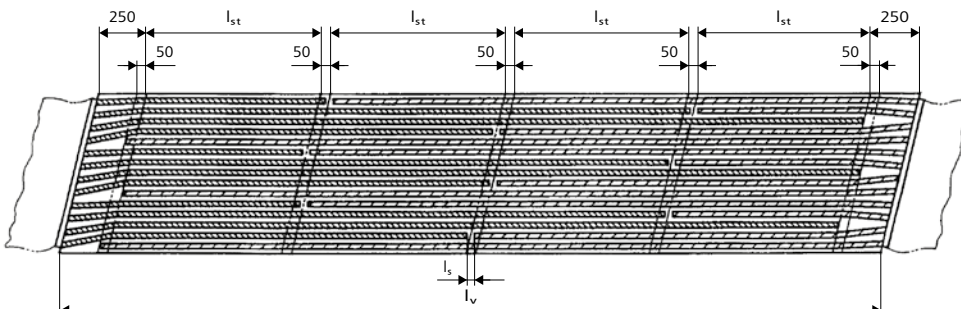
3-step splices¹

Refer to belt types ST 3500 to ST 4500



4-step splices¹

Refer to belt types ST 5000 to ST 5400

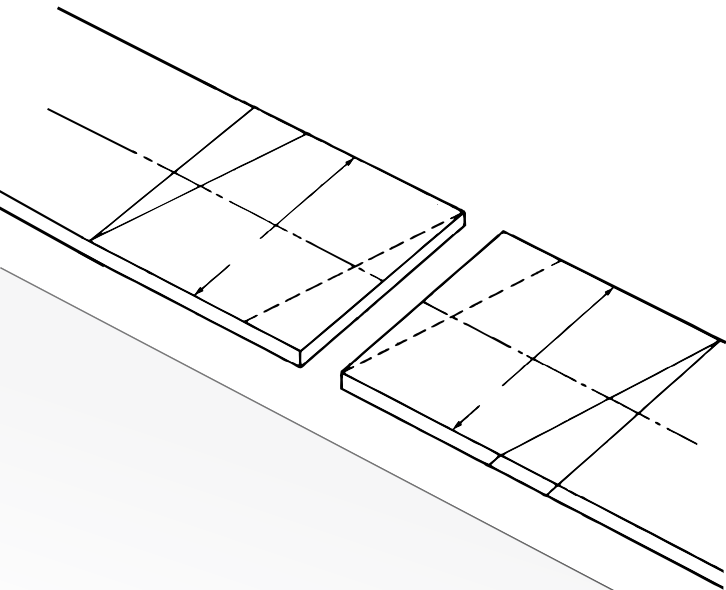


Instructions for splicing steel cord belts

3.3 Aligning and bracing the belt ends

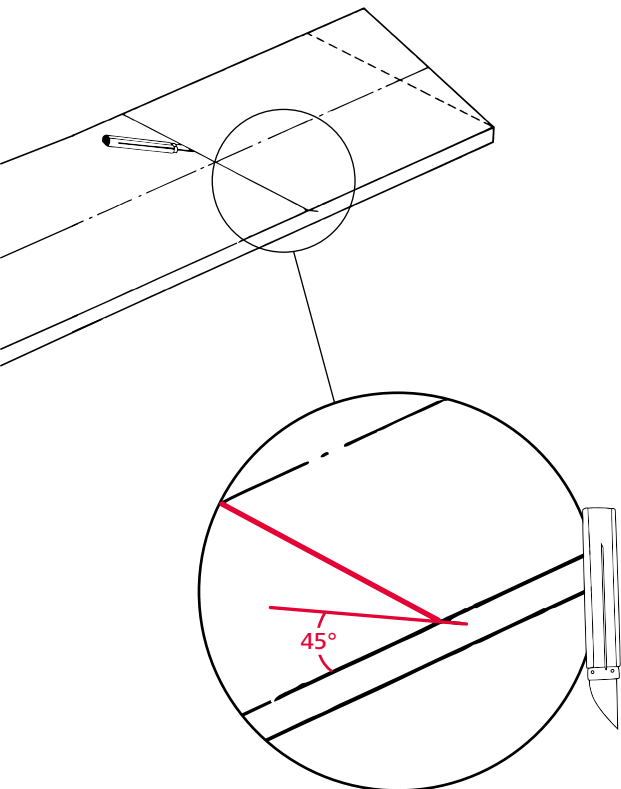
01. The belt ends must be a length of at least 15 metres on both sides of the splice and positioned to the centre of the conveyer system.
02. Pull the belt ends far enough over one another so that you have sufficient belt length to create the splice. Note in the case of a final splice that the belt must be pretensioned, taking into consideration the required tensioning drum position and the belt sag.
03. Align the belt heads with one another using the belt centres as a guide and fasten these using screw clamps, wooden clamping beams, a hydraulic clamping mechanism or another type of clamping device. Ensure that the belt heads cannot be displaced again during later work. It must however still be possible to pull these back.

Trace the splice onto the top belt head first and then transfer this to the belt edges on the bottom belt head. Under certain circumstances, a slanted splice must be plotted, depending on the vulcanising press that is available.

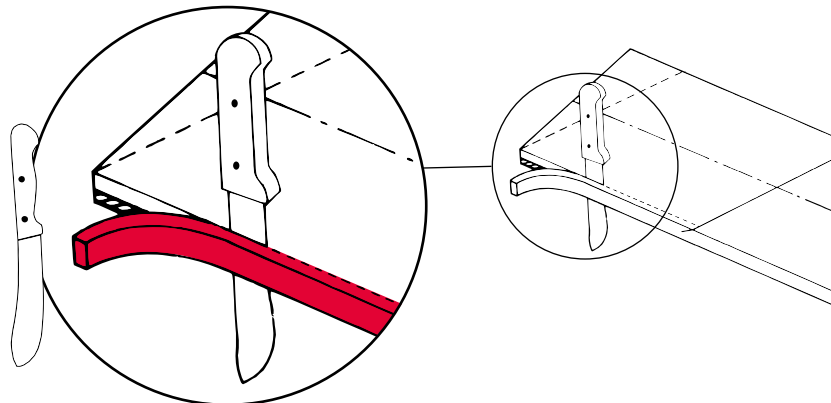


3.4 Cutting the cover plate

01. Using a cobbler's knife, cut down to the cord in the cover plate along the plotted line at the start of the splice at an angle of 45° on the carrier and runner side.
02. Now you must cut off the rubber edges alongside the edge cords on both sides of the splice area up to the cover plate chamfers.



1. Cut in until you reach cord level



2. Cut off rubber edges

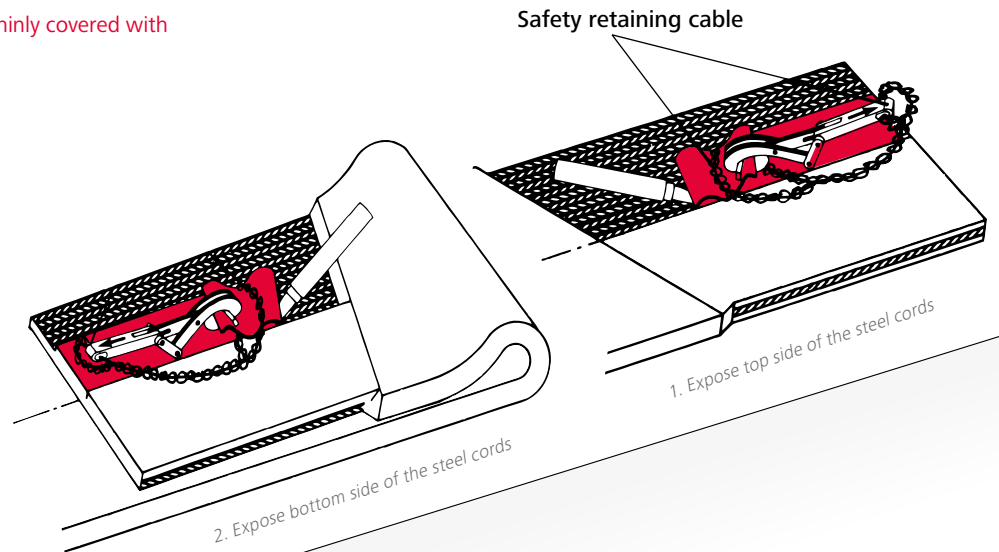
Instructions for splicing steel cord belts

3.5 Exposing the steel cords

01. Divide the cover plates to be cut off into strips of 400-700 mm parallel to the belt direction using a chalked string.
02. Using pliers, lift the cover plate at a splice or strip corner and cut into it above the steel cords until the cover plate can be gripped by wire grips.
03. Secure the wire grips against slipping out unintentionally using a retaining cable.
04. Now peel back the cover plates just above the steel cords using wire grips and a traction device (e.g. grip puller, winch).

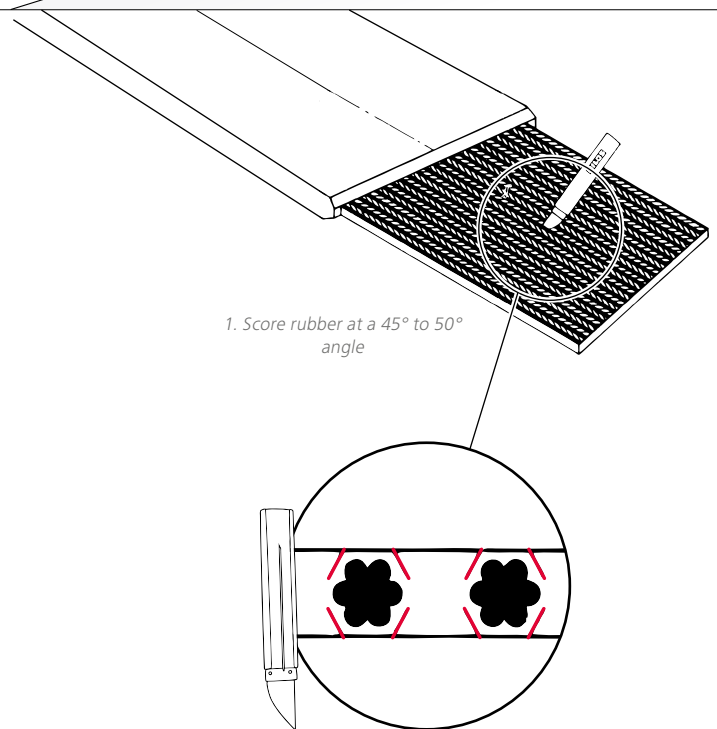
Please remember that the steel cords must be thinly covered with rubber!

05. Secure the tensioned cover plate using a retaining cable. Using an electric knife can make this work step considerably safer, easier and more effective.
06. After turning over the belt head, you can then peel back the underside of the belt.



3.6 Splitting the cords

01. Protect the exposed carcass surfaces from dirt and lay them on a clean substrate (e.g. PE protective film).
02. If splitting steel cords with a diameter of more than 4 mm, it is recommended that you score the rubber alongside the steel cords using a cobbler's knife at an angle of between 45° and 50° so that an octagonal rubber sheathing remains. Cords with a diameter of ≤ 4 mm should be split with a vertical cut alongside the cord.
03. Now, using a saddler knife, remove the remaining rubber strips between the cords until 10–20 mm before the cover plate chamfer. The split steel cords should remain covered with a residual rubber layer.

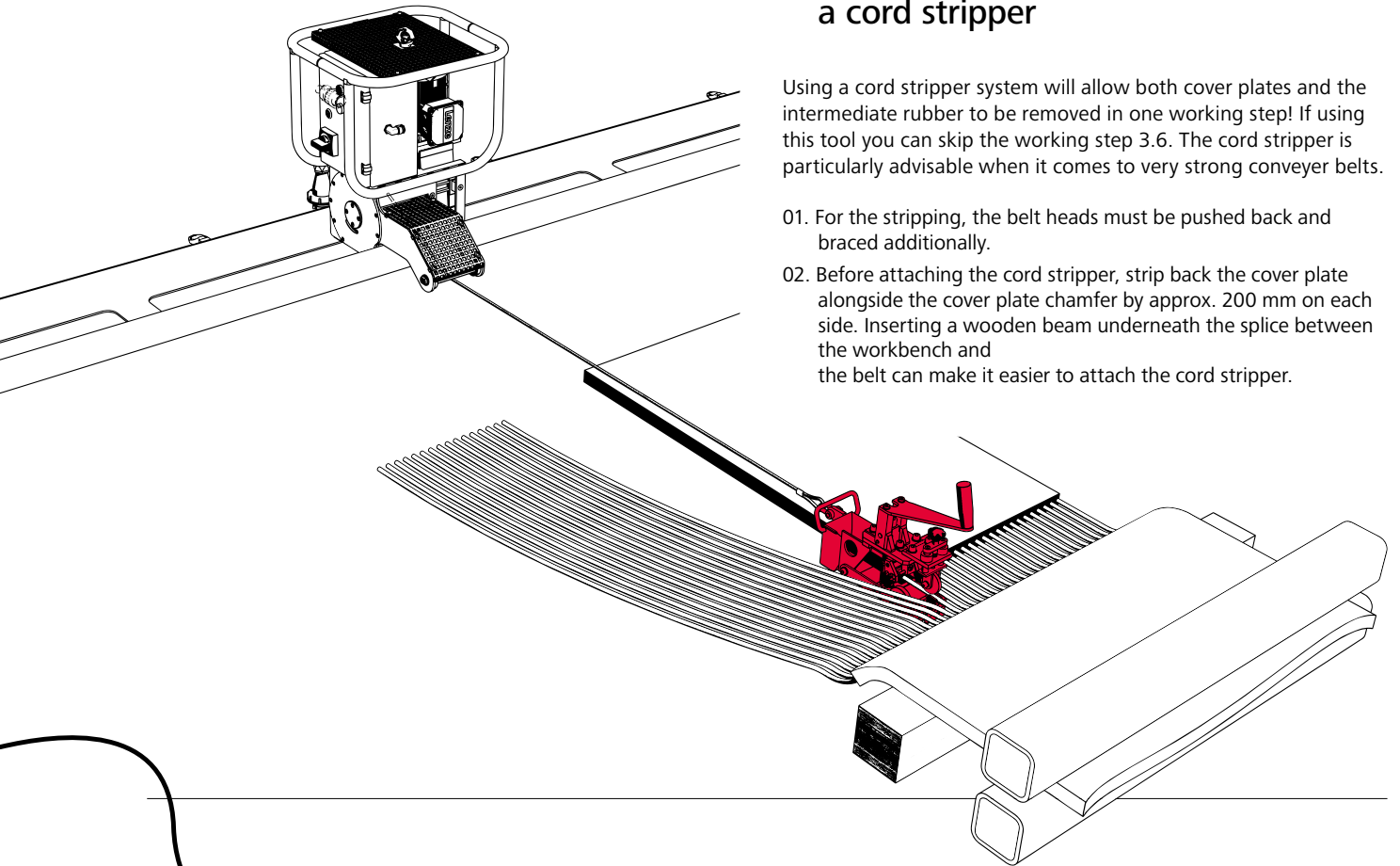


2. Cut out the rubber between the steel cords

Only touch the exposed steel cords when wearing gloves and place these on a clean surface.

Instructions for splicing steel cord belts

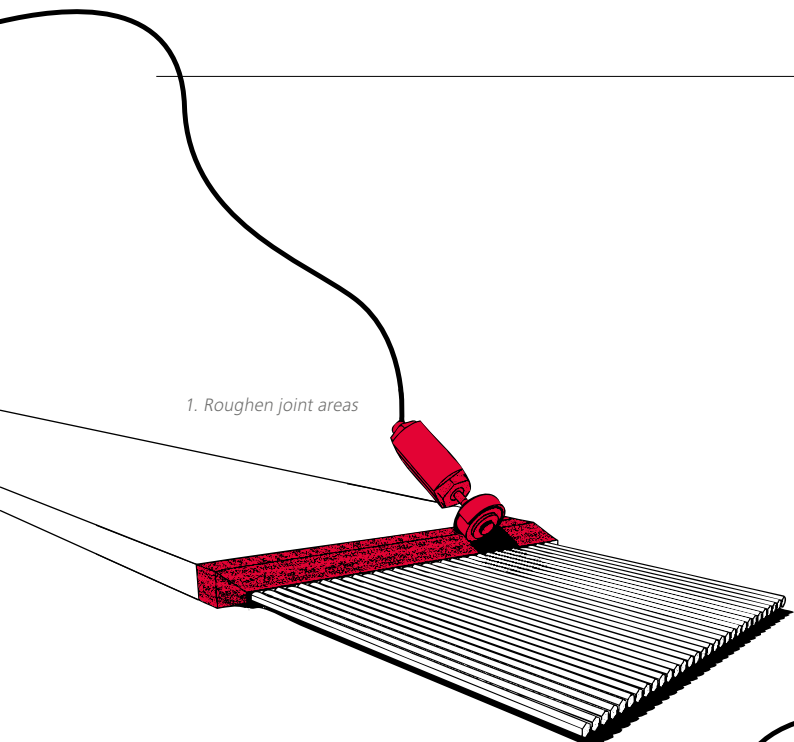
3.7 Exposing the steel cords with a cord stripper



Using a cord stripper system will allow both cover plates and the intermediate rubber to be removed in one working step! If using this tool you can skip the working step 3.6. The cord stripper is particularly advisable when it comes to very strong conveyer belts.

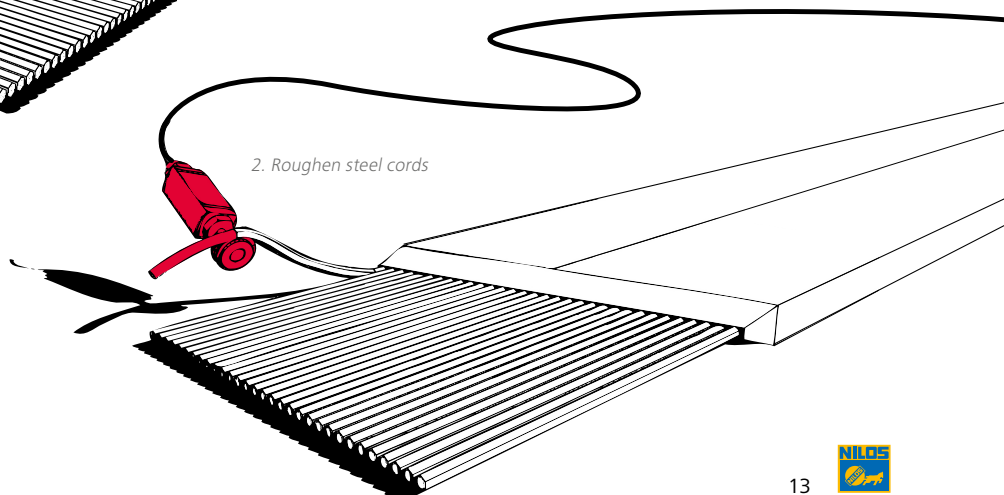
01. For the stripping, the belt heads must be pushed back and braced additionally.
02. Before attaching the cord stripper, strip back the cover plate alongside the cover plate chamfer by approx. 200 mm on each side. Inserting a wooden beam underneath the splice between the workbench and the belt can make it easier to attach the cord stripper.

3.8. Splicing preparation



01. After exposing the steel cords individually by hand or using the cord stripper, use the wheel wire brush or an alternative roughening device to first roughen the cover plate chamfer and the area stretching approx. 30–50 mm beyond the chamfer.
02. Then the rubber surface of the steel cords must be roughened until the edges are removed. The steel cords should be evenly encased in core rubber after roughening (0.3–0.5 mm). By roughening you will enlarge the adhesion surface. You should ensure that not too much heat is generated (no formation of smoke).
03. To ensure proper adhesion remove the sanding dust with a hand brush.

Impurities of any kind must be avoided.

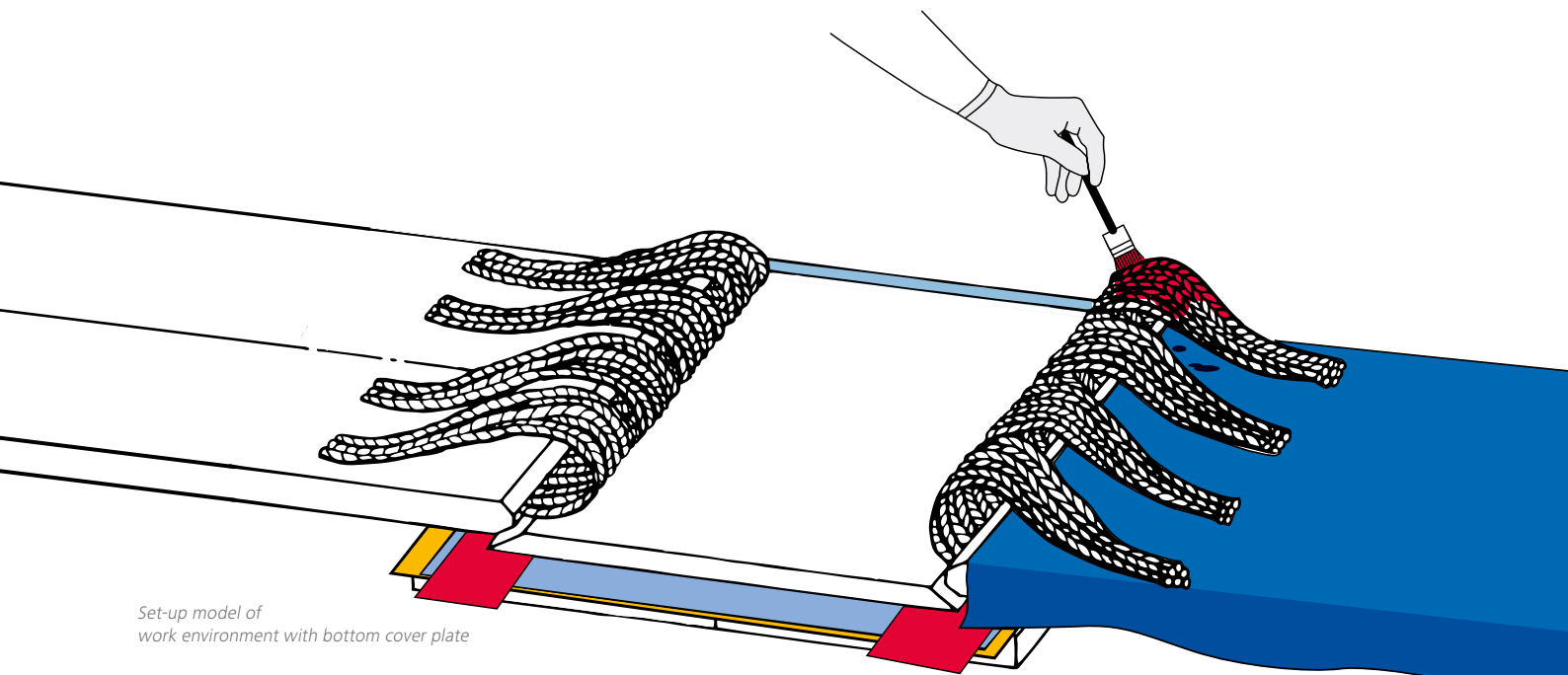


Instructions for splicing steel cord belts

3.9 Setting up the bottom cover plate

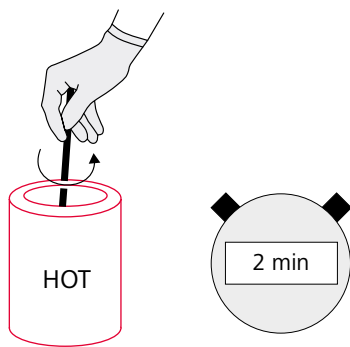
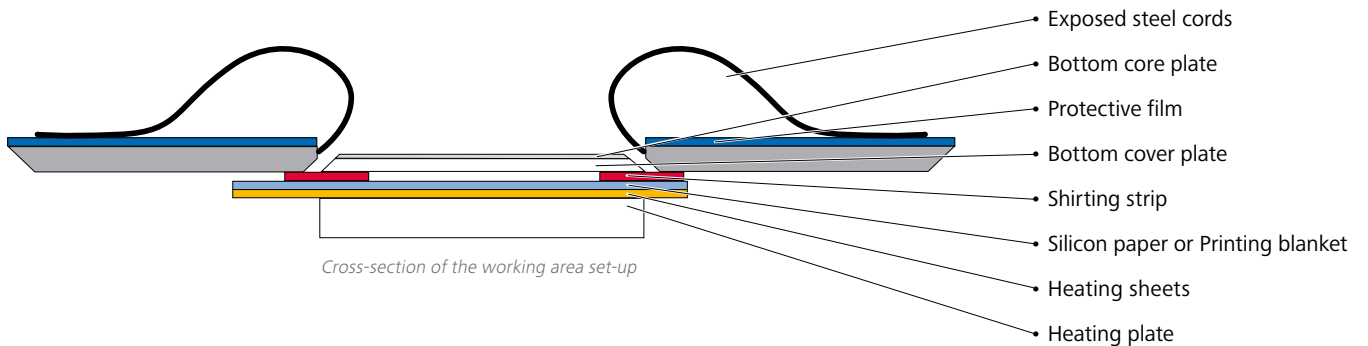
01. Cover working areas on the conveyer belt and the joint edges with a protective film in order to avoid impurities when turning over the steel cords and applying the vulcanisation solution. Turn over the cords and put down on the protective film in several bundles next to one another.
02. Cover the heating plate of the vulcanising press first with a printing blanket and then with heat-resistant silicon paper to prevent the rubber from becoming stuck to the heating plate during the vulcanisation process.
03. Before putting on the cover plate, place 200-250 mm wide shirting strips on the silicon paper in the transition zones in order to ensure that a higher pressure is built up in this area later. Then place the cover plate package on the heating plate (cover plate rubber facing downwards, core rubber plate facing upwards). Fold back the cords a little and transfer the position of the cover plate joint to the cover plate package. Then place the cords back onto the protective film.
04. Next cut the bottom cover plate to size along the transferred joint edge in line with the cover plate joint.

Note: splicing materials are offered both in the format of a separate cover plate and a separate core rubber plate as well as in the form of an already doubled cover plate package. The cover plate package offers the advantage of the cover plate and core rubber plate already being bonded to one another, eliminating the need for laborious individual gluing on site.



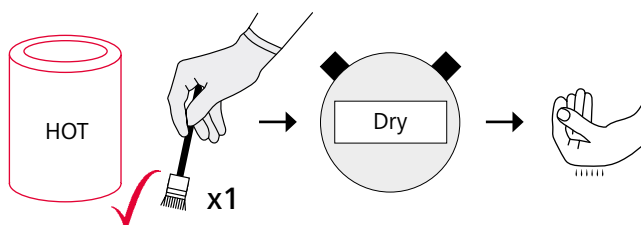
Set-up model of work environment with bottom cover plate

Instructions for splicing steel cord belts



3.10 Preparing the vulcanisation solution

Stir the vulcanisation solution well for 2 min.



3.11 Coating the splice

01. Lightly brush the turned-over steel cords on the upward facing side with the vulcanisation solution. Starting from the centre of the splice, pull the film from the core rubber plate across a width of approx. 400 mm. Also lightly brush the exposed area of the core rubber plate. You should also brush the trimmed joint chamfers of the cover plate package, the joint chamfers of the belt ends and strips of approx. 50 mm in width next to the joint chamfers.
02. Leave the vulcanisation solution in to dry for approx. 30 minutes.
03. Carry out an adhesion test using the back of your hand.
04. If it is not sticky enough, another coat should be added. Ensure that the vulcanisation solution has dried fully before commencing the next working steps.

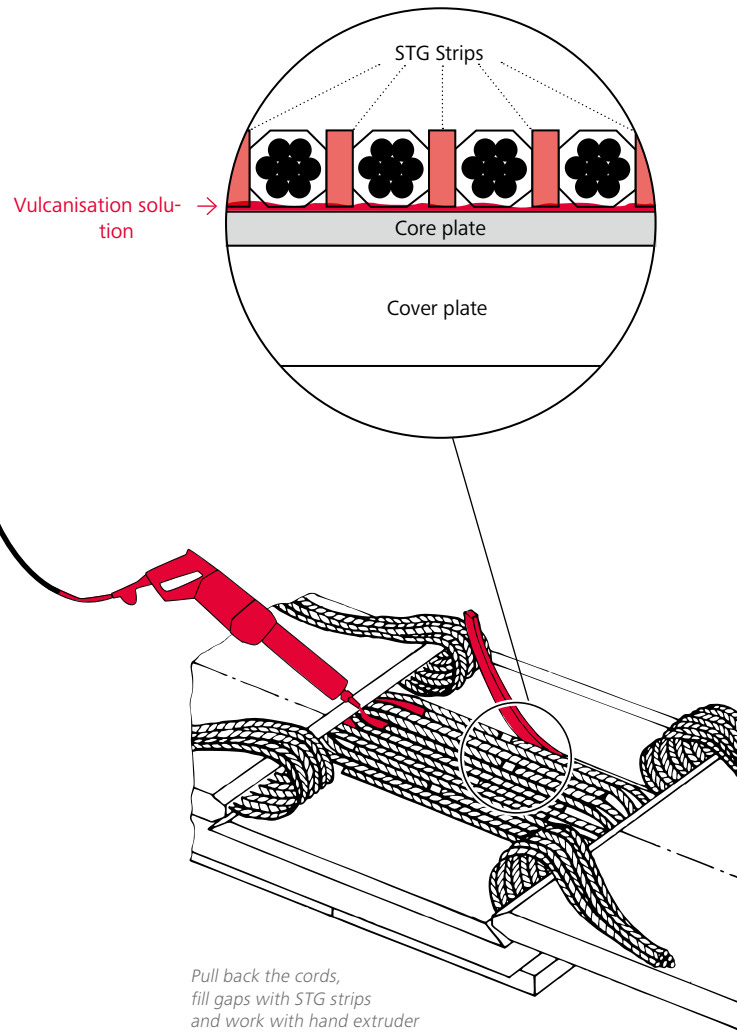
Instructions for splicing steel cord belts

3.12 Laying the cords

01. Transfer a centre line from both belt ends to the already-coated cover plate package using a chalked string. Roll the belt ends back, pushing the steel cords towards the splice a little until the joint chamfers of the belt ends and the cover plate package are fully superimposed. Press the chamfers together gently with a few taps of a hammer.
02. As per the connection diagram, start by pulling back the cords and lay out the first steel cord along the drawn-on centre line. Pressing from the centre outwards towards both sides, press one cord at a time to the bottom core rubber plate.
03. Before laying the next cord, a core rubber strip is attached along the side of the cord just laid in each case. As per the connection diagram, the cords are trimmed using cord scissors before they are laid. The film is gradually pulled further away from the core rubber plate in sections depending on how far the work has progressed. **Ensure that you keep the cords straight and monitor this continuously.**
04. Carefully fill the space between the cord joints and the run-off areas before the joint chamfers using the hand extruder, leaving no gaps. Use STG rubber strips for this. Position a core rubber strip laterally before the edge cord of the splice and build the rubber edge of the splice up to the upper edge of the cord position using cover plate material.

Caution: after the cords have been laid, they must not under any circumstances be coated with vulcanisation solution. Cover these with a protective film before the next working step if necessary.
05. Cut the top cover plate package in line with the cover plate joints of the belt ends to be spliced and pull the film from the core rubber plate. Then brush the core rubber plate and joints lightly with vulcanisation solution and leave these to dry fully.
06. Place the cover plate package with the core rubber plate facing downwards onto the laid cords and roll down from the inside to the outside. Hammer down in the area of the cover plate joints.
07. Using a chalked string, transfer the belt edges to both sides of the splice and cut off the splicing material left protruding at the sides along the marking.
08. Then tap the bottom shirting strips at the edge of the splice above the shirting strips on the top splicing plate. You can now insert the splice label according to customer specifications.
09. Now place silicon paper and a printing blanket on the top splicing plate.

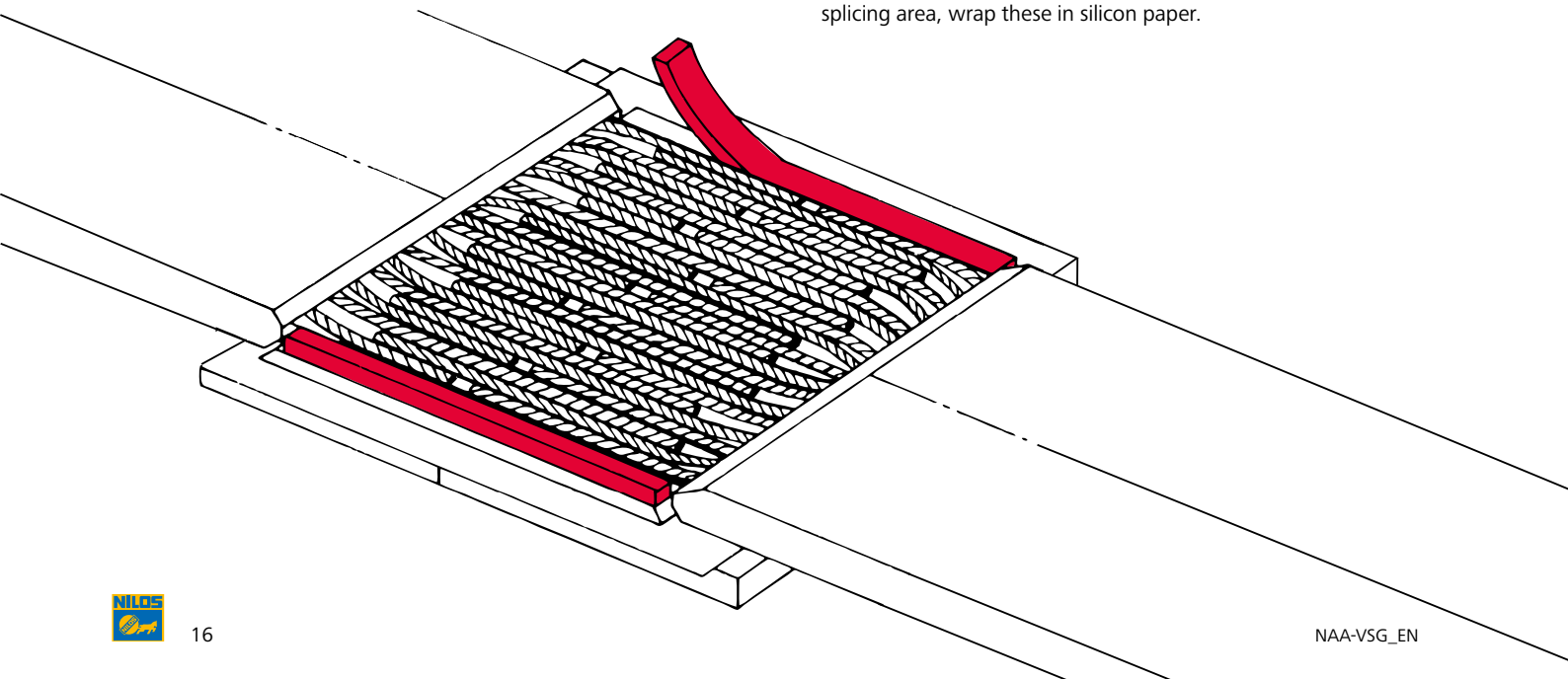
Caution: the entire splicing surface must be covered!



Pull back the cords, fill gaps with STG strips and work with hand extruder

10. Edge bars must be positioned on both splice sides. These must be pushed out of the pressing area to the belt edge using an edge tensioner following complete construction of the press unit.

Be sure to use edge bars that are 1 - 1.5 mm thinner than the conveyer belt!
11. In order to prevent the edge bars from becoming stuck in the splicing area, wrap these in silicon paper.



3.13 Closing the press

01. Place the heating sheet on the splice carefully, ensuring that the printing blanket, silicon paper and the printing blanket do not move.
02. Then place the heating plates on the heating sheet and place the top beams opposite the position of the bottom beams.
03. Now insert the tensioning bolts and pre-tension these individually by hand, starting from the middle beam going in the direction of the joint chamfer.
04. Then connect all additional wiring and the pressing system in line with the instructions.
05. Observe the operating instructions for the press.

3.14 Cooling down the splice

the following working sequence must be strictly adhered to:

01. First apply the specified pressing pressure and monitor this constantly. Readjust this in the event of pressure loss.
02. In order to prepare the material and the machine, carry out cold pre-pressing for a duration of 15 min under constant pressing pressure and then remove all the press pressure.
03. Now you can go back and tighten the tensioning bolts of each of the beams evenly.
04. Apply the full press pressure again.
05. Monitor this and readjust if need be.
06. Switch on the heating plates and allow these to heat up evenly across the entire pressing surface to 100° C.
07. Continuously monitor the press pressure and the temperatures of the heating plates and document these in the splice report.
08. The permitted pressure for the press must not be exceeded (see press operating instructions).
09. Once all heating plates have reached a heat temperature of 100° C, this will be held for 15 minutes by switching the heating plates on/off.
10. Then allow the heating plates to heat up to 145° C.
11. Monitor the temperature and the press pressure. Please note any deviations of 10° C or more in the splicing report. The vulcanising period begins once a temperature of 145° C has been reached on all heating plates. This equates to 3 min per mm of belt thickness, but no less than 30 min.
12. Switch off the heating plates once the vulcanising period has lapsed.
13. The splice will stay under pressure until the heating plates are cooled down to 60° C.
14. You can now release the pressure and loosen the tensioning bolts and the edge bars.

Instructions for splicing steel cord belts

3.15 Dismantling the press and final steps

01. The press can now be dismantled.
 02. Remove the shirting strips, the silicon paper or the printing blanket and check the quality of the splice to ensure the absence of bubbles and pores, elasticity, thickness and shore hardness.
 03. Cut the rubber burr from the edges and sand down any uneven points.
 04. Permanently mark the splice number as per DIN 22129/22131. The spliced belt can be put into operation once it has been cooled to the ambient temperature.
-

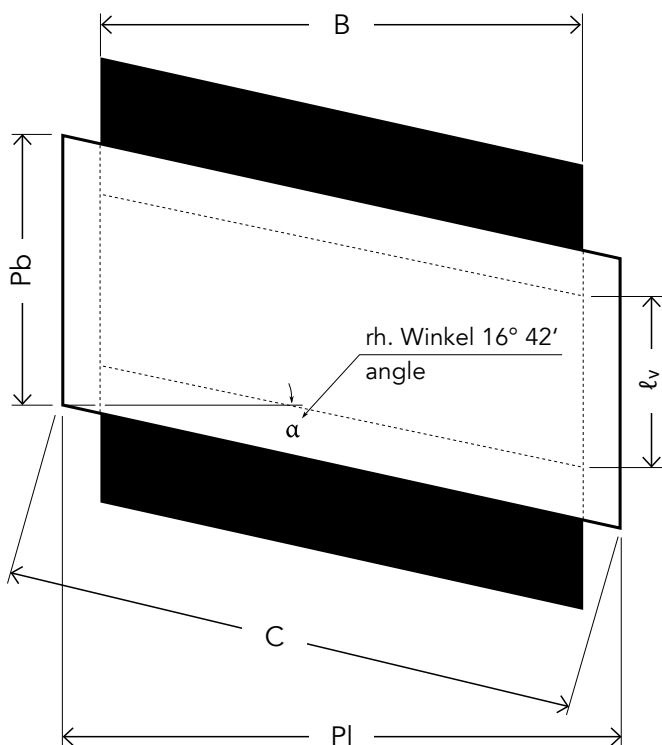
3.16 Splicing report

Complete the splice report fully and sign it. The customer must countersign the report. You will find the report on the following pages (page 19 - 20).



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Protokoll über die Herstellung der Fördergurtverbindung *Report of making of a splice*



Größenbestimmung der Heizplatte *Dimensions of the heating plate*

Pb = Plattenbreite / plate width	_____	mm
Pl = Plattenlänge / plate length	_____	mm
C = Kantenlänge / edge length	_____	mm
B = Gurtbreite / belt width	_____	mm
lv = Verbindungslänge / splice length	_____	mm

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This renders all previous instructions invalid.

NILOS GmbH & Co. KG
Reisholzstr. 15
40721 Hilden • Germany
Phone: +49 2103 951-0
Fax: +49 2103 951-209
info@nilos.de
www.nilos.de



Protokoll Nr. / Report No.

Erstellungsdatum / Date

Allgemeine Informationen / General informations

Kunde / Customer

Herstellungsbeginn / Start of cure

Gerät/Gurtförderer / Conveyor

Herstellungsende / End of cure

Servicefirma / service company

Auftragsnummer / Order Number

Details der Gurtverbindung / Details about the belt splice

Fördergurt / Conveyor Belt

Gurtnummer / Number of Belt

Hersteller / Producer Company

Anzahl Gewebelinien / Number of plies

Auftragsnummer / Order Number

Deckplattenstärke / Thickness of Top/Bottom-Cover

Materialnummer / Material Number

Gurttyp / Type of Belt

Gurtverbindung / Splice Design

Festigkeit EP / Tension of plies

Verbindungstyp / Type of splice

Vulkanisierpresse / Vulcanizing Equipment

Hersteller/ Typ / Producer/ Company

Verbindungslänge / Length of splice _____ mm

Eigentümer / Owner

MPa

Stufenlänge / Step length _____ mm

Hydraulik/ Wasserdruck / Hydraulic/ Air-Bag

Stück / Piece

Äußere Bedingungen / Environmental

Traversenpaare / Number of Cross-beams (pair)

Zelt / Tent

Wetter / Weather

Heizfolge / Heating

Außentemperatur °C / Outside Temperature F

Heizbeginn / Start up time

Uhrzeit / Time

Temperatur °C / Temperature F

Vulk.-beginn / Start of cure

Uhrzeit / Time

Temperatur °C / Temperature F

Vulk.-ende / End of cure

Uhrzeit / Time

Temperatur °C / Temperature F

Qualitätskontrolle/ Unregelmäßigkeiten / Quality Control/ Irregularities

Servicefirma / Service Company

Schicht oder Tätigkeit / Shift or activity

Datum / Date

Unterschrift / Signature

Schicht oder Tätigkeit / Shift or activity

Datum / Date

Unterschrift / Signature

Schicht oder Tätigkeit / Shift or activity

Datum / Date

Unterschrift / Signature

Arbeitsvorbereitung / Work preparation

Datum / Date

Unterschrift / Signature



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NILOS GmbH & Co. KG
Reisholzstr. 15
40721 Hilden • Germany
Phone: +49 2103 951-0
Fax: +49 2103 951-209
info@nilos.de
www.nilos.de