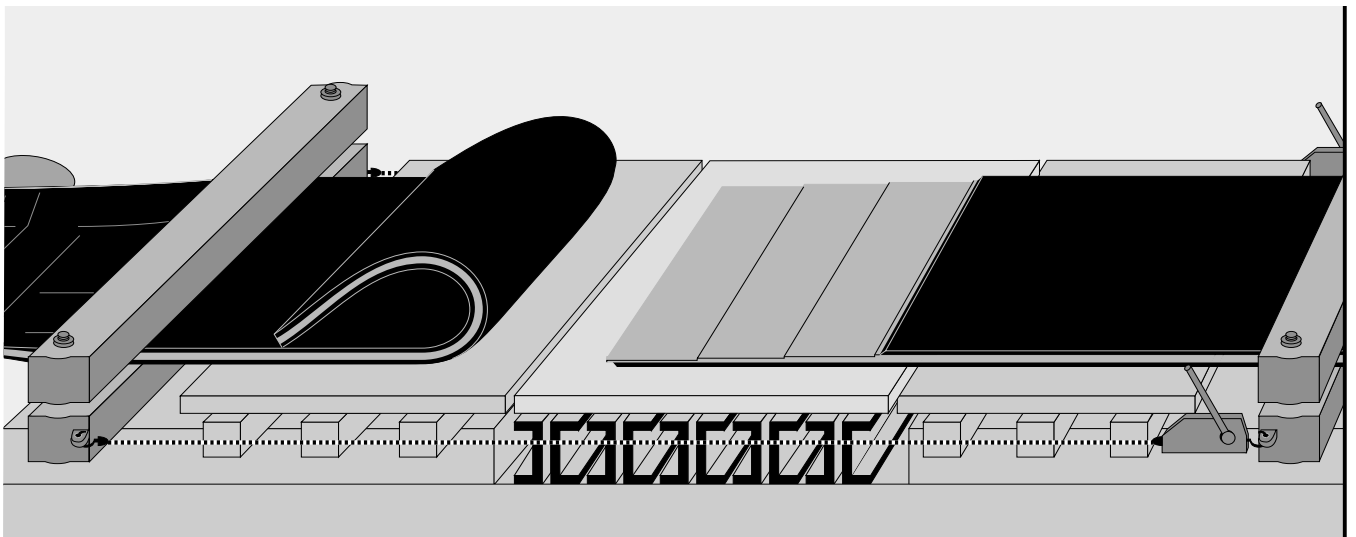


Hot Splicing

of Rubber Conveyor Belts with Fabric Plies

**NORTH
AMERICAN
EDITION**



- Splicing Manual -

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General recommendations

Storage of hot splicing products

The hot splicing products have to be stored in a dry and dark place, at a temperature between 59 and 77°F (DIN 7716).

Please observe the expiration date on the box!

When unvulcanized splice materials are stored under unfavorable conditions their physical and/or chemical characteristics change. Eventually these changes will render the unvulcanized splice materials unsuitable for use. These effects result in changes in the curing behavior and/or in the cured physical properties of the splice materials.

The harmful effects of these factors can be minimized by a careful choice of the following storage conditions.

1. Storage at 70° F will give a shelf life of 12 Months (higher temperatures shorten shelf life). Storage at 50° F will give a shelf life of more than 12 Months. If material is stored at extremely low temperatures (freezing is not recommended) the material should be allowed to stand at 70° F for at least 48 hours before use to avoid condensation.
2. The relative humidity should preferably be below 60% for long term storage. Damp conditions should be avoided since long term exposure to moisture can influence the curing and crosslinking behavior of the materials.
3. Sunlight and artificial light which has a substantial content of ultraviolet light can adversely affect the stability of unvulcanized rubber. Depending on the grade and the time span of exposure, chain rupture and/or crosslinking may occur. In view of this, exposure to light should be restricted to a minimum.
4. Where possible, unvulcanized rubber should be protected from excessive air circulation and should not be stored near electrical equipment (motors) that could be a source of ozone. For this reason it is advisable to keep the splice material boxes closed and sealed.
5. Unvulcanized rubber should be stored in an area which meets the usual standards of cleanliness, even though the rolls are individually wrapped in polyethylene sheeting. All direct contact with foreign materials, especially greases and oily contaminants of any type should be avoided. It is recommended that the material be kept in its original packaging until the moment it is used.
6. All though the REMA splice materials have a long shelf life they should not be stored for any longer than is necessary. It is therefore recommended that the FIFO (first in - first out) stock rotation system be used.

Application range of hot splicing products

Standard conveyor belts

Hot splicing of mono- and multi-ply conveyor belts with textile carcass (DIN 22102) and covers made of the following polymers

- | | |
|---|----------------|
| – Natural rubber | NR* |
| – Styrene butadiene rubber | SBR* |
| – Isoprene rubber | IR* |
| – Butadiene rubber | SBR* |
| – or a mixture of
the above polymers, e.g. | NR/SBR* |

In case of doubt, consult the supplier of the conveyor belt about the rubber quality.

For splicing other belt types, please contact your local TIP TOP agent.

Splicing methods

- bias (0.4 x belt width)

Place / site

- in a vulcanizing workshop or
- on site

* Abbreviation according to DIN ISO 1629

Note:

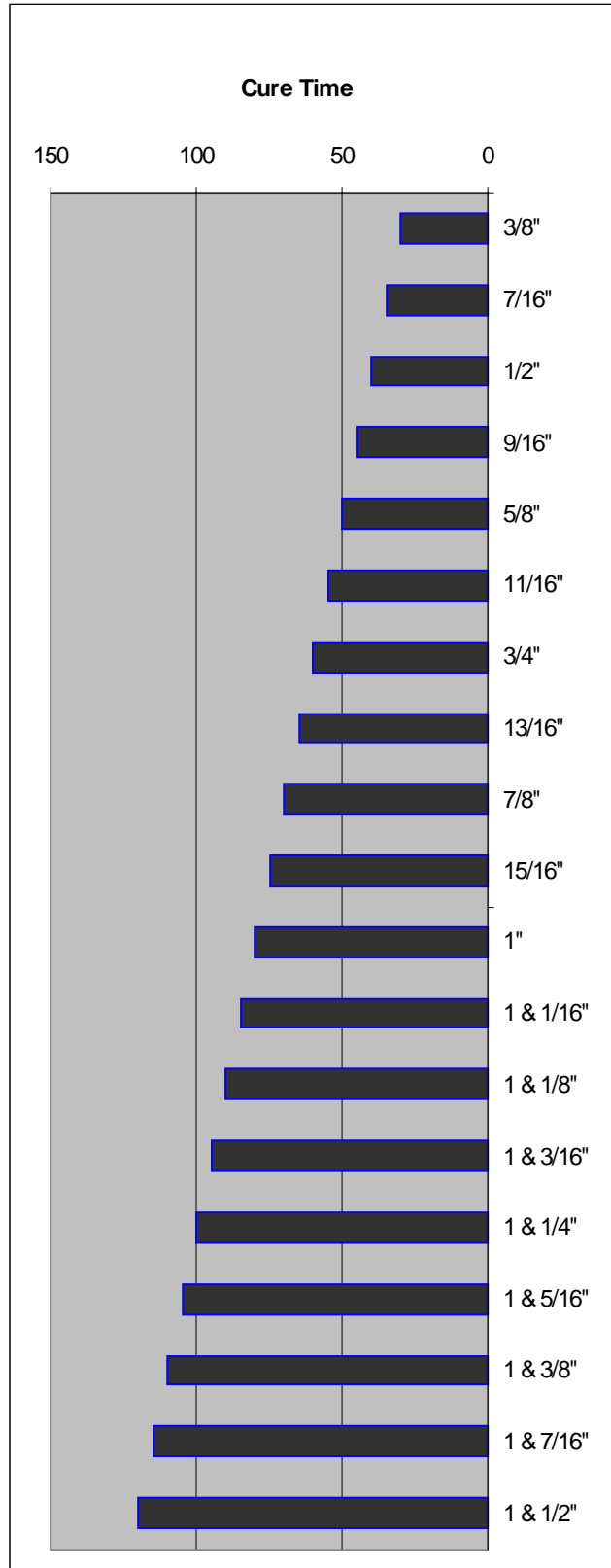
Our recommendations result from field tests and long experience.

In view of different materials and working conditions beyond our control, we recommend in any case doing enough tests locally.

We cannot assume any kind of liability resulting from these recommendations.

Hot Splice Material Curing Chart (300 Deg F)

Belt Thickness		Cure Time
mm	Inches	
9.5	3/8"	30 min.
11.1	7/16"	35 min.
12.7	1/2"	40 min.
14.2	9/16"	45 min.
15.8	5/8"	50 min.
17.4	11/16"	55 min.
19.0	3/4"	60 min.
20.6	13/16"	65 min.
22.2	7/8"	70 min.
23.8	15/16"	75 min.
25.4	1"	80 min.
26.9	1 1/16"	85 min.
28.5	1 1/8"	90 min.
30.1	1 3/16"	95 min.
31.7	1 1/4"	100 min.
33.3	1 5/16"	105 min.
34.9	1 3/8"	110 min.
36.5	1 7/16"	115 min.
38.1	1 1/2"	120 min.



Tools and Equipment

Safety Glasses
Tape Measure - 16' x 3/4" Blade
Angle square
Plumb line
White Mechanical Marking Pencil w/ Pocket Clip (Soft Crayon)
Claw hammer
Duplex belt nails
Smooth Flat Face Roller #50D - 2" x 2"
Smooth Flat Face Roller #50C - 1/2" x 2"
Corrugated Face Stitcher #50B - 1/4" x 2"
Corrugated Face Stitcher #50E - 1/8" x 2"
Needle Face Roller - 2" x 2"
Electric Stripping Cable Winch
Drying hood (not for use with Flammable Solvents & Cements)
Stainless Steel Stripping Frame or Grip tongs
Whetstone #68
Foxtail Hand Dust Brush
Curved Hand Rasp - #51
Drill Arbor for Wire Wheel
3" Rotary Wire Brush
Air buffer
Pincers - 250mm
Ply Lifter #78
Offset Knife #77
Rubber Knife - 6" Long #72
Bevel Point Knife - 4" x 1"
Curve V-Trim Knife - 2 1/4" X 3/4"
Mill Knife Handle (Dull & Rounded Tip)
Off Set Single Ply Knife - .065 Cutting Depth
11.5" Heavy Duty Bent Handle Sicissors w / Grips
18mm Break Off Tip Cutter with Rubber Grip
Replacement Blades for 18mm Cutter - 50 Pack
Splice Kit
Rags
Cement brush
White Marking Rubber
Belt Clamps
Come-a-longs
H.D. C-Clamps
Screw clamps
Vulcanizing press

Conditions for hot splicing

Work place

In order to ensure quality and durability of a hot splice, a clean work place and the careful use and application of the splicing products are essential.

Conveyor belt

Only clean and dry conveyor belts can be spliced reliably.

Clean the conveyor belt, if necessary:

- Scrape off water-soluble contamination (e.g. salt, fertilizers) and rinse with water.
- Remove oily or greasy substances with TIP TOP Cleaning Solvents.

If necessary, dry the belt using the TIP TOP Drying Hood, Air Dryer or the pre-heated lower part of the vulcanizing press, before any further preparation work.*

Ambient conditions

The ambient temperature and the temperature of the splicing products and the conveyor belt have to be between + 50°F to + 115 °F.

Any influence of humidity, e.g. formation of condensation water (due to temperature falling below the dew point), must be absolutely avoided. Avoid loss of heat due to strong air current (wind).

Take appropriate precautions, if necessary, e.g.:

- Set up a tent to protect the working area against adverse ambient conditions (strong sunshine, rain, wind, dust).
- Warm up the splice area of the belt using the TIP TOP Drying Hood, Air Dryer or the pre-heated lower part of the vulcanizing press.*

* Note:

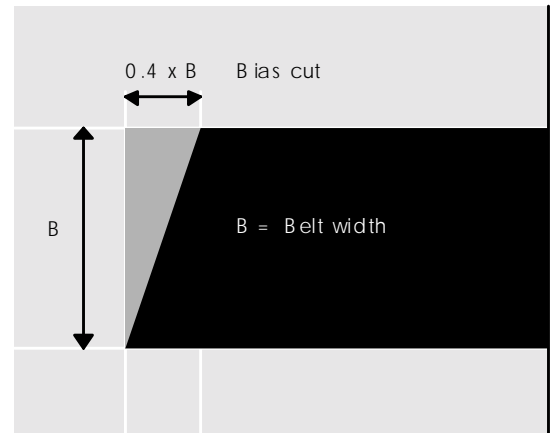
Electrical equipment must not be left unattended, when operating (e.g. fire risk) or exposed to humidity.

Structure and Dimensions of Hot Splices

Hot Splices Can Be Made As

- overlap splices
(mono- and two-ply belts)
- step splices
(multi-ply belts)

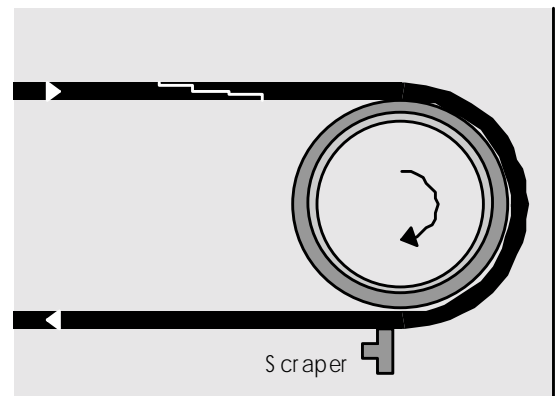
A bias cut ($0.4 \times$ belt width) favourably influences the durability of a splice.



Selection of Step Direction

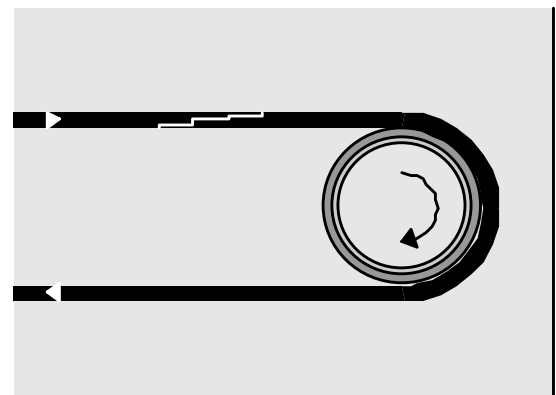
The splice runs against the conveying direction

We recommend this method, because it favourably influences the durability of the splice, even in case of aggressive scrapers.



The splice runs in the conveying direction

Alternative method for belts subjected to high tension and installations with relatively small drum diameters (see the ISO 3684 standard).

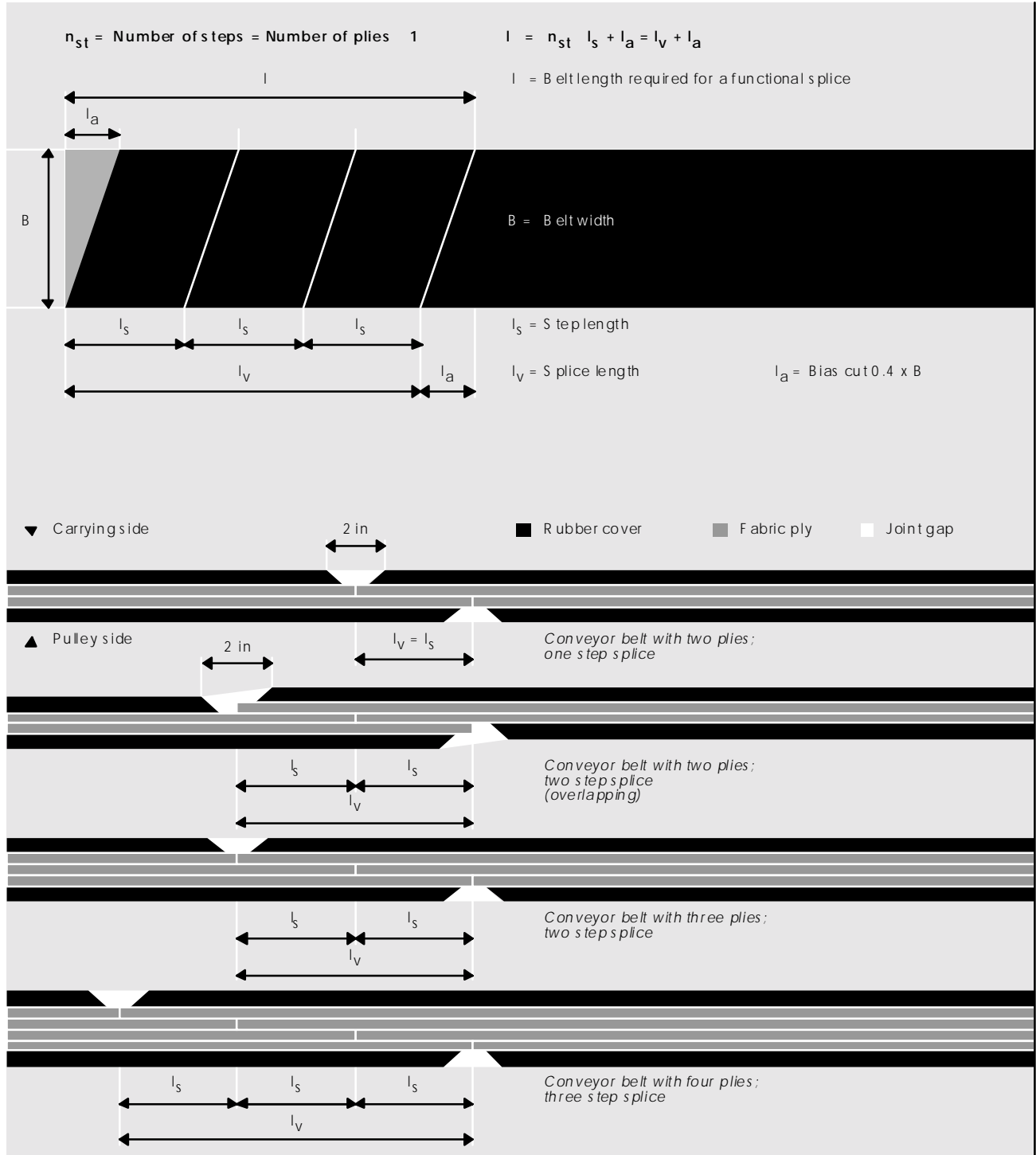




Vulcanized Splice Dimensions for Fabric Belt

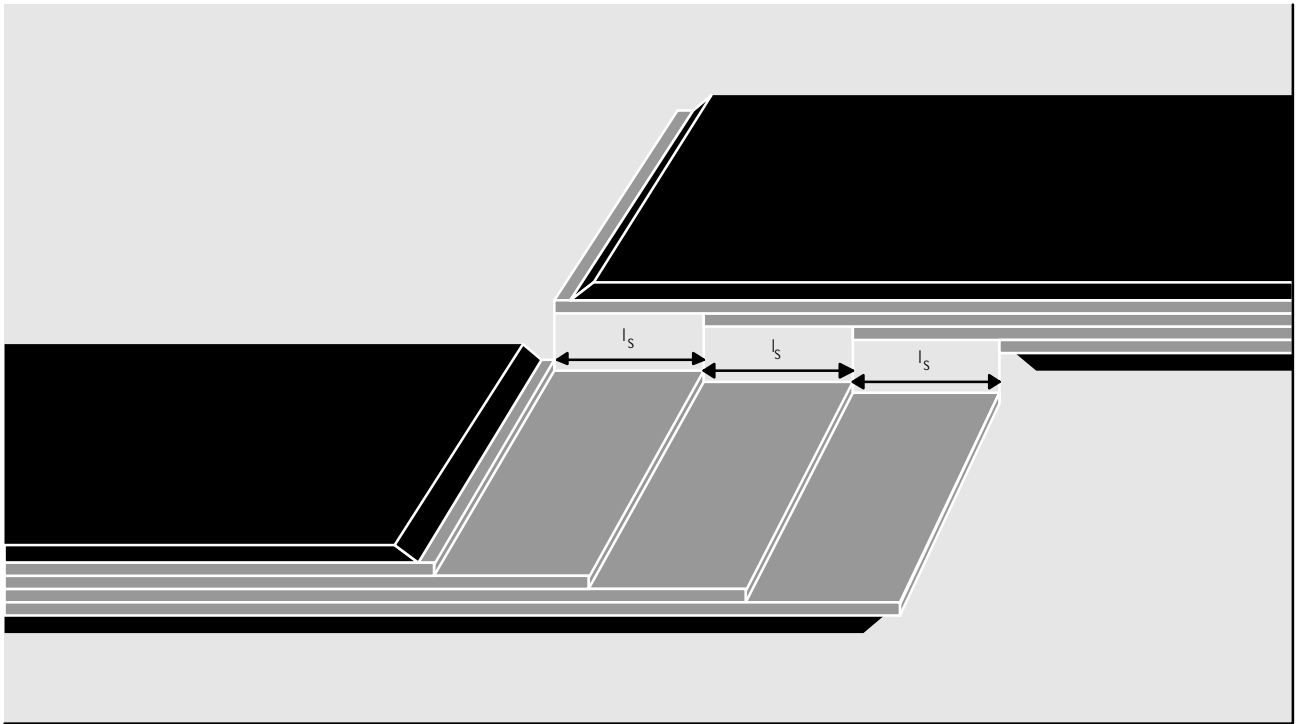
Belt type in PIW	Step Length	No. of Steps	Fill Strip Width (in)	Overall Splice Length	Minimum Press Curing Length
2ply-160	6"	1	3	9"	13"
2ply-220	8"	1	3	11"	15"
2ply-250	10"	1	3	13"	17"
2ply-300	12"	1	3	15"	19"
2ply-400	15"	1	3	18"	22"
2ply-500	18"	1	3	21"	25"
2ply-600	20"	1	3	23"	27"
3ply-240	6"	2	3	15"	19"
3ply-330	8"	2	3	19"	24"
3ply-375	10"	2	3	23"	27"
3ply-450	12"	2	3	27"	31"
3ply-600	15"	2	3	33"	37"
3ply-750	18"	2	3	39"	43"
3ply-900	20"	2	3	43"	47"
4ply-440	8"	3	3	27"	31"
4ply-500	10"	3	3	33"	37"
4ply-600	12"	3	3	39"	43"
4ply-800	15"	3	3	48"	52"
4ply-1000	18"	3	3	57"	61"
4ply-1200	20"	3	3	69"	73"
5ply-550	8"	4	3	35"	39"
5ply-750	12"	4	3	51"	55"
5ply-1000	15"	4	3	63"	70"
5ply-1250	18"	4	3	75"	79"
5ply-1500	20"	4	3	83"	87"

Structure and dimensions of step hot splices



Step splices

Splicing process



Overlap and step splice

General preparation

Provide tools, equipment and splicing products.

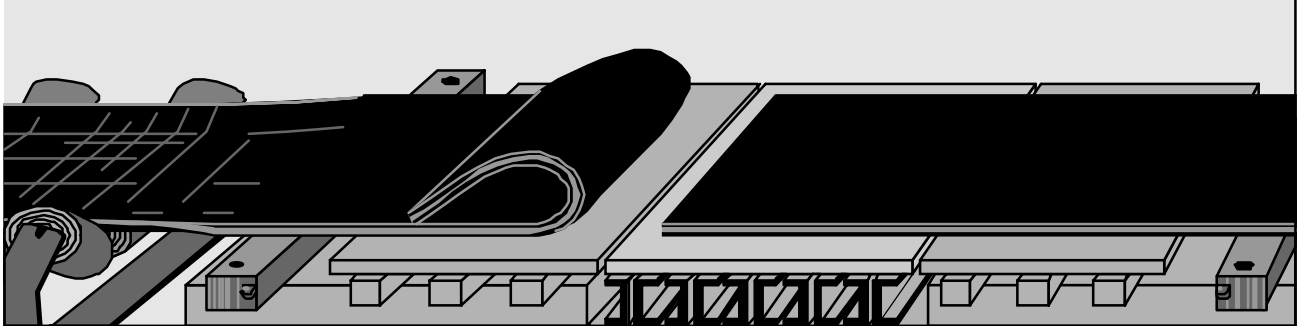
If a new belt is installed, place a working platform at the head or tail of the conveyor.

Otherwise install it in the conveyor construction (remove carrying idlers, if necessary).

Position it in such a way that the conveyor belt lies on it even and straight without tension.

Splicing process

The working platform (approx. 10 - 13 ft long) consists of three parts aligned in the direction of the conveyor belt: the lower part of the vulcanizing press, which forms the central part, and two working tables made of wooden boards or similar materials.

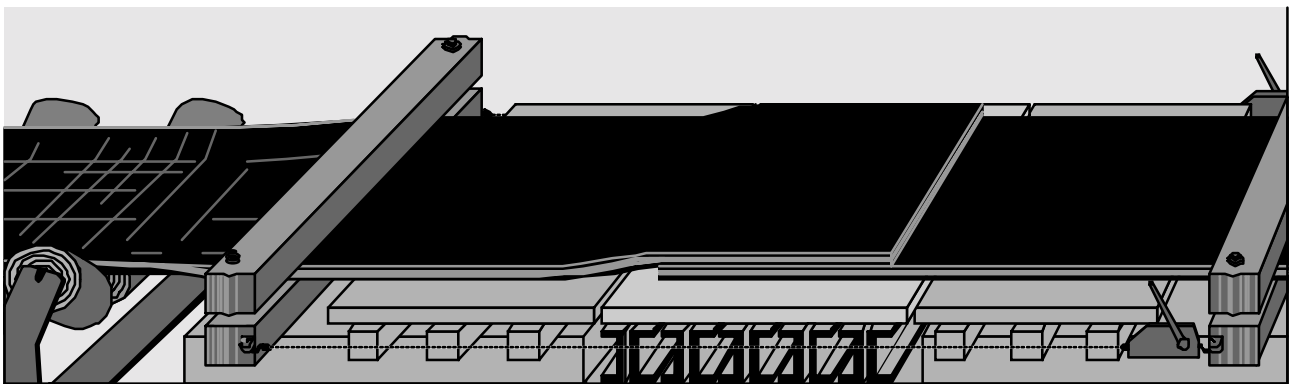


The free belt ends have to be secured (e.g. with belt clamps).

To splice the belt, pull the belt ends together, until the belt is tensioned. (Before this operation, release any tension in the take up station!)

The belt ends have to be aligned in the direction of the conveyor belt in such a way that they overlap each other on the lower part of the vulcanizing press and that the belt center lines are exactly superimposed.

The length of the overlapping area has to be splice length plus bias cut (l_v).



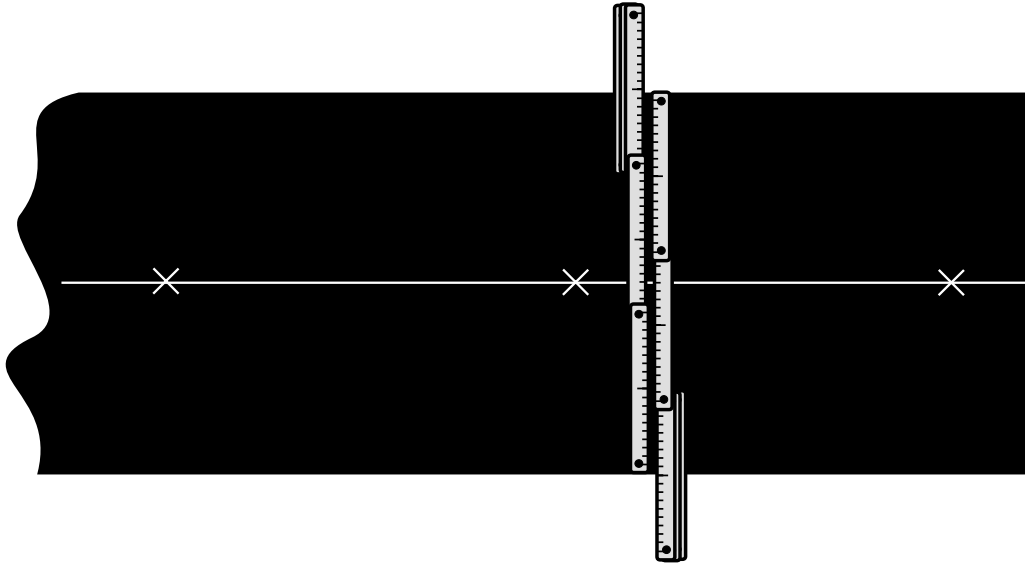
Secure the belt ends in this position.

Preparing the Belt Ends

On both belt ends establish and mark

- the belt center line
- the perpendicular square line and
- the belt cover transition lines.

Establish and mark center line of belt by measuring across width of belt at three points in length of each belt end at a distance of approx. 6". At least two center markings on each belt end must be outside the splice area.

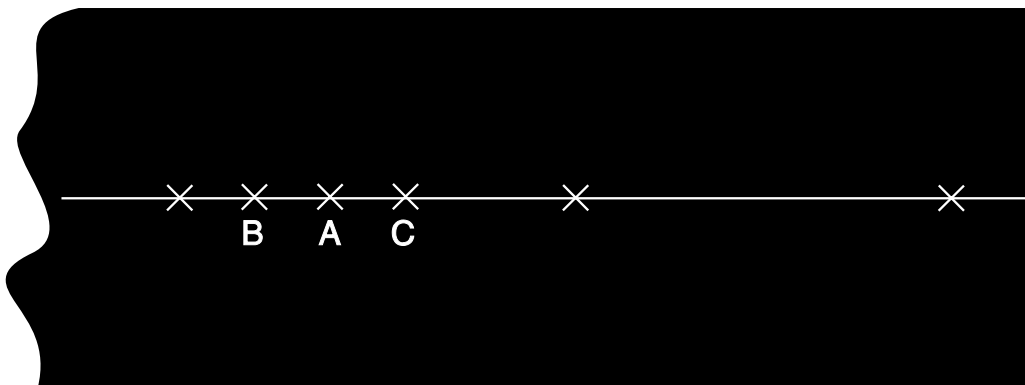


The establishment of the center line is easiest done with two rulers. The three center markings on each belt end are then connected by means of a chalk line which represents the belt center line.

This center line ensures exact alignment of the belt ends, which is indispensable for straight belt running.

The center line outside the splice area must be durable enough to remain evident throughout the entire splicing operation!

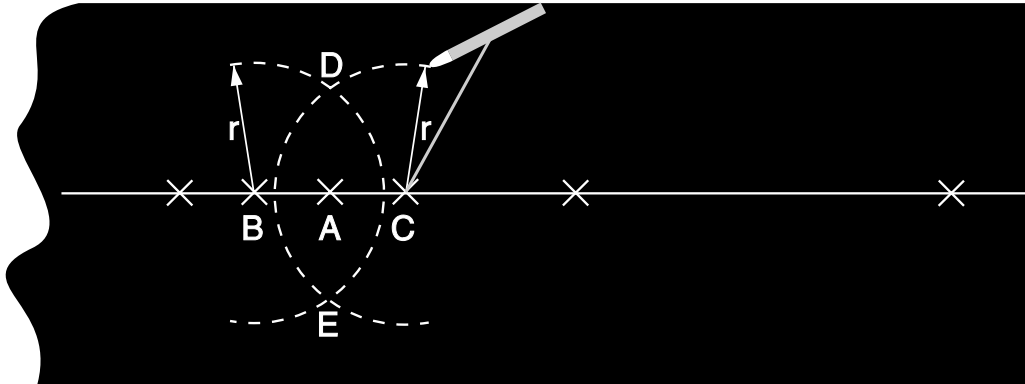
Destroyed or missing belt edges must be considered. The width of the belt edge is established by measuring the width of the belt at suitable areas of the undamaged belt ends.



Preparing the Belt Ends

Establish a perpendicular square line across the upper belt end at the end of the splice area.

On narrow belts this can be done by placing a metal square onto the center line.



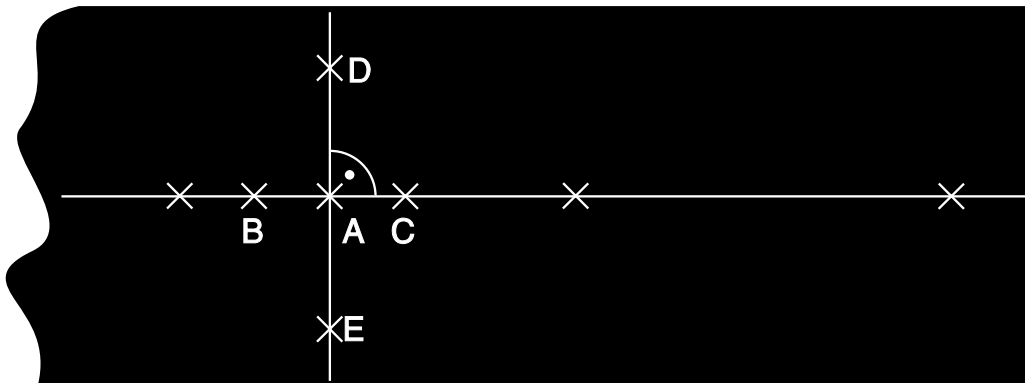
On wide belts it is recommended to establish the square lines as follows:

Near the end of the splice area select a point A on the center line. Mark points B and C on the center line equidistant to point A ($AB=AC$).

Now describe a circle with the same radius around points B and C by means of a plumb line and a pen. The points of intersection of both circles must still be on the belt. These intersections are points D and E.

A line drawn between these two points will be perpendicular to the belt edges and forms the square line, which should pass point A for additional control.

This square line will be the starting point from which the splice will be laid out.

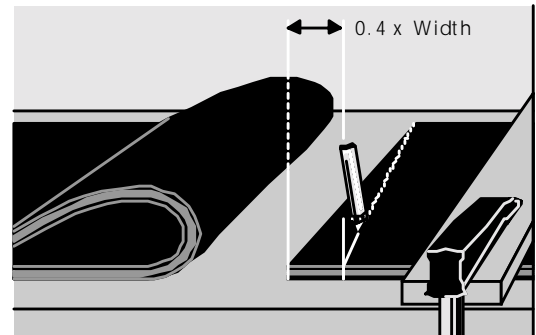


Splicing process

Preparation of the lower part of the belt

1. Fold back the upper part of the belt.

Make a bias cut on the lower belt part .

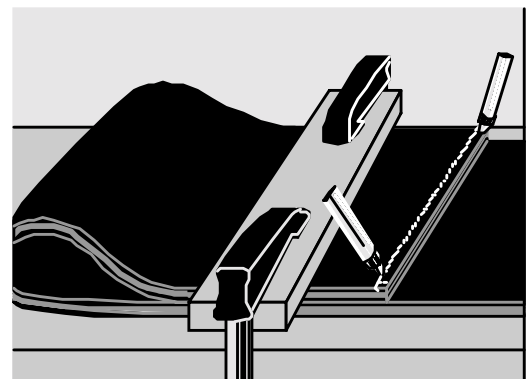


2. Fold back the lower part of the belt and draw a line parallel to the bias cut on the pulley side, at 1 inch from the belt end.

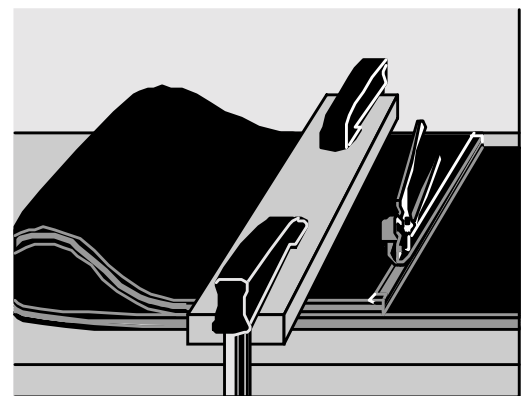
Also mark the belt rubber edges to be preserved.

Cut the rubber cover along that 1 inch line with a dull & rounded tip Mill Knife held at an angle (of approx. 45°), without damaging the top fabric ply.

Also cut the rubber cover along the marked rubber edges with the mill knife held vertically, without damaging the top fabric ply.



Using pincers, strip the rubber cover (thus preparing the future joint gap).



With an off-set knife, cut the rubber edges flush with the upper fabric ply.

Splicing process

3. Fold back the lower part of the belt again and mark the splice length (l_v according to the chart), step length (l_s) and rubber edges.

Draw another line 1 inch parallel to the splice length line.

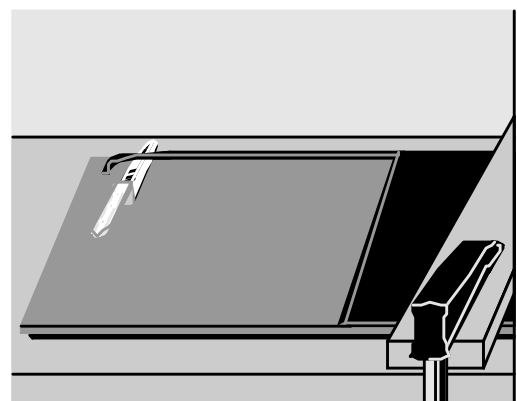
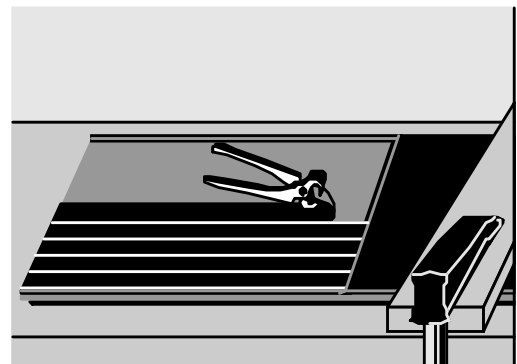
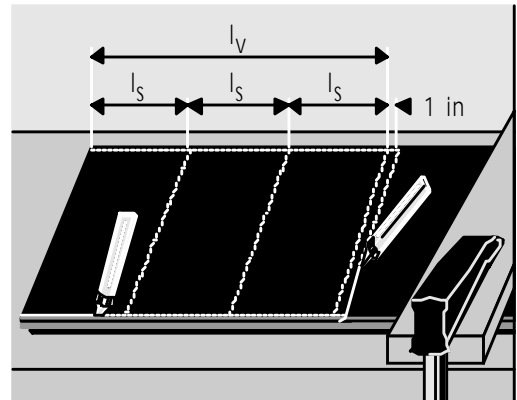
Cut the rubber cover along this line with a dull tipped Mill Knife held at an angle of approx. 45° .

Also cut the rubber edges with a Mill knife held vertically.

Avoid damaging fabric plies!

4. Cut the rubber cover in narrow strips (approx. 1 - 1.5 inch wide) and strip them using pincers or grip tongs.

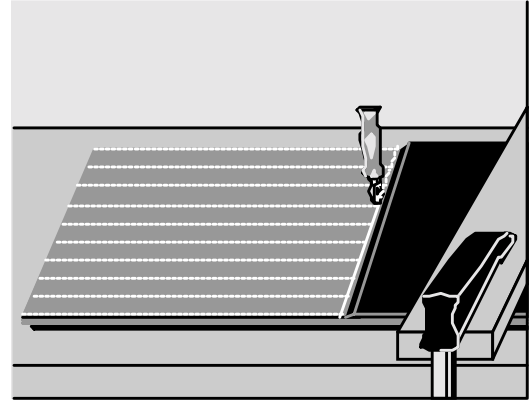
Cut the rubber edges of the conveyor belt flush, using an off-set knife.



Splicing process

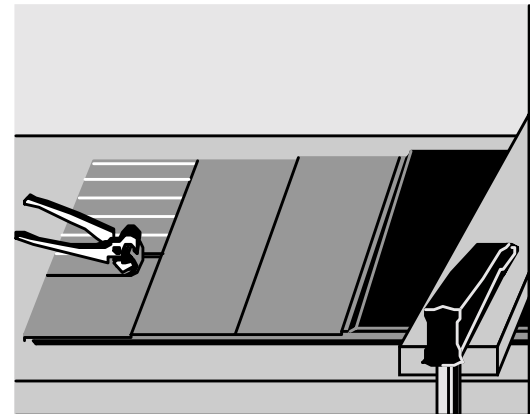
5. Cut the top fabric ply with the one ply knife 1 in. from the rubber cover, detach this ply using a ply lifter and strip it with pincers or grip tongs.

Mark the subsequent fabric plies according to the step length (l_s), cut them and detach these plies using a ply lifter and strip them off.



The last fabric ply has to be retained.

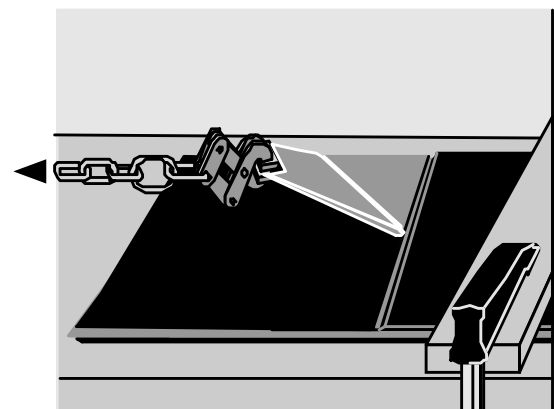
Using an off-set knife, cut the belt edges flush with each fabric step.



OR

5.1 Remove the rubber cover strip and detach this ply using a ply lifter. Strip the upper ply and rubber cover using the grip tongs.

Cut the rubber edges of the conveyor belt flush, using an off-set knife.



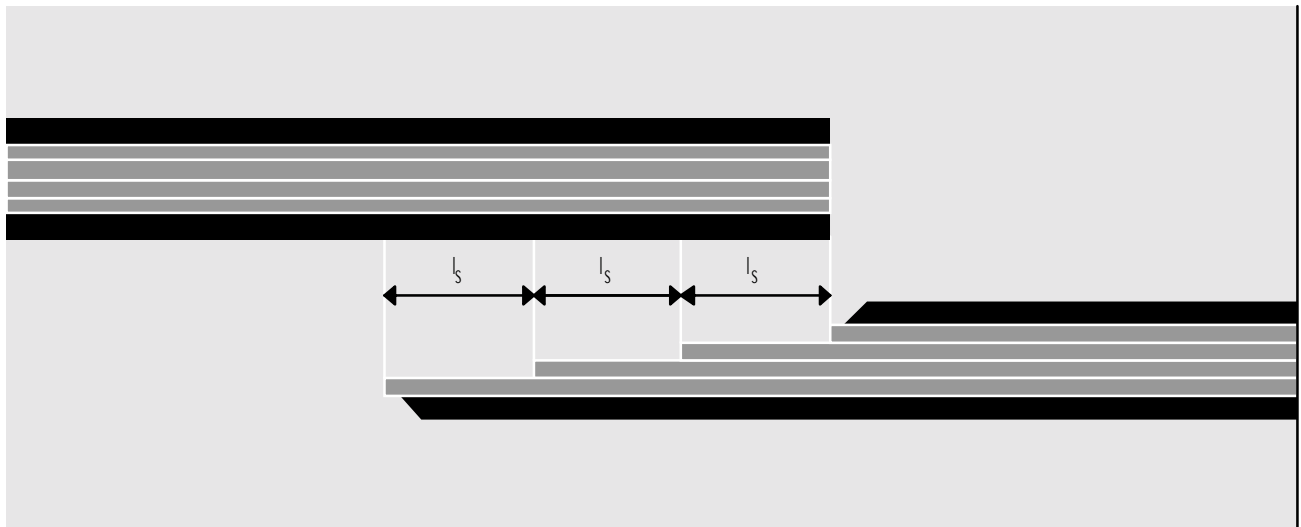
Splicing process

Preparation of the upper part of the belt

1. Superimpose the belt ends ensuring correct alignment. Secure both parts against dislocation (e.g. with clamps).

Exactly transfer the cut edge of the top fabric ply of the lower part to the upper part.

Transfer the subsequent fabric steps of the lower part to the upper part (make the marks with a marking crayon on both edges of the belt).



2. Cut off the excess length of the upper part put on the lower part.

3. Draw a line on the carrying side 1 inch from the cut.

Mark the rubber edges too.

Cut the rubber cover along the 1 inch line with a Mill knife held at an angle of 45°, without damaging the top fabric ply.

Also cut the marked rubber edges with the Don Carlos knife held vertically.

Strip off the rubber cover with pincers (thus preparing the joint gap).

Cut the rubber edges flush using an off-set knife.

Splicing process

4. Fold back the upper part of the belt, secure it and prepare the pulley side just as the carrying side of the lower part.

(Step the fabric plies, cut the rubber edges flush.)

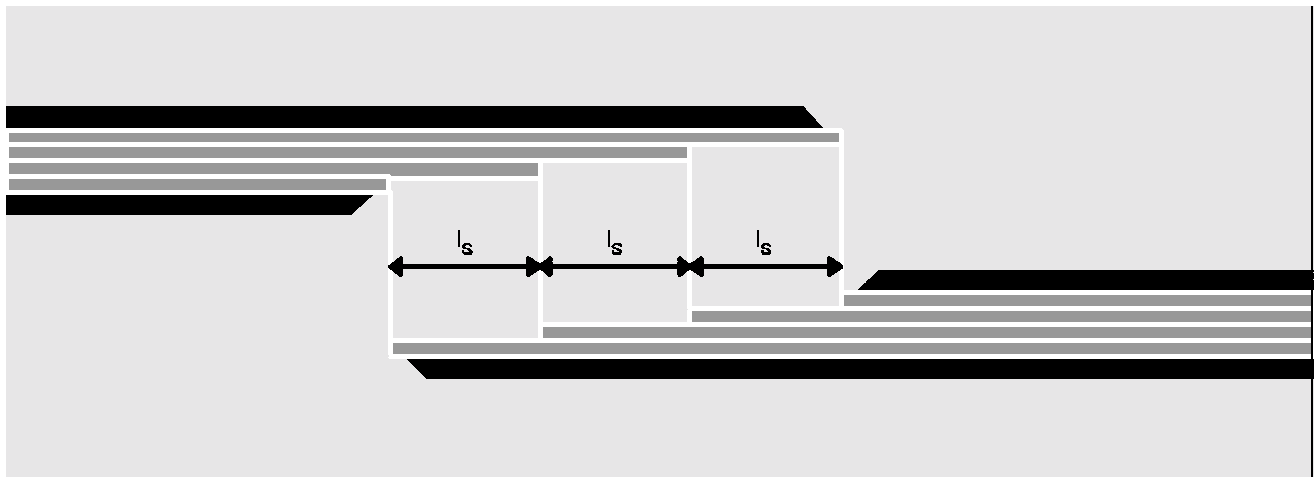
5. Control

Superimpose the two belt ends.

Check if the joints and fabric steps match exactly.

Rectify, if necessary.

Make sure that the edges of the two belt ends are correctly aligned.



Joining of the splice

1. Carefully buff the cut edges of the rubber covers and the surface of the rubber edges with a buffing tool (e.g. a rotating wire brush).

Buff the intermediate rubber and buff even any un-even spots.

When buffing, do not scorch or smear the rubber nor leave shiny spots on it. Round the edges of the fabric steps, without damaging the fabric (e.g. protect it with a thin tin plate).

Splicing process

Carefully remove the buffing dust with a dry brush.

2. Thoroughly stir the required quantity of splicing cement before use.

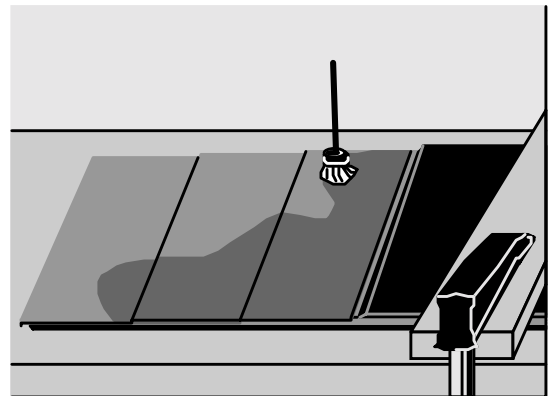
Attention:

The splicing cement should remain covered until use and then recovered to min thicking.

The fabric cement comes in two types.

STL-RF4 Cement (Flammable)

STL-RF Cement (Non-Flammable)



Apply two coats of the splicing cement to the whole splicing area and the joint gaps of both belt ends.

Use a brush with short bristles.

Let the first coat dry completely (minimum: 30 min.)

Let the second coat dry (for approx. 30 mins. at 68°F), until it is just a little sticky (check with the back of your finger).

Note:

The drying time will be shorter, if the conveyor belt is warmed up by means of the preheated lower part of the vulcanizing press.

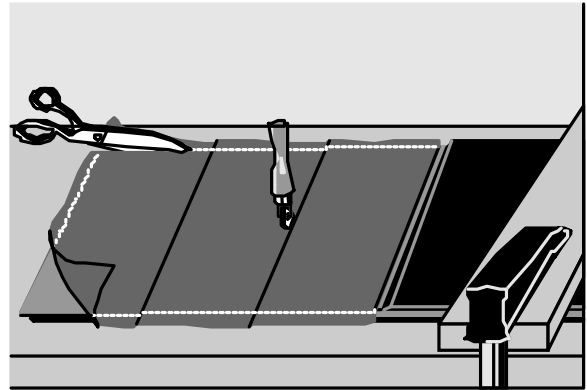
Splicing process

3. Cover the fabric steps of the lower belt part with uncured tie gum rubber.

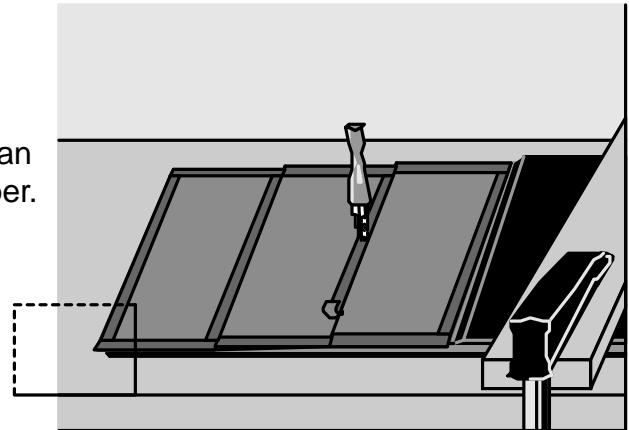
Stitch the rubber to avoid air entrapment.

Cut the tie gum rubber flush with the belt edge.

Remove the protective foil.

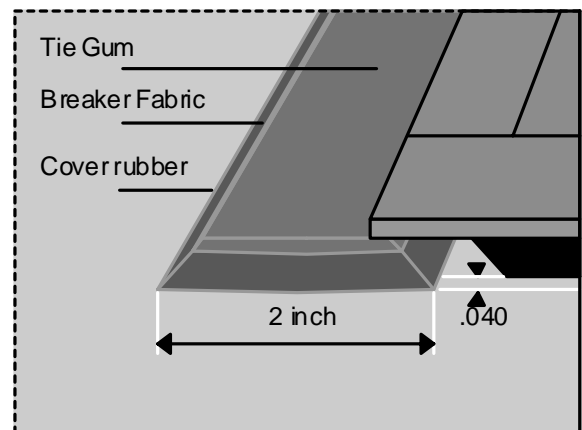


4. Cover the rubber edges and fabric steps with an approx. 1 inch wide strip of uncured tie gum rubber.



5. For the joint gap on the pulley side cut to size an exactly fitting filler strip consisting of a strip of uncured tie gum rubber, breaker fabric and uncured cover rubber.

The applied filler strip must be 0.040 in thicker than the rubber cover of the belt.



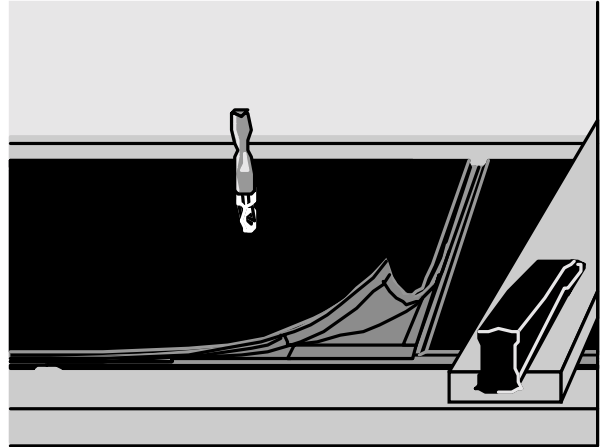
Splicing process

6. Superimpose the upper and lower belt ends, aligning them exactly using the center line of each belt and avoiding air entrapment.

The splicing areas have to match exactly.

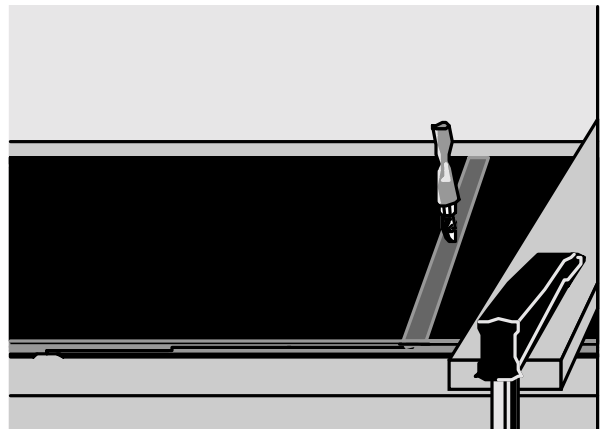
Do not superimpose fabric joints which are on the same level (i.e.- overlapped plies).

Stitch or roll the whole splicing area from the center outwards.



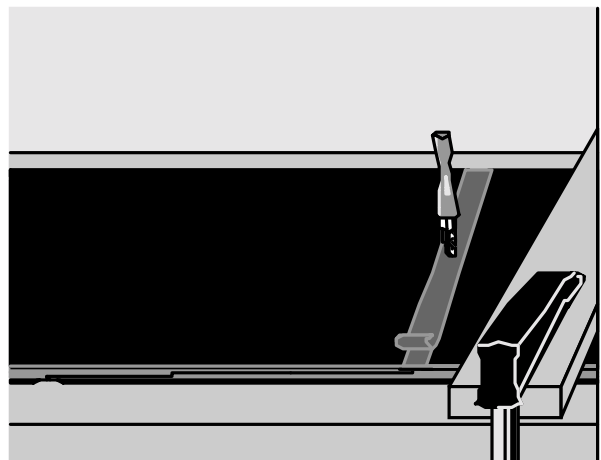
7. Apply one strip of uncured tie gum rubber to the joint gap on the carrying side, then fill the gap with uncured cover rubber and stitch vigorously.

Trim excess filling flush with the belt surface using an off-set knife.



Apply a strip of uncured rubber cover, approx. 2.5 inch wide and 0.040 inch thick, to the filled joint gap.

Stitch thoroughly and cover both joints with brown release paper.

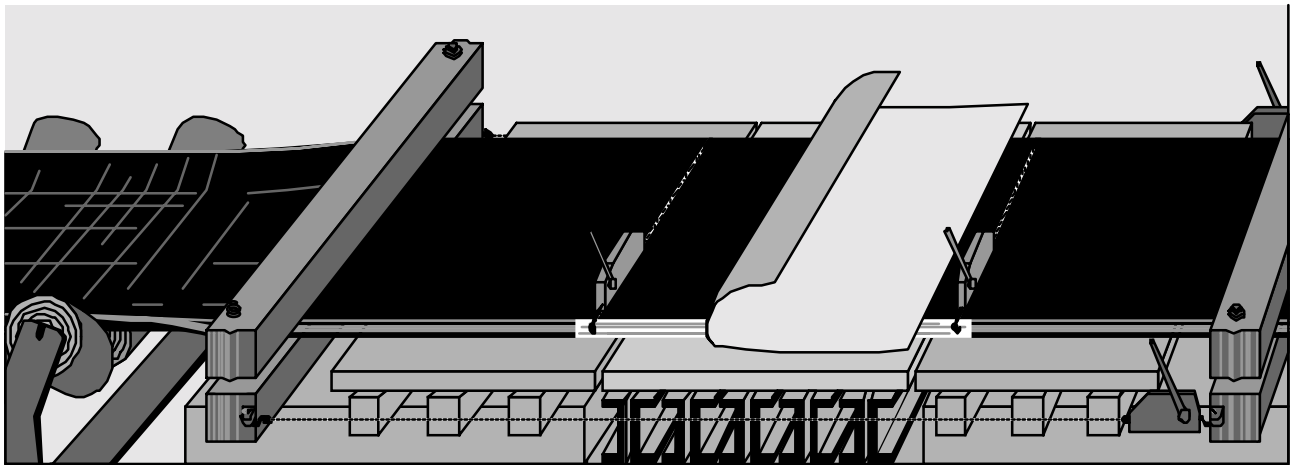


Splicing process

Vulcanizing the splice

1. Apply edge bars to either belt edge and press them against the edges of the splice, using tightening clamps mounted outside of the area of the vulcanizing press.

Note: The edge bars have to be approx. .060 inch thinner than the unspliced belt.



Cover the whole splicing area with Brown Release Paper.

Level out uneven surface areas using Pressure Compensation Cloth (especially if parts of the rubber cover are worn out or in case of overlap splices).

2. Apply and position the upper heating platens.

Position the upper cross arms, making sure that the two extreme cross arms are located outside of the splicing area.

The heating platens have to cover an area which is on either side at least 4 inches longer than the splice length and at least 2 inches wider than the belt width.

Splicing process

Secure the upper and lower cross arms and generate pressure and heat according to the operating instructions of the vulcanizing press:

Pressure (Surface pressure)	100 - 125 PSI
Curing temperature	300 F - 5 F
Curing time per 1/16 belt thickness	5 mins.
Minimum curing time	30 mins.*

3. After the curing cycle, switch off the curing system (unplug the press to cut off the power supply).

Let the conveyor belt cool down under pressure to a temperature below 150°F, in the closed vulcanizing press. Water cooling can also speed up the cool down process.

Then unlock the cross arms. Remove the upper cross arms, heating platens and Pressure Compensation Cloth and/or Brown Release Paper.

Detach the edge bars and remove them.

* Note:

The curing time is calculated as of the moment when 300°F is reached on the belt surface.

At least 125 PSI for heavy fabric conveyor belts.

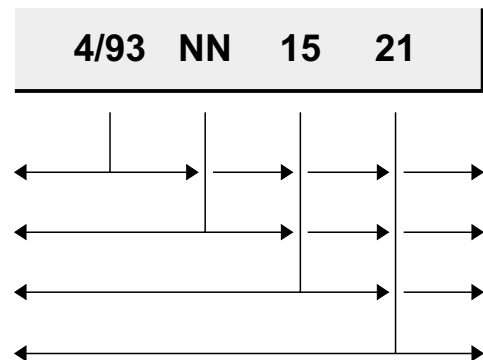
Splicing process

Final measures

1. Check for correct vulcanization (e.g. Shore hardness, absence of porosity, elasticity and thickness of the splice).
2. Remove material overflow (with knife, buffing tool) and cut even the belt edges.
3. If necessary, mark the splice:
 - by using the TIP TOP White Marking Rubber
 - by using the TIP TOP Rubber Cutter
 - by using the TIP TOP (electric) branding iron

Marking example according to the DIN 22102 part 1:

- Date of splicing (month / year)
- Manufacturer's identification
- ID abbreviation of vulcanizer
- Number of the splice



4. Remove the lower part of the vulcanizing press and the working table / platform.

Reinstall the carrying idlers, if necessary.

Remove belt tensioners.

5. The conveyor belt can be put back into operation, after the splice has cooled down to ambient temperature.



1. JOBDetails

Customer: Contact Name: Job Card No.:

Supervisor: Crew Names:

Date/Time: Scope of Work:

Special Instructions:

.....

2. SITE INFORMATION

Site Conditions: Accessibility:

Weather: Temperature:°F/°C Humidity:%

Arrival/Dept.:h/..... h Reported to:

Belt isolated/locked by: Waiting time:

3. BELT DATA

Belt Manufacturer: Belt Type:..... Belt Length:

Cover Thickness: Bottom Cover: Top Cover:

Cover Grade: Belt Condition:

Splice Length: Step Length:

Thickness	Left Side	Right Side	
Leading end (first belt end)	
Trailing end (second belt end)	
Alignment:	1	2	3
Width of first belt end (leading end)
Width of second belt end (trailing end)

4. MATERIALS USED

Splicing Product	STL Cement	Cover Stock	Breaker	Tie Gum
Manufacturing Date				
Expiration Date				

5. CURING PROCESS

Vulcanizing Press: Manufacturer: Model:
 Pressure System: o Hydraulic o Air Bag o Mechanical
 Heating Platens: o Rhombic (22°) o Rectangular
 Number of pairs of traverses: Calculated Curing Time:mins
 Thickness of edge bars:
 Heat up time to 300°F (145°C) Time started:h Time reached:h

Curing Time Heating Platens No.	Temperature °F (°C)						Pressure (PSI) Gauge Lbs
	1	2	3	4	5	6	
20 mins							
30 mins							
40 mins							
50 mins							
60 mins							
70 mins							
80 mins							
90 mins							
100 mins							
110 mins							

Cooling down time to 150°F (60°C) Time started:h Time reached: h

6. FINAL QUALITY CONTROL

Alignment: o Correct o Off centerinchs
 Edge trimming: o Yes o No
 Rubber Hardness (Shore A): Top Cover: Bottom Cover:
 Appearance of top and bottom cover surface: Splice marking:
 Signature of Shift Leader: Date:

7. CUSTOMER SATISFACTION

	Professional	Acceptable	Unacceptable
Job organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Safety regulations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Job performance / skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tools and equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work force appearance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work finishing / cleanliness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time keeping	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Observations:

Date: Site Manager: Signature:

Distributor:



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