FERROFLEX BELT SPLICE PROCEDURE

INSTRUCTIONS FOR

HOT SPLICING

OF FERROFLEX BELTING

ARAMID BRIDGE SPLICE

Version

2.1

Contents

1. INTRODUCTION

In this splicing instruction we trust that the knowledge of outlining and cleaning the belt is common to the splicer. However we have to take notice that the Ferroflex belt is only to be cleaned with benzine.

This splice instruction applies to Ferroflex belts of quality RA, RE, RS, RSW, RAS, RES, Betahete and BV K/S, up to and including a tensile strength of 1250 N/mm. For these belt types, this Aramid Bridge Splice System is an effective method for joining Ferroflex belts. For the splicing procedure pertaining to Ferroflex belting with a higher tensile strength and for Ferroflex Deltahete quality, we advise to use our “Ferroflex high tension finger splice instructions”.

When in doubt, please contact our Application Engineering Department on +31 (0) 512 585 555.

2. MATERIALS

Because the splice is the weakest spot in a conveyor belt, it is essential to make the splice with greatest possible accuracy. This can be best achieved by making the splice using the correct materials and by following the step by step procedures as described in this document.

The following names are used for the splicing materials:

Dundisol:	Solution to enhance tack	black liquid
Dunlofol:	Unvulcanised adhesion (skim) rubber	sheet
Insertion strips:	Aramid reinforcement fabric with unvulcanised adhesion (skim) rubber	strips
Rubberised fabric:	Reinforcement fabric with unvulcanised adhesion skim rubber	sheet
Duncover:	Unvulcanised cover rubber	sheet

Additional instructions and/or materials may be provided separately for specific belt types/constructions.

All splicing materials have a limited shelf life. Splice material past its expiry date should not be used. Each component of the splice kit is marked with an expiry date. These dates should always be checked prior to commencing splicing.

Splice kits stored at ambient temperature of approx. 20°C have a shelf life as indicated by the expiry date. Splice kits should be kept in a cold room below 10°C for an extended shelf life.

3. VULCANISATION REQUIREMENTS AND TOOLS

The first step in making a good quality splice is preparing the work area so that it is efficient, well lit, clean and adequately protected. Outside installations should be protected by a shelter against adverse weather conditions. Inside installations should be cleaned of excessive dust (especially overhead), have good lighting and protected against dripping water.

The edges of the platen must be parallel to the direction of the belt run travel.

A splicing table extending at least 2 m from each end of the bottom platen and 25 mm wider than the belt should be constructed. In addition, a separate table of sufficient size should be constructed on which to prepare the rubber splice components. The splicing table must be level or 5 mm lower than the platen surface.

The vulcanising press must be large enough to cure the splice in one heat with a minimum 100 mm overlap onto the original belt cover at each end of the splice and should be 100 mm wider than the belt width.

For multi platen vulcanising presses, use two solid platens to cover the entire area top and bottom with a minimum overlap of 50 mm on each end.

The vulcanising press must be capable of a curing pressure on the belt surface of 6 - 10 bar (87 – 145 psi).

The curing temperature must be accurately controlled between 150°C and 155°C (300°F and 310°F). The curing temperature must be accurately controlled over the whole platen area to +/-5°C during heating and curing. For this reason, vulcanising presses with thermostats must be carefully checked for functionality and monitored continuously with thermocouples to ensure they are operating properly. The thermocouples should be strategically placed over the surface of both top and bottom platens. Over cure and/or under cure do not provide sufficiently strong splices. The curing time starts when a temperature of 150°C is reached.

Refer to table 2 for vulcanising times.




SUGGESTED TOOLS:

- press: length: splice length + 200 mm
  width: belt width + 100 mm to accommodate belt and edge bars
  pressure: 6 - 10 bar
  temperature: minimum 150°C, preferably with forced cooling
- three wooden work boards, of at least 2 m long and width adjusted to belt width
- 4 U-clamps to fix the belt to the boards
- chalk cord for aligning purposes
- 2 edge bars: length: splice length +0.6 m, width: 100 mm, thickness: 0.8-1.5 mm below belt thickness
- 2 sash-clamps to tension the edge bars firmly to the belt edges
- oscillating knife (Fein or similar) to remove the cover
- sharpening tool for knives
- Stanley knives
- cord cutter / nibbler
- flat roller and stitch roller
- grinding tool with variable speed
- pinchers to remove cover
- thickness gauge
- two thermometers with gauges to insert between belt and heating plate
- two thermometers to measure temperature inside heating plates

4. BELT PREPARATION

4.1 Belt length

When preparing a splice, allowance must be made for the extra belt length needed for the splice and for pulling the belt on the installation.

4.2 Assemble the necessary splice materials and check accurately

Only use fresh materials (observe expiry date). Partly solidified solution can be diluted with benzine. If the cover quality is not abrasion resistant the solvent mentioned on the solution label should be used.

4.3 Splicing area

The tensioning system has to be released completely. The belt has to lie in the centre of the troughing idlers. The belt is pretensioned as tight as possible. The troughing idlers have to be removed at the place where the splice is to be made. The bottom press traverses with the bottom press platen have to be positioned under the splice.

A suitable working place has to be made. A worktable can be made up using beams and boards. If the circumstances make it necessary, a tent has to be erected in order to protect the splice area. Humidity and dirt have a very adverse effect on the quality and the strength of the splice. Check electricity connections.

4.4 Splice dimensions

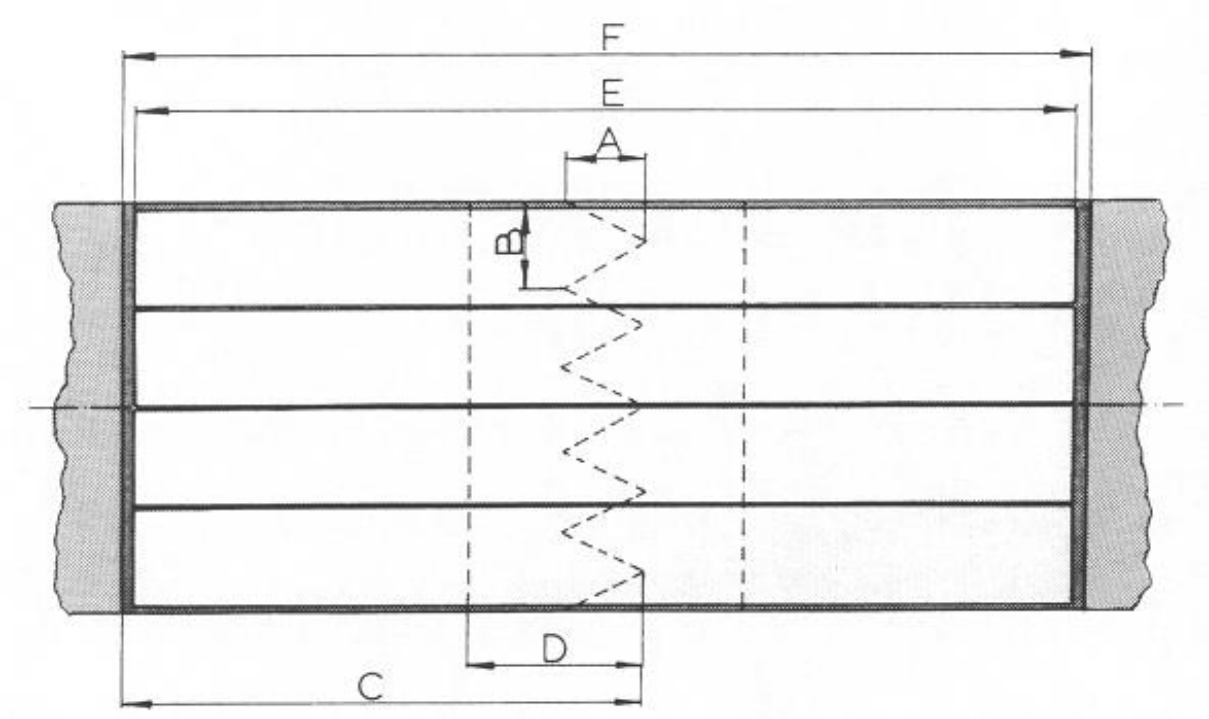

Figure 1: Schematic presentation of the building of the splice.

The dimensions corresponding to the letters are found in table 1.

Belt type	Over length A (mm)	Finger width B (mm)	Step length above C (mm)	Step length below D (mm)	Length of insertion strip E (mm)	Splice length F (mm)
F 500	100	100	290	160	440	480
F 630	100	100	340	160	540	580
F 800	100	100	390	160	640	680
F 1000	100	100	440	160	740	780
F 1250	100	100	490	160	840	880

Table 1: Dimensions of required splice materials and of the splices.

For the splicing procedure pertaining to Ferroflex belting with a higher tensile strength and for Ferroflex Deltahete or ROS quality, please refer to our “Ferroflex high tension finger splice instructions”.

5. MAKING THE SPLICE

5.1 Drawing of the centre and the base line (see figure 2)

Centre line: First mark the centre line of the belt by measuring the mid-point of the belt width at a minimum of three stations and join these points together. Using a square, mark off a base line at right angles to the centre line.

Base line: Draw a perpendicular line from the centre line of the belt with a square (see figure 2).

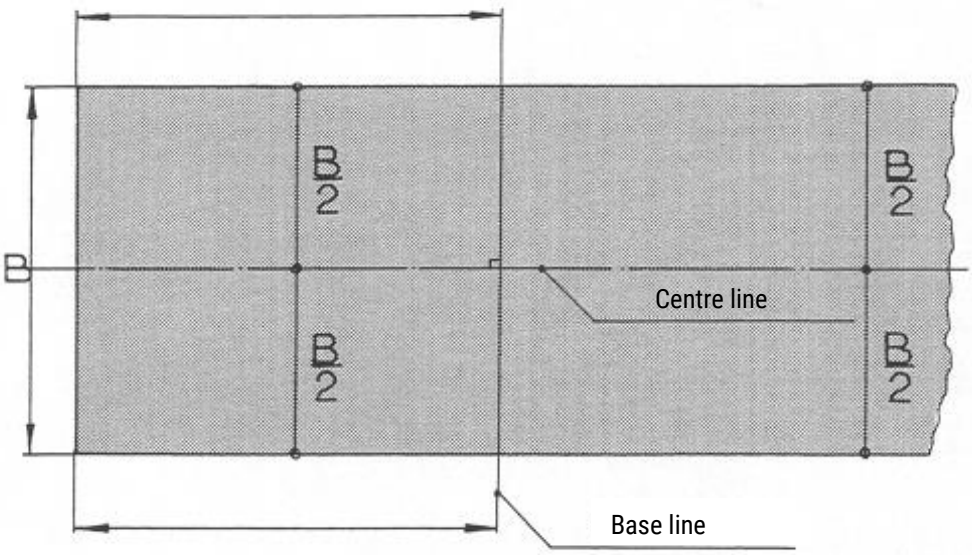

Figure 2: Drawing of the centre line and the base line.

5.2 Removal of the covers

Cut the belt end square. Draw the step length C on the top cover.

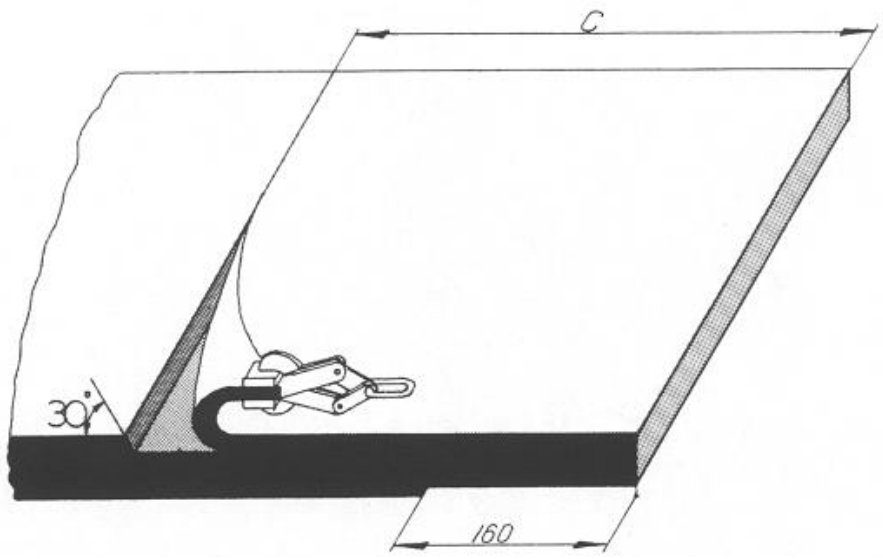

Figure 3: Removal of the covers

At a distance C from the belt end, a 45°-angled cut is made in the top cover to a depth just above the level of the longitudinal cords of the steel fabric.

At a distance D (see figure 3 on page 5) of 160 mm from the belt end the bottom cover must be cut as well at an angle of 45°.

For the removal of the covers a corner of the cover should be loosened with the aid of a knife and pincers, then placed in a clamp and kept under tension with the aid of a winch or a pull lift in the direction of the belt end. Cut with a knife just above the longitudinal cords so that the cover is being, so to speak, skimmed. **The transverse cords also need to be removed** together with the top cover. This means that the cutting should take place between longitudinal and transverse cords.

5.3 Alignment of the belt ends and drawing of the fingers

Start with the leading belt end. Draw a line at a distance of 100 mm from the belt end and parallel to the belt end. Working from the centre line the belt width is divided in equal parts of 100 mm, and subsequently the fingers are drawn as illustrated in figure 4.

Note: Ensure that the outside fingers trail in direction of belt travel (see figure 4).

When the belt ends have been perfectly aligned draw the fingers on the trailing end of the splice using the already prepared fingers of the leading ends as a template.

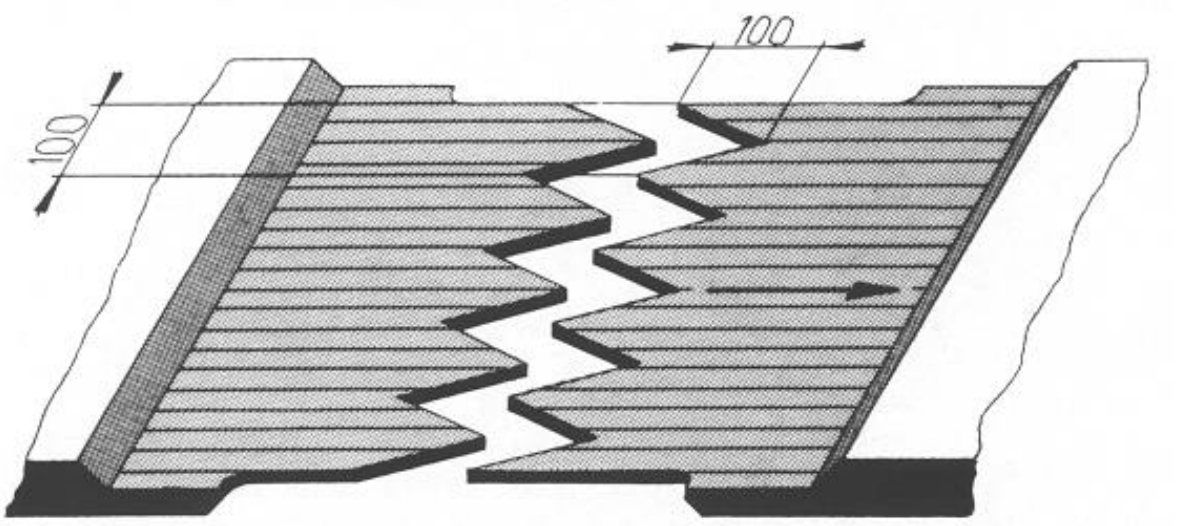

Figure 4: Alignment of the belt ends and drawing of the fingers.

5.4 Cutting of the fingers

Cut the fingers along the line with the cord cutter or the nibbler.

5.5 Finishing of the prepared belt ends

The surface of the skimmed belt ends have to be buffed and made level.

Dirt and dust must be removed completely. The rubber layer between the steel cords must remain undamaged!

The brass layer, which covers the steel cords, should not be damaged since it provides the good adhesion between rubber and steel cords. The covers which are cut at an angle (see figure 3 and 4) must be buffed by means of a rotating wire brush. Once buffed and cleaned, surfaces should not be touched.

The under surfaces of both belt ends have to be covered carefully with a thin coating of solution. The solution should be allowed to dry completely!

5.6 Building of the splice (see figure 6 page 14)

Key to the numbers in figure 6:

1 = Top cover

2 = Aramid insertion material

3 = Skim rubber Dunlofol (3.2 mm thick)

4 = Skim rubber Dunlofol (0.5 mm thick)

5 = Belt end

6 = Rubber edge

7 = Rubberized fabric

8 = Bottom cover

The rubberized fabric and the new bottom cover rubber, which has to fill the gaps, should be coated with a thin layer of solution. The rubberized fabric and cover rubber have to be stuck together and positioned in such a way that when the fingers are put together they fill the gap in the bottom cover completely, without any seams.

The belt ends are aligned in such a way that the centre line of one belt end is in a direct line with the centre line of the other belt end and leave a seam of approx. 1 mm between the fingers of both belt ends. Fill this seam with skim rubber. After doing so the top cover has to be built up.

The surface of the steel fabric must be coated once with solution. After drying the fabric is covered with a 0.5 mm thick layer of skim rubber. The skim rubber should be rolled on carefully so that air trapping is avoided.

After the removal of the protecting liner the surface is also coated once with solution.

The aramid insertion strips have to be cut to the required length in accordance with table I (page 7) and a single coat of solution applied.

After this the insertion strips are positioned in accordance with figure 6 on page 14. Commence from the centre line of the belt. When the edge of the belt is reached the outer edges of the aramid strips should be lined up with the outer edges of the steel fabric. The aramid strips may be trimmed to the desired width with a normal pair of shears. The space of approx. 20 mm between the end of the insertion strips and the chamfered cover must be filled with 3.2 mm skim rubber.

After this the top cover is built up with layers of cover rubber. The various layers of cover rubber are stuck together by means of solution. The solution should be completely dry. The overall splice thickness should be 0.5 mm to 1 mm thicker than the parent belt. After that the edges of the belt are added in the splice area and any seams have to be filled with rubber.

In order to achieve a surface free of air traps and unevenness it is advisable to lay a release cloth over the splice. The splice is retained at the edges by iron edge bars. These must be 0.8 to 1.5 mm less in thickness than the belt.

Prior to closing the vulcanising press the straightness of the prepared splice should be checked once more. Then the curing can begin.

6. VULCANISATION

Clamp both belt ends just outside the press to ensure that the belt ends do not move during vulcanisation.

Apply pressure. The pressure during vulcanisation must be minimal 6 bar (60 N/cm^2, 87 psi). See the temperature/time diagram for the exact pressure cycle. To improve flow of the splice materials and reduce air pockets, optionally stop heating the press for 5 minutes when both plates have reached 110°C, then continue the heating cycle.

The vulcanisation temperature is between 150°C and 155°C. The vulcanising time starts when a temperature of 150°C is reached (see figure 5). Refer to table 2 for vulcanising times.

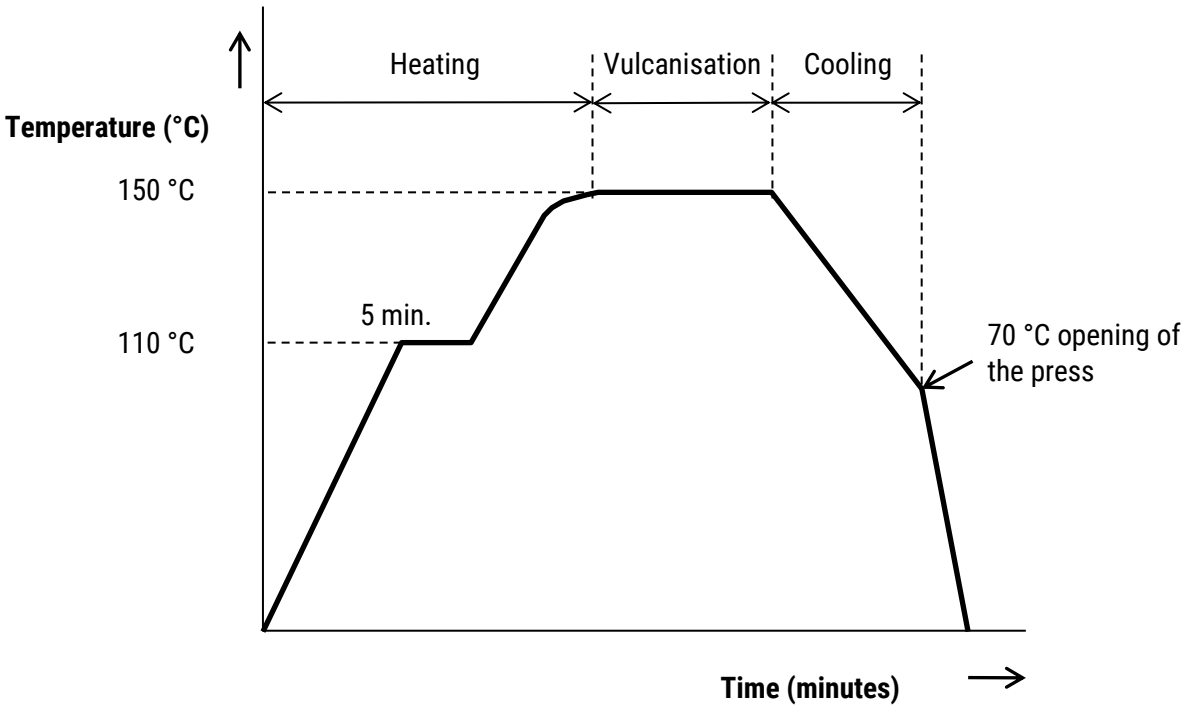

Figure 5: Temperature during vulcanisation

Qualities	Belt thickness (mm)			
	up to 10	10 – 15	15 – 20	20 – 30
AA, RA, RS, RSW, RE, RES, RAS	20	25	30	40
Betahete	20	25	30	40
BV K, BV S	25	30	35	45

Table 2: Vulcanisation time in minutes.

7. COOLING

When the splice has been vulcanised for the recommended time the power supply should be switched off. The press must cool down while still under pressure! When the cure is completed, water cool to 70ºC (160°F) and hold for 15 min before releasing the pressure. If no water cooling is available, allow to cool to 70ºC before releasing pressure. After this the press can be dismantled.

Any flash at the belt edges or at the transition of the covers should be trimmed off. The belt may be tensioned after the splice has reached the ambient temperature.

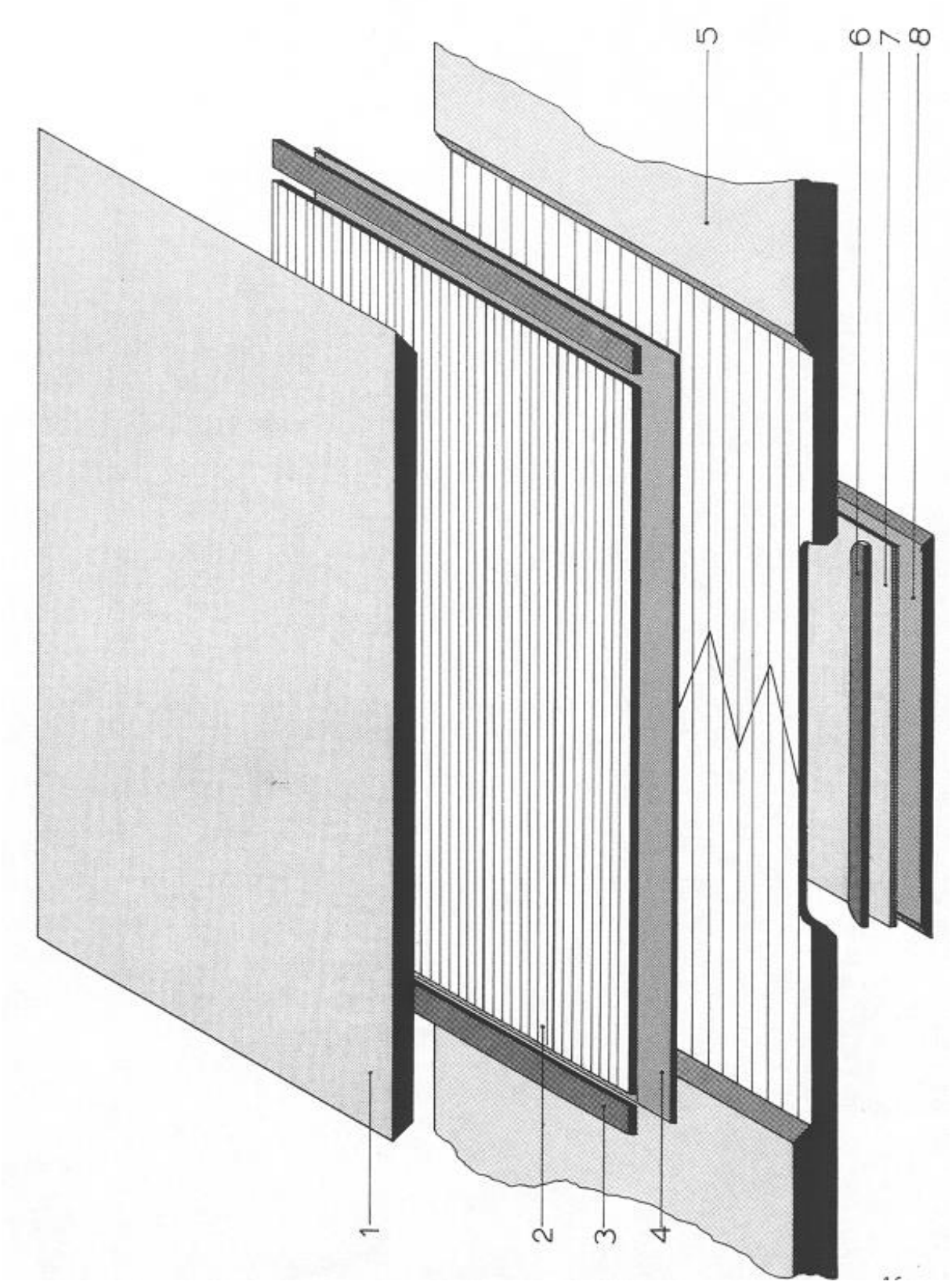

Figure 6: Building of the splice

APPENDIX 1

Using foreign splicing materials with Dunlop belts

Where materials other than those of Dunlop are being used there are two important considerations:

NOTWITHSTANDING THE ABOVE REMARKS, DUNLOP CANNOT GUARANTEE THE COMPATIBILITY OF THE MATERIALS BEING USED AND IT IS THE CARE OF THE PROVIDER OR MANUFACTURER OF THE MATERIALS TO PROVIDE ANY GUARANTEE OR ASSURANCE THAT MAY BE REQUIRED BY THE BELT USER.

AND

THE CURE RATE OF MATERIALS MAY DIFFER CONSIDERABLY AND THE DUNLOP CURING PROCEDURE AND TEMPERATURES ARE NOT APPLICABLE.
THE PROVIDER OR MANUFACTURER OF THE MATERIALS BEING USED MUST SUPPLY A CURING PROCEDURE OR SPECIFIC TIME/TEMPERATURE CONDITIONS.

APPENDIX 2

Instructions for splicing Deltahete quality

We advise to apply the Ferroflex High Tension finger splice procedure for all Ferroflex Deltahete belt qualities.

When using the above Aramid Bridge Splice procedure, the following additional instructions need to be applied:

- Before using rubbers they should always have solution applied, except for any cover chamfers.
- Make sure that the solution never touches the existing cover rubber!
- Apply the solution as thin as possible.
- Wait until the solution is almost dry but still tacky before executing the next step.
- Before putting the fingers in place they should always have solution applied.
- Make sure that the solution never touches the existing cover rubber.
- The vulcanisation temperature for Deltahete quality is between 155°C and 160°C.
- The vulcanising time starts when a temperature of 155°C is reached.
- See table below for the vulcanisation time.

	Belt thickness (mm)			
Quality	**up to 10**	**10 – 15**	**15 – 20**	**20 – 30**
Deltahete	40	45	50	60

Vulcanisation time in minutes for Deltahete quality

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