

# **VULCANISING PROCEDURE**

## **SOLID WOVEN PVC CONVEYOR BELTING**

- **PVC Covers**
- **Nitrile Covers**
- **Neoprene Covers**

## **CONTENTS**

1) SCOPE	2
2) CONDITIONS OF WORKPLACE	2
3) TOOLS AND EQUIPMENT REQUIRED	3
4) FINGER SPLICE DIMENSIONS	4
5) SPLICING MATERIALS TO BE USED	5
6) PREPARATION OF BREAKER FABRIC	6
7) PREPARATION OF FINGER SPLICE – CUSTOM ASSEMBLY	7
8) CURING METHOD	9
9) INSPECTION OF THE FINISHED SPLICE	11
10) IDENTIFICATION MARKINGS OF THE SPLICE	11
11) CONTACT DETAILS	12
APPENDIX A: INSPECTION CHECKLIST	13
APPENDIX B: SPECIAL INSTRUCTIONS FOR NEOPRENE COVERED BELTS	16
APPENDIX C: SPLICE RECORD SHEET	17

## **1 SCOPE**

This procedure details the requirements for hot vulcanizing of solid woven belts with PVC, Nitrile and Neoprene covers and / or a combination of same, to make endless belts using finger-splicing method.

The principle of this procedure shall be applied when splicing any belting made of solid woven carcass and impregnated with fire resistant antistatic PVC compound; and more particularly for ICL MINEPLAST fire resistant antistatic (FRAS) PVC conveyor belting as well as ICL Mineplast belt with Nitrile or Neoprene covers.

Composition of FRAS compounds differs from one country to the other and also in between surface and underground application conforming to the regulatory standard of each country. Therefore, care shall be taken to ensure that proper compounds are used when undertaking any splicing work on solid woven FRAS PVC belting.

The method of splicing described in these guidelines and the materials specified to be used have been developed to ensure that a high strength, reliable joint is achieved. Further, for high strength solid woven belts the finger method contained herein represent the preferred jointing methodology for these belts

## **2 CONDITIONS OF WORKPLACE**

A convenient workplace is a prerequisite for a good splice work. Preparing a suitable workspace well before undertaking the actual work optimizes the total time required between the start and end of the required work. The following conditions should be complied with:

- a) The workplace must be dry and as dust free as possible. Degree of atmospheric moisture and dust present at the workplace has a direct bearing on the quality and effectiveness of adhesion.
- b) Movement of air must be kept to a minimum.
- c) The workplace must have adequate light to ensure a clear and safe working environment.
- d) When working on a conveyor, a worktable to accommodate the press and a preparation table is required. About 3 metres (10 feet) free space at both ends of the worktable is recommended to allow correct alignment of the splice.
- e) Compressed air supply (if required) for the vulcanizing press.
- f) Suitable electrical supply and power points for the vulcanizing press.
- g) Water recirculation for the vulcanizing press if it has a water-cooling facility.
- h) Suitably rated clamps to restrain the belt during the complete procedure
- i) If the work is proceeding on a live conveyor system, ensure the correct and complete isolation procedures have been adhered to.

### **3 TOOLS & EQUIPMENT REQUIRED**

- a) White or yellow crayon pencil to draw datum and reference lines. b) Measuring Tape.
- c) Blade Knives (e.g. fixed blade or Olfa knife).
- d) Alligator Clamps with adequate cable pull. e) Vernier caliper for accurate measurement.
- f) Hand brush.
- g) Planer or slow speed rotary power tool with abrasive head.
- h) Cutting tool for cutting splice fingers as an alternate to blade knife.
- i) Spatula for spreading paste.
- j) Scissors.
- k) Vulcanizing Press complete with well calibrated electrical temperature and pressure controls, pressure and water hoses as required with temperature and pressure indicators.
  - Temperature accuracy  $\pm 3^{\circ}\text{C}$  ( $\pm 5^{\circ}\text{F}$ )
  - 689 kPa (100 psi) minimum pressure capacity
  - Platten length = Splice length + 150mm or 6 inches (minimum)
  - Platten width = Belt width + 150mm or 6 inches (minimum)
- l) Two edge bars, approx. 100mm wide and 0.5-1mm thinner than the belt thickness, but approx. 300mm longer than the press length.
- m) Suitable clamping device for the type of Solid Woven belt (usually sash clamps).
- n) Template for marking splice.

## 4 FINGER SPLICE DIMENSIONS (refer Fig 1&2)

Table 1: Dimensions for Finger Base of 50 mm and 1.5 mm gap between fingers

Belt Type (lbs/in or kN/m)	Finger Length 'FL' (mm)	Pull-back distance 'PB' (mm)	Breaker Fabric		Splice Length 'LS' (mm)
			Width 'BFW' (mm)	Side length 'SL' (mm)	
Up to 6000lbs/in or 1050 kN/m	870	55	1025	1450	1125
Up to 6500lbs/in or 1140 kN/m	1050	65	1215	1718	1315
Up to 8000lbs/in or 1400 kN/m	1060	65	1225	1732	1325
Up to 10000lbs/in or 1750 kN/m	1175	75	1350	1909	1450
Up to 12000lbs/in or 2100 kN/m	1215	75	1390	1966	1490
Up to 15000lbs/in or 2600 kN/m	1350	85	1535	2171	1635
Up to 18000lbs/in or 3150 kN/m	1460	90	1650	2333	1750

Note 1 to Table 1: These finger lengths are in consideration of the ICL solid woven carcass thickness for the given belt strengths and will not necessarily apply to other belt brands.

Note 2 to Table 1 If BFW exceeds belt width, it will be necessary to reduce the angle each end of the cut piece to a value less than 45 degrees to the Direction of Belt Travel so that the overlapped breaker fabric seams are contained within the belt width.

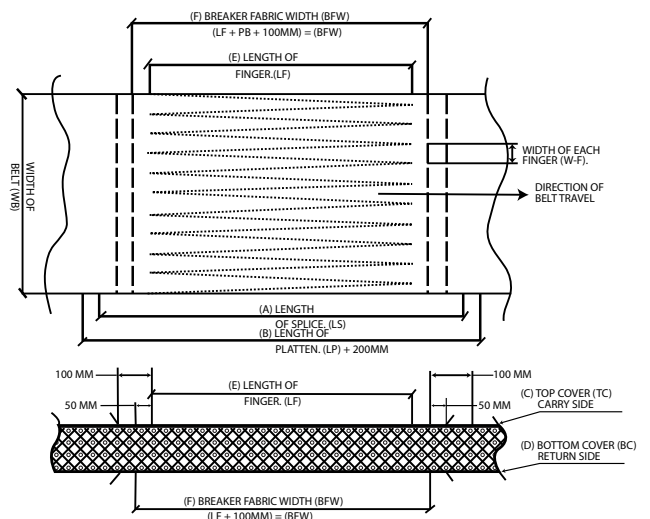


FIGURE - A

Minimum Platten Length = Splice Length + 150mm (6inches)

Minimum Platten Width = Splice Width + 150mm (6inches)

## 5 SPLICING MATERIAL TO BE USED

The dimensions and quantities of splice material are determined by the following:

1. Belt Type (Tensile Strength)
2. Belt Width
3. Belt Cover Thickness
4. Cover type

**The materials required for one splice are:**

- a) **Breaker Fabric:** Width BFW = FL + PB + 100mm  
Length = Belt width x 2 + 200mm (8 inches)
- b) **PVC Paste (FRAS):** High adhesive quality (Refer Table 2 for estimated quantity).

Table 2

Belt Width (in/mm)	GUIDE TO QUANTITY OF PVC PASTE (LTRS)	
	Type 6000 (1050 kN/m) or lower	Type 6500 (1140 kN/m) or higher
36/900	3.0	5.0
42/1050	4.0	6.0
48/1200	4.5	7.0
54/1350	5.0	8.0
60/1050	6.0	9.0
72/1800	8.0	11.0

c) **i) PVC or Nitrile Covered belt:**

Nitrile (FRAS) rubber sheet of thickness 1 mm less than belt covers: Adequate dimension to cover the total splice area. Nitrile rubber is fully compatible with PVC compound (paste).

**ii) Neoprene covered belt:**

- Tie gum (skim compound), 0.8 mm thickness, to go between PVC and neoprene cover.
- Neoprene rubber cover sheet cover thickness 1.8 mm less than belt bottom cover.
- Where top cover is thicker, additional neoprene cover of thickness to make up the difference.
- Adequate dimensions to cover the total splice area. Neoprene rubber has limited compatibility with PVC, hence the need for the tie gum

DO NOT USE NITRILE covers on Neoprene covered Mineplast belt.

d) Silicone Coated Paper (Release Paper): Width = Breaker Fabric Width + 100mm

$$\text{Length} = 2 \times \text{platen length} + 50\text{mm}$$

e) Shelf life

i) PVC (FRAS) Paste: Maximum of 12 months if stored in a dry place, not exposed to direct sunlight and within a temperature range between 5 – 20°C (41 – 68°F).

ii) Nitrile Rubber/Neoprene Cover Sheet: Maximum of 3 months if stored in a dry place, not exposed to direct sunlight and within a temperature range between 5- 20°C.

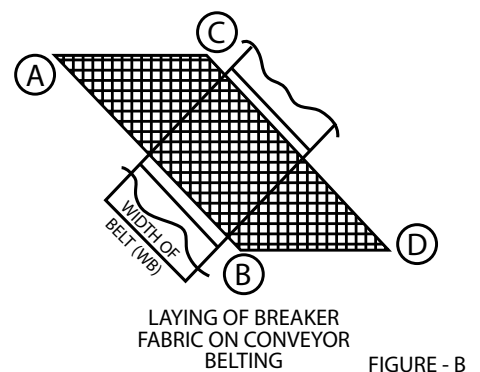
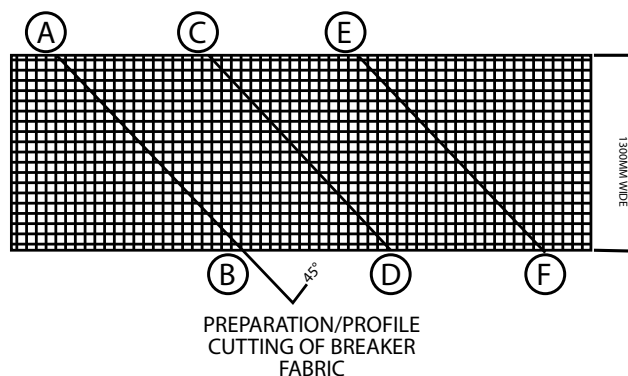
iii) Materials can last longer if stored at 5°C in a cool room, but need to be checked once exceeding the shelf life above

**IMPORTANT:** All materials must be clearly dated and batch marked with shelf life.

## 6 PREPARATION OF BREAKER FABRIC

Breaker Fabric is available in 1600 mm wide rolls and is required to be marked and cut prior to use, as shown in Figure B. This ensures that the fabric is used on the bias, ie. The warp and weft yarns are at 45° angles to that of the belt. For most standard belt strengths and widths, two bias cut pieces will be required.

- Start the process by drawing a 45° diagonal line across the fabric to provide a baseline from which to work (Line 'A' to 'B' in Figure B).
- Measure along one edge of the breaker fabric from the previously marked line at 'A' a distance of  $SL = BFW \times 1.42$  to 'C' as per Table 1.
- Thereafter, draw a line at 45° from point 'C' parallel to the baseline to point 'D'.
- Now cut along both lines to make the breaker fabric bias length as required.



### NOTE WELL:

When the sides of the breaker fabric are folded over the top of the joint, the two edges should overlap by about 50-100mm (2 – 4 inches):

## 7 PREPARING THE FINGER SPLICE – CUSTOM ASSEMBLY

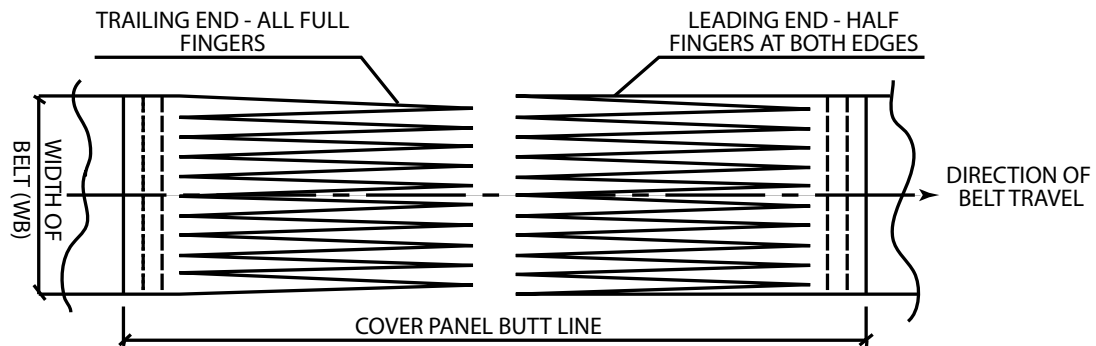


FIGURE - C

### 7.1 Marking & Cutting of Belt Ends

- 7.1.1 Assemble the bottom half of the press in the workstation.
- 7.1.2 Pull the two ends of the belt(s) that are to be joined onto the splicing area so that they have the required overlap length (splice length + 200mm).
- 7.1.3 Mark a centre line at both ends of the belt for a distance of 3 metres (10 feet). Once checked secure belt to table.
- 7.1.4 Using the template and the marked centre line, draw out fingers to be cut ensuring that the 'leading' end (direction of belt travel) will have the trailing fingers as per Figure C.
- 7.1.5 Mark cover panel butt lines 100mm (4 inches) from the end of the fingers as per Figure A.
- 7.1.6 Cut fingers as per marks established in step 8.1.4
- 7.1.7 Remove the cover material from the carcass using slow speed angle grinder fitted with 60 grit disc or alternatively using an electric planner so that the cotton wear interlay is just exposed. Extreme caution is essential to ensure not to grind into the synthetic carcass knuckles. Work only in the direction of belt travel. Neoprene covers can be stripped off the fingers exposing the cotton wear interlay which then can be lightly removed/buffed, ensure not to grind into carcass knuckles. Lightly scratch the finger sides.

**NOTE:** for Neoprene covers, the cover butts must be skived at an angle of 45 degrees and prepared as per Appendix B and kept free from PVC paste.

- 7.1.8 Lightly buff the cover of the belt on both sides for approximately 50mm past the cover panel butt line.

**NOTE 1:** Pre-heat the belt up to a maximum 50°C (122°F) to assist in cutting the finger. Warm carcass, impregnated with PVC compound (paste), eases the cutting effort.

**NOTE 2:** It is important to cut the fingers accurately to ensure a high joint strength. It is critical that the fingers are cut at right angle (90°) to the belt surface. Quality of adhesion is largely dependent on the quality and consistency of how the fingers are cut. Also ensure that fingers are scratched for preparation.



- 7.1.9 Arrange the fingers allowing a 1.5 mm gap between each finger and ensuring both ends are correctly centred. The required 1.5mm gap is obtained by laying both ends down with the additional Pull-Back distance per Table 1.between the two cover panel butt lines.
- 7.1.10 Check alignment of the belt onto the preparation tables to ensure no movement. (via string line).

## 7.2 Assembly of the Finger Splice

- 7.2.1 Mark the cover panel butt lines on the lower cooling plate.
- 7.2.2 Fold back each end of the splice and fasten. The splice area on top of the cooling plate is now empty.
- 7.2.3 Heat bottom platten to approximately 40°C (104°F).
- 7.2.4 Lay release paper over the lower cooling plate.
- 7.2.5 Lay the lower (bottom) cover of adequate length ("long piece" = belt width plus 400 mm) face up on the cooling plate.

For neoprene cover, roll down a layer of tie-gum of the same length over this.

- 7.2.6 Lay the breaker fabric of full wrap around length cut at 45° bias on top of the cover (or tie gum for neoprene). For belts over 1050 mm wide, two pieces will be required with an overlap of 50 to 100 mm ensuring that the diagonal seam so formed is centrally disposed and entirely within the belt width.

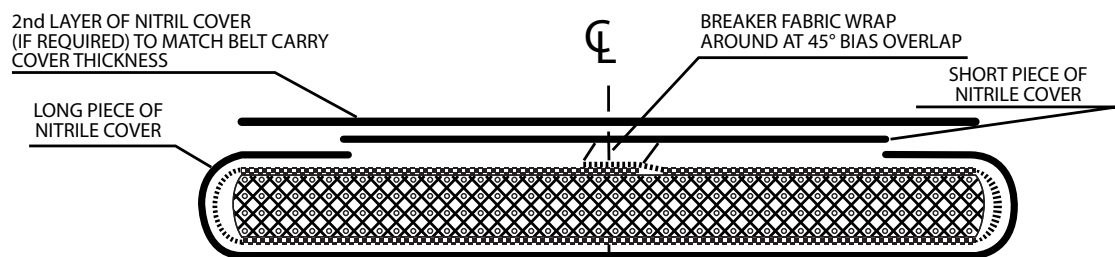


FIGURE - D

- 7.2.7 Spread FRAS PVC paste over this to a thickness of about 1.0mm.
- 7.2.8 Remove clamps and slowly place both ends of the belt (one end at a time) on top of the nitrile sheet and breaker fabric. Smear each finger thoroughly with paste.
- 7.2.9 Release 2nd belt end allowing the fingers to lie into the paste.
- 7.2.10 Ensure that the spacing between the fingers lie submerged in the paste.
- 7.2.11 Spread paste over the laid fingers ensuring that the paste completely fill the gaps between fingers and is spread to a depth of about 1mm.

**IMPORTANT:** The efficiency of any splice depends on the breaker fabric and splice fingers being properly impregnated with paste.

- 7.2.13 Wrap the breaker fabric around edges up to the top centreline of the belt width. Keep an overlap of 50 – 100mm (2 – 4 inches) and ensure that all the fingers from both ends – leading and trailing – are closed together without squeezing out the paste around the fingers or over-riding one another. Extreme care shall be taken to ensure this compliance.
- 7.2.14 Spread FRAS paste on the edges and on the top of the wrapped around breaker fabric to cover the interstices of the fabric as well as between the assemble fingers and the breaker fabric.
- 7.2.15 Wrap the long cover over the splice edges and wrap around breaker fabric to at least cover the outer fingers. This process will ensure fingers both ends of the belt sit side by side (male-female) without uneven gaps between the two adjacent fingers or without any over-ride.
- 7.2.16 For neoprene covered belts, prepare the shorter cover panel by rolling tie gum over the pre-cut Neoprene cover.  
Place the shorter cover on top of the paste (tie gum against the paste for neoprene) submerged and wrapped around breaker fabric in the position as shown in Figure D and trim to butt with the wrapped longer bottom panel. Ensure that there is adequate paste between the breaker fabric and the nitrile sheet.  
In cases where the top cover is thicker than the bottom, roll over a full width layer of cover of the appropriate thickness  
**Note well:** To ensure the PVC does not contaminate the skives, back off the paste by 4 to 5 mm during lay-up
- 7.2.17 Cover the entire splice with release paper.
- 7.2.18 Place and secure edge bars in the correct position adjacent to both edges of the belt width.
- 7.2.19 Assemble top of the press, securely clamping edge bars with restraining devices to prevent any movement of the spliced fingers during vulcanisation.

## 8 CURING METHOD

- 8.1 Assembling the curing process.
- 8.2 Pre-heat the press to 100 + 5°C (212°F) without applying the pressure.
- 8.3 Maintain the temperature at 100°C (212°F) for 10 minutes.
- 8.4 Then apply 690kPa (100 psi) pressure and simultaneously increase platten temperature to 150°C (302°F). Make sure all platten heat evenly (+3°C). If necessary, manually control the plattens.
- 8.5 The residual cure time per Table 3 starts when the temperature of all platten sections reaches 147°C. Maintain an even specified platten temperature within +3°C during the curing process.

- 8.6 It is essential that the temperature is maintained at 150°C (302°F) for the specified residual time for proper curing. Lower temperature for longer time or higher temperature for shorter time shall not give the required quality of curing.
- 8.7 Cool the press on completion of curing. It is preferable to use water to achieve rapid cooling and prevent any possibility of 'over cure'. The press should be selected accordingly.
- 8.8 Release pressure from the press once all plattens have cooled below 50°C (122°F), but not until at least 15 minutes have elapsed after the residual cure time (this ensures the belt centre has cooled to a "safe" temperature).
- 8.9 Disassemble the press and remove the release paper.
- 8.10 The conveyor may be tensioned only after the belt has naturally cooled to ambient temperature.

Table 3. Curing times (after achieving target temperature)

Belt Thickness	Cure Time, minutes			Cool down time / temp
	PVC	Nitrile	Neoprene	
0-10mm	25	30	35	15' / 50°C
10-12mm	26	31	36	15' / 50°C
12 – 15mm	28	33	38	15' / 50°C
15 – 17mm	29	34	39	15' / 50°C
17 – 20mm	32	37	42	15' / 50°C
20 – 22mm	34	39	44	15' / 50°C
22 – 25mm	37	42	47	15' / 50°C

## **9 INSPECTION OF THE FINISHED SPLICE**

The splice must be inspected from all sides for any visual defects.

- 9.1 Any spewed PVC, Nitrile or Neoprene rubber shall be trimmed off.
- 9.2 Any overrun on the cover panel shall be removed by knife or buffing.
- 9.3 Check the alignment of the splice to the parent belt.
- 9.4 Check the relevant splice dimensions such as:
  - Belt width immediately in front and behind the splice area.
  - Belt thickness immediately in front and behind the splice area.
  - Belt width at the splice area.
  - Belt thickness at the splice area.
- 9.5 All results are to be recorded on the splice record sheet per Appendix D.

## **10 IDENTIFICATION MARKING OF THE SPLICE**

- 10.1 Each splice shall be marked with a unique identification number. This number shall give complete traceability of date splicing, equipment used, batch numbers of splicing materials used, crew and vulcanising record sheets.
- 10.2 Marking shall be embossed onto the bottom cover of the splice, at least 1mm deep, approximately 100mm (4 inches) inside from the edge of the belt, Letters should be approximately 50mm (2 inches) high and clearly visible.
- 10.3 Where marking is not possible, the splice number and date should be neatly embossed into the trailing portion of the belt end approximately 2 meters (6.5 feet) from the splice, without damaging the belt carcass.

## **11 Contact Details**

### **International Conveyors Limited**

#### **Corporate Office**

10 Middleton Row,  
Kolkata 700 071, India  
Phone +91 33 2229 6033  
Fax +91 33 2217 2269  
Email icltd@iclbeltng.com

#### **Australia**

International Conveyors Australia Pty Ltd.  
Unit 24, 195 Prospect Highway  
Seven Hills, NSW, 2147  
Australia.  
Tel: 1300 737 180  
FAX: +61 2 4210 8810  
www.internationalconveyors.com.au

#### **ICL Works**

E-39, M.I.D.C. Industrial Area  
Chikalthana  
Aurangabad 431 006  
Maharashtra  
India  
Phone +91 240 248 5248 / 240 2485149  
Fax+91 240 248 4358  
Email admin@iclbeltng.com

### **North America**

#### **International Conveyors America Limited, Inc.**

10 W State Street, Suite 108,  
Geneva, IL 60134  
Phone 630 549 4007  
Email jeff.maranville@iclbeltng.com

### **China**

#### **Visa Trading (Shanghai) Co. Ltd**

Corporate office 2202, Hongjia Tower  
388 Fushan Road Pudong  
New Area Shanghai 200122  
People's Republic of China.  
Phone +86 21 5015 9651 / 9652 / 9653  
Fax + 86 21 5015 9650  
Email ashok@visatradingchina.com

### **Registered Office and Works I**

Falta SEZ, Sector - 2, Near Pump House No. 3,  
Village & Mouza - Akalmegh,  
District - South 24 Parganas, West Bengal - 743 504  
Email iblfaltasez@gmail.com

### **Works II**

E-39, MIDC Industrial Area, Chikalthana,  
Aurangabad 431 006, Maharashtra, India  
Phone+91 240 248 5248/ 5149  
Fax +91 240 248 4358  
Email admin@iclbeltng.com

## APPENDIX A – INSPECTION CHECKLIST

### A-1: ARRANGEMENT

ARRANGEMENT	Yes	No
Approved QA plan available		
Workstation suitable for splicing		
Idler Rollers & Brackets adjacent to splice area removed		
Top surface of bottom platten level with top of trough roller (if applicable)		
Bottom platten edges parallel to the direction of belt travel		
Wooden boards approximately 250mm (10 inches) wider than belt		
Top surface of boards at same level as top surface of bottom press platten		
Tables are stable to a minimum length of 3m (10ft)		

### A-2: ALIGNMENT

ALIGNMENT	Yes	No
Belt is lined up in either direction for a minimum distance of 3m (10ft)		
Belt is central on the conveyor supporting rollers		
Both ends overlap on the bottom platten		
Overlap is adequate		
Centre line is established in either direction for a minimum of 3m (10ft)		

### A-3: PREPARATION

PREPARATION	Yes	No
Centre line established and fingers cut to diagram as per specification.		
Fingers cut perpendicular to belt surface.		
Splice leading end fingers outermost as per diagram.		
Cover material removed from fingers using slow speed grinder or planner.		
Carcass not over buffed or degraded.		
Carcass lightly buffed for 50mm beyond cover panel butt line.		
Both ends of the belt firmly clamped to preparation table (outside splice area).		

## APPENDIX A – INSPECTION CHECKLIST

### A-4: ASSEMBLY

ASSEMBLY	Yes	No
Cover panel butt lines marked on lower plate surface.		
Both ends of the belt folded back and fastened.		
Release agent or silicon paper placed over lower plate.		
Lower cover panel is laid.		
Gaps between fingers are approximately 1.5mm.		
Paste spread over lower panel to a thickness of approximately 1mm.		
Fingers laid into paste and laid correctly.		
Paste spread between fingers filling the gaps completely.		
Bottom and top cover panels are laid.		
Release paper covering splice area and edge bars is correctly positioned.		
Top platten correctly positioned.		
Press platten correctly positioned.		
Edge bars securely clamped.		

### A-5: CURING

CURING	Yes	No
Temperature of the plattens is 100°C (212°F) then 150°C		
Length of the splice is correct.		
Alignment is correct.		
Upper platten is positioned to match lower plate.		
Traverses correctly positioned.		
Pre-tensioned bolts are uniformly tightened.		
Pressure reaches 690kPa (100psi).		

## APPENDIX A – INSPECTION CHECKLIST

### A-6: TESTING

TESTING	Yes	No
Dimensions are with tolerance.	<input type="checkbox"/>	<input type="checkbox"/>
Splice / parent belt alignment are within tolerance.	<input type="checkbox"/>	<input type="checkbox"/>
Spew PVC / Nitrile have been removed.	<input type="checkbox"/>	<input type="checkbox"/>
There is no blister.	<input type="checkbox"/>	<input type="checkbox"/>
There is no lack of adhesion.	<input type="checkbox"/>	<input type="checkbox"/>
Shore hardness of covers is within tolerance.	<input type="checkbox"/>	<input type="checkbox"/>
Commissioning is satisfactory and Engineer's approval has been obtained.	<input type="checkbox"/>	<input type="checkbox"/>



## APPENDIX B – Special Instructions for Neoprene covered belts

### B1 Skive Detail

The neoprene covers should be skived as shown, scratched up, cleaned and two coats SC2000 cement applied. Hardener / activator to be used in the first coat only.

A single coat of SC2000 is applied to the mating strip of cover.

When the second coat is dry but still tacky, stitch down the layer of tie gum to cover the skive but keep it off the carcass as far as possible.

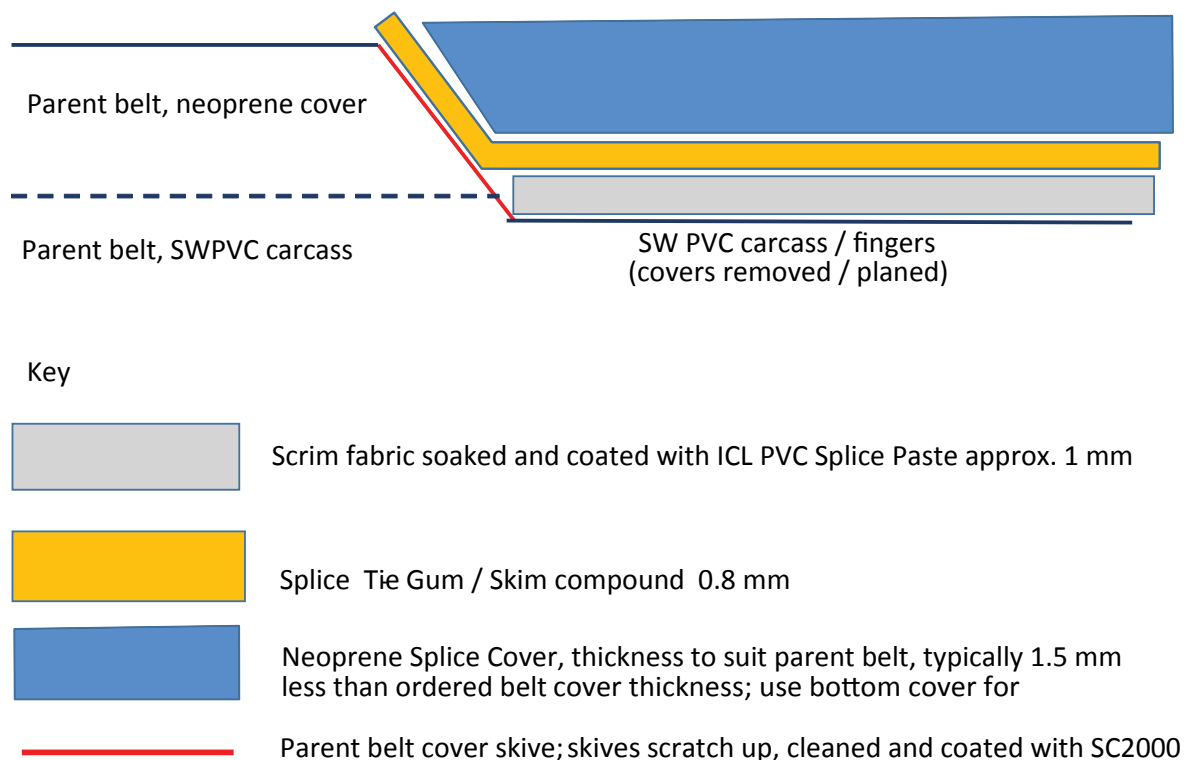
Repeat this for all skive surfaces.

Failure to follow this procedure could see a gap appear between the parent belt and the splice

### B2 Assembly

Once the skives are prepared as above, assemble the fingers as per the main method, but using a layer of tie gum between the neoprene covers and the PVC paste / scrim material.

It is important that the neoprene cover does not make direct contact with the PVC splice paste.



## INTERNATIONAL CONVEYORS BELT CURING SHEET RECORD.

SITE:
CONVEYOR:
DATE:
RECORDED BY:

splice Number		cure temp
belt roll number	belt thickness	cure pressure
belt roll number	belt thickness	duration

[illegible]

Visual report on splice: