
Vulcanized Splicing Procedures

**Uscothane
Conveyor Belt**

Using Polyurethane Bonded Finger Joints

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Scope

These instructions refer to the materials and techniques involved in finger splicing **Fenner Dunlop Uscothane** conveyor belt and must be strictly adhered to. Fenner Dunlop cannot be held responsible for any modification or shortcut in the operation of this procedure. ¹

¹ Note: All recommendations for the use of any product or products described herein and all other data or information set forth in this document, whether concerning such products or otherwise, are furnished without any guarantee, warranty, representation or inducement of any kind, whether express or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose, and Fenner Dunlop expressly disclaims liability under any theory including, without limitation, contract or negligence, misrepresentation or breach of any obligation relating to the recommendation, data or information set forth herein. Readers and customers are encouraged to conduct their own tests. Before using any product, read its label and all related instructions.

1. Health and Safety

The following instructions and procedures, in conjunction with the MSDS, shall be observed at all times during the preparation and manufacture of Fenner Dunlop Polyurethane spliced joints in **Fenner Dunlop Uscothane** Conveyor Belting.

- 1.1 All equipment used in the splicing of **Fenner Dunlop Uscothane** conveyor belt must comply with site regulations relating to the use of electrical equipment.
- 1.2 Only the materials listed in 2.0 are to be used.
- 1.3 The substances used in the Polyurethane splicing paste Part A and Part B are classified as harmful, and, therefore, need to be used strictly in accordance with the procedures given below to minimize health hazards.

Adherence to the following procedures will ensure safer use:

- a) The work area should be adequately ventilated.
 - b) Full protective clothing, including overalls, suitable PVC or rubber gloves and eye protection is worn at all times during the mixing and application of the splicing paste.
 - c) Avoid direct skin, eye contact and ingestion. Contact with the eyes may produce a strong irritant effect.
 - d) Clear accidental spillages immediately. The application of any absorbent dry power such as sepiolite sand will facilitate removal of the spillage.
 - e) Empty and/or unused tins are disposed of in an approved method.
- 1.4 General First Aid procedures to be followed in treating persons affected by the mishandling of Polyurethane paste are as follows:

a) Eye Contact

Give prolonged irrigation with water to the affected eye and get medical attention.

b) Ingestion

If any of the splicing paste enters the mouth, rinse the mouth thoroughly with water.

If any of the splicing paste has been swallowed, drink plenty of water and get medical attention.

c) Skin Contact

Wash the affected area with soap and water until all material is removed. If irritation persists after washing, obtain medical attention.

d) Inhalation

The process emits vapors, at a low concentration, during the spreading operation only. In the unlikely event that a person should experience any respiratory irritation, move them into fresh air and, obtain medical attention.

- 1.5 Make sure the conveyor belt is properly tagged out, de-energized and secured prior to initiating any work on the system.

2. Tools, Equipment and Materials Required

- 2.1 **Fenner Dunlop Uscothane** 5680 splicing kits. See Appendix I to determine the number of kits required or consult Fenner Dunlop splicing manager.

The following tools and supplies are required:

- 2.1.1 Chain hoist or come-along to tension belt.
- 2.1.2 Pneumatic or electric jigsaw with coarse blades with approximately 7 teeth/inch.
- 2.1.3 6" or 7" grinder / polisher. Maximum 2500 RPM with coarse grit, approximately #16 or #32.
- 2.1.4 Utility knife to skive finger edges.
- 2.1.5 Wire brush to remove loose abraded materials from buffed surfaces.
- 2.1.6 Hammer and 1 ¼" finishing nails to hold splice fingers flat.
- 2.1.7 Propane torch and matches to flame splice.
- 2.1.8 Solvent and clean rags to clean splice area. Suitable solvents are methyl ethyl ketone, toluene or trichloroethane.
- 2.1.9 Release paper to cover the splice and protect the work surface and vulcanizer platens. Release papers suitable to use are silicone treated Kraft paper or Teflon coated fiberglass. In an emergency, 8-mil polyethylene can be used.

Release paper will be wrapped with the belt when finger are factory prepared.
(Do not damage release paper when supplied in this manner.)
- 2.1.10 Duct tape (2" or wider) to catch any overflow.
- 2.1.11 Plywood ¾" thick, free of holes and preferably 2 ply. The work surface must be secure and level.
- 2.1.12 Eight 'C' clamps, approximately 8" size.
- 2.1.13 A heated press or 'vulcanizer' is recommended as a heat source to cure the splice. Other heat sources such as Calrod heaters or IR lamps can be used. A

temperature of 212°F must be maintained for a **minimum** of four (4) hours. **Uscothane** splices do not require heat from the bottom side, therefore, only the top half of a vulcanizer is required.

- 2.1.14 Hot plate or equivalent to pre-heat the 5680 Splicing Kits.
- 2.1.15 A steel pipe 3 to 4" in diameter. The pipe must be straight and smooth to roll out the splice. Pipe length is at least 4" wider than the belt.
- 2.1.16 Two (2) flat sheets of fir plywood 4' x 8' x ¾". Also, two pieces of wood measuring 2" x 4" x 8'.
- 2.1.17 The splice area must not be outside unless protected from the weather. The minimum temperature acceptable is 60°F, particularly on large splices.
- 2.1.18 Pull lifts and chain slings for belt handling and to take the tension in the belt away from area to be spliced.
- 2.1.19 Suitable level working surface on which to prepare the belt ends for splicing.
- 2.1.20 Straight edge, soft light colored pencil and tape or ruler for measuring and marking out the splice fingers.
- 2.1.21 Metal scrapers 3"-6" (75-150mm) wide for handling the urethane.
- 2.1.22 Micrometer or suitable instrument for measurement of belt thickness.
- 2.1.23 Powered stirrer or flat blade spatula for mixing the polyurethane paste components.

2.2 **Selection of Molded Edge Bars**

The molded edge bars should be 0.02" – 0.04" (0.5mm-1mm) less than the belt thickness, have a width of 2" +/- 0.75" (50mm +/- 20 mm) and a length not less than that of the mold plate. The edge bars should also be straight and true.²

² **Notes A.** The mean thickness is determined by measuring the thickness (before removing covers from the fingers) at eight equidistant points across the width of the belt, excluding any obvious imperfections in the belt surface. Thickness should be measured to the nearest 0.01" (0.25mm).
B. If the belt edges are badly abraded or otherwise damaged, they should be removed.

3.0 Procedures for Cutting to Correct Belt Width

(Ensuring the Belt Edges are Parallel and Constructing Datum Lines)

3.1 Cutting to Width and Ensuring the Belt Edges are Parallel

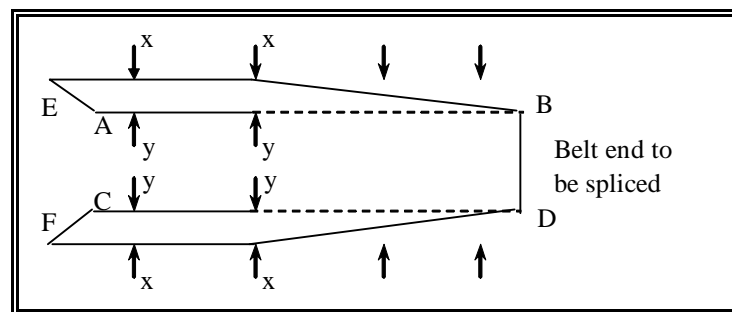
The method to be used is one of three, given below, under 3.1.1, 3.1.2 and 3.1.3. The method used depends on the condition of the belt edges (i.e., sound or unsound).

3.1.1 Belt with Sound Edges

3.1.1.1 Trimming the belt will **not** be necessary **unless** one belt end is wider than the other belt end to be joined. If one end is wider, cut the wider belt to the same width as the narrower belt, cutting off equal amounts from both sides of the belt. *However, it can be advantageous to make the joint slightly narrower than the parent belt to reduce the risk of edge damage.*

3.1.1.2 Construct the datum line as detailed in paragraph 4.2.

3.1.2 Belt with Unsound Edges



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[Diagram 1](#)

3.1.2.1 Refer to Diagram 1 and proceed as follows:

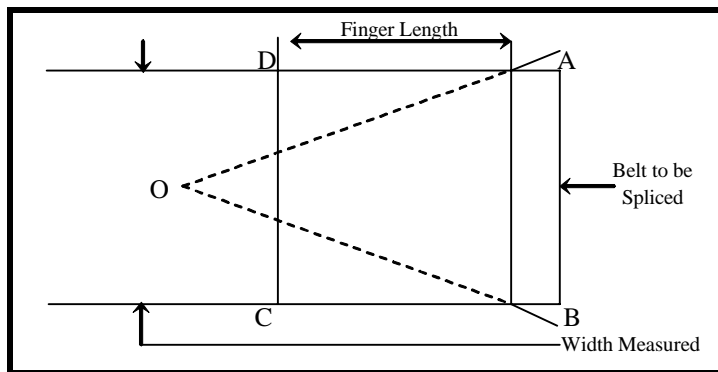
3.1.2.2 Measure the belt width at regular intervals of 12" (300mm) working back from the end to be spliced until the belt width is constant at consecutive intervals – xx.

3.1.2.3 Measure towards the center of the belt xy a distance sufficient to allow the most worn edge to be removed from the splice area. Make sure the

distance is sufficient to reduce the belt width to that of the other belt end. Project a line, AB, forward to the splice area.

- 3.1.2.4 Repeat the procedure at the other edge of the belt ensuring that the distance xy at each side of the belt is equal. Draw in line CD.
- 3.1.2.5 Use lines AB and CD to trim the belt edges parallel at the splice area.
- 3.1.2.6 To avoid “steps” in the belt edges at A and C, trim small amounts off at both edges back up the belt along AE and CF, if needed, to achieve a tapered edge.
- 3.1.2.7 Construct the datum lines as detailed in paragraph 3.2.

3.2 Constructing Datum Lines



[Diagram 2](#)

- 3.2.1 Refer to Diagram 3 and proceed as follows:
- 3.2.2 Measure the width of the belt a convenient distance back from the belt end [finger length plus 3” (75mm)], halve the width and mark the mid-point O. With center O, mark the belt edge at the position where the end of the first finger is to be located as A.
- 3.2.3 Using the same measurement and center O, mark the opposite belt edge as B. Join A and B.
- 3.2.4 Measure back from A, along the belt edges a distance equal to the finger length and mark the position as D.

- 3.2.5 Measure back from B, along the belt edge, a distance equal to the finger length and mark the position as C. Join C and D.
- 3.2.6 CD is the datum for the base line of the finger and AB the datum line for the tips of the fingers.

4.0 Marking and Cutting Belt End

Current finger dimensions for belt types up to 15000 lb/in (2500 kN/m) are shown below.

The above figures are minimum lengths. If longer presses are available, it is sometimes advisable to utilize the increased length by making a longer joint. (Consult Fenner Dunlop for recommendations.)

4.1 Marking Out

Table 1

	Splice Length (L)	Finger Base (B)
Belts Up To 16"	12"	1-1/2"
16" to 31"	16"	2"
31" to 48"	24"	3"
48" & Wider	32"	4"

Q:R:S:TT13-1

- 4.1.1 For example, with a finger length of 12" (300mm), the datum line CD will have been drawn across the belt at 12" (300mm) from the squared end (see diagram in Part 4.2) to indicate the position of the bases of the fingers. Draw a further line at 15" (375mm). The 15" (375mm) mark indicates the extent to which the belt cover is prepared. The markings for belts are shown in Diagram 4 and Table 1.
- 4.1.2 Mark the centerline of the belt ends perpendicular to the lines already drawn and the squared belt ends. These lines are used to lay the joint correctly and ensure that the joint is square and should be drawn at least 12" (300mm) beyond the parallel lines.
- 4.1.3 Start with the belt that will be on the leading part of the joint when running. It will be obvious, from studying Diagram 4, that one end of the belt will be divided into 'half cut fingers at the edges of the belt. These half fingers must be marked and cut on the leading part of the joint in order to prevent edge damage. From the measured belt width, calculate the number of fingers necessary to give an edge finger of not less than $\frac{3}{4}$ " (19mm) in width ³.

³ Dependent on the belt width the centerline from 4.1.3 will either fall between two fingers or divide the central finger.

The fingers are marked off 1½” (38mm) wide across the 12” (300mm) line commencing either ¾” (19mm) or 1½” (38mm) from each side of the centerline, i.e., for even number of ‘whole’ fingers commence ¾” (19mm) from this line.

The tips of the fingers are marked on the belt end at points in between the previous markings, again working outwards from the centerline.

- 4.1.4 The other (trailing) part of the joint is then marked out so that the fingers will mate with the first part. This part of the joint will have ‘whole’ fingers, but the other two may be wider than specified to accommodate the actual belt width. This is illustrated in Diagram 4.

4.2 Cutting

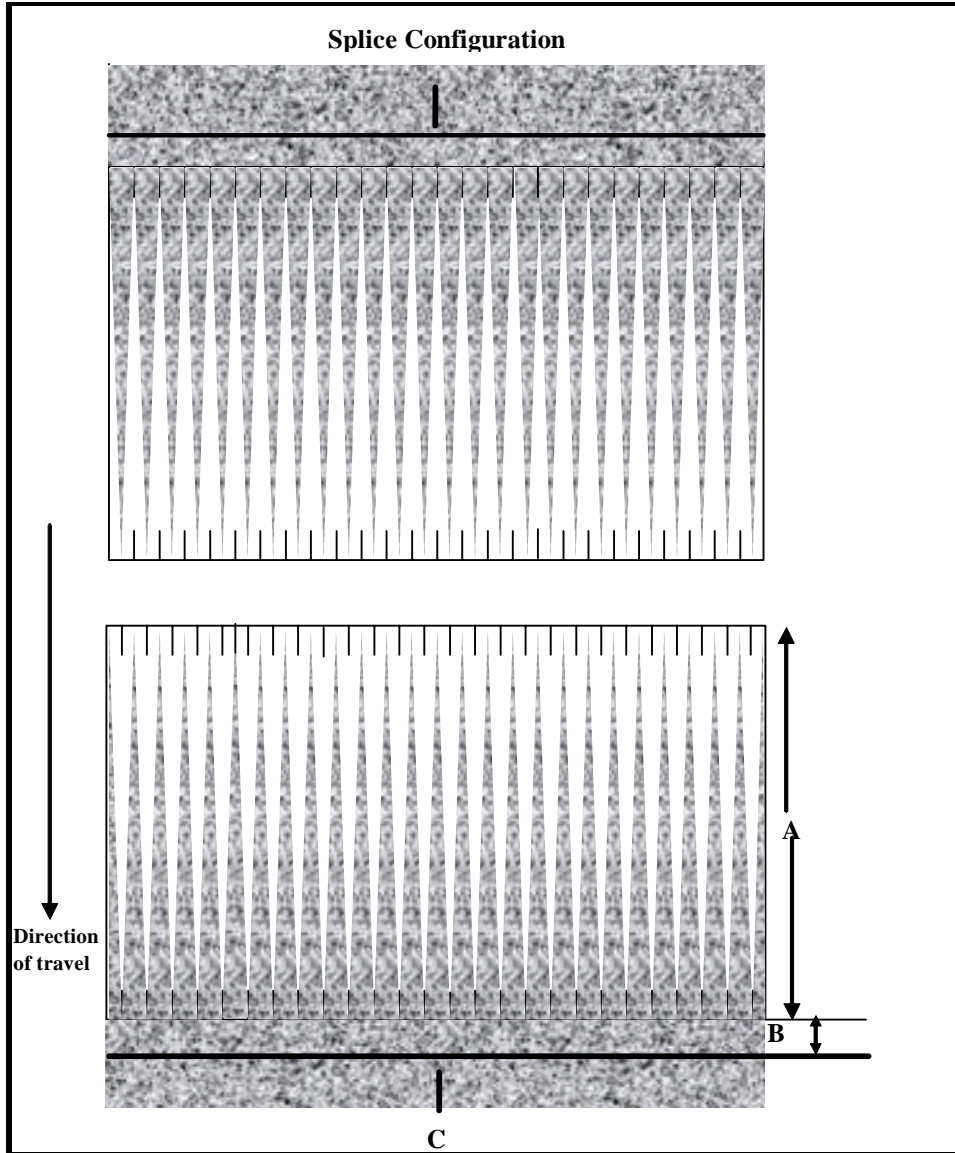
Using a jigsaw, cut from point to point as marked in 4.1 giving 12” (300mm) long fingers. Care should be taken to ensure that the cut is perpendicular to the belt surface.

A useful check on correct marking and cutting is that the tip of a finger on either the leading or trailing side of the joint, should always coincide exactly with the center line of the joint.

5.0 Belt Preparation

5.1 Preparing the Splice Fingers

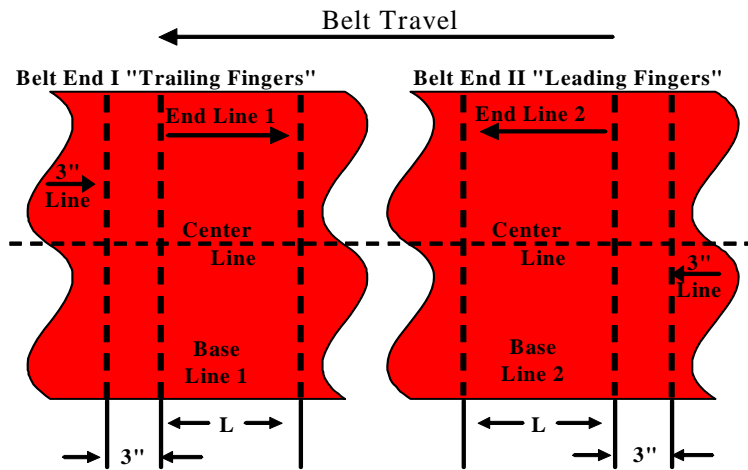
- 5.1.1 Skive the covers, face and back on the edges of the finger and taper toward the center, to ensure maximum surface area for bonding. Cut about ½ off the end of each finger to ensure that the fingers will lay flat. Diagram 6.
- 5.1.2 Using a low speed (2500 rpm) disc grinder, buff all the surfaces toward the middle of the face and back. Prepare the belt surface to within 1” of the 3” splice base line. Optimum preparation promotes adhesion of the splicing material. If the grinder speed is too high, excessive frictional heat will soften the urethane and gum up the sanding disc.
- 5.1.3 Use the wire brush to remove all loose abraded material from the buffed surfaces and wash with Methyl Ethyl Ketone, Toluene or Trichloroethane to remove dirt and grease. Wear disposable gloves to avoid contamination of cleaned surfaces. Observe proper safety precautions with the solvent.



Q:R:S:D/d13-3

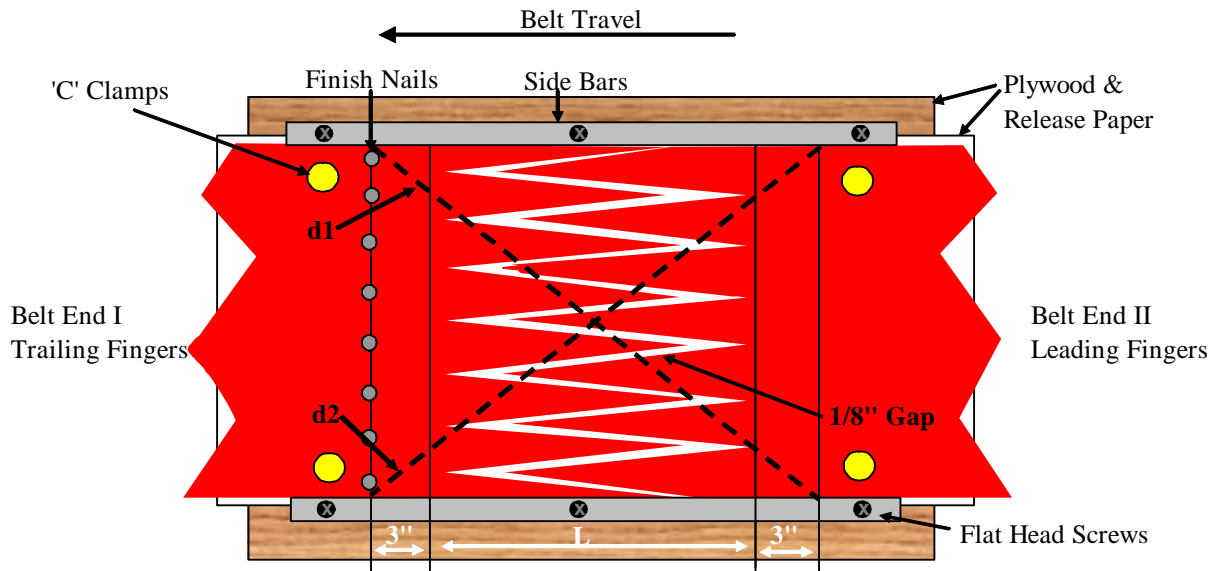
[Diagram 3](#)

Uscothane

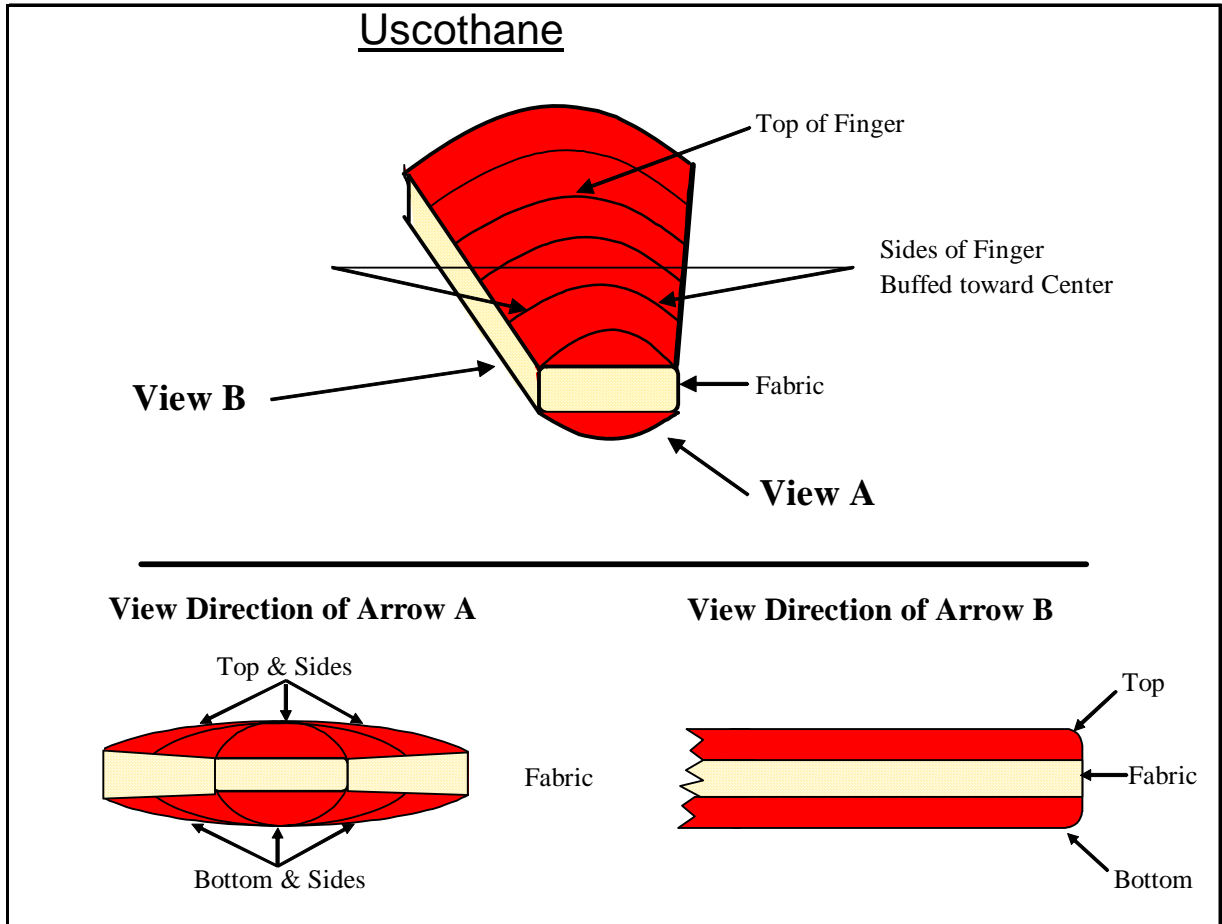


[Diagram 4](#)

Uscothane



[Diagram 5](#)



[Diagram 6](#)

6.0 Splice Procedure

- 6.1 Clean the entire surface area of dust, belting pieces, etc. Lift up fingers and cover surface of plywood with release paper, making sure the release paper extends beyond the '3" lines'.
- 6.2 Reposition the belt ends on the plywood so that the edges are aligned and the '3" lines' are distance "L+6" apart (splice length + 6") as specified in section 4. This should provide a gap of approximately 1/8" between the edges of the fingers.
- 6.3 Measure diagonally from the corner of the 3" lines to the corner 3" diagonally opposite. Reposition the belt so that these dimensions are equal (d1-d2). This ensures that the belt sides are parallel.
- 6.4 When the belt is correctly positioned, clamp or nail to the plywood. Use the finishing nails across the 3" lines to prevent the splicing compound from squeezing past this point.
- 6.5 Position sidebars tightly along each of side of the belt. Secure with flat head screws.
- 6.6 To facilitate the removal of the excess urethane from the face cover outside of the splice area use the duct tape to secure a 12" piece of release paper, starting at the 3" lines, and extending away from the splice.

6.7 Casting the Splice

- 6.7.1 Refer to "**Uscothane** 5680 Splice Kit" instructions in each kit for processing and mixing information *It is imperative that all tools and operations related to the mixing, casting, and curing be well planned because once the 580 "resin" and "curative" are mixed together, the urethane mixture only has a 'pot life' of several minutes before it is too thick to pour or spread.
- 6.7.2 Pull back the fingers to allow casting of the bottom cover. This can be done by lifting up each of a trailing and leading finger, starting from one side of the splice. Let them support each other to form a "teepee". Repeat with the remaining fingers across the splice. Pour enough urethane between the fingers to obtain approximately a 1/8" layer in the splice area. Spread out with a spatula so all the release paper is covered with urethane.

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- 6.7.3 Lay the fingers down into the urethane and press down firmly to force urethane into the gaps between the fingers. Nailing the fingers down with small finishing nails will assist in holding them in the correct position. If the fingers are laying flat, nailing may not be necessary.
 - 6.7.4 Pour sufficient urethane on the top of the splice to just cover the fingers and spread evenly over splice area. Avoid using excess urethane. Sweep the surface of the liquid urethane with the propane torch flame to break any air bubbles.
 - 6.7.5 Carefully cover the splice area with a sheet of release paper. Avoid wrinkles in the paper or move the paper once it has contacted the urethane. Smooth out the paper to displace any trapped air. *It is desirable on most belts to “roll out” the splice to avoid a resulting thick splice. Using a straight pipe that is long enough to be supported by both side bars, start at the center of the splice and roll out the excess urethane to the 3” line. Repeat the above to the other 3” line.

6.8 Curing the Splice

- 6.8.1 Position the vulcanizer top or heating platens on the splice and cure for a minimum of 4 hours at 212°F. Additional weight may be placed on the vulcanizer/platens to assist in leveling the urethane.

After 2 to 2 ½ hours of curing, the vulcanizer / platens and release paper can be carefully lifted off to inspect the splice. If any repairs are necessary, mix more of the “5680” material to fill any voids or bubbles. Replace release paper and vulcanizer / platens and cure for the balance of the 4 hours.

- 6.8.2 After the cure is complete allow the belt to cool down to room temperature.
- 6.8.3 Cut/trim off the excess urethane at the belt edges and at the 3” lines on the face. De-mold the splice from the plywood and repeat the above on the back. Grind/feather the splice compound at the 3” lines on both the face and back to ensure a smooth transition.

7.0 Procedure for Mixing Uscothane 5680 Splicing Kits

- 7.1 Remove the rims from both the resin and curative cans. (Screw top curative cans, rims do not have to be removed.)
- 7.2 A hot air oven or a hot plate can be used to heat the resin and curative. Use a thermometer to assure the correct temperature of the resin and curative. Wipe off thermometer to avoid cross-contamination.

Ensure belt ends are dry. Any moisture in the fabric will result in the splice compound foaming due to the liberation of CO₂ and weaken the material.

Processing Data:

Resin Temp. 120°F - 135°F (49°C - 57°C)

Curative Temp. 120°F - 135°F (49°C - 57°C)

If the curative has been exposed to low temperatures during shipping or storage, the appearance may be putty-like or else there may be sand-line particles in the bottom of the can. Dip a stir stick into the bottom of the can, and if particles are evident on the stir stick, heat the curative 200°F - 212°F to re-melt the particles. Cool down the curative to 120°F - 135°F before mixing the resin. ⁴

N.B. Using lower temperatures give a longer working life, but the two components will be more viscous, and therefore, more difficult to mix. Higher temperature will facilitate easier mixing, but the mixed life will be reduced.

Mixed Life 10-20 minutes before it becomes too thick to pour or spread.

Cure 4 hours minimum @ 212°F (100°C) to achieve maximum physical properties.

Curing for less time or a cooler temperature may impair the repair/splice.

⁴ Using lower temperatures give a longer working life, but the two components will be more viscous, and therefore, more difficult to mix. Higher temperature will facilitate easier mixing, but the mixed life will be reduced.

- 7.3 With resin and curative at the correct temperatures, add the curative to the resin while stirring the resin, Avoid pouring the curative down the inside wall of the resin can.
- 7.4 Using the square-tipped wooden stirrer, thoroughly scrape the walls, bottom corners and bottom of the can.
- 7.5 Continue stirring and scraping for approximately 2-3 minutes to assure a homogenous mixture.
- 7.6 Discard the stirrer. Do not use it to scrape the urethane from the can or to apply the urethane to the belt.
- 7.7 Pour the liquid urethane from the cleanest inside wall of the can.

Appendix I - continued

Calculation for determining the recommended number of kits for a field splice.
The example below is based on an **Uscothane II 600 -54"** Wide x 1/4" face and 1/8" back

No. of Fingers	x	Finger Length	x	Overall Belt Thickness	x 1.5 /	Cubic Inches in Gallon Kit	=	No. of Kits
14	x	32"	x	.750"	x 1.5 (=504) /	150	=	3.02 Kits

Q:R:S:R/A1-2

Number of Fingers: Calculated by dividing the belt width by the width of the finger base. Refer to the table below to determine "Finger Base" & "Finger Length".
 $54 / 4 = 13.5 = 14$ (round to the nearest whole number)

Belt Width	Finger Length	Finger Base
6" - 15 7/8"	12"	1-1/2"
16" - 30 7/8"	16"	2"
31" - 47 7/8"	24"	3"
48" - 80"	32"	4"

Q:R:S:R/A1-3

Finger Length: Generally 12", 16", 24" or 32" as shown in the above table.
32

Overall Belt Thickness: Measured in inches *.250" Face*
example .50", .65", 1.17", etc. *.125" Fabric Ply*
Use .125" for each fabric ply and *.125" Inter Ply*
the urethane between 2 fabric *.125" Fabric Ply*
plies (inter ply). *.125" Back*
.750" Total

5680 Gallon Kit ⁵: One kit = 150 cubic inches. In this example the total splice equals 504 cubic inches, divided by 150 cubic inches equating to 3.02 kits.

The recommended number of kits for this field splice is: Three (3) 5680 Gallon Kits
and One (1) 5680 Quart Kits
This quart kit may be used for the splice if required, or for subsequent repairs.

⁵ This is the theoretical number of gallon kits to splice the belt. A Quart Kit must be available in case of repairs, spillage or waste. Any extra materials can be used at a later date (within the shelf life), to make repairs to the splice or belt covers.