



Waterborne Catalyzed Polyurethane Fabric Covering and Finishing Procedures Manual 21

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STEWART SYSTEMS

PROCEDURES MANUAL

COVER
08/08/06
Rev. #: OR

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The Latest in Waterborne Technology for the Aerospace Industry

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INTRODUCTION

This manual is a guide in covering and finishing your fabric covered aircraft using Ceconite fabric and all the Stewart Systems products. We suggest that you read the entire manual prior to starting your project.



The Latest in Waterborne Technology for the Aerospace Industry.

Stewart Systems offers you a single source of a complete line of revolutionary aircraft coatings that are the Finest Finishes Available, People-Safe and EPA compliant. Discover the latest in aircraft covering along with coatings that are available for metal, composite and fabric covered aircraft.

All of our cements, fillers, primers and coatings are non-hazardous and non-flammable.

Just as our products are ahead of their time, so is our business concept. We've been in aircraft building, maintenance, painting, and flying for over a quarter-century. We had the idea of creating one source for everything required to coat and cover aircraft.

Genuine breakthroughs have been rare in aircraft coatings. In fact, there hasn't been one since the introduction of catalyzed paints over a generation ago, until now.

Finally, one of the country's leading coatings chemists has formulated a paint technology that does away with the high volatile organic compounds (VOCs) and other risky factors of today's leading conventional paints. These innovative breakthrough coatings compete on better-than-even terms with the leading, "old-name" brands in the qualities of a super coating.

The breakthrough was the discovery of how to use water as a carrier for the solids in the coatings. Up to now, the only carriers for the resins and other solids in paints have been the old-time, high VOC solvents, with their offensive odors and the health hazards that EPA and OSHA are cracking down on, with increasing pressure.

Our new, breakthrough coatings are not "water-based" they're waterborne. Water is added only as a carrier, to reduce the viscosity of the solids to allow the coatings to be sprayed. When dry, it is impossible to distinguish between our coatings and the other two or three top solvent-based paints.

Stewart Systems is competitively priced per gallon. The cost per square foot covered is actually less. Our coatings are high in solids. With water added as a reducer you get more product. There are no hazardous material shipping surcharges, so it's fair to say you save 20-25% over top conventional paints now in volume use.

Covering your aircraft can be a rewarding and enjoyable experience if you have the correct tools, materials and the knowledge you need to insure your aircraft covering project is a success. If this is your first covering experience there are many ways to educate yourself in regard to different covering systems and techniques. There are many videos, workshops, written information and of course an experienced mechanic to help guide you. If you are an experienced re-builder, you know there is no such thing as "too much information". (We have over 35 years of accumulated covering experience and are always looking for new techniques, covering tips, tools etc.). When you complete your first project you join a very elite group of aviation enthusiasts who can take pride in the fact that they played a great role in getting their aircraft into the air again or for the first time. Stewart Systems would like to assist you in that process.

Re-covering of any fabric covered aircraft is to be accomplished under the authority of the Federal Aviation Administration (FAA) or a delegated authority and the appropriate records made. Specific inquiry should be made if you are in doubt about how to accomplish such a repair. Consult the Stewart Systems Procedures Manual, original aircraft specifications and FAA AC 43-13-1B.

Our mission at Stewart Systems is to provide the best possible products available today and the technical support to assist our customers with their project. In addition to our fabric covering product line we offer fabric covering clinics, painting clinics, technical support via the telephone, fax or e-mail and very soon a video covering the basics.

AUTHORIZED DISTRIBUTORS

1. **Recreational Finishing Systems LLC**

P.O. Box 192

Troutdale, OR 97060

503-358-8228

E-mail: RFS97217@aol.com

Web: www.RFS-Services.com On-Line Ordering

David Harpster – EverShield Specialist

2. Western Aviation Services Ltd.

309-5980 2nd Street

Grand Forks BC V0H 1H4

250-442-8616

1-866-678-1234

E-mail: ron@westernaviation.bc.ca

Web: www.westernaviation.bc.ca

Ron Wyers

LIMITED WARRANTY

The information and directions for use of seller's products represent the result of tests believed to be reliable and should be followed carefully. Due to variations in consumer handling and methods of application which are unknown or beyond seller's control, however, seller makes no warranties, either expressed or implied, including but not limited to, any implied warranty or merchantability or fitness for a particular purpose. Buyer agrees, therefore, that the sole and exclusive remedy against seller shall be the replacement of materials or refund of the purchase price, at the option of the seller and limited to a period of one year from the date of actual purchase or delivery, whichever is sooner. Buyer agrees that no other remedy, including but not limited to incidental or consequential damages, shall be available from seller.

SAFETY INFORMATION

Use only with adequate ventilation. Avoid breathing vapor and spray mist. Avoid contact with skin and eyes. Wash hands before and after using. Keep container closed when not in use. Use a proper OSHA approved breathing device and protective equipment during any spray painting. Do not take internally. Keep out of reach of children. For industrial use only. Refer to the Stewarts Systems Procedures Manual for the proper application and mixing instructions of the products used.

Store in a cool dry place at room temperature (not to exceed 100 degrees Fahrenheit). Keep out of direct sunlight. Keep lid tight at all times. Do not allow material to freeze.

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Use within one year of purchase. All materials must be kept away from any source of combustion and all contaminated materials must be disposed of in an approved manner.

Please read all safety warnings and precautions. Material Safety Data Sheets (MSDS) are available upon request.

MATERIAL QUANTITIES

Every effort is made to properly estimate the amount of material required for your aircraft project. The amounts arrived at are the result of the years of experience we have doing the same type of work for your aircraft type.

Different users will apply and use the materials needed at rates which may be higher or lower than our experience. This is impossible to avoid as the application situations are of an almost infinite variety and the amount of material to be applied is often a "judgment call" based on the individual users skills and taste.

As your supplier this presents somewhat of a dilemma, if we didn't include enough material a customer might feel they were shorted and if we included too much material they may feel we sold extra material unnecessarily. Our goal is for you to have just what you need. If you are supplied materials which are in excess of what you need to complete your project we will be pleased to take back, for full credit, any new unused materials which are not out of date and can be resold as new. Exceptions would be any custom color blended for your project. Also, if your project requires a little more than originally supplied we hope you will not think we shorted you intentionally.

PREPARING SURFACES FOR FABRIC ATTACHMENT

Previously painted or zinc-chromate primer painted surfaces require special preparation.

Steel Surfaces – Steel must be thoroughly clean, oil free and primed with STEWART SYSTEMS Primer/Sealer (E7510). If the steel is lightly rusted, it is recommended to coat the surface with STEWART SYSTEMS Steel Conversion Coating (E7800) before priming. If moderate to heavy rust is present the steel should be sand blasted and any necessary repairs made first then primed. Topcoat the surface with STEWART SYSTEMS Waterborne Catalyzed Polyurethane Topcoat.



Aluminum Surfaces – Clean all surfaces with STEWART SYSTEMS EkoClean Heavy Duty Cleaner (E670), followed by STEWART SYSTEMS EkoEtch (E675). The EkoEtch may be applied while the aluminum is still wet from rinsing the STEWART SYSTEMS EkoClean Heavy Duty

Cleaner. Use a red Scotch Brite pad and remove the glaze from the aluminum. Let the EkoEtch work for 3-5 minutes; *do not let EkoEtch dry on the aluminum surface*, rinse with clean water. Remove excess water with compressed air. Prime with STEWART SYSTEMS one part Primer/Sealer (E7510) when aluminum is completely dry, or within 12 hours of using the EkoEtch.

Wood Surfaces – Apply STEWART SYSTEMS Waterborne One Part Polyurethane Clear Wood Sealer (E1800) before attaching fabric. After applying first coat of wood sealer, allow to dry, then lightly sand with 320 grit sand paper, apply second coat and let dry. The wood part may be sanded or covered with out further sanding if preferred.



Fiberglass Surfaces – Clean all surfaces with STEWART SYSTEMS EkoClean Heavy Duty Cleaner (E-670) or Lacquer Thinner and then scuff surface with a fine abrasive pad.

Previously Painted Surfaces – All surfaces must be clean of all oils, dirt and grime. Scuff sand with 320 grit sand paper or Scotch Brite before coating with STEWART SYSTEMS One Part Primer/Sealer (E7510).

Prior to covering be certain:

1. All repairs and maintenance items have been taken care of*.
2. Inter-rib brace tape (Tape IRB) has been installed
3. All chafing areas have been protected with anti-chafe tape (Tape SS).

* One of the most important items when covering aircraft is the proper preparation of the structure. Before covering, the airframe must be inspected and approved by a FAA-certified mechanic or repair station. (AC43.13-1B)

ATTACHING THE FABRIC TO THE AIRFRAME

Aircraft are usually covered by using the blanket method, or by using pre-sewn envelopes, or a combination of the two systems. Each system has its advantages and disadvantages.

Blanket Application – With the blanket system, FAA approved 101, 102 or 1.7oz Ultralight fabric is applied with cement joints usually made along the leading edges, trailing edges and fuselage surfaces overlapping on longerons and formers. In the case of wings with a chord that exceeds the width of the fabric (70”), the fabric is sewn with several chordwise seams and is cemented to the trailing edge only and wrapped from the trailing edge, over the leading edge and again cemented at the trailing edge.

The Blanket Application usually allows smoother surfaces over longerons and in areas where a bulky seam would show.

Envelope Application - Pre-sewn fuselage envelopes will usually speed up the covering project. However, poorly fit envelopes can cause loose fabric problems. During heat tautening of envelopes, care must be taken to avoid pulling seams out of line. Bring the temperature up very slowly while tautening envelope fabric and watch the seam alignment.

Envelopes are generally shipped as they are sewn. In other words, wrong side out. Be certain to turn them right side out before installing on the airframe. Check also to be sure the flap of fabric along the seam lies on the same side of the tubing to assure the smoothest surface.

Be certain that the fabric is firmly attached at all points before starting the tautening process. Areas around fuel tanks, small tubing in the forward sections of a fuselage, and window frame areas are only a few of the problem areas for fabric attachment. On wings especially, you will have areas like strut openings that will stick up and create an uneven attachment to the trailing edge as you lay the fabric over the wing. In some cases you may have to cut a small opening in the fabric to insure a smooth trailing edge. Be sure to cut the opening only as big as you need to. If there is a surface you can cement to around this opening do so before heat tautening the fabric.



NOTE:

If you cut the opening too large, it can create a problem for you during heat tautening of the fabric. Many times you will have to develop special methods for attachment. Slipped fabric around these difficult areas can ruin a covering project, so use extra care.

APPLICATION OF EKO BOND CEMENT



Fabric to Metal - EkoBond Cement (E610) is used in a different manner than most aircraft cements. Apply EkoBond Cement (E610) to the surface where the fabric will be attached. Let the cement tack up (tacky to the touch, approximately 5 minutes, depending on temperature and humidity). Apply the fabric to the cemented area. Using your hand, remove excess wrinkles, then with firm pressure rub fabric onto cemented areas. This will gently hold fabric in place. When fabric placement is acceptable, use a Close Quarter Iron set at 275 to 300°F and make a single pass over the cemented area, using firm pressure. This will heat activate the glue and hold fabric in place. You will see a glue bond of about 1/16" to 1/8" wide where the iron heat activated the glue. Brush additional glue down through the fabric to the cemented area and wipe away excess with a blue paper shop towel while at the same time smoothing the fabric down. The cemented area should show an even color indicating a complete bond to the substrate. Drying time will depend on temperature and humidity. When installing inspection rings or reinforcing patches, use EkoBond Cement like contact cement: apply to both surfaces, allow to become tacky, and then press the surfaces together.

NOTE: Be sure to wipe away excess cement immediately, while still wet.

Fabric to Wood - When applying fabric over plywood surfaces apply the EkoBond Cement (E610) to the plywood and allow to tack up. Apply fabric to cemented area, brush additional EkoBond Cement (E610) down through the fabric and wipe away excess with a blue paper shop towel while at the same time smoothing the fabric down.

NOTE: Be sure to wipe away excess cement immediately, while still wet.

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NOTE: EkoBond Cement is thermal active, meaning that if necessary you can insure a good bond or reattach cemented surfaces by applying heat to the area. See: Calibrating Your Electric Irons.

Fabric to Fabric – Fabric to fabric is used on the second surface to be covered.

Example: The fabric to steel would be the first surface to be covered. This should be the bottom (horizontal control surface, elevators, wings, fuselage, etc).

After the first surface is in place and shrunk to its first shrink of 250°F the second surface is installed. Mark first surface with pencil line along the perimeter where the second surface will glue to. Apply EkoBond Cement (E610) up to this line. Let dry. Place fabric in position. This piece should be cut oversize approximately 4". Place the fabric in position on the part and using firm pressure rub the fabric into the dried glue to lightly attach fabric in place.

When satisfied with the lay of the fabric use a 275 to 300°F iron to make a single stroke over the perimeter of the glued surface to hold fabric in place. (Refer to Page 6 Section 17 figure 17-9 for example photo) Now gently iron the fabric down to the surface of the pre glued panel to the edge of the pencil line, using the iron to shrink the fabric to a smooth



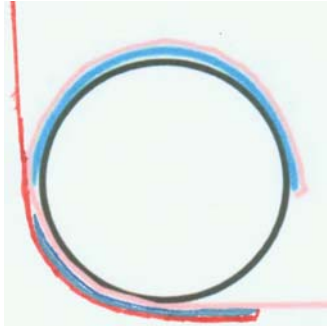
surface around any corners. When the fabric is wrinkle free and smooth to the pencil line draw a new pencil line on this lay of fabric directly over the previous pencil line. Now pull the pencil marked lay of fabric loose back to the previously bonded area where the single pass was made with the iron around the perimeter. Use pinking shears to cut off excess fabric following pencil mark. After cutting, lightly re-iron in place to remove any wrinkles, being careful to iron only enough to hold fabric in place, but not to shrink fabric (225°F-250°F). Brush EkoBond Cement (E610) under the fabric joint and then down through fabric into previously applied EkoBond Cement on first surface. Normally, glue about 12", wipe excess, and glue additional 12", and so on.

CEMENTED SEAMS

When EkoBond Cement is dry, shrink to 250°F. If additional surfaces are required (fuselage sides and top) repeat above steps. Once all surfaces are installed it is time to shrink the fabric.

For cemented seams, brush a coat of EkoBond cement (E610) on bottom piece of fabric. When dry place top piece of fabric in desired position, gently press both pieces together to hold in place and with a Close Quarter Iron set at 250°F make a single pass over the overlap seam of fabric to lock in place. (An area of approximately 1/8" wide is sufficient to lock fabric in place) Brush EkoBond cement (E610) down through top piece into glue previously applied to bottom piece. Glue approximately 12" at a time, wiping off excess glue with a blue paper shop towel. Continue until seam is totally glued.

Cemented overlap seams will have a glue width of at least 1". This generally applies to areas such as glued seams on stabilizers, elevators, rudders, flaps, ailerons and longerons. Sewn seams are not necessary. Glued seams over open areas such as at transition of vertical fin to top of fuselage skin are permissible without a sewed seam. A minimum overlap seam of 1" is required with a minimum width of 2" finish tape centered over the edge of glued seam.



Black – substrate
 Blue – EkoBond
 Lt Red - First Layer Fabric
 Dk Red – Second Layer Fabric

Cemented overlap seams at wing leading edge shall be a minimum of 3". This seam shall then be covered with a minimum of 4" wide finish tape, centered on outer edge of overlap seam. This over lap joint is acceptable over bare leading edge or over felt covered leading edge. Trailing edge shall be glued with a minimum of 2" glued seam. This seam shall be covered with a 3" or wider finish tape.

If leading edge is padded with felt the following procedure is suggested. Light weight felt that will compress to 1/32" thickness is recommended. Bulk bolts of this felt are available at most yardage outlets in 36" widths. This material when split in half lengthwise will be wide enough to cover most leading edges. To apply, spray a light coat of 3M77™ or equivalent spray adhesive to leading edge. While still damp, apply felt to leading edge and smooth out all wrinkles. Felt should now be coated with 2 brush coats of EkoBond cement to fill weave of felt. When EkoBond is dry, leading edge is ready for fabric.



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CALIBRATING YOUR ELECTRIC IRONS

Accurate calibration and proper use of the electric iron is critical for a proper covering job and can not be over emphasized. All temperatures shown in degrees Fahrenheit.

1. Select an iron with at least an 1100 watt heating element, and no auto-shut off feature.
2. Use a Coverite™ surface thermometer or an IR thermometer like a Flash Point™ to measure the soleplate temperature of the iron.
3. When calibrating your iron for the first time, determine the settings on the temperature control dial, which will give you 250°F, 300°F, and 350°F. It should take you from 30 to 45 minutes to accurately determine each temperature setting. Mark each setting.



NOTE: Check the temperature spread across the sole plate on a new iron. If there is a large temperature spread you might want to try a different iron. Ideally the large center portion of the sole plate will register the desired temperature and the surrounding areas will be a few degrees above or below this temperature. At the 350°F. calibration range no other parts of the sole plate should exceed 375°F.

4. While the surface thermometer is in place and the heat setting is at the 350°F mark, observe how low the temperature drops before the thermostat comes back on and also how accurately the iron returns to 350°F surface temperature. Ideally this temperature spread will be 15°F or less.
5. If the iron is dropped it must be recalibrated.



Polyester fibers crystallize at 425°F so it is very important to know your iron temperature exactly. It is a good idea to check the accuracy of your temperature marks at least once a day, as some irons tend to stray from the original settings the more they are used.

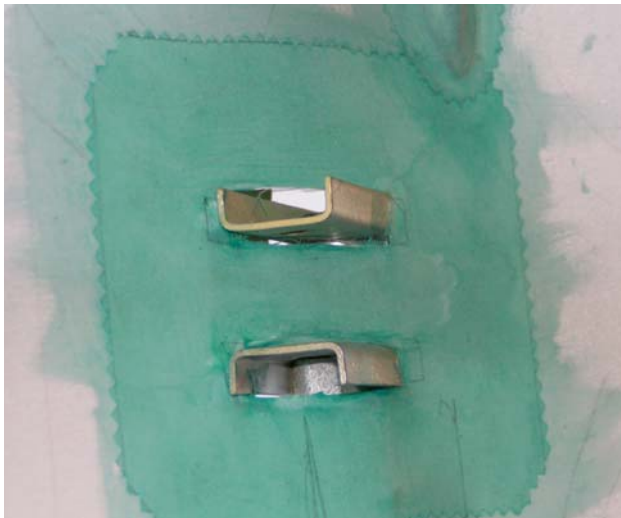
The speed of travel of the iron over the surface should be around 6" per second at all temperatures. It is advisable to iron the fabric at least two times at the 250°F and 300°F temperature range, and 3 times at 350°F. This will ensure that all the surface of the fabric has been evenly shrunk and brought to full tension. The second ironing should be done at 90 degrees to the first pass. Allow extra time over ribs and any substructure as they act as a heat sink. Also never start to shrink the fabric from one end. Always start at the center of the panel with a single pass, then split the difference between each end of the panel. Repeat this process until the entire panel is ironed. This is very important during the initial shrink at 250°F. When shrinking a wing panel it is a good idea to start this process over each rib and then repeat the pattern going between each rib. This will help minimize sag between the ribs.

NOTE: *Do NOT use heat guns to tauten fabric.* Accurate temperature control is not possible. Burning debris from the heating elements can burn small holes in the fabric.

THE USE OF HEAT GUNS TO TAUTEN FABRIC IS PROHIBITED BY THIS STC.

HEAT TAUTENING OF THE FABRIC

Set the iron to 250°F and perform a preliminary shrink, (smoothing the surface, but not stabilizing the fabric) over the entire fabric surface. Reference Section 4, Pg: 2 for initial ironing procedure. Apply reinforcing patches to openings around struts, control cables, control horn, etc. with polyester canvas or fabric reinforcing patches. On wings the first pass should be over each rib surface, then proceed to open bays between ribs. This will insure minimum sag between ribs. During the first two shrinks of fabric, it is important to get an even shrink of fabric. Do not shrink one direction only. Start at the center of the fabric and work from the center toward each end of panel in alternating steps.



Reinforcement Patches –

Reinforcement patches can be easily made by using fabric scraps from the covering process. Cut the reinforcing patch approximately 1" on each side larger than the opening to be reinforced. Smooth the area to be reinforced with a 250°F iron. Apply a coat of EkoBond cement to the fabric surface to same size as the patch. Apply the patch and press into place. Brush EkoBond cement down through the patch into the previously applied glue and wipe away the excess with a blue paper shop towel. These patches are used in any areas that need

to be cut open in the fabric cover such as: Rudder and aileron cable exits, quick drains, pitot tube and lift strut attach fittings. On areas such as strut fitting cut the opening after the first shrink and let the fabric settle into place. Lightly iron the loose fabric just enough to remove the wrinkles and then apply the patch. Patches should extend 1" beyond the edges of cut out.

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After attaching all the reinforcement patches and allowing to dry, set the iron to 300°F and iron the entire surface. Set the iron at 350°F for the final shrink and iron the entire surface three times, allowing the surface to cool and normalize between ironings. While heat tautening, move the iron slowly (around 6" per second) to allow the heat to maintain a constant temperature on the soleplate of the iron. Iron only to the edge of reinforcement patches and glued seams, (do not iron the patches and glued seams), alternating each ironing pass 90° to previous pass.

Ultralight airframes can be easily damaged during the tautening of the fabric. Do not try to bring the fabric on the Ultralight airframes up to 350°F stabilizing temperature.

For conventional aircraft, with more substantial structures, the fabric should be brought up to its final tension in several temperature steps with the final tautening at 350°F. Do not be alarmed by what appears to be smoke. This is moisture and lubricant used in the fabric manufacturing process.

NOTE: It is not necessary or desirable to final heat shrink fabric that has been glued to wooden or metal surfaces.

APPLICATION OF REINFORCING TAPE & RIB LACING

Apply reinforcing tape (Tape RT) over the ribs of the wings and control surfaces. The reinforcing tape should be the same width as the rib cap strips and extend at least $\frac{1}{2}$ " beyond any stitch. 1" long pieces of tape are used for single stitches if used.

Fabric is attached to cap strips in many ways, rib lacing, screws with fabric washers, rivets and wire clips. All of these methods require the use of reinforcing tape under the attaching device. Do not rely on cement to hold fabric to cap strips.



Figure 6-1

Stitching Control Surface

Rib

RIB LACING

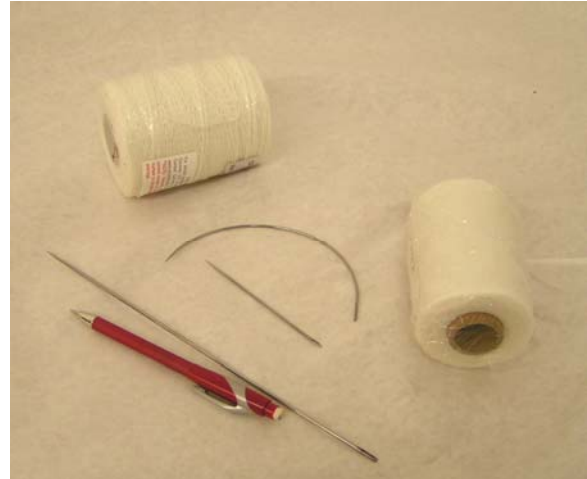
Items Needed:

Flat or round waxed rib lacing cord.

Rib stitching needle (sharpened brass welding rods make nice homemade needles, 3/32-1/8". Hammer down one end flat, drill hole for lacing).

Pencil.

Reinforcing tape as required for your rib width



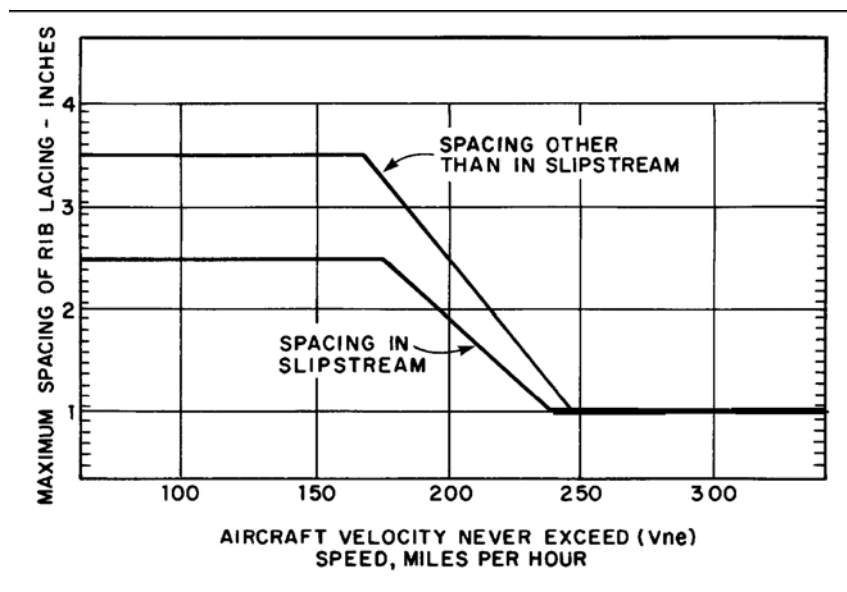
ACCEPTED KNOTS

Stewart Systems recommends the Modified Seine knot, see figure 6-3, and the Staggerwing Knot, see figure 6-4 as accepted rib stitch methods for use with Stewart Systems products.

When working on large areas like the wing sections, it is handy to have a helper on one side of the wing to push the needle back through to you while you are rib stitching.

Use caution to stay clear of control cables when rib stitching.

Figure 6-2 Rib Stitch Spacing



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NOTE: The first lace on a wing rib should be spaced from the leading edge fairing no more than $\frac{1}{2}$ the required rib lace spacing for the balance of the rib.

Figure 6-3 - Modified Seine Knot,

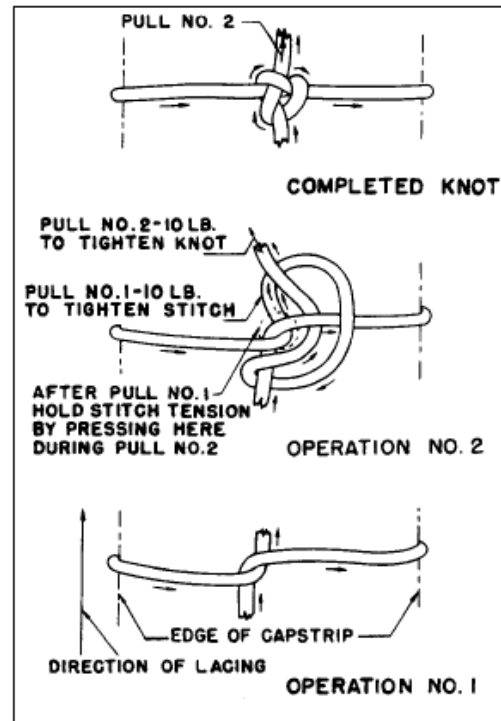
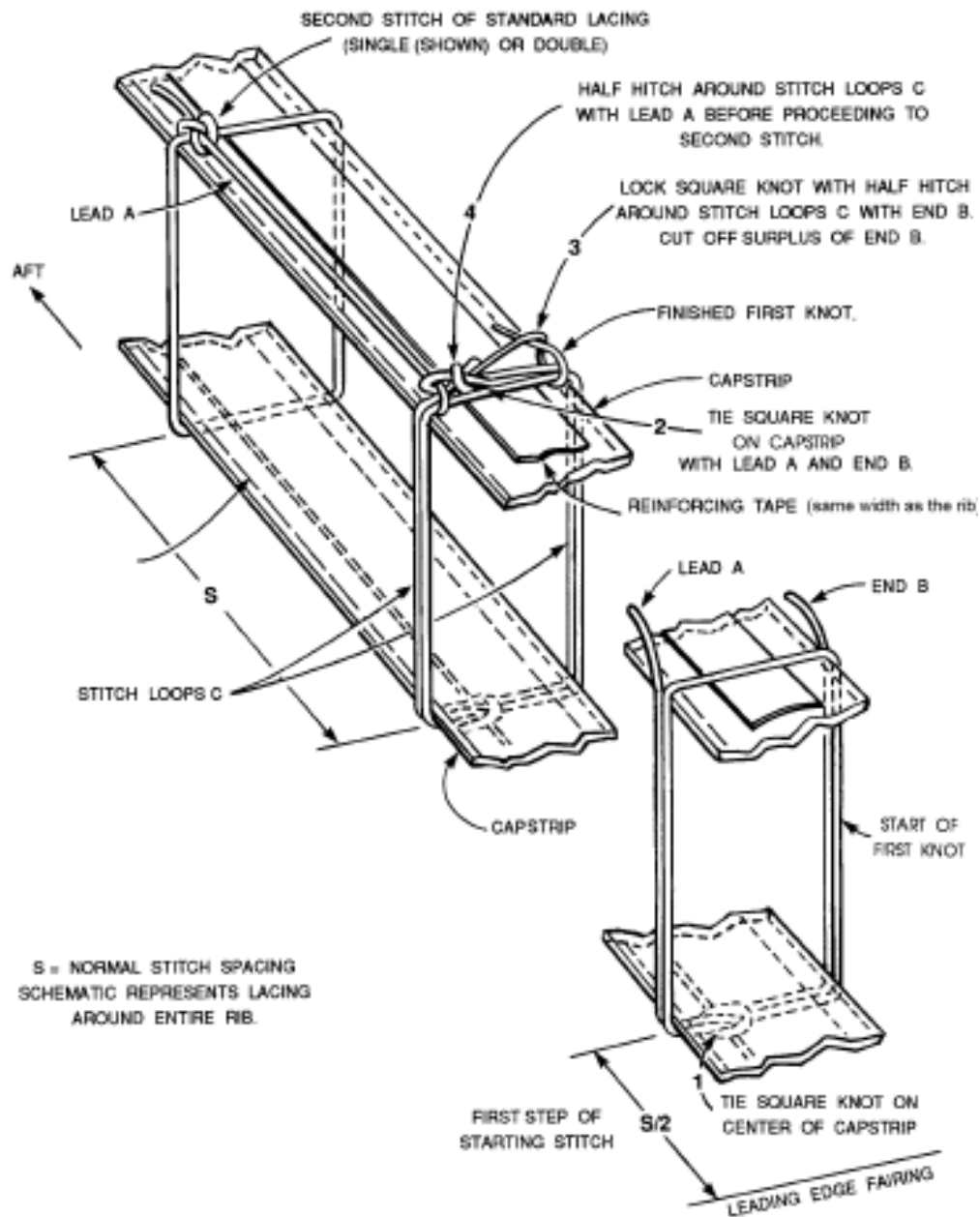


FIGURE 2-4. Standard external modified seine knot used for single and double rib lacing

After determining rib stitch spacing and locations, using a dull pencil, mark locations. The first stitch is normally started 1" from beginning of run. Draw a perpendicular line approx 1" across where each rib stitch location is. This will aid in finding location later.

Lay down rib stitch reinforcing tape across all ribs to be stitched. Cut off the tape approximately where it intercepts the cross structure. Make a neat cut here because it will show through finish coat. If doing "dollar patch" rib stitches, a 1" strip of reinforcing tape should be used on each dollar patch location.

Figure 6-5



Hidden Seine Knot

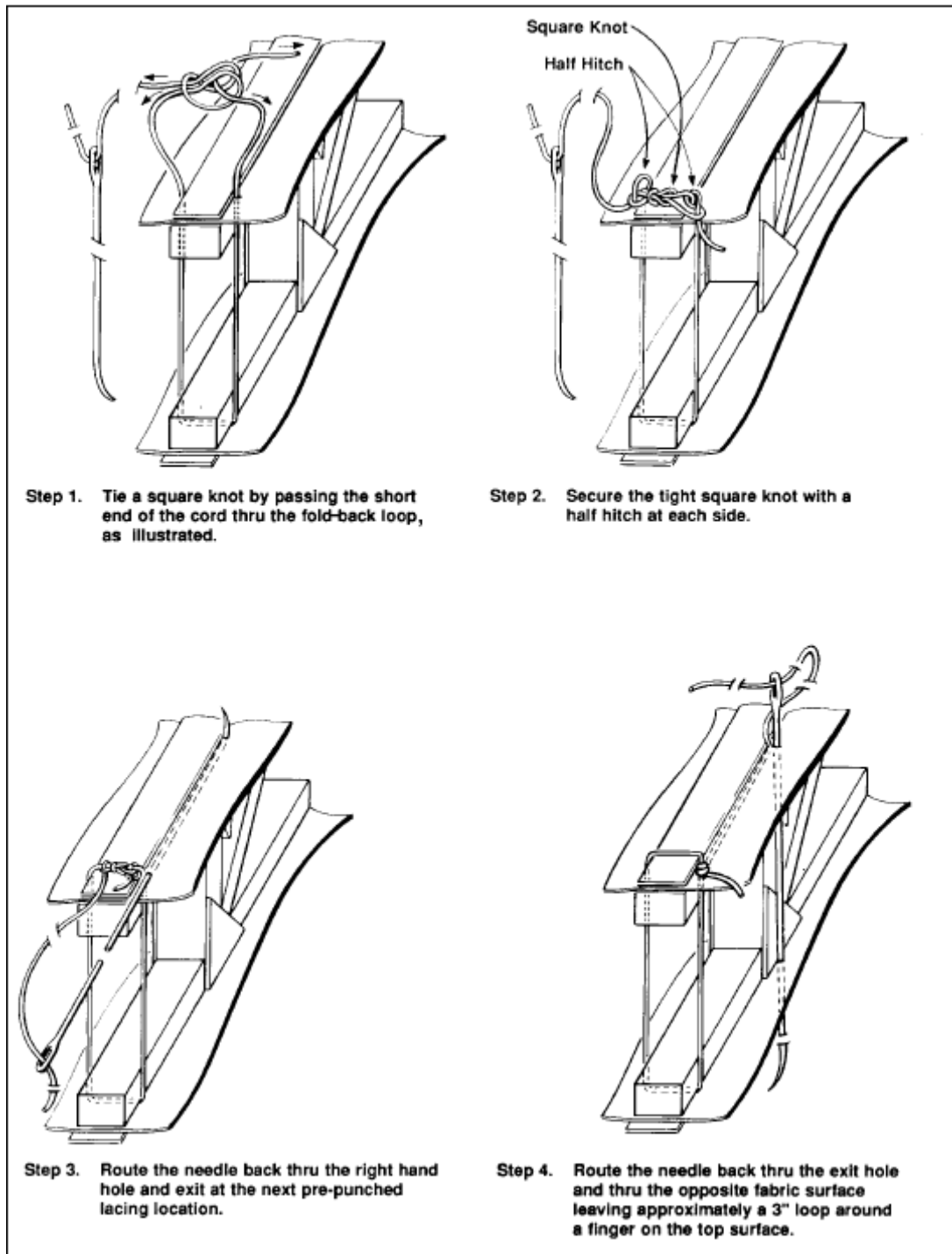
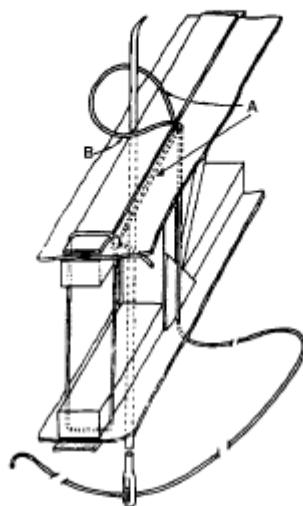
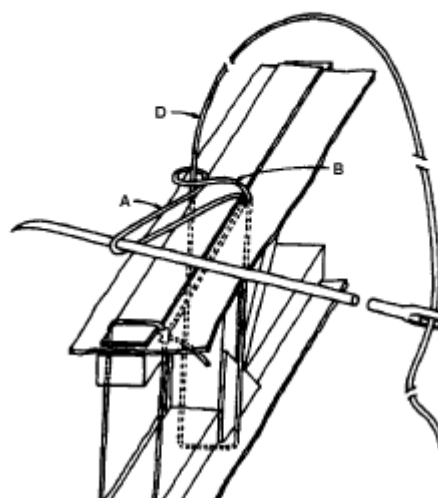


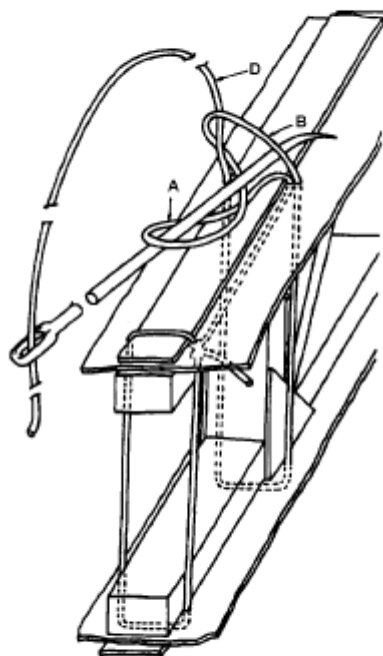
FIGURE 2-9a. Alternate sequence to tie a modified seine knot for rib lacing.



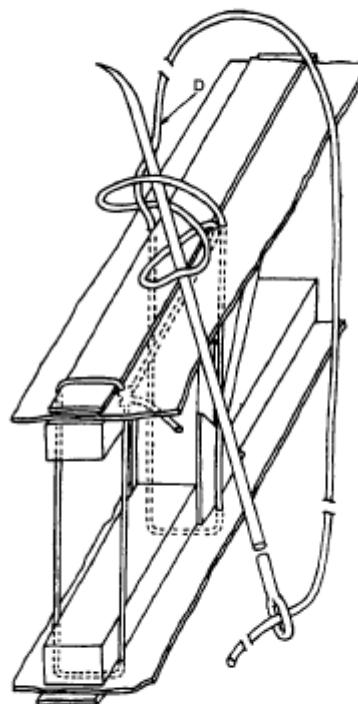
Step 5. As the needle is returned thru the top surface on the opposite side of the rib cap the loop is rotated to position cord section "A" to the forward side of the needle, then the needle is pulled thru.



Step 6. The needle tip is routed under cord section "B" to hook and pull cord section "A" aft.



Step 7. The needle tip is then routed over the top of cord section "A" and under cord section "B."



Step 8. The needle tip is then routed over cord section "D" and passed thru the lacing while holding cord section "D" perpendicular to the surface to avoid cord entanglement.

FIGURE 2-9b. Alternate sequence to tie a modified seine knot for rib lacing.

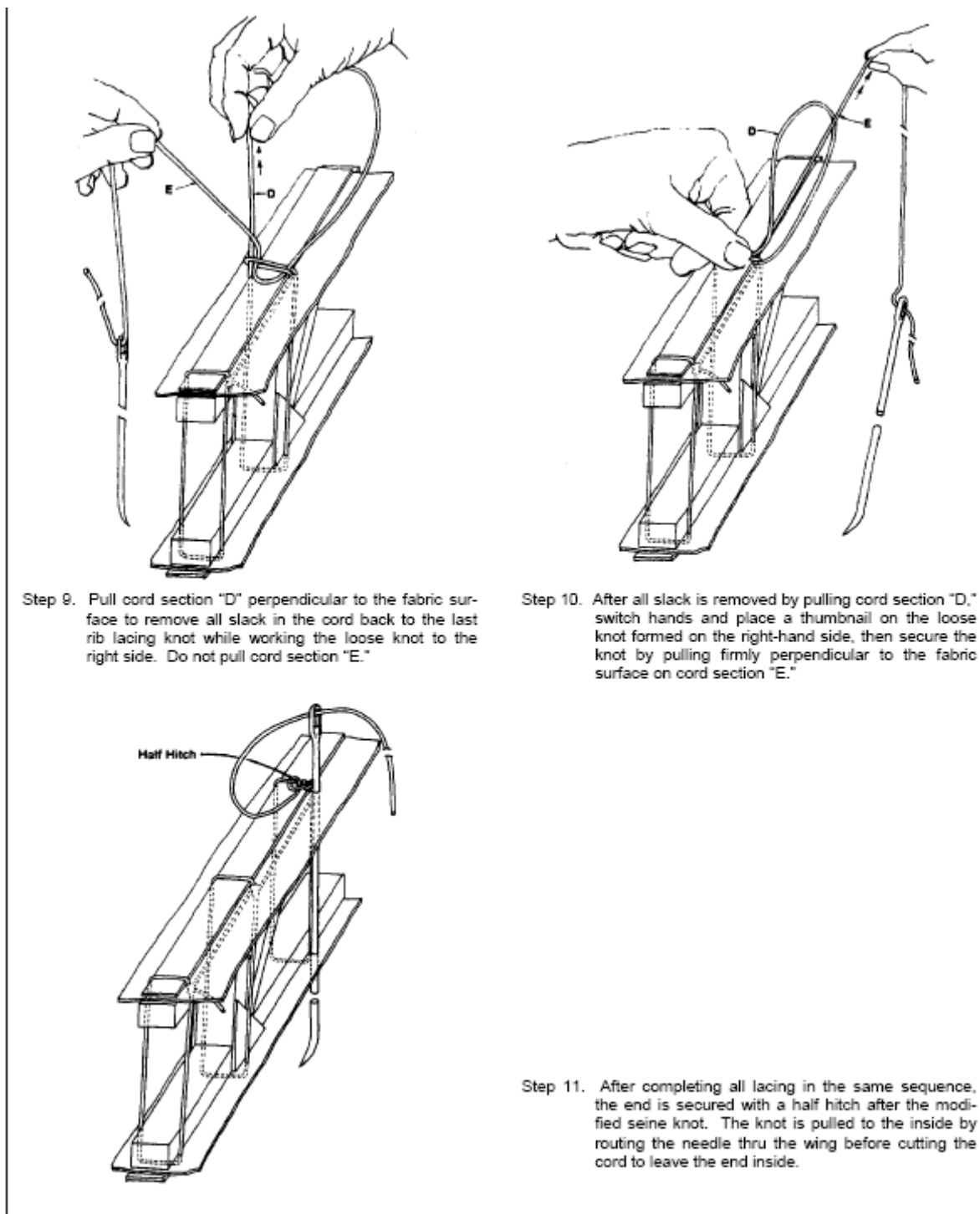


FIGURE 2-9c. Alternate sequence to tie a modified seine knot for rib lacing.

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Section VII

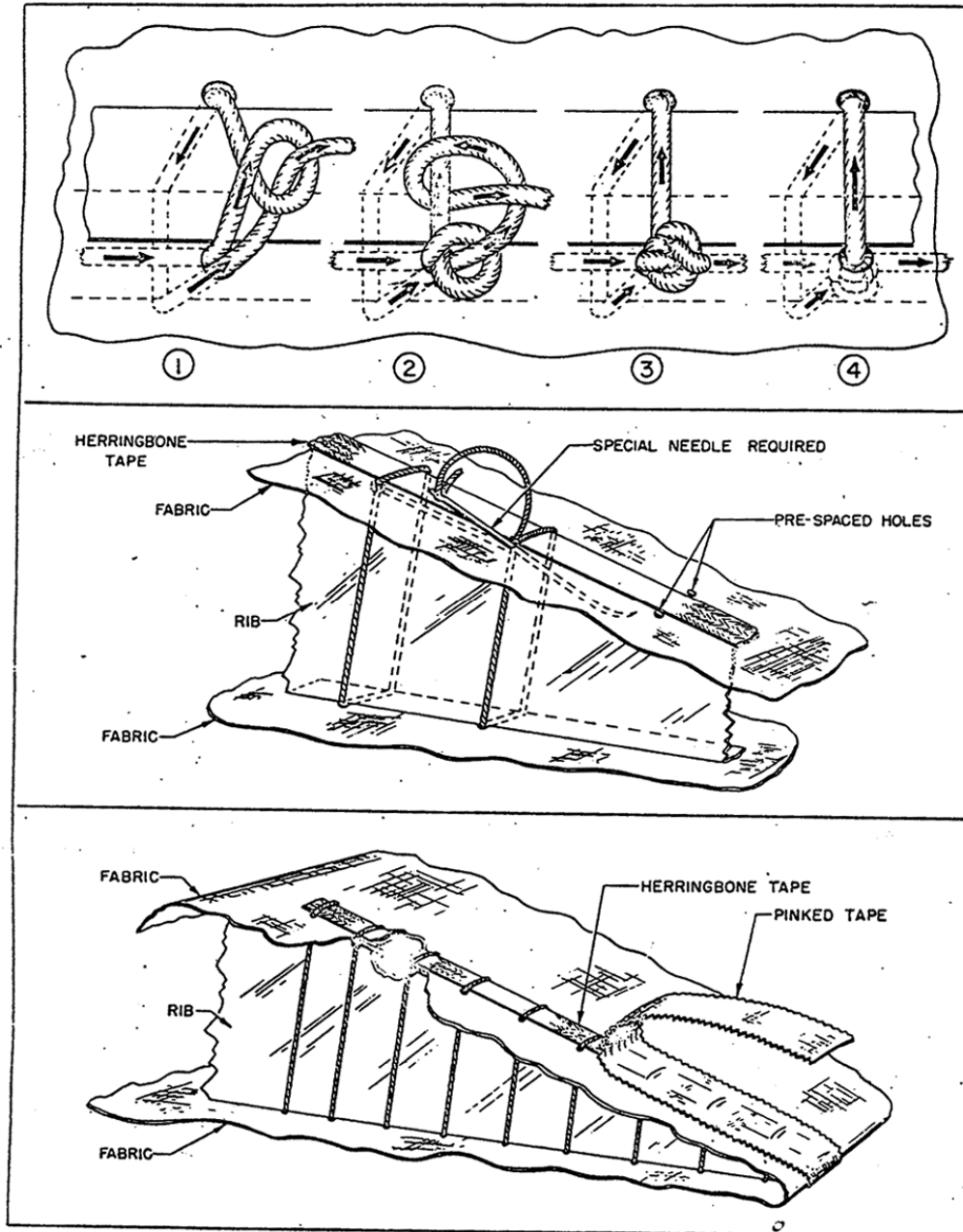


Figure 6-4 - Beechcraft Staggerwing knot

Using a sharp pencil or awl, pre punch all your rib stitch holes in the fabric, immediately adjacent the ribs. Pencil is better because it leaves an easy to see hole. Use your previously made 1" pencil lines as guides.

On wings, the first stitch is usually started with double square knots and double half hitches on both sides of the rib before the run begins. On tail surfaces, ailerons, and flaps, this is optional.

Proceed with rib lacing process as described by AC43.13-1B. See: Figure 6-6, 6-7, 6-8 & 6-9.



Figure 6-6 - Rib stitch ½" reinforcing tape.

Pre-punching stitch holes with a sharp pencil or awl.



Figure 6-7 - More rib stitching.



Figure 6-8 Forming loop for a modified seine knot.



Figure 6-9 - Rib lacing complete.

APPLICATION OF FINISHING TAPE

When application of reinforcing tape (Tape RT) and rib lacing has been completed, the aircraft is ready for application of finish tapes. Try to keep finish tapes straight and even. Use a gauge the same width as the finish tape and mark the areas to be taped using a soft lead pencil. A long piece of finish tape marked in the center makes an acceptable gauge. A 2" wide strip of plastic or venetian blind about 3ft long also works well.

APPLICATION ON STRAIGHT AREAS

Apply tapes that run chord wise first. Example, ribs, nose ribs etc. Then apply tapes that are span wise such as leading edge tapes, trailing edge tape, etc.



On wing ribs cut finishing tape about 2" longer than required. At the leading edge end of the rib, glue the first 3" of the finish tape with EkoBond cement (E610). Be sure all excess cement is wiped away. Apply a tape to each rib in the same manner. When the cement has set up enough to handle the tape without disturbing the cemented joint area, lift the first tape that was cemented and apply about 12" of EkoBond cement between the pencil lines previously marked, allowing the new glue line to intersect with the first 3" that was cemented in place. Lay the tape down on the cemented marked area and apply EkoBond cement down through the tape, wipe excess cement off using a blue paper shop towel before the cement begins to set up. By gently wiping excess cement off, glue ridges will be prevented. Continue this process until entire tape is cemented in place with the exception of the last 1 ½" of area to be taped. Using the excess 2" of tape, gently pull tension on finish tape and using masking tape, tape the finish tape end around trailing edge of wing. This tension will help force tape edges to lay down flat on the curved area of the rib contour. After cement is dry, trim surface tape to length and cement the last 1 ½" in place. Use this procedure for each of the straight finishing tapes.

APPLICATION AROUND A CURVE

Standard finish tapes require the use of heat to form the tape smoothly around the curved areas. The sharper the curve, the more heat is required.

1. Apply a 3/8" (approximately) wide strip of EkoBond Cement (E610) to the outer perimeter of the curve. .

2. Fold perimeter tape lengthwise to form a gentle crease. This gives a center line to keep the tape centered over the curved tube.
3. When cement on perimeter is tacky dry, place tape on perimeter with crease down. Starting on center of part, working toward each end, gently rub tape with hand to hold tape in place. Use a Close Quarter Iron set at 270°F and make a single pass down the center of the tape toward the ends. This will thermally bond the center of the tape to the perimeter and keep the tape from slipping.
4. With iron set at 290°F, begin working tape from middle to ends. Start in center of tape working back and forth to the edges. This will allow tapes to shrink around the curves. Apply the same heat the entire length of the tape to assure uniform tape width. If tape will not shrink around the curve, increase the heat until proper shrink is achieved. Do not exceed 375°F.
5. After the tape is in place, apply EkoBond Cement (E610) the same as the instructions for Application of Surface Tape. Lift the tape edges and apply about 12" of cement under the tape. Lay the tape down and brush cement down through the tape. Wipe excess EkoBond Cement with a blue paper shop towel, before the cement begins to set up. By gently wiping excess cement off, glue ridges will be prevented. Continue this process until entire tape is cemented in place.

Refer to Section 17, Pg: 17 & 18 for additional tips.



INSPECTION RINGS & GROMMETS

APPLICATION OF INSPECTION RINGS

When marking locations for inspection rings, use a soft lead pencil only. It is very important that you have a good bond between the inspection ring and the fabric and between the inspection ring and the inspection ring patch. To insure proper adhesion follow these steps.

1. Place the inspection ring on the fabric where it is to be located, trace the inside and outside diameters of the inspection ring onto the fabric surface.
2. Apply EkoBond Cement (E610) to the area on the fabric where the inspection ring is located, then apply EkoBond Cement (E610) to the bottom, (flat) area of the inspection ring. Place the inspection ring on the cemented area of the fabric (flat side down) and apply pressure while twisting the ring slightly to lock it into place. When applying the ring to the fabric, excess glue will seep from the edges of the ring. Wipe this excess away with a blue paper shop towel.
3. Cut patch with pinking shears 1" larger than the outside diameter of the inspection ring, (4" ring = 6" patch). After the inspection ring is securely cemented to the fabric apply cement to the inside fabric area of the inspection ring, to the inspection ring and outside the inspection ring, approximately $\frac{1}{4}$ ". Let the cement dry.
4. Center the fabric patch over the inspection ring. Start in the center and gently work fabric onto cement. Using a Close Quarter Iron set at 250°F, work the tip around the inside ring to seal the fabric tightly in place. Next seal the fabric to the outside of the ring. Be careful to not shrink the outer edge of the fabric patch.
5. When fabric patch is in place and all wrinkles are smoothed out, brush glue beginning in the center and working out. Remove excess glue in the center of ring with a blue paper shop towel before cementing the outer portion of fabric. On outer portion, gently wipe with a blue paper shop towel, from ring out toward the outer pinked edge of the patch to prevent fraying the fabric.

6. Refer to Section 17, Pg: 11 through 14



DRAIN HOLES AND DRAIN GROMMETS

Melt drain holes through the fabric in their proper location by use of a hot soldering iron with a round 3/16" to 1/4" tip. Be sure to not push too far to prevent burning a hole into the opposite side of the control surface. If desired cement drain grommets over these holes using the same technique as was used when installing the inspection rings. Be sure to open the covered drain hole using either the soldering iron or an x-acto knife.

NOTE: Melted drain holes do not require drain grommets.

Install drain grommets on the under side of all components, and at the lowest point in each fabric panel when the aircraft is in stored attitude. Seaplane grommets, which feature a protruding lip to prevent water splashes through the drain hole, are recommended over drain holes subject to water splashing on land planes as well as seaplanes. The appropriate size holes must be cut through the fabric before installing seaplane grommets. Plastic drain grommets may be glued directly to the fabric surface. Installing a small fabric patch over flat grommets is optional.

FINISH IRONING

Before you can seal the fabric with EkoFill (E620), you must make sure you have applied all surface tapes, reinforcing patches and drain grommets, if used. You must then "Finish Iron" all tape edges. Finish Iron is a term we use for ironing all of the finish tape edges and patch edges at 275°F with a Close Quarter Iron. Make sure to use care when ironing tapes and patches as careless use of the iron will warp straight lines and circles. Ironing all tape and patch edges is extra insurance that edges will not lift. This step also improves the appearance of the finished product.

After you have completed your finish ironing, you are ready to apply EkoFill (E620).



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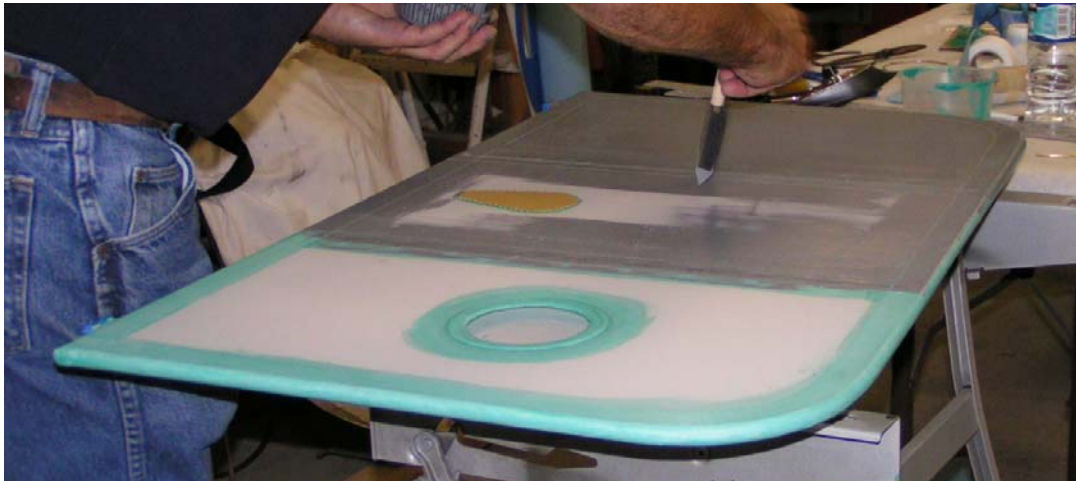
PROCEDURES MANUAL**EKOFILL APPLICATION**

STEWART SYSTEMS EkoFill (E620) when applied properly and with the minimum of 1½ to 2 mil thickness, fills and seals the weave of the fabric, provides excellent ultra violet light protection and gives an excellent base for finish coat colors.

Before application of STEWART SYSTEMS EkoFill (E620) to covered surfaces, the surface should be vacuumed to remove any dust and then wiped with a cloth dampened with STEWART SYSTEMS EkoClean (E670) Heavy Duty Cleaner, and rinsed with clean water per STEWART SYSTEMS label directions.

Thoroughly mix STEWART SYSTEMS EkoFill (E620). EkoFill has a very high solids content which may settle out in storage. Do not shake or “whip” EkoFill as it will foam or bubble. After mixing, strain EkoFill using a standard paint filter.

The first and second coat of STEWART SYSTEMS EkoFill (E620) must be applied using a 3” or 4” foam brush. Apply each coat very lightly. If wet and shiny, coat is too heavy. A single side test panel will show proper application with no drips or runs on the back side.



Using back and forth strokes, brush the first coat of STEWART SYSTEMS EkoFill (E620) into the fabric weave. Do small areas at a time. Use single direction strokes, 90° to back and forth strokes to “tip” out small bubbles formed while brushing. Repeat steps until entire surface is covered.

The second coat is applied the same as the first coat, except apply 90° to first coat. Two 90° coats are considered ONE cross coat. After first cross coat brushed application, apply one sprayed cross coat. Spray gun setting will be the same for all sprayed coats of EkoFill.

NOTE: A charcoal respirator must be worn during spray applications.

It is not necessary, or desirable to thin STEWART SYSTEMS EkoFill (E620) before spraying. HVLP spray equipment is recommended. Use a 1.5 mm fluid tip for best results. HVLP spray gun set-up; adjust fan control to full fan, set air pressure regulator on the spray gun to 20 to 25 psi with trigger pulled, open paint control knob $\frac{3}{4}$ turn to begin. On test panel (white butcher paper works well) the spray pattern should be very light, with no wet look.



When spray gun is properly adjusted, apply one cross coat (2 coats 90° to each other). Apply second coat of cross coat when first coat is dry to touch and has no damp looking areas.

When EkoFill is thoroughly dry, iron any loose tape edges with a Close Quarter Iron set at 250°F, then lightly dry sand with 320 grit open coat sandpaper. Under the right conditions STEWART SYSTEMS EkoFill could be ready to sand in 2 to 3 hours. Because temperature and humidity can greatly affect drying time, use the following test to determine when you are ready to sand. Choose a small area and sand lightly with 320 grit open coat sandpaper. You should create 'sanding dust'. If the material 'rolls up' under the sand paper, it is not ready to sand.

After sanding, an additional 2 cross coats minimum of STEWART SYSTEMS EkoFill are applied with a spray gun. When the spray gun is properly adjusted, apply 2 cross coats (4 coats 90° to each other). Apply each coat when preceding coat is dry to touch and has no damp looking areas. Overlap your spray patterns at surface tape edges where more fill is desired.

STEWART SYSTEMS EkoFill should again be dry sanded with 320-400 grit open coat sandpaper. At this point the top coat may be applied as sufficient UV protection has been achieved. However, this procedure may be repeated as many times as necessary to achieve the base coat and fill that you desire. The final EkoFill coat is sanded with 320-400 grit open coat sandpaper.

After STEWART SYSTEMS EkoFill has been applied and sanded the topcoat should be applied within 10 days. If left more than 10 days before top-coating, STEWART SYSTEMS EkoFill must be scuffed with a Scotch Brite pad.

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STEWART SYSTEMS EkoFill contains proven ultraviolet blocking agents so silver coatings are not needed. Be sure to use STEWART SYSTEMS EkoFill to fill the weave instead of using color coats to fill the weave.

NOTE: DO NOT WET SAND EKOFILL. DRY SAND ONLY!

EKOFILL CLEAN UP

Clean equipment promptly with water. If EkoFill has dried in the equipment, use lacquer thinner for removal.

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SURFACE PREPARATION FOR COLOR COATS

One of the main differences between solvent and waterborne paints is the method they use to attach themselves to each other. Solvent borne paints by their very nature penetrate and soften the substrate they are being applied to and solvent melts into the surface. This is called a chemical bond. Waterborne paints on the other hand rely on their ability to penetrate the surface pores and hold onto the texture of the substrate. This is called a mechanical bond. For this reason it is very important that the substrate primer be designed for waterborne paints. Old primers and paints can lend to inferior adhesion which will result in topcoat separation after time.

NOTE: Never apply STEWART SYSTEMS Waterborne Catalyzed Polyurethane Top Coats over zinc chromate primers or old paints.



Steel Surfaces – All steel surfaces must be free of rust before priming and top coating. Lightly rusted steel surfaces should be coated with STEWART SYSTEMS Conversion Coating (E7800). This process converts the iron oxide (rust) to ferric iron and the surface is further sealed in a coat of clear acrylic. This stops the rusting process and provides an excellent conversion coating for STEWART SYSTEMS Waterborne Primer/Sealer (E7510), which should be applied to all steel surfaces before top coating. If moderate to heavy rust is present the steel should be sand blasted and any necessary repairs made, then primed with STEWART SYSTEMS Primer/Sealer (E7510) Top coat with STEWART SYSTEMS Waterborne Catalyzed Polyurethane Top Coat.

Aluminum Surfaces – Aluminum surfaces should be cleaned of all oils and dirt by first washing with STEWART SYSTEMS EkoClean Heavy Duty Cleaner (E670) to prevent possible contamination. The aluminum to be painted should then be treated with STEWART SYSTEMS EkoEtch (E675). Wearing light rubber gloves and using a red Scotch Brite pad, further wash the aluminum surface with STEWART SYSTEMS EkoEtch (E675). Follow label instructions. Do not allow the solution to dry on the aluminum surface before rinsing with clean water.

The rinsed aluminum should be allowed to dry for at least 1 hour and not to exceed 12 hours before applying STEWART SYSTEMS Primer/Sealer (E7510). If more than 12 hours have elapsed,



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then re-apply STEWART SYSTEMS EkoEtch (E675) to the aluminum. Allow the STEWART SYSTEMS Primer/Sealer (E7510) to dry and cure for 12 hours before top coating.



Fiberglass & Composite Surfaces – Wash the surface thoroughly with STEWART SYSTEMS EkoClean Heavy Duty Cleaner (E670) to remove any wax, oil or dirt. Follow label instructions for heavy duty degreasing. Rinse with clean water. Repair any surface damage at this time using appropriate fillers. Lightly sand before applying STEWART SYSTEMS EkoFill (E620) which is a high build filler coat and UV block barrier.

STEWART SYSTEMS EkoFill (E620) may be finish sanded when dry to touch, approximately 2 to 4 hours.

Allow EkoFill to dry at least 12 hours before applying STEWART SYSTEMS Waterborne Catalyzed Polyurethane Top Coats.

Fabric Surfaces – If the fabric surface to be painted has been in a storage state after STEWART SYSTEMS EkoFill (E620) has been applied be sure to wash with STEWART SYSTEMS EkoClean Heavy Duty Cleaner (E670) and rinse with clean water. Follow label instructions for light duty cleaning. Allow surface to dry and lightly sand with 320 grit sandpaper prior to top coating.

NOTE: All STEWART SYSTEMS primers and fillers should be lightly sanded before top coating.

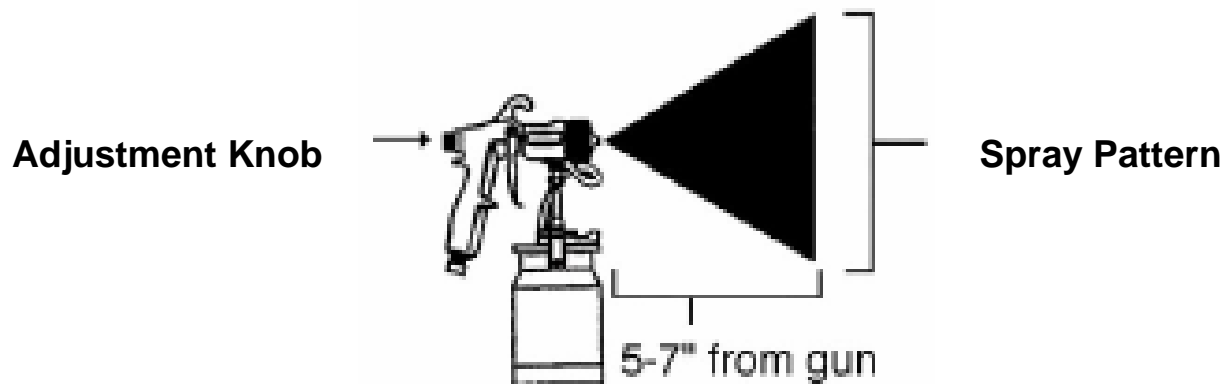
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SPRAYING A TEST PATTERN

It is very important that you test your spray gun pattern before you begin to paint your aircraft. A good way to accomplish this is to use white freezer paper. Attach a 6' length to a wall in your shop, shiny side out. This vertical smooth surface will give you practice in the most difficult spray application condition.

To test the spray pattern, open the fan control knob to the full fan position, (usually the top small knob turned counterclockwise). With the paint control knob full closed, pull the trigger fully and hold, set the air pressure on the air regulator mounted on the spray gun to 20 psi. With the trigger released, the gauge should read approximately 60 psi. Open fluid control knob approximately $\frac{3}{4}$ turn. Using water in lieu of paint, you can test the spray pattern or practice stroke techniques without making a mess.

The amount of paint and size of fan coming from your gun will vary depending on make and model of your spray gun. A spray pattern that is narrow on large surfaces will allow "tiger stripes" that make it difficult to achieve a good paint job. A good quality spray gun will normally have an acceptable fan width. An inexpensive spray gun may not be acceptable for painting large areas.



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PRIMER APPLICATION FOR METAL PARTS ONLY

STEWART SYSTEMS EkoPrime Primer/Sealer (E7510) is best applied by first spraying a light fog coat. We recommend a 1.5mm fluid tip for primer application. Allow to dry until tacky, (usually about 5 minutes), spray a second medium wet coat 90° to the first coat. Allow to dry at least 30 minutes before sanding. More coats can be applied if needed to cover pits or scratches. Try not to exceed 2 mils (4 coats) for best results. Let STEWART SYSTEMS EkoPrime Primer/Sealer (E7510) cure for at least 8 hours before top coating. Topcoat must be applied within 5 days. If you wait longer than 5 days before applying the topcoat, sand the primer with 400 grit sandpaper and clean with STEWART SYSTEMS EkoClean Heavy Duty Cleaner (E610)

NOTE: Always be sure the primed surface is clean before topcoating.

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COLOR COAT APPLICATION

READ COMPLETE INSTRUCTIONS BEFORE STARTING



Equipment needed:

- 3 calibrated mixing containers, graduated sizes
- Distilled Water
- DuPont M50 Viscosity Cup**
- Latex gloves
- Stir Sticks
- Paint Filters
- HVLP (non-turbine) paint gun
- 1.2 to 1.4 tips for paint gun
- Air Compressor (Recommend a minimum of 13 cfm)
- Charcoal Respirator

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Optimum temperature:

70° - 85° for application

Mixing Paint:

Prior to mixing paint you need three (3) calibrated mixing containers. One for the paint, Part A, one for the Catalyst, Part B, and one for distilled water. Container for Part A must be large enough to hold all three parts when combined.

Ratios of paint to catalyst and distilled water as follows: 3 parts Part A, (paint), 1 part Part B (catalyst) and approximately 1 part distilled water.

Begin by thoroughly mixing the Part A (paint). After mixing fill largest calibrated container with desired amount of Part A (paint). In second container fill with Part B (catalyst) for required 3 to 1 mix. I.e. 15 oz Part A (paint) to 5 oz Part B (catalyst), in third container, 1 part distilled water, using example above 5 oz.

Using mixing stick, begin stirring measured amount of Part A (paint) and pour in pre-measured Part B (catalyst) slowly, continuing to stir with mixing stick until paint thickens and becomes very smooth, about 3 minutes. *Do not* add water until this step is complete. Continue to mix and add 1/2 pre-measured distilled water. Mix thoroughly. Check viscosity of paint with DuPont M50 viscosity cup**. 20-22 seconds is very important, 21 seconds is ideal. If viscosity of paint is too thick (slow) add additional very small amounts of distilled water until 20-22 seconds is achieved. Use care when adding additional water as a little goes a long ways. It may take 3 or 4 tries to get the proper viscosity.

Applying Paint:

Use an HVLP non-turbine spray gun with 1.2 to 1.4 tip. Setting up the HVLP spray gun; open fan to desired setting (full for large areas and narrow for small areas), set air pressure at spray gun to 20-25 psi with trigger pulled, open fluid meter approximately ¾ turn. Be sure fluid meter knob has an index mark. If it doesn't make a mark on it with a felt tip pen or permanently etch a mark.

The first coat is applied as a light fog coat. There are two ways to do this. One is with fluid meter opened less and speed of travel of spray gun slow, or with fluid meter opened more, and travel of spray gun faster. The latter works the best. Paint is too heavily applied if it "spider webs".

Open fluid control knob an additional ⅛ turn

Apply second coat 90° to first coat when first coat "tacks", usually around five (5) minutes.

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Third coat is applied 90° to second coat, with fluid meter opened an additional $\frac{1}{8}$ of a turn. Apply when 2nd coat is “tacky” and just does not transfer paint when touched by the back of your finger.

Timing is very important, **Do Not** wait too long between coats. Open paint control knob an additional $\frac{1}{4}$ turn.

Fourth coat, apply 90° to third coat. After the fourth coat, the finish will appear “dry”. If properly applied, this will flow out and develop a wet look shine in approximately 5 to 10 minutes.

For fabric only a 5th and final coat may be applied when paint is “fly paper tacky”, again 90° to the fourth coat. Use same paint setting as fourth coat. Paint will be tack free in 2 hours, and dry overnight.

Depending on temperatures (70° minimum) masking may be done in 24 hours and a second trim color may be applied for up to 10 days without sanding. After 10 days, lightly sand before applying trim color or additional paint.

NOTE: Maintain a 70° temperature during curing period of 12 hours.

Pot Life:

Pot Life of the paint begins once the catalyst is added to the Part A. Pot life at 75 to 85 degrees is 45 minutes to 1 hour.

NOTE: Pot life of Stewart Systems Catalyzed Polyurethane Top Coat may be extended by cooling the Part A (paint) and Part B (catalyst). Be sure to not cool below 65°F. Room air-conditioned temperature is a good temperature for extending pot life.



****** To use a viscosity cup, completely submerge the cup in the mixed paint. Hold the cup vertical, and begin timing as soon as the cup is pulled out of the paint. Hold cup about 3” above the paint container so you can see the stream of paint. When the stream breaks, stop the time.

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It is good to check the drain hole in your viscosity cup periodically, as it can become clogged or diminished in size. To check and clear the drain hole, using your fingers run a #30 drill bit through the hole.

NOTE:

A charcoal respirator must be worn during spray applications. Fresh air breathing systems are not required.



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MASKING FOR APPLICATION OF TRIM COLORS

Allow at least 24 hours of drying time before applying masking tapes.

One part of a paint job that affects the final appearance more than anything else is the detail and quality of the trim color application. It is very important to use a high quality vinyl masking tape, such as 3M Vinyl Fine Line tape™ (Tape Fine Line). It is also very important that you use a plastic coated masking paper to prevent soak through. Do not use newspaper.

One of the biggest problems with masking for stripes using polyurethane paints is that due to their low viscosity the paint tends to penetrate into seams and under masking tapes. There are several steps to take to eliminate this problem. The first step is to use a good quality fine line tape to lay out your trim pattern. Use a good quality brand name masking tape and paper over this to finish the masking job. It is important to mask or cover the entire aircraft, otherwise fine overspray can get into and onto unwanted areas. The second step, to assure a sharp clean trim line is to spray the “masked off” trim area with the base color first. This way if there are any areas along the tape line that allow the paint to bleed through, it will be the same color as the base coat. When you spray your trim color it can’t get into any voids or under the tapes, because they are already filled.

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REMOVAL OF MASKING TAPES

There are two methods of removing the trim tapes. One is to let the paint dry for 8 hours and remove all the masking paper and hold down tapes. Then remove the fine line tapes by pulling them off at a very sharp angle toward the trim area. This will shear the paint edge and give a very sharp distinct line.

The second method is preferred by most professional shops but is a little trickier to do. After the final spray coat of paint is applied to the trim area remove the masking paper and hold down the tape very carefully so as not to touch the wet paint. Then remove the fine line tape, also very carefully, so as not to touch the paint. The theory behind the second method is that the paint edges have a chance to blend into the base coat and will not leave a sharp thick edge.

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REPAIRING FABRIC

Always refer to FAA Advisory Circular AC 43.13-1B Chapter 2 before repairing any fabric damage. This advisory circular spells out in detail how particular injuries to the aircraft fabric are to be repaired.

Repairing fabric damage with STEWART SYSTEMS method is a relatively simple and easy process. In the case of a fabric puncture, the area must be thoroughly cleaned with STEWART SYSTEMS EkoClean Heavy Duty Cleaner (E670) to remove any waxes, silicones, or contaminants which might be present. If the topcoat is STEWART SYSTEMS Waterborne Catalyzed Polyurethane you just need to scuff sand an area 2" around the damaged area before patching. If you are unsure of the topcoat or you know it is something other than STEWART SYSTEMS Waterborne Catalyzed Polyurethane Top Coat, you must sand down to the EkoFill coat 2" around the damaged area. Next glue your patch on the sanded area using EkoBond glue and allow to dry overnight. Heat shrink the fabric ONLY over the open hole under the patch. Finish Iron the patch edges at 250°F. Apply EkoFill to desired thickness, sand and spray matching top coat.

SPRAYING REPAIRED AREAS

When repainting a repair whether it is on fabric or metal, it is always best if you can paint to normal physical boundaries such as between ribs, stringers seam lines or hinge lines. In this way the new paint line can be somewhat hidden. If it is impractical to paint to a normal boundary, spot painting can be accomplished with just a little extra work.

First, mask the area around the repair area to be painted. DO NOT USE FINE LINE TAPE. Give yourself 4 – 6 inches beyond the repaired area to paint. Turn up the inside edges of the masking tape about 1/8". This prevents an abrupt paint edge out in the middle of nowhere. Apply the paint as you normally would. After the paint has dried and the masking tape and paper have been removed you will notice there is a dusty dry area where the new paint meets the old paint. After the new paint has cured for 7 days you can then buff out this area using regular buffing compound to blend the new and the old paint together.

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NOTES ON TYING IT ALL TOGETHER

DISCLAIMER: These are For Reference Only notes, using the STEWART SYSTEMS PRODUCTS on aircraft fabric covering. There are seminars offered by Stewarts Hangar 21 in Cashmere Washington or any of the Distributors listed in this manual. We can't emphasize enough the importance of attending one of our hands-on classes to learn all the correct and airworthy techniques for aircraft covering.



These are notes only. Used as a guide to help you understand the products, how they work and how they are applied. Used along with this manual, you should be able to tackle any aircraft fabric covering project. Make sure you read all the directions and if needed, pick up the phone and call 1-888-EKO-POLY to get professional answers to your questions. **USE THESE NOTES AT YOUR OWN RISK. FOLLOW THE INSTRUCTIONS OF THE PARTICULAR APPLICATIONS IN THE APPROPRIATE SECTIONS OF THIS MANUAL.**

INTRODUCTION NOTES:

Section 17 of this manual is taken from Christian Sturm's website <http://www.supercubproject.com>. Christian attended one of the Stewart Systems covering workshops, and took copious notes and pictures.

The STEWART SYSTEMS products are completely water based through the fill coats and waterborne for the Polyurethane topcoats. STEWART SYSTEMS products are non-hazardous and non-flammable. All product ships standard UPS ground or other

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common carrier. Your work area may be heated to optimum temperature using what ever method you have available without fear of explosion from any of the STEWART SYSTEMS product line. Be sure to contact Stewart's Hangar 21 if you have any specific technical or process questions.

PREPARATION NOTES:

Before beginning any fabric covering procedures make sure to wash your hands to clean any grease or dirt that may contaminate the process.

Get the workshop temperature to 75°F to work with any of the STEWART SYSTEMS products.

Pour a small amount of EkoBond glue into a disposable cup.

Have small 2 inch standard paint brush (not foam) for EkoBond.

Have 1 ply blue shop towels ready.

Preheat irons (applicable for the step) to 250°F. Important: make sure irons were previously calibrated using a temperature measuring device.

Have sharp scissors and single edge razor blades handy.

Have a rotary pinking shear handy.

Using electrical tape, protect any hinges or bushings completely.

Have sanding belt eraser handy.

Have a soft lead pencil (dull) handy.

Glue cup holder. Take a Dixie cup, cut in half. Glue the bottom half with EkoBond to a small paper plate. Insert full size cup with glue into the half cup. Throw away cup when not needed. Use a damp blue towel over cup to keep glue fresh.

COVERING PANELS NOTES: First side

Wash hands.

Preheat small iron to 250°F.

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Determine which side of surface you will cover first. Normally you will cover a bottom surface first and then the top as to hide any extra tapes or overlaps from sight. These instructions assume we are covering the bottom first.

Apply EkoBond glue (from this point forward EkoBond will be referred to as glue) to the opposite side of the surface to be covered. Put a medium coating approx 180° around the surface on the opposite side to cover. See: Figures 17-1, 17-2 & 17-3.

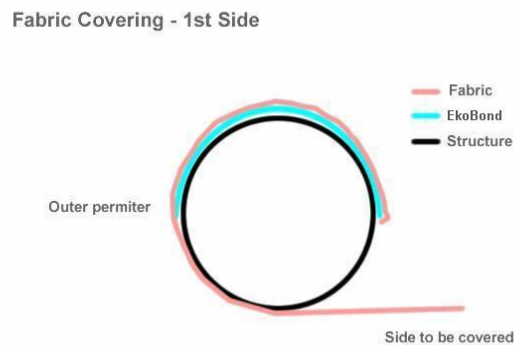


Figure 17-1 - Diagram of EkoBond application for the first panel.



Figure 17-2 - Covering first panel, apply EkoBond to opposite side to be covered.



Figure 17-3 - Hinges protected with vinyl tape. EkoBond applied to frame.

Lay control surface onto fabric panel, center as needed. See: Figure 17-4.

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Figure 17-4 - First fabric panel in place and wrapped over frame.

Use hand friction to tack fabric down.

Roll up edges by pulling and rubbing to tack the panel to previously glued surface. In this step you are using HAND pressure and rubbing friction to allow the fabric to temporarily attach to the glued areas. Pull out any slack.

Now, using iron slowly work iron around perimeter and iron down the fabric to the glue areas. Iron partially into the inner perimeter. Pull on fabric while ironing to remove puckers and bring taut. Repeat on all sides of the perimeter. See: Figures 17-5 & 17-6.



Figure 17-5 - First panel trimmed, applying EkoBond

Using a sharp pair scissors, cut along the inside perimeter to remove excess fabric. Allow enough material so the fabric will wrap around to approx 270° from the opposite side.

Continue ironing down fabric to inner perimeter, working out wrinkles in radius corners slowly without creasing.

Apply glue to the perimeters once again, this time soaking into the fabric and WIPE OFF with blue shop towel. Work in 6-12" sections at a time as to prevent the glue from setting up and makes wiping difficult. Throw away towel when it becomes saturated with glue.

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After the glue has become mostly dry, use the sanding belt eraser to remove any glue drops, globules, streaks, etc. Incidentally, the eraser is also used to remove glue from your hands and clothes! Clean up perimeter with eraser and remove any high points. These will show up on a finished surface if they are not cleaned up. As you become more proficient with your covering skills, this step will become unnecessary.

Do your first SHRINK. Using large iron at 250°F, shrink the whole panel. Begin with center bay (if applicable), then alternate side bays. Bring up all the fabric to the required first shrink temperature of 250°F. When making passes with large iron try to go 90 degrees to the previous pass to cross-shrink. Go around edges and shrink any puckers. Work out bubbles on perimeter with small iron if necessary.



Figure 17-6 - Glue applied.

COVERING PANELS NOTES: Second side

Wash hands.

Set the small iron to 250°F

Using your finger as a guide, draw a pencil (no Sharpies!) reference line approx 1" away from the outer perimeter of previously covered side. No need to be super precise here, just make a line to establish a glue boundary. See: Figure 7.



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Figure 7 - First side is shrunk to 250 ° F.

Make pencil reference line 1" from edge.

Apply glue around perimeter and all the way to the previously made 1" line. DO NOT WIPE OFF glue in this step. Just brush on glue and let dry tacky. See: Figure 17-8.

Lay surface onto the pre-cut fabric panel. Roll the fabric around the perimeter and overlap up to the pencil line. Use hand rubbing friction to pre-tack the panel to the perimeter, removing any excess wrinkles bringing fabric panel taut. See: Figure 17-8.



Figure 17-8 - Apply EkoBond for second side, up to the pencil line.

Begin lightly ironing around perimeter and iron down fabric towards previously marked pencil line. See Figure 17-9.



Figure 17-9 - Ironing second panel in place.

EkoBond is being heated well for good penetration.

For radius corners, set iron to 350°F. You want to HEAT FORM radius corners by using the extra hot iron to pre-form the overlap for glue down. Work radius corners slowly by pulling and shrinking at the same time. Shrink and smooth all the way to the 1" pencil reference line. Try not to touch the underlying fabric surface to prevent premature shrinking there. In this step you are simply forming the overlap corner.

Once satisfied with the heat forming and the small iron still set to 350°F, tack down the outer perimeter firmly establishing a 1/16" line of penetration of heat to glue. This penetration should look like a shiny dark line where the heat has permeated the glue. Only iron the very outer perimeter.

On the overlap which goes to the glue line, transfer the 1" pencil border by redrawing the line on the overlap you previously heat formed.

Pull up the heat formed overlap and using a pair of rotary pinking shears, cut along this newly drawing 1" border line to remove the excess fabric. Try to be as neat as possible because this cut will lightly show through (under tapes) on finished surface.

Set iron back to 250°F.

After cutting off excess, iron the overlap back down. Smooth out and remove any wrinkles or creases.

Apply glue on TOP of overlap. Work glue in thoroughly and WIPE OFF. Work in 6-12" sections at a time to prevent glue from setting up. When wiping off pinked surfaces, be careful not to wipe too aggressively against the pinks. This may cause pinks to lift up and fray, which may continue to lift up in the future. Try to bias your wiping outwards with the pinks.

After dry, set iron back down to 350°F and work out any puckers or wrinkles on the perimeter. Run the tip of the iron quickly over the pinked edges to iron any lifted spots down. Use eraser to remove excess globs or drops of glue.

First shrink. Using large iron at 250°F, shrink the second side. Starting at center then alternating bays. Move large iron over entire surface evenly and bring all fabric up to 250°F.

Set large iron to 300°F.

Second shrink. Repeat panel shrinking as described above at 300°F. DO BOTH TOP AND BOTTOM SIDES at this time. Make sure all fabric gets up to temperature.

Set large iron to 350°F. See: Figure 17-10.

Figure 17-10 - Shrinking panel all the way to 350 ° F.



Third shrink. Repeat panel shrinking at 350°F. DO BOTH TOP AND BOTTOM SIDES. Make sure all fabric gets up to temperature.

RIB STITCHING NOTES:

Stuff Needed:

Flat or round waxed rib lacing cord.

Rib stitching needle (sharpened brass welding rods make nice homemade needles, 3/32-1/8". Hammer down one end flat, drill hole for lacing).

Pencil.

Reinforcing tape of proper width for your ribs.

ACCEPTED KNOTS

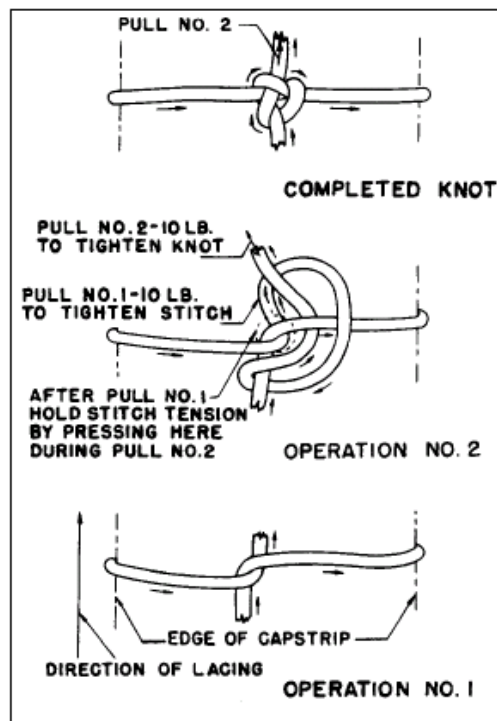


FIGURE 2-4. Standard external modified seine knot used for single and double rib lacing

Stewart Systems recommends the Modified Seine knot, see figure 17-11, the Hidden Seine knot, and the Staggerwing Knot, see figure 17-12. as accepted rib stitch methods for use with Stewart Systems products.

When working on large areas like the wing sections, it is handy to have a helper on one side of the wing to push the needle back through to you while you are rib stitching.

Figure 17-11 - Modified Seine Knot, figure 2-4 of AC43.13-1B (9/8/98).

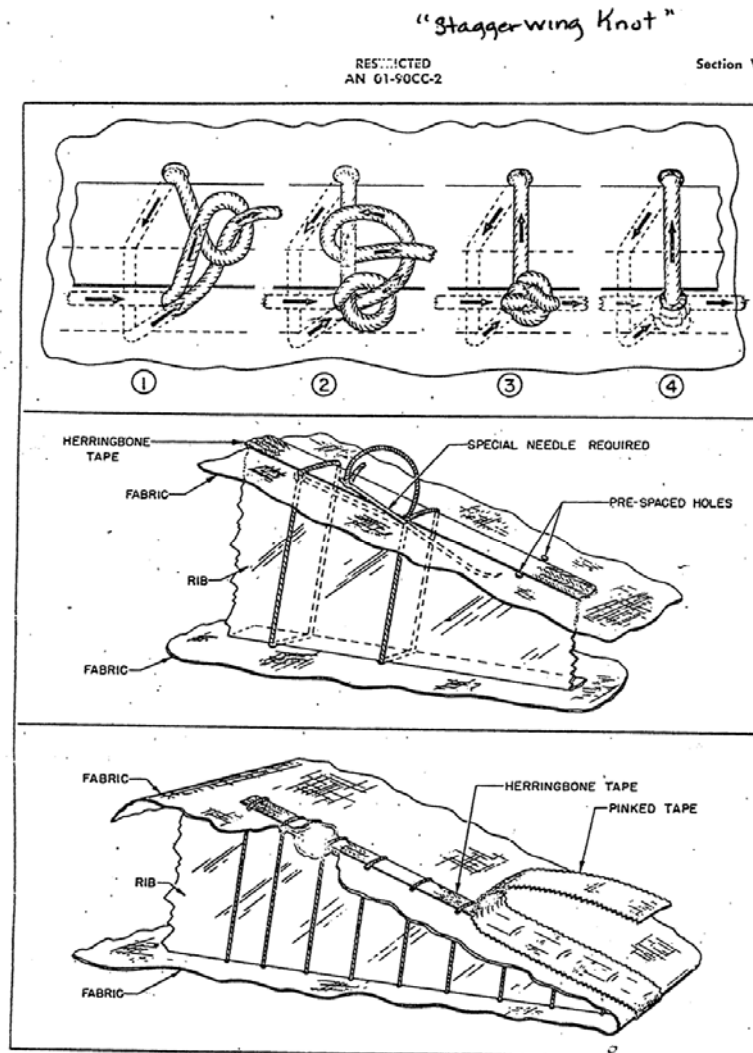


Figure 17-12 - Beechcraft Staggerwing knot,.

Wash hands.

After determining rib stitch spacing and locations, using a dull pencil mark locations. The first stitch is normally started 1" from beginning of run. Draw a perpendicular line approx 1" across where each rib stitch location is. This will aid in finding location later.

Lay down rib stitch reinforcing tape across all ribs to be stitched. Cut off the tape approximately where it intercepts the cross structure. Make a neat cut here because it will show through finish coat. If doing "dollar patch" rib stitches, a 1" strip of reinforcing tape should be used on each dollar patch location. The width of ribs will determine the width of reinforcing tape required

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Using a sharp pencil or awl, pre punch all your rib stitch holes in the fabric, immediately adjacent the ribs. Pencil is better because it leaves an easy to see hole. Use your previously made 1" pencil lines as guides.

On wings, the first stitch is usually started with double square knots and double half hitches on both sides of the rib before the run begins. On tail surfaces, ailerons, and flaps, this is optional. See AC43.13-1B or a fabric covering manual for specific instructions.

Proceed with rib stitching process as described by AC43.13-1B. See: Figure 17-13, 17-14, 17-15, & 17-16.

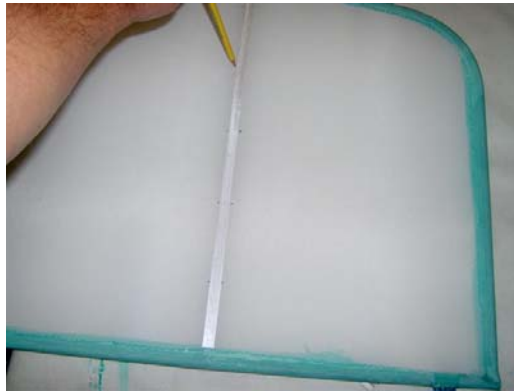


Figure 17-13 - Rib stitch ½" reinforcing tape.

Pre-punching stitch holes with a sharp pencil or awl.



Figure 17-14 - More rib stitching.

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Figure 17-15 - Forming loop for a modified seine knot.



Figure 17-16 - Rib stitching complete.

INSPECTION RINGS NOTES:

Wash hands.

Pre locate all inspection hole locations. If you covered the wing bottom first, it is easy to determine the locations from the top. Draw the locations with a pencil on the inside of the wing. The pencil mark will be visible from the outside.

Prepare inspection rings by removing any sharp molding burrs.

Prepare correct sized patches for rings. A large coffee can is just the right size to use as a template. Use rotary pinking shears to cut patch from fabric.. Do NOT cut patches from scrap fabric where there are creases, because they WILL show. These patches will not be shrunk.

Using the ring as a template, draw the inner and outer ring on the surface.

Apply EkoBond inside the newly drawn region where the ring attaches to the fabric.

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Apply glue on the mating surface of the ring.

Set ring onto glued fabric surface and give a slight twist to seat in glue bed.

Carefully wipe off any excess glue before it becomes tacky. See: Figure 17-17.



Figure 17-17 - Inspection ring application.

Allow EkoBond to set up for several minutes.

Brush on glue in center of ring, on ring, and approx ¼ - ½" outside of ring. LET DRY several minutes. See: Figure 17-18.



Figure 17-18 – Glued center with the patch showing.

Set appropriate sized patch on inspection ring, center as necessary.

Use your fingernail and run along the inner and then outer perimeter of ring to form fabric. Work out any wrinkles.

Carefully use small iron at 250°F tip to go over the area you previously did with your fingernail to tack the patch in place. Do not shrink the patch! Use only the very tip of the iron. See: Figure 17-19 & 17-20.



Figure 17-19 - Iron in the inspection ring patch.



Figure 17-20 - Inspection ring patch glued down.

No shrinking performed.

Apply a good coat of glue over the entire patch and WIPE OFF gently.

You're done! You can use the same instructions for applying reinforcing patches. See: Figure 17-21, 17-22 & 17-23.



Figure 17-21 - Reinforcing patch.



Figure 17-22 - Apply glue to fabric and patch.



Figure 17-23 – Patch set in place.

TAPES NOTES:

Stuff Needed:

Pinked (or straight) Finish tapes, 2", 3" or whatever your plane calls for.

EkoBond

Brush 1" & 2" Chip brush

Surface previously rib stitched (if applicable).

Wash hands.

Note: No heat or shrinking in this step.

Mark rib tape locations with a straight edge and pencil first. For example, if using 2" tape, draw marks approx 1" on each side of rib and then draw parallel line to rib using straight edge. This gives you a boundary to align your tape and to brush glue. If rib is not perfectly straight, try to center the tape for best aesthetics.

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Determine order of tape layout for best slip stream performance and aesthetics.

Pre-cut your tapes for the proper length. They should extend far enough to go under the perimeter tapes.

Working short 6-12" sections at a time, brush glue down in tape region (pencil boundary), lay the tape on surface and align. Proceed to brush glue over top of tape and then WIPE OFF excess using blue shop towel. Repeat for the next 6-12" until entire tape is encapsulated in glue and in position. See Figure 17-24.



Figure 17-24 - Applying tapes over rib stitch.

Tip: For wings or similar surfaces, it can be handy to do the first 3" of tape for every rib first. Let glue set up. Then go back and finish off the tapes. This allows you to slightly tug on the tape for a tighter fit. This is especially handy for the upper wing surface to assist the tapes in conforming to the "scallop" that is between each rib. See: Figure 17-25 & 17-26.



Figure 17-25 - Glue down tapes over rib stitch.

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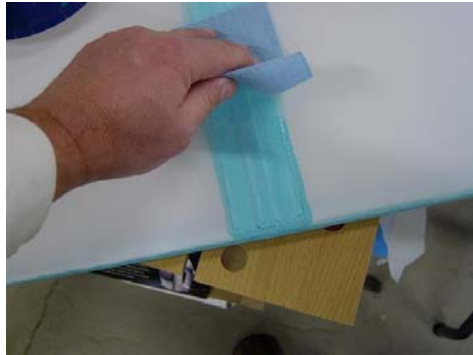


Figure 17-26 - Wipe off excess glue for tapes.

Let dry.

PERIMETER TAPES NOTES:

Stuff Needed:

Pinked (or straight) Finish tapes, 2", 3" or whatever your plane calls for. 3" is often used for perimeters because of shrinking.

EkoBond

Brush

Small iron 350°F

Wash hands.

Unlike regular tapes, perimeter tapes go around an outer surface and fold down on both sides of the surface. Tail feathers, tip bows, etc. If going around radius corners, it will be necessary to pre-shrink and heat-form these tapes to achieve a consistent width perimeter tape.

Determine length of tape and pre-cut. Use pinked scissors for better look.

Fold the tapes in half and crease in order to establish a centerline down the middle of the tapes.

Determine order of tape placement. For example, if doing a horizontal stab, normally you would want to cover the trailing edge first. Then the leading edge as to allow this tape to overlap the rear tape and finish off the edges in a clean manner. It's a personal choice how to approach this.

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Brush a bead (not too thick) of EkoBond along the perimeter to be taped. The bead should be approximately $\frac{1}{4}$ in. Let dry tacky.

This is a good time to go over any existing pinked overlaps with the small iron and iron down any raised pinks and trim any frays. These will show through the tapes if not corrected now.

Place the creased tape (with the "V" point down, i.e. V where the line below the V is the surface, this will insure the crease disappears later) around the perimeter. Use the crease as a centerline guide. See Figure 17-27.



Figure 17-27 - Placing perimeter tapes on surface.

Tack down one end with the iron (on the $\frac{1}{4}$ " bead). Lift the tape up and pull around surface again to bring taught. Make any necessary adjustments with the tape and then proceed to tack down the entire perimeter along the $\frac{1}{4}$ " glue bead and crease. Press the iron down fairly hard in this region so you can see a dark shiny line on the tape, indicating the glue has permeated through. This step insures the tape will not get out of position while you heat-form in the following steps. See Figure 17-28.



Figure 17-28 - Heat forming and shrinking perimeter tape on radius corner.

Preshrinking and heat-forming tapes. This step may not be necessary on perimeters that are straight. For example, the trailing edge of the horizontal stab or fin. You can

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elect to not pre-shrink here and just glue the tape down. Heat forming and preshrinking tapes is necessary for radius perimeters to insure the entire run is uniform. See Figure 17-29.

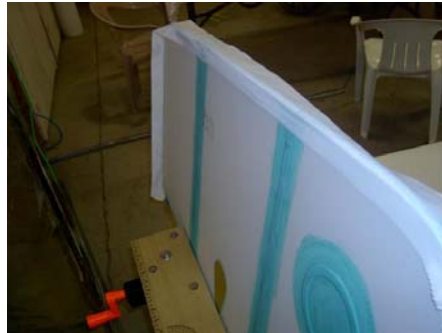


Figure 17-29 - Perimeter tape in place.

Using the small iron at 350°F, heat-form and shrink the radius corners, working slowly from each side as to slowly shrink the wrinkles out from the corners. Have patience and keep working the wrinkles. Using the hot hobby iron, come in from both sides of the corner to equally shrink from both sides and assist with wrinkle removal. After the corner is completely wrinkle free and ironed down, proceed to iron down the remaining edges along the perimeter and shrink down for uniformity with the corners. When done with one side, flip surface and do the same on the opposite side. See Figure 17-29.

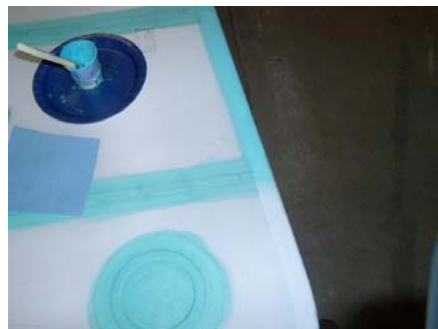


Figure 17-30 - Perimeter tapes being glued down.

When all the perimeter tapes are down, formed, and trimmed, proceed to glue the tapes down. Working 6-12" sections at a time, lift up tape on one side. Brush glue under tape, lay tape back down, brush glue over tape and then WIPE OFF excess with blue shop towel. Repeat for other side of surface. Figure 17-30

PRE FINISH NOTES:

Stuff Needed:

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Small iron at 250°F

EkoClean Heavy Duty Cleaner in spray bottle, diluted as printed on container.

Blue shop towels.

Using the small iron, go over any raised pinks or edges to iron back down. Go around the perimeters with the iron and work out puckers, bubbles, wrinkles, etc.

Round over perimeters with the iron.

CLEAN SURFACE. Using EkoClean heavy duty cleaner in a spray bottle, spray the surface lightly (do not soak!).

Wipe off surface with blue shop towel. See: Figure 17-31.



Figure 17-31 – Completed test surface ready for EkoFill.

EKOFILL PRIMER/SEALER NOTES: UV BLOCKER/FILLER

Stuff Needed:

EkoFill, well stirred and strained. Do not shake - will cause foaming.

3" foam brush.

Cleaned fabric surface to be coated.

320 grit open-coat sand paper.

Spray gun equipment

Clean terry cloths. Note: Don't use tack rags. They leave residue which will show.

Wash hands.

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Dip foam brush TIP into EkoFill, using quick brushing motion; proceed to brush on EkoFill in one direction. Avoid excess EkoFill and move quickly to avoid any drops of EkoFill spilling through to the other side. Watch build up on edges, keep smooth. See: Figure 17-32.



Figure 17-32 – Applying first brush coat of EkoFill Primer/UV Blocker/Filler.

Using the same brush but without adding anymore EkoFill, brush 90° to your first coat to "knock down" the EkoFill and get a smooth surface.

At this point if you have the means, you can repeat on the other side of the surface. It is recommended to do one side at a time of the process for easier handling.

Allow to dry a few hours or as recommended on container.

This is another good time to use the small iron to knock down any raised areas. You have to move quickly with the iron on EkoFill.

Repeat the entire brush process a second time, at 90° to the first, for a total of two brush coats. This completes one brushed "cross-coat".

Allow to dry overnight.

Using 320 grit "open coat" sand paper, lightly sand the EkoFill. Easy, don't sand through the fabric! Go in between rib stitches. All EkoFill should be a light gray after light sanding. DON'T OVERSAND. The surface should be noticeably smoother. Watch for hidden bracing or wires under surface that may cause you to sand through fabric. Lead with your opposite hand while you sand to detect any hidden stuff before it's too late. See Figure 17-33.



Figure 17-33 - Fabric surface after two brush coats of EkoFill and lightly sanded. Vacuum off or air-blow surface and wipe down with shop towel. See: Figure 17-34.



Figure 17-34 - Preparing surface by air blowing and wiping with a terry cloth.

EkoFill spray coats. Setup your spray gun (DeVilbiss Finishline 3 with 1.5 tip recommended) with well stirred and strained EkoFill. No thinning. Run about 20psi of pressure at gun. See: Figure 17-35.



Figure 17-35 - DeVilbiss Finishline 3 spray gun with a 1.3mm tip.

Spray 2 cross coats (4 total coats) of EkoFill (approximately 10 minutes between each coat). See: Figure 17-36.



Figure 17-36 - First spray coat of EkoFill.

Let dry overnight.

Perform light sanding with 320 grit. Don't over sand!

Vacuum and wipe with clean terry cloth.

Last chance to gently iron down any problem areas. Be diligent and only use the tip of the iron here. It is possible to mar the EkoFill if you are not careful. This will show on the finish coat. See: Figure 17-37.



Figure 17-37 - Second spray coat of EkoFill.

Two cross coats are recommended.

Before painting top coat, blow off surface and wipe with clean terry cloth simultaneously.

This completes the primer, UV blocking, and filling steps. If desired during the spray process, you can spray an additional 1 or 2 coats of EkoFill to build up the surface to your liking. 2 spray cross coats should normally be plenty. Think light! See: Figure 17-38 & 17-39.



Figure 17-38 - Light sanding with 320 grit open coat paper.

Careful here!



Figure 17-39 - Drain holes burned in with a soldering iron.

STEWART SYSTEMS Waterborne 2-PART TOPCOAT NOTES: FINISH

Stuff Needed:

STEWART SYSTEMS 2 part topcoat in your favorite color, mixed, stirred, and strained.

HVLP sprayer such as a DeVilbiss Finishline 3, with 1.3mm tip.

13cfm @40psi compressor recommended. Tee together two compressors to bring up your pressure if needed.

Charcoal respirator.

DuPont M50 viscosity cup.

Good spray booth or room, wet down floor.

EkoFilled surface prepared.

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Blow off part and wipe with terry cloth (if not already done).

STEWART SYSTEMS Waterborne Topcoat preparation.

Topcoat is 3 part resin, 1 part catalyst, and about 1 part water.

After measuring, stir in catalyst to resin slowly. After stirring for a while notice the Topcoat becoming creamy.

Start with ½ part water, stir in.

Using DuPont M50 viscosity cup, take viscosity measurements. The target is 19-20 seconds.

Add small increments of the remaining water until correct time achieved. 19 seconds is desirable.

Spray Gun Setup

Open fan control all the way to max.

Adjust pressure at gun (inline regulator) to 20psi.

Open paint knob approx ¾ from closed.

Setup part in spray room.

Before starting - between each coat, allow the paint to dry to a tacky feel. If you just barely touch the surface with your knuckle a tiny bit of paint comes off. This should be around 10-15 minutes.

1st coat - very light tack coat. Spray edges, then surface. Barely any paint here, just enough to fog coat. Watch "tiger striping" - this is a no-no. See: Figure 17-40 & 17-41.



Figure 17-40 - First coat of 2 part topcoat (Insignia White).



Figure 17-41 - First coat complete.

2nd coat - 90° to first, turn up paint control 1/8 turn. Another light fog coat. See: Figure 17-42.



Figure 17-42 - Second coat with 1 cross coat completed.

3rd coat - 90° to second, turn up paint control 1/8 turn. Paint going on thicker here. Keep moving and don't lay it on heavy! No tiger stripes! Point of no return here if you have stripes. See: Figure 17-43.



Figure 17-43 - Third coat completed.

4th coat - 90° to third, turn up paint control 1/4 turn again. Starting to get very close to a finished surface. Almost acceptable to stop after this coat. See: Figure 17-44.



Figure 17-44 - Fourth coat with 2nd cross coat completed.

After the fifth and final coat, the finish will be beautiful!

5th and final coat, 90° to fourth. Remember to keep moving and no heavy coat!

This completes a total of 2 ½ cross coats.

Allow to dry overnight.

Flip parts over (if applicable) and repeat for the other sides.

Allow to dry overnight before applying masking tape and trim coats.

YOU'RE DONE WITH THAT PART!

MOVE TO THE NEXT PART!

CLEANUP NOTES:

Everything cleans up with water!

For the 2 part Topcoat - clean with water but then final cleanup with lacquer thinner.
Spray out gun with lacquer thinner.

FAA APPROVAL AND COMPLIANCE FOR CONTINUED AIRWORTHINESS

This information is offered to assist in returning the aircraft to service.

Compliance or approval under the referenced STC requires strict adherence to the Stewart Systems Procedures Manual including the use of Stewart Systems materials approved for such use under a Parts Manufacturer Approval (PMA). Deviation from approved procedures and/or substitution of other materials violates both Federal Regulations and this Supplemental Type Certificate (STC).

For an aircraft or component listed on the STC Certificate of Eligibility the repair and return to service is handled in the normal manner. A certified mechanic must fill out the FAA Form 337 and make the corresponding entries in the aircraft log book. The entries must state that the repair or covering was performed in accordance with the Stewart Systems Procedures Manual; Revision and Date noted and under the STC referenced herein. The aircraft must be inspected and returned to service by an FAA representative or delegated authority with an Inspection Authorization (IA).

For an aircraft or component not yet listed on the FAA Approved Model List No. STxxxxxSE fill out the Stewart Installation Report on page 3. The mechanic who completed the work should complete this form and sign it.. The form should be sent to Stewart Systems, 5500 Sullivan St, Cashmere WA 98815. Stewart Systems will obtain approval for you aircraft from the FAA and mail a copy of this approval to you. You must keep this approval in your aircraft maintenance records as proof of applicability of this STC to your aircraft.

As an alternative one can request a field approval from local FAA authorities. Granting of this varies from location to location but it is usually possible.

Instructions for continued airworthiness:

1. Inspect the aircraft fabric covering as recommended by the manufacturer and/or AC 43-13-1B.
 2. Inspect the fabric covering annually "per FAR 43 appendix "D".
 3. Clean fabric on a regular basis using a mild soap and water solution rinsing thoroughly thereafter.
 4. Use a good wax to maintain cosmetic appearance as necessary.
 5. Make fabric covering repairs per Stewart Systems Procedures Manual, Section 16: "Repairing Fabric" Procedures.
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Note: Make a copy of this information and attach to airframe log.

Make an entry in the remarks section of FAA form 337. ICA as addressed in the Stewart Systems Procedures Manual with the latest Revision Number Used.

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If an aircraft is not listed on the Stewart Systems FAA Approved Model List, it may be added as follows.

1. The mechanic who did the work should complete this form and sign it.
2. Send the form to Stewart Systems, 5500 Sullivan St. Cashmere WA 98815,
3. Stewart Systems will obtain the approval for your aircraft from the FAA and send you a copy of the approval. You must keep a copy of the approval in your aircraft maintenance records for proof of applicability of this STC for your aircraft

Stewart Systems Installation Report

I certify that fabric covered surfaces on the follow aircraft has been recovered in accordance with STC ST09913SE-A & the Stewart Systems Procedure Manual. No problems were noted during installation.

Aircraft Make: _____

Aircraft Model: _____

Aircraft Type Certificate Number _____

Date of Installation Completion _____

Components Recovered: _____

Signed:

Signature & Date

Printed Name

Address

Phone

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