## CHAPTER 2 REVISION LIST

The following list of revisions will allow you to update the Lancair IV construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shown and "R" to remove the pages.

Page(s) affected	Current Rev.#	Action		Description			
2-1 & 2-2 2-2 thru 2-15 2-15a 2-16 thru end	0 or 1 4 4 0	None R&R Add None	Eith Revi Revi	er Rev. # is cor sed Speed Bral sed Speed Bral	rect kes Sect kes Sect	ion ion	
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## **CHAPTER 2** SUPPLEMENTS

#### REVISIONS

From time to time, revisions to this assembly manual may be deemed necessary. When such revisions are made, you should immediately replace all outdated pages with the revised pages. Discard the out dated pages. Note that on the lower right corner of each page is a "revision date". Initial printings will have the number "0" printed and the printing date. All subsequent revisions will have the revision number followed by the date of that revision. When such revisions are made, a "table of revisions" page will also be issued. This page (or pages) should be inserted in front of the opening page (this page) of each affected chapter. A new "table of revisions" page will accompany any revision made to a chapter.

#### ARROWS

Most drawings will have arrows to show which direction the parts are facing, unless the drawing itself makes that very obvious. "A/C UP" refers to the direction that would be up if the part were installed in a plane sitting in the upright position. In most cases the part shown will be oriented in the same position as the part itself will be placed during that assembly step. However, time goes on and changes are made, so careful attention should be paid to the orientation arrows.

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Manual supplement for

Precise Flight Speed Brakes PF2000

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### 1. SPEED BRAKE INSTALLATION

The Precise Flight Model 125 speed brakes are specially designed for the Lancair IV wing. Precise Flight speed brakes have proven reliable in hundreds of aircraft and will add a new safety dimension to your fast, high altitude flying. High rate of descents, whether voluntary or involuntary, can be made without risking engine damage by shock cooling. The throttle can still be left open, although a partial power reduction is highly recommended for maximum sink rate.

Installation is very straight forward, but please locate the speed brake units where we instruct you to. Mounting the units further inboard would give you more room to work, but the turbulence of the deployed brakes would cause turbulence over the horizontal stabilizer.

Note: In the following assembly steps and figures, the term "Speed Brake" has been abbreviated to "S/B".

**Precise Flight speed brakes** 

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### CONTENTS

- A. MOUNTING S/B TO TOP WING SKIN
- B. CABLE INSTALLATION
- C. BOTTOM WING SKIN SUPPORT



### A. MOUNTING S/B TO TOP WING SKIN

The S/B is mounted to the top wing skin with countersunk screws and nutplates. A flange must be formed in the top wing skin so that the S/B will be flush when screwed in position.

A1. Figure SB:A:1 and SB:2 show the location of the cutout in the top wing skin. Notice that the rear wing spar is notched slightly. This notch is to provide more clearance between the S/B and the long aileron pushrod. Draw the 11.5" x 1.8" rectangular shape on the inside of the top wing skin. Drill four #50 holes through the top wing skin, one through each corner of the rectangle. These holes will help you locate the rectangle from the outer side of the top wing skin. Do not cut into the top rear spar cap more than .25".



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- A2. Carefully cut the rectangular section out of the top wing skin as shown. Use the four small holes you drilled in Step A1 to locate the rectangle from outside the top wing skin. Cutting from outside is much easier than from the inside. Don't cut more than 1/4" into the rear spar.
- A3. From outside the wing, insert the S/B cartridge into the rectangular hole and center it. It will be necessary to grind a small notch in one side to allow the cable to fit. Notice that the S/B connector and cable are on the right side facing forward for both wings and the opening in the Speed Brake Cartridge for Blade Passage is biased toward the forward side (thin forward, thick aft). When the blades are deployed the cupped-machined blade surfaces will be forward. This allows for a slightly greater air spill for the blades and incrementally increases their effective-ness.
- A4. When the S/B is properly centered, mark the outline of the large S/B mounting flange onto the outer surface of the top wing skin. An awl type scribe works well for this step.
- A5. Remove the S/B. Carefully trim back the OUTER laminate and core of the top wing skin to the outline you drew in Step A4. Don't trim back the inner laminate of the wing skin. Also recess the core material around the cutout 1/4" between the inner and outer laminates.



Core removal for S/B Figure SB:A:2

- A6. Mark (with a felt pen) the orientation of the large aluminum S/B flange. (i.e. forward, outer surface, etc.) Remove this flange from the S/B and cover it with thin release tape. Apply a light coat of wax to the S/B housing and let it dry prior to putting on the release tape. This is to keep the adhesive backing of the tape from permanently sticking to the aluminum.
- A7. Use instant glue to temporarily bond straight wood pieces to the outer surface of the aluminum S/B flange. These wood pieces will hold the flange flush with the wing skin. See Figure SB:A:3.
- A8. Use 40 grit to sand the inner surface of the top wing skin in the area around the S/B cutout. Clean this area with MC.
- A9. Place the aluminum S/B flange into position in the top wing skin. The wood pieces should hold the flange flush with the top surface. Use instant glue to hold the wood pieces and flange in position.





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- A10. Fill the area between the aluminum S/B flange and the inner wings skin laminate with a thick epoxy/flox mixture. Be sure to push the flox back into the wing skin where the core has been removed.
- A11. When the flox has cured, carefully use the countersunk mounting holes in the aluminum flange as guides to drill #28 holes through the flox and wing skin.
- A12. Remove the aluminum mounting plate from the wing skin and remove the release tape from the flange.
- A13. Attach MS21069 nutplates to the inside of the top wing skin at each S/B mounting hole. Use either of the methods shown in Figure SB:A:4 to mount the nutplates.



### Securing S/B mounting nutplates Figure SB:A:4

A14. Reattach the aluminum S/B flange to the S/B.

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A15. You should now be able to mount the entire S/B to the top wing skin using MS24693-S30 countersunk screws.

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### B. CONDUIT INSTALLATION

The S/B electrical wiring is routed into the fuselage through a plastic conduit. The same type of black plastic electric conduit that you used for routing electrical wires through the wing will work well for the S/B cable.

B1. Place the S/B unit in position and mark on the BL 76 rib where the aft edge of the S/B is located. The conduit should be centered top to bottom in each of the four ribs.

Note that the Speed Brake electrical wires exit out the right side of the S/B cartridges. This makes it necessary to extend the conduit in the right wing to a point 1" past the outboard edge of the S/B. Run this conduit through the BL 76 on the aft side of the S/B. The left wing conduit should also exit the BL 76 rib slightly aft of the S/B cartridge. Remove the S/B unit from the wing.



- B2. Grind 3/4" dia. holes in the BL 76, 52, 38, and 25.5 ribs as shown in Figure SB:B:1. These holes will properly route the cable conduit to the inboard edge of the wing.
- B3. Insert the plastic conduit into the ribs. The conduit should end 15" inboard of the BL 25.5 rib and may be trimmed later as necessary.
- B4. Use a thick epoxy/flox mixture to pot the conduit into the BL 76, 52, 38, and 25.5 ribs.

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### C. BOTTOM WING SKIN SUPPORT

A fiberglass pocket must be secured to the bottom wing skin to brace the S/B assembly. The pocket is molded around your S/B housing to assure a close tolerance fit.

- C1. Temporarily add .25" of foam to the outboard side of the S/B unit. This will give you some free room, sided to side, in the fiberglass pocket, easing alignment in the future.
- C2. Apply one layer of release tape to the bottom and sides of the S/B housing. The fiberglass pocket will only extend up 1.25" so cover the S/B housing at least 2" up from the bottom. Duct tape is a good release material for this step.

Fiberglass pocket Figure SB:C:1



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- C3. Build up a 3 BID fiberglass pocket around the bottom of the S/B housing. One piece laminates would be too difficult so just overlap pieces in the corners by 1". Extend the 3 BID up the S/B housing 1 1/2".
- C4. When the 3 BID has cured, remove it from the S/B housing. Trim the pocket to 1 1/4" in height.
- C5. Remove the release tape and the 1/4" foam piece.
- C6. Install the S/B into the top wing skin. Locate the four bottom corners of the S/B housing on the inside of the bottom wing skin. Mark the outline of the housing on this surface.
- C7. Remove the inner laminate and core of the bottom wing skin only in the rectangular area of the S/B housing. DO NOT cut into the outer skin. Also remove 1/4" of core from around the perimeter of the cutout area.
- C8. Use 40 grit to sand and clean the areas 2" around the recesses area of the bottom wing skin.
- C9. Apply a 3 BID reinforcement to the coreless area extending 1 1/4" forward and outboard of the recessed area in the bottom wing skin. (Applying BID to the inboard and aft sides would interfere with the aft spar cap and BL 76 capstrip.)

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- C12. When satisfied with the fit of the fiberglass pocket, remove the bottom wing skin and prepare both it and the fiberglass pocket for bonding. Sand and clean all bonding areas.
- C13. Fill the recessed area of the bottom wing skin with an epoxy/flox mixture. With the fiberglass pocket in position on the S/B housing. Lower the bottom wing skin into position so the flox will bond to the fiberglass pocket. Be sure the bottom wing skin is resting on the aft spar cap, BL 76 capstrip, and wing center spar cap. A limited inspection can be made through the aileron bellcrank inspection hole.

Note: In warmer climates, the flox buildup under the pocket could exotherm while curing. Use a fan to reduce this possibility or keep your shop cool while bonding



#### Bonding pocket to bottom wing skin Figure SB:C:3

- C14. After the flox has cured, remove the S/B from the top wing and remove the bottom wing skin.
- C15. Apply a 3 BID reinforcement covering the forward face of the fiberglass pocket and overlapping onto the 3 BID previously applied. Be sure to sand and clean all areas where the BID is applied.



C16. Drill a 1/8" dia. drain hole in the inboard, aft corner of the fiberglass pocket and though the bottom wing skin. Also drill a 1/8" drain hole in the forward, inboard corner of the rib bay, where the BL 76 rib meets the fuel bay web. See Figure SB:C:4.

This completes the Precise Flight Speed brake installation in the wings of your Lancair IV. This is all that can be done on the speed brake until after the wing is finally closed.

For final installation, the electrical cable must be pulled through the conduit and routed appropriately through the cockpit. Attach the cable connector at the S/B and lower the unit into the wing. Install the MS24693-S30 countersunk screws.



# 2. OPTIONAL ELECTRIC DOOR SEAL PUMP

The optional door seal pump for the standard Lancair IV and Lancair ES is the same as used on the Lancair IVP. The seal is automatically inflated and kept at 20 psi. The electric door seal pump comes in 12 or 24 volts version. Read the pump label to determine if you have the proper voltage.



- A1. Use the 317-02 nutplate to mount the pump to the 317-04 plate. The 317-04 plate is countersunk to accommodate the MS24694 screws. See Figure 1.
- A2. The 317-04 pump mounting plate is secured to the left side of the fuselage behind the shear panel supports. A phenolic block with studs is bonded to the side of the fuselage as a mounting base for the 317-04 plate. Grind flats on the heads of three MS24694-S54 screws, then pot them into the phenolic base with Hysol. At the same time, use Hysol to bond the phenolic base to the fuselage side.

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- A3. When the studded phenolic base has cured, secure the 317-04 plate to the base with AN365-1032A locknuts. Notice that the forward, upper stud is also used to secure the pressure switch with a MS21919-DG16 clamp.
- A4. Mount the MJTV-3 control valve switch to the instrument panel in a location of your choice.



Door Seal Hookup Fig. 2:2:A:2

5. Use 3814-6 flexible plastic hose to connect the electric inflation system as shown in the figure above. Note there is a check valve installed between the pump and the pressure switch to prevent air from leaking back through the pump when it is not running. When the pump is turned off, the pressure in the door seal will vent out through the panel mounted on/off switch.



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## 3. WINGLETS

### 1. INTRODUCTION

The winglets for the Lancair IV are optional. The optional kit, part # 1048/1049, includes the winglet skins, carbon graphite cloth, NACA scoops, and all the necessary hardware.

The winglets can either be installed with the wings still in the cradles or with the wings mounted on the aircraft. Since the winglets are a "retrofit" option and since you may not still have the wing cradles, this supplement is written assuming you are installing the winglets with the wings installed on the aircraft. You can also install the winglets with your wings still in the cradles, although this will take some creative thinking on your part.

The alignment of the aircraft is critical for installing the winglets! Before beginning, position the aircraft in such a manner that it is possible to leave it exactly where it is for several days. Chalk the wheels and support the wings with saw horses and foam blocks or whatever is necessary to stabilize the aircraft.

### 2. CONSTRUCTION PROCEDURE

### A. WINGTIP FLANGE REINFORCEMENT

A1. Remove the old wing tips. Remove the nutplates from the wing tip joggle. Suggestion: Use a sharp chisel between the nutplates and the wing tip. We have found this to be easier than drilling out all the rivets.

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- A2. Install the 10 BID carbon graphite reinforcement as shown in Figure A1. First, using 40 grit sandpaper, sand the bonding surfaces in preparation for the 10 BID. Clean the bonding surfaces with MC. The graphite should run all the way to the edge of the joggle and 1" onto the rib.
- A3. After the 10 BID has cured sand the 10 BID flush with the old wing tip flange.
- A4. Wipe the outside, or exterior, of the winglets with a degreaser like Dupont © Prepsol, PPD© DX330, MC or acetone and then followed up with a dry rag. While the parts are still wet, wipe with a dry cloth to remove the wax.

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There is an E-glass "window" for mounting the NAV antenna in the winglets. The recommended antenna is the SA-004, one for the left winglet and one for the right winglet. These antennas were specially built for the Lancair IV and are available through Lancair.



Positioning the antenna:

B1.

- 1. Refer to Figure B1 to position the antenna spanwise (1" from edge).
- 2. Position the antenna for/aft such that the antenna fits in the coreless area of the wingtip.
- 3. None of the antenna should extend onto the carbon portion of the winglet.

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- B2. Secure the antenna as shown in Figure B2. Secure the outboard members with 1 BID and the inboard member using 3 AN3-5A rivets. Some of the screws securing the winglets will pass through the antenna, sandwiching the antenna between the winglet and the wing tip joggle. The reason for this is that the wing's carbon bottom is being used as a ground plane.
- B3. With an ohmmeter, you can test the continuity between the nav antenna and the bottom wing skin. There must be contact for the antenna to work properly. The bottom wing skin is used as the ground plane.
- B4. Follow the manufacturers instructions for wiring the nav antenna. This is a process of stringing the RG-58 coaxial cable through the electrical tube you have previously installed, then wiring the connectors on the inboard and outboard ends of the wing.

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### C. FUEL VENT LINE COMPLETION

The fuel vent line runs from the fuel tank out to the wing tip. From there it connects to the aluminum vent line that runs up to the NACA scoop in the winglet.



## Positioning the NACA Scoops

Fig. 2:3:C:2



- C2. Install the NACA scoops. It is easier to install the NACA scoops before you start mounting the winglets. The NACA scoop should be approximately centered in the coreless area on the outboard end of the lower winglet skin. The NACA scoop should be "pointing" straightforward. Use the upper/outboard edge of the winglet as reference to level the NACA scoop.
- C3. Using 40 grit sandpaper, sand all bonding surfaces of the winglet and the NACA scoop. Clean the winglet bonding area with MC. Wipe off the NACA scoop with acetone (MC will melt the NACA scoop).
- C4. Bond the NACA scoop into position with epoxy/flox.

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# Trimming around the NACA Scoop Inlet

Fig. 2:3:C:3



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- C6. Cut a 40" piece of 1/4" dia. aluminum tube (Part # 5052-.250x035) and flare one end. Bend the tube as shown in Fig. C5. The exact routing is not critical as long as you stay clear of the antenna. It must also be in a convenient location to connect the plastic hose to the vent line in the wing.
- C7. Drill a 1/4" hole through the aft face of the small NACA scoop. Sand the area around the 1/4" dia. hole. Rough up the surface of the aluminum tube where it will be bonded to the NACA scoop. Clean all the areas with MC.
- C8. Use Hysol (with a little flox added) to pot the non-flared end of the 30" long tube into the aft face of the NACA scoop. Install the vent line approx. 0.1" above the carbon fiber winglet skin to avoid contact problems between the carbon fiber and the aluminum. Install with Hysol and secure with 1 BID as shown in Figure C5.
- C9. The final link will be installed when the winglet is completed. It consists of a B44-3 plastic tube that secures with a hose clamp in each end.

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### Routing Aluminum Tube Fig. 2:3:C:5



### D. INSTALLING WINGLET INTERNAL STRUCTURE

- D1. Establish a centerline on the floor underneath the aircraft from the tail to the nose. Also run a line at 90° from the centerline out to the winglets. This will serve as the reference line for aligning the winglets.
- D2. Make a cradle to support the end of the wing. Plywood bondoed to the floor works good. Keep this in position until the winglet is completely built. Steady the aircraft with jacks.





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D3. Align the lower winglet skin.

The alignment criteria are:

- 1. The L.E. of the winglets must align with the L.E. of the wing.
- 2. The lower skin of the winglet must align to the lower skin of the wing.

Clamp the lower winglet skin into place.

Note: The thickness of the winglet in the area where it fits into the joggle of the wingtip is thicker than what the joggle allows for. This is faired in with epoxy/micro later.

D4. Make another wooden jig for the winglet tip (see Figure D1). Hot stuff or Bondo into place. The purpose of this is to stabilize the tip of the winglet. This jig is also sets the incidence of the winglet. (The incidence must be set prior to installing the ribs and the spar).

To set the winglet incidence:

- 1. Drop a plumb bob straight down from the L.E. of the winglet at the approximate location shown in Figure D1.
- 2. Drop a plumb bob straight down from the T.E. of the winglet at the approximated location shown.
- 3. Set the incidence such that the L.E. is 3/16" closer to the fuselage centerline than the T.E. of the winglet. This sets the incidence.

Periodically check the incidence through the construction.







- D5. Following the bolt pattern of Figure D3, install (12) MS24694-S51 screws, (12) K1000-3 nutplates, (12) NAS390B10P tinnerman washers, and (24) AN426A3-5 rivets in the lower winglet skin. The screws should be centered on the flange and evenly spaced apart. Scuff up the tinnerman washers and Hysol in place.
- D6. Drill holes along joggle of winglet and wing, nutplate, and screw into position. You'll need to remove the winglet from the fixture for this step. After you have installed the nutplates, reinstall the winglets with the screws support the winglets at the tip.





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D11. Fit the upper winglet skin. When you fitted the lower wing skin you had cradles to accurately determine the size of the ribs. Use the wing skins to align the winglet. The winglet should match the wings at the BL 171 location. Using straight edges, adjust the height of the winglet by trimming the ribs and spar of the winglets. Winglet Capstrips Fig. 2:3:D:6:a Remove overflow micro **Slayer** 3/16" core duct tape removal, fill with micro (2)(1)leave one layer duct tape 1/4" fillet 2 BID 2 BID 4 3) Chapter 2 REV. 0/02-01-98 2-36Supplements

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D12. Fitting the upper winglet skin is done in a similar manner to the way the wing skins are fitted. If you have not done this before, refer to Lancair IV manual Chapter 6, section D.

In summary:

- 1. Apply 3 layers of duct tape on the bonding surface of the lower winglet skin.
- 2. Fit the ribs and spar by performing trimming and performing a micro release.
- 3. Remove two of the three layers of duct tape.

4. Lay the capstrips on the duct tape of the upper winglet skin and apply peel ply on top of the BID. Let cure then remove the peel ply.

- 5. Using 40 grit, sand the capstrips.
- 6. Install the capstrips using a wet epoxy/micro mixture on the ribs
- D13. Form an epoxy/micro radius between the capstrips and the rib. Reinforce with 2 BID as shown in Figure D6a.

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## E. CLOSING THE WINGLETS

The winglets are closed in a similar manner to the wings. It is especially important that the winglets are properly aligned and supported during the closing. This is your last chance to adjust the incidence! Do a practice run before closing the winglet. Epoxy mixed with flox or Hysol mixed with flox may be used for closing the winglets.



- E1. Sand all the capstrips, the joggles, and the bonding surfaces of the inside of the upper winglet skin. Clean with MC. (Did you drill your vent holes?)
- E2. Apply a pure coat of epoxy or Hysol to all bonding surfaces. Mix flox into the Hysol or the epoxy (1 tbsp. per 2 oz.) Build this mix up as shown in Fig. E1.
- E3. Lower the upper winglet skin into place. Clamp and weight down as required. Check the winglet incidence.

**Closing the Winglets** 



- E4. After the winglet has cured, install (8) MS24594-S51 screws and (8) K1000-3 and (16) AN426A3-5 rivets.
- E5. Fill as required to form a smooth transition from the wingskins to the winglets.

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# F. WINGLET LIGHTING

The Lancair IV winglet is molded to accept a Whelen A650-PG/PR position/strobe light (red light on left tip, green on right). Fiberglass tip light mounts are provided for easy mounting of the position/strobe light assemblies and lenses. A tail strobe light (Whelen A500) is mounted on the rudder to conform to FAA regulations. The power supply (Whelen A413A) for all lighting is located in the fuselage.



Locate the position light/strobe assembly on the winglet light mount as shown in F1. Figure F2. There are scribe marks on the vertical face of the light mount. Use the scribe marks as a guide to grind out the fiberglass so the position light/strobe assembly can rest flat on the light mount. Some additional trimming may be necessary, but keep the grinding to a minimum. Locating Position Light/Strobe Assembly Fig. 2:3:F:2 Prelocated scribe line REV. 0/02-01-98 Chapter 2 2-41 T.I. Supplements

- F2. Use the position light's mounting holes as guides to drill #29 holes through the winglet light mount.
- F3. Use AN426A3-5 rivets to secure an MS21069 nutplate to the inboard face of the wingtip light mount at each mounting bolt hole.
- F4. Secure the position light assembly to the winglet light mount with MS24694-S26 countersunk screws.

Securing Light Assembly to Winglet Light Mount



F5. Trim the winglet light mount so it will fit in the wingtip joggle. The surface of the light mount should be about 0.090" below the surface of the winglet around the perimeter of the joggle. This will allow the clear lens to fit flush with the wingtip.

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# Fitting Winglet Light Mount to Winglet

Fig. 2:3:F:4



- F6. When you are satisfied with the fit of the winglet light mount, use a few drops of instant glue to temporarily secure the mount to the wingtip joggle.
- F7. Trim the clear lens to fit into the winglet joggle, flush with the surface of the wingtip.



F8. When satisfied with the fit of the lens, temporarily secure the lens to the wingtip with masking tape. Don't use instant glue to secure the lens as the glue will fog up the clear plastic.

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F9. Drill six #29 holes through the lens, light mount and winglet joggle. The locations for these holes are given in Figure 10:B:6. Be extremely careful when drilling through the clear plastic lens. There are drills made especially for plexiglass available (Aircraft Spruce has them) that make the drilling process safer. If you must use normal drills it is a good idea to apply masking tape to the lens first, then lightly centerpunch (no, not with a big hammer) where you are about to drill. Drill a very small, #50 hole first, then drill progressively larger ones until you reach #29. If you don't drill very slowly, the plastic could shatter.





- F10. When you've finished drilling, remove the lens and winglet light mount from the winglet. Use AN426A3-5 rivets to secure MS21069 nutplates to the joggle at each mounting hole location.
- F11. Carefully countersink the clear plastic lens for MS24694-S26 screws.
- F12. That was easy, wasn't it? Now assemble the position light assembly, light mount, and clear lens onto the winglet. If the lens still doesn't rest flush with the winglet surface, you can insert a thin cork washer between the lens and the light mount to bring the lens surface up flush with the winglet surface.



# 4. DOOR LATCH, L-IV

(In Chapter 28, follow pages 28-1 through 28-15 then follow this supplement.)

## A. DOOR STIFFENER

In this section you will cut out the 2 latch access panels. You will then make flanges and install the nutplates. The door stiffener will then be bonded to the door skin.



Use a rotary type cutter.

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	Access Panel Nutplate Locations Fig. 2:4:A:2	~
	The 3 BID flange is 1/2" at nut- plate locations and 1/4" clsewhere	
	The lower aft left access panel requires a third out- plate in this corner so make sure to leave enough flange. This outplate is installed later.	
A2.	<ul> <li><u>Make 3 BID flanges for the access panels in the door stiffener.</u> (See blueprint#B-316.)</li> <li>a.) Cover the panels with release tape.</li> <li>b.) Tape the panels back into position in the door stiffener.</li> <li>c.) Lay a 3 BID flange onto the inside of the stiffener extending about 1/2" (15mm) onto the piece that was cut out. This forms the joggled flange to hold the access panels.</li> <li>d.) After cure, remove the panels, trim the 3 BID flange down to about 1/4" (6mm) except where nut plates are to be installed. At the nutplate locations leave 1/2" (15mm).</li> </ul>	
(Co	ontinue with nutplate installation in Chapter 28-18 and follow to page 28-32.)	
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## B. DOOR LATCHES

The latches will surely be a lot of fun, they always are with any door! The latch system developed by Lancair was designed, by the motion of the latch itself, to reach out and pull down thus helping to achieve a better fit.



B1. <u>Assemble the latches.</u> These assemblies swing the hook through a 90° plane, draw down and achieve an "over-center" self locking condition. They should be smooth operating with very little drag when properly assembled. Look for any burrs etc. in the laser cut pieces. Hand file and smooth as necessary. The latches are very similar. The differences will be explained in the assembly instructions.

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#### Attaching the Clevis to the Links

Figure 28:B:2



a.) Press the small pins into the ends of the clevis, they must be centered on the clevis tab end. The vise is handy for this purpose. Insert a link on each side as shown.





clip on each side.

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c.) Both latches use AN5-33A bolts for the drive pins.

Assemble the latches as follows:

1. If necessary, insert AN960-516L washers on each side in between the latch housing and the hook on each side.

2. Insert a bolt from the side shown. You will need a 1/32" (1mm) gap between the bolt head and the latch house.

3. Using the hole in the clevis as a guide, drill a #41 size hole through the center of the drive pin (CD315-11). Insert the RP-01 spiral pin.



**Drive Pin Installation (Aft Latch)** 

Figure 28:B:5

4. Make sure both of the latches operate smoothly and lock in place.

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## C. MOUNTING PADS



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Latch Pad Fixtures Figure 28:C:2





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- C4. Prep all the surfaces that will receive the mounting pads.
- C5. Cover the fixture bottoms with plastic release tape.
- C6. <u>Make the latch mounting pads</u>. You will need to plan this step as it requires the door to be shut. We suggest the following procedure using a helper:

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1. Bolt the door shut using the existing holes along the perimeter of the door skin. It is important that the door is properly closed as the mounting pads will dictate the final fit of your door.

2. Have your helper mix up a bunch of resin to hand to you inside the fuselage. Apply a thin coat to the latch mounting pad areas.

3. Mix flox in with the remaining resin. Apply a generous mound at each of the 2 mounting pad locations. You should have a good idea of how much flox you will need from the gap under the fixture bases. You will at some pads require up to a 1/4" (6mm) thick pad.

4. Set the fixtures in place and have your helper install the screws from the outside. Make sure the fixture is installed with the 0.14" (4mm) shim on the door side. Wipe up all the excess squeezed out flox that can be reached. This saves having to grind it later.

NOTE: It is important to keep the micro/flox pad relatively thin inside the door. If the pad were allowed to get too thick, then the latch body might not fit inside the stiffener. To see this, simply place the latch inside the stiffener in the approximate position, trial fit the inspection cover over it, and observe how much room you have available. Use this as a reference when setting the fixture with micro/flox. If pressed firmly in place during cure, the pad height should be OK.

After the pad cures, remove the fixture and clean up the pad areas. You will not C7. need these fixtures again so don't worry about wrecking them. There will be plenty of squeezed out flox so it's worth a little time cleaning this up with a rotary tool.

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D3. <u>Install the latches</u>. The door must be bolted in place when installing the latches and the actuator arm(316-51) should be installed **but not drilled**. (The door hinges should already be bolted on). In summary the alignment criteria are:

1. The latches should be centered on the latch pads.

2. The latches should be as close as possible to the lower side of the stiffener.

3. The latches must be in parallel alignment with each other, the fixture has already assured that the pads are in plane with one another. The tubular connecting shaft will assure this parallel latch alignment.

When satisfied with the alignment, superglue the latches in place.

## Latch/anchor Installation X-section Figure 28:D:3



D4. <u>Position the anchors.</u> It is important that the anchors are positioned correctly on the adjustor plate as previously described. When satisfied with the alignment, superglue the anchors in place.

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NOTE: The receiver is slightly wider than the hook. It is generally best to orient the hook so it is slightly aft of center in the receiver. This is because, the gas strut on the door will tend to drive the door forward and this hook / receiver orientation will then best accommodate any variations due to the gas strut's influence.

- D5. <u>Drill the 3/16" dia. holes for the door latches.</u> Countersink the holes. Find the correct screws for the latches. It would be wise to get some castle nuts or equivalent for easy removal (you'll need to remove the latches a few times). You have been supplied with a variety of MS24694 bolts. Note: Screw lengths vary depending on the thickness of your flox pad. If you need a different length screw(s), please contact one of our service representatives.
- D6. <u>Drill the 3/16" dia. holes for the lower two anchors.</u> Make sure that the anchor is still positioned correctly on the adjustor plate. Notch the screw head. This will keep the head from turning, should you ever have to undo the lock nuts securing the anchors. Countersink & flox them in.
- D7. <u>Remove the bolts securing the door.</u> The latches should now hold the door tightly shut. You can make minor adjustments (if necessary) with the adjustor bolt.
- D8. <u>Install the actuator arm on the tube shaft.</u> Do not drill for the roll pin. See step E7-4 for adjustment.
- D9. <u>Drill and pin the tube shaft</u>. Use a 1/8" drill and install the spiral roll pins (RP-02). Make sure that both latches are in the same position.

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A few words on door movement/pin alignment: The Centering Pin will engage in a sliding motion, sweeping into the Guide Block slot as the door is closing. Thus the pin will sweep from outboard side of the block and move inboard. And typically, the pin will engage along the outbd, <u>aft</u> edge of the slot so as the door closes, it will be shifted forward slightly into its proper closed position due to the pin. This slight rearward door shift is typically due to the forces exerted onto the door by the gas strut.

To install the Centering Pin:

a.) Close the door and note the distance between your nylon block and the door stiffener. Place 5/16" washers over the pin to equal this distance (minus the thickness of the pin bonding flange).

b.) Place the pin (with the 5/16" temporary spacing washers) into the Guide Block, locating the pin toward the inboard end of the block's slot.

c.) Place a dab of bondo or equiv. on the top of the bonding flange of the pin and then close the door. Allow the bondo to set up against the door stiffener, then try opening the door being careful to not break the bondo and pin off the door stiffener. This will verify that you've located the pin in an acceptable manner. If you can not open the door without breaking the pin off, then it was not properly orientated in the nylon slot. This is all pretty simple, but adjust as necessary and when finished, note the pin position (with the door closed) which works correctly.

d.) Clean off the bondo and set the pin back in the noted position in the Guide Block. It is a good idea to cover the block and local area with some release tape just in case some epoxy/flox were to drop off the pin's bonding flange.

e.) Apply a mound of Hysol to the top of the pin's bonding flange and simply close the door onto it.

Secure the door in the closed position until the Hysol cures. Then open the door and clean up the area as desired.

f.) We recommend applying a small 1 BID tape over the pin to assure that it remains in place (and this can help dress up the installation as well).

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The door handle is mounted in the aft section of the door. The latches are activated by a push/pull rod. When the door handle is in the shut position, the over center spring helps lock the mechanism in place.

Bond the phenolic block with flox and 2 BID, and secure the spring tab #CD316-06 by bonding an AN3-7A screw into the phenolic block.





# Installing the Collet

Figure 28:E:3



The door handle should be parallel to the lower edge of the window. CN(FT to the lower edge of the door).

E2. <u>Install the collet</u>. To position the collet, see blueprint #B-316.

1. Drill a 1 1/2" hole at this location. A circle saw works well.

2. The notch in the collet (the notch that the exterior door handle drops into) must be positioned such that the handle is pointed aft and parallel to the lower edge of the window.

NOTE: DO NOT USE THE DOOR SKIN BOTTOM AS A LEVEL REFERENCE SINCE THAT DOES NOT FORM A HORIZONTAL LINE.

Thoroughly sand the bonding area on the collet. The anodize should be completely removed for a good bonding surface. When satisfied with the alignment, pot the collet in place with Hysol<sup>TM</sup> or epoxy/flox.

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## Spring Tab Mounting Block

Figure 28:E:4



E3. Using the dimensions given, make the spring tab mounting block out of a 1/2" thick orkot block (316-06). Drill a 3/16" diameter hole for the AN3-7A bolt. Roughen the bolt with sandpaper or the equivalent. Slide the bolt through the spring tab and bond in place with Hysol<sup>TM</sup>.



E4. <u>Attach the handle (external) to the spindle.</u> First install the spring and then use the roll pin to lock them together. Refer to the exploded view, Figure 28:E:2.

Install the screw into the spindle until it bottoms out. Cut off the exposed threads and remove the screw. Grind some more off so that the screw will bottom out on its shank when installed.

- E5. <u>Install the two O-rings on the spindle</u>. Put a light lubrication film over the pieces before assembly (bearing grease works well).
- E6. <u>Slide the spindle into the collet mounted in the door</u>. Insert the screw through the door handle drum, collet, and spindle. You may as well wait with installing the door knobs as it will give you a little more room to install the push/pull rod with them off. This is also a good time to test fit the overcenter hoop and spring. Use caution as the spring is a very snug fit. See blueprint#B-316.
- E7. <u>Assemble the push/pull rod (316-50) and install as shown on blueprint #B-316.</u> Extra threads have been provided so that it can be shortened. Cut or grind a slot in the stiffener for the push/pull rod to get past. Other helpful hints:

1. Install the clevis pin for the over center hoop and tape in place. This is difficult to install after the push/pull rod is in place.

2. Latch "open" stop is achieved by clevis #6D-330-12 and actuator arm #316-51 hitting the inner surface of the door stiffener. Make sure that the end of the clevis is round to prevent damage to the stiffener and allow maximum travel of the latch.

3. Use sufficient washers to shim the rod end (HFC-3) away from the door handle tab to prevent it from rubbing in the closed position.

4. Adjustment - Wait until the door is installed to drill the hole through the torque tube, for the spiral roll pin (RP-02) in the actuator arm. With the door installed, open the bottom latches until the door can just barely be opened. Allow +/-1/4" clearance between the latch and door frame. Move the actuator arm to it's open stop position (see hint#2). Drill the hole and install the spiral roll pin in the actuator arm. Readjust the push/pull rod until the interior handle is in the correct position when the door is closed. See Figure 28:E:1. The exterior handle should be in a neutral position with no force on the handle drum screw (91251A155). It should rest freely and not be bound to the collet.



# F. DOOR LOCK

To keep all the crooks out of your Lancair we supply a lock that locks the door handle in place. To install the door lock we recommend that you remove the door from the aircraft (it is easier to install the door handle cover with the door off too).





- F1. Using the dimensions in blueprint #B-316, mark the door lock location. Most likely your hole will be at the edge of the door stiffener flange. Drill a 1/4" diameter pilot hole at this location.
- F2. Drill a 7/8" diameter hole from the outside as shown in Figure 28:F:3. It is ideal if you can make it 3/8" deep, but you **must not** drill all the way through the door! Every door will vary in thickness at this location so check you door. You can simply check the depth of your 1/4" hole that you drilled. You should leave at least 3/16" of material beyond the 7/8" diameter hole. It is OK if the face of your lock sticks out a little.
- F3. <u>Drill through the remainder of the hole</u> using a 5/8" diameter drill.
- F4. <u>Enlarge the hole so the rest of the lock will fit.</u> First place the aft door handle in the locked position. It is somewhat difficult to determine exactly on which sides to enlarge the hole. Ideally the lock will drop into its hole with a snug fit on all sides to prevent it from rotating. Here is our suggested method:
  - 1. Turn the lock over so you are looking at the front of it. With the key, turn the lock all the way clockwise. This is the locked position.
  - 2. Put the lock tab on the assembly.
  - 3. Point the lock tab directly at the tab on the door handle drum. Grind the hole so the door lock will fit snugly in this orientation. Should you remove too much material you can fill with epoxy/flox.

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F5. <u>Shape and bend the door lock tab.</u> Slide the door lock through and tighten down the lock with the ring nut. Bend and shape the lock tab so that it hits the tab on the door handle drum as shown. Operate the door lock. It is possible you'll need to make a notch in the door stiffener for the lock tab to fit through in the open position.

#### G. HANDLE COVER

In this section you'll cover up the work you've spent so much time on with the handle cover. The handle cover can be removed with the handles in the open position.



- G1. <u>Fit the handle cover.</u> You may find it easiest to remove the door handle for this step. The cover fits into the flange on the door stiffener and covers the latch mechanism.
- G2. <u>Drill a 1 1/4" diameter hole for the door handle drum.</u> This will allow room for upholstery. Make sure you are able to install and remove the handle cover with door handle in place.
- G4. <u>Install the four nut plates and J-nuts.</u> (See blueprint B-316.)
- G5. <u>Install the door knob.</u> Chances are that you will take it on and off many more times but at least you'll know where it is.

(Continue in Chapter 28, with page 28-67.)

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## 5. FUEL DRAIN

Fuel Drain Installation (Optional)

Fig. 2:5:A:1





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- A4. Use a small amount of bondo to hold particle board in position for supporting skin.
- A5. Attach the fuel drain, #502-01, with Hysol. Use a deep well socket with electrical tape wrapped around it to hold the fuel drain in position. Weight the drain with an aileron lead weight.

Attaching the Fuel Drain



Drilling for the Safety Wire Attachment

Fig. 2:5:A:6





- A7. Complete the installation of the fuel drain with 3 BID over micro.
- A8. Cap the fuel drain with the dome (502-02). Scuff the inside of the dome and attach with Hysol. Use teflon pipe dope when assembling. Make sure the venthole is open on top of dome.





## 6. SA-008 ANTENNA

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# 7. INTERIOR CABIN HEAT- NON PRESSURIZED

CABIN HEAT VALVE (Standard IV with a TSIO-550)



A1. Normally, the heat value arm is installed so that when the push/pull cable is pulled, heat flows into the cabin. When the cable is pushed, the heat stops.

A2. Hot air is supplied from sonic port nozzles which may be located in several places such as, in front of the intercooler, the aft end of the intercooler, and the aft intercooler tube.

A3. Hook the hot air up to the tube nearest to the mounting flange for the most efficient air flow.

A4. The valve arm and shaft may be mounted on either side of the heat valve depending upon where the push/pull cable comes through the firewall (refer to note #1).

WARNING: There must be an exit hole out of the cabin and into the gear box for pressure relief!

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# 8. INTERIOR CABIN HEAT- PRESSURIZED

Overview Fig. 2:8:1



NOTE: If your mixer box outlet is 1-3/8" dia, use the part #9-22056 adapter to secure the SCAT tubing.

The main components of the interior cabin heat option for the Lancair IVP:

1) The Cabin Air Diverter Valve. The diverter valve mounts on the firewall support brace. The diverter valve takes the air from the mixer box and distributes it as selected. The two positions are "defrost", "cabin", or anywhere in between. Go ahead, play with it!



2) The Cabin Heat Valves. Two of the cabin valves are supplied with each interior cabin heat supplement. One valve is installed at each aft seat. The location is not critical, we recommend that the valves be mounted relatively low. The (cold) air tends to get trapped in the low spots of the cabin. Also mount the valves in a location where they may be reached easily. Keep in mind the location of the front seats when installing the valves. The heat valves are installed on the interior panels.

SCAT tubing, "T", clamps, and all the hardware needed to install the system is included with the kit.



A1. Install the diverter valve. Location: not critical. We suggest anywhere you haver room on the right side of the firewall. In deciding on the location keep the following points in mind:

- The location of the control cable on the instrument panel. The length of the supplied cable os 2' (This extra length allows you to offset the selector valve and the knob on the instrument panel).

- The routing of the rest of the hoses

A2. Form hard points at the bolt locations of the firewall brace using an epoxy/flox mix. We suggest removing the upper laminate and core material. Fill the two holes with an epoxy/flox mixture. Drill the 3/16" diameter hole for the attachment on the left side of the selector valve. Refer to the above figure. Secure the selector valve with the hardware shown.

A3. Cut one piece of SCAT 6 tubing for the mixer box to the selector valve and one piece for the selector valve to the defrost. Secure with MS21919DG24 clamps.





#### Installing the Cabin Heat Valves

Fig. 2:8:A:4



A6. Cut the SCAT 5 hoses to length and install using the 5614K15 clamps. Route the SCAT tubing over the front seats. It is acceptable to cut holes through the reinforcements directly underneath the armrests.



A7. Modify the AN742-D4 clamp as shown in Fig. 5. This is required in order for the clamp to properly secure the cable.

A8. Drill a 7?16" dia. hole in the instrument for the cable at the desired location. Run the cable through and tighten the nut in place. It is suggested to label the knob for the two settings: "DEFROST" and "CABIN HEAT".

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## 9. SUN VISOR

The sun visor attachment fixtures are mounted over the windshield 1/2" from the edge of the glass and 27" from each other. After positioning, cover the base with 2 BID to attach.



## **10. GASCOLATOR**

The Lancair gascolator performs two functions: It separates fuel and water, secondly it filters particles to 40 micron size. The drain is designed to allow you to use a simple tube to drain and inspect the fuel during your preflight inspection. The Lancair gascolator also comes with a shroud to keep the gascolator cool. A cool gascolator reduces the chances of vapor lock due heat emitted from the engine.



- A1. Using AN426A3-5 rivets, install the K1000-3 nutplates on the gascolator shroud mounting plate.
- A2. Install the gascolator referring to print A-504 and the firewall layout print specific to your aircraft model (ES, IV, or IVP). Note that the gascolator is shipped preassembled, the exploded view of the gascolator is only for your reference. The gascolator is typically secured using AN3H11A Bolts, AN960-10 washers, AN970-3 area washers, and AN365-1032A locknuts. Be sure to install some form of a hardpoint on the firewall to prevent the core from crushing (either an epoxy/flox hardpoint or an area of "glass to glass"). Double check that the gascolator is safety wired as shown on blueprint A-504. Install the gascolator shroud. The gascolator shroud secures to the shroud mounting plate with AN3-3A bolts and AN960-10 washers.
- Install the appropriate fittings in the gascolator. Use the C5205X6X8 fittings for A3. an IO360ES installation and the C5205X8X8 fittings for the IO550 and the TSIO550 engines. You may wish to use a 45° fitting on the aft side of the gascolator for clearance purposes.
- The inlet flange for the gas colator shroud installs on the aft right side of the engine A4. baffling. The exact location for mounting the inlet flange is not critical as long as it does not interfere with other engine functions. The shroud should be at least 6" above the cylinder to avoid heat developed by the cylinders. Install the inlet flange using the BSPQ-44 pop rivets.
- Install the 1" Dia. SCAT tubing from the inlet flange to the gascolator shroud with 5. 5416K14 clamps in each end.



## **11. LANDING LIGHT**



Overview Fig. 2:11:1

#### A. DESCRIPTION

This supplement will describe the installation of the Lancair Landing Light Kit, part number 300-0025 for the 12V or 300-0026 for the 24V.

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#### B. EQUIPMENT REQUIRED

B1. Tools

-Solder and soldering iron or lug crimping tool and lugs to fit the

headlight.

-Normal fiberglass layup tools -Drill and drill bit -Dremel tool and attachments -#40-50 grit sandpaper

B2. Materials

-Landing Light Kit #300-0025, or #300-0026 -Machined PVC tube -Landing Light -Clear Lens

#### C. PROCEDURE

C1. Locate a spot in the lower right portion of your engine cowling where you will have the clearance inside for the tube, without interfering with your exhaust, carb box, etc. The tube will be mounted inside this area, pointing downward at 5° relative to the cowl split line, with the smaller diameter in toward the cowling. There is a cutting line marked on the outside of the tube for reference but don't cut it yet.

C2. When you are sure you have a good spot picked out for the tube, mark the center of the spot and drill a starting hole for your saw or Dremel.

C3. Open the hole up until it is about 1/2" smaller than the inside diameter of the PVC tube.

C4. Now cut the tubing in the area indicated, Keeping its length to a minimum, so that the lamp will sit as close to the lens as possible. Trim it so that it matches the contour of the inside of the cowling where it will be mounted later.

C5. Holding the tube inside the cowling (a couple of dabs of hot glue will do it), trim out the cowling hole until it just matches the inside diameter of the tube.

C6. Remove the tube and any hot glue residue.

C7. Using sandpaper, bevel the inside of the cowling so you will have a smooth transition from cowling to lens, for clean airflow.

C8. Using only as much heat as necessary, form the clear lens to fit over the inside of the cowling hole, centering it. Make a couple of marks at the edge so you can reposition it easily. Trim away the excess lens that falls more than 1" away from the hole. By using heat, get the lens to fit flush into the hole.

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C9. Use masking tape on both sides, protecting the lens portion of the clear sheet from contamination.

C10. Using #40 grit sandpaper, scuff up the area around the inside of the cowling hole for a distance of 2".

C11. Scuff the area of the clear sheet that will attach to the cowling.

C12. Using Hysol, bond the lens into position inside the cowling, cleco, clamp, or weight it in position. Wipe away any excess Hysol and let it sit until cured.

C13. Scuff the area of the lens outside the diameter of the hole in the cowling lightly, and finish fastening the lens in place with Hysol.

C14. Using sandpaper on your Dremel, form the tube until it is flush with the inside of the lens. Mark the tube on the outside at its bottom most point. Drill an 1/8" hole near the lamp end, so that heat and moisture can escape.

C15. Scuff the outside end of the tube that ill go against the lens for a distance of about 1" and clean thoroughly for BID tape application.

C16. Clean the lens inside the cowling very well (this will be the last time you can easily get to it) and, using a 2 BID layup, fasten the tube to the lens and overlap 1" onto the cowl.

C17. Using 4 or 5 dabs of silicone adhesive, mount the lamp into the large end of the tube, facing forward, so the writing on the rear of the lamp is right side up.

C18. Using crimp or solder lugs, and the screws provided with the lamp, fasten your wiring to the lamp.

> NOTE: The lamp will draw nearly 9 amps. You should use at leas size 14ga wire for the 12 volt, and 18ga for the 24 volt. Use a 15 amp circuit breaker.



# **12. FAST BUILD FUSELAGE**

Dear Lancair Builder,

This section covers both the standard and fast built kits. Some of the steps in the manual have already been completed in the fast built kit. Verify that the step has been completed and then go on to the next step.

For example: The bulkheads may be secured with BID on only one side so it will be necessary to install the BID on the opposite side according to the manual.

Specific issues of the fast build kit:

1. The phenolic hardpoints on the firewall **have been installed** in the fast built kits. They may be difficult to see because they are installed from the aft side of the firewall and are covered by the 18 BID reinforcement. Though they are not easily seen, they are there.

2. The 1 BID covering the exhaust tunnels on the forward side of the firewall **have not been installed.** 



3. The H. Stab cradle capstrips are **pre-installed but it will still be necessary** to align the Stab. according to the manual.



## **13. ALIGNING THE CRADLES**

- A1. Measure 9" in from the long edge of the table and snap a chalk line that extends the full length of the table.
- A2. Then across this line, draw a perpendicular chalk line at BL 0, BL 25.5, BL 76, BL 104, BL 147, and BL 171.



- A3. After knocking out the angle iron locations on the cradles, align the inboard and outboard cradles to the line that runs the length of the table using chord line 17.58%. Clamp the bottoms of the cradles in place using C-clamps. (Angle iron makes a great straight edge when installed later through each of the cradles and running the length of the table.)
- A4. Using a level/water line, align the four cross hairs on the inboard and outboard cradles. Using a water level, make sure that they are on the same horizontal plane.
- A5. Align the remaining cradles using a string line along the leading and trailing edges. (See figure 1 for information on aligning the cradles to the string.)

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# 14. ONE PIECE "B" KIT FB

Because the fast build kit comes with the gear wells already cut out, a few small changes need to be made throughout Chapter 19. Simply make the following adjustments.

A1. Follow Chapter 19 to section D, Installing the Extension Fairings. It will be necessary to replace the gear will cut outs in the fuselage because the one piece gear doors are shaped slightly different than the cutouts that came with your kit. This is not a difficult process and it won't take very long. Fit the cutouts into their appropriate locations and hold in place with tongue depressors attached to the outside of the fuselage. Use a 2 BID layup on the inside of the fuselage around the area shown below. On the outside of the fuselage, remove the tongue depressors and cover the seam with 1 BID, around the same area as the 2 BID. Continue through D1.



A2. The extension fairings should just cover the old gear well cut outs. In step D2 be careful not to trim too much of the fairings away from the old cut outs. Allow the fairings to cover this area even if it means not trimming a portion of it.

A3. Continue through the remainder of the chapter, being careful to line up blue print#A-335 with the hinge line of the old gear well cut outs in section N.



