FLAP, AILERON, FLAP/FUSELAGE AND STABILATOR GAP SEAL INSTALLATION AND MAINTENANCE MANUAL

Aircraft Eligibility: Piper PA-28-151, PA-28-161, PA-28-181, PA-28-201T, PA-28-236, PA-28R-201, PA-28R-201T, PA-28RT-201, PA-28RT-201T.

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Revision Control

Rev. No.	Date	Effect
A	11-15-90	Pages 6 & 8. Deleted revision date from individual pages. Added revision page. Corrected end space clearance on stabilator gap seal.
B	1-1-91	Corrected outboard flap seal installation. Using P/Ns LOF and ROF in place of (2) P/N OF
C	6-1-97	Changed name and address.
D	4-14-99	Changed rivnuts from countersunk to standard for aileron seals, General cleanup. Added Freise Aileron Seals for early PA-28-151.
E	2-12-11	ECO 0189

Table of Contents

Section 1.0 Introduction

PERFORMANCE FLIGHT TESTING.

1. The rigging of the aircraft should be checked before the installation, and any changes to the rigging should be performed before the flight testing.

2. The flight testing must be done with the aircraft loaded to the same gross weights, and as far as possible under the same atmospheric conditions. Early morning or late evening will usually provide the smoothest air.

3. Under identical conditions, a good indication of performance change is the “indicated” airspeed. Example, if you climb to 5,000 feet and find after stabilizing at maximum cruise you have 24 inches of manifold pressure, the altitude that gives you 24 inches of manifold pressure on the after flights will be close to the same density altitude as the early flights. If the air pressure is creating an identical manifold pressure reading, and the air speed indicator is reading higher, it is obvious airspeed has increased. This is because the airspeed indicator is a pressure reading device. A density altitude indicator will help to verify the same flight conditions.

4. Another method is timing across 2 parallel roads between which you know the exact distance. (The further apart, the less chance for error) Stabilize the aircraft perpendicular to the roads and fly straight across the first. Punch the timer at the exact point where the leading edge of the wing crosses the road and maintain a constant heading at 90 degrees to the road. After maintaining constant altitude and power settings, punch the clock again when the leading edge crosses the second road. Repeat the procedure back and forth several times and record all resulting times. Calculate the ground speed for each flight in all directions and average the number of flights. Repeat after the mod installation.

Note #1
This manual describes the installation of the Knots 2U Flap, Aileron, Flap/Fuselage and Stabilator gap seals. The appropriate Piper service manual for your aircraft should be used in conjunction with this manual.
The best time to paint the seals is either before the installation or after all of the holes are drilled and before the final installation. The seals are primed and ready for paint, they should be scuffed with a scotch brite or equivalent, cleaned and painted. The anti-chafe strip should be covered with masking tape before painting.

Section 2.0 Installation – Aileron Gap Seals

(PA-28-151 models before serial number 28-7615001 use freise aileron gap seals described in section 3 of this manual.)

2.1 P/N LIA-T, Left Inboard Aileron Seal Locating and Drilling.

(Detail #1) While referencing the appropriate Piper Service Manual, remove the left aileron from the aircraft.

Position P/N LIA-T 1/8" outboard of the flap with the center of the break radius even with the bottom of the wing. (Note: The bow in the aileron seal will cause the center part of the seal to be slightly below the bottom of the wing surface)
Drill clearance holes in the seal flange to allow the seal to clear any existing rivets that prevent the seal from laying flush against the spar.
Drill #40 (.098") holes through the pilot holes and cleco in place.

2.2 P/N 2A, 2nd Aileron Seal Locating and Drilling

(Detail #1) Locate P/N 2A 1/32" from the outboard edge of P/N LIA-T previously installed.
Drill clearance holes in the seal flange to allow the seal to clear any existing rivets that prevent the seal from laying flush against the spar.
Drill #40 (.098") holes through the pilot holes and cleco in place.

2.3 P/N 3A, 3rd Aileron Seal Locating and Drilling.

(Detail #1) Locate P/N 3A 1/32" from the outboard edge of P/N 2A previously installed.
Drill clearance holes in the seal flange to allow the seal to clear any existing rivets that prevent the seal from laying flush against the spar.
Drill #40 (.098") holes through the pilot holes and cleco in place.

2.4 P/N 4A, 4th Aileron Seal Locating and Drilling.

(Detail #1) Locate P/N 4A 1/32" from the outboard edge of P/N 3A previously installed.
Drill clearance holes in the seal flange to allow the seal to clear any existing rivets that prevent the seal from laying flush against the spar.
Drill #40 (.098") holes through the pilot holes and cleco in place.

2.5 P/N 5A, 5th Aileron Seal Locating and Drilling.

(Detail #1) Locate P/N 5A 1/32" from the outboard edge of P/N 4A previously installed.
Drill clearance holes in the seal flange to allow the seal to clear any existing rivets that prevent the seal from laying flush against the spar.
Drill #40 (.098") holes through the pilot holes and cleco in place.

2.6 P/N 6A, 6th Aileron Seal Locating and Drilling.

(Detail #1) Locate P/N 6A 1/32" from the outboard edge of P/N 5A previously installed.
Drill clearance holes in the seal flange to allow the seal to clear any existing rivets that prevent the seal from laying flush against the spar.
Drill #40 (.098") holes through the pilot holes and cleco in place.

2.7 Checking Aileron Travel and Seal Adjustment.

Remove clecos from the seals and hold seals in place with small sheet metal screws. Hold the aileron on position and rotate through its full travel. Check the rivets along the bottom leading edge of the aileron to confirm they are not rubbing on the seal. If any rivet heads are rubbing, more bow can be added to the seal.
With the aileron in the neutral position check the seals against the bottom of the aileron. The seals should be adjusted so when the aileron is in the neutral position the seals will apply light pressure to the aileron. If the seals are not contacting the aileron or are contacting it too snugly the seals may be adjusted by bending them slightly.

2.8 Enlarging Mounting Holes For P/N LIA-T, 3A and 6A.

(Detail #1) Enlarge the #40 attachment holes in the wing (P/N LIA-T, 3A, 6A only) to a #12 (.189") hole size (proper hole size is critical for Rivnut installation, it is suggested to use a dial calipers to confirm the exact drill is used)
De-burr holes and use alodine or equivalent to corrosion proof holes. Remove all drill shavings from aircraft. Install P/N A6K-75 Riv-Nuts in each hole. Enlarge pilot holes in the gap seal to a #20 (.161") hole size and de-burr.

2.9 Enlarging Mounting Holes For P/N 2A, 4A, and 5A.

(Detail #1) Enlarge the #40 attachment holes in the wing and gap seals to a #27 (.144") hole size. De-burr holes and corrosion proof with alodine or equivalent. Remove all drill shavings from aircraft.

2.10 Final Installation of Aileron Seals.

(Detail #1) Install P/N LIA-T, 3A and 6A using (10) AN526C-632-R8 screws. Install P/N 2A, 4A, and 5A using (25) CR3243-4-2 Cherry Max Rivets.

2.11 Final Check.

Per the appropriate Piper Service Manual re-install the aileron and check seals for proper contact. Move the aileron through it's full up and down travel to confirm no contact is made between the aileron and the seals except at the trailing edge of the seal where the ant-chafe tape is applied.

2.12 Installing Right Side Aileron Seals.

Repeat steps 2.1 thru 2.11 on right aileron. All part numbers are the same except P/N RIA-T is used in place or P/N LIA-T.

2.13 Aileron Seal Removal.

If the aileron seals need to be removed it can be accomplished by removing the screws and drilling the rivets.

2.14 Aileron Seal Parts List.

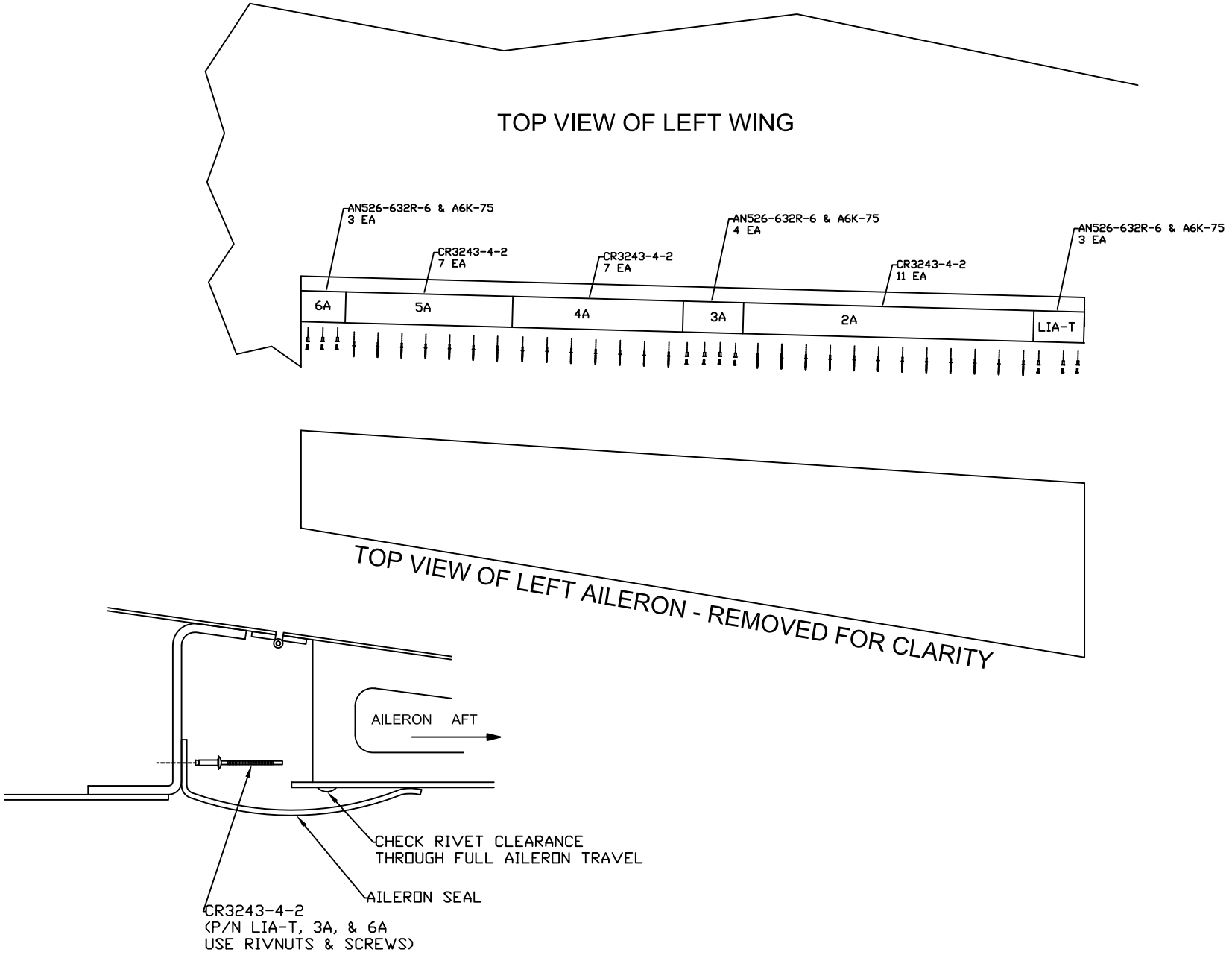
Part Number	Qty	Description
LIA-T	1	Left Inboard Aileron Seal
RIA-T	1	Right Inboard Aileron Seal
2A	2	Aileron Seal
3A	2	Aileron Seal
4A	2	Aileron Seal
5A	2	Aileron Seal
6A	2	Aileron Seal
AN526C-632-R8	20	Screw
A6K-75	20	Riv-Nut
CR3243-4-2	50	Cherry Max Rivet

2.15 Weight and Balance.

Weight of Aileron Seal Kit = 1.94 pounds
Arm = 129"

2.16 Paperwork.

Complete FAA Form 337 and log book entry. Place this manual in aircraft logs for future reference.


TOP VIEW OF LEFT WING
AN526-632R-6 & A6K-75
3 EA
CR3243-4-2
7 EA
CR3243-4-2
7 EA
AN526-632R-6 & A6K-75
4 EA
CR3243-4-2
11 EA
AN526-632R-6 & A6K-75
3 EA
6A
5A
4A
3A
2A
LIA-T
TOP VIEW OF LEFT AILERON - REMOVED FOR CLARITY
AILERON AFT
CHECK RIVET CLEARANCE
THROUGH FULL AILERON TRAVEL
AILERON SEAL
CR3243-4-2
(P/N LIA-T, 3A, & 6A
USE RIVNUTS & SCREWS)

Section 3.0 Freise Aileron Gap Seal Installation

(PA-28-151 models before serial number 28-7615001 use Freise aileron gap seals. Later model PA-28-151 models use the aileron seal kit described in Chapter 2 of this manual)

3.1 Disconnecting Left Aileron and Removing Rivets.

Remove the actuator arm bolt from the left aileron. The aileron will now swing down enough to allow the installation of the aileron seals. (Detail #2) Remove the rivets from the trailing edge upper wing skin in front of the aileron.

3.2 Installing P/N 28FIA, Inboard Aileron Seal.

(Detail #2) With the anti-chafe strip facing the aileron insert the inboard aileron seal P/N 28FIA between the upper wing skin and stiffener. Slide the seal into the wing 1” with the inboard edge of the seal even with the inboard edge of the aileron. The outboard edge of the seal should be even with the actuator arm cut out. If the seal is too long it should be trimmed.
With the seal held firmly in place drill #30 (.128”) holes in seal using wing holes as a guide. Install a cleco in each hole as you drill.

3.3 Installing P/N 28FOA, Outboard Aileron Seal.

(Detail #2) With the anti-chafe strip facing the aileron insert the outboard aileron seal P/N 28FOA between the upper wing skin and stiffener. Slide the seal into the wing 1” with the inboard edge of the seal even with the actuator arm cut out. The outboard edge of the seal should be even with the outboard end of the aileron. If the seal is too long it should be trimmed.
With the seal held firmly in place drill #30 (.128”) holes in seal using wing holes as a guide. Install a cleco in each hole as you drill.

3.4 Checking Aileron Travel.

With the aileron seals clecoed in place rotate the aileron through its full travel. Check the amount of friction between the aileron and the aileron seal. There should be an approximate .020” gap between the aileron and the seal. The seal can be slightly adjusted by using a straight edge and applying even pressure either up or down.
Mark any locations where the aileron seal interferes with rivets on the aileron. Rivets around the actuator arm cut out or at the ends of the aileron may be removed and replaced with a flush rivet. For other rivets the seal can be bent up slightly to prevent it from catching on the rivet head.

3.5 Final Cleanup.

Clean all drill shavings from the aircraft and gap seals. De-burr and corrosion proof all holes in the aircraft and gap seals with alodine or equivalent.

3.6 Riveting Aileron Seals.

Rivet the gap seals in place using AN470AD-4-4 Rivets.

3.7 Re-connection the Aileron.

While referencing the appropriate Piper Service Manual re-connect the aileron actuating rod. Check for smooth and full travel of the aileron.

3.8 Right Side Installation.

Repeat steps 3.1 thru 3.7 on the right side of the aircraft.

3.9 Removal of aileron seals.

If removal of the seals is necessary, drill the attachment rivets and remove the seals.

3.10 Parts List.

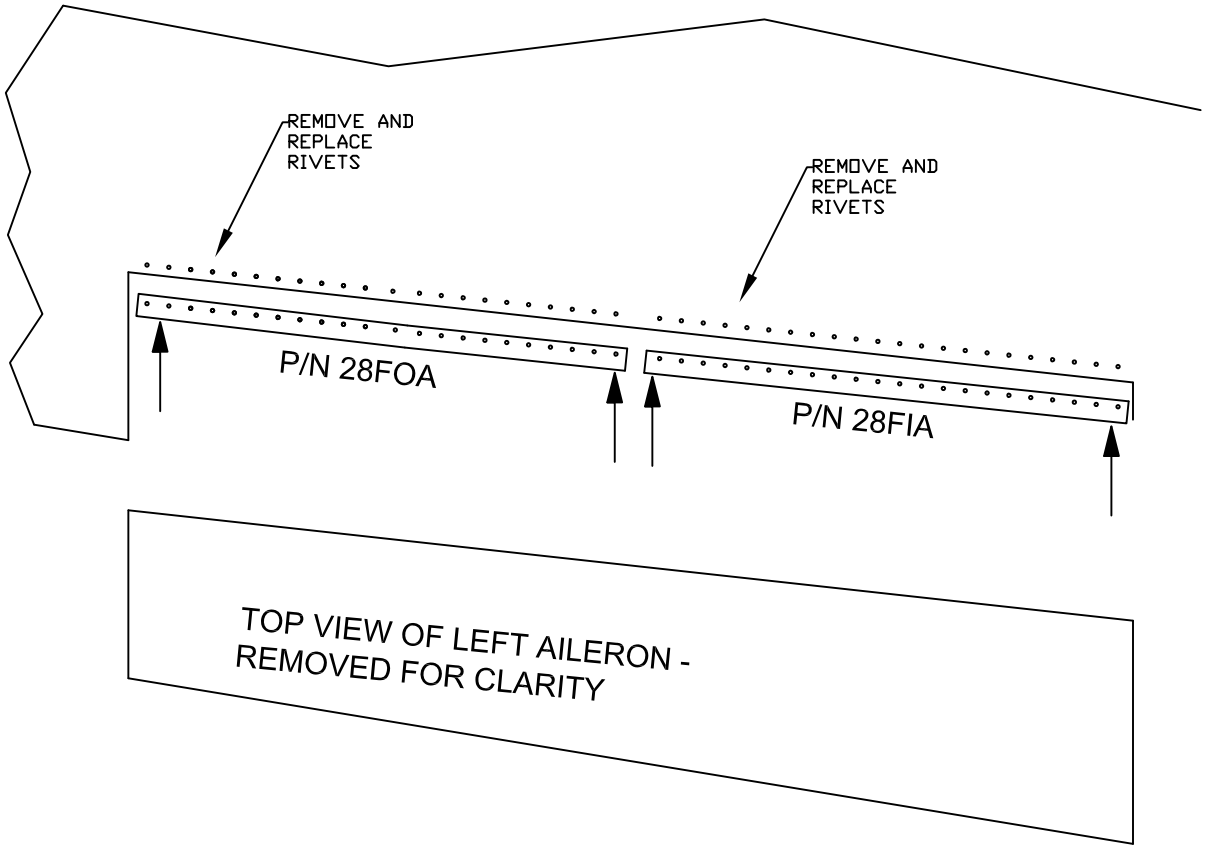
Part Number	Qty	Description
28FIA	2	Freise Aileron Seal Inboard
28FOA	2	Freise Aileron Seal Outboard
AN470AD-4-4	90	Roundhead Rivet

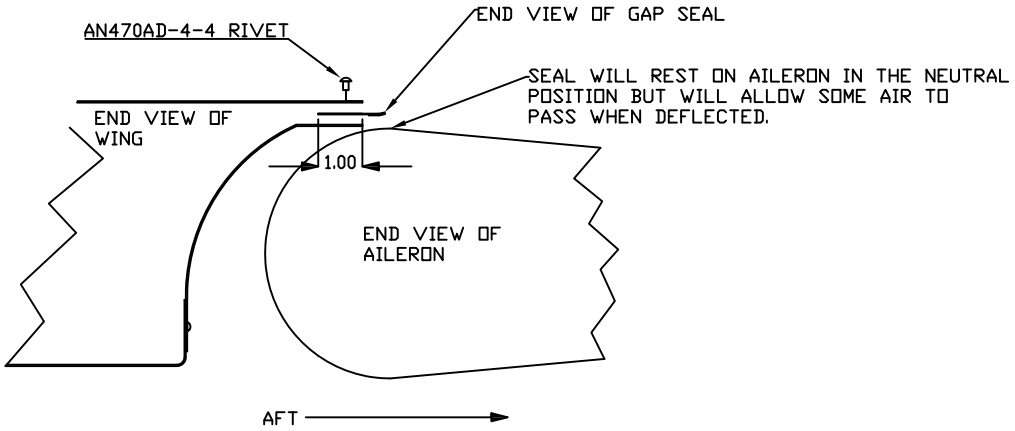
3.11 Weight and Balance.

Weight of Aileron Seal Kit = 0.44 pounds
Arm = 129”

3.12 Paperwork.

Complete FAA Form 337 and log book entry. Place this manual in aircraft logs for future reference.


REMOVE AND
REPLACE
RIVETS
REMOVE AND
REPLACE
RIVETS
P/N 28FOA
P/N 28FIA
TOP VIEW OF LEFT AILERON -
REMOVED FOR CLARITY


AN470AD-4-4 RIVET
END VIEW OF GAP SEAL
SEAL WILL REST ON AILERON IN THE NEUTRAL
POSITION BUT WILL ALLOW SOME AIR TO
PASS WHEN DEFLECTED.
END VIEW OF
WING
1.00
END VIEW OF
AILERON
AFT

Section 4.0 Left and Right Flap Gap Seal Installation

NOTE #2:
If Knots 2U flap hinge fairings are being installed on the aircraft, some labor savings can be accomplished by installing them before the flap gap seals. If rigging of the flaps is necessary it should be completed before installation of flap seals.

NOTE #3:
Left blank intentionally.

4.1 P/N LIF, Left Inboard Seal Locating And Drilling.

(DETAIL #3) Per the appropriate Piper Service Manual, fully lower flaps. At the inboard end remove the clevis bolt and spacer from the flap actuating rod terminal end. Retain parts for re-installation. The flap will now swing down and allow room for installation. Position P/N LIF with the end tab against the fuselage and 5/8" flange against rear of the wing. Position the bottom of the seal flush with the bottom of the wing skin. There are (2) existing rivets on the fuselage where the P/N LIF meets it. These rivets may be drilled out and the holes used to attach P/N LIF. (If these holes do not allow enough edge distance, drill (2) new holes while observing edge distances) With the seal properly located using the pilot holes, mark and drill the (2) outboard holes in the rear wing spar to a #40 (.098") hole size. Cleco seal in place.

4.2 P/N OF & LOF, Outboard Flap Seal Locating and Drilling.

(DETAIL #3) Using 1/32" edge spacing, place (1) P/N OF 1/32" outboard of P/N LIF just installed. Position the bottom of the seal flush with the bottom of the wing skin. Drill clearance holes in the seal flange to allow the seal to clear any existing rivets that prevent the seal from laying flush against the spar. Drill # 40 (.098") holes through pilot holes and cleco seal in place. Repeat procedure for next outboard seal P/N LOF.

4.3 Enlarging Holes.

Enlarge attachment holes in wing to a #27 hole size. Also enlarge the pilot holes in the P/N's OF, LOF, and LIF to a #27 (.144") hole size. De-burr all holes in gap seals and airframe, remove all shavings from aircraft and corrosion proof all holes with Alodine or equivalent. The seals may be painted at this time.

4.4 Final Installation of Flap Seals.

(DETAIL #3) With gap seals temporally held in place with PK screws, move flap up and down and check for proper contact and alignment with seals. With flap in full up position the seals should make light contact with flap. If seals are not making contact they can me moved up slightly by re-bending them. If the seals are too high, they may be bent down slightly using a straight edge. Rivet flap seals in place using P/N CR3243-4-2 Cherry Max Rivets.

4.5 Re-Connecting Flap.

Per the appropriate Piper Service Manual, reinstall clevis bolt and spacer in flap actuating rod terminal end. Run flap up and down several times to check seal for any binding and proper alignment.

4.6 Right Side Installation.

Repeat steps 4.1 thru 4.5 on right wing. P/N LOF will be replaced by P/N ROF and P/N LIF will be replaced by P/N RIF. All other parts are the same.

4.7 Removal of Flap Seals.

If a seal needs to be removed it can be accomplished by lowering the flap per section 4.1 and drilling the attachment rivets out. Care should be taken to not enlarge the attachment holes while drilling.

4.8 Parts List.

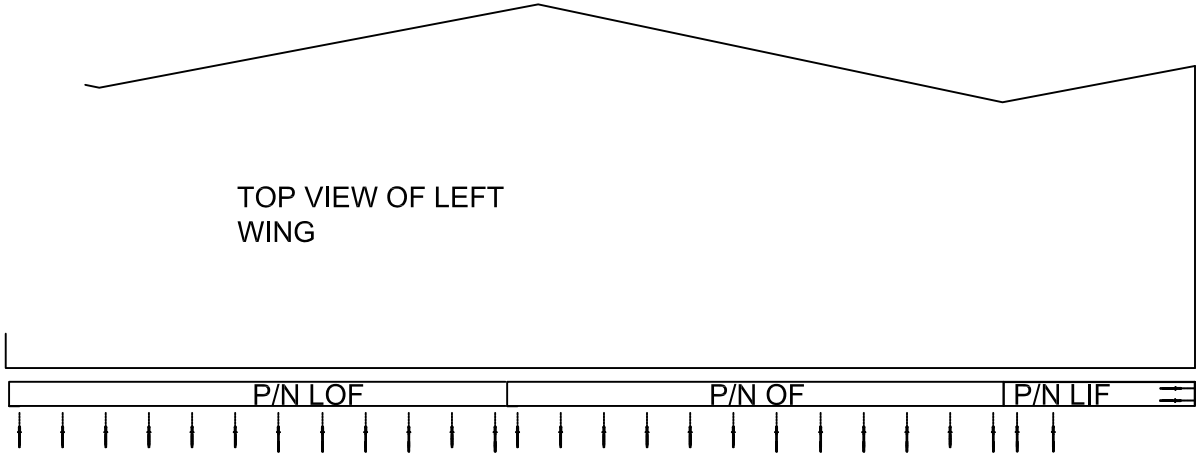
Part Number	Qty	Description
OF	2	Flap Seal
LOF	1	Left Outboard Flap Seal
ROF	1	Right Outboard Flap Seal
LIF	1	Left Inboard Flap Seal
RIF	1	Right Inboard Flap Seal
CR3243-4-2	56	Roundhead Cherry Max Rivet

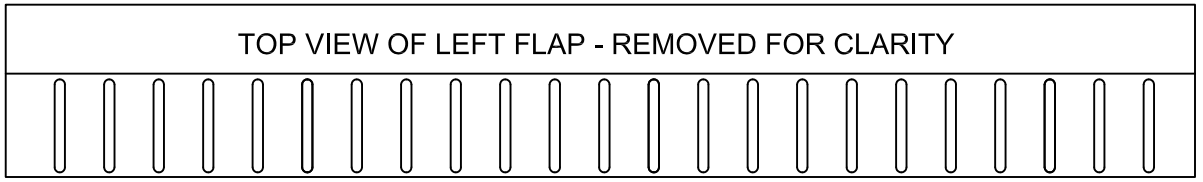
4.9 Weight and Balance.

Weight of Flap Seal Kit = 1.00 pounds
Arm = 129”

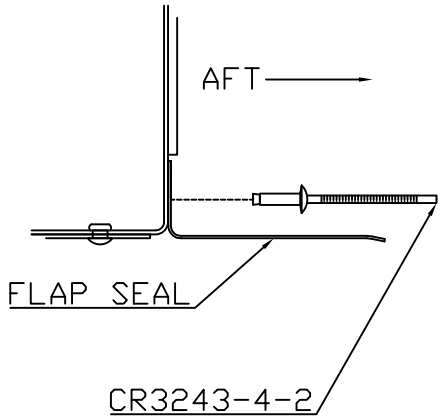
4.10 Paperwork.

Complete FAA Form 337 and log book entry. Place this manual in aircraft logs for future reference.





END VIEW OF FLAP
SEAL INSTALLATION



Section 5.0 Left and Right Flap / Fuselage Gap Seals

NOTE #4: If rigging of the aircraft is necessary, it should be accomplished before the installation of the flap / fuselage gap seals.

5.1 P/N LFF, Left Flap / Fuselage Gap Seal Installation.

(DETAIL #4) With Flap full up, place P/N LFF, (Left Flap / Fuselage Gap Seal) on top of inboard end of flap against fuselage so the seal covers the space between the inboard edge of the flap and the fuselage. Position so that the forward end of the curved portion is even with the trailing edge of the flap, and so it makes solid contact with the top of the flap surface. If rivets interfere with the seal it may be trimmed to clear. With seal properly located, and observing all edge distances, mark (3) hole locations, (1) at each end of the seal flange and (1) in the center. If existing hardware falls under a hole location, the hole may be relocated. Drill #40 (.098") hole locations at these points and temporarily attach seal using (3) P/N TRA 4X1/4 screws. Lower and raise the flap several times to confirm proper contact and no binding. Mark the seal where it overhangs the bottom of the aircraft. Excess material should be trimmed off and the seal de-burred. Enlarge holes to a #27 (.144") hole size. De-burr and corrosion proof holes and trimmed edges with Alodine or equivalent. Seal may be painted at this time. Rivet seal in place using (3) P/N CR3243-4-2 Cherry Max rivets or equivalent.

5.2 P/N RFF, Right Flap / Fuselage Gap Seal Installation.

Repeat step 6.1 on right side of aircraft.

5.3 Removal of Flap / Fuselage Seals.

If a seal needs to be removed it can be accomplished by lowering the flap and drilling the attachment rivets out. Care should be taken to not enlarge the attachment holes while drilling.

5.4 Flap / Fuselage Seal Parts List

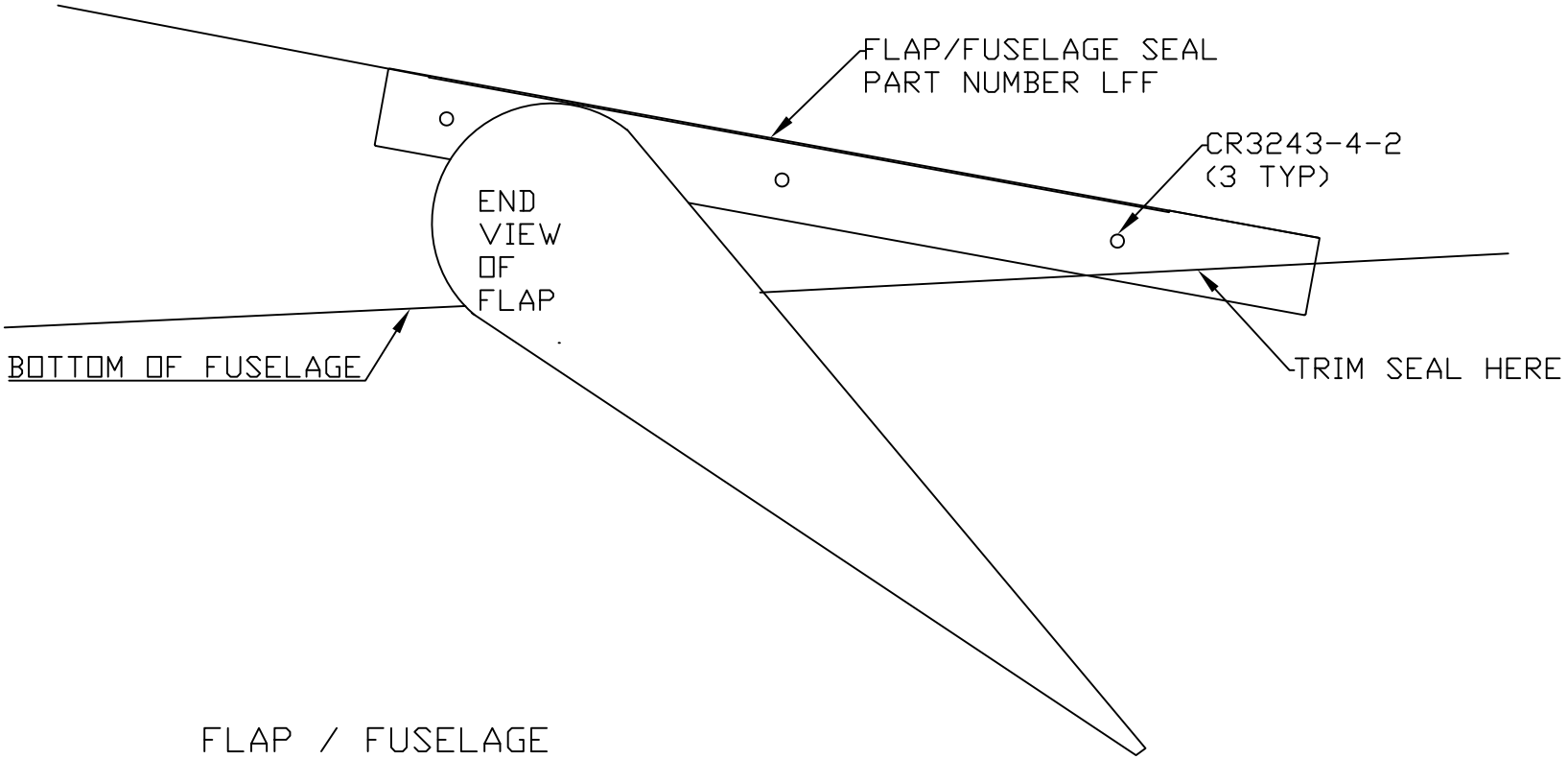
Part Number	Qty	Description
LFF	1	Left Flap / Fuselage Seal
RFF	1	Right Flap / Fuselage Seal
CR3243-4-2	6	Cherry Max Rivet

5.5 Weight and Balance

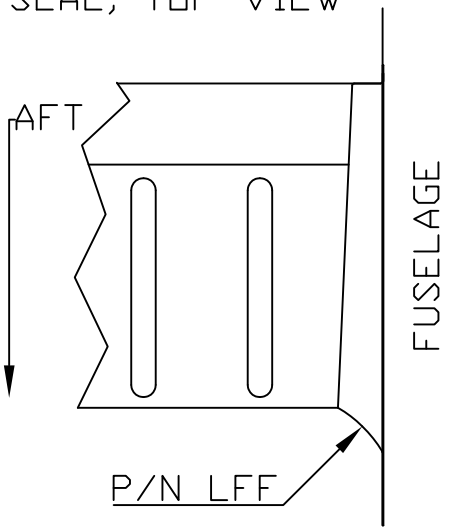
Kit	Weight in lbs	Arm in inches
Flap / Fuselage Seals	0.14	129

5.6 Paperwork

Perform paperwork (337, log book entry and Weight & Balance change). Place this manual and Supplemental Type Certificate with aircraft log books.



FLAP / FUSELAGE
SEAL, TOP VIEW



Section 6.0 Stabilator Gap Seal Installation

Note #5. It is required that the stabilator be balanced after installation and painting of the seal is complete. Reference the proper service manual for balancing procedures. If stabilator will be balanced off the plane it is easier to accomplish the installation after stabilator has been removed.

6.1 Disconnecting Trim Tab Actuator Arm.

Remove the (4) bolts connecting the Stabilator trim tab actuator arm. Move the left and right tabs upward as far as free travel allows.

6.2 Rivet Removal.

Remove existing #4 rivets from the lower rear spar of the Stabilator.

6.3 Installing Stabilator Gap Seal

(DETAIL #5) Insert gap seal P/N T28 on left side between lower spar flange and lower Stabilator skin. Position the seal 5/8 inch (nominal) inward between spar and skin with chafe strip aft and facing up toward trim tab. Seal should be positioned so that there is a 1/8 inch gap between the inboard edge of the seal and the trim tab actuator base. Seal may then be trimmed on the outboard end so that it does not extend further outboard than the trim tab. Lower trim tab so it rests against seal. At the very outboard end of seal some models have a roundhead rivet on the trim tab that will interfere with flush fit of Stabilator Seal. This rivet should be removed and replaced with a countersunk rivet of the same size. Repeat procedure on right side.

6.4 Drilling Rivet Holes.

With seal in proper location and using rivet holes in skin as a guide, drill # 30 (.128”) holes in P/N T28 Stabilator Seal, Cleco as you go. With seal drilled and clecoed, lower trim tab and confirm proper contact of seal against trim tab. With the trim tab in the neutral position it should lightly contact the seal. Move trim tab through its full travel and confirm there is no excess binding. If binding occurs or seal does not meet with the trim tab in the neutral position, the seal may be bent slightly up or down using a straight edge.

6.5 Final Cleanup.

Remove the gap seal from aircraft and clean all drill shavings from area. De-burr all holes and trimmed areas, corrosion proof holes and trimmed edges with Alodine or equivalent. Seal may be painted at this time.

6.6 Riveting P/N T28 Stabilator Seal.

Cleco gap seals in place. Rivet every other hole using AN470AD-4-4 rivets, while leaving every other cleco in place. After 1/2 of the rivets are in place, remove the other clecos and finish riveting seals.

6.7 Re-Balancing Stabilator.

It is the responsibility of the installer to assure that the stabilator is properly balanced per the appropriate Piper Service Manual. If any painting is done to the seals or stabilator, it must be done before balancing. Check for full travel after balancing and that any weights added to balance arm do not restrict stabilator travel. Trim tab actuator arm should be reconnected and the stabilator run through its full travel to check for binding.

6.8 Removal of Stabilator Seal.

If a seal needs to be removed it can be accomplished by drilling the attachment rivets out. Care should be taken to not enlarge the attachment holes while drilling. Reference Section 6 of this manual for details.

6.9 Stabilator Seal Parts List

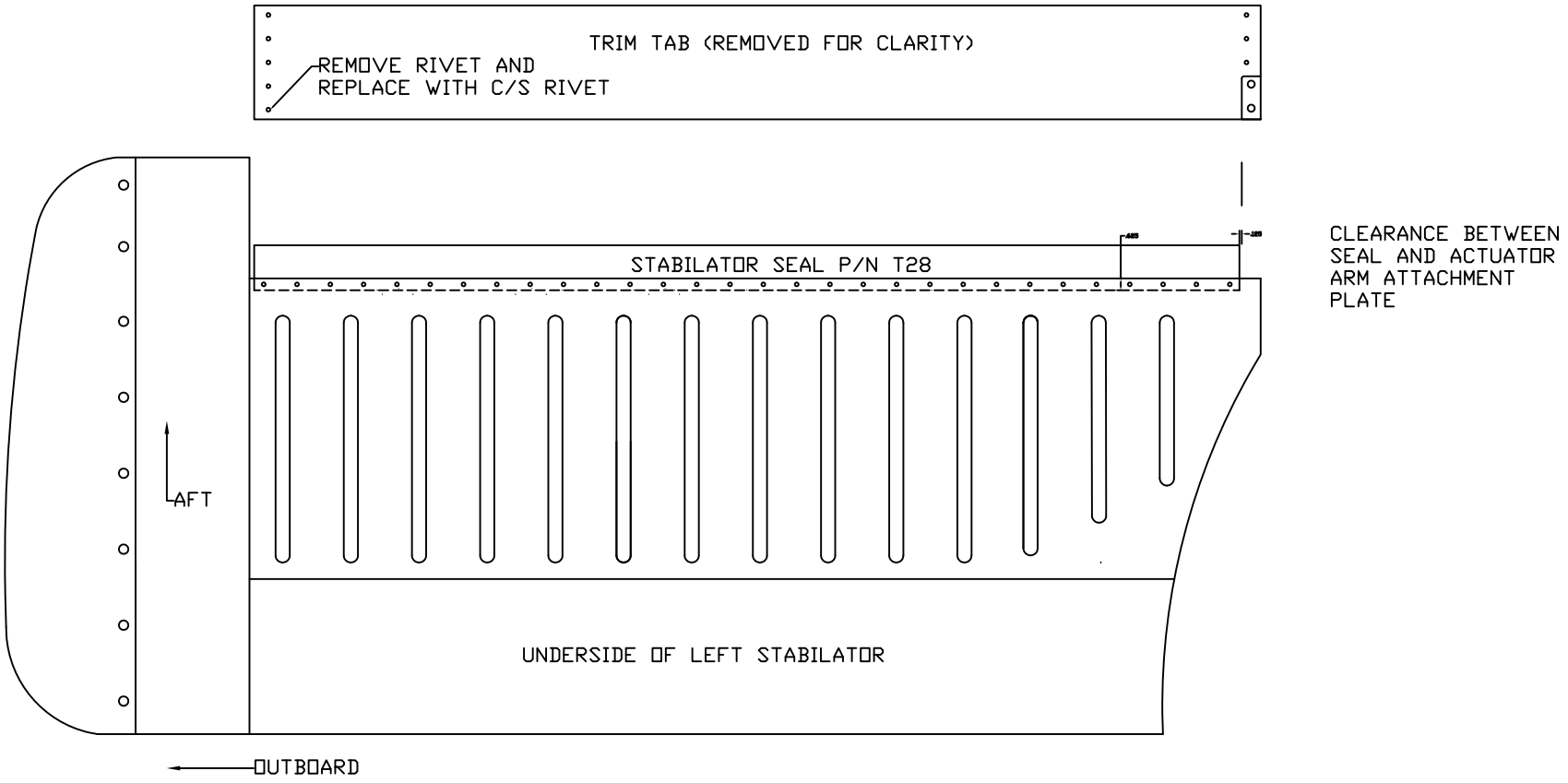
Part Number	Qty	Description
T28	2	Stabilator Gap Seal
AN470AD-4-4	67	Rivet

6.10 Weight and Balance

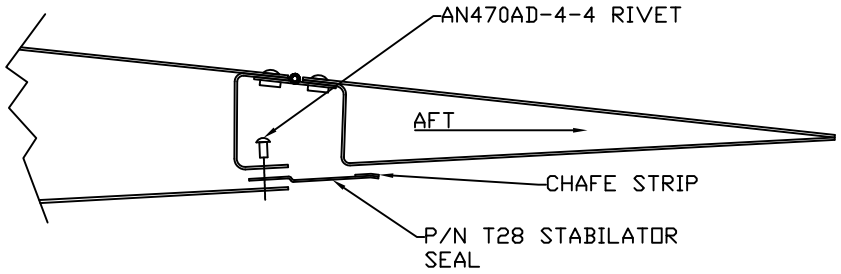
Kit	Weight in lbs	Arm in inches
Stabilator Gap Seals	0.42	Per appropriate Piper Service Manual

6.11 Paperwork.

Perform paperwork (337, log book entry and Weight & Balance change). Place this manual and Supplemental Type Certificate with aircraft log books.



END VIEW OF STABILATOR AND TRIM TAB



Section 7.0 Maintenance / Instructions for Continued Airworthiness

The Airworthiness Limitations section is FAA approved and specifies maintenance required under Secs. 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

For the current copy of this manual please contact Knots 2U, Ltd. at 262 763-5100 or via email at technical@knots2u.com.

PART A. INSPECTION

1. Daily inspection at preflight to ensure there is no binding of controls, bent gap seals, abrading of rivets or control surfaces, or broken parts.
2. When aircraft has been stored outside during snow or freezing conditions, a careful inspection should be made of the areas behind and under the seals for ice accumulations. If ice is found, which cannot be removed by careful brushing, the aircraft should be de-iced.
3. 100 hour inspections are suggested to check for abrading of rivets, control surfaces, and seals. Chafe tape should be inspected for peeling or excessive wear. Check all hardware and attachment of all seals.

PART B. MAINTENANCE

1. There are no special tools required to maintain the seals. Any tools needed are basic hand tools.
2. Keep the seal surface clean of oil and dirt, and the edge of the seal touching the control surface smoothly. If the Gap Seal appears to be abrading the control surface, 3M 5490 Teflon Tape, or equivalent, may be applied to the Gap Seal to act as a wear surface. The tape should be applied before further flight to prevent control wear.
3. If upon installation, or through wear, there is a warp in the seal or it lies unevenly, you may drill a #40 (.098) hole and cut the seal in a direction 90 degrees from the trailing edge. Drill the hole in the center of the warp, 1/2 inch from the trailing edge of the surface that the seal is attached to. The cut in the seal should be trimmed to give a slot 1/16th" wide, with parallel edges. The slots should be no closer than 6 inches from each other or the end of the seal. Refer to detail MM Detail, next page.
4. When aircraft is painted, care should be taken to prevent paint, paint remover, or solvents from contacting the Chafe Strip. If Chafe Strip is damaged, refer to PART B Paragraph 2 of this manual for replacement specifications.

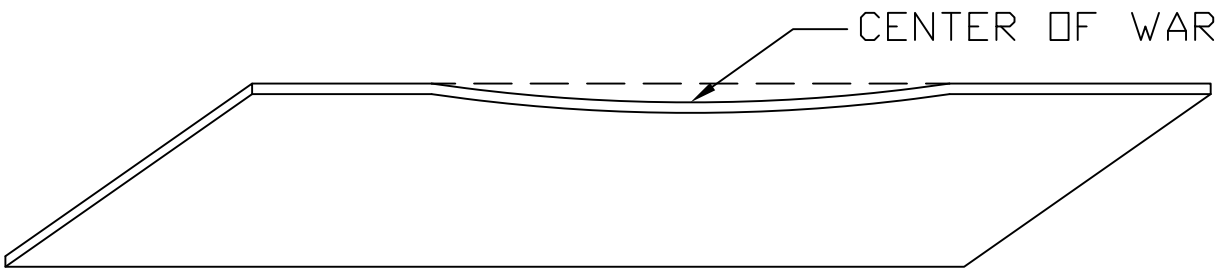
PART C. BALANCING

1. If any change is made to the horizontal stabilator; if chafe strip is added, if slots are cut to relieve warping, or if the seals are painted, the stabilator must be rebalanced.

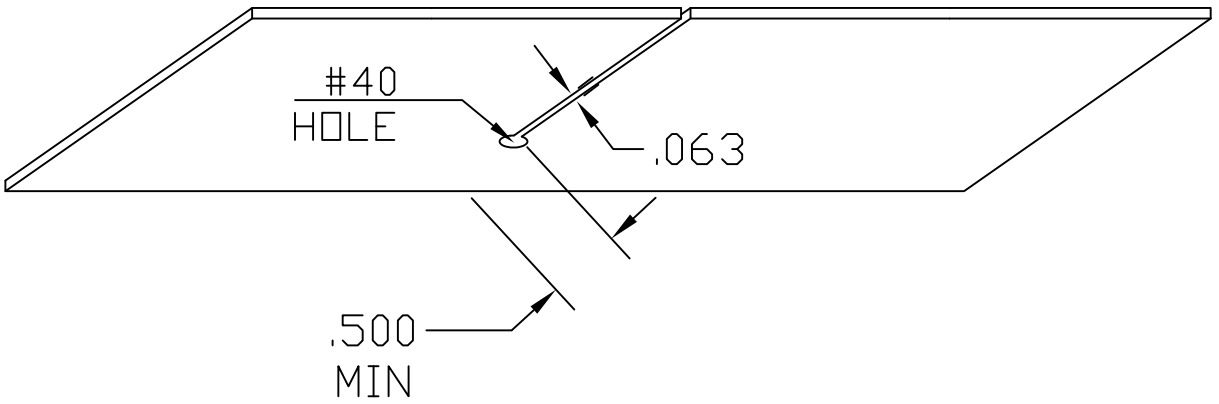
PART D. CRACKING, DEFECTS, LOOSE RIVETS.

1. If cracks are found in a gap seal, stop drill the crack. If there are more than 3 cracks in a gap seal, the seal must be replaced.
2. If the chafe strip peels, 3M 5490 Teflon Tape, or equivalent, may be applied
3. If there are excessive bends or kinks in the seal, and the airflow over the control surface is disturbed, the seal must be replaced.
4. If seal rivets become loose you may drill the rivets and replace with the next size rivet.

WARPED GAP SEAL BEFORE REPAIR



WARPED GAP SEAL AFTER REPAIR



ALLOW A MINIMUM OF 6″ BETWEEN THE WARP REPAIR SLOT AND THE END OF THE GAP SEAL OR ANOTHER WARP REPAIR SLOT.