

Main landing gear wheels, brake disks and calipers reversed from left to right sides. Brake disk and calipers now facing inboard. Brake line hose rerouted to inboard fork. Wing rib at Wing Station 33.06 modified per report HDN-01-090188, "Modification to Rib Assembly, PA-24/PA-30 Aircraft, Wing Station 33.06" dated 1 September 1988, prepared by Hans D. Neubert, FAA Structures DER, DERT-605393-NM, and per AC 43.13-1B. This report is a permanent part of the aircraft documentation. Log book entry made. Weight and balance change is negligible.

ICA Checklist

Introduction:	Section 1 of Report
Description:	Section 2.1 of Report
Control, Operating Info.:	Not Applicable
Servicing Information:	Annual Inspection per Piper Service Manual
Maintenance Instructions:	Section 4 of Report
Troubleshooting:	Not Applicable
Removal & Replacement:	Not Applicable
Diagrams	Drawing No's. 041288 and 041388
Special Inspection Reqmts:	Not Applicable
Protective Treatments:	Section 3 of Report
Data	Section 2.2 of Report
Special Tools	Not Applicable
Commuter Aircraft	Not Applicable
Overhaul Period	Not Applicable
Airworthiness Limitations:	Not Applicable
Revision:	Initial Installation, Log Book Entry

-----END-----

H. D. NEUBERT & ASSOCIATES, INC.

ADVANCED COMPOSITE APPLICATIONS

MATERIALS, DESIGN & STRUCTURAL ANALYSIS,
PROTOTYPE FABRICATION DEVELOPMENT,
COMPOSITE ANALYSIS SOFTWARE

28 Aug 1998

FAA
Riverside Flight Standards District Office
6961 Flight Road
Riverside, CA 92504

and

Inland Valley Aviation
ATTN: Dennis Travino
23155 Miners Road
Gavilan Hills, CA 92570

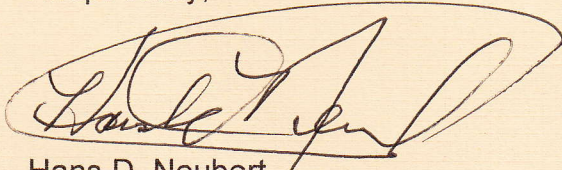
Subject: Alteration to Sta. 33.06 Rib Assembly on PA-24 Series Aircraft

Reference: "Modification to Rib Assembly PA-30 Sta. 33.06", Hans D. Neubert,
FAA DER NM-536, dated 1 September 1988.

Gentlemen,

I have reviewed the design configuration and analysis in the subject report and find that this alteration performed on the PA-30 series aircraft is also applicable to the PA-24 single engine Comanche series aircraft. I recommend approval of this alteration when performed to the specifications found in the reference report.

Respectfully,



Hans D. Neubert
FAA DER NM-536

Main landing gear wheels, brake disks and calipers reversed from left to right sides. Brake disk and calipers now facing inboard. Brake line hose rerouted to inboard fork. Wing rib at Wing Station 33.06 modified per report HDN-01-090188, "Modification to Rib Assembly, PA-24/PA-30 Aircraft, Wing Station 33.06" dated 1 September 1988, prepared by Hans D. Neubert, FAA Structures DER, DERT-605393-NM, and per AC 43.13-1B. This report is a permanent part of the aircraft documentation. Log book entry made. Weight and balance change is negligible.

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Revision:	Initial Installation, Log Book Entry

-----END-----

MAJOR REPAIR AND ALTERATION
(Airframe, Powerplant, Propeller, or Appliance)

FOR FAA USE ONLY
OFFICE IDENTIFICATION

INSTRUCTIONS: Print or type all entries. See FAR 43.9, FAR 43 Appendix B, and AC 43.9-1 (or subsequent revision thereof) for instructions and disposition of this form.

1. AIRCRAFT	MAKE Piper	MODEL PA30
	SERIAL NO. 30-292	NATIONALITY AND REGISTRATION MARK N9331Y
2. OWNER	NAME (As shown on registration certificate) Hans D. Neubert	ADDRESS (As shown on registration certificate) 6051 Prado Street Anaheim, CA 92807

3. FOR FAA USE ONLY

The data described herein complies with applicable airworthiness requirements and is approved only for the above described aircraft subject to conformity inspection by a person authorized in FAR 43.7

9-28-88

Date 9-28-88 Approving Inspector [Signature] WP-FSDO-0

4. UNIT IDENTIFICATION

UNIT	MAKE	MODEL	SERIAL NO.	5. TYPE	
				REPAIR	ALTERATION
AIRFRAME	***** (As described in item 1 above) *****				X
POWERPLANT					
PROPELLER					
APPLIANCE	TYPE				
	MANUFACTURER				

6. CONFORMITY STATEMENT

A. AGENCY'S NAME AND ADDRESS Wm E. Hodge Chino Valley Aviation 7000 Marrill Ave, Box 26 Chino, CA 91710	B. KIND OF AGENCY	C. CERTIFICATE NO. A & P 1179253
	<input checked="" type="checkbox"/> U.S. CERTIFICATED MECHANIC	
	<input type="checkbox"/> FOREIGN CERTIFICATED MECHANIC	
	<input type="checkbox"/> CERTIFICATED REPAIR STATION	
	MANUFACTURER	

D. I certify that the repair and/or alteration made to the unit(s) identified in item 4 above and described on the reverse or attachments hereto have been made in accordance with the requirements of Part 43 of the U.S. Federal Aviation Regulations and that the information furnished herein is true and correct to the best of my knowledge.

DATE 12-3-88	SIGNATURE OF AUTHORIZED INDIVIDUAL <u>[Signature]</u>
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7. APPROVAL FOR RETURN TO SERVICE

Pursuant to the authority given persons specified below, the unit identified in item 4 was inspected in the manner prescribed by the Administrator of the Federal Aviation Administration and is APPROVED REJECTED

BY	FAA FLT. STANDARDS INSPECTOR	MANUFACTURER	<input checked="" type="checkbox"/> INSPECTION AUTHORIZATION	OTHER (Specify)
	FAA DESIGNEE	REPAIR STATION		
DATE OF APPROVAL OR REJECTION 12-3-88	CERTIFICATE OR DESIGNATION NO. IA1179253	SIGNATURE OF AUTHORIZED INDIVIDUAL <u>[Signature]</u>		

NOTICE

Weight and balance or operating limitation changes shall be entered in the appropriate aircraft record. An alteration must be compatible with all previous alterations to assure continued conformity with the applicable airworthiness requirements.

8. DESCRIPTION OF WORK ACCOMPLISHED (If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)

Main landing gear wheels, brake disks, and brake calipers reversed from left to right sides. Brake disk and calipers now facing inboard. Wing rib station 33.06 modified per design and analysis of Report Number HDN-01-090188, "Modification to Rib Assembly, PA-30, Sta 33.06", Hans D. Neubert, 6051 Prado Street, Anaheim, CA 92807, dated 1 September 1988. Weight and balance change negligible.

-----END-----

ADDITIONAL SHEETS ARE ATTACHED

**Report Number
HDN-01-090188**

**Modification to Rib Assembly
PA-24/PA-30 Aircraft
Wing Station 33.06**

submitted to

**Federal Aviation Administration
Riverside FSDO, WP-FSDO-8
6961 Flight Road
Riverside, CA 92504**

prepared by

**Hans D. Neubert
6051 Prado Street
Anaheim, CA 92807
FAA DER DERT-605393-NM**

1 September 1988

1.0 INTRODUCTION

1.1 Background Information

Piper Aircraft Model 30 Twin Comanche uses two design configurations for the location of the brake disk and brake caliper on the main landing gear. For serial numbers 30-2 thru 30-597, the main landing gear axle is supported by a forged symmetrical aluminum fork having two members. The brake disk is oriented to the outboard side, with the brake caliper attached to the outboard leg of the fork. For serial numbers 30-846 and on, the main landing gear axle is supported by a forged aluminum fork having only an inboard member. The brake disk is oriented to the inboard side, with the brake caliper attached to the inboard leg of the fork. The one member fork design with brakes facing inboard is also used on all versions of the later Model 39 series.

For serial numbers 30-598 thru 30-845, the two member gear fork is used with the brakes facing inboard, and a common two member gear fork is used for all three wheels. For serial numbers 30-846 and on, as well as for the PA39 model, the nose wheel fork remains as before, while the two main gear forks have a new part number.

The primary motivation for the change from a two member fork to the single member fork is aerodynamic enhancement. For serial numbers 30-2 thru 30-597, the outboard fork, brake disk, and brake caliper remain in the slipstream when the landing gear is retracted. For serial numbers 30-846 and on, the brake disk

and brake caliper are within the wing cavity when the landing gear is fully retracted.

In order for Piper Aircraft to place the brake disk and brake caliper facing inboard, the partial rib at Wing Station 33.06 was modified to provide geometric clearance between members when in the retracted position. Piper Aircraft accounts for this modification by adding two additional dash numbers to the rib drawing. The modification involves removing a small portion of the rib, and adding a reinforcing angle section to bypass the load around the cutout. Identification of the rib and gear fork part numbers is shown in Table 1-1, below.

Table 1-1 Rib Station 33.03 and Gear Fork Part Numbers

<u>Part Number</u>	<u>Location</u>	<u>Usage</u>
22803-00	Rib-Left Wing	30-2 thru 30-597
22803-01	Rib-Right Wing	30-2 thru 30-597
22803-04	Rib-Left Wing	30-598 and on
22803-05	Rib-Right Wing	30-598 and on
20790-02	Gear Fork (2 Member)	30-2 thru 30-845
24680-00	Gear Fork-Left	30-846 and on
24680-01	Gear Fork-Right	30-846 and on

1.2 Purpose

The primary purpose of the proposed modification is to reduce parasite drag of the 30-2 thru 30-597 models by orienting the brake disk and caliper inboard. To accomplish this goal, a

modification to Piper Aircraft part number 22803, Rib Assembly, Wing Station 33.06 is proposed. The proposed modification is similar to part number 22803-04 and -05, with the addition of an extruded reinforcing angle member and further strengthened by an additional doubler. The proposed modification is considered structurally more conservative than the design used by Piper Aircraft.

A secondary purpose of the modification is to permit the attachment of a fixed fairing to the outboard gear fork member. This fixed fairing is the subject of a separate proposal.

Alternatively, the proposed modification will allow the substitution of the single fork assembly for the dual fork assembly, thus completing the conversion to that of serial numbers 30-846 and on.

Close-up photographs of the rib from aircraft with serial numbers less than and greater than 30-547, as certified by Piper Aircraft, are shown in Figures 1.2.1 and 1.2.2.

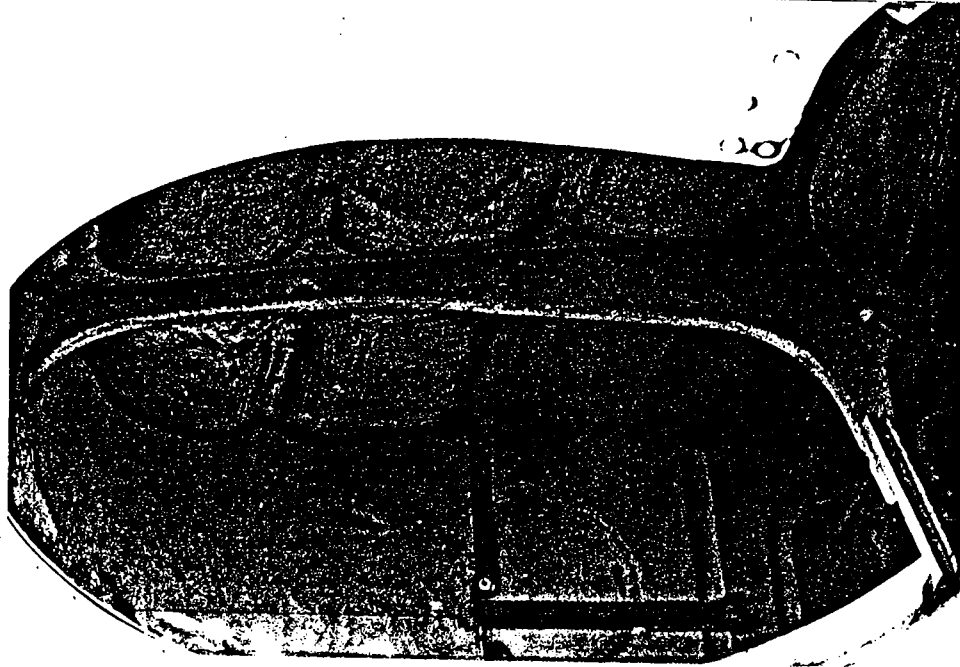


Figure 1.2.1 Rib Station 33.06 - Serial No. < 30-597

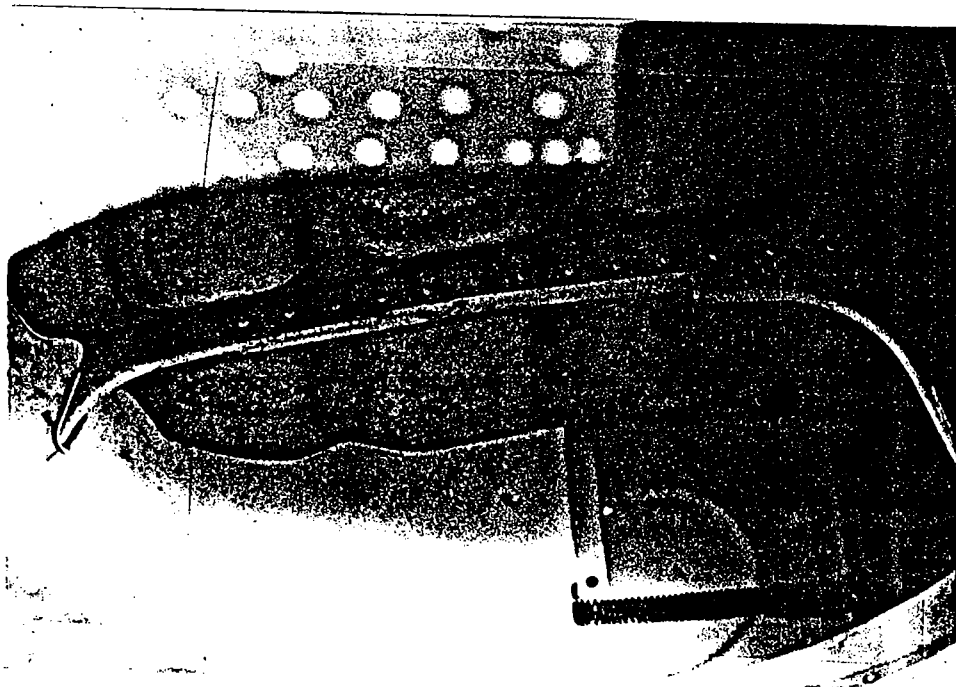


Figure 1.2.2 Rib Station 33.06 - Serial No. > 30-597

2.0 DESIGN AND ANALYSIS

2.1 Design

The proposed design change to Rib Station 33.06 is similar to the design implemented by Piper Aircraft on Models 30-597 and on. A full size tracing of the cutout to the rib taken from a PA30 was used to generate drawings. At Rib Station 33.06, the wing chord is computed to be 81.0 inches. Coordinates for the NACA 64₂A215 airfoil (from reference 2) were used to generate the detail of the wing between the front and rear spars, located at 40% and 70% chord, respectively. Setback from the exterior coordinates to the interior of the wing, accounting for skin, interior stiffening skin, and rib thickness used the data from Reference 1. Measurements were also taken from the subject aircraft.

Placement of the 5/8 x 5/8 x .063 2024-T851 angle stiffener on the rib is essentially identical to that of the -04,-05 ribs. Piper uses a 3/4 x 3/4 x .032 angle stiffener. In addition to the stiffener, a .025 doubler is added to the rib side opposite of the stiffener. The purpose of the doubler is to reduce overall stress in the rib at its minimum height location, thus minimizing the possibility of fatigue initiation at the corner. For convenience of installation, structural blind rivets are acceptable, although AD driven rivets are specified.

Detail drawings (Dwg 041288 and 041388) of the proposed modification are attached.

2.2 Analysis

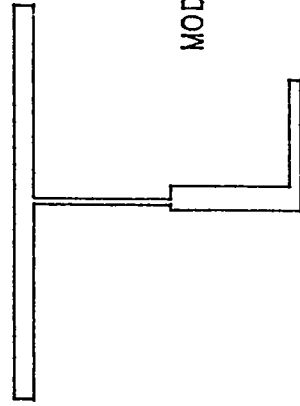
The Piper Aircraft Model 30 Twin Commanche was designed and certified before the advent of detailed finite element analysis. The state of stress on the 33.06 rib before and after the modification is unknown. To validate the proposed modification per the structural requirements of FAR Part 23, the cross sections at two critical locations along the rib chord are computed before and after the change. Strength capability is determined for axial loads (membrane stress) and bending loads (bending stress).

The structural basis of the proposed change is that the rib alteration will result in equal or greater capability to carry loads. Moment of inertias and cross-section areas for two locations are given in Figures 2.2.1 and 2.2.2. The comparison of the rib cross section properties (before and after modification) are given in Table 2.2-1, below.

Table 2.2-1 Rib Properties Comparison

	Area (Before) in ²	Area (After) in ²	% Change	Inertia (Before) in ⁴	Inertia (After) in ⁴	% Change
50.1% Chd	.297	.362	21.9%	.119	.121	1.7%
60.2% Chd	.274	.357	30.3%	.051	.120	135.3%

10T EFFECTIVE SKIN



MODIFIED RIB W/ DOUBLER & ANGLE

ORIGINAL RIB SECTION

SECTION TAKEN AT MAXIMUM CUTOUT

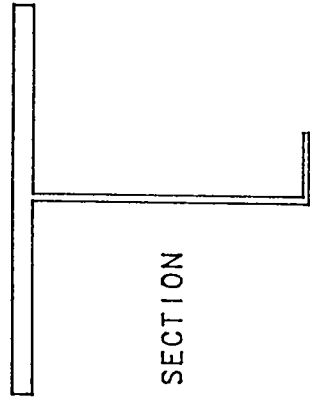
0.75 INCHES REMOVED FROM RIB

50.1% WING CHORD

AREA = 0.29651	AREA = 0.36208
GPER = 9.23600	GPER = 8.49400
LPER = 9.23600	LPER = 8.49400
XBAR = 1.41787	XBAR = 4.27565
YBAR = -0.36960	YBAR = -0.48640
IXX = 0.11847	IXX = 0.12068
IYY = 0.08216	IYY = 0.08339
IXY = -0.00379	IXY = -0.01507
RXX = 0.63209	RXX = 0.57731
RYY = 0.52639	RYY = 0.47992
IPXX = 0.11886	IPXX = 0.12601
IPYY = 0.08177	IPYY = 0.07807
ZETA = 5.89185	ZETA = 19.47572
RPXX = 0.63313	RPXX = 0.58992
RPYY = 0.52513	RPYY = 0.46433

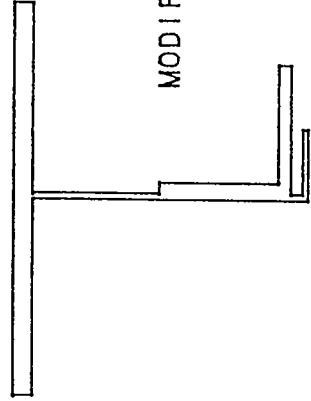
Figure 2.2.1

Cross Section Properties



ORIGINAL RIB SECTION

AREA = 0.27379
 GPER = 7.96000
 LPER = 7.96000
 XBAR = 0.01117
 YBAR = -0.24360
 IXX = 0.05060
 IYY = 0.07857
 IXY = -0.00342
 RXX = 0.42989
 RYY = 0.53568
 IPXX = 0.07898
 IPYY = 0.05019
 ZETA = -6.87824
 RPXX = 0.53709
 RPYY = 0.42813



10T EFFECTIVE SKIN

MODIFIED RIB W/ DOUBLER & ANGLE

SECTION TAKEN AT AFT EDGE OF
CUTOUT

60.2% WING CHORD

AREA = 0.35651
 GPER = 9.33600
 LPER = 9.33600
 XBAR = 3.12196
 YBAR = -0.47914
 IXX = 0.11980
 IYY = 0.08527
 IXY = -0.01958
 RXX = 0.57969
 RYY = 0.48906
 IPXX = 0.12864
 IPYY = 0.07643
 ZETA = 24.29409
 RPXX = 0.60069
 RPYY = 0.46303

For a given axial load in the rib (chordwise), the stress level is reduced by the area ratio, ie. 18.1% and 23.2% at 50.1% and 60.2% chord, respectively. For a given bending moment, the stress level is reduced by the section modulus ratio, which is the distance from the neutral axis to the extreme fiber divided by the moment of interia. For bending moments, the stress level is reduced by 46.8% and 65.1% at 50.15 and 60.2% chord, respectively. Those computations are summarized in Table 2.2-2, below.

Table 2.2-2 Rib Stress Comparison

	Axial Stress (Before) (psi)	Axial Stress (After) (psi)	% Chg	Bending Stress (Before) (psi)	Bending Stress (After) (psi)	% Chg
50.1% Chd	3.37	2.76	-18.1%	15.96	8.48	-46.8%
60.2% Chd	3.65	2.80	-23.2%	25.62	8.94	-65.1%

Unit Force (1 lb.) and Unit Bending Moment (1 in-lb.) are used in the above computations.

50.1% Chord - Original Rib:

Axial Stress = $P/A = 1/.297 = 3.37$ psi

Bending Stress = $Mc/I = (1)(2.26-.3696)/.1185 = 15.96$ psi

50.1% Chord - Modified Rib:

Axial stress = $P/A = 1/.362 = 2.76$ psi

Bending Stress = $Mc/I = (1)([2.26-.75]-.4864)/.12068 = 8.48$ psi

60.2% Chord - Original Rib:

Axial Stress = $P/A = 1/.274 = 3.65$ psi

Bending Stress = $Mc/I = (1)(1.55-.2436)/.0510 = 25.62$ psi

60.2% Chord - Modified Rib:

Axial Stress = $P/A = 1/.357 = 2.80$ psi

Bending Stress = $Mc/I = (1)(1.55-.4791)/.1198 = 8.94$ psi

3.0 INSTALLATION PROCEDURE

The following procedure is to be followed during the implementation of the rib modification and disk/caliper change.

1. Elevate aircraft using jacks per Piper procedure.
2. Remove left and right main gear wheels and left and right brake calipers from forks.
3. Plug brake lines to prevent leakage of brake fluid.
4. Install left brake caliper on right fork, inboard side.
5. Install right brake caliper on left fork, inboard side.
6. Incrementally retract landing gear until brake caliper just touches unmodified ribs.
7. Mark ribs indicating interference with brake caliper. Add .10 inches to edge of marked area to provide clearance between brake caliper.
8. Trim ribs to marked edges.
9. Fully retract landing gear, verifying .10 inch clearance.
10. Lower landing gear.
11. Using drawing 041388 and cutout in ribs as templates, fabricate .032 doublers.
12. Fit angle extrusion to follow contour of rib cutouts.
13. Drill rib, doubler and angle extrusion, clecoe as necessary.
14. Prepare ribs, doublers and angle extrusions for installation.
15. Zinc-chromate primer all surfaces.
16. Install doublers and angle extrusions using AD or structural blind rivets.
17. Install left main wheel on right fork, brake disk facing inboard. Right wheel similarly.
18. Bleed brakes per Piper procedure. Remove A/C from jacks.

4.0 INSPECTION

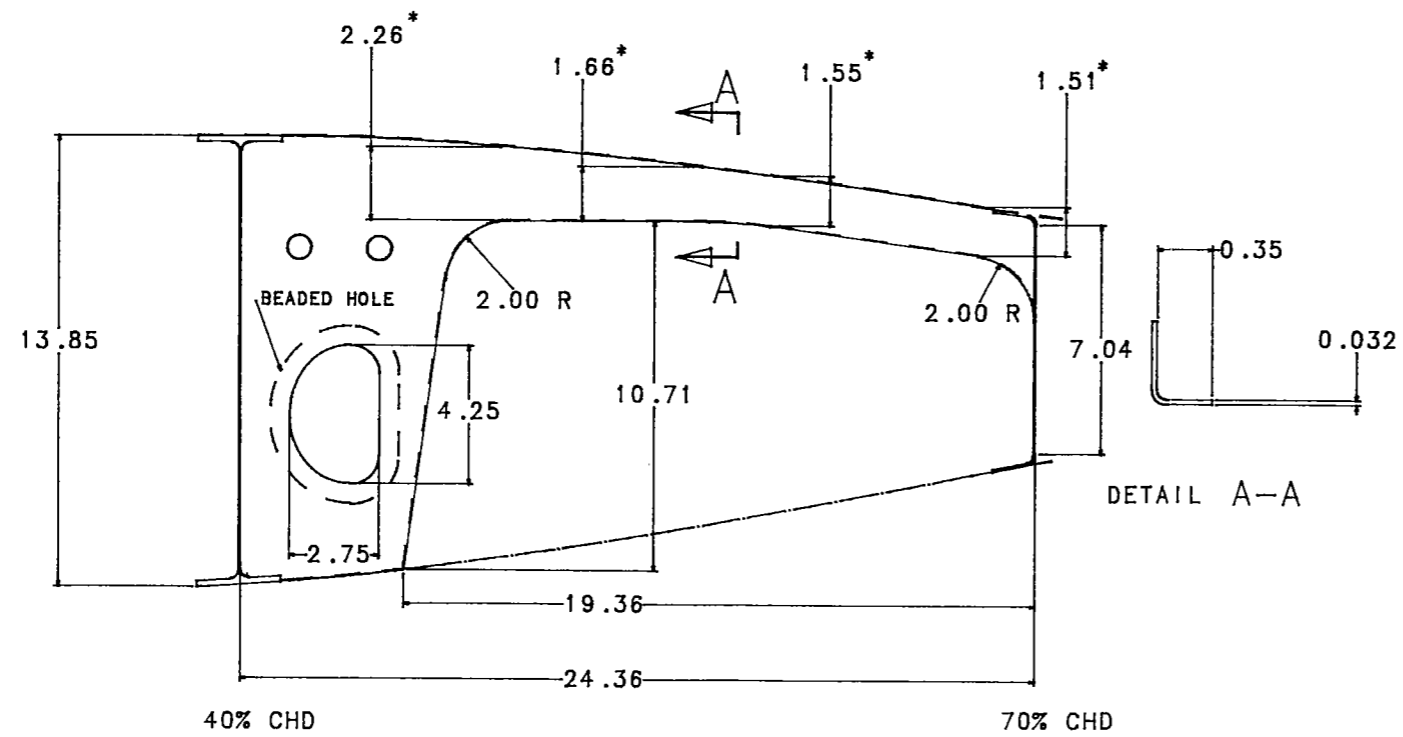
During annual inspection, inspection of rib area is as follows:

1. Verify tightness of all rivets between rib, doubler and angle extrusion.
2. Verify by visual inspection absence of cracks, corrosion between rib, doubler and angle extrusion.

5.0 REFERENCES

1. *Illustrated Parts Catalog*, Piper Aircraft Corporation, issued February 1973.

2. *Theory of Wing Sections*, I. H. Abbott and A. E. Von Doehoff, Dover Publications, 1959.

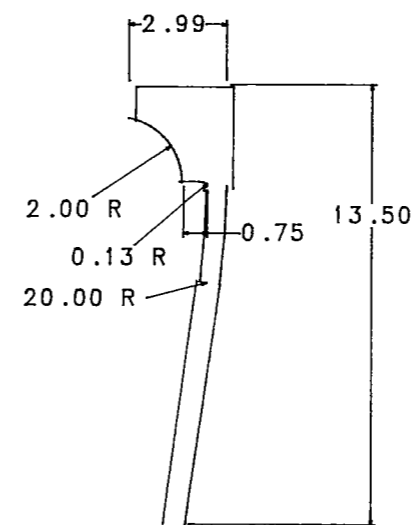
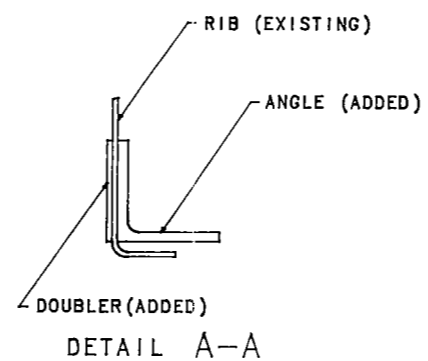
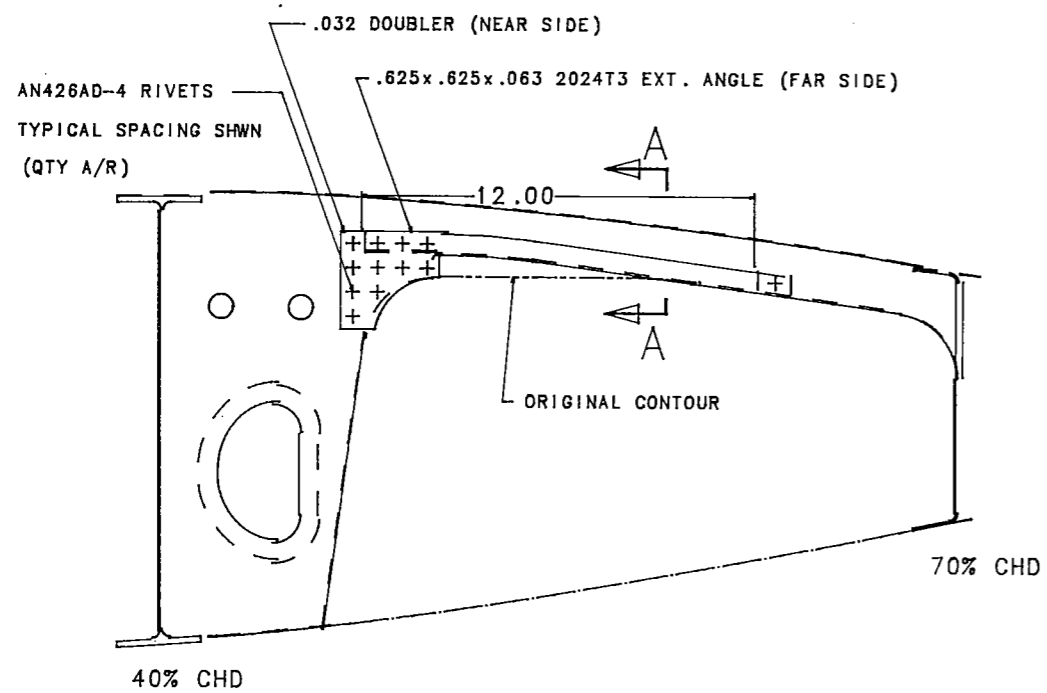


INBOARD RIB PROFILE AT STATION 33.06

NOTES:

1. DIMENSIONS NOTED WITH ASTERISK ARE .104 LESS THAN SHOWN AT RIB INTERIOR. VALUES SHOWN ARE TAKEN FROM AIRFOIL EXTERIOR.
2. NOT ALL RIB/SPAR DETAILS SHOWN FOR CLARITY.

H. D. NEUBERT & ASSOCIATES, INC., ANAHEIM, CA.		
OWN BY:	HDN	INBOARD RIB, STA.
ENGR:	HDN	33.06, PIPER PA30
STRESS:	HDN	SN292
MFG:	HDN	DRAWING NO.
SCALE:	DATE: 12 APR 88	041288
.238:1		



DOUBLER DETAIL
(ROTATED 90 DEG CW FOR CLARITY)

INBOARD RIB PROFILE AT STATION 33.06
(MODIFIED)

NOTES:

1. DIMENSIONS OF DOUBLER AND RIB CUTOUT MAY VARY SLIGHTLY DUE TO A/C TOLERANCES AND GEAR UP LIMIT SWITCH ADJUSTMENT.
2. NOT ALL RIB/SPAR DETAILS SHOWN FOR CLARITY.

H. D. NEUBERT & ASSOCIATES, INC., ANAHEIM, CA		
DWN BY:	HDN	INBOARD RIB, STA.
ENGR:	HDN	33.06, PIPER PA30
STRESS:	HDN	SN292 (MODIFIED)
MFG:	HDN	DRAWING NO.
SCALE:	DATE:	041388
.238:1	12 APR 88	