GOVERNMENT AIRCRAFT FACTORIES
Nomad

Reference No. 166

SERVICE BULLETIN

SUBJECT: INSPECTION OF STUB WING UPPER FRONT SPAR CAP FLANGES OUTBOARD OF LANDING GEAR SCREW ACTUATOR BAYS

1. Planning Information:

A. Effectivity

(1) All Nomad aircraft.

(2) Spares Affected

Nil

B. Reason

Airworthiness requirements call for the evaluation of the fatigue life of certain critical components by either theoretical analysis or laboratory testing in order to determine the safe operating lives of the components. A fatigue testing programme is being conducted on the Nomad aircraft to determine the life of the wing and associated structure. This has so far produced two laboratory test specimen stub wing failures at BL 47.6. The first failure, at 138,000 test hours, did not give rise to major concern. However, an unexpected failure of the second stub wing front spar occurred at 36,660 test hours during this extensive fatigue testing programme. This result has necessitated the introduction of in-service inspections as a precautionary measure to ensure flight safety. Selected lead time aircraft inspected have not exhibited any cracks to date. It should be noted that airworthiness regulations require fatigue test-to-failure lives to be significantly reduced when determining allowable lives for use in civil aircraft. The specified inspection is a mandatory requirement for a revised method of fatigue certification. "Safety by Inspection" will ensure that the fatigue life of this component will be optimised, and components will not be retired prematurely.

C. Description

The stub wing upper front spar cap and flanges require inspection visually, and by the eddy current method, in the area of Buttock Line 47.6 (outboard of the main landing gear screw actuator bays). If defects are revealed by the eddy current inspection, further inspection will be required to determine the extent of the defect.

D. Compliance

The applicable inspection threshold and frequency is specified in Table 1 for each aircraft type and average flight duration (Ref notes below). Aircraft with more than the stated inspection threshold airframe hours, and when the implementation of the first inspection under GAF Engineering Note N580/B is not shown in the airframe Log book: First inspection is to be implemented within 300 hours time in service, or 3 months, whichever is sooner following receipt of this bulletin.

Aircraft with less than the stated inspection threshold airframe hours: First inspection is to be implemented within 300 hours time-in-service of the specified inspection threshold airframe hours.

Apart from the special conditions applicable to the first inspection of the airframe, compliance with the inspection frequency is to be accomplished within 100 hours time-in-service of the specified inspection frequency. First inspection of the airframe at the specified threshold hours is not required when the airframe log book indicates that the inspection under GAF Engineering Note N580/B has been carried out.

AVERAGE FLIGHT DURATION (MINUTES)	N22, N22B, N24 AND N22F SERIES AIRCRAFT		N24A, N22C, N22S SERIES AIRCRAFT	
	FIRST INSPECTION THRESHOLD (HOURS)	INSPECTION FREQUENCY (HOURS)	FIRST INSPECTION THRESHOLD (HOURS)	INSPECTION FREQUENCY (HOURS)
NOT MORE THAN 55	1700	3500	1700	2650
MORE THAN 55	2700	6900	2700	5100

INSPECTION SCHEDULE FOR VARIOUS AUW NOMAD SERIES AIRCRAFT

TABLE 1

NOTES: 1. The applicable average flight duration for first inspection is to be determined by dividing the total airframe hours by the total number of landings, and converting the fractions of hours to minutes (Ref Table 8).

2. The average flight duration applicable to the determination of the inspection frequency is the number of airframe hours since the last inspection divided by the number of landings since the last inspection (Refer Table 8).

3. If the average flight duration is less than 25 minutes the first inspection threshold of 1700 hours is applicable but GAF is to be advised since the inspection frequency may need to be revised.

4. The number of inspections or the final life of the spar will be limited by the safe life of other critical areas to be advised by GAF in the future.

5. Future review of this inspection schedule may be possible in the light of the service results, future modifications and/or new technical data.

6. The method by which the inspection area is accessed is not directly applicable to the N22F floatplane or amphibian models but the method is envisaged to be similar. Currently GAF does not hold sufficient drawing data to specify in detail the removal of the floatplane fairing.

E. Approval

The inspection procedures and reworks detailed herein have been approved pursuant to Air Navigation Regulation 40 and conform with the type certification requirements.

F. Manpower

(1) Visual Inspection - 1 manhour.

(2) Non-Visual Inspection - 5 manhours.

G. Materials - Price and Availability

Refer to Para 3.

H. Tooling - Price and Availability

Test Standard P/N 1/N-02-379 available from GAF (Ref Figure 3). (Price $353.02)
Eddy Current Tester - HOCKING LOCATOR Model UH or equivalent.
NFe Hole Probe 0.196 in. dia., 500 Khz.
NFe Hole probe 0.216 in. dia., 500 Khz (Required if oversize fasteners fitted).
Test cable BNC to MICRODOT.
HUCK Fastener Installation Tool with offset adaptor or extension adaptor.
HUCK Blind Bolt Removal Kit or equivalent.

J. Weight and Balance

Not applicable

K. References

IPC - Illustrated Parts Catalogue
MM - Maintenance Manual

L. Publications Affected

IRM - Inspection Requirement Manual.

2. Accomplishment Instructions

2.1 Visual Inspection.

(1) Gain access to the interior of the main landing gear pods by disconnecting the pod forward door actuating rod at its connection to the bellcrank (Ref MM 32-10-15 Figure 1).

(2) Using a torch, visually inspect for cracks the upper forward face of the stub wing front spar cap just inboard of the inner end of the wing strut attachment pick-up fittings (Ref Figures 1 and 2).

(3) If any doubt exists, a magnifying glass, dye penetrant, or other more sensitive NDI method should be used.

(4) Aircraft exhibiting cracks on the forward face of the spar are prohibited from further flight until the spar is replaced.

2.2 Non-visual Inspection (Eddy Current Inspection)

NOTE: The eddy current inspection should be carried out only by persons holding an appropriate NDT authority.

Before commencing the inspection of the stub wing upper front spar cap flanges, the following notes on the inspection procedures are to be read.

Calibration Procedure

A test standard with similar geometric and material properties to the article to be inspected is required (Ref Para 1.H above). The test instrument should be calibrated according to the procedure stated in the applicable NDT technique (Ref Appendix 1).

Preparation for Eddy Current Inspection of Holes

Prior to performing inspection, all foreign material must be removed from the hole (Ref Para 2.2(4)). Holes which are severely damaged during service or during fastener insertion or removal may require reaming prior to eddy current inspection. Inspection cannot be reliably performed on holes through mating parts which are offset at the interfaces. Holes in mating surfaces must be re-aligned prior to eddy current inspection or re-drilled and reamed to a larger diameter which is concentric through mating parts. Holes which have excessive ovality may also give misleading results due to uncontrolled lift-off effects.

CAUTION: REF PARA 2.2(5) BEFORE OPENING ANY HOLES UP TO A LARGER DIAMETER. OPERATORS ARE ADVISED THAT THE OVERSIZE RIVETS SPECIFIED MAY NOT BE READILY AVAILABLE EX-STOCK FROM AIRFRAME HARDWARE SUPPLIERS, AND THEY SHOULD ENSURE THAT THEY HAVE ACCESS TO SUPPLIES OF OVERSIZE RIVETS BEFORE BEGINNING THE INSPECTION.

Reporting of Inspection Results

To provide sufficient data to ensure that unnecessarily conservative inspection intervals or component lives are not promulgated it is requested that the results of all inspections be reported to GAF Product Support (Attention : Fatigue Group, Design and Development) regardless of whether any cracking is found. This report should include the date of inspection, details of the total aircraft hours flown and landings, the name and employer of the inspector, and any other details pertinent to the inspection. To assist in reporting the results of inspections, the proforma shown in Figure 8 should be used for the report. All information provided will be treated as confidential. GAF are investigating fatigue life enhancement measures to improve stub wing spar lives. To enable representative testing to be done, the measurements of actual rivet hole edge distances in the stub wing spar are required. Operators are requested to supply the information on Figure 9 for their particular aircraft as soon as possible.

Please send report to:

Product Support Manager
Government Aircraft Factories
Private Bag No. 4
PO PORT MELBOURNE
VIC 3207 AUSTRALIA

ATTENTION: Design and Development
(Fatigue Group)

(1) Remove the fairings from the top LH and RH inboard side of the main landing gear pods to gain access to the six HUCK fasteners along the forward edge of the top outboard skin panel (outboard of the main landing gear screw actuator bays) (Ref IPC 53-16-01 Figure 2 item 2).

(2) Prior to removal of any fasteners the NDT inspector should inspect the fasteners for fretting. Any signs of fretting should be noted since they may indicate that micro cracks are present and/or imminent.

(3) Remove the inboard three HUCK fasteners from the forward edge of the LH and RH outboard skin panels as follows:

CAUTION: UNLESS THE AIRCRAFT FUSELAGE AND WINGS HAVE BEEN TRESTLED IT IS RECOMMENDED THAT ONLY ONE FASTENER BE REMOVED AT A TIME, AND IT BE REPLACED BEFORE THE NEXT FASTENER IS REMOVED (Refer MM 7-00-00 Maintenance Practices Para 3A for details of trestling).

NOTES: 1. It is recommended that the stub wing be protected by using a suitable guard when removing the HUCK fasteners. A guard may be made from a piece of sheet metal with holes punched out to just clear the heads of the fasteners. This will avoid damage to the skin panel during the grinding operation.

2. If a grinder is used, ensure that adequate fire precautions are taken and that the landing gear retraction mechanism is covered to prevent ingress of grinding dust etc.

3. When removing the second fastener (centre one of three fasteners to be removed) it will be necessary to deflect the fastener stem as it is driven out of the hole in order to clear one of the wing strut attachment fitting bolts.

(a) Grind away the locking ring in the head of the fastener.

(b) Punch out the pin using a 5/32 in. dia. pin punch.

(c) Using a 3/16 in. dia. drill, drill the head of the fastener to just above the surface of the skin panel.

NOTES: 1. If a HUCK Blind Bolt removal kit is available it may be used as follows: Using Micro-Limit tool, with 3/16 in. dia. Cutter, counterbore sleeve to depth .005 to .015 in. above the skin, holding the anti-rotation cap firmly against the head of the fastener.

2. If oversize HUCK fasteners were previously installed it will be necessary to open up the 3/16 in. counterbore in the head using a 7/32 in. dia. drill in order to remove the head cleanly.

CAUTION: DO NOT RUN THE DRILL THROUGH THE SKIN OR FRONT SPAR CAP FLANGE.

(d) Shear off the head of the fastener using a suitable chisel. Inspect the stem of the fastener for any burrs or projections, which are to be removed before driving out the fastener. This will avoid scratches within the hole which could reduce fatigue life.

(4) Prior to performing inspection of the hole, all foreign material must be removed from the hole. Commonly, foreign material can include sealant, lubricants, metal slivers and paint chips and can be removed using cotton swabs and a suitable hydrocarbon solvent (e.g. white spirit).

(5) Prior to NDT inspection the inspector should inspect the holes in the upper spar cap flange for the following:

(a) Size : manufacturing limits are .199 to .202 in. dia. (Oversize .215 to .218 in. dia.). If oversize fasteners have been fitted then a probe to suit the hole diameter will be required together with an appropriately sized calibration block.

(b) Damage : holes which have been severely damaged during service, fastener insertion, or removal cannot be reliably inspected and may require reaming prior to eddy current inspection.

(c) Alignment at skin/spar interface : if the hole in the skin panel is misaligned with the hole in the spar flange, eddy current inspection cannot be reliably performed and the holes must be realigned or redrilled and reamed to a larger diameter which is concentric through both parts.

CAUTION: 1. USE OF OVERSIZED FASTENERS AT THESE LOCATIONS MAY PREJUDICE FUTURE FATIGUE LIFE ENHANCEMENT MEASURES BEING DEVELOPED. IF USE OF OVERSIZED FASTENERS IS NECESSARY THEN THE SMALLEST OVERSIZE FASTENER SUITABLE SHOULD BE USED AND SHOULD NOT EXCEED 0.218 IN. DIAMETER. SUITABLE OVERSIZE FASTENERS ARE HUCK OSBP-T6-5 (.215/.218 IN. DIA. HOLE).

2. THE USE OF 3/16 IN. DIA CHERRY RIVETS (CHERRY MAX, CHERRY LOCK, OR BULB CHERRY LOCK) IS NOT RECOMMENDED IN THIS AREA SINCE THESE FASTENERS DO NOT HAVE SUFFICIENT STRENGTH FOR THIS APPLICATION. IF ANY OF THESE FASTENERS HAVE BEEN INSTALLED ALONG THE FRONT EDGE OF THE SKIN PANEL IN THIS AREA THEY SHOULD BE REMOVED AND REPLACED WITH THE OSBP-T6-5 FASTENERS.

(6) Inspect the holes for defects using the inspection technique detailed in GAF NDT TECHNIQUE N-1 (Ref Appendix 1) paying particular attention to the expected location of fatigue cracks i.e. across the hole in the chordwise direction.

(7) Following completion of the inspection of each hole, record the inspection details requested (Refer Notes at beginning of Para. 2.0) on the Inspection Record pro-forma (Ref Figure 8)

(8) If no cracks are found, replace the HUCK fasteners (P/N MS 90354S0605 or alternative HUCK P/N SBP-T6-5 or oversize fasteners if required - Ref Para 2.2(5)). If a crack is present refer to Para 2.3 for further information.

NOTE: 1. Ensure the underside of the hole through the spar is free of burrs from drilling operations otherwise difficulty may be experienced in installng the replacement rivets correctly.

2. Wet assemble rivet using pigmented jointing compound.

(9) Repeat the procedure detailed in (6) and (7) for each of the remaining two holes on the one side of the stub wing upper front spar cap and for the other three holes on the opposite side of the stub wing (Ref CAUTION note Para 2.2(3)).

(10) Refit all doors and panels removed to facilitate access to areas to be inspected. Refit landing gear drag link pivot shaft (Ref Para 2.3) if removed to facilitate inspection of spar flange inside the stub wing (Ref MM 32-30-11 Maintenance Practices Para 2K).

(11) Remove the shoring, if used, from the aircraft and wings (Ref MM 7-00-00 Maintenance Practices Para 3B).

2.3 Guidelines for Disposition

If the inspection has revealed the presence of a crack further investigation may be necessary to determine the extent of the crack.

(1) If a crack is detected on the aft side of the hole only, the aircraft may continue in service with the inspection frequency unchanged.

(2) If a crack is found originating from the forward side of the hole further inspections will be necessary to determine the extent of the crack.

CAUTION: THESE SHOULD BE UNDERTAKEN BY A FULLY QUALIFIED NDT INSPECTOR ACCEPTABLE TO THE AIRWORTHINESS AUTHORITY RESPONSIBLE FOR THE AIRCRAFT AND ADVICE SOUGHT FROM GAF.

NOTE: It is suggested the extent of the crack should be determined by inspecting the spar flange inside the stub wing. This will require removal of the landing gear drag link pivot shaft (Ref MM 32-30-11 Maintenance Practices Para 2J). Eddy current inspection of the spar cap flange can be undertaken with a right-angled shielded probe attached to a suitable extension handle. Calibration of the detector should be carried out using a calibration block with a 1.0 mm deep slit, manufactured from aluminium alloy 2024-T851.

(3) Aircraft may be returned to service with a crack from the forward side of the hole, provided that the crack does not extend more than halfway into the fillet radius at the intersection of the spar flange and the spar cap (Ref Figure 7). In this case more frequent inspections will be necessary, and GAF must therefore be advised in order that a revised inspection interval may be established.

3. Material Information

The only material needed is that required for the local manufacture of the calibration block (Ref Figure 3) for the calibration of the Eddy Current Flaw Detector Probe, plus 6-off HUCK fasteners P/N MS90354S0605 (HUCK P/N SBP-T6-5) or if oversize fasteners are required use HUCK P/N OSBP-T6-5.

NOTE: The oversize rivets may not be readily available ex-stock from airframe hardware suppliers so operators should ensure that they have access to supplies of oversize rivets before beginning the inspection.

4. Recording Action

Recording compliance with Service Bulletin NMD-53-6 in the airframe log book.

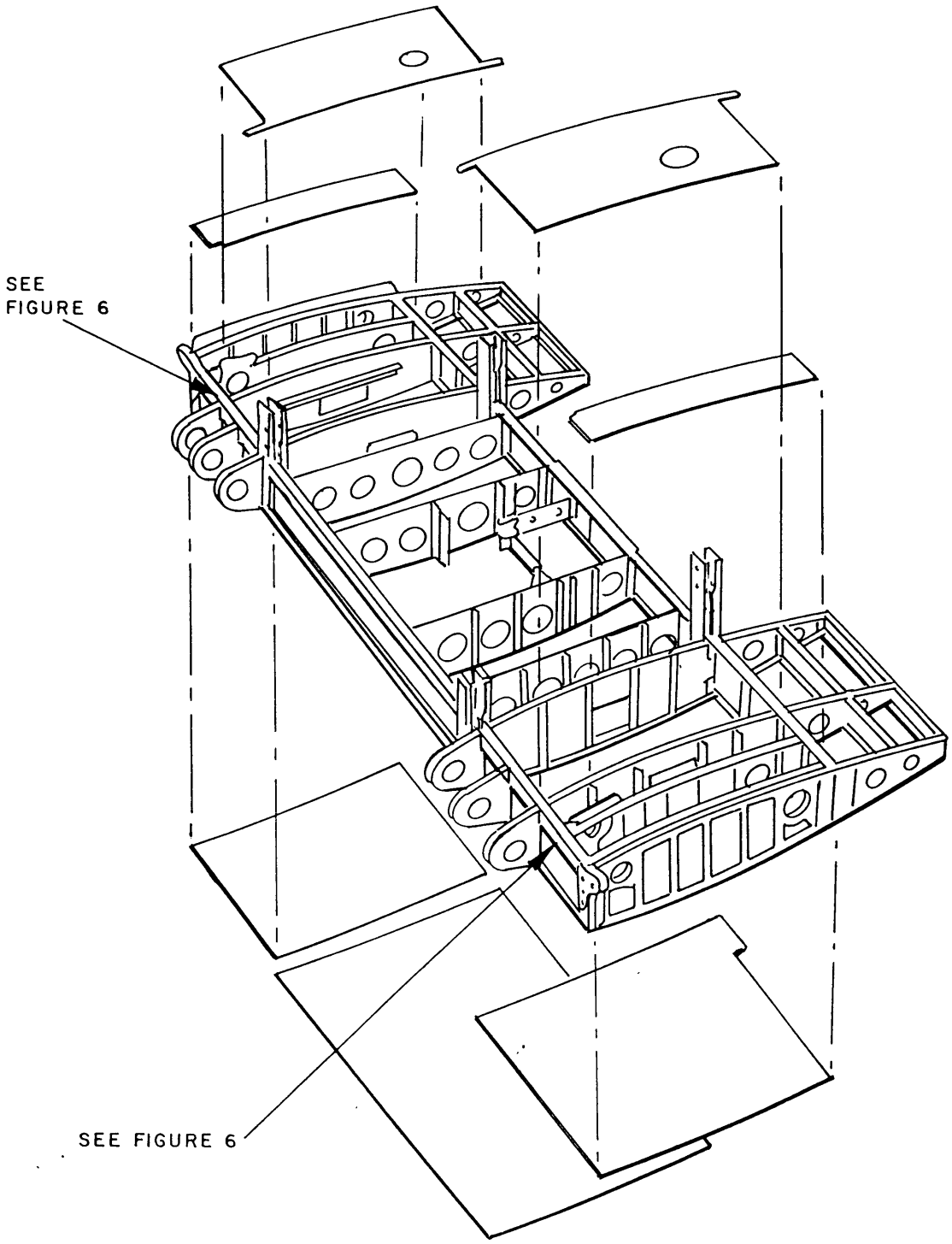


FIGURE 1 STUB-WING INSPECTION LOCATIONS

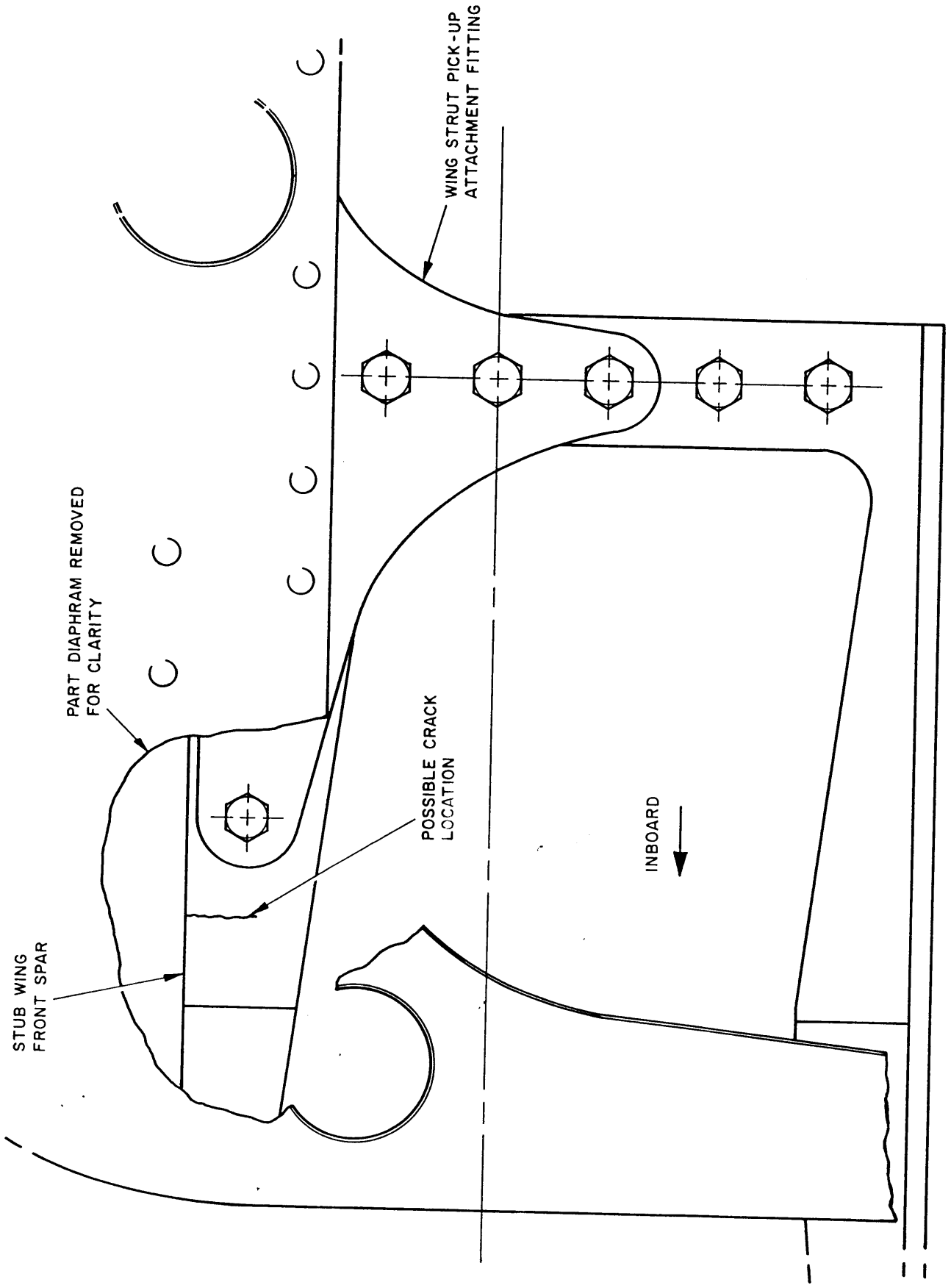
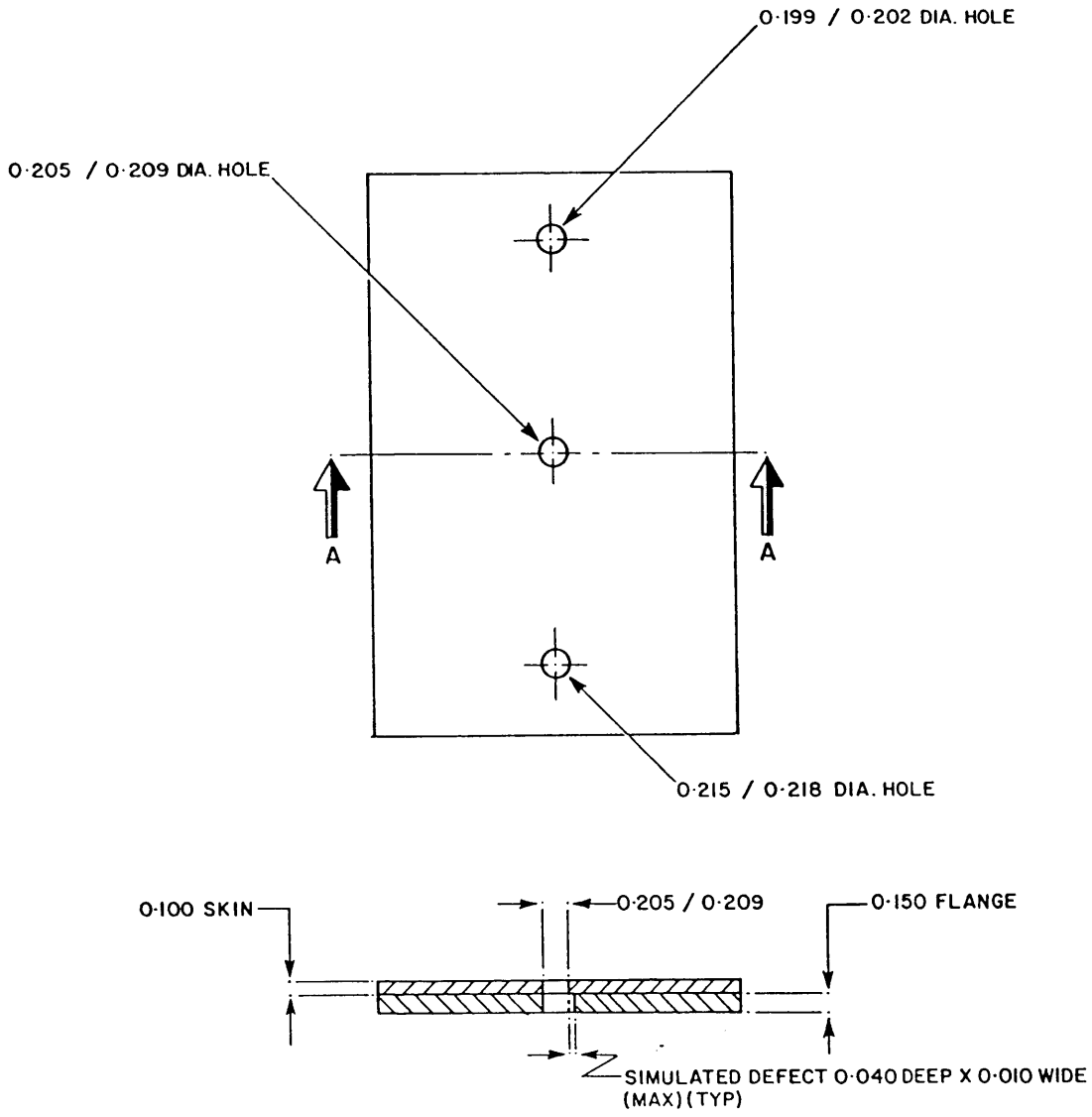


FIGURE 2 VIEW LOOKING AFT FROM INSIDE LH POD



SECTION A—A

MATERIAL - SKIN QQ-A-250/5 T3

- FLANGE QQ-A-250/4 T851
ALT. QQ-A-225/6 T851

ALL DIMENSIONS ARE GIVEN IN INCHES

FIGURE 3 TEST STANDARD 1/N-02-379

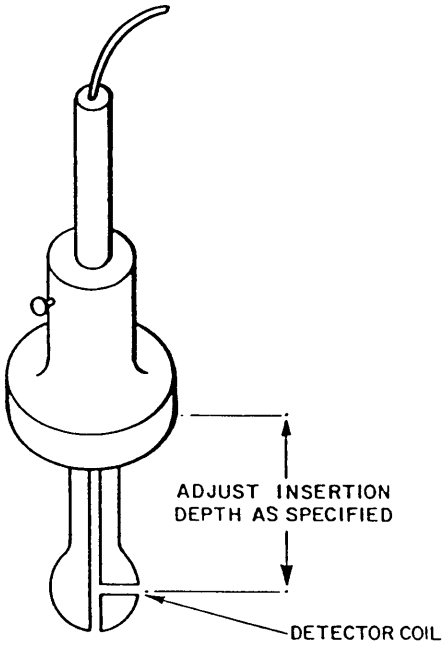
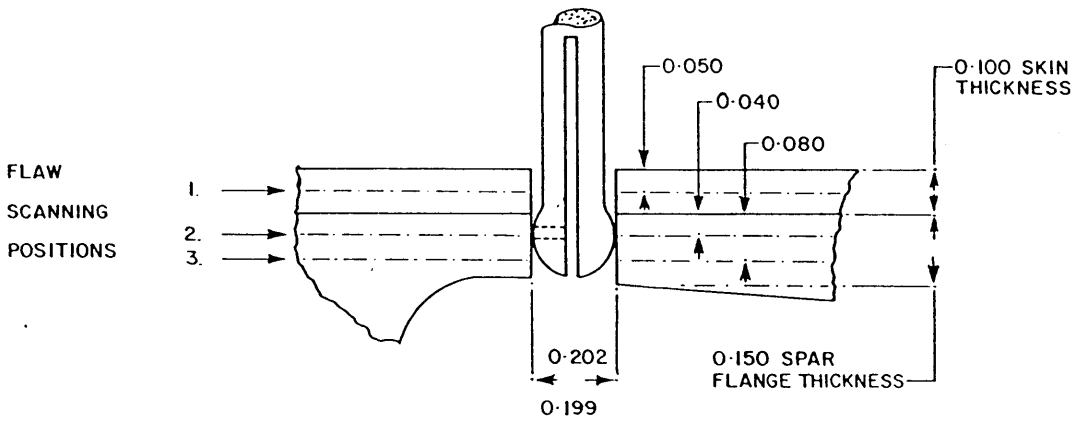
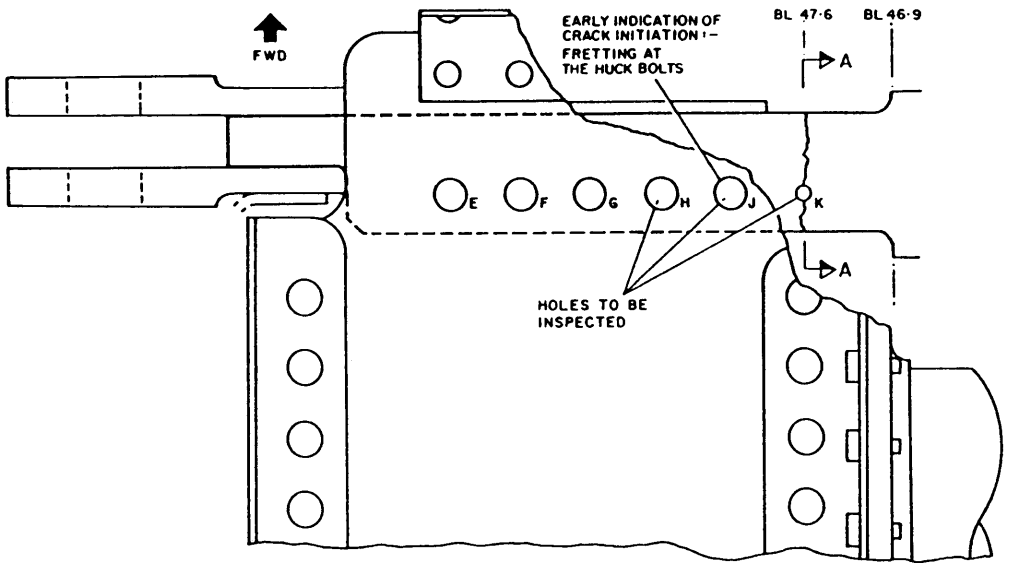


FIGURE 4 EDDY CURRENT PROBE

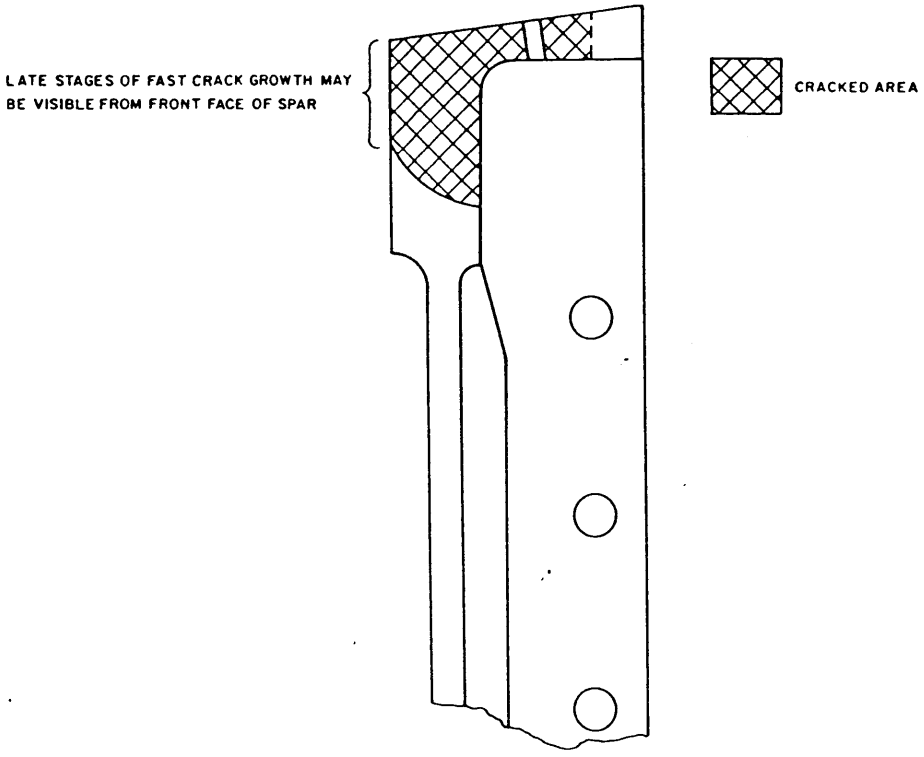


ALL DIMENSIONS ARE GIVEN IN INCHES

FIGURE 5 EDDY CURRENT INSPECTION OF SPAR CAP FLANGE

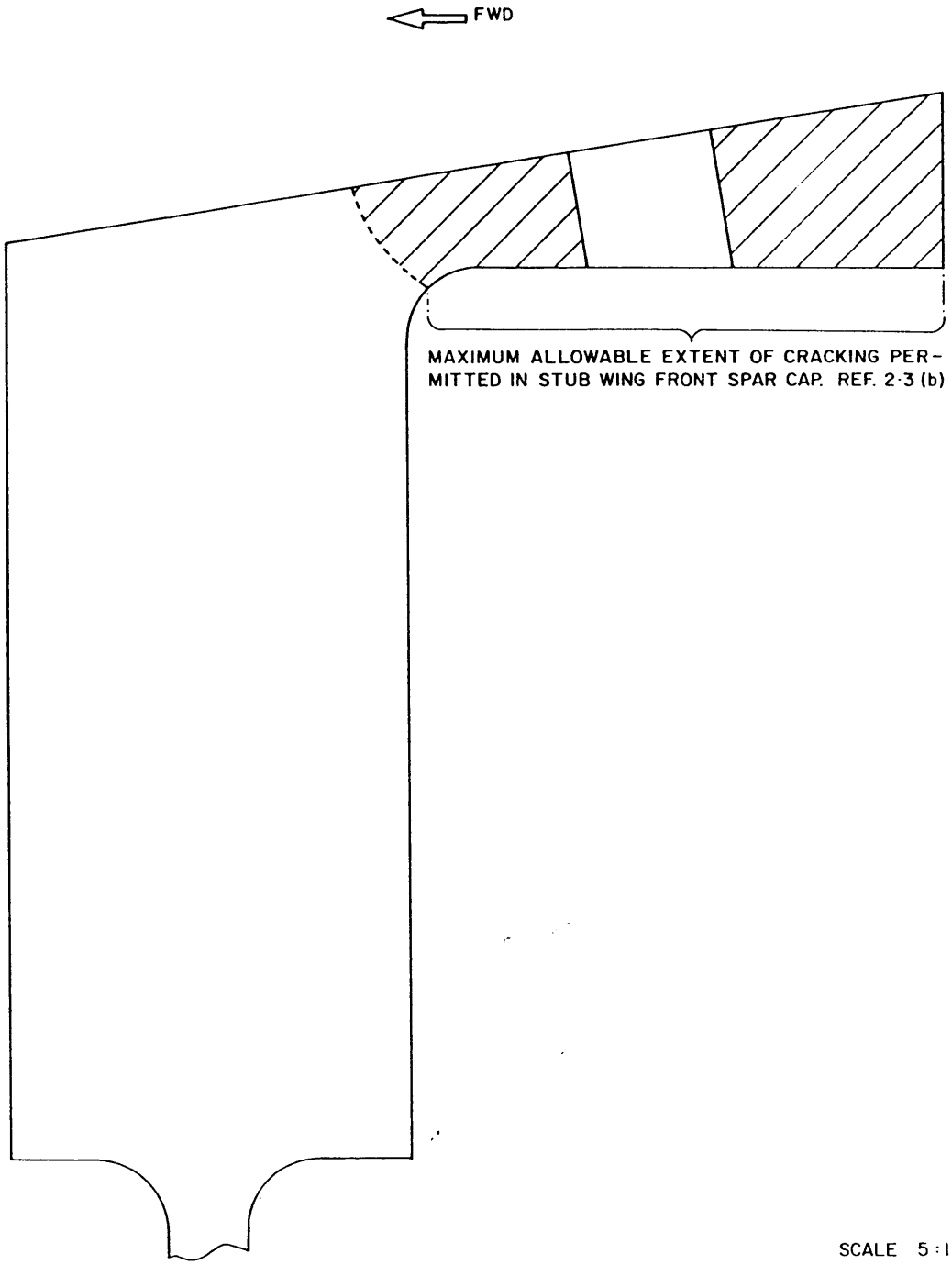


VIEW LOOKING DOWN ON L.H.S.



SECTION A–A

FIGURE 6 STUB WING FRONT SPAR UPPER CAP



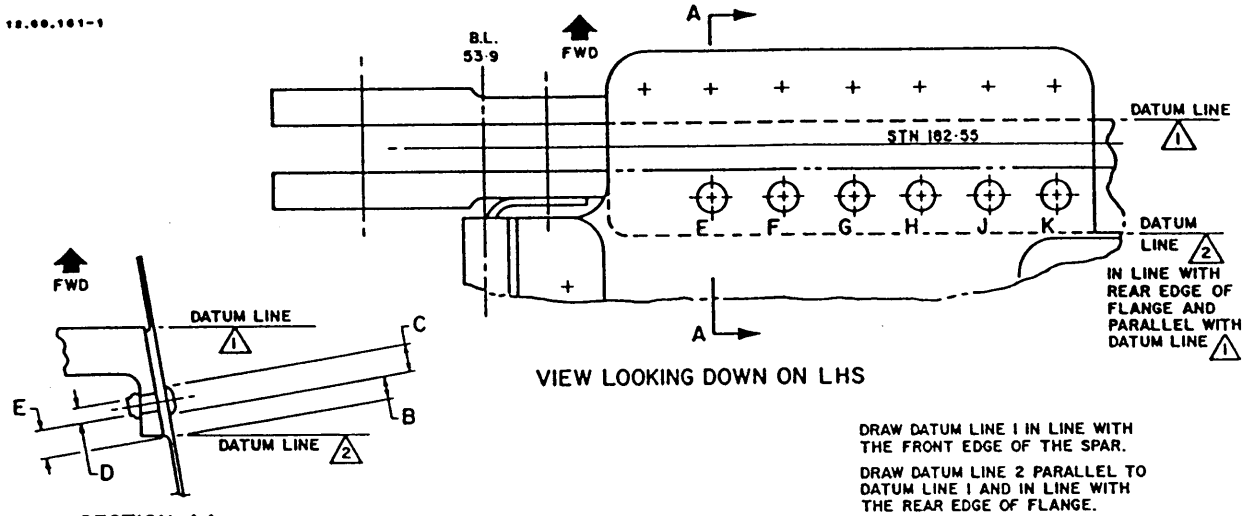
NOTE : THE CRITICAL CRACK LENGTH IS GREATER THAN THE MAXIMUM ALLOWABLE CRACK SIZE INDICATED ABOVE.

FIGURE 7 MAXIMUM ALLOWABLE EXTENT OF CRACKING PERMITTED IN SPAR CAP

DATE OF INSPECTION: A/C TYPE
A/C LINE SEQUENCE NO. STUB WING S/N
TOTAL AIRFRAME HOURS: [HT]
AIRFRAME HOURS SINCE LAST INSPECTION: [HI]
TOTAL LANDINGS: [LT]
LANDINGS SINCE LAST INSPECTION:[LI]
AVERAGE FLIGHT DURATION (MINUTES) $[\frac{HT}{LT}]$ x 60 =
AVERAGE FLIGHT DURATION SINCE LAST INSPECTION (MINUTES) $[\frac{HI}{LI}]$ x 60 =

INSPECTION RECORD						
FEATURE	LEFT HAND SIDE			RIGHT HAND SIDE		
	HOLE H	HOLE J	HOLE K	HOLE H	HOLE J	HOLE K
Fretting, looseness, etc.						
Rivet type removed						
Hole condition : - skin						
: - spar						
Hole dia in skin: - chordwise						
: - spanwise						
Hole dia in spar: - chordwise						
: - spanwise						
Misalignment						
Oversize necessary						
Dia. to clean up						
Final dia						
Replacement Rivet Type						
Eddy current results O.K./cracked Crack location						
Sensitivity						
Meter reading						
Eddy Current Detector Maker :			Model :			
Inspector :		: Organisation:				
Remarks						

RIVET HOLE INSPECTIONS
FIGURE 8



DRAW DATUM LINE 1 IN LINE WITH THE FRONT EDGE OF THE SPAR.

DRAW DATUM LINE 2 PARALLEL TO DATUM LINE 1 AND IN LINE WITH THE REAR EDGE OF FLANGE.

USE DATUM LINE 2 TO OBTAIN THE FOLLOWING MEASUREMENTS.

A/C LINE SEQUENCE No. TYPE HRS

STUB WING S/N DATE LANDINGS

	LOCATION	E	F	G	H	J	K
LH	DIMENSION 'B'						
	DIAMETER 'C' (HEAD DIA.)						
	DIAMETER 'D' (HOLE DIA.) *						
	DIMENSION 'E' *						
RH	DIMENSION 'B'						
	DIAMETER 'C' (HEAD DIA.)						
	DIAMETER 'D' (HOLE DIA.) *						
	DIMENSION 'E' *						

* IF RIVET IS REMOVED MEASURE DIMENSION 'E' FROM DATUM TO EDGE OF HOLE AND MEASURE HOLE DIAMETER (HOLES H,J AND K).

Rivet Hole Position Measurement

Figure 9

APPENDIX 1

GAF NDT Number N-1

NDT TECHNIQUE

A. Subject: Nomad Stub Wing Front Spar - BL 47.6

B. References: S.B. NMD-53-6

C. Equipment: HOCKING LOCATOR Model UH (or similar)
NFe Hole Probe 0.196 in. dia. 500 KHz
Test Standard GAF P/N 1/N-02-379 (Ref. Figure 3)
Test cable BNC to MICRODOT.

D. Calibration/Set Up:

Connect probe to instrument
Set material switch to - Al. Mg
Set Gain to Nominal - 100
Alarm - Off
Operating mode - Normal
Frequency - 500 KHz
Alarm level - 100
Turn Main Switch to "Batt Test"
Check meter reading within the green band - if not charge Battery
Turn Main Switch to - ON.

Place probe in 0.199 - 0.202 in. dia. hole in Test Standard at position 2. Ensure that the sensing coil is not pointing at the calibration slot.

NOTE: If holes in stub wing are oversize then a corresponding sized hole in test standard should be used.

Press the "Train" Button and release. The lower indicator will light.

Press the probe away from the hole surface to create "lift off" until the top indicator lights and then relax the probe so that the coil sensor is again in contact with the hole wall.

On completion of successful "training" both indicator lights will go out.

"Lift Off" calibration is now complete.

Press "Zero" button and then turn the Zero trim until the meter reads "0".

Scan the probe slowly around the hole at position 2 - see Figure 5.

Note the magnitude of the indication from the 1.0 mm slot.

Adjust the "Sensitivity" control so that the indication from the 1.0 mm slot is at 100% Full Scale Deflection (FSD).

Recheck zero position.

Calibration is now complete.

E. Preparation:

Ensure that the hole to be inspected is free from dirt/grease/loose paint/corrosion products etc. and that the hole is not damaged, scored, stepped or otherwise affected such that it cannot be reliably inspected.

F. Inspection:

Scan each of the 6 holes at positions 1,2, & 3 for at least 2 complete rotations and re-zero the probe at each position - Ref Figure 5.

Monitor the meter for any variations and zero drift.

G. Disposition:

A sharp upscale meter deflection in excess of 20% FSD is reason for further investigation. Indications from cracks are characteristically abrupt upscale meter deflections.

Note the magnitude and direction of any indication. Also its depth in the hole i.e. on Scans 1,2 or 3 or combinations of scans.