WINGS – STRUT – UPPER END FITTING (PN 1/N–20–643) – INSPECTION, REPLACEMENT AND BOLT REPLACEMENT (MOD N654A AND N654B)

1. PLANNING INFORMATION

A. Effectivity

(1) Aircraft affected

(a) **N22 Series** line sequence numbers 1 to 9, 11 to 29, 31, 33, 35, 37, 39 to 41, 43, 45, 47 to 59, 61, 63, 65 to 70, 82 to 88, 90 to 95, 97, 100, 102 to 114, 116, 118, 125,126, 131 to 134, 137, 138, 141, 143 to 170.

(b) **N24 Series** line sequence numbers 10, 30, 32, 34, 36, 38, 42, 44, 46, 60, 62, 64, 71 to 81, 89, 96, 98, 99, 101, 115, 117, 119 to 124, 127 to 130, 135, 136, 139, 140, 142.

(2) Spares affected

None.

B. Reason

Ongoing Nomad component fatigue tests have generated a test piece failure which initiated from attachment holes of the Strut Upper End Fitting and ultimately led to the complete failure of the end fitting.

Revision 1

Repeat interval data for inspection is include at this revision and threshold compliance times are changed to match AD/GAF N22/70.

Revision 2

The compliance requirements are amended by revising the initial inspection periods and including incorporation of Mod N654A and N654B using the line reamer shown in Figure 1.

A requirement to line ream washers when the oversize bolts are fitted is included.

A procedure is included for the field replacement of the Strut Upper End Fittings.

The accomplishment instructions of SB ANMD-57-10 Rev 2 are now incorporated in this bulletin.

NOTE

SB NMD 57-10 Rev 2 is hereby withdrawn from the list of current publications.

C. Description

(1) The attachment holes of the Wing Strut Upper End Fitting are inspected for signs of cracking and/or damage. This is to be achieved by visual and eddy current inspections of the bolt holes after each bolt has been removed in turn.

Page No	1	2	3	4	5	6	7	8	9	10
Rev No	2	2	2	2	2	2	2	2	2	2

(2) The Wing Strut Upper End Fitting is then modified to fit oversized bolts.

(3) If necessary, a replacement Wing Strut Upper End Fitting is fitted using oversized bolts:

(4) Step 1 – Bolt Removal.
Step 2 – Inspection.
Step 3 – Bolt Replacement.
Step 4 – Strut Upper End Fitting Replacement (if necessary).

(5) The strut as originally manufactured had a first inspection threshold as in Table 1. Thereafter, repeat inspections are as per Table 3. Bolt replacement only (Mod N654, as per Service Bulletin NMD-57-10) has no effect on this.

(6) Once all 6 holes have been line-reamed, the threshold is increased to the TTIS as in Table 2. Note that this time is still measured from original manufacture; the strut is still not rejuvenated. Subsequent repeat inspections are still as per Table 3.

(7) If the Wing Strut Upper End Fitting is replaced, the threshold is as per Table 4, measured from the time of replacement. Thus the strut is in effect rejuvenated. Subsequent repeat inspections are as per Table 3.

D. **Compliance**

(1) The compliance requirements of this Service Bulletin are MANDATORY.

(2) Initial Inspection and Modification for aircraft which do NOT have ALL 6 holes securing the Strut Upper End Fitting line reamed in accordance with this Service Bulletin, or Service Bulletin 57-10:

(a) Initial Inspection is to be carried out prior to reaching the TTIS as per Table 1.

(b) If aircraft hours(TTIS) exceed those shown in Table 1, inspect before the the next flight, unless already inspected within the interval defined by Table 3, in which case inspection and modification can await the next inspection defined by Table 3.

Aircraft Type	Average Flight Duration	
	Less than 45 minutes	45 minutes or more
N24, N24A, N22S, N22C, N22F	3600	5000
N22B	5400	7200

Table 1 TTIS — Strut Upper End Fitting Initial Inspection

(3) Next Inspection after repair in accordance with 1.D.(2) above, AND for aircraft which have ALL 6 holes line reamed:

(a) Next Inspection at the total aircraft hours (TTIS) specified in Table 2.

Aircraft Type	Average Flight Duration	
	Less than 45 minutes	45 minutes or more
N24, N24A, N22S, N22C, N22F	7200	10000
N22B	10800	14400

Table 2 TTIS — Strut Upper End Fitting Inspection After Repair

NOTE

- All holes in the line of 6 securing the Strut Upper End Fitting have to be line reamed using ASTA defined line reamers (refer Para H. and Fig 1).
- For aircraft which have 3/8 in bolts, contact Boeing Aircraft Systems- ASTA, Nomad Support before any further enlargement of holes.

(b) Further repeat Inspections, following those of Table 2 should be made at the intervals (TIS) of Table 3.

Aircraft Type	Average Flight Duration	
	Less than 45 minutes	45 minutes or more
N24, N24A, N22S, N22C, N22F	900	1200
N22B	1200	1800

Table 3 TIS — Strut Upper End Fitting Repeat Inspection Following Table 2 Inspection

E. **Approval**

(1) The requirement detailed herein has been approved by a person authorised under Civil Aviation Regulation 35 and conforms with the type certification requirements.

(2) The Australian Civil Aviation Safety Authority has been requested to further amend Airworthiness Directive AD/GAF-N22/70 Amdt 1 to reflect the later fatigue test results.

(3) Until such further amendment of the Airworthiness Directive has been issued, Australian aircraft owners may apply to the Australian Civil Aviation Safety Authority for an exclusion from AD/GAF-N22/70 Amdt 1 citing Service Bulletin ANMD-57-12 Rev 2 as part of their technical justification.

(4) Overseas aircraft owners who may be subject to an airworthiness directive issued by their national airworthiness authority should approach that authority.

F. **Manpower**

(1) Inspection - 12 manhours.

(2) Replacement - 12 manhours (2 people - 6 hours each) - Bolts only.

(3) Replacement - 12 manhours - Strut Upper End Fitting and bolts.

G. **Materials, Price and Availability**

Contact Boeing Aircraft Systems- ASTA, Nomad Support for price and availability of parts.

H. **Tooling, Price and Availability**

(1) Special line reamers PN 1/N–88–267 (1st oversize) and PN 2/N–88–267 (2nd oversize) are available for purchase or lease from Boeing Aircraft Systems - ASTA, Nomad Support. Price available on application.

(2) Alternatively, the special line reamers may be locally manufactured as per Figure 1.

I. **Weight and Balance**

Not applicable.

J. **References**

Maintenance Manual Chap 20-30-00, 57-40-00

Inspection Requirements Manual – Part 4

Illustrated Parts Catalogue Chap 57-40-01

K. **Publications Affected**

Inspection Requirements Manual

Maintenance Manual

Illustrated Parts Catalogue

2. **ACCOMPLISHMENT INSTRUCTIONS**

A. **Step 1 - Strut to Upper Strut Fitting Bolt Removal** (Ref IRM Part 4 Fig 26)

(1) Remove the wing strut (Ref MM Chap 57-40-00).

CAUTION

TO AVOID DISPLACING THE SHIMS FITTED BETWEEN THE UPPER END FITTING AND THE STRUT, REMOVE ONLY ONE BOLT AT A TIME AND REPLACE IT BEFORE REMOVING THE NEXT BOLT.

(2) Remove and replace each bolt before the next bolt is removed.

NOTE

Extra care is to be taken on the upper-most hole as it is considered the most fatigue critical hole.

CAUTION

ENSURE THAT, DURING THE GRINDING PROCESS, NO SPURS, BURRS OR SHARP EDGES REMAIN WHICH COULD SCRATCH THE BOLT HOLE INNER SURFACE LEAVING A POTENTIAL CRACK INITIATION SITE.

(3) Remove the bolt. If it is peened (the basic Pre-Mod N654 configuration) remove by grinding off the end, and then discard the bolt.

B. **Step 2 – Inspection**

(1) Visual Inspection

After removal of the bolt, visually inspect each attachment hole for scoring, ovality, fretting and corrosion and check its dimensions (Ref Step 3, para 2.C.(3)).

(2) Eddy Current Inspection

NOTE

Only personnel qualified to operate eddy current test equipment and who hold approval to carry out the tests specified are to perform eddy current inspections. The operator requires level 2 or level 3 MIL-STD-410D or AS3669 approval or is to hold a current NDT approval from the appropriate airworthiness authority specifically approving him/her to perform the required inspection.

(a) Equipment

1 Suitable Eddy Current machine operating at 100 kHz to 500 kHz.

2 NFe 5/16 in split ball bolt hole type probe of suitable size.

3 Test cable BNC to Microdot.

4 Aluminium Test Standard ASTA PN 1/N-02-384 available from Boeing Aircraft Systems - ASTA, Nomad Support (POA) or locally manufactured (Ref IRM Part 4 Fig 27).

(b) Preparation

For example:

1 Connect a 200 kHz to 500 kHz shielded probe and select 200 kHz to 500 kHz operating frequency.

2 Select “Al/Mg”.

3 Train the probe on the test block.

4 Set “Zero”.

5 Set “sensitivity” to give a deflection of 60% from the hole conforming with the wing strut upper attachment bolt hole.

6 Ensure the deflection obtained exceeds 100%.

7 Set the alarm to 60%.

(c) Inspection

1 In turn, and commencing with the upper-most hole, insert and rotate the probe in each hole. Ensure each hole is inspected through 360° throughout its entire length.

2 Cracks will be indicated by a sharp upscale needle movement and the alarm signal.

3 Perform the eddy current inspection numerous times on each hole to ensure that conclusive results are obtained.

NOTE

Ensure needle does not move below “Zero”. Re-zero the instrument whenever necessary.

(3) Action On Completion of Inspection

(a) If a crack was detected, the Strut Upper End Fitting must be replaced, go to Step 4.

(b) If the hole had previously been line reamed and is undamaged, re-install the original bolt. Proceed to the next bolt (until all 6 have been inspected).

(c) If the hole in the strut itself is oval or damaged, and it is estimated that the 2nd oversize line reamer may not repair it, contact Boeing Aircraft Systems – ASTA, Nomad Support.

(d) If only the hole in the the Strut Upper End Fitting is damaged and will not clean up with the 2nd oversize line reamer, the the Strut Upper End Fitting must be replaced, go to Step 4.

(e) If none of the above apply, the hole must be line reamed and the bolt replaced. Go to Step 3.

WARNING

LOCALLY DEVISED REPAIR SCHEMES ARE STRICTLY PROHIBITED. THIS SERVICE BULLETIN CONTAINS THE REPAIR SCHEME APPROVED BY BOEING AIRCRAFT SYSTEMS– ASTA, NOMAD SUPPORT.

C. **Step 3 Bolt Replacement**

(1) After the visual and eddy current inspections, use Post-Mod N654 bolts to secure the Strut Upper End Fittings.

NOTE

- Pre-Mod N260 struts use Mod N654A bolts.
- Post-Mod N260 struts use Mod N654B bolts.
- Post-Mod N260 bolts (Mod N654B) may be used in place of Pre-Mod N260 bolts (Mod N654A) on Pre-Mod N260 struts provided adequate extra shims/washers (approximately 1/8 in thickness required) placed under the nut are used to take up extra bolt shank length.

CAUTION

TO AVOID DISPLACING THE SHIMS FITTED BETWEEN THE UPPER END FITTING AND THE STRUT, REMOVE ONLY ONE BOLT AT A TIME AND REPLACE IT BEFORE REMOVING THE NEXT BOLT.

(2) During the fatigue critical inspection (Ref IRM Part 4) or either the initial or subsequent inspection/modification (as per Sub para 1 D. (3)), remove the existing bolts, nuts and washers one at a time, and replace with new bolts, washers, nuts and split pins according to para 3.A. below.

NOTE

During subsequent inspections, the Post-Mod N654 bolts need only be replaced if bolt and/or hole condition warrants bolt replacement.

(3) The hole diameters for the replacement bolts are:

(a) 1st oversize 0.3281/0.3290 (H8)

(b) 2nd oversize 0.3437/0.3446 (H8)

NOTE

- No further oversize is permitted.
- Determine the hole diameter using a 5/16 in ball gauge and 1.00 in micrometer, which reads 0.0001 in increments.

(4) Carefully line ream the bolt holes, using a suitable lubricant, with special line reamer PN 1/N-88-267 for 1st oversize bolts and special line reamer PN 2/N-88-267 for 2nd oversize bolts (Ref Figure 1).

NOTE

Any combination of sizes (within all other noted limits) is permitted to preserve extrusion at minimum hole size of acceptable quality.

(5) When the oversize bolts are installed, line ream the associated washers to suit the new bolt diameter.

NOTE

- Use a suitable lubricant when reaming. Remove the line reamer every 4 to 6 turns to remove cuttings from the line reamer flutes and to apply lubricant.
- If inserting the special line reamer (1/N-88-267 or 2/N-88-267) into the entrance of the far side hole is difficult due to hole misalignment, correct the hole misalignment by using a normal hand reamer, of the same nominal size as that of the existing hole.

(6) Wet assemble the bolts (Ref MM Chapter 20-30-00 for materials to be used for wet assembly of bolts) and torque tighten to 30 - 35 lb in to allow the cotter pin to be installed.

(7) Install the cotter pin.

(8) Install the wing strut (Ref MM 57-40-00).

(9) When the inspection is complete and the new bolts are installed, remove the existing identification plate and install new identification plate PN SD340 then re-identify the Wing Strut Assembly with the appropriate Part Number as follows:

(a) 1/N-20-1027 (Pre-Mod N260)

(b) 1/N-20-1028 (Post-Mod N260)

D. **Step 4 - Strut Upper End Fitting Replacement**

Strut Upper End Fittings can be replaced in the field using the following procedure:

NOTE

Strut Upper End Fittings shall be replaced for the following reasons:

- A crack or defect is found during inspection
- The hole quality is such as to require replacement. Hole enlargement to clean up holes is permitted, but strict limits exist on maximum hole size.

This replacement procedure can only be carried out on those struts having a maximum hole size of 0.3290 in (1st oversize). If any hole is larger, contact Boeing Aircraft Systems - ASTA, Nomad Support for advice.

(1) Replacement Procedure.

During Strut Upper End Fitting replacement, the new upper end fitting is attached with bolts through line reamed holes of minimum diameter commensurate with acceptable quality (i.e. ALL HOLES LINE REAMED USING ASTA LINE REAMERS).

(a) Replacement Strut Upper End Fittings are supplied with 5/16 in dia mounting holes pre-drilled.

(b) On receipt, the operator should line ream (using ASTA line reamers) the holes in the Strut Upper End Fitting to the diameter of the existing holes in the extrusions to which it is to be attached (maximum hole size of 0.3290 in 1st oversize).

NOTE

At this stage do not ream larger than 1st oversize (0.3290 in).

(c) Offer up the Strut Upper End Fitting (with shims) and secure it using 2 bolts of suitable size.

(d) Line ream the other 4 holes up to the next oversize (using ASTA line reamers), and fit the correct size bolts.

(e) Remove the bolts used in item (c) to locate the fitting, and line ream those holes as per item (d).

(2) Inspection Requirements For Replaced Strut Upper End Fitting.

(a) A replacement Strut Upper End Fitting attached as detailed in this Service Bulletin requires its first inspection at the interval (TIS after replacement) specified in Table 4.

Aircraft Type	Average Flight Duration	
	Less than 45 minutes	45 minutes or more
N24, N24A, N22S, N22C, N22F	7200	10000
N22B	10800	14400

Table 4 TIS — Replacement Strut Upper End Fitting First Inspection

(b) Subsequent inspections at intervals as per Table 3.

3. **MATERIALS INFORMATION**

A. **Parts Required per Aircraft**

The following parts are required for each aircraft and are available from Boeing Aircraft Systems – ASTA, Nomad Support.

New Part No	Qty	Description	Old Part No	Remarks
Pre-Mod N260 Aircraft				
NAS6205-44DX	A/R	BOLT, Close Tolerance, 1st O/size	NAS1105-44 NAS6205-44D	Scrap Scrap
NAS6205-44DY	A/R	BOLT, Close Tolerance, 2nd O/size		
Post-Mod N260 Aircraft				
NAS6205-46DX	A/R	BOLT, Close Tolerance, 1st O/size	NAS1105-46 NAS6205-46D	Scrap Scrap
NAS6205-46DY	A/R	BOLT, Close Tolerance, 2nd O/size		
Common Parts				
MS20002C5	12	WASHER, CSK		
AN960KD516	A/R	WASHER, Flat	AN960-516	Scrap
AN960KD516L	A/R	WASHER, Flat, Thin	AN960-516L	Scrap
MS17826-5	12	NUT, Self-locking, Castellated		
MS24665-136	12	PIN, Cotter (Split)		
SD340	2	Identification Plate	SD340	

NOTE

Post-Mod N260 bolts (Mod N654B) may be used in place of Pre-Mod N260 bolts (Mod N654A) on Pre-Mod N260 struts provided adequate extra shim/washers (approx. 1/8 in thickness required) placed under the nut are used to take up extra bolt shank length.

4. **SPECIAL TOOLS AND EQUIPMENT**

Refer to this Service Bulletin 1.B.(2)(a) – Eddy Current Inspection Equipment.

Special Line Reamer PN-1/N-88-267 (Ref Fig 1).

Special Line Reamer PN-2/N-88-267 (Ref Fig 1).

5. **RECORDING ACTION**

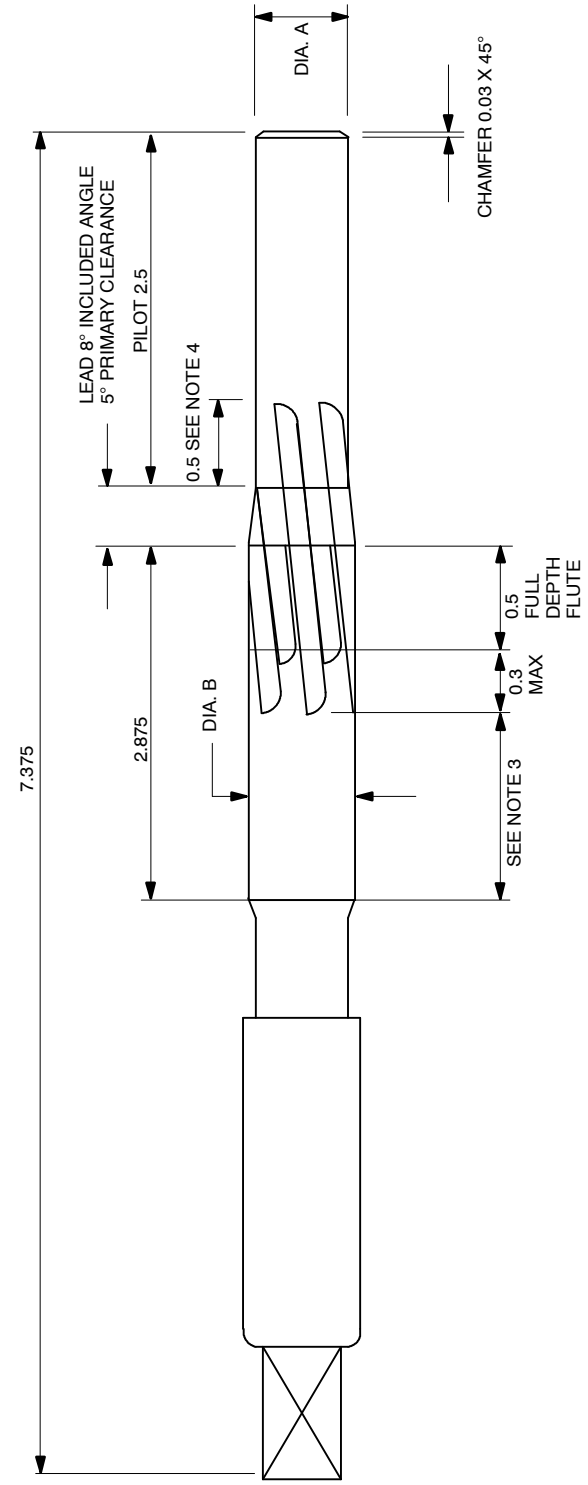
Record compliance with Alert Service Bulletin ANMD–57–12 Rev 2 in the Airframe Log Book as follows:

(a) If inspection only - record compliance with ANMD-57-12 Rev 2 Para 2.A,B.

(b) If any line reaming was done, and ALL holes are now line reamed - record compliance with ANMD-57-12 Rev 2 Para 2.C.

(c) If peened bolts were replaced - record compliance with ANMD-57-12 Rev 2 Para 2.C (Mod N654A or Mod N654B).

(d) If the Strut Upper End Fitting was replaced - record compliance with ANMD-57-12 Rev 2 Para 2.D.



	PART NO	DIA. A	DIA. B	PILOT HOLE DIA.	FINISHED HOLE DIA.
FIRST OVERSIZE	1/N-88-267	0.3125/0.3123	0.3281/0.3284	5/16 H8 (SEE NOTE 2)	0.3281/0.3290 H8 (SEE NOTE 2)
SECOND OVERSIZE	2/N-88-267	0.3281/0.3279	0.3437/0.3440	21/64 H8 (SEE NOTE 2)	0.3437/0.3446 H8 (SEE NOTE 2)

NOTES:

1. EXCEPT AS SHOWN, REAMER IS A HELICAL FLUTED (6 FLUTES) HAND REAMER MADE FROM HIGH SPEED STEEL - COMMERCIAL TO ANSI B 94.2-1964.
2. FOLLOWING GRINDING, A TRIAL HOLE IN QQ-A-225/6 T 851 MATERIAL (PREVIOUSLY PILOT REAMED - REFER TABLE) IS TO BE REAMED USING SUITABLE LUBRICANT. FINISHED HOLE DIAMETER IS TO BE AS PER TABLE AND AT LEAST THREE FLUTES MUST BE SHARING THE CUTTING. REAMER TO BE RE-GROUND OR STONED UNTIL THESE CONDITIONS ARE MET.
3. FLUTES NOT REQUIRED OVER THIS LENGTH. BACK TAPER NOT TO EXCEED LIMITS OF TOLERANCE ON DIA.
4. NO CUTTING EDGES OVER THIS LENGTH.

Figure 1 Special Line Reamer — Strut Upper End Fitting