RESTRICTED

TECHNICAL ORDERS

NENE INSTRUCTIONS

Issued May, 1949

ISSUED FOR THE INFORMATION AND GUIDANCE OF ALL CONCERNED,

BY COMMAND OF THE AIR BOARD,

Secretary.

AIR FORCE HEAD-QUARTERS,
MELBOURNE, S.C.1

RESTRICTED

AIR FORCE HEAD-QUARTERS

AMENDMENT LIST NO. 1

TO

NENE INSTRUCTIONS

Nene Instruction No. 1 is amended as follows:-

In paragraph 2, column 3 of table, delete "760°C, 760°C, 710°C" and insert "745°C, 745°C, 705°C"; and in column 6, delete "5" twice appearing and insert "10" in lieu.

Delete sub-heading and paragraph 6.

Reference: / File R.A.A.F. 150/4/7797.

Date of Issue: 6th April, 1951.

(T.O. 33/51)

Restricted

Department of Air

Amendment List No. 3

To

Nene Instructions

Nene Instructions are amended as follows:-

1. Nene Instruction No. 10, paragraph 8, line 6, after "housing." insert "The Measurement from the tip of the shaft to the mounting flange on these pumps is 3.125 ± 0.050 .".

2. When the above amendment has been incorporated, make the necessary entry in the amendment certificate.

Reference: File R.A.A.F. 150/4/8346.

Date of Issue: 8th December, 1954.

Restricted

AIR FORCE HEAD-QUARTERS — NENE INSTRUCTION NO. 3

TECHNICAL ORDER — APPLICATION: Nene (All types)

NOZZLE GUIDE VANES - LIMITS OF CRACKING AND DISTORTION

INTRODUCTION

1. Nozzle guide vane deterioration, which may occur in service, will be shown by -

(a) cracking, tending ultimately to cause pieces of the vane to become detached due to intersection of the cracks; and

(b) bowing, causing local alteration in the turbine inlet area with consequent increase in jet pipe temperature, in addition to the undesirable distortion of the vanes with increased tendency to cracking.

2. This Instruction lays down the standards of acceptance and rejection for nozzle guide vanes during engine life.

Note. - The figures laid down are based on overseas experience and are to be carefully adhered to. They may, however, be subject to amendment as additional operating experience is gained. Should any case occur which is obviously different from those quoted in this Instruction, the individual problem is to be submitted to Air Force Head-Quarters for a decision.

LIMITS

3. Guide vanes are to be rejected for further service if -

(a) leading edge cracks exceed 1.1 inches in length on either side of the vane (see Fig. 2);

(b) trailing edge cracks exceed 0.75 inches in length (see Fig. 4);

(c) the sum of the lengths of the longest leading and trailing edge cracks exceed 1.1 inches;

(d) the bow of the trailing edge is greater than 0.250 inches (see Fig. 6);

(e) the bow is within above limits, but after eliminating other causes, excessive jet pipe temperatures are being experienced.

References: File R.A.A.F. 150/4/7890.
Rolls-Royce Serving Note Section 3, Part 5, No.11.

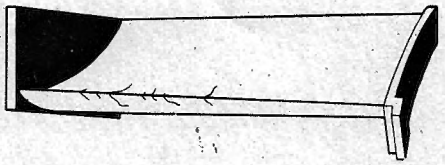
Drawings: Drawing No. B.11072, Sheets 1 and 2 attached.

Date of Issue: 23rd December, 1949.

DO NOT SCALE

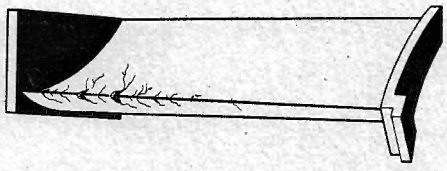
ISSUE NO.	DATE	ALTERATION	D & L	INITIALS	APPROVED
1					

FIG 1



ACCEPT

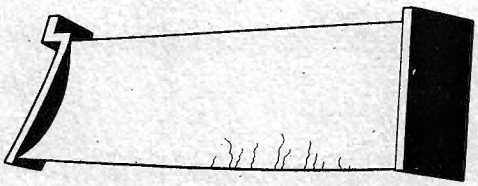
FIG 2



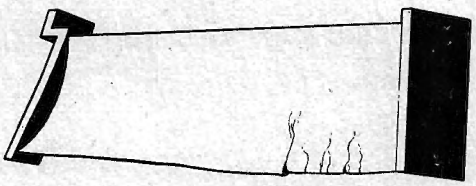
REJECT

LEADING EDGE

FIG 3



ACCEPT



REJECT

TRAILING EDGE

NOZZLE GUIDE VANE CRACKING

REFERENCE	ISSUED BY	TITLE
	DIRECTORATE OF TECHNICAL SERVICES R.A.A.F	NOZZLE GUIDE VANE, LIMITS OF CRACKING & DISTRIBUTION

LIMITS UNLESS STATED		MATERIAL	
DECIMALS	± .010"	SPEC.	
FRACTIONS	± 1/32"	TREATMENT	
ANGLES	± 1°	FINISH	
SURFACE FINISH AUSTRALIAN STANDARD ENG. DRWG. PRACTICE A.S.CZI		SCALE	
		DRAWN	APPROVED
		TRACED	CHECKED

COMPONENT OF	
MACHINE	
ENGINE	NENE 2- VH- AUS.
TECH. ORDER	NENE INST N°3
DRAWING NO.	B.11072 SHT 1

DRWG. A SIZE

RESTRICTED

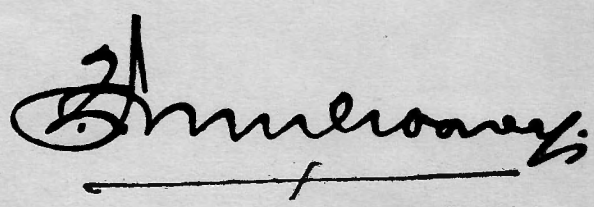
TECHNICAL ORDERS

NENE INSTRUCTIONS

Issued May, 1949

ISSUED FOR THE INFORMATION AND GUIDANCE OF ALL CONCERNED,

BY COMMAND OF THE AIR BOARD,



Secretary.

AIR FORCE HEAD-QUARTERS,
MELBOURNE, S.C.1

NENE INSTRUCTIONS

AMENDMENT RECORD SHEET

Amendment List		Amendments made by	Date
No.	Date		
1	6 April 51	A Mansfield	6 July 51
2			
3	8 Dec 54	J Rogers	14 Sept 55
4			
5			
6			
7			
8	29 Aug 58		13/10/58
9	31-10-58	J Rogers	17-12-58
10	12-3-59	J Rogers	26-6-59
11	12-3-59	JR	26-6-59
12	31-3-59	JR	22-5-59
13	2 7-59	JR	11-2-60

CEED

Restricted

Air Force Head-Quarters

Technical Order

NENE INSTRUCTION NO. 1
(Issue 3)

Application: Nene 2 VH Aus. installed in Vampire aircraft

STARTING AND OPERATING INSTRUCTIONS

Introduction

1. The life of a turbo-jet or turbo-prop engine depends to a large extent on the temperature to which it is subjected and the number of times it is heated up and cooled down. In view of this, ground running, accelerations and idling and re-lighting in the air must be kept to an absolute minimum.

Jet pipe temperatures are critical and care must be exercised to ensure that the limits laid down are not exceeded.

As the fuel pumps are lubricated by the fuel, the low pressure (L.P.) fuel cock must be in the "ON" position before the engine is turned.

Before starting and during ground running see that the Safety Precautions laid down in Aircraft Engineering Instructions, General, Part 21, Section 1, Instruction No. 12 are observed.

2. Operational Limitations - 5,000 lb. Static Thrust

Condition	R.P.M. (Max.)	J.P.T. (Max.)	Oil Press. (Min.)	Oil Temp. Inlet (Max.)	Remarks
Take-off	12,300	745°C	20 lb.	80°C	10 minute limit
Combat	12,300	745°C	20 lb.	80°C	10 minute limit
Climb	12,000	705°C	20 lb.	80°C	30 minute limit
Cruise	11,600	650°C	20 lb.	80°C	
Idling sea level 20,000 to 30,000 feet 30,000 feet and above	~~2500~~ 2650 ± 200 (A.L.12) 4,000 6,000	550°C	3 lb.	80°C	Minimum oil temperature for opening up - 40°C

Starting

3. (a) Ground Starting Equipment - Plug into aircraft circuit.

Note: Engine cannot be started from aircraft batteries. Starting equipment of 24 volts and minimum of 230 amps. is required.

(b)	Ground/flight switch	- Set to flight
(c)	Low pressure (L.P.) and high pressure (H.P.) cocks	- ON
(d)	Throttle lever	- Fully closed.
(e)	Interlocked S.C. safety switch	- ON
(f)	Boost coil isolating switch	- ON
(g)	When fuel pressure warning light goes out	- Press starter button for 2 seconds.

After about 5 seconds the engine R.P.M. will increase and light-up should occur. Engine will then accelerate to idling R.P.M. (~~8500~~ 2650 ± 200) without movement of throttle.

(AL 12)

Caution: Do not attempt to open throttle until engine is running at idling R.P.M.

Action Immediately after Starting

4. (a) Oil pressure - Check minimum 3 lb./sq.in.

(b) Temperature - The jet pipe temperature may momentarily rise above the idling limit (550°C) but should soon settle down to this figure. If temperature exceeds 600°C close high pressure cock and stop engine.

Failure to Start. - If engine fails to start - close high pressure cock. Do not attempt a further start until engine has stopped rotating and until fuel has ceased to drain from engine drain pipe.

Ground Running

5. (a) Open up to 7,500 R.P.M. - Check that generator warning light goes out.

(b) Open up to 8,000 R.P.M. - Turn on fuel pump emergency switch (warning light ON).

- Check that there is a rise in R.P.M.

- Turn OFF fuel pump emergency switch and ensure that warning light goes out.

(c) Open up to 11,600 R.P.M. - Check that oil pressure is not less than 20 lb./sq.in.

(d) Open up to full throttle - Check that governed R.P.M. is 12,300.

- Check that jet pipe temperature does not exceed 745°C. (Normal 720°).

(e) Turn on fuel pump emergency switch (warning light ON) - The normal desired reaction on governed R.P.M. is nil change, but a tolerance of $^{+\ 50}_{-\ 100}$ is acceptable.

- Turn OFF fuel pump emergency switch and ensure that warning light goes out.

(f) Close throttle slowly and smoothly to idling R.P.M.

(g) Carry out one acceleration check of not less than 10 seconds from idling to take-off R.P.M. During this acceleration the jet pipe temperature may momentarily exceed the maximum, but it should drop to normal when the R.P.M. has stabilized.

(h) Close throttle to 7,500 R.P.M. and maintain at this speed for approximately 1 minute.

(i) Close throttle to idling R.P.M.

Stopping Engine

6. (a) Throttle - Close

(b) High pressure cock - OFF

(c) Interlocked S.C. safety switch - OFF

(d) Boost coil isolating switch - OFF

(e) Low pressure cock - Leave in ON position unless maintenance work is to be carried out on fuel system.

(f) Ground/flight switch - Set to ground.

7. Nene Instruction No. 1 (Issue 2), dated 25th May, 1951, having been superseded by this Instruction, is hereby cancelled.

Reference: File R.A.A.F. 150/4/7797.

Date of Issue: 12th October, 1951.

Air Force Head-Quarters

Technical Order

NENE INSTRUCTION NO. 2
(ISSUE 2)
Application : Nene 2-VH Installed in Vampire Aircraft.

DISTORTION AND CRACKING OF FLAME TUBES - ACCEPTANCE STANDARDS

Introduction

1. Distortion, cracking, &c. of Flame Tubes occurs during service and in many instances may be quite considerable after prolonged service.

2. This standard defines the extent of such deterioration of tubes which is acceptable during overhaul without the necessity of repair or replacement.

3. Flame Tubes which are cracked or otherwise damaged beyond these acceptance standards may, within limitations, be salvaged by welding, patching or replacement of sections, &c. as instructed by the relevant Repair Schemes.

4. To facilitate visual detection of cracks, all tubes are to be thoroughly cleaned of all carbon, &c. by an approved method prior to inspection.

Cracking

5. Cracking is acceptable in the respective sections of Flame Tubes within the following limits, as illustrated.

Snout

6. No cracking is permitted.

Scoop

7. Radial cracks from the inlet bore are acceptable up to .250 inch in length, provided they are at least 2 inches apart.

8. One crack only is acceptable from or between adjoining key-hole slots in the rim, providing it does not exceed 2 inch in length.

Grid

9. Radial or circumferential cracking between air holes is acceptable, provided not more than three (3) holes are inter-connected. More than one such crack is permitted, provided they are at least 3 inches apart.

Diffuser Swirl Vanes

10. Cracking of the Swirl Vanes or detachment of the vane lugs from the hub or rim is not acceptable. Tubes with this type of defect are to be rejected outright as unsuitable for repair. The most effective means of inspecting these Vanes is to use a light gauge rod or stick as a lever between vanes.

11. Cracking or detachment of the spot welds in the outer rim securing the Vane Assembly to the Flare is permitted, provided not more than three (3) welded areas between Vanes are cracked or detached, and that these be separated by at least alternate sound welded areas of the rim.

Flare

12. Separate circumferential or radial cracks from or between air holes are acceptable, provided not more than two (2) adjoining holes are interconnected, or the crack does not exceed 1 inch in length. More than one such crack is permitted, provided they are at least 3 inches apart.

13. A combination of radial and circumferential cracking from the same hole, or separate radial or circumferential cracks less than 3 inches apart are not permitted under any circumstances.

14. In some cases, minute cracks are found radiating from the holes in the flare. Providing these are less than .100 inch in length, a maximum of four such cracks is permitted from any one hole, providing adjacent holes are free from any cracks. This type of cracking is mostly encountered after repair by direct welding of the flare.

15. One (1) single circumferential crack in the formed corner radius of the outer rim is acceptable to a maximum length of 2 inches.

Cylindrical

16. Single line cracks from air holes are acceptable up to 1 inch in length, providing the end of the crack is not within .500 inch of any other air hole or crack. More than one crack is permitted from the same hole, provided their origins are at least 90° apart and the cracks are divergent.

17. Cracks from the first row of air holes to the nearest keyhole slot at the front of the cylindrical ("Derwent" only) are acceptable.

18. Cracks from adjacent air holes to suspension tube, torch igniter, interconnector sleeves are acceptable, providing they are within the length limitation of 1 inch and do not enter the boss through one of the keyhole slots if present.

19. Cracks radiating from the projecting edge or lip of holes through the cylindrical at suspension tube, torch igniter or interconnector sleeves are acceptable, providing such cracks are terminated by the surrounding weld and do not pass through any keyhole slots of the sleeves flanges. Any number of such cracks are permitted in any of these holes.

20. In instances where it is found that a series of minute cracks are radiating from the edge of an air hole in the cylindrical, it is permissible to blend out such cracks, provided the air hole is not enlarged by more than .125 inch in diameter at any point. After blending, the edge of the air hole is to be re-radiused. Alternate air holes only may be enlarged in this way. It is not permitted to enlarge adjoining holes nor a cluster of holes.

Suspension, Torch Igniter and Interconnector Sleeves

21. A crack forming an extension to a "keyhole" slot in suspension tube, torch igniter or interconnector sleeves, thereby splitting the sleeve, is acceptable. Only one crack is permitted in any one sleeve, although each sleeve may be cracked in this way.

22. Frettage in the bore of suspension tube, torch igniter or interconnector sleeves is acceptable, providing the clearance is not excessive.

Front Conical

23. No cracking is permitted.

Window Piece

24. Longitudinal cracks from the air holes are acceptable, providing they do not run through the adjacent circumferential welded joints with the front and rear conical sections.

25. The maximum acceptable length of circumferential cracking through holes in the window piece is 2 inches, either as one continuous crack (connecting four consecutive holes) or as the sum of the lengths of a number of small cracks between holes.

26. Where longitudinal and circumferential cracks are present, these must be separated by a least three (3) undamaged holes. A combination of longitudinal and circumferential cracking through the same hole is not acceptable.

27. Circumferential cracking in the rim of the window piece is not acceptable.

Rear Conical

28. Single line cracks from air holes are acceptable up to 1 inch in length, providing they do not extend to within .500 inch of any other air hole or crack. More than one crack is permitted from the same hole, if their origins are at least 90° apart and the cracks are divergent.

29. On flame tubes incorporating stiffening rolls in the rear conical, a maximum of two (2) circumferential cracks up to 2 inches in length are acceptable in any of these ribs, if the adjacent ends are at least 6 inches apart and the cracks do not run off the ribs.

30. Longitudinal cracks from the sheet edge of the early type internal "upstream" overlap with the window piece are acceptable, provided they do not extend through the adjacent circumferential welded joint with the window piece, and that no detachment of the weld has resulted. Any number of such cracks is acceptable from this upstream sheet edge. Circumferential cracks in or adjacent to the edge of this type welded joint are not permitted.

31. Fretting or wear of the rear locating "pips" is acceptable providing no cracking or perforation of the metal is apparent and the diametral clearance with the outer casing does not exceed the permitted limits.

General

32. The following limitations apply to all cracking present in flame tubes.

33. Single line cracks only are acceptable, within the limitations detailed. Forked or branched cracks are not permitted.

34. A crack running to a welded joint at a substantially obtuse angle and so bounded by it can generally be accepted. Cracks running alongside a welded joint are not permitted.

35. A combination of cracks which could readily develop in such a way as to cause break away of an unsupported section are not permitted under any circumstances.

36. All cracks in accessible regions of flame tubes which are not bounded by an adjacent weld or hole are to be terminated by an .062 inch drilled hole, if within acceptable limits.

Note: Care is to be taken when drilling terminating holes to ensure the hole is drilled at the visible end of the crack to approximately .062 inch ahead of the crack.

37. Distortion normally only occurs in the rearward sections of the tube and is acceptable within the following limits.

Cylindrical

38. Distortion of the cylindrical is usually local and is acceptable providing the tube can be satisfactorily assembled in the air casing, preserving the necessary alignment for suspension tubes, burner, &c.

Front Conical and Window Piece

39. These sections usually distort together, the effect being to displace the axis of the rear conical. If extensive, this can be checked with the tube assembled in the air casing to ensure adequate clearance exists with the outer casing.

Rear Conical

40. Distortion in the form of flats between air holes is acceptable provided the tube has not buckled inwards appreciably. Distortion of the rear end causing ovality is acceptable providing the out of roundness measured over the rear locating pips does not exceed .030 inch.

General

41. In general, distortion need not be rectified unless it is extensive or causes misalignment, &c. as outlines above.

42. Accidental damage to tubes is acceptable unless extensive or sharply indented. Damage causing distortion of the snout inlet is to be rectified.

Drawings

43. B.11484, Sheets 1 to 4, is attached.

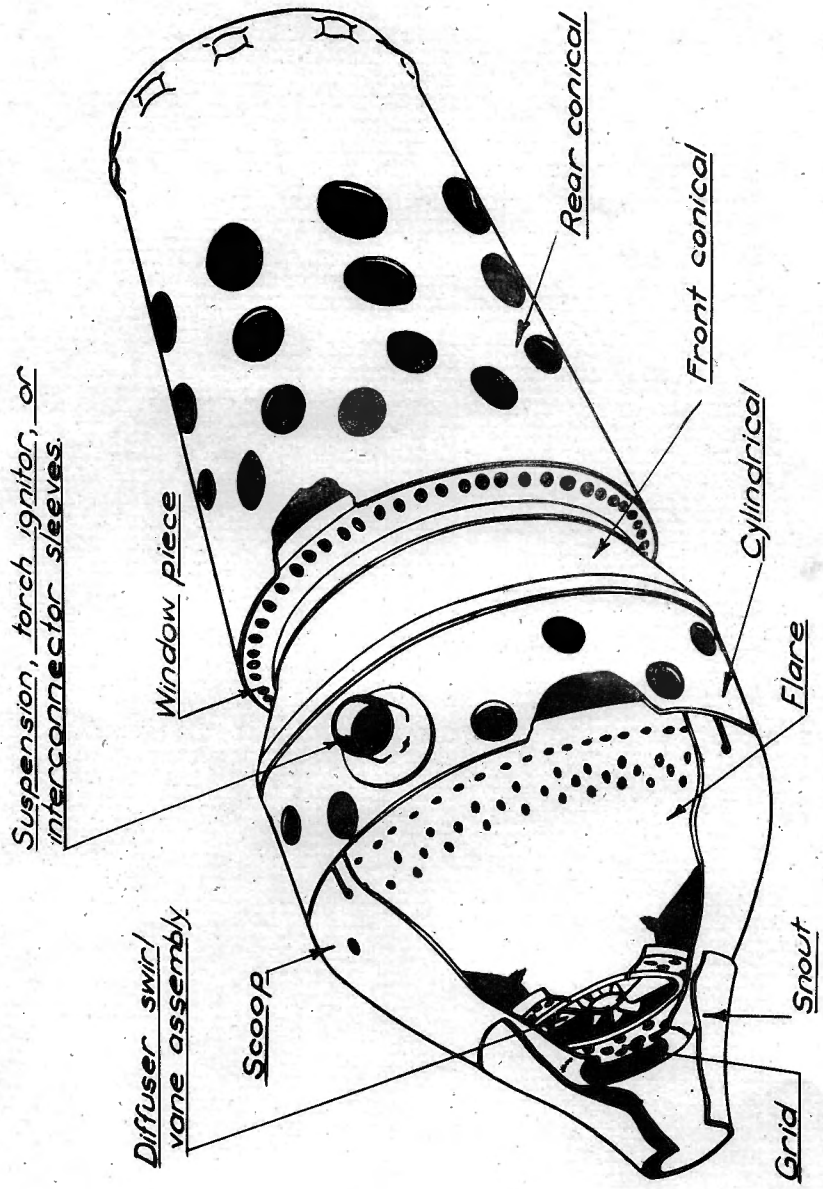
44. This Instruction cancels and supersedes Nene Instruction No. 2 dated 11th July, 1949.

References	:	File R.A.A.F. 150/4/7834.
Attachment	:	Drawing B.11484, sheets 1 to 4.
Date of Issue	:	11th June, 1954.

DO NOT SCALE

ISSUE	DATE	ALTERATION	D. L.	INITIALS	APPROVED
	20-4-56				

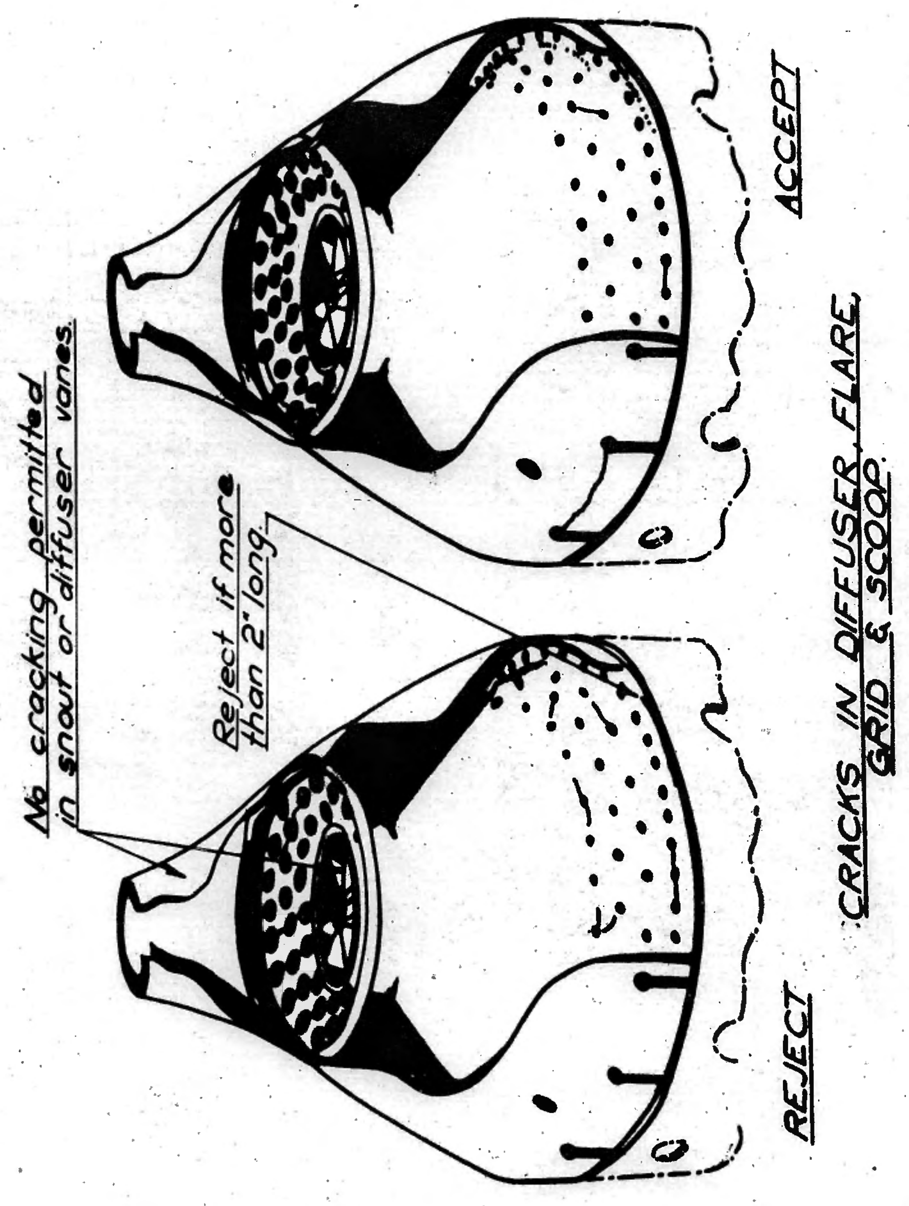
FLAME TUBE - REFERENCE DRAWING



REFERENCE		ISSUED BY				TITLE	
		DIRECTORATE OF TECHNICAL SERVICES R.A.A.F.				FLAME TUBES. ACCEPTANCE STANDARDS.	
LIMITS UNLESS STATED		MATERIAL				COMPONENT OF	
DECIMALS	± .010"	SPEC.				MACHINE	
FRACTIONS	± 1/32"	TREATMENT				ENGINE	NENE & DERWENT
ANGLES	± ½°	FINISH				TECH. ORDER	NENE INSTRUCTION No 2 DERWENT INSTRUCTION No 2
SURFACE FINISH AUSTRALIAN STANDARD ENG. DRWG. PRACTICE A.S.C.21		SCALE				DRAWING NO.	B11484 SHT. 1 OF 4 SHTS.
		DRAWN		APPROVED			DRWG. A SIZE
		TRACED	W.J.S.	CHECKED			

DO NOT SCALE

ISSUE No.	DATE	ALTERATION	D.I.L.	INITIALS	APPROVED
2	29-7-58				

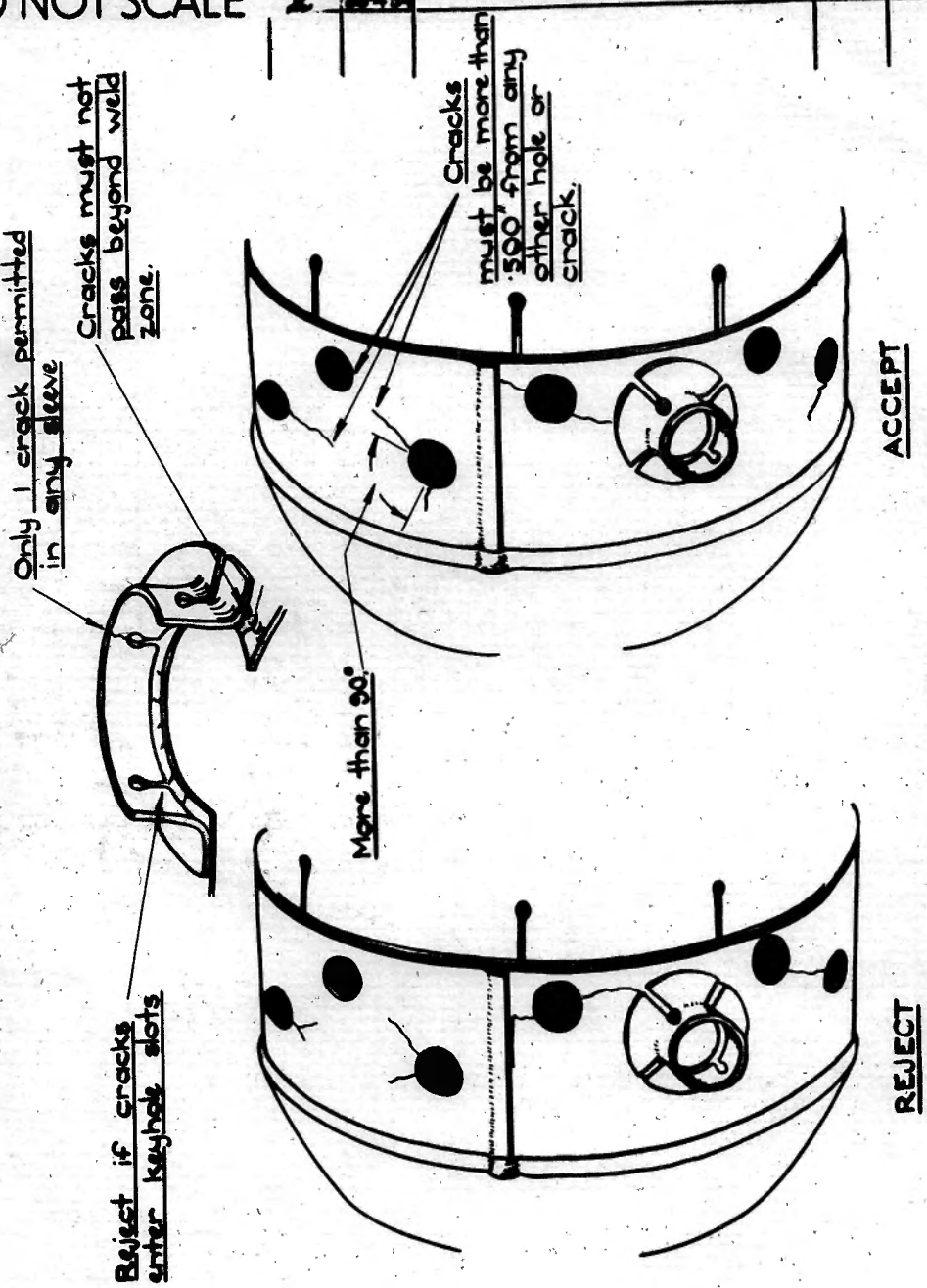


SUPERSEDES	ISSUED BY	TITLE
	DIRECTORATE OF TECHNICAL SERVICES R.A.A.F.	FLAME TUBES. ACCEPTANCE STANDARDS

LIMITS UNLESS STATED		MATERIAL		COMPONENT OF	
DECIMALS	± .010"	SPEC.		MACHINE	
FRACTIONS	± 1/64"	TREATMENT		ENGINE	NENE & DERWENT
ANGLES	± ½°	FINISH		TECH. ORDER	NENE INSTRUCTION No. 2. DERWENT INSTR. No. 2.
SURFACE FINISH AUSTRALIAN STANDARD ENG. DRWG. PRACTICE A.S.CZ1		SCALE			
		DRAWN	APPROVED	DRAWING No.	B11484 SHT. 2 OF 4 SHTS
		TRACED W.J.S.	CHECKED		DRWG. A SIZE

DO NOT SCALE

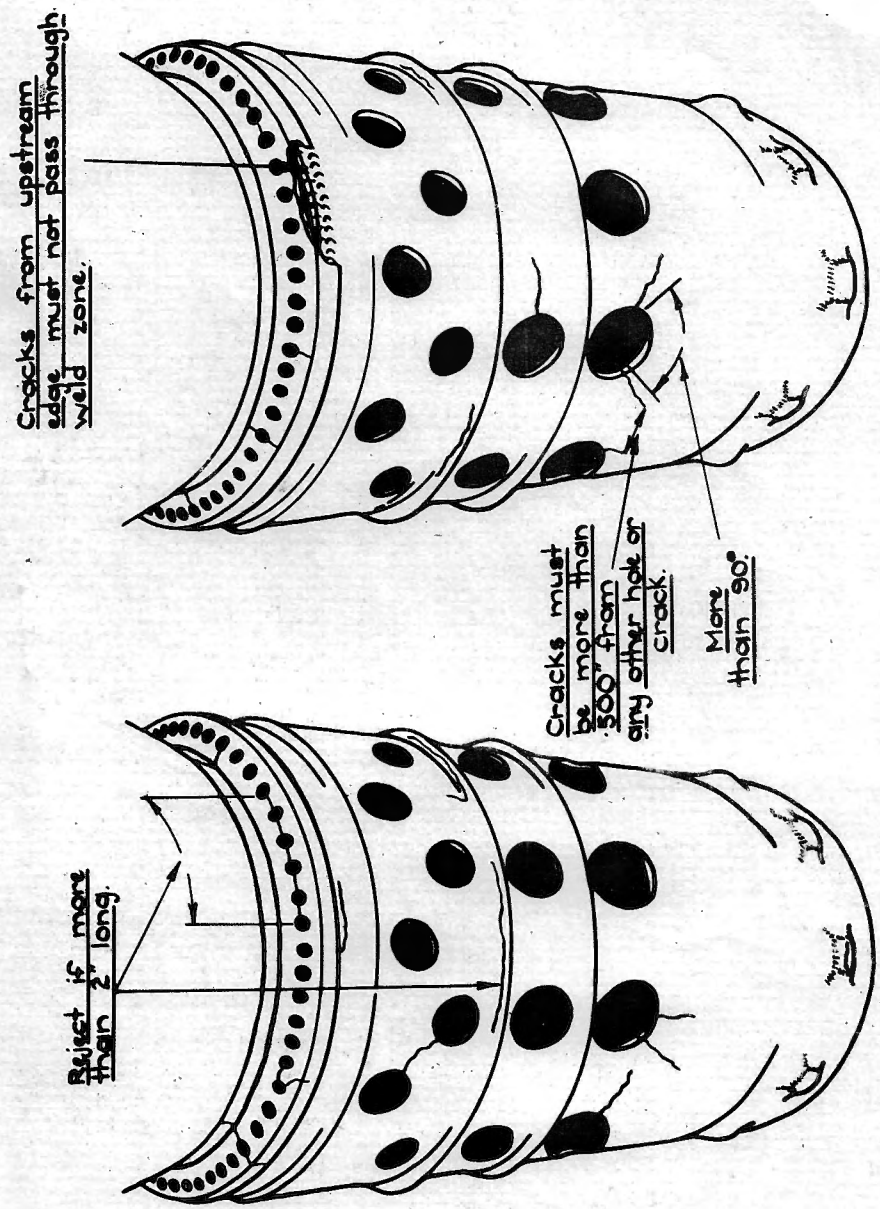
ISSUE NO.	DATE	ALTERATION	B. I. L.	INITIALS	APPROVED
2	[illegible]				



REFERENCE		ISSUED BY				TITLE	
		DIRECTORATE OF TECHNICAL SERVICES. R.A.A.F.				FLAME TUBES ACCEPTANCE STANDARDS	
LIMITS UNLESS STATED		MATERIAL				COMPONENT OF	
DECIMALS	± .010"	SPEC.				MACHINE	
FRACTIONS	± 1/32"	TREATMENT				ENGINE	NENE + DERWENT
ANGLES	± ½°	FINISH				TECH. ORDER	NENE MAINT. No 2 DERWENT INSTRUCTION No 2
SURFACE FINISH AUSTRALIAN STANDARDS		SCALE					
		DRAWN		APPROVED		DRAWING NO.	B-11484 Sht. 3 of 4 Shts.
		TRACED	B.L.S.	CHECKED	[illegible]		DRWG. A SIZE

DO NOT SCALE

ISSUE NO.	DATE	ALTERATION	D. I.	INITIALS	APPROVED
2	29-4-54				



CRACKS IN WINDOW PIECE + REAR CONICAL

REFERENCE	ISSUED BY	TITLE
	DIRECTORATE OF TECHNICAL SERVICES. R.A.A.F.	FLAME TUBES ACCEPTANCE STANDARDS

LIMITS UNLESS STATED		MATERIAL		COMPONENT OF	
DECIMALS	± .010"	SPEC.		MACHINE	
FRACTIONS	± 1/32"	TREATMENT		ENGINE	NENE + DERWENT
ANGLES	± ½°	FINISH		TECH. ORDER	NENE INSTRUCTION No 2 DERWENT INSTRUCTION No 2
SURFACE FINISH AUSTRALIAN STANDARD ENG. DRWG. PRACTICE A.S.E.21		SCALE		DRAWING NO.	B-11484 DRWG. A
		DRAWN		APPROVED	
		TRACED	B.L.S.	CHECKED	

Sht. 4 of 4 Shts. SIZE

Department of Air

Technical Order

NENE INSTRUCTION NO.3 (Issue 2)
(Cancels and supersedes Issue 1)

Application: Nene (All types)

NOZZLE GUIDE VANES - LIMITS OF CRACKING AND DISTORTION

Introduction

1. Nozzle guide vane deterioration, which may occur in service, will be shown by:-

(a) cracking, tending ultimately to cause pieces of the vane to become detached due to intersection of the cracks; and

(b) bowing, causing local alteration in the turbine inlet area with consequent increase in jet pipe temperature, in addition to the undesirable distortion of the vanes with increased tendency to cracking.

2. This instruction lays down the standards of acceptance and rejection for nozzle guide vanes during engine life.

NOTE: The figures laid down are based on overseas experience and are to be carefully adhered to. They may, however, be subject to amendment as further operating experience is gained. Should any case occur which is obviously different from those quoted in this instruction, the individual problem is to be submitted to Department of Air for a decision.

3. Generally, only the trailing edges of the N.G.V. will be seen during service inspections. Only in cases where flame tubes are to be inspected or changed will the leading edges be visible through the discharge orifices.

4. It is pointed out that the associated deterioration of the leading edges has been taken into account in the compilation of this standard which refers only to the trailing edges.

5. Engines should only be rejected from service if any of the following conditions or combination of conditions are observed:-

(a) The bow on the trailing edge exceeds .250 inch or a number of vanes are bowed to a lesser degree, but are considered to be responsible for a J.P.T. outside the operational limitations.

(b) Thermal cracks in excess of .750 inch in length.

(c) Multiple tears, with associated deformation of trailing edge caused by mechanical damage, or a single tear in excess of .300 inch in length.

6. It should be noted that where mechanical damage to N.G.V.'s is apparent, the flame tubes should be inspected for break up and if confirmed, the offending tube or tubes must be changed. Where the flame tubes are intact and the cause of the damage is obscure, the engine should be submitted for complete overhaul.

Replacement of N.G.V.'s service

7. In cases where N.G.V. deterioration is the criterion for engine rejection, up to 9 vanes may be changed with no throat area checks. It is important, however, that the replacement vanes are fitted in the original position of the rejected vanes. Serviceable vanes which, for any reason, have been removed must be replaced in their original positions.

NOTE: The replacement of vanes must be entered in the Engine Log Book, as not more than a total of 9 vanes may be replaced, without throat area checks, during the overhaul life of the engine.

8. The recommended sequence of operations for replacing N.G.V.'s in the field is given below, and assumes that an engine build stand TH.122 and turbine transport stand SE.254 are available. For full details of the dismantling and reassembly procedure, reference should be made to the Nene Overhaul Manual Australian Air Publication 861.

(a) Remove Nos.1 and 9, 3 and 4 or 6 and 7 combustion chambers to gain access through one of the hand holes in the centre bearing housing through which the main shaft centre coupling may be disconnected.

Note: It may be found necessary for an operator to remove the two hand hold covers.

(b) Disconnect the centre coupling and remove the turbine assembly.

(c) With the engine still in the vertical position remove the N.G.V. outer ring complete with shroud ring.

(d) Remove the cooling air guide plate from the rear bearing housing.

(e) Slacken off the 18 nuts securing the N.G.V. inner ring just enough to allow the removal of the required N.G.V.'s.

(f) Fit new N.G.V.'s, but do not tighten the inner ring at this stage.

(g) Replace the N.G.V. outer ring complete with shroud ring, ensuring that the shroud ring locating dowel is at the top of the engine.

(h) Turn the engine to the horizontal position and very carefully remove the N.G.V. inner ring securing nuts one at a time in order to renew the tab washers. (This operation requires great care since there is nothing to prevent the bolts from slipping forward and falling inside the support ring when the nuts are removed).

(j) Tighten and lock the nuts securing the N.G.V. inner ring.

(k) Refit the cooling air guide plate to the rear bearing housing.

(l) Replace the turbine assembly and complete the reassembly of the engine.

References : Files Department of Air 150/4/7890 and 69/35/6, R.R. Turbine Servicing Notes, Section 16, No.3.

Attachments : Figures 1, 2, 3 and 4.

Date of Issue : 23rd February, 1955.

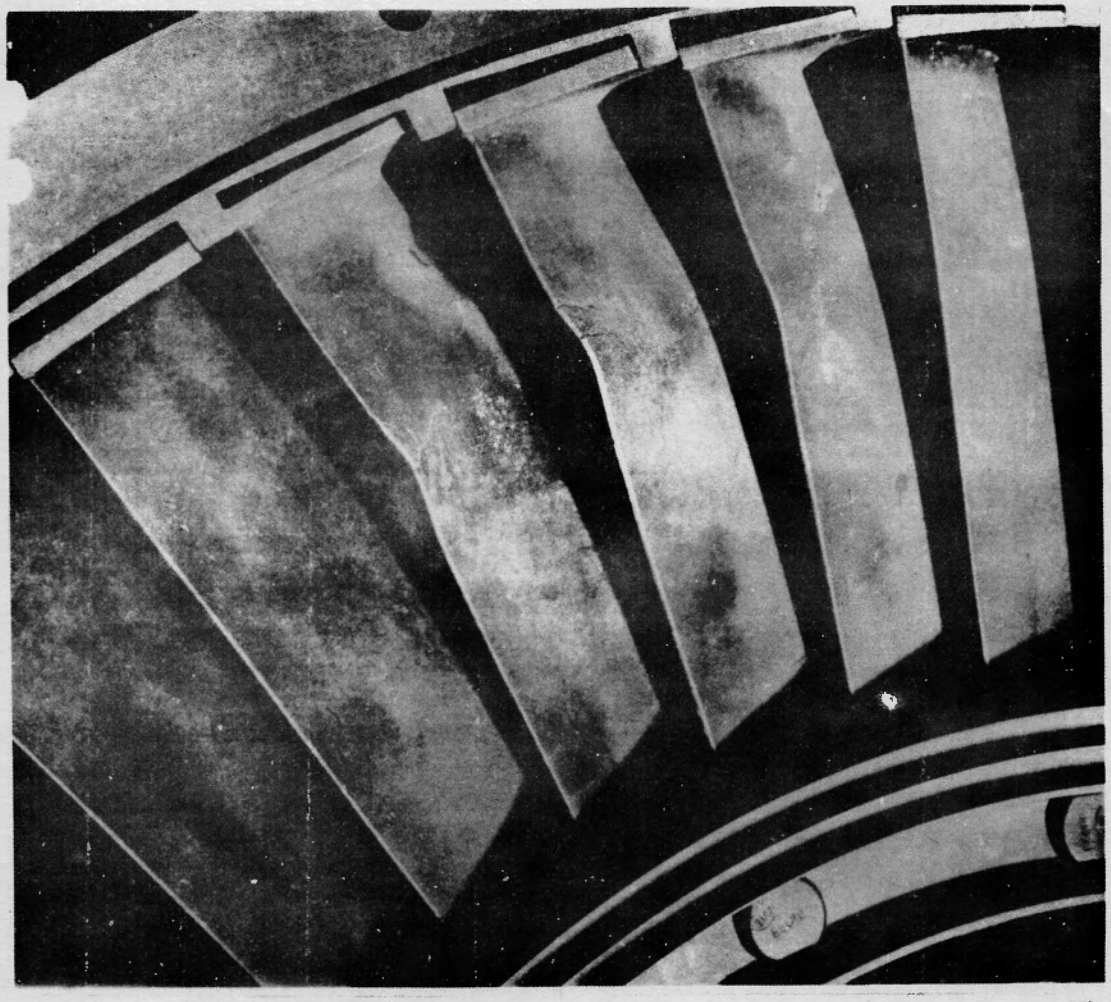


Fig. 1

View of N. G. V. trailing edges showing bowing and cracking at the limiting condition of the visual standard. When vanes are seen in this condition a further examination is necessary as detailed in the standard.

NOTE The turbine assembly has been removed for ease of photography.

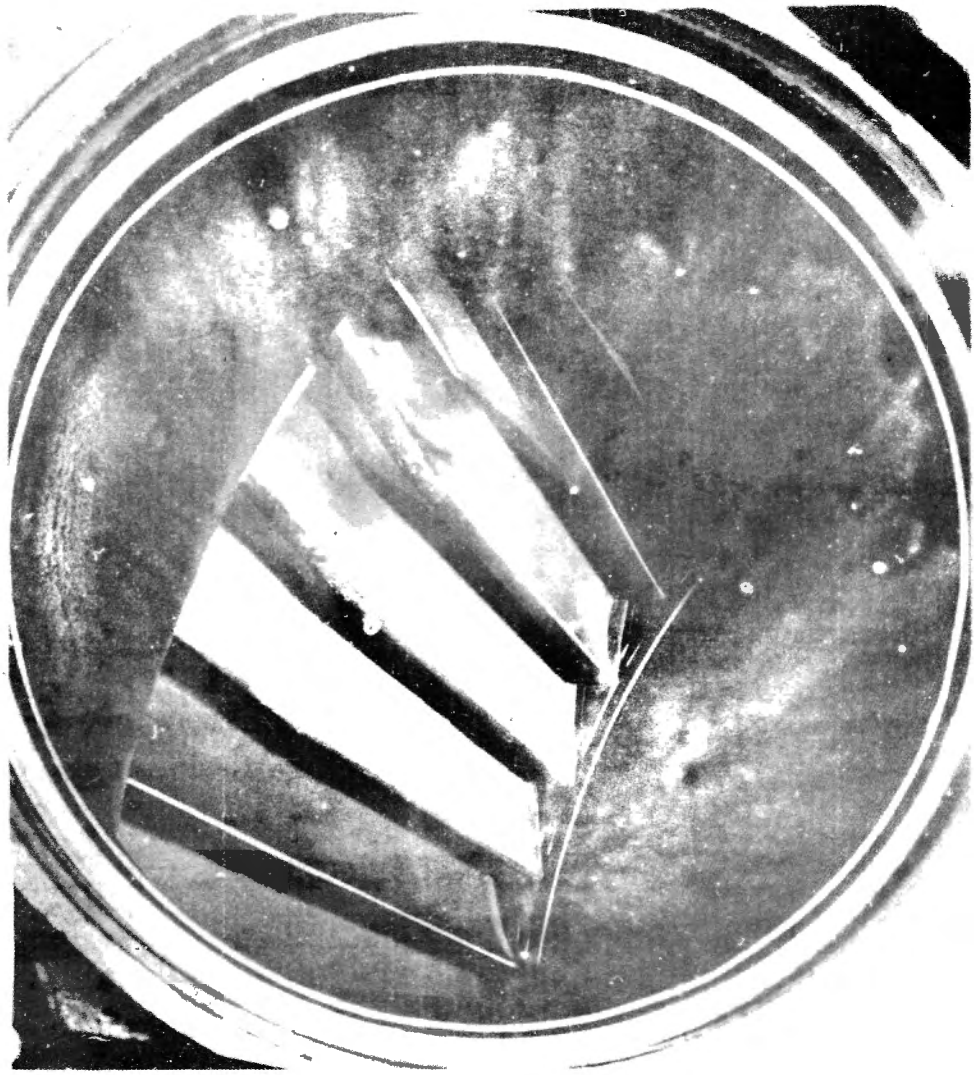


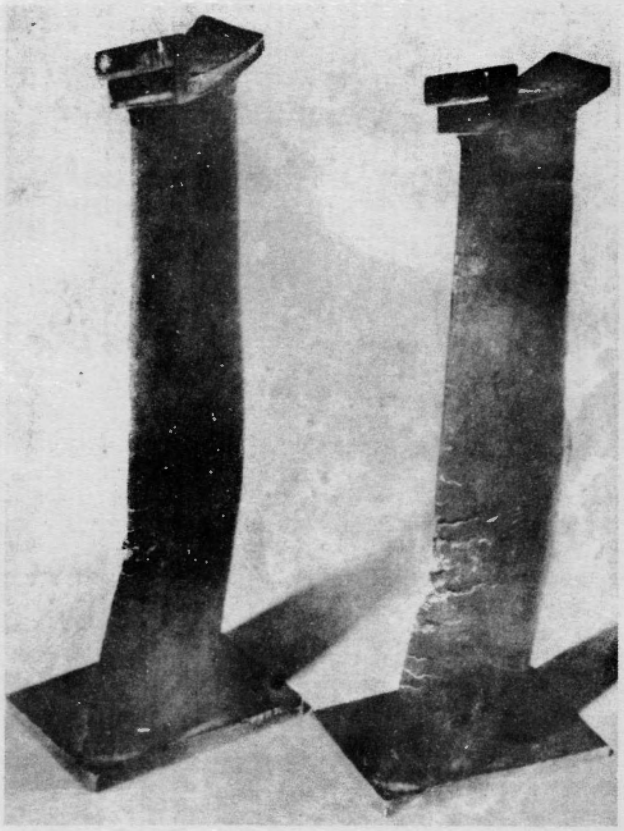
Fig. 2

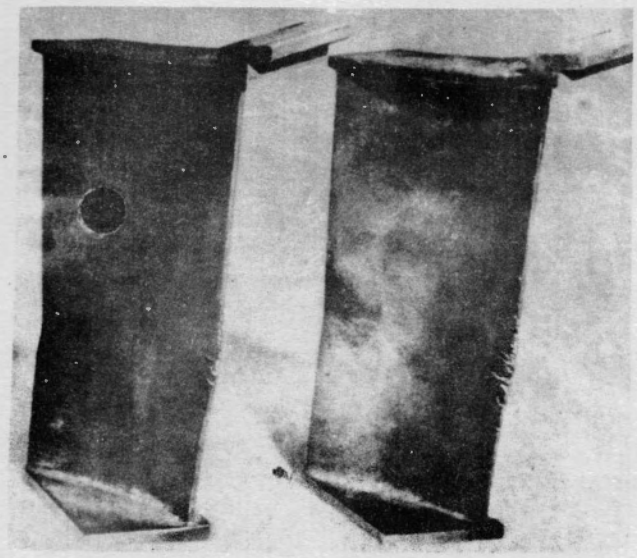
View of N. G. V's with No. 3 (~~Port Torch Igniter~~) combustion chamber removed. Showing N. G. V's approaching the limit of acceptance for both bowing and cracking.

Fig. 3

Views of the convex and concave surfaces of 2 N. G. V's, showing cracking and bowing of the leading edge at the limit of acceptance.

N. B. It is normal for cracking to progress further on the convex surface than on the concave as shown in photographs.





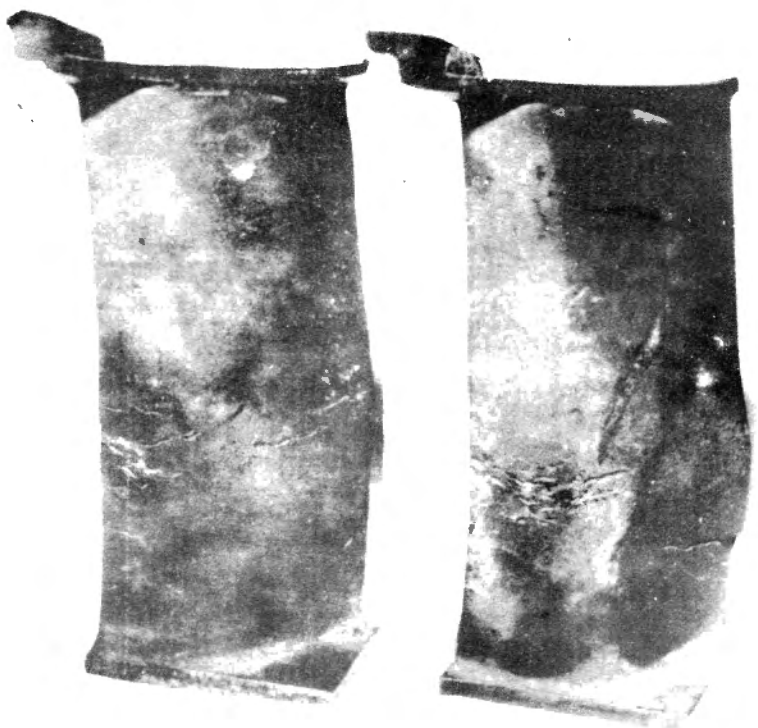


Fig. 4

View of two typical unacceptable Vanes showing cracking progressing across each vane.

Restricted

AIR FORCE HEAD-QUARTERS — NENE INSTRUCTION NO. 4

TECHNICAL ORDER — APPLICATION: NENE 2 VH

TURBINE BLADE TIP CLEARANCES - METHODS OF CHECKING AND ADJUSTING

INTRODUCTION

1. Turbine blade tip clearances tend to decrease in service due to a slight diametrical growth of the turbine blades and disc, and in some cases, by shrinkage and distortion of the shroud ring.

2. It is important that the minimum tip clearance, measured with engine cold, does not fall below .040 inch.

METHOD OF CHECKING BLADE TIP CLEARANCE

3. Tip clearance is to be checked against the longest blade in the turbine assembly. The longest blade is found by making a chalk mark on a convenient part of the shroud ring and checking the clearance between each blade and the shroud ring at this point. Mark the longest blade with chalk and use this blade for all subsequent checks.

4. Rotate the turbine assembly and check the clearance between the longest blade and the shroud ring at twelve equidistant points around the ring. Record clearances found at each of these points. If minimum clearance at any point is less than .040 inch the clearance is to be adjusted by one of the methods described below.

Notes. - (a) As the weight of the exhaust unit tends to reduce the clearance at the upper portion of the shroud ring all clearances are to be checked with this unit in place and care must be taken not to apply additional weight by leaning on the exhaust unit.

CAC 261

(b) A special long handled feeler gauge is ~~being~~ provided for checking the blade tip clearance. ~~Until this is available~~ a gauge can be made by attaching a standard 6-blade feeler gauge to a 28 inch length of suitably bent tubing.

If this is not

METHODS OF ADJUSTING BLADE TIP CLEARANCE

5.

PART I

REPOSITIONING OF SHROUD RING (Pre RAAF Mod 34 shroud rings only)

(a) Disconnect the thermocouples and remove the 30 bolts attaching the exhaust unit to the shroud ring. Remove exhaust unit.

Note.- Do not remove the four short set screws from the exhaust unit flange.

(b) Check and record the blade tip clearances and compare the figures with those recorded before exhaust unit was removed.

(c) Remove the 60 bolts which attach the shroud ring to the nozzle guide ring, drifting out the four dowel bolts which will be found opposite the four large holes in the rear flange of the shroud ring.

(d) Turn the shroud ring and ascertain if a position can be found in which the minimum blade tip clearance is within limits, if possible a position should be found which will give a minimum tip clearance of .050 inch. In establishing the final clearance make allowance for any differences already noted (see sub-paragraph (h) of this paragraph).

(e) At this stage the following points must be checked:-

(i) See that a rear flange bolt hole does not coincide with the 12 o'clock position, otherwise the exhaust unit cannot be replaced in its original radial position.

(ii) See that the four reamed holes in the front flange of the shroud ring are aligned with the holes in the nozzle guide ring. If the latter have already been reamed the alignment must be good, but if not previously reamed some misalignment is permitted provided that the holes will clean up when reamed.

(f) Insert two bolts on each side of the four shroud ring dowel holes and tighten firmly. Check that shroud ring has not moved and ream the four dowel holes to .3125 inch $^{+.0005}_{-.0000}$.

A special reamer Part No. BK-8564-T-1 is ~~being~~ provided for this purpose, but if this is not available a standard expanding reamer may be used. When using an expanding reamer care must be taken to maintain correct tolerances.

(g) Re-check blade tip clearances to ensure that shroud ring has not moved during the reaming operation.

(h) Etch shroud ring at the 12 o'clock position with the engine number and the word "TOP". Deface any previous top markings that may appear on the shroud ring.

(i) Check that all remaining bolts will clear the holes in the nozzle guide ring and shroud ring flanges. If any will not clear mark them so that the holes may be enlarged slightly in the correct direction when the shroud ring is removed.

(j) Remove shroud ring and remove the sharp edges from the freshly reamed holes.

(k) Re-install shroud ring taking care that the "TOP" mark is at the 12 o'clock position and install the four dowel and remaining bolts. Fit new tab washers and tighten bolts in normal manner. Do not lock the tab washers at this stage.

(l) Install the exhaust unit using new tab washers under the nuts of the attachment bolts.

(m) Make a final check of the blade tip clearances and record figure in log book.

(n) Lock all tab washers and replace thermocouples.

6.

PART 2

RE-OPERATING SHROUD RING (Pre RAAF Mod 34 Type shroud rings only)

In some cases it may be found that minimum blade tip clearance cannot be obtained by repositioning of the shroud ring, in these circumstances, it is permissible to rework the ring. Procedure is as follows:-

(a) See that the shroud ring is installed with the word "TOP" at the 12 o'clock position.

(b) Mark with chalk the area at which tip clearance is to be increased.

(c) Remove shroud ring.

(d) Mount the shroud ring in a lathe and set up so that when the cut is taken metal will be removed from that portion indicated by the chalk marks. Care must be taken to ensure that the minimum wall thickness of the shroud ring is not reduced below .225 inch. See drawing No. B11179.

If a suitable lathe is not available metal can be removed by careful hand scraping or grinding, but this method should only be used in emergency.

(e) Re-install shroud ring and proceed as described in Part I, paragraph 5, sub-paragraphs (k), (l), (m) and (n).

Note:- Shroud rings BK2622 may be reoperated in accordance with RAAF Mod N° 34 (see Part 4)

7.

PART 3

INSTALLATION OF OVERSIZE SHROUD RING

In cases where the blade tip clearances cannot be obtained by methods described in Parts I and 2, a .030 inch oversize shroud ring Part No. BK-13842 ~~is to~~ may be fitted. Procedure for fitting is as follows:-

(a) Remove exhaust unit and existing shroud ring as described in Part I, paragraphs 5(a) and 5(c).

(b) Install the shroud ring in a position that will bring the four dowel holes in line with four unreamed holes in the nozzle guide ring. Note that a rear flange bolt hole does not coincide with the 12 o'clock position.

(c) Check the turbine blade tip clearances and if possible, position the shroud ring, so that the clearance at the top of the ring is .010 inch to .020 inch greater than at the bottom.

(d) Proceed as described in Part I, paragraph 5, sub-paragraphs (f), (g), (h), (i), (j), (k), (l), (m) and (n).

8. Part 4

INSTALLATION OF ECCENTRIC SHROUD RING

(a) RAAF Nene Mod 34 introduces a shroud ring machined eccentrically to give an additional .020" tip clearance at the top. This eccentric shroud ring part No BK18741 may be obtained by reworking the existing shroud ring part No BK 2622

(b) The new shroud ring is fitted with a dowel which engages in a hole drilled in the nozzle guide vane outer ring. This necessitates reoperating the existing nozzle guide vane outer ring part No BK 2626 and redentifying it as BK 19015.

(c) As both of these reoperations require special tools and jigs, the reworking will be carried out by Commonwealth Aircraft Corporation.

d Oversize shroud rings ident No B23/S00836 Part No BK 13842 may be fitted to the reworked nozzle guide vane outer ring, Part No BK 19015 but must not be reworked.

(e) Install the eccentric shroud ring in the same manner as described in Part I para 5 sub paragraphs (k), (l), (m) and (n)

Note :- Shroud rings & nozzle guide vane outer rings which incorporate Mod 34 are not subject to repositioning

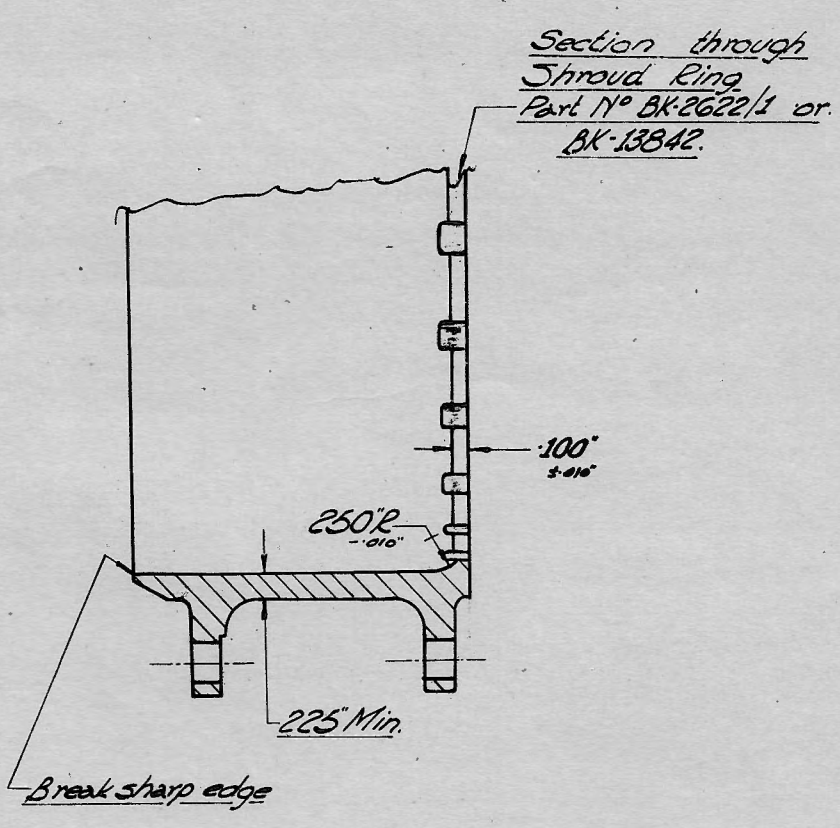
Reference: File R.A.A.F. 150/4/8002.

Drawing: B11179 attached.

Date of Issue: 30th June, 1950.

DO NOT SCALE

ISSUE NO	DATE	ALTERATION	D. I. L.	INITIALS	APPROVED
1	5.6.50				



REFERENCE	ISSUED BY	TITLE
	DIRECTORATE OF TECHNICAL SERVICES R.A.A.F.	SHROUD RING – LIMITS OF RE-WORK

LIMITS UNLESS STATED		MATERIAL		COMPONENT OF	
DECIMALS	± .010"	SPEC.		MACHINE	
FRACTIONS	± 1/32"	TREATMENT		ENGINE	VENE
ANGLES	± ½°	FINISH		TECH. ORDER	VENE INST. N° 4.
SURFACE FINISH AUSTRALIAN STANDARD ENG. DRWG. PRACTICE A.S.CZI		SCALE		DRAWING NO.	B/1179
		DRAWN	APPROVED		DRWG. A SIZE
		TRACED	CHECKED		

Restricted

Air Force Head-Quarters

Technical Order

NENE INSTRUCTION NO.5

Application: Nene 2-VH Engines

TORCH IGNITER BOSS - OUTER AIR CASING - SALVAGE

Introduction

1. This Instruction specifies a method of repair for stripped or damaged setscrew (CA.20137) threads in torch igniter bosses welded into numbers 3 and 8 outer air casing assemblies (BK.4270, BK.4274). If any one of the four setscrew threads in the torch igniter boss is stripped or damaged, all threads are to be repaired as described in paragraphs 2 and 3.

2. Tap threads to the next oversize required to clean up and select a KL.351 (standard, +4, +8 or +62 oversize) stud to give a .003"L to .006"L fit; modify as shown on Drawing B11313 Figure 2 attached.

3. Fit stud, holding a projection of .600" and low temperature braze into position from inside of casing. Outer face of boss must be free from braze metal.

4. On completion of repair assemble gasket (BK.1347) and torch igniter assembly (BK.8105), and secure with existing grover washer (KJ.4508) and new nut (KJ.4310), as shown on Drawing No. B11313 Figure 1 attached.

References: R.A.A.F. File 150/4/8124;
C.A.C. Salvage Scheme SL-447.

Drawing: B11313 attached.

Date of Issue: 30th March, 1951.

DO NOT SCALE

ISSUE NO	DATE	ALTERATION	D. I. L.	INITIALS	APPROVED
1					

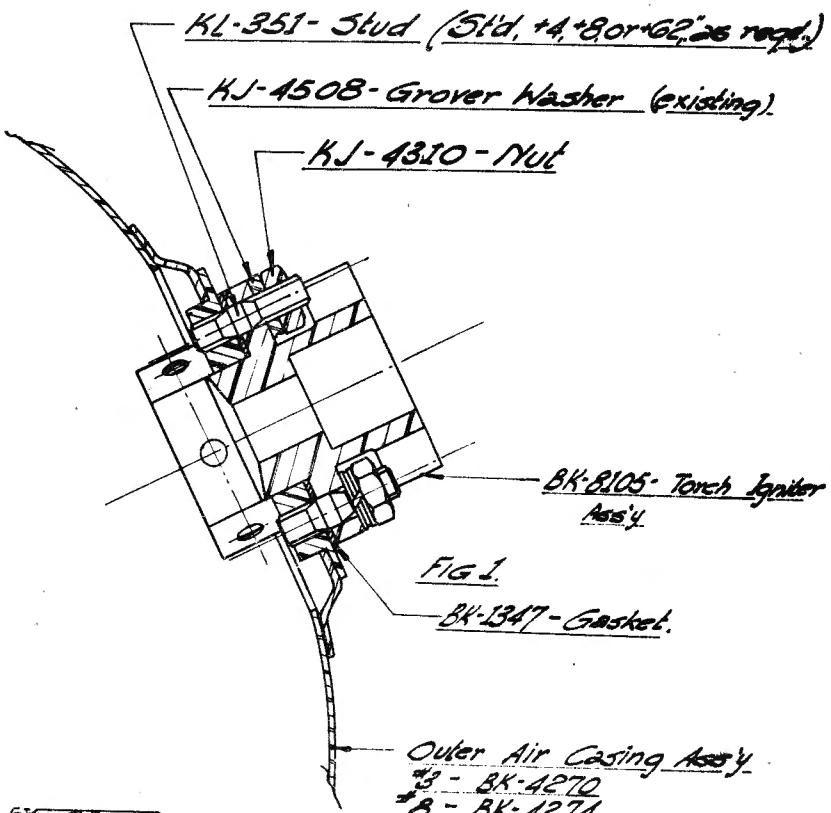
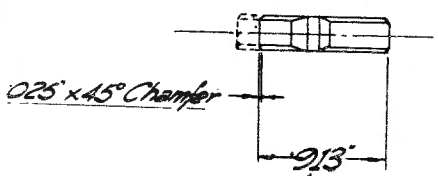


FIG 1.



Machine KL-351 - Stud to dims shown

FIG. 2.

REFERENCE	ISSUED BY	TITLE
	DIRECTORATE OF TECHNICAL SERVICES RAAF.	TORCH IGNITER BOSS - OUTER AIR CASING - SALVAGE

LIMITS UNLESS STATED		MATERIAL		COMPONENT OF	
DECIMALS	± .010"	SPEC.		MACHINE	
FRACTIONS	± 1/32"	TREATMENT		ENGINE	NENE - 2VH
ANGLES	± ½°	FINISH		TECH. ORDER	NENE INSTRUCTION 3
SURFACE FINISH AUSTRALIAN STANDARD ENG DRWG. PRACTICE A.S.C.2		SCALE		DRAWING NO.	B-11313
		DRAWN	J. MARTIN	APPROVED	W.S. McALONEY
		TRACED		CHECKED	D. Elliston

DRWG. A SIZE

CT/FD

Restricted

Air Force Head-Quarters

Technical Order

NENE INSTRUCTION NO. 6

Application: Nene 2-VH

SUSPENSION POINT BOSS - OUTER AIR CASINGS - SALVAGE

Introduction

1. If care is not taken it is possible to strip the 1BA setscrew threads in the suspension point bosses welded onto all outer air casings (BK.4269, BK.4270, BK.4271, BK.4272, BK.4273 and BK.4274).

2. This instruction lays down the repair method to be used when outer air casings become unserviceable because of stripped threads.

3. If any one of the setscrew threads in a suspension point boss is stripped, all four threads are to be repaired as described below in sub-paragraphs (a) and (b):-

(a) Tap threads to the next oversize required to clean up and select a KL.349 (standard, +4, +3 or +41 oversize) stud to give a .003"L to .006"L fit.

(b) Fit stud, holding a projection of .475" and low temperature braze into position from inside of casing. Outer face of boss must be free from braze metal.

4. On completion of repair, assemble gasket (BK.253) and suspension tube (BK.254), and secure with existing grover washer (KJ.4507) and new nut (KJ.4007), as shown on Drawing No. B.11322 attached.

References: File R.A.A.F. 150/4/8131;
C.A.C. Salvage Scheme SL-452.

Drawing: B.11322 attached.

Date of Issue: 13th April, 1951.

DO NOT SCALE

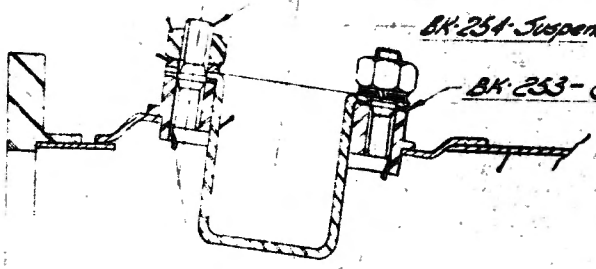
KJ-4007-Nut

KJ-4507-Grover Washer (existing)

KL-349-Stud.

BK-254-Suspension Tube

BK-253-Gasket



Low temperature braze stud into position, from inside

Outer Air Casing Ass'y. BK-4269, BK-4270 BK-427[illegible] BK-4272, BK-4273, BK-4274

REFERENCE	ISSUED BY	TITLE
	Directorate of Technical Services RAF	Suspension Point Boss - Outer Air Casing - Salvage
	MATERIAL	COMPONENT OF
	FINISH	MACHINE
	FINISH	ENGINE Merlin 21, 23
	FINISH	TYPE Instruction C
	DRAWN Martin APPROVED	DRAWING NO B-11322

WSMA

LEED

Restricted

Air Force Head-Quarters

NENE INSTRUCTION No. 7

Technical Order

Application: Nene 2-VH

FUEL SYSTEM - METHOD OF PRIMING

Introduction

1. This instruction sets out the method of priming the fuel system to remove all air (or inhibiting oil) from the system when an engine is first installed in an aircraft or whenever any point up to and including the high pressure cock has been disconnected. Similarly, this operation will be necessary whenever the low pressure cock has been inadvertently closed during the engine "run down", or when the fuel tanks have been drained.

2. The priming operation is carried out in two stages:-

(a) Priming the low pressure section.

(b) Priming the high pressure section.

Priming the Low Pressure Section

3. During this operation both pumps may be bled simultaneously or separately as follows:-

(a) Remove the blanking caps from the upper bleed valve on each of the fuel pumps.

Note: The remaining bleed valve on each pump is to be disregarded.

(b) Screw the special bleed tool BL.3384 into the upper bleed valve on each of the pumps. Bleed the lower pump first

(c) OPEN the low pressure cock. This cock can then remain open and need not be closed except in case of emergency, or for work on the fuel system

(d) Ensure that the high pressure cock is CLOSED.

(e) Check that the boost coil isolating switch is in the OFF position.

(f) Switch the interlocked S.C. safety switch to the ON position.

(g) When the fuel pressure light goes out screw down the bleed tool plunger until the fuel flow from the bleed valve is free from oil and/or bubbles. Bleed the fuel into a suitable container.

Note: The bleed tool plunger must be fully screwed down so that oil and/or air is removed from both sides of governor diaphragm.

(h) Switch OFF the interlocked S.C. safety switch.

(i) Remove the bleed tool BL.3384 from the bleed valves, replace the blanking caps and secure with stainless steel lockwire.

Priming the High Pressure Section

4. The high pressure section is to be primed as follows:-

(a) Plug in fully charged ground starting equipment.

(b) Disconnect the H.T. leads from the torch igniter.

(c) Remove the lockwire from the union nut securing the right angled fuel elbow at the base of the Barometric Pressure Control.

(d) Ensure that throttle is in CLOSED position.

(e) ~~OPEN~~ Ensure that the low pressure cock. is OPEN

(f) OPEN the high pressure cock.

(g) Switch ON master switch.

(h) Switch ON the interlocked S.C. safety switch.

(i) Switch ON the boost coil isolating switch.

(j) When the fuel pressure warning light goes out, press the engine starter button for approximately 2 seconds.

(k) While the engine is turning over, slacken off the union nut below the Barometric Pressure Control, to allow the fuel to emerge. When the fuel flows freely re-tighten the union nut.

(l) When a steady mist of fuel appears from the exhaust unit close the high pressure cock. This occurs after approximately 15 seconds.

(m) After the engine has ceased turning, ~~close the low pressure cock and~~ switch OFF the interlocked S.C. safety switch and boost coil isolating switch.

(n) Switch OFF the master switch.

(o) Re-fit the torch igniter H.T. leads.

(p) Re-lockwire the union nut securing the right angle fuel elbow at the base of the Barometric Pressure Control.

(q) After the fuel has stopped flowing from the drains, remove the surplus fuel from the exhaust unit by raising the nose of the aircraft or by mopping up.

(r) Ground run engine in accordance with NENE Instruction No. 1. During run inspect fuel system assemblies for leaks.

Note: It may be necessary to bleed the low pressure section of the fuel system a second time to eliminate further air. This will be apparent from inconsistent governed R.P.M. If this is necessary disconnect the ground starting equipment and repeat the procedure laid down in paragraph 3, followed by a further ground run of engine.

(s) On completion of priming and ground running carry out final check of fuel line unions for tightness and security of lockwiring.

Reference: File R.A.A.F. 150/4/8214.

Date of Issue: 19th October, 1951.

M 162

DEPARTMENTAL COMMUNICATION

Date 29-3-54

To Service Engineer

From Quality Dept.

Subject: R.A.A.F. Nene Instructions.

The R.A.A.F., through the R.T.O., have queried whether Nene Instructions Nos. 3, 4 and 7 are up to date. These instructions apply to field ac and therefore we bring this query to your attention.

? # 2

A Fishlock

M 163

DEPARTMENTAL COMMUNICATION

Date.....

To.....

From..... Insert Before Part 2. Page 2 (Nene Instr No 4)

RAAF Mod No 34 (CAC Nene Mod No 69) introduces a shroud ring machined eccentrically to give an additional .020" Tip clearance at the Top. This later assembly Part No BK 18742 supercedes the old assembly Part No BK 2622.

This modification has been carried out on all productions engines from S/No 91 onwards, and has been incorporated on engines returned to CAC for overhaul. Shroud ring P/No BK18741 have one dowel and the N.G.V. outer ring is P/No BK 19015. This combination of shroud ring and NGV outer ring is not subject to repositioning of shroud ring.

When the shroud ring and NGV outer ring are P/No BK 2622 and P/No BK 2626 respectively the following methods of adjusting blade tip clearance may be resorted to:-

Nene Instr. No 4

Part 1.

Part 2

CEED

Restricted

Air Force Head-Quarters

NENE INSTRUCTION NO. 8

Technical Order

Application: NENE 2-VH

FUEL PUMPS - TYPES FITTED TO NENE 2-VH

Introduction

1. The integral fuel system of the Nene 2-VH engine contains two Lucas high pressure positive displacement, variable stroke, multi-plunger pumps. These pumps form part of a Lucas series supplied for the Nene and other turbo-jet and turbo-prop engines.

2. These Lucas pumps carry individual type numbers. One pump fitted to the Nene 2-VH quoted to illustrate this, is a Lucas GC. 21/4H. This type number is explained as follows:-

G	-	Governor controlled.
C	-	Indicates size of pump or potential capacity.
21	-	Relates to the specification and drawing standard.
4	-	Indicates the installation standard.
H	-	Relates to the rating.

The general description and principles of operation of these pumps are laid down in Air Publication 4282A, Volume 1, "Fuel System Components for Gas Turbine Engines".

3. Nene 2-VH engines 1 to 8 inclusive were originally issued from the manufacturer with a GC.13/4H series pump fitted in the upper position and a GC.14/5H series fitted to the lower position. Nene 2-VH engines 9 to 60 inclusive were issued from the manufacturer with Type GC. 21/4H fitted to the upper position and GC.14/5H fitted to the lower.

4. The basic difference between the GC.13/4H and the GC.21/4H is in the isolating valve solenoid unit. The operating capacity of the solenoid unit on the GC.21/4H is double that of the GC.13/4H. Fitment of the larger solenoid unit to the GC.13/4H pump alters its specification and drawing standard and thus creates the alteration of the type to GC.21/4H. Nene Modification No. 6 calls for the change-over of the GC.13/4H to GC.21/4H on the first 8 engines. Nene 2-VH present standard pump fitment then becomes GC.21/4H pump, upper and GC.14/4H pump, lower. All three pumps referred to in this paragraph are cleared only for an overhaul life of 200 hours. Reason for this short life is primarily excessive wear on the internal cam plate at the point of contact of the rotor pistons.

5. Later types of Lucas pumps have now become available with the overhaul life extended to 300 hours. The extra life has been obtained by fitment to rotor piston heads of special slipper pad bearing surfaces with an associated modification of the cam plate bearing surface. Both upper and lower pumps are affected by this change, new upper type being GC.205/8F, and lower GC.204/25F One of the main advantages of

these later type pumps is not only the longer life but its ability to run on straight gasoline. It is not possible to run the GC.14 and 21 series pumps on neat gasoline due to the excessive wear and danger of early pump failure. Consequently if gasoline is used with these early type pumps it must have 3% of lubricating oil mixed with it.

Aircraft Engineering Instruction-General, Part 5, Section 1, Instruction No. 1 lays down fuels to be used in the Nene and is to be adhered to irrespective of which types of pump are fitted.

6. C.A.C. Nene 2-VH 61 inclusive onwards will be issued by C.A.C. with GC.204 and GC.205 series pumps fitted. In order that stocks of the GC.14 and 21 series pumps are fully used it is desirable that when any pump replacements are made on engines 1 to 60 that they be of similar type and the same procedure followed with engines 61 onwards with the later type pumps. Both the early and later series pumps may be mixed on engines, however, if spares availability is such that there is no alternative, Nene Modifications are to be checked at such times to ensure that installation standards have not altered.

References: File R.A.A.F. 150/4/8223.
C.A.C. Nene Mod. No. 46.
Rolls-Royce Nene Mod. 164.

Date of Issue: 7th December, 1951.

Restricted

Air Force Head-Quarters — NENE INSTRUCTION NO. 9

Technical Order — Application: NENE 2-VH

FUEL SYSTEM - MAINTENANCE OF FILTERS

Introduction

1. This instruction has been raised to record certain defects that have occurred during operation of the Nene. Reasons for these defects have been found in partially and fully blocked fuel system component filters.

2. There are several filter units placed at various stages of the Nene fuel system with each filter designed to protect vital section operating characteristics.

3. The first protective filter is the main low pressure unit mounted at the bottom of the wheelcase. This filters the main primary fuel supply to the engine. It is a star shaped felt element designed for complete protection to fuel system components. However, several other small filters exist in the system as a further safeguard. Each pump has a small wire strainer in its inlet union housing for initial protection and another small wire wound filter in the metering orifice to protect delivery pressure fuel to the servo piston chamber. The barometric pressure control unit has a small wire wound filter situated in its pump servo pressure fuel connection housing. Each burner has a small wire wound filter fitted in its primary pressure connection housing.

4. These small wire wound filters in the pumps, B.P.C., and burners, are of extreme importance as the fuel passing through them is supplied to very small metering units which rely on consistent uniform flow for efficiency.

Low Pressure Fuel Filter

5. No cases of partial or complete blockage of low pressure filters have occurred to date on the Nene 2-VH. This is due mainly to the excellent initial fuel filtering protection given by the streamline filter units fitted on tanker delivery hoses. Contamination of the low pressure fuel filter is then entirely dependent on the efficiency of refuelling equipment in regard to stopping foreign matter. It is consequently important to ensure that streamline filters are serviced regularly. If they are kept in an efficient condition no trouble should ever be experienced in regard to fouling of the low pressure filter element. A symptom of low pressure filter blockage shows itself normally in inability to obtain full engine power.

6. The following precautions and inspection requirements are to be adhered to. All other instructions on servicing of these filters being hereby cancelled.

7. There are no really satisfactory methods of cleaning these felt filter elements. Once they are impregnated with foreign matter or plain sludge it is impossible to remove all of it. If attempts are made to brush or rub the surface of the element it will have the effect of forcing some of the particles of dirt further into the wool and, in addition, will tend to tear the outer fibres. Trichlorethylene or similar de-greasing agents must not be used. Washing filters in such liquids results in the natural greases being removed from the wool fibres with their resultant brittleness. These brittle fibres could then break off and be carried into the fuel system and consequently clog some of the smaller wire filters. Extreme care is therefore to be taken when removing and refitting filters to ensure that the surface or ends of the element are not even slightly damaged. New elements are to be fitted at each complete overhaul or when an inspecting unit considers that an element is damaged or contaminated with foreign matter. Filter inspection laid down at present is at engine installation and minor inspections. Dismantling of the filter unit should be avoided as much as possible outside these times.

8. If new filter elements are not available then the following method of cleaning a blocked element can be done as an emergency measure only. The element is to be sealed at each end by two flat plates held together by a bolt passing down the centre of the element. This end seal is to prevent sludge washed off the outside finding its way into the centre. The sealed element can then be swilled in petrol to remove sludge and foreign matter. Care is to be taken that the cleaning is confined to swilling and no attempt is made to clean the felt surface by physical means.

9. Reports from overseas state that the existing method of sealing the ends of the filter element is considered unsatisfactory with possibility of foreign matter by-passing the filter. The filter element has been re-designed with more efficient end sealing and modification action will be taken to introduce these elements as soon as supplies are available.

Pump Filters

10. No trouble has been experienced to date with blockage of pump inlet strainers or orifice wire filters and it is not considered necessary to lay down inspection of these before pump complete overhaul for the following reasons:-

(a) The wire strainer is of a relatively large area and can cope with any normal passage of foreign matter that may in rare cases by-pass the low pressure filter. Access to this pump inlet filter is gained by removing the inlet flexible hose and removal of the inlet union housing from the pump body.

10. (b) The wire wound filter in the servo chamber metering orifice is not in the main pump high pressure fuel flow and does not suffer from blockage for this reason. This filter is extremely difficult to remove and can easily suff· dam-age when attempts are made.

(c) Inspection carried out to date on pumps returned for investigation of faults has not revealed any degree of blockage of either pump inlet or orifice metering filters.

B.P.C. Filter

11. Trouble has been experienced with blockage of the wire wound filter on the Barometric Pressure Control Unit. Blockages have been due to extremely fine pieces of metal and fibre matter. The metal particles have probably originated from various fuel system units as a result of insufficient attention to cleaning when the units were first assembled. The small fibre particles appear to have originated from the low pressure filter element. The wire wound filter in the B.P.C. is of an extremely fine filtering capacity and when first inspected may appear to be quite clean. It is necessary in most cases to inspect it with a magnifying glass to reveal the foreign matter obstructing it.

12. Blockage of this filter has a direct effect on the performance of the B.P.C. unit as it affects the twin pumps servo piston fuel delivery past the B.P.C. half-ball valve. Complete blockage of the filter would therefore make the B.P.C. inoperative with consequent lack of correction on engine R.P.M. with altitude. Partial blockage of the filter would cause sluggish operation of the B.P.C. with relevant varying reaction on engine R.P.M. over altitude.

13. A practical method of checking cleanliness of the B.P.C. filter is to run the engine at 8000 R.P.M. and check the R.P.M. rise when the fuel pump emergency switch is placed "ON". Nene Instruction No. 1 lays down only "a rise in R.P.M.". No tolerance of R.P.M. range change is given as it varies considerably with pump efficiency and is not a critical factor in the operation of the Nene fuel system. Normally the rise in R.P.M. will take within 2-3 seconds and average R.P.M. increase will be approximately 800. However, rises over a 200 to 1500 R.P.M. range can still be obtained from a serviceable Nene fuel system.

14. When carrying out the engine running check at 8000 R.P.M., the following R.P.M. reactions, with use of the fuel pump emergency switch, can be used as a guide for assessing blockage of B.P.C. filters:-

(a)	No change in R.P.M.	- completely blocked filter.
(b)	Small R.P.M. rise, i.e., under 200	- major filter blockage.
(c)	Sluggish R.P.M. rise (over any of normal range)	- partially blocked filter.

15. Due to the variations on engines of the total R.P.M. rise and the fact that this can be accepted as normal it is not possible to give detail information above that referred to in paragraph 14 (a), (b) and (c). It may also be found that an engine giving no R.P.M. rise with this check may have a serviceable B.P.C. unit with clean filter and the reason for the lack of R.P.M. rise being associated with a defective fuel pump or inoperative solenoid isolating valve on the top pump.

16. However, when pilots report unusual lack of automatic control of engine R.P.M. with altitude variations or when weekly engine checks reveal symptoms as outlined in paragraph 14, sub-paragraphs (a), (b) and (c), the B.P.C. filter is to be removed and cleaned. Filters should be very carefully cleaned with a high pressure air/kerosene jet making sure that the inside flutes of the filter as well as between the wires are thoroughly cleaned out. A final inspection should be done with a magnifying glass.

17. In view of the fact that several cases of partially blocked B.P.C. filters have been found by units, removal and cleaning is now to be done at each minor inspection.

Burner Filters

18. Each duple burner fitted to the Nene 2-VH has a wire wound filter fitted in its primary fuel supply union housing. This filter is similar to the one in the B.P.C., being of fine filtering design. A case has occurred of these filters being blocked by foreign matter which included small fibre pieces in a manner similar to the B.P.C. filter.

19. If one or more of these burner filters becomes partially or completely blocked the burner efficiency suffers. It is difficult to lay down precise symptoms of fouled burner filters, but as loss of burner efficiency affects combustion efficiency the result is always a higher jet pipe temperature for a given engine condition. The following signs during engine operation may indicate burner filter defects:-

(a) Signs of heat inside of exhaust cone with associated buckling or cracking.

(b) Distortion and bracking of nozzle guide vanes.

(c) Distortion of turbine wheel shroud ring with associated loss of turbine tip clearance.

(d) High jet pipe temperatures, particularly at idling.

20. In view of the fact that several cases of burner filter blockages have occurred with subsequent damage to engines from overheating, removal and cleaning of these filters is now to be done at each minor inspection in like manner to the B.P.C. filter.

21. Blockage of burner filters may assist build-up of carbon formation on burner orifice faces but the two are not necessarily always associated. Carbon fouling of burners is usually the result of incorrect or contaminated fuel. No defects have been reported to date in connection with carbon fouling of burners and it is not proposed to introduce any standard inspection cycle of these items between overhaul times.

Reference: File R.A.A.F. 150/4/8283.

Date of Issue: 29th February, 1952.

J. NELB

Restricted

Department of Air

Technical Order

NENE INSTRUCTION NO. 10
(ISSUE 2)

Application: Nene 2-VH

FUEL PUMPS GC.204 AND GC.205 SERIES - INSTALLATION PRECAUTIONS

Introduction

1. The above fuel pumps are of the slipper pad type and are now coming into service on Nene 2-VH engines.

2. With the introduction of the slipper pad pump the sealing system has been re-designed.

3. The inner diameters of the seals now bear on an extension sleeve of the pump rotor and not on the quill shaft as previously.

4. The quill shafts on these slipper pad pumps (Pre Lucas Modification CP.236) are splined into their rotor bodies and sealed by a rubber ring retained by a circlip at the inner end of their shafts. Any fuel that passes this rubber seal can leak along the quill shaft and into the engine wheelcase.

5. Cases have occurred where the quill shaft has been moved longitudinally due to the shaft being accidentally knocked, which has resulted in the rubber seal at the driving end of the quill shaft being moved away from its sealing face in the rotor body.

6. Care should be exercised in order to avoid shock loading the quill shaft which could result in a fuel leak, and it is necessary to check the free length of the quill shaft before fitting the pump to the engine.

7. The measurement should be 3.300" $\pm$ .020" from the tip of the quill shaft to the locating flange face. Units not conforming to this measurement should be returned for rectification.

8. GC.204 and GC.205 series pumps incorporating Lucas Modification CP.236 feature a shouldered quill shaft with a diametrical seal located by a groove mid-way along the quill shaft. This seal is unaffected by longitudinal movement of the quill shaft. Pumps with Lucas Modification CP.236 can be identified by a raised shoulder on the drive end of the splined shaft protruding from the pump housing. The measurement from the tip of the shaft to the mounting flange on these pumps is 3.125 + 0 - .050".

Ref AL.3

Reference : File Department of Air 150/4/8346.

Date of Issue : 15th February, 1955.

Restricted

ES/ED

Restricted

Air Force Head-Quarters

NENE INSTRUCTION NO. 10

Technical Order

Application: Nene 2-VH

FUEL PUMPS GC.204 AND GC.205 SERIES - INSTALLATION PRECAUTIONS

Introduction

1. The above fuel pumps are of the slipper pad type and are now coming into service on Nene 2-VH engines.

2. With the introduction of the slipper pad pump the sealing system has been re-designed.

3. The inner diameters of the seals now bear on an extension sleeve of the pump rotor and not on the quill shaft as previously.

4. The quill shafts on these slipper pad pumps (Pre Lucas Mod. CP. 236) are splined into their rotor bodies and sealed by a rubber ring retained by a circlip at the inner end of their shafts. Any fuel that passes this rubber seal can leak along the quill shaft and into the engine wheelcase.

5. Cases have occurred where the quill shaft has been moved longitudinally due to the shaft being accidentally knocked, which has resulted in the rubber seal at the driving end of the quill shaft being moved away from its sealing face in the rotor body.

6. Care should be exercised in order to avoid shock loading the quill shaft which could result in a fuel leak, and it is necessary to check the free length of the quill shaft before fitting the pump to the engine.

7. The measurement should be 3.300" $\pm$ .020" from the tip of the quill shaft to the locating flange face. Units not conforming to this measurement should be returned for rectification.

8. GC.204 and GC.205 series pumps incorporating Lucas Mod CP. 236 feature a shouldered quill shaft with a diametrical seal located by a groove mid-way along the quill shaft. This seal is unaffected by longitudinal movement of the quill shaft. Pumps with Lucas Mod. CP. 236 can be identified by a raised shoulder on the drive end of the splined shaft and protruding from the pump housing.

Reference: File R.A.A.F. 150/4/8346.

Date of Issue: 9th May, 1952.

Restricted

Air Force Head-Quarters

Technical Order

NENE INSTRUCTION NO. 11

Application Nene 2-VH
Installed in Vampire Aircraft

NENE FUEL SYSTEM - HIGH PRESSURE COCK CONTROL SHAFT END LEVER

Introduction

1. In order to minimise end float in the H.P. cock control shaft assembly, the H.P. cock control lever should be installed in such a position that one corner of the square end of the shaft is directly in line with the clamping slot in the lever. (See Fig. 1).

2. Should the control lever be installed using the alternative square, the clamp bolt will have so little engagement with the shaft groove that excessive end float in the assembly is likely. By using one corner of the shaft square, the greatest depth of engagement between the clamp bolt and the groove is obtained and this results in considerable reduction of the total end float, with less possibility of fuel leaks past the shaft seal.

3. Where necessary, the position shown in Fig. 1 can be obtained by removing the lever stop plate and altering the engagement of the rack and pinion teeth, ensuring that the open and closed positions of the valve are controlled by the lugs of the stop plate.

4. Components as fitted to the engines comply with this instruction, however, should a H.P. cock be received from stores not complying with this instruction, it is to be carried out before fitment.

DESIRED ASSEMBLY OF LEVER TO SHAFT

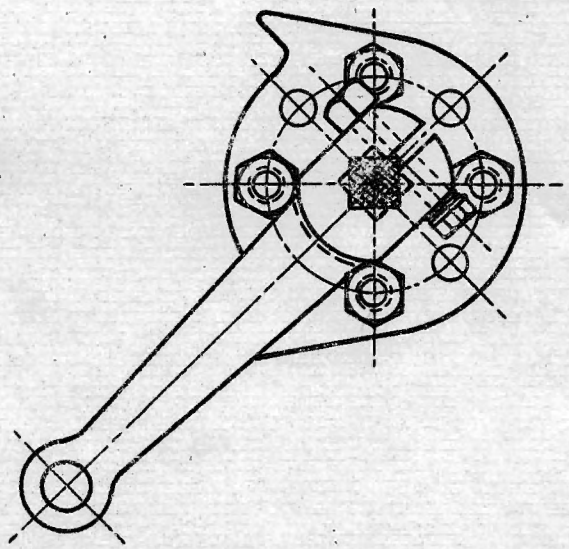


FIG. I.

Reference : File R.A.A.F. 150/4/8491.
C.A.C. "Nene" Engineering Bulletin No. 11

Date of Issue : 26th January, 1953.

AAP 711.23, Vol 2, Pt 1

NENE INSTRUCTION NO 12
(ISSUE 2)
Application: ALL NENE
2-VH ENGINES

PRESERVATION FOR STORAGE AND TRANSIT OF NENE ENGINES

Introduction

1. This instruction details the preservation treatment applicable to Nene engines to ensure an adequate standard of protection against corrosion during storage and transit.

Short Term Storage

2. This term applies to engines in storage or inoperative for periods of less than one month.

Engines which can be run

3. (a) Run the engine at least once in every seven days at idling speeds for about four minutes with a further one minute at maximum continuous RPM to clear the engine.

(b) Examine the external surfaces of the engine for traces of corrosion and damage to the protective finish. Remove any corrosion found and re-enamel exposed metal; treat affected parts with rust preventative PX-1, K2/229. Clean all control joints and lubricate with clean engine oil.

Engines which cannot be run

4. Where it is not possible to run installed engines or in the case of uninstalled engines which are expected to be out of use for periods of over 7 days, but not exceeding one month, the engine must be inhibited and protected as described in the following paragraphs.

Long Term Storage

5. This term applies to engines which are expected to be in storage or inoperative for one month or more; engines are to be internally and externally treated and the fuel system fully inhibited within 48 hours of the last ground run.

(Issued with A/L No 8 - August, 1958)

Fuel System - Inhibition

6. The "Nene" engine fuel system is to be inhibited by filling with oil to Specification OM-11 D ENG RD 2490, Stores Reference K2/248, whenever it is likely that the engine will be inoperative for a period of seven days or longer. The equipment and procedure recommended are as follows:-

Equipment

7. (a) The use of a compressed air operated oil primer is recommended, when inhibiting the fuel system of these engines. The equipment is to be adjusted for use on jet engines, so that the priming pressure does not exceed the safe maximum. The normal priming pressure should be 10 to 12 psi. On no account is the pressure to be allowed to exceed 20 psi, or damage to the system will result.

(b) When the primer mentioned in the preceding paragraph is not available, a suitable rig may be made up in the following manner:-

Set up an oil tank with a capacity of at least four (4) gallons, to give a head of three (3) feet on the fuel pump. Then, using 7/8 inch or 1 inch bore pipe line, make a pipe run free from sharp bends to the fuel filter inlet.

(c) If the aircraft fuel tanks are to be drained and the equipment mentioned in sub-paragraphs (a) and (b) is not available, oil may be poured into the main fuselage tank and the engine motored over. After making sure all fuel is drained from the main fuselage tank, pour 5-6 gallons of oil to Specification OM-11 D ENG RD 2490, Stores Reference K2/248 oil into the main fuel tank and use the tank booster pump to supply the oil to the low pressure fuel filter.

8. Proceed as set out in paragraph 9 below. Ensure that the LP cock is turned off and that all tanks, pipe lines and oil to be used for inhibiting purposes are clean and uncontaminated. See that the engine sump contains an adequate quantity of oil to Specification OM-11 D ENG RD 2490 to ensure that the various engine bearings are lubricated during motoring.

(Issued with A/L No 8 - August, 1958)

Procedure

9. The sequence of operations is then as follows:-

(a) Check that the HP and LP cocks are in the "OFF" position.

(b) Close the throttle.

(c) Disconnect the booster coils or high emergy igniter units from the aircraft supply.

(d) Remove the blanking plug from the highest bleed point on each fuel pump and attach the bleed tools BL 3384.

(e) Loosen the LP filter drain plug and drain the fuel system, depressing both bleed tool plungers in turn, to permit gravity draining. The top plunger should be depressed first. After all the fuel has drained off, retighten the filter drain plug.

(f) If inhibiting oil is being supplied from a rig, disconnect the fuel inlet pipe to the filter and blank off the pipe. Connect the inhibiting rig pipe to the filter. If the oil is being supplied from the aircraft main tank, leave the inlet pipe to the fuel filter intact.

(g) Check that the inhibiting rig tank contains at least four (4) gallons of oil. Turn on the oil supply. When the inhibiting oil is to be drawn from the main fuel tank, turn "ON" tank booster pump and open the LP cock.

(h) Depress the bleed tool plungers on both pumps, until oil is emitted in a steady stream, free from air bubbles. Remove the bleed tools from both pumps and refit the blanks.

(j) Check that the fuel pump isolating switch is "OFF" (ie, pumps in "normal" condition) and on engines with torch igniters, that the main and T.I. feed pump switches are "ON". Carry out a motoring cycle with the engine starter, and after ten seconds of this cycle, open the HP cock and the throttle valve in order to flush the pilot burners and manifold. Check that the inhibiting oil flows freely from the drain valve between Nos 5 and 6 combustion chambers.

(issued with A/L No 8 - August, 1958)

(k) When the engine has stopped turning, close the HP cock and the throttle valve and disconnect the inhibiting rig pipe. To minimise loss of oil from the fuel system, immediately close off the fuel inlet to the LP filter. If the oil has been supplied from the fuel tank, close the LP cock, switch "OFF" tank booster pump and drain unused oil from the fuel tank.

(l) Replace the booster coil connections or high energy igniter units, first checking that the current supply is switched "OFF".

WARNING: Operation of the starter motor, while the engine is turning, will result in damage to the starter motor engaging mechanism.

Notes:- (a) When no means exist for rotating the engine, as, for example when the engine is removed from the aircraft or the aircraft facilities are not available for use, the engine turning handle (HW4855) may be used, but it is essential that the maximum speed possible be attained (400 rpm approximately), two minutes' turning in a clockwise direction being the equivalent of one motoring cycle. If hand turning is employed, a 24-volt electrical supply is to be connected to the Plessey priming pump and the torch igniter solenoid valves when fitted, to ensure a flow of inhibiting oil through these components during the turning cycle.

(b) Where turning handle is not available, the engine may be turned over by hand at the turbine, making sure that the direction or rotation is correct (anti-clockwise from the rear). Prior to starting the engine after an inoperative period, where inhibiting the fuel system has been carried out, it will be necessary to bleed the fuel system as described in RAAF "Nene" Instruction No 7.

General Internal Preservation, Installed Engines

10. Interior of the engine is to be inhibited in the following manner:-

(Issued with A/L No 8 - August, 1958)

After the Fuel System has been inhibited, 10 grams (approximately one table spoon) of Vapour Phase Inhibitor powder K4/10993 is to be introduced to each of the following positions:-

(a) Inside the jet pipe as near the turbine blades as is possible without uncoupling the jet pipe.

(b) Through the front and rear intake screens taking care that the powder does not fall through the lower screens and out of the engine. This can be done with canvas covers fitted.

(c) Into the cooling air intake through the rear end of the rear main screen.

(d) Into the bottom of the engine bay. The engine should now be sealed from atmosphere as far as possible by blanking off engine and nacelle apertures including the cabin pressure pipe, and doping fabric covers and the jet pipe orifice and the aircraft air-intakes.

General Internal Preservation for engines which are not installed.

11. These engines are to be treated in the same manner as installed engines, but in addition 10 grams of VPI powder should be introduced through the turbine blades and nozzle guide vanes into the nozzle bore using a rubber bulb and nozzle.

12. (a) Engine is to be thoroughly cleaned with kerosene or white spirit taking care that the cleaning agent does not enter the compressor inlets.

(b) Inspection of engine is to be carried out and where paint has been removed by abrasion or impact, corrosion if any is to be removed by scraping and/or scrubbing with fine emery cloth.

(c) With the exception of the oil sump and external wheelcase all main castings are of aluminium. These after removal of corrosion if any are to have a coat of zinc chromate (K3/176) applied and allowed to dry for 15 minutes. A coat of air drying enamel is then to be applied.

(d) Magnesium castings (oil sump and external wheelcase) which shows signs of corrosion are to have a 10%

solution of selenious acid in water applied to the affected part until a dark brown film is formed. The solution is then wiped off with a wet rag and the area dried immediately. This item is identified as K4/11055 Acid Selenious Crystals and is to be used in accordance with AP 2656A, Vol, 1 Sect 5, Chap 2, para 11. The casting is then to be given a coat of zinc chromate K2/176 and finished off with a coat of air drying enamel.

(e) All engine openings are to be fitted with appropriate covers, if necessary seal with adhesive tape.

(f) Corrodible exterior parts ie controls, studs, nuts, clips etc are to be treated locally with K2/229 (Protective PX 1).

(g) Ball ends, and control joints are to be liberally coated with grease XG-275, K2/210.

Note: Care is to be taken to prevent corrosion preventative mixtures used in external inhibition from entry to air intakes. Under no circumstances is the exhaust unit to be treated.

13. Uninstalled engines are to be packed in metal lined, or water vapour proofed containers and stored in a dry, cool place, or stored covered by a plastic reusable moisture proof envelope on a transit stand.

14. The following are types of approved casings, and plastic moisture proof envelopes.

(a) Case Steel Nene Engine approx 5 ft diam x 7' long (Ident No B23/800001)

(b) Container Steel, Blast Tube. (Ident No B23/800002)

(c) Cases C/W Stand 7'10¼" x 5'4¼" x 5'7½" high (Ident No B23/800000)

(d) Stands Nene Engine Tubulor Steel Mobile (for Airfreights) (Ident No B23/800003)

(e) Cover Moisture Vapour Proof (Ident No B23/800004)

(f) Case Transit Exhaust Unit (Ident No B23/800005)

(Issued with A/L No 8 - August, 1958)

15. Engines must be enveloped in the Covers Moisture Proof before being installed in Case Steel Ident No B23/800001. Immediately before sealing engines in air tight cases, a liberal number of bags containing Silica gel(K4/546) is to be distributed around the engine. Care must be taken to ensure that the silica gel bags do not touch the metal surfaces of the engine. Grease proofed paper may be inserted between engine and desiccant and taped to the engine to prevent contact. Sprinkle between ¼ to ½ lb of VPI on the bottom of the case or blow same into envelope. Insert a humidity indicator if provision is made for one. Seal envelope and case.

Note: It is imperative that the Silica gel and indicators are not exposed to the atmosphere for more than 10 minutes before sealing in container. The certificate RAAF Form E/E 203 is to be completed and attached to the engine in a conspicuous position.

Represervation During Storage

16. (a) The requirements for represervation will depend upon the conditions under which the engine is stored and the results of the periodic inspections. An engine which is to be represerved is to have the complete internal treatment applied as described in the foregoing paragraphs; damage or deterioration to the original external treatment is to be rectified before the engine is repacked.

(b) Unless inspection indicates the necessity for more frequent attention, the represervation of engines held in store is to take place at the following intervals:-

(i) Installed engines: every six months.

(ii) Engines packed in unlined wooden cases: every six months.

(iii) Engines packed in hermetically sealed containers or cocooned engines. The humidity indicator is to be checked every three months and provided it shows no discolouration, the engine may remain in storage without further treatment.

(Issued with A/L No 8 - August, 1958)

Preparation for use after Storage

17. Prior to starting the engine after an inoperative period, where inhibiting of the fuel system has been carried out, the fuel system is to be bled.

18. This instruction cancels and supersedes Nene Instruction No 12, dated 3rd June, 1954.

Reference : File, Department of Air, 150/4/8776.

Date of Issue: 29th August, 1958.

(Issued with A/L No 8 - August, 1958)

Restricted

Air Force Head-Quarters

NENE INSTRUCTION NO. 13

Technical Order

EXPANSION CHAMBERS - OUTLET ELBOW BOLTS - TIGHTENING PROCEDURE

Introduction

1. To ensure that the spherical sealing ring is properly bedded, and that undue tightness of the nuts, which would cause fracture of the flange during hot running conditions, is prevented, the following procedure is to be adopted.

Instruction

2. Tighten the nuts to a torque of 35 in. lb. The nuts must then be released, relieving the bolts of tension. Again tighten the nuts to finger tightness only. Increase the tension by a further constellation, then insert split pin and lock.

3. This instruction cancels and supersedes D.T.S. Special Instruction Nene No./26.

Reference : File R.A.A.F. 150/4/8818, C.A.C. Turbine Engineering Bulletin No. 19.

Date of Issue : 11th August, 1954.

A.A.P.711:23, Vol.2, Part 1

NENE INSTRUCTION NO. 14

Application: Nene 2VH Engines

PRESSURIZING VALVE PLUNGERS - PARTIAL SEIZURE

1. Cases have occurred where pressurizing valve plungers featuring carbon sleeves to Nene Modification 286 (Lucas Modification CP.308) have partially seized in their respective guide bushes, resulting in the engines becoming unresponsive to throttle movement.

2. Investigation has revealed that there is a tendency for the carbon sleeves to grow slightly in service, but the reason for this growth is not yet known.

3. The existing drawing limits are such that units may be built with a minimum diametrical clearance between the plunger and its bush of .0001 inch, and in view of the tendency of the carbon sleeves to grow, this is now considered inadequate.

4. Modification action is being taken to alter the drawing limits to ensure a minimum clearance of.0003 inch, but it is obvious that action must also be taken to ensure a safe working clearance of engines in service.

5. When a plunger is suspected to be partially seized, proceed as follows:-

Note:- Extreme care is to be taken at all stages of this work to prevent ingress of dust or grit into the pressurizing valve and fuel system.

(a) Remove engine cowlings to gain access to the pressurizing valve.

(b) Remove the seven 1/4 inch nuts, spring washers and plain washers securing the plunger spring cover.

(c) Remove the cover, the plunger spring and two spring seatings. Withdraw the plunger.

(d) Where the plunger is a plain alum. bronze type, then Modification 286 is not featured, and any high spots or signs of stiction are to be removed by lightly polishing with crocus paper, followed by polish with metal polish, and wash in kerosene.

(e) Plungers featuring carbon sleeves to Modification 286 are to be treated as follows:-

(i) One operator holds the plunger at the extreme ends with his finger tips and rotates it slowly, while another operator, with a strip of crocus paper approximately 1 inch wide looped around the plunger, polishes the carbon sleeve by first pulling one end of the strip and then by the other in rapid succession. This operation continues for four (4) minutes, during which time a moderate pressure is to be applied to the crocus paper. Under these conditions, the

diameter of the sleeve should be reduced by .0002 inch. A fresh piece of paper is to be used for each plunger treated, and care is to be taken to ensure a parallel finish.

(ii) The plunger is then to be thoroughly scoured in kerosene, using a small stiff bristled brush to remove any particles of crocus powder that may be embedded in the surface of the carbon.

(iii) Polish the carbon sleeve for approximately thirty seconds with a piece of clean rag soaked in metal polish and then thoroughly wash in kerosene.

(f) Replace the plunger in the pressurizing valve and check that it is a free sliding fit in its guide bush.

(g) Replace the spring seatings and the plunger spring.

(h) Examine the two cover sealing rings and renew, if there are any signs of stretching or damage.

(j) Fit the top cover.

(k) Bleed the fuel system.

(l) Ground run the engine and check for leaks and satisfactory operation.

References : File Department of Air 150/8/566 Nene Service Bulletin Sect.6 No.1

Date of Issue : 11th July, 1955.

A.A.P. 711.23, Vol.2, Pt.1. NENE INSTRUCTION NO.15

APPLICATION : NENE 2VH ENGINES

INTRODUCTION OF HIGH ENERGY IGNITION AND RECOMMENDED STARTING AND RELIGHTING PROCEDURES

Introduction

1. The standard method of lighting up a "Nene" 2-VH engine has been to utilise a torch igniter, consisting of a small combustion chamber in which was mounted a suitable sparking plug and atomisers. To feed this igniter, it was necessary to have an electrical system and a secondary fuel system, consisting of pump, valves and associated pipe work.

2. The advent of the high energy igniter system (R.A.A.F. Nene Mod.53) means that the fuel system for the ignition can be dispensed with, thus saving a considerable amount of complication and weight. It also provides improvement in relighting at high altitude and with comparatively high windmilling speeds.

Construction

3. The engine plug differs from the conventional sparking plug and is a high energy surface discharge plug with ceramic insulation and steel electrodes. The discharge end of the plug is made up solid with centre electrode, insulator and outer metal housing, which is earthed.

Operation

4. A trembler coil interrupts the normal aircraft battery supply and transforms this to a higher voltage. This higher voltage supply is passed through a rectifier to a storage condenser, the rectifier acting as a non-return valve, thus preventing the condenser from discharging back into the winding of the trembler coil. When the potential across the storage condenser reaches a predetermined value (2,000 volts), the sealed spark gap operates. The condenser then discharges and its stored energy is dissipated in a flashover on the surface of the discharge igniter plug. The process is repeated at a frequency of approximately one discharge every second. Resistances are fitted to limit the value to which the condenser can be charged in the event of an open circuit occurring in the H.T. circuit, and to dissipate the stored energy if the unit is stored.

(Issued with A.L.7 - June, 1957)

Servicing

5. Because of the high speed discharge, the instantaneous current flow rises to an extremely high value, thus all connections must be firmly made by either soldered joints or high pressure contacts, otherwise serious losses in resultant output energy at the igniter plug will be experienced. It is therefore most essential that the lead between the igniter plug and the igniter unit is making good contact and that the securing nuts are tight. If care is taken to see that this condition is fulfilled, no trouble should be experienced during the normal life of the system.

6. The maximum and minimum operating voltages of the igniter unit are through the range from 29 down to 16 volts on the aircraft battery supply. In practice, a heavily carboned igniter will give a better spark than a clean one. This is because the initial electrical leakage is more positive and decisive.

Note: The energy stored in the condenser can, under certain circumstances, be lethal. It is therefore recommended that when the low tension Breeze plug is disconnected, one minute should be allowed before handling the unit for servicing or maintenance.

Serviceability Check

7. Set the engine controls and check as follows:

H.P. Cock	CLOSED.
Ground/Flight switch	GROUND.
Starter battery switch	ON.

8. Ensure that all fuel has drained from the combustion chambers. Turn "Venner" time switch ON and listen for the pronounced "snapping" sparks from the igniter plugs. This switch may be returned to OFF position before its thirty second time cycle is completed.

Warning: Never test a high energy plug or igniter unit by earthing the plug to enable the spark to be viewed, or by making an air gap with the H.T. lead. Apart from possible danger to personnel, this can also damage the engine by local burning.

(Issued with A.L.7 - June, 1957)

Note: Normally, the igniter plugs and ignition units should last for the life of the engine, without any servicing being necessary, but if either is suspected of unserviceability, the item should be renewed. No servicing or rectification of igniter plugs or ignition units is permitted, neither is it advisable to remove carbon from the plugs.

Starting the Engine

9. (a) Ensure flap lever is in the DOWN position and brakes locked ON.

(b) Have a 240 ampere-hour, 24 volt ground starter battery plugged into the starter socket in the port flap shroud.

(c) Turn ground/flight switch to FLIGHT.

Note: If aircraft batteries are flat, it may be necessary to use an external 24 volt battery in the front, or test socket, in which case the ground/flight switch should be at GROUND until the starting cycle is complete and the engine idling satisfactorily.

(d) Check L.P. cock ON (Fully forward and up). Check fuel contents. Check fuel pressure warning light ON.

(e) Fully close the throttle lever.

(f) Switch ON interlocked S.C. SAFETY switch and the ignition switch.

(g) Check fuel pressure warning light is OUT.

(h) Press ENGINE STARTING button for two seconds and release. Seven (7) seconds after releasing engine starting button, OPEN H.P. cock smoothly.

(j) After ignition has taken place, the engine will accelerate up to idling r.p.m. (2650 $\pm$ 100), without further attention and should reach that speed approximately 55/60 seconds after pressing the engine starting button. During starting, jet pipe temperature may momentarily exceed maximum permissible idling temperature of 550°C.

(k) In the event of ground and aircraft batteries being not fully charged, it is possible that after preliminary light up of the engine during the starting cycle, it will be found that the engine r.p.m. will not build up to idling figures and jet pipe temperatures have exceeded normal maximum. When under this condition engine r.p.m. refuses to increase and jet pipe temperatures have reached a maximum of 600°C., the H.P. cock should be closed and an investigation carried out on the state of the aircraft and ground batteries before attempting further starts. If batteries are found to be satisfactory and the engine r.p.m. still does not build up to idling figures after light up, change of starter should be effected.

Relighting

10. Engine Failure in Flight

(a) Above 15,000 feet:

If combustion ceases above 15,000 ft., immediate relight action should be carried out, as follows:-

(i) CLOSE H.P. cock IMMEDIATELY. (Do not close L.P. cock).

(ii) CLOSE throttle.

(iii) Reduce windmilling to between 750-1000 r.p.m., by decreasing I.A.S.

(iv) Turn "Venner" time switch ON.

(v) After five seconds have elapsed, OPEN H.P. cock smoothly.

(vi) When r.p.m. or J.P.T. rises and slow running r.p.m. have stabilised, open throttle slowly to required r.p.m.

(vii) If the relight is unsuccessful, CLOSE the H.P. cock and descend to 15,000 feet and proceed as for (b).

(Issued with A.L.7 - June, 1957)

(b) Below 15,000 feet:

If combustion ceases below 15,000 feet, immediate relight action must be carried out, as follows:

(i) CLOSE H.P. cock IMMEDIATELY. (Do not close L.P. cock).

(ii) CLOSE throttle.

(iii) Turn ON the FUEL PUMP EMERGENCY switch.

(iv) Reduce windmilling to between 750-1000 r.p.m., by decreasing I.A.S.

(v) Turn "Venner" time switch ON.

(vi) After five seconds have elapsed, OPEN H.P. cock smoothly.

(vii) When r.p.m. or J.P.T. rises and slow running r.p.m. have stabilised, open throttle slowly to required r.p.m.

(viii) If the relight is unsuccessful, CLOSE H.P. cock and repeat relighting procedure as above.

Notes: 1. The H.P. fuel cock must not be left OPEN for more than thirty seconds if engine fails to start, and one minute should be allowed between attempts to relight, to permit any residual fuel to be blown from the combustion chambers.

2. The operating period of the "Venner" time switch is nominally thirty seconds. If the engine fails to relight at the first attempt, switch again to ON at the start of the next attempt to relight, and if necessary, at the start of each subsequent attempt.

3. Better relighting is obtained if the I.A.S. is as low as possible when H.P. fuel cock is OPENED.

4. Relights are obtained more easily at lower altitudes and with lower airspeeds.

5. Wait until the engine is running steadily before opening up to desired r.p.m.

(Issued with A.L.7 - June, 1957)

(c) If combustion again ceases when the FUEL PUMP EMERGENCY switch is switched OFF, the inference is that part of the fuel system is faulty. Relight procedure must again be adopted with the FUEL PUMP EMERGENCY switch ON and left ON, after the restart and for the remainder of the flight. The r.p.m. will then be controlled manually by the throttle.

References: R.A.A.F. File 150/8/1020.
C.A.C. Nene Service Bulletin Section 13, No.2.

Date of Issue: 28th June, 1957.

(Issued with A.L.7 - June, 1957)

AAP 711.23 Vol 2 Pt 2

NENE INSTRUCTION NO 16

APPLICATION: Nene 2 VH Engines

INSPECTION OF NENE FLAME TUBES AND TURBINE BLADES AT 200 HOURLY INTERVALS

Introduction

1. A special inspection as detailed in the following paragraphs, is to be carried out on all Nene 2 VH engines on completion of 200 hours running time, to ensure that certain vital sections are in satisfactory state.

Instruction

2. Closely examine recorded life of the engine, paying particular attention to any small characteristics which have been noted by pilots or ground staff during unit operation of the engine.

3. Remove the engine from the airframe and fit to a suitable work stand.

4. Remove exhaust cone, check and record tip clearance, check and record variations in blade length, using 6 o'clock as a datum point. For the purposes of this test, the shortest blade is to be located and used as a standard to determine the longest. Maximum stretch limit for field operation is 0.010". Mark with chalk any blades near or on this limit.

5. Remove shroud ring. Lightly polish the backs of all turbine blades in a longitudinal direction using grade "00" crocus paper. Check for stretch mottling surface effect particularly on blades with longest stretch. Polish each blade with medium grade emery cloth on the trailing edge and for a distance of ½" from the edge on the convex side, working longitudinally. Polish blades transversely for not more than ½" from the tip on the convex side. These polished areas must then be carefully inspected with an X5 glass for cracks, particular attention being paid to the tips and edges. The leading edges in particular should also be checked for damage such as sharp nicks which might lead to fatigue failure.

6. Carry out an inspection of the nozzle guide vanes in accordance with Nene Instruction No 3.

(Issued with A/L No 9)

AAP 711.23 Vol 2 Pt 2

NENE INSTRUCTION NO 16

APPLICATION: Nene VH Engines

7. Remove all flame tubes and inspect in accordance with Nene Instruction No 2 Issue 2.

8. Remove wire screens from intake and inspect intake and torroidal vanes for damage. Pay particular attention to the large inner vane for cracking starting from the trailing edge. Single line cracks showing no signs of branching are acceptable up to 1" length. More than one crack is permitted if more than 6" apart.

9. Inspect as far as possible rotating guide vanes for excessive damage from foreign matter. Check closely for signs of vane cracking.

10. If the engine is satisfactory to all these special inspections, a "D2" servicing is to be completed, new parts fitted as required, and the engine re-installed for a further period of operation to overhaul life.

References : Files, Department of Air, 69/35/6 and 150/8/1514

Date of Issue : 31st October, 1958

(Issued with A/L No 9)

AAP 711,23 Vol 2, Pt 1

NENE INSTRUCTION NO 17

Application : Nene 2VH Engines

EFFECT ON GOVERNED RPM BY VARIATIONS OF FUEL SPECIFIC GRAVITY

Introduction

This instruction details the procedure to be adopted when fuels of varying Specific Gravity are used and their effect on Governed RPM.

Instruction

1. The governing of maximum speed on Nene 2-VH engines is a function of the top Lucas fuel pump.

2. The principle of operation of this governing device is an adjustable hydraulic device in the pump which, in conjunction with the pump servo, limits maximum pump delivery. Centrifugal pressure set up in radial drillings in the pump rotor provides the governor action. This pressure is passed to a spring tensioned diaphragm which operates a half ball relief valve in the pump. As the centrifugal pressure reaches its maximum value at maximum RPM, the half ball valve is opened, creating out of balance forces on the servo piston, which in moving alters the swash plate angle and reduces the pump delivery. Adjustment of the diaphragm spring provides the setting of the governor, provision being made externally for this purpose on each pump. There are two fuel pumps on the Nene but engine maximum speed governing is controlled by the upper. The lower pump is set 150 RPM higher to prevent hunting between pumps.

3. It will be seen therefore that the function of the diaphragm is dependent on fuel pressure generated by the pump rotor. Pressure delivered by the rotor at any given engine RPM is proportional to the specific gravity of the fuel.

4. It will be found therefore that governor settings are affected directly by changes in specific gravity of fuel used and these changes can cause excessive variations of engine maximum governed speed at full throttle.

5. Investigations carried out have shown that specific gravity readings taken of samples of aviation kerosene supplied by three major fuel companies vary from .78 to .83. This range of specific gravity will give a variation of maximum governed Nene speed of up to 350 RPM.

6. The change in RPM is a rise for decrease in specific gravity and a reduction in RPM for an increase in specific gravity. To illustrate this point if an aircraft was fuelled at a Unit using kerosene to a specific gravity of .83 with the engine governed speed adjusted to 12,300 RPM , and the aircraft then moved to a unit using kerosene to a specific gravity of .78, it would be then found that engine maximum governed speed had risen to 12,650 RPM.

7. This variation of fuel specific gravity may always be present in supplies as the latest British specification to which RAAF fuel is supplied does not lay down any limitations in this regard. Action is being taken by this Headquarters to investigate this problem with the major oil companies involved, but it is anticipated that variations of fuel specific gravity will always exist.

8. There is no known means as yet to modify existing Lucas pumps to provide for fuel specific gravity variations and a solution does not appear practicable on the Nene itself unless a mechanical overspeed device is developed and fitted independent of the fuel pump.

9. Consequently, the problem is to be countered in Units operating Nene 2-VH engines by ensuring when receiving aircraft from contractors or other RAAF Units, that the engine maximum speed is checked and re-set to the correct maximum speed of 12,300 before allowing general flight use. Pilots should also be warned that under or overspeeding may occur with different supply fuels and in the latter case are to manually control the maximum speed until rectification action can be taken by ground staff re-setting the pump governors. Use of full throttle for the permitted 10 minutes can cause rapid deterioration of the engine if it is overspeeding. Continuous take-off periods with excessive RPM will also shorten the life of the engine.

(Issued with A/L 10 - March 1959)

10. This is bought about by the fact that the life of a turbo-jet is largely dependent on its operation within specified maximum jet pipe temperatures and increase of jet pipe temperatures is the normal result of higher RPM.

11. In conclusion it should be borne in mind that close adherence to the requirements of this instruction will considerably help to maintain general unit engine serviceability.

References : Files, Department of Air, 69/35/1 and 150/8/1681

Date of Issue : 12th March, 1959

(Issued with A/L 10 - March 1959)

AAP 711.23, Vol 2, Pt 1

NENE INSTRUCTION NO 18

APPLICATION : Nene 2VH Engines

OIL CONSUMPTION CHECKS

Introduction

1. Following investigations into bearing and lubrication failures in Nene Engines it was found that on long travel flights involving intermediate landings the oil contained in the sump had been lowered to a dangerous level.

Instruction

2. The sump capacity is 11 pints, but it should be noted that a minimum of 5 pints is necessary for oil circulation. Topping up intervals must be adjusted for engines showing evidence of above average oil consumption.

The normal oil consumption for Nene Engines is 1 pint per hour and maximum allowed oil consumption is 1½ pints per hour. The maximum oil consumption given is acceptable provided the necessary topping up and inspection of filters is observed.

3. The topping up intervals and quantity of oil required are to be annotated in Current and Travel copies of Forms E/E 77.

References : Files, Department of Air, 69/35/6 and 150/8/1682

Date of Issue : 12th March 1959

(Issued with A/L 11 - March 1959)

AAP 711:23, VOL 2, PART 1 NENE INSTRUCTION NO 19

APPLICATION: NENE 2-VH ENGINES

OIL SUMP FILLER CAP - PRECAUTIONS WHEN REFITTING

Introduction

1. Several instances have occurred where the cap on the oil filler had not been correctly fitted. This resulted in loss of oil and subsequent damage to the engines. The procedure to be observed when refitting the filler cap is detailed in this instruction.

Instruction

2. Before attempting to refit the filler cap, screw the locking wheel back at least three full turns, this will ensure that the cross bar engages under the two lugs. Failure to screw the lock back far enough can result in the engagement of only one end of the cross bar under the lugs as shown in Fig 1 of drawing B13309 attached.

3. It is appreciated that due to the position of the filler assembly it is difficult to see whether the cross bar is correctly engaged, however, it is possible to feel that both ends of the cross bar are under the lugs, before tightening the locking wheel.

4. Care should be taken to fully tighten the cap, as failure to do this has resulted in "flash back" in the wire intake screens and resultant damage to the impeller in addition to damage caused by lack of lubrication on bearings etc.

Reference : Files, Department of Air 150/8/1762.

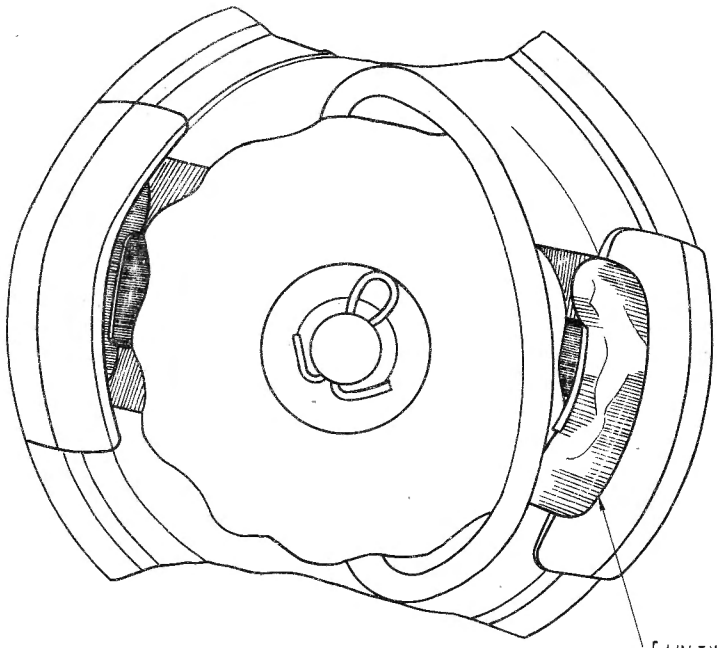
Attachment : Drawing B13309.

Date of Issue : 2nd July 1959.

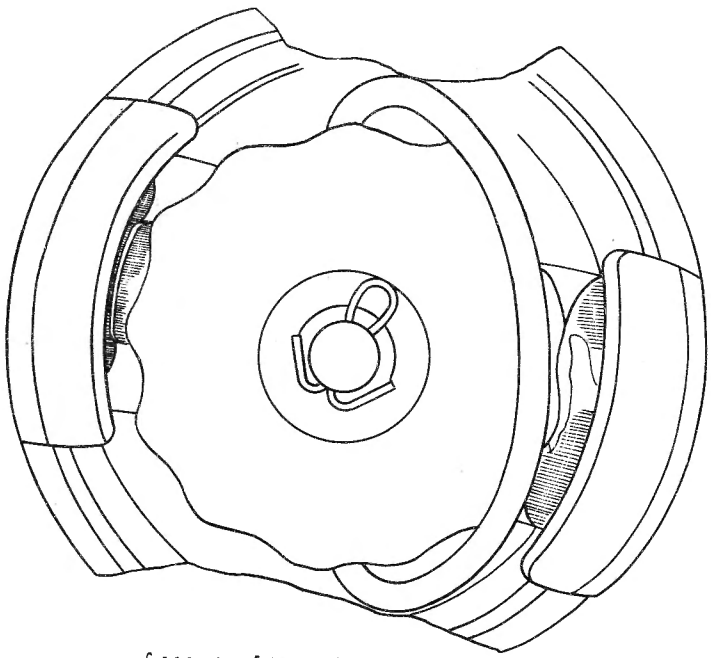
(Issued with A/L 13 - July 1959)

DO NOT SCALE

ISSUE NO.	DATE	ALTERATION	D. I. L.	INITIALS	APPROVED
1	18·9·59.				



INCORRECT



CORRECT ENGAGEMENT

REFERENCE	ISSUED BY	TITLE
	DEPARTMENT OF AIR DIRECTOR GENERAL OF ENGINEERING	OIL SUMP FILLER CAP PRECAUTION WHEN FITTING

LIMITS UNLESS STATED		MATERIAL		COMPONENT OF	
DECIMALS	± .010"	SPEC.		MACHINE	
FRACTIONS	± 1/32"	TREATMENT		ENGINE	
ANGLES	± ½°	FINISH		TECH. ORDER	NENE INSTRUCTION NO. 15
SURFACE FINISH AUSTRALIAN STANDARD ENG. DRWG. PRACTICE A.S.CZI		SCALE		DRAWING NO.	B. 13309
		DRAWN	APPROVED		DRWG. A SIZE
		TRACED R.W.	CHECKED		