

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.

(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.

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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 subparagraph (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.

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- (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 $\pm$ $\frac{.0005}{.0000}$.

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:-

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- (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).

7.

Note:- Shroud rings BK2622 may be resoperated in accordance with RAAP Mod No 34 (See Part 4)

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 be~~ ^{may} 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.

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- (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 reidentifying it as BK 19015.
- (c) As both of these operations require special tools and jigs, the reworking will be carried out by Commonwealth Aircraft Corporation.
- d Oversize shroud rings ident No B23/500836 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 (h), (i), (m) and (n).
- Note :- Shroud rings of nozzle guide vane outer rings which incorporate Mod 34 are not subject to repositioning

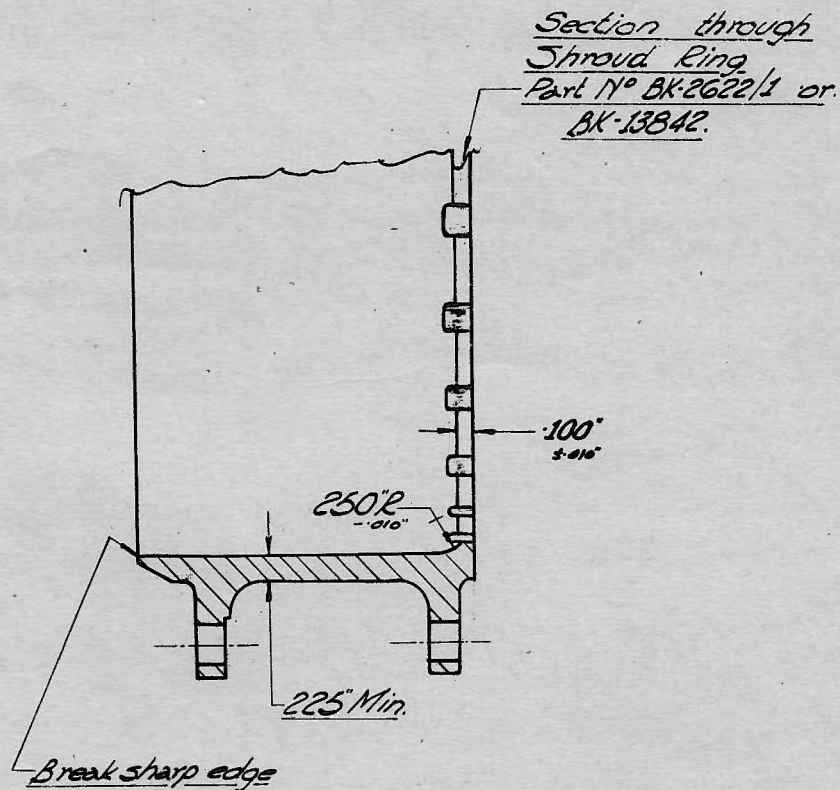
Reference: File R.A.A.F. 150/4/8002.

Drawing: B11179 attached.

Date of Issue: 30th June, 1950.

DO NOT SCALE

ISSUE NO.	DATE	ALTERATION	D. I. L.	INITIALS	APPROVED
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REFERENCE		ISSUED BY			TITLE	
		<i>DIRECTORATE OF TECHNICAL SERVICES R.A.A.F.</i>			<i>SHROUD RING - LIMITS OF RE-WORK</i>	
LIMITS UNLESS STATED		MATERIAL			COMPONENT OF	
DECIMALS	± .010"	SPEC.			MACHINE	
FRACTIONS	± 1/32"	TREATMENT			ENGINE	<i>None</i>
ANGLES	± 1°	FINISH			TECH. ORDER	<i>None INST. N° 4.</i>
SURFACE FINISH		SCALE			DRAWING NO.	<i>B11179</i>
AUSTRALIAN STANDARD		DRAWN	<i>Martin</i>	APPROVED		DRWG. A
ENC. DRWG. PRACTICE A.S.G.21		TRACED		CHECKED		SIZE

DEPARTMENTAL COMMUNICATION

Date.....

To.....

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

RAAF Mod No 34 (CAC Nene Mod No 60) Introduces a shroud ring machined eccentrically to give an additional .020" tip clearance at the top. This later assembly part NO ~~BK 18742~~ ~~part~~ supersedes the old assembly Part NO BK 2622.

This modification has been carried out on all production engines from S/No 91 onwards, and has been incorporated on engines returned for to CAC for overhaul. Shroud rings P/NO BK 18741 have one dowel and the N.G.V. outer ring is P/NO BK 19015. This combination of shroud ring and N.G.V. outer ring is not subject to repositioning of shroud ring.

When the shroud ring ~~is fitted~~ and N.G.V. 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:-

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Part 1.Part 2

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