

Draft Chapter 33G

DIFFUSER CASING, REASSEMBLING

*This draft chapter is issued for advance information
pending the publication of the final chapter.*

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GENERAL

1. The reconditioning described in this chapter is confined to operations whereby unserviceable parts are replaced by serviceable standard parts. Instructions for major repairs and rectification and the processes essential to such repairs are contained in Chapter 28E.

2. Consumable stores, required to replace items automatically discarded during dismantling, are listed at the end of the chapter. Tools are referred to in the text as they are used and are also listed at the end of the chapter.

3. Throughout the text, the phrase "within the limits" implies that reference must be made to the Table of Fits and Clearances in Chapter 38 to ascertain limits permissible.

4. Before making any renewals prior to rebuilding, the inspection sheet must be read carefully and all work carried out as directed. Minor rectifications, which may not be entered on the inspection report, include renewing damaged or loose studs, removing burrs and sharp edges, and polishing out scratches. After any work has been carried

out the component in question must be resubmitted for inspection.

RENEWALS

5. With the exception of damaged studs, damaged diffuser bolts, and damaged tip clearance unions, no additional work other than that required for normal assembly is necessary to renew any standard part; the defective parts rejected being discarded and new, serviceable, or repaired parts substituted. A new diffuser bolt must be blended to accord with the requirements detailed in fig. 5 in Chapter 27H, to suit the diffuser vane through which it passes, and after blending must be cadmium plated. Tip clearance unions which are renewed should be fitted with a new tab-washer (Part No. N3775). The effective length of the new union must be checked as follows. Position setting gauge T72502 on a surface table; insert the spindle of the dial test indicator T72779 into the setting gauge; abut the body of the D.T.I. on the gauge and set the D.T.I. to read zero. Insert the spindle of the dial indicator gauge into the tip clearance union. Place a steel rule or similar flexible strip over the inner face of the union to follow the contour of the diffuser casing so that the stylus of

the gauge abuts the rule. The gauge will indicate the difference between the effective length of the union and the dimension stamped on the setting gauge, and this sum when added to or subtracted from the setting gauge dimension will determine the effective length of the union. If this is not within the limits shown in fig. 1, the minimum amount of metal must be removed from the outer end of the union to bring the length of the union within the high limit. The original length which is stamped on the diffuser casing must be obliterated and the new length stamped thereon immediately adjacent to it. To renew damaged studs, a $\frac{5}{16}$ in. B.S.F. stud box T71006, a $\frac{1}{4}$ in. B.S.F. stud box T70809, and a 2 B.A. stud box T70965 are required. Damaged studs may be removed, and serviceable replacements fitted, in accordance with standard practice.

Note . . .

Studs (Part No. N870) are to have a minimum protrusion of 1.050 in. from the front face of the rear cover.

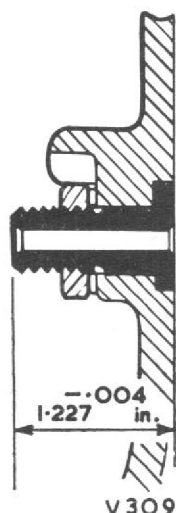


Fig. 1. Tip clearance union dimension

PAINTING

6. As the diffuser casing and its rear cover will have been stripped of paint in preparation for crack detection, they must be repainted prior to assembly. Before commencing to paint the castings ensure that the chromate finish is undamaged. Where the original chromate finish has been removed from small areas only, it may be rectified by the application of selenious acid; where large areas are affected the component must be re-chromated in accordance with D.H. process specification No. 167 contained in Chapter 32.

7. Primer and finishing coats must be applied in accordance with the requirements of D.H. process specification No. 168 (protection of magnesium-rich alloy against corrosion).

(1) Degrease the castings by immersion in a trichlorethylene vapour degreaser; the casting should remain in the degreaser until it attains the temperature of the vapour.

- (2) Lightly smear the rear cover joint face with grease, assemble the rear cover to the diffuser casing, and secure it with slave washers and nuts.
- (3) Using the blanks made from local resources described in Chap. 21, blank off the air-intake face on the diffuser casing, the twenty deflector pockets, and the sealing plate aperture in the rear cover.
- (4) Using twenty blanks T72764, blank off the deflector pockets in the rear cover.
- (5) Using the blanks made from local resources described in Chap. 21, blank off the air annulus apertures.
- (6) Coat all exposed threads with grease and using adhesive tape, improvised blanks, and plugs as appropriate, blank off the diffuser bolt holes, the impeller clearance unions, and the air-pipe faces.
- (7) Smear the three trunnion mounting bracket spigot recesses with grease and blank off the bolt holes.
- (8) Spray the casings with the approved primer and allow to air dry.
- (9) Spray the casings with the approved finishing coat and allow to air dry.
- (10) Remove the blanks.

ASSEMBLY

Diffuser casing rear cover and diffuser casing

8. Diffuser bolts must be assembled in their correct numerical positions in accordance with the markings stamped on the bolts and the casing. The disposition of the bolts in the diffuser casing is shown in fig. 4, Chapter 27H. The diffuser casing and diffuser casing rear cover must be handled carefully to avoid damage to studs and mating surfaces. Ensure that the trunnion mounting bolt holes have been spot-faced to enable the bolt heads and washers to seat correctly.

- (1) Separate the rear cover from the diffuser casing
- (2) *48 Mk. 1 only.* Assemble the lockwire tab to the stud adjacent to No. 8 diffuser bolt and secure it with the spring washer and nut.
- (3) Thoroughly clean the rear joint face of the diffuser casing and apply a thin film of grease.
- (4) Position a new joint strip (Part No. 48715) in the groove, with the strip cut at an angle to make a scarf joint, cement the strip at the bends with Wellseal or another approved jointing compound.
- (5) Thoroughly clean the joint face of the rear cover.
- (6) Align the mounting bolt holes adjacent to No. 1 combustion chamber and assemble the rear cover to the diffuser casing.
- (7) Smear the four diffuser mounting bolts with grease and assemble them to their correct positions as marked; secure them with slave washers and nuts.
- (8) Secure the diffuser casing to the rear cover with plain and spring washers and nuts.

Note . . .

There are fifty $\frac{3}{8}$ in. and eight $\frac{5}{16}$ in. B.S.F. studs. A lockwire tab instead of a plain washer is used on each of the two studs adjacent to the air supply unions.

- (9) Remove the four diffuser mounting bolts.
- (10) Assemble seventeen air annulus covers to the rear cover (48 Mk. 1) or fourteen on (48 Mk. 2), two adapter covers to both marks, and one slave blanking cover (48 Mk. 1) and four (48 Mk. 2). The disposition of the covers is shown in fig. 2.

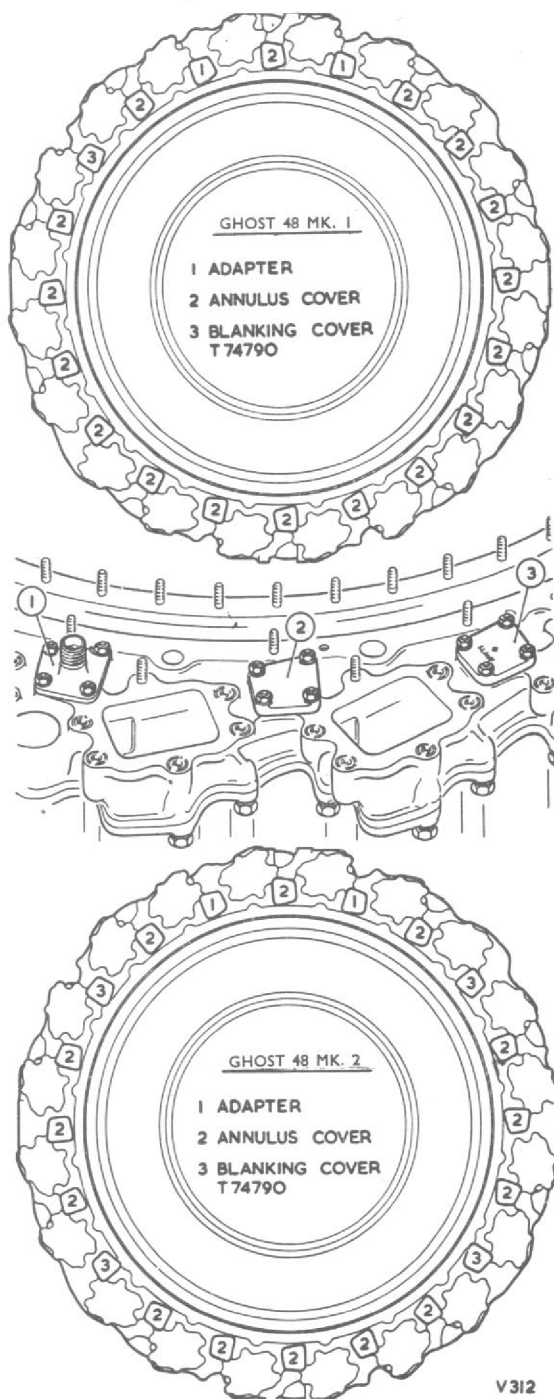


Fig. 2. Disposition of air annulus covers

- (11) *Pre-mod. 507.* Secure the covers with plain and spring washers and nuts.

Note 1 . . .

A lockwire tab instead of a plain washer is used on one of the outer studs of each adapter cover.

Note 2 . . .

When Mod. No. 507 is embodied forty of the studs are replaced by bolts, and to prevent the bolts biting into the air annulus covers Mod. No. 936 introduces plain washers under each bolt head.

- (12) Using two new washers (Part No. AGS 568B) secure the banjo union to each of the adapters with the banjo union facing away from the centre of the diffuser casing.
- (13) Blank off the banjo union with a screw cap.
- (14) Remove the nuts and washers from the cabin air supply connection studs. Position a new washer (Part No. 601890) and secure the connection with the nuts and washers.
- (15) Remove the nuts and washers from the gun heating air supply connection studs. Position a new washer (Part No. 96716) and secure the connection with the nuts and washers. Alignment checks (Para. 9 to 23) only apply when any of the following parts have been renewed; diffuser casing, air-intake, front bearing housing, rear bearing housing.

Diffuser casing and air-intake

9. (1) Assemble dummy front bearing T72477 into the front bearing housing.
- (2) Assemble the bearing housing and the bearing housing retaining plate to the air-intake and secure with slave washers and nuts.
- (3) Mount the air-intake in build stand T74789, with the diffuser flange uppermost.
- (4) Clean the diffuser and air-intake joint faces, and lightly smear with grease.
- (5) Attach lifting sling T74792 to the two side diffuser trunnion mounting faces and secure with the bolts.
- (6) Release the four handwheels on each corner of the build stand.
- (7) Hoist the diffuser casing; align the dowel with the hole in the air-intake joint face and lower the casing on to the air-intake.

Note . . .

The weight of the diffuser casing should depress the four jacking pins and allow the joint faces to come together, but it may be necessary to assist this by slightly loading the diffuser casing by hand pressure.

- (8) Secure the casings with slave washers and nuts.
- (9) Tighten the handwheels on the stand, so that the diffuser casing is free from rock.

Centre casing and rear bearing

10. A dummy centre casing and rear bearing are used to check the alignment of the assembled casings (fig. 3). The dummy rear bearing must be assembled to the bearing housing as detailed in Chapter 33A.

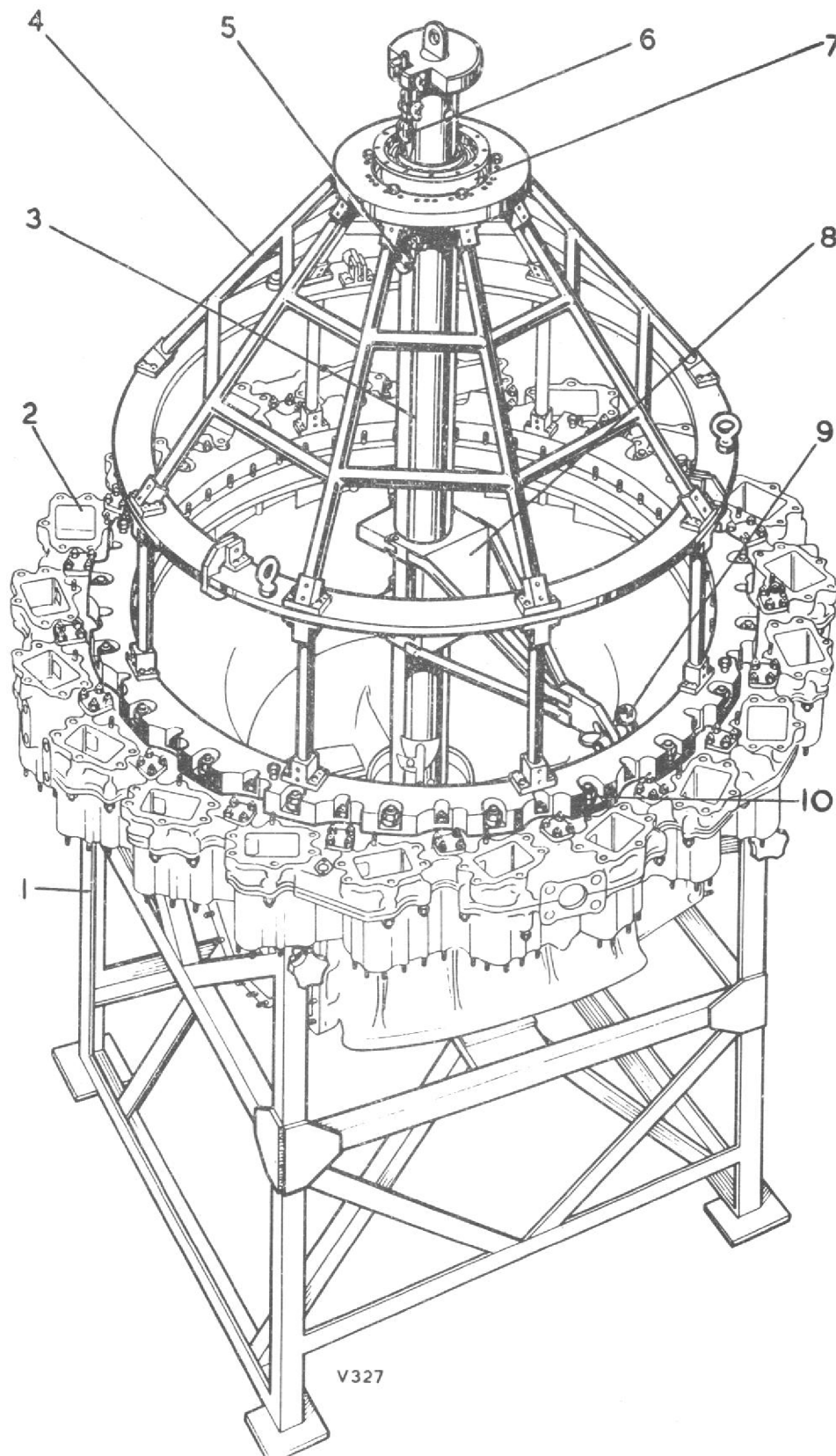


Fig. 3. Diffuser casing and dummy centre casing assembled with mandrel in position

KEY TO FIG. 3 (V327)

- 1 BUILD STAND
- 2 DIFFUSER CASING
- 3 ALIGNMENT MANDREL
- 4 DUMMY CENTRE CASING
- 5 VICTOR DIAL GAUGE MOUNTED ON THE MANDREL
- 6 VICTOR DIAL GAUGE MOUNTED ON THE MANDREL
- 7 REAR BEARING HOUSING
- 8 CARRIER
- 9 VICTOR DIAL GAUGE MOUNTED ON THE CARRIER
- 10 PACKING WASHERS ON THE DIFFUSER BOLTS

- (1) Secure the rear bearing housing to the front flange of the dummy centre casing T76961 with five equally spaced set-screws.
- (2) Hoist the dummy centre casing and lower it on to the diffuser casing.
- (3) Lightly grease the twenty diffuser bolts and insert them in their correct numerical positions in accordance with the numbers stamped on the bolts and the diffuser casing.
- (4) Using sixteen packing washers T76174 and four packing washers T76182, secure the bolts with slave nuts.

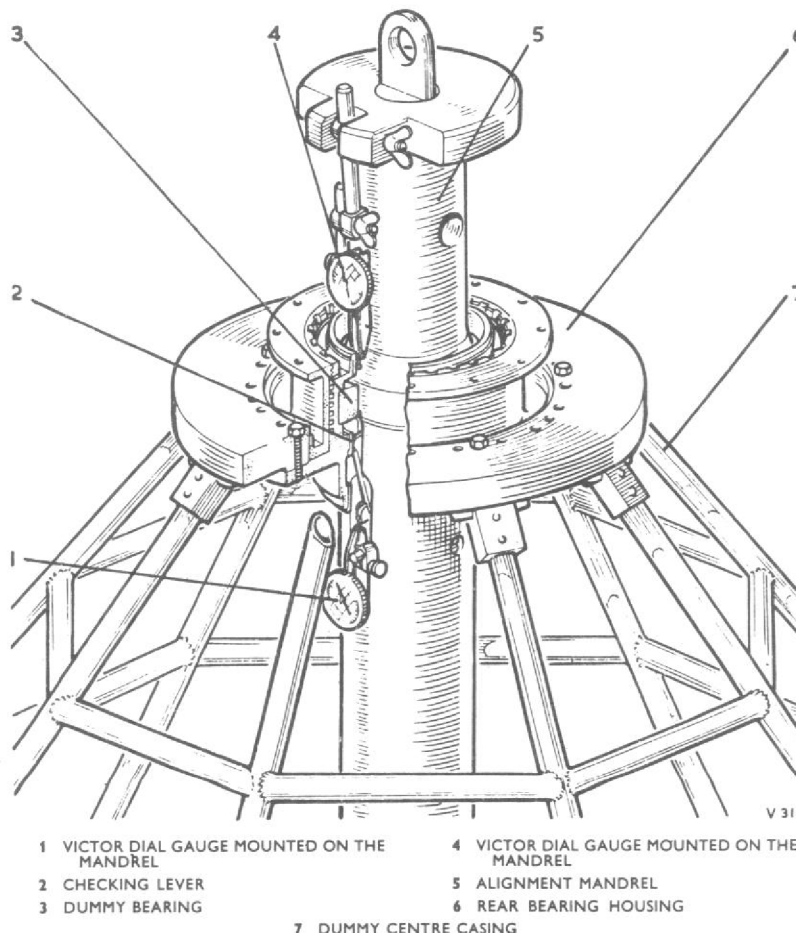


Fig. 4. Checking concentricity of the rear bearing safety bearing

- (5) Using a standard $\frac{5}{8}$ in. B.S.F. socket and torque-meter wrench TQ150, or similar, tighten the nuts to the torque specified in Chapter 22.
- (6) Hoist the alignment mandrel T72482 by its eye bolt; ensure that the datum surfaces are clean and lower the mandrel through the dummy rear bearing and dummy front bearing until the shoulder of the mandrel abuts the rear face of the dummy front bearing.
- (7) Secure the carrier T72484 to the mandrel by closing the clamp rings around the grooves and tightening the thumbscrews.

Checking the concentricity of the rear bearing safety bearing

11. (1) Insert the support bar of a Victor dial test indicator into the hole below the rear bearing position on the mandrel; adjust the position of the D.T.I. until the stylus contacts the button on the operating lever, then secure the D.T.I. by tightening the Allen set-screw on to the support bar; rotate the mandrel and check that the eccentricity of the inner housing plain bearings in relation to the front and rear dummy main bearings is within the limits (fig. 4).

- (2) Remove the Victor D.T.I. and attach it to the collar above the rear bearing position on the mandrel; adjust the position of the D.T.I. until the stylus contacts the bore of the sealing housing plain bearing as shown in fig. 4, then secure it by tightening the wingnut. Rotate the mandrel and check that the eccentricity of the sealing housing plain bearing in relation to the front and rear dummy main bearings is within the limits.

Checking the concentricity and squareness of the diffuser casing rear cover

12. The concentricity of the diffuser casing rear cover at the sealing plate spigot bore and the squareness of the flange abutment face must be checked as follows:—

- (1) Secure a Victor dial test indicator to the corner end of the carrier by inserting the D.T.I. attachment bar into the clamp blocks and tightening the wing nuts (fig. 5).

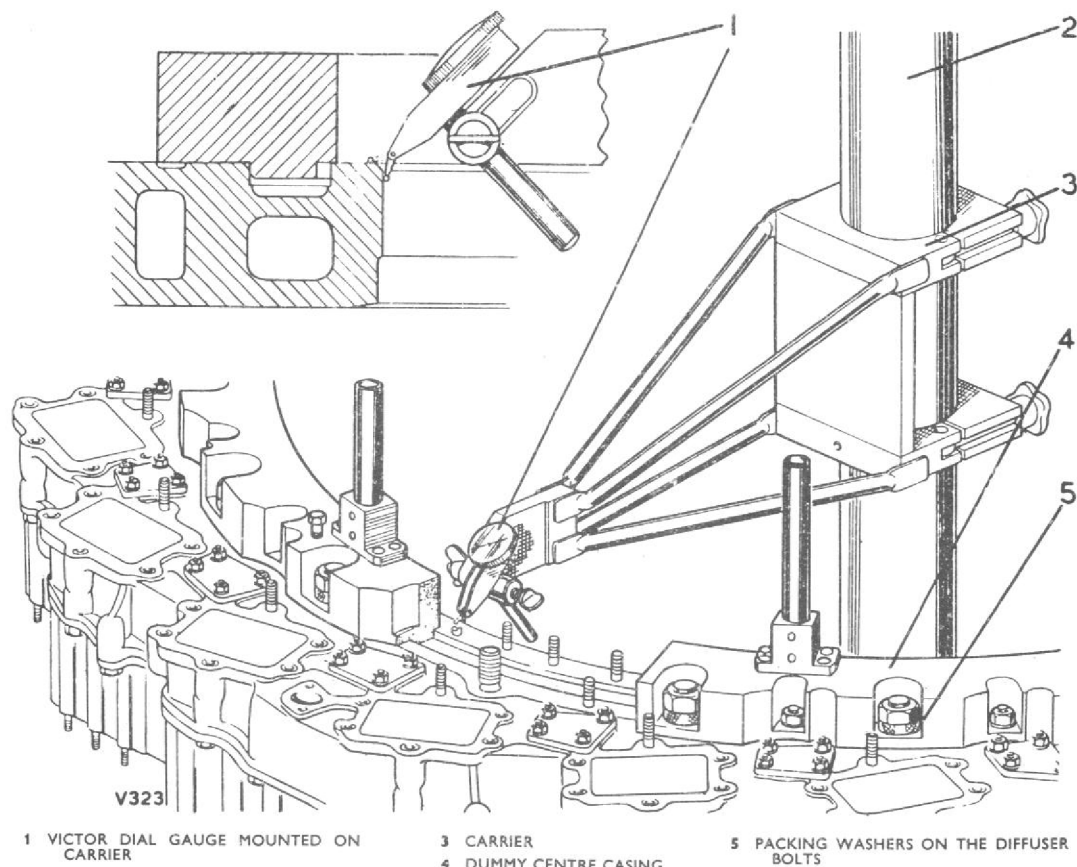


Fig. 5. Checking concentricity of the diffuser rear cover and sealing face

- (2) Locate the stylus of the D.T.I. on the diffuser casing rear cover at the sealing plate flange abutment face, rotate the mandrel and check that the squareness of the flange abutment face in relation to the axis through the main bearings is within the limits (fig. 5).
- (3) Remove the carrier, the mandrel, and the dummy centre casing from the diffuser casing.

Impeller and air-intake

13. (1) Assemble mandrel T72497 to adapter plate T72504.
- (2) Mount the mandrel and adapter plate assembly on the mainshaft face of the impeller and secure with slave washers and nuts.

Note . . .

Adapter plate T72504 is for a standard size impeller. Alternative plates must be used for impellers marked TR201 on which the spigot has been machined undersize to one of the following amounts.

Plate No.		Oversize
T72505		0.010 in.
T72506		0.020 in.
T72507		0.030 in.

- (3) Remove the front bearing housing and the dummy bearing from the air-intake.
- (4) Assemble a slave front bearing to the bearing housing.

Note . . .

The bearing should have an end float as near to the maximum permissible end float as possible.

- (5) Assemble the bearing housing and the bearing housing retaining plate to the air-intake and secure with slave washers and nuts.
- (6) Place the front bearing adjusting washer on the bearing with the chamfer facing uppermost towards the impeller.
- (7) Hoist the impeller, insert guide mandrel T77359 into the pivot bore and using a screwdriver, screw in the centre rod of the guide mandrel to secure it in the pivot bore.
- (8) Lower the impeller assembly into the front bearing.

Note . . .

If the impeller pivot is tight in the bearing and does not seat fully home, position the tube of draw bar T77967 over the mandrel, screw the bar into the threaded bore in the mandrel and turn the tommy-bar in a clockwise direction until the impeller is drawn fully home.

- (9) Position the sleeve of the special spanner T77360 in the threaded bore of the impeller guide mandrel; engage the screwdriver in the slot (fig. 6) and unscrew the rod. Remove the guide mandrel from the pivot bore.

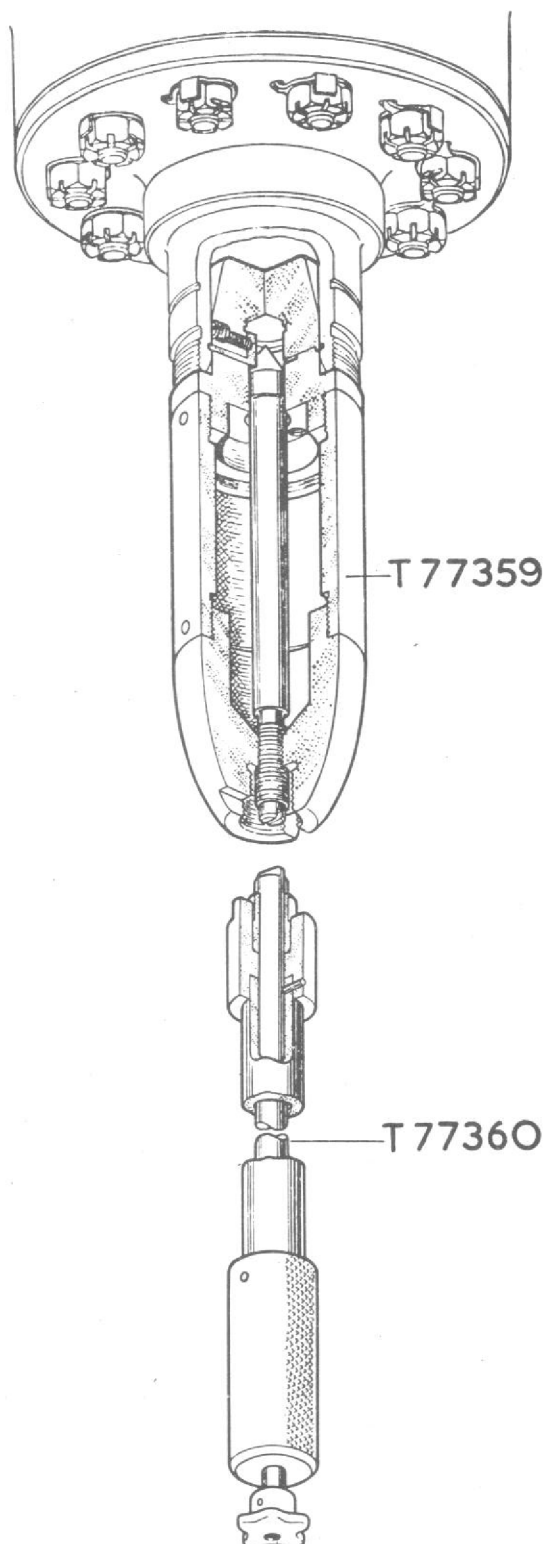


Fig. 6. Guide mandrel assembled in impeller pivot bore

- (10) Position a slave spacing washer, a new cup locking washer (Part No. N2883), and the ring nut to the pivot.
- (11) Position the spanner guide plate T74791 over the centre housing studs on the air-intake and secure with slave washers and nuts.
- (12) Using spanner T72785 inserted through the guide plate, tighten but do not lock the ring nut.

Sealing plate to diffuser casing

14. (1) *Pre-mod. 897.* Using extractor T76563, remove the inspection covers from the sealing plate.

Note . . .

When Mod. No. 897 is embodied the inspection covers are deleted and op. 1 is not applicable.

- (2) Position the sealing plate inside the dummy centre casing, using the hooks for temporary support.
- (3) Position the dummy centre casing over the impeller mandrel on to the diffuser casing rear cover.
- (4) Lightly grease the twenty diffuser bolts and insert them in their correct numerical positions in accordance with the numbers stamped on the bolts and the diffuser casing.
- (5) Using sixteen packing washers T76174 and four packing washers T76182, secure the bolts with slave nuts.
- (6) Using a standard $\frac{5}{8}$ in. B.S.F. socket and a torquemeter wrench TQ150 tighten the nuts to the torque specified in Chapter 22.

Impeller vane tip clearance check

15. The impeller vane tip clearance must be checked over a number of blades at varying angular positions.

- (1) Set dial indicator gauge T72779 to read zero from the setting gauge T72502.
- (2) Rotate the impeller until one of the vanes is opposite the tip clearance union.
- (3) Insert the dial indicator gauge into the clearance union and check the impeller blade tip clearance. Add the dimension stamped on the setting gauge to the dial indicator gauge reading and from this sum subtract the figure stamped on the diffuser casing. Rotate the impeller and repeat this check at not less than every third vane. Ensure that the clearance is within the limits.
- (4) Repeat op. 3 at each of the clearance unions.

Note . . .

If the clearance is below the minimum limit a new adjusting washer (Part No. 25305) will be required; if the clearance is above the maximum limit, the washer must be reduced in thickness by grinding.

- (5) If the washer requires grinding, remove the front pivot nut, the cup washer, and the spacer.
- (6) Hoist the impeller sufficiently to allow the adjusting washer to be removed.
- (7) Grind the washer to the required thickness and remove any burrs and sharp edges.
- (8) Position the washer to the front bearing, chamfer uppermost towards the impeller, and lower the impeller into place.
- (9) Assemble the spacer, the cup locking washer, and the pivot nut.
- (10) Re-check the tip clearance as detailed in op. 1, 2, 3, and 4.

Labyrinth clearance check

16. Pre-mod. 897 the labyrinth clearance can be checked by two alternative methods. When Mod. No. 897 is embodied the sealing plate inspection covers are deleted and the labyrinth clearance must be checked as described in para. 19.

- (1) Remove the sealing plate from the dummy centre casing and assemble it to the diffuser casing rear cover, with the correlation marks aligned so that No. 1 inspection cover is at the top centre.
- (2) Secure it with slave washers and nuts.

1st method Pre-mod. 897

17. (1) Using a depth micrometer, measure the length of the inspection cover from the crest of the labyrinth grooves to the underside of the flange (fig. 7).
- (2) Check the length at several positions round the cover and determine the mean length.
- (3) Using a depth micrometer, measure the depth from the flange of the inspection cover aperture in the sealing plate to the crest of the labyrinth grooves on the impeller (fig. 8).

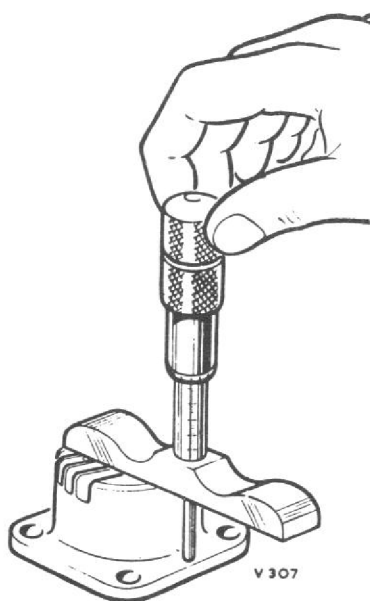


Fig. 7. Measuring the length of an inspection cover

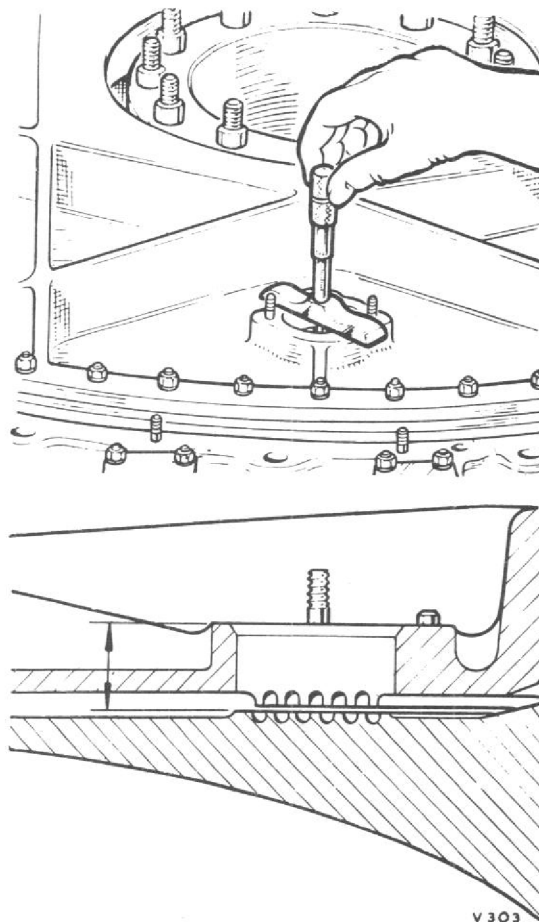


Fig. 8. Measuring the depth from the sealing plate to the impeller

- (4) Check the depth at several positions round the aperture and determine the mean length.
- (5) Subtract the mean length of the inspection cover from the mean depth of the aperture to obtain the labyrinth clearance.
- (6) Check that the clearance is within the limits.
- (7) Repeat this check for the other two positions.

2nd method Pre-mod. 897

18. (1) Position a slip gauge, say, 0.010 in., into the inspection cover aperture on the crest of the impeller labyrinths.
- (2) Push the cover into its aperture in the sealing plate.
- (3) Hold the cover down and using feeler gauges check the clearance round the cover flange (fig. 9).
- (4) Subtract the feeler gauge reading from the slip gauge size to obtain the labyrinth clearance.
- (5) Check that the clearance is within the limits.
- (6) Repeat this check for the other two positions.

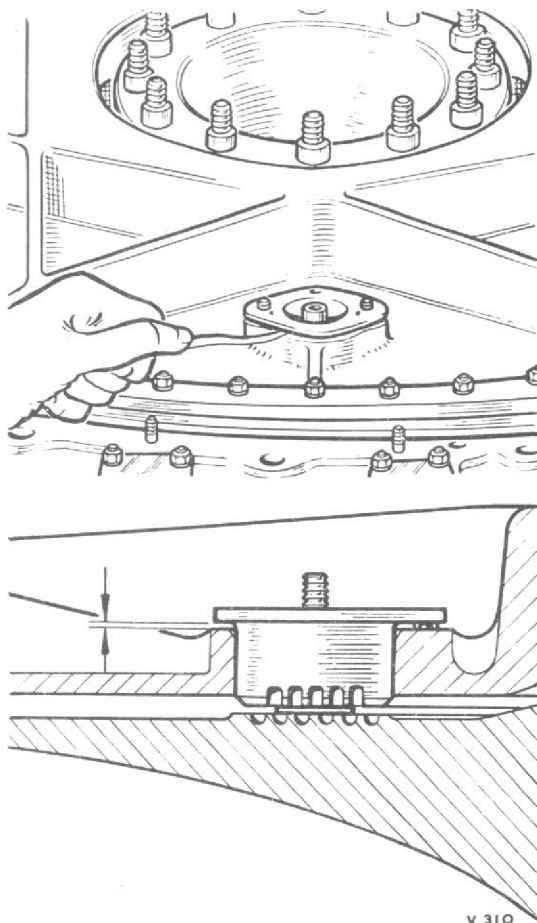


Fig. 9. Using feeler gauges to measure the clearance between the inspection cover flange and sealing plate

Mod. No. 897

19. (1) Check the clearance by inserting feelers through the main shaft aperture underneath the sealing plate at three equally spaced positions (fig. 10).
- (2) Check that the clearance is within the limits.

20. Remove the dummy centre casing and the sealing plate.

Adjustment of the labyrinth clearance

21. Pre-mod. 850 the clearance must be adjusted by machining. If the clearance is below the minimum limit, the labyrinth lands on the sealing plate must be reduced. If the clearance is above the maximum limit, the sealing plate joint face flange must be reduced. When Mod. No. 850 is embodied the clearance is adjusted by shims which are segment in form. Twelve shims are required to cover the periphery of the sealing plate.

Pre-mod. 850

- (1) Set the sealing plate on turning fixture T72547 which should be mounted on a lathe with a minimum swing of twenty inches, or an equivalent vertical boring mill.

- (2) When the machining has been completed the machined face must be chromated or treated with selenious acid.

Mod. No. 850

22. (1) If the clearance is below the minimum limit, shims (Part No. 601915) must be fitted between the sealing plate flange and the diffuser rear cover as required to obtain the correct clearance.

Note . . .

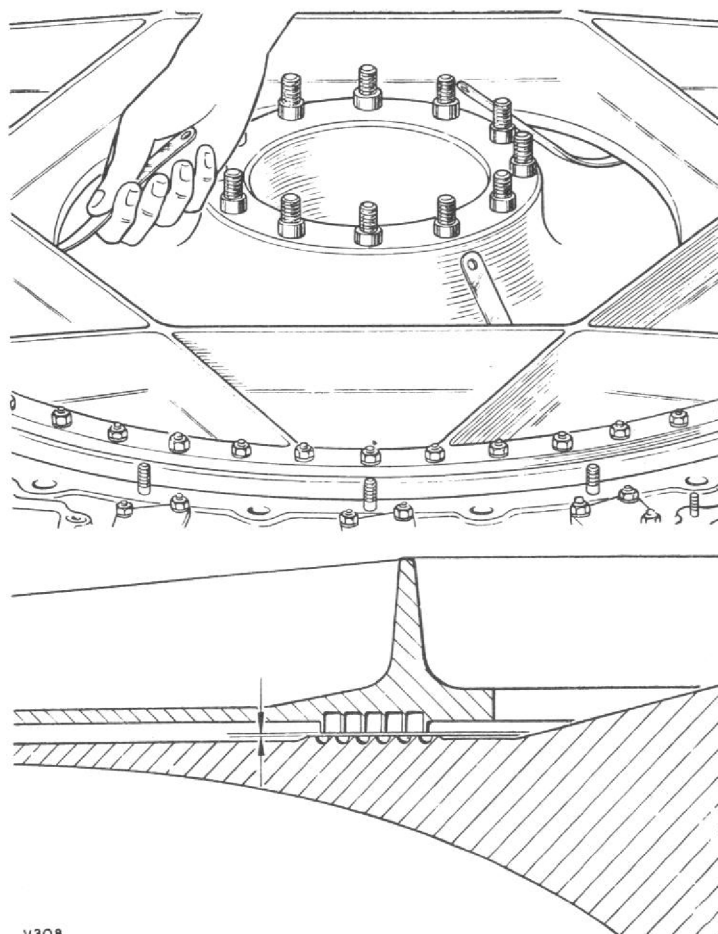
If it is necessary to use a number of shims, it must be ensured that full engagements of the nuts can be obtained.

- (2) If the clearance is above the maximum limit, shims must be removed.
 - (3) After adjustment, assemble the sealing plate to the diffuser casing rear cover and re-check the labyrinth clearance.
 - (4) Remove the sealing plate using lifting sling T75118, and refit the inspection covers to their respective positions.
-
23. (1) Remove the front pivot nut, the cup locking washer and the spacer.
 - (2) Secure guide mandrel T77360 into the impeller pivot bore, using special spanner T77359.
 - (3) Lift the impeller from the diffuser casing and remove the guide mandrel.
 - (4) Lower the impeller on to a suitable stand.
 - (5) Remove the adjusting washer from the front bearing and if necessary etch on the engine number and size.
 - (6) Using new tab-washers (Part No. AGS518L), fit the four cap-nuts to the tip clearance unions but do not bend up the tabs.
 - (7) Using extractor T72479, remove the front bearing housing from the air-intake.
 - (8) Remove the slave nuts and washers from the air-intake.
 - (9) Using lifting sling T74792, separate the diffuser casing from the air-intake.

LIST OF CONSUMABLE PARTS

24. The following is a list of consumable parts which will be required during the assembly of the diffuser casing.

Part No.	Description	Quantity
48715	Joint strip, diffuser casing	1
AGS568B	Washer, adapter cover banjo	4
601890	Joint washer, cabin air supply connection	1
96716	Joint washer, gun heating air supply connection	1
N2883	Cup locking washer, impeller pivot shaft	1
601915	Shim, sealing plate (Mod. 850)	As required
AGS518L	Tab washer, tip clearance union cap-nuts	4



V308

Fig. 10. Measuring the clearance between the sealing plate and the impeller

LIST OF TOOLS

25. The following tools are required for assembly of the diffuser casing.

Tool No.	Description
T72779	Clock gauge, impeller tip clearance union
T72502	Setting gauge, impeller tip clearance union
T71006	Stud box, $\frac{5}{16}$ in. B.S.F.
T70809	Stud box, $\frac{1}{4}$ in. B.S.F.
T70965	Stud box, 2 B.A.
T72764	Deflector blank (20 off)
T74790	Air annulus blanks (48 Mk. 1 and 48 Mk. 2)
T72477	Dummy front bearing
T74789	Build stand, air-intake
T74792	Lifting sling
T76961	Dummy centre casing
T76174	Packing washers, diffuser casing (16 off)
T76182	Packing washers, diffuser casing (4 off)
Standard	Torquemeter wrench TR150

Tool No.	Description
T72482	Alignment mandrel, dummy centre casing
T72484	Carrier, alignment mandrel
T72497	Mandrel, impeller.
T72504	Adapter plate, mandrel
T72505	Adapter plate, mandrel "undersize 0.010 in."
T72506	Adapter plate, mandrel "undersize 0.020 in."
T72507	Adapter plate, mandrel "undersize 0.030 in."
T77359	Guide mandrel, impeller pivot bore
T77967	Draw bar, impeller.
T77360	Spanner, guide mandrel
T74791	Guide plate, spanner T72785
T72785	Spanner, front bearing ring nut
T76563	Extractor, sealing plate inspection covers
T72547	Turning fixture
T75118	Lifting sling, sealing plate

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