LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
LEP	1	Jun 16/2006
	2	Jun 16/2006
Contents	1	Jun 16/2006
	2	Jun 16/2006
	3	Jun 16/2006
	4	Jun 16/2006
72-50-00	1	Feb 11/2000
Description and Operation	2	Feb 11/2000
72-50-01	1	Feb 11/2000
Description and Operation	2 blank	Feb 11/2000
72-50-01	201	Aug 27/2004
Maintenance	202	Aug 27/2004
Practices	203	Aug 27/2004
	204	Aug 27/2004
	205	Aug 27/2004
	206	Aug 27/2004
	207	Aug 27/2004
	208	Nov 26/2004
	209	Aug 27/2004
	210	Aug 27/2004
	211	Aug 27/2004
	212	Jun 16/2006
	213	Aug 27/2004
	214	Aug 27/2004
	215	Aug 27/2004
	216	Aug 27/2004
	217	Aug 27/2004
	218	Aug 27/2004
	219	Aug 27/2004
	220	Aug 27/2004
	221	Aug 27/2004
	222	Dec 02/2005
	223	Aug 27/2004
	224	Aug 27/2004
	225	Aug 27/2004
	226	Dec 02/2005
	227	Aug 27/2004
	228	Aug 27/2004
	229	Nov 26/2004
	230	Nov 26/2004
	231	Aug 27/2004
	232 blank	Aug 27/2004
72-50-02	1	Feb 11/2000
Description and Operation	2 blank	Feb 11/2000
72-50-02	201	Nov 26/2004
Maintenance	202	Aug 27/2004
Practices	203	Aug 27/2004
	204	Aug 27/2004
	205	Aug 27/2004
	206	Nov 26/2004
	206 A	Nov 26/2004
	206 B blank	Nov 26/2004
	207	Aug 27/2004
	208	Aug 27/2004
	209	Nov 26/2004
	210	Aug 27/2004
	211	Aug 27/2004
	212	Aug 27/2004
	213	Aug 27/2004
	214	Aug 27/2004
	215	Aug 27/2004
	216	Aug 27/2004
	217	Aug 27/2004
	218 blank	Aug 27/2004
72-50-03	1	Feb 11/2000
Description and Operation	2 blank	Feb 11/2000
72-50-03	201	Aug 16/2002
Maintenance	202	Feb 15/2002
Practices	203	Feb 15/2002
	204	Aug 16/2002

LIST OF EFFECTIVE PAGES

CHAPTER SECTION	PAGE	DATE
	205	Feb 15/2002
	206	Feb 15/2002
	207	Feb 15/2002
	208	Feb 15/2002
	209	Aug 16/2002
	210	Feb 15/2002
72-50-04	1	Feb 11/2000
Description and Operation	2	Feb 11/2000
72-50-04	201	Apr 02/2004
Maintenance	202	Apr 02/2004
Practices	203	Apr 02/2004
	204	Apr 02/2004
	205	Apr 02/2004
	206	Apr 02/2004
	207	Apr 02/2004
	208	Apr 02/2004
	209	Apr 02/2004
	210	Apr 02/2004
	211	Apr 02/2004
	212	Apr 02/2004
	213	Nov 26/2004
	214 blank	Apr 02/2004
72-50-05	1	Feb 11/2000
Description and Operation	2	Feb 11/2000
72-50-05	201	Dec 06/2001
Maintenance	202	Dec 06/2001
Practices	203	Dec 06/2001
	204	Dec 06/2001
	205	Dec 06/2001
	206	Dec 06/2001

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TURBINES SECTION - DESCRIPTION AND OPERATION

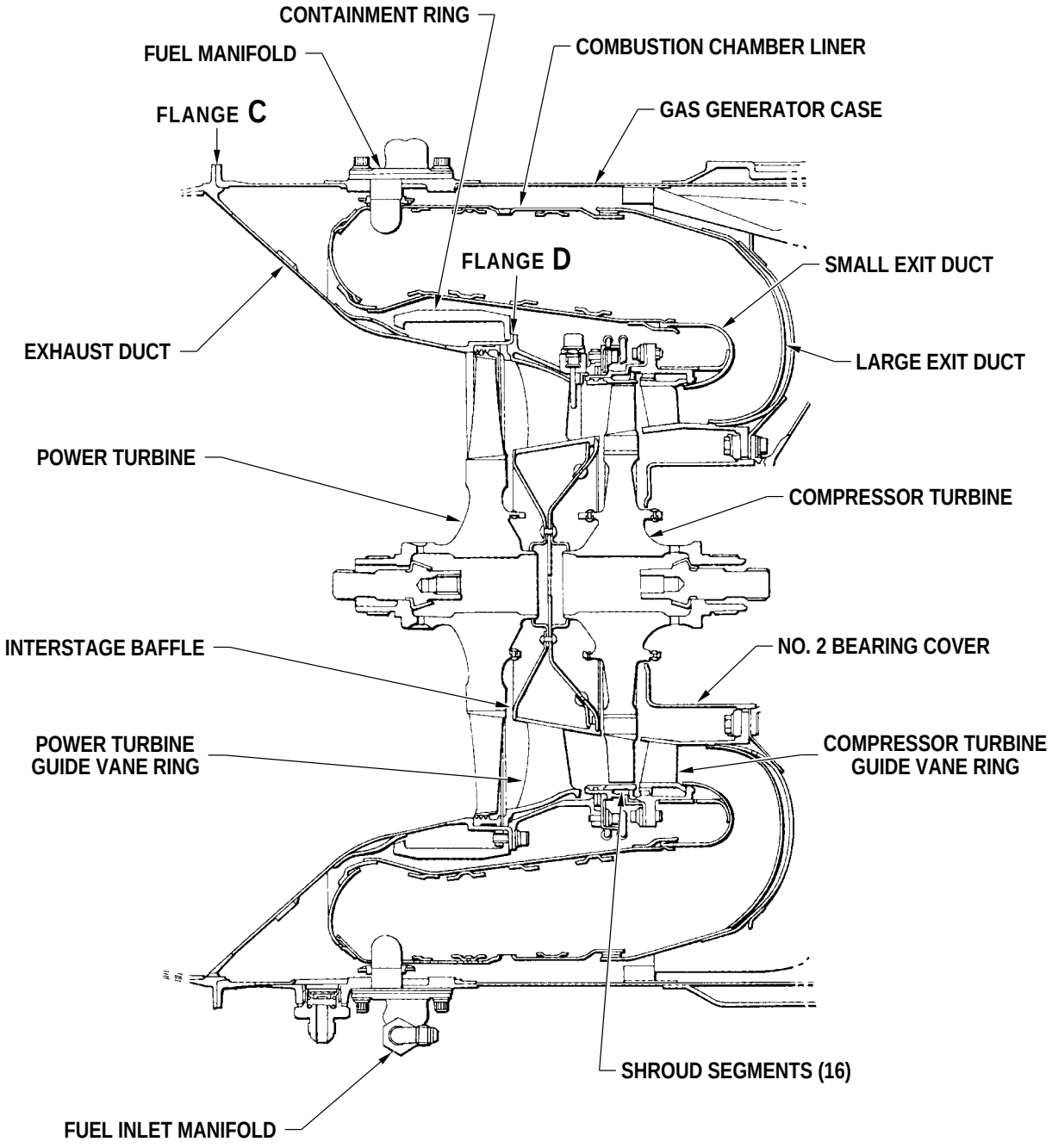
1. General (Ref. Fig. 1)

The engine incorporates two turbines, one for the compressor section and the other for the power section. The compressor turbine is splined to the compressor front stubshaft, while the power turbine is splined to the power turbine shaft assembly, which, in turn, drives the reduction gearbox (Ref. 72-10-00).

Each turbine is preceded by an inlet guide vane assembly which directs the gas flow onto its associated turbine at the most efficient angle. The compressor turbine inlet guide vanes are provided with cored cooling air passages (Ref. 75-30-00). The compressor turbine rotates within a shroud housing which incorporates 16 shroud segments. The segments are ground to provide the necessary blade tip clearance.

The power turbine vane ring and interstage baffle, which form part of the power turbine stator assembly, are contained within the power turbine stator housing which is bolted at its front end, together with power turbine containment ring, to the exhaust duct.

The gas flow from the combustion chamber liner is directed into the engine turbine area via the annular passage between the small and large exit ducts. This passage changes the gas flow 180 degrees to provide a forward flow.



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Compressor Turbine and Power Turbine - Cross-section
Figure 1

COMPRESSOR TURBINE STATOR - DESCRIPTION AND OPERATION

1. Description and Operation (Ref. 72-50-00, Fig. 1)

The compressor turbine classified guide vane ring consists of 29 vanes integrally cast between inner and outer rings. The airfoil section of the vanes directs the expanding gases from the combustion chamber to the compressor turbine blades at the optimum angle for maximum efficiency. The inner ring is cast with an extended rearward platform and internal flange. Lugs on the flange engage with slots in the No. 2 bearing cover flange.

An annular lockplate and 16 bolts secure the vane ring, No. 2 bearing cover and large exit duct to the gas generator case. The outer ring locates the compressor turbine shroud housing and small exit duct.

The compressor turbine shroud housing extends forward toward the power section. The extension provides two features: the outer diameter incorporates a circumferential groove which accommodates the interstage sealing ring(s) while the inner diameter is machined to accommodate the classified compressor turbine shroud segments. The segments are held in position by a retaining ring seated inside, and riveted to, the shroud housing. The shroud segments act as a seal and provide running clearance for the compressor turbine. The interstage sealing ring seals the mechanical separation between the combustion section and the interturbine area.

The large exit duct is located at the rear of the combustion chamber liner, adjacent to the diffuser in the front section of the gas generator case. The duct forms the outer section of an envelope to change direction of gas flow 180 degrees and directs it to the compressor turbine guide vanes. The duct, fabricated from nickel alloy, incorporates a heatshield at the rear. Compressor discharge air (P3) is routed into the space formed by the heatshield to cool the duct. The outer flange of the duct incorporates a ‘‘wiggle strip’’ Pre-SB1434 or sliding joint Post-SB1434 to provide a mating flange for the outer wall of the combustion chamber liner and ports for the passage of cooling air over the duct wall. The inner section of the duct incorporates a bolting flange for mounting at the gas generator case centerbore.

The small exit duct locates in the rear of the combustion chamber liner via a sliding joint and slotted seal ring and attaches to the compressor turbine guide vane ring . The duct forms the inner section of an envelope that changes the direction of gas flow 180 degrees and directs it to the compressor turbine inlet guide vanes. The duct is fabricated from nickel alloy and incorporates a heatshield and mounting flange at the front. Holes in the heatshield allow cooling air to be routed through the space between the duct wall and heatshield; the air then passes out of the space and into the gas stream at the ID of the duct wall.

COMPRESSOR TURBINE STATOR - MAINTENANCE PRACTICES

1. General

   A. Maintenance personnel should make reference to the INTRODUCTION section and Chapter 70-00-00, STANDARD PRACTICES of this manual to familiarize themselves with general procedures.

   B. Install suitable protective caps/covers over all disconnected tubes/lines and component openings.

   C. Lockwire shall comply with specification AMS 5687, heat and corrosion resistant steel wire MS9226-03 which is 0.025 inch diameter, and will not be called out in instructions.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC11-010	Alcohol, Methyl
PWC11-012	Acetone
PWC11-014	Alcohol, Isopropyl
PWC11-027	Solvent, Petroleum
PWC11-031	Cleaner, Engine

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC30478	Spacer
PWC30863	Puller
PWC32209	Adapter
PWC32380	Gage, Shroud
PWC32396	Jackscrew, Accessory Gearbox
PWC32528	Wheel, Grinding
PWC37917	Dresser, Diamond, Grinding Wheel Dressing
PWC37918	Grinder, Compressor Turbine Shroud
PWC64241-1 or -5	Guidepin

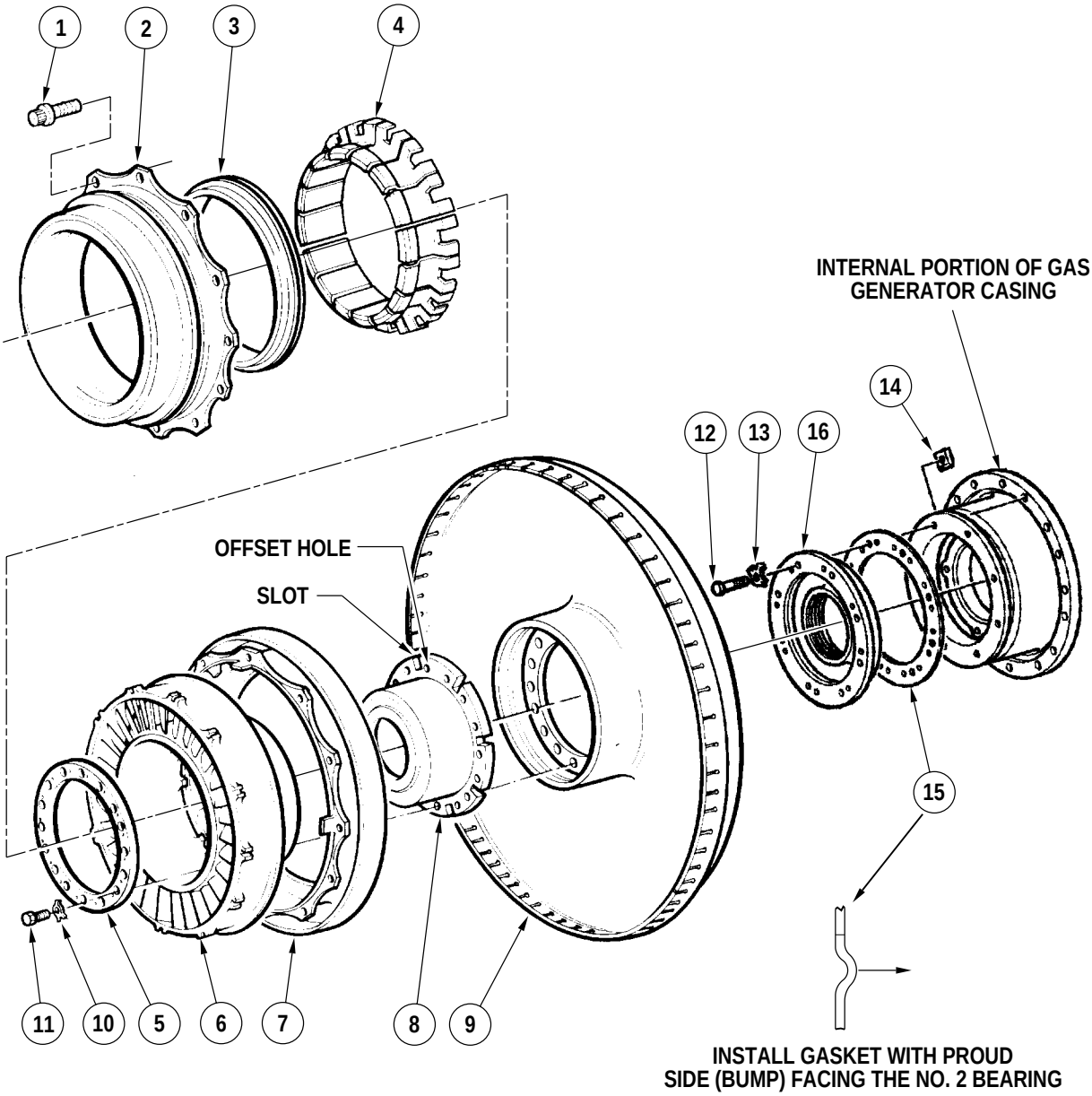
4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Removal/Installation (Heavy Maintenance Only)

   A. Removal of Compressor Turbine Stator (Ref. Fig. 201)

      (1) Remove the power section from the gas generator assembly (Ref. 72-00-00).



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Removal/Installation of Compressor Turbine Stator Assembly
Figure 201

Key to Figure 201

1. Silver-plated Bolt
2. Shroud Housing
3. Heatshield
4. Shroud Segments (Post-SB1158)
5. Lockplate
6. Vane Ring
7. Small Exit Duct
8. No. 2 Bearing Cover
9. Large Exit Duct
10. Tabwasher
11. Bolt
12. Bolt
13. Keywasher
14. Nut
15. Gasket
16. No. 2 Bearing Stator Air Seal

(2) Install the power section in a stand (Ref. 72-00-00).

(3) Remove the compressor turbine disk and blade assembly (Ref. 72-50-02).

(4) Remove the combustion chamber liner (Ref. 72-40-01).

(5) Remove bolts and tabwashers securing the lockplate (5), compressor turbine vane ring (6), shroud housing assembly (2) and small exit duct (7) to the gas generator case.

NOTE: Before moving the compressor turbine vane ring, mark the location of the vane ring relative to the no. 2 bearing cover flange using an approved marker (Ref. 70-00-00).

(6) Withdraw lockplate (5), compressor turbine vane ring (6), shroud housing (2) and small exit duct (7) assembly from large exit duct and gas generator case.

CAUTION: MAKE SURE COMPRESSOR TURBINE STATOR AIR SEAL (16) AND GASKET (15) ARE NOT DISTURBED WHEN REMOVING THE NO. 2 BEARING COVER. IF AIR SEAL AND GASKET ARE INADVERTENTLY DISTURBED, INSTALL NEW GASKET AT ASSEMBLY.

(7) Install the puller (PWC30863) and withdraw the No. 2 bearing cover (8).

NOTE: Post-SB1231 engines incorporate four threaded holes. If deemed necessary, the cover may be removed using jackscrews (PWC32396) in these holes. It should be noted that the material thickness of cover flange is such that care should be exercised when tightening jackscrews to avoid stripping the threads.

(8) Remove the large exit duct (9) from the gas generator case.

NOTE: For Pre-SB1178 Engines: Apply hand pressure evenly on each side of centerbore of large exit duct, and at the same time rotate duct in a counterclockwise direction for approximately 23 degrees to disengage scallops from support brackets on the gas generator case.

(9) Using an approved marker (Ref. 70-00-00, Marking of Parts), index mark the compressor vane ring (6), small exit duct (7), heatshield (3, Pre-SB1305) and shroud housing (2) to correctly align mating surfaces on reassembly.

(10) Remove bolts (1) which secure the vane ring (6) and shroud housing (2) to the small exit duct (7).

(11) Separate the vane ring (6) from the shroud housing (2) and small exit duct (7).

(12) Remove shroud segments and heatshield (3, Pre-SB1305) from shroud housing.

NOTE: Unless shroud segments are to be replaced, the assembly should not be disassembled or disturbed if avoidable.

B. Installation of Compressor Turbine Stator (Ref. Figs. 201, 202 and 203)

(1) Place small exit duct (7, Fig. 201) on wooden blocks, flange uppermost, and install compressor turbine vane ring (6) in ID of duct. Make sure slots in ring engage with corresponding lugs on duct and vane ring is correctly seated and centralized. Index (rotate) vane ring until best fit is obtained.

(2) Check clearance between slots in vane ring and lugs on duct, take measurements on unloaded side of slots at all locations. Clearance should be between 0.002 and 0.005 inch.

(3) If insufficient gap exists at any location, appropriate slots in vane ring may be lightly stoned until acceptable clearance of 0.002 to 0.005 inch is obtained at all locations.

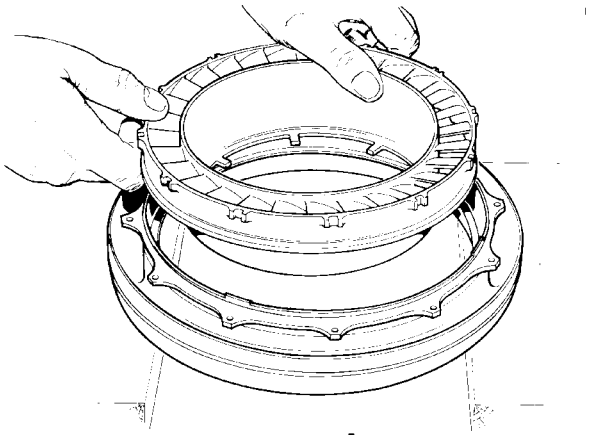
NOTE: If side play is found in excess of 0.002 inch, vane ring and small exit duct must be reworked at an approved overhaul facility. Excessive clearance can displace true center of shroud housing and ground shroud segments from the running center of compressor turbine disk. This condition may cause a blade tip rub on one side and an excessive tip clearance on diametrically opposite sides.

(4) Install shroud segments on vane ring:

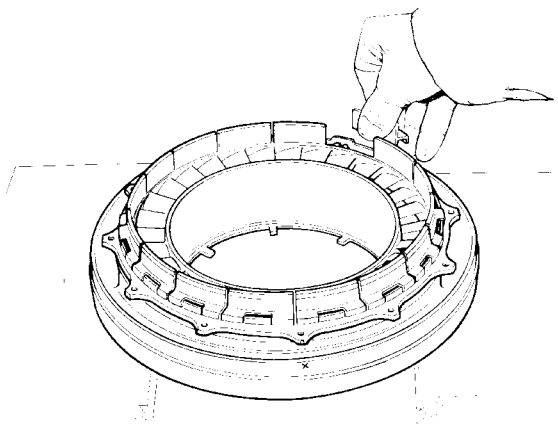
(a) Starting at most convenient point, position segments of appropriate class in sequence on vane ring (Ref. Fig. 202, Detail B).

(b) Clean ID of segments with alcohol (PWC11-010)/(PWC11-014) or acetone (PWC11-012), then apply masking tape to cleaned area to prevent segments from falling out of position during subsequent handling.

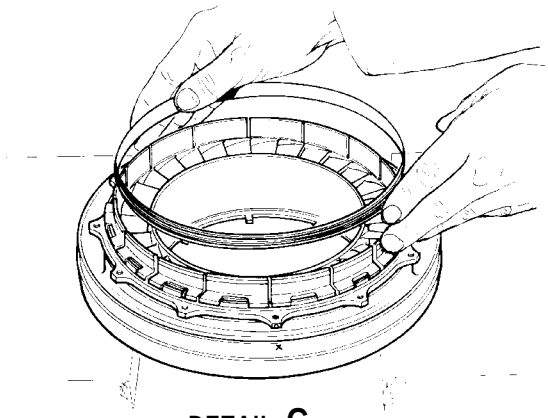
(c) Locate heatshield (Pre-SB1305) over shroud segments (Ref. Fig. 202, Detail C). Align index marks on vane ring and heatshield.



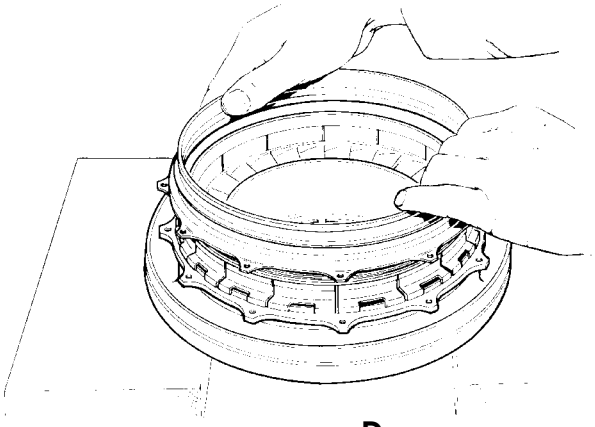
DETAIL A
INSTALLTION OF VANE TO SMALL EXIT DUCT



DETAIL B
INSTALLATION OF COMPRESSOR TURBINE SHROUD SEGMENTS



DETAIL C
INSTALLATION OF COMPRESSOR TURBINE SHROUD HOUSING HEAT SHIELD (PRE−SB1305)



DETAIL D
INSTALLTION OF COMPRESSOR TURBINE SHROUD HOUSING

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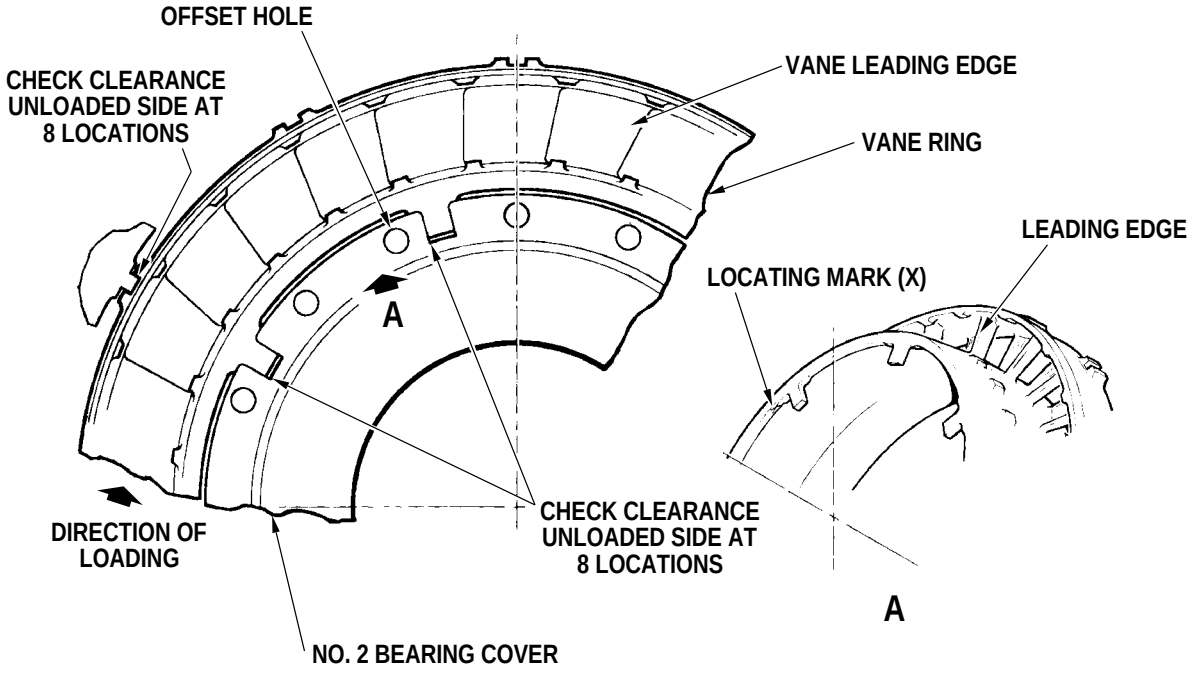
Compressor Turbine Vane Ring and Shroud Housing Assembly Sequence
Figure 202



C1316C

Small Exit Duct/Vane Ring Clearance Check
Figure 203

(5) Locate compressor turbine shroud housing over vane ring and small exit duct, align index marks on housing and duct, then press housing into position.

(6) Remove masking tape, if used at assembly, and thoroughly clean off all traces of adhesive with alcohol or acetone.

(7) Secure shroud housing to small exit duct with bolts (1, Fig. 201). Torque bolts 20 to 25 lb.in. and lockwire in pairs.

(8) Inspect ID of vane ring (adjacent to lugs) for index mark (Ref. Fig. 203). If mark is legible, align mark with offset hole in No. 2 bearing cover (8, Fig. 201) then proceed with assembly at Step (10).

(9) If the index mark is not legible, or if a new vane ring is being installed (Ref. Fig. 203):

(a) Install assembly on No. 2 bearing cover.

(b) Check clearance between lugs on vane ring and slots in No. 2 bearing cover, taking measurements on unloaded side of slot at all eight locations. A 0.001 inch feeler gage should enter gaps between lugs and slots, but a 0.003 inch feeler gage must not.

NOTE: If the clearance or side play is found to be excessive, it must be corrected by rework at an overhaul facility. Excessive clearance can displace the true center of shroud housing and the ground shroud segments from the running center of compressor turbine disk. This condition may cause a blade tip rub on one side and excessive tip clearance on the diametrially opposite side.

(c) If insufficient gap exists at any location, the appropriate lug(s) may be lightly stoned until correct clearance of 0.001 to 0.002 inch is obtained at all eight locations. Minimum lug width after rework to be not less than 0.245 inch.

(d) Vibropeen index (X) mark on ID of vane ring adjacent to offset hole in No. 2 bearing cover (Ref. Fig. 203).

(10) Make sure the mating surfaces of vane ring, shroud housing, No. 2 bearing cover and large exit duct are clean.

(11) Locate large exit duct (9, Fig. 201) on flange of gas generator case, and align offset holes.

NOTE: For Pre-SB1178 Engines: Locate exit duct in gas generator case with offset hole positioned approximately 23 degrees counterclockwise. Apply hand pressure to centerbore of duct while rotating clockwise to engage scallops on rear face of duct with brackets in case. Align offset hole in duct with corresponding hole in case.

(12) Locate No. 2 bearing cover (8) on large exit duct (9) and align offset holes.

NOTE: Due to relative tolerances, tightness may be encountered when fitting cover on gas generator case. When such conditions prevail, the use of a soft-faced hammer is permissible.

(13) Secure No. 2 bearing cover:

(a) If air seal (16) and gasket (15) have been inadvertently disturbed (Ref. CAUTION before Para. A. step (7)):

1 Install new gasket (15) (with the proud side towards the No. 2 bearing) and No. 2 bearing stator air seal (16) on flange of gas generator case. Install two guide pins (PWC64241-1) or (PWC64241-5) into gas generator case.

2 Secure No. 2 bearing stator air seal (16) with keywashers (13) bolts (12) and nuts (14). Remove the guide pins and install the remaining bolts. Torque the bolts 32 to 36 lb.in. and lock keywashers.

NOTE: Depending on SB standard of gas generator case, Dee-nuts (14) may be present.

(14) Locate vane ring and shroud housing assembly on to the No. 2 bearing cover. Align index mark on vane ring with offset hole in bearing cover, then engage lugs on vane ring with slots in cover. Install lockplate (5) and secure with tabwashers (10) and bolts (11). Tighten bolts and torque 36 to 40 lb.in. Check that vane ring and shroud housing assembly can be moved slightly by hand (REF. NO. 489). Lock tabwashers. Total side play of assembly should not exceed 0.003 inch.

(15) Install compressor turbine disk and blade assembly (Ref. 72-50-02).

(16) Check compressor turbine tip clearance (Ref. 72-50-02).

(17) Install combustion chamber liner (Ref. 72-40-01).

(18) Install power section (Ref. 72-00-00).

6. Inspection/Check

A. Compressor Turbine Vane Ring (Ref. Table 201 and Fig. 205)

(1) Inspect turbine vane ring.

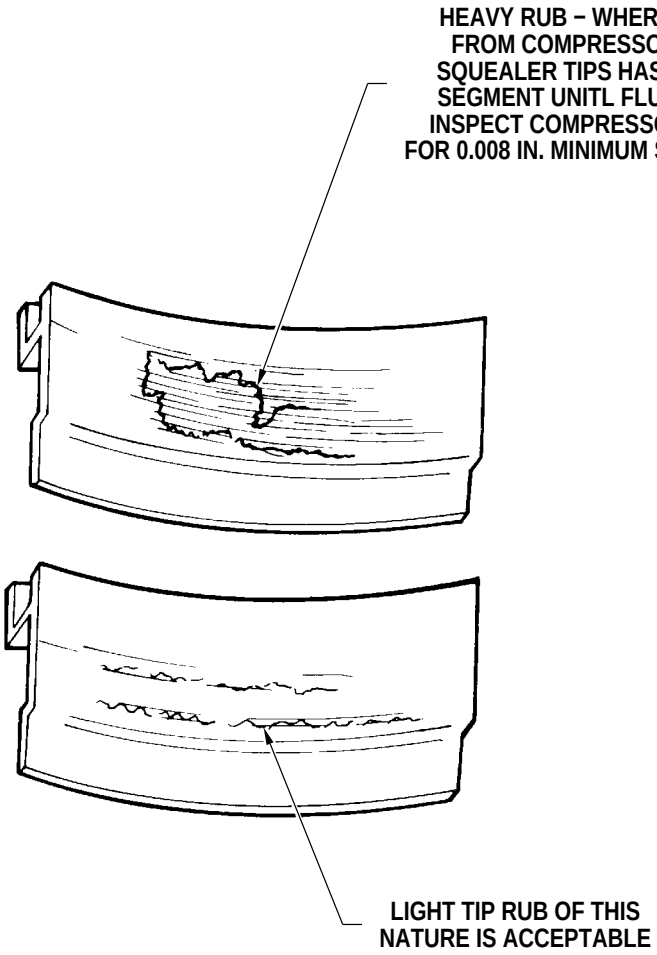
(2) Inspect turbine shroud housing and shroud segments:

(a) Inspect OD of shroud housing for wear and grooving in contact area with interstage sealing ring. If wear is uneven and conducive to gas leakage, return housing to an approved overhaul facility for repair.

(b) Inspect shroud housing (Post-SB1305) for cracks in shroud segment retaining lip. Cracks not exceeding 0.150 in. in length and separated by a minimum of 1.00 in. of sound material are acceptable. Shroud housings cracked in excess of limits are unserviceable; ship to an approved overhaul facility for possible repair.

(c) Inspect compressor turbine shroud segments for metal build-up and cracks (Ref. Fig. 204).

NOTE: To maintain concentricity and accuracy during machine grinding, No. 2 bearing cover should accompany compressor turbine hot section hardware returned to a repair facility.



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Metal build-up and Cracks on Shroud Segments
Figure 204

TABLE 201, Compressor Turbine Stator Inspection

Inspection	Max. Serviceable	Max. Repairable	Corrective Action
COATING LOSS			
Vanes	Not critical without erosion.	**	*
Outer ring	Not critical without erosion.	**	*
Inner ring	Not critical without erosion.	**	*
CRACKS			
Vane trailing edges	Open cracks up to 0.500 inch long are acceptable on any number of vanes provided their progression will not result in loss of vane materials.	**	*
CAUTION: OUTER RING CRACKS ARE ACCEPTABLE ONLY IF SLOT-TO-LUG CLEARANCE CAN BE OBTAINED AT ASSEMBLY.			
Inner ring	Up to ten through cracks are acceptable provided they are not convergent and/or do not display signs of air leakage.	**	*
Outer ring	Three cracks across the length of the outer ring are acceptable. Outer ring cracks that extend into vanes are acceptable. Multiple hairline cracks in, but not across, the ring are acceptable.	**	*
EROSION AND BURNING			

TABLE 201, Compressor Turbine Stator Inspection (Cont'd)

Inspection	Max. Serviceable	Max. Repairable	Corrective Action
Vanes	0.005 inch deep on any airfoil surface on any number of vanes. When compressor turbine vane ring inspection reveals that vane trailing edge burning (Ref. Fig. 205) has resulted in loss of airfoil area of 0.125 sp.in. or more (i.e. average length multiplied by average width; eg. length 0.350 x width 0.350 = 0.1225 sq.in.), on any one vane, and burned area can be seen from leading edge of vane ring when viewed parallel to engine longitudinal axis, the entire set of compressor turbine blades must be scrapped (Ref. 72-50-02).	**	*
Outer and Inner rings	Any amount.		
CONTOUR	Vane airfoil contour distortion or surface irregularities may degrade engine performance. A cracked outer ring may incur geometric location errors in the slots which effect small exit duct fit and therefore shroud segment concentricity. These effects must be considered in determining the serviceability of the vane ring.		

GENERAL NOTES

If distressed vanes are encountered, check fuel nozzles functioning.

Acceptance criteria is based on structural integrity considerations and apply only if engine performance was satisfactory prior to an HSI.

Replace stator assembly if its condition appears to be the cause for loss of performance. If stator assembly must be replaced, an assembly of same class or ± 0.03 in^2 or ± 0.12 class (REF. S.I.L. No. GEN 020).

* A stator exhibiting defects in excess of Maximum Serviceable limits must be replaced.

TABLE 201, Compressor Turbine Stator Inspection (Cont'd)

Inspection	Max. Serviceable	Max. Repairable	Corrective Action
**Stator considered unacceptable for continued service may be sent to P&WC or following vendors for possible repair. Pratt & Whitney Canada 7007 de la Savane St. Hubert, Quebec Canada J3Y 3X7 Attention: Receiving Area No. 9 Vac-Hyd, Dallas, Blade and Vane Division 1177 Great Southwest Parkway Grand Prairie, TX 75050 USA Howmet Turbine Components Corp. 555 Benston Rd. Whitehall, MI 49461 USA Attention: Thermatech Division Sifco Turbine Component 2430 Winnetka Avenue North Minneapolis, MN 55427 USA Classification: When compressor turbine vane ring is to be replaced, a vane ring of the same class, or within ± 0.03 in^2 or ± 0.06 variation of the class from the last test cell performance run, is recommended for installation. If a vane ring class is unknown, refer to the last test cell performance run (log book) or contact your local P&WC Customer Support Representative.			

B. Small and Large Exit Ducts

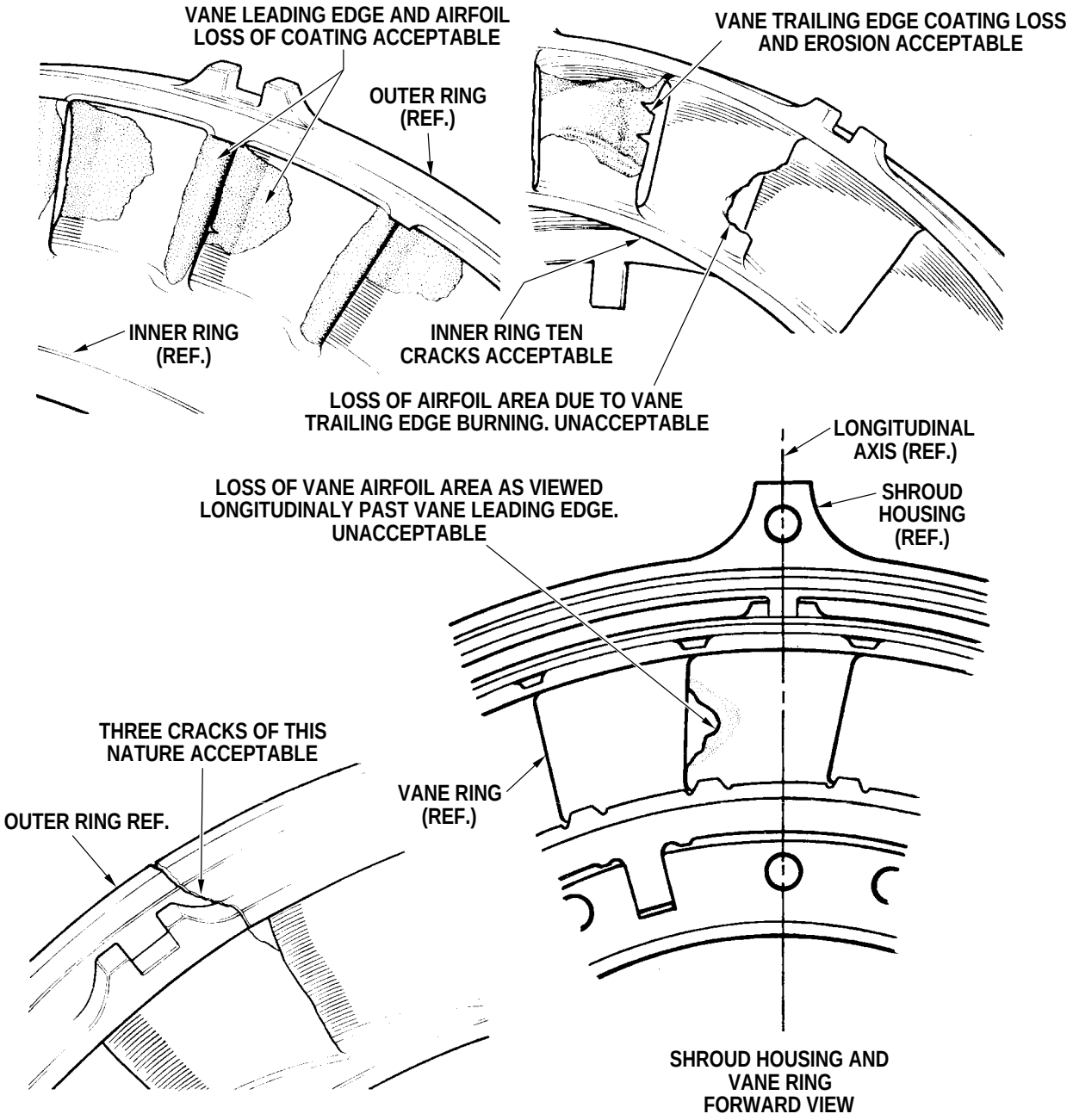
(1) Inspect the small exit duct for fretting wear at the duct flange which contacts the combustion chamber liner. Wear up to 0.010 inch is acceptable. If wear is in excess of 0.010 inch, the duct should be returned to an approved overhaul facility for possible repair.

(2) Radial cracks up to 1.00 inch long in the small exit duct outer wall are acceptable provided they are stop drilled using a 1/16 (0.0625) inch drill.

(3) Inspect the large exit duct for fretting wear along the area which contacts the combustion chamber liner. Wear up to 50 percent of the material thickness is acceptable. If the wear is in excess of 50 percent, the duct should be returned to an approved overhaul facility for possible repair.

(4) Cracks up to 1.00 inch long in the large exit duct inner wall are acceptable provided they are stop-drilled using a 1/16 (0.0625) inch drill.

(5) Coating loss of any amount is acceptable on both the small and large ducts provided there is not evidence of burning or erosion of the parent metal.



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Compressor Turbine Vane Ring Inspection (Typical)
Figure 205

7. Approved Repairs (Heavy Maintenance Only)

A. Grinding Compressor Turbine Shroud Segments

(1) General

(a) To maintain concentricity and uniform turbine blade tip to shroud segment clearance, grinding should be carried out with all components, especially No. 2 bearing cover, fitted to the engine.

(b) Replacement of the compressor turbine shroud segments may entail localized grinding to remove high spots and/or any slight eccentricity of the segments to obtain the correct turbine blade tip clearance. If the tip clearance exceeds the specified limit (REF. NO. 318, Fits and Clearances, Chap. 72-50-02) after the removal of the high spots and/or eccentricity, select the next class (thicker) of segments (Ref. Table 202). Install (Ref. Para. 7.) and grind as necessary.

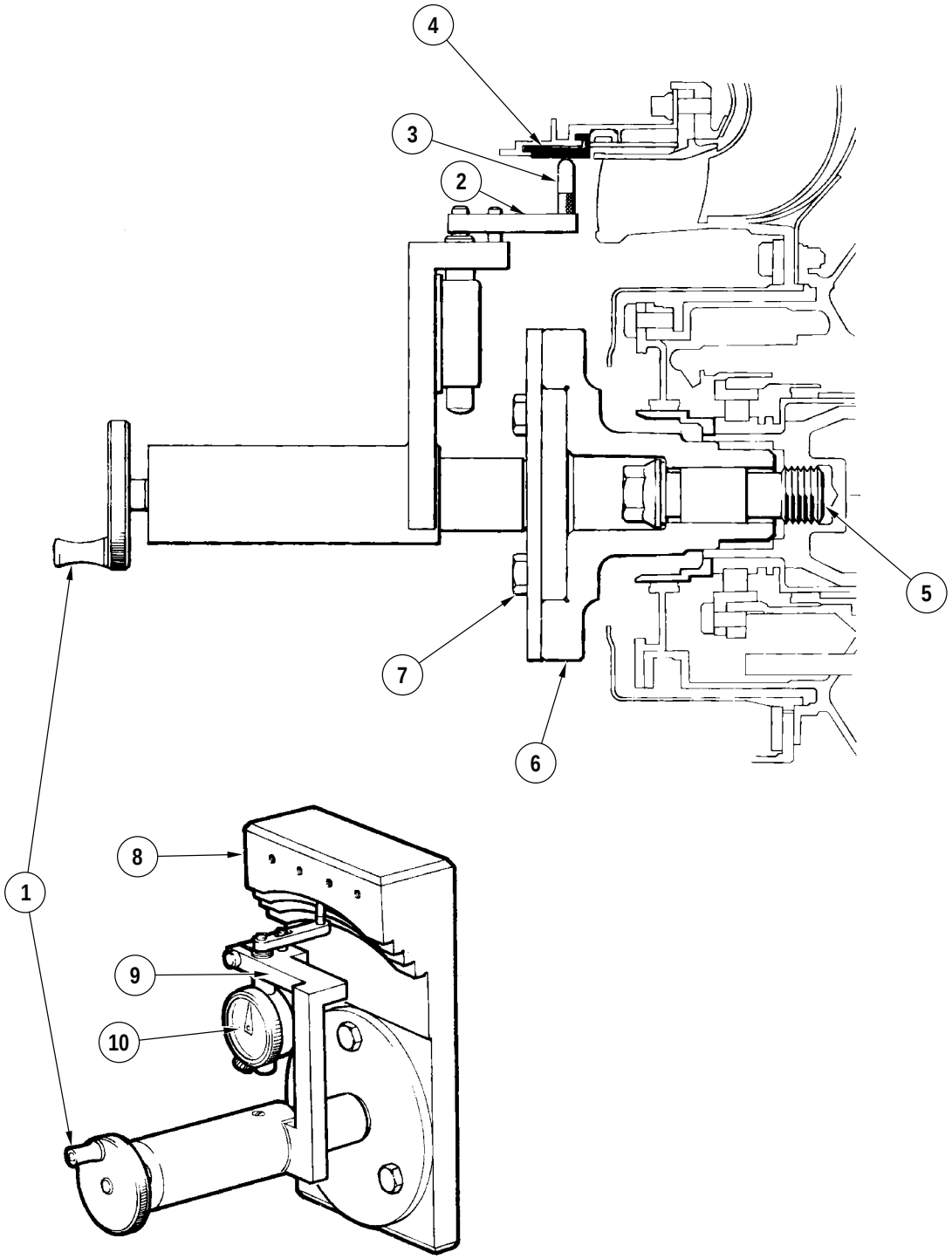
NOTE: Pre-assembled compressor turbine vane ring with shroud housing and bladed compressor disk procured as repaired and/or replacement assemblies, are usually machine ground to provide the minimum compressor turbine blade tip to shroud segment clearance. Upon installation, a final grind may be necessary to make sure the prescribed clearances are maintained.

TABLE 202, Compressor Turbine Shroud Segment Classification

Pre-machined Turbine Bladed Disk OD (in)	Recom-mended Class	Shroud Segment Dim. A (in.)	Grind Shroud Segment ID (in.)	
			Min.	Max.
8.556 max.	Class 1	0.042 - 0.043	8.575	8.581
8.550	Class 2	0.045 - 0.046	8.569	8.575
8.544	Class 3	0.048 - 0.049	8.563	8.569
8.538	Class 4	0.051 - 0.052	8.557	8.563
8.532	Class 5	0.054 - 0.055	8.551	8.557
8.526	Class 6	0.057 - 0.058	8.545	8.551
8.520	Class 7	0.060 - 0.061	8.539	8.545
8.512 min.	Class 8	0.069 - 0.072	8.521	8.527
	Class 9	0.079 - 0.083	8.501	8.507

NOTE: 1. If the blade tip clearance exceeds the specified limits after removing the eccentricity of the shroud segments, select the next class (thicker) of segments and grind as necessary.

NOTE: 2. Minimum grind to remove ovality only. Minimum thickness of shroud segment after grinding on assembly is 0.055 in. Refer to Figure 206 for details of Dimension 'A'.



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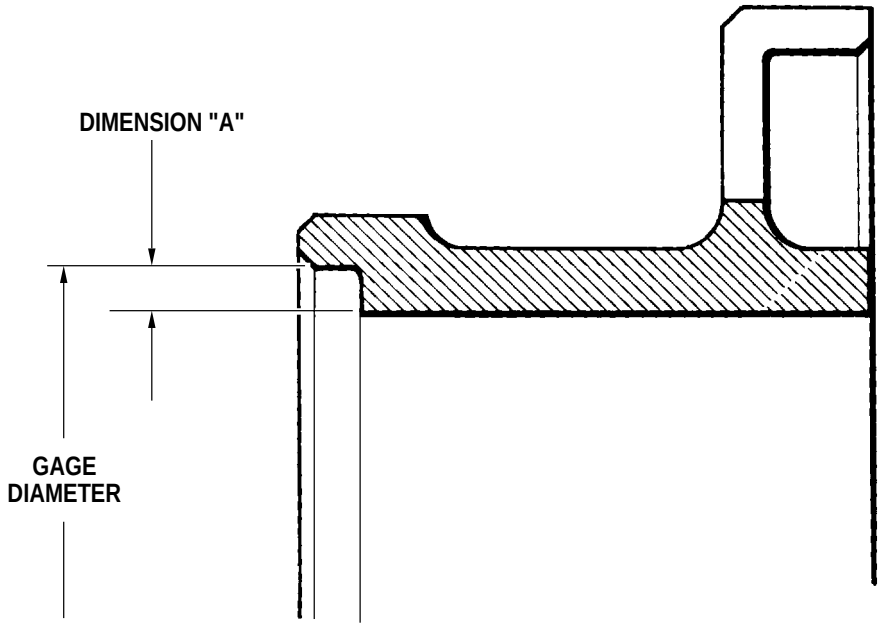
Compressor Turbine Shroud Segments - Blade Tip Clearance Check
Figure 206 (Sheet 1 of 2)

Key to Figure 206

1. Axial Adjuster
2. Tip
3. Contact Point
4. Shroud Segment
5. Bolt
6. Adapter (PWC32209)
7. Bolt (3 req'd)
8. Gage Master
9. Gage Body (PWC32380)
10. Dial Indicator



C3994

Compressor Turbine Shroud Segments - Blade Tip Clearance Check
Figure 206 (Sheet 2)

(2) Determine Shroud Segment Concentricity and Diameter (Ref. Fig. 206).

(a) Install adapter (6, PWC32209) on compressor front stubshaft and secure with bolt (5).

(b) Install four spacers (11, Fig. 207, PWC30478) under the small exit duct. Set the spacers approximately 90 degrees apart.

(c) Select the contact point (3, Fig. 206) for the radius to be measured and fasten to the radius gage tip (2).

NOTE: The radius gage and gage master are common to all PT6 engines. The gage is supplied with four contact points of different lengths, while the gage master has four ''steps'' of different radii. These variables allow the gage and master to be used on all PT6 engine models.

(d) Install the radius gage (9) on the adapter (6) with bolts (7). Tighten the bolts 20 to 30 lb.in. Check for the correct mounting by trying to insert a 0.001 inch shim stock between the gage and adapter.

(e) Position the contact point (3) at the center of the segment (4) using the adjuster (1).

(f) Take four readings, 90 degrees apart around the shroud segments. If the shroud segments are not concentric with the rotor shaft, check the correct positioning of the spacers (11, Fig. 207).

(g) Remove the radius gage from the adapter (6, Fig. 206) and install in the gage master (8). Set the dial indicator (10) to zero.

(h) Remove the radius gage from the master (8). Make sure the dial indicator setting is not disturbed.

(i) Install the radius gage on the adapter (6) with bolts (7). Tighten the bolts 20 to 30 lb.in. Check that a 0.001 inch shim stock will not fit between the gage and adapter.

(j) Rotate the gage and record the high and low readings. Adjust the gage in and out to determine the segment taper. A low reading and/or segment taper will determine whether the segments are suitable for further use or if replacement is required.

(3) Calculate the grinding or replacement of the shroud segments as shown in following typical examples:

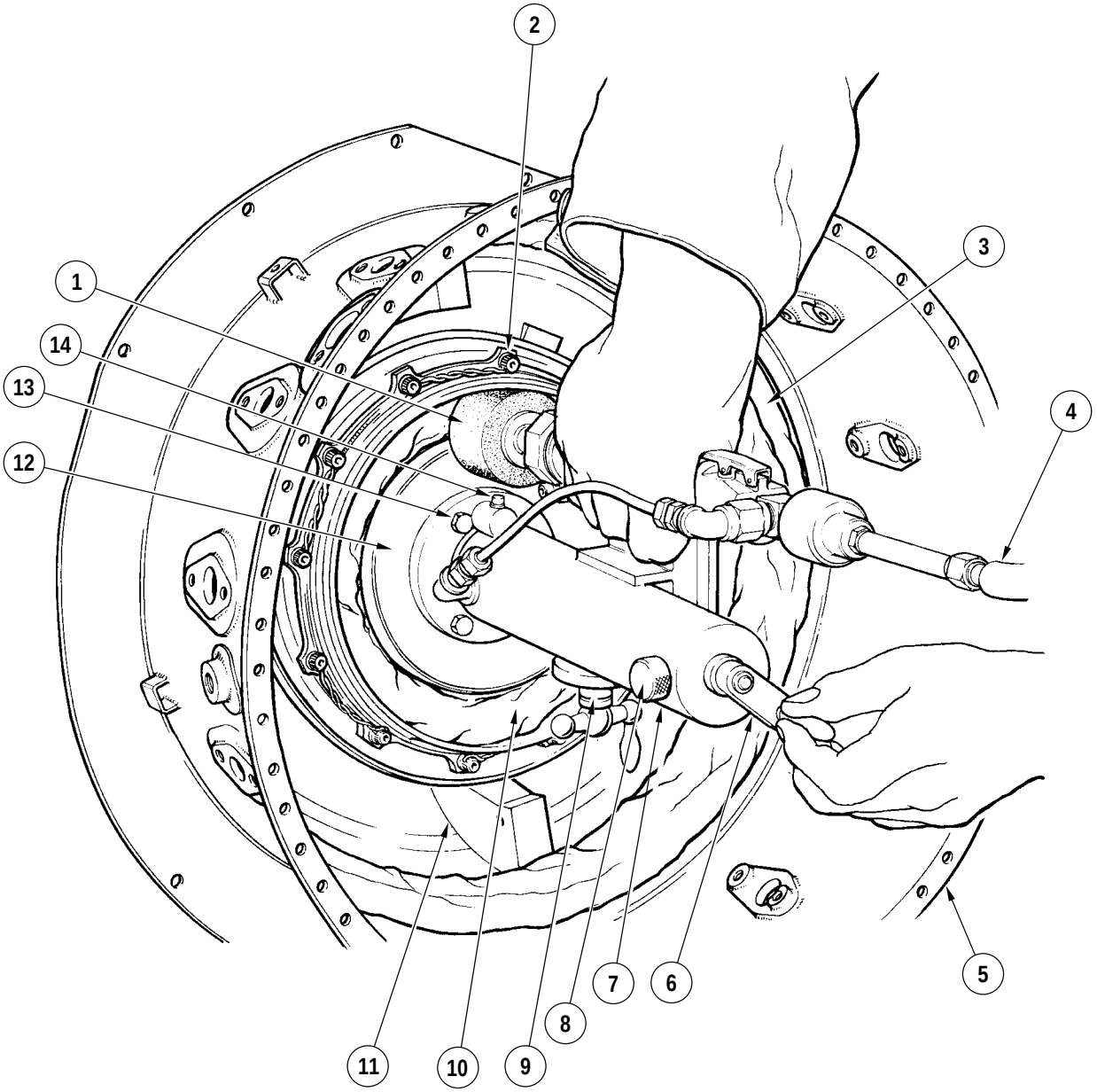
Where: A = True radius as stamped on gage master

B = Radius of bladed disk, ½ OD, as measured with micrometer

C = Dial indicator reading on shroud segments

D = Radius of shroud segments

E = Existing blade tip clearance, before grinding



C41203

Compressor Turbine Shroud Segment Grinding
Figure 207

Key to Figure 207

1. Grinding Wheel (PWC32528)
2. Bolt (Shroud Housing)
3. Blanking Material (Exit Duct)
4. Air Hose
5. Gas Generator Case
6. Axial Vernier Adjust
7. Grinder (PWC37918)
8. Axial Adjustment Lockscrew
9. Radial Vernier Adjust
10. Blanking Material (Stator Assembly)
11. Spacer (PWC30478)
12. Blanking Disk
13. Bolt
14. Diamond Dresser (PWC37917)

EXAMPLE 1:

Where A = 4.282 inches

B = 4.266 inches

C = 0.013 inch clockwise reading on the minus side of the gage zero datum

D = A minus C = 4.282 inches minus 0.013 inch = 4.269 inches

E = D minus B = 4.269 inches minus 4.266 inches = 0.003 inch

(4) In this example, 0.010 inch must be ground from the existing shroud segments to provide a minimum blade tip clearance of 0.013 inch.

EXAMPLE 2:

Where A = 4.282 inches

B = 4.266 inches

C = 0.012 inch counterclockwise reading on the plus side of the gage zero datum

D = A plus C = 4.282 inches plus 0.012 inch = 4.294 inches

E = D minus B = 4.294 inches minus 4.266 inches = 0.028 inch

(5) In this example, the existing blade tip clearance exceeds the maximum permissible limit of 0.016 inch.

EXAMPLE 3:

Where A = 4.282 inches

B = 4.266 inches

C = 0.002 inch, clockwise reading on the minus side of the gage zero datum.

D = A minus C = 4.282 inch minus 0.002 inch = 4.2800 inches

E = D minus B = 4.280 inches minus 4.266 inches = 0.014 inch

(a) In this example, the existing blade radial tip clearance is within the limits and therefore no grinding of the shroud segments is required, except for the removal of local high spots.

(6) Grinding (Ref. Fig. 207)

(a) Using suitable material (3, 10 and 12), blank off the cavities around the combustion chamber liner and compressor turbine vane ring.

(b) Install the dresser (PWC37917) and grinding wheel (1, PWC32528) on the grinder (7) and install the grinder (7) on the adapter with bolts (13). Tighten the bolts 20 to 30 lb.in. Check that a 0.001 inch shim stock will not fit between the grinder and adapter to be sure of correct mounting.

NOTE: Dressing of the wheel may be done before or after the installation of the grinder on the adapter, or during the grinding operation.

(c) Position the wheel (1) in line with and slightly overlapping the segments, using the axial adjustment (6). Allow the wheel to touch the vane ring. Back off the adjustment (6) one turn and lock using the screw (8).

(d) Rotate the grinder around the segments, adjusting the radial adjustment (9) until the wheel (1) contacts the high spots. Back off the radial adjuster one turn.

(e) Connect the grinder air line (4) to the shop air of 90 psig with a flow rate of 36 SCFM.

NOTE: Where pronounced high spots exist, rotate the shroud grinder, back and forth, through an arc of 40 to 50 degrees to reduce the high spots before carrying out the normal 360 degree grinding.

CAUTION: ROTATE THE GRINDER SLOWLY AND AVOID REMOVING AN EXCESSIVE AMOUNT OF MATERIAL IN ONE PASS.

(f) Operate the grinder. Adjust the wheel (1) with the radial adjustment (9) until the wheel contacts the segments, and grind the upper half of the segment ID to the required dimension.

NOTE: When grinding the upper half of the segments, do not load the grinder to compensate for any compressor rotor bearing play. Support the grinder when grinding the lower segment half to prevent taper grinding.

(g) Loosen the radial adjuster until the grinding wheel contacts the high spot on lower segments. Continue grinding, using complete revolutions, until the required dimensions are obtained.

(h) Disconnect the air hose (4) and remove the grinder from the adapter.

(i) Install the radius gage and recheck the shroud segment diameter. Check the segment taper by running the contact point across the width of segments.

(j) Remove the radius gage and return to the gage master. Remove the adapter.

(k) Remove all grinding residue from gas generator case with a suitable suction cleaner.

(l) Remove all blanking material and repeat step (k).

(m) Remove all masking adhesive residue using solvent (PWC11-027) or (PWC11-031).

(n) If the grinding has produced a lip with a sharp edge on the inner edge of the segment, or is raised from the ground surface by more than 0.005 inch, remove by local grinding with a hand held rotary tool, grinding wheel attachment and flexible drive, or similar equipment.

B. Restoration of Hot Section Sealing Surfaces (Ref. Fig. 208, 209 and 210)

(1) Gas tightness and sealing of the hot section surfaces depends on the surface finish, flatness, degree of oxidation and fretting.

(2) Surfaces must be lapped using compound (PWC05-019) to obtain a surface finish better than 32 AA and surface waviness of 0.0008 inch to achieve 100% contact for gas tightness.

(3) Lap face E (Ref. Fig. 208) of the small exit duct until 100% of the lapped finish of the contacting area is achieved.

(4) Lap face A and G (Ref. Fig. 209) of the compressor turbine vane ring until 100% of the lapped surface is achieved.

(5) Lap the vane ring lockplate contact face (Ref. Fig. 210) until 100% of the lapped surface is achieved.

(6) After lapping, each part must be index marked to its mating part.

(7) Thoroughly clean all lapped surfaces using petroleum solvent (PWC11-027) or (PWC11-031), making sure all traces of compound are removed, then allow to dry.

(8) When the surfaces cannot be restored by lapping, return parts to an overhaul facility for repair.

8. Fits and Clearances

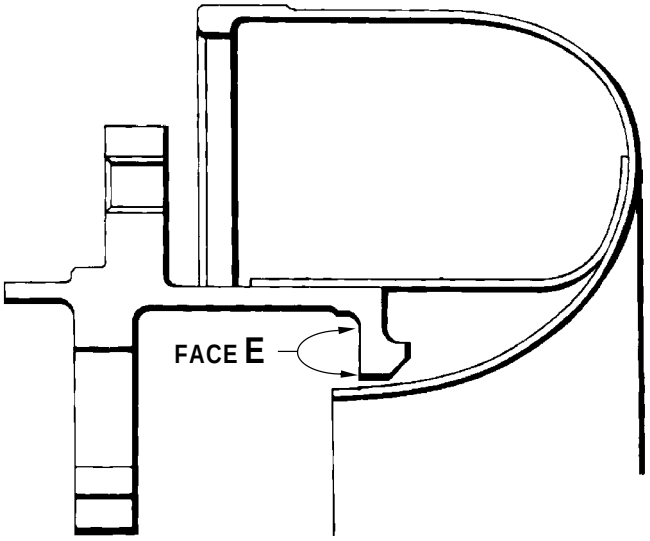
A. General

The following provide the fits and clearances, torques, spring pressures, special assembly, and backlash checks where applicable.

The REF. NO. should be used in conjunction with Figure 211.

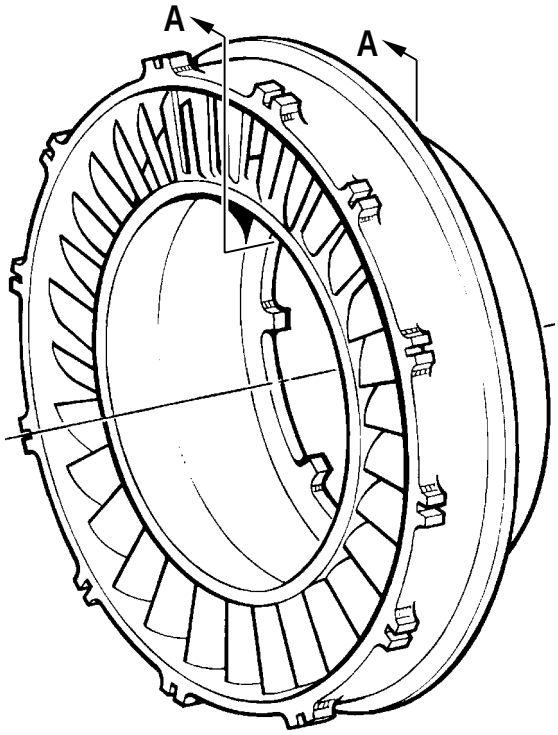
B. Dimensional Checks

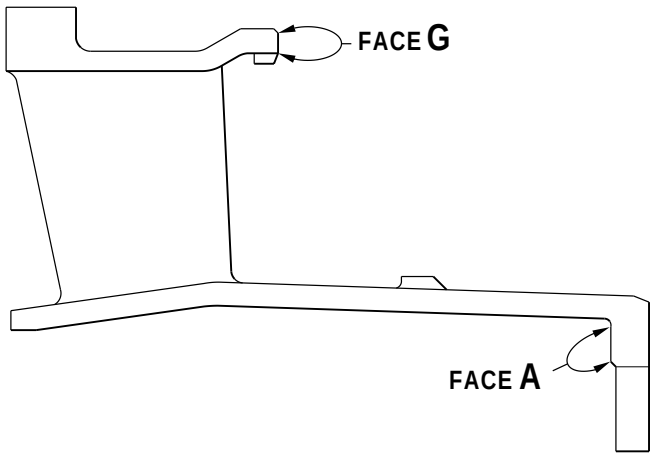
The DIMENSIONS FOR REF. column indicates minimum and maximum manufacturing dimensions of two mating parts. These dimensions are provided for information only.



C79444

Small Exit Duct - Repair
Figure 208

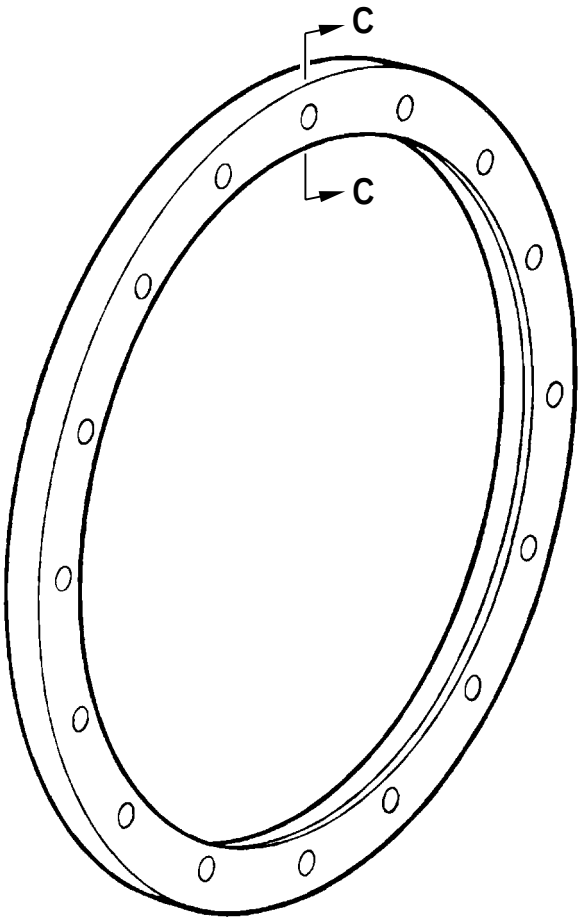


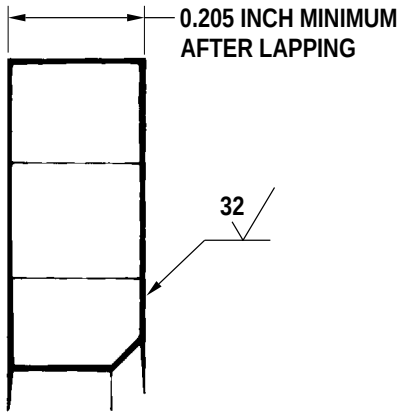


SECTION A–A

C79447

Compressor Turbine Vane Ring - Repair
Figure 209





SECTION C–C

C79446A

Vane Ring Lockplate - Repair
Figure 210

The LIMITS column indicates the desired minimum and maximum fits and clearances between new parts, and also the allowable limit to which these parts may wear before replacement is necessary.

The letter T indicates a tight fit; L or no letter, a loose fit.

BY SELECTION means parts must be matched by selection to provide a required fit.

FIT TO means a fitting operation may be required at assembly to obtain the required fit.

An asterisk (*) indicates part(s) should be replaced if any looseness is evident.

Unless otherwise stated, all fits are diametrical. Spline fits are calculated from chordal dimensions.

C. Torque Limits

Unless otherwise stated, apply thread lubricant to all parts that are to be torque-loaded.

Use engine lubricating oil or equivalent, unless otherwise specified.

Where torque limits for castle nuts are provided in the MINIMUM column only, these nuts should be tightened to the designated torque and then further tightened, if necessary, to properly align the locking slots and holes.

Where MINIMUM and MAXIMUM values are given, the alignment of the locking slot must be obtained without loosening the nut and without exceeding the maximum limit. If this is not possible, back-off the nut half a turn, then retighten. If alignment cannot be accomplished, select another nut.

Torque requirements for interference fit applications, such as studs, may be obtained with or without lubrication, unless otherwise specified.

TABLE 203, Fits and Clearances

REF. NO.	Name	Dim. for Ref. (inches)		Limits (inches)		
		Min.	Max.	Min.	Max.	Replace
260	Plate, Lock, C.T. Vane Ring	5.3090	5.3130	0.0050	0.0150	
	Cover, No. 2 Bearing Housing	5.2980	5.3040			
263	**For Aluminum Enamel Coated Gas Generator Case**	5.3020	5.3040			
	Cover, C.T. Bearing Housing			0.0040T	0.0010	
	Case, Gas Generator Assembly	5.3000	5.3030			

TABLE 203, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. (inches) Min.	Dim. for Ref. (inches) Max.	Limits (inches) Min.	Limits (inches) Max.	Limits (inches) Replace
263	**For Diffused Aluminide Coated Gas Generator Case Only:** Cover, C.T. Bearing Housing	5.3020	5.3040	0.0045T	0.0015	
	Case, Gas Generator Assembly	5.2995	5.3035			
318	Compressor Turbine Blade Radial Tip Clearance			0.011 (Run Segments)(Ref. NOTE)	0.018	
				0.013 (New Segments) (Ref. NOTE)	0.016	
359	Vane Ring Class, Power Turbine			12.7	13.9	
484	**Post-SB1434** Duct, Combustion Chamber Exit Large	15.945	15.955	0.020	0.040	
	Liner, Combustion Chamber	15.975	15.985			
489	Vane Ring, Turbine	0.1360	0.1400	0.0020 (End Float)	0.0100	
	Cover, No. 2 Bearing Housing	0.1420	0.1460			
509	Compressor Turbine, Rotor Diameter			8.546	8.556	8.512
541	Compressor Turbine Stubshaft Center Bolt (Tighten to 600 - 650 lb.in., release to zero, re-tighten to final limits.)			420 (Pre-SB1439)	460	
				500 (Post-SB1439)	550	

TABLE 203, Fits and Clearances (Cont'd)

REF. NO.	Name	Dim. for Ref. (inches) Min.	Dim. for Ref. (inches) Max.	Limits (inches) Min.	Limits (inches) Max.	Limits (inches) Replace
654	Minimum thickness of shroud segment after grinding is 0.055			0.055	0.040	
	NOTE: New segment limits are to be used when a new set of segments is required to be ground under field conditions.					

TABLE 204, Torque and Stretch

REF. NO.	Name	Limits Min.	Limits Max.
	Not Applicable		

TABLE 205, Spring Pressures

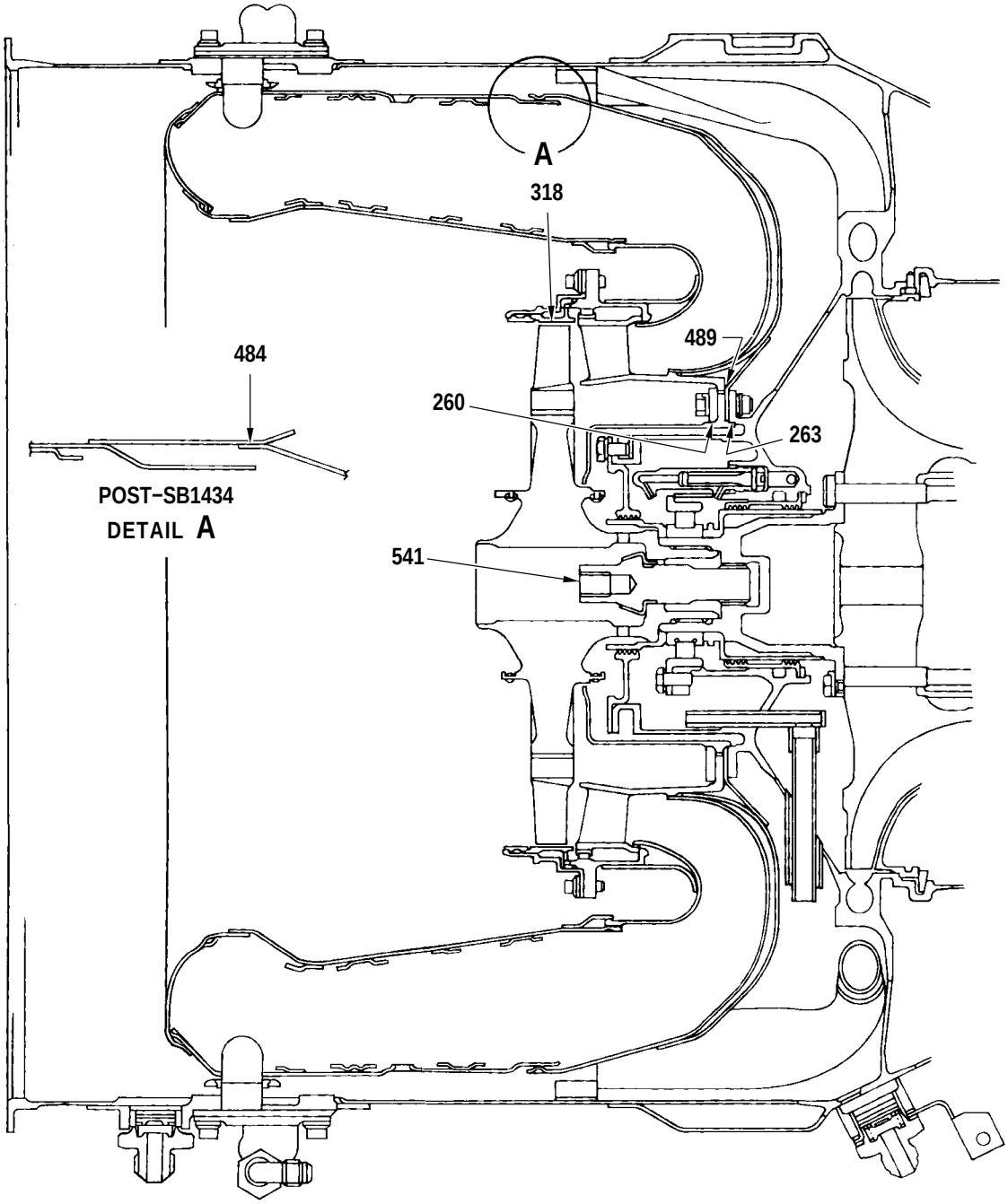
REF. NO.	Name	Limits Min.	Limits Max.
	Not Applicable		

TABLE 206, Special Assembly Procedures

REF. NO.	Name	Limits Min.	Limits Max.
318	Compressor Turbine Radial Tip Clearance (1) With the CT disk and CT vane removed, measure the CT disk OD and the CT vane assembly shroud ID. Calculate clearances must be within limits. If not, grind or replace the shrouds. NOTE: CT blades may be flat on the tip or may have a taper. For CT blades that are flat on the tip, measure the CT disk OD at the highest point of the blades (leading or trailing edge). For blades with a taper, measure the CT disk OD at the blade trailing edge. (2) With the CT vane assembly mounted in the gas generator, measure the shroud ID at four places, approximately mid segment position. The ID of shroud segments should be within 0.003 (new segments) or 0.005 (run segments) F.I.R. If necessary, machine the shrouds to get the correct clearance. (3) With the CT disk installed, measure radial tip clearance, with wire or tapered feeler gages, at several locations (Ref. Step (1)). Load disc at 180 degrees opposite of the clearance being checked and correct results for bearing play. Machine shroud segments or replace it if necessary to produce clearances within final build limits.		

TABLE 207, Backlash

REF. NO.	Name	Limits Min.	Limits Max.
Not Applicable			



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Fits and Clearances
Figure 211

COMPRESSOR TURBINE - DESCRIPTION AND OPERATION

1. Description and Operation (Ref. 72-50-00, Fig. 1)

The compressor turbine installation consists of a two-plane balanced turbine disk with an integral shaft extension, turbine blades, and classified weights. The assembly is an independently balanced unit which can be replaced by another balanced unit without affecting the compressor rotor assembly balance.

The turbine drives the compressor rotor assembly in a counterclockwise direction through the shaft extension, which is externally splined to fit into the internally splined compressor stubshaft. A master spline ensures positive location of the turbine assembly to retain original balance. A center bolt and keywasher secure the turbine assembly to the compressor rotor assembly.

The turbine disk embodies a circumferential groove to enable disk growth to be checked. The blades are secured to fir-tree serrations machined in the disk circumference and retained in position by rivets. Blades are of cast high temperature alloy and are parallel or tapered according to requirements of individual engine model. They incorporate squealer tips to make sure minimum rub should they contact the shroud segments. Classified balance weights are riveted, as necessary, to the front and rear disk flanges during turbine balancing

COMPRESSOR TURBINE - MAINTENANCE PRACTICES

1. General

   A. Maintenance personnel should make reference to the INTRODUCTION section and Chapter 70-00-00 STANDARD PRACTICES of this manual to familiarize themselves with general procedures.

   B. Install suitable protective caps/covers over all disconnected tubes/lines and component openings.

   C. Lockwire shall comply with specification AMS 5687, heat and corrosion resistant steel wire MS9226-03, is 0.025 inch diameter, and will not be specified in instructions.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC04-004	Grease, High Temperature
PWC04-005	Grease, Extreme Pressure
PWC05-103	Marker, Pencil
PWC06-004	Compound, Anti-seize

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC30331	Wrench
PWC30335	Spreader
PWC30336	Protector
PWC30403	Puller
PWC30458	Squeezer, Keywasher
PWC50057	Drill Kit
PWC50060	Injector

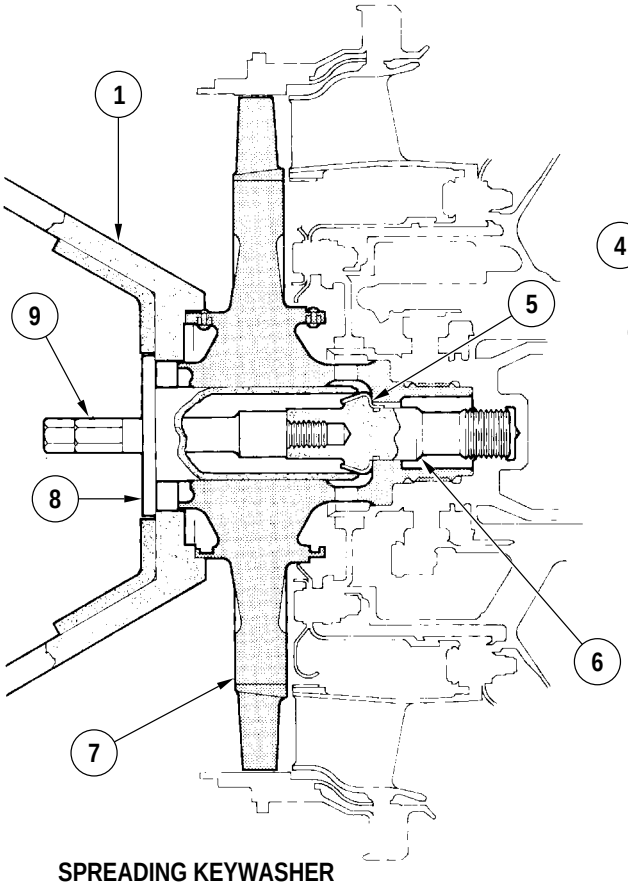
4. Fixtures, Equipment and Supplier Tools

   Not Applicable

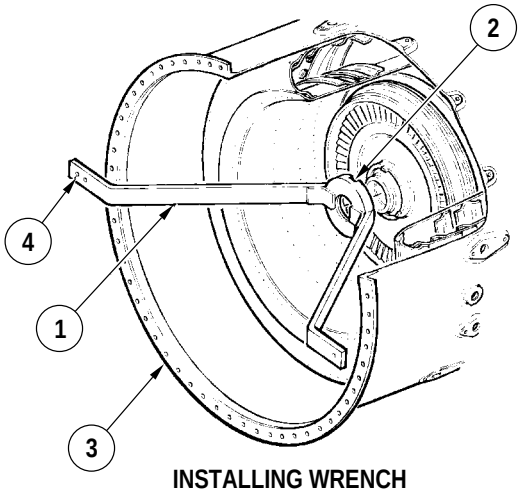
5. Removal/Installation

   A. Removal of Compressor Turbine Disk Assembly (Ref. Figs. 201 and 202)

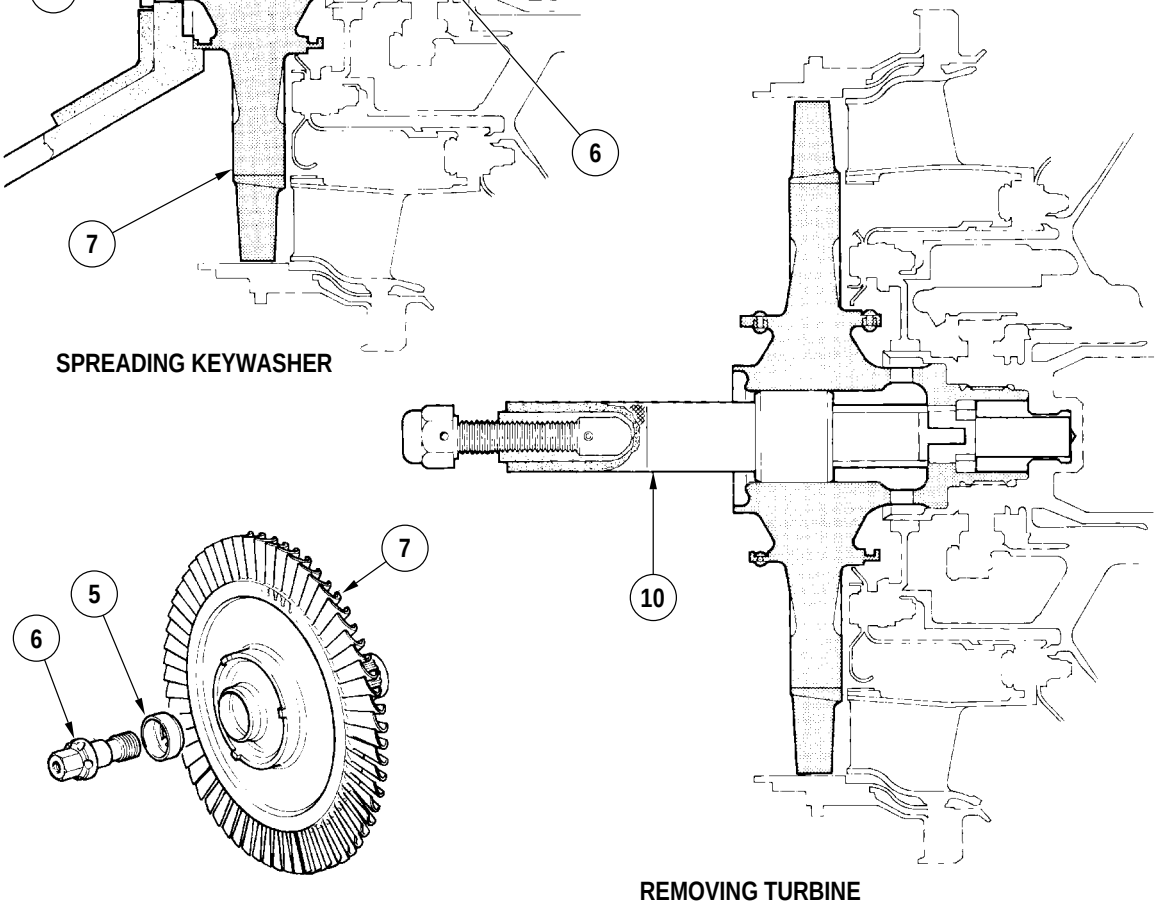
      (1) Remove the power section and install in stand (Ref. 72-00-00, REMOVAL/INSTALLATION).



SPREADING KEYWASHER



INSTALLING WRENCH



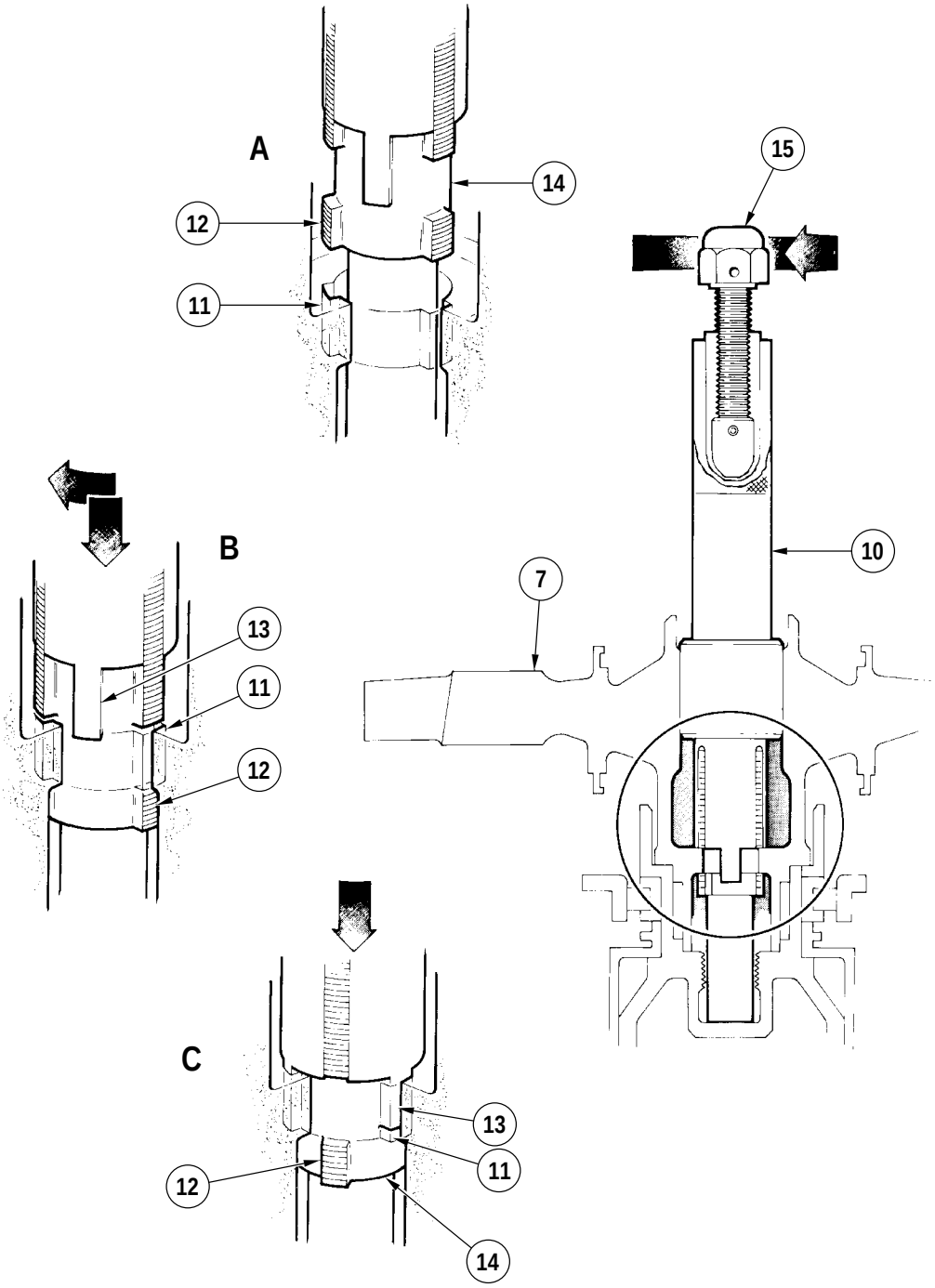
REMOVING TURBINE

C6640

Removal/Installation of Compressor Turbine Disk Assembly
Figure 201 (Sheet 1 of 2)

Key to Figure 201

1. Wrench (PWC30331)
2. Slot
3. Flange C
4. Locating Pin
5. Keywasher
6. Stubshaft Bolt
7. Compressor Turbine
8. Protector (PWC30336)
9. Spreader (PWC30335)
10. Puller (PWC30403)
11. Disk Slot
12. Lug
13. Lock
14. Puller Body
15. Centerscrew



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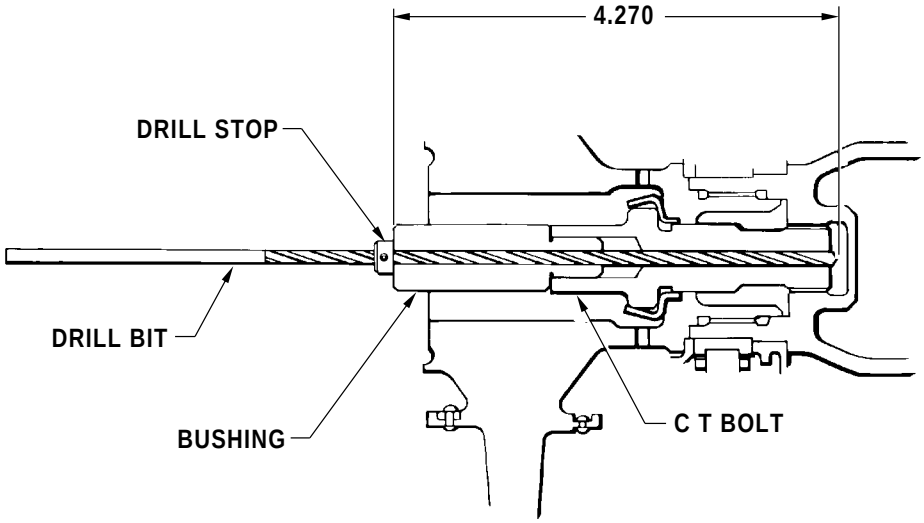
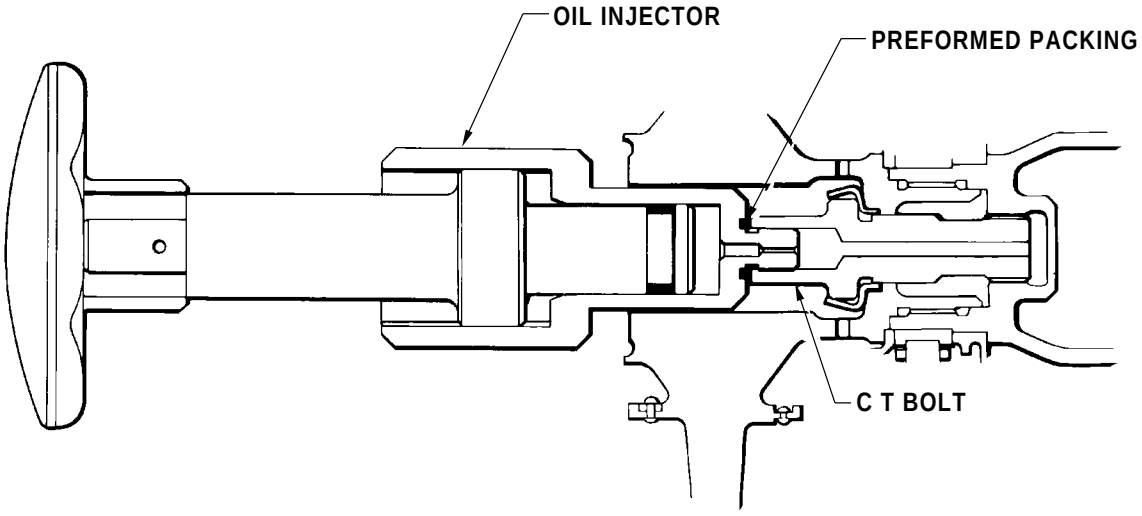
Removal/Installation of Compressor Turbine Disk Assembly
Figure 201 (Sheet 2)





C25663

Removal of CT Bolt
Figure 202

(2) Use wire or tapered feeler gages to measure the clearance of each blade at the 6 o'clock position and determine the longest blade. Put a mark on the longest blade using marker (PWC05-103).

NOTE: CT blades may be flat on the tip or may have a taper. For CT blades that are flat on the tip, measure the CT disk OD at the highest point of the blades (leading or trailing edge). For blades with a taper, measure the CT disk OD at the blade trailing edge.

(3) Use wire or tapered feeler gages to measure and record the tip clearances between the longest blade and the center and butt ends of each shroud segment. Load the disk 180 degrees opposite of the clearance being checked and correct the results for bearing play.

(4) Check that the tip clearances are within acceptable limits (Ref. Chap. 72-50-01, FIT. No. 318, Fits and Clearances). If the tip clearances are not within limits, length of longest blade must be calculated and one or more shroud segments may require replacement or grinding (Ref. Chap. 72-50-01, Approved Repairs).

(5) Place wrench (1, PWC30331, Fig. 201) on gas generator case with extension arm locating pins (4) inserted into bolt holes in Flange C (3). Turn compressor turbine (7) to engage disk lugs with wrench slots (2).

(6) Insert protector (8, PWC30336) into bore of wrench (1, PWC30331) and compressor turbine disk.

(7) Place spreader (9, PWC30335) with center bolt in protector (8, PWC30336). Screw the center bolt into thread in head of compressor turbine stubshaft bolt (6) until keywasher is unlocked. Remove the spreader.

CAUTION: DO NOT EXCEED 150 LB.FT TORQUE ON BOLT.

(8) With wrench (1, PWC30331) firmly held in position, break torque (50 to 100 lb.ft.) on stubshaft bolt (6) using standard socket and wrench.

(9) If Pre-SB1439 bolt is seized (Ref. Fig. 202):

(a) Install drill bit, part of kit (PWC50057) in a suitable hand drill.

(b) Install stop on drill bit 4.270 in. from tip.

(c) Install bushing into CT bolt hole fingertight.

(d) Set drill at slow speed and drill through bolt until drill stop contacts bolt head. Use cutting oil, and remove debris at regular intervals.

(e) Remove bushing from CT bolt and clean surrounding area.

(f) Fill oil injector (PWC50060): turn knob cw until plunger bottoms. Place injector tip in penetrating oil (50 % kerosene, 50 % engine oil is suitable, and turn knob ccw to draw in oil.

(g) Install injector in CT bolt. Make sure packing seals between injector and bolt head.

(h) Turn injector knob cw fingertight to empty injector and flood stubshaft cavity. Maintain pressure in cavity by tightening knob at regular intervals for 5 minutes minimum.

(i) Remove injector, and loosen bolt.

(j) If bolt does not move, repeat steps (f) through (i) until bolt is removed.

(10) If Post-SB1439 bolt is seized:

(a) Put sufficient penetrating oil (50 % kerosene, 50 % engine oil is suitable) through bolt center hole to flood stubshaft cavity.

(b) Rotate CT several times to let oil reach slots in bolt thread, and let soak for 20 minutes minimum.

CAUTION: IF FORCE DOES NOT DECREASE, DO NOT EXCEED 150 LB.FT. THIS INDICATES PERMANENT SEIZURE, AND BOLT MUST BE DRILLED OUT. DRILL OUT IN TWO STAGES. DO NOT EXCEED MINOR THREAD DIA. OF 0.5538 IN. (REF. STEP (9) PRECEEDING).

(c) Break torque on bolt (50 to 100 lb.ft.). If bolt does not move, apply sufficient tightening force to move bolt, then loosen. Repeat tightening/loosening until bolt is free and can be removed.

(11) Remove protector (8, PWC30336, Fig. 201), wrench (1, PWC30331), bolt (6) and keywasher (5).

(12) Insert puller (10, PWC30403) into compressor turbine bore to release turbine:

(a) View A: Engage lugs (12) with slots (11) in turbine disk.

(b) View B: Ease puller body (14) into turbine bore until lugs (12) are below slots (11).

(c) View C: Turn puller body (14) to position lugs (12) behind internal shoulder of disk.

(d) Push puller body (14) in to engine locks (13) in disk slots (11).

CAUTION: WHEN THE DISK IS RELEASED, DISCONTINUE TURNING THE CENTER SCREW TO AVOID COMPRESSOR TURBINE BLADES CONTACTING THE SHROUD HOUSING AND BECOMING DAMAGED.

(e) Turn the centerscrew (15) clockwise until the disk is released. This will be felt when the puller becomes free.

(13) Withdraw puller (10) and compressor turbine (7) from stubshaft and place on bench. Remove puller.

(14) Protect turbine in a suitable container.

B. Installation of Compressor Turbine Disk Assembly (Ref. Figs 203 and 204)

CAUTION: HANDLE THE TURBINE DISK AND BLADE ASSEMBLY WITH CARE.

(1) Apply a light film of compound (PWC04-004), (PWC04-005) or (PWC06-004) to the splines of the compressor turbine disk (3, Fig. 203), threads and shoulder of stubshaft bolt (1) and inside surface of new keywasher. Make sure lubricating axial hole and slots in threads of stubshaft bolt (Post-SB1439) are free of compound.

(2) Align the master splines and install the compressor turbine (3) on the compressor front stubshaft.

(3) Place keywasher (2) on bolt (1). Locate bolt in turbine bore and engage threads in stubshaft.

(4) Place wrench (4) on gas generator case (7) with extension arm locating pins inserted into bolt holes in Flange C. Align disk lugs with wrench slots.

(5) Insert protector (5) into bore of wrench (4) and compressor turbine disk.

(6) Using a conventional socket wrench and torque wrench (6), tighten the stubshaft bolt (1):

(a) Initially tighten 600 to 650 lb.in.

(b) Slacken off to zero.

(c) For Pre-SB1439 Engines: Torque 420 to 460 lb.in.

(d) For Post-SB1439 Engines: Torque 500 to 550 lb.in.

NOTE: Refer to Chapter 72-50-01, Table 203 for REF. NO. 541.

(7) Remove torque wrench, socket, protector and wrench from gas generator case.

(8) Check CT blade radial tip clearance (Ref. Para. 6.A.).

(9) When the clearances are satisfactory, mount wrench (2, Fig. 204) on gas generator case (Ref. Step (4) preceding).

(10) Install the compressor turbine disk squeezer (3) into disk bore and engage center bolt with thread in stubshaft bolt head (5). Crimp keywasher (4) by turning hexagon nut until squeezer reaches maximum travel.

(11) Remove squeezer (3) and wrench (2). Check keywasher for correct locking.

(12) Remove the power section from stand (Ref. 72-00-00, REMOVAL/INSTALLATION).

(13) Install power section onto the gas generator assembly (Ref. 72-00-00, REMOVAL/INSTALLATION).

6. Inspection/Check

A. Compressor Turbine Blade Tip Clearance

NOTE: The turbine blade tip clearance should be measured after the installation of the compressor turbine disk and blade assembly and whenever the engine performance is unsatisfactory (Ref. Removal/Installation and Chap. 72-00-00, FAULT ISOLATION).

(1) Measure and record the turbine tip clearance at several locations (Ref. Removal/Installation).

NOTE: DELETED

(2) The tip clearance at any one location should not normally exceed 0.022 inch or be less than 0.008 inch. However, if the clearance does exceed 0.022 inch at one location only, the shroud segments may remain in service provided the engine performance has been satisfactory.

(3) If the tip clearances are less than 0.008 inch due to a high spot in a shroud segment, the segment may be ground locally, as required, over a length not exceeding one inch on any one segment.

NOTE: For the grinding procedure, refer to 72-50-01, Approved Repairs.

(4) Inspect the turbine shroud segments for evidence of metal buildup and cracks .

B. Compressor Turbine Blades

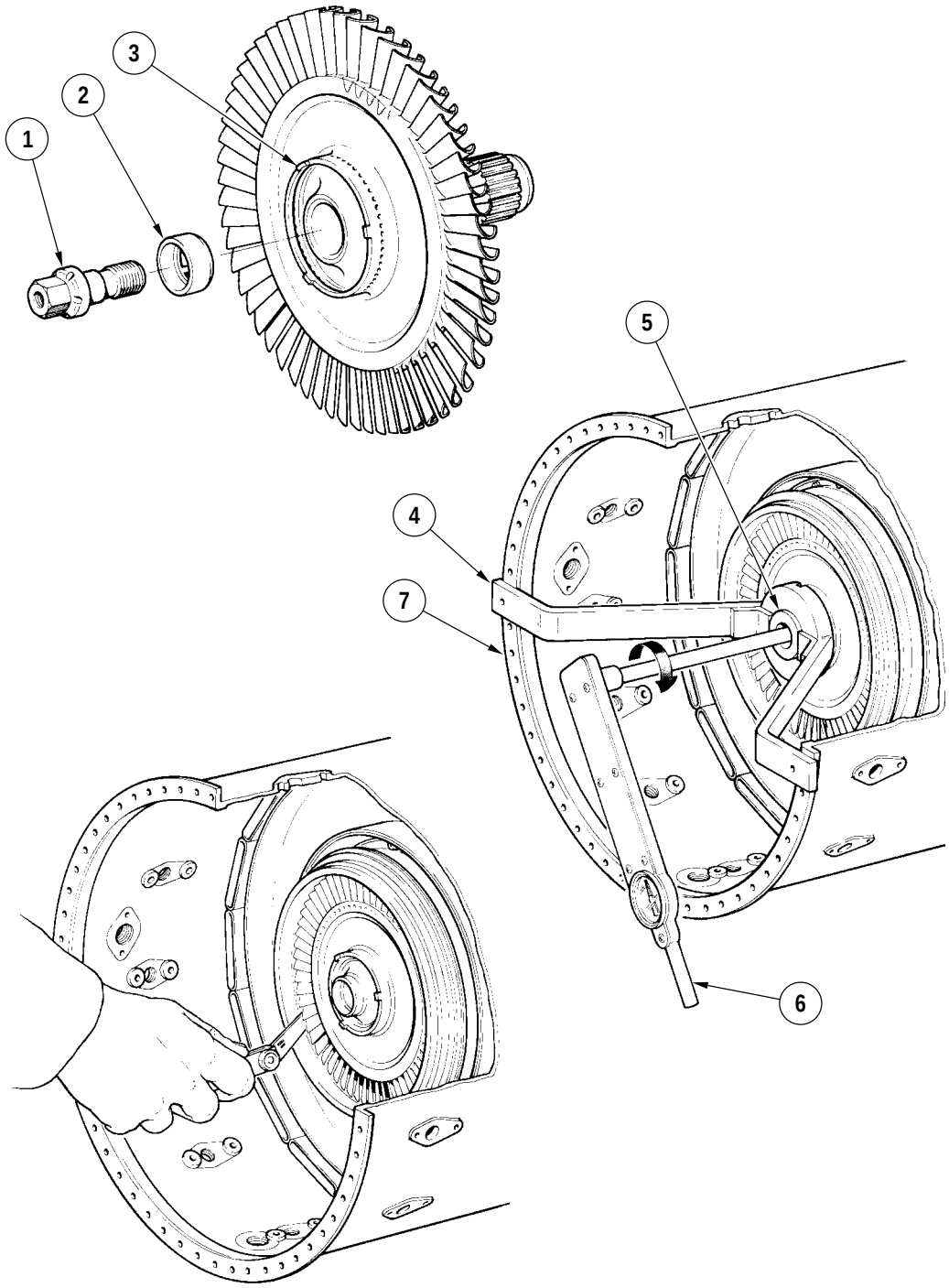
(1) Inspect the compressor turbine blades (Ref. Table 201 and Fig. 205).

(2) The entire set of the compressor turbine blades must be scrapped when a compressor turbine vane ring inspection reveals that vane trailing edge burning has resulted in the loss of an airfoil area of 0.125 sq.in., or more, on any one vane and burnt area can be seen from the leading edge of the vane ring when viewed parallel to the longitudinal axis of the engine (Ref. 72-50-01, Table 201).

(3) Inspect blade airfoil surfaces, particularly concave surface for corrosion and loss of coating using 10-power magnification. Assess stage of deterioration and accept or reject bladed disk as follows:

Stage 1 - Initial Coating Deterioration (Sulfidation)

Evidenced by slight color change of part of coating area. May be rust colored or dark gray. Coating has deteriorated but is probably still intact. Blades are acceptable for further service.



C2920

Installation of Compressor Turbine and Turbine Blade Tip Clearance Check -Typical
Figure 203

Key to Figure 203

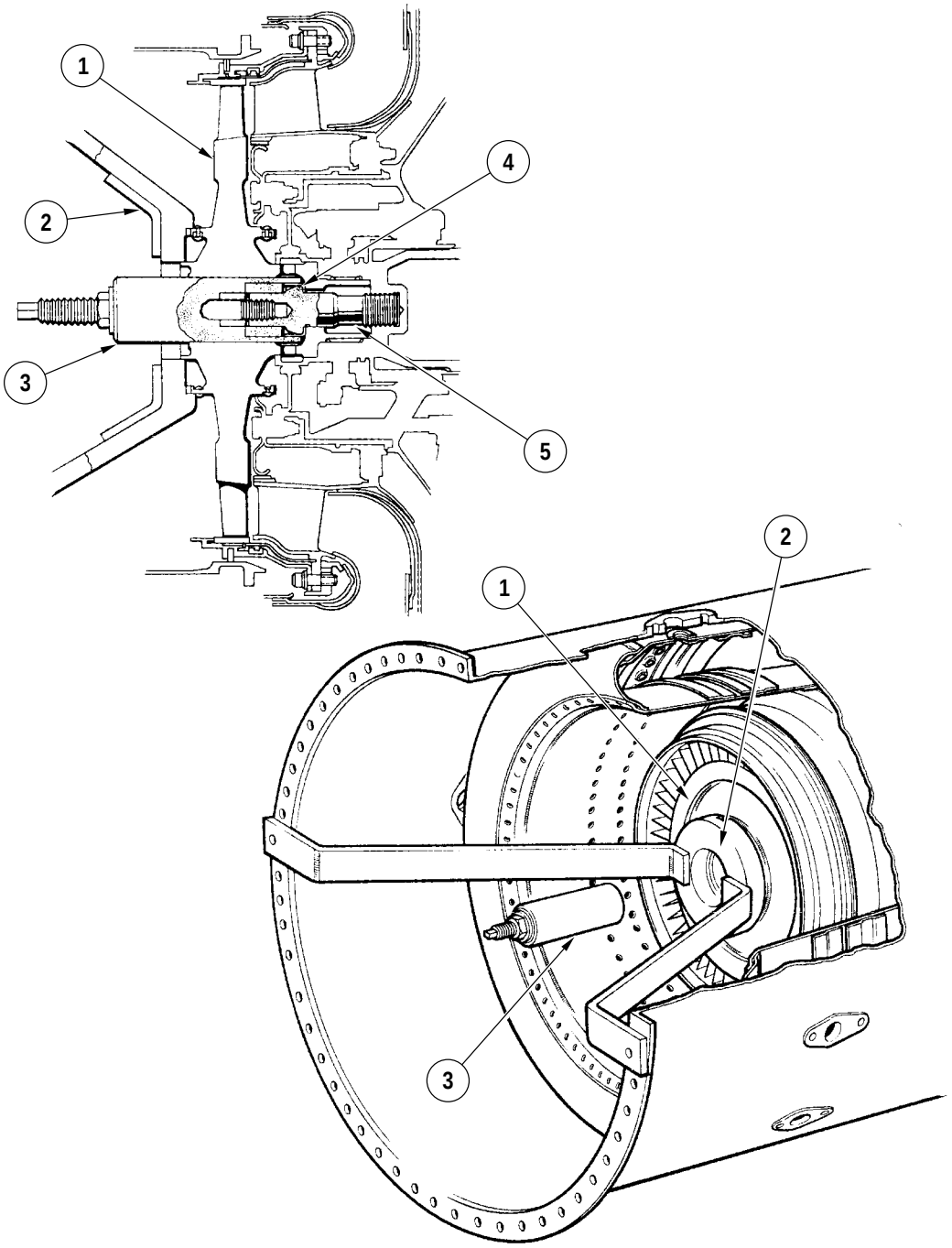
1. Compressor Turbine Stubshaft Bolt
2. Keywasher
3. Compressor Turbine Disk Assembly
4. Wrench (PWC30331)
5. Protective Sleeve (PWC30336)
6. Torque Wrench
7. Gas Generator Case

Stage 2 - Initial Corrosion

Evidenced by apparent rise of sulfidated coating over surrounding surface, with small, scattered blisters appearing in coating. Corrosion of base material has started. Accept or reject disk, at discretion of operator, based on previous experience. If blades are to remain in service, operator must increase desalination washes and schedule regular borescope inspection of blades every 200 hours.

Stage 3 - Advanced Corrosion

Evidenced by clusters of ruptured blisters exposing bare material. Craters so formed progressively deepen and crater surfaces darken with glazed appearance. Ship disk assembly to an approved overhaul facility for blade replacement.

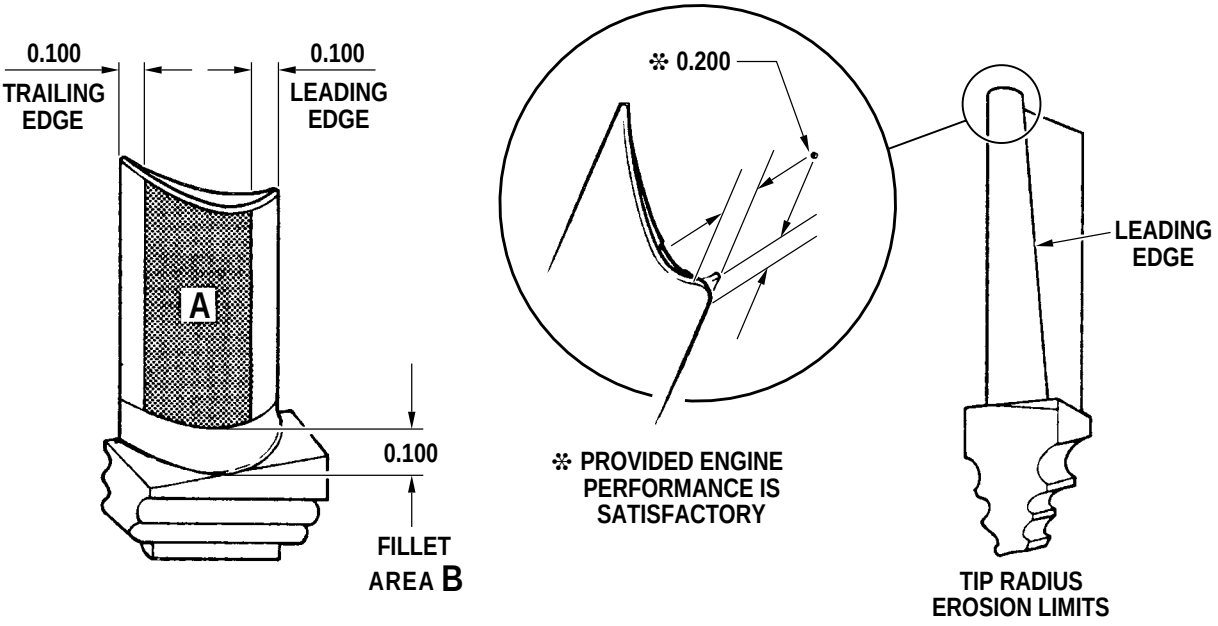


C6806

Locking Keywasher on Stubshaft Bolt
Figure 204

Key to Figure 204

1. Compressor Turbine Disk Assembly
2. Wrench (PWC30331)
3. Squeezer (PWC30458)
4. Keywasher
5. Stubshaft Bolt



BLADES HAVING THINNED OR FEATHERED LEADING EDGES DUE TO EROSION ARE NOT ACCEPTABLE

C3112E

Compressor Turbine Blade Inspection
Figure 205

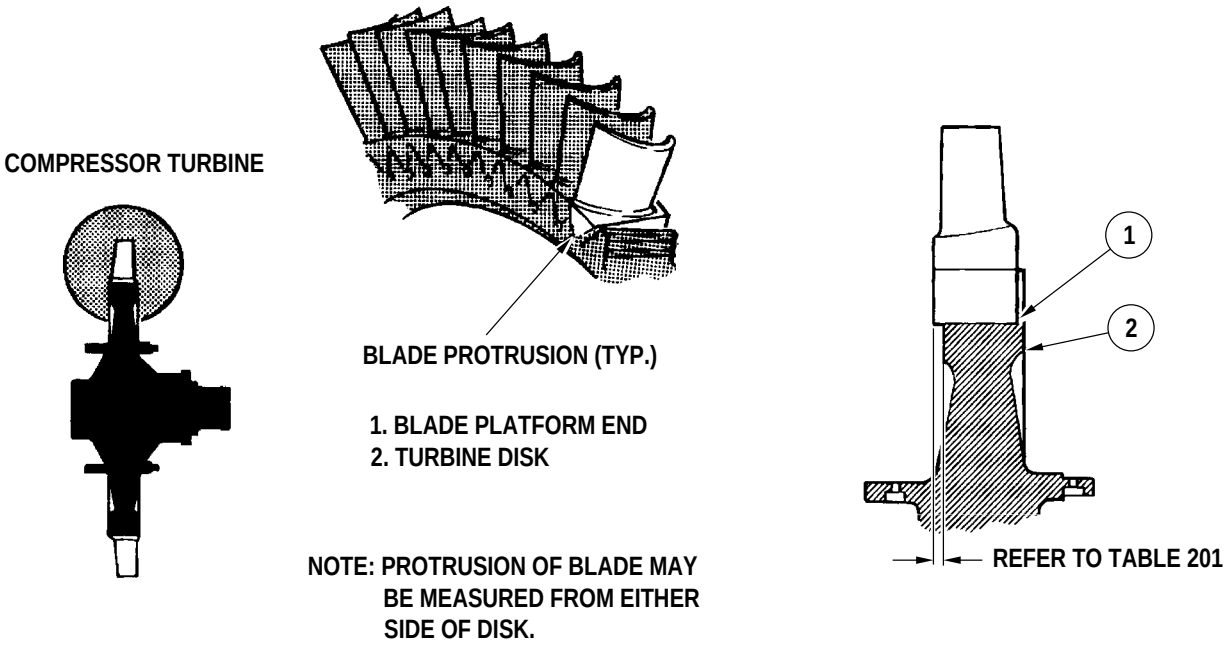
TABLE 201, Compressor Turbine Blade Inspection

Inspection	Maximum Serviceable	Corrective Action
CORROSION (Ref. 72-00-00)	Inspect blade airfoil surfaces, paticularily concave surface for corrosion and loss of coating using a 10X magnification. A loss of up to 25% of coating is permissible. Assess stage of deterioration and accept or reject bladed disk.	Not repairable
BLADE SHIFT	Protrusion of blade root beyond disk rim must be equal within 0.016 inch on either side of disk (Ref. Fig. 206).	Ref. NOTE 1
CIRCUMFERENTIAL MOVEMENT	Max. 0.030 inch acceptable at blade tip	
SQUEALER TIP RUB	Minimum squealer tip height 0.008 inch.	Ref. NOTE 1
AREA A		
Nicks, dents and pits	Three 0.005 inch deep per blade.	Ref. NOTE 1
Cracks	Not acceptable	Ref. NOTE 2
AREA B (FILLET)		
Nicks, dents and pits	One 0.005 inch deep per blade.	Ref. NOTE 1
Cracks	Not acceptable	Ref. NOTE 2
LEADING AND TRAILING EDGES		
Nicks, dents and pits	One 0.020 inch deep per blade.	Ref. NOTE 1
Cracks	Not acceptable	Ref. NOTE 2
LEADING EDGE TIP		
Erosion	Radius 0.200 inch max. without blending (Ref. Fig. 205)	Ref. NOTE 1

NOTE: 1. Replacement of individual blades is not authorized. Send bladed disk assembly to an approved overhaul facility.

NOTE: 2. If any blade is found cracked, return turbine assembly to an approved overhaul facility for replacement of complete set of blades.

NOTE: 3. Cracks may not extend beyond coating depth. If, after stripping coating, the cracks do not extend into the base metal, the blades may be considered serviceable. Other, normal inspection criteria must be applied.



C396

Compressor Turbine Blade Shift
Figure 206

C. Compressor Turbine Stubshaft Bolt (Post-SB1439)

(1) Examine the stubshaft bolt lubricating axial hole and the two slots in the threads to make sure these areas are clear of compound and debris.

POWER TURBINE INTERSTAGE STATOR - DESCRIPTION AND OPERATION

1. Description and Operation (Ref. 72-50-00, Fig. 1)

The power turbine stator housing consists of a conical casting, machined with open ends to accommodate the power turbine stator. A flange at the front of the housing is bolted together with a containment ring to the rear inner flange of the exhaust duct, while a machined inner diameter on the housing rear extension encasing the interstage sealing ring(s) which fit over a machined extension at the front end of the compressor turbine shroud housing and provides a mechanical joint and seal between the compressor and power turbines.

Eight thermocouple bosses are provided on the rear of the housing for the temperature sensing probes. The threaded bosses are located at the 1, 2, 3, 4, 8, 9, 10 and 11 o'clock positions on the housing. Clips are welded on the outer face of the housing for location and lockwiring of the T5 thermocouple wiring harness . The interstage baffle assembly is between the compressor turbine assembly and the power turbine, and forms part of the power turbine stator assembly. The baffle prevents dissipation of turbine gases and consequent transmission of heat to the turbine disk faces. The center section of the baffle incorporates lipped flanges on the front and rear faces. The flanges fit over corresponding rotor seal flanges on the turbine disks to provide control of cooling air flow through the bore of the compressor turbine and a hole in the center of the baffle. Cooling air is allowed to bleed through the seal and flange interface to cool the front and rear faces of the compressor and power turbine disks respectively; cooling air is then exhausted into the gas stream at the turbine blade roots.

The power turbine stator assembly consists of an inner ring and an outer ring. Nineteen integrally-cast cobalt or nickel alloy vanes between the rings direct the compressor turbine discharge gases onto the power turbine blades at the most efficient angle and velocity. The outer ring is slotted to mate with lugs in the power turbine stator housing. The interstage baffle assembly is secured to a flange in the centerbore of the inner ring by three retaining plates and rivets.

POWER TURBINE INTERSTAGE STATOR - MAINTENANCE PRACTICES

1. General

   A. Maintenance personnel should make reference to the INTRODUCTION section and Chapter 70-00-00, STANDARD PRACTICES of this manual to familiarize themselves with general procedures.

   B. Install suitable protective caps/covers over all disconnected tubes/lines and component openings.

   C. Lockwire shall comply with specification AMS 5687, heat and corrosion resistant steel wire MS9226-03, which unless otherwise specified is 0.025 inch diameter, and will not be specified in instructions.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC05-110	Lockwire
PWC06-015	Beeswax

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC32212	Pin, Alignment

4. Fixtures, Equipment and Supplier Tools

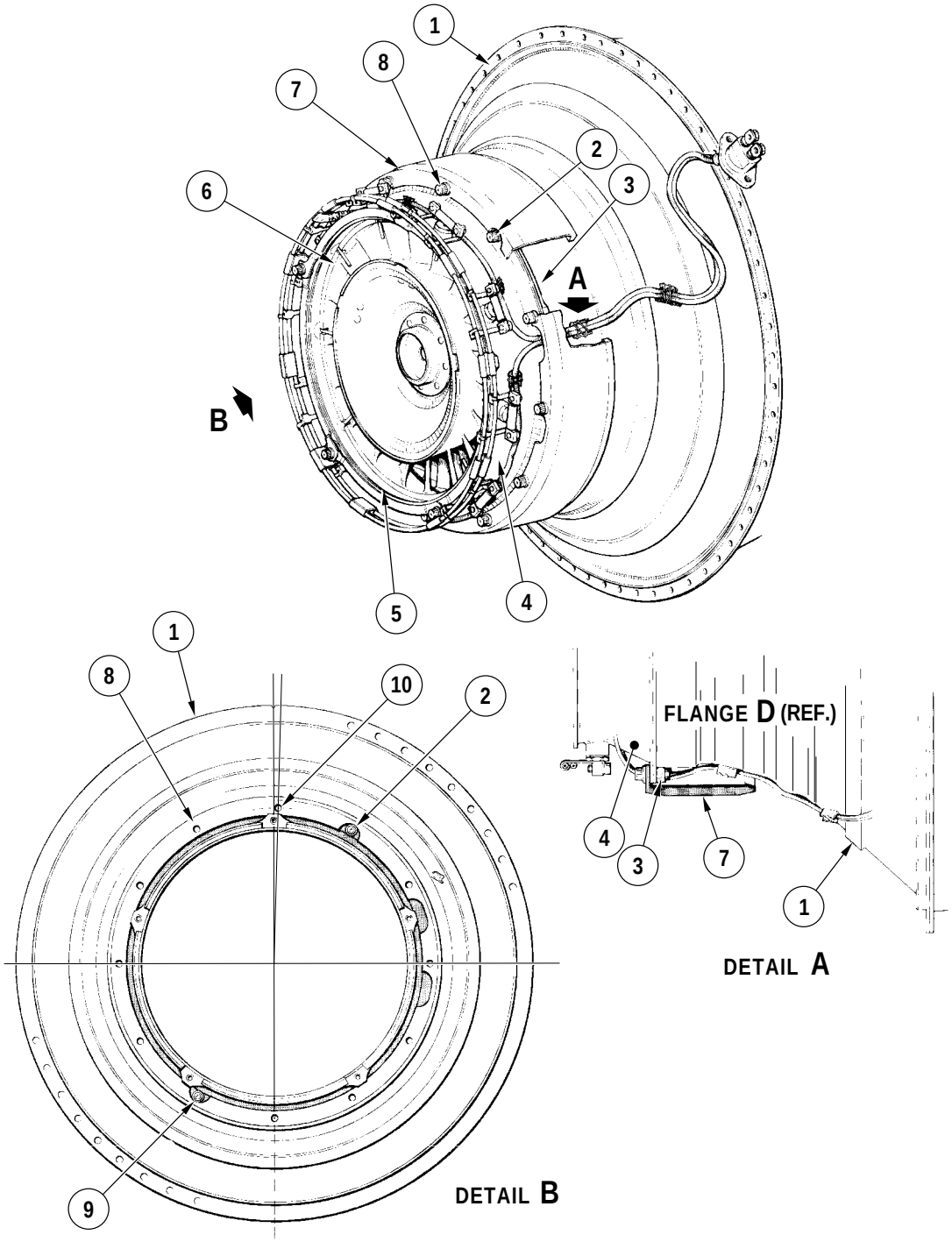
   Not Applicable

5. Removal/Installation (Heavy Maintenance)

   NOTE: Disassembly of the power section should only be undertaken whenever hot section distress requiring corrective action is indicated and/or whenever the performance requirements necessitate power turbine vane ring removal. Whenever a replacement power section is installed on an engine at maintenance, the original power turbine vane ring and interstage baffle assembly should be retained and installed on the new power section if practicable. This requirement is to make sure the throat area matches between the compressor turbine and power turbine vane rings which can affect the operating parameters of the engine.

   A. Removal Post-SB1220 Power Turbine Stator (Ref. Fig. 201)

      (1) Remove power section and install in engine stand (Ref. 72-00-00).



Post-SB1220 C3992

Removal/Installation of the Power Turbine Stator Assembly
Figure 201

Key to Figure 201

1. Exhaust duct
2. Bolt
3. Half-rings
4. Stator Housing
5. Interstage Sealing Ring(s)
6. Vane Ring Assembly
7. Containment Ring
8. Bolt
9. Bolt
10. Off-set Hole

(2) Cut lockwire and remove T5 thermocouple harness, bus-bar assembly, T5 thermocouple probes, containment ring, seal retaining plates (Ref. 77-20-01) and interstage sealing ring(s) (5).

NOTE: For PT6A-21 engines and Post-SB1177 PT6A-27 and PT6A-28 engines: the bus-bar assembly, interstage sealing ring(s) need not be removed unless they are to be replaced. If Pre-SB1218 interstage sealing rings are to be removed, mark position of the sealing ring gaps on the power turbine housing with an approved marker (Ref. 70-00-00, MAINTENANCE PRACTICES, Marking of Parts).

(3) Remove two bolts (2 and 9), at 1 o'clock and 7 o'clock positions, retaining power turbine stator housing (4) to exhaust duct (1) at Flange D. Remove two half rings (3).

(4) Withdraw assembly and vane ring and interstage baffle assembly (6) from power section by pulling on vanes.

(5) Place assembly on bench with leading edge of vanes facing upward. Lift stator housing (4) from vane ring assembly (6).

B. Installation of Power Turbine Stator (Ref. Fig. 201)

CAUTION: ON ALL ENGINE CONFIGURATIONS, EXERCISE EXTREME CARE NOT TO DAMAGE THE T5 PROBES WHEN FITTING THE POWER TURBINE VANE RING. ON ENGINES INCORPORATING THE INTENT OF SB1212 (EIGHT T5 PROBES ONLY), MAKE SURE THAT NONE OF THE PROBES ARE ALIGNED WITH EITHER OF THE TWO CLOSELY SPACED SLOTS IN THE POWER TURBINE VANE RING.

(1) Locate power turbine vane ring (6) in stator housing (4). Align slots in vane ring with respective thermocouple probe holes in stator housing and mate lugs in housing with slots in vane ring. Parts should mate freely and without force.

(2) Holding vanes of vane ring firmly to prevent separation of ring and housing, install complete assembly on Flange D of exhaust duct (1). Use care to prevent chafing T5 thermocouple harness.

(3) Locate two half rings (3) at front face of Flange D and temporarily secure vane ring (6), stator housing (4) and containment ring (7) to exhaust duct (1) and ring halves with alignment pins (PWC32212).

(4) Secure vane ring (6) and stator housing (4) to Flange D with single bolt at 1 o'clock and 7 o'clock positions.

(5) Remove alignment pins (PWC32212). Secure containment ring (7) together with vane ring and housing to Flange D and ring halves with 10 bolts (8). Tighten bolts and torque 32 to 36 lb.in., and lockwire (PWC05-110).

(6) Install T5 thermocouple probes (if removed), bus-bar assembly and the seal ring retaining plates (Ref. 77-20-01)

(7) Install the interstage sealing ring(s)(5). Make sure the interstage sealing ring(s) are centralized in the stator housing.

NOTE: 1. For Pre-SB1218 sealing rings, make sure the ring gaps are diametrically opposite as noted at disassembly. For Post-SB1218 sealing rings, make sure the side of the ring marked ″PRESS″ faces the rear of the engine.

NOTE: 2. To keep the sealing ring centralized, insert suitable sized pieces of beeswax (PWC06-015) in the cavity of the housing, at the 6 o'clock position, to support the ring.

(8) Connect T5 harness to bus-bar, and lockwire harness to exhaust duct (Ref. 77-20-01).

(9) Do a functional check on the T5 system (Ref. 77-20-01).

(10) Install the power section (Ref. 72-00-00).

6. Inspection/Check

A. General

Acceptance criteria outlined herein is based on structural integrity considerations and apply only if engine performance /handling was satisfactory prior to HSI. Replace stator assembly if its condition appears to be the cause for loss of performance.

Stator assemblies considered unacceptable for continued service may be sent to PWC for possible repair.

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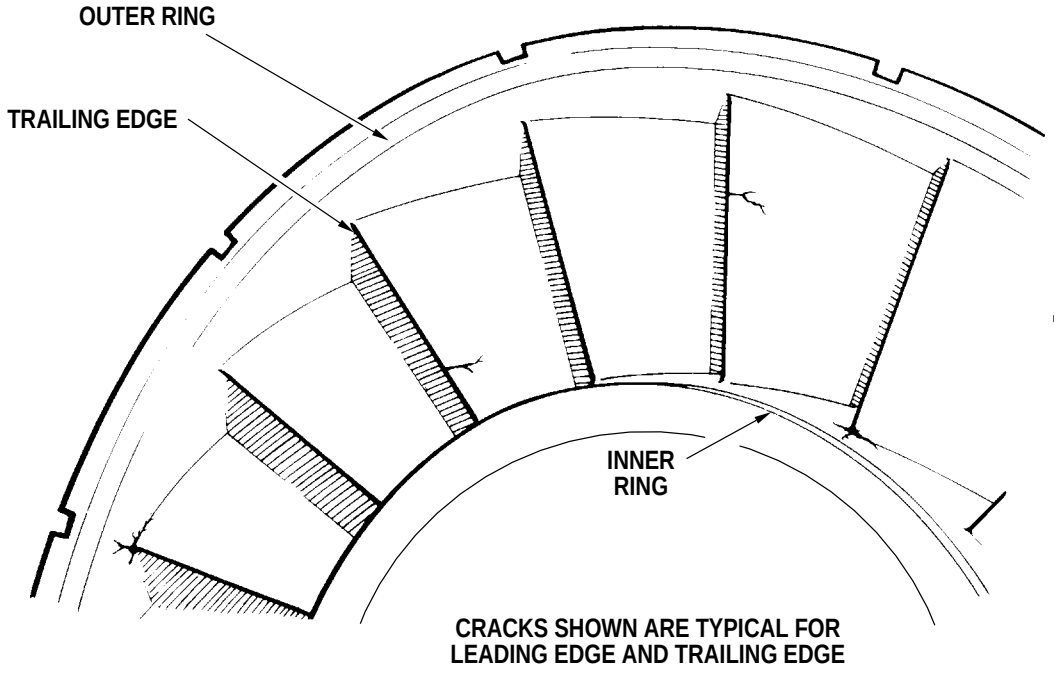
Canada J3Y 3X7

Attention: Receiving Area 5-1

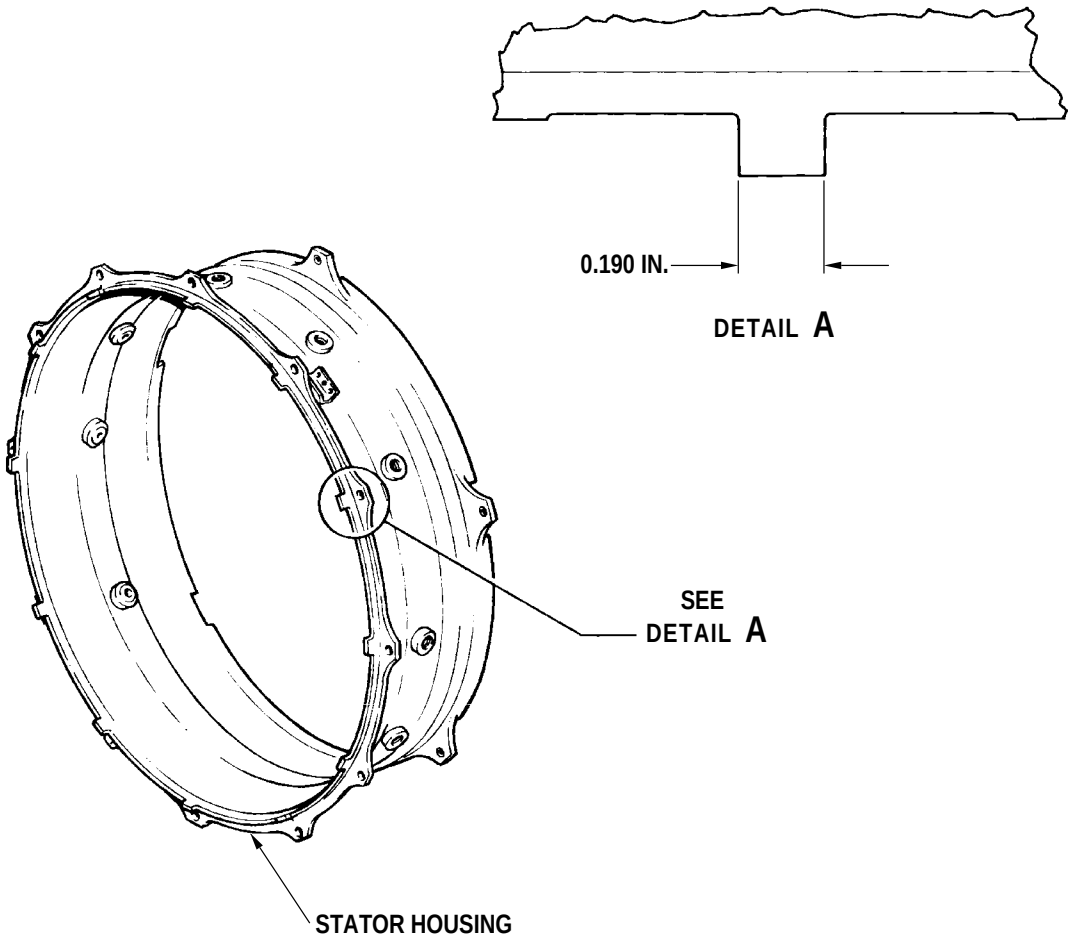
B. Power Turbine Stator Assembly (Ref. Figs. 202 and 203)

(1) Inspect the power turbine stator assembly (Ref. Table 201).



C1264

Power Turbine Vane Ring Inspection (Typical)
Figure 202



C13381

Power Turbine Stator Housing Lug Wear Limits
Figure 203

TABLE 201, Power Turbine Stator Assembly Inspection

Item	Max. Serviceable	Action
VANE RING		
Cracks:		
Leading and/or trailing edges	Cracks up to 0.400 in. long on any number of vanes.	Replace
Outer ring	0.600 in. long	Replace
Inner ring	One crack through entire length is acceptable provided crack is not open more than 0.020 in.	Replace
Erosion or Pitting:		
Airfoil Surfaces	Erosion or pitting, 0.250 sq.in. by 0.010 in. deep on any airfoil surface, any number of vanes.	Replace
POWER TURBINE STATOR HOUSING		
Fretting wear:		
Lugs	Check with vane ring for circumferential movement. Average 0.190 inch minimum lug width acceptable.	Repairable
Sealing Face	Acceptable providing face shows witness of contact around complete circumference when checked against sealing ring.	Replace
NOTE: Light stoning to remove localized high spots on sealing face (i.e. witness mark from sealing ring joint) is acceptable.		
INTERSTAGE BAFFLE	Examine for correct attachment. Replace loose rivets.	Repairable
INTERSTAGE SEALING RINGS		
Fretting Wear:		
Inside Diameter	Acceptable provided end faces of ring do not meet when ring is installed in sealing location over CT shroud housing.	Replace

TABLE 201, Power Turbine Stator Assembly Inspection (Cont'd)

Item	Max. Serviceable	Action
Sealing Face	Acceptable provided face shows witness of contact around complete circumference when checked against true flat surface. Install original or new ring(s) individually in correct location and orientation on compressor turbine shroud housing. Check gap between ring and housing sealing diameter; maximum acceptable gap in free state is 0.002 inch over not more than 120 degrees of arc, remaining area to be light tight. Reject ring and/or housing if this limit is exceeded.	Replace
NOTE: Light stoning of ring ID and compressor turbine shroud housing sealing surface to remove localized high spots is acceptable.		

7. Approved Repairs

A. Replacement of Interstage Baffle Rivets (Ref. Fig. 204)

(1) Remove the 16 rivet heads at the baffle assembly by grinding or drilling, and carefully punch out the rivet stems with a parallel pin punch.

(2) Remove the sealing plate and the two interstage air seals from the baffle on the vane ring.

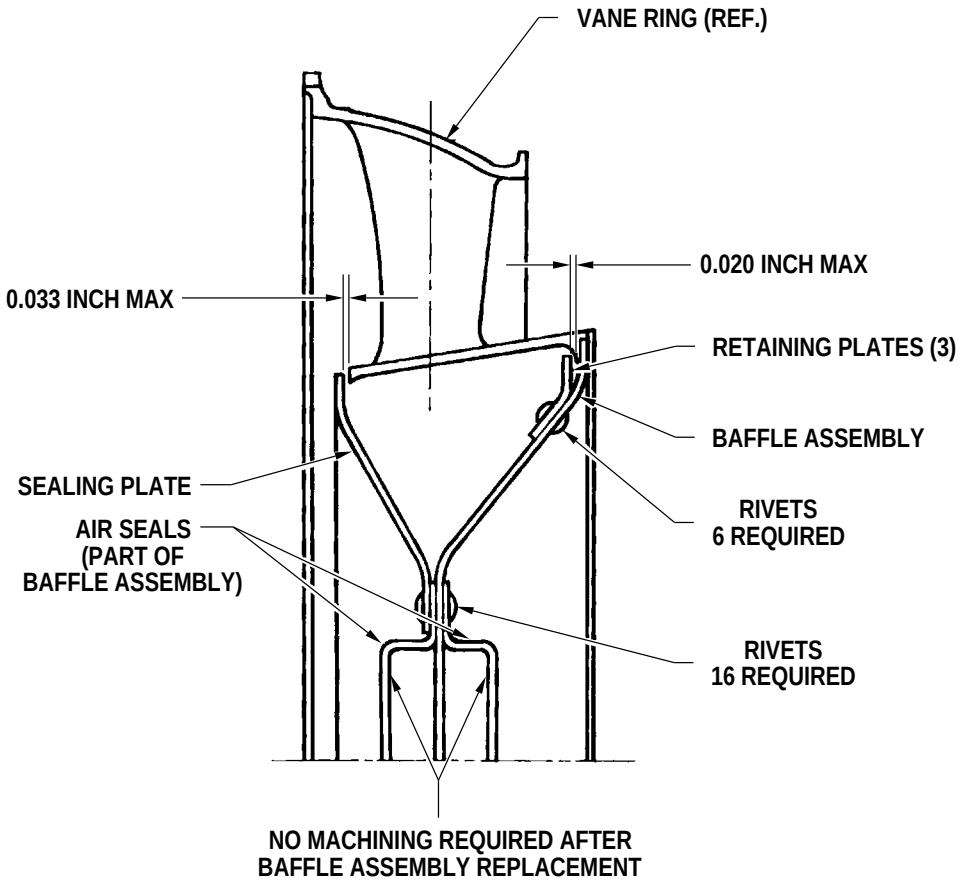
(3) Remove the six rivet heads and carefully press out the rivet stems with a parallel pin punch. Remove the baffle assembly and retaining plates from the vane ring.

(4) Install the baffle on the vane ring with three retaining plates and six rivets. Maintain the dimensions indicated.

(5) Locate the two interstage air seals on the baffle, and position the sealing plate relative to the dimension indicated, relative to the vane ring.

(6) Fasten the baffle assembly on the vane ring with 16 rivets.

NOTE: Use care when riveting to avoid distortion of the sealing plate or the baffle assembly.



C8087A

Replacement of Interstage Baffle Rivets
Figure 204

POWER TURBINE - DESCRIPTION AND OPERATION

1. Description and Operation (Ref. Fig. 1)

The power turbine consists of a disk and blade assembly which is mounted on the rear end of the power turbine shaft and retained by a retaining bolt and keywasher. The disk incorporates 41 blades which differ from those of the compressor turbine blades in that they are cast with notched and shrouded tips. Each blade is located in a fir-tree serration in the circumference of the turbine disk and retained by a rivet. The disk and blade assembly rotates within a double knife-edge shroud to form a continuous seal at the blade tips when the engine is running.

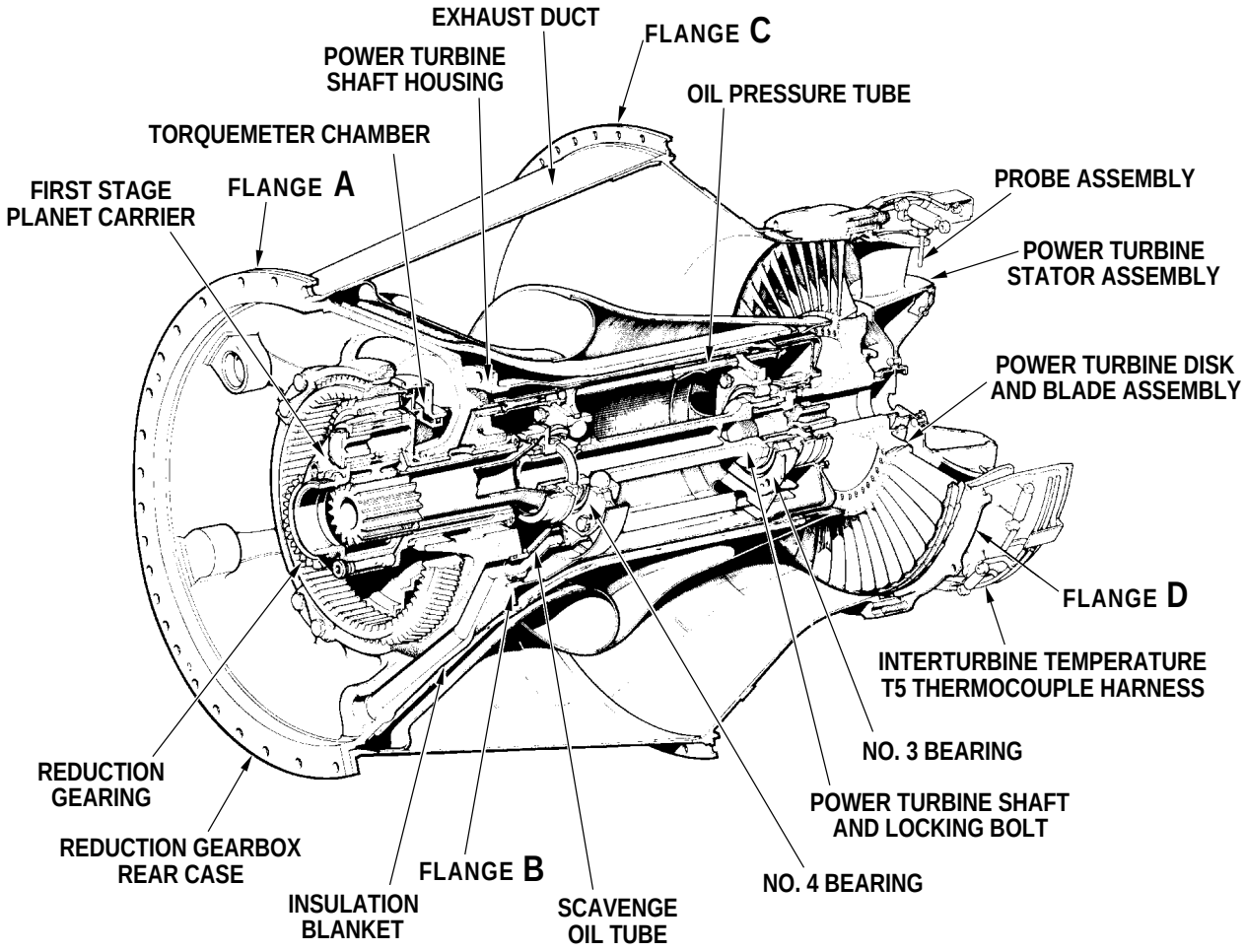
The power turbine disk incorporates a flange for disk balancing. The required number of classified weights and rivets is determined during assembly balancing procedures.

The turbine disk and blade assembly is splined to the power turbine shaft and secured by a single retaining bolt and keywasher. A master spline makes sure that the turbine assembly may be removed and reinstalled in the same position to retain its original balance.

The turbine rotor balancing assembly is supported and secured in the power turbine shaft housing by the No.3 and No.4 bearings. The No.3 bearing is a roller-type while the No.4 bearing is a ball-type; both bearings have flanged outer races which permit bolting within the centerbore of the shaft housing. The No.3 bearing inner race and ball cage are positioned on the power turbine shaft by the power turbine disk and air seal runner at the rear and a shoulder on the shaft at the front. The No.4 bearing has a split inner race that is stacked between a shoulder power turbine shaft and a positioning ring and coupling which, in turn, are secured by a keywasher and spanner nut. The front half of the inner race has a puller groove for removal.

The power turbine shaft housing consists of a fabricated steel cylindrical housing attached at its front end to the rear case of the reduction gearbox. A labyrinth-type air seal, secured at the rear of the housing by a retaining ring, prevents lubricating oil from leaking into the power turbine area. An oil transfer tube which has four nozzles provides lubrication requirements for the No. 3 and No. 4 bearings. In normal operation, scavenge oil drains forward into the reduction gearbox sump; however, a scavenge tube is provided at the bottom of the shaft housing to scavenge the housing when the engine is in a nose-up attitude.

The power turbine shaft housing, together with the shaft assembly, is protected from the hot exhaust gases, when the engine is running, by an insulation blanket interposed between the inner wall of the exhaust duct and the power turbine shaft housing and associated rear case of the reduction gearbox.



C1258B

Power Section (Typical)
Figure 1

POWER TURBINE - MAINTENANCE PRACTICES

1. General

   A. Maintenance personnel should make reference to the INTRODUCTION section and Chapter 70-00-00, STANDARD PRACTICES of this manual to familiarize themselves with general procedures.

   B. Install suitable protective caps/covers over all disconnected tubes/lines and component openings.

   C. Lockwire shall comply with specification AMS 5687, heat and corrosion resistant steel wire MS9226-03 which is 0.025 inch diameter, and will not be called out in instructions.

2. Consumable Materials

   The consumable materials listed below are used in the following procedures.

Item No.	Name
PWC06-004	Compound, Antiseize

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC30332	Wrench
PWC30335	Spreader
PWC30336	Sleeve
PWC30403	Puller
PWC30458	Squeezer

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Removal/Installation (Heavy Maintenance Only)

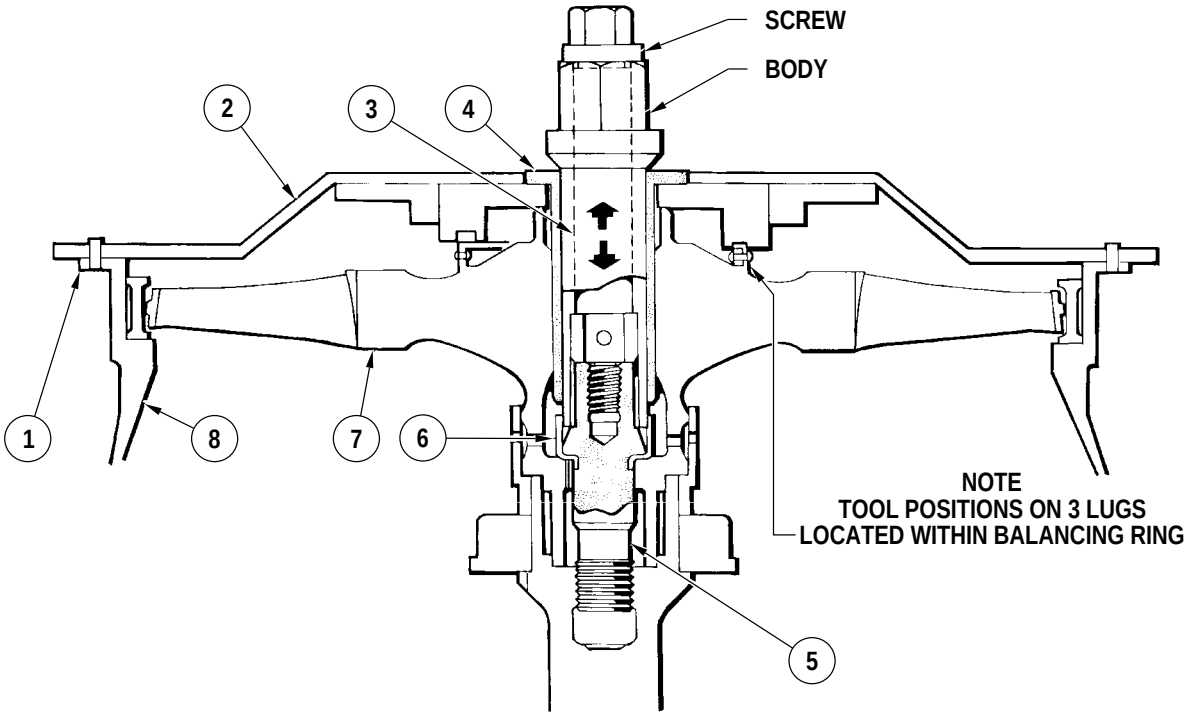
   A. Removal of Power Turbine (Ref. Figs. 201, 202, 203 and 204)

      (1) Remove the power section from the gas generator assembly and install in the stand (Ref. 72-50-03, Removal/Installation).

      (2) Remove the power turbine vane ring and stator housing (Ref. 72-50-03).

      (3) Install the wrench (PWC30332) (2, Fig. 201) on Flange D of the exhaust duct. Make sure the wrench slots are correctly seated over the lugs on the balancing ring of the disk (7).

      (4) Insert the protector sleeve (PWC30336) (4) into the centerbore of the wrench.



C1279A

Unlocking Retaining Bolt Keywasher
Figure 201

Key to Figure 201

1. Flange D
2. Wrench
3. Spreader
4. Protector Sleeve
5. Retaining Bolt
6. Keywasher
7. Power Turbine Disk Assembly
8. Exhaust Duct

(5) Turn the screw of the spreader (PWC30335) (3) until the shoulder seats on the body and insert the spreader into the protector sleeve to rest on the retaining bolt (5). Tighten the screw of the spreader to engage the bolt until resistance is felt.

(6) While holding the head of the screw with a conventional wrench, turn the body of the spreader with another conventional wrench to open the crimps on the keywasher (6). Remove the spreader.

(7) Using a conventional socket wrench, remove the retaining bolt (5) and keywasher (6). Remove the protector sleeve and wrench.

(8) Remove the power turbine disk using the puller (PWC30403) and conventional wrench (Ref. Fig. 203).

(9) If the No. 3 bearing cover assembly (3, Fig. 204) Pre-SB1430 shows evidence of wear or looseness, remove the retaining ring (4) securing the bearing cover assembly to the power turbine shaft housing assembly (5). Withdraw the No. 3 bearing cover assembly.

NOTE: On the exhaust duct assembly Post-SB1430, the No. 3 bearing cover is an integral part.

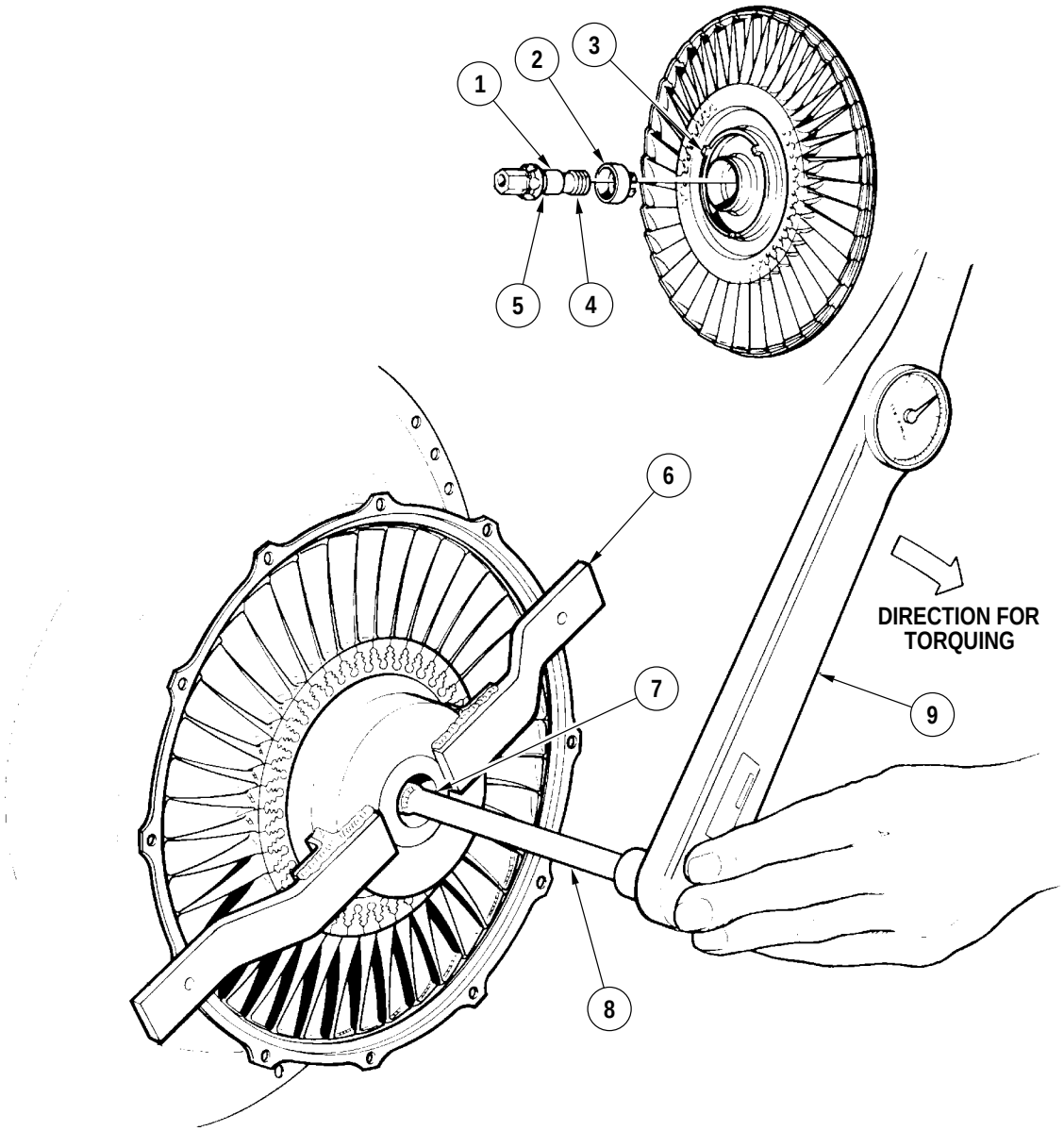
B. Installation of Power Turbine (Ref. Figs. 201, 202 and 205)

(1) Install the No. 3 bearing cover assembly (3, Fig. 204) Pre-SB1430 over the end of the power turbine shaft housing assembly (5). Secure with the retaining ring (4).

NOTE: On the exhaust duct assembly Post-SB1430, the No. 3 bearing cover is an integral part.

(2) Apply a light film of the compound (PWC06-004) to the splines of the turbine disk, to the inside surface of the keywasher (2, Fig. 202) and to the shoulder (5) and threads (4) of the retaining bolt (1).

(3) Locate the turbine disk at flange D and align the master splines of the disk and power turbine shaft.



C486C

Removal/Installation of Power Turbine Retaining Bolt
Figure 202

Key to Figure 202

1. Turbine Retaining Bolt
2. Keywasher
3. Lugs
4. Threads
5. Shoulder
6. Wrench
7. Protector Sleeve
8. Extension
9. Torque Wrench

CAUTION: WHEN POSITIONING THE POWER TURBINE DISK, EXERCISE CARE NOT TO DAMAGE THE SHROUD LANDS BY CONTACT WITH THE TIPS OF THE DISK BLADES.

(4) Insert the keywasher (2, Fig. 202) and retaining bolt (1) into the centerbore of the disk. Make sure the key of the washer is correctly seated.

(5) Install the wrench (PWC30332) (6) and protector sleeve (PWC30336) (7) over the disk. Make sure the wrench slots are correctly seated over the lugs (3) of the disk and the dowels in the wrench are mated with the appropriate mounting holes on Flange D.

(6) Using a conventional socket, extension and torque wrench (Ref. Fig. 202), tighten the disk retaining bolt as follows:

(a) Initially torque 600 to 650 lb.in.

(b) Loosen to zero.

(c) For Pre-SB1459 Engines: Final torque 420 to 460 lb.in.

(d) For Post-SB1459 Engines: Final torque 500 to 550 lb.in.

(7) Remove the protector sleeve.

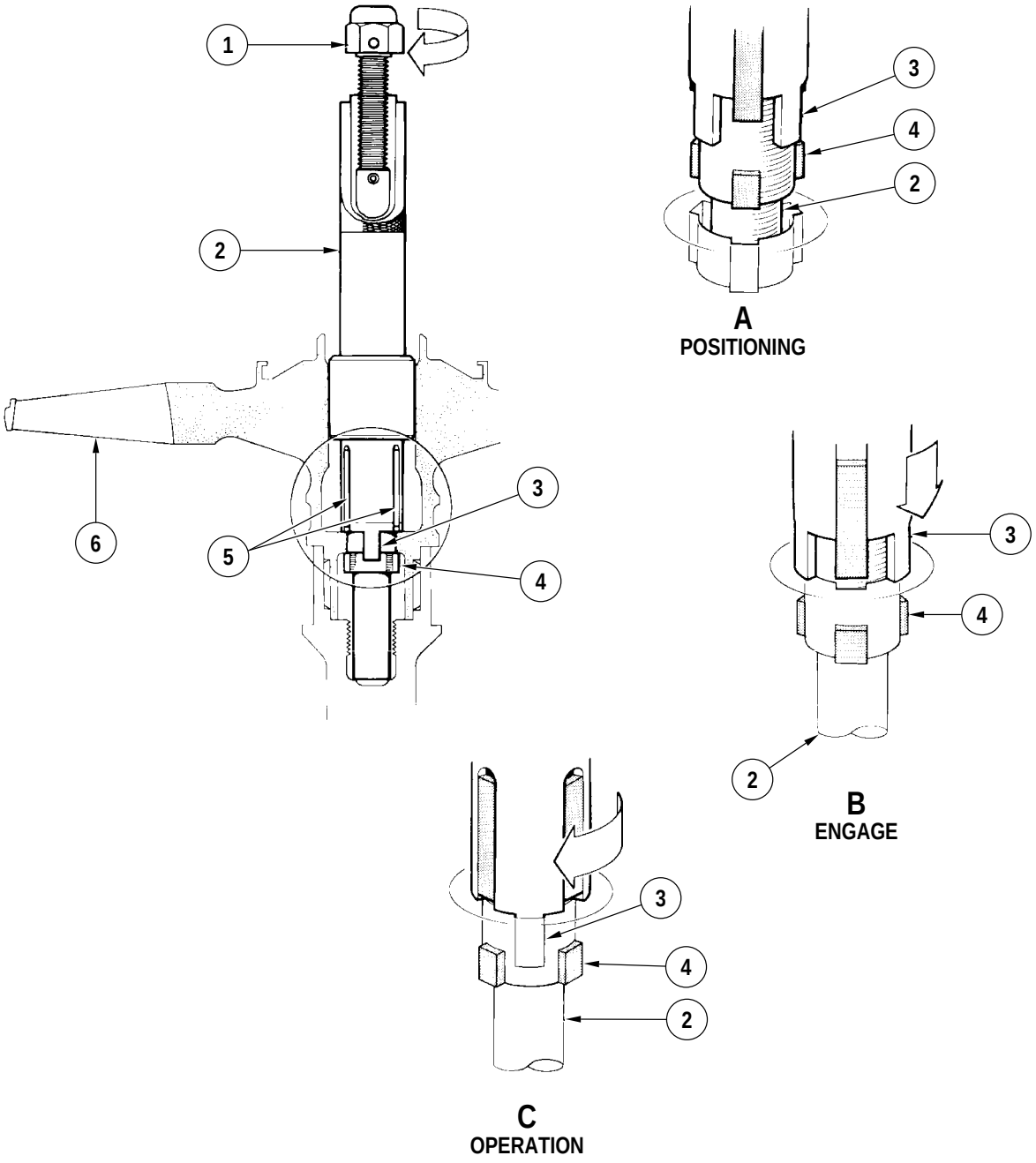
(8) Install the squeezer (PWC30458) (6, Fig. 205) in the centerbore of the wrench (2). Turn the screw (3) to engage the threads in the retaining bolt (8) until resistance is felt.

(9) Turn the nut (5) clockwise until the keywasher (7) is correctly crimped.

(10) Remove the squeezer (6) and wrench (2).

(11) Install the power turbine vane ring and stator housing (Ref. 72-50-03).

(12) Install the power section onto the gas generator (Ref. 72-00-00).



C1261

Removal of Power Turbine Disk
Figure 203

Key to Figure 203

1. Puller Screw
2. Puller
3. Lock
4. Legs
5. Slots
6. Turbine Disk

6. Inspection/Check (Heavy Maintenance Only)

A. Procedure (Ref. Figs. 206, 207 and Table 201)

TABLE 201, Power Turbine Blade Inspection

Inspection	Max. Serviceable	Action
BLADE SHIFT	Protrusion of any blade root must be equal within 0.005 in. either side of disk (Ref. Fig. 206).	Replace *
BLADE LOOSENESS		
Circumferential movement	0.030 in. max. at tip	Replace *
Axial Movement	None permitted.	Replace *
AREA A:	(Ref. Fig. 207).	
Nicks	Three 0.003 in. deep max.	Replace *
Dents and pits	Three 0.003 in. deep max.	Replace *
Cracks	None permitted.	Replace *
AREA B:		
Nicks, dents and pits	One max., 0.020 in. deep max.	Replace *
LEADING AND TRAILING EDGES:		
Nicks, dents and pits	One max., 0.010 in. deep max.	Replace *
Cracks	None permitted.	Replace *

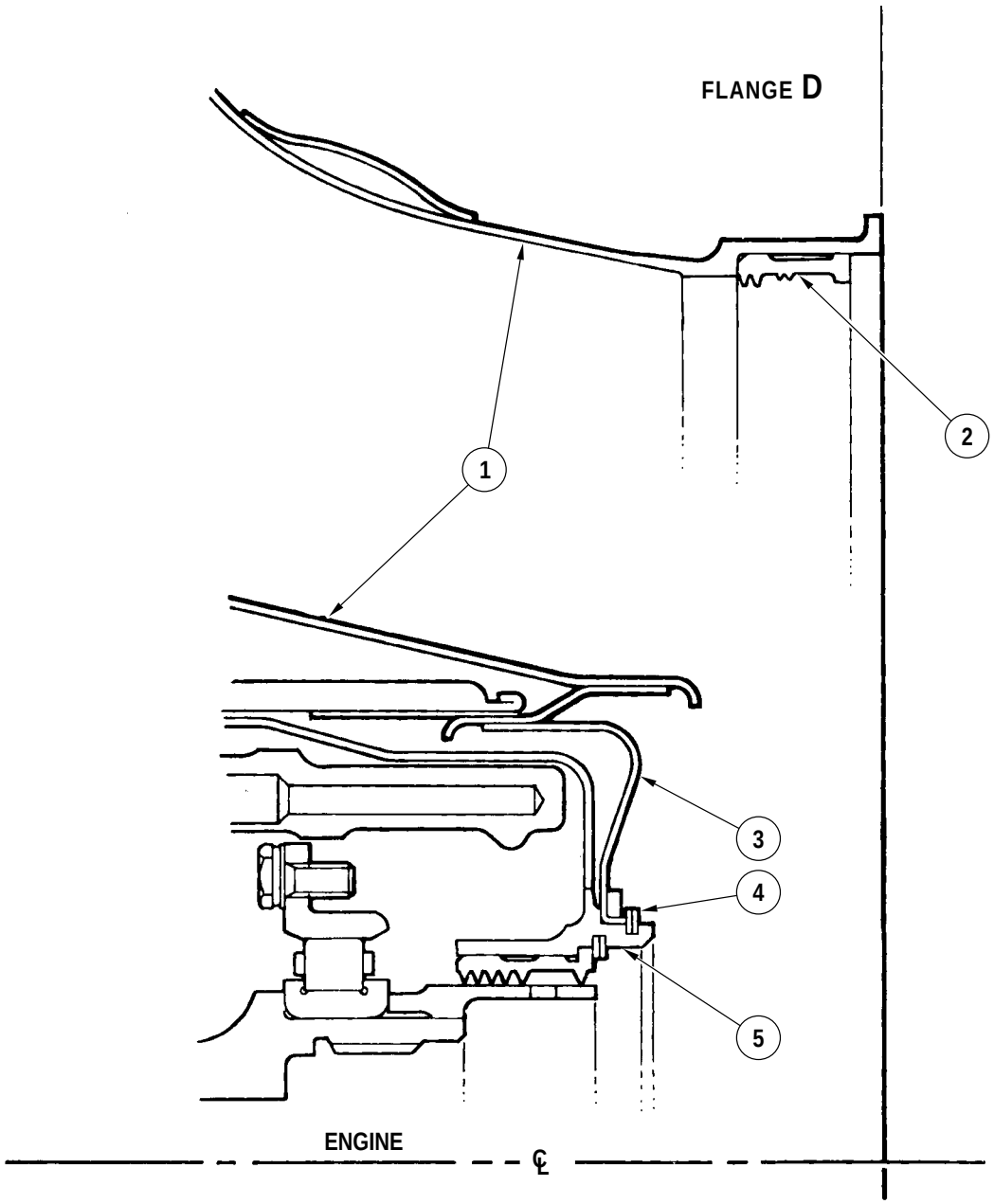
* Ship power section/turbine disks to an approved overhaul facility.

(1) Examine the power turbine blades (Ref. Table 201).

(2) Inspect power turbine vane ring for condition and signs of damage, including nicks, dents, pits and minor cracks.

(3) Inspect turbine for condition and signs of damage. Inspection should be done by viewing through ports in exhaust duct.

(4) Inspect the No. 3 bearing cover assembly (Pre-SB1430). Replace the cover if evidence of rotation, rubbing or wear are noted.

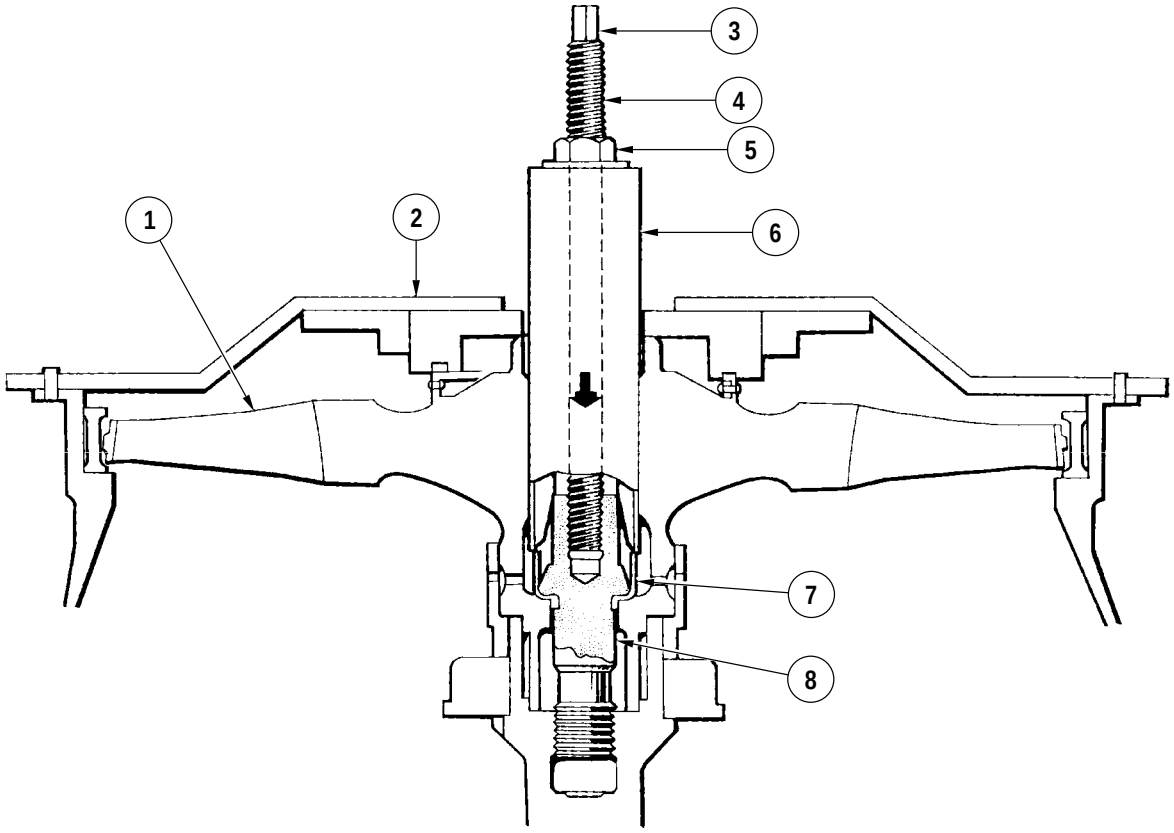


Pre-SB1430 C13432

Removal/Installation of No. 3 Bearing Cover
Figure 204

Key to Figure 204

1. Exhaust Duct
2. Power Turbine Shroud
3. No. 3 Bearing Cover Assembly
4. Bearing Cover Retaining Ring
5. Power Turbine Shaft Housing Assembly



C1280

Crimping Retaining Bolt Keywasher
Figure 205

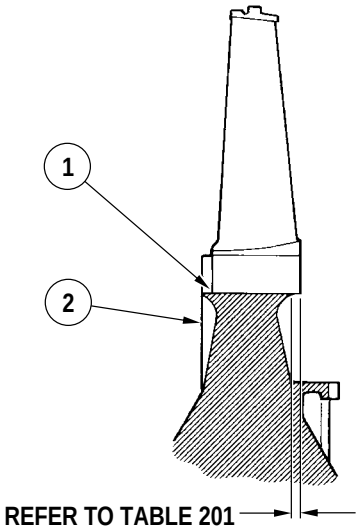
Key to Figure 205

1. Turbine Disk
2. Wrench
3. Screw
4. Thread
5. Nut
6. Squeezer
7. Keywasher
8. Retaining Bolt

POWER TURBINE

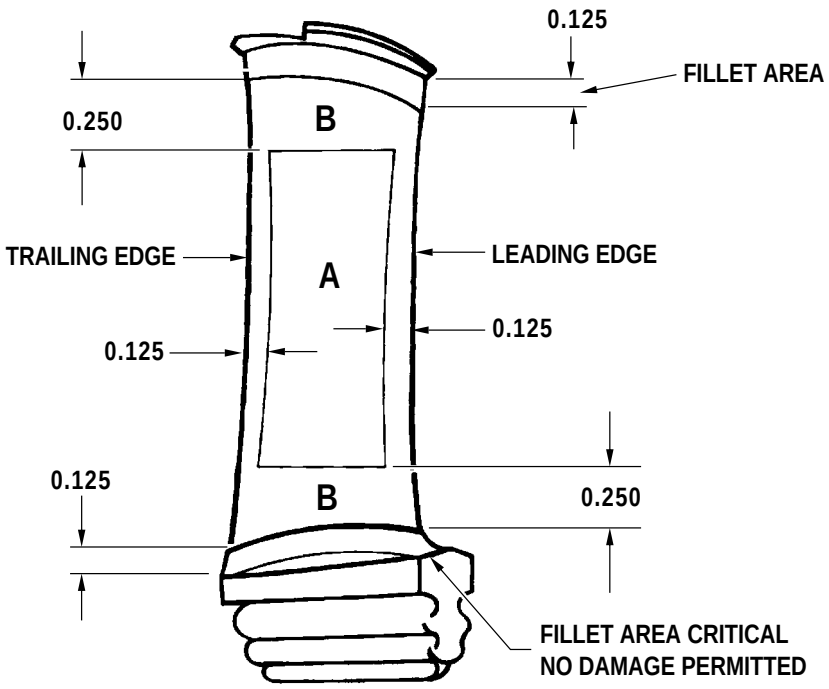
1. BLADE PLATFORM END
2. TURBINE DISK

NOTE: PROTRUSION OF BLADE MAY BE MEASURED FROM EITHER SIDE OF DISK



C1868

Power Turbine Blade Shift
Figure 206



NOTE: RIPPLING OF TRAILING EDGE IS NOT ACCEPTABLE

C748C

Power Turbine Blade Inspection
Figure 207

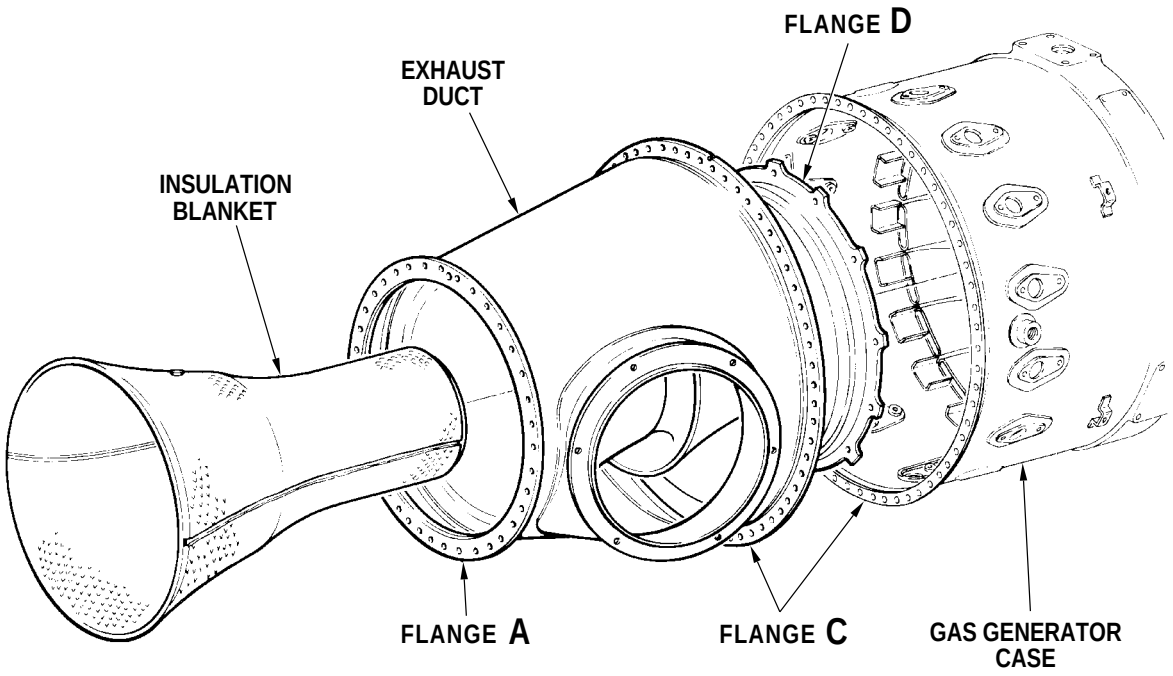
EXHAUST DUCT - DESCRIPTION AND OPERATION

1. Description and Operation (Ref. Fig. 1)

The exhaust duct assembly consists of a heat-resistant nickel-alloy sheet, truncated cone fabrication with twin opposed exhaust ports and an annular sheet metal inlet. The exhaust port flanges provide the mounting for the airframe-supplied exhaust nozzles. Exhaust gases from the power turbine area enter the annular inlet around a coned inner sheet metal fabrication designed to impart gas swirl and to scavenge the duct with maximum efficiency.

The front flange of the duct (Flange A) provides the support and mounting flange for the reduction gearbox. Two flanges are provided at the rear of the duct; the inner flange (Flange D) provides the mounting for the power turbine stator housing, while the outer flange (Flange C) forms the major dividing flange between the gas generator assembly and the power section.

A dimpled, stainless steel/ceramic fiber laminate insulation blanket is installed between the inner cone of the duct and the power turbine shaft housing to minimize transfer of heat from the exhaust gases to the power turbine shaft bearings and rear section of the reduction gearbox.



C7067

Exhaust Duct and Insulation Blanket
Figure 1

EXHAUST DUCT - MAINTENANCE PRACTICES

1. General

   A. Maintenance personnel should make reference to the INTRODUCTION section and Chapter 70-00-00 STANDARD PRACTICES of this manual to familiarize themselves with general procedures.

   B. Install suitable protective caps/covers over all disconnected tubes/lines and component openings.

   C. Lockwire shall comply with specification AMS 5687, heat and corrosion resistant steel wire MS9226-03, is 0.025 inch diameter, and will not be specified in instructions.

2. Consumable Materials

   Not Applicable

3. Special Tools

   The special tools listed below are used in the following procedures.

Tool No.	Name
PWC32179	Base, Assembly

4. Fixtures, Equipment and Supplier Tools

   Not Applicable

5. Removal/Installation (Heavy Maintenance Only)

   A. Removal of Exhaust Duct (Ref. Fig. 201)

      (1) Remove the power section from the gas generator assembly (Ref. 72-50-03, Removal/Installation).

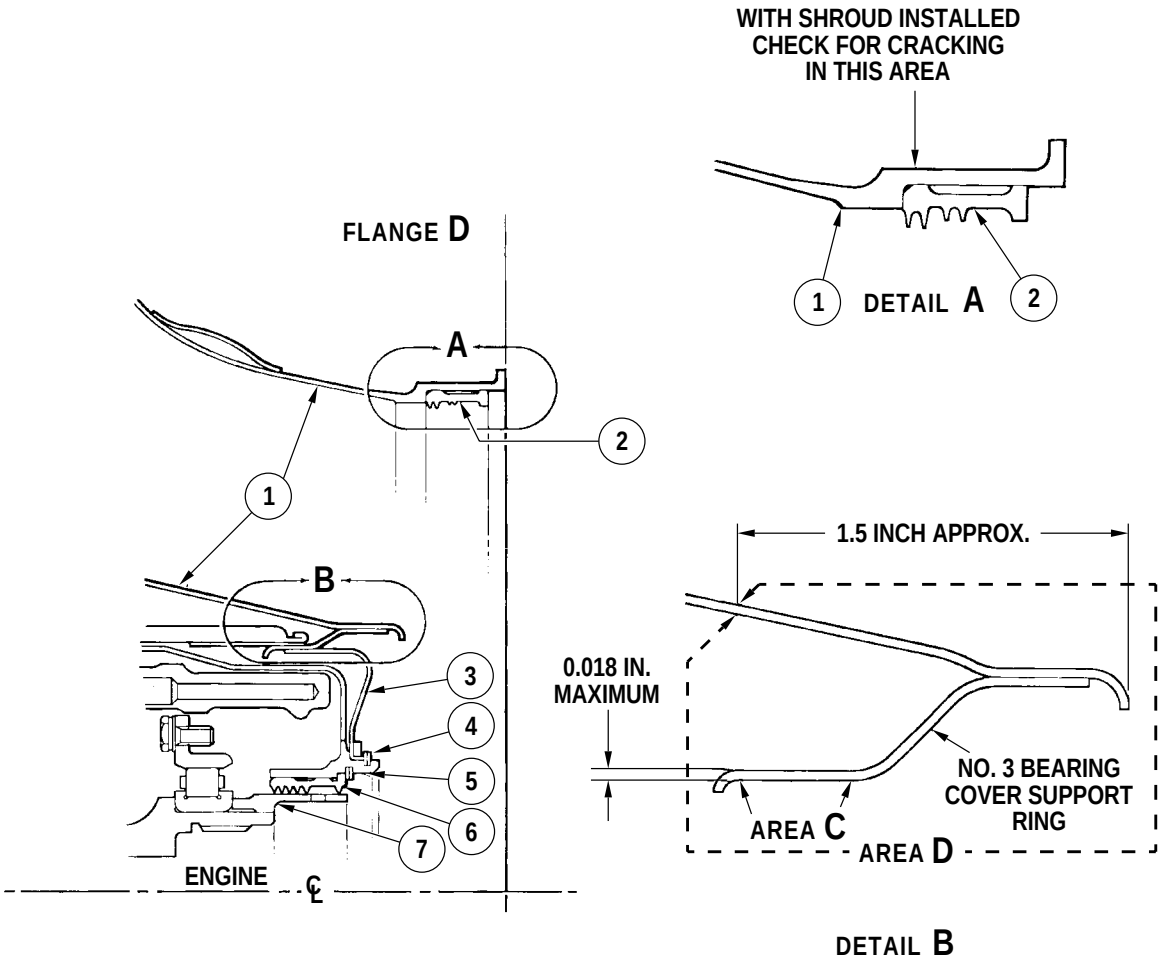
      (2) With the base assembly (PWC32179) firmly secured to the workbench or other suitable fixture, position the power section vertically on the base, with the power turbine uppermost, and secure to the base using slave bolts.

      (3) Remove the power turbine stator housing, power turbine vane ring, and interstage baffle (Ref. 72-50-03, Removal/Installation).

      (4) Remove the power turbine disk and blade assembly (Ref. 72-50-04, Removal/Installation).

      (5) Remove the retaining ring (4) and withdraw the No. 3 bearing cover (3) Pre-SB1430.

          NOTE: The Post-SB1430 No. 3 bearing cover is an integral part of the exhaust duct assembly.



Pre-SB1430 C13407A

Removal/Installation of Exhaust Duct
Figure 201

Key to Figure 201

1. Exhaust Duct
2. Power Turbine Shroud
3. No. 3 Bearing Cover
4. Bearing Cover Retaining Ring
5. Power Turbine Shaft Housing Assembly
6. Air Seal, Power Turbine Stator
7. Air Seal, Power Turbine Rotor

CAUTION: DO NOT SEPARATE THE REDUCTION GEARBOX FRONT AND REAR HOUSINGS AT FLANGE A.

(6) Remove the nuts, washers, bolts and lifting bracket at Flange A.

(7) Remove the exhaust duct assembly (1).

(8) Remove the thermal insulation blanket from the exhaust duct.

NOTE: Whenever the exhaust duct assembly is removed from the power section, inspect the reduction gearbox rear housing (Ref. 72-10-00).

(9) If the exhaust duct is cracked beyond limits (Ref. Para. 6.), remove the power turbine shroud (2) as follows:

(a) Apply a sufficient amount of dry ice to chill shrink the shroud diameter.

(b) Withdraw the power turbine shroud (2) evenly from the exhaust duct (1).

(c) Retain the shroud for installation in the replacement exhaust duct.

B. Installation of Exhaust Duct (Ref. Fig. 201)

(1) When the replacement exhaust duct is to be installed, install the power turbine shroud (2):

(a) To facilitate installation, chill shrink the shroud diameter using dry ice.

(b) Install the power turbine shroud (2) in the exhaust duct (1) with double knife edge lands toward the front of the engine. If the original shroud is being installed, align the “X” mark with the offset hole on the exhaust duct Flange D.

(c) Make sure the power turbine shroud (2) is properly seated.

(2) Install the thermal insulation blanket into the front of the exhaust duct assembly.

(3) Position the exhaust duct over the reduction gearbox rear housing.

(4) Position the lifting bracket (Ref. 72-00-00, REMOVAL/INSTALLATION). Secure Flange A using bolts (heads toward rear of engine), washers and self-locking nuts. Tighten the nuts, in diametric sequence, 36 to 40 lb.in.

(5) Install the No. 3 bearing cover (3) Pre-SB1430 over the end of the power turbine shaft housing. Secure with the retaining ring (4).

NOTE: No. 3 bearing cover (Post-SB1430) is an integral part of the exhaust duct assembly.

CAUTION: WHEN POSITIONING THE POWER TURBINE DISK AND BLADE ASSEMBLY, EXERCISE CARE TO AVOID DAMAGING THE SHROUD LANDS BY CONTACT WITH THE BLADE TIPS.

(6) Install the power turbine blade and disk assembly (Ref. 72-50-04).

(7) Install the power turbine stator housing, vane ring and interstage baffle (Ref. 72-50-03).

6. Inspection/Check

The extent of power section disassembly will determine the scope of inspection to the exhaust duct.

A. Procedure

(1) For periodic, hot section, or unscheduled inspections such as engine sudden-stoppage (Ref. 72-00-00, INSPECTION, Unscheduled Inspection) or suspected aircraft heavy landing, examine the exhaust duct critically for evidence of the following:

(a) Examine the outer surface condition for buckling, ripples or similar distortion.

(b) Inspect outer surface, particularly in vicinity of flanges A and C for cracking in metal skin, welds, or flange bolt holes.

(c) Inspect exhaust port flanges for cracking. Cracks not exceeding 0.500 inch in length and do not progress into the stitch weld or cracks in a tangential direction not exceeding 1.000 inch long are acceptable provided they are stop drilled with a 1/16 (0.0625) inch drill.

(d) Check for the integrity of internal structure through the exhaust ports.

NOTE: Refer to the Aircraft Maintenance Manual for removal/installation of the exhaust stubs.

(e) Using suitable lighting or a borescope, examine the internal structure as far as possible for cracks, looseness and distortion.

(2) For engines that have incorporated SB1610 since the last overhaul and that exhibit inferior welds.

(a) Inspect for cracks at each minor inspection and repeat the inspection (Ref. Step (c)) at intervals not to exceed 150 hours of flight time.

(b) If cracks are found, repeat the inspection (Ref. Step (c)) at intervals not to exceed 25 hours flight time. All cracks will be marked with a suitable metal marking pencil (PWC05-018), and the length, location, duct hours and Time Since Overhaul recorded.

(c) Using 5x magnification, visually inspect the forward area of the exhaust duct for cracks, from the propeller reduction gearbox mounting flange to 2 inches aft around the entire circumference of the duct.

1 Exhaust ducts are considered serviceable provided;

- There are no more than 3 cracks.
- The total length of all cracks does not exceed 2 inches.
- No one crack exceeds 1 inch.
- When there are 2 or 3 cracks they must be separated by a minimum of 6x the length of the longest crack or 3 inches, whichever is greater.
- The growth rate of any crack does not exceed 0.015 inch/hour of operation.

(3) With the power turbine vane ring and stator housing removed (Ref. Fig. 201):

(a) Inspect the exhaust duct (1) for cracks at Flange D in the location shown in detail A. Close visual and dye penetrant inspection should be carried out. When cracks are indicated, remove the exhaust duct for overhaul (Ref. Para. 5.A.).

(4) With the power turbine disk removed:

(a) Inspect the installed No. 3 bearing cover (3) Pre-SB1430. If evidence of looseness or rotation is present, refer to 72-50-04 Heavy Maintenance Only.

(b) Inspect the exhaust duct (1) area C where the bearing cover (3) Pre-SB1430 outside diameter mates with the exhaust duct. Light fretting may be polished out to the minimum material thickness of 0.018 inch. Evidence of the bearing cover rotation requires close visual and fluorescent dye penetrant inspection. The presence of cracks requires the removal of the exhaust duct for overhaul (Ref. Para. 5.A.).

(c) Inspect the end of the ski jump Pre-SB1430 area D, Detail B, for cracks using fluorescent dye penetrant inspection. No cracks allowed.

NOTE: After the exhaust duct has been removed, inspect the reduction gearbox rear housing (Ref. 72-10-00).

7. Cleaning/Painting

A. Procedure

(1) Remove salt and smog deposits from the outer surface of the exhaust duct with clean water. Dry with clean, dry compressed air.

(2) Clean light surface corrosion build-up with a non-metallic brush.