Ci-U-A

*DMWR 1-2840-113-2

DEPOT MAINTENANCE WORK REQUIREMENT

for

ENGINE, AIRCRAFT, TURBO–PROP

MODEL	PART NUMBER	NATIONAL STOCK NUMBER
T53–L–15	1–000–100–01	2840–00–957–2853
T53–L–701	1–000–110–01	2840–00–116–7134
T53–L–701A	1–000–110–03/07	2840–00–176–9132

and

ENGINE, AIRCRAFT, TURBO–SHAFT

MODEL	PART NUMBER	NATIONAL STOCK NUMBER
T53–L–13B	1–000–060–22	2840–00–134–4803
T53–L–703	1–000–060–23	2840–00–621–1860

This publication is a reprint of DMWR 1-2840-113-2, dated 15 January 1999, including change 1.

* This manual supersedes DMWR 1-2840-113-2 dated 30 September 1994, including all changes.

This publication is not available through U.S. Army Publication Distribution Centers. It must be obtained from U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-LS-LP, Redstone Arsenal, AL 35898-5230.

US ARMY AVIATION AND
MISSILE COMMAND
15 JANUARY 1999

CHANGE

NO. 1

U.S. ARMY AVIATION AND
MISSILE COMMAND
REDSTONE ARSENAL, AL 35898-5230
26 MAY 2000

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DMWR 1-2840-113-2, dated 15 January 1999, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove Pages	Insert Pages
A/(B blank)	A/(B blank)
i through vi	i through vi
xi through xiv	xi through xiv
xvii and xviii	xvii and xviii
5-687 through 5-694	5-687 through 5-694
------------	5-694.1 through 5-694.7/(5-694.8 blank)
5-695 through 5-702	5-695 through 5-702
------------	5-702.1/(5-702.2 blank)
5-705 through 5-708	5-705 through 5-708
5-711 through 5-714	5-711 through 5-714
------------	5-714.1 and 5-714.2
5-723 and5-724	5-723 and5-724
5-731 and 5-732	5-731 and 5-732
5-735 and 5-736	5-735 and 5-736
------------	5-822.1 through 5-822.7/(5-822.8 blank)
5-823 and 5-824	5-823 and 5-824
------------	5-823.1 and 5-832.2

2. Retain this sheet in front of manual for reference purposes.

FOR THE COMMANDER:

HERBERT M. CARR
Colonel, AD
Chief of Staff

OFFICIAL:

Richard E. Turner

RICHARD E. TURNER
Director
Logistics Support Directorate
Integrated Materiel Management Center

WARNING

WARNING AND FIRST AID DATA PAGE

For artificial respiration and other first aid data, refer to FM 21-11.

Personnel performing instructions involving operations, procedures, and practices which are included or implied in this work requirement shall observe the following instructions. Disregard of these warnings and precautionary information can cause serious injury, illness, death or an aborted mission.

WARNING

COMPRESSED AIR

Eyes can be permanently damaged by contact with liquid or large particles propelled by compressed air. Inhalation of air-blown particles or solvent vapors can damage lungs. At an air-exhausted workbench, wear approved goggles or face shield. At non air-exhausted work-benches, wear approved respirator and goggles.

To preclude personnel injury, do not direct air near or directly against skin.

To prevent damage or contamination when drying parts, do not use air under high pressure or from a source not having a moisture–trap/filter system.

To prevent personnel injury or bearing damage, do not roll bearings with compressed air.

WARNING

NOISE

Operation and maintenance personnel shall wear ear protection devices when working near or around an operating test stand. Ear plugs and sound attenuating headsets shall be available at all times to personnel in the vicinity of the test stand. Sound pressure levels in excess of 100dB are common.

WARNING

HANDLING HOT PARTS

To prevent injury to operator, asbestos gloves must be worn when removing gear from oven. Bare handling of heated parts may cause blistering and third degree burns. If skin is burned, immediately immerse the affected area in cold water for ten minutes. Seek medical attention if blistering or pain persists.

WARNING

EQUALIZING SHIPPING CONTAINER PRESSURE

Make certain that all air pressure has been released before loosening nuts. If nuts are removed before pressure is released, internal pressure could blow cover off and the high energy fragments may severely injure personnel.

WARNING

VAPOR-BLASTING (CLEANING)

Because of toxicity of some deposited material, when removing all remaining contaminants by hand scrubbing, keep both part and brush wet with water to prevent airborne dust.

WARNING

PROLONGED CONTACT WITH LUBRICATING OIL

Prolonged contact with lubricating oil may cause a skin rash. These areas of skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Saturated clothing should be removed immediately. Areas in which lubricating oil is used should be adequately ventilated to keep mist and fumes to a minimum.

WARNING

DANGEROUS CHEMICALS

When using nondiluted Magnus magnustrip or a solution in a ration of 3 pounds of Turco compound per gallon of water, avoid direct contact of solution with skin or eyes. This solution is a strong caustic, and protective garments, to include agent resistive gloves, aprons, and face shields/goggles, should be worn when handling it. Ensure that tank is exhausted to outside atmosphere.

Both liquid nitric acid and its vapors are a personnel hazard. Avoid contact with skin, eyes, or clothing. Avoid inhalation of vapors. In case of contact, flush skin or eyes immediately with water for at least 15 minutes and get medical attention.

Molding compound, consisting of base compound and accelerator compound and lamp black is toxic and care should be exercised to avoid prolonged contact with skin. Keep containers closed, except when mixing and transferring material.

When using a solvent of four parts Magnus 61C solution by volume; one part Magnus 751 solution; four parts Oakite rust stripper; and 14 parts water, provide adequate ventilation around bath. If inhaled deeply the solution may be injurious to the lungs. Wear rubber gloves to protect hands from chemicals as skin will be harmed by prolonged contact.

When using Brulin 815 GD, Desoclean 45, DS-108, Positron, denatured alcohol or acetone, avoid prolonged inhalation of fumes. Perform cleaning operation in a well-ventilated area.

Use extreme care when handling ammonium nitrate, hydrochloric acid, concentrated nitric acid, sodium hydroxide pellets, hydrogen peroxide; ammonium bifluoride crystals, concentrated sulphuric acid and concentrated phosphoric acid; these chemicals are hazardous and require special handling. Solid ammonium bifluoride is crystalline and can be conveniently stored in a dry place.

Desoclean 45 is flammable. Do not use near open flames, near welding areas, or on hot surfaces. Do not smoke when using, and do not use where others are smoking. Vapors of this product are heavier than air and may collect in low or confined areas, forming explosive mixtures with air.

Contact with Desoclean 45 liquid or vapor can cause skin an eye irritation, dermatitis, and drowsiness. If there is any prolonged skin contact wash contacted area with soap and water. Remove solvent saturated clothing. If vapor causes drowsiness, get to fresh air. If irritation persists, get medical attention.

WARNING

CLEANING

When removing carbon by the solvent-immersion method, ensure that cleaning area is well ventilated. If carbon-removal compound comes in contact with skin, eyes, or clothing, thoroughly flush affected area with cold water.

When using dry cleaning solvent P-D-680, avoid prolonged inhalation of vapors. Wear rubber gloves and use hand cream to prevent contact with skin. Do not heat solution.

Solvent flash point must not be less than 100°F.

When handling Desoclean 45 at air exhausted workbench, wear approved gloves, goggles, and long sleeves. When handling liquid or liquid-soaked cloth in open unexhausted area wear approved respirator, wear approved gloves, goggles, and long sleeves. Dispose of liquid-soaked rags in approved metal container. Metal containers of solution must be grounded to maintain electrical continuity.

WARNING

EXPLOSIVE MATERIAL

Never attempt to burn more than a few particles of metal suspected to be magnesium. Magnesium powder or dust is explosive.

WARNING

TEST STAND OPERATION

Improper use of a test stand can cause severe damage to personnel or components, Test stands shall be operated by authorized personnel only.

WARNING

USE OF PIN DRIVER FIXTURE

To properly operate, control buttons must be activated simultaneously as a safety precaution to ensure the operator's hands are clear of driver sleeve.

WARNING

COMBUSTION CHAMBER INTERNAL PARTS

When handling internal parts of the combustion chamber that have been exposed to fuel containing tetraethyl lead, ensure that the byproduct (poisonous lead oxide) is not inhaled or taken into the body through cuts or other external openings. If accidental exposure occurs, drench affected area with large amounts of clear water, and obtain immediate medical assistance.

WARNING

FLUORESCENT-PENETRANT INSPECTION

Wear rubber gloves when performing the fluorescent-penetrant inspection, as oil on the skin may cause skin inflammation. Presence of penetrating oil on the skin can be detected under ultraviolet (black) light. Developing powder is harmless if inhaled, but heavy concentration can be annoying.

WARNING

RADIOGRAPHIC (X-RAY) INSPECTION

To guard operating personnel from possible danger of X-ray absorption, cover rear side of film holder with a sheet of lead thick enough to absorb fully any secondary reflected radiographic rays. As a further precaution, all radiographic operating personnel shall wear a radiation detector-type badge or cylinder.

WARNING

RADIOACTIVE MATERIAL

Aircraft engine igniter exciters include electron tubes which contain a small amount of Cesium/Barium 137 or Krypton-85. No special handling precautions normally apply, however, personnel should consult their supporting Radiation Protection Officer in the event these tubes are severely damaged.

WARNING

MARKING OF ENGINE PARTS

To prevent detrimental chemical/material reactions which could cause cracks and/or parts failure, never use a lead (graphite) pencil to mark hot end parts. Use only approved marking materials on all engine parts.

WARNING

FLIGHT SAFETY PARTS

This manual contains procedures identifying critical characteristics of flight safety parts. Critical characteristics may be identified as dimensions, tolerances, finishes, materials, assembly, or inspection procedures. Some processes may require qualified sources. Flight safety parts indicating a maximum allowable limit shall not be continued in use when limits have been exceeded. These parts must be replaced.

CAUTION

CURRENCY OF INFORMATION

The information in this manual is current for the T-53-L-13B and T-53-L-703 Engines **only**. The other models are not maintained in the U.S. Army inventory. Removal of these procedures was not feasible at the time of revision.

LIST OF EFFECTIVE PAGES

Insert latest changed pages. Dispose of superseded pages in accordance with regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by a miniature pointing hand. Changes to wiring diagrams are indicated by shaded areas.

DATES OF ISSUE FOR ORIGINAL AND CHANGED PAGES ARE:

Original ...... 0 ...... 15 January 1999
Change ...... 1 ...... 26 May 2000

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*A zero in this column indicates an original page.

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WORK REQUIREMENT
NO. 1-2840-113-2

US ARMY AVIATION
AND MISSILE COMMAND
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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Aviation and Missile Command, ATTN: AMSAM-MMC-LS-LP, Redstone Arsenal, AL 35898-5230. You may also submit your recommended changes by E-Mail directly to ls-lp@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. A reply will be furnished directly to you. Instruction for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028.

ENVIRONMENTAL/HAZARDOUS MATERIAL INFORMATION

This document has been reviewed for the presence of Class I Ozone Depleting Chemicals. As of 30 October 1998, the status is: All references to Class I Ozone Depleting Chemicals have been removed from this document by substitution with chemicals that do not cause atmospheric ozone depletion.

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

NOTE

This manual is printed in four volumes as follows:

DWMR 1-2840-113–1, consisting of Table of Contents (complete), Chapter 1, Chapter 2, Chapter 3, Chapter 4, and Chapter 5, pages 5–1 through 5–309.

DWMR 1-2840-113–2, consisting of Table of Contents (-2 only), Chapter 5, pages 5–310 through 5–991.

DWMR 1-2840-113–3, consisting of Table of Contents (-3 only), Chapter 5, pages 5–992 through 5–1370, and Chapter 6.

DWMR 1-2840-113–4, consisting of Table of Contents (-4 only), Chapter 7, Chapter 8, Chapter 9, and Chapter 10, Appendix A through Appendix F, and an Alphabetic Index.

The Appendices and Index are applicable to Volumes 1 through 4.

* This manual supersedes DMWR 1-2840-113-2 dated 30 September 1994, including all changes.

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SECTION IX. COMBUSTOR TURBINE ASSEMBLY

5-245. DISASSEMBLY. Proceed as follows:

a. Remove nuts (18, figure 5-135), spacers (17), and bolts (16) that secure V-band retainer and trunnion (15). Remove V-band retainer and trunnion.

b. On T53-L-703 engines, remove two screws (35) from connector (34). Open connector and remove lead of thermocouple harness (21).

c. Remove diffuser support cone assembly (37). On T53-L-703 engines, remove screws (33), nuts (36), and connector (34).

d. Unscrew and remove oil strainer housing adapter (30) from tube power turbine (24) at top of fire shield (29 or 40). Remove packing (25) and strainer (31).

e. Unscrew and remove connector (41) from tube (24) at bottom of fire shield (29 or 40). Remove packing (42).

CAUTION

In following step f, use care when removing manifold to prevent damage to fuel nozzles. Cap open ports, and place in dust-free area or in plastic bags. Place the packaged manifold assemblies in reusable shipping containers, P/N P-1393, or equivalent.

f. Remove bolts (38) that secure main fuel manifold assembly (32) to rear of combustion chamber assembly (14). Carefully remove manifolds from combustion chamber housing and remove seals (39) from fuel nozzles.

g. On T53-L-703 engines, remove two screws (28) that secure cover assembly (27) to fire shield (29 or 40). Remove cover assembly from fire shield and from lead of thermocouple harness (21).

h. Remove fire shield (29 or 40) from around exhaust diffuser (43).

NOTE

To facilitate nozzle removal, combustion chamber liner may be removed at this time; on T53-L-703 engines, nozzle cannot be removed until liner is removed. Remove liner by straightening tabs on key washers and removing nuts and washers from liner studs. (Refer to paragraph 5-296).

i. Remove two power turbine tubes (24) from exhaust diffuser struts.

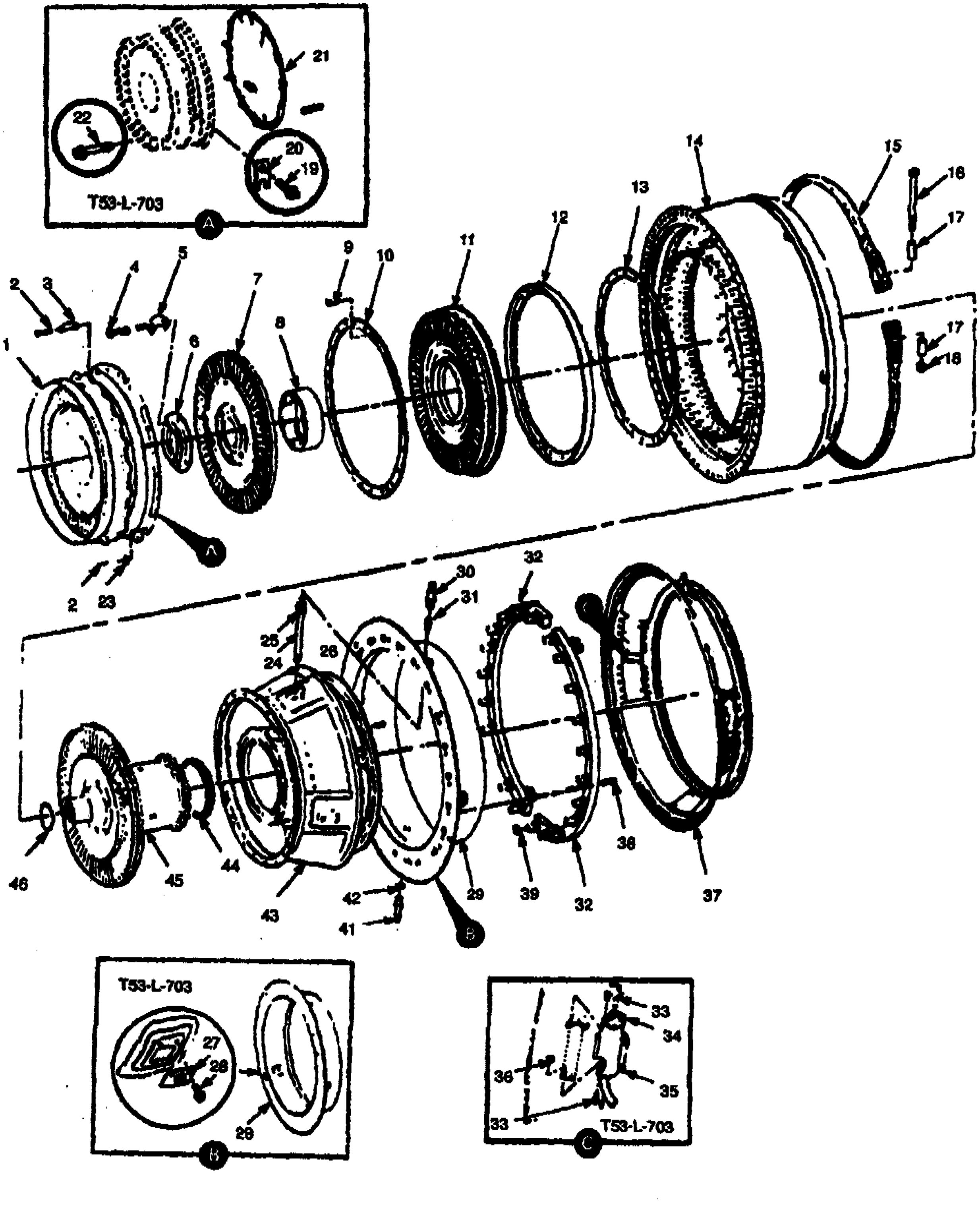


Figure 5-135. Combustor Turbine Assembly.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1234567	QTY PER ASSY	USABLE ON CODE
5-135	No Number	. COMBUSTOR TURBINE ASSEMBLY AND RELATED PARTS (NHA 1-000-100-01, 1-000-110-01, 1-000-060-10, 1-000-060-23 1-130-630-08, 1-170-330-06, 1-170-330-09, 1-170-330-13, and 1-170-330-21	REF	
	1-130-630-08	. COMBUSTOR TURBINE ASSEMBLY	1	A, C, D, E
	1-130-630-19	. COMBUSTOR	1	B
-1	1-190-050-06	. . NOZZLE, Turbine first stage	1	B
	1-190-000-09	. . NOZZLE, Turbine first stage (Replace with 1-190-050-07)	1	A, C, D, E
	1-190-050-07	. . NOZZLE, Turbine first stage	1	A, C, D, E
-2	1-130-245-01	. . BOLT, Internal wrenching	22	
-3	1-190-019-02	. . LOCKING PLATE, Nut and bolt	1	
-4	1-140-168-02	. . BOLT, External relieved body (use with spacer, 1-140-169-03)	6	A, C, D, E
	1-140-168-03	. . BOLT, External relieved body (use with spacer, 1-140-169-04)	6	
-5	1-140-142-02	. . LOCKING PLATE, Nut and bolt	3	
-6	1-190-016-01	. . SEALING FLANGE, First stage nozzle	1	
-7	1-190-010-02	. . TURBINE ROTOR, First stage	1	A, C, D, E
	1-190-010-03	. . TURBINE ROTOR, First stage	1	A, B, E
-8	1-140-169-03	. . SPACER, Power turbine rotor	1	A, C, D, E
	1-140-169-04	. . SPACER, Power Turbine Rotor	1	
-9	1-190-021-01	. . PIN, Straight headed, 0.2495-0.2505 inch diameter	3	
	1-190-021-02	. . PIN, Straight headed, 0.2510-0.2515 inch diameter	3	
	1-190-021-03	. . PIN, Straight headed, 0.2520-0.2525 inch diameter	3	
	1-190-021-04	. . PIN, Straight headed, 0.2530-0.2535 inch diameter. (Select three of one dash number to obtain proper fit)	3	
-10	1-140-276-01	. . SPACER, Ring, second stage, 0.022-0.028 inch thick	AR	A, C, D, E
	1-140-276-02	. . SPACER, Ring, second stage, 0.029-0.035 inch thick	AR	A, C, D, E
	1-140-276-03	. . SPACER, Ring, second stage, 0.036-0.044 inch thick	AR	A, C, D, E
	1-140-303-01	. . SPACER, Ring, second stage, 0.022 - 0.028 inch thick	AR	
	1-140-303-02	. . SPACER, Ring, second stage, 0.029 - 0.035 inch thick	AR	
	1-140-303-03	. . SPACER, Ring, second stage, 0.036 - 0.044 inch thick	AR	
-11	1-140-170-05	. . NOZZLE, Turbine, second stage	1	
-12	1-140-275-01	. . RING, Mounting	1	A, C, D, E

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-135				
-12	1-140-275-06	.. RING, Mounting	1	
-13	1-140-276-01	.. SPACER, Ring, second stage 0.022 - 0.028 inch thick	AR	A, C, D, E
	1-140-276-02	.. SPACER, Ring, second stage 0.029 - 0.035 inch thick	AR	A, C, D, E
	1-140-276-03	.. SPACER , Ring, second stage 0.036 - 0.044 inch thick	AR	A, C, D, E
	1-140-303-01	.. SPACER, Ring, second stage 0.022 - 0.028 inch thick	AR	
	1-140-303-02	.. SPACER, Ring, second stage 0.029 - 0.035 inch thick	AR	
	1-140-303-03	.. SPACER, Ring, second stage 0.036 - 0.044 inch thick	AR	
-14	1-130-620-05	.. COMBUSTION CHAMBER ASSEMBLY	1	A, C, D, E
	1-130-620-16	.. COMBUSTION CHAMBER ASSEMBLY	1	B
	TS5210S4	.. V-BAND, Special latch (94581) (Lycoming Source Cont Dwg 1-300-239-01)	1	
	56454	.. V-BAND, Special latch (97625) (Alternate) (Lycoming Source Cont Dwg 1-300-239-02)	1	
	TS5210S4-3	... V-BAND ASSEMBLY	2	
-15	No Number	.... RETAINER AND TRUNNION, V-Band (NHA TS5210S4-3)	1	
-16	TS5210S4-5	.... BOLT, (94581)	1	
-17	214HS5-82	.... SPACER, (94581)	1	
-18	Z1200-054	.... NUT (72962)	1	
	6085914	.... NUT(66640)	1	
-19	MS-9565-05	.. BOLT, Machine	12	B
-20	1-190-036-01	.. PLATE, Mounting	12	B
-21	1-300-563-01	.. HARNESS ASSEMBLY, Thermocouple	1	B
-22	STD 3061-12	.. MACHINE BOLT	2	B
-23	1-190-019-03	.. LOCKING PLATE, Nut and bolt	10	
-24	1-150-005-02	.. TUBE, Power turbine	2	
-25	NAS617-6	.. PACKING, (Replace with STD3017E6)	1	
	STD 3017E6	.. PACKING, (Replace with NAS1595-6)	1	
-26	AN510C10-6	.. SCREW, Machine	2	
-27	1-150-400-02	.. COVER, Combustion Chamber (Use with 1-150-250-08)	1	
-28	MS9564-02	.. SCREW (Use with 1-150-250-08)	2	
-29	1-150-250-02	.. SHIELD, Fire	1	A, C, D, E
	1-150-250-08	.. SHIELD, Fire	1	B

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-135				
-30	1-150-108-01	. . ADAPTER, Oil strainer housing	1	
-31	1-150-107-01	. . STRAINER, Oil (Replace with 1-150-107-03)	1	
	1-150-107-03	. . STRAINER, Oil	1	
-32	1-130-730-02	. . MANIFOLD ASSEMBLY, Fuel	2	
-33	MS35275-245	. . SCREW, Machine	2	B
-34	1-300-564-01	. . CONNECTOR, Thermocouple	1	
-35	MS35276-212	. . SCREW, Machine	2	B
-36	MS21043-08	. . NUT, Self Locking	2	
-37	1-150-260-02	. . CONE ASSEMBLY, Support, exhaust diffuser	1	
-38	NAS1351C4H14	. . BOLT (replace with STD 3061-12)	22	
	STD 3061-12	. . BOLT	22	
-39	AR100199	. . SEAL, Plain (00624) (Lycoming Source Cont Dwg 1-300-151-01)	22	
	A00500	. . SEAL, Plain (05939) (Alternate) (Lycoming source Cont Dwg 1-300-151-02)	22	
-40		. . Deleted		
-41	1-150-006-01	. . CONNECTOR, Oil tube	1	
-42	NAS617-6	. . PACKING, (Replace with STD 3017E6)		
	STD 3017E6	. . PACKING, (Replace with NAS1595-6)	1	
	NAS1595-6	. . PACKING	1	
-43	1-150-240-03	. . DIFFUSER ASSEMBLY, Exhaust	1	A, C, D, E
	1-150-240-06	. . DIFFUSER ASSEMBLY, Exhaust	1	
-44	AR100260	. . SEAL, Plain encased (70128) (Lycoming Source Cont Dwg 1-300-462-01)	1	
-45	1-140-530-06	. . TURBINE ROTOR AND BEARING HOUSING ASSEMBLY, Power	1	A, C, D, E
	1-140-530-14	. . TURBINE ROTOR AND BEARING HOUSING ASSEMBLY, Power	1	
-46	MS9205-013	. . PACKING		

CAUTION

Support diffuser assembly (43) when performing step j to prevent diffuser assembly and turbine rotor (7) from damaging second stage turbine nozzle (11).

j. Straighten locking plates (3 and 23) and remove 22 bolts (2). Remove and discard locking plates.

k. On T53-L-703 engines, cut lockwire and remove two bolts (22) securing thermocouple harness (21) to flanges of first stage power turbine nozzle assembly (1) and exhaust diffuser (43).

CAUTION

Use care when removing the thermocouple harness from flanges to avoid damaging electrical contacts.

l. Remove first stage power turbine nozzle from power turbine rotor and remove spacer (10). Record thickness of spacer for reassembly.

m. Withdraw pins (9) from flange of combustion chamber assembly (14).

n. On T53-L-703 engines, cut lockwire and remove 12 bolts (19) and plates (20) securing harness probes to first stage power turbine nozzle assembly (1). Carefully withdraw probes from nozzle and remove thermocouple harness (21).

o. Straighten tabs of locking plates (5); then remove bolts (4) and locking plates (5). Discard locking plates (5).

p. Remove sealing flange (6) from face of first stage power turbine rotor assembly (7).

q. Using mechanical puller (LTCT4680) with arms (LTCT4682), detail of LTCT4780 extended and hooks counter-clockwise as viewed from handle end, remove first stage power turbine rotor assembly (7) and spacer (8) as a unit. Remove and discard packing (46).

r. Turn rotor and spacer over and, using puller (LTCT4680) arms retracted and hooks clockwise, remove spacer (8) from turbine rotor assembly (7).

s. Remove second stage power turbine nozzle assembly (11), mounting ring (12), and ring spacer (13). Record thickness of spacer for reassembly.

t. Separate combustion chamber assembly (14) from exhaust diffuser (43).

u. Position exhaust diffuser (43), with second stage power turbine rotor assembly down, in holding fixture (LTCT4553).

v. Remove screws (26) that secure power turbine rotor and bearing housing assembly (45) to exhaust diffuser (43).

w. Raise assembly slightly from holding fixture. Using mechanical puller (LTCT4800), separate power turbine rotor and bearing housing assembly (45) from exhaust diffuser (43).

x. Remove and discard seal (44).

5-246. GENERAL REASSEMBLY OF COMBUSTOR TURBINE ASSEMBLY. Proceed as follows:

NOTE

Inspect power turbine rotor splined shaft for a RED "H" on disk face, indicating the heavy point. Mark position of RED "H" on outside diameter of splined shaft, using an approved marker. Prior to reassembly of combustor turbine, measure rear land (diameter "C", figure 5-331) and forward land (diameter "B") of second stage Power Turbine Rotor at four locations. Log the largest diameters for later reference during tip clearance check.

a. Place power turbine rotor and bearing housing assembly (45, figure 5-135), forward face down, into holding fixture (LTCT4553), or equivalent. Position new seal (44) in groove on aft end of bearing housing.

NOTE

Ensure that groove in bearing housing is clean. Coat groove with shortening compound (item 270, table C-1) to facilitate holding seal in groove during assembly.

b. Measure the clearance between the rear bearing cover (8, figure 4-36) OD and the exhaust diffuser assembly (43, figure 5-135) ID. Using tapered thickness gages, measure the gap at eight equally spaced locations. The clearance may not total more than 0.010 inch at any two opposite measured locations, or more than 0.007 inch at any one measured location.

c. Place exhaust diffuser (43) over bearing housing and align screw holes.

d. Temporarily install four 1/4-28 bolts through exhaust diffuser assembly over bearing housing until seated.

e. Secure bearing housing to exhaust diffuser with screws (36). Tighten screws to 20 to 30 pound-inches (3572 to 5358 gm cm) torque.

NOTE

A minimum clearance of 0.070 inch (0.178 cm) shall be maintained between the cone of the exhaust diffuser and blade root aft surface of second stage power turbine rotor assembly. (See figure 5-136).

f. Position exhaust diffuser and bearing housing on bench, with exhaust diffuser rear flange down.

g. Position combustion chamber assembly (14, figure 5-135) on flange of exhaust diffuser and align bolt holes on mating flanges.

h. Install ring spacer (13) of nominal thickness and mounting ring (12) on combustion chamber flange. Align bolt holes. Install three pins (9). Select pins to obtain 0.0005 to 0.0010 inch (0.0013 to 0.0030cm) loose fit. Install second stage power turbine nozzle (11). Secure with four bolts (2) and suitable spacers, equally spaced. Tighten bolts 70 to 95 pound-inches (81 to 109 cm kgs) torque.

i. Establish tip clearance between second stage turbine rotor and second stage power turbine nozzle. (Refer to paragraph 5-335.)

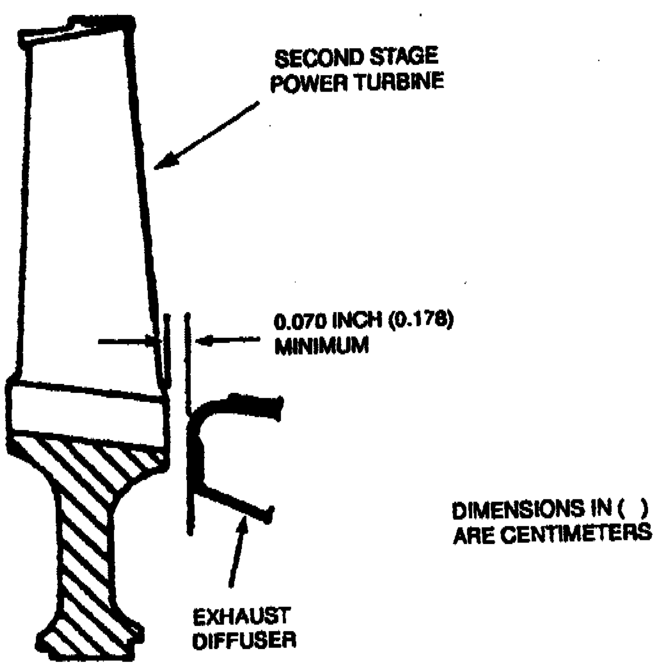


Figure 5-136. Clearance Between Exhaust Diffuser Cone and Second Stage Power Turbine Rotor.

CAUTION

In following step j, ensure that bolts do not bottom against seal housing.

j. Install power turbine rotor spacer (8) over end of power turbine rotor and align bolt holes and balance marks. Secure spacer with three equally spaced 5/16-24 bolts and washers.

k. Rotate turbine rotor components and listen for audible rubbing between seal flanges of second stage turbine nozzle assembly (11) and power turbine rotor spacer (8). If no rubbing is evident, proceed with reassembly procedure. If rubbing is evident, remove turbine components and rework nozzle seal flanges, using a half-round file to obtain minimum clearances of 0.016 inch (0.041 cm) at the forward flange and 0.016 inch (0.041 cm) at the aft flange.

NOTE

If rework is required due to rubbing of nozzle assembly seals to spacer. Make certain that 0.025 inch (0.064 cm) out-of-roundness, or less, is maintained on seal flanges in order to ensure that maximum clearance is not exceeded. (Maximum clearance shall be 0.030 inch (0.076 cm).

l. Establish clearance between first stage power turbine rotor and second stage power turbine nozzle (dimensions G and H, figure 5-137) as follows:

NOTE

On T53-L-703 engines, position a piece of 0.750 inch (1.905 cm) ground stock or parallel bar on combustion chamber bolt hole flange, under each end of locating bar, to prevent bar from contacting inner lip of combustion chamber liner.

(1) Place locating bar (LTCT153) on flange of combustion chamber housing.

(2) Using vernier depth gage, measure from bar to the outer shroud of the second power turbine nozzle (dimension A).

(3) Using vernier depth gage, measure from bar to the power turbine spacer (8, figure 5-135) dimension B, figure 5-137).

(4) Subtract dimension B from dimension A. Result will be dimension C.

(5) Place first stage power turbine rotor assembly (7, figure 5-135) on bench with forward face down. Position locating bar (LTCT153) on blade disk.

(6) Using vernier depth gage, measure from bar to ring spacer surface (dimension D, figure 5-137).

(7) Using vernier depth gage, measure from bar to shrouded lip of highest blade (dimensions E).

(8) Subtract dimension E from dimension D. Result will be dimension F.

(9) Subtract dimension F from dimension C. Result will be dimension G.

(10) Dimension G must be within 0.062 inch (0.157 cm) minimum to 0.077 inch (0.196 cm) maximum. Dimension H, measured with a suitable wire gage at the inner flow path, must be within 0.065 inch (0.165 cm) minimum to 0.150 inch (0.381 cm) maximum. If desired dimensions are not obtained, adjustment of spacer thickness will be required to position second stage power turbine nozzle. Select necessary ring spacer (13, figure 5-135). (Refer to table 5-67).

(11) Install ring spacer (13), mounting ring (12), and nozzle assembly (11). Temporarily secure nozzle assembly with pins (9) and bolts (2).

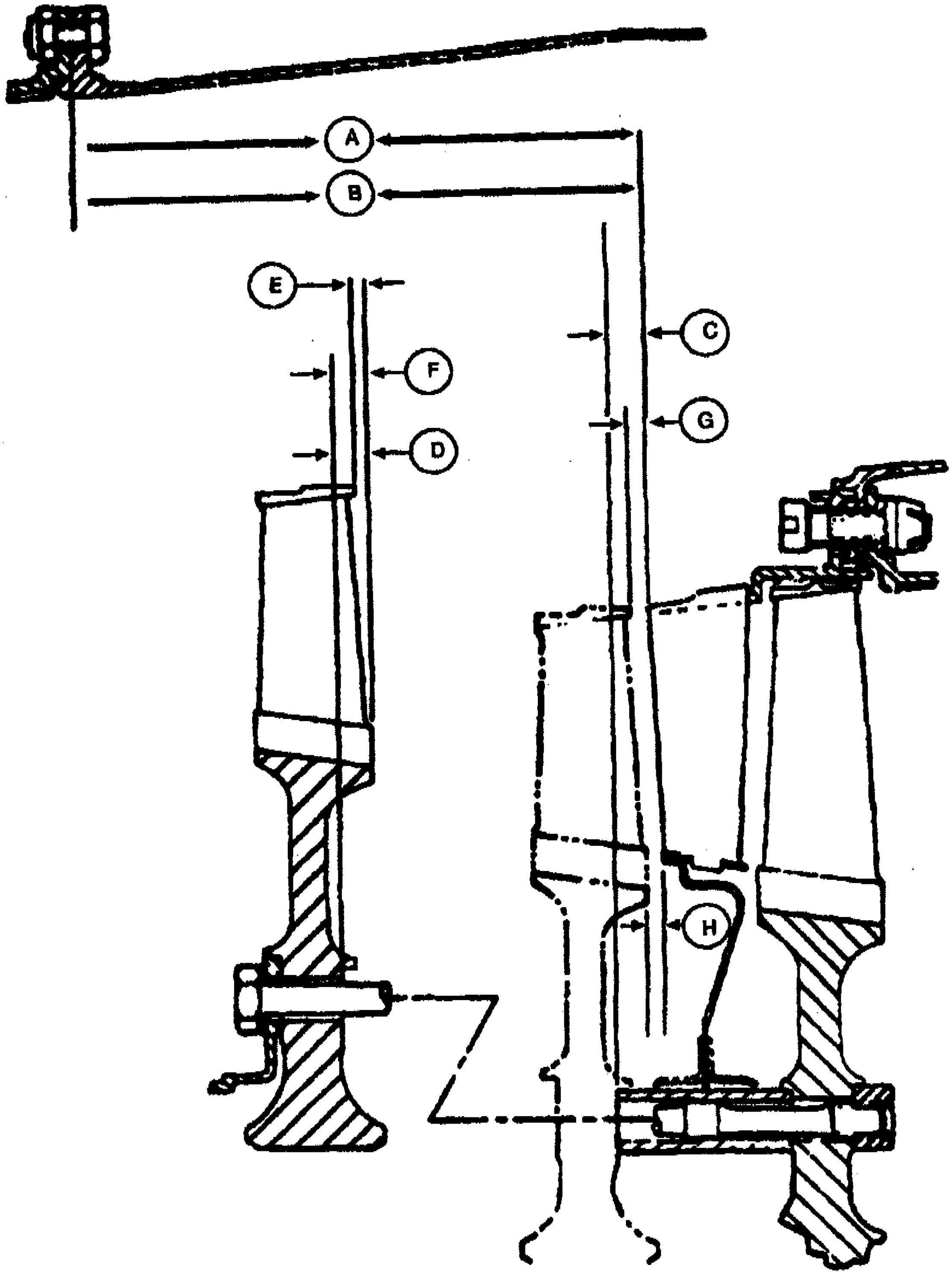


Figure 5-137. Determining Clearance Between First Stage Power Turbine Rotor and Second Stage Power Turbine Nozzle.

m. Remove bolts and washers installed in preceding step d. Install torque adjustment fixture (LTCT962) or equivalent into rear of exhaust diffuser assembly and engage tangs of locking plate assembly with three bolts. Place combustor turbine assembly with exhaust diffuser rear face down.

Table 5-67. Spacer Thickness.

PART NUMBER	THICKNESS
1-140-276-01	0.022 to 0.028 inch (0.056 to 0.071 cm)
1-140-276-02	0.029 to 0.035 inch (0.074 to 0.089 cm)
1-140-276-03	0.036 to 0.044 inch (0.091 to 0.112 cm)

n. Remove bolts and washers installed in preceding step j.

o. Install packing (46) over end of power turbine rotor shaft.

NOTE

Prior to installing first stage Power Turbine Rotor, measure forward land (diameter "B", figure 5-332) and rear land (diameter "C") at four positions. Record the largest diameters for reference during tip clearance check.

p. Position first stage power turbine rotor assembly (7) over end of power turbine rotor shaft. Locate RED "H" on disk face, 180 degrees from mark on outside diameter of power turbine splined shaft. Align bolt holes.

q. Apply anti-seize thread compound (item 47, table C–1) to bolt (4). Secure rotor with sealing flange (6), locking plates (5) and bolts (4). Tighten bolts to 140 to 160 pound-inches (25004 to 28576 gm cm) torque. Do not bend locking plate tabs at this time. Remove torque adjustment fixture (LTCT962).

NOTE

Ensure that locking plates do not cover the three small air-bleed holes in the sealing flange.

r. Establish clearance between first stage turbine nozzle and shrouded tip of first stage turbine rotor blades (dimension D, figure 5-138) as follows:

NOTE

On T53-L-703 engines, position a piece of 0.750 inch (1.905 cm) ground stock or parallel bar on combustion chamber bolt hole flange, under each end of locating bar, to prevent bar from contacting inner lip of combustion chamber liner.

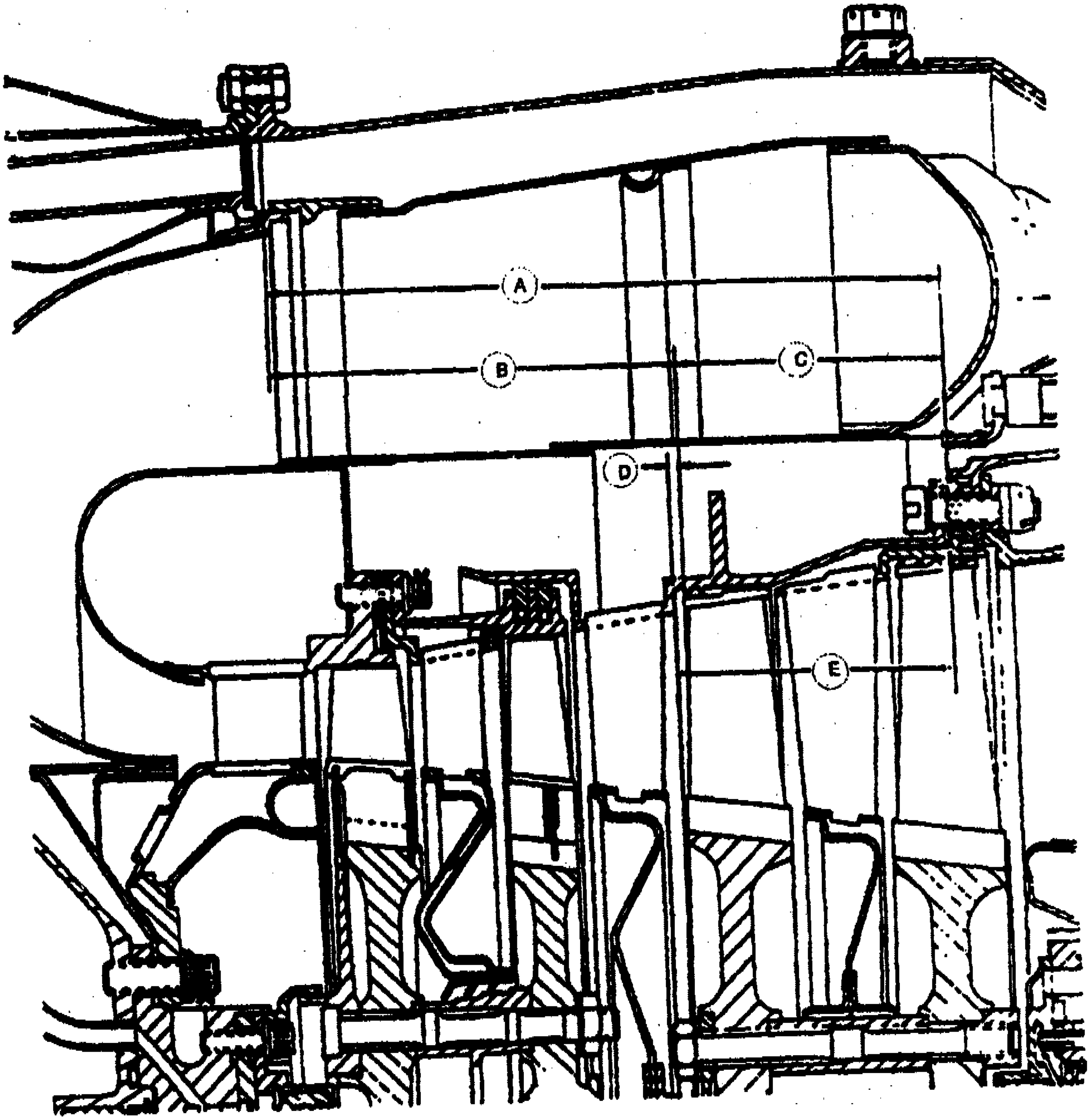


Figure 5-138. Determining Clearance Between First Stage Power Turbine Nozzle and Rotor Assemblies.

(1) Place locating bar (LTCT153) on flange of combustion chamber housing.

(2) Using depth micrometer, measure from bar to mounting ring (12, figure 5-135) installed on combustion chamber housing flange (dimension A, figure 5-138). Subtract distance from top of bar to flange.

(3) Using depth micrometer, measure from bar to shrouded tip of highest second stage power turbine blade (dimension B). Subtract distance from top of bar to flange.

(4) Subtract dimension B from dimension A. Result will be dimension C.

(5) Place first stage power turbine nozzle assembly (1, figure 5-135) on bench with forward face down. Position locating bar (LTCT 153) on aft flange of nozzle assembly.

(6) Using depth micrometer, measure from bar to outer shroud (dimension E, figure 5-138). Subtract bar thickness.

(7) Subtract dimension C from dimension E. Result will be dimension D.

(8) Dimension D must be within 0.063 inch (0.160 cm) minimum to 0.078 inch (0.198 cm) maximum. If desired dimension is not obtained, select required spacer (10, figure 5-135). (Refer to table 5-67).

s. Establish tip clearance between first stage power turbine rotor and first stage power turbine nozzle. (Refer to paragraph 5-336.) Remove four bolts (2), spacers (10) and three pins (9).

NOTE

In following step t, bolts (2) may not extend through retaining nuts on exhaust diffuser.

t. Position spacer (10), selected in preceding step (8), on mounting ring (12). Install four equally spaced bolts (2) through spacer (10), mounting ring (12), and into exhaust diffuser. Tighten bolts evenly and sufficiently to insure complete parts contact for checking clearances.

u. Position combustor turbine assembly at 45-degree angle and support it in this position.

v. Position dial indicator against a point just inboard of first stage power turbine blade roots. Rotate power turbine assembly and record runout. Runout shall be within 0.004 TIR.

w. Position dial indicator on upper step of sealing flange (6). Rotate power turbine rotor assembly and record runout. Runout shall be within 0.006 TIR.

x. If runouts are not within limits, loosen and re-torque bolts (4).

y. Reposition combustor turbine assembly on bench.

z. Bend tabs of locking plate (5) against bolts (4).

aa. Remove four bolts (2) and spacers. Ensure that proper spacer (10) selected in preceding step (8), is installed.

ab. On T53-L-703 engines, position thermocouple harness (21) around first stage power turbine nozzle assembly until 12 probes and harness lead are aligned. Secure probes with 12 plates (20) and bolts (19). Tighten, as required, and lockwire.

ac. Install first stage power turbine nozzle assembly (1) over power turbine rotor, and align bolt holes.

ad. Apply anti-seize thread compound (item 221, table C–1) to bolts (2).

ae. Secure first stage power turbine nozzle with bolts (2) and locking plates (3 and 23).

af. On T53-L-703 engines, insert harness assembly lead through exit hole in flanges of first stage power turbine nozzle assembly (1) and exhaust diffuser (43). Secure lead to flanges with two bolts (22). Tighten, as required, and lockwire.

ag. Rotate combustor turbine assembly to horizontal position with combustion chamber drain valve at 6-o'clock position. Rotate turbine rotor components and listen for audible rubbing between seal flanges of first stage power turbine nozzle assembly (1) and sealing flange (6). If no rubbing is evident, proceed with reassembly procedure. If rubbing is evident, remove turbine components and rework nozzle seal flanges, using a half-round file to obtain minimum clearances of 0.016 inch (0.041 cm). Maximum clearance shall be 0.025 inch (0.063 cm); however, 1/4 of seal circumference may have a maximum clearance of up to 0.030 inch (0.076 cm).

NOTE

Every effort should be made to center nozzle assembly at assembly in order to align flange diameters to prevent future rubs. This can be accomplished by shifting nozzle assembly on mounting bolt holes.

ah. Bend tabs of locking plates against bolts and stake securely.

CAUTION

Do not force liner into housing. Check and reposition studs if required.

The combustion chamber inner inside diameter must be 0.010 to 0.020 inch (0.025 to 0.051 cm) tight fit with the first stage gas producer nozzle deflector. This may be accomplished by part selection or by carefully bending tabs on liner inward.

NOTE

Ensure TOP index mark on liner aligns with 12-o'clock position on combustion chamber housing.

To ascertain proper hole alignment for fuel nozzles, alignment fixture (LTCT4174) should be inserted in combustion chamber assembly through the liner assembly.

ai. On T53-L-703 engines, install springs (3, figure 5-221) on six liner assembly studs and retain with petroleum (item 197 table C–1). Install liner assembly.

aj. On T53-L-13B, -15, -701, -701A engines, place spacer sleeves (2) on three studs (1-030-256-02) and retain with shortening compound (item 270 table C–1). Rotate all studs to face keyways inward and lower liner into housing. Ensure that stud keyways engage with tabs in housing.

ak. Install key washers (6) and nuts (5) on studs.

al. On T53-L-13B, -15, -701, -701A engines, first tighten nuts on the three studs without spacer sleeves (2) to 35 to 40 pound-inches (6251 to 7144 gm cm) torque; then tighten nuts on three studs with washers to 35 to 40 pound-inches (6251 to 7144 gm cm) torque. Bend tabs of washers (2) to secure nuts.

am. On T53-L-703 engines, tighten nuts (5) on studs to 20 to 30 pound-inches (3572 to 5358 gm cm) torque. Bend tabs of washers to secure nuts.

NOTE

Protrusion of stud threads beyond nut is not required.

an. Remove alignment fixture (LTCT4174).

NOTE

Steps "an" and "ao" are an alternate procedure for checking or replacing the power turbine tubes.

ao. Lightly coat tapered seats of two power turbine tubes (24, figure 5-135) with iron-blue pigment (item 172, table C–1). Install tubes into top and bottom bosses of the bearing housing and thread finger-tight. Remove tubes and inspect seats.

CAUTION

To prevent oil leaks, the power turbine tubes must seat perfectly. If seating is still not perfect, replace tubes and repeat preceding step "an". A perfect seat will be indicated by an unbroken ring on the tapered seat of the power turbine.

ap. If seating is imperfect, check tubes for clean connectors. Replace tubes and repeat preceding step "an". Install two power turbine tubes through exhaust diffuser struts and into the bearing housing bosses.

aq. The tube numbered 1 shall be installed at the 12 o'clock position; the tube numbered 2 shall be installed at the 6 o'clock position. Tighten each power turbine tube to 90 to 110 pound-inches (16074 to 19646 gm cm) torque and lockwire.

ar. Position combustor turbine assembly on workbench with exhaust diffuser side up.

as. To ascertain proper hole alignment for fuel nozzles, temporarily install fixture (LTCT4174) through combustion chamber housing. Remove fixture. Position fire shield (29 or 40) on combustion chamber housing rear flange and align pin in combustion chamber housing with hole in fire shields.

at. On T53-L-703 engines, push thermocouple harness lead through fire shield access hole.

au. Install seals (39) on fuel nozzles, using a suitable plastic cap. Carefully position two main fuel manifold assemblies (32) over fire shield and align atomizers with port holes. Install fuel manifold assemblies and secure with bolts (38). Lockwire. Tighten bolts as required. Ensure there is no contact between fuel manifold assemblies (32) and igniter boss assemblies on fire shield (29 or 40). Minor grinding is permitted on the igniter boss assemblies adjacent to the manifold assemblies to eliminate contact. Lockwire bolts.

av. Install strainer (31) into oil strainer housing adapter (30) at 12-o'clock position and tighten finger-tight. Install oil strainer housing adapter and packing (25), and tighten to 80 to 100 pound-inches (14288 to 17860 gm cm) torque and lockwire.

aw. Install connector (41) and packing (42) into power turbine tube at 6-o'clock position. Tighten connector to 80 to 100 pound-inches (14288 to 17860 gm cm) torque and lockwire.

ax. Position sealing gasket (14, figure 4-16) on starting fuel nozzle (13) and insert into main fuel manifold.

ay. Secure nozzles with screws (12). Tighten screws to 18 to 20 pound-inches (3215 to 3572 gm cm) torque and lockwire.

az. On T53-L-703 engines, insert lead of thermocouple harness (21, figure 5-135) through cover assembly (27); then install cover assembly onto fire shield (29). Secure cover assembly with two screws (28). Lockwire screws.

ba. Install flow divider and dump valve assembly. (Refer to paragraph 6-45.)

bb. Install diffuser support cone assembly (37) over fire shield and exhaust diffuser. Position starting fuel manifold bracket at 12 o'clock position.

bc. On T53-L-703 engines, install connector (34) on bracket on diffuser support cone assembly (37) and secure with screws (33) and nuts (36).

bd. On T53-L-703 engines, connect thermocouple lead assembly (2, figure 4-20) to connector (34, figure 5-135).

be. On T53-L-703 engines, open cover of connector (34) and install lead of thermocouple harness (21).

NOTE

Lead shall bottom in connector.

bf. On T53-L-703 engines, close connector cover and secure with two screws (35). Tighten screws, as required, and lockwire.

bg. Position V-band retainer and trunnion (15) on fire shield and support cone.

bh. Secure retainer and trunnion (15) with nut (18), spacers (17), and bolt (16).

NOTE

To ensure proper seating of the support cone on the combustion chamber, tap the V-band assembly starting at the middle and moving toward the bolts at the ends. Tighten the nuts. Repeat tapping and tightening until the nuts cannot be easily drawn up further.

bi. Tighten V-band assembly nuts to 200 pound-inches (35720 gm cm) torque. Seat clamps by tightening. Release torque to zero pound-inches torque. Retighten to 145 to 155 pound-inches (25897 to 27683 gm cm) torque. Ensure an equal gap, plus or minus 3/32 inch (0.238 cm); exists between V-band coupling assembly ends. Lockwire nuts and bolts.

CAUTION

Igniters that are installed shall not make contact with fixed parts of linear assembly.

bj. Apply anti-seize compound (item 47, table C-1) to threads of igniter plugs. Install igniters and spacers. If igniters make contact with fixed parts of liner, blend liner to eliminate contact. Blend to obtain a smooth contoured radius. Torque to 85 to 95 inch pounds (98 to 109 kg cm).

5-247. SECOND STAGE GAS PRODUCER ROTOR ASSEMBLY NOZZLE ASSEMBLY, AND CYLINDER.

5-248. DISASSEMBLY. Disassembly of second stage gas producer rotor assembly, nozzle assembly, and cylinder is not required.

5-249. CLEANING. Proceed as follows:

a. Clean all parts by dry cleaning solvent method. (Refer to SP No. 3002 in Appendix E.)

b. Clean second stage turbine nozzle by dry cleaning solvent method or hot-alkali-soak method No. 2. (Refer to SP Nos. 3002 or 3005 in Appendix E.)

5-250. INSPECTION. Perform specific inspections listed in table 5-68.

a. Coated second stage GP blades P/N 1-100-189-01/02/03 and coated first stage blades P/N 1-100-187-01/02/03:

(1) Coating:

(a) The only inspection required for coating is a visual examination for sulfidation. Sulfidation attack on second stage turbine blades will generally be first observed on the leading edge surface. The other area most prone to attack is the concave surface adjacent to and extending along the length of the trailing edge. Blades showing sulfidation attack on the above two surfaces may also show signs of attack on the concave surfaces just above the airfoil platform fillet.

(b) Sulfidation is unacceptable. Any evidence of a greenish tint, metal spalling or a glazed porcelain-like finish on the leading edge is cause for blade rejection. Loss of the protective quality of the coating will be signalled by the presence of a green color (nickel oxide) and generally by an observed reduction in blade surface smoothness. A blade with satisfactory coating will have a continuous smooth surface with light to dark gray colored oxide.

(2) Tip Rub: Tip rub is acceptable provided the limits in DMWR are maintained.

(3) Foreign Object Damage (F.O.D.): Smooth bottom nicks and dents on air foil surfaces from F.O.D. are acceptable provided they do not exceed 0.010 depth.

b. Inspection and Repair of Uncoated Blade:

NOTE

Sulfidation inspection does not apply to blade P/N 1-100-118-07.

(1) Dents and nicks (figure 5-139):

(a) Critical area (figure 5-139):

1 No repair allowed.

2 Smooth dents and nicks not exceeding 0.030 inch (0.076 cm) on longest side and 0.010 inch (0.025 cm) deep, are acceptable without rework. Any damage in excess of these limits is cause for blade replacement.

(b) Area A and B (figure 5-139).

1 Smooth dents or nicks not exceeding 0.190 inch (0.483 cm) on longest side and 0.015 inch (0.038 cm) deep are acceptable without repair.

2 Rework of nicks and dents shall be confined to smooth and blending of damage not exceeding 0.190 inch (0.483 cm) on longest side and 0.015 inch (0.038 cm) depth after repair.

Table 5-68. Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38				
-40	Ring	Visual	Severe damage.	Not allowed. Replace
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**				
-41	Second Stage Gas Producer Nozzle Assembly	Dimensional	Wear. (Refer to table 5-69 for limits.)	Replace nozzle assembly if limits are exceeded.
		Visual and SIE	Nicks, and dents on vane trailing edge (Refer to table 5-70 for limits).	Replace vanes. (Refer to paragraph 5-251.)
			Nicks, and dents on vane leading vane. (Refer to table 5-70 for limits).	Replace vanes. (Refer to paragraph 5-251.)
			Nicks, and dents on vane airfoil surface. (Refer to table 5-70 for limits)	Replace vanes. (Refer to paragraph 5-251.)
		Visual	Worn or damaged seals.	Repair or replace. (Refer to paragraph 5-251.)
			Clogged cooling air passages.	Clean. (Refer to SP No. 3002 or SP No. 3005 in Appendix E.)
		Visual and Fluorescent-Penetrant.	Cracks in leading edge of vane. (Refer to table 5-70 for limits.)	Replace vane if limits are exceeded. (Refer to paragraph 5-251.)
			Cracks in trailing edge of vane. (Refer to table 5-70 for limits.)	Replace vanes if limits are exceeded. (Refer to paragraph 5-251.)
			Cracks in vane to shroud brazement (1-120-000-06), figure 5-145 for limits.)	Replace vanes if limits are exceeded. (Refer to paragraph 5-251.)
		Visual and SIE	Burns on vane leading edge (1-120-000-06). (Refer to table 5-70 for limits.)	Replace vanes if limits are exceeded. (Refer to paragraph 5-251.)
			Burns on vane trailing edge (1-120-000-06). (Refer to table 5-70 for limits.)	Replace vanes if limits are exceeded. Refer to paragraph 5-251.)
		Visual and Fluorescent-Penetrant.	Cracks in inner and outer shroud brazements (1-120-000-06). (Refer to table 5-70 for limits.)	Repair vanes if limits are exceeded. (Refer to paragraph 5-251.)

Table 5-68. Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38 -41 (cont)	Second Stage Gas Producer Nozzle Assembly (Cont)	Visual	Evidence of spalling. (Loss of surface coating on vanes) (1-120-000-14 and 1-120-050-03).	Repair if limits are not exceeded. (Refer to paragraph 5-251).
		Visual and Fluorescent-Penetrant.	Cracks in outer shroud parent metal (1-120-000-06.) Refer to table 5-70 for limits.)	Repair if limits are exceeded. (Refer to paragraph 5-251.)
			Cracked or mutilated outer shroud tangs.	None allowed Replace.
		Visual	Nicks, burrs, or rolled effect on tangs.	Repair. (Refer to paragraph 5-251.)
			Slightly bent tangs.	Repair. (Refer to paragraph 5-251.)
		Visual and Fluorescent Penetrant	Cracks through inner shroud through inner and aft seal supports. (Refer to table 5-70 for limits.)	Repair if limits are exceeded. (Refer to paragraph 5-251.)
		Visual and SIE	Out-of-roundness and rubs on seal land inner diameters. (Refer to table 5-70 for limits.)	Replace seals if limits are exceeded. (Refer to paragraph 5-251.)
			Damage or oversized seals of nozzle assembly with retaining rings installed (1-120-000-06 and 1-120-000-14).	Repair. (Refer to paragraph 5-251.)
			Damage vanes or clogged vanes that cannot be reopened, nozzle assembly with retaining rings installed (1-120-000-06 and 1-120-000-14).	Repair. (Refer to paragraph 5-251.)
			Metal fallout of inner shroud nozzle assembly with retaining rings installed (1-120-000-06).	Repair. (Refer to paragraph 5-251.)

Table 5-68. Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38 -41 (Cont)	Second Stage Gas Producer Nozzle Assembly (Cont)	Visual	Erosion on vanes (1-120-000-06). (Refer to table 5-70 for limits.)	Replace vanes exceeding limits. (Refer to paragraph 5-251.)
			Metalization of vane (1-120-000-06).	Repair. (Refer to paragraph 5-251.)
			Voids in inner shroud to forward and aft support brazements (1-120-000-06). (Refer to table 5-70 for limits.)	Repair if limits are exceeded. (Refer to paragraph 5-251.)
			Burns on vanes 1-120-000-14 and 1-120-050-03). (Refer to table 5-70 for limits.)	Replace vanes if limits are exceeded. (Refer to paragraph 5-251.)
		Visual and Fluorescent-Penetrant.	Cracks in outer shroud (1-120-000-14 and 1-120-050-03). (Refer to table 5-70 for limits.)	Replace nozzle assembly if limits are exceeded.
			Cracks in inner shroud (1-120-000-14 and 1-120-050-03). (Refer to table 5-70 for limits.)	Replace nozzle assembly if limits are exceeded.
			Cracks in forward and aft supports (1-120-000-14 and 1-120-050-03). (Refer to table 5-70 for limits.)	Replace supports if limits are exceeded. (Refer to paragraph 5-251.)
		Airflow Inspect.	Effective Flow Area (EFA) per paragraph 5-250 or Geometric Flow Area (GFA) per table 5-71.	Adjust or replace.
			Cracks in inner shroud to seal support joint. (Refer to table 5-70 for limits.)	Replace nozzle assembly. If limits are exceeded.
	Fiber Metal Seal	Visual	Rubs to base metal.	Replace seal.
			Breakout between 3 adjacent grooves.	Replace seal.
			Breakout between edge and 2 grooves.	Replace seal.
			Separating of braze joint.	Replace seal.
			Cracks in back-up ring.	Replace seal.

Table 5-68. Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38				
	WARNING FLIGHT SAFETY PART **Fluorescent penetrant inspection of the following part is flight safety critical.**			
-42	Spacer (T53-L-13B, -15, -701A)	Visual and Fluorescent-Penetrant.	Cracks.	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-69.)	Repair or replace if limits are exceeded. (Refer to paragraph 5-251.)
		SIE and Visual	Rubs and scoring on lands beyond 0.0020 inch (0.0051 cm) in depth. (Refer to table 5-69.)	Repair or replace if limits cannot be met. (Refer to paragraph 5-251.)
-44	Seal Ring	Visual	Nicks and burrs.	Repair. (Refer to SP No. 5000 in Appendix E.)
		SIE and Dye-Penetrant	Cracks.	Not allowed. Replace.
		Dimensional.	Wear. (Refer to table 5-69.)	Replace if limits are not met.
	WARNING FLIGHT SAFETY PART **Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.**			
-45	Second Stage Gas Producer Rotor Assembly	Visual	Unseated sealing plates.	Seat sealing plates. (Refer to paragraph 5-236.)
			Loose or improperly staked blades.	Repair. (Refer to paragraphs 5-250 and 5-251.)
			Blade flushness beyond 0.012 inch (0.030 cm) of disk face.	Repair. (Refer to paragraph 5-251.)
		Visual and SIE	Erosion or tip rubs on forward and aft diameters (Refer to table 5-70 for limits).	Replace rotor assembly if limits are not met.
		Visual and Fluorescent-Penetrant.	Cracks in disk and blades following over temperature condition.	Not allowed. Replace rotor assembly.
		Visual	Unusual heat discoloration of disk and burning of blades following over-temperature condition.	Not allowed. Replace rotor assembly.

Table 5-68. Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38 -45 (Cont)	Second Stage Gas Producer Rotor Assembly (Cont)	Visual and SIE	Blade growth. (Refer to table 5-69 for limits.)	Replace blades. (Refer to paragraph 5-317.) Blade sets (two blades located 180° apart) which are beyond acceptable limits (table 5-69) must be removed from assembly and scrapped. **CAUTION** Grinding is not allowed to bring used blades back into dimension when blade growth exceeds limits. Replace Blades.
		Dimensional	Wear. (Refer to table 5-69 for limits.)	Replace rotor assembly if limits are not met.
		Visual and SIE	Dents and nicks on sides of blades (Refer to figure 5-139 for limits.)	Replace blades exceeding limit. (Refer to paragraph 5-317.)
			Dents and nicks on leading and trailing edges of blades. (Refer to figure 5-139.)	Replace blades exceeding limit. (Refer to paragraph 5-317.)
			Rubs on tips of blades. (Refer to figure 5-139.)	Repair or replace blades. (Refer to paragraph 5-251.)
		Visual and Fluorescent Penetrant.	Cracked blades.	Not allowed. Replace blades. (Refer to paragraph 5-317.)
		Visual	Blade sulfidation.	Not allowed. Replace blades.
		Visual and Fluorescent Penetrant.	Cracks in disk.	Not allowed. Replace disk. (Refer to paragraph 5-251.)
		Dimensional	Disk for wear and fits. (Refer to table 5-69 for limits)	Repair or replace if limits are not met. (Refer to paragraph 5-251.)
		Visual	Nicks, burrs, and raised metal on outer edges of locking pin holes of disk. (Refer to table 5-70.)	Replace disk if limits cannot be met. (Refer to paragraph 5-251.)

Table 5-68. Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38				
	WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection to ensure that nut is crack-free is flight safety critical.**			
-47	Nut	Visual and Fluorescent Penetrant	Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
		Visual	Cracks	Not allowed. Replace nut.
-49	Seal Ring	Visual	Nicks and burrs.	Repair. (Refer to SP No. 5000 in Appendix E.)
		Visual and Dye Penetrant	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-69 for limits.)	Replace if limits are not met.
-50	Retaining Plate	Visual	Cracks	Not allowed. Replace.
-51	Pin	Visual	Cracks	Not allowed. Replace.
-52	Second Stage Gas Producer Cylinder	Visual	Nicks and burrs.	Repair. (Refer to paragraph 5-251.)
		Visual and Fluorescent Penetrant	Cracks	Crack at bolt hole at the thin wall area, emanating outward to the outside diameter is acceptable. Only one hole is allowed to be cracked. No other cracks allowed.
		Dimensional	Wear. (Refer to table 5-69 for limits.)	Replace if limits are not met.
		Visual	Worn ID surface dimensions. (Refer to table 5-69.)	Repair. (Refer to paragraph 5-251).
			Loss of protective surface finish (electrofilm). See figure 5-166.)	Repair. (Refer to SP No. 6010 in Appendix E.)
		Visual and SIE	Rubbing on inside diameter (12.194 to 12.197 inches (30.973 to 30.980 cm). (Refer to table 5-69 for limits).	Repair if limits are exceeded. (Refer to paragraph 5-251.)
		Visual	Damaged threads.	Not allowed. Replace.

Table 5-68. Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38				
	WARNING **FLIGHT SAFETY PART** **Verification that there is no loss of silver plate on ID threads and forward face is flight safety critical.**			
	WARNING **FLIGHT SAFETY PART** **Magnetic particle inspection to ensure that the following part is crack-free is flight safety critical.**			
-53	Nut	Visual	Nicks, burrs, and scratches.	Repair. (Refer to paragraph 5-251.)
			Damaged threads.	Repair. (Refer to paragraph 5-251.)
		Visual and magnetic particle. (Refer to table 5-74.)	Cracks.	Not allowed. Replace.
4-38 -55	Rear Cone	Visual and Fluorescent Penetrant.	Cracks.	Not allowed. Replace.
	WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.**			
-56	Spacer (T53-L-703)	Visual and Fluorescent-Penetrant.	Cracks.	Not allowed. Replace.
		Dimensional	Wear (refer to table 5-69).	Replace if limits are not met.
	WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.**			
-57	Sealing disk (T53-L-703)	Visual and Fluorescent-Penetrant.	Cracks.	Not allowed Replace.
		Visual	Nick, dents, burrs, and scratches.	Blend-repair. (Refer to SP No. 5000 in Appendix E.)
		Dimensional	Wear (refer to table 5-69).	Replace if limits are not met.

(c) Area C (Figure 5-139).

1 Leading edge: Dents or nicks in an area tapering chord-wise from 0.000 at the critical area to 0.025 inch (0.064 cm) at the outboard extremity of area "C". Depth of blend repairs will be proportional to the spanwise location; i.e., 0.000 at critical area 0.012 inch (0.030 cm) at midpoint, 0.025 inch (0.064 cm) at the extremity of "C" with a maximum of 0.100 inch (0.254 cm) in length (per fig 5-139). No more than two repair blends per edge are allowed in any one area.

2 Trailing edge: Dents or nicks in an area tapering chordwise from 0.000 at the critical area to 0.050 inch (0.127 cm) at the outboard extremity of area "C". Depth of blend repair will be proportional to the spanwise location; i.e. 0.000 at critical area, 0.025 inch (0.064 cm) at the midpoint, and 0.050 inch (0.127 cm) at the extremity of "C", with a maximum of 0.200 inch (0.508 cm) in length. No more than two repair blends per edge are allowed in any one area.

3 Sides: Dents or nicks not exceeding 0.300 inch (0.762 cm) on the longest side and 0.015 inch (0.038 cm) deep after repair are acceptable provided the original material thickness is not reduced by more than 20 percent.

(d) Area D (Figure 5-139).

1 Leading edge: Dents or nicks in an area tapering chordwise from 0.024 inch (0.064 cm) at area "C" to 0.050 inch (0.127 cm) at the blade tip. Blend repair depth will be proportional to the spanwise location; i.e. 0.025 inch (0.064 cm) at area "C" 0.037 inch (0.094 cm) at the midpoint and 0.05 inch (0.127cm) at the tip (Figure 5-139), with a maximum length of 0.375 inch (0.953cm). No more than two blend repairs are allowable in any one area.

2 Trailing edge: Nicks or dents in an area tapering chordwise from 0.050 inch (0.127 cm) at area "C" to 0.100 inch (0.254 cm) at the blade tip. Depth of blend repair shall be proportional to the spanwise location; 0.050 inch (0.127 cm) at area "C" 0.075 inch (0.191 cm) at the midpoint and 0.100 inch (0.254 cm) at the tip (Figure 5-139), with a maximum length of 0.375 inch (0.953 cm). No more than two blend repairs are allowable in any one area.

Table 5-69. Dimensional Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM
			MIN	MAX	MIN	MAX	MIN	MAX	
	4-38								5-141
Second Stage Gas Producer	41	OD	12.340 (31.344)	12.360 (31.394)					A, E
Nozzle Assembly (1-120-000-06) and 1-120-000-14)		ID	5.529 (14.044)	5.534 (14.056)	5.521 (14.023)				B*, F*
		ID	5.609 (14.247)	5.614 (14.260)					C*, G*
		ID	5.689 (14.450)	5.694 (14.463)	5.688 (14.448)				D*, H*
Second Stage Gas Producer Nozzle Assembly (1-020-050-03)	41	OD	12.34 0 (31.344)	12.360 (31.394)					I
		ID	5.815 (14.770)	5.820 (14.783)					J
WARNING **FLIGHT SAFETY PART** **Inspection of the 5.5010-5.5015 and 4.4990-4.4995 dimensions is flight safety critical.**									
Spacer (T53-L-13B, -15, -701, 701A)	42	OD	5.659 (14.374)	5.661 (14.379)					K
		OD	5.579 (14.171)	5.581 (14.176)					L
		OD	5.5010 (13.9725)	5.5015 (13.9738)					M
		ID	4.4990 (11.4275)	4.4995 (11.4287)					N
Seal Ring	44	OD	12.420 (31.547)	12.440 (31.598)					O

Table 5-69. Dimensional Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM
			MIN	MAX	MIN	MAX	MIN	MAX	
	4-38								
Second Stage Gas Producer Rotor Assembly	45	OD AFT	12.113 (30.767)	12.122 (30.790)	12.103 (30.742)	12.128 (30.805)			P
	45	OD FWD	12.104 (30.744)	12.122 (30.790)	12.094 (30.719)	12.128 (30.805)			Q
WARNING **FLIGHT SAFETY PART** **Inspection of the 4.5000-4.5010 and 4.4995-4.5010 dimensions is flight safety critical.**									
		OD	4.5000 (11.43)	4.5010 (11.4325)	4.4995** (11.4287)	4.5010 (11.4325)			R
		ID	2.697 (6.850)	2.698 (6.850)	2.697 (6.850)	2.701 (6.861)			S
Q Point ***			4.104 (10.4224)	4.109 (10.437)		4.110 (10.439)			5-142
	4-38								5-141 T
Seal Ring	-49	OD	13.240 (33.630)	13.260 (33.680)					U
Second Stage	-52	ID	12.428 (31.567)	12.430 (31.572)					V
Gas Producer Cylinder		ID	12.194 (30.973)	12.197 (30.980)	12.194 (30.973)	12.215 (31.026)			
Second Stage Gas Producer Rotor Assembly (T53-L-13B, -15, -701A, -701)	-45	OD	4.5000 (11.4300)	4.5010 (11.4325)	4.4995* (11.4287)	4.5010 (11.4325)	0.0005T (0.0013)	0.0015T (0.0038)	R

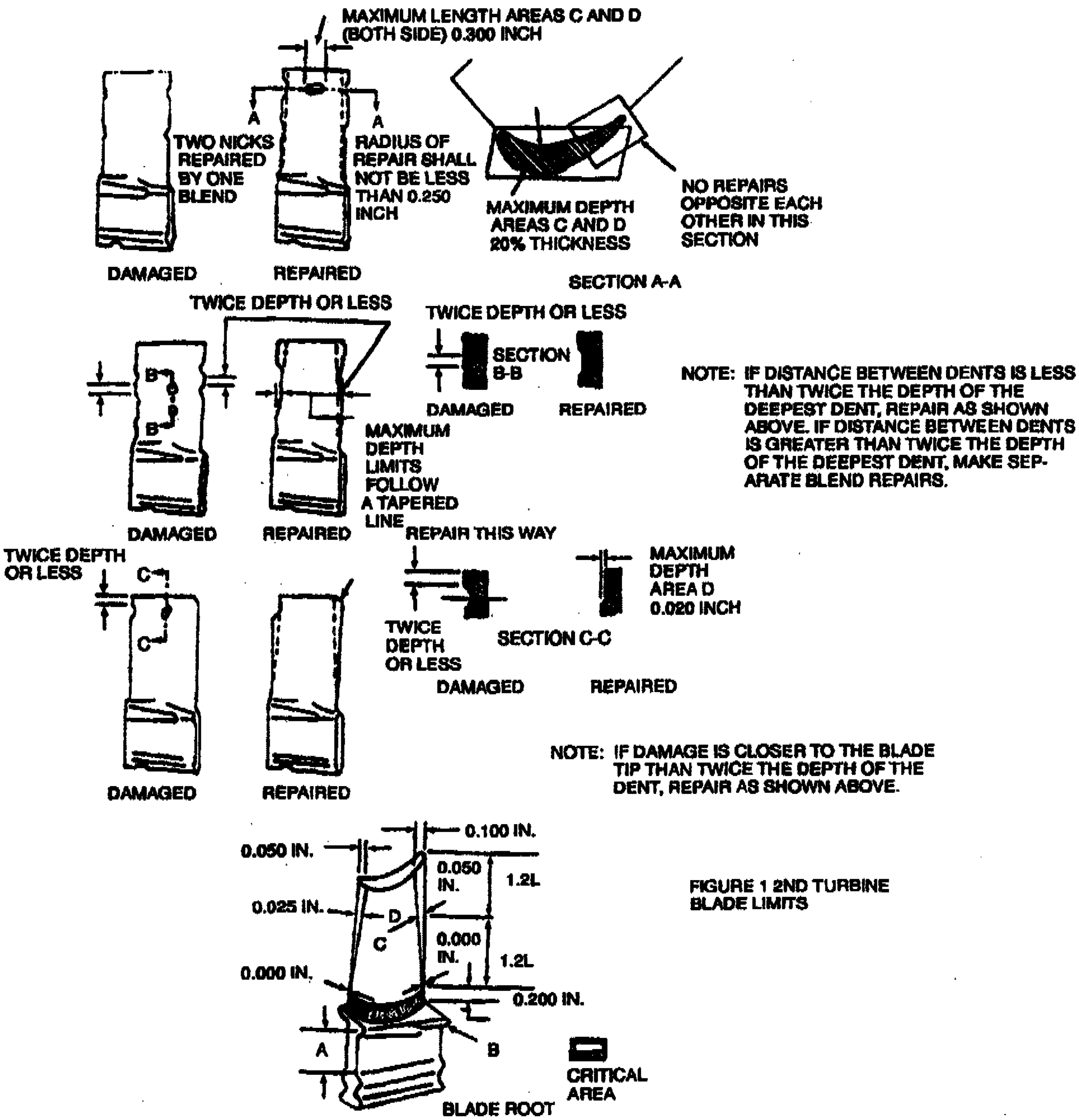
Table 5-69. Dimensional Inspection of Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS MIN	BLUEPRINT DIMENSIONS MAX	OVERHAUL SERVICE DIMENSIONS MIN	OVERHAUL SERVICE DIMENSIONS MAX	OVERHAUL SERVICE FITS MIN	OVERHAUL SERVICE FITS MAX	REFER TO FIG. & DIM
	4-38								
To Spacer	-42	ID	4.4990 (11.4275)	4.4995 (11.4287)					N
Second Stage Gas Producer Rotor Assembly (T53-L-703) Disc to Spacer	-45	OD	4.5000 (11.4300)	4.5010 (11.4325)	4.4995* (11.4287)	4.5010 (11.4325)	0.0005T (0.0013)	0.0020T (0.0051)	R
WARNING **FLIGHT SAFETY PART** **Inspection of 4.4985-4.4995 and 5.501-5.502 dimensions is flight safety critical.**									
Spacer (T53-L-703)	-56	ID	4.4985	4.4995					W
		OD	5.501	5.502					X
WARNING **FLIGHT SAFETY PART** **Inspection of 5.4700-5.4705 dimensions is flight safety critical.**									
Second GP Sealing Disk	-57	ID	5.4700	5.4705	5.4700	5.4705			Y

* Fit as an assembly.

** Diameter has tendency to yield undersize.

*** Q Point check need only be performed every 45 degrees. Remove blades, as necessary, as close as possible to the 45 degree interval to take measurements.



WARNING

FLIGHT SAFETY PART
VERIFICATION THAT CRITICAL AREA MEETS REQUIREMENT IS FLIGHT SAFETY CRITICAL.

Figure 5-139. Second Stage Turbine Blade Limits.

Table 5-70. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Nicks and Dents on Vane Leading Edge	5-143 to 5-144	a. Leading edge nicks and dents are acceptable with blend-repair to a depth of 1/16 inch (0.159 cm) and a length of 3/32 inch (0.238 cm) provided no greater than three defects per vane are evident.
	5-143 to 5-144	b. Separation shall be at least twice the length of the longest defect.
	5-143 to 5-144	c. Smooth dents within limits are acceptable without repair. Blend burrs to remove surface projections as outlined in SP No. 5000 in Appendix E.
	5-143 to 5-144	d. If limits are exceeded, replace vanes as outlined in paragraph 5-251.
Nicks and Dents on Vane Trailing Edge	5-143 to 5-144	a. Trailing edge nicks and dents are acceptable with blend-repair to a depth of 3/32 inch (0.238 cm) and length of 3/16 inch (0.476 cm) provided no greater than two defects are evident.
	5-143 to 5-144	b. Separation shall be at least twice the length of the longest defect.
		c. Blend-repair burrs to remove surface projections as outlined in SP No. 5000 in Appendix E.
		d. If limits are exceeded, replace vane as outlined in paragraph 5-251.
Nicks and Dents on Vane Airfoil Surface	5-143 and 5-144	a. Random airfoil surface nicks and dents are acceptable to a depth of 0.030 inch (0.076 cm) on all vanes.
		b. Blend-repair to remove surface projections as outlined in paragraph 5-251.
		c. If limits are exceeded, replace vane as outlined in paragraph 5-251.
Cracks in Vane Leading Edge	5-143 and 5-144	a. Any number of cracks in vane leading edge up to 1/16 inch (0.159 cm) in length.
		b. If limits are exceeded, replace vane as outlined in paragraph 5-251.
Cracks in Vane Trailing Edge	5-143 and 5-144	a. Any number of cracks in vane trailing edge up to 0.100 inch (0.254 cm) maximum length.
		b. If limits are exceeded, replace vane as outlined in paragraph 5-251.

Table 5-70. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Cracks In Inner and Outer Shroud Brazements 1-120-000-06)	5-145	Cracks are acceptable on all brazements up to 1/2 inch (1.27 cm) in length (cumulative) in each vane. If limits are exceeded, repair as outlined in paragraph 5-251.
Cracks in Outer Shroud Parent Metal (1-120-000-06)	5-145	a. Cracks up to 3/16 inch (0.476 cm) maximum of length on a maximum of 20 vanes are acceptable. b. Cracks into seal ring up to 1/4 inch (0.635 cm) maximum length and no more than two cracks, separated by at least 20 vanes, are acceptable. c. Vane to vane or circumferential cracks are not acceptable. d. Converging cracks are not acceptable. e. Cracks which could result in material fallout are not acceptable. f. If limits are exceeded, repair as outlined in paragraph 5-251.
Voids in Inner Shroud To Forward Aft Support Brazement (1-120-000-06)	5-143	a. Voids are acceptable provided no greater than 20 percent of the total circumference is affected. b. If limits are exceeded, repair as outlined in paragraph 5-251.
Cracks Through Inner Shroud Extending into Forward and Aft Seal Supports	5-143 and 5-144	a. Four such cracks are acceptable provided length into seal support does not propagate into the flat section of the support and a minimum of 5 vanes separate defects.
	5-143 and 5-144	b. If limits are exceeded, repair as outlined in paragraph 5-251.
Burns on Leading Edge of Vanes (1-120-000-06)	5-143	a. Burns not exceeding 1/16 inch by 3/8 inch (0.159 to 0.952 cm) on a maximum of 5 vanes are acceptable. b. If limits are exceeded, replace vanes as outlined in paragraph 5-251.
Burns on Trailing Edge of Vanes (1-120-000-06)	5-143	a. Burns not exceeding 1/8 by 1/4 inch (0.318 to 0.635 cm) on a maximum of five vanes are acceptable. b. If limits are exceeded, replace vanes as outlined in paragraph 5-251.

Table 5-70. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Erosion on Nozzle Vanes (1-120-000-06)	5-146	a. A thinning out of the area slightly aft of vane leading edge (convex side) adjacent to the outer shroud is acceptable, provided the trailing edge does not exhibit any loss of material due to erosion. (See figure 5-146.) Replace vanes that exceed limits. b. Nozzle vanes that exhibit thinning out of trailing edge due to erosion, and have been subjected to burring (overtemperature), shall be replaced. **NOTE** This condition can easily be detected by exerting thumb pressure on trailing edge areas and noting if there is any metal depression or break out. Due to the nature of erosion patterns, vane replacement will probably be confined to particular quadrants. c. Thinning out on vane trailing edge without burning is acceptable. d. Loss of material on vane trailing edge is unacceptable. Replace vane.
Burns		Burns (loss of material) is not allowed. Surface discoloration (oxidation) is acceptable.
Out-of-Roundness and Rubs on Nozzle Seal Land Diameters	5-143 and 5-144	a. On T53-L-13B, -15, -701, -701A engines, perform a diametric dimensional inspection of seal land inner diameters, taking two measurements, 90° apart. The following maximum overhaul limits shall be adhered to: Forward 5.540 inches (14.072 cm) Mid Seal 5.620 inches (14.275 cm) Aft Seal 5.700 inches (14.478 cm) **NOTE** On T53-L-703 engines, the maximum overhaul limit for nozzle assembly shall be 5.815 inches (14.770 cm). b. Inspect seal lands for visible rubs. If rubs are evident, perform an out-of-roundness check. A value of 0.020 inch (0.051 cm) or less is acceptable.

Table 5-70. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Out-of-Roundness and Rubs on Nozzle Seal Land Diameters (Cont)	5-143 and 5-144 (Cont)	**NOTE** Minimum seal flange to spacer clearance shall be adhered to in accordance with step 6-10h, paragraph 6-10. Maximum diameters in rubbed area are allowed to exceed above limits provided 0.020 inch (0.051 cm) or less out-of-roundness is maintained. c. If above limits are exceeded on gas producer nozzle, 1-200-000-06, replace seals as outlined in paragraph 5-251, step 5-251b. On T53-L-703 engines, if limit is exceeded on gas producer nozzle (1-120-050-03), replace seals as outlined in paragraph 5-251, step e. If above limits are exceeded on gas producer nozzle (1-120-000-14), replace seal as outlined in paragraph 5-251, step e.
Cracks in Outer Shroud (1-120-000-14 & 1-120-050-03)	5-147	a. Any number of axial cracks originating at vane leading edge areas and progressing to edge of shroud are acceptable. Seven of these are allowed to continue up forward face to flange radius. b. Any number of cracks at vane trailing edge/shroud areas are acceptable up to 3/32 inch (0.238 cm) in length. c. Circumferential, converging, and vane-to-vane cracking is not allowed. Cracks in outer shroud locations other than noted are not acceptable. d. If limits are exceeded, replace nozzle.
Cracks in Inner Shroud (1-120-000-14 & 1-120-050-03)	5-147	a. Any number of cracks up to 3/32 inch (0.238 cm) in length at vane trailing edge/shroud radius areas are acceptable. No cracking is allowed in other areas of inner shroud. b. If limits are exceeded, replace nozzle. **NOTE** Inspect each support individually with respect to crack separation.
Cracks in Forward and Aft Supports (1-120-000-14 & 1-120-050-03)	5-141	a. A maximum of four radial cracks emanating from support to inner shroud junctions are acceptable in both supports, if crack does not propagate into flat section of support and a minimum of 5 vanes separate defects.

Table 5-70. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Cracks in Forward and Aft Supports (1-120-000-14 & 1-120-050-03) (Cont)	5-141 (Cont)	b. Inspect FWD to AFT support spot welds for cracks. If cracks are found, weld repair as outlined in paragraph 5-251. c. If limits are exceeded, replace supports as outlined in paragraph 5-251, step d or i.
Cracks in Inner Shroud to Seal Support Joint		Cracks up to 1/2 inch (1.27 cm) in length located in braze deposits, as viewed from the nozzle rear, are acceptable provided joint passes all other inspections.
Pilot Diameter Exceeds Maximum Overhaul Dimensional Limits	5-141	a. Measure bore diameter only if pilot minimum diameter exceed overhaul limits. (Refer to figure 5-146). b. If bore diameter exceeds maximum overhaul limits in table 5-69, replace disk assembly. c. Disks that exhibit acceptable bore diameters shall have a Q point (Ball root) dimensional check performed. (Refer to table 5-69.) (See figure 5-142). d. Disks that indicate Q point equal to or less than maximum overhaul dimensions are acceptable for repair. If tip diameter exceeds overhaul limits, tip-grind or reblade as outlined in paragraph 5-252. If pilot diameter exceeds overhaul limits, repair as outlined in paragraph 5-251. e. Replace disks that fail to meet requirements of the Q point dimensional inspection.
Rubbing on Cylinder Inside Diameter (12.194 to 12.197 inches)		Inspect cylinder inside diameter 12.194 to 12.197 inch (30.973 to 20.980 cm) diameter for evidence of rubbing. If part is not rubbed, dimensional inspection of above diameter is not required unless designated by the using authority. Tip clearance between second stage gas producer cylinder at final assembly (refer to paragraph 6-11) shall be as follows: a. If tip clearance is under minimum, machine the cylinder inside diameter to 12.194 to 12.208 inch (30.973 - 31.008 cm) dimension. (Refer to paragraph 5-251).

Table 5-70. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly and Cylinder Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Rubbing Cylinder Inside Diameter (12.194 to 12.197 inches)		b. If tip clearance is over maximum, metal-spray the cylinder inside diameter. (Refer to paragraph 5-251). c. If cylinder is rubbed, measure cylinder. If measurement is not within 12.194 to 12.208 inch (30.973 to 31.008 cm) overhaul limit, metal-spray the inside diameter. (Refer to paragraph 5-251).
Leading and Trailing Edges Of Second Stage Gas Producer Nozzle Vanes For Missing Parent Material Due to Blending of Casting Defects During Manufacture (1-120-000-14 and 1-120-050-03)		a. A maximum of three missing parent material areas are acceptable. b. A maximum of 10 missing parent material areas on a nozzle assembly are acceptable. c. Depth of missing material shall not exceed 1/16 inch (0.159 cm) on leading edge of vanes and 0.220 inch (0.559 cm) on trailing edge of vanes, as measure from the unaffected portions. **NOTE** Any amount of leading edge blends 0.020 inch (0.051 cm) or less and trailing edge blends 0.030 inch (0.076 cm) or less are acceptable in addition to the limits given in step a through c. d. If above limits are exceeded, replace vanes as outlined in paragraph 5-251. **NOTE** Do not apply burn-area limits to the missing parent material described above.
Forward and Aft Diameter of Second Stage Gas Producer Rotor Erosion or Tip Rubs		Inspect forward and aft diameter for erosion or tip rubs. Erosion or tip rubs are acceptable, provided minimum overhaul service limits (table 5-69) are met. Blend-repair blades to remove burrs in rubbed areas. **NOTE** Remove material only to the extent of eliminating rolled over material.
Nicks, Burrs, and Raised Metal in Locking Pin Holes		Nicks, burrs, and raised metal are acceptable, provided they can be blend-repaired to parent metal. Blend-repair using carborundum stone or equivalent.

3 Blade tips: Dents or nicks not exceeding 0.025 inch (0.064 cm) on longest side and 0.125 inch from the top after repair are acceptable. No more than two repair blends per tip surface. (Repair-blending on both tip surfaces on both sides of a blade counts as two blends.) Blade tip deformation up to 0.050 inch (0.127 cm) displacement and 0.100 inch (0.254 cm) in chordal width and/or radial length is permissible.

4 Sides: Dents or nicks not exceeding 0.300 inch (0.762 cm) on the longest side and 0.015 inch (0.038 cm) deep after repair are acceptable provided the original material thickness is not reduced by more than 20 percent. No more than 4 dents or nicks on either the concave or convex sides, which require blending, are allowable.

(2) Cracks: No cracks allowed.

(3) Burning: None allowed.

NOTE

Burning is indicated by melting or loss of metal. Evidence of burning usually denotes that other damage exists to the assembly.

(4) Bending or Distortion: None allowed.

c. "Q" POINT INSPECTION: The "Q" point position can be determined by either of two methods: Set up turbine disk with radial line vertical and measure the "Q" point vertical dimension to center line; or set up in turbine disk bore and measure "Q" point radius. The dimensional requirements for both methods of measurement are provided in figure 5-142.

CAUTION

If any of the four turbines indicate a growth beyond acceptable limits in the pilot and "Q" point dimensions, over-temperature is suspected. Check remaining three rotors closely. If either gas producer turbine indicates a growth beyond acceptable limits in the pilot and bore dimensions, overspeed is suspected. Check mating gas producer rotor closely.

d. Airflow inspect second stage gas producer nozzles 1-120-000-14 and 1-120-050-03 using Fleming AF36 airflow machine adapter and deflector, or equivalent, and flow test instructions. Preferable effective flow area measurement should be 18.35 to 18.85 square inches with a water level to 5.0 inch. Cross out any previous EFAs and vibroetch the measured EFA in the vicinity of the original GFA marking (or serial number if no GFA marked).

NOTE

Q point defines the point of intersection between centerline of broach slots and centerline of 0.081 inch diameter gage rolls along the face of disc. (See figure 5-142)

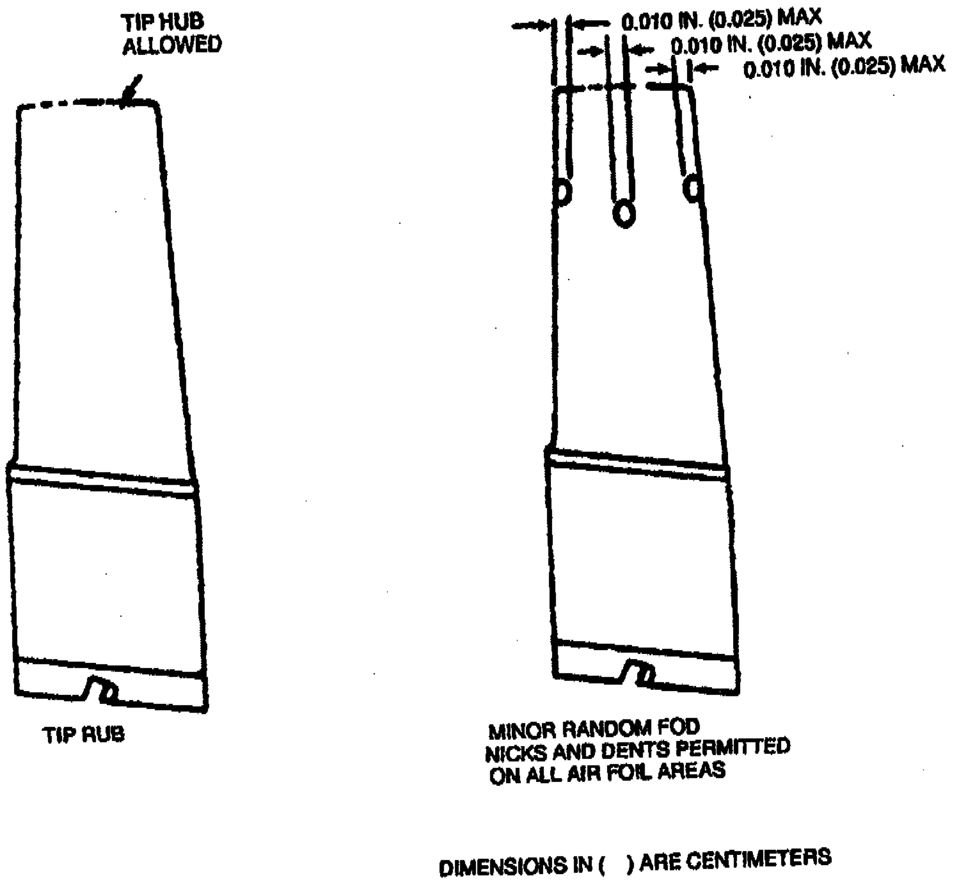


Figure 5-140. Second Stage Gas Producer Rotor Assembly Blade Damage Limits.

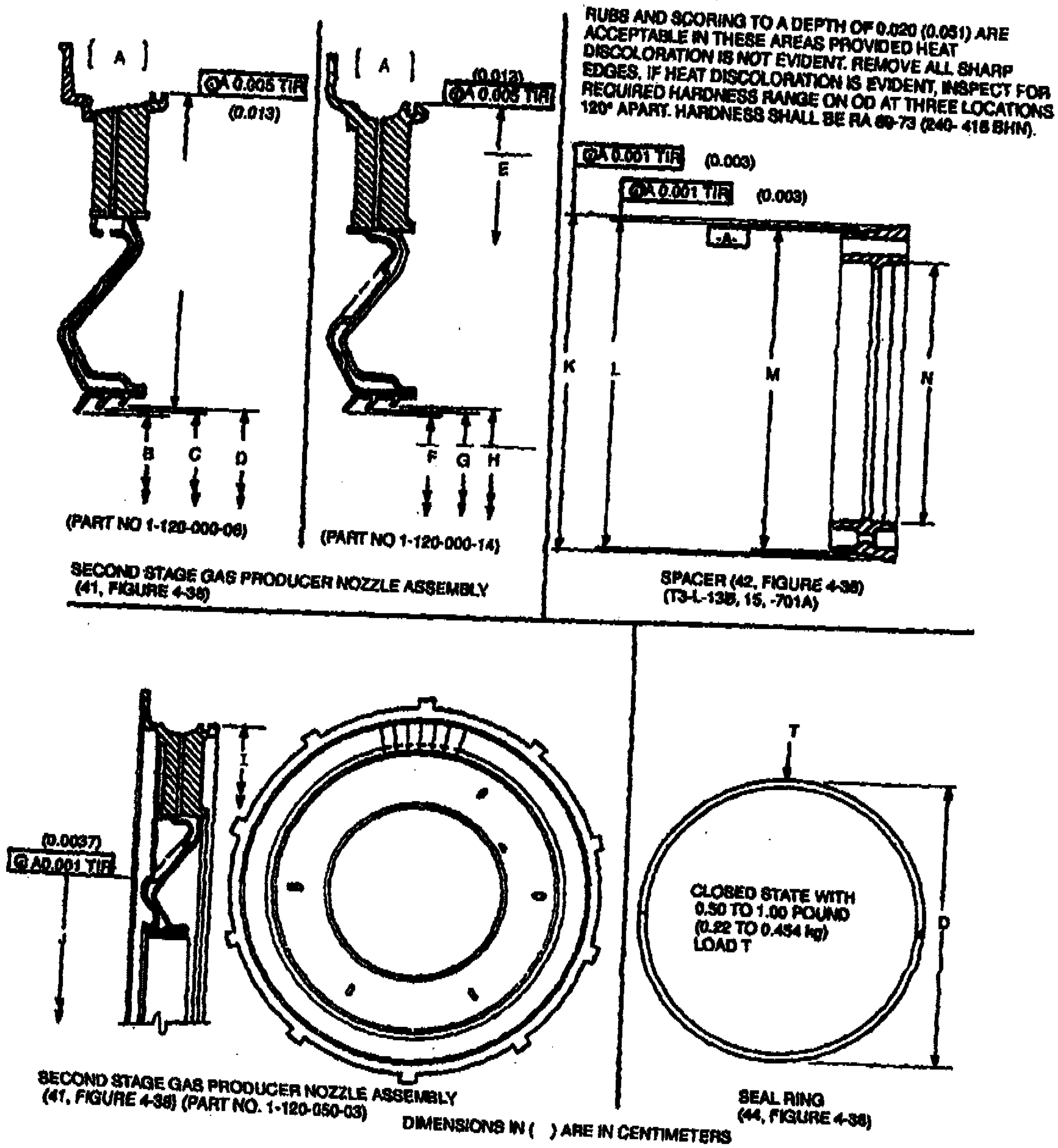
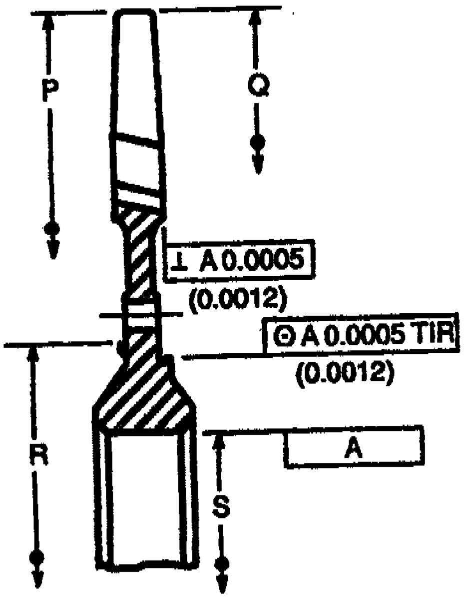
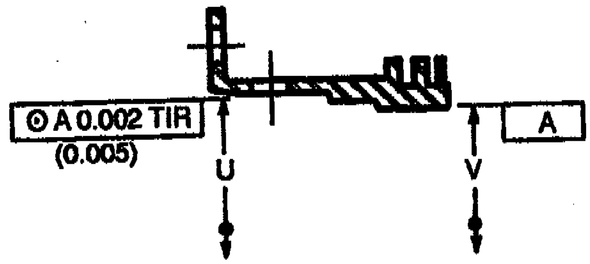


Figure 5-141. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly, and Cylinder Dimensional Inspection Locations (Sheet 1 of 3).

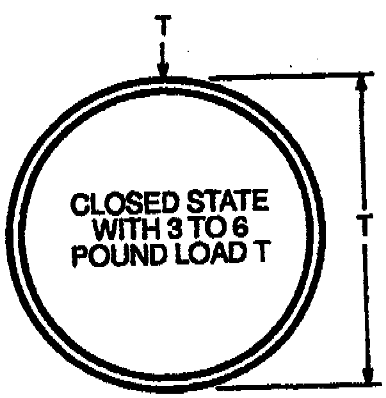


SECOND STAGE GAS PRODUCER
ROTOR ASSEMBLY (45, FIGURE4-38)
(T53-L-13B, -701, -703)



CYLINDER MAY BE
INSPECTED IN
RESTRAINED POSITION

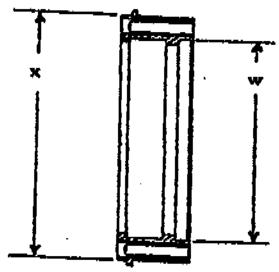
SECOND STAGE GAS PRODUCER
CYLINDER (52, FIGURE 4-38)



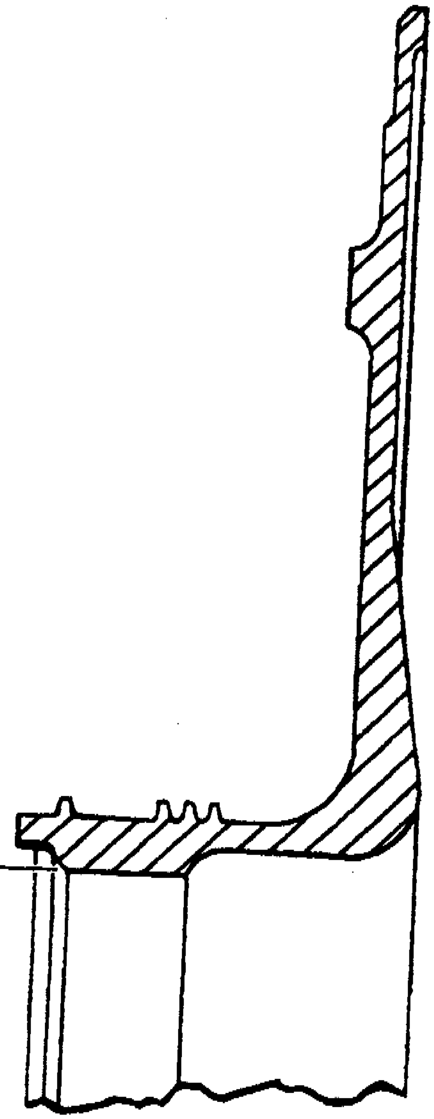
SEAL RING (49, FIGURE 4-38)

DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-141. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly, and Cylinder Dimensional Inspection Locations (Sheet 2 of 3).



SPACER (56, FIGURE 4-38)
(T53-L-703)



SEALING DISC (57, FIGURE 4-38)
(T53-L-703)

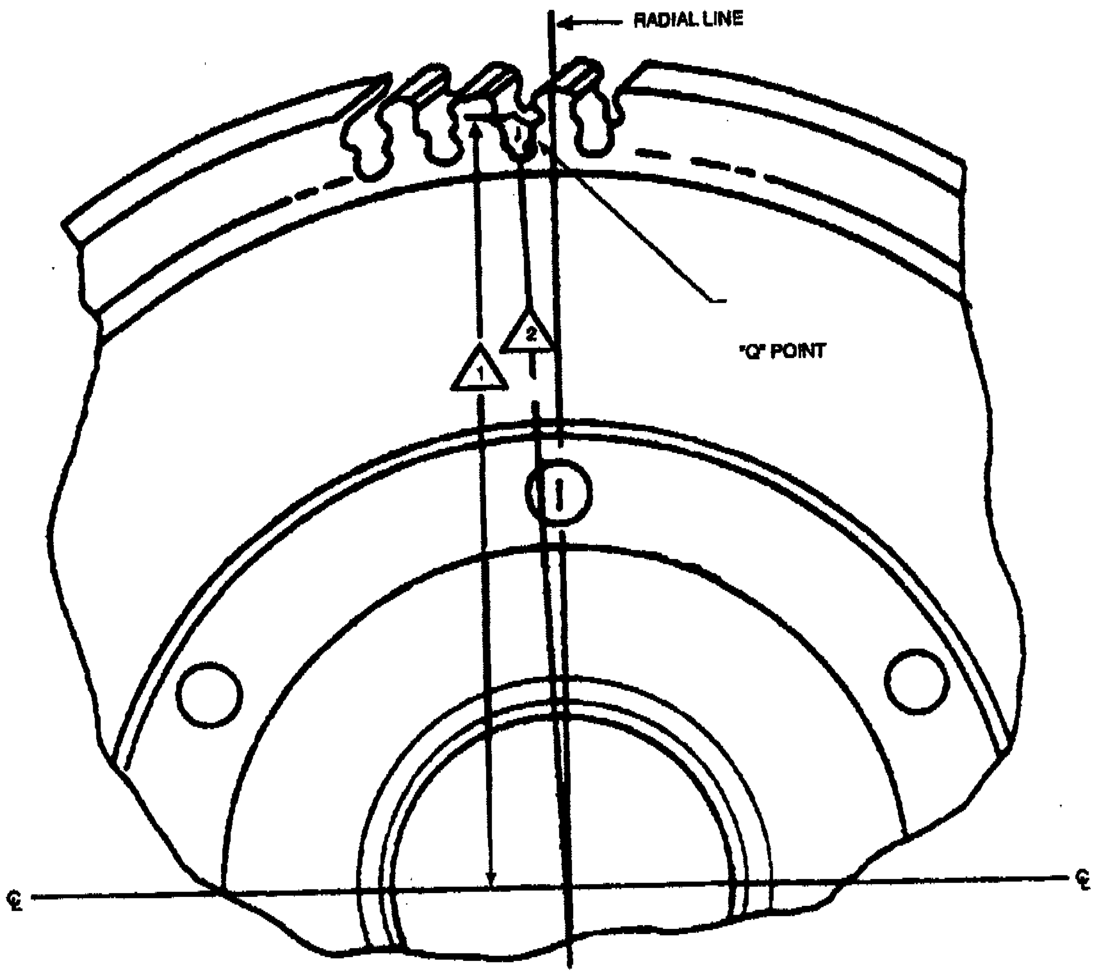
WARNING

FLIGHT SAFETY PART

Dimension is flight safety critical

Figure 5-141. Second Stage Gas Producer Rotor Assembly, Nozzle Assembly, and Cylinder Dimensional Inspection Locations (Sheet 3 of 3).

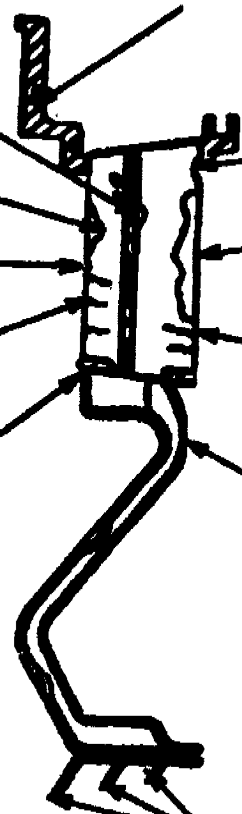
1. "Q" POINT DIMENSION TO ℄
2. "Q" POINT RADIUS (USE THIS DIMENSION IF "Q" POINT IS TAKEN FROM CENTER OF BORE.



TURBINE	"Q" POINT DIM. TO CENTER LINE 1		"Q" POINT RADIUS TO CENTER OF BORE 2	
DISC	DRAWING DIM.	O/H SVC. DIM	DRAWING DIM	O/H SVC. DIM
SECOND G.P.	4.104/4.109 (10.424/10.437	4.110 (10.439)	4.105/4.1102 (10.4269/10.4399)	4.112 (10.4424)

DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-142. Second Stage Gas Producer Disc Assembly "Q" Point Dimension.



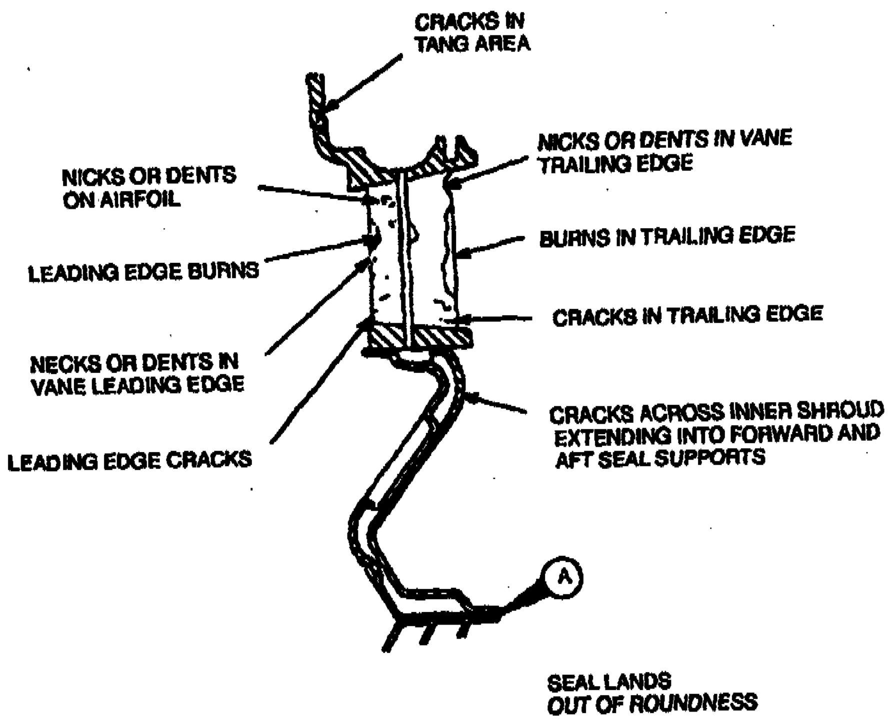
(PART NO 1-120-000-06)

WARNING

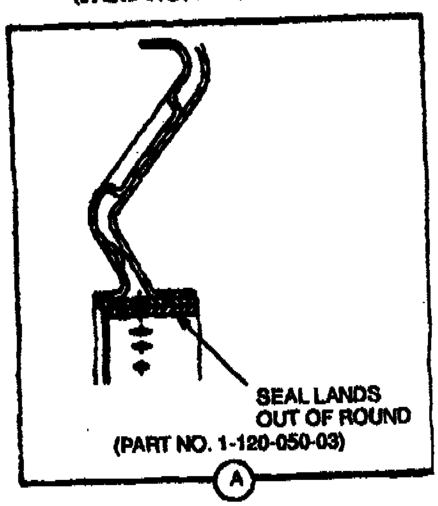
FLIGHT SAFETY PART

Fluorescent penetrant inspection of the above part (to ensure that cracks are within limits) is flight safety critical.

Figure 5-143. Second Stage Gas Producer Nozzle Assembly.



(PART NO. 1-120-000-14)

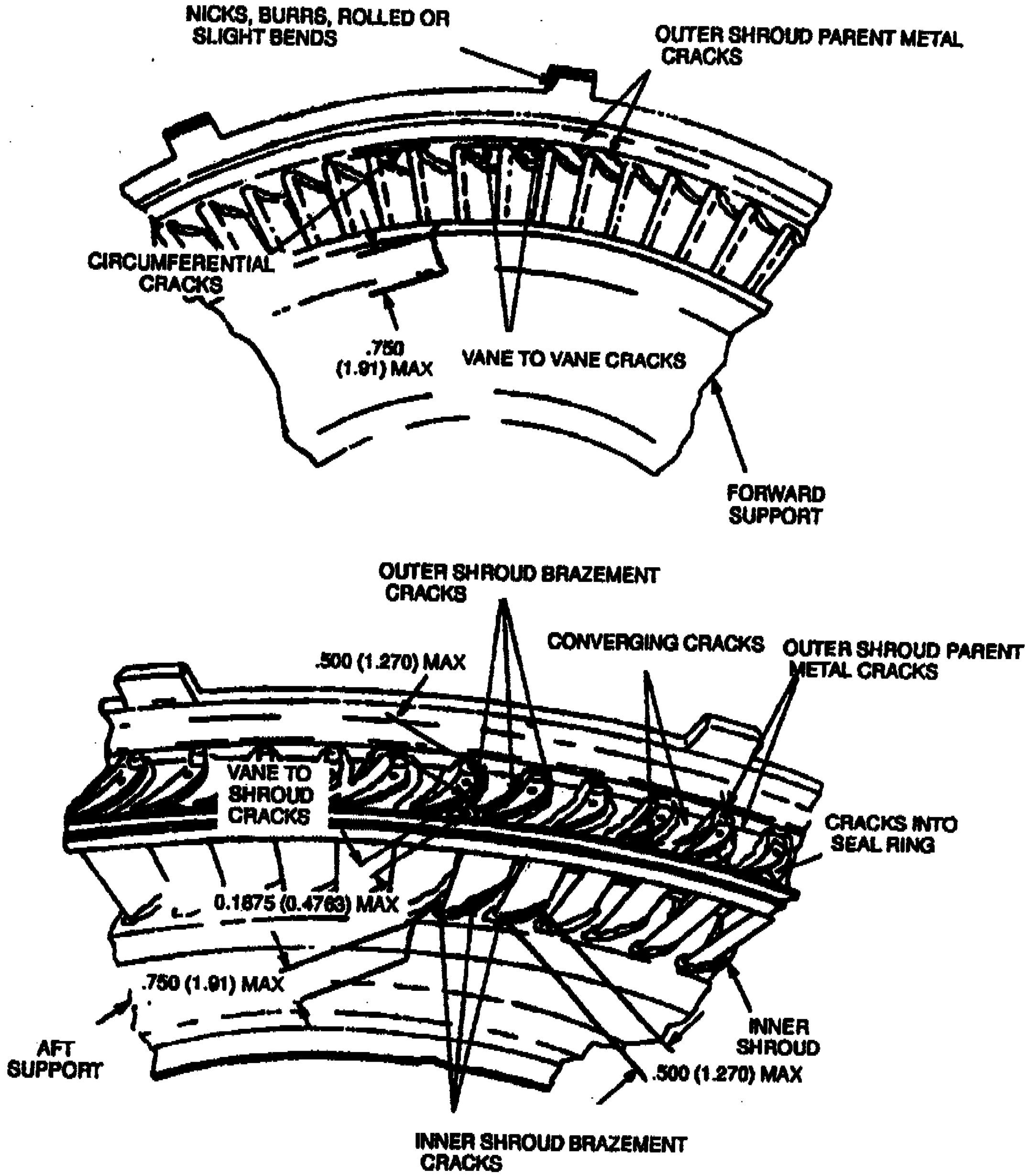


WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the above parts (to ensure that cracks are within limits) is flight safety critical.

Figure 5-144. Second Stage Gas Producer Nozzle Assembly.

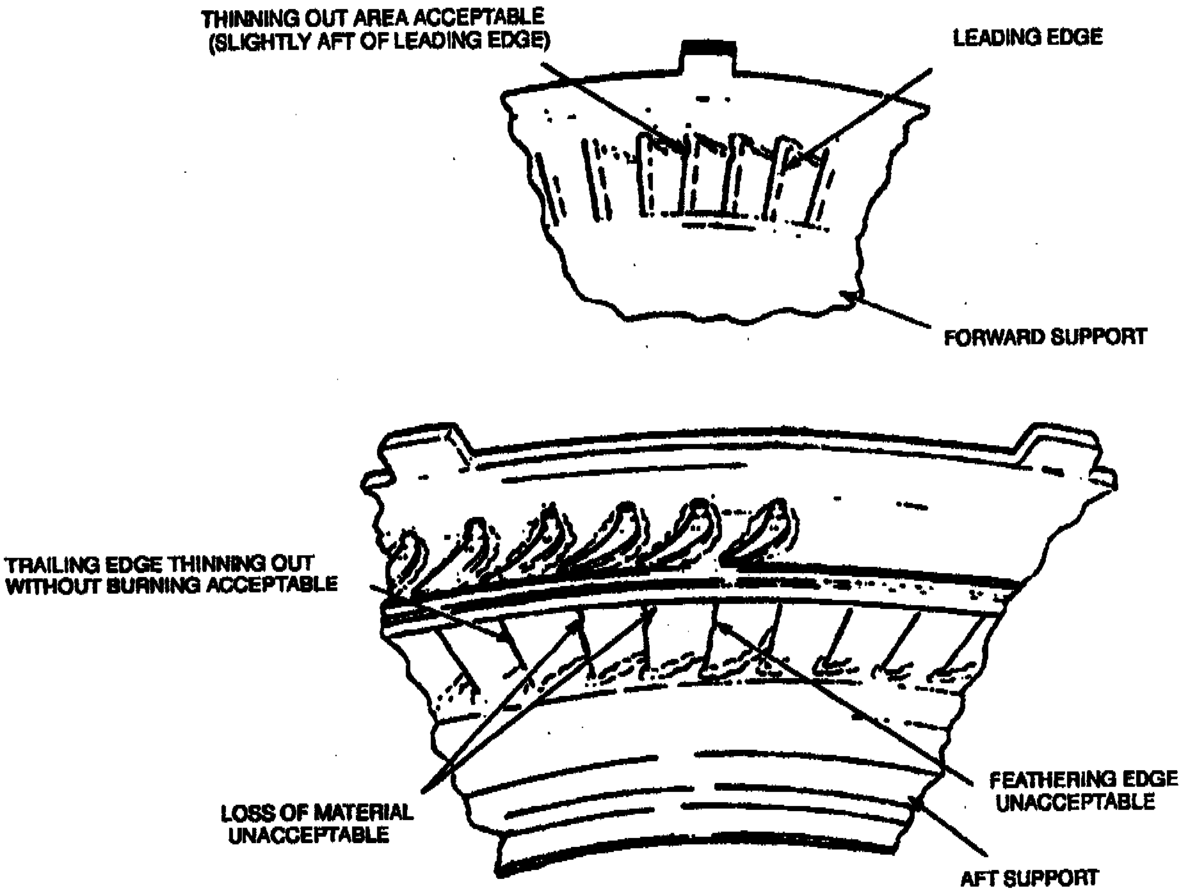


WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the above part (to ensure that cracks are within limits) is flight safety critical.

Figure 5-145. Second Stage Gas Producer Nozzle Assembly - Inner and Outer Shroud and Forward and Aft Support Inspection Areas.



(PART NO 1-120-000-06)

WARNING

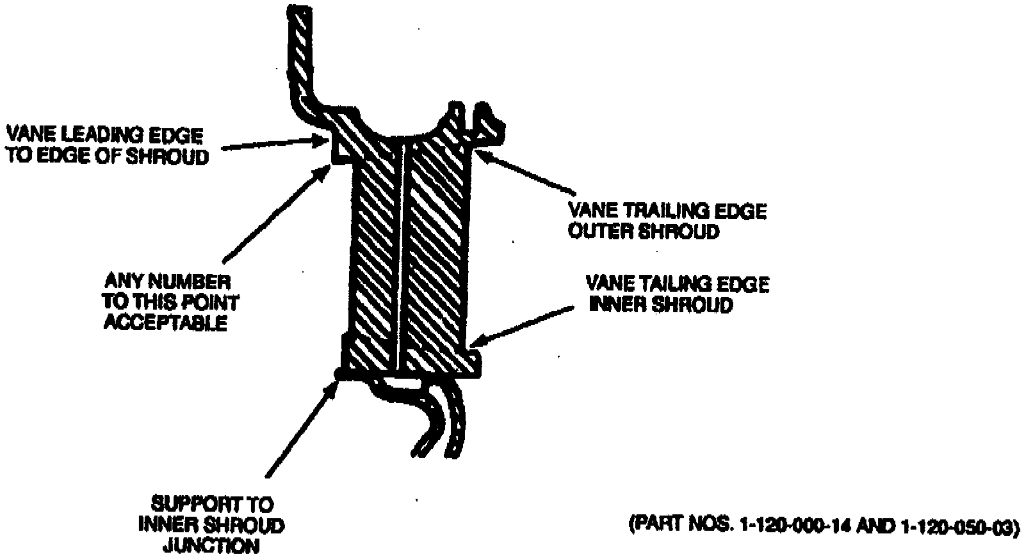
FLIGHT SAFETY PART

Fluorescent penetrant inspection of the above part (to ensure that cracks are within limits) is flight safety critical.

NOTE

Thinning out is not to be considered loss of material for purposes of this inspection.

Figure 5-146. Second Stage Gas Producer Nozzle Assembly Vane Erosion Limits.



WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the above part (to ensure that cracks are within limits) is flight safety critical.

Figure 5-147. Second Stage Gas Producer Nozzle Assembly, Inner and Outer Shroud, and Aft Support Inspection Areas.

5-251. REPAIR (See figure 4-38.). Proceed as follows:

a. On nozzle assembly (41), (1-120-000-06), replace vanes as outlined in following steps b. (1), (2), (3), and (5)., if inspection limits are exceeded.

NOTE

The braze requirements for each specific repair procedure may be performed as one braze cycle when multiple repair is accomplished, providing all inspection requirements are met.

b. Repair shrouds, supports, seal, and vanes of second stage gas producer nozzle assembly (1-120-000-06) as follows:

(1) Remove supports and seals by machining. (See figure 5-148).

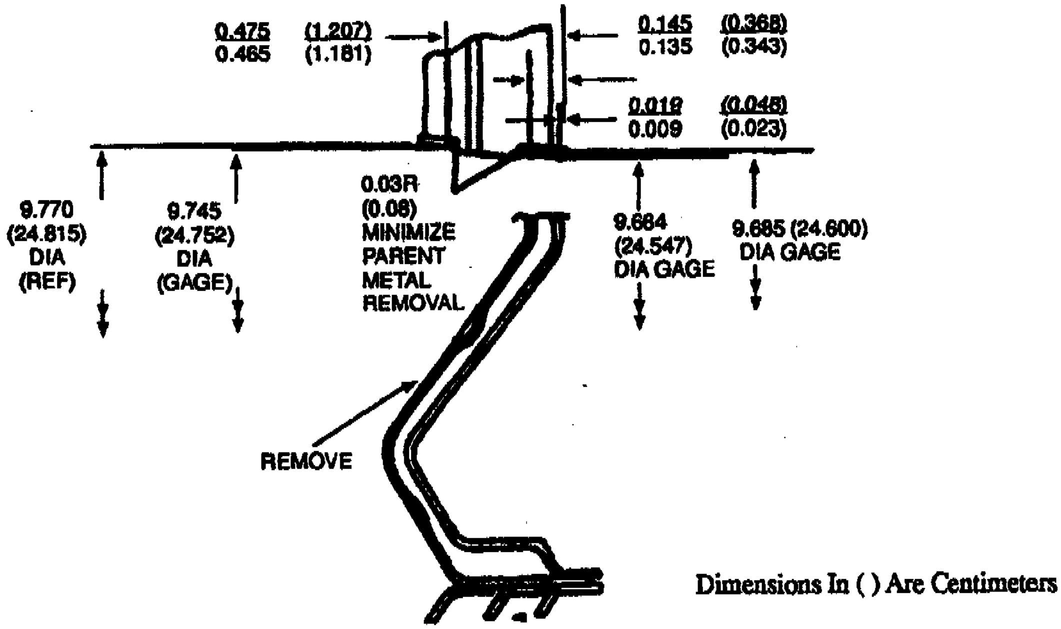


Figure 5-148. Removal of Seals and Supports.

CAUTION

After support removal, a 0.025 inch (0.064 cm) minimum allowable shroud thickness shall remain.

Use care not to damage shroud surfaces. In order to retain integrity of assembly, do not remove more than five consecutive vanes at one time.

Use care not to undercut or deform shrouds.

NOTE

Vanes may be removed mechanically by grinding vane brazement and driving vanes from shroud slots.

(2) Using an electric discharge machine and a flat copper or brass electrode, remove damaged vanes flush with inner and outer shroud. (See figure 5-149.)

NOTE

When vanes are removed for replacement, shroud cracks in old braze joint area may be weld-repaired. It is not detrimental to rebraze over repair weldments.

(3) Using inner shroud electrode (LTCT11293) and outer shroud electrode (LTCT11294), remove remaining vane stubs from inner and outer shrouds. (See figure 5-149.)

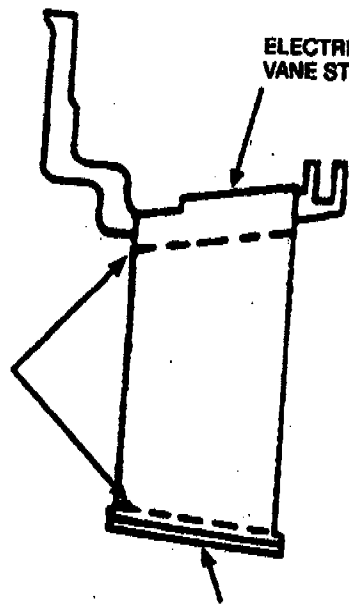


Figure 5-149. Removal of Damaged Vane by Electric Discharge Machine.

NOTE

Holes in shroud should provide for a 0.002 to 0.010 inch (0.005 to 0.025 cm) clearance for replacement vanes (1-120-003-04).

(4) Repair inner and outer shrouds, if inspection limits are exceeded, as follows:

(a) Using a stainless steel wire brush, clean cracked areas.

CAUTION

Do not rout in, or less than 1/16 inch (0.159 cm) from any brazed joint.

(b) Rout all cracks in outer shroud to within 1/16 inch (0.159 cm) from any brazed joints.

NOTE

Do not rout inner shroud.

(c) Clean areas to be welded with acetone (item 13, table C–1)

CAUTION

Weldments must end 1/16 inch (0.159 cm) from any brazed joint except as noted.

(d) Using welding wire (item 349, table C–1), weld routed areas in outer shroud, and cracks in inner shroud, as outlined in SP No. 5001 in Appendix E.

(e) Blend all repair welds flush with base metal.

(5) Replace vanes damaged beyond inspection limits as follows:

(a) Clean areas to be welded with acetone (item 13, table C–1)

NOTE

Using 0.020 inch (0.051 cm) stainless steel safety wire, check air passage in vane to ensure that it is not blocked.

(b) Insert replacement vanes into shrouds. Use stainless steel shims to maintain a clearance of 0.002 to 0.010 inch (0.005 to 0.025 cm) around vanes. Position the vane radially so that spacing between vane overhang and outer diameter of inner shroud is at a minimum.

(c) Using welding wire (item 355, table C–1), tack-weld vanes as outlined in SP No. 5001 in Appendix E.

NOTE

Do not tack-weld over shims.

(d) Remove shim stock spacers and, using a stainless steel wire brush, clean tack welds.

(e) Clean areas to be brazed with acetone (item 13, table C–1)

(f) Apply brazing alloy (item 63, table C–1) to joints.

NOTE

Brazing alloy should be applied to cracks in shroud joints and shroud base metal.

Table 5-71. Second Stage Gas Producer Nozzle - Geometric Flow Area Inspection Limits.

DEFECT	INSPECTION LIMITS
Geometric Area (GFA)	Nozzles may have GFA inspection as an alternative to EFA inspection. Use area flow comparator set (LTCT6484) and digital transducer (LTCT6339). a. If the GFA is within the 16.54 to 17.22 square inches (106.71 to 111.10 sq cm) limit, erase the original GFA number, using a Vibropeen Etching Tool, and mark the new GFA number, approximately one inch to the right of the old GFA number. If the GFA is outside of the above limits, adjust GFA or replace nozzle. b. Overhaul nozzles that have been repaired or originally manufactured to previous GFA inspection limit of 16.78 to 16.98 square inches (100.26 to 109.55 sq cm) may be utilized on a use-to-depletion basis.

(g) Place nozzle on a flat, heat resistant stainless steel support, forward face down, and vacuum braze as outlined in SP No. 5004 in Appendix E.

NOTE

Braze deposit at junction of shroud and vane is allowed within area cleared by a 0.060 inch (0.152 cm) radius gage. Excess braze deposits shall be ground smooth. No undercutting of shroud or vane is allowed.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(h) Perform visual and fluorescent-penetrant inspection of nozzle.

(6) Install retaining rings as follows:

(a) Grind outer shroud to dimensions shown in figure 5-150.

(b) Grind inner shroud (if necessary) to dimensions shown in figure 5-148.

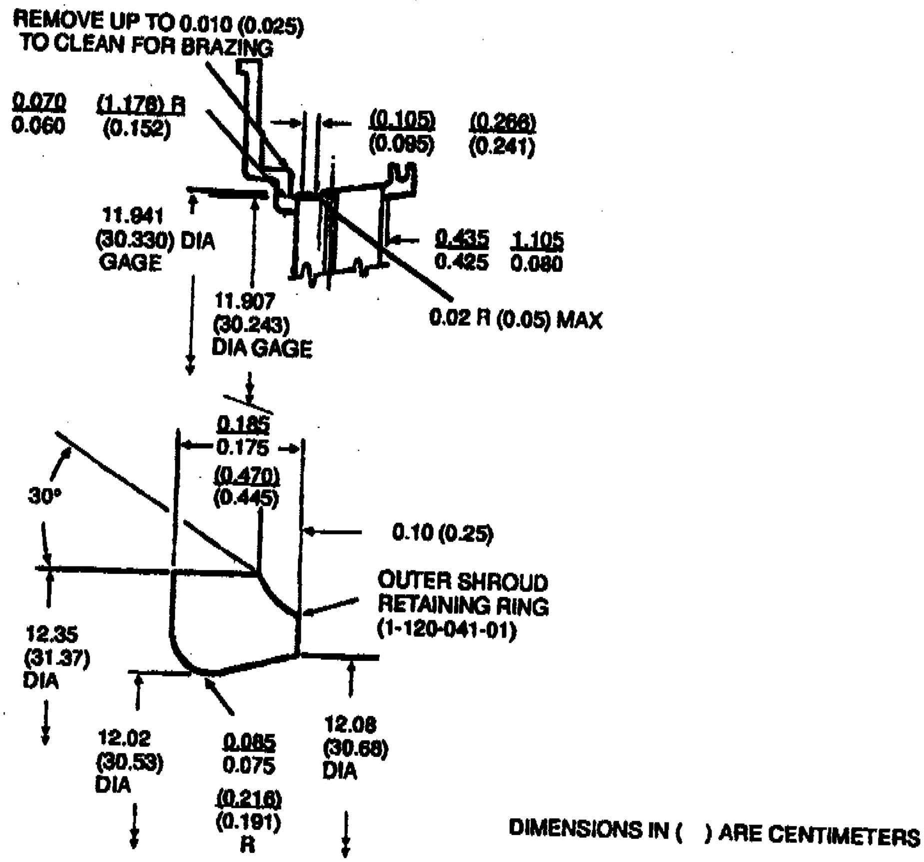


Figure 5-150. Machining Preparations for Outer Shroud Retaining Ring.

(c) Clean areas to be welded with acetone (item 13, table C–1)

(d) Fit retaining rings to assembly. (See figure 5-151.) Maximum allowable gap after fitup shall be 0.010 inch (0.025 cm).

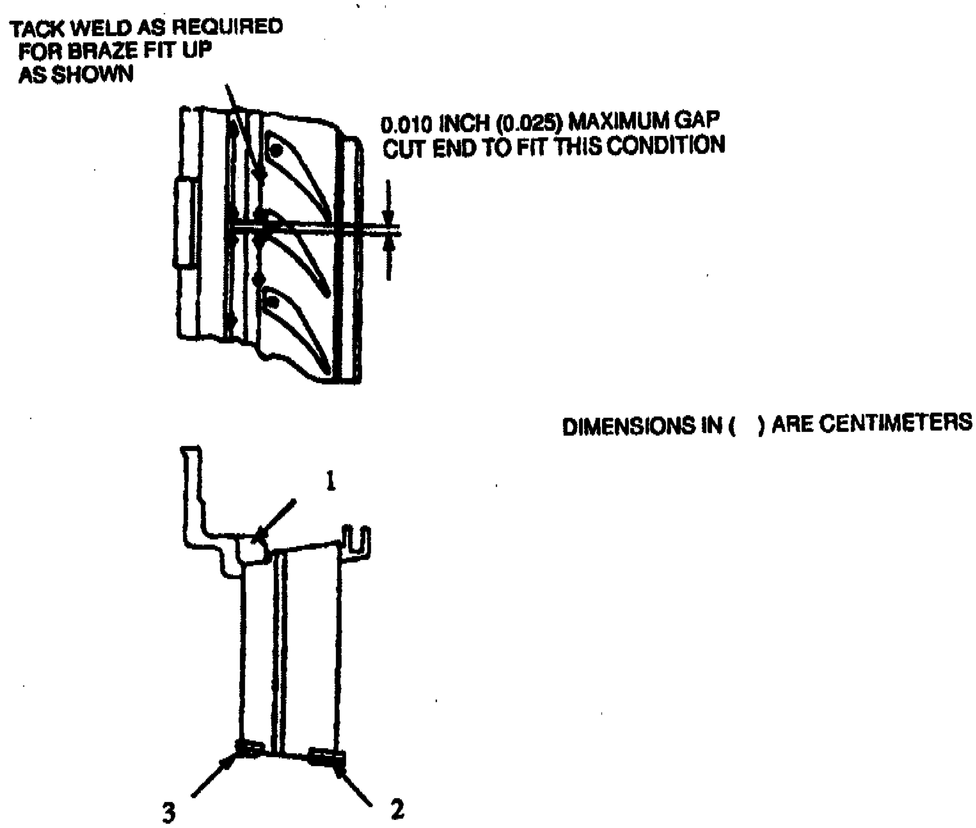
NOTE

Retaining rings may be split to facilitate fitup and brazing.

(e) Using welding wire (item 349, table C–1), tack-weld outer retaining ring in place as outlined in SP NO. 5001 in Appendix E.

(7) Install support and seals as follows:

(a) Using nozzle support holding fixture (LTCT11296), rework forward support and seal assembly to provide fit required in following step (g). (See figure 5-152.)



1. RETAINING RING (1-120-041-01)
2. RETAINING RING (1-120-043-01)
3. RETAINING RING (1-120-042-01)

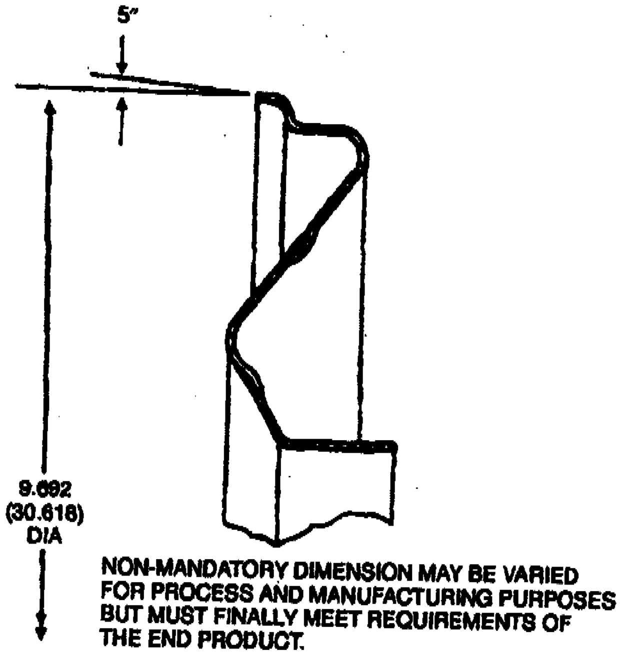
Figure 5-151. Location of Retaining Rings on Nozzle.

(b) Using nozzle support holding fixture (LTCT11295), rework rear support by spinning to provide fit required in following step (e). (See figure 5-153.)

(c) Vapor-blast supports as outlined in SP No. 3003 in Appendix E.

(d) Place nozzle in holding fixture (LTCT11043).

(e) Fit modified rear support into nozzle. Use stainless steel shims to maintain a clearance of 0.002 to 0.010 inch (0.005 to 0.025 cm) brazing gap. Using welding wire (item 349, table C–1), tack-weld support and rear inner retaining ring to shroud, in eight places evenly spaced, as outlined in SP No. 5001 in Appendix E. (See figure 5-154.)



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-152. Rework Dimensions of Forward Support.

(f) Remove shims and, using a stainless steel wire brush, clean tack weld.

(g) Fit modified forward support assembly to nozzle. Use stainless steel shims to maintain a clearance of 0.002 to 0.010 inch (0.005 to 0.025 cm) brazing gap. Using welding wire (item 349, table C–1), tack-weld support and forward retaining ring to shroud in eight or more places, evenly spaced, as outlined in SP No. 5001 in Appendix E. (See figure 5-154).

(h) Remove assembly from holding fixture.

(i) Remove shims and, using a stainless steel wire brush, clean tack welds.

(j) Apply brazing alloy (item 63, table C–1) to assembly.

(k) Place nozzle on a flat, heat-resistant stainless steel support, forward face down, which has been machined to provide for clearance at the inner shroud and forward support joints. Vacuum braze as outlined in SP No. 5004 in Appendix E.

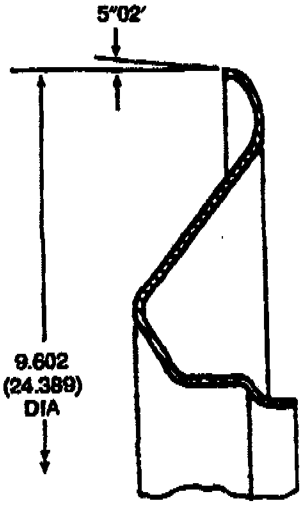


Figure 5-153. Rework Dimension of Rear Support.

NOTE

No cracks are permitted in braze joints; however, visual and fluorescent-penetrant indications within limits specified in table 5-72 are acceptable. If the nozzle does not pass inspection after brazing, investigate for cause. Do not repeat brazing procedure more than three times.

(l) Inspect nozzle vane air passage for clogging by running a piece of 0.020 inch (0.051 cm) stainless steel wire through each hole. A maximum of four clogged passages per nozzle are acceptable without further rework. If limit is exceeded, use a No. 56 drill (0.046 inch diameter) mounted in an airchuck to remove contaminant.

(8) Machine seal area to required dimensions shown in figure 5-154.

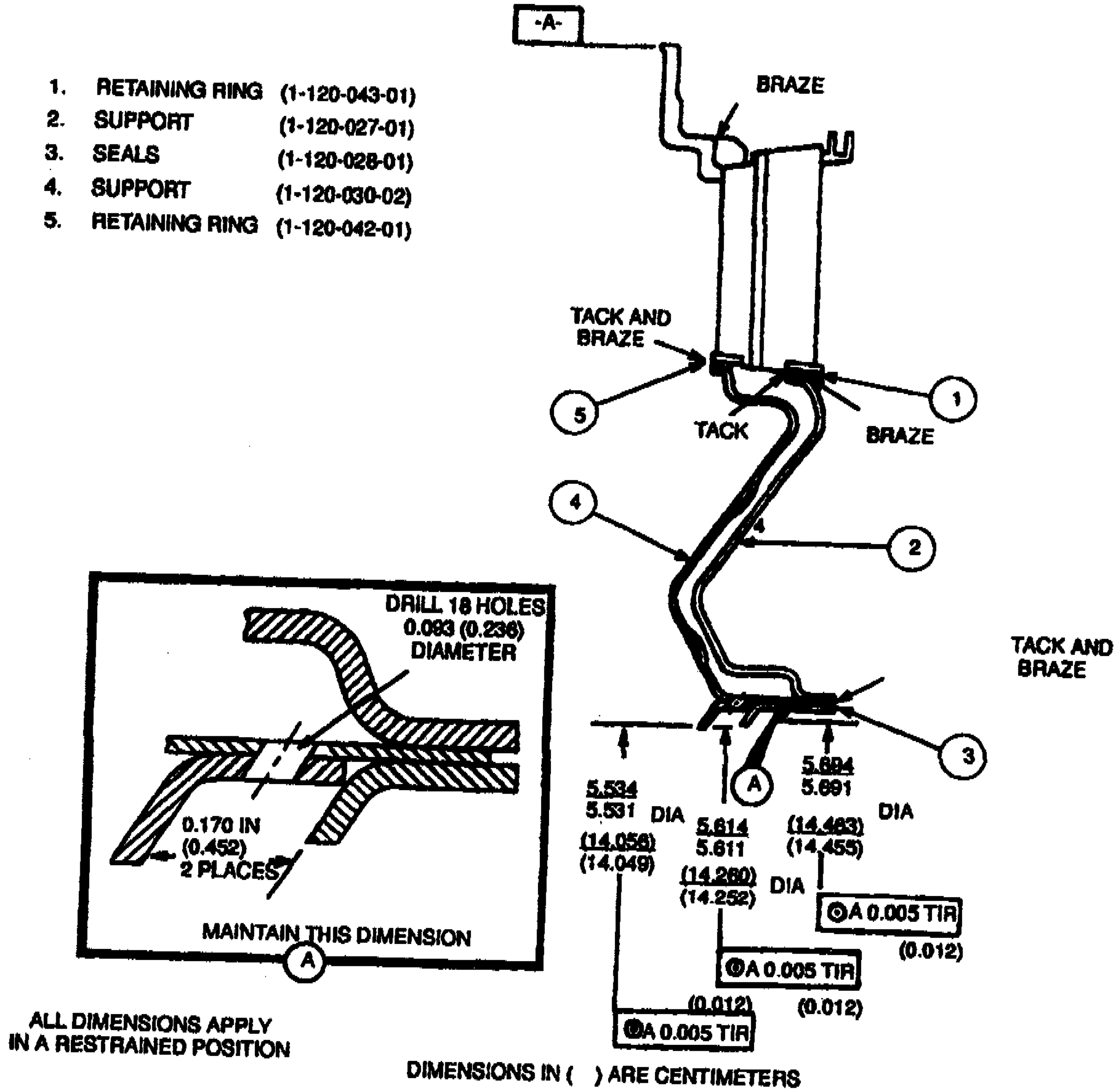


Figure 5-154. Assembly of Retaining Rings and Support.

c. Alternate procedure for vane replacement for second stage gas producer nozzles; P/N 1-120-000-14, P/N 1-120-000-06, P/N 1-120-050-03. Damaged vanes may be replaced without removing supports and seals, when supports and seals meet inspection requirements, as follows:

(1) Cut through vane center portion adjacent to shrouds by electric discharge machine and remove.

(2) Remove remaining portion of vanes from outer and inner shrouds by electric discharge machine in that order, maintaining .002-.010 inch clearance for brazing.

Table 5-72. Visual and Fluorescent-Penetrant Acceptance Limits for Brazed Joints.

Brazed Joints	Cracks	Voids (1)	Lack Braze (2)	Surface Porosity (3)	Cumulative Indications (4)
Vane To Outer Shroud	Not allowed	0.120 inch (0.305 cm) maximum length. 0.120 inch (0.305 cm) maximum cumulative length per vane 0.60 inch (1.52 cm) maximum cumulative length per assembly	0.120 inch (0.305 cm) maximum length. 0.250 inch (0.635 cm) maximum cumulative length per vane.	0.120 inch (0.305 cm) maximum length. 0.250 inch (0.635 cm) maximum cumulative length per vane.	0.350 inch (0.889 cm) per vane.
Vane To Inner Shroud	Not allowed	0.120 inch (0.305 cm) maximum length. 0.120 inch, (0.035) maximum cumulative length per vane. 1.00 inch (2.54 cm) maximum cumulative length per assembly.	0.120 inch (0.305 cm) maximum length. 0.125 inch (0.318 cm) maximum cumulative length per vane.	0.120 inch (0.305 cm) maximum length 0.125 inch (0.318 cm) maximum cumulative length per vane.	0.375 inch (0.953 cm) per vane. Not more than 15 percent of joints/assembly shall exceed 0.300 inch (0.762 cm)
Support To Flange And Support to Deflector	Not allowed	Not allowed.	Allowed.	Allowed.	
Support To inner Shroud, Inner Shroud to Deflector Inner Shroud To Seal Ring	Not allowed	Not allowed.	0.50 inch (1.27 cm) maximum length. 1.50 inch (3.81 cm) maximum cumulative length. 1.00 inch (2.54 cm) minimum distance between indications.	Allowed.	
Support To Support And Support To Seal	Not allowed		1.00 inch (2.54 cm) maximum length 6.00 inch (15.24 cm) maximum cumulative length. Minimum distance between indications shall be length of the shorter indication.	Allowed.	
Seal Ring To Seal	Not allowed		0.75 inch (1.91 cm) maximum length. 4.00 inch (10.16 cm) maximum cumulative length. Minimum distance between indications shall be length of the longer indication.	Allowed.	

NOTE

(1) A "void" is defined as an interruption in the braze which is continuous through the joint cross section.
(2) A "lack of braze" is defined as an interruption in the braze which is not continuous through the joint cross section. Lack of braze on opposite sides of a joint is not allowed.
(3) Porosity is acceptable to the limits noted, provided there are no indications in the same location on the opposite side of the joint.
(4) Cumulative length of voids, lack of braze, and porosity.

NOTE

Electric Discharge Machine vane peg hole in inner shroud through hole in outer shroud.

(3) Remove all surface scale on inner and outer shroud braze areas.

(4) To reinstall vanes: .

(a) If P/N 1-120-000-06, complete paragraph 5-251b(4) through 5-251b(5)(h).

(b) If P/N 1-120-000-14 or P/N 1-120-050-03, complete paragraph 5-251d(2)(c) through 5-251 d(3)(f)

d. On turbine nozzle (1-120-000-14 and 1-120-050-03), replace vanes as follows if inspection limits are exceeded.

(1) Remove supports and seals or seal assembly as outlined in following step (e).

(2) Remove damaged vanes as follows:

CAUTION

Do not damage shroud surface or undamaged vanes.

(a) Using an electric discharge machine and a flat copper or brass electrode, remove damaged vanes.

(b) Using inner shroud electrode (LTCT11368) and outer shroud electrode (LTCT11367), remove remaining vane stubs from inner and outer shrouds.

NOTE

Holes in shrouds should provide 0.002 to 0.010 inch (0.005 to 0.025 cm) clearance for replacement vanes (1-120-039-14).

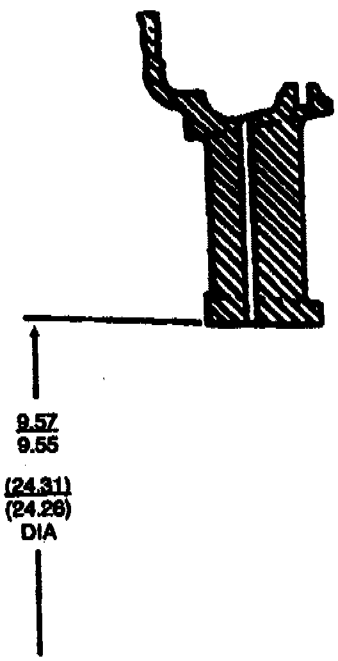
(c) Remove coating around electric discharge machine vane slots.

(d) Machine inside diameter of nozzle and clean as outlined in following step (d). (See figure 5-155.)

(e) Nickel plate inner and outer shroud braze joint are 0.0004 to 0.0008 inch just before brazing per SP No. 6018 in Appendix E. Bake at 255° to 275°F after plating for one hour.

(3) Install new vanes as follows:

(a) Insert replacement vane(s) (1-120-039-14) into prepared holes in shrouds.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-155. Second Stage Gas Producer Nozzle - Limits After Machining.

(b) Using tungsten inert-gas-arc method and welding wire (item 346, table C–1), tack-weld vanes to shroud in accordance with Military Specification MIL-W-8611. (Refer to SP No. 5001 in Appendix E.)

(c) Using a stainless steel wire brush, clean tack welds.

(d) Clean areas to be brazed with acetone (item 13, table C–1)

NOTE

Perform geometric flow area (GFA) check of nozzle as outlined in table 5-71.

(e) Apply brazing alloy (item 63, table C–1) to joints to be brazed. (See figure 5-156.)

(f) Place nozzle on a flat, heat-resistant stainless steel support, forward side down. Vacuum-braze nozzle at 2.050°F (1.121°C) for 2 to 10 minutes. (Refer to SP No. 5004 in Appendix E.) Remove any excess braze deposits.

NOTE

Braze deposit at junction of shroud and vane is allowed within area cleared by 0.060 inch (0.152 cm) radius gage. Excess braze deposits shall be ground smooth. No undercutting of shroud or vane is allowed. Vanes, supports, and seals are allowed to be vacuum-brazed in one operation.

(4) Replace supports and seals or seal assembly as outlined in following step e.

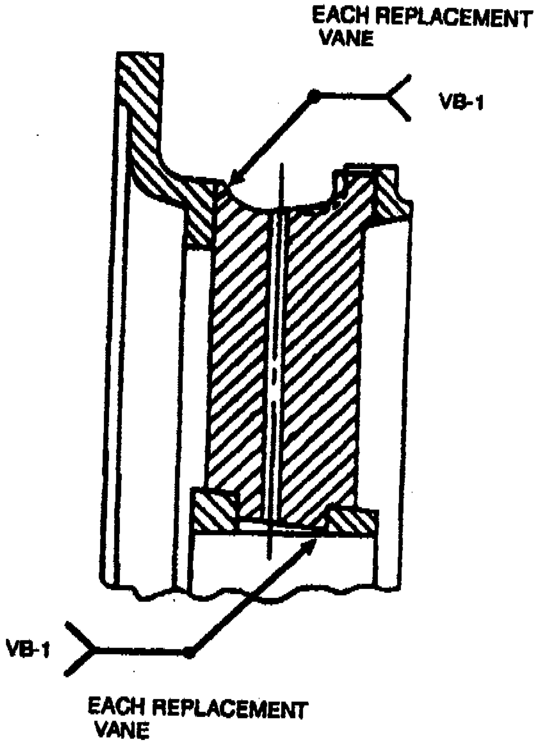


Figure 5-156. Second Stage Gas Producer Nozzle - Applying Brazing Alloy to Vane-to-Shroud Joints.

NOTE

Cracks are not permitted in braze joints. (Refer to table 5-72.)

(5) Complete rework of nozzle as follows:

(a) Machine ring groove in replaced vanes as shown in figure 5-157.

(b) Complete machining of nozzle as outlined in step e.

(c) Inspect nozzle for proper dimensions as outlined in following step e and given in table 5-69.

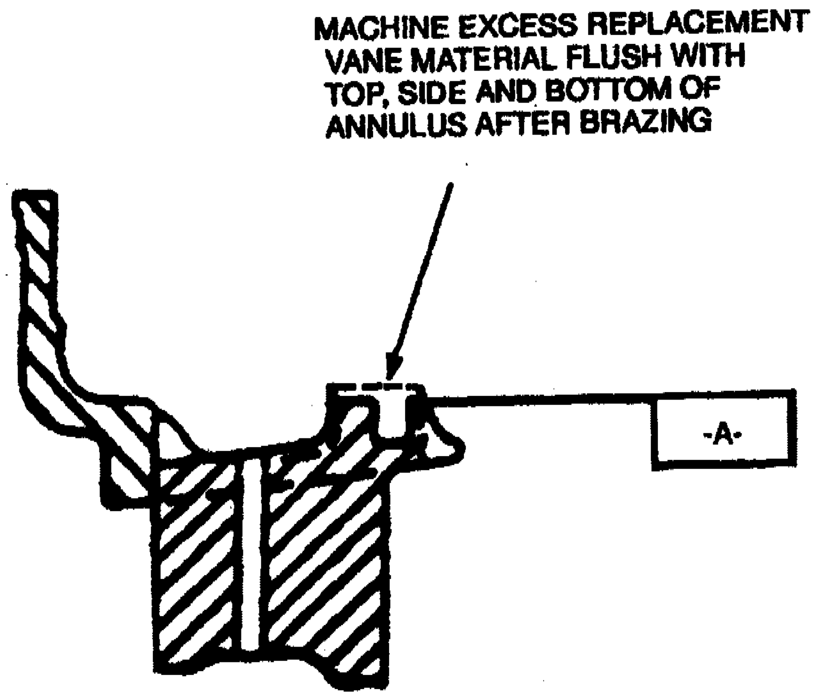


Figure 5-157. Machining Replacement Vane Ring Groove.

e. On turbine nozzle (1-120-000-14 and 1-120-050-03), replace defective seals or seal assembly and supports oil second stage gas producer nozzle as follows:

(1) Remove supports (1-120-026-03, or -05, and 1-120-027-02, or -03) and seals (1-120-028-01) by machining per figure 5-158. Machine off all support material until inner shroud is cleaned up flush. For seal assembly (1-120-040-03) replacement only, machine to the basic requirements in figure 5-159. The forward and aft inner support should be machined to a dimension allowing a 0.002 to 0.005 inch braze gap to the replacement seal assembly.

NOTE

Using a routing tool, locally clean up excess braze material.

(2) Clean areas to be welded with acetone (item 13, table C–1)

NOTE

The following steps (3) through (13) apply to turbine nozzle (1-120-000-14); for replacement procedures of turbine nozzle (1-120-050-03), refer to paragraph 5-406, step 5-406d(3) through 5-406d(10). If replacing seal assembly (1-120-040-03), only final machining dimensions are shown in figure 5-160.

(3) Assembly replacement supports and seals as follows: (See figures 5-161 and 5-162.)

NOTE

The fit-up between all details shall provide 0.002 to 0.005 inch (0.005 to 0.013 cm) radial clearance for brazing. Use stainless steel shims, as necessary.

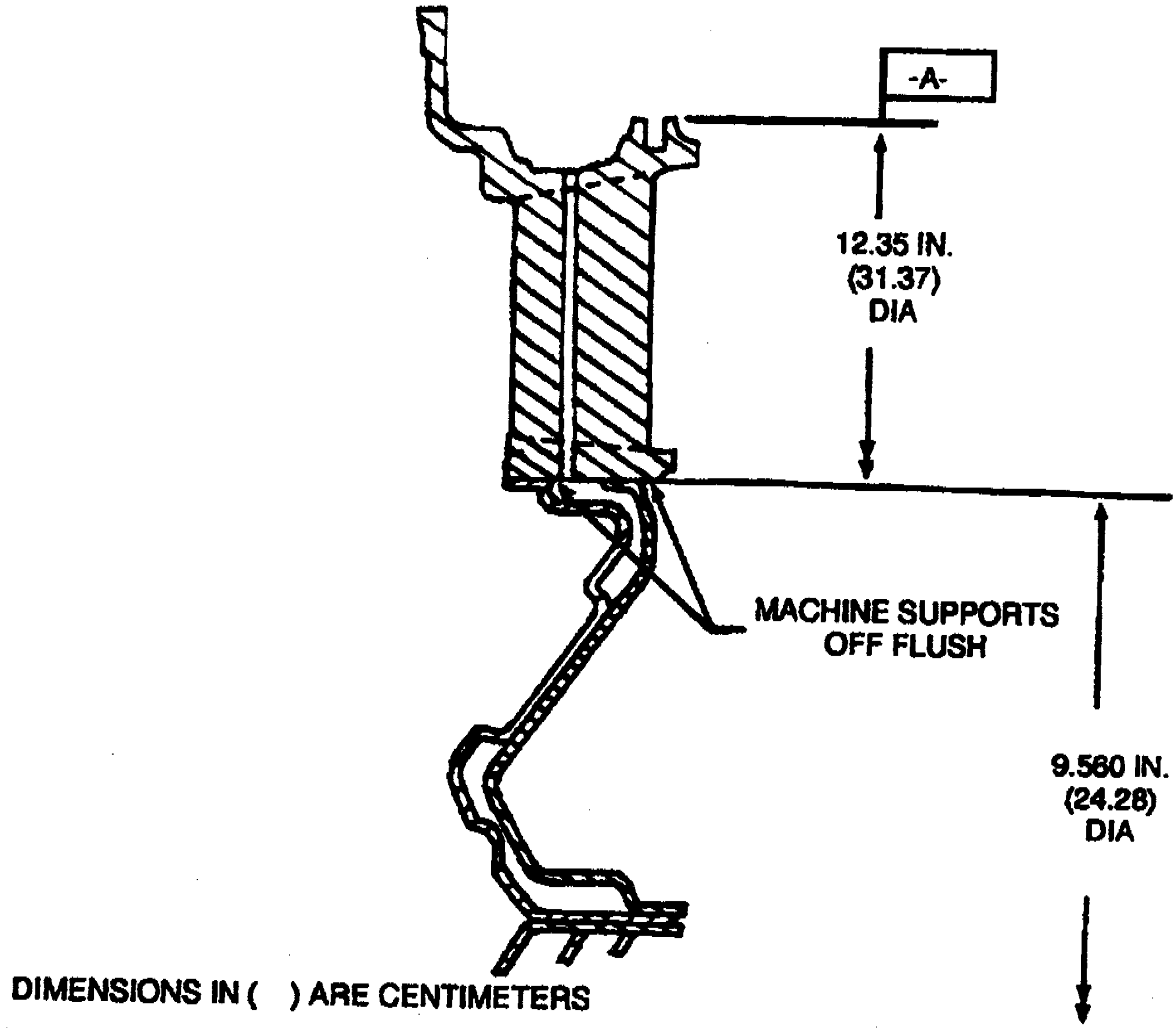


Figure 5-158. Removal of Seals and Supports (Typical).

(a) Assemble replacement seals (1-120-028-01) to replacement forward support (1-120-026-03) as follows (see figure 5-161):

1 Prick-punch No. 2 (middle) seal in six equally spaced places on seal ID. This prevents seal from shifting during assembly to forward support.

2 Place forward support into tack-weld fixture (LTCT11366), and assemble No. 1 (aft) seal.

3 Slide lower spacers of tack-weld fixture (LTCT11366) into position.

4 Assemble No. 2 (middle) seal.

5 Slide upper spacers of tack-weld fixture (LTCT11366) into position, and assemble No. 3 (forward) seal. Tighten fixture spider clamp lightly.

6 Using welding wire (item 349, table C–1), tack-weld forward and aft seals in six or more equally spaced places in accordance with SP No. 5001 Appendix E.

7 Remove support from tack-weld fixture.

8 Remove shims, and clean tack welds.

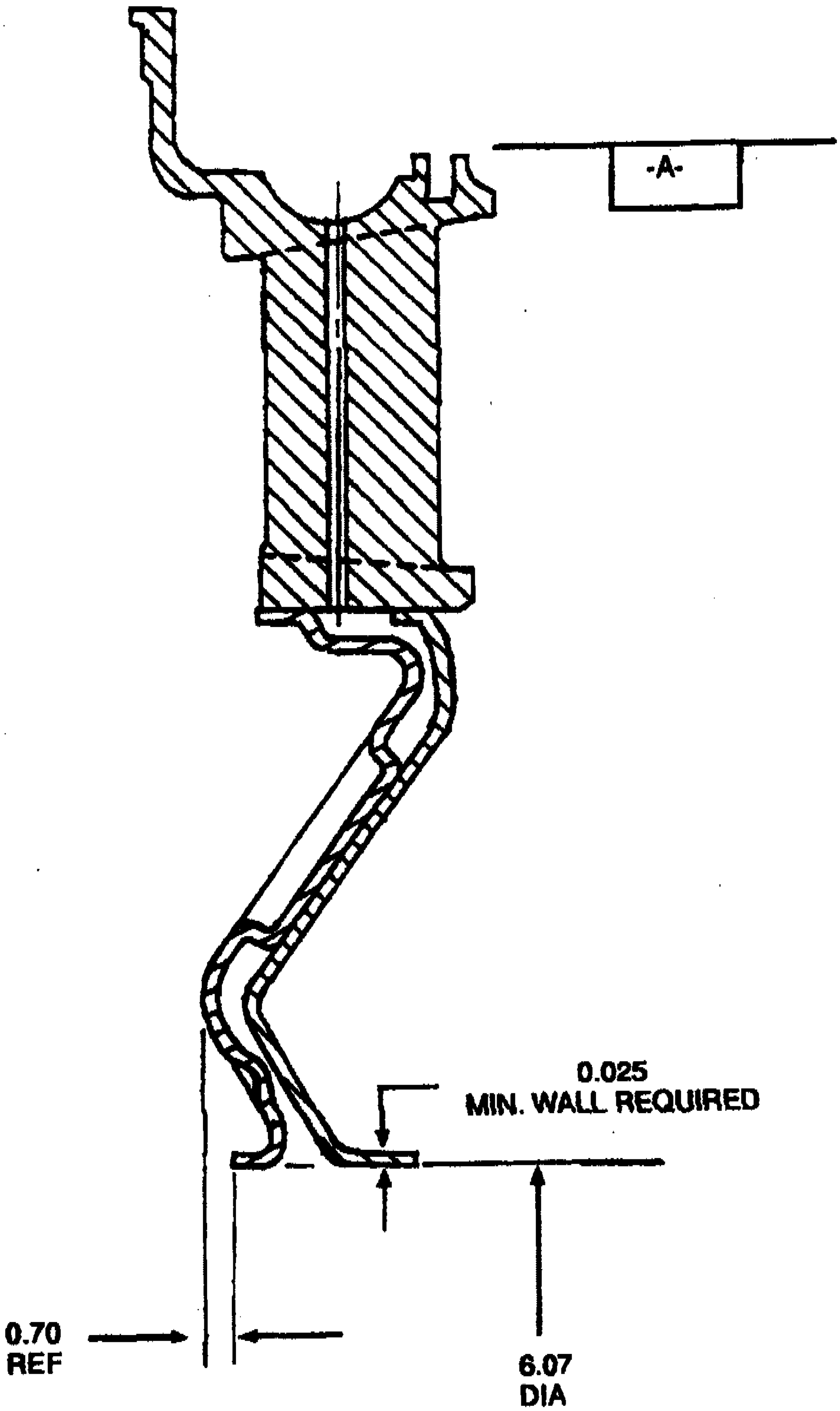
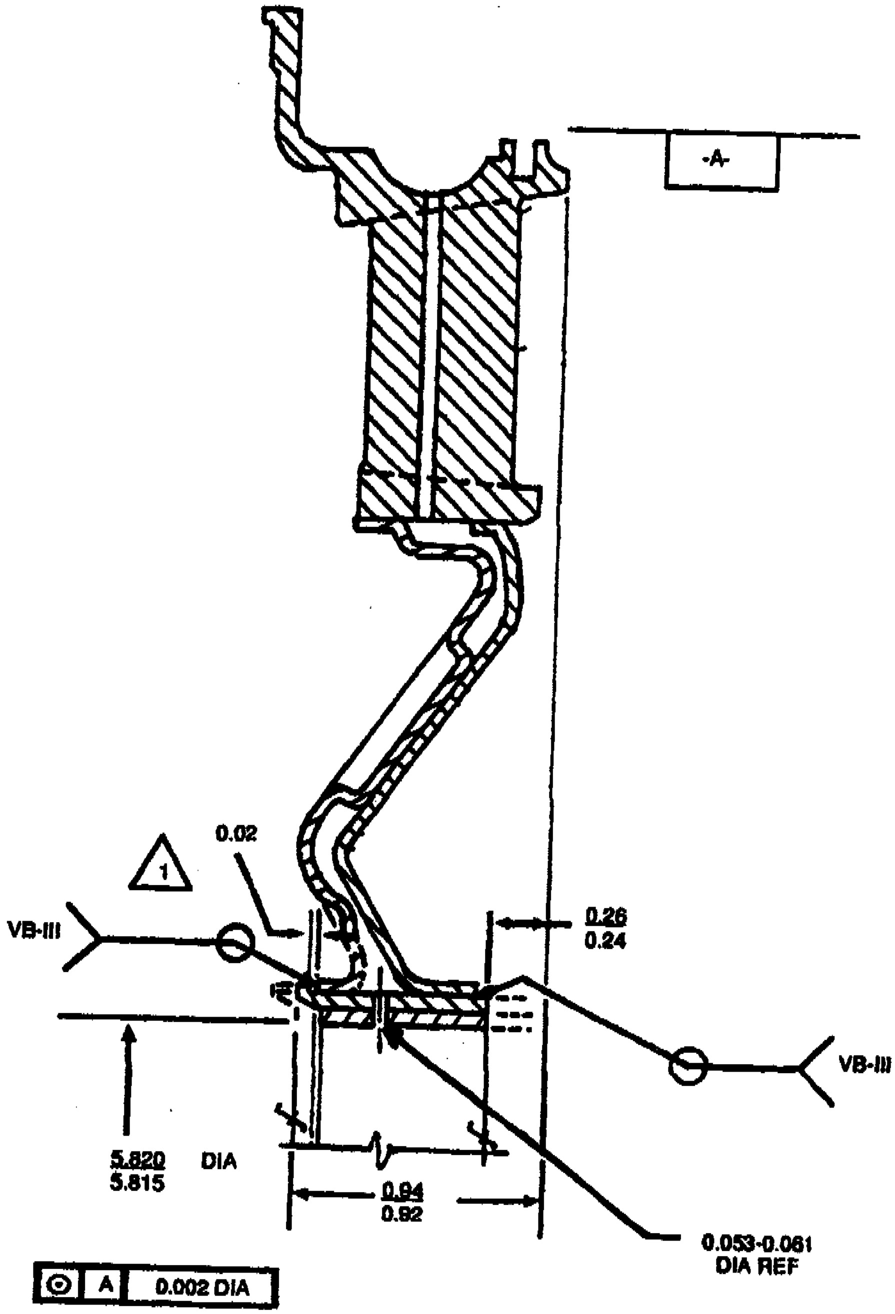


Figure 5-159. Initial Machining DIM's.



NOTE

⚠ GAP AT ASSY.

Figure 5-160. Final Machine DIM's.

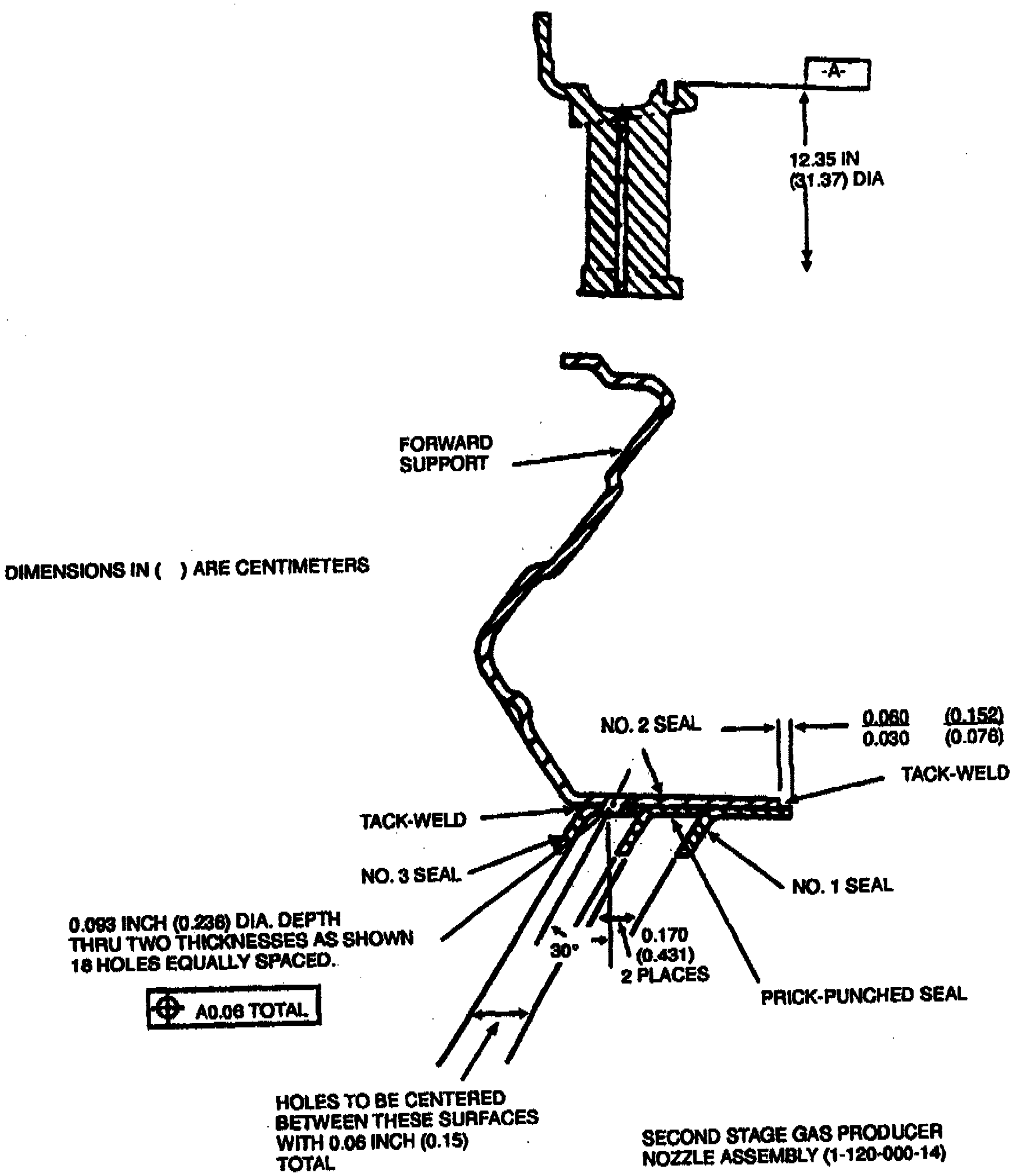


Figure 5-161. Assembly of Forward Support and Seals.

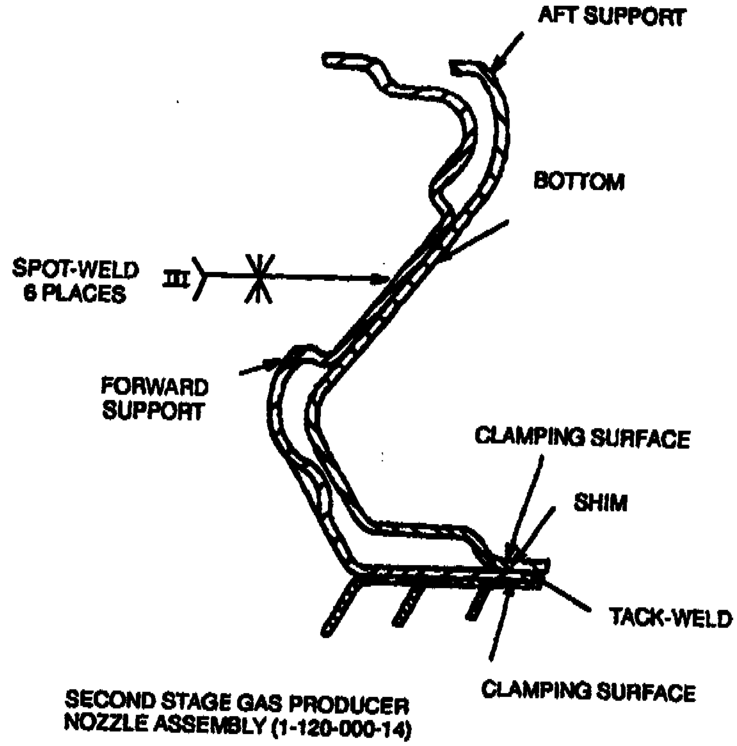


Figure 5-162. Assembly of Aft Support to Forward Support.

9 Drill 18 holes, equally spaced, through forward seal and support as shown in figure 5-161, deburr holes.

(b) Assemble aft support (1-120-027-02) to assembled forward support and seals as follows: (See figure 5-162.)

1 Clamp, using shims as necessary between supports at clamping area shown in figure 5-162. Bottom the aft support on area shown in figure 5-162, and align support end within limits shown before tacking.

2 Using welding wire (item 349, table C–1), tack-weld in eight equally spaced places in accordance with SP No. 5001 in Appendix E.

3 Remove clamp and shims, and clean tack-welds.

4 Spot-weld aft support to forward support in six places (center of dimple) in accordance with SP No. 5002 in Appendix E. (See figure 5-162.)

(4) Install nozzle assembly into holding fixture (LTCT11043).

NOTE

This fixture is used to position replacement supports to nozzle.

(5) Fit assembled supports and seals to nozzle, using shims to maintain 0.002 to 0.005 inch (0.005 to 0.013 cm) brazing gap.

(6) Using welding wire (item 346, table C–1), tack-weld both supports to inner shroud in six equally spaced places in accordance with SP No. 3001 in Appendix E.

(7) Remove nozzle assembly from holding fixture.

(8) Remove shims, and clean tack-welds.

(9) Apply brazing alloy (item 63, table C–1) to all joints specified in figure 5-163.

(10) Place nozzle on a flat, heat-resistant stainless steel support, forward face down, which has been machined to provide for clearance at the inner shroud and forward support joints. Vacuum-braze at 2.050°F (1.121°C) for 2 to 10 minutes in accordance with SP No. 5004 in Appendix E.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(11) Perform a visual and fluorescent-penetrant inspection of nozzle.

NOTE

No cracks are permitted in braze joints; however, visual and fluorescent-penetrant indications within limits specified in table 5-72 are acceptable.

(12) Machine seal area to required dimensions shown in figure 5-163. Machine forward support 0.003 to 0.010 inch (0.008 to 0.025 cm) above face of nozzle.

(13) Inspect nozzle assembly for conformance to dimensions specified in table 5-69.

f. On turbine nozzle (1-120-000-06), repair cracks in braze metal of second stage gas producer nozzle, that exceed acceptable limits, by rebrazing part, using standard vacuum braze cycle for the brazing alloy used in original manufacture. (Refer to SP No. 5004 in Appendix E.) Additional brazing alloy may be used prior to the braze cycle if required.

g. On turbine nozzle (1-120-000-06), repair outer shroud parent metal cracks in nozzle, that exceed acceptable limits, as outlined in preceding step b(4).

h. Blend-repair tangs of second stage gas producer nozzle (1-120-000-06), that are nicked or blurred or edges that have rolled-over effect, as outlined in SP No. 5000 in Appendix E.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

i. Cold-straighten slightly bent tangs of second stage gas producer nozzle (1-120-000-06). After straightening, inspect area for cracks by fluorescent-penetrant method. Cracks are not acceptable. Weld repair cracks in support spot welds using welding wire (item 349, table C–1) as outlined in SP No. 5001 in Appendix E. Perform a visual and fluorescent penetrant inspection. (Refer to MIL-STD-6866.)

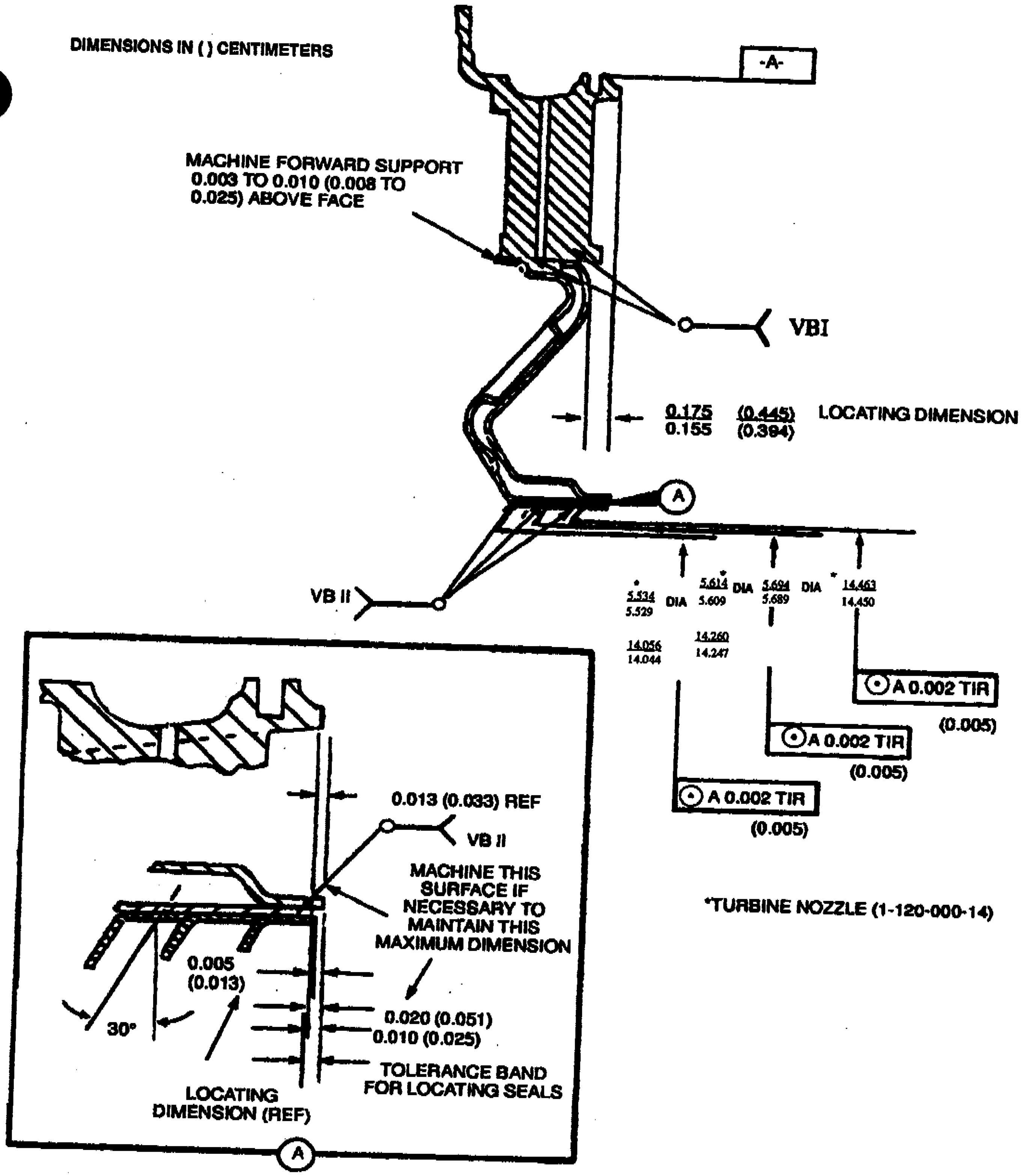


Figure 5-163. Final Machining Dimensions.

j. Replace cracked or damaged nozzle supports and seals, if inspection limits are exceeded, as outlined in preceding step b for turbine nozzle (1-120-000-06) and preceding step e for turbine nozzle (1-120-000-14 and 1-120-050-03).

k. Replace damaged or oversized seals of second stage gas producer nozzle (1-120-000-06), that has had retaining rings installed, as follows:

(1) Remove seals by machining, using care not to reduce thickness of the support.

(2) Drill holes in one seal, (See figure 5-164.)

DIMENSIONS IN ( ) ARE CENTIMETERS

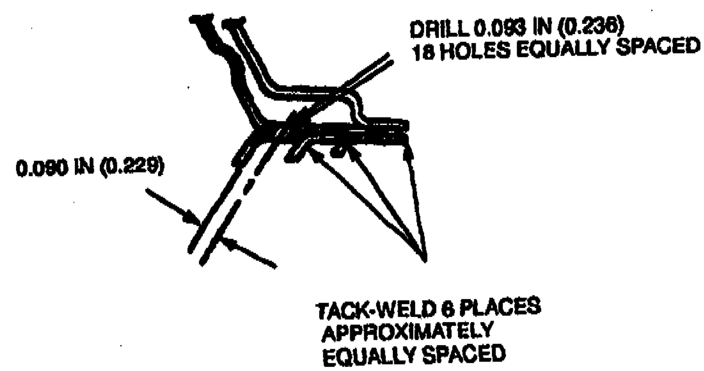


Figure 5-164. Assembly of Seals on Second Stage Gas Producer Nozzle.

(3) Clean areas to be welded with acetone (item 13, table C–1)

(4) Using welding wire (item 349, table C–1), assemble and tack-weld seals, (See figure 5-164.) Maintain a 0.002 to 0.010 inch (0.005 to 0.025 cm) braze gap, and align drilled holes in seal with existing holes in support.

(5) Using 220-grit aluminum oxide powder (item 36, table C–1) dry grit-blast area to be brazed. Clean area to remove grit.

(6) Apply brazing alloy (item 63, table C–1) to the assembly, and vacuum-braze as outlined in SP No. 5004 in Appendix E.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(7) Perform a visual and fluorescent-penetrant inspection. (Refer to table 5-72.)

(8) Machine seal area to required dimensions shown in figure 5-154.

l. Replace damaged or clogged vanes, that cannot be reopened by drilling or eloxing of second stage gas producer nozzle (1-120-000-06), that has had retaining rings installed, as follows:

(1) Using outer shroud electrode (LTCT11294), elox the outer vane stub(s) and part of the vane radial airfoil cross section through the outer shroud.

(2) Tap the remaining portion of the vane to detach it from the inner shroud brace joint, and completely disengage the vane.

(3) Remove excess braze alloy by grinding flush with the outer and inner shrouds.

(4) Clean areas to be welded with acetone (item 13, table C–1)

(5) Install replacement vanes and, using welding wire (item 350, table C–1), tack-weld vanes as outlined in SP No. 5001 in Appendix E.

(6) Check geometric flow area of nozzle. (Refer to table 5-71.)

(7) Using welding wire (item 349, table C–1), weld voids in outer retaining ring as outlined in SP No. 5001 in Appendix E, and grind flush.

(8) Clean areas to be brazed with acetone (item 13, table C–1)

(9) Apply brazing alloy (item 63, table C–1)to the assembly, and vacuum-braze as outlined in SP No. 5004 in Appendix E.

(10) Check geometric flow area of nozzle. (Refer to table 5-71.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(11) Perform a visual and fluorescent-penetrant inspection of welds and braze joints. (Refer to table 5-72.) Cracks are not acceptable.

m. On second stage gas producer nozzles (1-120-000-06/14), repair metal fallout of the inner shroud, that has had retaining rings installed, as follows:

(1) Using a stainless steel wire brush, clean area of void.

(2) Clean areas to be welded with acetone (item 13, table C–1)

(3) Using welding wire (item 349, table C–1), build up void as required (or use a piece of inner shroud from a nozzle of the same part number and butt-weld in place).

NOTE

Weldments must end 1/16 inch (0.159 cm) from any brazed joint.

(4) Blend welds flush with base metal.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(5) Perform a visual and fluorescent-penetrant inspection of repaired areas. Cracks are not acceptable.

n. On second stage gas producer nozzles (1-120-000-06/14) remove metalization, that cannot be removed by normal cleaning procedures, from vanes by using 220-grit aluminum oxide powder (item 36, table C–1), applied as a dry blast with 30 to 40 psi air pressure.

WARNING

FLIGHT SAFETY PART

Dimensional inspection after the following repair is flight safety critical.

o. Repair undersize 5.5010 to 5.5015 inch outside diameter of spacer (42, figure 4-38) with metal spray or chrome plate, as follows:

(1) Metal spray spacer as follows:

(a) If necessary, machine surface to obtain 0.003 inch (0.076 mm) minimum plate thickness after final machining.

(b) Clean surfaces to be metal sprayed with acetone (item 13, table C–1), isopropyl alcohol (item 25,table C–1), or denatured alcohol (item 24,table C–1).

(c) Mask areas not to be grit-blasted with tape (item 327, table C–1). Grit-blast exposed area using silicon carbide grit (item 272, table C–1); then remove all silicon carbide particles.

(d) Immediately flame spray using nickel aluminide powder (item 224, table C–1). (Refer to SP No. 5006 in Appendix E.)

(e) Machine spacer to dimensions given in table 5-69.

(2) Chrome plate spacer as follows:

(a) Machine OD as necessary to obtain 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final machining. Length of machine area will be 0.150 ± inch (0.381 ± 0.025 cm).

(b) Chrome-plate spacer. (Refer to SP No. 6014 in Appendix E.)

(c) Bake at 365° to 385°F (180° to 196°C) for 3 hours.

(d) Machine spacer to dimensions given in table 5-69.

p. Repair loose or improperly staked blades, or blades that are not flush within 0.012 inch (0.030 cm) of disk face by removing blades. Reinstall blades, repin, and stake as outlined in paragraph 5-317.

WARNING

FLIGHT SAFETY PART

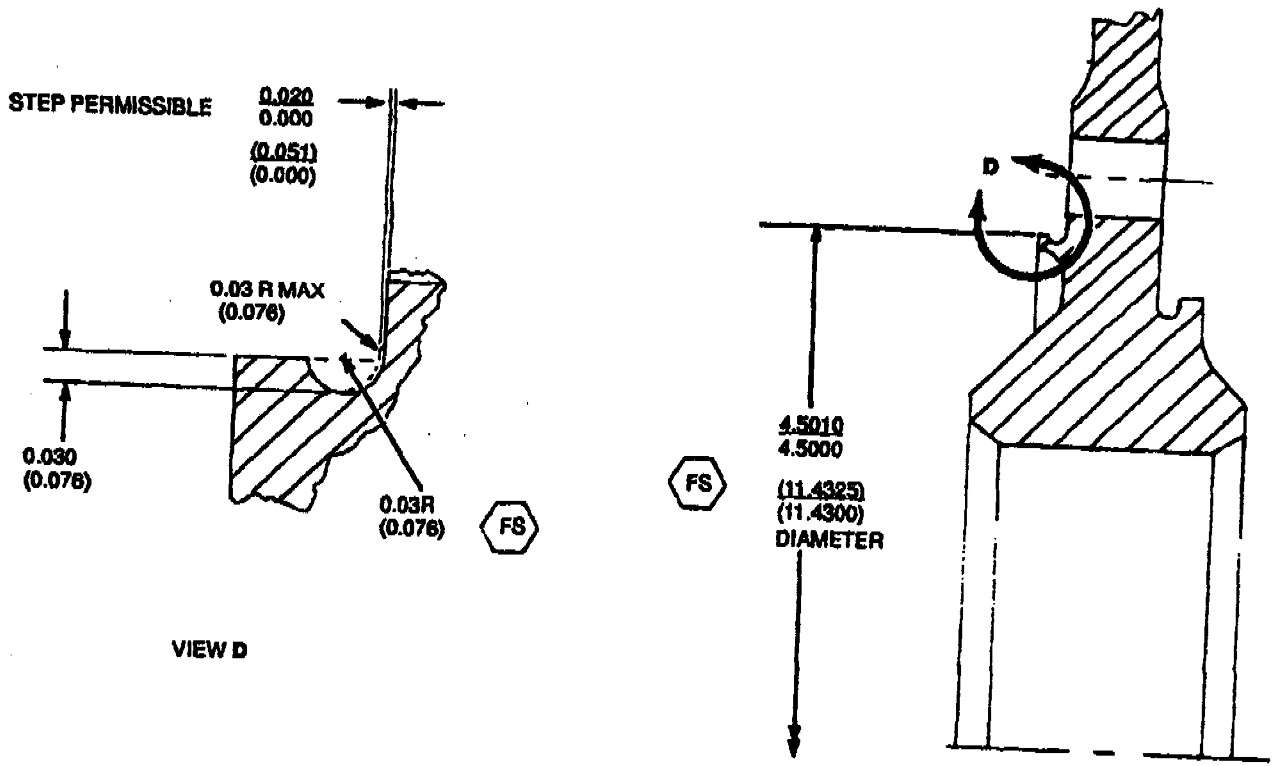
The following dimensional inspection is flight safety critical.

q. Repair worn surfaces on 4.5000 to 4.5010 inch (11.4300 to 11.4325 cm) diameter of rotor disk, where 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup is required, by thermo flame spraying as follows: (See figure 5-165.)

(1) Machine, if necessary, to obtain a 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup thickness after final machining.

(2) Plasma spray rotor disk with Metco 450 (item 218, table C–1). (Refer to SP No. 5006 in Appendix E.)

(3) Machine to dimensions given.



WARNING

Flight Safety

0.03 Maximum Radius and the 4.5000 to 4.5010 Diameter are flight Safety Critical.

Figure 5-165. Second Stage Gas Producer Turbine Rotor - Repair Area.

r. Repair second stage gas producer cylinder surface projections, nicks, and dents as follows:

CAUTION

Do not blend-repair using power tools, or damage to parts may result.

(1) Using small diesinker type file and India or Carborundum stones, blend-repair. Use crocus cloth (item 125, table C–1) for final polishing.

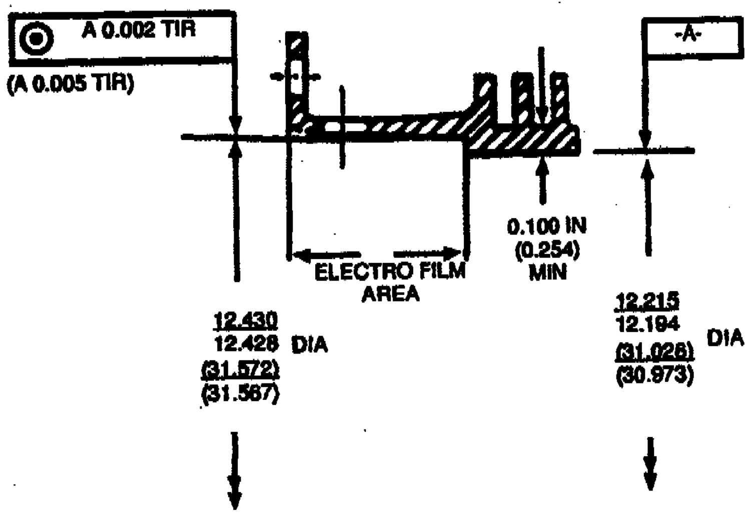
(2) Blend all repairs and finish smoothly.

s. Repair worn ID surface dimensions on cylinder by flame-spraying as follows: (See figure 5-166.)

NOTE

If inspection reveals the need of repairs, other than spraying, they must be accomplished before the spraying procedure is started.

(1) Plasma flame-spray the 12.194 to 12.215 inch (30.973 to 31.026 cm) diameter using nickel aluminide wire (item 218, table C–1). (Refer to SP No. 5006 in Appendix E.)



CYLINDER MAY BE INSPECTED
IN RESTRAINED POSITION

DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-166. Second Stage Gas Producer Cylinder - Repair Area.

(2) Build sufficient metal on the surface to allow approximately 0.005 inch (0.013 cm) to 0.010 inch (0.025 cm) diametrically for machining to size.

NOTE

Continuous coating is not required after grinding to final size. Areas of exposed base metal are acceptable.

t. Repair second stage gas producer cylinder ID as follows:

(1) Using suitable lathe, machine cylinder to obtain allowable tip clearance between second stage gas producer turbine rotor assembly and second stage gas producer cylinder. Minimum cylinder wall thickness is 0.100 inch (0.254 cm). If rework is necessary, due to turbine tip rub, grind cylinder until 60 percent of the circumferential surface area has been cleaned up. Maximum dimension after cleanup shall not exceed 12.208 inch (31.008 cm). (Refer to table 5-69.)

CAUTION

Do not blend-repair using power tools, or damage to parts may result.

(2) Blend-repair nicks, dents, burrs, and pits using small diesinker type files and India or Carborundum stones. Use crocus cloth (item 125, table C-1) for final polishing.

u. Repair nut (53, figure 4-38) as follows:

(1) Blend-repair nicks, burrs, and scratches as outlined in SP No. 5000 in Appendix E. If, during repair, surface coating has been disturbed, repair as outlined in SP No. 6019 in Appendix E.

(2) Repair damaged threads as outlined in SP No. 5007 in Appendix E. If, during repair, surface coating has been disturbed, repair as outlined in SP No. 6019 in Appendix E.

WARNING

FLIGHT SAFETY PART

Verification that there is no loss of silver plate on ID threads and forward face is flight safety critical.

(3) Repair damaged surface coating as outlined in SP No. 6019 in Appendix E.

v. Nozzle may be reworked to increase or decrease flow area within published flow limits by shot peening. (Refer to SP No. 5015 in Appendix E).

w. Repair coating on second stage gas nozzles. Repair coating using Sermaloy "J" per SP. No. 6033.

5-252. REASSEMBLY. Reassembly is not required.

5-253. FUNCTIONAL TEST. Functional test is not required.

5-254. FIRST STAGE GAS PRODUCER ROTOR ASSEMBLY.

5-255. DISASSEMBLY. Proceed as follows:

a. Perform tip diameter check. Proceed as follows:

NOTE

If it is evident (by bowing of the retaining ring) that the blades have shifted forward, disassemble, clean (paragraph 5-256), and reassemble (paragraph 5-260) the rotor, prior to tip diameter check.

Disassembly is mandatory on all first stage gas producer rotors. If it is suspected that a heavy buildup of sand and dust has collected, disassemble as outlined in steps g and h. If no buildup is suspected, disassemble as outlined in steps b through f.

(1) Using a suitable outside micrometer, measure rotor assembly OD at various points on blade ends.

(2) Record maximum reading. Reading shall not exceed 11.695 inches (29.705 cm).

b. Using a yellow Marks-A-Lot ink pencil (item 238, table C–1), number the turbine rotor blades (6, figure 5-167) 1 through 66 in a clockwise direction starting with number one at the alignment "0".

NOTE

If "O" is not evident on inner flange of sealing disk, vibropeen "0" on forward sealing disk at circumferential location in line with anti-rotation knob on retaining ring.

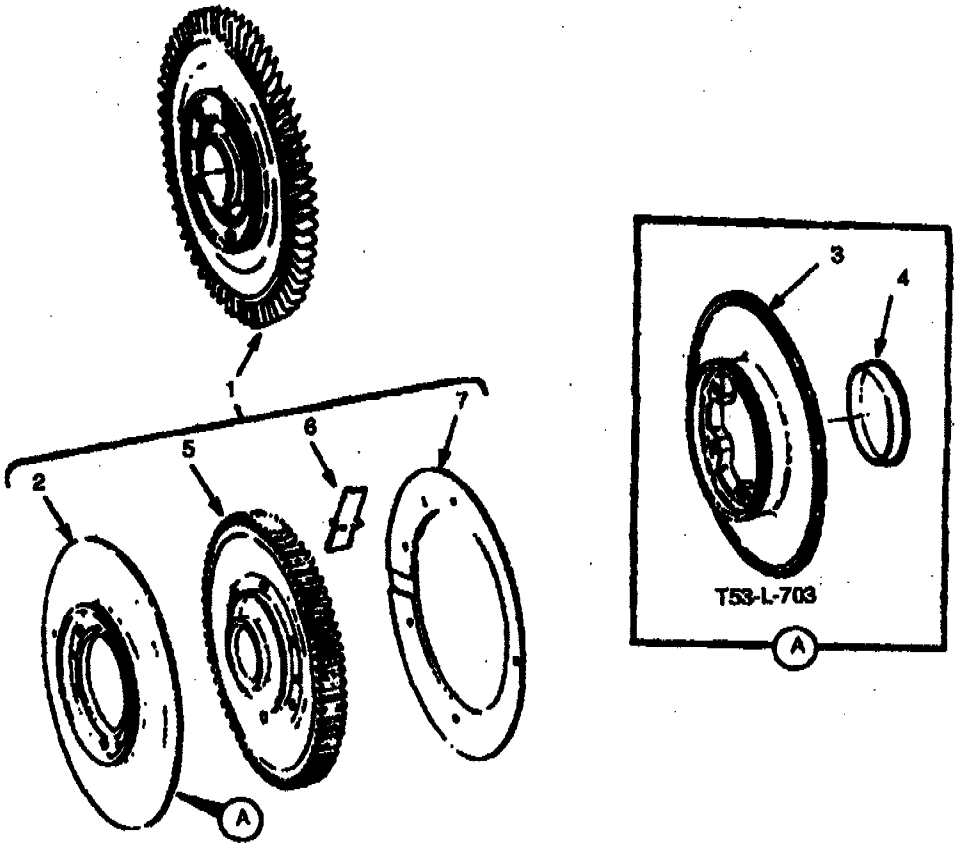


Figure 5-167. First Stage Gas Producer Turbine Rotor Assembly.

c. Position first stage gas producer turbine rotor assembly (1) with forward face up.

d. Using drift (LTCT4731), lightly tap sealing disk (2 or 3) to misalign bolt holes in turbine disk (5).

NOTE

Apply penetrating oil (item 230, table C–1), or equivalent, to sealing disk (2) and allow the oil to soak in for as long as possible.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-167				
-1	1-101-100-08	TURBINE ROTOR, First Stage Gas Producer	1	B
	1-100-880-12	TURBINE ROTOR, First Stage Gas Producer	1	A, C, D, E
	1-101-530-01	TURBINE ROTOR, Gas Producer	1	A, C, D, E
-2	1-100-135-03	. DISK, Turbine Rotor, Sealing	1	A, C, D, E
-3	1-100-545-03	. DISK, Turbine Rotor, Sealing	1	B
-4	1-100-559-01	. SPACER, Rotor	1	B
-5	1-100-133-01	. DISK, Turbine	1	
-6	1-100-362-06	. BLADE, Turbine	66	B
	1-100-132-06	. BLADE, Turbine (NHA 1-100-880-12)	66	A, C, D, E
	1-100-563-01	. BLADE, Turbine (NHA 1-100-530-01)	66	A, C, D, E
-7	1-100-890-03	. RING ASSEMBLY, Retaining	1	

e. Turn first stage gas producer turbine rotor assembly over and position on support (LTCT4728).

CAUTION

In following step f, in the event blades are lodged in disk, do not attempt removal by striking with a sharp metal tool. Use a soft fiber drift and tap gently.

f. Insert drift (LTCT4731) into bolt hole and, using blade removal tool (LTCT4734), remove retaining ring (7) by lightly tapping drift until sealing disk (2 or 3) is lowered sufficiently to remove retaining ring and blades (6).

After all blades have been removed, remark blade position numbers using vibropeen method, 0.002 to 0.005 inch deep, on front surface of blade root, below sealing plate tang.

CAUTION

In the following step g, prevent damage to rotor components while pressing by using soft blocks as required.

NOTE

When reinstalling blades, blades are to be installed into the slots from which they were removed.

NOTE

If it is suspected that a heavy buildup of sand and dust has collected (as evidenced by bowed retaining ring), disassemble as outlined in following steps g and h.

g. Place turbine rotor assembly in a suitable arbor press, sealing disk facing down, and apply pressure to the aft rotor bore area while supporting the leading edge blade platforms.

h. When retaining ring assumes its normal flat position, remove components as outlined in steps b through f.

5-256. CLEANING OF FIRST STAGE GAS PRODUCER ROTOR ASSEMBLY, AFT OIL RING, AND ORIFICE PLATE. Proceed as follows:

CAUTION

When vapor blasting blade root area, mask top of blade platforms and airfoil areas to protect surface coating.

NOTE

During cleaning procedure, make certain blade platform slots and air holes are free of contaminant buildup. Repeat cleaning procedure, using stiff non-metallic brush, until slots and air holes are clean. It is permissible to vapor blast blade slots using 220 grit aluminum oxide powder applied as a dry blast with 30 to 40 psi air pressure (item 36, table C–1) or plastic media blast (refer to SP. No. 6003.1).

a. Clean all parts as follows:

(1) Place parts on a stainless steel rack or in a basket.

(2) Clean all parts by dry cleaning solvent method (refer to SP. No. 3002 in Appendix E)

(3) Immerse parts in alkaline rust remover (item 259, table C–1) for approximately 1/2 hour.

(4) Rinse in cold water for 2 to 3 minutes.

(5) Using a water hose, pressure flush parts. Brush clean, if necessary.

(6) Soak in a hot water rinse for 2 to 3 minutes. Dry, using forced air.

(7) Repeat preceding steps (1) through (6), if necessary.

WARNING

Prior to performing cleaning method in following step b, protect surface coating by masking the top of the blade platforms and airfoil areas, as required. The following method shall not be used on coated blades.

b. Vapor-blast underpart of blade platforms paying particular attention to dislodging buildup in disk and ring slots. (Refer to SP No. 3003 in Appendix E.)

NOTE

As an alternate procedure, 220-grit aluminum oxide powder (item 36, table C–1) may be applied as a dry blast with 30 to 40 psi (210.9 to 2812.3 gm sq cm) air pressure. Do not allow grit to clog air passages.

c. Ensure that all contaminant has been removed from slots. If contaminant remains in slots, repeat step b.

5-257. CLEANING OF FIRST STAGE GAS PRODUCER TURBINE ROTOR BLADES.

NOTE

The following is an alternate cleaning procedure for uncoated blades P/N 1-100-362-06.

a. Equipment: Roto-finish, Vibratory Machine, Spiratron ST-3, tub capacity 3.5 cu. feet, or equivalent.

b. Material Requirements:

(1) Finishing compounds: Unibrite 141 Bio-degradable compound (item 156, table C–1), or equivalent.

(2) Finishing media: Class I (Plastic Bonded, fast cutting): Type BI (I small media).

(3) Media source: Class I, type B ceramic cones, CD-30, 1/2 x 1/2 inch, or equivalent (item 83, table C–1).

(4) Rust inhibitor: RP-1 (item 256, table C–1), or equivalent.

c. Procedure:

(1) Set vibratory machine media for 200 lbs (ST-3), and use Class 1 media. Eccentric motor weights should be set as follows: Top 1-1/2 - bottom 2-1/2; and position 8 or 9.

(2) Set compound pump to measure proper amount of finishing compound and use compound as per manufacturers instructions.

(3) Set timer as follows for the type of metal being cleaned:

(a) Aluminum - 20 to 30 minutes.

(b) Magnesium - 20 to 45 minutes.

(c) Steel - 20 to 120 minutes.

(4) Clean blades by dry cleaning solvent method per SP 3002 to remove any oil, dirt, or grease which may contaminate the finishing media in the vibratory cleaning machine.

(5) Protect blade, slots, holes, recesses from clogging by media, by plugging holes, slots, etc. with rubber masking tape, or plastic dip coating. Sometimes even lacquer may be used.

(6) Place 60 to 65 degreased blades in the vibrating finish machine and clean for two (2) hours. For most effective cleaning, media to parts ratio should be 4:1 by volume.

(7) Remove parts (blades) and rinse thoroughly in cold water (room temperature).

(8) Immerse blades in rust inhibitor (item 256, table C–1) as per manufacturers' recommendation.

(9) After cleaning blades, mount blades ("fir-tree" up), in a suitable welding fixture padded with cork or rubber to prevent damage to air foil surfaces of the blade, and to mask the blades' air cooling holes.

(10) Bead-blast the "fir-tree" area of each blade with MIL-G-9954, size 10 glass beads (item 4, table C–1), using a pressure of 20 to 30 psi (1406 to 2109 gm per sq cm) to remove carbon deposits. After blasting each blade, blow out "fir-tree" area with clean, dry compressed air to remove loosened carbon deposits and broken glass bead residue.

5-258. INSPECTION OF FIRST STAGE GAS PRODUCER TURBINE ROTOR ASSEMBLY AFT OIL RING AND SEALING RING. Perform specific inspection procedures listed in table 5-73.

Table 5-73. Inspection of First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring, and Sealing Ring.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38				
-19	Aft Oil Ring	Visual and SIE	Wear, or scoring on finish.	Repair. (Refer to paragraph 5-259).
		Visual and Magnetic-Particle (Refer to table 5-74)	Cracks.	Not allowed. Replace.
-24	Sealing Ring (T53-L-13B, -15, -701, -701A)	Visual and SIE	Scoring on 5.760 to 5.762 inch (14.630 - 14.635 cm) diameter. (Refer to table 5-75 for limits).	Replace if limits are not met.
-26	Forward Cone	Visual	Scratches, burrs, scoring, galling on seating surface.	Repair. (Refer to paragraph 5-259).
		Visual and Dye-Penetrant	Cracks.	Not allowed. Replace.
		Visual and SIE	Concentricity, if assembled runout is not met. (Refer to figure 5-168 for limits).	Replace if limits are not met.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
-27	Bolt	Visual	Damaged threads.	Repair or replace. (Refer to SP No. 5007 in Appendix E).
		Visual and Fluorescent Penetrant	Cracks.	Not allowed. Replace.
-38	Sealing Ring (T53-L-703)	Visual and SIE	Scoring on 6.236 to 6.238 inch (15.839 - 15.845 cm) diameter (Refer to table 5-75 for limits).	Replace if limits are not met.
		Assembly	Warpage	If part cannot be installed, repair per paragraph 5-259.
5-167				

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
-1	First Stage Gas Producer Turbine Rotor Assembly	Visual	Unusual heat discoloration of disk and burning of blades following overtemperature condition.	Not allowed. Replace.

Table 5-73. Inspection of First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring, and Sealing Ring.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-167 (Cont)				
-1 (Cont)	First Stage Gas Producer Turbine Rotor Assembly (Cont)	Visual and SIE	Blade growth. (Refer to table 5-76 for limits).	Replace blades. (Refer to paragraph 5-318).
				Blade sets (two blades located 180 degrees apart), which are beyond limits given in table 5-76 must be removed from assembly and scrapped. **CAUTION** Grinding is not authorized to bring used blades back into dimension when blade growth exceeds limit.
		Visual and Fluorescent Penetrant	Cracks.	Not allowed. Replace.
			Cracks in disk and blades following over-temperature condition.	Not allowed. Replace.
		Dimensional	Wear and fits.	Replace if limits are not met.
-2	Sealing Disk (T53-L-13B, -15, -701, -701A)	Visual	Rubs in labyrinth seal area. (Refer to table 5-75 for limits).	Repair or replace. (Refer to paragraph 5-259).
		Visual and SIE	Wear in labyrinth seal area. (Refer to table 5-76 for limits).	Check OD in three places. Replace is limits are not met.
			Nicks and dents in labyrinth seal area. (Refer to table 5-75 for limits).	Repair. (Refer to paragraph 5-259).
		Visual and SIE	Mutilation and distortion of outer disk area. (Refer to table 5-75 for limits).	Repair or replace. (Refer to paragraph 5-259).
			Check bore diameter. (See figure5-178).	Diameter exceeding maximum will be repaired per paragraph 5-259.

Table 5-73. Inspection of First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring, and Sealing Ring.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-167				
	WARNING FLIGHT SAFETY PART Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.			
-2 and -3	Sealing Disk	Visual and Fluorescent-Penetrant	Cracks on OD. (Refer to table 5-75 for limits).	Repair or replace. (Refer to paragraph 5-259)
			Cracks other than those on OD.	Not allowed. Replace. (Refer to paragraph 5-259.)
		Visual and SIE	Raised material around bolt holes.	Repair. (Refer to paragraph 5-259.)
-5	Turbine Disk	Visual and SIE	Circumferential rubs on forward and aft face beyond 0.003 inch (0.008 cm) deep and 0.100 inch (0.254 cm) wide.	Replace if limits are exceeded.
			Raised material bolt holes. (Refer to table 5-75 for limits.)	Repair. (Refer to paragraph 5-259.)
	WARNING FLIGHT SAFETY PART The following dimensional inspection is flight safety critical.			
			Wear on 4.1200 to to 4.1205 inch (10.465 - 10.466 cm) diameter or 5.4995 - 5.5005 inch (13.9687 to 13.9713 cm) diameter.	Repair. (Refer to paragraph 5-259).
	WARNING FLIGHT SAFETY PART Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.			
			Nicks and dents in face area of disk tenon. (Refer to table 5-75 for limits).	Replace if limits are exceeded.
		Visual and Fluorescent Penetrant	Cracks.	Not allowed. Replace.
		Dimensional	Wear and fits. (Refer to tables 5-75 and 5-76 for limits.)	Repair or replace. (Refer to paragraph 5-259).

Table 5-73. Inspection of First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring, and Sealing Ring.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-167 (Cont)				
-6	Turbine Rotor Blade	Visual and SIE	Tip rub. Refer to table 5-75 for limits and see figure 5-169.	Repair. (Refer to SP No. 5000 in Appendix E).
			Minimum shroud wall thickness on trailing edge. (Refer to table 5-75 for limits).	Replace if limits are exceeded. (Refer to paragraphs 5-259 and 5-318.)
			Dents and nicks on side. (See figure 5-169 for limits).	Replace blades if limits are exceeded. (Refer to paragraphs 5-259 and 5-318).
			Dents and nicks on leading and trailing edges. (See figure 5-169 for limits.	Replace blades if limits are exceeded. (Refer to paragraphs 5-259 and 5-318).
			Chips, dents, spalls, blisters and crazing on surface coating (P/N 1-100-132). (Refer to table 5-75 for limits).	Replace blades if limits are exceeded. (Refer to paragraphs 5-259 and 5-318).

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.

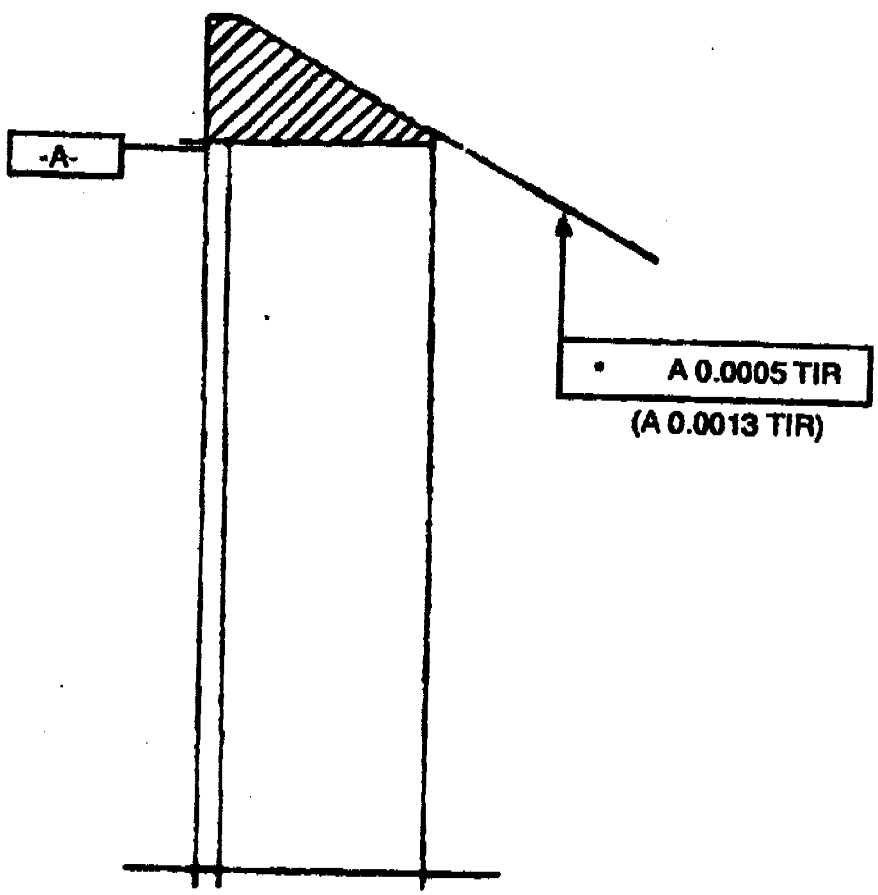
FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
		Visual and Fluorescent-Penetrant	Cracks.	Not allowed. Replace blades. (Refer to paragraph 5-318).
-7	Retaining Ring	Visual	Permanent distortion, bowing, and mutilation. (Refer to table 5-75 for limits).	Replace if limits are not met.
		Visual and Fluorescent-Penetrant	Cracks.	Not allowed. Replace.
			Retaining rings with missing or damaged knobs may be repaired.	Manufacture the knob in accordance with drawing P/N 1-100-457-01. Replace knob per assembly drawing P/N 1-100-890-03.
-4	Spacer Ring (T53-L-703)	Visual	Nicks, burrs, and scratches.	Repair. (Refer to SP No. 5000 in Appendix E).
			Cracks.	Not allowed. Replace.
		Dimensional	Wear and fits. (Refer to table 5-76 for for limits).	Replace if limits are not met.

Table 5-74. Magnetic-Particle Inspection of First Stage Gas Producer Rotor Assembly, Aft Oil Ring, and Sealing Ring.

Figure and Index	Nomenclature	Method of Magnetization
4-38, 19	Aft Oil Ring	Circular, use central conductor at 1000 amperes.
4-38, 53	Nut, plain, round	Circular, use central conductor at 600 amperes.

NOTE

Concentricity is only required if unable to obtain runouts at engine assembly



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-168. Forward Cone Concentricity Check.

Table 5-75. First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring and Sealing Ring Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Pilot Diameter Exceeds Maximum Overhaul Dimensional Limits	5-170	a. Measure bore diameter only if pilot diameter exceeds the maximum overhaul limits. (Refer to table 5-76. Dim E is pilot diameter.) b. If bore diameter exceeds maximum overhaul limits in table 5-76, replace disk assembly c. Disks that exhibit acceptable bore diameters shall have a Q point (ball root) dimensional check performed. (Refer to table 5-76.) d. Disks that indicate a Q point equal to or less than maximum overhaul dimension, are acceptable for repair. If tip diameter exceeds overhaul limits, tip-grind as outlined in paragraph 5-318, or reblade as outlined in paragraph 5-318. If the pilot diameter exceeds overhaul limits, repair as outlined in paragraph 5-259. e. Replace disks that fail to meet requirements of the Q point dimensional inspection.
Nicks and Dents in Face Area of Disk Tenon		Inspect both sides of disk tenons for nicks and dents in face area. a. Nicks are acceptable up to 0.005 inch (0.013 cm) in depth. Remove sharp edges by blending. b. Dents are acceptable up to 0.005 inch (0.013 cm) in depth. Smooth dents do not require rework. c. Replace disk if limits are exceeded. **NOTE** Defects located on blade slot edges must be blended to a 0.010/0.020 inch (0.025/0.051 cm) radius if existing radius has been damaged.

Table 5-75. First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring and Sealing Ring Inspection Limits.

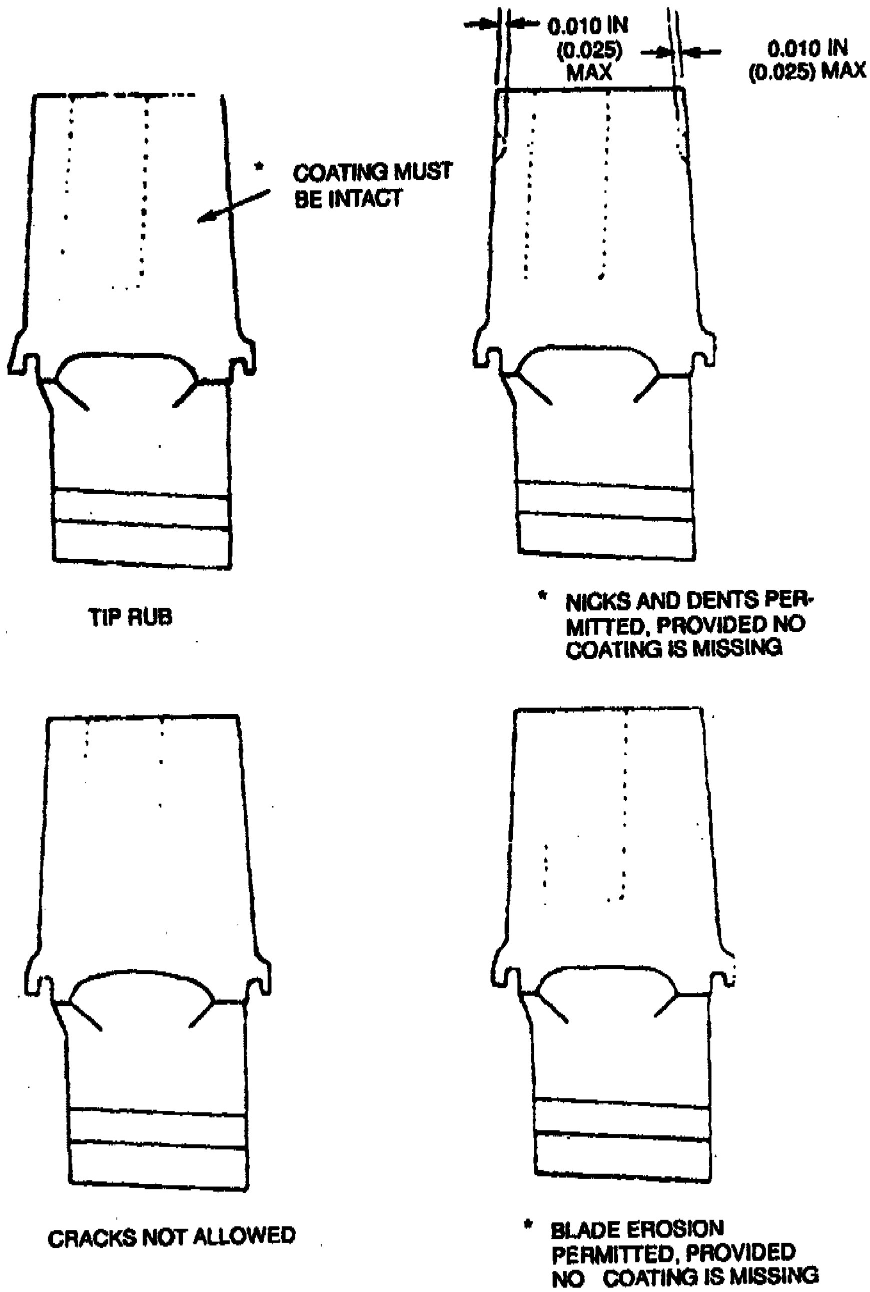
DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Raised material round bolt holes	5-171	Inspect aft side of disk that mates with spacer. Material deformed around bolt holes or surface not perpendicular to surface A-B per print, shall be repaired per paragraph 5-259.
Cracks in Outer Diameter of Sealing Disk.		a. Cracks less than 0.060 inch (0.152 cm) in length in the outer diameter of the sealing disk shall be reworked as outlined in paragraph 5-259. b. If cracks exceed 0.060 inch (0.152 cm) in radial length, replace sealing disk.
Sealing Disk for Mutilation and Distortion of Outer Disk Area	5-172	a. If mutilation is evidenced, replace sealing disk. b. Inspect for distortion by placing sealing disk on a flat surface and performing dimensional check in accordance with figure 5-172. If the 0.090 inch (0.229 cm) maximum dimension between the sealing disk rim and the flat surface cannot be maintained, rework as outlined in paragraph 5-259. c. An alternate method of performing a dimensional check is to check the OD of sealing disk in a suitable fixture and measure requirements of figure 5-172, using standard inspection equipment. **NOTE** Dimensional check need only be performed in event sealing disk is suspect as indicated by a heavy buildup of contaminants and difficulty in disassembly.
Scoring on 5.760 to 5.762 inch or 6.236 inch Diameter of Outer Sealing Ring	5-173	a. Scoring is acceptable to a depth of 0.010 inch (0.025 cm) provided no greater than 120 degrees (cumulative or continuous) of the circumference is affected. **NOTE** Remove surface projections before measuring score depth so as to obtain a more accurate reading. b. If above limit is exceeded, replace sealing ring.
Retaining Ring for Permanent Distortion, Bowing, and Mutilation		Replace retaining ring if defective. **NOTE** In most cases, distortion of retaining ring noted before disassembly will be eliminated by removal.

Table 5-75. First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring and Sealing Ring Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Nicks and Dents in Sealing Disk Labyrinth Seal Area		Nicks and dents are allowed up to 0.032 inch (0.081 cm) in depth. No more than six defects per land are acceptable. Replace disk if limits are exceeded. If defects do not exceed limits, repair as outlined in paragraph 5-259.
Rub in Sealing Disk Labyrinth Seal Area	5-174	Rubs are allowed provided 5.726 inch minimum OD is maintained for (P/N 1-100-132) blades, and 6.214 inch minimum OD is maintained for T53-L-703 engines. If within limits, repair as outlined in paragraph 5-259.
Chips, Dents, Spalls, Blisters, and Crazing on Surface Coating of Blades (Inspect for Maximum Dimension of Discrepancy) (P/N 1-100-132)	5-175	Defects are acceptable in the shaded areas noted in figure 5-175, excluding the platform airfoil fillet radius area, provided that the following conditions are met: **NOTE** Any number of defects are allowed on blade platform (excluding blades fillet radii). This applies to concave and convex sides. a. Airfoil defects are within 0.130 inch (0.330 cm) of blade tips. b. Defects are not in excess of 0.060 inch (0.152 cm). c. Defects of 0.030 to 0.060 inch (0.076 to 0.152 cm) are not evident in more than two locations per blade area. d. Defects under 0.030 inch (0.076 cm) maximum are not evident in more than six locations per blade area. e. Distance between defects is greater than maximum dimensions of smallest defect. **NOTE** Burnish marks in other areas are acceptable provided that coating is not removed.

Table 5-75. First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring and Sealing Ring Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Chipped, Missing or Nicked Coating (P/N 1-100-132)	5-175	Minor surface defects in coating in all areas may be repaired. (Refer to SP. No. 6032).
Tip Rub at Leading Edge Tip of Blades	5-176	a. Defects that do not exceed 0.060 inch (0.152 cm) on leading edge, and 0.060 inch (0.152 cm) on outer diameter are acceptable. (See figure 5-176). Blend-repair tip rub only to the extent of eliminating the rolled-over material. If limits are exceeded, replace blades. (Refer to paragraph 5-318). b. Inspect areas with missing coating (i.e., leading edge); adjacent surface adjacent to and extending along length of trailing edge; and on concave surface just above airfoil/platform fillet) for sulfidation. Sulfidation is unacceptable. Any evidence of a greenish tint, metal spalling or a glazed porcelain-like finish on leading edge is cause for rejection. **NOTE** Sulfidation inspection does not apply to blade P/N 1-100-362-06. **NOTE** Loss of protective quality of coating will be signaled by the presence of a green color (nickel oxide) and generally by an observed reduction in blade surface smoothness. A blade with satisfactory coating with have a continuous smooth surface with light to dark-gray colored oxide. Refer to paragraph 5-250a.(1).
Minimum Shroud Wall Thickness on Trailing Edge of Blades	5-177	If outer wall thickness is greater than 0.019 inch (0.048 cm) blades are acceptable.



* REFERENCE TO COATING APPLIES ONLY TO P/N 1-100-132

DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-169. First Stage Gas Producer Turbine Rotor Assembly Blade Damage Limits.

Table 5-76. Dimensional Inspection of First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring and Sealing Ring.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-167								
First Stage Gas Producer Turbine Rotor Assembly*	-1	OD	11.686 (29.682)	11.689 (29.690)	11.671 (29.644)	11.695 (29.705)			5-178 5-178 A
WARNING FLIGHT SAFETY PART The following dimensional inspection is flight safety critical.									
Sealing Disk*	-2	ID	4.1190 (10.4623)	4.1195 (10.4635)	4.1190 (10.4623)	4.1195 (10.4635)			C
Sealing Disk**		OD	5.731 (14.557)	5.733 (14.562)	5.720 (14.529)	5.733 (14.562)			5-174 C.1
Sealing Disk**		OD	5.731 (14.557)	5.733 (14.562)	5.726 (14.544)	5.733 (14.562)			C.2
WARNING FLIGHT SAFETY PART The following dimensional inspection is flight safety critical.									
Sealing Disk**	-3	ID	4.3190 (10.9703)	4.3195 (10.9715)	4.3190 (10.9703)	4.3195 (10.9715)			5-178 C
WARNING FLIGHT SAFETY PART The three following dimensional inspections are flight safety critical									
Turbine Disk	-5	OD	4.1200 (10.4648)	4.1205 (10.4661)	4.1200 (10.4648)	4.1205 (10.4661)			D
		ID	5.4995 (13.9687)	5.5005 (13.9713)	5.4995 (13.9687)	5.5010 (13.9725)			E
		ID	2.195 (5.575)	2.200 (5.588)	2.195 (5.575)	2.203 (5.596)			F
Q Point***			4.368 (11.095)	4.373 (11.107)					5-170

Table 5-76 . Dimensional Inspection of First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring and Sealing Ring.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-167 (Cont)								
Spacer Ring (T53-L-703)	-4	OD	4.3216 (14.9769)	4.3221 (10.9781)	4.3216 (10.9769)	4.3221 (10.9781)			5-178, G
		ID	4.1190 (10.4623)	4.1195 (10.4635)	4.1190 (10.4623)	4.1195 (10.4635)			H
Turbine Disk to	-5	OD	4.1200 (10.4648)	4.1205 (10.4661)	4.1200 (10.4648)	4.1205 (10.4661)	0.0005T (0.0013)	0.0015T (0.0038)	D
Sealing Disk (T53-L-13B, -15, -701, -701A)	-2	ID	4.1190 (10.4623)	4.1195 (10.4635)	4.1190 (10.4623)	4.1195 (10.4635)			O
Turbine Disk to	-5	ID	5.4995 (13.9687)	5.5005 (13.9713)	5.4995 (13.9687)	5.5010 (13.9725)	0.0000	0.0015T (0.0038)	E
WARNING **FLIGHT SAFETY PART** **The following dimensional inspection is flight safety critical.**									
Spacer (T53-L-13B, -15, -701, -701A)	4-38 -42	OD	5.5010 (13.9725)	5.5015 (13.9738)	5.5010 (13.9725)	5.5015 (13.9738)			5-141 M

* If it is evident that blades have shifted, disassemble, clean and reassemble the rotor prior to tip diameter check.

** Part to be inspected in a restrained position.

*** "Q" POINT INSPECTION: The "Q" point position can be determined by either of two methods: Set up turbine disk with radial line vertical and measure the "Q" point vertical dimension to the center line; or set up in turbine disk bore and measure "Q" point radius. The dimensional requirements for both methods of measurement are provided in figure 5-170. Point Q check need only be performed every 45 degrees. Remove blades, as necessary, as close as possible to the 45 degree interval to take measurements.

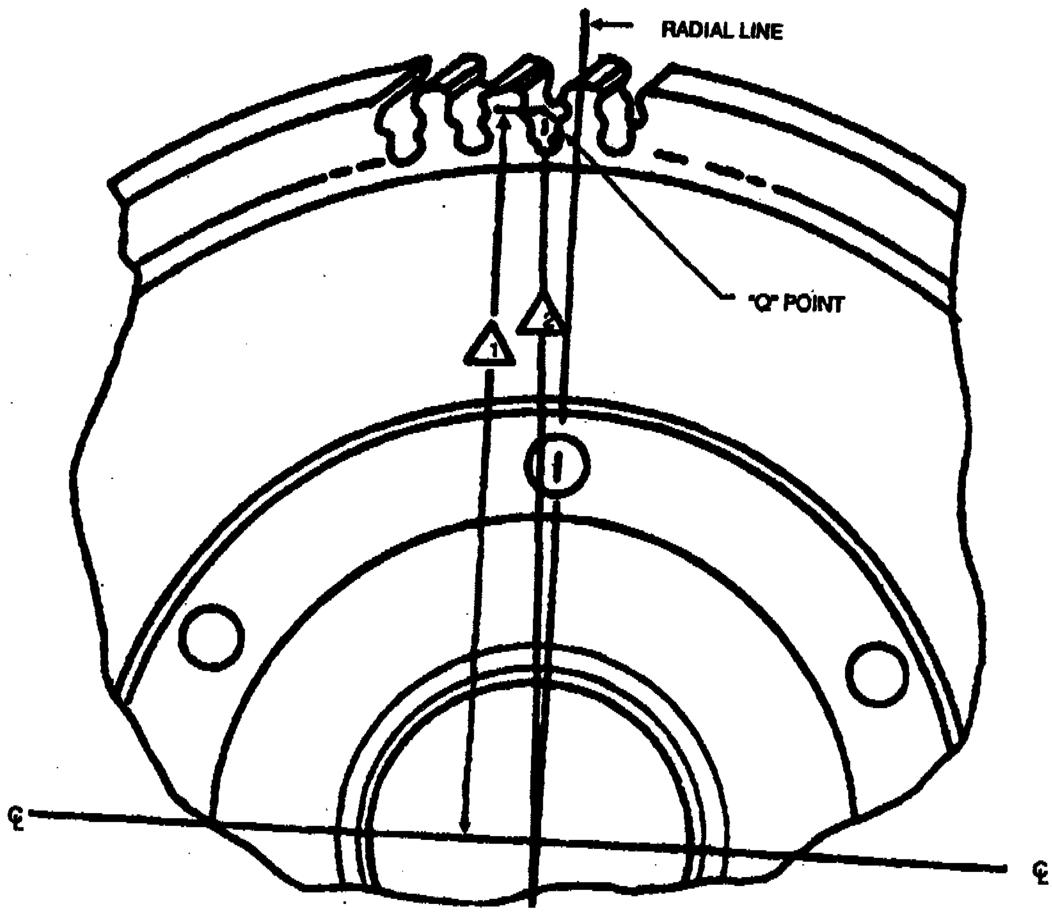
CAUTION

If any of the four turbines indicate a growth beyond acceptable limits in the pilot and "Q" point dimensions, over-temperature is suspected. Check remaining three rotors closely. If either gas producer turbine indicates a growth beyond acceptable limits in the pilot and bore dimensions, overspeed is suspected. Check mating gas producer rotor closely.

1 "Q" POINT DIMENSION TO ℄

2 "Q" POINT RADIUS (USE THIS DIMENSION IF "Q" POINT IS TAKEN FROM CENTER OF BORE).

DIMENSIONS IN ( ) ARE CENTIMETERS



"Q" POINT DIM. TO CENTER LINE 1		"Q" POINT RADIUS TO CENTER OF BORE 2	
DRAWING DIM.	O/H SVC. DIM	DRAWING DIM	O/H SVC. DIM
4.366/4.371 (11.089/11.102)	4.372 (11.105)	4.3672/4.3722 (11.0927/11.1054)	4.3732 (11.1079)

Figure 5-170. First Stage Gas Producer Turbine Disk Assembly "Q" Point Dimension.

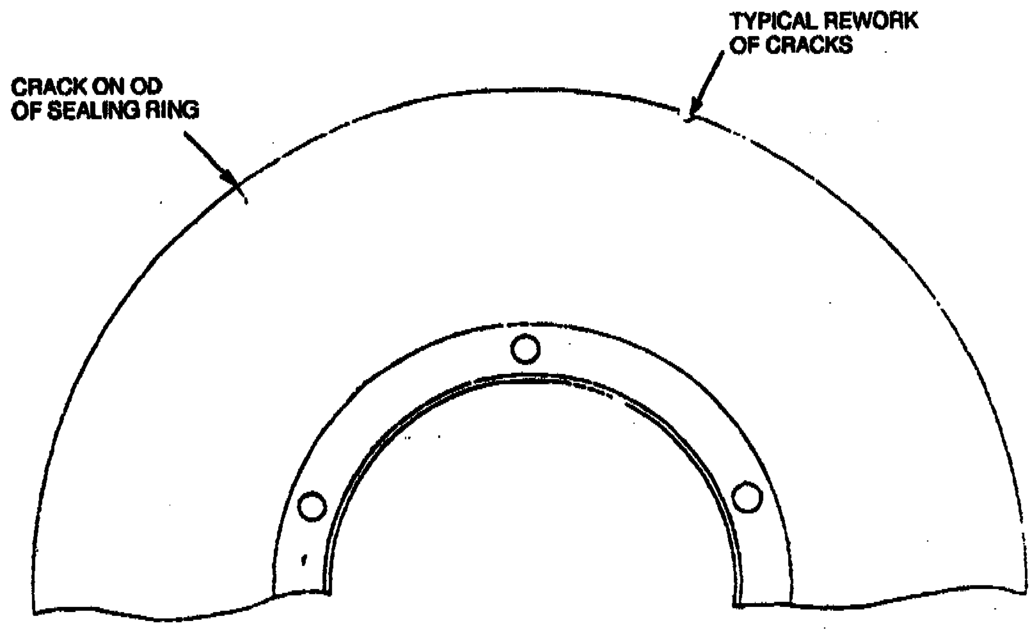


Figure 5-171. Sealing Disk Crack Areas (T53-L-13B, -15, -701, -701A, -703) (Typical).

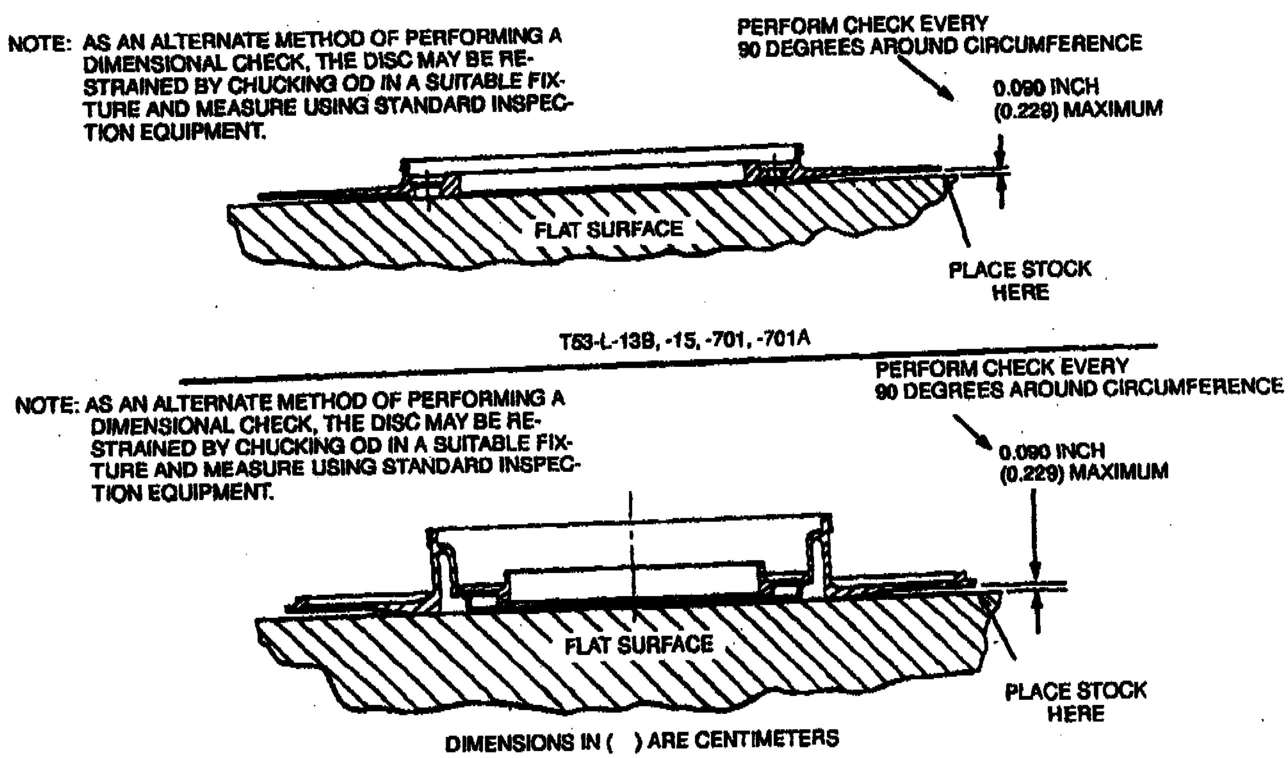


Figure 5-172. Sealing Disk Distortion Check.

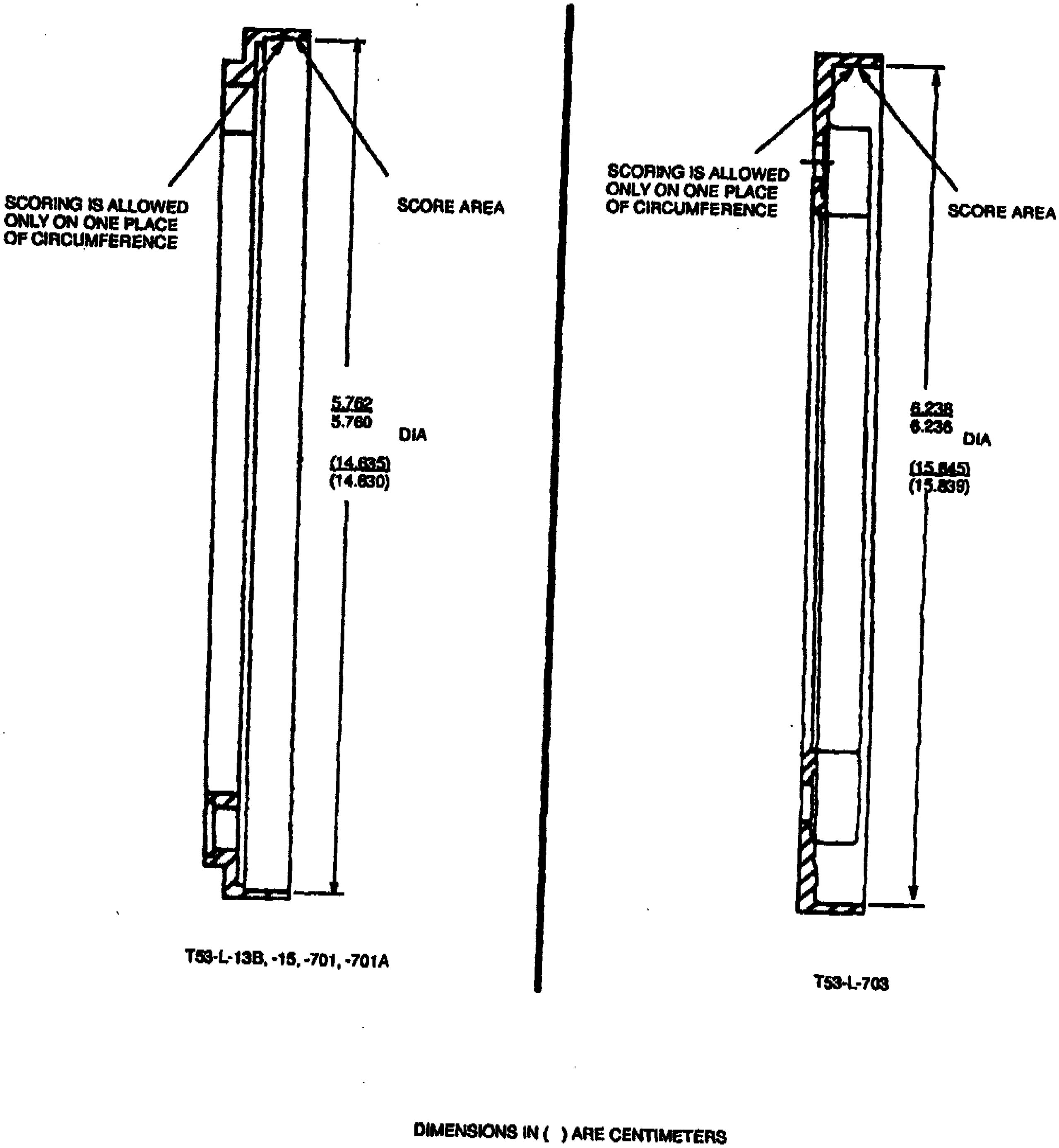


Figure 5-173. Sealing Ring Scoring Area.

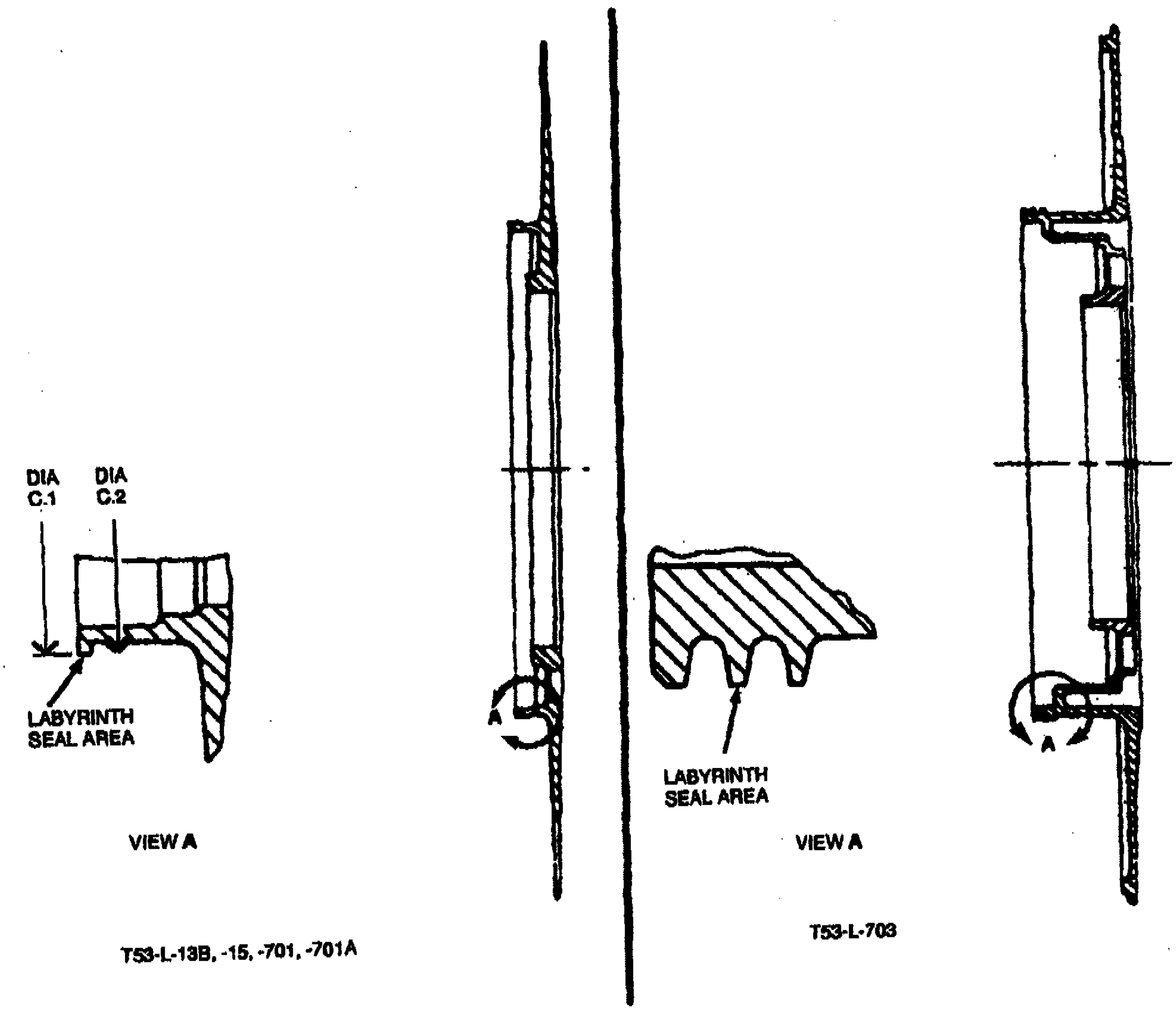


Figure 5-174. Sealing Disk Labyrinth Seal Area.

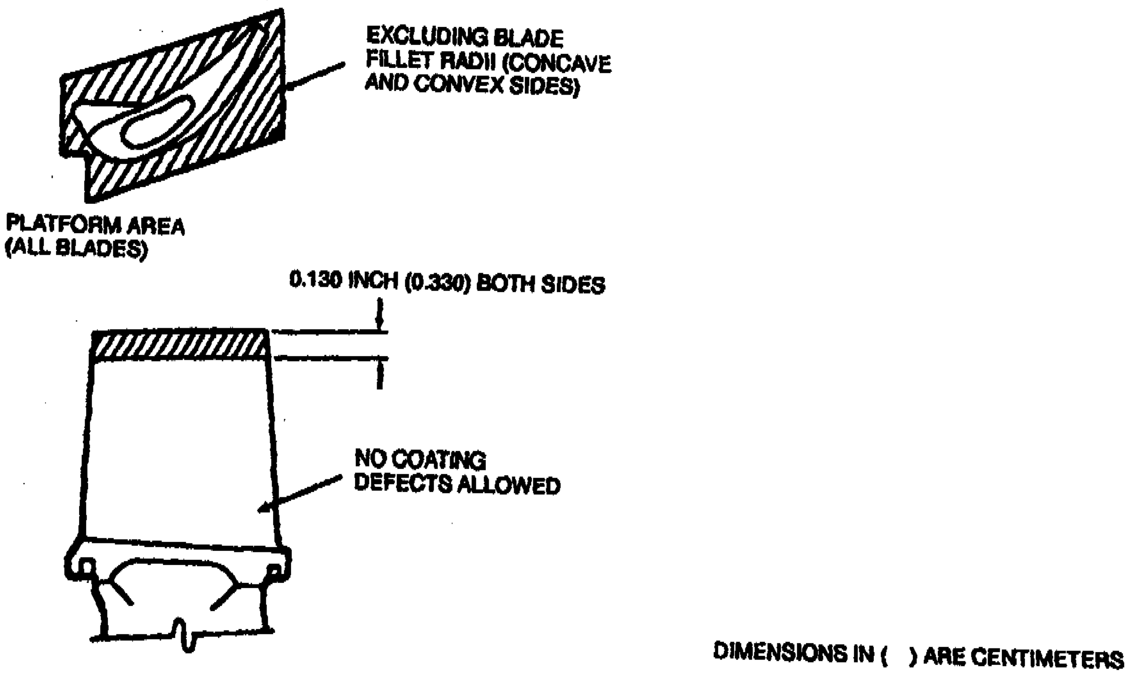


Figure 5-175. First Stage Gas Producer Rotor Assembly Blade Inspection Limits.

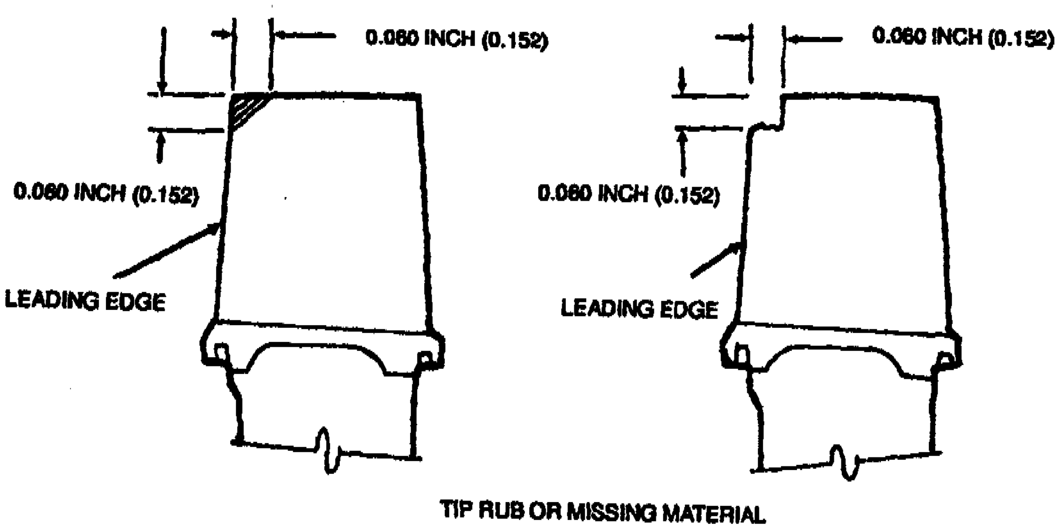


Figure 5-176. First Stage Gas Producer Turbine Rotor Assembly Blade Leading Edge Tip Inspection Limits.

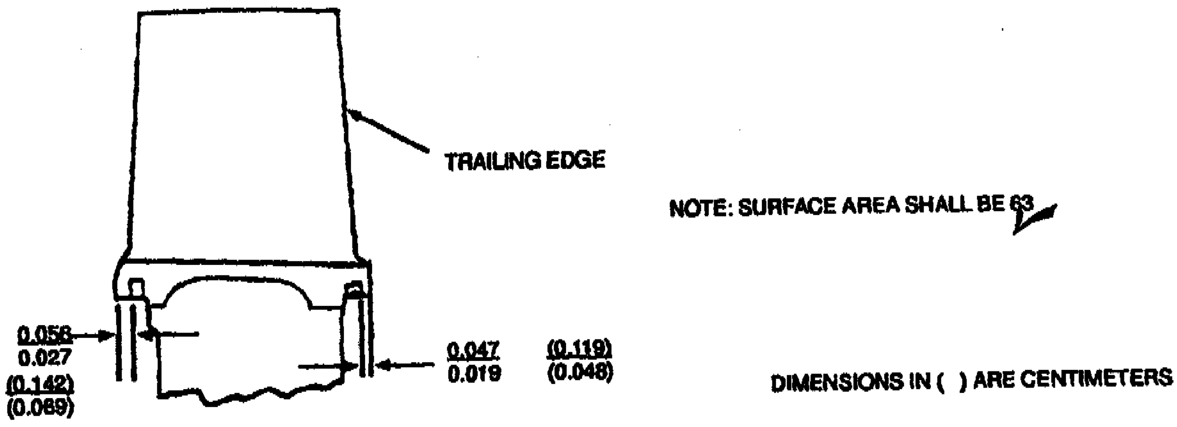


Figure 5-177. First Stage Producer Turbine Rotor Assembly Blade Trailing Edge Shroud Thickness Limits.

5-259. REPAIR OF FIRST STAGE GAS PRODUCER TURBINE ROTOR ASSEMBLY, AFT OIL RING, AND SEALING RING. (See figure 4-38 and 5-167). Proceed as follows:

a. Refinish plating on aft oil ring (19, figure 4-38) as follows. (See figure 5-179.)

(1) Chrome plate 3.0575 to 3.0580 inch (7.7661 to 7.7673 cm) diameter to obtain a 0.002 to 0.010 inch (0.005 to 0.025cm) thickness after final grind as outlined in SP No. 6014 in Appendix E.

(2) Bake at 680° to 720°F (360° to 382°C) for 3 hours.

(3) Machine to dimensions given in figure 5-179.

b. Blend-repair scratches, burrs, and minor scoring and galling on seating surface of forward cone (26, figure 4-38) as outlined in SP No. 5000 in Appendix E. Replace cone if heavy scoring and galling occurs on seating surface.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

c. Blend-repair rolled-over edges caused by rubs on labyrinth seal area. Perform fluorescent-penetrant inspection of reworked area to ensure cracks have not been generated. Replace disk if cracks are evident.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

WARNING

FLIGHT SAFETY PART

Dimensional inspection after the following repair is flight safety critical.

d. Blend-repair nicks and dents in labyrinth seal area of sealing disk to remove projections. Perform fluorescent-penetrant inspection of reworked area to ensure cracks have not been generated. Replace disk if cracks are evident.

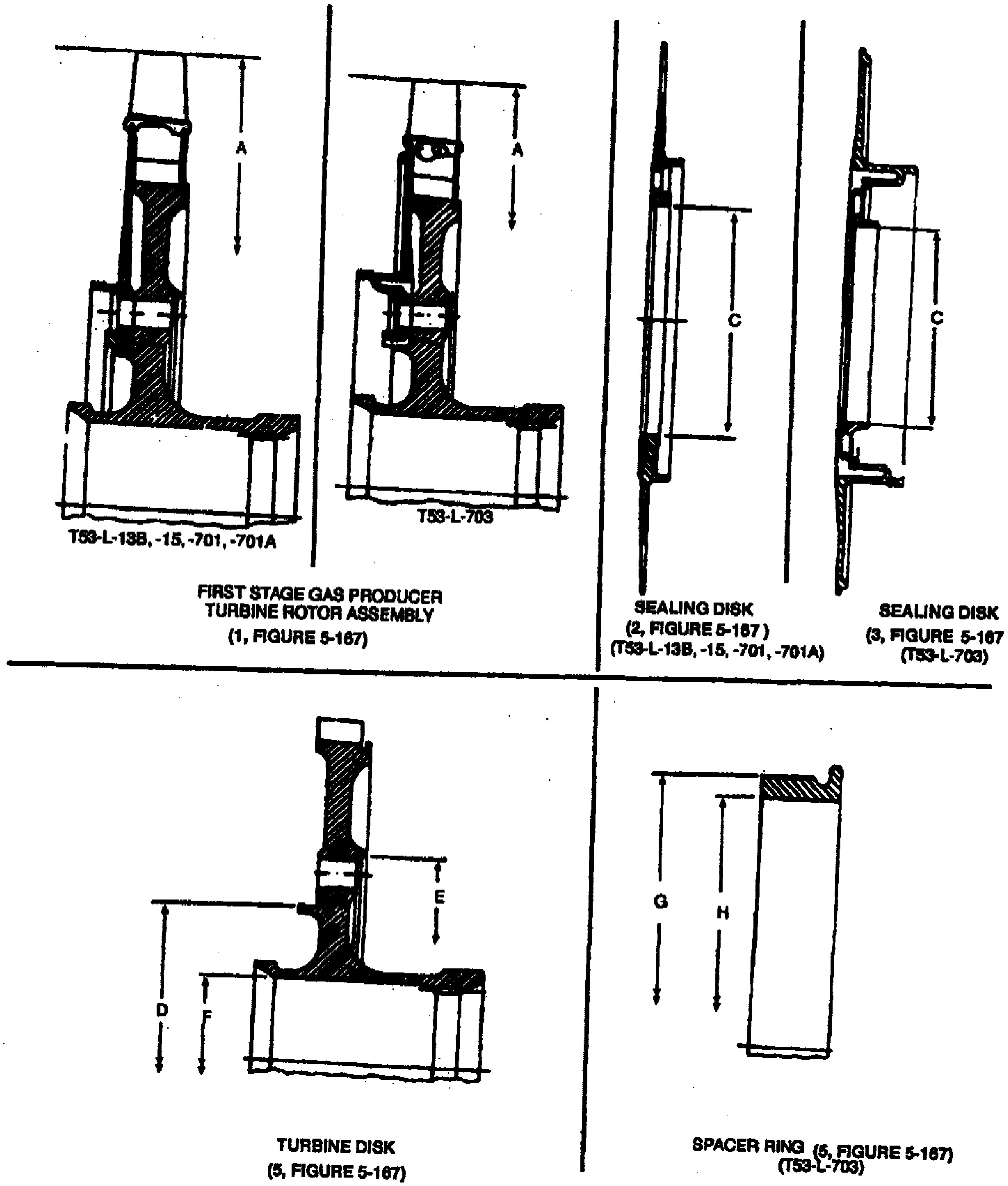


Figure 5-178. First Stage Gas Producer Turbine Rotor Assembly, Aft Oil Ring, and Seal Ring Dimensional Inspection Locations.

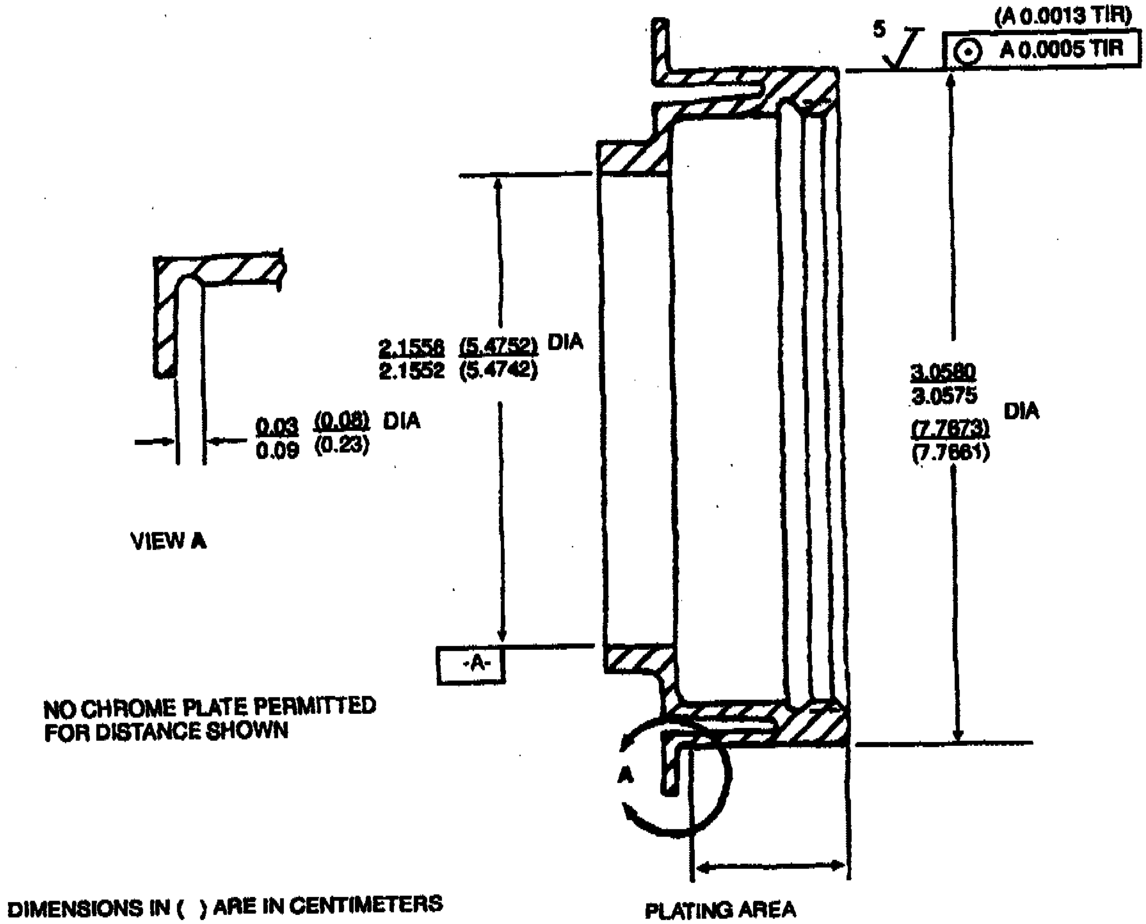


Figure 5-179. Rear Compressor Bearing Oil Ring - Plating Area.

WARNING

FLIGHT SAFETY PART

For the blend repair of the bolt hole 63 RMS surface finish is flight safety critical.

CAUTION

In following step e, do not enlarge bolt holes during repair.

e. Blend-repair nicks and burrs in bolt hole and sealing flange area of sealing disk as outlined in SP No. 5000 in Appendix E. Using a suitable punch made of soft material, rework any small bulges to bring metal back to original contour before blend-repairing.

f. Rework distorted outer flange of sealing disk by spinning method as follows: (See figure 5-180.)

(1) Using a suitable wooden block, apply pressure to forward side of sealing disk outer diameter until the 0.090 inch (0.229 cm) maximum dimension between sealing disk rim and a flat surface is obtained. (See figure 5-172.)

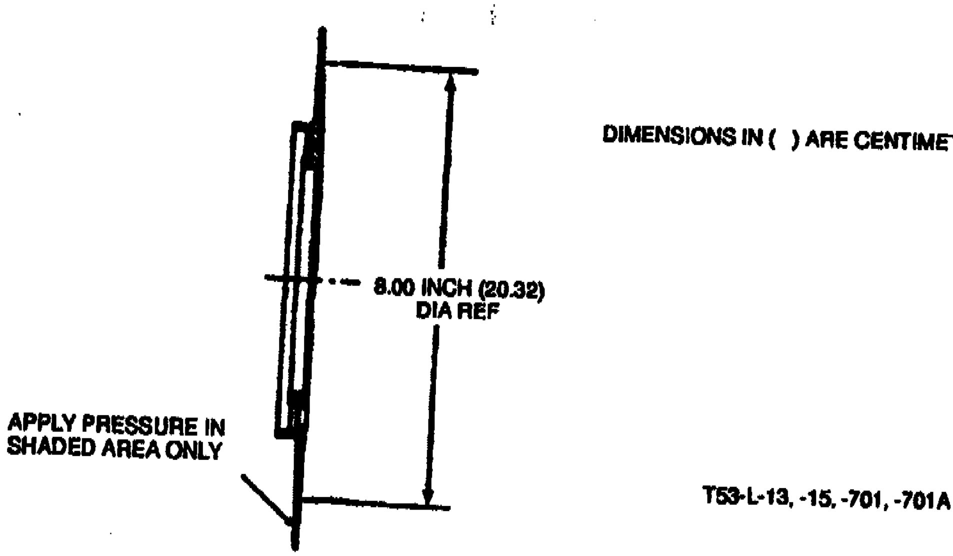


Figure 5-180. Sealing Disk Outer Flange- Rework.

(2) Clean sealing disk with cleaning solvent (item 102, table C–1), or cleaning solvent (item 103 or item 311, table C–1), followed by isopropyl alcohol (item 25, table C–1) to facilitate drying.

(3) Place sealing disk in an oven, and heat treat at 1,185° to 1,215°F (640° to 657°C) for 2 hours.

(4) Perform a hardness check in reworked area. Reject sealing disk if harness value is not within RA 69-73 range.

(5) Perform a fluorescent-penetrant inspection. Replace sealing disk if cracks exceed 0.060 inch (0.152 cm) in radial length.

(6) Perform dimensional inspection in accordance with table 5-76.

g. Repair cracks less than 0.060 inch in length on OD of sealing disk as follows:

(1) Use a 1/16 inch diameter carbide rotary to rout out cracks.

NOTE

Width of routed area is to be equal to or greater than depth of routed area. Radius all sharp corners.

(2) Perform a fluorescent-penetrant inspection of repaired area to ensure complete removal of cracks.

h. Repair oversized ID of the sealing disk, by thermal flame-spraying as follows:

(1) Machine, if necessary, to obtain a 0.003 to 0.010 inch buildup thickness after final machining.

(2) Plasma spray sealing disk with Metco 450 (item 218, table C–1). (Refer to SP No. 5006 in Appendix E.)

(3) Machine to dimensions referenced in figure 5-178 and table 5-76.

WARNING

FLIGHT SAFETY PART

Dimensional Inspection after the following repair is flight safety critical.

i. Repair worn surface on 4.1200 to 4.1205 inch (10.4648 to 10.4661 cm) diameter of first stage gas producer turbine disk, where 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup is required, by thermal flame-spraying as follows: (See figure 5-181).

(1) Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup thickness after final machining.

(2) Plasma spray rotor disk with Metco 450 (item 218, table C–1). (Refer to SP No. 5006 in Appendix E.)

WARNING

FLIGHT SAFETY PART

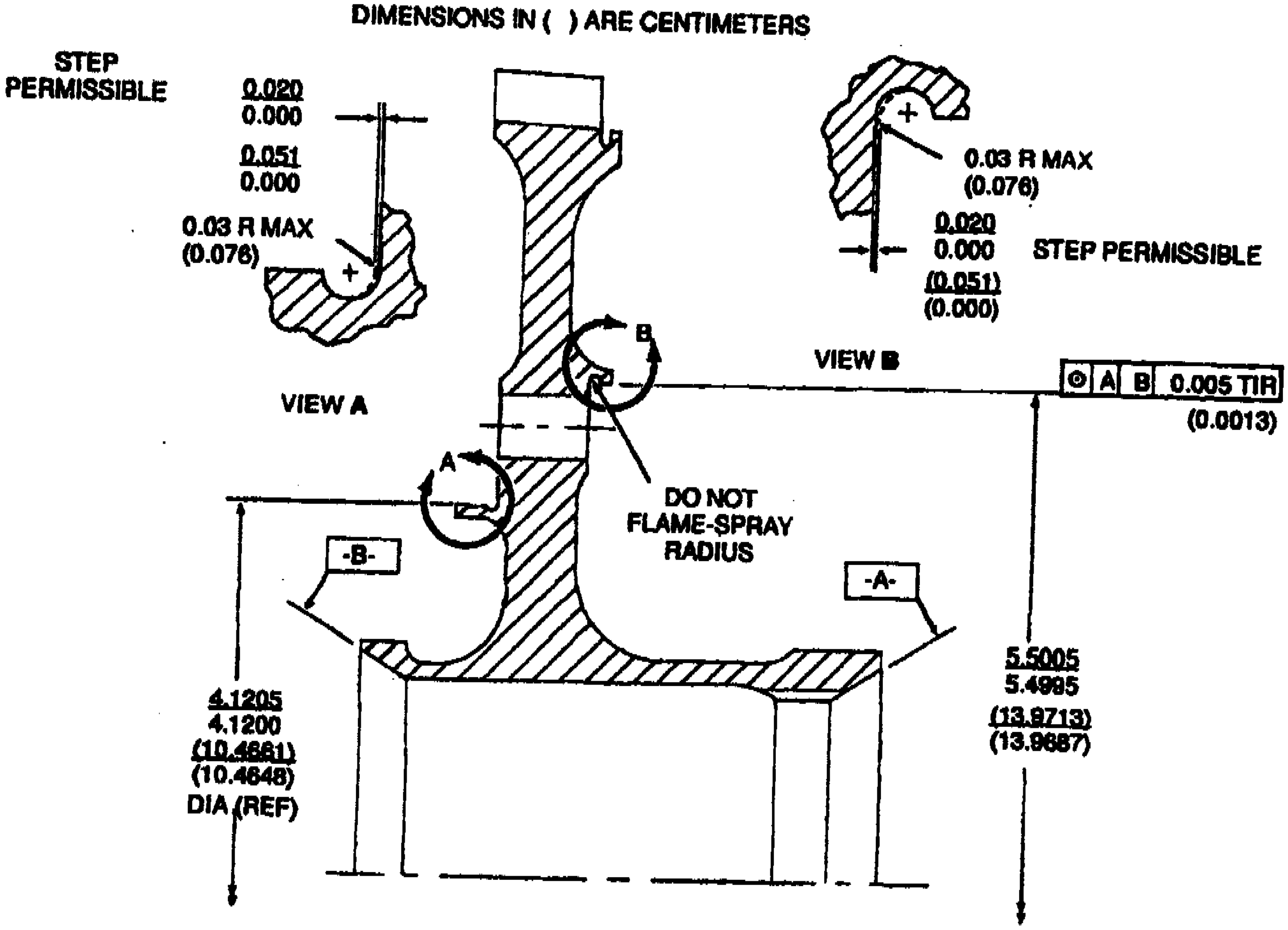
Dimensional Inspection after the following repair is flight safety critical.

(3) Machine to dimensions given.

j. Repair worn surfaces on 5.4995 to 5.5005 inch (13.9687 to 13.9713 cm) diameter of rotor disk, where 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup is required, by thermal flame-spraying as follows: (See figure 5-181).

(1) Machine, if necessary, to obtain a 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup thickness after final machining.

(2) Plasma spray rotor disk with Metco 450 (item 218, table C–1). (Refer to SP No. 5006 in Appendix E.)



WARNING

FLIGHT SAFETY PART

The 0.03 maximum radius and the .4995 to 5.5005 diameter are flight safety critical.

Figure 5-181. First Stage Gas Turbine Disk - Repair Area.

(3) Machine to dimensions given.

k. Repair warped sealing ring as follows:

(1) Restrain part between two suitable clamping plates to restore flatness.

(2) Heat assembly to 1,825° ± 25°F for 10 minutes in vacuum or control atmosphere to prevent oxidation.

5-260. REASSEMBLY OF FIRST STAGE GAS PRODUCER TURBINE ROTOR, AFT OIL RING, SEALING RING AND ORIFICE PLATE. Proceed as follows:

a. Assemble retaining ring (7, figure 5-167) into the groove on aft face of rotor with anti-rotation knob located adjacent to "O" mark on turbine disk (5) and facing forward.

b. Compress retaining ring (7) with blade removal tool (LTCT4734).

c. Assemble turbine rotor blade sets (6) into wheel so that each blade is 180 degrees from its mate.

NOTE

Blades are to be installed into the slots from which they were removed.

d. Align "O" mark on sealing disk (2or 3) forward inner flange with "O" mark on 4.1200 to 4.1205 inch (10.4648 to 10.4661) diameter flange of turbine disk (5). Position sealing disk (2) against forward surface of the face of the rotor approximately one-half the length of the blade shank.

e. Apply pressure to sealing disk (2or 3) so that the full complement of blades move axially rearward. As the sealing disk and blades move, all internal grooves on the face of the blades must hook over and trap the outside diameter of the sealing disk.

f. Move sealing disk (2 or 3) and blades (6), as a unit, until the rear faces of the blades contact retaining ring (7). Bolt holes in sealing disk must align with the holes in turbine disk (5).

g. Remove the restraint from retaining ring (7), allowing the ring to expand into the internal groove of blades.

h. Press sealing disk (2 or 3) against turbine disk (5) until disk contacts rotor.

i. The aft face that mates with the spacer can be machined to correct for raised material around the bolt holes or to correct for nonperpendicularity. Thickness of disk must meet print limits after machining. Machine corner radius of holes to 0.03 - 0.06 inch on rear side of disk.

5-261. FUNCTIONAL TEST. Functional Test is not required.

5-262. FIRST STAGE POWER TURBINE NOZZLE.

5-263. DISASSEMBLY. Disassembly is not required.

5-264. CLEANING. Proceed as follows:

a. Clean first stage power turbine nozzle assembly (1, figure 5-135) by dry cleaning solvent method or hot-alkali-soak method. (Refer to SP Nos. 3002 or 3004 in Appendix E.)

b. Clean first stage power turbine nozzle that has metalization (slag) deposits that cannot be removed by normal cleaning procedures, using aluminum oxide powder (item 36, table C-1) applied as dry blast with 30 to 40 psi (2109 to 2812 gm sq cm) air pressure or plastic media blast(reference SP. No. 6003.1).

5-265. INSPECTION. Perform specific inspections listed in table 5-77.

Airflow inspect first stage power turbine nozzles 1-190-050-06/07 using Fleming AF36 airflow machine, adapter provided by airflow machine manufacturer, and Fleming flow test instructions. Preferable effective flow area measurement should be 30.20 to 32.50 square inch with a water level to 1.0 inch. Cross out any previous EFAs and vibroetch the measured EFA in the vicinity of the original GFA marking (or serial number if no GFA marked).

5-266. REPAIR. (See figure 5-135.) Proceed as follows:

NOTE

The braze requirement for the turbine nozzle assembly for each specific repair procedure may be performed as one braze cycle when multiple repair is accomplished, provided all inspection requirements are met.

a. Repair distorted front lip of nozzle assembly (1) as follows:

(1) Straighten lip to dimension shown in figure 5-182 by spinning or an equivalent method.

(2) Inspect for cracks in lip visually and by dye-penetrant method, if cracks are suspected. Replace if cracks are evident.

b. Repair nozzles that are grooved on forward ID 13.248 to 13.252 inch (33.650 to 33.660 cm diameter) (figure 5-184) by metal-spraying as follows:

(1) Clean nozzle with acetone (item 13, table C–1)

(2) After cleaning nozzle, grit blast this part with aluminum grit (item 7 or 8, table C–1), before building up surface by means of the metallizing process, using nickel aluminide powder (item 225, table C–1), or an alternate procedure using plasma flame-spray or thermal flame-spray as outlined in SP No. 5006 in Appendix E.

CAUTION

During machining, take only light cuts and use extreme care to prevent spalling, smearing, or pickup of the coating.

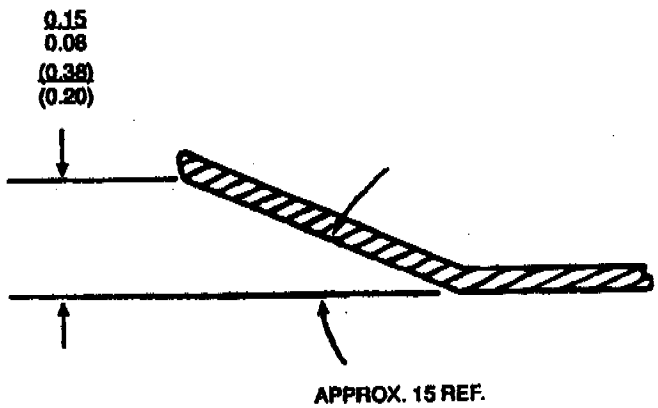
(3) Using a carbide bit, WA63 Style Tpg 432, or equivalent, grind ID to 13.248 to 13.252 inch (33.650 to 33.660 cm) diameter.

Table 5-77. Inspection of First Stage Power Turbine Nozzle Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135 -1	First Stage Power Turbine Nozzle Assembly	SIE and Visual	Wear. Refer to table 5-78.	Replace if limits cannot be met.
			Distorted front lip, (See figure 5-182.)	Repair. (Refer to paragraph 5-266).
			Nicks, dents, or pits in vane leading edge beyond acceptable limits.	Refer to table 5-79.
			Nicks, dents, or pits in vane trailing edge beyond acceptable limits.	Refer to table 5-79.
			Nicks, dents, or pits on airfoil surface beyond acceptable limits.	Refer to table 5-79.
			Grooving in forward ID 13.248 to 13.252 inch (33.650 to 33.660 cm) diameter caused by movement of sealing rings within nozzle shroud beyond acceptable limits.	Refer to table 5-79.
			FOD induced distortion at vane leading and trailing edges	Repair. (Refer to paragraph 5-266).
			Out-of-roundness and rubs on sealing flange inner diameters beyond acceptable limits	Refer to table 5-79.
			Out-of-roundness on rear flange 13.650 to 13.660 inch (34.671 to 34.969 cm) diameter beyond acceptable limits	Refer to table 5-79.

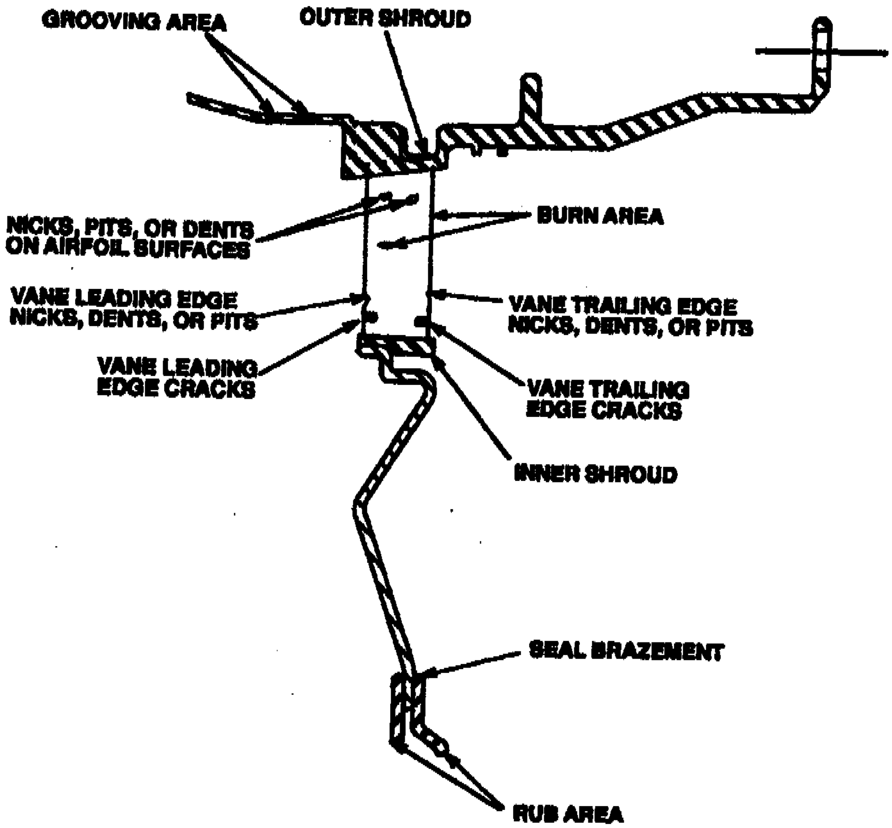
Table 5-77 . Inspection of First Stage Power Turbine Nozzle Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135 (Cont)				
	WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**			
1 (Cont)	First Stage Power Turbine Nozzle Assembly (Cont)	Visual and Fluorescent-Penetrant	Cracks in vanes	Refer to table 5-79.
			Cracks in outer shroud parent metal	Refer to table 5-79.
			Cracks in seal ring to flange braze area	Refer to table 5-79.
			Cracks at mounting flange bolt holes either in an inward or circumferential direction	One crack per bolt hole is acceptable provided it extends radially to outer diameter of flange.
			Cracks at thermocouple lead hole. (On mounting flange)	Crack is acceptable provided it extends radially to outer diameter of flange.
		Visual.	See Burned Vane (figure 5-183).	On 1-190-000-09, replace vane. Refer to paragraph 5-266). On 1-190-050-06/07, refer to table 5-79.
		Visual.	Scoring or heavy tip rubs on cylinder inside diameter.	Replace if limits specified in figure 5-184 cannot be met.
			Vane metalization.	Refer to paragraph 5-266.
		Airflow Inspect.	Effective Flow Area (EFA) per paragraph 5-265 or Geometric Flow Area (GFA) per table 5-80.	Adjust or replace.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-182. First Stage Power Turbine Nozzle Assembly - Front Lip Inspection.



1-190-050-06/07

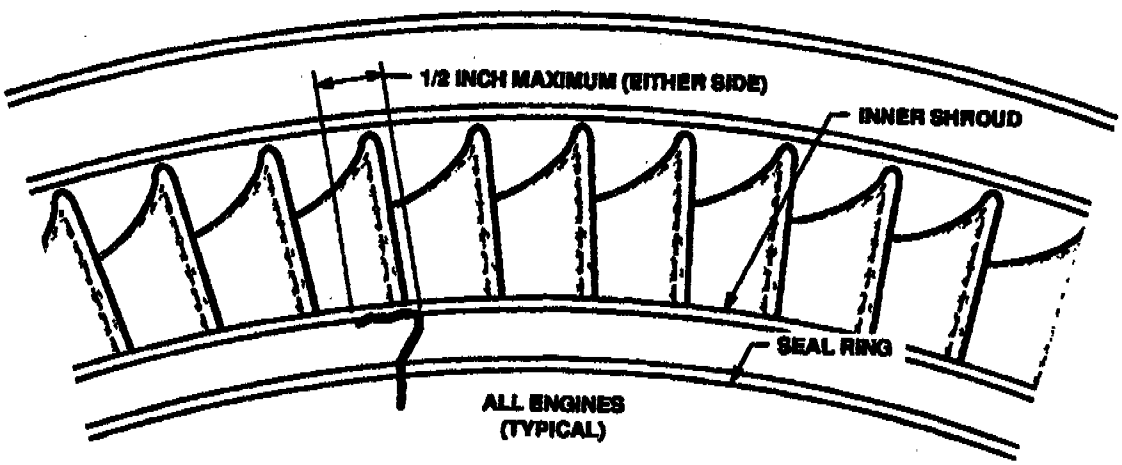


Figure 5-183. First Stage Power Turbine Nozzle Assembly Inspection Areas.

Table 5-78. Dimensional Inspection of First Stage Power Turbine Nozzle Assembly.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-135								5-184
First Stage Power Turbine Nozzle Assembly	1	ID	13.248 (33.650)	13.252 (33.660)	13.245 (33.642)	13.267 (33.698)			A
		ID	13.048 (33.142)	13.052 (33.152)	13.036 (33.111)	13.052 (33.152)			B
		OD*	14.736 (37.429)	14.740 (37.440)	14.732 (37.419)	14.740 (37.440)			C
		Axial	2.691 (6.835)	2.701 (6.861)	2.665 (6.769)	2.715 (6.896)			D
Seal Land Height		ID			0.015 (0.038)				E
Wall Thickness		*			0.060 (0.152)				F

* Dimensional inspection not required unless visual inspection indicates obvious damage, fretting, corrosion, or wear.

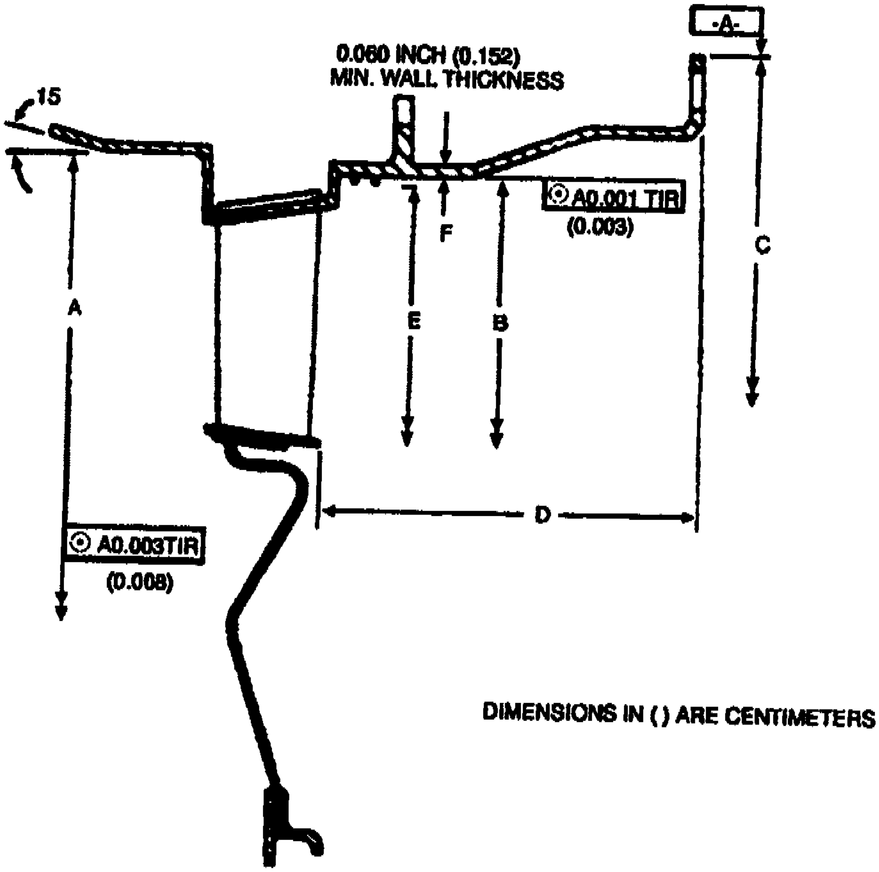


Figure 5-184. First Stage Power Turbine Nozzle Assembly Inspection Locations.

NOTE

It is not necessary that coating be continuous over ID surface after machining. Areas of exposed base metal are acceptable. Use new seal rings at engine assembly.

(4) Measure areas of exposed (parent) metal to ensure a minimum allowable wall thickness of 0.032 inch (0.081 cm) remains after machining.

c. Repair grooves of 0.010 inch (0.025 cm) or less on forward ID (13.248 to 13.252 inch (33.650 to 33.660 cm) diameter of nozzle assembly (1, figure 5-135) as follows:

(1) Blend sharp edges as outlined in SP No. 5000 in Appendix E.

(2) Electrofilm inside surface of forward ID as outlined in SP No. 6010 in Appendix E.

(3) Blend-repair nicks, dents, or pits on leading and trailing edges of vanes and on vane airfoil surfaces as outlined in SP No. 5000 in Appendix E.

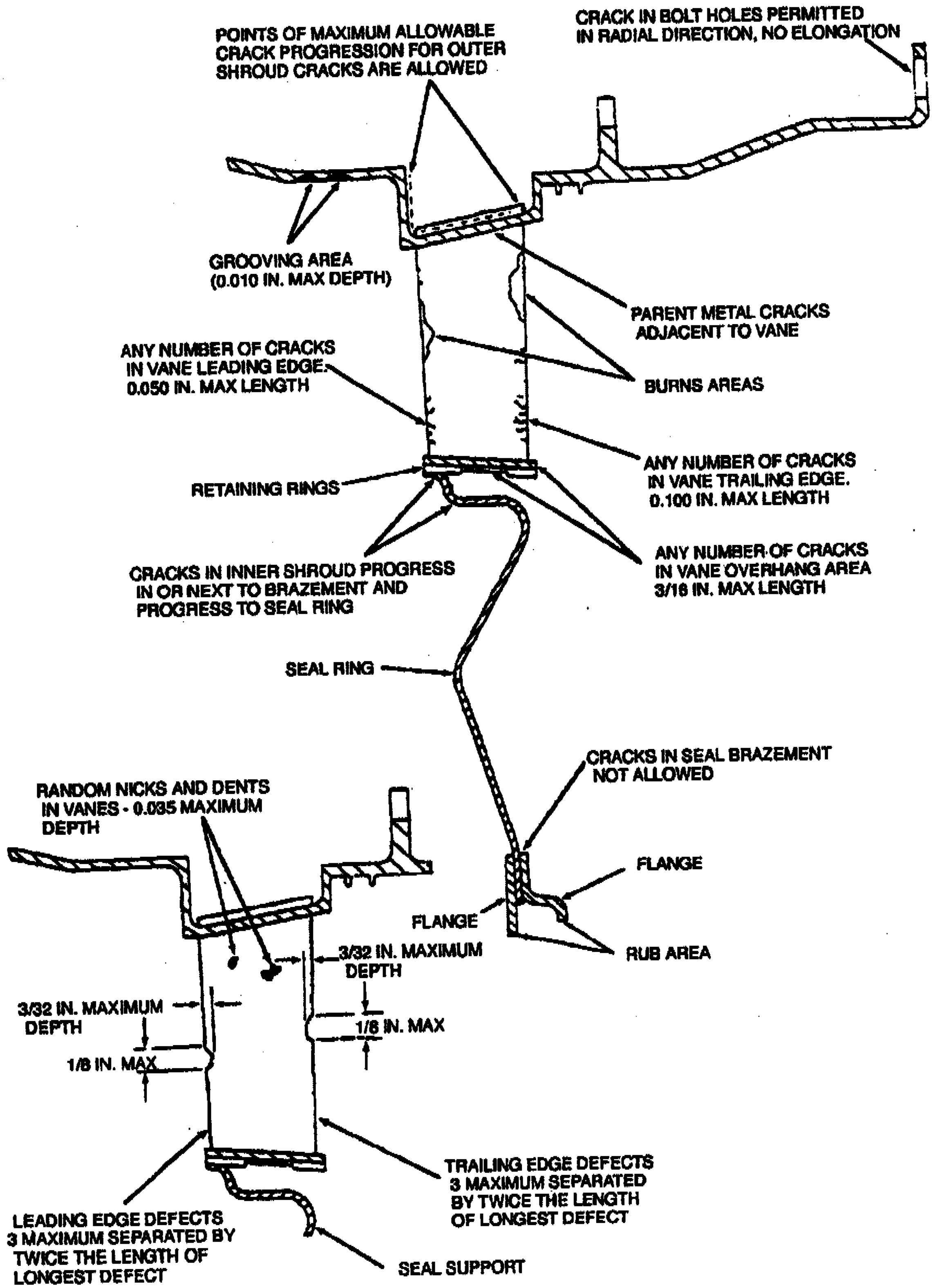


Figure 5-185. First Stage Power Turbine Nozzle (1-190-000-09) Inspection Areas.

d. Repair forward ID with damage exceeding paragraphs b and c.

(1) Remove by machining discrepant forward portion of outer shroud. (Refer to figure 5-186.)

(2) Fabricate a replacement shroud from AMS5769 material. (Refer to figure 5-187.)

(3) Clean nozzle and replacement shroud using acetone (item 13, table C–1) .

(4) Position replacement shroud so that the maximum gap between mating surfaces is 0.001 inch.

(5) Secure with necessary fixturing and E.B. weld as outlined in SP No. 5005, Appendix E. (Refer to figure 5-188.)

(6) Final machine shroud to dimensions shown in figure 5-189. Do not reduce nozzle parent metal.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(7) Perform a visual, fluorescent penetrant and radiographic inspection of the repair.

(a) Surface porosity and inclusions not to exceed 0.080 maximum diameter.

(b) Surface undercutting not to exceed 1/16 inch depth. Total length of undercut greater than 1/32 inch depth not to exceed 1/2 of weld length.

(8) Clean parts with acetone (item 13, table C–1) or cleaning solvent (item 101, table C–1)

(9) Electrofilm 13.252 inch diameter as outlined in SP No. 6010, Appendix E. Mask adjacent areas.

(10) Perform a complete dimensional inspection of nozzle. (Refer to table 5-77.)

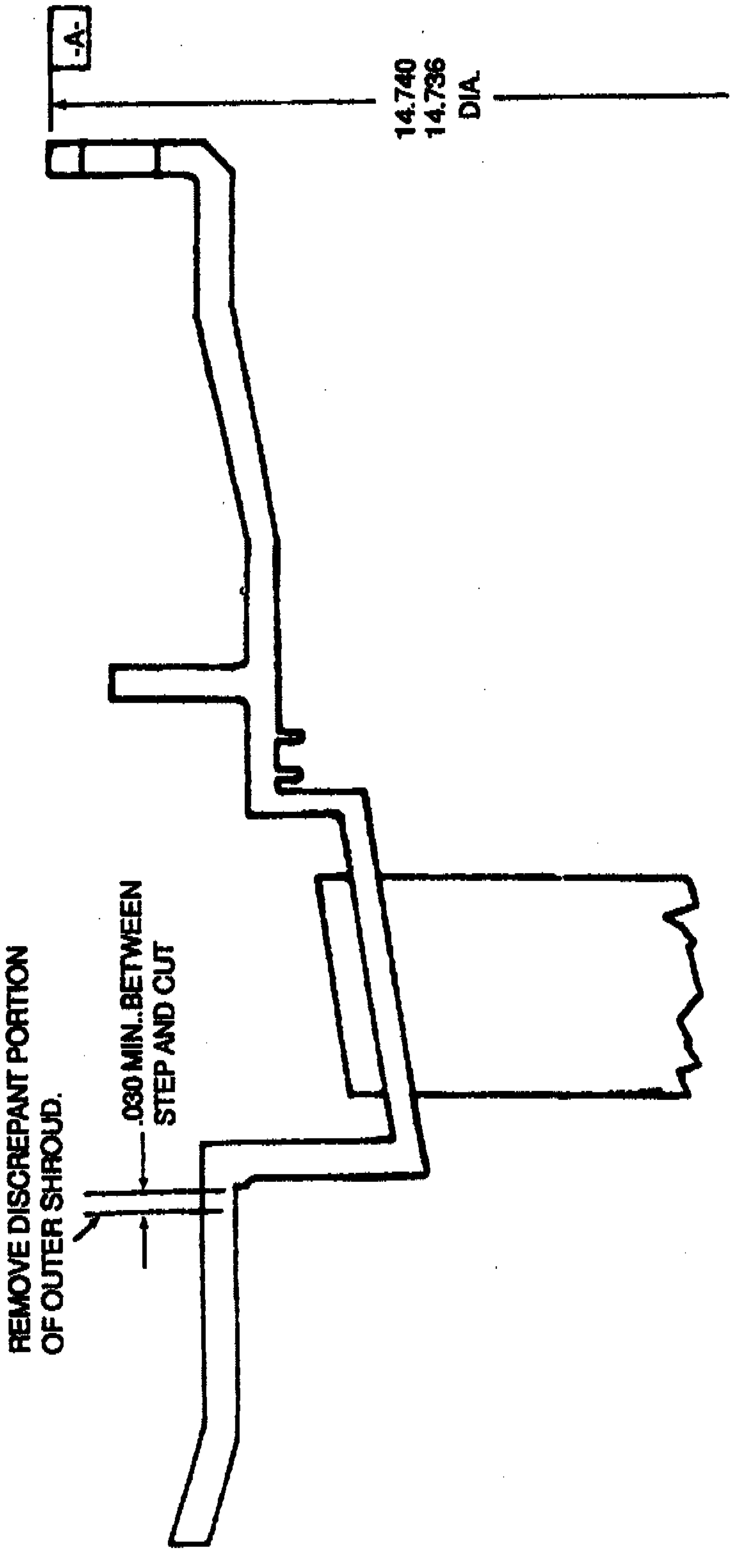


Figure 5-186. Removal of Discrepant Portion of Outer Shroud.

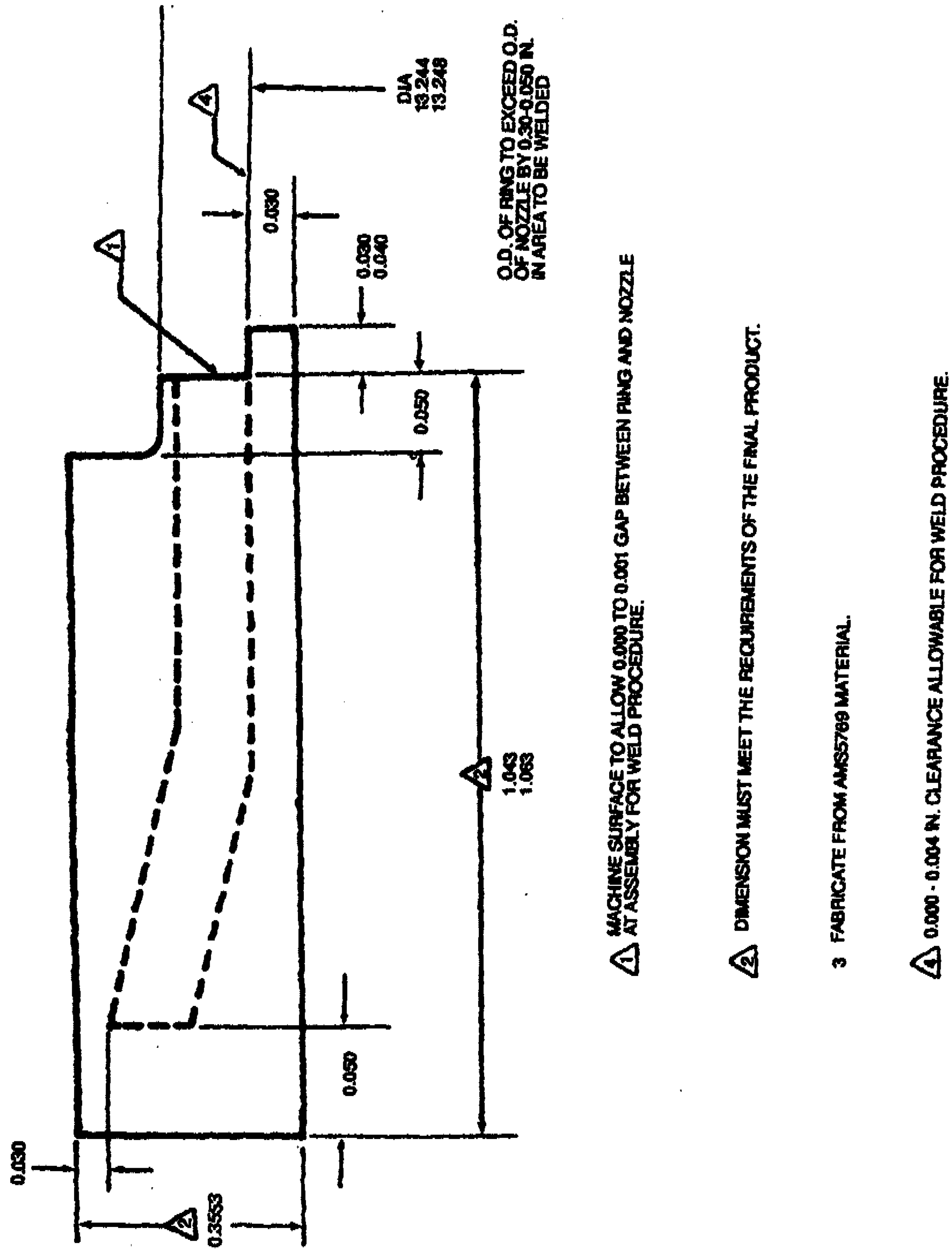


Figure 5-187. Fabrication of Replacement Portion of Outer Shroud.

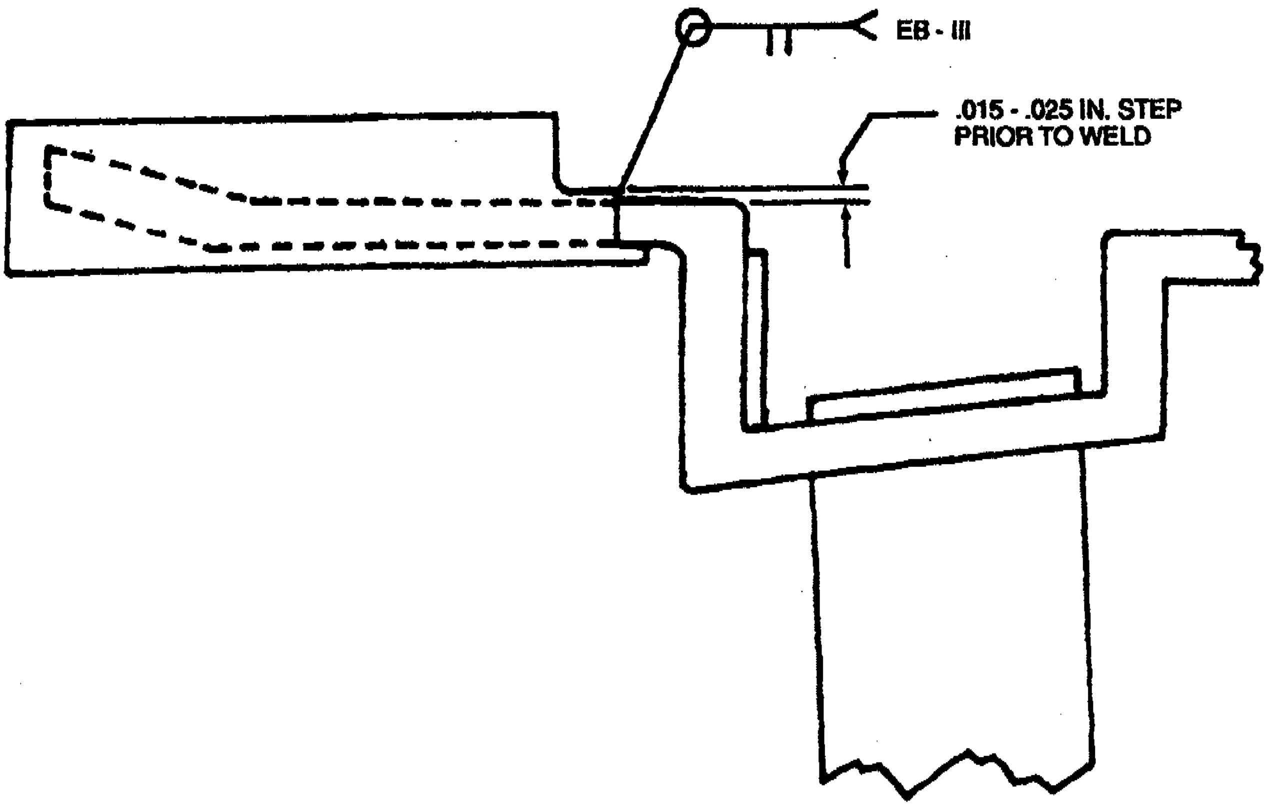


Figure 5-188. Welding of Outer Shroud.

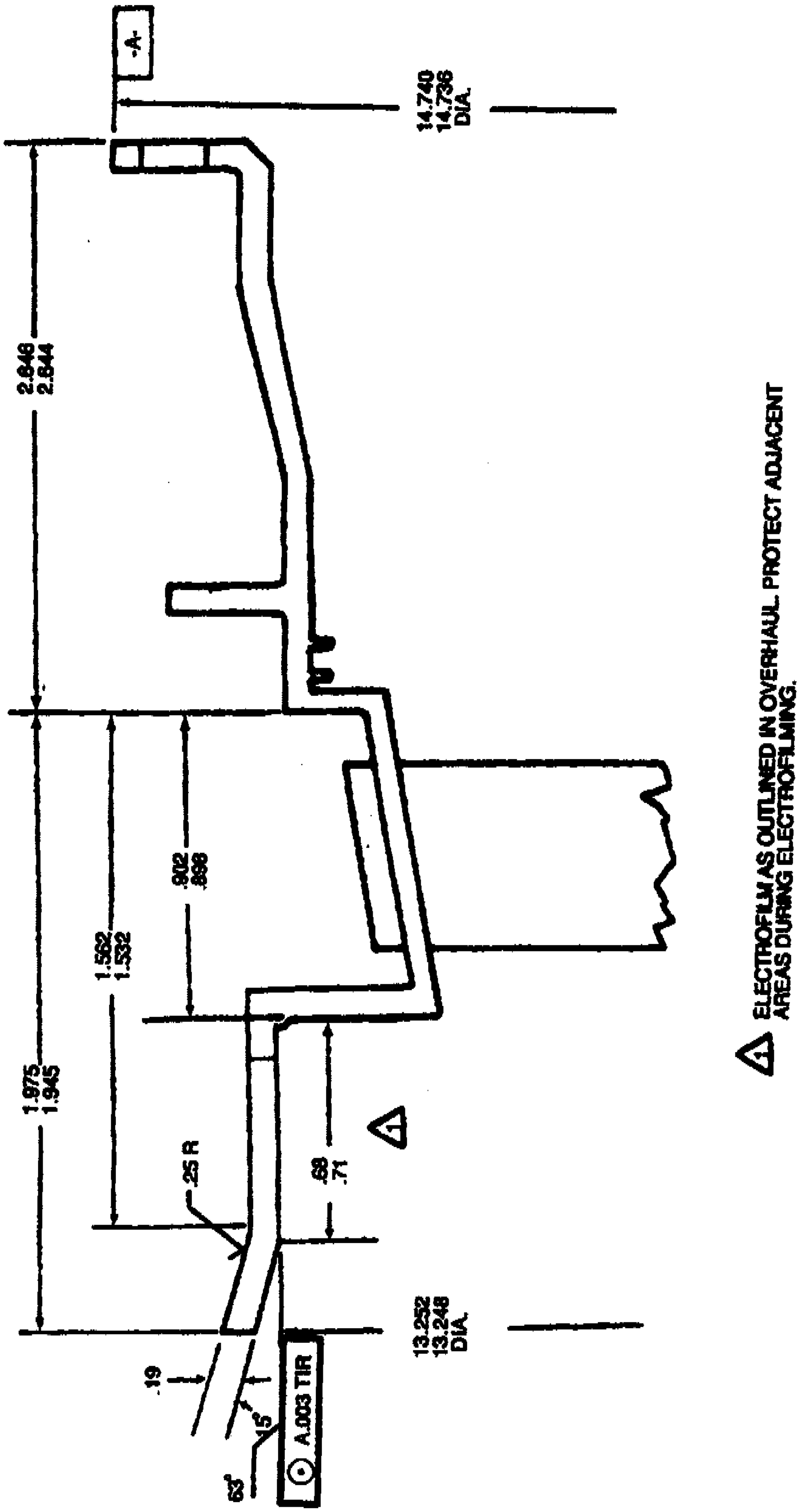


Figure 5-189. Final Machining of Nozzle Forward Outer Shroud.

Table 5-79. First Stage Power Turbine Nozzle Assembly Inspection Limits (1-190-050-06/07).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**		
Cracks in Vane Leading Edge	5-184	Any number of cracks in vane leading edge 3/8 inch maximum length are acceptable. If limits are exceeded, repair nozzle assembly per paragraph 5-266.
Cracks in Vane Trailing Edge		Any number of cracks in vane trailing edge 3/16 inch maximum in length are acceptable. If limits are exceeded, repair nozzle assembly per paragraph 5-266.
Cracks in Vane Trailing Edge to Outer Shroud Junction Areas	5-184	Small, multiple cracks under 1/8-inch in length are allowed at all junctions.
Cracks in Outer Shroud	5-184	a. Axial/radial cracks in aft flange area up to 1/4-inch in length are allowed. b. Three 1/4-inch long radial cracks in forward flange area are allowed. Circumferential cracking is not allowed other than the small cracks referenced in step a.
Cracks Extending from Inner Shroud Into Seal Ring Area	5-184	A maximum of six cracks are allowed up to 2-inches in length is acceptable, provided no turbine rub occurs.
Cracks in Outer Shroud ID and OD	5-184	a. Six 1/4-inch long cracks are allowed on outer shroud leading edge. b. Ten 1/4-inch long cracks are allowed on outer shroud trailing edge.
Cracks in Seal Brazement	5-184	Cracks in seal brazement are not acceptable.
Axial Rubs	5-184	Axial rubs resulting from contact with turbine rotor are not permitted.

Table 5-79. First Stage Power Turbine Nozzle Assembly Inspection Limits (1-190-050-06/07) (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**		
Grooves in Sealing Area	5-184	Grooves up to 0.010 inch (0.025 cm) in depth are acceptable, provided sharp edges are blended to form a smooth contour. (Refer to SP No. 5000 in Appendix E). Grooves up to 0.025 inch (0.064 cm) in depth are acceptable at any point within the circumference with metal spray repair (refer to para 5-266). Prior to metal spraying, measure shroud thickness in the thinnest grooved area. Minimum allowable thickness is 0.032 inch (0.081 cm).
Nicks, Pits, or Dents in Vane Leading Edge	5-183	a. Leading edge nicks, dents, or pits are acceptable with blend repair as follows: A maximum of four blends 0.060 to 0.120 inch deep and ten blends less than 0.060 inch deep is permissible. b. Blend repair per paragraph 5-266. c. If limits are exceeded, repair nozzle assembly per paragraph 5-266.
Nicks, Pits, or Dents in Vane	5-183	a. Trailing edge nicks, dents or pits are acceptable with blend repair as follows: A maximum of four blends 0.090 to 0.220 inch deep and ten blends less than 0.090 inch deep is permissible. Blended area shall be at least twice as long as it is deep. b. Blend repair per paragraph 5-266. c. If limits are exceeded, repair nozzle assembly as per paragraph 5-266.
Nicks and Dents on Vane Airfoil Surfaces	5-183	Random nicks and dents are acceptable on all vanes. Blend-repair. (Refer to SP No. 5000 in Appendix E).
Burrs on Vane Leading and Trail Edges		Burrs are acceptable with blend-repair. (Refer to SP No. 5000 in Appendix E).
Burned Vanes	5-183	Burned vanes are not allowed. Repair nozzle assembly per paragraph 5-266.

e. Repair FOD induced distortion at vane leading and trailing edges of nozzle assembly (1) as follows:

CAUTION

In following step (1), do not tap directly on vane.

NOTE

A slight amount of vane distortion is acceptable without rework, provided that GFA is within acceptable range (refer to table 5-80), and all other inspection requirements are met.

(1) Blend-repair vanes as outlined in SP No. 5000 in Appendix E. If distortion cannot be removed by blend-repair, cold-straighten vanes to retain original contour by use of suitable blocks and tapping.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(2) Perform fluorescent-penetrant inspection on repair vanes to determine if cracks have been generated by rework. Cracks that exceed inspection limits specified in table 5-79 are cause for vane replacement.

f. On 1-190-050-06/07 nozzle, repair nozzle assembly if inspection limits are exceeded as follows:

(1) Degrease nozzle by the dry cleaning solvent method (Refer to SP. No. 3002 in Appendix E). Seal rings and flanges do not have to be removed if only the vanes require replacement.

(a) Remove damaged vane(s) from path by electric discharge machining (E.D.M.). Use a flat, copper or brass electrode. Make cuts approximately 1/2 inch inboard of shrouds.

CAUTION

Do not damage shroud surface or undamaged vanes. Holes in shrouds should provide 0.002 to 0.010 inch clearance for replacement vanes (1-190-038-01).

Table 5-80. First Stage Power Turbine Nozzle Assembly Geometric Flow Area Inspection Limits.

DEFECT	INSPECTION LIMITS
Geometric Flow Area (GFA)	Nozzles may have GFA inspection as an alternative to EFA inspection. Use area flow comparator set (LTCT6485) and digital transducer (LTCT6339) a. If the GFA is within the 29.97 to 30.73 square-inch limit, eradicate the original GFA number, using a Vibropeen Etching Tool, and mark the new GFA number approximately 1 inch to the right of the old GFA number. If the GFA is outside the above limit, replace nozzle. b. Overhaul nozzles that have been repaired or originally manufactured to previous GFA inspection limit of 29.65 to 29.85 square inches may be utilized on a use-to-depletion basis. c. When a nozzle has a GFA between 29.86 to 29.96 square inches, it shall be utilized on a use-to-depletion basis. d. Any nozzle being processed for repair by vane replacement should have the vanes installed to obtain a GFA within 29.97 to 30.73 square inches. **NOTE** It may be uneconomical or not practical to revise the GFA to the desired value. In this situation areas within the previous GFA may be used; however, priority should be given to the new GFA values optimum engine test requirements.

NOTE

Any number of vanes may be replaced on overhaul. However, replacement of more than half of the vanes is not recommended. No more than seven adjacent vanes may be replaced in one braze cycle. If more than two adjacent vanes are replaced, position vanes per manufacturer's drawing maintaining the required throat opening. If replacement of more than the initial seven adjacent vanes is necessary, position the next set of replacement vanes to a point farthest from the initial set of vanes. Continue this random positioning until all vanes are replaced.

(b) Remove vane stud(s) from the outer shroud by E.D.M. Use outer shroud vane electrode (LTCT11466) or equivalent. Outer shroud electrode will automatically index vane stub(s) to proper position. Remove stubs from outboard side of shroud.

CAUTION

When grinding the boss away, do not grind into the shroud parent material.

NOTE

If vane(s) being removed are located under any of the twelve (12) thermocouple bosses, the boss must be ground away prior to vane removal. Grind area must be contoured to match existing contour of the outer shroud (see figure 5-190.)

(c) Remove vane peg(s) (Base) from inner shroud by E.D.M. Use inner shroud vane electrode (LTCT 11445 or equivalent). Inner shroud electrode will automatically index vane stub(s) to proper position. Remove stubs from inboard side of shroud.

(2) Replacement of vanes:

(a) Clean the assembly using acetone (item 13, table C–1) or cleaning solvent (item 100 or 101, table C–1). Nickel-plate the vane skirt and shroud slots where braze alloy is to be applied per SP No. 6018 in Appendix E.

NOTE

As an alternate to purchasing vane 1-190-038-01, vane may be obtained from casting 1-190-038-02 or 1-190-032-01. Cut ends of vane 1-190-038-01 with skirt in accordance with vane print dimensions.

(b) Insert replacement vane(s) (1-190-038-01) into prepared hole(s) in shroud. Use stainless steel shim (0.002 - 0.010 inch) thick to position the vane(s) in the hole(s).

NOTE

Do not tack weld over shim stock.

(c) Tack-weld the vane(s) to shroud by the gas tungsten arc method in accordance with SP No. 5001 in Appendix E. Use filler material AMS5675.

(3) Thermocouple boss replacement (if required).

NOTE

As an alternate to purchasing thermocouple boss 1-190-039-01, boss may be manufactured in accordance with part number print.

(a) Locate the thermocouple boss (1-190-039-01) onto the outer shroud using an alignment (0.160 - 0.163 inch drill rod, figure 5-191). To insure correct location, use a piece of shim stock 0.002 to 0.010 inch thick to provide gap for braze flow (figure 5-191). Bore a 0.165 inch diameter thermocouple hole in a manufactured boss to align with hole in shroud and to allow a gap for shim stock 0.002 to 0.010 inch thick.

(b) Nickel-plate outer shroud in area(s) where thermocouple boss(es) are to be brazed, and mating surface(s) of boss(es). Clamp the replacement thermocouple boss(es) (1-190-039-01) in place with the locating pin (0.160 - 0.163 DIA DRILL ROD) and shim per figure 5-191.

NOTE

Do not weld shims or locating pin.

(c) Tack-weld the boss(es) to the shroud (6 places) by the gas tungsten Arc method in accordance with SP No. 5001 in Appendix E. Use filler material AMS 5675.

(d) Remove the locating pin and shims.

(e) Clean the tack welds with a stainless steel brush.

(4) Brazing vane(s) and thermocouple boss(es).

(a) Apply brazing paste AMS4776 to joints in accordance with SP No. 5004 Appendix E (see figure 5-192).

(b) Place nozzle on a flat, heat-resistant stainless steel support, forward side up. Vacuum, braze at 2.050°F for 2 to 10 minutes. Remove excess braze deposits.

(c) Machine outer circumference and drill and tap holes in manufactured boss(es) in accordance with nozzle part number print.

NOTE

No cracks are permitted in braze joints. The visual and fluorescent-penetrant limits specified in table 5-172 are applicable.

Vanes, seal ring, bosses and flanges are allowed to be vacuum-brazed in one cycle.

(5) Removal of seal ring (1-190-033-01) and flanges (1-190-014-02 and 1-190-015-02):

(a) Remove seal ring (1-190-033-01) and flanges (1-190-014-02 and 1-190-015-02) by machining. Remove all seal ring material until inner shroud is cleaned up flush to parent metal (figure 5-190).

NOTE

Locally, clean up excess braze material using a routing tool.

(b) Clean areas to be welded with acetone (item 13, table C–1).

(c) Assemble both the replacement seal ring, and the flanges as follows (see figure 5-191):

NOTE

Fit-up between all details shall provide .002 to .005 inch radial clearances for brazing. Use stainless steel shims as necessary (figure 5-191).

1 Position the seal ring (1-190-033-01) into the nozzle inner shroud and place the assembly onto tack-welding fixture (LTCT11448). Position the forward flange ring over the center hub of the tack-weld fixture and tighten the fixture clamp lightly.

2 Tack-weld the seal ring to the nozzle shroud by the gas tungsten-arc method in accordance with SP No. 5001 in Appendix E (figure 5-191), in eight (8) places equally spaced. Use filler material AMS5675.

3 Tack-weld the forward flange (1-190-014-02) to the seal ring (1-190-033-01) by the gas tungsten-arc method in accordance with SP No. 5001 in Appendix E). Tack-weld in six (6) places equally spaced. Use filler material AMS5794.

4 Remove the assembly from the tack-weld fixture: remove the shims, and clean the tack-welds with a stainless steel brush.

5 Invert the nozzle assembly and install it onto tack-weld fixture (LTCT11448). Position the aft flange (1-190-015-02) into the seal ring (1-190-033-01). Tighten the fixture clamp lightly.

6 Tack-weld the aft flange (1-190-015-02) to the seal ring (1-190-033-01) by the gas tungsten arc method in accordance with SP No. 5001 in Appendix E (figure 5-191), in six (6) places equally spaced. Use filler material AMS5794.

7 Remove the nozzle assembly from the tack-weld fixture, remove the shims, and clean the tack welds with a stainless steel brush.

8 Apply braze alloy paste AMS4776 to all joints specified in figure 5-192.

9 Place nozzle on a flat, heat-resistant stainless steel support. Vacuum braze at 2,050°F for 2 to 10 minutes. Refer to SP No. 5004 in Appendix E. Remove excess braze deposits.

NOTE

Vanes, seal rings, bosses, and flanges are allowed to be vacuum-brazed in one cycle.

10 Inspect the nozzle visually, and by the fluorescent-penetrant method, per table 5-50.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

NOTE

No cracks are permitted in braze joints. However, visual and fluorescent-penetrant indications within limits specified in table 5-79 are acceptable.

11 Final machine the assembly to the required dimensions.

a Machine the seal area per blueprint dimensions. Machine the forward edge of the seal ring flush to the nozzle inner shroud. (See figure 5-193.)

b Inspect the nozzle for conformance to dimensions specified in figure 5-193 and table 5-57.

(6) Blend-repair leading and trailing edge of vanes as follows:

(a) Blend-repair per SP No. 5000 in Appendix E.

(b) A maximum of 3 blends per vane and 20 blends per nozzle is acceptable.

(c) If distance between 2 blends is less than the depth of the shallowest blend, area shall be reworked to form one blend.

(d) The minimum acceptable distance between a leading edge blend and a trailing edge blend shall be 0.55 inch.

(e) The outer shroud may be blended in the area of the vanes provided 0.040 inch minimum stock remains after blending.

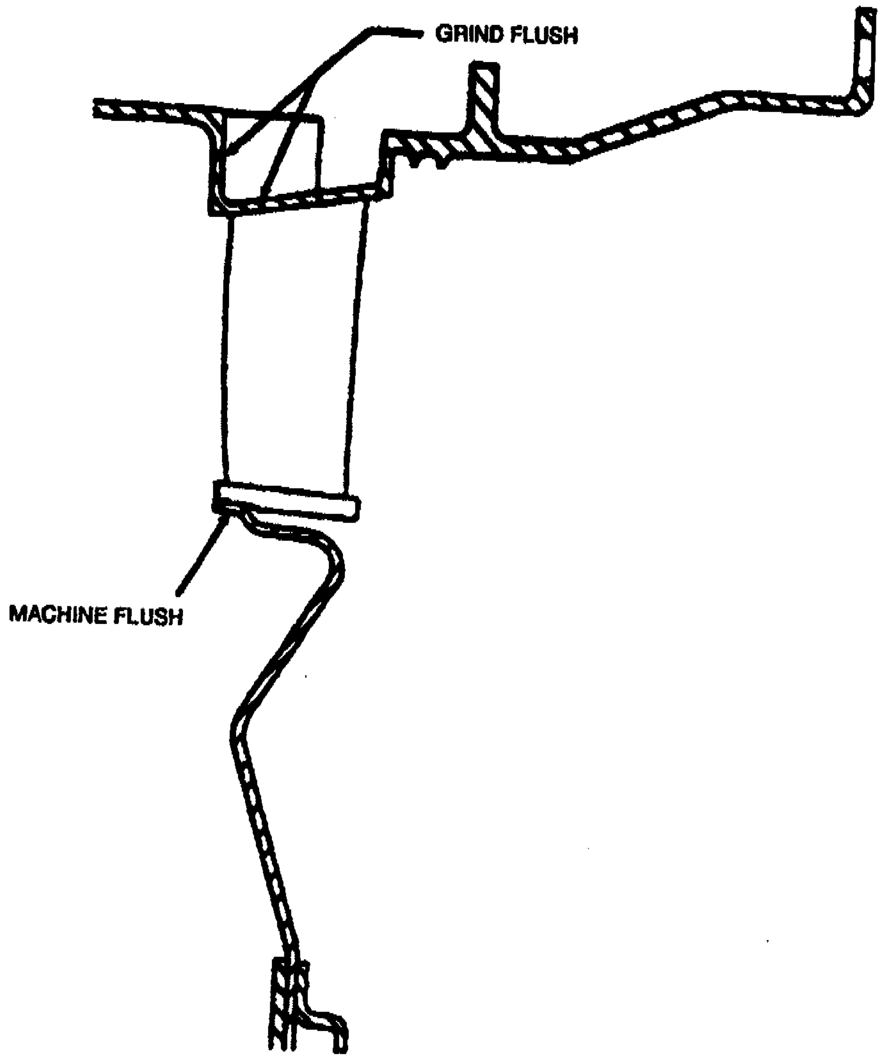


Figure 5-190. Removal of Seal Ring and Thermocouple Bosses (1-190-050-06/07).

(f) Smooth dents within limits are acceptable without blend repair.

g. Remove metalization that cannot be removed by normal cleaning procedures from the turbine nozzle vanes, by using 220-grit aluminum oxide powder (item 34, table C–1) applied as a dry blast with 30 to 40 psi (2109 to 2812 gm sq cm) air pressure.

h. Repair cracks in brazement of first power turbine nozzle assembly (1, figure 5-135), that exceed acceptable limits, by TIG welding using (item 348, table C–1) as outlined in SP No. 5001 in Appendix E.

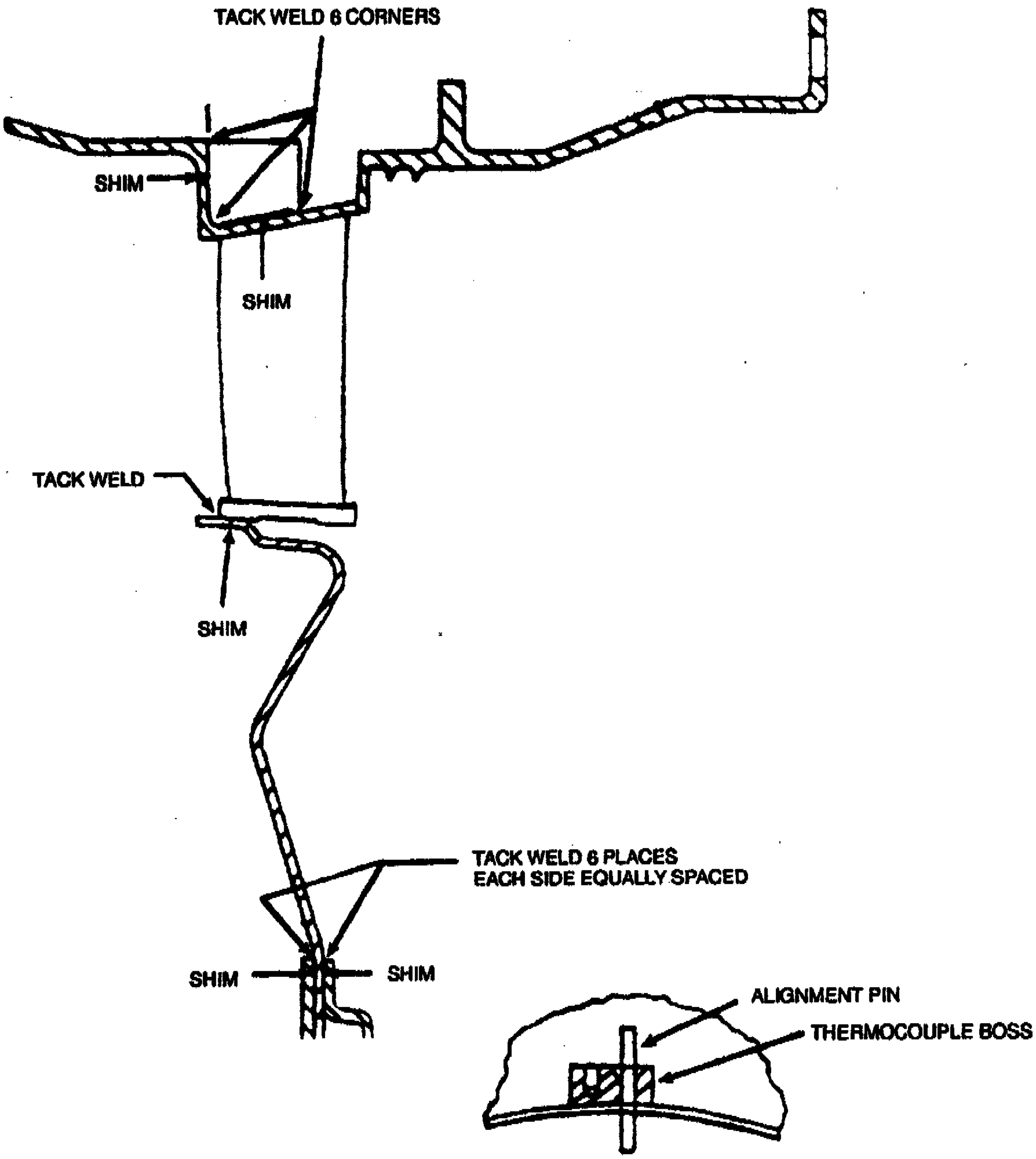


Figure 5-191. Installation and Tack-Welding of Seal Ring, Flanges and Thermocouple Bosses (1-190-050-06/07).

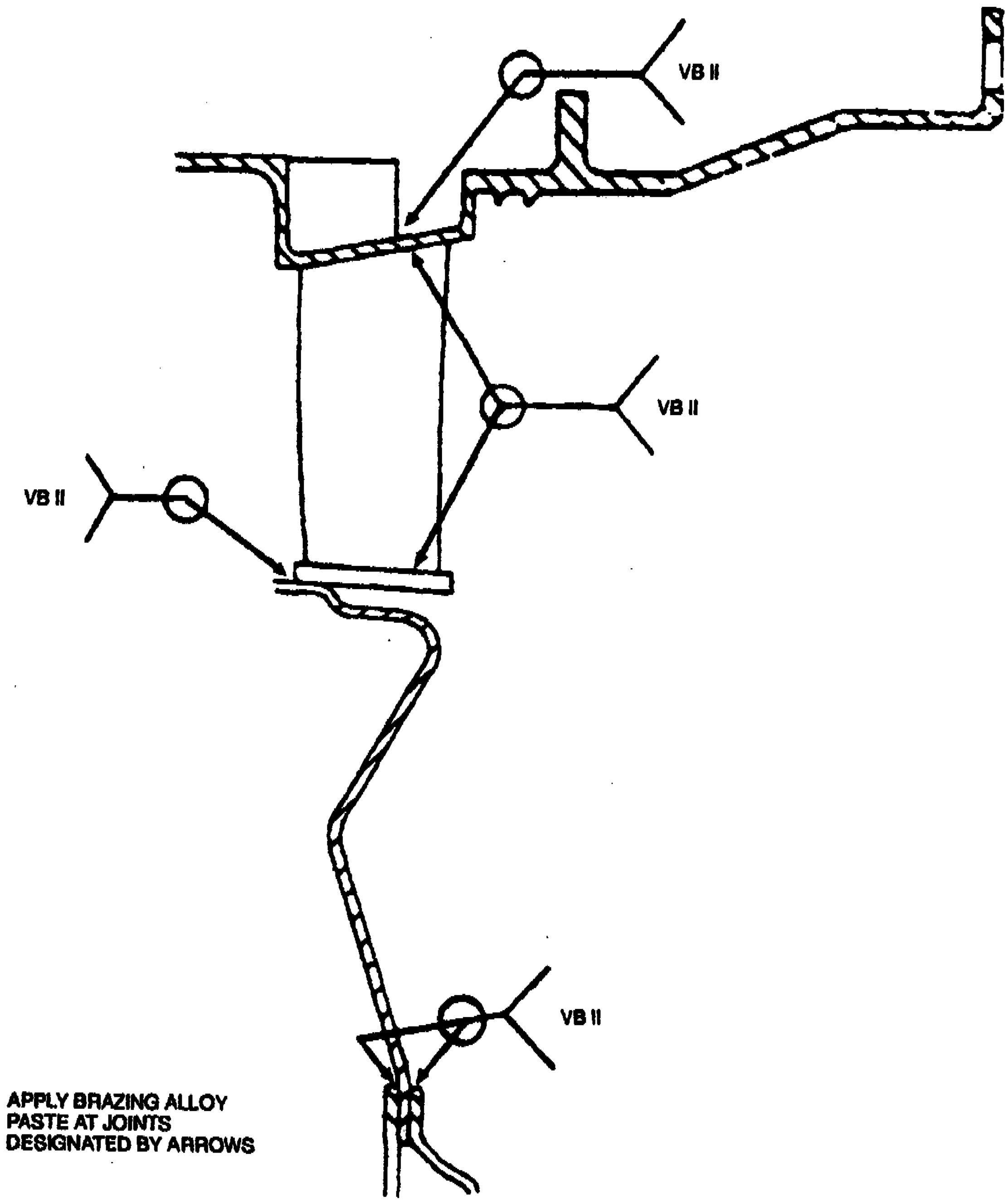


Figure 5-192. Brazing of Seal Ring, Flanges, and Thermocouple Bosses (1-190-050-06/07).

l. Reform the out-of-roundness on rear flange of first stage power turbine nozzle assembly (1, figure 5-135) 13.650 to 13.660 inch (34.671 to 34.696 cm) diameter as follows:

(1) Using steel (item 294, table C–1), fabricate a plug to dimensions shown in figure 5-194.

(2) Preheat nozzle to assemble plug 400°F (204° C) maximum.

(3) Position nozzle rear flange onto plug. See figure 5-195.

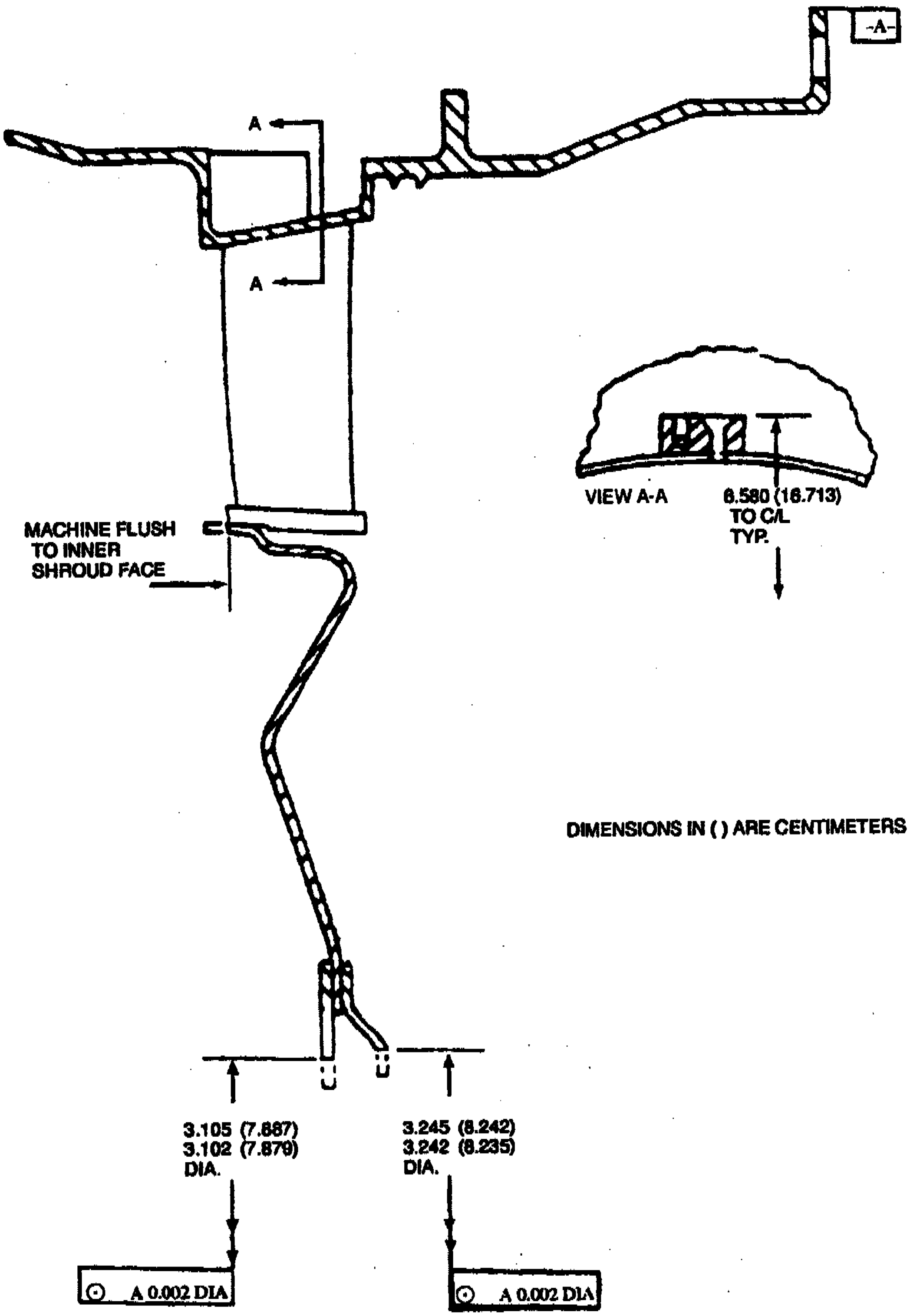
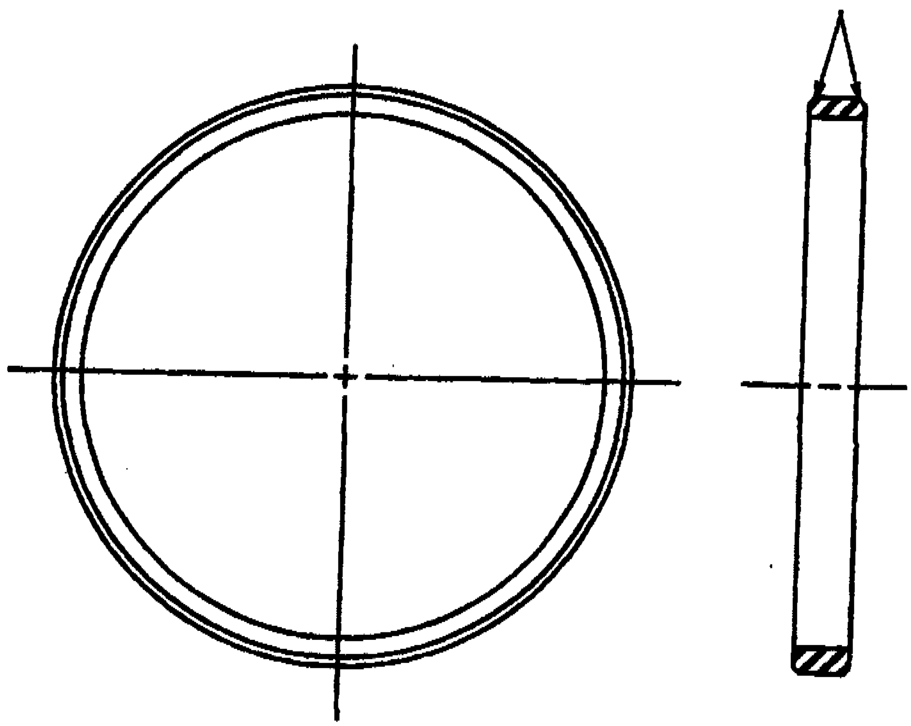


Figure 5-193. Final Machining Dimensions (1-190-050-06/07).

DIMENSIONS IN ( ) ARE CENTIMETERS

CHAMFER 0.070 (0.177) X 45°



THICKNESS 0.750 TO 0.760 INCH (1.905 TO 1.930)
ID 10.00 ± 0.010 INCH (25.40 ± 0.025)
OD 13.645 ± 0.005 INCH (34.650 ± 0.013)

Figure 5-194. Fabrication of Plug.

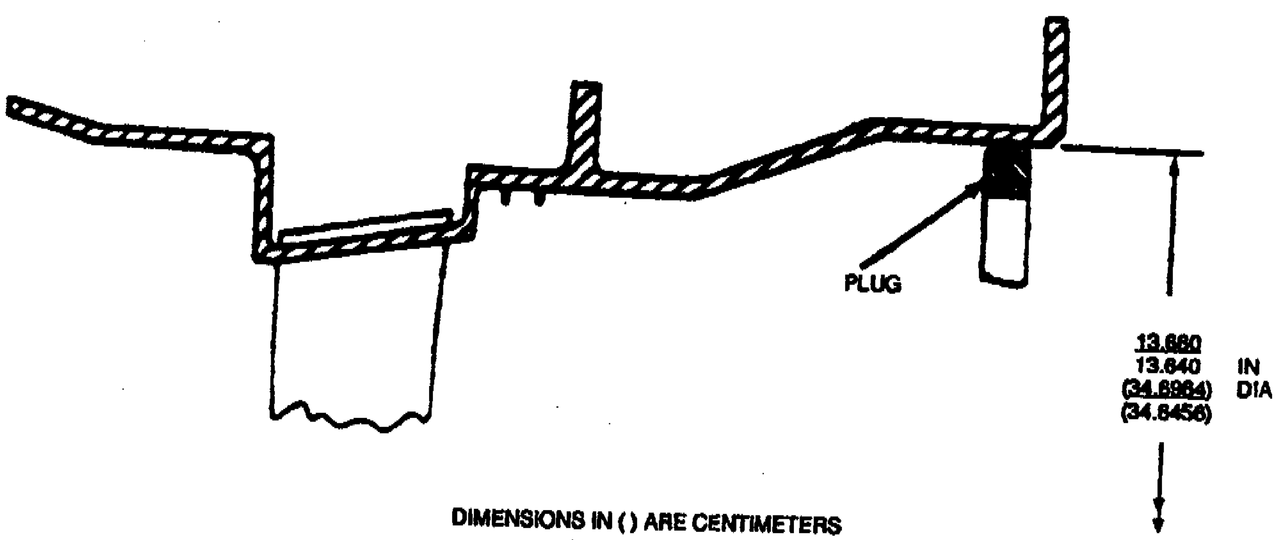


Figure 5-195. First Stage Power Turbine Nozzle Rear Flange - Reforming (Typical).

(4) Load nozzle and plug into vacuum furnace (plug side down). Heat to 1,900° F (1,0380° C) and hold for 10 minutes.

(5) As an alternate for preceding step (4), load nozzle with assembled plug into oven (plug side down). Heat to 550° to 650°F (288° to 343°C) and hold for a minimum of 15 minutes.

NOTE

If criteria outlined in preceding step (5) does not produce desired results, use criteria outlined in step (4).

(6) Fast-cool. Remove plug and reinspect diameter. A minimum of 13.640 inches (34.646 cm) is acceptable.

(7) Fluorescent-penetrant inspect the ID of the reformed nozzle rear flange.

NOTE

After use, inspect the plug OD to ensure 13.640 to 13.650 inch (34.646 to 34.671 cm) dimension is maintained.

j. Repair out-of-roundness, distortion, or wear on forward and aft seal ring flanges of nozzle assembly (1, figure 5-135) as follows:

(1) Using gas-tungsten method and welding wire (item 349, table C–1, build up worn surfaces. (Refer to SP No. 5001 in Appendix E.)

(2) Machine to dimensions shown in figure 5-193.

k. Repair worn labyrinth sealing lands on nozzle assembly (1, figure 5-135), worn below the 0.015 minimum height as follows:

(1) Machine as required to clean up wear or removal of any plasma spray.

(2) MIG weld using AMS5794 Wire, (item 349, table C–1). No welding permitted in well adjacent to vane because of proximity to vane brazement. (Refer to figure 5-196.)

(3) Heat treat as follows:

(a) Place part in oven. Heat to 1015° ± 15°F and hold for 2 hours.

(b) Cool to 500°F, not faster than 100°F every 15 minutes.

(4) Finish machine seal lands per figure 5-196.

WARNING

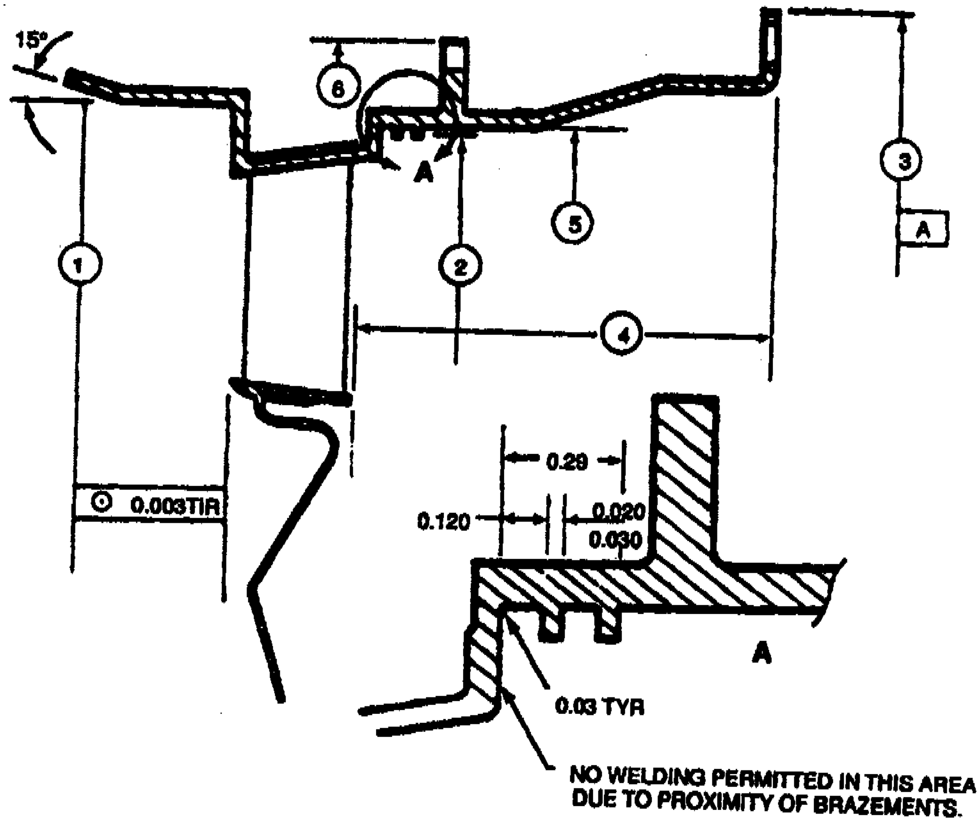
FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(5) Fluorescent penetrant inspect. No cracks allowed in repaired seal area.

(6) Wear or distortion to rear cylinder ID exceeding 0.003 TIR or reference No. 5 ID size will require metalizing repair, providing the remaining parent metal wall thickness is not less than 0.060 inch.

l. Nozzle may be reworked to increase or decrease flow area within published flow limits by shot peening. (Refer to SP No. 5015 and SP No. 6033 in Appendix E).



1	13.245 - 13.267
*2	12.930 - 12.934
*3	14.732 - 14.740
4	2.665 - 2.715
*5	13.048 - 13.052
6	13.920 - 13.965

* TO BE WITHIN 0.003 TIR

Figure 5-196. First Stage P.T. Nozzle Sealing Land Repair.

5-267. REASSEMBLY. Reassembly is not required.

5-268. FUNCTIONAL TEST. Functional test is not required.

5-269. FIRST STAGE POWER TURBINE ROTOR AND SPACER.

5-270. DISASSEMBLY. Disassembly is not required.

5-271. CLEANING. Proceed as follows:

a. Clean first stage power turbine rotor assembly (7, figure 5-135) and spacer (8) using dry cleaning solvent method. (Refer to SP No. 3002 in Appendix E.)

CAUTION

The method given in following step b shall not be used on coated blades.

b. Clean first stage power turbine rotor that has metalization (slag) deposits that cannot be removed with normal cleaning procedures using aluminum oxide powder (item 36, table C–1) applied as dry blast with 30 to 40 psi (2109 to 2812 gm sq cm) air pressure, or plastic media blast (reference SP. No. 3003.1).

5-272. INSPECTION. Perform specific inspections listed in table 5-81.

5-273. REPAIR. (See figure 5-135.) Proceed as follows:

a. On T53-L-13B, -15, -701, -701A engines, repair bolt (4, figure 5-135) by silver plating as follows:

(1) Remove surface rust, if required, by lightly abrading.

(2) Silver-plate as outlined in SP No. 6019 in Appendix E.

b. Loose or improperly staked blades, or blades that are not flush within 0.012 inch (0.030 cm) of disk face shall be removed. Reinstall blades, repin, and stake as outlined in paragraph 5-279.

c. Remove metalization that cannot be removed by normal cleaning procedures, from blades of turbine rotor assembly (7) by using 220-grit aluminum oxide powder (item 36, table C–1) applied as a dry blast with 30 to 40 psi (2109.2 to 2812.3 cm sq cm).

Table 5-81. Inspection of First Stage Power Turbine Rotor and Spacer.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135				
	WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.**			
-4	Bolt	Visual.	Bowing or distortion.	Not allowed. Replace.
			Rust or loss of surface coating.	Refer to table 5-82.
			Damaged threads.	Not allowed. Replace.
			Elongation.	Not allowed. Replace.
		Visual and Flo-rescent-Penetrant.	Cracks.	Not allowed. Replace.
-6	Sealing Flange	SIE and Visual.	Scoring on 3.059 to 3.061 (7.770 to 7.775 cm) and 3.199 to 3.201 inch (8.125 to 8.131 cm) diameters exceeding 0.010 inch in depth	Repair by removing burrs and sharp projections. (Refer to SP No. 5000 in Appendix E and to table 5-83.)
			Air bleed holes.	6 holes required (refer to paragraph 5-319 and figure 5-308).
		Visual and Fluorescent-Penetrant.	Cracks.	Not Allowed. Replace.
	WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.**			
-7	First Stage Power Turbine Rotor Assembly	Visual.	Loose or improperly staked blades.	Repair (Refer to paragraph 5-273).
			Damaged or elongated bolt holes.	Not Allowed. Replace blades.
			Metalization of blades.	Refer to paragraph 5-273.
			Thinned out or sharp edges on blades shroud trailing edge.	Repair. (Refer to paragraph 5-273).
			Shroud edge overlap of A and B blades.	Not allowed. Replace.
			Unusual heat discoloration and burning of blades following overtemperature condition	Not allowed. Replace.
			Heat discoloration and burning of blades	Refer to table 5-82.
			A and B blades installed out of sequence.	Refer to table 5-82.
		Visual and Fluorescent Penetrant	Cracks in disk and blades following over-temperature condition	None allowed. Replace.

Table 5-81. Inspection of First Stage Power Turbine Rotor and Spacer (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135 -7 (Cont)	First Stage Power Turbine Rotor Assembly (Cont)		Worn 4.9200 to 4.9205 in (12.4968 to 12.4981 cm) diameter	Repair. (Refer to paragraph 5-273).
		Visual.	Nicks, burrs, and raised metal in locking pin holes.	Blend-repair. (Refer to SP No. 5000 in Appendix E).
		SIE and Visual.	Blade flushness inch beyond 0.012 of disk face.	Repair. (Refer to paragraph 5-273).
			Scoring or grooves on OD of disk or blades beyond 0.005 inch.	Replace if limits are exceeded.
			Blades shroud gap beyond acceptable limits.	Refer to table 5-82.
			Rub damage or scoring on blade tip shroud.	Refer to table 5-82, and see figure 5-199.
			Wear and fits.	Repair or replace. (Refer to tables 5-82 and 5-83).
		Visual and Fluorescent-Penetrant.	Cracks or crack like indications.	None allowed. Replace.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
-8	Spacer	Visual	Cracks in blades.	None allowed. Replace.
			Pitting on turbine disk mating surface	None allowed. Replace.
			Loss of protective surface finish (T53-L-13B, -15, -701, -701A)	Repair. (Refer to SP No. 6000 in Appendix E).

WARNING

FLIGHT SAFETY PART

The following dimensional inspection is flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
		SIE and Visual	Corrosion pitting on 4.9210 to 4.9215 inch (12.4993 to 12.5006 cm) diameter	Repair. (Refer to paragraph 5-273).
			Worn 4.9210 to 4.9215 inch (12.4993 cm to 12.5006 cm) diameter	Repair. (Refer to paragraph 5-273).
			Worn 1.479 to 1.481 inch (3.757 to 3.762 cm) surface	Repair. (Refer to paragraph 5-273).
			Scoring or grooves on 4.9210 to 4.9215 inch (12.4993 to 12.5006 cm diameter caused by contact with second stage power turbine nozzle exceeding 0.010 inch (0.025 cm) in depth	Repair or replace. (Refer to paragraph 5-273).
		Visual and fluorescent penetrant	Cracks.	None allowed. Replace.

Table 5-82. First Stage Power Turbine Rotor and Spacer Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Pilot Diameter Exceeds Maximum Overhaul Dimensional Limits	5-197	a. Measure bore diameter only if pilot diameter exceeds the maximum overhaul limits. (Refer to table 5-83). b. If bore diameter exceeds maximum overhaul limits in table 5-83, replace the disk assembly. c. Disks that exhibit acceptable bore diameters shall have a point Q (ball root) dimensional check performed. (Refer to table 5-83.) (See figure 5-197). d. Disks that indicate a point Q equal to or less than maximum overhaul dimension are acceptable for repair. If tip diameter exceeds overhaul limits, tip-grind as outlined in paragraph 5-279. If pilot diameter exceeds overhaul limits, repair as outlined in paragraph 5-273. e. Replace disks that fail to meet requirements of the point Q dimensional inspection.
Rubs on Blade Tips		Rubs shall not exceed limits specified in figure 5-199. If limits are exceeded, replace blades. (Refer to paragraph 5-279). **NOTE** Disks that have blades replaced due to rubs beyond limits shall have a broach slot inspection performed between 0.0810 inch (0.2057 cm) diameter gage rolls on every other slot. (See figure 5-197.) Dimension shall be 0.1010 to 0.1036 inch (0.2565 to 0.2631 cm).
Blade Shroud Gap	5-198	a. There shall be no clearance between the A and B blades on the rotors which were rebladed (figure 5-198). Clearance between A and B blades on the rotors which were not rebladed shall be 0.000 to 0.005 inch (0.013 cm) (figure 5-198). These blades are designed to operate with an interference fit. b. On rotors which are completely rebladed, the maximum cumulative gap between all tip shrouds shall not exceed 0.165 inch (0.419 cm). No individual gap between pairs of A and B blades shall exceed 0.010 inch (0.025 cm). The minimum cumulative gap shall not be less than 0.016 inch (0.041 cm).

Table 5-82. First Stage Power Turbine Rotor and Spacer Inspection Limits. (Continued)

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Blade Shroud Gap (Cont)	5-198 (Cont)	c. On rotors which are not completely rebladed, the maximum cumulative gap between all tip shrouds shall not exceed 0.165 inch (0.419 cm). No individual gap between pairs of A and B blades shall exceed 0.020 inch (0.051 cm). The minimum cumulative gap shall not be less than 0.016 inch (0.041 cm). If individual gap exceeds 0.020 inch (0.051 cm), or the total cumulative gap exceeds 0.165 inch (0.49 cm), replace blades as necessary to obtain proper gap (refer to paragraph 5-279). If individual gap is less than 0.001 (0.002 cm), determine accumulated gap. If gap is greater than 0.016 inch (0.041 cm), no rework is required. If accumulated gap is below 0.016 inch (0.041 cm), repair as outlined in paragraph 5-273.
Rust or Loss of Surface Coating on Externally Relieved Body Bolt		Loss of silver plate with light surface rust is acceptable with repair. (Refer to paragraph 5-273.) Heavily corroded and pitted bolts shall be replaced.
Nicks, Burrs, and Raised Metal in Disk Locking Pin Holes		Nicks, burrs, and raised metal in disk locking pin holes shall be blend-repaired to parent metal using a carborundum stone or equivalent.
A and B Blades Out of Sequence		a. A and B blades out of sequence are acceptable on turbine rotors which need no blade replacement, provided there is no shroud edge overlap. b. Turbine rotors which require reblading shall have affected blades installed in sequence as outlined in paragraph 5-279. c. Turbine rotors which require complete reblading shall have blades installed in proper sequence (paragraph 5-273.)
Heat Discoloration and Burning of Blades		a. Discoloration of blades caused by normal operation is allowed. b. Any loss of material caused by burning is cause to replace blades. c. Visual distortion and deformation cause by excessive heat is reason to reject blades.

Table 5-83. Dimensional Inspection of First Stage Power Turbine Rotor Assembly.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-135								5-199
Sealing Flange	-6	OD	3.199 (8.125)	3.201 (8.131)					A
		OD	3.059 (7.770)	3.061 (7.775)					
WARNING **FLIGHT SAFETY PART** **Inspection of 4.9200 - 4.9205 dimensions is flight safety critical.**									
First Stage Power Turbine Rotor	-7	ID	4.9200 (12.4968)	4.9205 (12.4981)	4.9200 (12.4968)	4.9210 (12.4993)	0.000	0.00151 (0.0038)	C
WARNING **FLIGHT SAFETY PART** **Inspection of 4.9210 - 4.9215 dimensions is flight safety critical.**									
Assembly To Spacer Pilot	-8	OD	4.9210 (12.4993)	4.9215 (12.5006)	4.9210 (12.4993)	4.9215 (12.5006)			D
First Stage Power Turbine Rotor Assembly Aft	-7	OD	12.935 (32.855)	12.937 (32.860)	12.935 (32.855)	12.943 (32.875)			E
Forward		OD	12.837 (32.606)	12.839 (32.611)	12.837 (32.606)	12.845 (32.626)			F
Bore Diameter		ID	1.919 (4.874)	1.920 (4.877)	1.919 (4.874)	1.923 (4.884)			G
Q Point*			4.299 (10.919)	4.304 (10.932)		4.305 (10.935)			5-197

* "Q" POINT INSPECTION: The "Q" point position can be determined by either of two methods: Set up turbine disk with radial line vertical, and measure the "Q" point vertical dimension to center line; or set up in turbine disk bore and measure "Q" provided in figure 5-197. Q point check need only be performed every 45 degrees. Remove blades, as necessary, as close as possible to the 45 degree interval to take measurements.

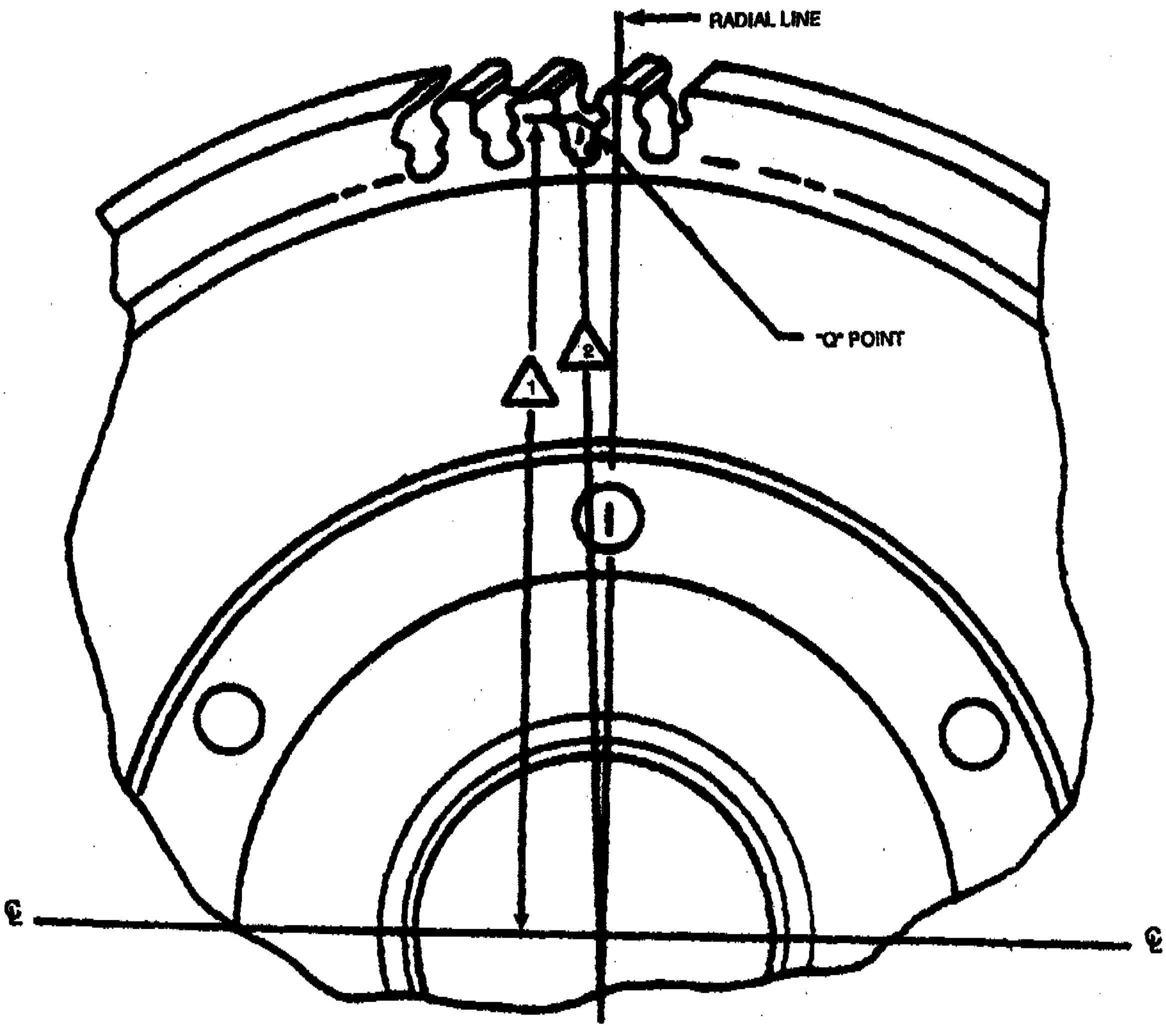
CAUTION

If any of the four turbines indicate a growth beyond acceptable limits in the pilot, and "Q" point dimensions, overtemperature is suspected. Check remaining three rotors closely. If either power turbine indicates a growth beyond acceptable limits in the pilot and bore dimensions, overspeed is suspected. Check mating power turbine rotor closely.

1 "Q" POINT DIMENSION TO ℄

2 "Q" POINT RADIUS (USE THIS DIMENSION IF "Q" POINT IS TAKEN FROM CENTER OF BORE).

DIMENSIONS IN () ARE CENTIMETERS



"Q" POINT DIM. TO CENTER LINE 1		"Q" POINT RADIUS TO CENTER OF BORE 2	
DRAWING DIM.	O/H SVC. DIM	DRAWING DIM	O/H SVC. DIM
4.299/4.304 (10.919/10.932)	4.305 (10.9347)	4.3033/4.3083 (10.9304/10.9431)	4.3093 (10.9456)

Figure 5-197. First Stage Power Turbine Disk Q Point Dimension.

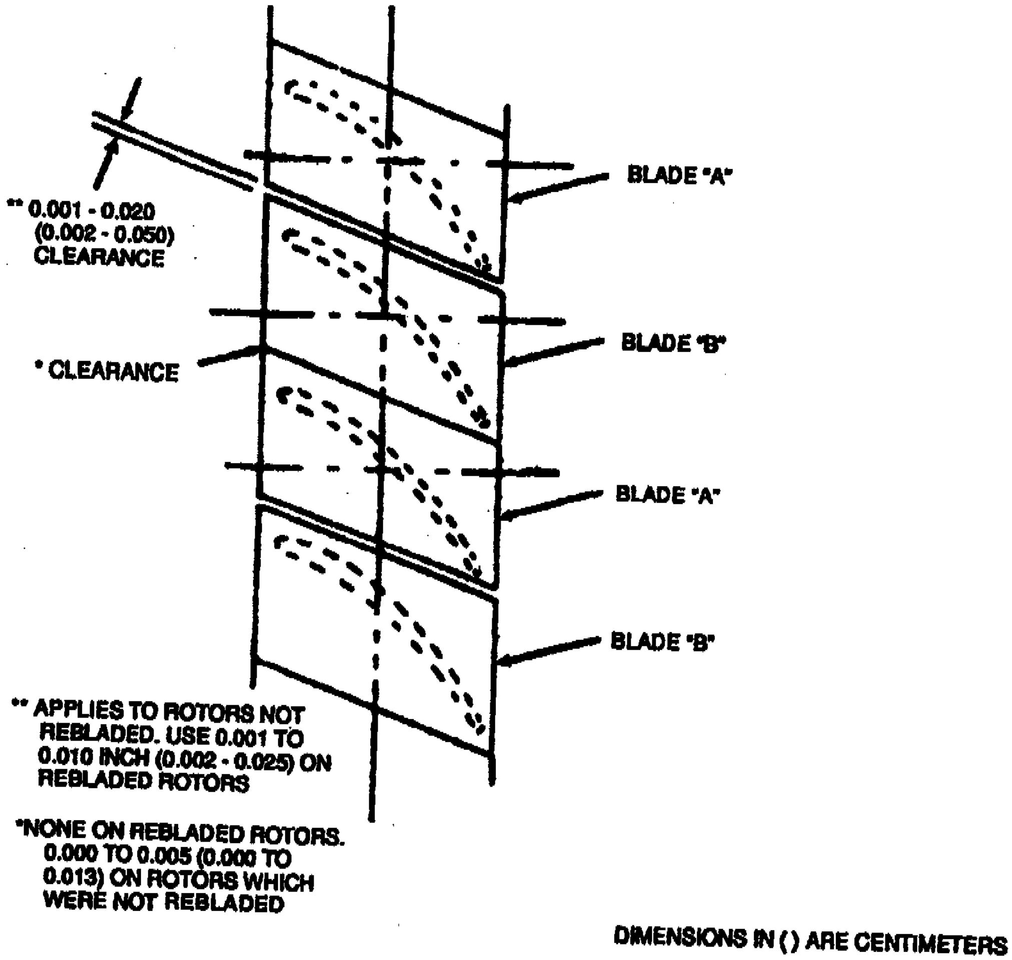


Figure 5-198. Power Turbine Rotor Blade Shroud Gap.

d. Repair thinned out (sharp edges) on trailing edge of blade shroud by blending area to a maximum depth of 1/16 inch. (see figure 5-199.) Minimum shroud thickness must be adhered to.

e. Repair worn surfaces on 4.9200 to 4.9205 inch (12.4968 to 12.4981 cm) diameter (0.050) minimum parent metal wall thickness is required) of first stage power turbine rotor disk, when 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup is required by plasma flame spraying as follows: (See figure 5-201.)

(1) Machine, if necessary, to obtain 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup thickness after final machining.

(2) Plasma-spray rotor disk with nickel-aluminide powder (item 218, table C–1) or equivalent, complying with general processing requirements for the application of plasma flame-spraying coating to metal surfaces for dimensional buildup cited in SP No. 5006 in Appendix E.

f. Repair worn surfaces on 4.9200 to 4.9205 inch (12.4968 to 12.4981 cm) diameter (0.050 minimum parent metal wall thickness is required) of first stage power turbine rotor disk, where 0.002 inch maximum buildup is required by electroless nickel plate as follows:

(1) Machine oversize to obtain 0.002 maximum buildup after final machining. Clean disk using dry cleaning solvent (item 134, table C–1). Mask part as required.

(2) Electroless nickel plate per MIL-C-26074.

(3) Rinse part in cold water (room temperature) and then hot water (180°F) and then blow air dry.

(4) Remove masking and bake at 365° to 385°F for 3 hours.

(5) Visually inspect plated area for cracking, peeling or blistering of plating. None allowed.

(6) Machine to requirements of figure 5-201.

g. Repair worn surfaces on 4.9200 to 4.9205 inch (12.4968 to 12.4981 cm) diameter (0.050 minimum parent metal wall thickness is required) of first stage power turbine rotor disk, where 0.002 to 0.010 inch buildup is required, by chrome plating as follows:

(1) Machine, if necessary, to obtain a 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final machining.

(2) Chrome plate rotor. Refer to SP No. 6014 in Appendix E.

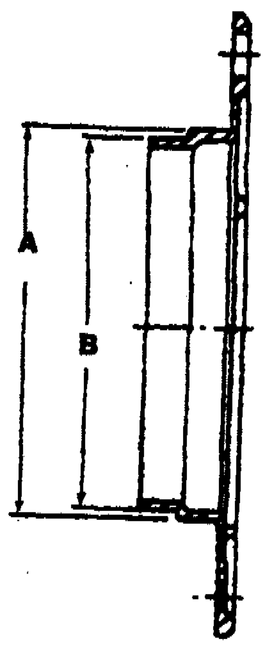
(3) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Machine to requirements of figure 5-201.

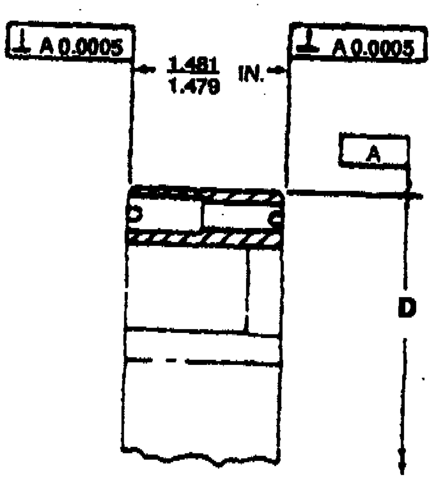
h. If total blade shroud gap is below 0.016 inch (0.041 cm) repair as follows:

(1) Using a nylon wedge, spread blades enough to allow polishing with crocus cloth (item 125, table C–1).

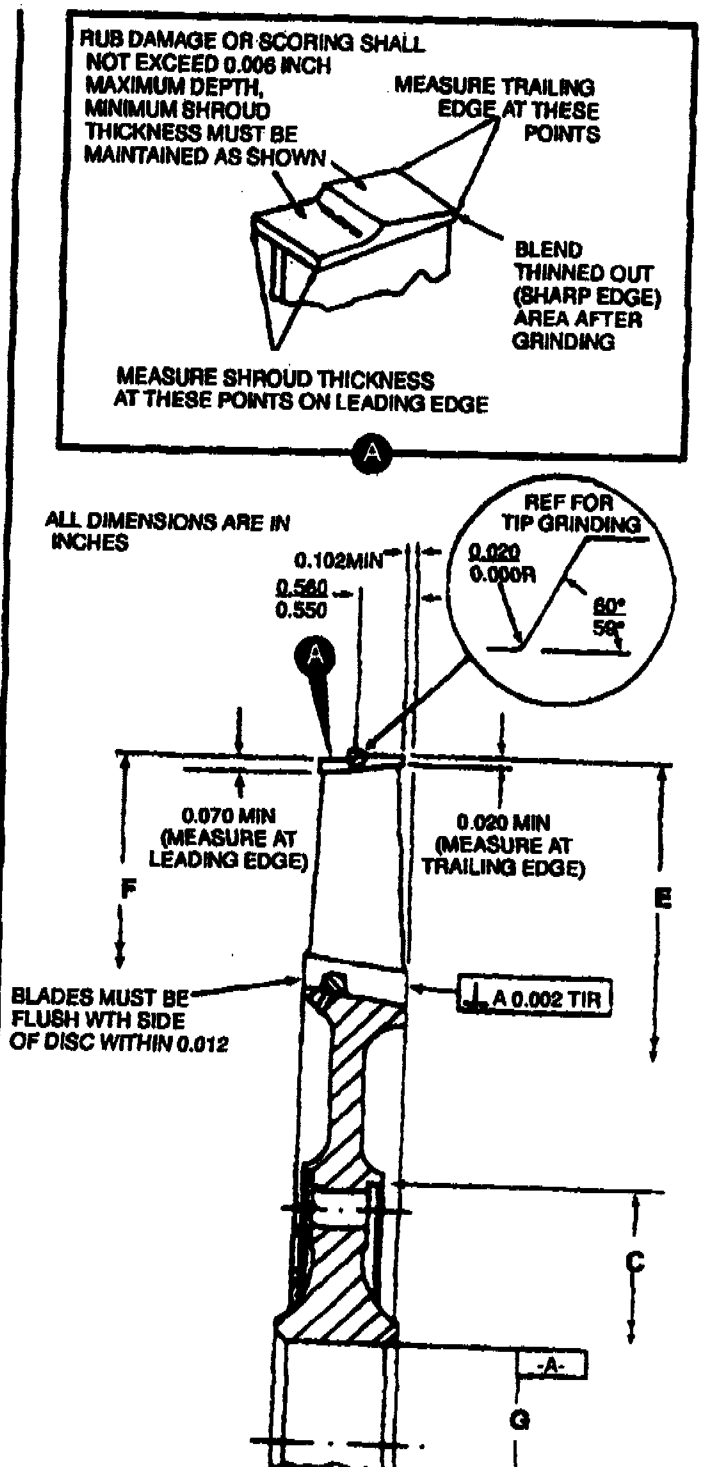
(2) If accumulated gap is still below 0.016 inch (0.041 cm) replace blades as necessary. (Refer to paragraph 5-279.)



SEALING FLANGE (6, FIGURE 5-135)



SPACER (8, FIGURE 5-135)



FIRST STAGE POWER TURBINE ROTOR ASSEMBLY
(7, FIGURE 5-135)

Figure 5-199. First Stage Power Turbine Rotor and Spacer Dimensional Inspection Locations (English).

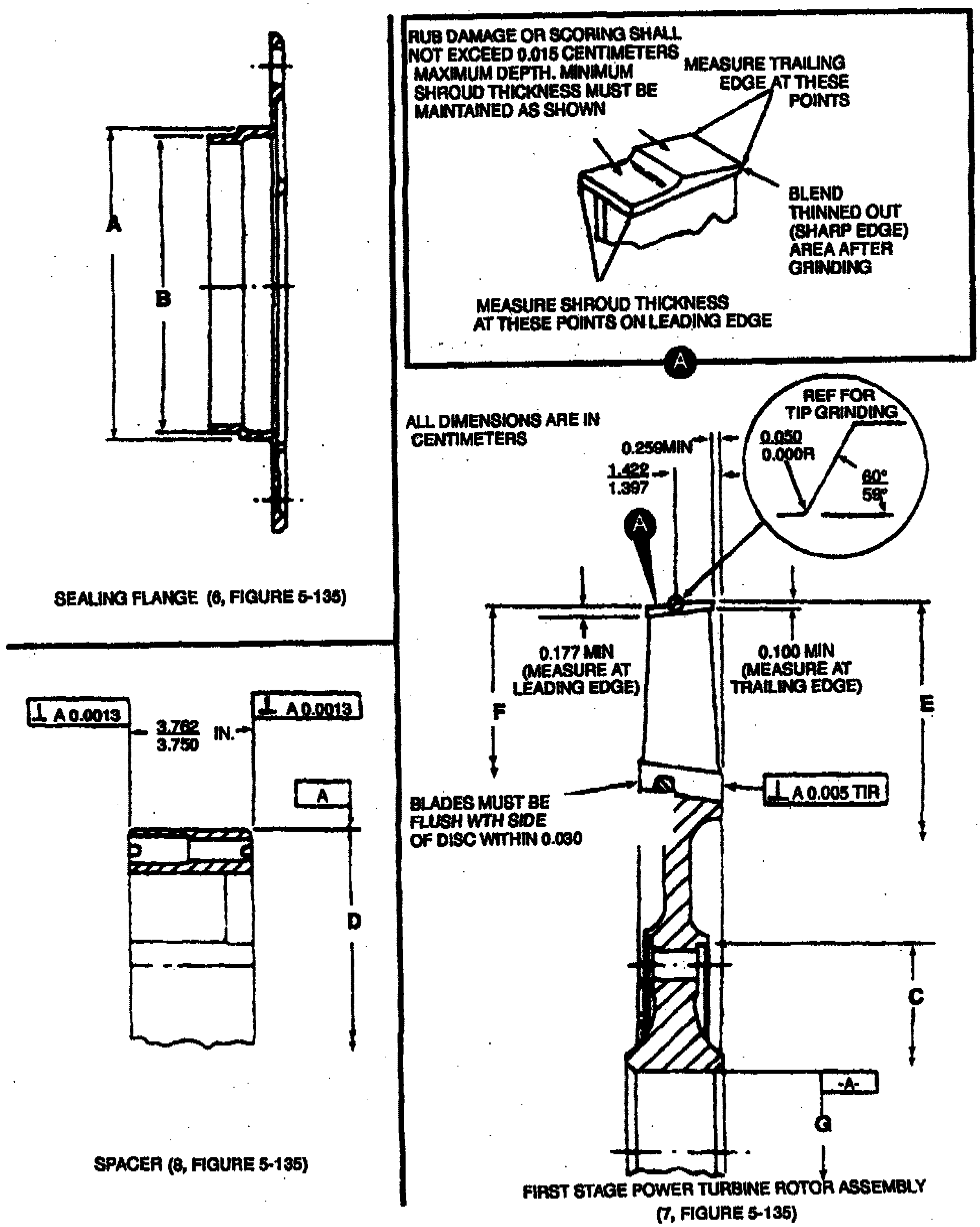
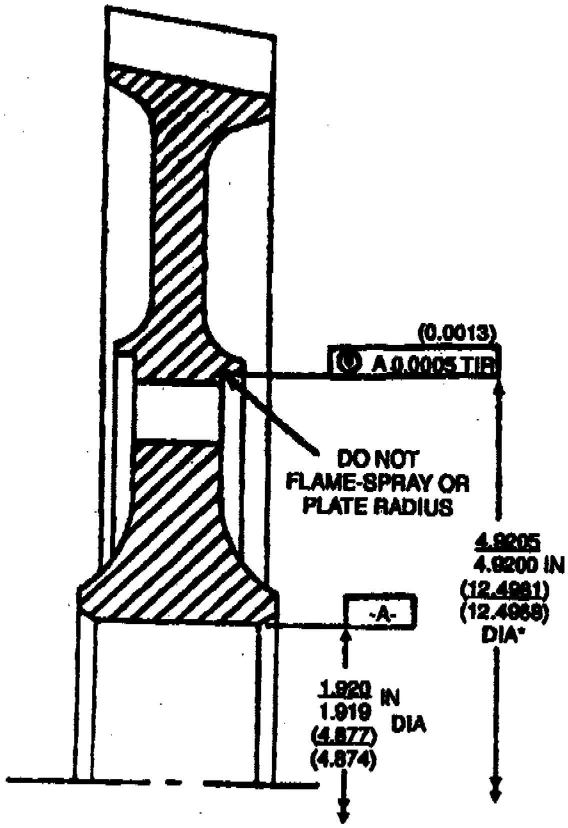


Figure 5-200. First Stage Power Turbine Rotor and Spacer Dimensional Inspection Locations (Metric).

DIMENSIONS IN ( ) CENTIMETERS



WARNING

FLIGHT SAFETY PART

THE AFT PILOT 4.9200-4.9205 DIMENSION IS FLIGHT SAFETY CRITICAL *.050 (0.127) MINIMUM PARENT METAL WALL THICKNESS IS REQUIRED.

Figure 5-201. First Stage Power Turbine Rotor Disk - Repair Area.

i. On T53-L-13B, -15, -701, -701A engines repair corrosion-pitted surfaces on spacer (8, figure 5-135). (Refer to SP No. 6000 in step e, in Appendix E.) If, after refinishing, corrosion pitting can be felt with a 0.060 inch (0.152 cm) radius scribe or pitting exceeds 0.030 inch (0.076 cm) in depth, spacer must be replaced.

WARNING

FLIGHT SAFETY PART

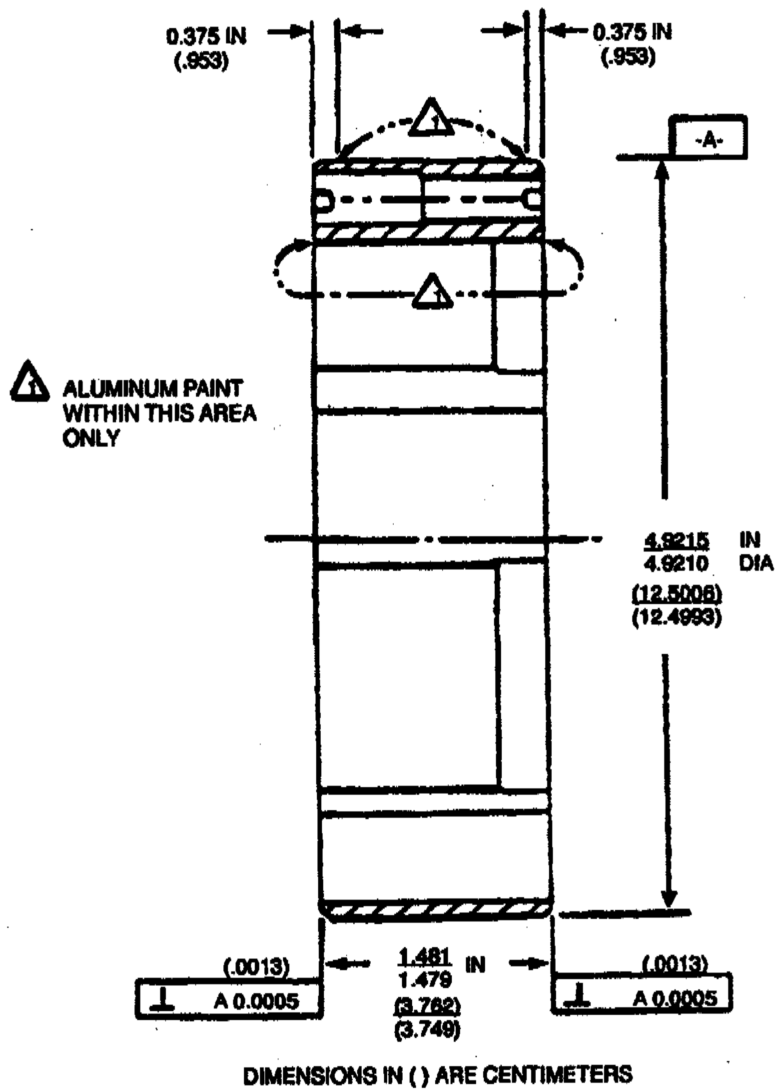
Dimensional inspection after the following repair is flight safety critical.

j. Repair worn surfaces on 4.9210 to 4.9215 inch (12.4993 to 12.5006 cm) diameter of spacer (8) where 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup is required, by plasma flame spraying, or where 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness is required by chrome plating as follows: (See figure 5-202.)

(1) Plasma flame-spray spacer as follows:

(a) Machine OD, if necessary, to obtain a 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup thickness after final machining.

(b) Plasma spray rotor disk with Metco 450 (item 218, table C-1). (Refer to SP No. 5006 in Appendix E.)



WARNING

FLIGHT SAFETY PART

THE 4.9210 TO 4.9215 OD IS FLIGHT SAFETY CRITICAL

NOTE

No build-up in holes. Build-up allowed on both faces if necessary

Figure 5-202. Power Turbine Rotor Spacer - Repair Areas.

(c) Machine to required dimensions shown in figure 5-202.

(2) Chrome-plate spacer as follows:

(a) Machine OD, if necessary, to obtain 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final machining.

(b) Chrome-plate spacer. (Refer to SP No. 6014 in Appendix E.)

(c) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(d) Machine to required dimensions shown in figure 5-202.

k. Repair worn 1.479 to 1.481 inch (3.757 to 3.762 cm) surface on spacer (8, figure 5-135), where 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup is required, by plasma flame spraying or thermo flame spraying, or where 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness is required, by chrome-plating as follows: (See figure 5-202.)

(1) Plasma flame-spray or thermo flame-spray spacer as follows:

(a) Machine, if necessary, to obtain 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup thickness after final machining.

(b) Plasma flame-spray or thermo flame-spray spacer, using nickel aluminide powder (item 218, table C–1). (Refer to SP No. 5006 in Appendix E.)

(c) Machine to required dimensions shown in figure 5-202.

(2) Chrome-plate spacer as follows:

(a) Machine, if necessary, to obtain a 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final machining.

(b) Chrome-plate spacer. (Refer to SP No. 6014 in Appendix E).

(c) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(d) Machine to required dimensions shown in figure 5-202.

l. Repair scoring or grooves on 4.9210 to 4.9215 inch (12.4993 to 12.5006 cm) diameter of spacer (8, figure 5-135) by blend-repairing as follows:

(1) Blend-repair sharp edges and protrusions as outlined in SP No. 5000 in Appendix E.

(2) On T53-L-13B, -15, -701, -701A engines, repair protective surface finish as outlined in SP No. 6000, step e, in Appendix E.

m. Observe following rules during first stage power turbine blade repair:

(1) Use a portable power drill or rotary file equipped with carbide burr. If these are not available, small diesinker-type file or India or carborundum stone may be substituted.

(2) Finish strokes shall be parallel to leading and trailing edges of blades.

(3) Final polishing of area shall be made with crocus cloth (item 125, table C–1). All repairs should be blended and finished smoothly.

(4) Leading or trailing edge repairs shall be blended to smooth radius as part of repair. (See figure 5-203.)

(5) Finish-repair length shall be blended to-minimum of three times depth of damage.

n. Repair leading and/or trailing edges of first stage power turbine rotor blades as follows:

(1) Round bottom dents, 0.010 inch (0.025 cm) or less in depth, require removal of sharp edges only.

(2) When distance between damage and shroud end of blades is less than twice the depth of damage, extend repair to include shroud end.

(3) When distance between two damaged areas is less than twice the depth of the deeper damage, make one repair area. When distance between two damaged areas is greater than twice the depth of the deeper damage, make separate repair areas. (See figure 5-203.)

(4) The maximum permissible finished-repair depth to 0.031 inch (0.079 cm) from leading edge and 0.023 inch (0.058 cm) from trailing edge. (See figure 5-204.) Allowable depths decrease as distance between damage and point A (figure 5-204) on leading edge, or point B on trailing edge, decrease.

(5) No repair is allowed within 0.500 inch (1.270 cm) of blade platform.

(6) Cracks are cause for blade replacement. Damage that cannot be completely eliminated by allowable blade repairs shall be cause for blade replacement.

o. Repair blade surface as follows:

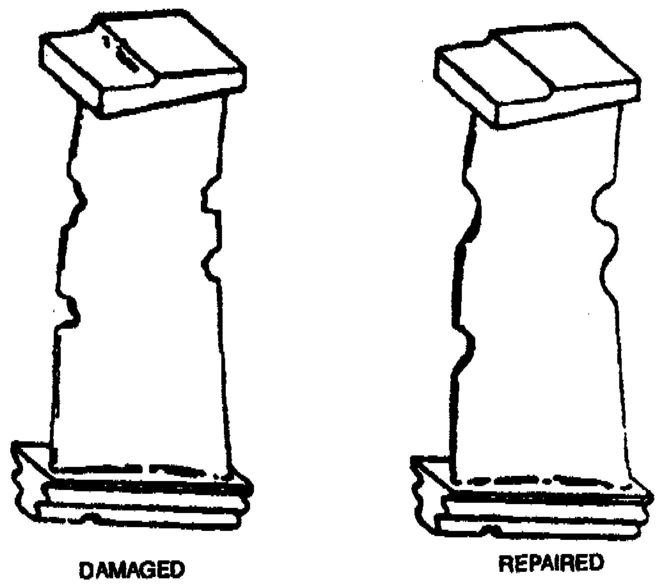
(1) Maximum permissible decrease in thickness at any point on the blade shall be 0.010 inch (0.025 cm).

(2) Maximum permissible finished single repair on blade surface shall be 0.200 square inch (1.29 sq cm) on either concave of convex side.

(3) Repairs shall be blended to a minimum of twice the depth of the damage.

(4) Total repaired surface area shall not exceed 10 percent of blade surface.

WHEN THE DISTANCE BETWEEN THE DAMAGE IS GREATER THAN TWICE THE DEPTH OF THE DEEPER DAMAGE, MAKE SEPARATE REPAIRS.



WHEN THE DISTANCE BETWEEN THE DAMAGE IS LESS THAN TWCE THE DEPTH OF THE DEEPER DAMAGE, MAKE ONE REPAIR AREA.

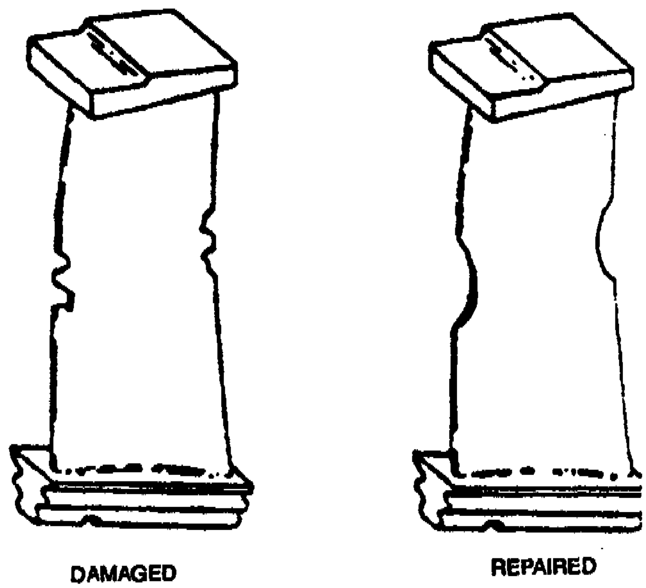


Figure 5-203. First Stage Power Turbine Blade Repair.

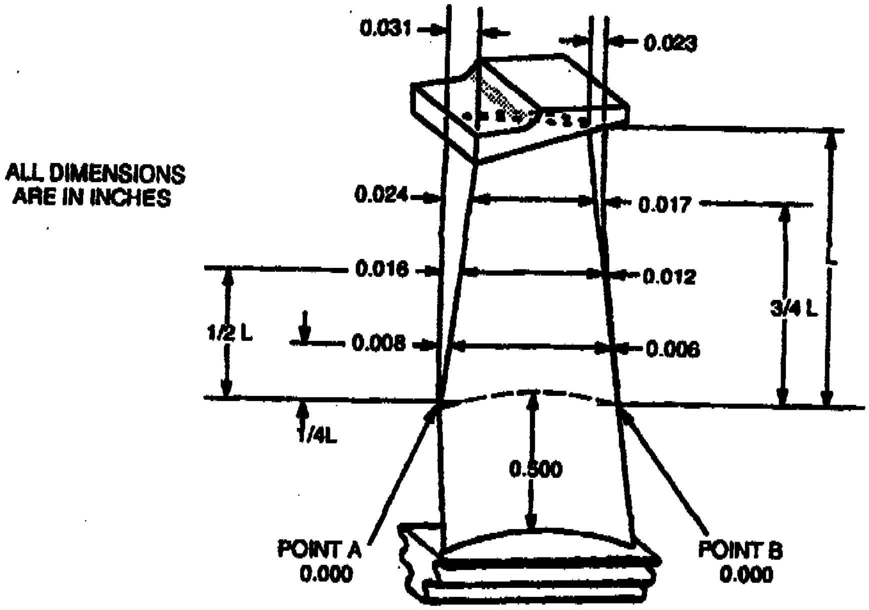


Figure 5-204. First Stage Power Turbine Rotor Blade Maximum Repair Depth (English).

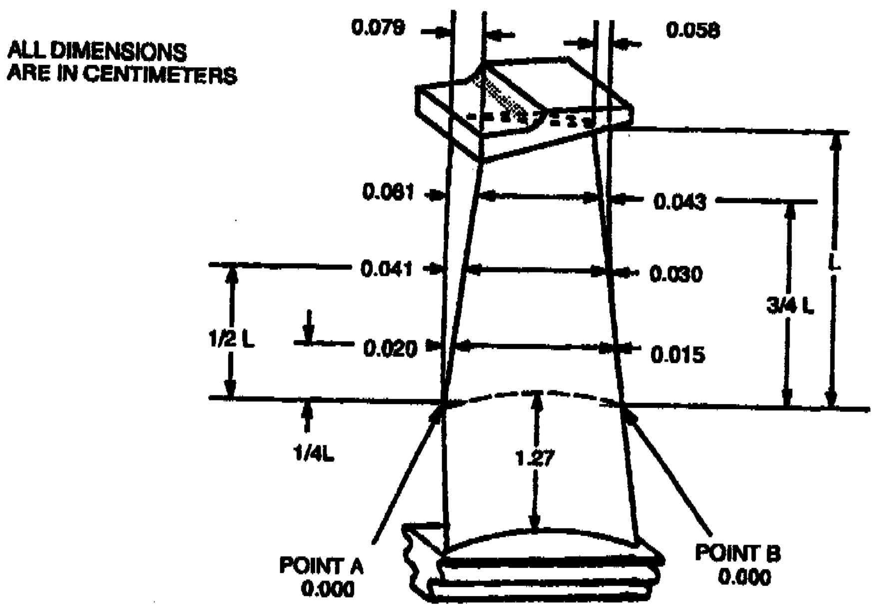


Figure 5-205. First Stage Power Turbine Rotor Blade Maximum Repair Depth (Metric).

(5) When distance between two damaged areas is less than twice the depth of the deeper damage, make one repair area. When distance between two damaged areas is greater than twice the depth of the deeper damage, make separate repair areas (See figure 5-203).

(6) No repair is allowed within 0.500 inch (1.270 cm) of blade platform. (See figure 5-204.)

(7) Cracks are cause for blade replacement. Damage that cannot be completely eliminated by allowable blade repair shall be cause for blade replacement.

5-274. REASSEMBLY. Reassembly is not required.

5-275. FUNCTIONAL TEST. Functional test is not required.

5-276. MODIFICATION OF POWER TURBINE ROTOR AND BEARING HOUSING ASSEMBLY. This modification includes the incorporation of a new, second power turbine disk (1-140-272-04), a new spacer (1-140-169-04), and new bolts (1-140-168-03), all new material. Also included is a rework for the incorporation of a pinned No. 3 bearing.

a. Replace second stage power turbine disk bolts (1-140-168-02) with new bolts (1-140-168-03).

b. Replace spacer (1-140-169-03) with new spacer (1-140-169-04).

c. Replace second stage power turbine rotor disk as follows:

(1) Remove blades from second stage power turbine rotor (1-140-550-02) as outlined in paragraph 5-316. Keep the blades in sequence so that they can be reinstalled in the same sequence.

(2) Reinstall blades in new second stage power turbine disk (1-140-272-04), as outlined in paragraph 5-316. Keep the blades in sequence so that they can be reinstalled in the same sequence.

(3) Grind rotor assembly OD to the maximum overhaul service dimension. (Refer to paragraph 5-316.) Cleanup is not required.

(4) Inspect and balance wheel as outlined in paragraph 5-316.

(5) Reidentify the second stage power turbine rotor from 1-140-550-02 to 1-140-550-07.

d. Rework bearing housing 1-140-590-04 to 1-140-590-07 configuration as follows:

(1) Using an electric discharge machine, burn a slot in the forward bearing bore according to the dimensions and specifications shown in figure 5-206. Remove all sharp edges and burrs.

(2) Fluorescent-penetrant inspect housing.

(3) Reidentify bearing housing from 1-140-590-04 to 1-140-590-07.

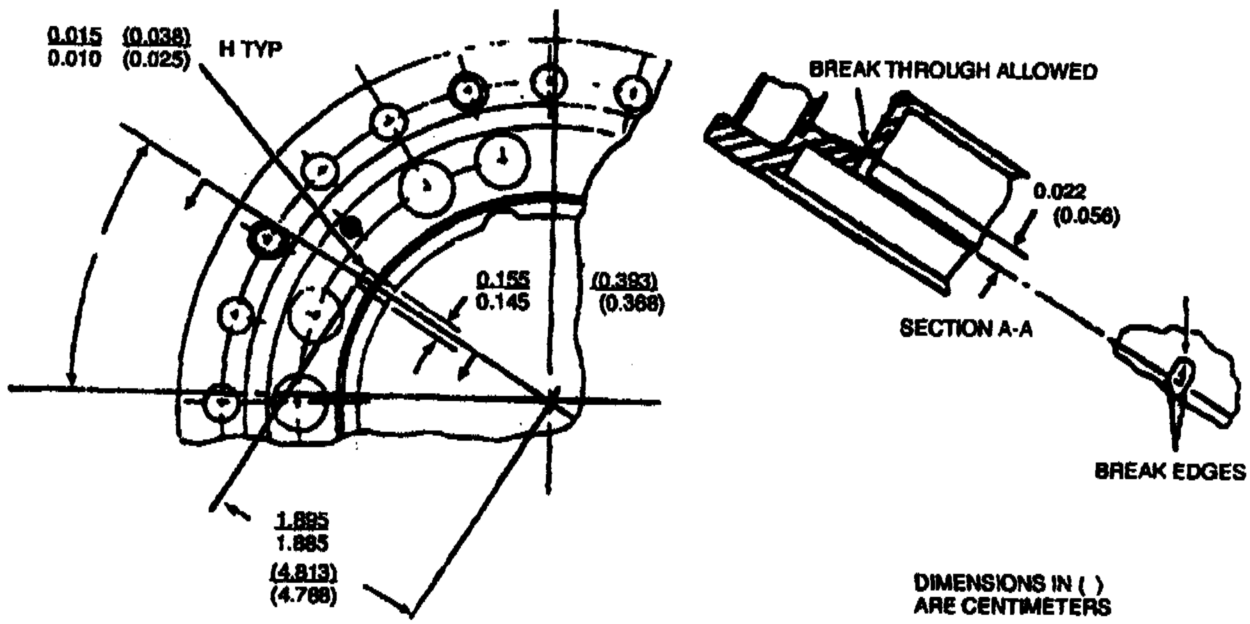


Figure 5-206. Rework of Numbers 3 and 4 Bearing Housing.

e. Reidentify the power turbine rotor and bearing housing from 1-140-530-05/06 to 1-140-530-14.

f. Reidentify combustor turbine assembly 1-130-630-08 to 1-130-630-19.

5-277. MODIFICATION OF NO. 3 BEARING. Modification same as that specified for No. 2 bearing. (Refer to paragraph 5-407 step 5-407c.)

5-278. MODIFICATION OF FIRST STAGE POWER TURBINE ROTOR. The following instructions provide data for the incorporation of new first stage power turbine rotor blades (1-190-007-07 and- 1-190-008-04):

a. Deblade first stage power turbine rotor as outlined in paragraph 5-279.

b. Clean and inspect turbine rotor disk as outlined in paragraph 5-271.

c. Reblade turbine rotor disk with new "A" blades (1-190-007-07) and "B" blades (1-190-008-04). Install new blades in accordance with requirement given in paragraph 5-279, including tip grinding and balancing, using pins (1-140-285-01).

d. Grind front face of blade roots to within 0.005 inch (0.013 cm) of disk face.

e. Using a vibropeen marking tool, reidentify the first stage power turbine rotor from a 1-190-010-02 to a 1-190-010-03 configuration.

5-279. REPLACEMENT OF FIRST STAGE POWER TURBINE ROTOR BLADES. (See figure 5-207.) Proceed as follows:

a. Remove blades as follows:

NOTE

This procedure is for total reblading, Replace individual blades in sets, as required.

(1) Using a vibropeen etching tool, number forward face of blade roots, clockwise, from 1 through 66 starting at the balancing "O" mark.

(2) Position the first stage power turbine rotor (1), forward face down, on table (LTCT13358, detail of LTCT13356).

CAUTION

In following step (3), ensure rotor is secured in position by hand tightening clamp assembly (LTCT13355, detail of LTCT13356).

(3) Align blade to be removed under punch assembly (LTCT13357, detail of LTCT13356) and, using press (LTCT6073), drive against the blade (3) to shear locking pin (2). Remove blade.

(4) Repeat preceding step (3) for remaining blades.

(5) From the blade groove end, use suitable drift to unseal the locking pin and drive the pin from the hole.

(6) Using 0.093 inch (0.236 cm) diameter reamer mounted in a T-handle, ream out pin hole from groove side.

b. Install blades as follows: (See figure 5-207.)

(1) Select required replacement blades.

(2) Position first stage power turbine rotor (1) on a suitable fixture with forward face down.

(3) Install blades (3) into disk so that each "A" blade is 180 degrees from its matching "B" blade.

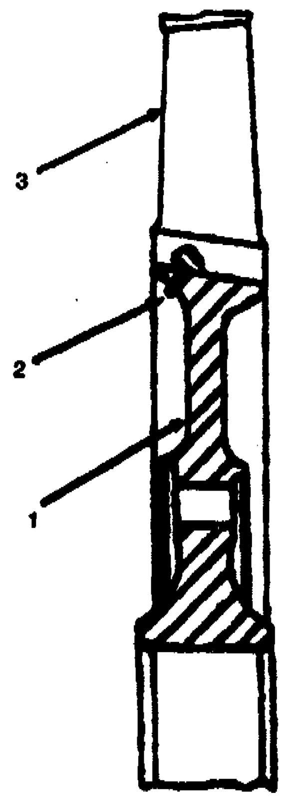
NOTE

Every other blade must be a "B" blade.

(4) Repeat preceding step (3) for remaining blades.

(5) Remove turbine rotor from fixture.

(6) With forward face of turbine rotor up, insert new locking pins (2) (1-140-285-01) into holes of disk.



1. First stage power turbine rotor.
2. Locking pin.
3. Blade.

Figure 5-207. First Stage Turbine Rotor Blade Removal.

(7) Using pin driver fixture (LTCT6646) and pin driver fixture power supply (LTCT6616), drive pins as follows: (See figure 5-208.)

(a) Install fixture (15) on table (16) of power supply.

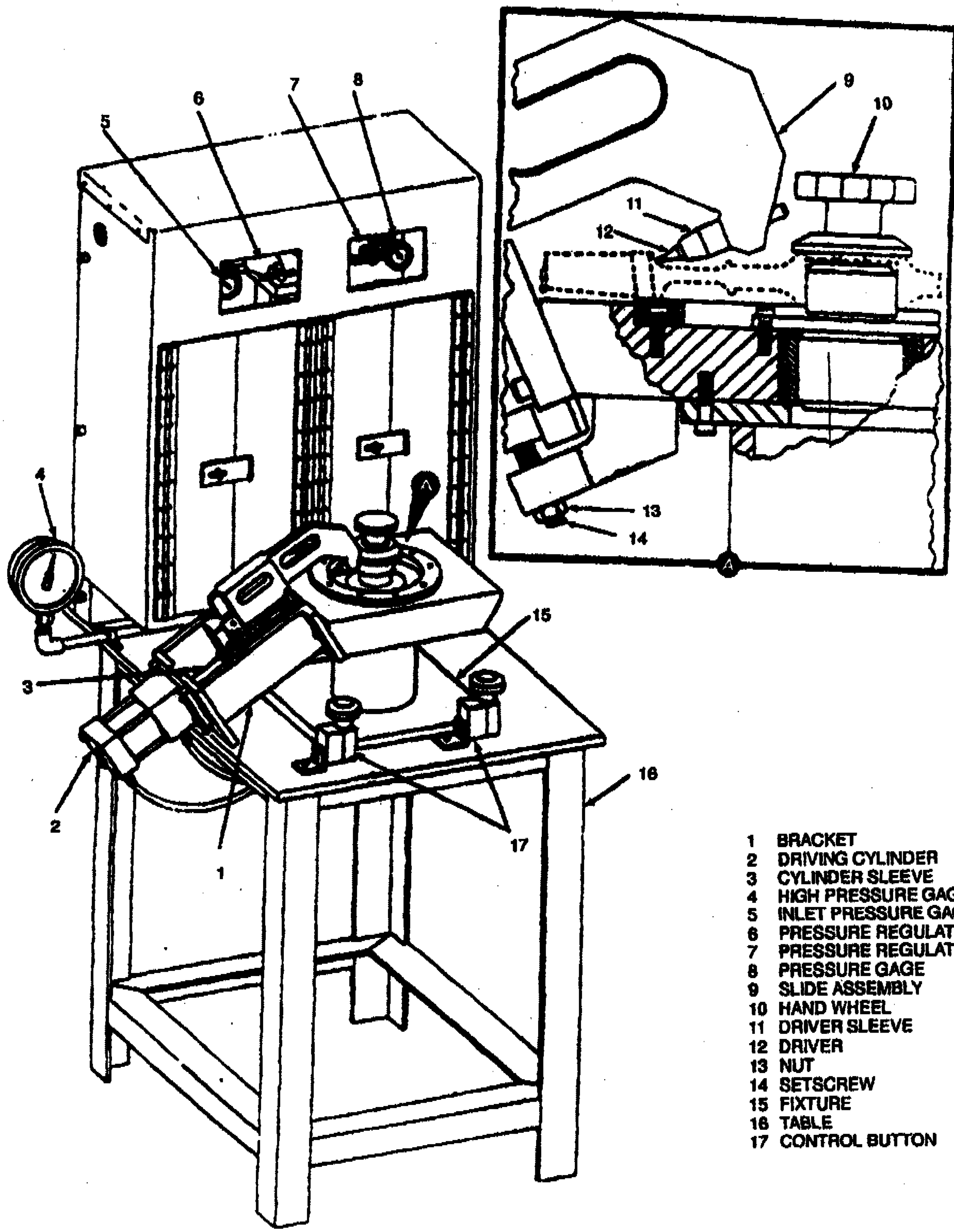
(b) Connect shop air supply to power supply. Using pressure regulator (6) regulate inlet air pressure to approximately 40 psi (2812 gm sq cm) as indicated on inlet pressure gage (5).

(c) Using pressure regulator (7), regulate piston return pressure to 20 to 30 psi (1406 to 2109 gm sq cm) as indicated on pressure gage (8).

WARNING

Control buttons must be actuated simultaneously as a safety precaution to ensure the operators hands are clear of driver sleeve.

(d) Simultaneously actuate control buttons (17) and readjust inlet air pressure, as required, to produce a reading of 990 to 1,010 psi (69604 to 71010 gm sq cm) on high pressure gage (4).



1 BRACKET
2 DRIVING CYLINDER
3 CYLINDER SLEEVE
4 HIGH PRESSURE GAGE
5 INLET PRESSURE GAGE
6 PRESSURE REGULATOR
7 PRESSURE REGULATOR
8 PRESSURE GAGE
9 SLIDE ASSEMBLY
10 HAND WHEEL
11 DRIVER SLEEVE
12 DRIVER
13 NUT
14 SETSCREW
15 FIXTURE
16 TABLE
17 CONTROL BUTTON

Figure 5-208. Power Assembly and Fixture Setup.

NOTE

A 990 to 1,010 psi (6960 to 71010 gm sq cm) reading on high pressure gage provides 2,375 to 2,425 pounds of force for driving the blade retaining pin.

(e) Release buttons and reactuate to confirm proper inlet pressure adjustment. Slight readjustments of inlet air pressure may be required during daily use.

(f) Position first stage turbine rotor on fixture with pin face up, and secure to fixture using hand wheel (10).

NOTE

Hand wheel (10) is used in conjunction with hub (LTCT6898, detail of LTCT6646) and plate (LTCT6808-03, detail of LTCT6646).

(g) Install driver sleeve (LTCT6770, detail of LTCT6646)(11), with driver (12) installed, into slide assembly (9).

(h) Mount driving cylinder (2) on bracket (1).

NOTE

Cylinder must be mounted on side of fixture designated for use with power turbine rotor (1-190-010-02).

(i) Install slide assembly (9) on fixture (15). Ensure that slide assembly engages cylinder sleeve (3).

NOTE

Ensure that vertical adjustment of driver (12) is made when pin driver fixture is used for the first time or whenever driver (12) has become misaligned with pin hole of disk. Make adjustments as outlined in following step (j).

(j) Loosen nut (13) and turn setscrew (14) to raise or lower slide assembly (9) and align driver(12) with pin hole in disk. To ensure correct adjustment, rotate rotor and align driver with several other pin holes. When satisfactory adjustment is made, tighten nut (13).

(k) Starting with number one blade, align driver with pin hole. Insert driver into hole until it contacts top of blade retaining pin.

(l) Simultaneously actuate control buttons (17) and observe high pressure gage (4). A reading of 1,000 psi (7030 gm sq cm) maintained for a minimum of 1 second provides the required pin installation force. Release buttons.

(m) Inspect blade retaining pin for proper installation as follows:

NOTE

This inspection is required only on first rotor of run or after change-over of fixture.

1 Remove number one blade.

2 Examine the blade end of the sheared retaining pin for evidence of mushrooming to partially fill the slot in blade.

3 Mushrooming is evidence of proper pin installation. Recheck fixture installation or pressure adjustment if pin is not properly installed.

(n) Reinstall number one blade and pin and repeat preceding steps (k) and (l).

(o) Shift turbine rotor to align driver with next blade retaining pin hole and repeat step (7)(l).

(p) Repeat step (o) until all pins are driven.

(q) Remove turbine rotor from fixture.

(8) Using dial indicator, check that blade root does not protrude beyond face of disk more than 0.012 inch (0.030 cm).

(9) Tip-grind blades to dimensions shown in figure 5-199. Minimum shroud thickness on leading edge shall be 0.070 inch (0.178 cm.)

NOTE

Blades that are not tip ground at overhaul need not be measured for shroud thickness.

(10) Vibropeen a delta (Δ) after turbine rotor part number or the forward face of the first stage turbine rotor disk at the base of the front.

(11) Ensure that a minimum distance of 0.102 inch exists from aft side of blade shroud to aft face of disk. See figure 5-199). If distance is less than 0.102 inch, machining of blade shroud is permissible (PN 1-190-010-03) to obtain distance of 0.102 inch minimum to 0.104 inch minimum. Full cleanup is not required.

WARNING

Verification that balance is within limits is flight safety critical.

c. Balance first stage power turbine rotor assembly (7, figure 5-135) as follows:

(1) Mount first stage power turbine rotor assembly on balancing arbor (LTCT456) used in conjunction with collet (LTCT2129), sleeve bearing (LTCT2712-39, detail of LTCT2712), and bearing holder (LTCT4029), and tighten cap screws to 180 pound-inches (17860 gm cm) torque.

(2) Using dial indicator check runout of turbine rotor assembly. Radial runout shall not exceed 0.001 TIR and face runout shall not exceed 0.002 TIR. Refer to figure 5-209 for runout location.

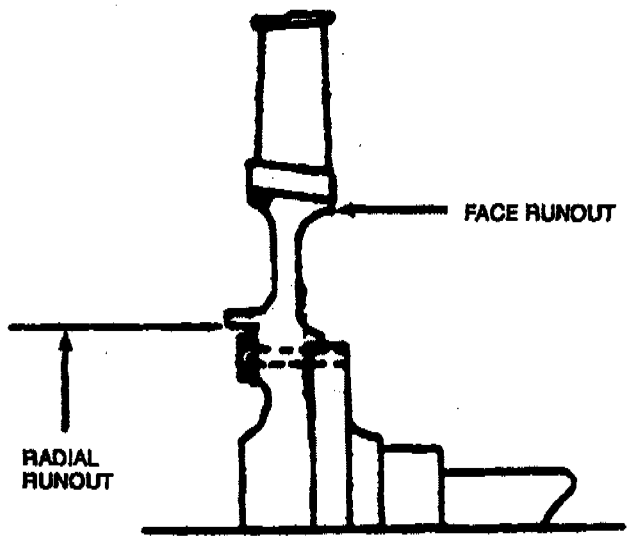


Figure 5-209. First Stage Power Turbine Rotor Runout Locations.

NOTE

If runouts exceed values, loosen capscrews, reposition wheel on arbor, and repeat preceding step (2).

(3) Install first stage power turbine rotor in balancing machine cradle.

(4) Close balance shroud (LTCT499) and secure.

(5) Balance first stage power turbine rotor as follows:

(a) Using running static balance, as outlined in balancing machine instruction manual, balance wheel.

NOTE

To ensure sufficient balancing accuracy, rotate the first stage power turbine rotor assembly between 1,000 and 2,000 rpm.

(b) Record unbalance and mark its location (clock position) on first stage power turbine rotor. Unbalance shall exceed 0.5 gram-inch.

(6) Correct unbalance as follows:

(a) To remove material, use hand grinder and grinding disk or sander.

(b) Correct unbalance to within 0.5 gram-inch of true balance by removing material from underside of shoulder adjoining the ball-root area at rear side of disk only. (See figure 5-210).

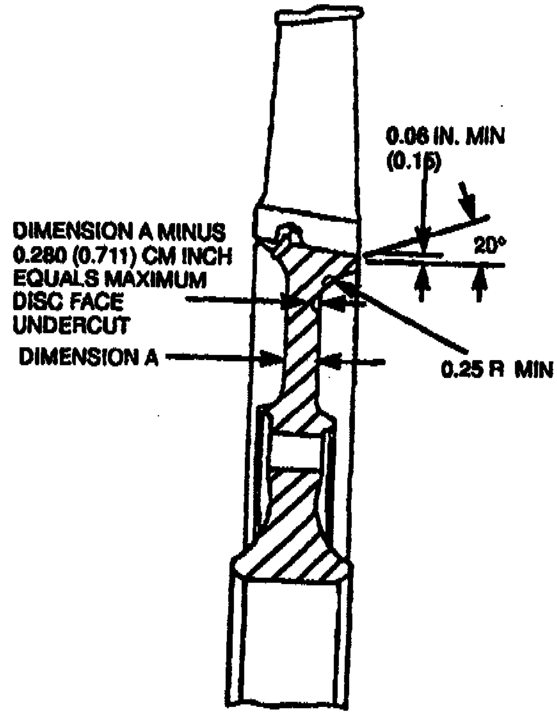


Figure 5-210. First Stage Power Turbine Rotor Grinding Area.

NOTE

When removing material to correct unbalance, maintain a minimum dimension of 0.060 inch (0.152 cm) between the base of ball-root and underside of shoulder. If possible, avoid undercutting the disk face area.

(c) Inspect the ground area. If disk face area exhibits any amount of grinding, measure an unaffected portion of disk web section not in undercut and radius areas. Record measurement as Dimension A. (See figure 5-210.)

(d) Subtract 0.280 inch (0.711 cm) from dimension.

NOTE

Every effort shall be made to remove material within applicable radius areas in order to preclude the necessity of measuring web thickness. Measure all disks that indicate any amount of grinding (undercutting) in disk face areas.

NOTE

Maximum allowable face undercut for each disk is the result of subtracting 0.280 inch (0.711 cm) from Dimension A. (See figure 5-210).

(7) Clean surface of ground area.

(8) After grinding unbalanced area, repeat preceding step (5) to check balance of first stage power turbine rotor assembly. If check balance indicates 0.5 gram-inch or less, remove rotor assembly from balancing machine.

(9) Remove first stage power turbine rotor from arbor.

NOTE

Designate heavy point with an "H" using RED opaque ink (item 232, table C–1) or Marks-A-Lot (item 238, table C–1).

5-280. THERMOCOUPLE HARNESS ASSEMBLY (T53-L-703).

5-281. DISASSEMBLY. Not required.

5-282. CLEANING. Refer to paragraph 5-141.

5-283. INSPECTION. Perform specific inspection listed in table 5-84.

Table 5-84. Inspection of Thermocouple Harness Assembly (T53-L-703).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135				
-21	Thermocouple Harness Assembly	Visual	Severe damage on probes or cables	Not allowed. Replace.
			Damaged contacts.	
			Cracked harness bracket	Not allowed. Replace.
			Bracket missing.	Fabricate. (Refer to paragraph 5-331.)
			Cable braid for fraying or chafing. (Refer to table 5-85 for limits.)	Repair or replace. (Refer to paragraph 5-284.)
			Loose sensors or probe saddle damage. (Refer to table 5-85 for limits.)	Repair or replace. (Refer to paragraph 5-284.)
			Cracks or cuts through rubber connector	Replace harness assembly.
			Deteriorated rubber connector	Replace harness assembly
-34	Thermocouple Connector	Visual	Cracks in rubber extending from mounting bracket.	Replace connector.
			Cracked, cut nicked rubber totaling no more than 0.75 square inch area of connector cover.	Repair per paragraph 5-143f.

5-284. REPAIR OF THERMOCOUPLE HARNESS ASSEMBLY (T53-L-703).

a. Remove broken strands by trimming strands flush with braid.

b. Repair frayed or chafed cable braid as follows:

(1) Remove projecting wire strands of braid at discrepant area.

(2) Wind lockwire (item 181 or 182, table C–1) around braid, extending wrap 3/8-inch beyond both ends of braid defect as shown in figure 5-40. Wrap to dimension noted in figure 5-40.

(3) Finish wrap with whip-finish technique by inserting wire end A through loop B. Hold end A taut while pulling end C to close loop. Release end A, and carefully pull end C until end A is anchored beneath wrapping. Remove excess wire ends. (See figure 5-40).

NOTE

Use care when pulling end C. Pull only far enough to firmly anchor end A beneath several wraps of the wire.

(4) Functional-test thermocouple assembly in accordance with paragraph 5-146.

Table 5-85. Thermocouple Assembly Inspection Limits (T53-L-703).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Cable braid for fraying or chafing except in saddle areas		Up to two broken strands in braid are repairable by trimming, provided adjacent braids do not have severe damage. Repair as outlined in paragraph 5-284.
	5-38	Fraying or chafing is acceptable for wrapping repair provided discrepant area is within limits shown in figure 5-38 and is not in saddle areas or between bracket and connector. The thermocouple assembly must pass functional test requirements. Repair as outlined in paragraph 5-284. If limits are exceeded, replace thermocouple assembly.
Loose sensors or probe saddle damage.		Looseness in saddle area up to 0.75 inch (1.90 cm) on each side of probe is unacceptable. Evidence of twisting is unacceptable. Up to two broken strands in any braid in saddle area are repairable by trimming provided damaged braids are separated by 0.25 inch (0.63 cm). No other type braid damage is acceptable. Repair as outlined in paragraph 5-284.

c. Replace thermocouple assembly if it cannot be repaired or if it fails to meet functional test requirements.

5-285. REPLACEMENT. Not required.

5-286. FUNCTIONAL TEST. Not required.

5-287. SECOND STAGE POWER TURBINE NOZZLE ASSEMBLY.

5-288. DISASSEMBLY. Disassembly is not required.

5-289. CLEANING OF SECOND STAGE POWER TURBINE NOZZLE ASSEMBLY. Proceed as follows:

a. Clean second stage power turbine nozzle assembly (11, figure 5-135) by dry cleaning solvent method, or hot-alkali-soak No. 2 method. (Refer to SP Nos. 3002, or SP No. 3005 in Appendix E.)

b. Clean second stage power turbine nozzle assembly that has metalization slag deposits that cannot be removed with normal cleaning procedures, using aluminum oxide powder (item 36, table C–1) applied as dry blast with 30 to 40 psi (2109 to 2812 gm sq cm) air pressure.

5-290. INSPECTION. Perform specific inspections in table 5-86.

Airflow inspect second stage power turbine nozzles 1-140-470-05 using Fleming AF 36 airflow machine, adapter provided by airflow machine manufacturer, and Fleming flow test instructions. Preferable effective flow area measurement should be 47.20 to 49.57 square-inch with water level to 0.5 inch. Cross out any previous EFAs and vibroetch the measured EFA in the vicinity of the original GFA marking (or serial number if no GFA marked).

5-291. REPAIR. (11, figure 5-135). Proceed as follows:

NOTE

The braze requirement for the nozzle assembly for each specific repair procedure may be performed as one braze cycle when multiple repair is accomplished, provided all inspection requirements are met.

a. Machine 13.500 to 13.504 inch (34.290 to 34.300 cm) diameter to remove scoring and rubbing. Nozzle may be machined to 13.492 to 13.519 inch (34.270 to 34.338 cm) diameter.

b. Remove metallization, that cannot be removed by normal cleaning procedures, from turbine nozzle vanes by using 220-grit aluminum oxide powder (item 36, table C–1) applied as a dry blast with 30 to 40 psi (2109 to 2812 cm) air pressure.

c. If inspection limits are exceeded, repair nozzle assembly as follows:

(1) Clean nozzle assembly by the cleaning solvent method. (Refer to SP. No. 3002 in Appendix E).

Table 5-86. Inspection of Second Stage Power Turbine Nozzle Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135				
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**				
-11	Second Stage Power Turbine Nozzle Assembly	Visual	Vane to inner shroud voids and crack indications	Refer to table 5-87
			Burns on vane leading and trailing edges	Refer to table 5-87
			Scoring or heavy tips rubs on cylinder ID	Repair (Refer to paragraph 5-291)
			Metallization of vanes	Repair (Refer to paragraph 5-291)
		SIE and Visual	Dents, nicks, or pits on vane leading edge	Refer to table 5-87
			Dents, nicks, or pits oil vane trailing edge	Refer to table 5-87
			Nicks, dents, or pits on air-foil surface	Refer to table 5-87
			Out-of-roundness and rubs on seal inner diameters	Refer to table 5-87
			Worn 4.948 to 4.952 inch (12.568 to 12.578 cm) Seal Diameters	Repair. (Refer to paragraph 5-291)
			Metal-fallout of inner shroud with forward retaining ring	Repair. (Refer to paragraph 5-291)
			Inner shroud with aft retaining ring previously installed	Scrap nozzle as it is a high-time nozzle with increase probability of failure
			Wear. (Refer to table 5-88)	Repair or replace. (Refer to paragraph 5-291)

Table 5-86. Inspection of Second Stage Power Turbine Nozzle Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135				
-11 (Cont)	Second Stage Power Turbine Nozzle Assembly (Cont)	Visual and Fluorescent Penetrant	Crack in outer shroud to vane brazement.	Refer to table 5-87.
			Cracks in outer shroud parent metal.	Refer to table 5-87.
			Cracks in vane.	Refer to table 5-87.
			Cracks in vane to inner shroud brazement.	Refer to table 5-87.
			Cracks in inner shroud.	Refer to table 5-87.
			Cracks in support.	Refer to table 5-87.
			Circumferential cracks at inner shroud joint.	Refer to table 5-87.
			Cracks in support to seal brazement.	See figure 5-211. Refer to paragraph 5-291.
			Nozzle with retaining ring installed at previous overhaul.	None allowed. Replace nozzle.
			Cracks starting at inner shroud and progressing through forward retaining ring into seal support area on nozzle with retaining rings installed.	Refer to table 5-87.
			Cracks in cylinder tangs.	Not allowed. Replace.
		Airflow Inspect.	Effective Flow Area (EFA) per paragraph 5-290 or Geometric Flow Area (GFA) per table 5-89.	Adjust or replace.
-12	Mountings Ring	Visual.	Cracks.	Not allowed. Replace.

Table 5-87. Second Stage Power Turbine Nozzle Assembly Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**		
Outer Shroud Parent Metal Cracks	5-211	a. Ten axial cracks per assembly are acceptable, provided individual crack length does not exceed 3/8 inch. b. Three of the 10 cracks are permitted to be cracked up to 5/8 inch and one is acceptable up to 1 inch in length. c. Circumferential or converging cracks not acceptable. **NOTE** Cracks are not allowed to continue into brazements and are acceptable provided that parent metal and braze defects do not exceed their respective length limits. d. Replace nozzle if above limits are exceeded.
Outer Shroud Brazement Cracks		a. Cracking up to 3/8 inch cumulative length per vane is acceptable on a maximum of 25 vanes. b. Five of the 25 cracks are allowed on one side of the vane for its entire length, provided no cracking exists on the other side. If cracks occur on both sides of the vane, 3/4 inch is the maximum cumulative length allowed. c. If above limits are exceeded, repair as outlined in paragraph 5-291.
Cracks In Vane To Inner Shroud Brazement		a. Cracking up to 3/8 inch cumulative length per vane is acceptable on a maximum of 25 vanes. b. Five of the 25 cracks are allowed to be cracked up to 1/2 inch maximum cumulative length. c. If above limits are exceeded, repair as outlined in paragraph 5-291.

Table 5-87. Second Stage Power Turbine Nozzle Assembly Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**		
Cracks in Vane Trailing Edge	5-211 (Cont)	Any number of cracks up to 0.100 inch (0.254 cm) in length is acceptable. If limits are exceeded, repair as outlined in paragraph 5-291.
Vane to Inner Shroud Brazement Voids and Cracks Indications		Vane to inner shroud voids, and crack indications in all joint portions other than in vane peg area are acceptable. Braze defects in vane peg area associated with inner shroud cracks are acceptable provided inner shroud cracks are within limits,
Cracks in Inner Shroud/Seal Ring Joint Brazement (Viewed from Nozzle Rear)		Cracks are acceptable provided joint passes all other inspections as viewed from the front.
Cracks Starting Inner Shroud and Progressing Through Forward Ring into Seal Ring Area.		a. Five cracks which travel across at the entire inner shroud axial width are acceptable per assembly provided maximum length of seal support area portion does not exceed one inch in length and the defects are separated by a minimum of three vanes. b. Crack conditions that result in support and seal warpage and distortion are unacceptable. c. Converging cracks which could result in support metal fallout are unacceptable. **NOTE** On nozzles with retaining rings installed, the same limits apply except that the forward retaining ring is allowed to be cracked in conjunction with inner shroud and seal ring cracks. d. If above limits are exceeded, repair all cracks as outlined in paragraph 5-291
Cracks in Inner Shroud Which Progress into Seal Support		a. Inner shroud cracks that continue into support are acceptable, provided length of each crack does not propagate into the flat section of the seal support.

Table 5-87. Second Stage Power Turbine Nozzle Assembly Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**		
Cracks in Inner Shroud which Progress into Seal Support (Cont)	5-211(Cont)	b. Crack conditions that result in support and seal warpage and distortion are unacceptable. c. Converging cracks which could result in support metal fallout are not allowed. d. If above limits are exceeded, repair as outline in paragraph 5-291.
Circumferential Cracks at Inner Shroud to Support Joint		a. Circumferential cracks, crack like indications, or brazement voids starting from inner shroud and/or support are acceptable up to 1 inch in length in a maximum of three areas. In addition one of the three areas is allowed cracks up to 1-1/2 inches in length. b. Cracking indications shall indicate no accompanying separation of the support from inner shroud. No distortion or warpage is allowed. c. Minimum distance between circumferential cracks shall be 2 inches. **NOTE** Circumferential cracks and voids not associated with shroud or support cracking are acceptable up to a total length of 3-1/2 inches, provided individual lengths are no greater than 1 inch and 2 inches minimum separates defect. In no circumstance shall the total crack or void length exceed 3-1/2 inches in any combination. d. If limits are exceeded, repair as outlined in paragraph 5-291.
Cracks in Vane Leading Edge		Any number cracks not exceeding 0.050 inch (0.127 cm) in length are acceptable.
Cracks in Seal Support		a. If cracks originate in the seal support without affecting the inner shroud, then five such cracks up to 1 inch in length are acceptable. If limits are exceeded, repair as outlined in paragraph 5-291.

Table 5-87. Second Stage Power Turbine Nozzle Assembly Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Cracks in Seal Support (Cont)	5-211 (Cont)	b. Circumferential cracking in seal support parent metal is not acceptable. Repair as outlined in paragraph 5-291.
Nicks, Dents, and Pits on Vane Trailing Edge		a. Nicks, dents, and pits are acceptable with blend repair to a depth of 3/32 inch and length of 3/16 inch, provided no greater than four defects per vane are evident. b. Separation shall be at least twice the length of the longest defect. c. Blend-repair burrs to remove surface projections (Refer to SP No. 5000 in Appendix E). d. If limits are exceeded, repair as outlined in paragraph 5-291.
Nicks, Dents, and Pits on Vane Leading Edge		a. Leading edge nicks, dents, and pits are acceptable with blend-repair to a depth of 3/32 inch and length of 3/16 inch provided no greater than four defects per vane are evident. b. Separation shall be at least twice the length of the longest defect. c. Blend-repair burrs to remove surface projections (Refer to SP No. 5000 in Appendix E.). d. If limits are exceeded, repair as outlined in paragraph 5-291.
Nicks, Dents, and Pits oil Vane Airfoil		a. Random nicks, dents, and tears are acceptable to a depth of 0.035 inch (0.089 cm) on all vanes. b. If within limits, blend-repair to remove surface projections. (Refer to SP No. 5000 in Appendix E). c. If limits are exceeded, repair as outlined in paragraph 5-291.
Burns on Vane Leading and Trailing Edge		Surface oxidation (discoloration, is acceptable provided warpage or loss of material is not evident.
Out-of-Roundness and Rubs on Nozzle Inner Diameters		a. Perform a dimensional inspection of seal inner diameters, taking two measurements, 90 degrees apart. The following maximum overhaul limits shall be adhered to: Forward Seal 4.960 In. (12.6 cm) Aft Seal 4.960 In. (12.6 cm)

Table 5-87. Second Stage Power Turbine Nozzle Assembly Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Out-of-Roundness and Rubs on Nozzle Inner Diameters (Cont)	5-211 (Cont)	b. Inspect seals for visible rubs. If rubs are evident, perform an out-of-roundness check, A value of 0.020 inch (0.051 cm) or less is acceptable. **NOTE** Minimum seal flange to spacer clearances shall be adhered to in accordance with step k, paragraph 5-246. Maximum diameters in rubbed areas are allowed to exceed above limits, provided 0.020 inch (0.051 cm) or less out-of-roundness is maintained. c. If above limits are exceeded, repair as outlined in paragraph 5-291.

Table 5-88. Dimensional Inspection of Second Stage Power Turbine Nozzle Assembly.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-135								5-212
Second Stage Power Turbine Nozzle Assembly	11	OD	13.615 (34.582)	13.625 (34.608)					A
		OD	14.305 (36.335)	14.315 (36.360)					B
		ID	13.500 (34.290)	13.504 (34.300)	13.492 (34.270)	13.519 (34.338)			C
Cylinder Wall Thickness					0.040 (0.102)				D
Seal Land Height					0.015 (0.038)				E
Seal*		ID	4.948 (12.568)	4.952 (12.578)					F

* Non-mandatory dimension. Check clearance during engine buildup.

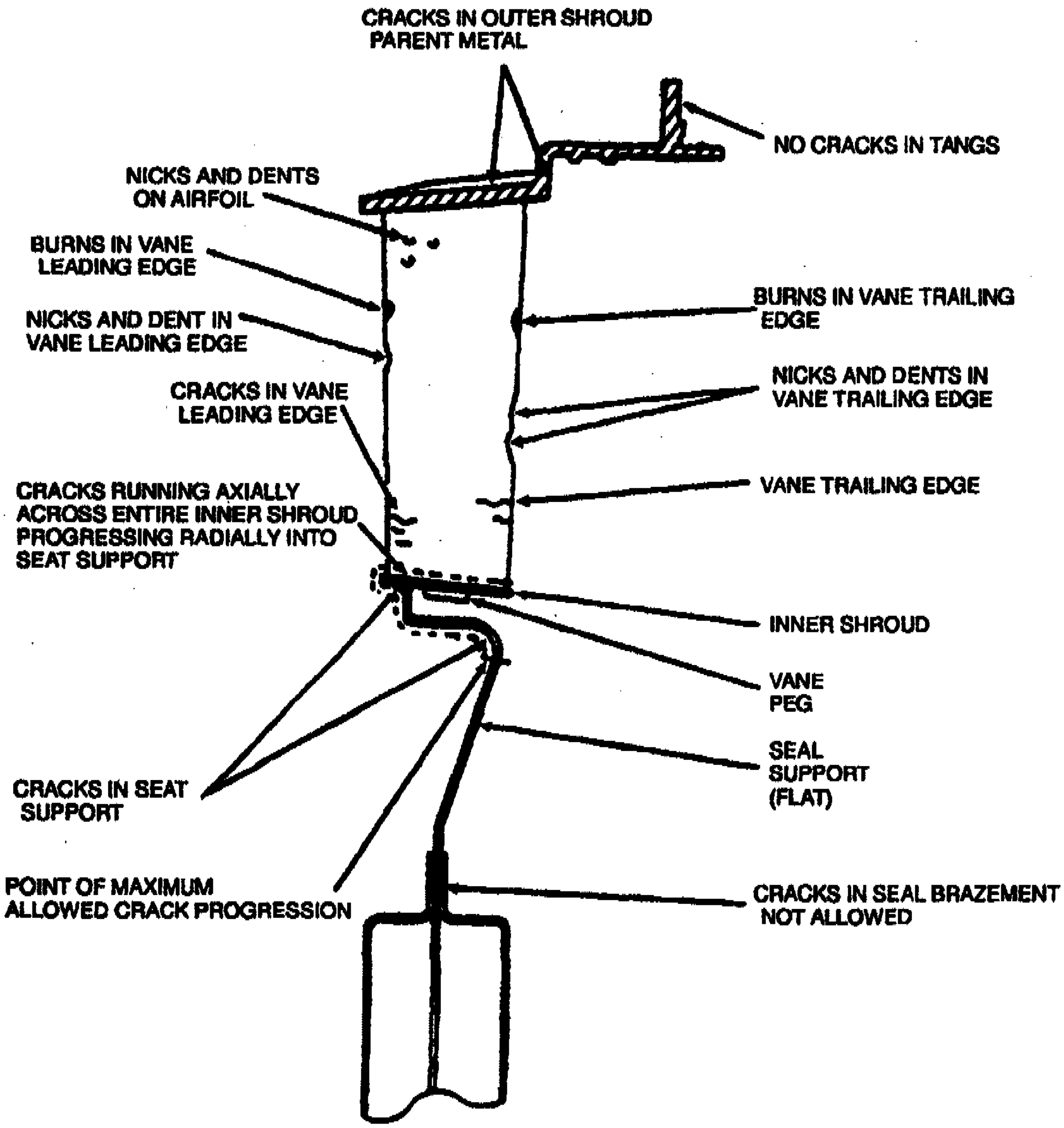
CAUTION

In following step (2), do not reduce thickness of inner shroud to less than 0.025 inch (0.064 cm).

NOTE

On nozzle assemblies that require vane removal only, it is not necessary to remove support and seals in following step (2).

(2) Remove seals, support, and forward retaining ring, if installed, by machining. (See figure 5-213).



WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

Figure 5-211. Second Stage Power Turbine Nozzle Assembly Inspection Area (Sheet 1 of 2).

(3) Remove damaged vanes as follows:

CAUTION

In following step (a), do not damage shroud surfaces or undamaged vanes. Use care not to undercut or deform the shrouds.

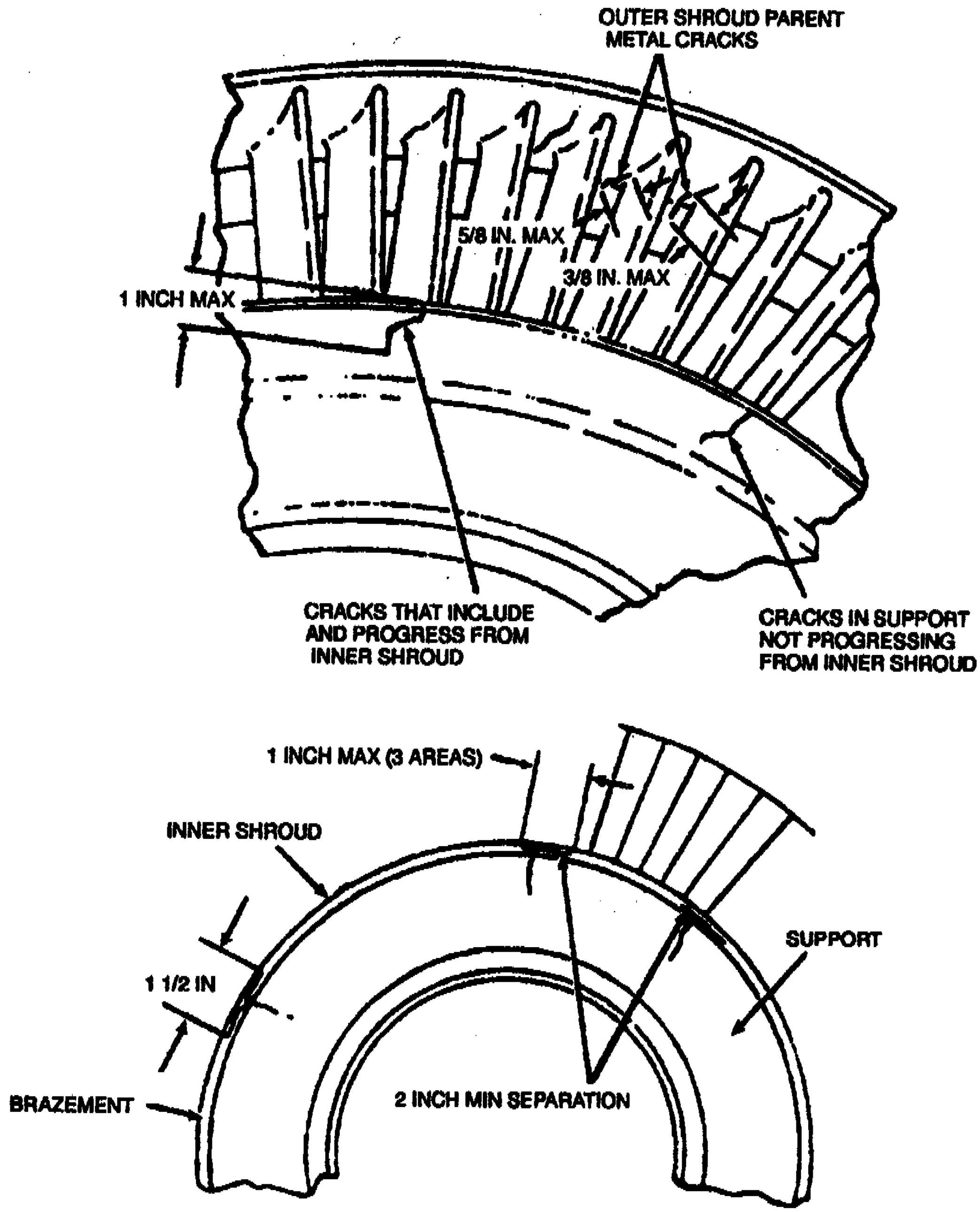


Figure 5-211. Second Stage Power Turbine Nozzle Assembly Inspection Area (Sheet 2 of 2).

(a) Using a flat copper or brass electrode and an electric discharge machine, remove damaged vane(s) from flow path. (See figure 5-214).

NOTE

Vanes may be removed mechanically by grinding vane brazement and driving vanes from shroud slots. When vanes are removed for replacement, shroud cracks in old braze joint area may be weld-repaired. It is not detrimental to rebraze over repair weldments.

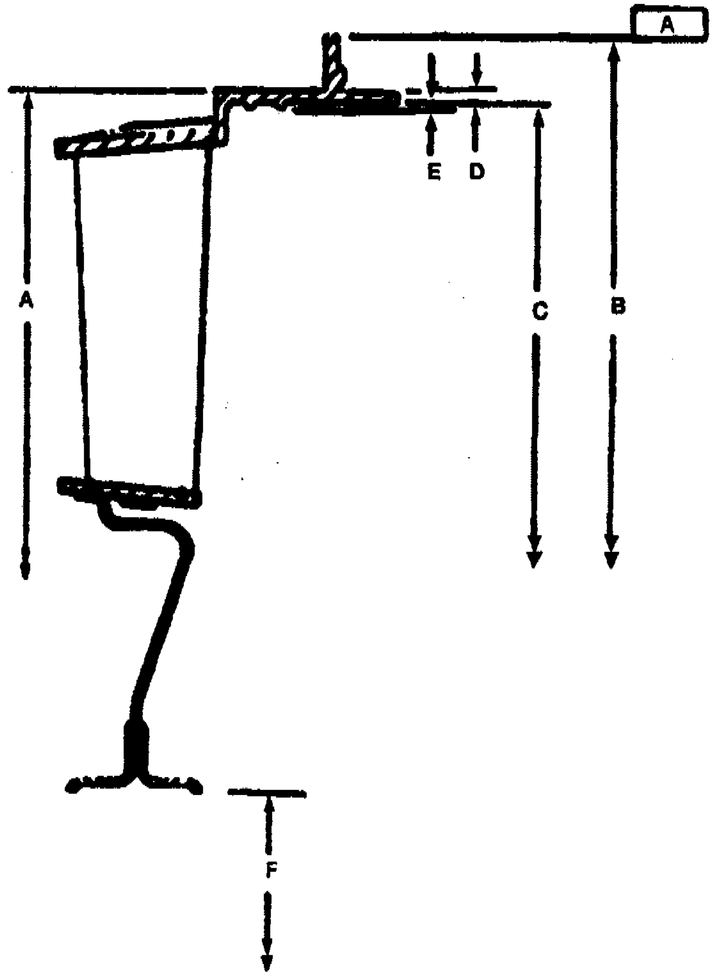


Figure 5-212. Second Stage Power Turbine Nozzle Assembly Dimensional Inspection Locations.

(b) Using an electric discharge machine and outer shroud electrode (LTCT11322), remove vane stubs from outer shroud.

(c) Using an electric discharge machine and inner shroud electrode (LTCT11323), remove vane stub(s) from inner shroud.

NOTE

Holes in shrouds should provide a 0.002 to 0.010 inch (0.005 to 0.025 cm) clearance for replacement vanes (1-140-258-04).

(4) Repair inner and outer if required, as follows:

NOTE

Whenever inner shroud cracks exceed limit, all cracks shall be repaired.

(a) Using a stainless steel wire brush, clean cracked areas of shrouds.

(b) Clean areas to be welded with acetone (item 13, table C–1)

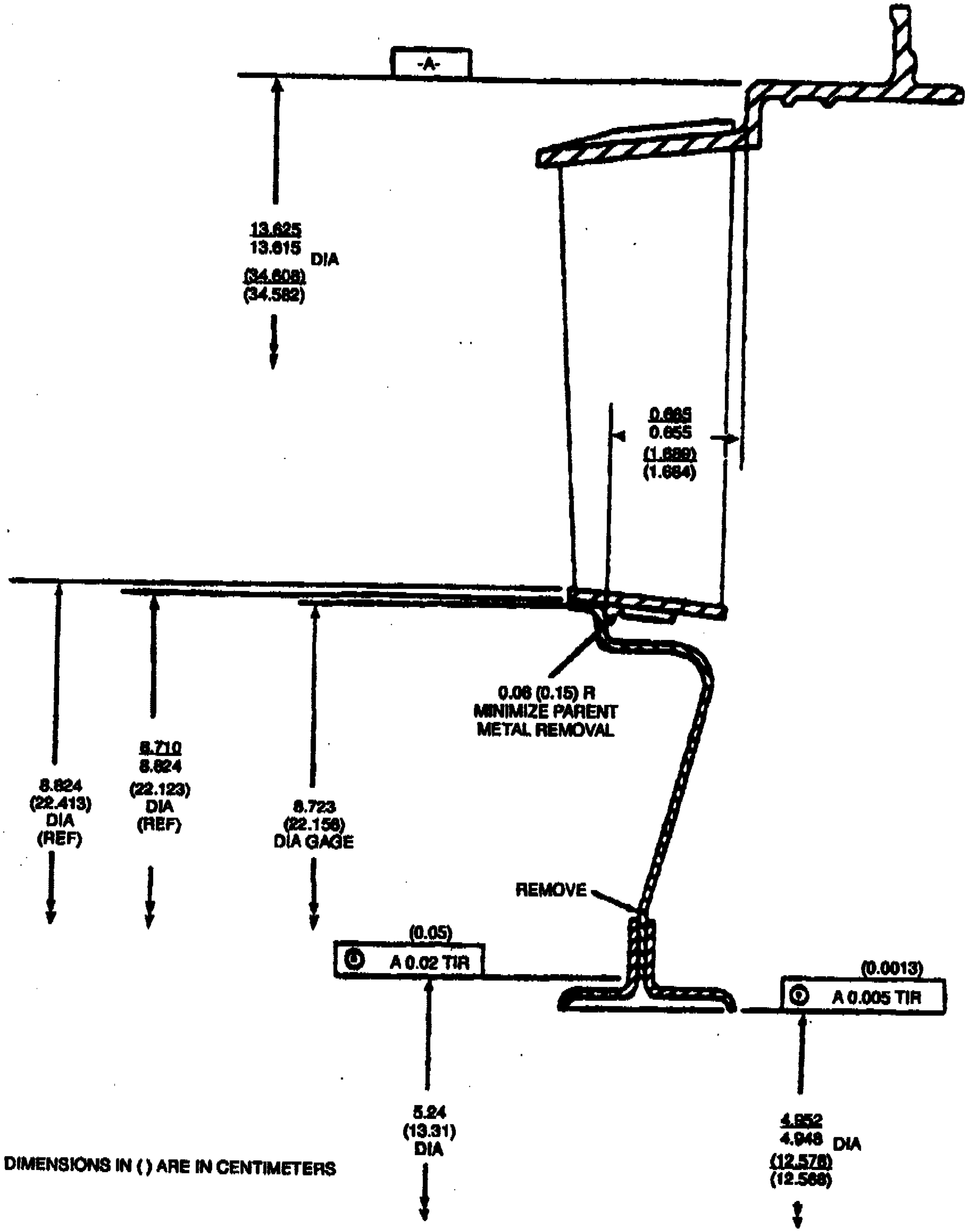


Figure 5-213. Removal of Support and Seals.

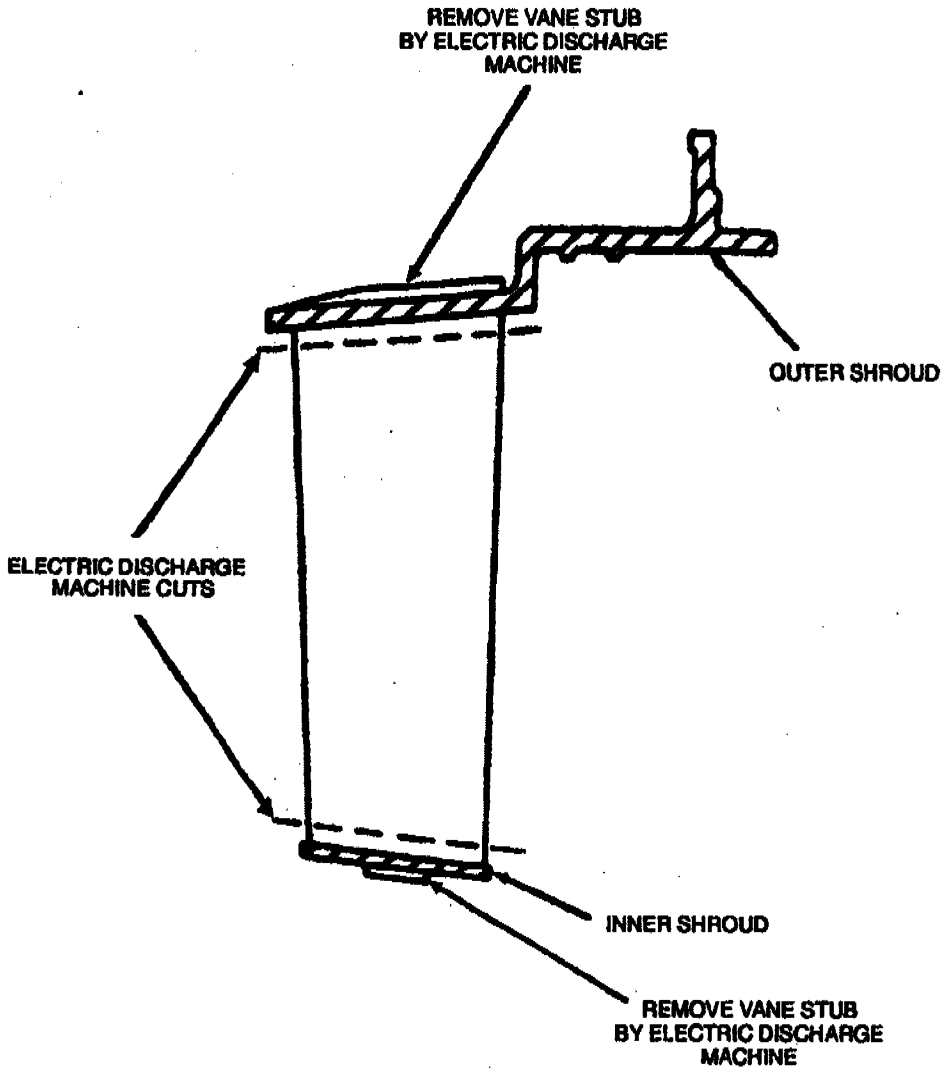


Figure 5-214. Removal of Vane by Electric Discharge Machine.

CAUTION

In following step (c), welds must end 1/16 inch from any brazed joint, except as noted.

(c) Using welding wire (item 349, table C–1), weld-repair cracks in inner and outer shrouds as outlined in SP No. 5001 in Appendix E.

(d) Knurl brazing surface of ID and OD of forward ring 0.003 to 0.005 inch.

(5) Install vanes as follows:

(a) Clean areas to be welded with acetone (item 13, table C–1)

(b) Insert replacement vane(s) (1-140-258-04) into prepared hole(s) in shrouds.

NOTE

Use stainless steel shims to position vane to maintain 0.002 to 0.010 inch (0.005 to 0.025 cm) clearance between shroud and vane. Position vane radially so that overhang at 00 of inner shroud is at a minimum.

(c) Using welding wire (item 350, table C–1), tack-weld vanes to shrouds as outlined in SP No. 5001 in Appendix E.

NOTE

Do not tack weld over shim stock.

(d) Remove shim stock spacers.

(e) Using a stainless steel wire brush, clean tack welds.

(f) Clean areas to be welded with acetone (item 13, table C–1)

(g) Apply brazing alloy (item 64, table C–1) to joints to be brazed. (Refer to SP No. 5004 in Appendix E.)

NOTE

Brazing alloy should be applied to all cracks in shroud joints and shroud base metal.

(h) Place nozzle on a flat, heat resistant stainless steel support, aft side down, and braze for 2 to 5 minutes at 1,875°F (1,024°C). (Refer to SP No. 5004 in Appendix E.)

NOTE

Braze deposits at junction of shroud and vane are allowed within area cleared by a 0.060 inch (0.152 cm) radius gage. Excess braze deposits are to be smooth. No undercutting of shroud or vane is allowed.

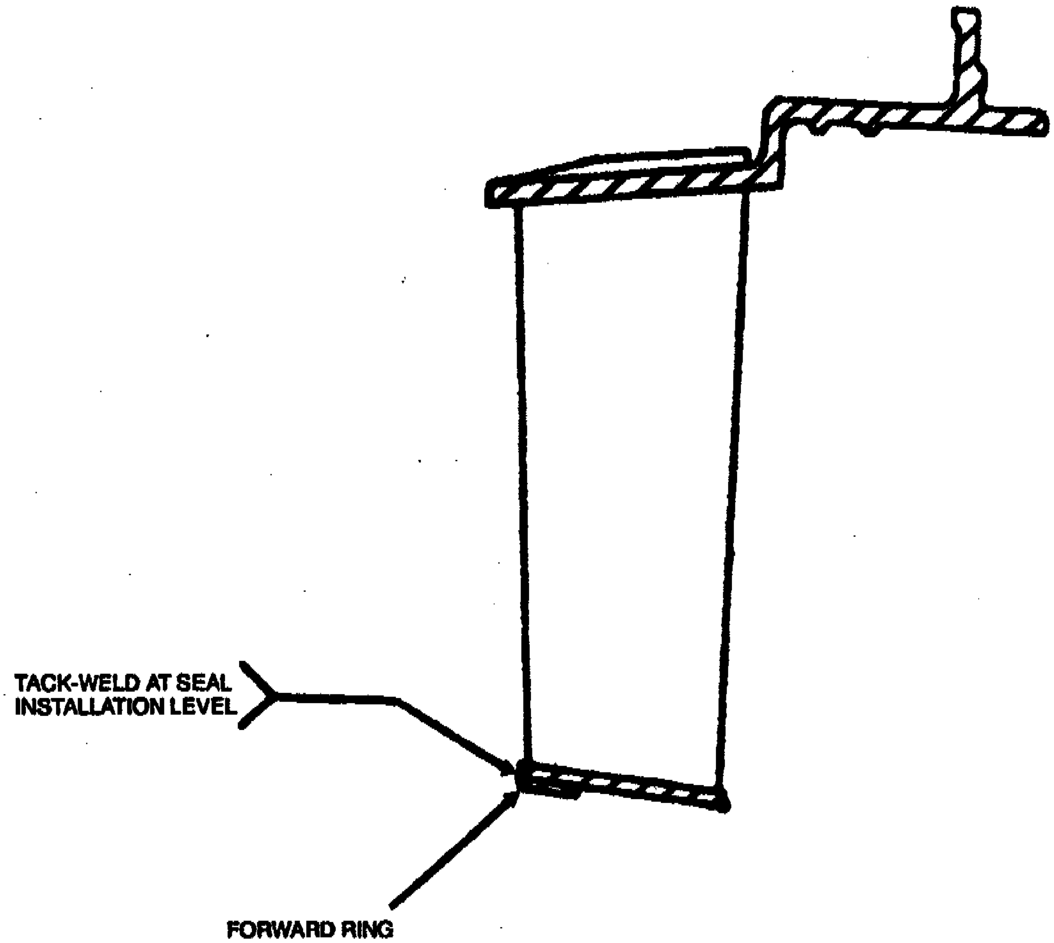


Figure 5-215. Installation of Rings.

(i) Perform a visual and fluorescent-penetrant inspection of the nozzle.

(6) Install forward ring as follows:

(a) Grind inner shroud to clean up sufficiently to allow for installation of forward ring. Do not reduce thickness of inner shroud below 0.025 inch (0.064 cm).

(b) Clean assembly and ring with acetone (item 13, table C–1)

(c) Fit ring to assembly as shown in figure 5-215.

NOTE

Ring may be split to facilitate fit for brazing.

Table 5-89. Second Stage Power Turbine Nozzle Geometric Flow Area Inspection Limits.

DEFECT	INSPECTION LIMITS
Geometric Flow Area (GFA)	Nozzles may have GFA inspection as an alternative to EFA inspection. Use area flow comparator (LTCT6486) and digital transducer (LTCT6339) a. If the GFA is within the 44.29 to 46.09 square-inch limit, eradicate the original GFA number. Using a Vibropeen Etching Tool, mark to the right of the old GFA number. If the GFA is outside the above limits, adjust GFA or replace nozzle. b. Overhaul nozzles that have been repaired, or originally manufactured, or originally manufactured to previous GFA inspection limit of 45.09 to 45.29 square inches, may be utilized on a use-to-depletion basis.

(7) Install support and seals as follows:

(a) Using holding fixture (LTCT11320), rework support (1-140-176-02) by spinning to fit ID of forward ring installed in inner shroud. (See figure 5-216.)

(b) Inspect dimensions of support. (See figure 5-216.)

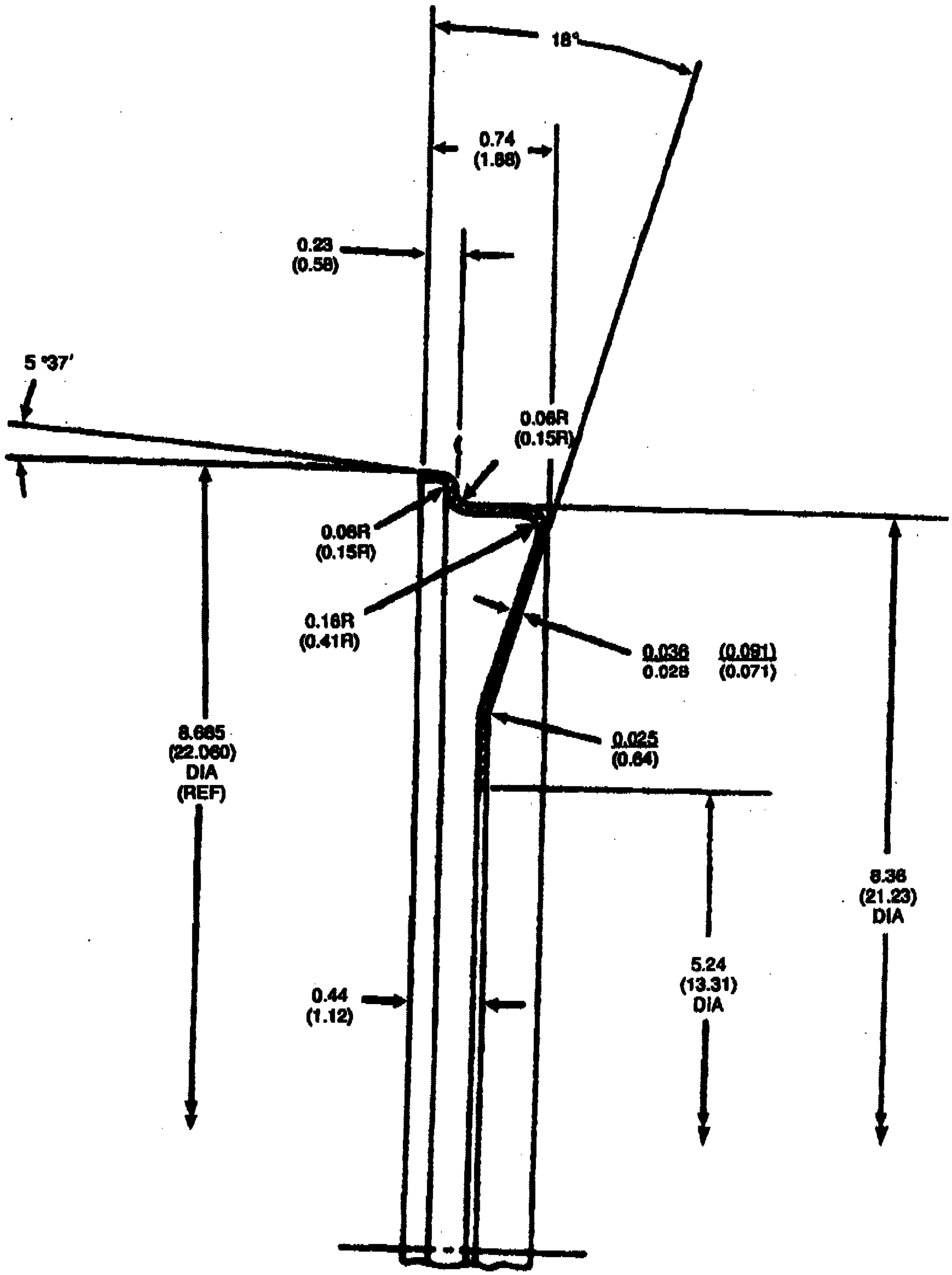
(c) Clean areas to be welded with acetone (item 13, table C–1)

(d) Install nozzle into nozzle assembly fixture (LTCT11321).

(e) Fit forward ring (1-140-197-01), support (1-140-176-02), and seal flanges (1-140-102-02) to nozzle.

NOTE

Use stainless steel shims to maintain clearance of 0.002 to 0.010 inch (0.005 to 0.025 cm) between parts as brazing gap. Nozzles requiring support and/or seal replacement, and having inner shroud parent metal cracks within limits, need only installation of the forward ring.



DIMENSIONS IN ( ) ARE IN CENTIMETERS.

Figure 5-216. Rework of Support.

(f) Using welding wire (item 349, table C–1), tack-weld at eight equally spaced points as follows: (Refer to SP No. 5001 in Appendix E.) (See figure 5-217.)

NOTE

The number of tack-welds may vary as required, but must be equally spaced and separated by a minimum of three vanes.

1 Tack-weld rear seal flange to support.

2 Tack-weld forward seal flange to support.

3 Tack-weld forward ring and support to inner shroud.

(g) Remove shims and, using a stainless steel wire brush, clean tack welds.

(h) Apply brazing alloy (item 64, table C–1) to all joints. Refer to SP No. 5004 in Appendix E.)

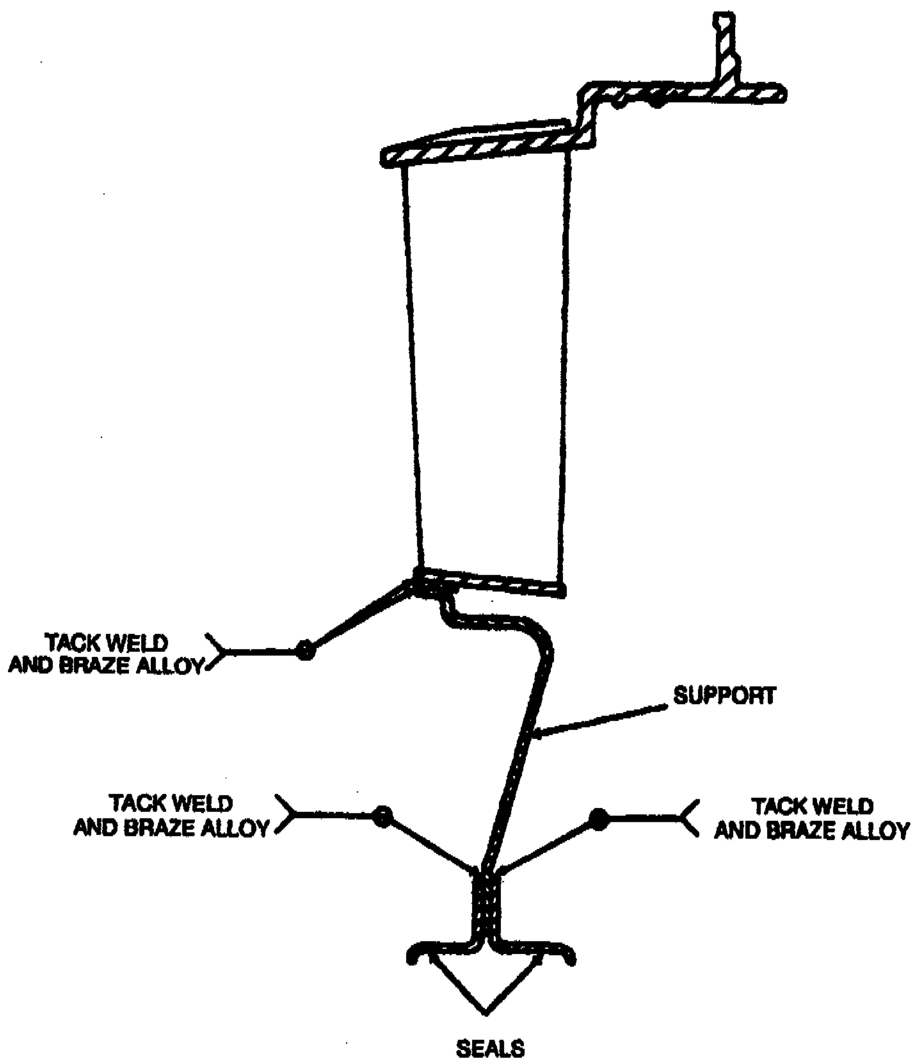


Figure 5-217. Tack-Weld and Braze Alloy Locations.

(i) Place nozzle on a flat, heat resistant stainless steel support, aft side down, and vacuum braze for 2 to 5 minutes at 1.875°F (1.024°C). (Refer to SP No. 5004 in Appendix E.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(j) Perform a visual and fluorescent-penetrant inspection of the nozzle assembly.

NOTE

Cracks are not acceptable in brazed joints; however, visual and fluorescent-penetrant inspection limits specified in table 5-90 are acceptable.

If the nozzle does not pass inspection after brazing, investigate for cause. Do not repeat brazing procedures more than three times.

(k) Machine seal area to dimensions shown in figure 5-218.

CAUTION

In following step (1), use care not to machine into vanes.

(l) Face machine support and forward and aft rings, if required, flush with inner shroud.

(m) Inspect nozzle for conformance to dimensions shown in figure 5-213.

(n) If dimensional inspection of cylinder areas indicate remachining is required due to distortion or shrinkage, use grinding fixture (LTCT11222) to support nozzle during remachining operation.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(o) Perform a visual and fluorescent-penetrant inspection of the cylinder areas.

d. Repair nozzles having worn surfaces on 4.948 to 4.952 inch (12.568 to 12.578 cm) ID air seal as follows:

(1) Determine the amount of wear by measuring the forward and aft seal ID. (See figure 5-218.)

CAUTION

In following step (2), use shim stock between chuck jaw and nozzle to prevent galling and fretting of surface.

(2) Set up nozzle on surface A (see figure 5-218) using a six or eight-jaw chuck or a suitable fixture mounted on a horizontal or vertical lathe.

NOTE

Care should be taken so as not to cock or distort the nozzle in the chuck. Prior to rolling each seal, the nozzle assembly is to be positioned in the chuck so that it rotates about the axial centerline of the seal to be rolled. Roller pressure angle is to be maintained at 45 degrees from centerline of part during rolling.

Seal support must be supported when rolling to prevent oil canning (flexing) of the support.

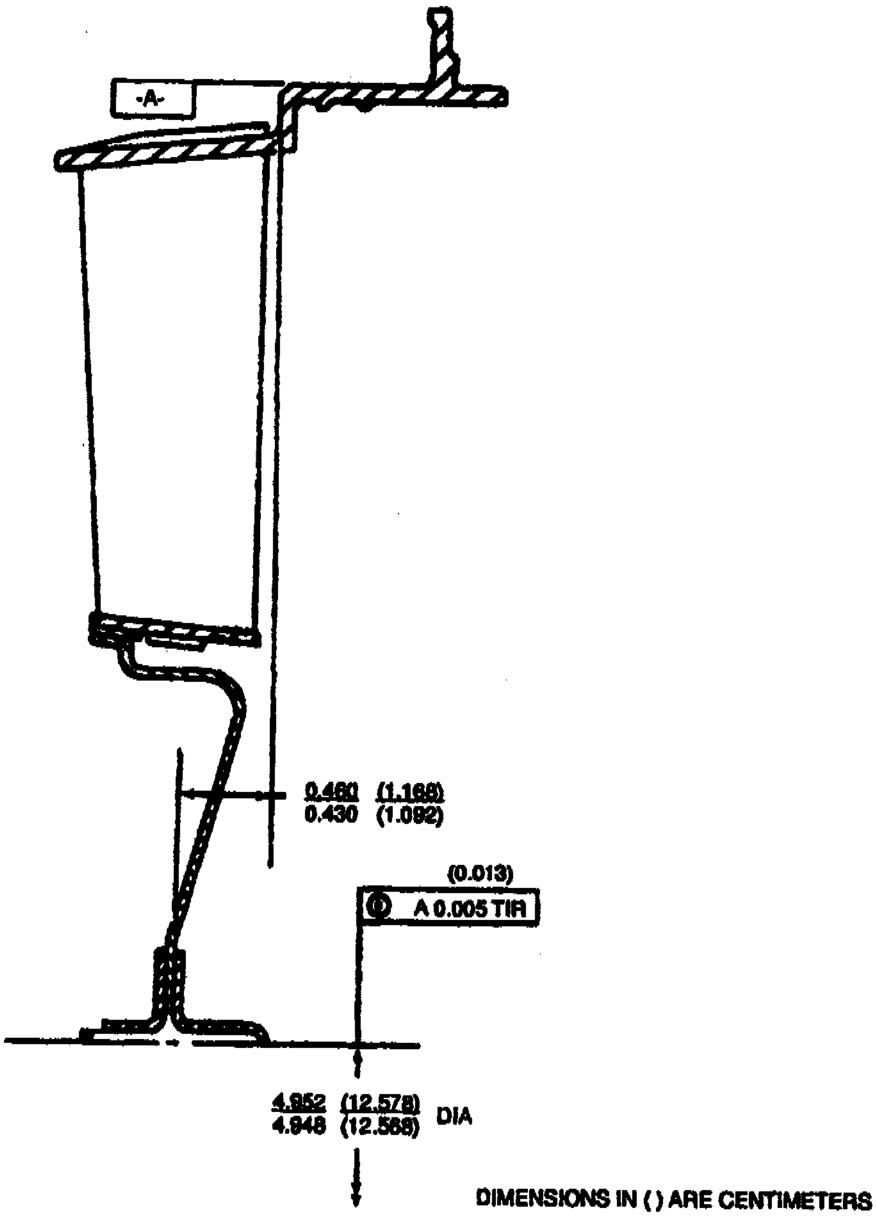


Figure 5-218. Finish-Machine Dimensions - Seal Area.

Table 5-90. Visual and Fluorescent-Penetrant Acceptance Limits for Brazed Joints.

Brazed Joints	Cracks	Voids (1)	Lack Braze (2)	Surface Porosity (3)	Cumulative Indications (4)
WARNING FLIGHT SAFETY PART Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.					
Vane to Outer Shroud	Not allowed.	0.120 inch (0.305 cm) maximum length. 0.120 inch (0.305 cm) maximum cumulative length per vane. 0.60 inch (1.520 cm) maximum cumulative length per assembly	0.120 inch (0.305 cm) maximum length. 0.250 inch (0.635 cm) maximum cumulative length per vane	0.120 inch (0.305 cm) maximum length. 0.250 inch (0.635 cm) maximum cumulative length per vane.	0.305 inch (0.889 cm) per vane
Vane to Inner Shroud	Not allowed.	0.120 inch (0.305 cm) maximum length. 0.120 inch (0.305 cm) maximum cumulative length per vane. 1.00 inch (2.54 cm) maximum cumulative length per assembly.	0.120 inch (0.305 cm) maximum length. 0.125 inch (0.318 cm) maximum cumulative length per vane	0.120 inch (0.305 cm) maximum length. 0.125 inch (0.318 cm) maximum cumulative length per vane.	0.375 inch (0.953 cm) per vane. Not more than 15 percent of joints/assembly shall exceed 0.300 inch (0.762 cm)
WARNING FLIGHT SAFETY PART Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.					
Support to Flange and Support to Deflect or	Not allowed.	Not allowed.	Allowed.	Allowed.	

See Notes on last page of this table.

Table 5-90. Visual and Fluorescent-Penetrant Acceptance Limits for Brazed Joints (Continued).

Brazed Joints	Cracks	Voids (1)	Lack Braze (2)	Surface Porosity (3)	Cumulative Indications (4)
Support to Inner Shroud, Inner Shroud to Deflector Inner Shroud to Seal Ring	Not allowed.	Not allowed.	0.50 inch (1.27 cm) maximum length. 1.50 inch (3.81 cm). Maximum cumulative length 1.00 inch (2.54 cm) minimum distance between indications.	Allowed.	
Support to Support and Support to Seal	Not allowed.		1.00 inch (2.54 cm) maximum length. 6.00 inch (15.24 cm) maximum cumulative length. Minimum distance between indications shall be length of the shorter indication.	Allowed.	
Seal Ring to Seal	Not Allowed.		0.75 inch (1.91 cm) maximum length 4.00 inch (10.16 cm) maximum cumulative length. Minimum distance between indications shall be length of the longer indication.	Allowed.	

NOTES:
(1) A "void" is defined as an interruption in the braze which is continuous through the joint cross section.
(2) A "lack of braze" is defined as an interruption in the braze which is not continuous through the joint cross section. Lack of braze on opposite sides of a joint is not allowed.
(3) Porosity is acceptable to the limits noted, provided there are no indications in the same location on the opposite side of the joint.
(4) Cumulative length of voids, lack of braze, and porosity.

(3) Machine spindle RPM shall be between 40 and 50 RPM.

(4) Roll seals at a radial feed of 0.0005 to 0.001 inch (0.0013 to 0.0025 cm) per second.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

CAUTION

In following step (5), take care that tool pressure does not distort seal during machining. Remove sharp edges after machining.

NOTE

Seal diameter after rolling shall be 0.015 to 0.025 inch (0.038 to 0.064 cm) below diameter of 4.948 to 4.952 inches (12.568 to 12.578 cm).

(5) Machine to dimensions shown in figure 5-218.

(6) Perform a fluorescent-penetrant inspection of seal and seal support area of nozzle assembly. Cracks are not acceptable in parent metal of seals.

e. Repair metal fallout of the inner shroud of second stage turbine nozzle, that has had retaining rings installed, as follows:

(1) Using a stainless steel wire brush, clean area of void.

(2) Clean areas to be welded with acetone (item 13, table C–1)

(3) Using welding wire (item 349, table C–1) build up void, as required, (or use a piece of inner shroud from a nozzle of the same part number and butt-weld in place).

NOTE

Weldments must end 1/16 inch from any brazed joint.

(4) Blend welds flush with base metal.

(5) Perform a visual and fluorescent-penetrant inspection of repaired areas. Cracks are not acceptable.

f. Repair cracks in brazement of second power turbine nozzle that exceed acceptable limits by TIG welding using (item 348, table C–1) as outlined in SP No. 5001 in Appendix E.

NOTE

Repair cracks starting at inner shroud and progressing through forward retaining ring into seal support area, on nozzles that have had inner shroud retaining rings installed, as follows:

(1) Using a stainless steel wire brush, clean cracked areas.

(2) Clean areas to be welded with acetone (item 13, table C–1).

CAUTION

In following step (3), do not weld cracks in retaining rings.

(3) Using welding wire (item 349, table C–1), weld-repair cracks in inner shroud and seal support in accordance with SP No. 5001 in Appendix E.

(4) Blend all weldments flush with base metal.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(5) Perform a visual and fluorescent-penetrant inspection of repaired areas. Cracks are not acceptable.

(6) Perform dimensional inspection of nozzle. (Refer to table 5-88).

g. Repair nozzle assembly if outer shroud (13.615 to 13.625 inch (34.582 to 34.608 cm) diameter) is out-of-round. Maximum allowable diameter is 13.635 inches (34.633 cm) or flatness exceeds 0.010 inch (0.025 cm) as follows:

NOTE

Replace nozzle assembly if any other dimensions given in table 5-88 are exceeded.

(1) Using steel (item 293, table C–1), fabricate a plate and plug as shown in figure 5-219.

(2) Heat nozzle assembly to 550° to 650°F (289° to 343°C) and hold at temperature for 15 minutes.

(3) Remove nozzle assembly from heat source and position on plug as shown in figure 5-219.

(4) Position plate and secure with thru-bolt as shown in figure 5-219.

(5) Using air blast, rapidly cool nozzle to room temperature.

(6) Remove plate and plug from nozzle and inspect as follows:

(a) Outer shroud to ensure diameter does not exceed 13.635 inches (34.633 cm).

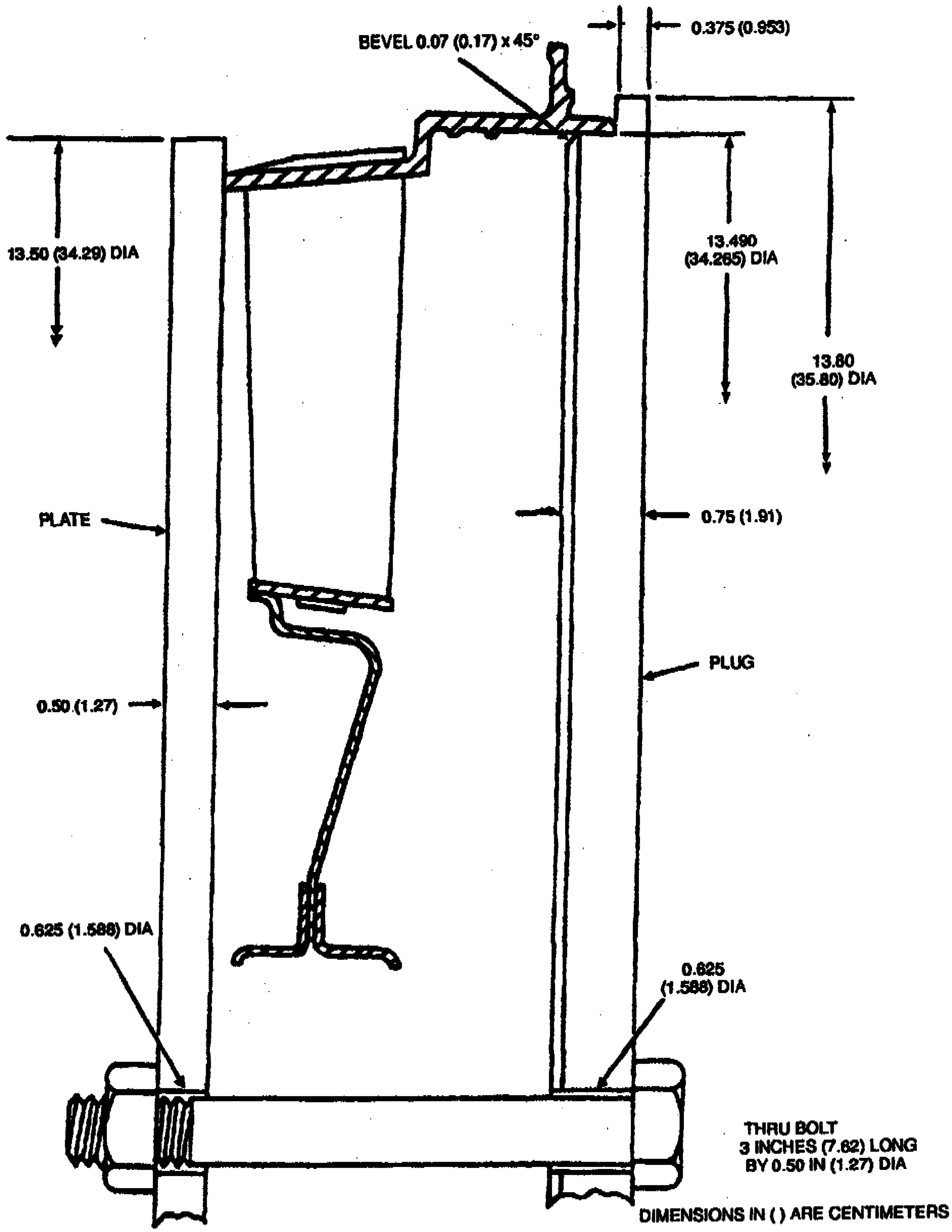


Figure 5-219. Straightening Outer Shroud - Second Stage Power Turbine Nozzle.

(b) With nozzle assembly on a flat surface, attempt to insert a 0.010 inch (0.025 cm) feeler gage between rear lip of outer shroud and surface plate. If feeler gage cannot be inserted, flatness is acceptable.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(c) Perform fluorescent-penetrant inspection on outer shroud.

h. Repair nozzles experiencing cracks or voids in the inner shroud to support braze joint that exceed existing limits.

(1) Braze repair void or cracked areas per MIL-B-7883 using AMS-4776 alloy paste with a TIG torch as a source of heat.

(2) Finish machine brazed area as required.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(3) Inspect area per MIL-STD-6866. No cracks allowed.

i. Repair worn labyrinth sealing lands on nozzle assembly worn below the 0.015 minimum height as follows:

(1) Machine as required to clean up wear or removal of any plasma spray.

(2) MIG weld build-up using AMS5794 wire (item 349, table C–1). No welding permitted in wall adjacent to vane because of proximity to vane brazement. (Refer to figure 5-220).

(3) Heat treat as follows:

(a) Place part in oven. Heat to 1,015°±15°F and hold for 2 hours.

(b) Cool to 500°F, not faster than 100°F every 15 minutes.

(4) Finish machine seal lands per figure 5-220.

WARNING

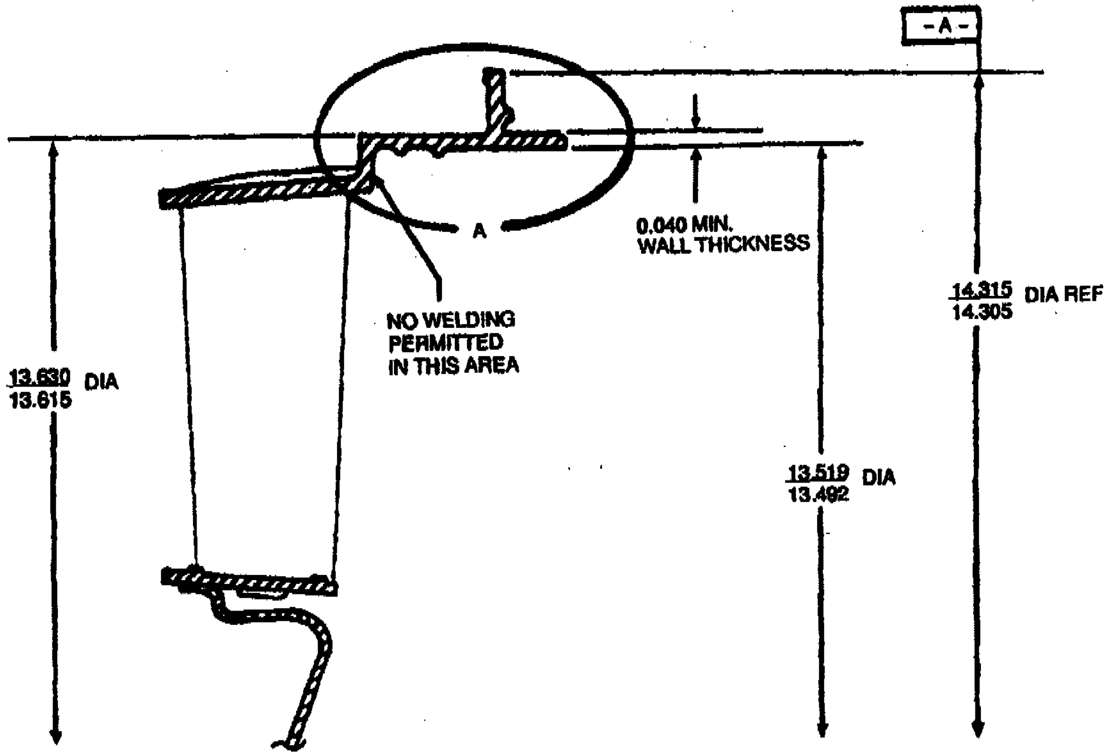
FLIGHT SAFETY PART

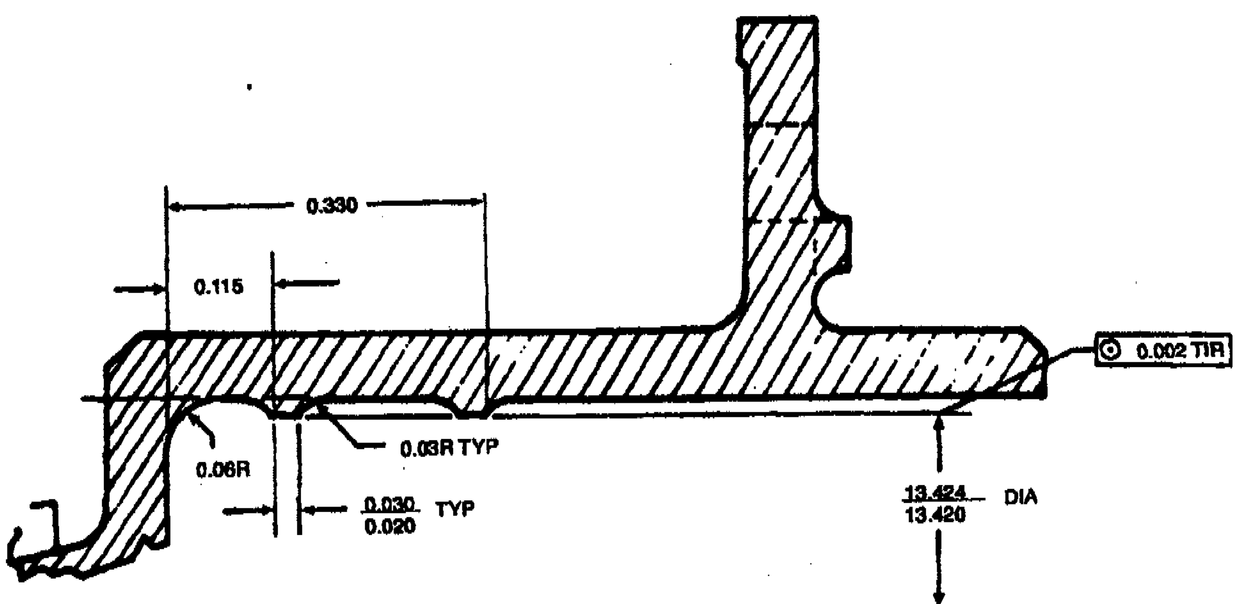
Fluorescent penetrant inspection is flight safety critical.

j. Repair second turbine nozzle assembly (1-140-470-05) when nozzle cylinder 13.492 inch ID is undersize due to wear or distortion as follows:

NOTE

Minor nozzle cylinder distortion of less than 0.004 inch may be repaired by skimming only. Do not exceed minimum wall thickness of 0.040 inch. It may not be possible to eliminate all distortion. Do not damage nozzle assembly.





VIEW A

Figure 5-220. Second Stage P.T. Nozzle Sealing Land Repair.

(1) Install nozzle assembly in a suitable fixture and roll ID to true it up.

(2) Heat-treat nozzle assembly at 1,500°F (816°C) for 4 hours. Allow nozzle assembly to air cool.

NOTE

In following step, minimum wall thickness after skimming shall not be less than 0.040 inch. Nozzle cylinder ID may be skimmed up to 13.504 inch diameter, provided a 0.040 inch minimum wall thickness is maintained.

(3) Dimensionally check nozzle cylinder ID. Then skim nozzle cylinder ID, as required, to obtain 13.500 to 13.504 inch diameter.

(4) After skimming, ensure nozzle cylinder radius is smoothly blended. (Refer to SP No. 5000 in Appendix E.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(5) Fluorescent penetrant inspect cylinder machined surface for cracks. No cracks allowed.

5-292. NOZZLE. Nozzle may be reworked to increase or decrease flow area within published flow limits by shot peening. (Refer to SP No. 5015 in Appendix E).

5-293. REASSEMBLY. Reassembly is not required.

5-294. FUNCTIONAL TEST. Functional test is not required.

5-295. COMBUSTION CHAMBER ASSEMBLY.

5-296. DISASSEMBLY. Proceed as follows:

a. Remove six nuts (5, figure 5-221) and key washers (6).

b. Carefully withdraw combustion chamber liner (1) from combustion chamber housing (4).

c. On T53-L-13B, -15,-701, and -701A engines, remove three flat washers (2) from studs on liner (1).

d. On T53-L-703 engines, remove six springs (3) from studs on liner (1).

5-297. CLEANING. Proceed as follows:

a. Clean combustion chamber housing (4, figure 5-221) by either dry cleaning solvent method or solvent-immersion method. (Refer to SP Nos. 3001 to 3002 in Appendix E.)

b. Clean parts of combustion chamber drain valve assembly (16, figure 4-14) using cleaner (item 87, table C–1), or equivalent.

c. Clean combustion chamber liner (1, figure 5-221) by dry cleaning solvent method. (Refer to SP No. 3002 in Appendix E). If this method is inadequate, use either solvent-immersion or vapor-blasting method, (Refer to SP No. 3001 or SP No. 3003 in Appendix E.)

d. Clean all other parts by dry cleaning solvent method. (Refer to SP Nos. 3002 in Appendix E.)

5-298. INSPECTION OF COMBUSTION CHAMBER ASSEMBLY. Perform specific inspections listed in table 5-91.

5-299. REPAIR. (See figure 5-221.) Proceed as follows:

a. Repair combustion chamber liner (1, figure 5-221) as follows:

(1) Repair slot cracks on inner and outer liners and in louver areas, that exceed limits, as follows:

(a) Clean areas to be welded with acetone (item 13, table C–1)

(b) Using welding wire (item 351, table C–1), fusion-weld repair liner as outlined in SP No. 5001 in Appendix E.

(c) Blend-repair the welded area with surrounding parent metal to minimize stress concentration. (Refer to SP No. 5000 in Appendix E.)

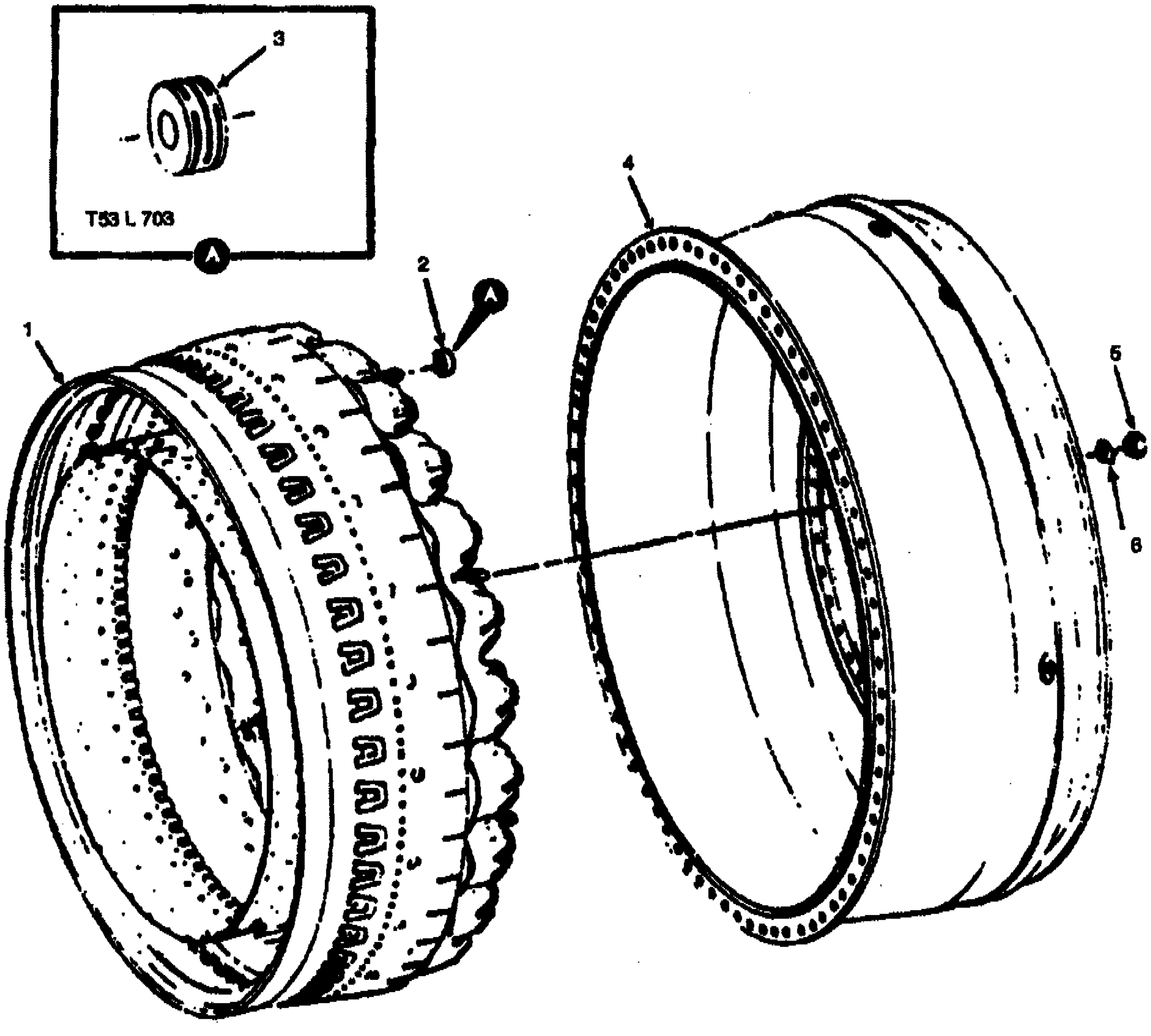


Figure 5-221. Combustion Chamber Assembly.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-221		COMBUSTOR CHAMBER ASSEMBLY	Ref	
		(NHA 1-130-630-06, 1-130-630-08, 1-130-620-05, 1-130-630-16, 1-130-630-19)		
		COMBUSTOR CHAMBER ASSEMBLY		
		(NHA 1-130-630-19)		
-1	1-130-780-03	. LINER, Atomizing combustion chamber	1	B
	1-130-780-01	. LINER, Atomizing combustion chamber	1	A, C, D, E
-2	1-130-218-03	. SPACER, Sleeve	3	A, C, D, E
-3	1-130-278-01	. SPRING, Stud	6	B
-4	1-130-610-05	. HOUSING, Combustion chamber	1	A, C, D, E
	1-130-610-12	. HOUSING, Combustion chamber	1	
-5	AN121528	. NUT, Plain, hexagon	6	
-6	1-130-235-01	. WASHER, Key	6	

(d) Cracks and crack like indications shall be rejected.

(2) Repair inner liner, outer liner, and end liner burn-through as well as forward inner liner wear-through as follows:

CAUTION

In following step (a), all cuts must be made in sound, unaffected metal.

NOTE

A plasma arc metal cutting system in accordance with MIL-C-80090, is an alternate procedure.

(a) Using an air drill and thin cutoff wheel, remove defective area.

(b) Using an air drill and stainless steel wire brush, remove all traces of foreign matter in the repair area.

CAUTION

In following step (c) replacement patches must have the same hole pattern and configuration as removed section.

(c) Using sheet and plate alloy (item 299, table C–1), fabricate a replacement patch of equal thickness as the area where patch is removed to required dimensions, allowing a maximum 0.010 inch (0.025 cm) clearance on a side.

Table 5-91. Inspection of Combustion Chamber Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-221				
-1	Combustion Chamber Liner	Visual	Cracks. (See figure 5-222.)	Cracks in atomizer louver-to-louver resulting in material fall-out not allowed. For other cracks, see figure 5-223 and refer to paragraph 5-299.
			Cracks at atomizer seal weldment	Not allowed. Replace.
			Burn-through on inner liner	Refer to table 5-92.
			Burn-through on outer liner	Refer to table 5-92.
			Burn-through on end liner	Refer to table 5-92.
			Missing tabs (T53-L-13B, -15, -701, -701A)	Not allowed. Replace.
			Wear on dimples through liner (T53-L-13B, -15, -701, -701A)	Repair. (Refer to paragraph 5-299.)
			Clogged cooling louvers	Not allowed. Replace.
			Cracks in end liner and under seal guide adapter	See figures 5-223 and 5-225. Repair. (Refer to paragraph 5-299.)
			Damaged or worn studs	Replace. (Refer to paragraph 5-299.)
			Damaged threads on studs	Replace. (Refer to paragraph 5-299.)
		Visual	Cracks in liner deflector	See figures 5-226 and 5-227 and see paragraph 5-299.
			Cracks around defector on outer liner	One circumferential crack is allowed in each hole adjacent to deflector. Refer to Figure 5-224.
			Bends or distortion of deflector ends	Repair. (Refer to paragraph 5-299.)
			Damaged or worn seal guides	Repair. (Refer to paragraph 5-299.)

Table 5-91. Inspection of Combustion Chamber Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-221 -1 (Cont)	Combustion Chamber Liner (Cont)	Visual	Distortion or buckling that exceeds 0.100 inch (0.254 cm) from profile	Replace if damage is excessive.
			Nicks, burrs, distortion, cracks, and mutilation of liner deflectors	Refer to table 5-92.
			Bent or warped outer liner flange	Repair. (Refer to paragraph 5-299.)
		SIE and Visual	Seal guide adapters for excess clearance and mounting holes for elongation	Refer to table 5-92 and repair as outlined in paragraph 5-299.
			Stud bracket wear in excess of 0.020 inch (0.051 cm)	See figure 5-228. If limits are exceeded, replace.
			Proper air gap clearances	See figure 5-229. Replace if limits are exceeded.
		Visual (Fluorescent Penetrant Optional)	Cracks exceeding 1/8-inch in length on louvers fuel nozzle	Repair. (Refer to paragraph 5-299.
			Cracks from all louvers to fuel nozzle holes.	See figure 5-222. Replace if louver-to-louver cracks are present. All other cracks are acceptable.
			Cracks in inner and outer slot areas which are greater than 1/2 inch in length	See figure 5-223. Repair. (Refer to paragraph 5-299.)
			Cracks in stud bracket weldments	Repair. (Refer to paragraph 5-299.)
			Cracks in stud bracket parent metal	Repair. (Refer to paragraph 5-299.)
			Cracks from cooling holes in inner and outer liner.	One crack per slot is acceptable provided it is less than 1/2 inch long and does not converge with another crack. Repair if limits are exceeded. (Refer to paragraph 5-299.)

Table 5-91. Inspection of Combustion Chamber Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-221				
-4	Combustion Chamber Housing	Visual	Nicks, burrs, or scratches	Blend-repair. (Refer to SP No. 5000 in Appendix E.)
			Damaged threads	Repair. (Refer to SP No. 5007, Appendix E and paragraph 5-299.)
			Missing rivets or damaged or missing liner support	Repair. (Refer to paragraph 5-299.)
			Missing or damaged anchor nuts	Repair. (Refer to paragraph 5-299.)
			Missing or damaged drain valve pad	Repair. (Refer to paragraph 5-299.)
		SIE and Visual	Wear and fits. (Refer to table 5-93.)	If limits cannot be met, replace.
		Visual and Fluorescent Penetrant	Cracks in welded area	Not allowed. Replace.
			Cracks around atomizer mounting boss	Not allowed. Replace.
			Cracks in combustion chamber supports	Repair. (Refer to paragraph 5-299.)
			Punctures and cracks	Refer to table 5-92.
			Cracks in ignitor adapter braze joints	Cracks are acceptable provided there are no cracks in fusion weld on opposite side. (Refer to paragraph 5-299.)
			Cracks in fuel adapter braze joints	Repair. (Refer to paragraph 5-299.)
			Elongated guide pin hole on rear flange	Repair. (Refer to paragraph 5-299.)
		Visual and Dye Penetrant	Dents and cracks in outer housing	Refer to table 5-92.
	Combustion Chamber Housing Static Pressure Tap	Visual	Damaged static pressure tap	Repair. (Refer to paragraph 5-299.)

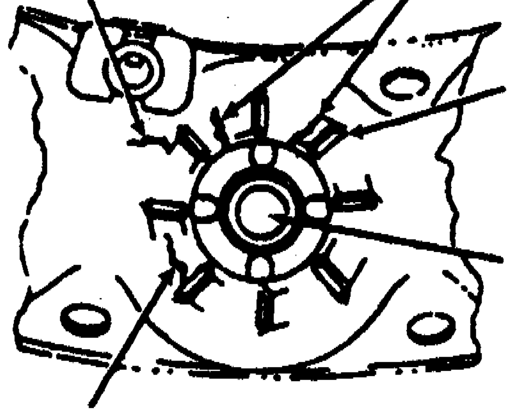


Figure 5-222. Fuel Nozzle Hole Cracks.

(NOT APPLICABLE TO T53-L-703)

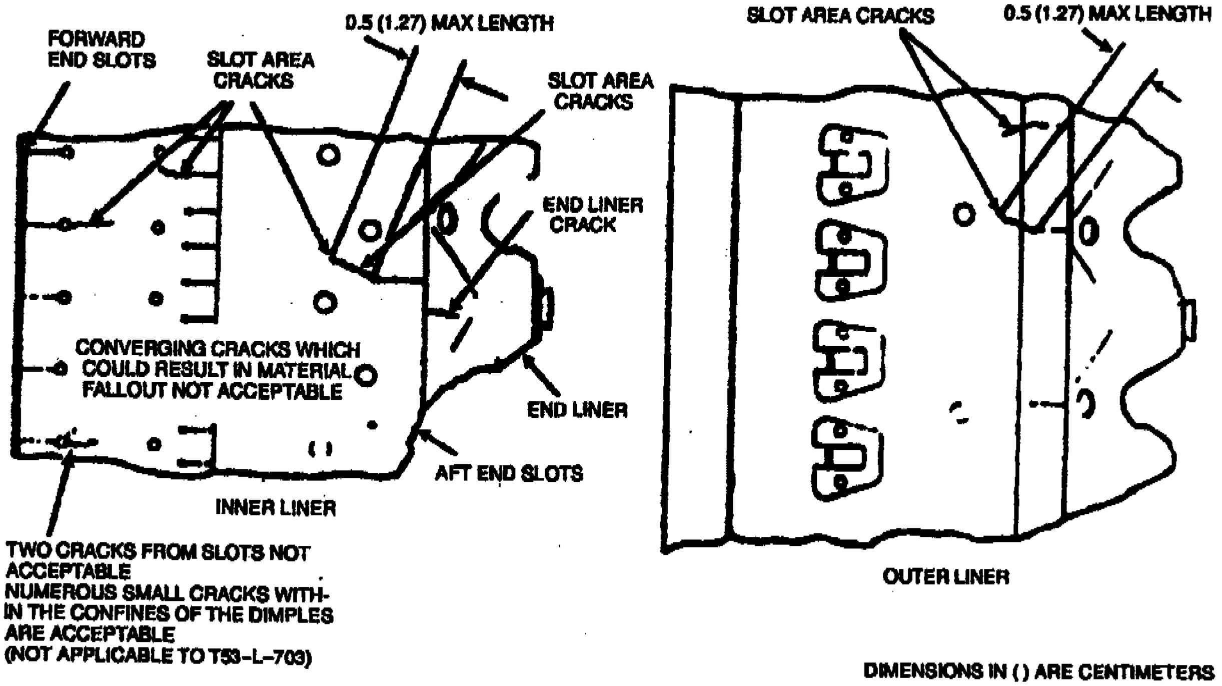


Figure 5-223. Inner and Outer Liner Crack Limits.

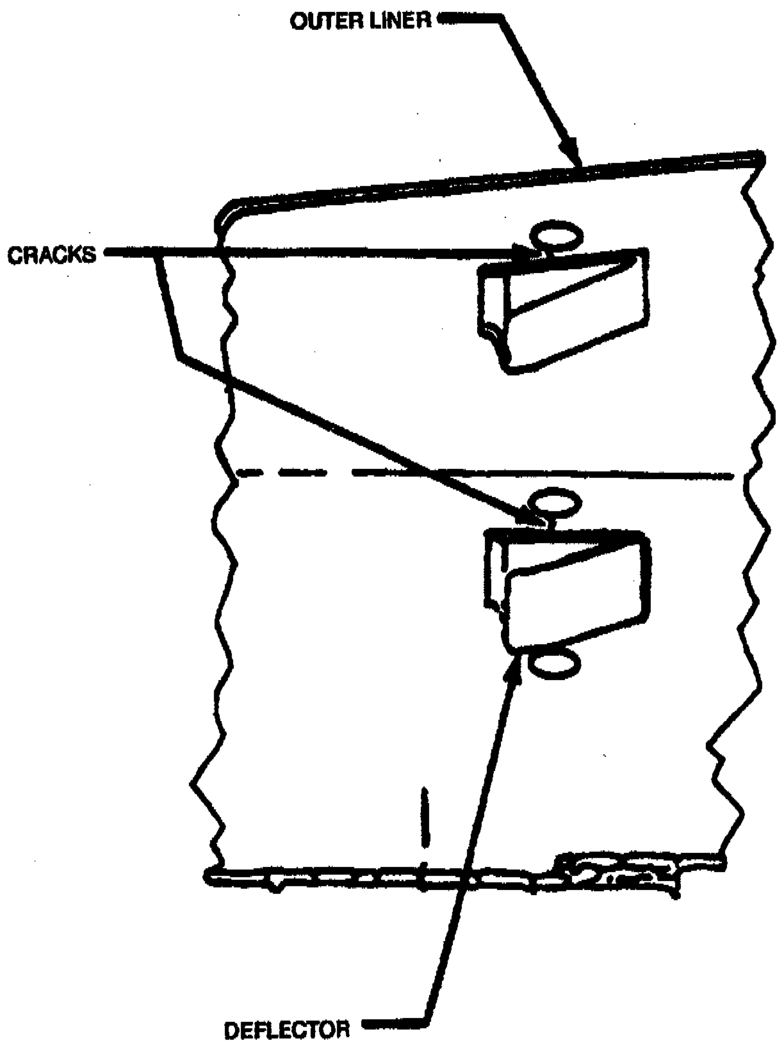


Figure 5-224. Inner and Outer Liner Crack Limit.

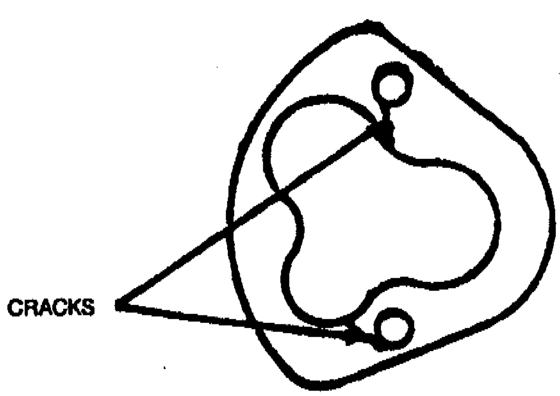


Figure 5-225. Cracks Under Seal Guide Retainer.

Table 5-92. Combustion Chamber Assembly Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Cracks and Burns in 0.570- to 0.580 inch (1.448 to 1.473 cm) Diameter End Liner Fuel Nozzle Holes	5-230	a. Loss of material caused by burning around the circumference of the nozzle holes is acceptable, provided measurement at the widest diameter does not exceed 0.700 inch (1.778 cm). Minor burning away of metal at the four starting fuel nozzle hole locations, up to 1/16 inch 1.63 in. as measured from original contour, is allowed. (See figure 5-230.) End liner burn-through in areas of end liner (exclusive of nozzle hole area) is allowed to be repaired as outlined in paragraph 5-299, step a(2). **NOTE** Burning is considered to be metal that is missing through the entire cross section of the end liner. A thinned out, oxidized, or puddled surface appearance is not cause for rejection. b. Cracks emanating from nozzle holes and progressing towards swirler holes are acceptable, provided they do not converge so as to eventually cause material fallout, and progression is not past holes. (See figure 5-230.) Repair as outlined in paragraph 5-299, a(1).
Burn-Through on Inner Liner		Burn-through on inner liner up to a 1/2-inch square total is acceptable. No single area should exceed 1/4 inch by 1/4 inch. If limits are exceeded, repair as outlined in paragraph 5-299.
Burn-Through on Outer Liner		Any amount of outer liner burn-through is cause for repair. Repair as outlined in paragraph 5-299.
		Burn-through on end liner up to 1/4-inch square total is acceptable. No single area should exceed 1/8 inch by 1/8 inch. If limits are exceeded, repair as outlined in paragraph 5-299.
Dents and Cracks in Outer Housing		a. Any number of smooth dents are acceptable for repair, provided that the depth is no deeper than 0.200 inch. Measure depth from unaffected portion of housing.

Table 5-92. Combustion Chamber Assemblylnspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
	5-230 (Cont)	
Dents and Cracks in Outer Housing (Continued)		b. Cracks in casing and cracks emanating from dented areas are acceptable for repair, provided crack repair locations are a minimum of 5 inches apart. Cracks shall not exceed 1-1/2 inches in length.
Cracks around Deflector on Outer Liner		One circumferential crack is allowed in each hole adjacent to deflector. See figure 5-224.
Seal Guide Adapters for Excess Clearance and Elongated Rivet Holes		a. Clearance shall not exceed 0.050 inch (0.127 cm). Measure feeler gage across north rivets. If maximum clearance is exceeded, replace seal guide adapters. (Paragraph 5-299).
		b. Maximum elongation of rivet hole (on end liner) shall be when rivet has been moved to one side of hole and gap is measured. Allowable gap shall not exceed 0.032 inch (0.081 cm). If limit is exceeded, repair. (Refer to para. 5-299).
Cracks in Fuel Nozzle Hole and Louver Area	5-222	a. Cracks are acceptable from all louvers-to-nozzle hole. Louver-to-louver cracks that could cause metal fall-out, are not acceptable.
		b. Cracks from all louvers extending in opposite direction from nozzle hole are acceptable provided they do not exceed 1/8 inch in length and are not associated with louvers which have cracks extending into atomizer hole. Cracks exceeding limits given shall be repaired. (Refer to paragraph 5-299).
Punctures and Cracks in Housing		a. Cracks or punctures requiring a patch, 4 by 4 inches or smaller, are acceptable for repair. Punctures shall not exceed 4 by 4 inches (10.16 cm) after cleanup, and corners shall have generous radii. Defect after cleanup shall not be less than 1/4 inch (.64 cm) from any seal or joint. (Refer to paragraph 5-299 and table 5-93.)

Table 5-92. Combustion Chamber AssemblyInspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Punctures and Cracks in Housing (Cont)	5-222 (Cont)	b. Patches must be separated by sound metal at a distance equal to greater dimension of largest patch. c. No more than three patches of any size are permitted in housing. d. If limits are exceeded, replace housing.
Liner Deflector for Nicks, Burrs, Distortion, Cracks, and Mutilation (See figures 5-226 and 5-227.)		a. Nicks and burrs are acceptable with blend-repair. (Refer to paragraph 5-299). b. Deflectors with distorted (bent) areas, without cracks are allowed to be cold-straightened and blend-repaired. Cracks, after straightening are not allowed without repair. (Refer to paragraph 5-299). c. Cracks and torn areas adjacent to spot welds are acceptable with weld repair. (Refer to paragraph 5-299). d. Other axial cracks up to 1/8 inch are acceptable without repair. (Refer to fig. 5-226, View A-A).

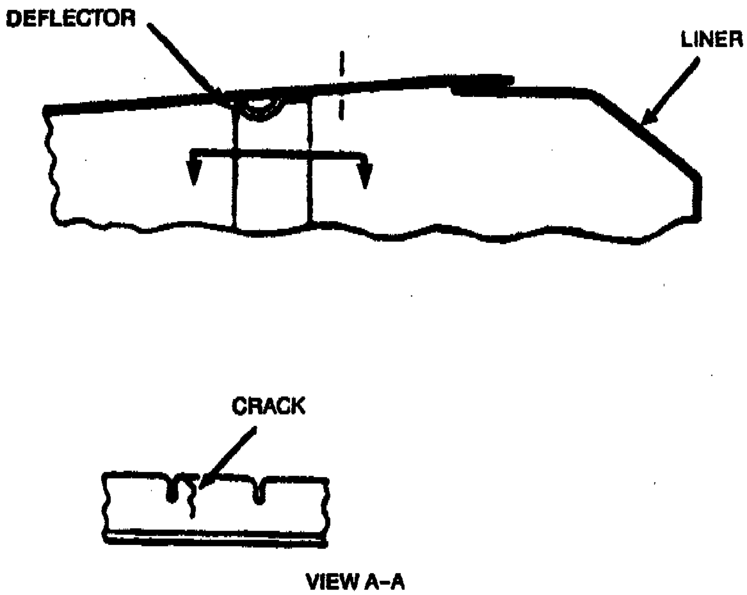


Figure 5-226. Crack in Liner Deflector.

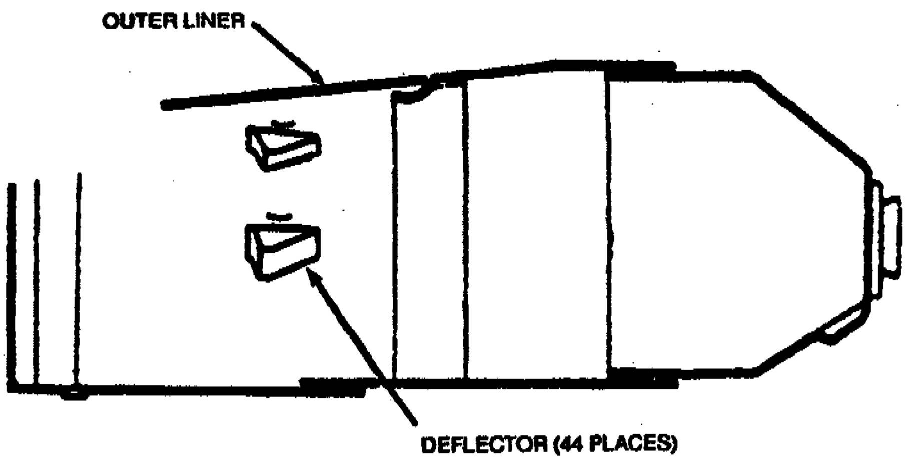


Figure 5-227. Liner Deflector Orientation.

NOTE

Sound sections from scrapped housing may be used for patches.

(d) Using welding wire (item 351, table C–1), weld patch in place as outlined in SP No. 5001 in Appendix E.

CAUTION

In following step (e), do not reduce the thickness of weld repair to less than that of the parent metal.

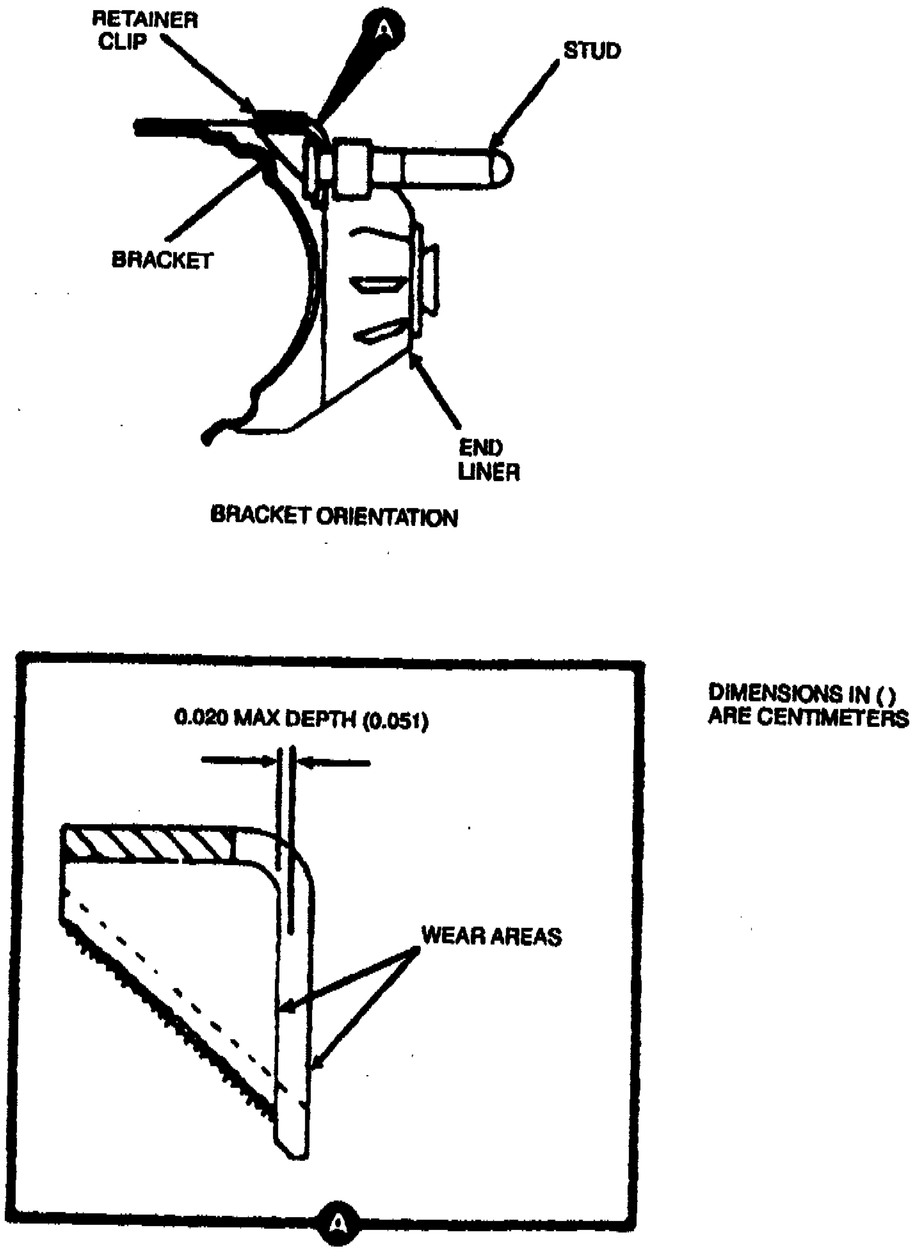


Figure 5-228. Stud Bracket Wear Limits.

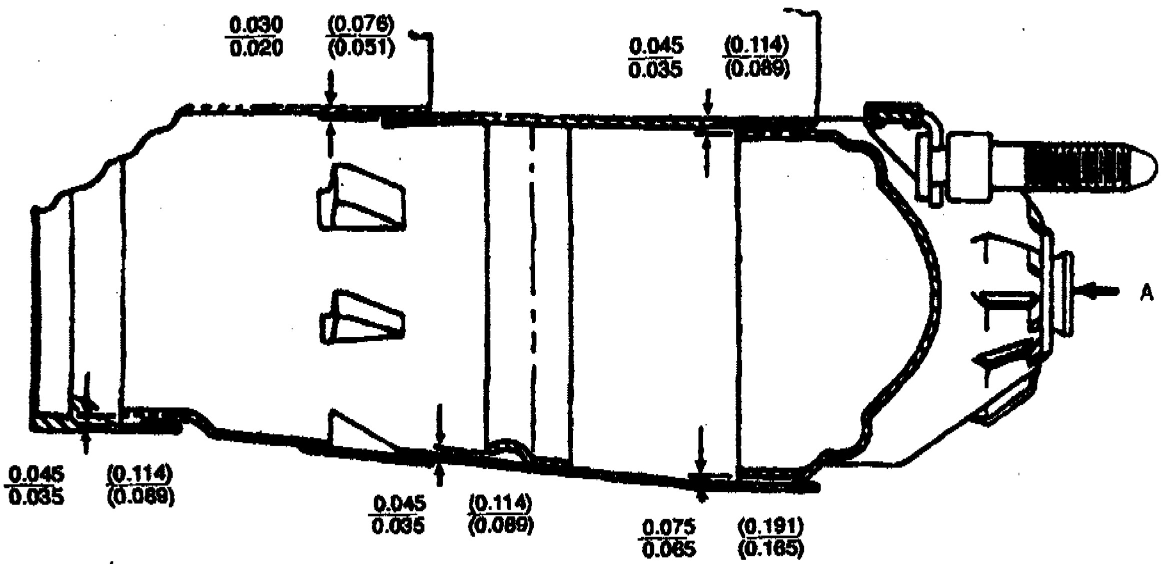
NOTE

In following step (e), if a rotary file is not available, a small diesinker type file may be used.

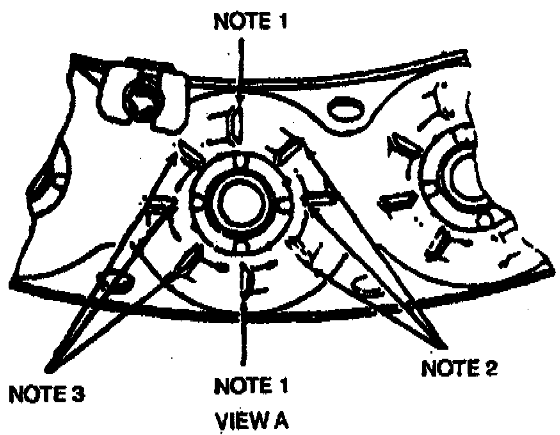
(e) Using an air drill and carbide burr, or rotary file, blend the weld beads.

(f) Perform a visual and fluorescent-penetrant inspection of the repaired area. Cracks or crack-like indications shall be rejected.

(3) Repair damaged threads on studs as outlined in SP No. 5007 in Appendix E.



NOTES	AIR GAP (TYPICAL 18 PLACES)
1	0.075 (0.191)
2	0.050 (0.127)
3	0.100 (0.254)



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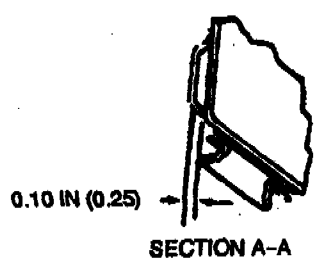


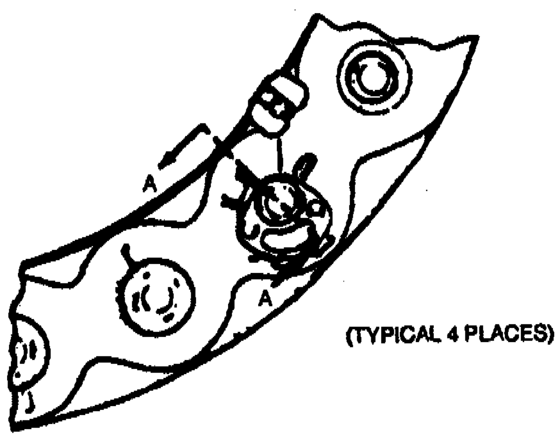


Figure 5-229. Combustion Chamber Liner Air Gap Dimension.

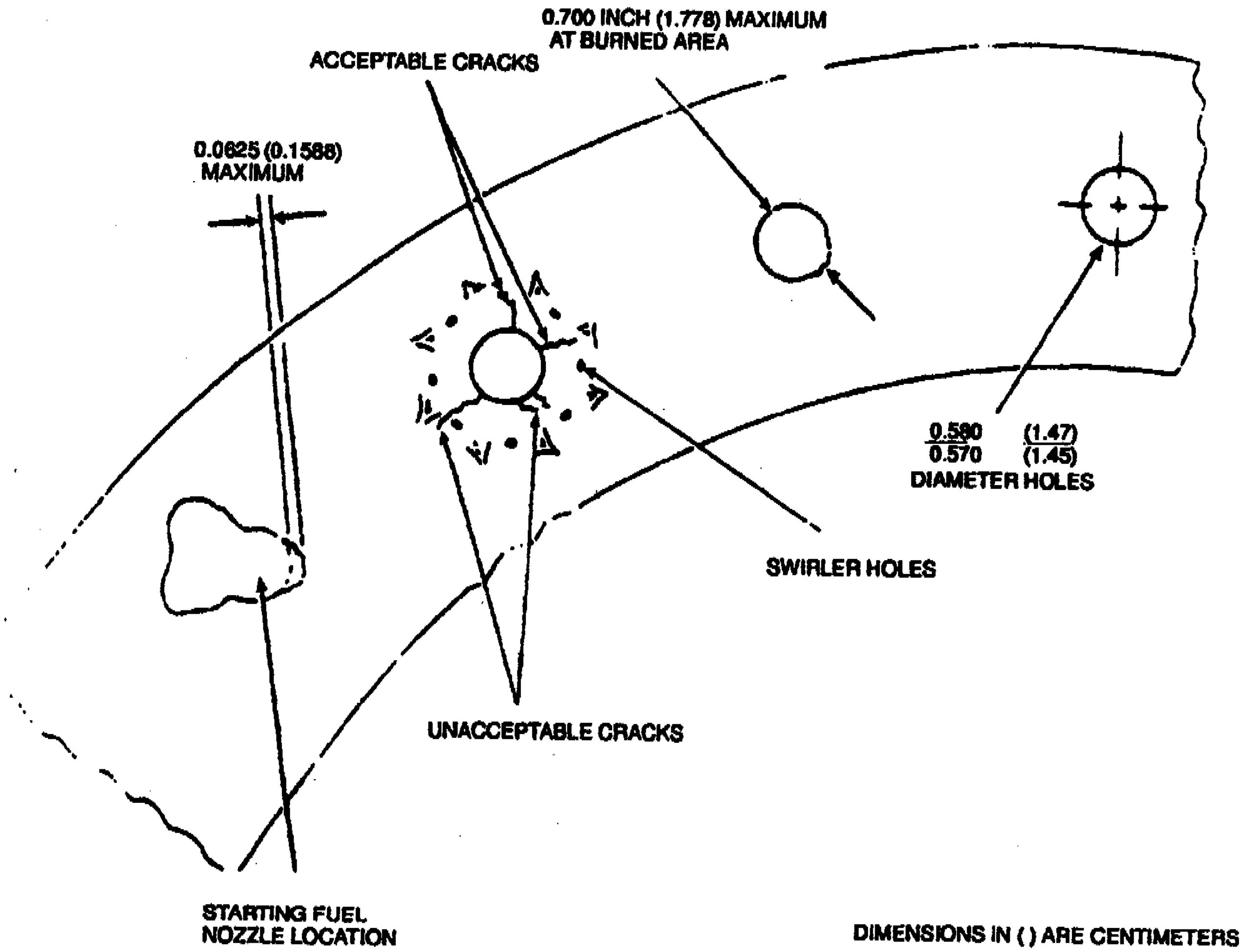


Figure 5-230. End Liner Inspection Limits.

(4) Replace unrepairable liner assembly studs as follows:

(a) Remove and discard retainer clip that secures stud to bracket. (See figure 5-232.)

(b) Remove damaged stud and replace with new stud having same part number. (See figure 5-232 for stud part numbers.)

(c) Install new retainer clip and bend tabs to lock stud in place.

(5) Repair discrepant liner deflectors (1-130-248-02) as follows:

(a) Blend-repair nicks and burrs in deflectors as outlined in SP No. 5000 in Appendix E.

(b) Cold-straighten distorted deflectors as follows:

1 Using smooth-jawed padded tools, cold-straighten deflectors.

Table 5-93. Dimensional Inspection of Combustion Chamber Housing.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
Combustion Chamber Housing to Diffuser Housing	5-221 4	OD	21.873 (55.557)	21.875 (55.563)	Either part may vary. (Use overhaul service fit)		0.001T (0.003)	0.010L (0.025)	5-231 A
	4-50 1	ID	21.875 (55.563)	21.877 (55.568)					B
Combustion Chamber Housing to Second Stage Power Turbine Nozzle Assembly (Cylinder)	5-221 4	ID	13.650 (34.671)	13.665 (34.684)	Either part may vary. (Use overhaul service fit.)		0.025L (0.064)	0.050L (0.127)	C
	5-135 11	OD	13.615 (34.582)	13.625 (34.608)					D
Combustion Chamber Housing to Diffuser Support Cone Assembly	5-221 4	OD	21.794 (55.357)	21.796 (55.362)	Either part may vary. (Use overhaul service fit.)		0.001L (0.003)	0.014L (0.036)	E
	5-135 37	ID	21.797 (55.364)	21.803 (55.380)					F
Combustion Chamber Housing Face Flatness	4	TIR	"B"*	Surface			Flat within 0.004 inch (0.010 cm)		G

* This tolerance is not mandatory if fits and clearances can be otherwise maintained.

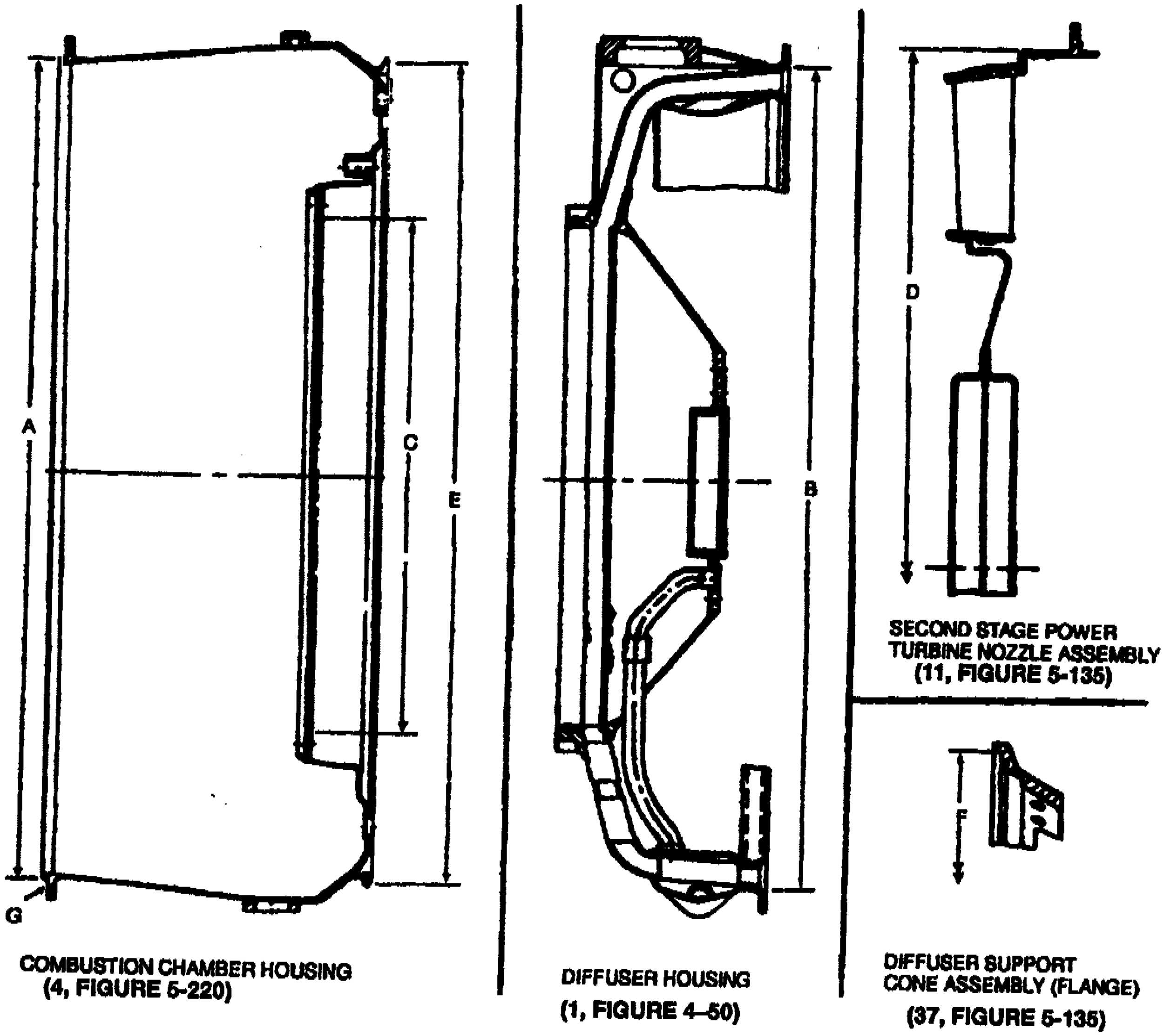
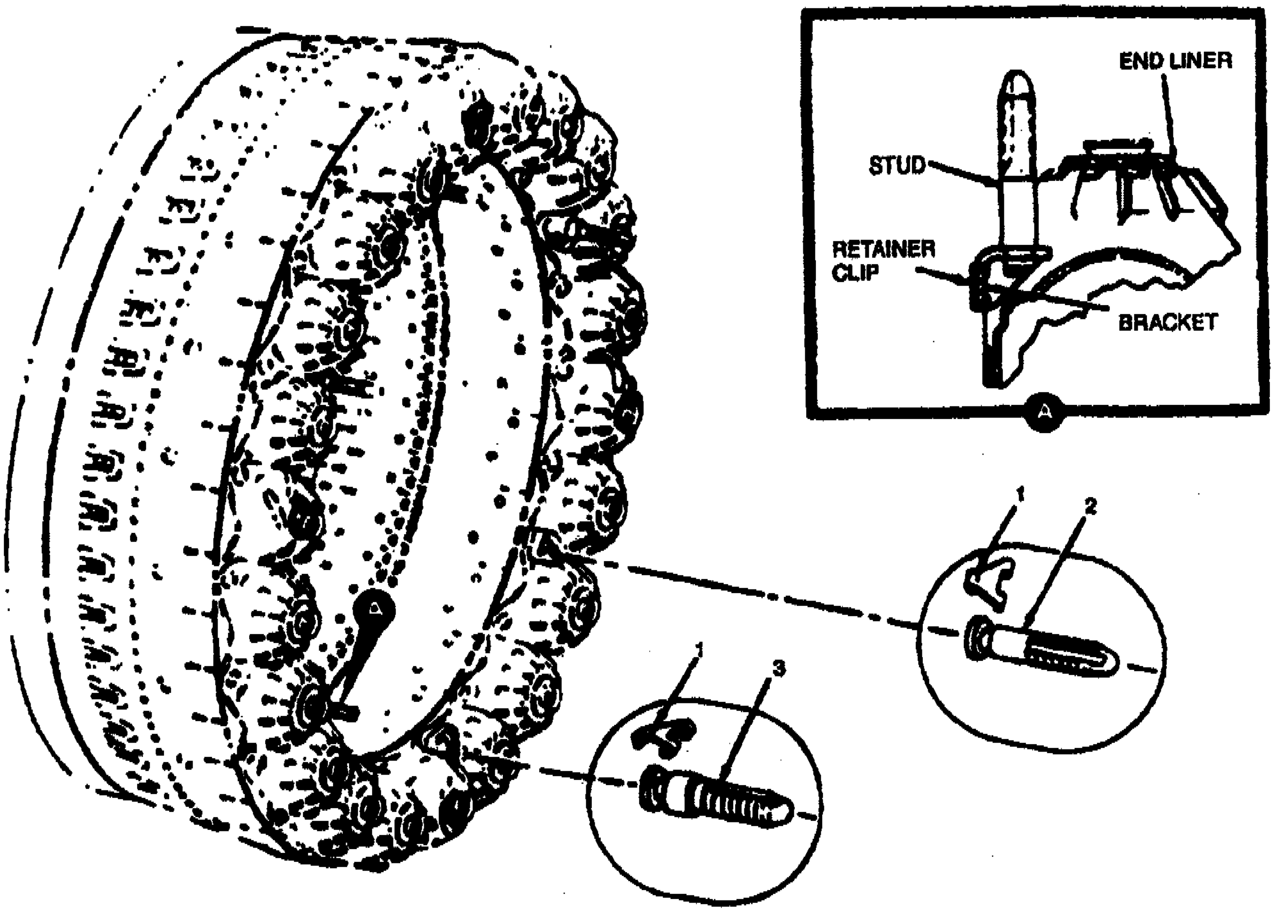


Figure 5-231. Combustion Chamber Housing Inspection Locations.



1. RETAINER CLIP (1-130-257-01)
2. STUD (1-130-256-02)
3. STUD (1-256-01)

Figure 5-232. Replacement of Liner Studs.

2 Blend-repair deflectors as outlined in SP No. 5000 in Appendix E.

(c) Using welding wire (item 351, table C–1), weld-repair cracks in deflectors and inspect weld repairs as outlined in SP No. 5001 in Appendix E.

(d) Repair bent or distorted deflector ends by one or both of the following procedures: (See figure 5-233.)

1 Deflectors with bent or distorted ends not affecting spot welds shall be repaired as outlined in preceding steps (b) and (c).

2 Deflectors with bent or distorted ends affecting spot welds shall be straightened (step (b) 1) or ground to unaffected metal. Weld-repair cracks as outlined in step (c).

3 Repair of deflector.

a Weld cracks per MIL-W-8611 using welding wire, (item 351, table C–1). Back up parent metal with inert gas or copper during welding (see figure 5-226).

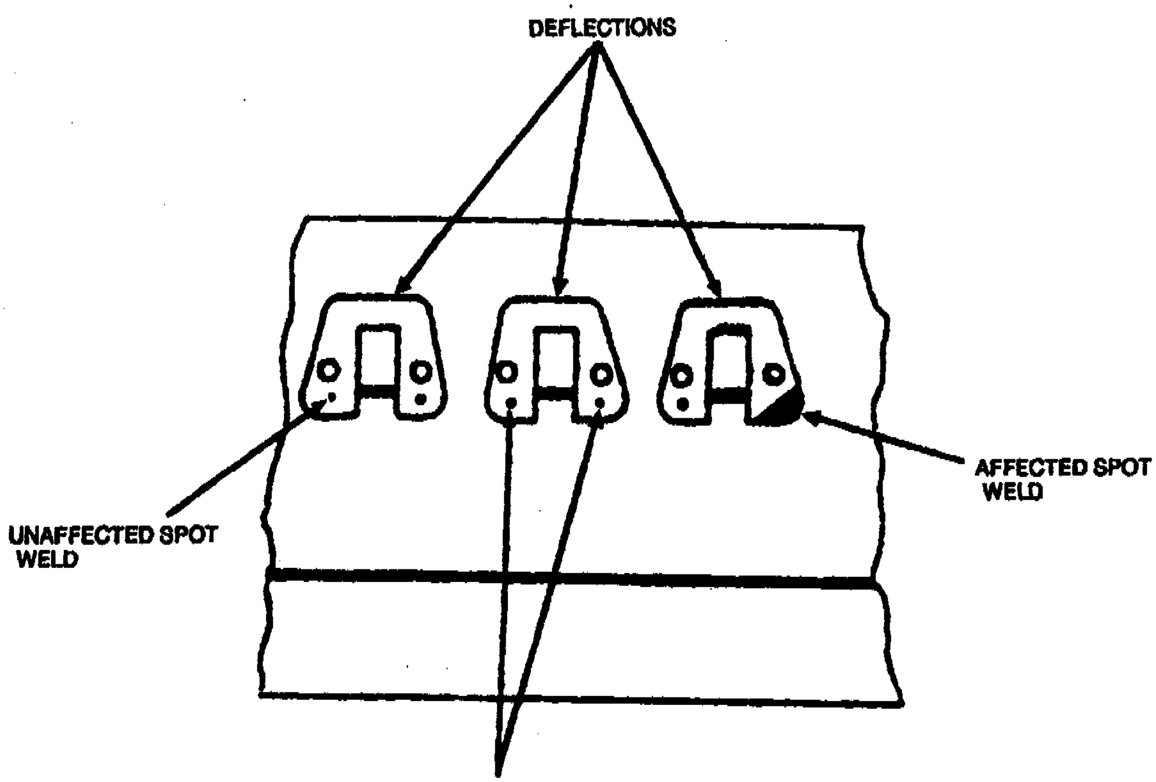


Figure 5-233. Deflector Repair Areas.

b Blend weld flush on I.D. side (flow area).

c Inspect per MIL-STD-6866. No cracks allowed.

(e) Replace mutilated deflectors as follows:

1 Using a thin cutoff wheel, grind discrepant deflectors flush with outer liner parent metal.

2 Using a suitable grinder and suitable rotary files or cartridge rolls, blend all deflector removal areas.

3 Clean areas to be welded with acetone (item 13, table C–1)

4 Using welding wire (item 351, table C–1), weld-repair all cracks observed in the deflector removal area, blend smooth, and inspect weld repairs as outlined in SP No. 5001 in Appendix E.

5 Position replacement deflectors (1-130-249-01) (see figure 5-234), and spot-weld in place and inspect. (Refer to SP No. 5002 in Appendix E.)

NOTE

Clamps or tack welds, using welding wire (item 351, table C–1), may be used, as necessary, for holding deflectors in position for spot-welding.

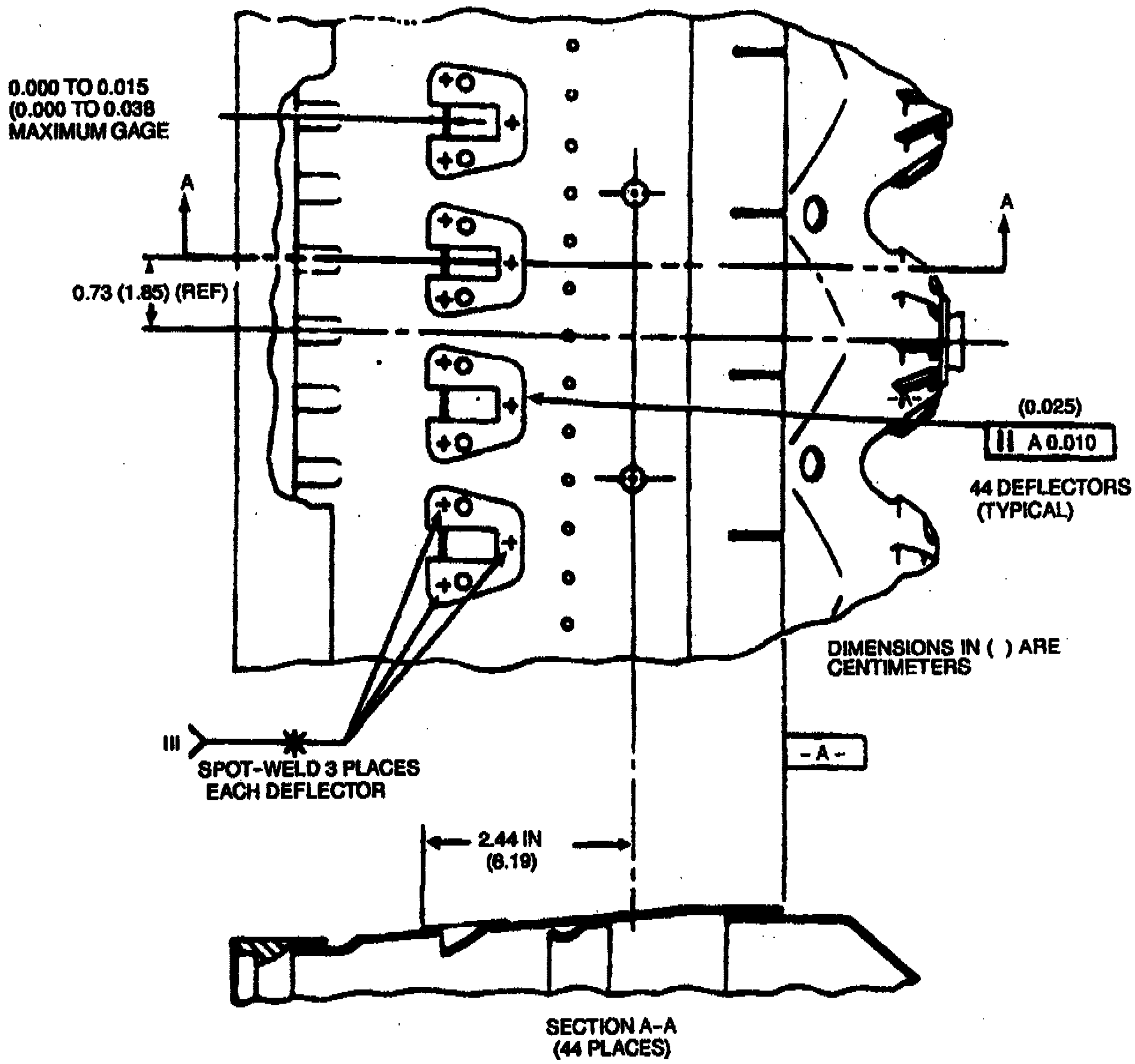


Figure 5-234. Liner Deflector Replacement.

(6) Straighten bent or warped outer liner flange as follows:

(a) Using crimping and bending machine (Stowe and Wilcox Company), or equivalent, install detail parts -3, -5, and -6 of die-straightening tool, P/N 73SAVAE-D-0078, or equivalent, on upper spindle and -7 detail parts on lower spindle.

(b) Install bent or warped outer liner flange between the two parallel roller dies, compressing and rolling flange until it is straight.

(c) If procedure of step (b) produces an elliptically shaped flange, install alignment tool, P/N 73SAVAE-D-0079, and work flange until round, using rawhide mallet.

NOTE

Using an approved marker, outline position of seal guides being replaced.

(7) Replace worn or damaged liner seal guides (1-130-790-01) as follows:

CAUTION

In following step (a), use care not to grind parent metal of liner.

(a) Using carbide burr, grind tack-weld and remove worn or damaged guide.

(b) Position new seal assembly and tack-weld in four places, using welding wire (item 351, table C-1). (See figure 5-235.)

(8) Replace worn or damaged liner seal guides (1-130-800-01) as follows:

(a) Remove rivets by grinding formed heads.

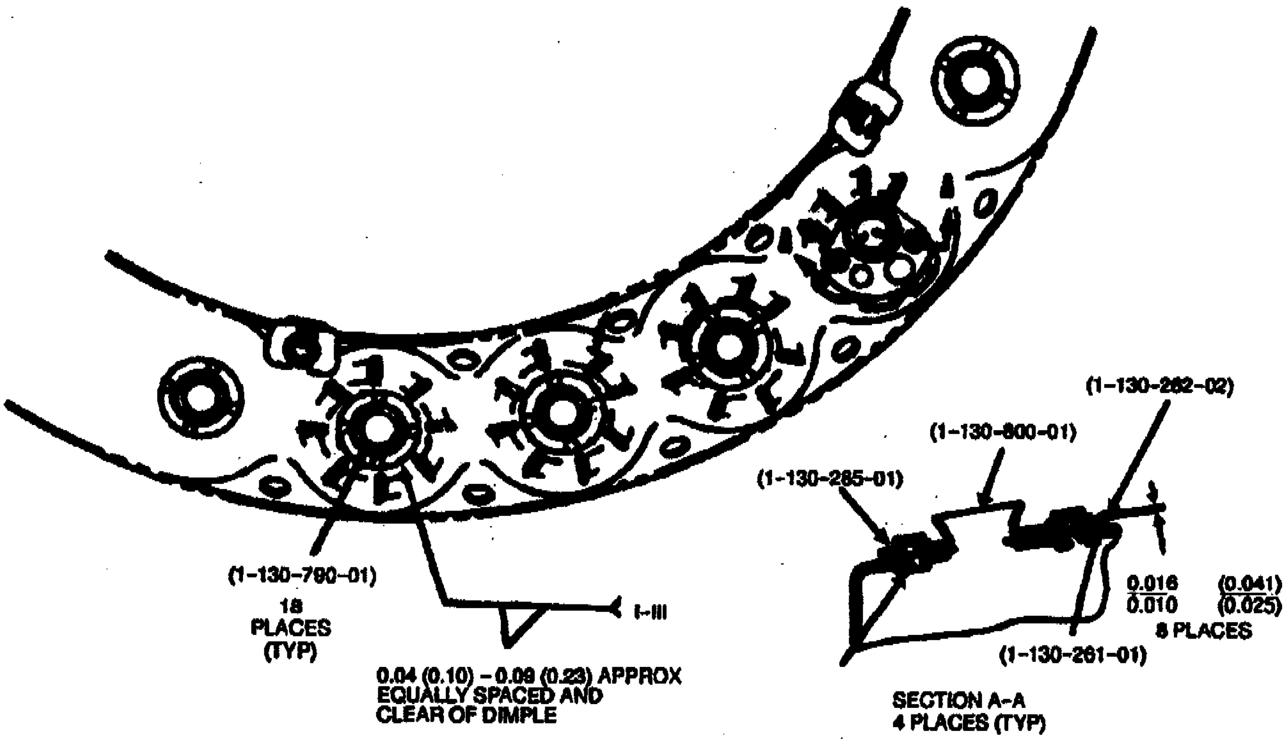


Figure 5-235. Replacement of Seal Guides.

(b) Remove damaged seal guide assembly, rivets (1-130-264-01), washers (1-130-265-01), and gaskets (1-130-262-02 and 1-130-261-01).

(c) Install new gasket, seal assembly, washers, rivets.

(d) Head over rivets. Maintain 0.005 to 0.015 inch (0.013 to 0.038 cm) gap by temporarily inserting shim stock while forming rivet heads.

(e) Remove shim stock and check seal guide assembly for freedom of movement. (See figure 5-235.)

(9) Rework liner seal guide adapters, which cause chafing or wear on starting fuel nozzles due to interference. (See figure 5-236.)

(a) Remove four seal guides as outlined in step (8).

(b) Fabricate a template simulating opening in top of adapter. (See figure 5-236.)

(c) Align template on top of adapter using rivet holes and 0.245 to 0.255 inch (0.622 to 0.648 cm) and 0.285 to 0.290 inch (0.724 to 0.737 cm) radius contours as a guide.

(d) Scribe an outline in area where material is to be removed as shown in figure 5-236.

(e) Using a small rotary grinding tool or rat-tail file, remove excess material within the scribed outline.

(f) Break all sharp edges and corners to approximately 0.005 to 0.015 inch (0.013 to 0.038 cm) radius.

(g) Re-install seal guides as outlined in step (8).

(10) Repair elongated mount hole of liner seal guide adapter as follows:

(a) Remove seal guides as outlined in step (8).

(b) Using welding wire (item 351, table C–1), fill-weld elongated rivet hole of seal guide adapter in accordance with SP No. 5001 in Appendix E. Back up metal with inert gas or copper.

(c) Drill rivet hole to 0.273 to 0.280 inch (0.693 to 0.711 cm) diameter.

(d) Perform a visual and fluorescent-penetrant inspection of repaired area. Cracks are not acceptable.

(e) Install seal guide adapter as outlined in step (8).

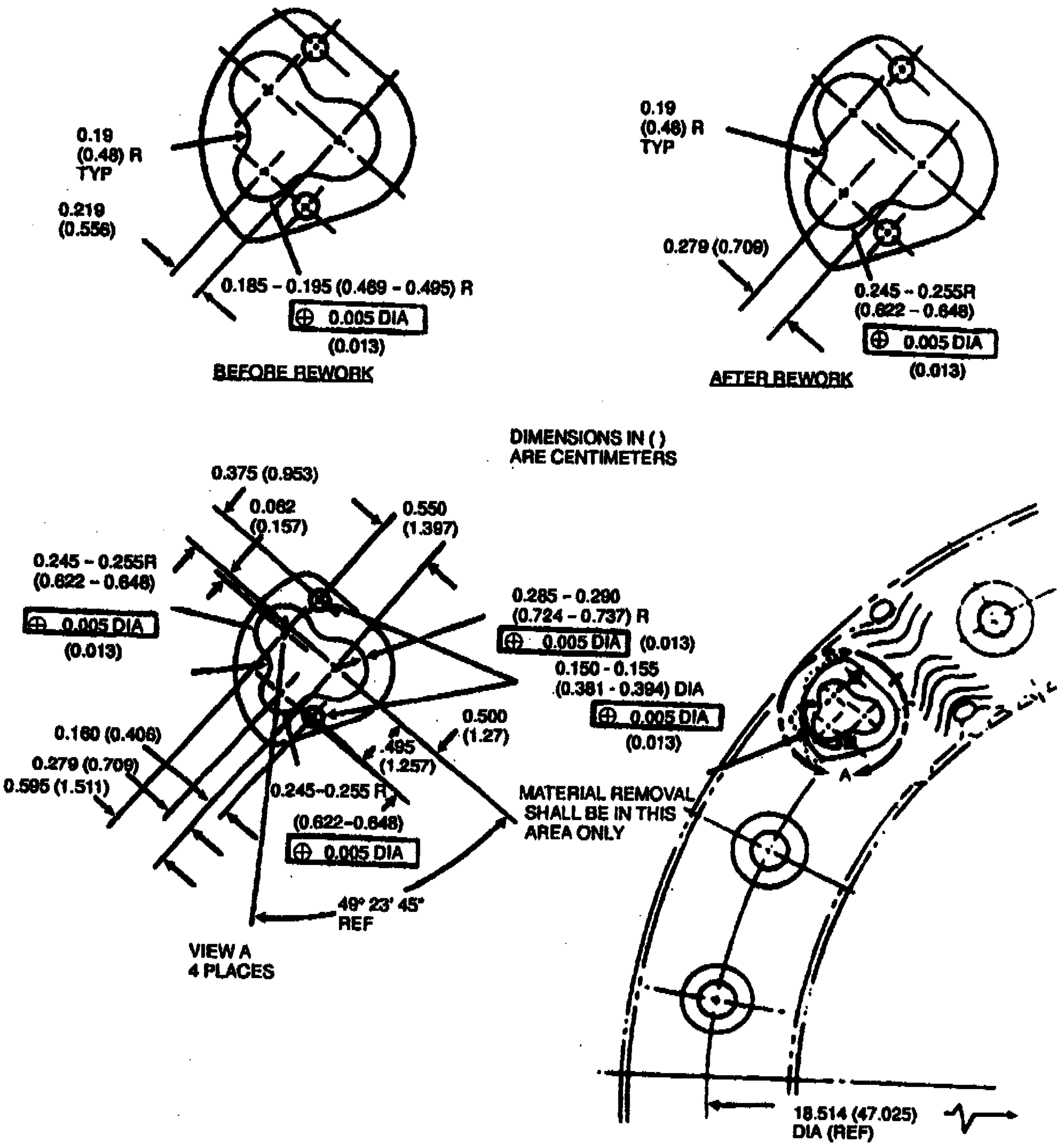


Figure 5-236. Seal Guide Adapter Rework.

(11) Replace brackets with parent metal cracks as follows:

(a) Remove and discard liner stud retainer clip and stud of bracket to be replaced. (See figure 5-232.)

CAUTION

In following step (b), use care not to grind parent metal of liner.

(b) Grind weld, using a hand grinder to remove mounting bracket to be replaced.

(c) Remove remaining stud retainer clips and studs in order to accommodate bracket welding fixture (LTCT11069), (See figure 5-237.)

(d) Clean liner by the dry cleaning solvent method. (Refer to SP. No. 3002 in Appendix E).

(12) Repair cracks in bracket weldment areas as follows:

CAUTION

In following step (a), use care not to grind parent metal of liner.

(a) Grind cracked area of weld, using a carbide burr to rout out defect.

(b) Clean area to be welded with acetone (item 13, table C–1)

CAUTION

In following step (c), apply the bulk of heat toward bracket to prevent burn-through of liner assembly. Back up parent metal using gas or copper.

(c) Using welding wire (item 351, table C–1), fusion-weld repair weldment as outlined in SP No. 5001 in Appendix E.

(d) Blend-repair the welded area with surrounding parent metal to minimize stress concentrations. (Refer to SP No. 5000 in Appendix E.)

(e) Cracks and crack-like indications shall be rejected.

(f) Position replacement bracket on holding fixture (LTCT11069), and mount fixture to liner assembly, using remaining five brackets as retaining points. Bottom retaining screws and hand tighten thumb nuts. (See figure 5-237.)

NOTE

The replacement mounting bracket may have to be trimmed slightly by filing in order to fit base plate of fixture and radius of liner assembly.

(g) Using welding wire (item 351, table C–1), tack-weld replacement bracket, using fusion-weld method. Weld as musch of bracket as possible prior to fixture removal. (Refer to SP. No. 5001 in Appendix E.)

(h) Remove welding fixture.

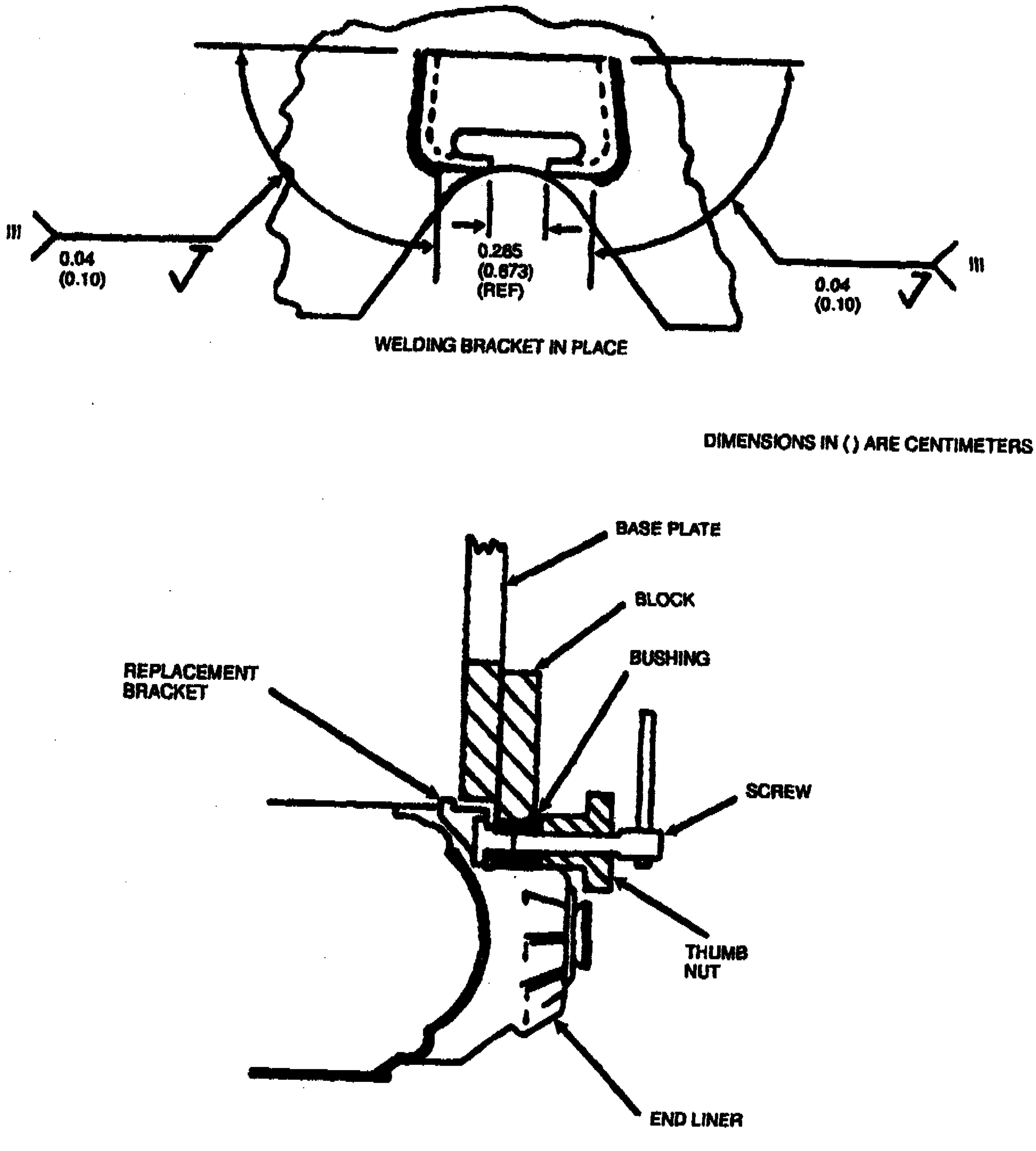


Figure 5-237. Bracket Installed In Holding Fixture.

CAUTION

In following step (i), apply the bulk of heat toward bracket to prevent burn-through of liner assembly. If necessary, back up parent metal with gas or copper.

(i) Using welding wire (item 351, table C–1), fusion-weld mounting bracket to liner assembly.

(j) Weld beads shall be reasonably smooth and free of irregularities. The weld bead shall blend into adjacent parent metal in gradual, smooth curves.

(k) Overlapping and lack of fusion of weld are not acceptable.

(l) Cracks or crack-like indications shall be rejected.

(13) Using gapping and inspection tool (LTCT13022, LTCT13023, or LTCT13024, details of LTCT13020), correct improper air gaps. (See figure 5-229.)

b. Repair combustion chamber housing (4, figure 5-221) as follows:

(1) Replace missing or damaged liner supports (1-130-710-01) as follows: (See figures 5-238, 5-239, and 5-240.)

NOTE

To properly position the combustion chamber liner in the combustion chamber housing assembly, the dimension from the rear flange of the combustion chamber housing assembly to the forward faces of the installed liner supports must be maintained at 1.095 to 1.105 inches (2.781 to 2.807 cm), (dimension A, figure 5-238). Improperly installed liner supports can result in preloading and eventual cracking of the combustion chamber liner and also chafing of the fuel manifold nozzles.

(a) Fabricate a liner support holding fixture as shown in figure 5-239.

(b) Replace missing or damaged liner supports as follows:

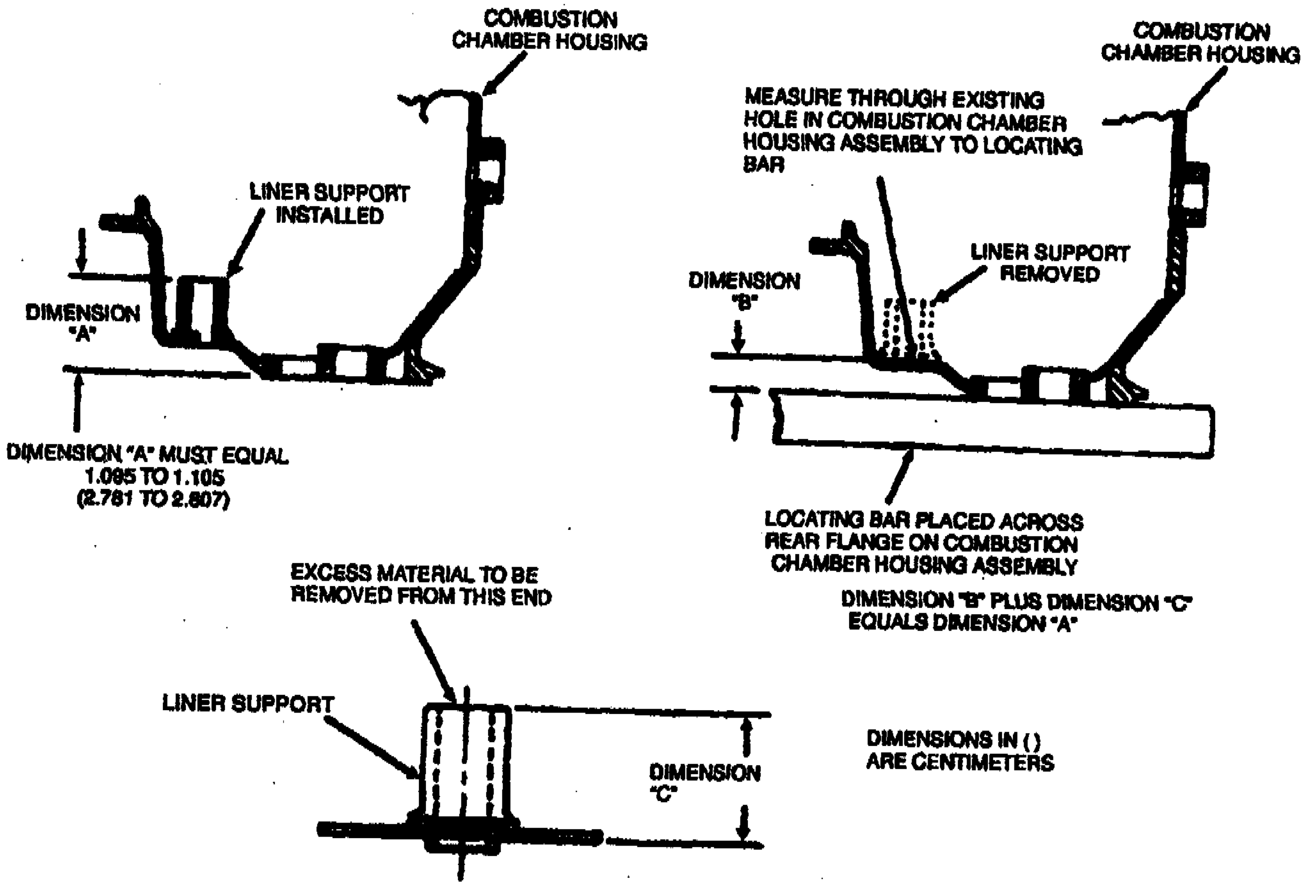


Figure 5-238. Determining Dimension for Proper Position of Combustion Chamber Liner.

CAUTION

In following step1 , use care to grind only that portion of the rivet that protrudes through the liner support to preclude the possibility of grinding damage to the housing parent metal.

1 Grind existing rivets (figure 5-240) to remove formed heads. Using a 1/8-inch diameter pin punch, drive rivets from holes and remove damaged supports.

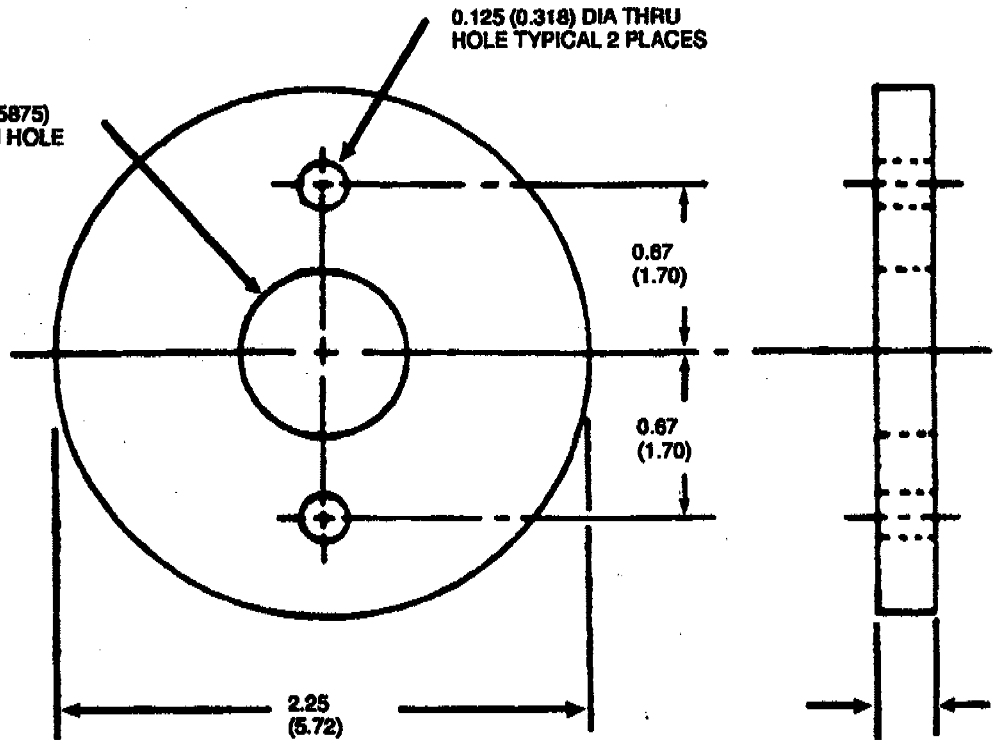
2 Remove all grinding residue and foreign matter from affected surfaces. Place a locating bar (LTCT153) across rear flange of combustion chamber housing. Using a vernier depth gage, measure through the housing to the locating bar, and record Dimension B. (See figure 5-238.)

3 Subtract dimension B from 1.100 inches (2.794 cm). Result will be Dimension C. (See figure 5-238.)

CAUTION

In following step 4, ensure reworked liner support shoulder remains 90 degrees to the perpendicular.

4 Using a suitable lathe and the holding fixture fabricated in preceding step (1), machine length of replacement liner support to Dimension C. (See figure 5-238.)



NOTE

1. FABRICATE FIXTURE FROM ANY COMMON FLAT STEEL STOCK
2. MOUNT LINER SUPPORT TO HOLDING FIXTURE, USING NO 4 X 1/2 INCH STEEL SCREWS MS35206-17, NO 4 STEEL WASHERS, AN960-4L, AND NO 4 NUTS, MS21042-04, OR SUITABLE EQUIVALENTS

Figure 5-239. Fixture for Machining Liner Supports.

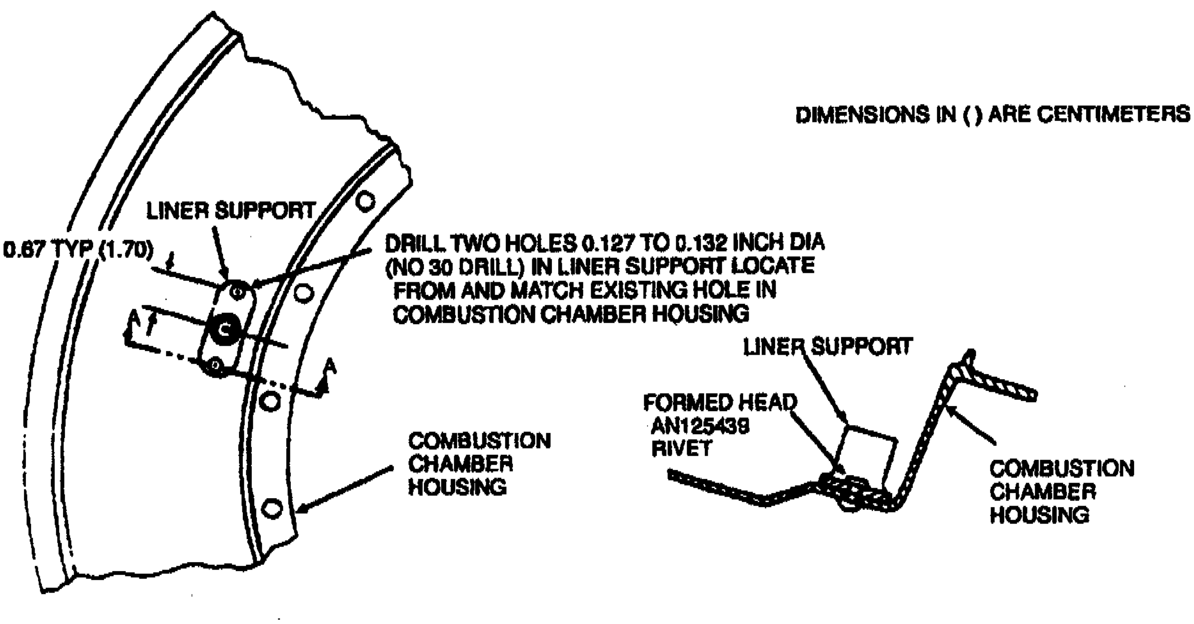


Figure 5-240. Replacement of Liner Supports.

NOTE

The combined length of the liner support plus Dimension B should equal Dimension A (1.095 to 1.105 inch) (2.781 to 2.807 cm)).

5 If not previously accomplished, drill two holes in the replacement liner support, matching holes with existing holes in the combustion chamber housing. Use number 30 drill.

6 Align holes in the liner support with holes in housing, and secure with rivets, AN125439. (See figure 5-240).

(c) Repair braze damage on liner support assemblies as follows:

1 Cracks in braze or complete separation between plate and support may be repaired by welding.

2 Remove liner support assembly from combustion chamber housing.

NOTE

Mark liner support assembly location. Repaired liner support assembly will be reinstalled in same location since rivet holes match.

3 Weld per SP. No. 5001. Weld around base of support using welding wire (item 348, table C–1).

4 Reinstall liner support assembly in combustion chamber housing. Liner support assembly installation must meet requirements of paragraph 5-299b(1).

(2) Replace missing or damaged housing anchor nuts as follows: (See figure 5-241.)

CAUTION

In following step (a), exercise care not to grind housing parent metal.

NOTE

This repair may be accomplished when combustion chamber housing is assembled to engine.

(a) Grind nut-to-housing weld and remove nut.

(b) Position replacement nut (1-300-085-01) and fillet-weld using welding wire (item 348, table C–1). (See figure 5-241). Weld shall be 0.04 inch (0.10 cm) deep by 0.12 inch (0.30 cm) long at each end of nut.

(c) Perform fluorescent-penetrant inspection of weld areas. No cracks are allowed.

(3) Replace missing or damaged drain valve mounting pad on combustion chamber housing as follows:

(a) If drain valve mounting pad is not missing, remove by grinding.

(b) Using a carbide burr, rout imperfections to expose clean sound metal.

(c) Using welding wire (item 348, table C–1), weld-repair any parent metal cracks as outlined in SP No. 5001 in Appendix E.

(d) Clean area to be welded with acetone (item 13, table C–1)

(e) Assemble and tack-weld new drain valve mounting pad (1-130-018-02) to combustion chamber housing.

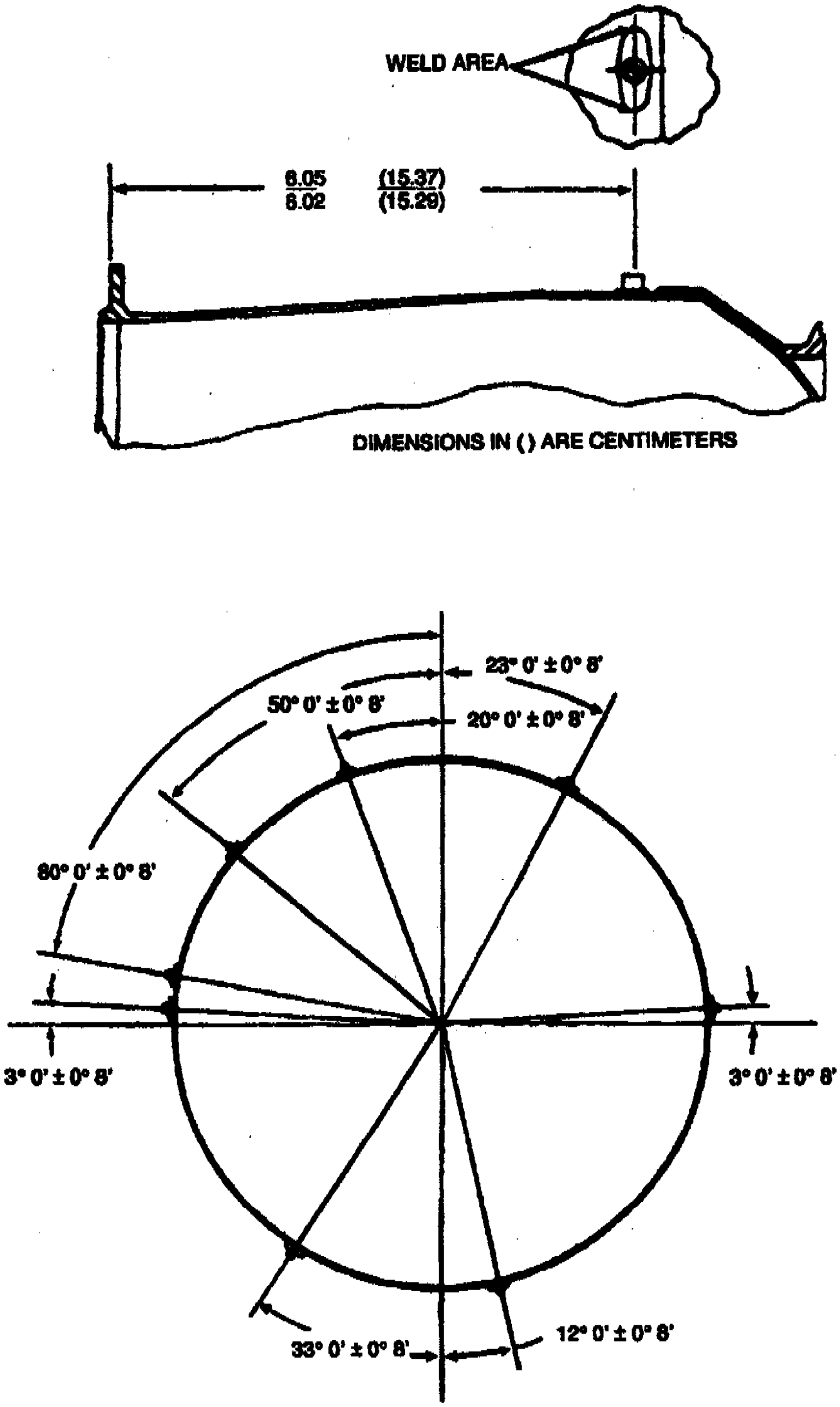


Figure 5-241. Replacement of Anchor Nuts.

(f) Using welding wire (item 345, table C–1), weld drain valve mounting pad to combustion chamber housing. Weld from inside diameter of housing. A 100 percent penetration is required. Drop-through shall not exceed 0.010 inch (0.025 cm). Blend weld flush to inside diameter of housing within 0.010 inch (0.025 cm).

(g) Perform a visual and fluorescent-penetrant inspection of repaired area. Cracks are not acceptable.

(4) Repair punctures and cracks in combustion chamber housing as follows:

(a) Reform all dents to original contour of combustion chamber housing.

(b) Using a scribe or other suitable marking tool, draw a rectangle around the section to be removed, making sure that the full length of any crack is within the scribed rectangle (See figure 5-242.) (Refer to table 5-94 for typical size and radii of patches.)

(c) Using a drill of proper size, drill a hole inside of each corner of the outlined section to establish the radius of the corner. (Refer to table 5-94.)

NOTE

Ensure that edge of drill hole does not extend beyond the outlined of section to be removed.

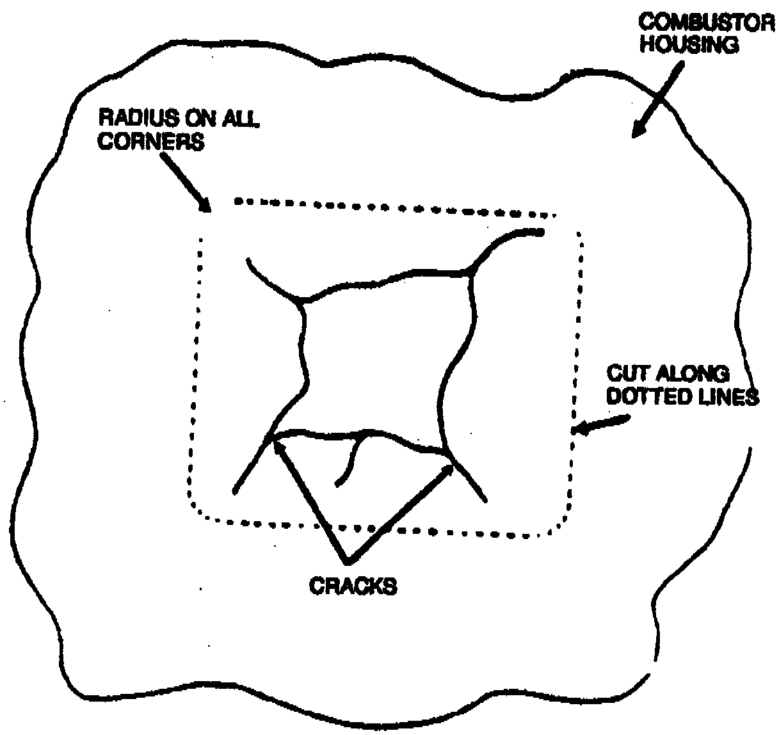


Figure 5-242. Marking Damaged Area.

Table 5-94. Typical Patch Size and Corner Radius.

SIZE INCHES	CENTIMETERS	RADIUS (INCH) INCH DECIMAL	FRACTION	CM
4.0 x 4.0	10.16 x 10.16	.375	3/8	.953
4.0 x 3.0	10.16 x 7.62	.375	3/8	.953
4.0 x 2.0	10.16 x 5.08	.375	3/8	.953
4.0 x 1.0	10.16 x 2.54	.250	1/4	.635
3.0 x 3.0	7.62 x 7.62	.375	3/8	.953
3.0 x 2.0	7.62 x 5.08	.375	3/8	.953
3.0 x 1.0	7.62 x 2.54	.250	1/4	.635
2.0 x 2.0	5.08 x 5.08	.375	3/8	.953
2.0 x 1.0	5.08 x 2.54	.250	1/4	.635
1.0 x 1.0	2.54 x 2.54	.250	1/4	.635

(d) Using an air drill and a thin cutoff wheel, cut out damaged section of housing.

(e) Prepare patches from a scrapped housing or steel sheet (item NO TAG, table C–1), 0.040 to 0.048 inch (0.102 to 0.122 cm) thick, allowing for a clearance of 0.010 to 0.025 inch (0.025 to 0.064 cm) between patch and housing on all sides.

1 If patch is to be made from scrapped housing, select material from a section corresponding as nearly as possible to the section to be patched.

2 If patch is to be made from steel sheet (item NO TAG, table C–1) it must be heat-treated as follows:

a Place patch in furnace and heat to 1,685° to 1,735°F (918° to 946°C). Hold at temperature for 30 minutes. Cool to ambient temperature.

b Cool patch to -90° to -110°F (-68° to -79°C). Hold at temperature for 3 hours; then warm to ambient temperature.

c Heat patch to 990° to 1,010°F (532° to 543°C). Hold at temperature for 3 hours; then cool to ambient temperature.

d Check patch for hardness. Hardness should be equivalent to RC 37 to 44.

(f) Using a No. 320-grit sanding cartridge roll (item 292, table C–1), clean patch and area to be welded.

(g) Using welding wire (item 345, table C–1), tack-weld patch to housing as outlined in SP No. 5001 in Appendix E.

NOTE

Initial tack welds, 1 through 8, are to be made in sequence and positioned as shown. Secondary tack welds are to be positioned at 1/2-inch intervals around patch. (See figure 5-243.)

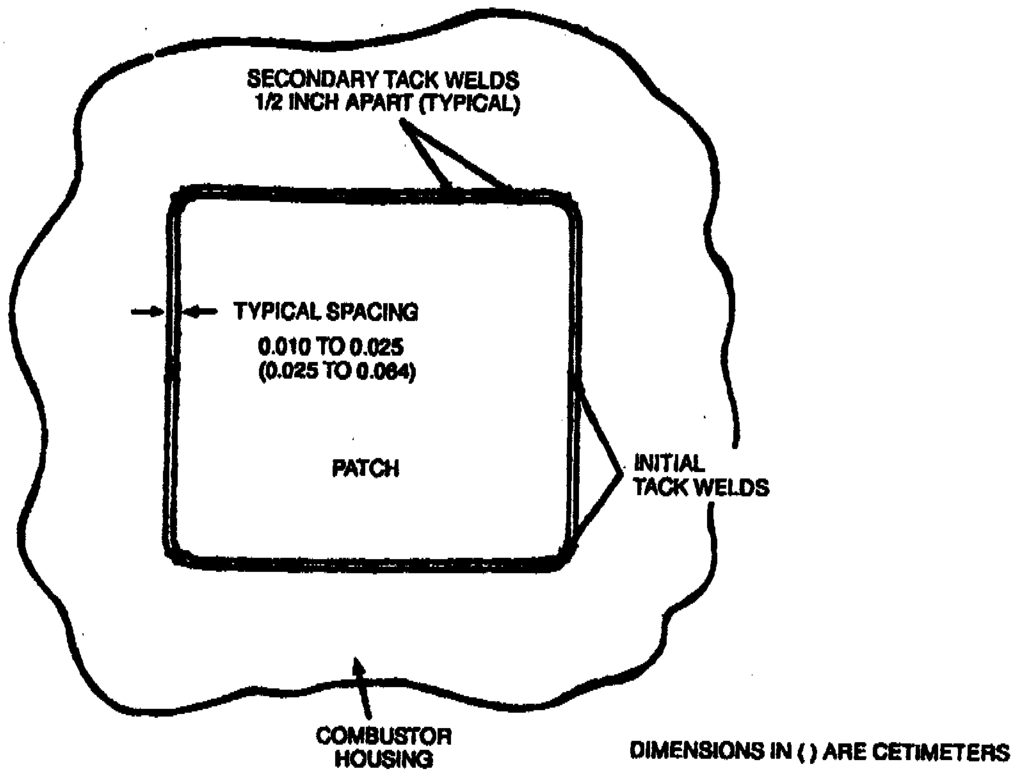


Figure 5-243. Typical Tack Weld Sequence and Location.

(h) Using welding wire (item 345, table C–1), complete welding patch to housing by fusion welding as outlined in SP No. 5001 in Appendix E.

CAUTION

In following step (i), do not reduce thickness of weld to less than that of the parent metal.

(i) Using an air drill and a No. 320-grit sanding cartridge roll (item 292, table C–1), blend all repair-welds flush with base metal.

(j) Reform patched area to original contour of housing.

(k) Perform a visual and fluorescent-penetrant inspection of repaired area.

(5) Repair dents and cracks in combustion chamber housing as follows:

(a) Remove all dents using a plastic mallet and a plastic-faced backup bar. Dents shall be removed to within 0.020 inch (0.051 cm) or original contour of housing. (Compare with unaffected portion of housing.)

CAUTION

In following step (b), use a minimum diameter thin cutoff wheel in order to remove the least amount of metal.

(b) Using a carbide cutting wheel, rout out cracks.

(c) Clean housing with cleaning solvent (item 15, table C–1), or cleaning solvent (item 103 or 311, table C–1), followed by isopropyl alcohol (item 25, table C–1) to facilitate drying.

(d) Dye-penetrant inspect both sides of casing to ensure complete cracks removal.

(e) Using welding wire (item 348, table C–1), weld-repair cracks as outlined in SP No. 5001 in Appendix E. Back up parent metal, using inert gas or copper.

NOTE

Use copper backup bars against the housing 1/2-inch from the crack area to be welded, so as to minimize the heater zone.

(f) Using a rotary file, blend the weld repairs with surrounding parent metal (ID and OD).

(g) Visually and dye-penetrant inspect repaired areas. Cracks are not acceptable.

(6) Repair cracks in the braze joints securing the fuel adapter as follows:

(a) Using gold filler wire (item 163, table C–1), weld using fusion welding method per SP No. 5001 in Appendix E.

(b) Perform a visual and fluorescent-penetrant inspection of the repaired area. Cracks or crack-like indications are not allowed.

(7) Cracks in the joints that secures the ignitor adapter to the combustor housing can be repaired as follows:

NOTE

If the fusion weld on the outside of the adapter to housing is racked, the adapter must be removed and replaced. Rewelding of this joint with adjacent gold braze present is not allowed.

(a) Repair cracks in the fusion weld by removing adapter. Replace adapter and locate as shown in figure 5-245.

(b) Using welding wire (item 348, table C–1), weld ignition adapter on the outside of the housing as outlined in SP No. 5001 in Appendix E.

(c) Using gold filler wire (item 163, table C–1), weld adapter on inside of housing for a replacement or repair using fusion welding per SP No. 5001 in Appendix E.

(d) Perform a visual and fluorescent penetrant inspection of repaired area. No cracks are allowed.

(8) Repair defective static pressure tap adapter as follows:

(a) If required, remove static pressure tap adapter by grinding.

(b) Using a carbide burr, rout imperfections in parent metal or weld joint to expose clean sound metal.

(c) Using fusion weld method per SP No. 5001 in Appendix E and welding wire (item 348, table C–1), repair parent metal cracks.

(d) Clean areas to be welded with acetone (item 13, table C–1).

(e) Position replacement adapter P/N 1-130-026-02 as shown in figure 5-245.

(f) Tack weld adapter to combustion chamber housing, using welding wire (item 345, table C–1).

(g) Using fusion weld method per SP No. 5001 in Appendix E, and welding wire (item 345, table C–1). weld adapter to housing.

(h) Visually and fluorescent-penetrant inspect the welded areas. No cracks allowed.

c. Repair of Atomizing Holes.

(1) Remove seal guide.

(2) Removal material as shown in figure 5-247 from damaged end liner comes by machining, abrasive cut or other practical method.

(3) Rout cracks that exceed DMWR limits and TIG weld, per MIL-W-8611, using welding wire (item 351, table C–1).

(4) Blend all welds to original contour and thickness.

(5) Fabricate washer-shaped part for replacement of damaged material removed in (2) above, from sheet alloy (item 299, table C–1) in same thickness as original, as shown in figure 5-247. Washers may be cut from sound portions of scrapped liners.

(6) Weld in place by method same as (3) above. Blend weld to manufacturers' drawing specification.

d. Repair for Damaged Igniter and Fuel Adapter Threads.

(1) Repair damaged igniter boss threads that cannot be restored using a chasing tool, tap or die as follows:

(a) Remove damaged threads by machining.

CAUTION

To prevent warping housing, use only enough heat to perform task.

(b) Using a suitable fixture to restrain housing, build up hole by welding per SP No. 5001 using welding wire (item 345, table C–1). Use only enough material around perimeter of hole to replace threads.

(c) Drill hole, tap and finish machine area per Manufacturer's Drawing.

NOTE

Back up parent metal with inert gas or copper during welding.

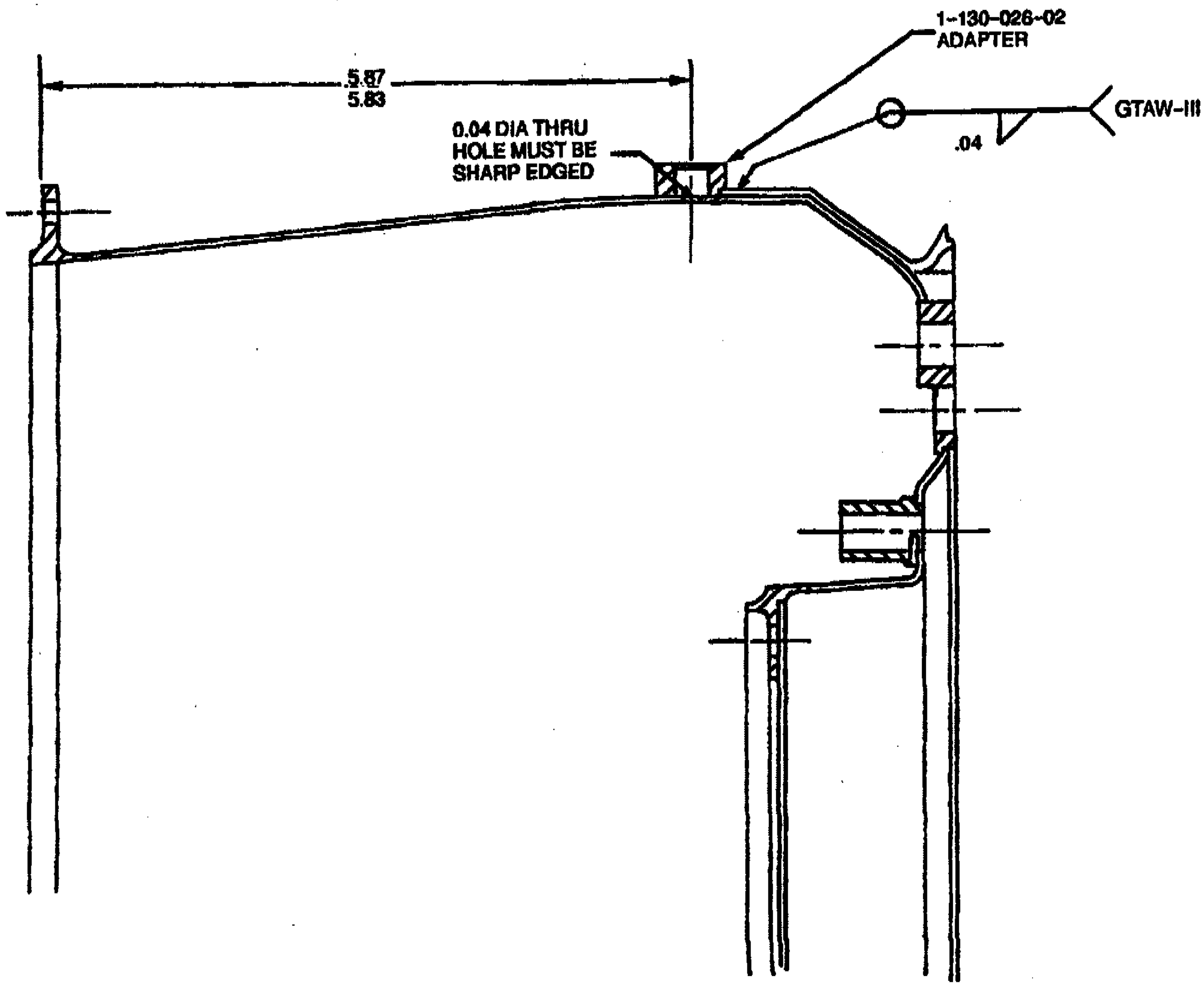


Figure 5-244. Static Pressure Tap Adapter (Sheet 1 of 2).

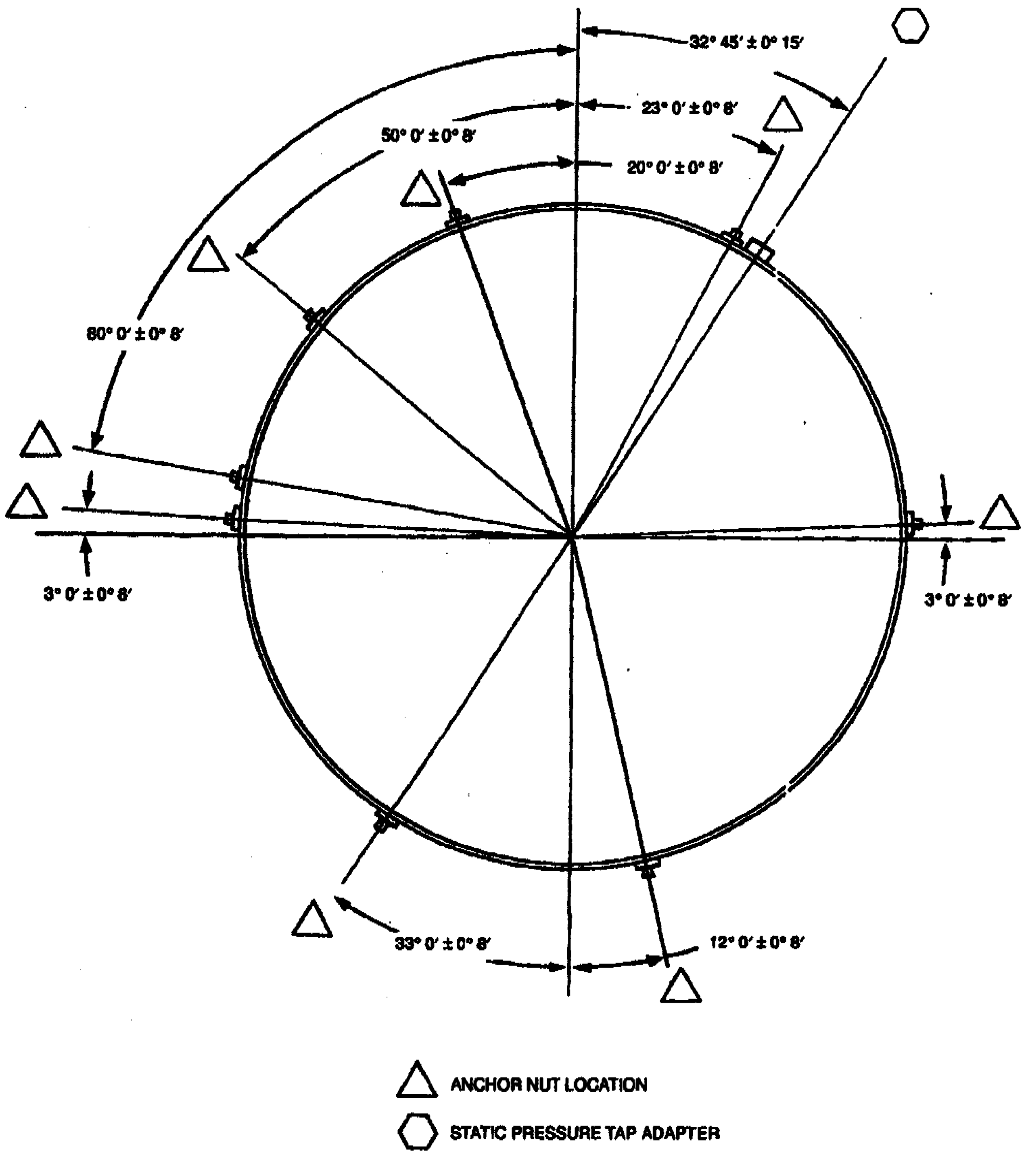


Figure 5-244. Static Pressure Tap Adapter (Sheet 2 of 2).

(2) Electron beam weld repair for damaged igniter and fuel adapter threads. Repair as follows:

(a) Drill out 7/16-28 threaded hole to 0.5000 inch diameter in the igniter adapter or drill out 1/4-28 threaded hole to 0.3125 inch diameter in the fuel adapter. Refer to figure 5-245.

(b) Fabricate a plug from AMS5745 steel bar as follows:

1 Machine OD to 0.0005 to 0.0010 inch tight fit with hole.

2 Cut length to allow 0.005 to 0.010 inch protrusion above and below hole to be plugged.

3 Press plug into hole.

4 Electron beam weld all around plug in accordance with SP No. 5005 in Appendix E.

5 Visually and fluorescent-penetrant inspect weld per limits in SP No. 5005 in Appendix E.

6 Machine plug flush per figure 5-244.

7 Drill hole, tap, and finish machine area per figure 5-244.

(3) Repair elongated guide pin hole as follows:

(a) Clean part and build up hole by welding per SP No. 5001, Appendix E, using welding wire (item 348, table C–1).

(b) Drill hole and finish machine area per figure 5-246.

(c) Fluorescent-penetrant inspect repaired area. No crack allowed.

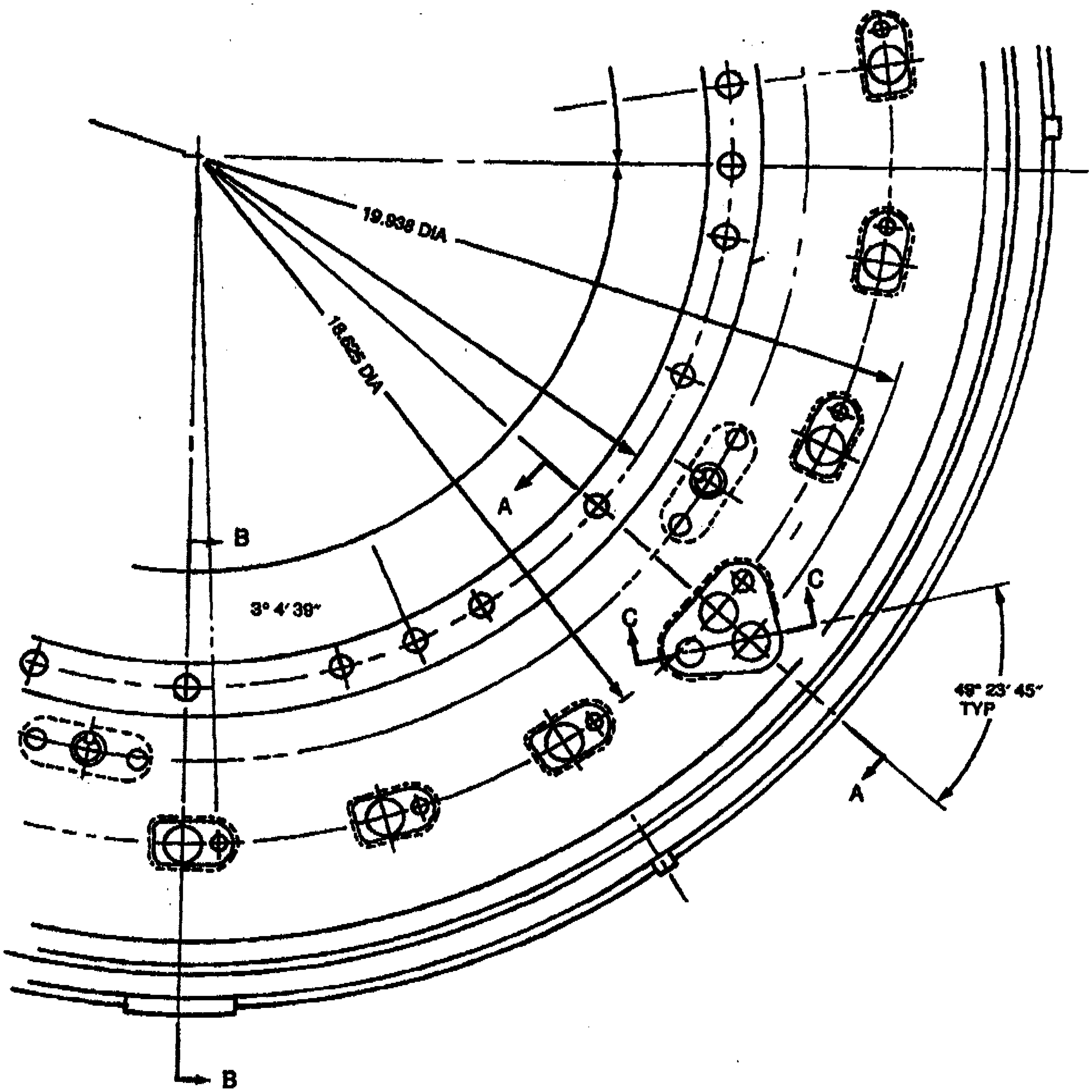


Figure 5-245. Ignitor and Fuel Adapters, Combustor Housing (Sheet 1 of 2).

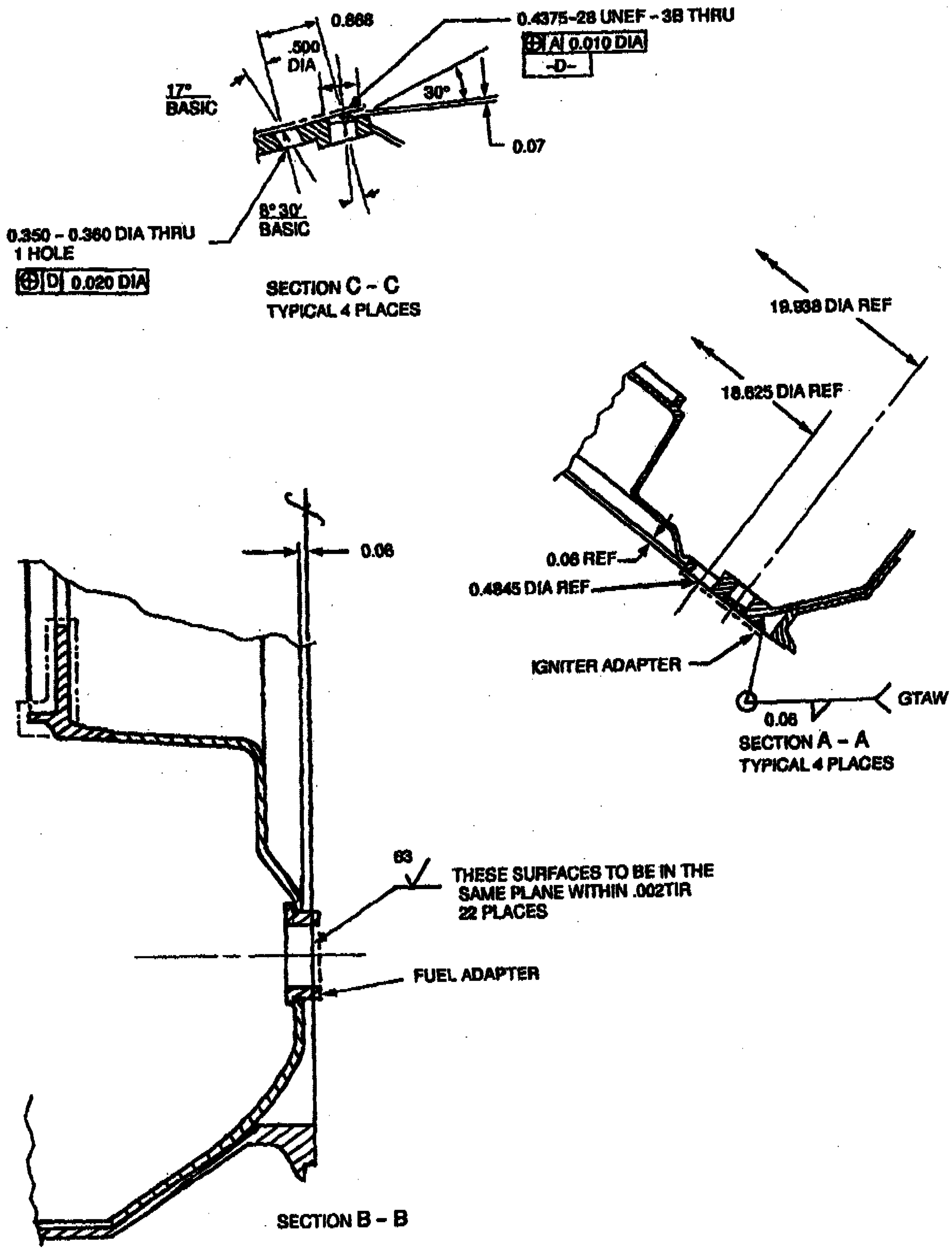


Figure 5-245. Ignitor and Fuel Adapters, Combustor Housing (Sheet 2 of 2).

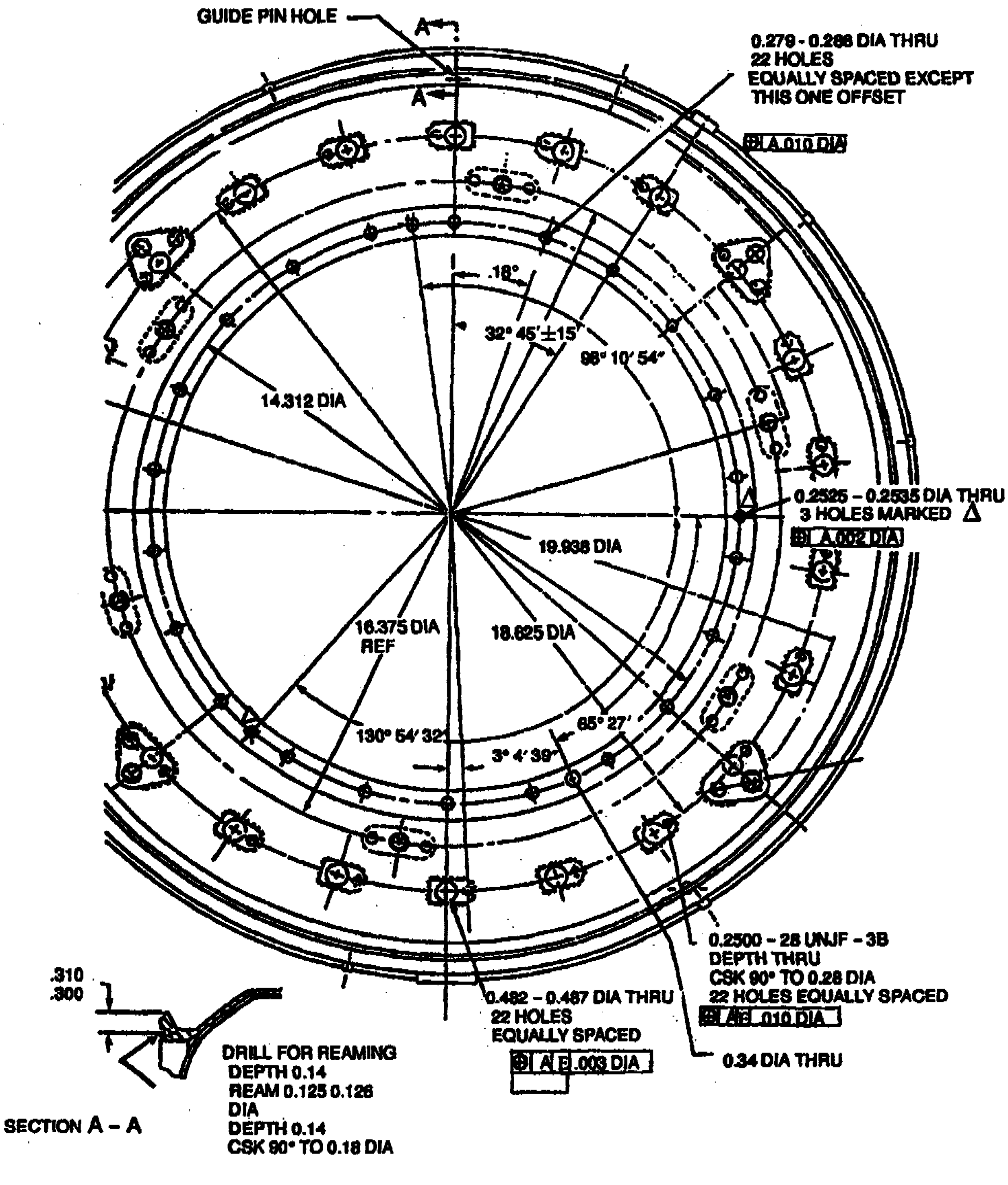


Figure 5-246. Combustion Chamber Housing Guide Pin Hole.

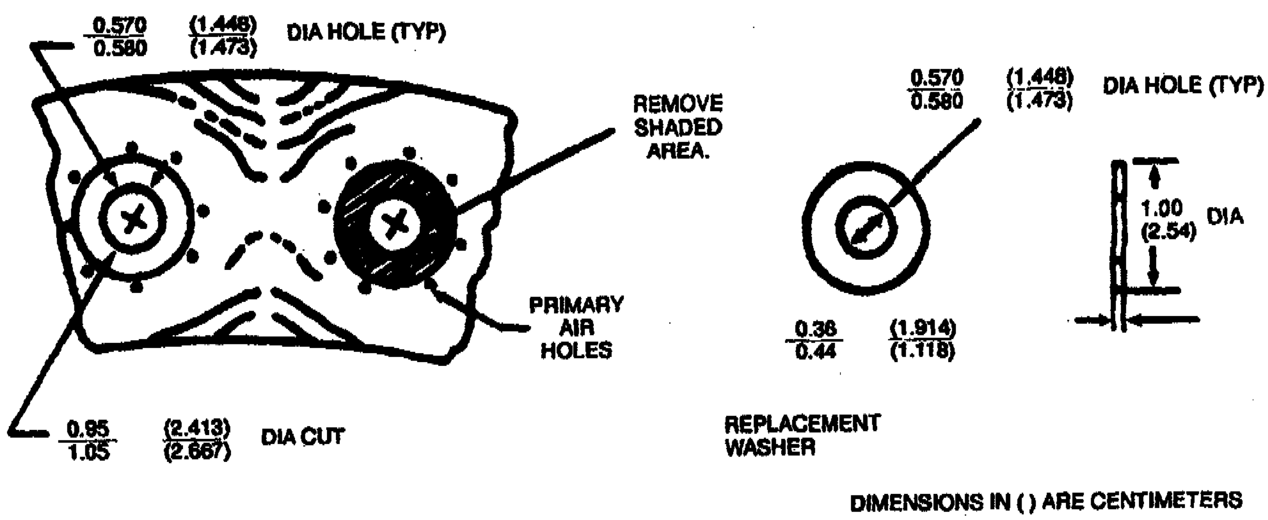


Figure 5-247. Combustion Chamber Liner Rework.

5-300. REASSEMBLY. Combustion chamber assembly is reassembled during reassembly of combustor turbine assembly.

5-301. FUNCTIONAL TEST. Functional test is not required.

5-302. FUEL MANIFOLD (COMPLETE) ASSEMBLY.

5-303. DISASSEMBLY. Complete disassembly procedures are presented in the following steps. Prior to disassembly, remove and clean primary filter assembly (9, figure 5-248) and secondary filter assembly (10). Reinstall filters and perform functional test, in accordance with paragraph 5-308 to determine if fuel manifold (complete) assembly is acceptable or to determine discrepant components. Disassemble fuel manifold (complete) assembly only to the extent required to remove and replace necessary seals and discrepant parts.

a. Remove three screws (1), and sealing gaskets (2) from manifold (7).

b. Remove screw (1), and sealing gasket (3) from manifold (7). Discard gasket.

c. If present, break weld between primary filter assembly (9), and manifold (7). Remove primary filter assembly from manifold.

d. Remove packing (8) from manifold (7).

e. If present, break weld between secondary filter assembly (10) and manifold (7). Remove secondary filter assembly from manifold.

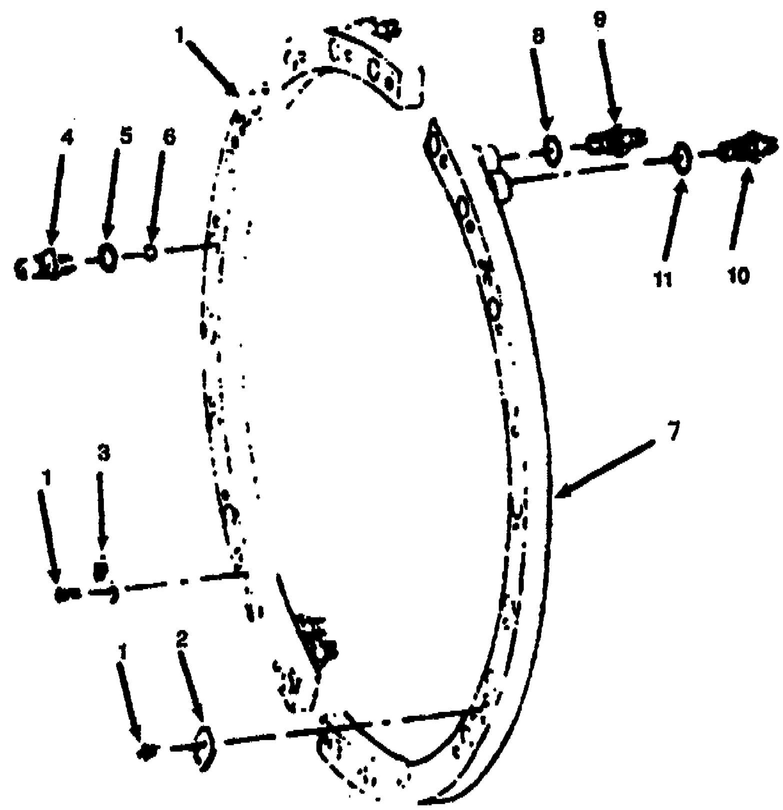


Figure 5-248. Fuel Manifold (Complete) Assembly.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-248	No Number	FUEL MANIFOLD ASSEMBLY AND PARTS (NHA 1-130-630-08, 1-130-630-19, and 1-130-730-02)	Ref	
-1	AN507C836-5	. SCREW	4	
-2	1-130-23 6-03	. GASKET, Sealing	4	
-3	1-130-23 6-02	. GASKET, Sealing (Replace with 1-130-236-03)	4	C
-4	6660001	. NOZZLE, Fuel injection, atomizing (09523) (Lycoming Source Cont Dwg 1-300-347-01)	22	
	26518	. NOZZLE, Fuel injection, atomizing (71895) (Alternate) (Lycoming Source Cont Dwg 1-300-347-03)	22	
-5	3-904L610-8	. PACKING, Performed (83259) (Lycoming Source Cont Dwg 1-300-369-01)	22	
	3-6-8S58	. PACKING, Preformed (07060) (Alternate) (Lycoming Source Cont Dwg 1-300-371-02)	22	
	906-11628	. PACKING, Preformed (07060) (Alternate) (Lycoming Source Cont Dwg 1-300-371-02)	22	
-6	AR100187-009	. SEAL, Plain (00624) (Lycoming Source Cont Dwg 1-300-366-01)	22	
	CEC3043	. SEAL, Plain (07060) (Alternate) (Lycoming Source Cont Dwg 1-300-366-02)	22	
	11811	. SEAL, Plain (12599) (Alternate) (Lycoming Source Cont Dwg 1-300-366-02)		
-7	1-130-720-02	. MANIFOLD ASSEMBLY	1	
-8	3-6L610-8	. PACKING, Preformed (83259) (Lycoming Source Cont Dwg 1-300-371-01)	2	
	3-6-8S58	. PACKING, Preformed (07060) (Alternate) (Lycoming Source Cont Dwg 1-300-371-02)	2	
	906-11628	. PACKING, Preformed (25184) (Alternate) (Lycoming Source Cont Dwg 1-300-371-03)		
-9	54321-1	. FILTER ASSEMBLY, Relief valve, primary (15472) (Lycoming Source Cont Dwg 1-300-361-01)	2	
	21228-3	. FILTER ASSEMBLY, Relief valve, primary (10989) (Alternate) (Lycoming Source Cont Dwg 1-300-361-02)	2	
-10	54322-1	. FILTER ASSEMBLY, Relief valve, secondary (15472) (Lycoming Source Cont Dwg 1-300-362-01)	2	
	21228-4	. FILTER ASSEMBLY, Relief valve, secondary (10989) (Alternate) (Lycoming source Cont Dwg 1-300-362-02)	2	
-11	3-6L610-8	. PACKING, Preformed (83259) (Lycoming Source Cont Dwg 1-300-371-01)	2	
	3-6-8S56	. PACKING, Preformed (07060) (Alternate) (Lycoming Source Cont Dwg 1-300-371-02)	2	
	906-11628	. PACKING, Preformed (25184) (Alternate) (Lycoming Source Cont Dwg 1-300-371-03)	2	

f. Remove packing (11) from manifold (7).

g. If present, break weld between fuel nozzles, (4) and manifold (7). Using 7/16, 6-point deep socket 701411, or equivalent, or 7/16, 6-point deep socket with bolt clearance diameter reamed to 7/16 inch, remove fuel nozzles(4), packings (5), and seals (6) from manifold (7).

NOTE

Removal procedure is the same for each of the 11 nozzles on each manifold half. During storage or shipment, nozzles shall be individually packaged in paper (item 235, table C–1).

h. Cap or plug all openings and parts to prevent entry of foreign objects.

5-304. CLEANING. Proceed as follows:

CAUTION

Prior to cleaning, cap or plug all openings and parts to prevent entry of foreign objects. Clean only exterior surface of fuel manifold (complete) assembly.

NOTE

Inspect and, if necessary, remove transferred metal or other foreign material from start nozzle interface area on manifold. Ensure that this interface area is free of all defects or foreign material.

a. Clean fuel manifold (complete) assembly using dry cleaning solvent method. (Refer to SP No. 3002 in Appendix E.)

b. Using dry cleaning solvent (item 134, table C–1) and stiff fiber brush, clean primary and secondary filter assemblies (9 and 10, figure 5-248).

WARNING

The following procedure generates toxic fumes. Perform cleaning in a well ventilated area.

c. Complete manifold assemblies that are not required to be disassembled completely may be cleaned externally as follows:

(1) Attach manifold primary ports with filters to a fuel hose arrangement connected to an air supply. Cap secondary ports 1 and 2. Apply air at approximately 3 psi to give a positive air flow through the fuel nozzles to prevent entrance of cleaning solutions.

(2) Clean assemblies in an ultrasonic cleaner using cleaning solution (item 321, table C–1 or equivalent) for 5 minutes.

(3) Rinse manifolds in rinse tank with positive air flow through manifolds at approximately 3 psi pressure.

(4) Blow dry manifolds with air.

(5) Flow test manifolds and replace parts as necessary.

(6) Individual nozzles may be cleaned externally using this method by installing the nozzles on a slave manifold.

NOTE

The procedure given in following step d applies to completely stripped manifolds (7) only.

d. Clean manifold using ultrasonic cleaner, P/N US3F-24185, or equivalent, as follows:

CAUTION

In following step (1), if fluid level is not at proper level, ultrasonic cleaner coils may be damaged.

(1) Check fluid level in boiling sump. Fluid level shall be approximately 2 inches (5.08 cm) below the center divider before performing the following steps:

(2) Position main power electrical switch to ON.

(3) Turn COOLING WATER valve to ON.

(4) Position HEAT switch to ON.

(5) Position ultrasonic generator switch to ON.

(6) Position CONTROL switch ON. Ultrasonic sump will start to fill. When sump is filled to proper level, ultrasonic generator will start operating.

(7) When ultrasonic generator starts operating, position PUMP switch to ON.

e. Clean and air-flow test fuel nozzles (4, figure 5-248). as follows:

WARNING

In following step (1), avoid direct contact of solution with skin or eyes. This solution is a strong caustic and protective garments shall be worn when handling. Ensure that tank is exhausted to outside atmosphere.

(1) Cleaning.

(a) Remove nozzles from fuel manifold prior to cleaning.

(b) Remove traces of fuel from nozzles with clean, dry, filtered compressed air.

NOTE

Position fuel nozzles vertically with ejector tips down to facilitate cleaning and rinsing. If necessary manufacture fixture to maintain the vertical position of the nozzles.

(c) Clean nozzles for at least 15 minutes in an ultrasonically agitated tank containing Alconox (item 338, table C–1) detergent (or equivalent) 1 ounce of Alconox to 1 gallon of water. Maintain temperature of cleaning solution at 150°±10°F. Rinse nozzles under warm water spray for 5 minutes to remove detergent solution.

(d) Using an automatic Magnakleen Cylsonic (Ultrasonic) cleaning system (or equivalent) mix 17 pounds of Ultra-Kleen cleaning compound (98, table C–1) or equivalent to 17 gallons of water.

NOTE

Before filling up Magnakleen makeup tank with water, pre-mix dry cleaning compound in a five (5) gallon bucket with water at room temperature. Mix in bucket until all compound is dissolved and liquid becomes clear. Slowly add mixture to makeup tank with water in accordance with instructions contained in Magnavue, Inc. manual.

(e) Turn on machine and set thermostat at 190°F.

(f) When the ready light comes on, load the racks and place in cleaning reservoir. Push cycle "start" button. Ensure jet nozzles are placed with their support assembly in basket and with nozzle/nut facing down.

(g) Wash nozzles in bath for 2 to 2-1/2 hours.

(h) Use rinse cycle for 5 minutes.

(i) Remove supports from bath and rinse nozzles under warm water spray for 5 minutes followed by rinsing in warm water with several rinse-drain cycles for 15 minutes.

NOTE

Nozzles may be vacuum backflushed with warm water.

(j) Remove nozzles from warm water rinse and test several nozzles for the presence of residual alkali with acid-base indicating paper. If any nozzle tested shows alkali is present (paper turns blue), continue testing until a negative test for alkali is obtained.

(k) Remove residual water from nozzles with dry, clean, filtered compressed air.

CAUTION

Perform operation under a hood and wear safety glasses.

(l) Heat cleaned nozzles in a hot air dryer maintained at 200°F for approximately 30 minutes.

(m) Conduct manifold test. Reclean any low flow nozzles failing manifold test in Cylsonic Cleaner. Reject any high flow nozzles failing manifold test and do not reclean.

(2) Air gage screening test.

(a) Purpose: This is a quick, inexpensive test used to measure the effectiveness of the cleaning procedure. Test results show: that a nozzle is ready for the more extensive DMWR flow test: that further cleaning is required; or that the nozzle should be scrapped without further expense.

(b) Equipment required:

1 Sheffield Modular Precisionaire Column Air Gauge Instrument (Bendix Corporation), Automation and Measurement Division.

2 "Master" fuel injection nozzles:

a Select four (4) of each type nozzle for use as "master" nozzles in calibrating the air gauge.

b The "master" nozzles, when flow tested per DMWR, should represent (respectively): minimum primary flow rate; maximum primary flow rate; minimum combined flow rate; and maximum combined flow rate.

(c) Calibration of air gauge tool:

1 Using "master" nozzles with air pressure set at 10±1 psig, (703.1±70.3 gm sq cm) establish upper and lower float limits.

2 Because at varying air temperature and degree of contaminants in the air, it may be necessary to reestablish flow limits several times during a test day. Experience should dictate whether this is necessary.

3 When not in use, "master" nozzles should be properly stored to prevent contamination.

NOTE

Gauges associated with this equipment do not need to be individually calibrated as master nozzles will be utilized by shop personnel to obtain reference settings.

(d) Procedure:

1 Functionally-test fuel nozzles per DMWR. Scrap fuel nozzles which fail maximum flow requirements. Clean and air test nozzles which fail to meet minimum flow requirements.

2 Fuel nozzles which fail to meet minimum flow requirements on air gauge shall be recleaned. Scrap fuel nozzles that fail to meet minimum air flow requirements after recleaning.

3 Fuel nozzles which pass minimum air flow requirements after cleaning, shall be placed in self sealing bag or equivalent container to prevent contamination.

5-305. INSPECTION. Perform specific inspections listed in table 5-95.

Table 5-95. Inspection of Fuel Manifold (Complete) Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135				
-32	Main Fuel Manifold Assembly	Visual	Discrepant components	Not allowed. Replace.
5-248				
-4	Fuel Nozzle	Visual	Scratches, wear deformation, or other slight damage	Refer to paragraph 5-306.
-7	Manifold	Visual	Cracks	Not allowed. Replace.
			Crossed, stripped or worn threads	Not allowed. Replace.
			Clogged passages	Clean. (Refer to paragraph 5-304.)
		Visual and Functional Test	Crossflow between primary and secondary passages	Refer to paragraph 5-306.

5-306. REPAIR. Proceed as follows:

CAUTION

Repair of fuel nozzles (1-300-347-01) shall be accomplished only if nozzle fails functional test (paragraph 5-308). Ensure extreme care is exercised during disassembly and reassembly of nozzles, by properly trained personnel with adequate equipment in clean shops with air-conditioned and humidity-controlled facilities.

NOTE

Repair of the fuel manifold (complete assembly) is limited to the repair of individual fuel nozzles, 1-300-347-01 only, in accordance with the following procedures: other damaged components shall be replaced. Proceed as follows: (See figures 5-249 through 5-253.)

a. Inspect nozzles for obvious physical defects. (For nozzles having only excessive shroud damage, hold nozzle for pending shroud replacement procedure.)

b. Inspect assembled nozzles (exterior only) in accordance with following step g.

c. Clean assembled nozzles as outlined in paragraph 5-304, step e.

d. Perform fuel flow and air shroud blockage functional test in accordance with applicable steps in paragraph 5-308, with the exception that the flow values for functional test are as follows:

Primary - 156 to 170 cc in 170 seconds
Combined- 165 to 172 cc in 40 seconds

NOTE

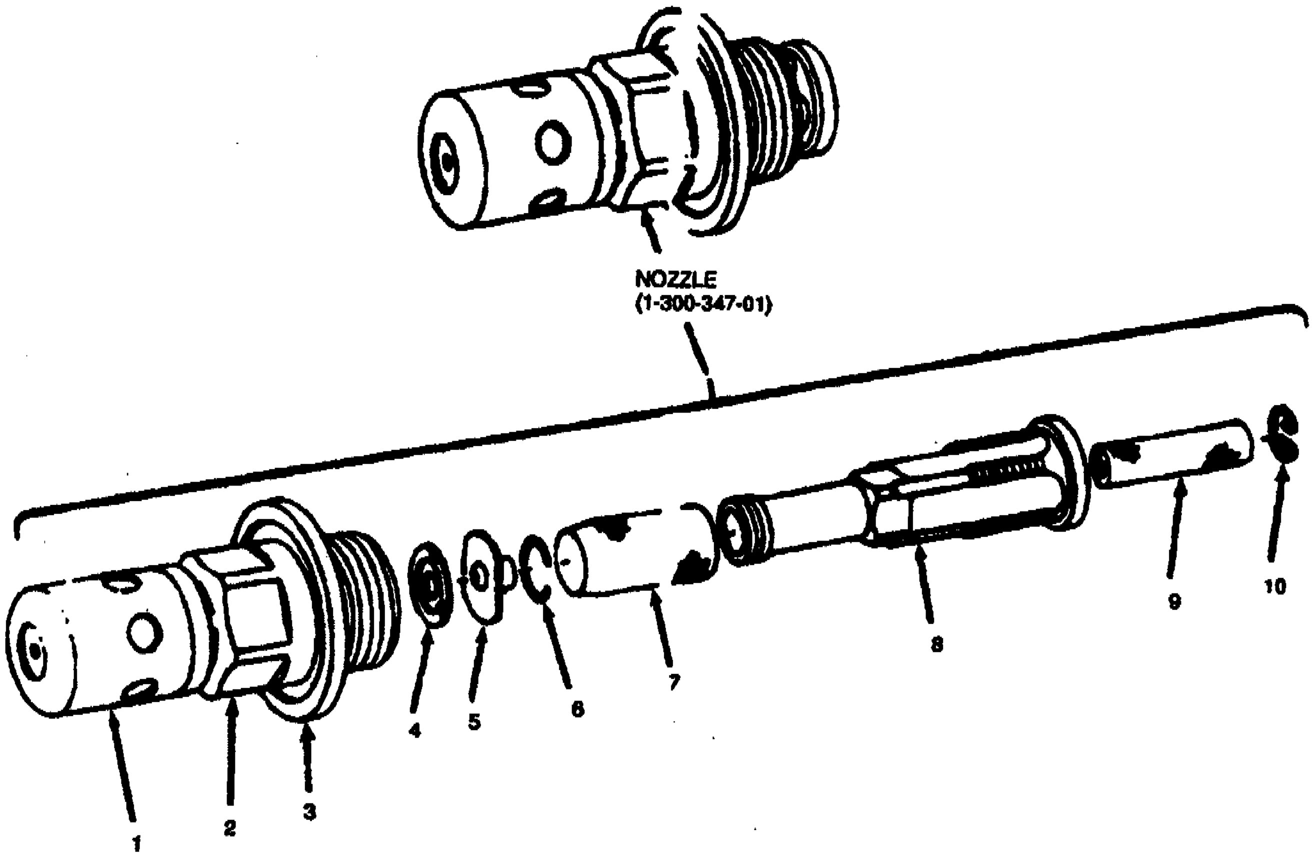
Nozzles shall be inserted in a new manifold half with applicable seals and correct torque.

(1) Nozzles, which pass functional test, shall be identified and packaged in accordance with following step m.

(2) Nozzles that have failed to meet the fuel manifold assembly functional test requirements for minimum primary and combined flow rates specified shall be reworked per paragraph 5-304.

NOTE

Fuel nozzles exceeding maximum primary and combined flow rates should be scrapped without further expense. The air flow test can be used to select potential repairable fuel nozzles if records as to cause of rejection are not available.



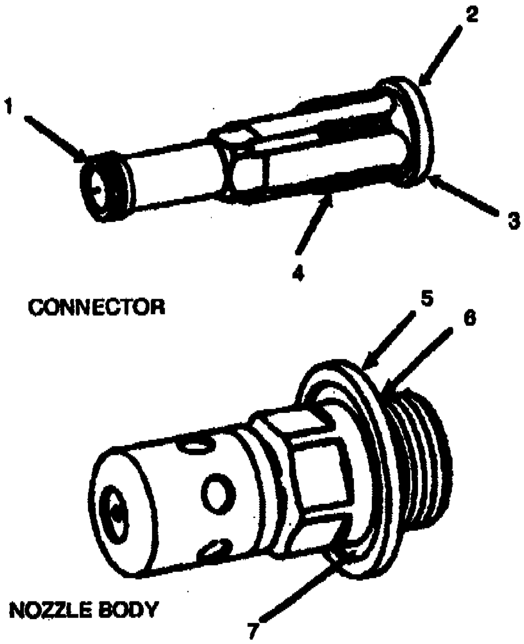
1. SHROUD, P/N 1445-663101
2. BODY SUBASSEMBLY, P/N 1445-663098
3. FLANGE
4. SECONDARY RING, P/N 1445-663102
5. PRIMARY TAP AND SWIRL PLUG, P/N 1445-663103
6. SECOND RETAINING RING, P/N 1445-663112
7. SECONDARY SCREEN, P/N 1445-663107
8. CONNECTOR, P/N 1445-663106-1 THROUGH -9
9. PRIMARY SCREEN, P/N 1445-663108
10. PRIMARY RETAINING RING, P/N 1445-663113

Figure 5-249. Atomizing Nozzle - Exploded View.

e. Disassemble rejected nozzles as follows: (See 5-249.)

NOTE

For limited or full rework, all parts shall be maintained as matched sets with the exception of screens and retaining rings. Place parts in suitable tray, as removed, ensuring matched sets are kept together.



1. FRONT FACE
2. REAR FACE
3. FLANGE
4. THREADS
5. FLANGE
6. O-RING SEAL AREA
7. SEAL GROOVE AREA

Figure 5-250. Nozzle Body and Connector.

(1) Clamp nozzle in holding fixture, P/N PH106-1-102, or equivalent, and holding collar, P/N PH106-0-167, or equivalent.

(2) Bend back crimps on body subassembly (2); then remove connector (8) from body subassembly.

(3) Remove primary retaining ring (10) and secondary retaining ring (6) from connector; then remove primary screen (9) and secondary screen (7).

(4) Remove primary tip and swirl plug (5) and secondary ring (4) from body subassembly.

f. Clean disassembled nozzle as follows:

(1) With individual parts in suitable tray and matched sets together, clean in accordance with preceding step c.

(2) Wire-brush connector (8) and body subassembly (2), as necessary, to remove minute deposits and burrs, particularly in crimped areas. (See figure 5-252.)

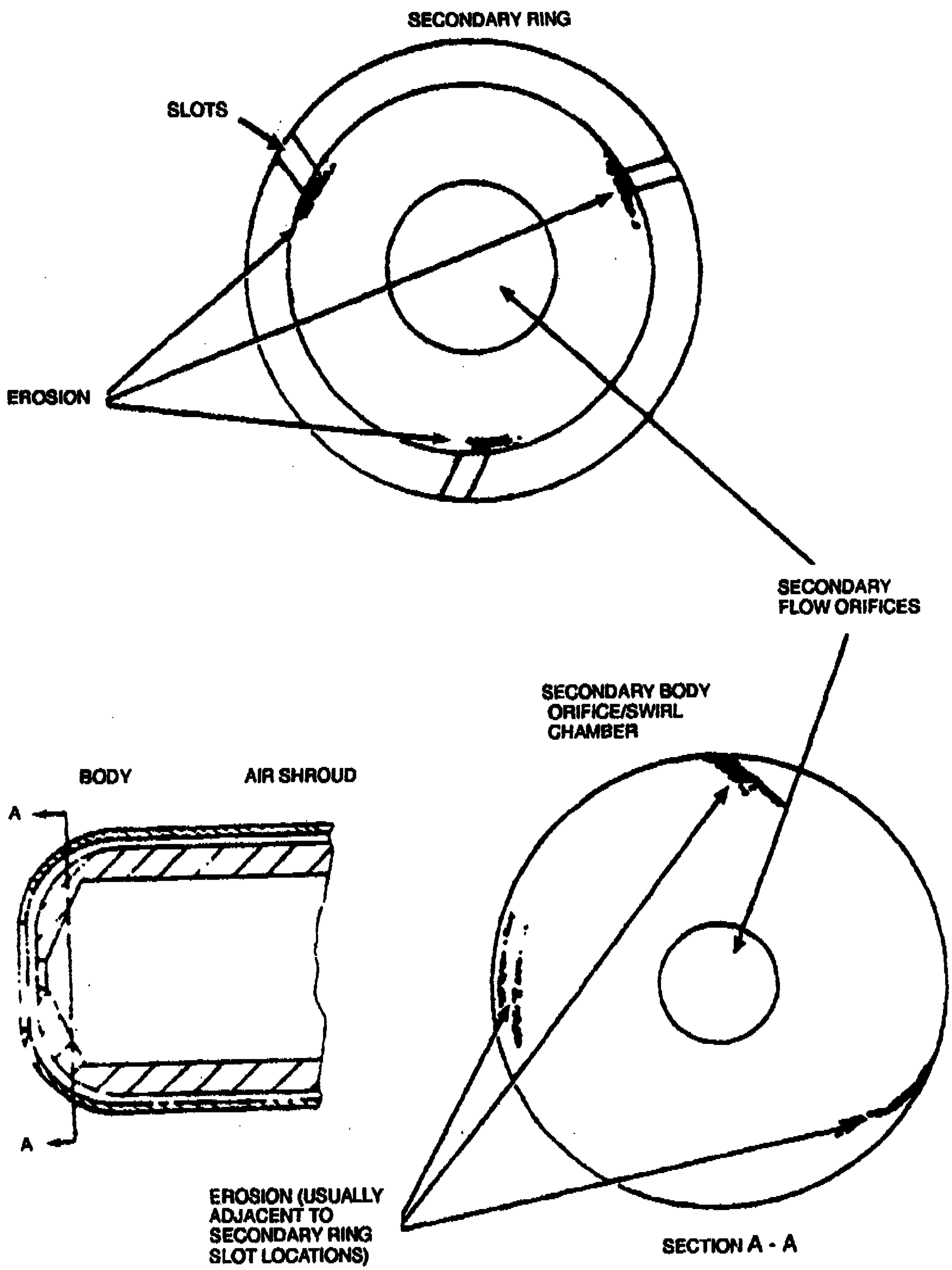


Figure 5-251. Nozzle Body and Secondary Ring/Swirl Chamber - Inspection.

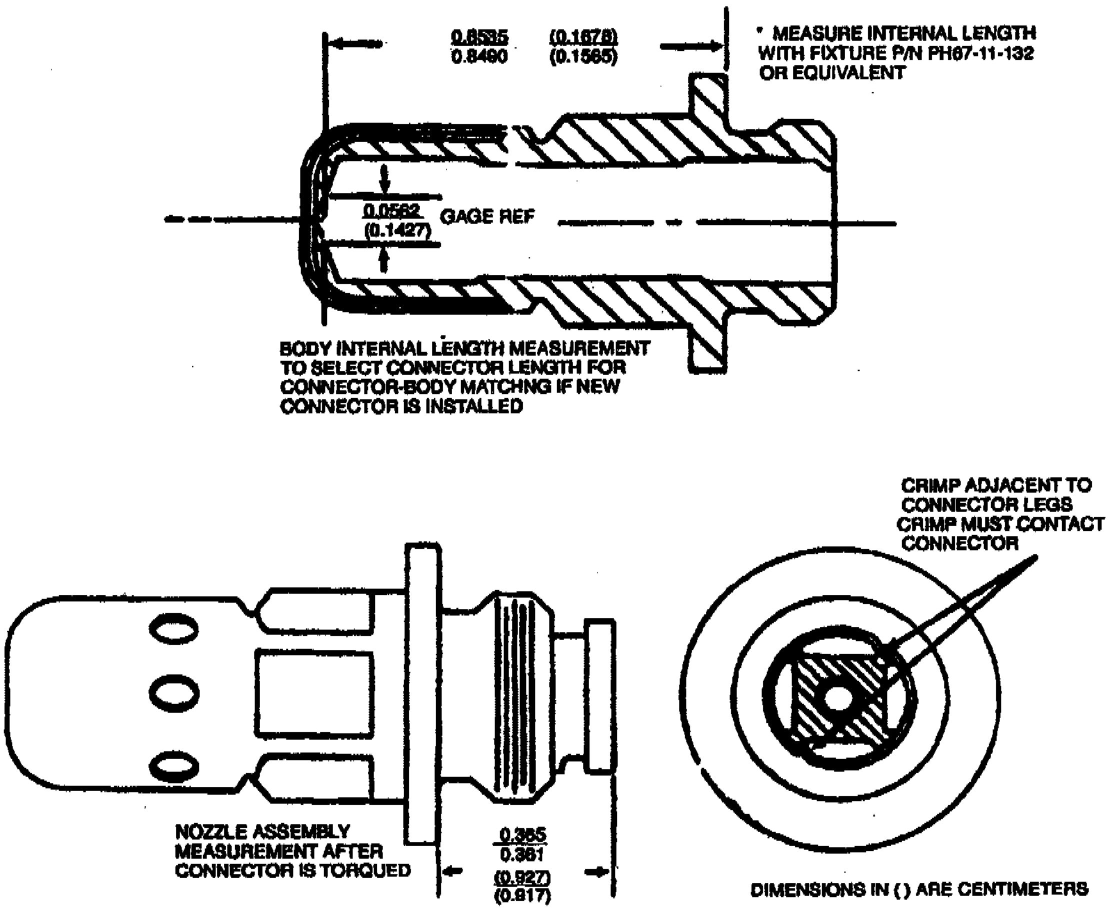


Figure 5-252. Nozzle Dimensions.

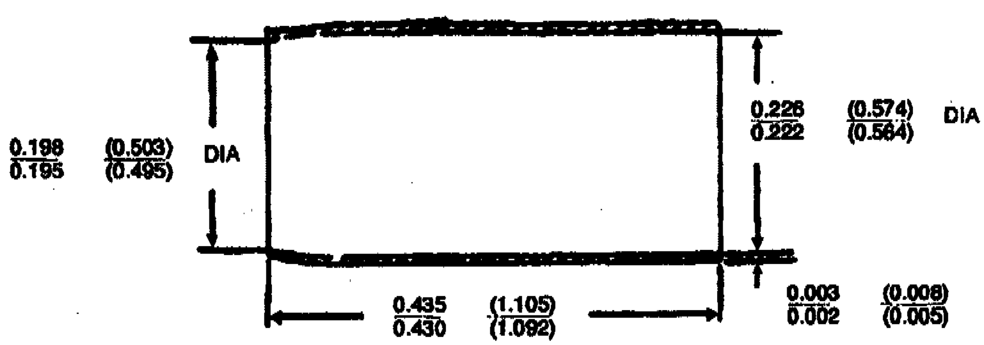


Figure 5-253. Nozzle Secondary Screen Dimensions for Fabrication of Sizing Brass Rod.

g. Inspect assembled or disassembled atomizing nozzle, as applicable, by checking the nozzle body subassembly (2, figure 5-249) and components as follows:

(1) Threads. (See figures 5-249 and 5-250.) Damage is permitted, provided it can be cleaned up with a file or thread chaser. Discard nozzle if threads are stripped or heavily gouged.

NOTE

Thread size is 0.4375-28 UNEF-2A MOD. MAJ. Diameter 0.421 to 0.427 MOD PDO. 40967 to 0.4132.

(2) Flange (3, figure 5-249). Inspect as follows:

(a) Thread Side - no radial or circumferential scratches are permitted in O-ring seal area that cannot be refinished to a 63 RMS finish. No uneven surface depression is permitted outside O-ring seal area (125 RMS finish necessary from O-ring seal area to flange OD). Flange deformation shall not exceed 0.006 inch (0.015 cm) TIR, measured perpendicularly between flange aft face and mounting threads.

NOTE

O-ring seal area is defined as the area between the thread OD and a point measured approximately 0.050 inch (0.127 cm) radially inward from the flange OD.

(b) Hex Side - No wear or fretting is permitted in seal groove area that cannot be finished to a 63 RMS finish. Minor eccentric scoring outside the seal groove area is acceptable, provided it can be cleaned up to minimum 125 RMS finish. No burr marks allowed at seal groove area.

(c) Width - Must be maintained at 0.0535 to 0.0595 inch (0.1359 to 0.1511 cm).

(3) Hex - Must not be excessively stripped or rounded on all hex faces. Where excessive stripping is noted, hexes must have at least two opposing faces which will accept an open-end wrench. A minimum of 80 percent of usable wrench face areas shall remain.

(4) Orifice and/or Swirl Chamber Areas (figure 5-251). Proceed as follows:

(a) Secondary Ring - Erosion or flange deformation is not permitted. Slot blockage or erosion is not permitted.

NOTE

If secondary ring (4, figure 5-249) is eroded, both secondary ring and primary tip and swirl plug (5) must be replaced with new parts. (These two parts are matched and must be procured and used as a matched metering set.)

(b) Secondary Orifice - Damage or scratch marks are not permitted.

(c) Secondary Swirl Chamber - Scoring is not permitted. Erosion to 0.005 inch (0.013 cm) depth is acceptable. Any other erosion is not permitted. (This erosion to be visually measured with reference to a nozzle chamber having known 0.005 inch (0.013 cm) depth erosion.)

(5) Connector (8). Inspect as follows:

(a) Front or Rear Seal Faces (see figure 5-250) - Minor discrepancies are permitted, provided they can be finished to a 32 RMS finish (rear surface) and a 16 RMS finish (front surface) without deviating from 1.1500 to 1.1544 inch (2.9210 to 2.9322 cm) connector length requirements. Minor thread damage is permitted, provided it can be cleaned up with a file or thread chaser.

(b) Flange (3, figure 5-250) - Allowable O.D. 0.328 to 0.334 inch (0.833 to 0.848 cm). (Blueprint 0.332 to 0.334 inch (0.843 to 0.848 cm)).

(6) Shroud (1, figure 5-249.)

(a) Shroud Depressions - Any cave-in or other heavy depression of the shroud is unacceptable. Minor fretting or marking of the shroud is acceptable, provided depression depth does not exceed 0.004 inch (0.010 cm).

(b) Shroud Finish - Forward section must be able to be polished to a 32 RMS finish to a point 0.200 inch (0.508 cm) measured from the front face, except in areas of minor fretting.

(c) Shroud Blockage - Perform functional test (air shroud blockage test) in accordance with paragraph 5-308.

(7) Screens (7 and 9, figure 5-249) - Crushing or breakage is not permitted. Secondary screen (7) may be reshaped, using a suitable brass rod, in accordance with dimensions specified in figure 5-253.

(8) Retaining Rings (6 and 10, figure 5-249). Replace if damaged.

h. Reassemble nozzles as follows: (See figure 5-249 and 5-252.)

(1) Carefully install secondary ring (4, figure 5-249) into body subassembly (2) (flanges forward).

(2) Using extreme care, install primary tip and swirl plug (5). Secondary ring (4) and primary tip and swirl plug (5) must be originally from the same nozzle, or if new, must be procured together as a matched metering set.

(3) If a new connector is being installed, select connector with same length classification number as body classification number, in accordance with following table 5-96 and figure 5-252, by measuring body internal length using measuring fixture, P/N PH 67-11-132, or equivalent, and by measuring connector length using measuring fixture, P/N PH 67-11-19, or equivalent.

Table 5-96. Nozzle Connector-Body Length Matching Requirements.

Connector Length No.	Length Inches	Body No.	Body Internal Length Inches
1	1.1500-1.1504 (2.9210 - 2.9220)	1	0.8490-0.8494 (2.1565 - 2.1575)
2	1.1505-1.1509 (2.9223 - 2.9233)	2	0.8495-0.8499 (2.1577 - 2.1587)
3	1.1510-1.1514 (2.9235 - 2.9246)	3	0.8500-0.8504 (2.1590 - 2.1600)
4	1.1515-1.1519 (2.9248 - 2.9258)	4	0.8505-0.8509 (2.1603 - 2.1613)
5	1.1520-1.1524 (2.9261 - 2.9271)	5	0.8510-0.8514 (2.1615 - 2.1626)
6	1.1525-1.1529 (2.9274 - 2.9284)	6	0.8515-0.8519 (2.1628 - 2.1638)
7	1.1530 - 1.1534 (2.9286 - 2.9296)	7	0.8520 - 0.8524 (2.1641 - 2.1651)
8	1.1535 - 1.1539 (2.9299 - 2.9309)	8	0.8525 - 0.8529 (2.1654 - 2.1664)
9	1.1540-1.1544 (2.9312 - 2.9322)	9	0.8530-0.8535 (2.1666 - 2.1679)

NOTE
DIMENSIONS IN ( ) ARE CENTIMETERS.

(4) Install, as necessary, secondary screen (7, figure 5-249) and secondary retaining ring (6) in connector (8).

(5) Insert primary screen (9) and primary retaining ring (10) into connector.

(6) Assemble matched connector into original body subassembly.

(7) Tighten connector to 14 to 16 pound-inches (2500 to 2858 sq cm torque).

(8) Inspect 0.361 to 0.365 inch (0.917 to 0.927 cm) assembly dimension. (See figure 5-252.)

i. Perform fuel flow and air shroud blockage functional test in accordance with applicable steps in paragraph 5-308, with the exception that the flow values for functional test shall be as follows:

Primary - 156 to 170 cc in 170 seconds.
Combined- 165 to 172 cc in 40 seconds.

NOTE

Nozzles shall be installed in a new manifold half with applicable seals and correct torque.

Nozzles which pass functional test shall have connector torque rechecked and then crimped in two places, 180 degrees apart, at the body aft threads adjacent to connector flange, using crimping tool, P/N PH 106-0-1020, or equivalent. (See figure 5-252.)

j. For nozzles which fail functional test (preceding step i), disassemble by removing connector (8, figure 5-249) (maintaining parts as matched sets) and remove and reject primary tip and swirl plug (5) and secondary ring (4).

k. Reassemble nozzles (preceding step h), except install new primary tip and swirl plug and secondary ring.

l. Reaccomplish functional test of reassembled nozzles and crimp nozzles which pass test in accordance with preceding step i.

NOTE

Recheck connector torque after functional test but before crimping.

m. Identification and storage or shipment instructions of nozzles after overhaul processing are as follows:

(1) Each nozzle shall be identified with the letter "R", vibroetched adjacent to the nozzle serial number.

(2) If nozzles are to be packaged in complete engine sets (22 nozzles per package), the package shall be identified "Overhaul Nozzles."

NOTE

During storage or shipment, nozzles shall first be individually packaged. (Refer to paragraph 5-303.)

5-307. **REASSEMBLY.** Proceed as follows:

CAUTION

Exercise extreme caution during reassembly to prevent foreign material from entering fuel manifold (complete) assembly or components.

a. Install seal (6, figure 5-248) in manifold (7).

CAUTION

To prevent leakage, ensure that seal is properly seated before nozzle is inserted. A cocked seal can cause leakage.

b. Install packing (5) on fuel nozzle (4), using a 7/16, 6-point deep socket, 70141H (Proto Tool Co.), or equivalent, or a 7/16 6-point deep socket with bolt clearance diameter reamed to 7/16 inch. Install nozzle (4) into manifold (7). Tighten nozzle(4) to 80 to 90 pound-inches torque.

NOTE

Installation procedure is the same for each of the 11 nozzles on each manifold half. Install protective caps over each nozzle.

c. Install packing (11) on secondary filter assembly (10) and install in manifold (7).Tighten secondary filter assembly (10) to 160 to 175 pound-inches (28576 to 31255 gm cm) torque.

d. Install packing (8) on primary assembly (9), and install in manifold (7). Tighten filter assembly (9) to 160 to 175 pound-inches (28576 to 31255 gm cm) torque.

e. Position sealing gasket (3) on right-hand fuel manifold half, in the 5-o'clock position, and secure with screw (1). Position sealing gasket (2) on right-hand fuel manifold half, in the 1-o'clock position, and secure with screw (1).

f. Position sealing gaskets (2) on left-hand fuel manifold in the 7- and 11-o'clock positions. Secure with screws (1).

WARNING

FLIGHT SAFETY PART

Verification that part passes functional test is flight safety critical.

5-308. FUNCTIONAL TEST OF FUEL MANIFOLD ASSEMBLY. (See figure 5-248.) Proceed as follows:

NOTE

If fuel manifold assembly has less than 50 hours of operation, a nozzle air blockage test, as outlined in following step b, need only be performed. If the requirements of step b cannot be obtained, perform all following procedures.

a. Functional-test fuel manifold (complete) assembly using calibrating fluid (item 68 or 69, table C–1) heated to 78° to 82°F (26° to 28°C) as follows: (Refer to test schematic, figure 5-254.)

(1) Mount fuel manifold complete assembly in modification kit (LTCT3941) or suitable flow fixture on test stand (LTCT314).

(2) Connect pressure hose from test stand to primary port number one.

(3) Connect pressure gage hose from test stand to primary port number two.

(4) Flow at 585 to 615 psig (411230 to 43239 gm sq cm) to primary port number one, and hold pressure for 1 minute. With the secondary lines disconnected, blow filtered shop air through secondary system and observe for any indication of leakage from primary into secondary. No external leakage is allowed.

(5) Decrease pressure to zero. Connect pressure hose from test stand to secondary port number one and pressure gage hose from test stand by secondary port number two.

(6) Flow at 585 to 615 psig (411230 to 43239 gm sq cm) to secondary port number one and 440 to 460 psig (30935 to 32341 gm sq cm) to primary port number one simultaneously. Hold pressure for a minimum of 1 minute. Observe for any indication of leakage at the seals between the nozzle and manifold. No external leakage allowed.

(7) Decrease pressure to zero. Remove pressure gage hose from primary port number two and cap port.

(8) Position test stand shift mechanism and TIMER SWITCH to allow fluid at 99 to 101 psig (6960 to 7101 gm sq cm) to flow through primary port number one for 170 seconds.

NOTE

Step (8) may be performed in two cycles of 85 seconds.

(9) Start timed flow test.

(10) When fluid stops flowing, check fluid level in each standpipe. Level of fluid in each of the 11 standpipes shall be 51 to 73 cubic centimeters. This is an indicated value. To obtain actual volume, add 100 cubic centimeters. Record fluid level for each nozzle.

NOTE

Card numbers at standpipes on LTCT314 stand are not marked in cubic centimeter graduations. Stand card readout must be calibrated by using a known volume of fluid in standpipes. Card then can be compensated and marked for allowable cc range.

(11) Empty calibrating fluid from standpipes.

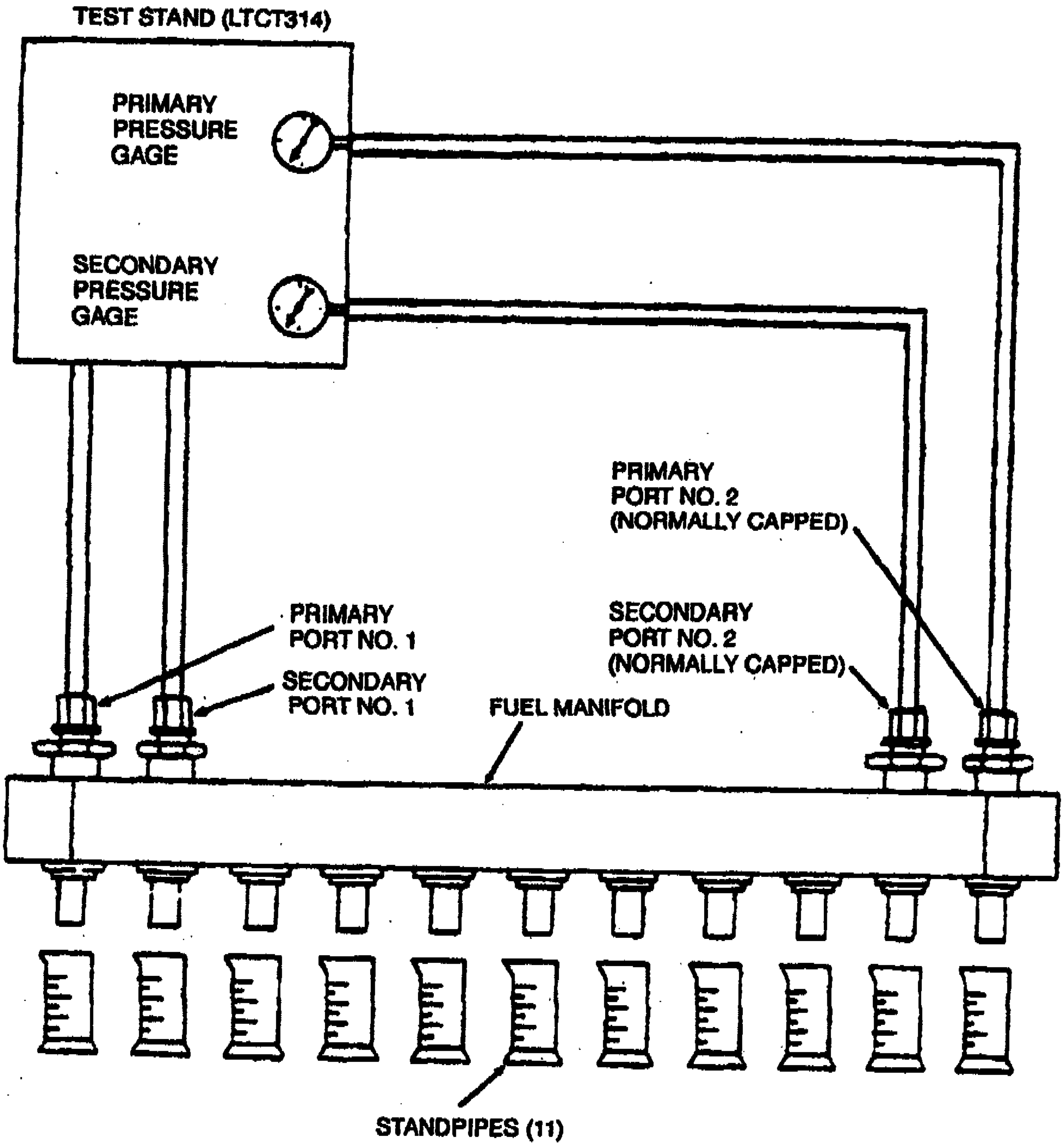


Figure 5-254. Functional Test Schematic of Fuel Manifold Assembly.

(12) Position test stand shift mechanism and TIMER SWITCH to allow fluid at 99 to 101 psig (6960 to 7101 gm sq cm) to flow simultaneously through primary port number one and secondary port number one for 40 seconds.

(13) Empty standpipes and start timed flow test.

(14) When fluid stops flowing, check fluid level in each burrette. Level of fluid in each of the 11 standpipes shall be 60 to 76 cubic centimeters. This is an indicated value. To obtain actual volume, add 100 cubic centimeters. Record fluid level for each nozzle.

NOTE

Card numbers at standpipes on LTCT314 stand are not marked in cubic centimeter graduations. Stand card readout must be calibrated by using a known volume of fluid in standpipes. Card then can be compensated and marked for allowable cc range.

(15) Empty standpipes and remove from under nozzles.

(16) Decrease pressure to zero. Disconnect and remove all test hoses and fittings from fuel manifold (complete) assembly. Remove assembly from test fixture.

CAUTION

Cap or plug all openings and ports.

(17) If fuel manifold assembly failed any of the above tests, repair or replace discrepant atomizing nozzle (1-130-347-01) only in accordance with paragraph 5-306, or replace other discrepant components, and repeat functional test.

b. After fuel flow functional test of manifold assemblies has been completed satisfactorily, perform atomizing nozzle air shroud blockage test as follows:

(1) Mount manifold assembly half in test fixture (LTCT13688) as shown in figure 5-255.

(2) Engage fixture clamps to hold manifold half in place as shown in figure 5-256.

(3) Make the following pipe connections. (See figure 5-255.)

(a) Install filtering bowl and air regulator between the air supply source and test fixture (LTCT13688).

(b) Connect manifold primary port to test stand (LTCT314).

(c) Block off manifold secondary port.

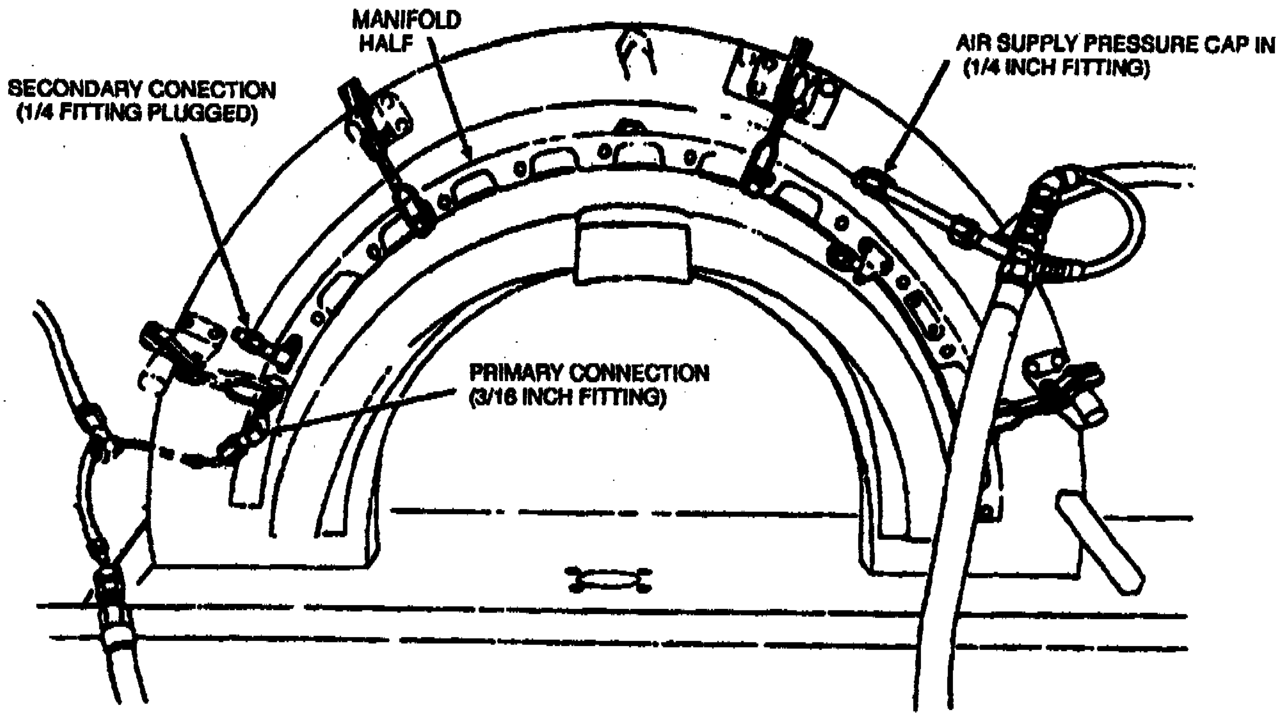


Figure 5-255. Location of Manifold and Fixture Fittings for Test.

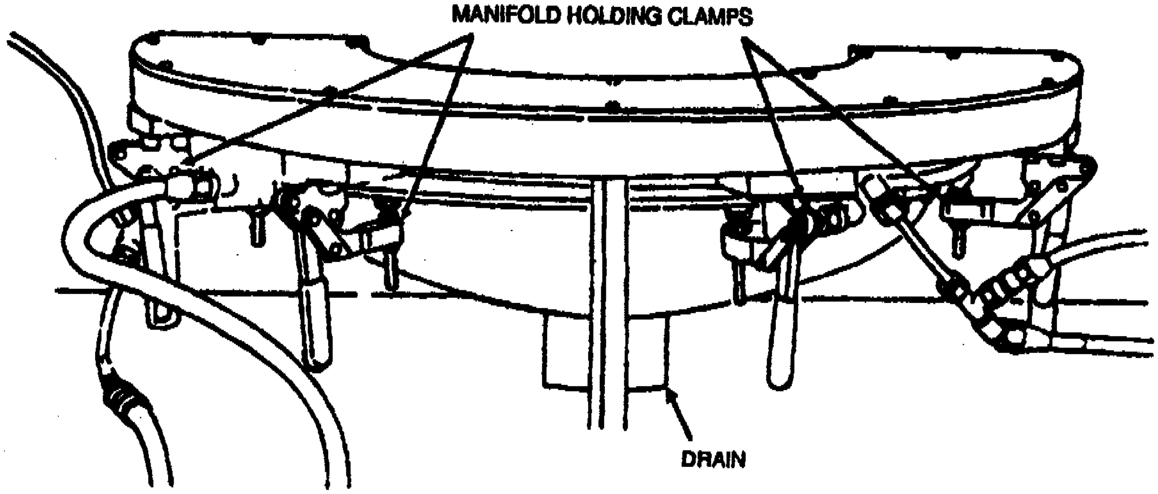


Figure 5-256. Fuel Manifold Assembly Test Fixture.

(4) Using clean, dry compressed air supply at 3 psi (211 gm sq cm) and calibrating fluid (item 68 or 69, table C-1) at 100 psig (703.7 gm sq cm) at a temperature of 78° to 82°F (26° to 28°C), perform air flow test by noting acceptable spray pattern definition on test fixture target, in accordance with figures 5-257 and 5-258.

NOTE

Air shroud blockage is evident when the resulting nozzle spray pattern is outside target parameters indicated on test fixture, or when spray pattern presents other than a circular pattern of impingement on target area. (See figure 5-257and 5-258.)

(5) Decrease pressure to zero. Disconnect and remove all test hoses, fittings, and clamps from fuel manifold assembly. Remove assembly from test fixture and blow out test fluid, using clean, dry compressed air.

CAUTION

Cap or plug all openings and ports. Safety-wire inlet elbow assemblies and covers.

(6) Repair or replace individual nozzles (1-300-347-01) only if nozzle does not meet the standards of the tests described above in accordance with paragraph 5-306. Replace all other discrepant nozzles.

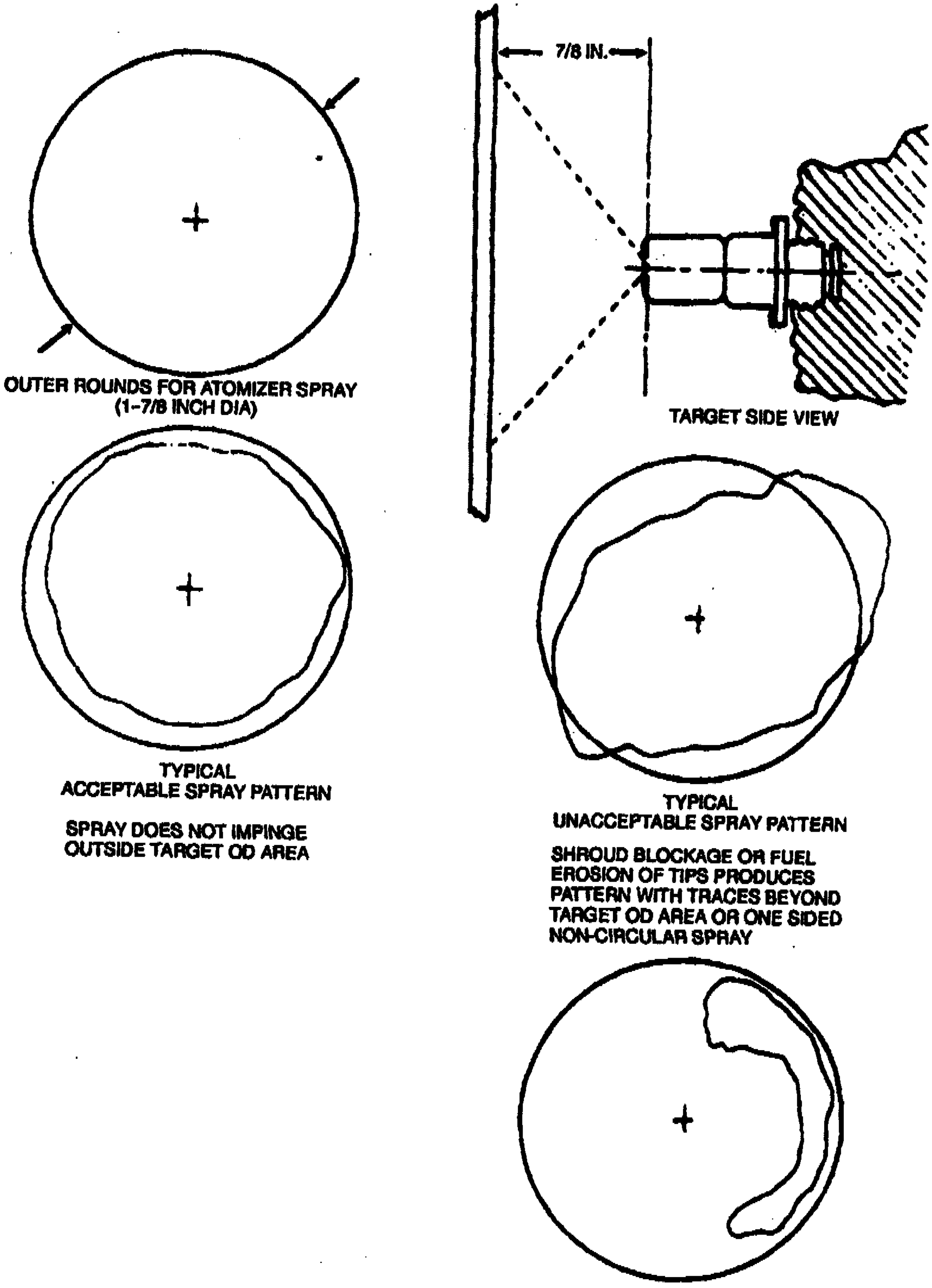


Figure 5-257. Manifold Nozzle Spray Cone Pattern Definition on Test Fixture Target.

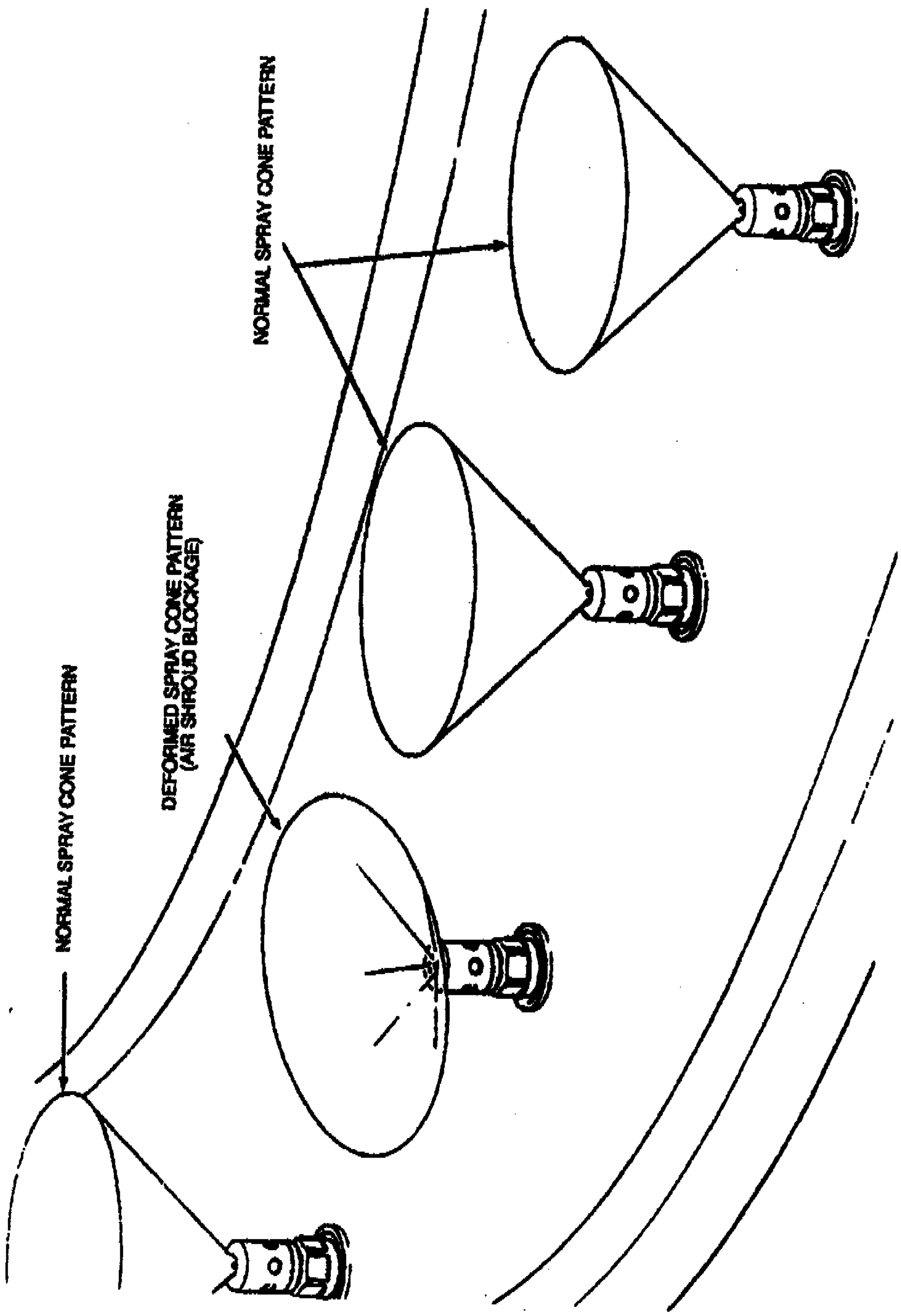


Figure 5-258. Manifold Nozzle Spray Cone Pattern Comparison (Sheet 1 of 2).

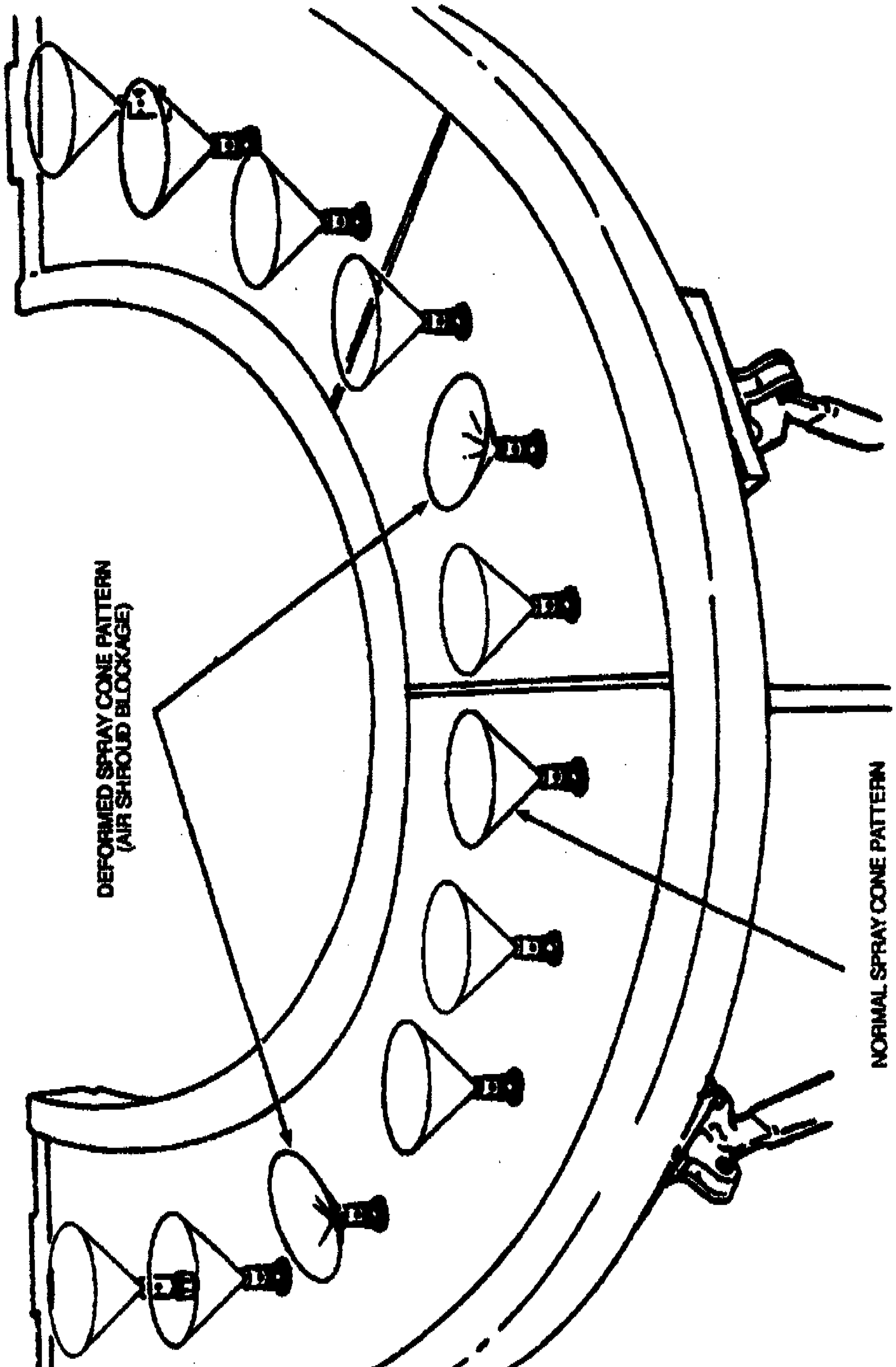


Figure 5-258. Manifold Nozzle Spray Cone Pattern Comparison (Sheet 2 of 2).

5-309. POWER TURBINE ROTOR AND BEARING HOUSING.

5-310. DISASSEMBLY. Proceed as follows:

a. Place power turbine rotor and bearing housing assembly in holding fixture (LTCT4553).

b. Straighten lock cup (21, figure 5-259), and, using wrench (LTCT 915), remove nut (20), Remove lock cup.

c. Remove screw (22) and impeller cover (23).

d. Remove second stage turbine impeller (24) and key washer (25).

e. Remove capscrews (26) and rear bearing retainer ring (27).

f. Install bearing housing puller (LTCT2023) or mechanical puller (LTCT4800) on bearing housing (19). Pull bearing housing from second stage power turbine rotor (30).

g. Remove bolts (3) and deflector support (4).

h. Remove seal housing (9) and turbine forward impeller (11). Remove retaining ring (5) from seal housing. Using arbor press and bushing assembly (LTCT4947), press seal (7) out of seal housing. Remove packing (8).

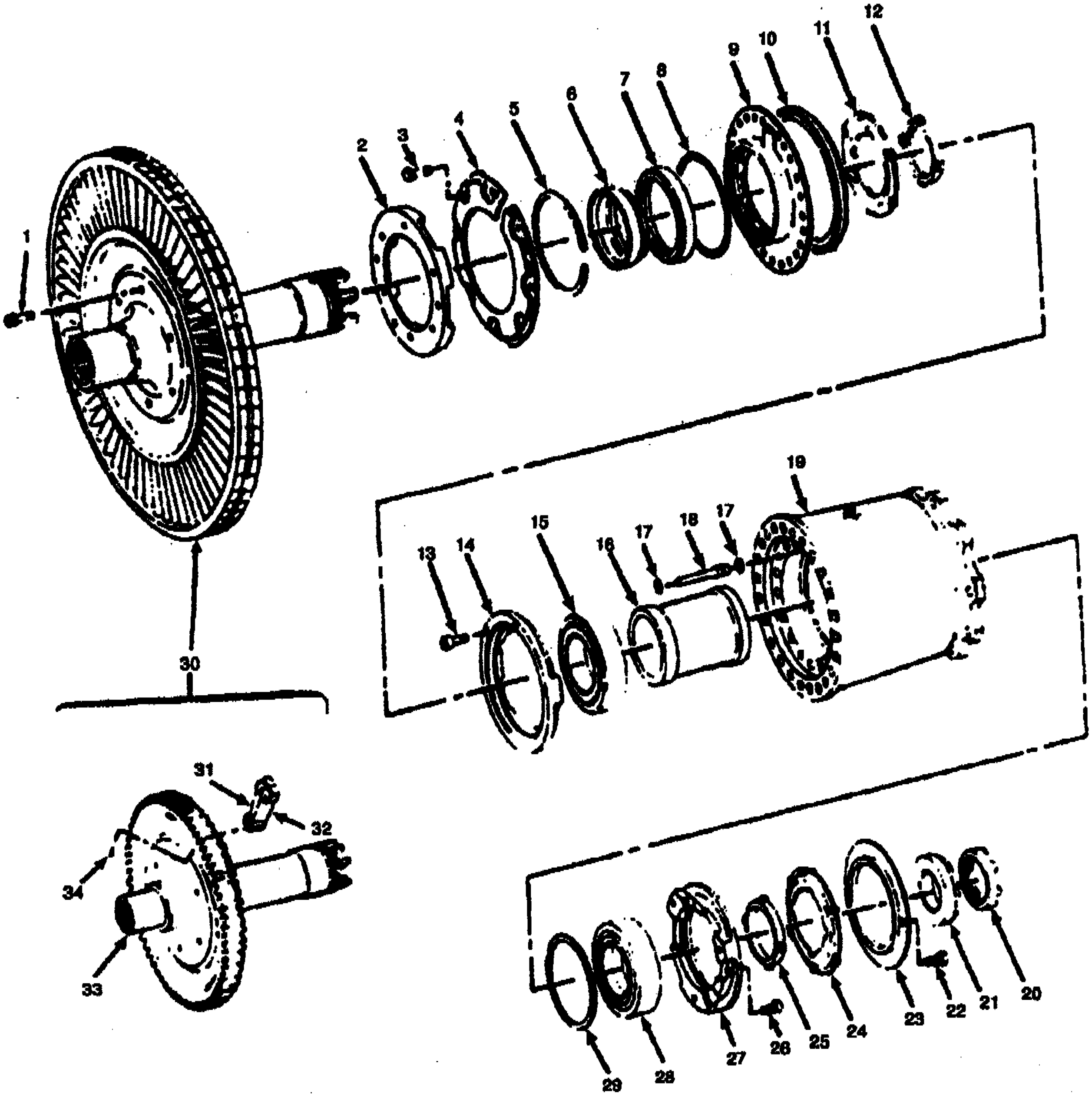


Figure 5-259. Power Turbine Rotor and Bearing Housing Assembly.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-259	No Number	POWER TURBINE ROTOR AND BEARING HOUSING ASSEMBLY AND RELATED PARTS (NHA 1-130-630-06, 1-130-630-08 and 1-130-630-19)	Ref	
-1	1-140-157-02	. BOLT, Machine	3	
-2	1-140-144-02	. PLATE, Clamping	1	
	1-140-530-06	. TURBINE ROTOR AND BEARING HOUSING ASSEMBLY, Power	Ref	A, C, D, E
	1-140-530-14	. . TURBINE ROTOR AND BEARING HOUSING ASSEMBLY, Power	Ref	
-3	AN106506	. . BOLT, Drilled hex head	8	
-4	1-140-025-05	. . SUPPORT, Deflector	1	
-5	UR362BX	. . RING, Retaining (80756) (Lycoming Source Cont Dwg 1-300-316-01)	1	
-6	1-140-268-01	. . RING, Power turbine seal	1	
-7	B107642	. . SEAL, Positive contact (71840) (Lycoming Source Cont Dwg 1-300-336-01)		
	75-281-04	. . SEAL, Positive contact (24981) (Alternate) (Lycoming Source Cont Dwg 1-300-336-02)	1	
-8	STD3019E58	. . PACKING, Preformed	1	
-9	1-140-190-01	. . HOUSING, Seal (Replace with 1-140-190-03)		
	1-140-190-03	. . HOUSING, Seal	1	
-10	AR100260	. . SEAL, Plain encased (70128) (Lycoming Source Cont Dwg 1-300-462-01)	1	
	A01071	. . SEAL, Plain encased (05939) (Alternate) (Lycoming Source Cont Dwg 1-300-362-02)	1	
-11	1-140-189-02	. . IMPELLER, Turbine, forward	1	
-12	1-140-162-02	. . RING, Forward	1	
-13	MS16995-11	. . SCREW, Cap, socket head	2	
-14	1-140-660-02	. . RING, Forward bearing retaining	1	
-15	1-300-584-01	. . BEARING, Roller (Replace with 1-300-665)	1	
	1-300-584-02	. . BEARING, Roller (Replace with 1-300-665)	1	
	1-300-176	. . BEARING, Roller (Replace with 1-300-665)	1	A, C, D, E
	1-300-665	. . BEARING, Roller	1	
-16	1-140-009-02	. . SPACER, Bearing	1	
-17	STD3000E1	. . PACKING, Preformed	2	
-18	1-140-271-01	. . TUBE, Oil Transfer	1	
-19	1-140-590-07	. . HOUSING, Bearing	1	
	1-140-590-04	. . HOUSING, Bearing (Replace with 1-140-590-07)	1	A, C, D, E
-20	1-140-061-01	. . NUT, Plain, round	1	
-21	1-140-062-03	. . CUP, Lock	1	

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-259-22	AN510C5R4	. . SCREW, Machine	2	
-23	1-140-192-02	. . COVER, Impeller cavity	1	
-24	1-140-191-02	. . IMPELLER, Second stage turbine	1	
-25	1-140-161-01	. . WASHER, Key, oil impeller	1	
-26	MS16995-11	. . SCREW, Cap, socket head	2	
-27	1-140-670-02	. . RING, Rear, bearing retaining	1	
-28	3210APS5470	. . Bearing, Ball (43334) (Lycoming Source Cont Dwg 1-300-119-01) (Replace with 1-300-015)	1	
	MM210VM2SMBR E7730	. . BEARING, Ball, annular (21335) (Alternate) (Lycoming Source Cont Dwg 1-300-015-04	1	B
	V3210RS5470	. . BEARING, Ball annular (43334) (Alternate) (Lycoming Source Cont Dwg 1-300-015-02)	1	
	3210ACS5470	. . Bearing, Ball, annular (43334) (Alternate) (Lycoming Source Cont Dwg 1-300-015-03)	1	
	MM210VM6MSRE 9896	. . BEARING, Ball, annular (21335) (Alternate) (Lycoming Source Cont Dwg 1-300-119-04) (Cancelled)	1	
-29	1-100-227-01	. . SHIM, Bearing, outer race, 0.020-0.022 inch thick	AR	
	1-100-227-02	. . SHIM, Bearing, outer race, 0.023-0.025 inch thick	AR	
	1-100-227-03	. . SHIM, Bearing, outer race, 0.026-0.028 inch thick	AR	
	1-100-227-04	. . SHIM, Bearing, outer race, 0.029-0.031 inch thick	AR	
	1-100-227-05	. . SHIM, Bearing, outer race, 0.032-0.034 inch thick	AR	
	1-100-227-06	. . SHIM, Bearing, outer race, 0.035-0.037 inch thick	AR	
	1-100-227-07	. . SHIM, Bearing, outer race, 0.038-0.040 inch thick	AR	
	1-100-227-08	. . SHIM, Bearing, outer race, 0.041-0.043 inch thick	AR	
	1-100-227-09	. . SHIM, Bearing, outer race, 0.044-0.046 inch thick	AR	
	1-100-227-10	. . SHIM, Bearing, outer race, 0.047-0.049 inch thick	AR	
	1-100-227-11	. . SHIM, Bearing, outer race, 0.050-0.052 inch thick	AR	
	1-100-227-12	. . SHIM, Bearing, outer race, 0.053-0.055 inch thick	AR	
	1-100-227-13	. . SHIM, Bearing, outer race, 0.056-0.058 inch thick	AR	
	1-100-227-14	. . SHIM, Bearing, outer race, 0.059-0.061 inch thick	AR	
	1-100-227-15	. . SHIM, Bearing, outer race, 0.062-0.064 inch thick	AR	
	1-100-227-16	. . SHIM, Bearing, outer race, 0.065-0.067 inch thick	AR	
	1-100-227-17	. . SHIM, Bearing, outer race, 0.068-0.070 inch thick	AR	
	1-100-227-18	. . SHIM, Bearing, outer race, 0.071-0.073 inch thick	AR	
	1-100-227-19	. . SHIM, Bearing, outer race, 0.074-0.076 inch thick	AR	
	1-100-227-20	. . SHIM, Bearing, outer race, 0.077-0.079 inch thick	AR	
	1-100-227-21	. . SHIM, Bearing, outer race, 0.080-0.082 inch thick	AR	

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-259-29	1-100-227-22	. . SHIM, Bearing, outer race, 0.083-0.085 inch thick	AR	
	1-100-227-23	. . SHIM, Bearing, outer race, 0.086-0.088 inch thick	AR	
	1-100-227-24	. . SHIM, Bearing, outer race, 0.089-0.091 inch thick	AR	
	1-100-227-25	. . SHIM, Bearing, outer race, 0.092-0.094 inch thick	AR	
	1-100-227-26	. . SHIM, Bearing, outer race, 0.095-0.097 inch thick	AR	
	1-100-227-27	. . SHIM, Bearing, outer race, 0.098-0.100 inch thick	AR	
	1-100-227-28	. . SHIM, Bearing, outer race, 0.101-0.103 inch thick	AR	
	1-100-227-29	. . SHIM, Bearing, outer race, 0.104-0.106 inch thick	AR	
	1-100-227-30	. . SHIM, Bearing, outer race, 0.107-0.109 inch thick	AR	
	1-100-227-31	. . SHIM, Bearing, outer race, 0.110-0.112 inch thick	AR	
	1-100-227-32	. . SHIM, Bearing, outer race 0.113-0.115 inch thick	AR	
-30	1-140-550-02	. TURBINE ROTOR, Second stage	1	A, C, D, E
	1-140-550-07	. TURBINE ROTOR, Second Stage	1	
-31	1-140-273-03	. BLADE, Turbine rotor, blade A	31	
-32	1-140-274-02	. . BLADE, Turbine rotor, blade B	31	
-33	1-140-272-01	. . Disk, Turbine rotor	1	A, C, D, E
	1-140-272-04	. . Disk, Turbine rotor	1	
-34	1-140-285-01	. . PIN, Straight, headless	62	

i. Remove capscrews (13) and forward bearing retaining ring (14). Remove seal (10) from forward groove of bearing housing (19). Discard seal.

j. Remove oil transfer tube (18) and packing (17). Remove second packing (17) from bearing housing.

k. Using mechanical puller (LTCT4846 or LTCT4700), remove seal ring (6) and forward ring (12).

l. Remove inner race and rollers of bearing (15) and bearing spacer (16).

m. Using a brass drift on outer race, remove ball bearing (28) from bearing housing. Remove shim (29).

n. Using a brass drift, remove outer face of bearing (15).

o. Remove bolts (1) and clamping plate (2) from turbine rotor disk (33).

5-311. CLEANING. Proceed as follows:

a. Clean second stage power turbine rotor (30, figure 5-259) by dry cleaning solvent method. (Refer to SP. No. 3002 in Appendix E.) If this method is not adequate, use vapor-blasting method or plastic media blast. (Refer to SP No. 3003.1 in Appendix E.)

b. Clean seal (7) by dry cleaning solvent method. (Refer to SP No. 3002 in Appendix E.)

c. Clean strainer (31, figure 5-135) using bristle brush. Ensure all holes are open. Check outer holes with a 1/64 inch drill bit, and check inner hole with a 5/32 inch drill bit. Rinse oil strainer with dry clearing solvent (item 134, table C–1) and dry with clean dry air.

d. Clean all other parts by dry cleaning solvent method. (Refer to SP No SP. No. 3002 in Appendix E.)

CAUTION

The method outlined in following step e shall not be used on coated blades.

e. Clean second stage power turbine rotor (30, figure 5-259) that has metalization (slag) deposits that cannot be removed with normal cleaning procedures, using aluminum oxide powder (item 36, table C–1) applied as dry blast with 30 to 40 psi (2109 to 2812 gm sq cm) air pressure.

f. Using dry air, unclog oil passages in rings (14 and 27, figure 5-259) and bearing housing (19).

g. Seal housings which have been cleaned and still have oil passages blocked shall be repaired as follows:

(1) Grind off weld area to base material at end of oil nozzle.

(2) EDM a 0.025 - 0.030 inch (0.064 - 0.076 cm) hole to intersect the 0.036 - 0.041 inch (0.090 - 0.104 cm) oil passage (about 0.050 inch deep (0.127 cm)).

(3) Clean oil passage and intersecting nozzle, using cleaning solvent and air. A wire may be used to clear blockage.

(4) Weld hole closed per instructions on drawing using welding rod AMS 5680 (item 347, table C–1).

(5) Pressure test using oil at 70 psi (4921 gm sq cm). No leakage allowed.

5-312. INSPECTION. Perform specific inspections listed in table 5-97.

Table 5-97. Inspection of Power Turbine Rotor and Rear Bearing Housing Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135				
24	Power Turbine Tubes	Visual	Cracks.	Not allowed. Replace.
		SIE and Visual	Stripped, crossed, or worn threads	Repair. (Refer to SP No. 5007 in Appendix E.)
30	Oil Strainer Housing Adapter	Visual	Cracks.	Not allowed. Replace.
			Damaged threads	Not allowed. Replace.
			Damaged conical seat	See figure 5-260 and repair as outlined in paragraph 5-313.
31	Strainer	Visual	Bore contamination	Clean. (Refer to paragraph 5-311).
41	Connector	Visual	Cracks	Not allowed. Replace.
			Damaged threads	Not allowed. Replace.
			Damaged conical seat	See figure 5-261 and repair as outlined in paragraph 5-313.

WARNING
FLIGHT SAFETY PART

Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-259				
2	Clamping plate	Visual	Loss of surface finish (aluminum)	Repair. (Refer to SP No. 6000, step e, in Appendix E).
		Visual and fluorescent penetrant inspect	Cracks	Not allowed. Replace.

WARNING
FLIGHT SAFETY PART

Verification that there is no loss of Aluminum paint is flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
		Visual	Loss of aluminum paint on exterior	No loss of surface coating is allowed.
4	Deflector Support	Visual	Cracks	Not allowed. Replace.
			Surface rust or corrosion and pitting	Not allowed. Replace.

Table 5-97. Inspection of Power Turbine Rotor and Rear Bearing Housing Assembly (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-259				
6	Seal Ring	Visual	Groves or track marks on chrome plate.	Repair. (Refer to paragraph 5-313.)
			Scratches, nicks, or dents in plated area	Repair. (Refer to paragraph 5-313.)
			Tracking marks or varnish, carbon, or coke deposits on 2.824 to 2.825 inch (7.173 to 7.176 cm) journal surface	Repair. (Refer to paragraph 5-313.)
		Visual	Cracks	None allowed. Replace.
		Visual	Loss of protective surface finish	Repair. (Refer to SP No. 6002 in Appendix E.)
		SIE and Visual	Worn 2.824 to 2.825 inch (7.173 to 7.176 cm) diameter journal surface	Repair. (Refer to paragraph 5-313.)
			Wear. (Refer to table 5-98)	Repair or replace as required. (Refer to paragraph 5-313.)
9	Seal Housing	Visual	Clogged oil jet	Unclog. (Refer to paragraph 5-311.)
		SIE and Visual	Worn 3.640 to 3.641 inch (9.246 to 9.248 cm) diameter	Repair. Refer to paragraph 5-313.)
			Dimensions within acceptable limits. (Refer to table 5-98.)	Repair or replace as required
		Visual and Magnetic Particle. (Refer to table 5-99.)	Cracks	Not allowed. Replace.
11	Turbine Impeller (Forward)	Visual	Cracks	Not Allowed. Replace.
			Loss of protective surface finish (phosphate coating)	Repair. (Refer to SP No. 6012 in Appendix E)
		SIE and Visual	Distortion or warpage. (Refer to table 5-98.)	Repair or replace as required.
			Evidence of chipped silver	*Strip all plating and phosphate coat. (Refer to SP No. 6012 in Appendix E.)

* Maximum thickness of phosphate coating shall be 0.00025 inch. Measurement of coating thickness and size dimensions to be taken after removing loose phosphate crystals by rubbing with a cloth and degreasing locally or as applicable.

Table 5-97. Inspection of Power Turbine Rotor and Rear Bearing Housing Assembly (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-259				
12	Forward Ring	Visual	Cracks in ring	Not allowed. Replace.
			Damage in lugs.	Not allowed. Replace.
			Loss of protective surface finish (black oxide)	Repair. (Refer to SP No. 6002 in Appendix E.)
			Sharp Protrusions and/or rolled over metal	Blend-repair. (Refer to SP No. 5000 in Appendix E.)
		SIE and Visual	Warped or distorted ring. (Refer to table 5-98.)	Replace if limits cannot be met.
			Wear on lug ends in excess of 0.004 inch (0.010 cm) total on sets of opposite lugs. (Refer to table 5-98.)	Replace if limits cannot be met.
			Wear on sides of lugs in excess of 0.006 inch (0.015 cm) total on both sides. (Refer to table 5-98.)	Replace if limits cannot be met.
14	Forward Bearing Retaining Ring	Visual	Scoring or fretting on bearing contact area	Repair. (Refer to paragraph 5-313.)
			Cracks	Not allowed Replace.
		Visual	Loss of protective surface (black oxide)	Repair. (Refer to SP No. 6002 in Appendix E.)
		SIE and Visual	Wear. (Refer to table 5-98.)	Repair or replace. (Refer to paragraph 5-313.)
		WARNING **FLIGHT SAFETY PART** **Verification that bearing is crack-free is flight safety critical.**		
15	Bearings	Magnetic Particle Inspection	Check for cracks in the outer ring. None allowed.	Replace if limits cannot be met.
15 and 28	Bearings	SIE and Visual	Wear. (Refer to tables 5-100.)	Replace if limits cannot be met.
			Wear or damage	
			Loose fitting pins (1-300-665)	Replace by select fitting a new MS 9105-52 in to obtain a 0.0002 to 0.0007 inch (0.0005 to 0.00018 cm) interference fit.

Table 5-97. Inspection of Power Turbine Rotor and Rear Bearing Housing Assembly (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-259				
16	Bearing Spacer	Visual	Cracks	Repair. (Refer to Paragraph 5-313.)
			Nicks, dents, or burrs	Blend-repair. (Refer to SP No. 5000 in Appendix E.)
			Loss of surface finish	Repair. (Refer to SP No. 6002 in Appendix E.)
		SIE and Visual	Wear. (Refer to table 5-98.)	Replace if limits cannot be met.
18	Oil Transfer Tube	Visual	Clogged oil passages	Clean. (Refer to paragraph 5-313.)
			Cracks	Not allowed. Replace.
			Nicks, dents, or burrs	Blend-repair (Refer to SP No. 5000 in Appendix E.)
			Loss of protective surface finish (black oxide)	Repair. Refer to SP No. 6012 in Appendix E.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
19	Bearing Housing	Visual	Stripped and damaged threads, damaged tube seats, and mutilation and distortion of bosses	Repair. (Refer to paragraphs 5-313.)
			Bends, dents, or mutilation of scavenge oil tube	Repair bent tube. (Refer to paragraph 5-313.) Replace dented or mutilated tube.
			Loss of surface finish	Repair. (Refer to paragraph 5-313.)
			Misaligned retainer screw holes	Refer to paragraph 5-313.
		4-Power Magnifying glass	Cracks, blisters or fretting on chromium plating. See figure 5-263.	Repair. (Refer to paragraph 5-313.) Replace if limits cannot be met.

Table 5-97. Inspection of Power Turbine Rotor and Rear Bearing Housing Assembly (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-259				
19 (Cont)	Bearing Housing (Cont)	SIE and Visual	Worn 0.709 to 0.712 inch (1.801 to 1.808 cm) or 0.806 to 0.812 inch (2.047 to 2.062 cm) dimension	Repair. (Refer to paragraph 5-313.)
			Worn or damaged 3.5430 to 3.5434 inch (8.9992 to 9.0002 cm) or 3.5432 to 3.5436 inch (8.9997 to 9.0007 cm) diameter	Repair. (Refer to paragraph 5-313.)
			Dented or cracked baffle. Cracks, lack of braze, and porosity in braze joints	Refer to table 5-101. Repair. (Refer to paragraph 5-313.)
			Damaged or over-sized oil jet holes	Repair. (Refer to paragraph 5-313.)
			Wear. (Refer to table 5-98.)	Repair or replace as required. (Refer to paragraph 5-313.)
		Pressure Test and Visual	Leakage between power turbine tube and mating bearing housing boss	Refer to paragraph 5-313.
		SIE and Visual	Cracks, incomplete fusion, porosity and voids in stainless steel baffle weld joints	Refer to table 5-101.
5-259				

WARNING

FLIGHT SAFETY PART

Magnetic particle inspection to ensure that the following part is crack-free is flight safety critical.

20	Nut	Visual and magnetic particle (Refer to table 5-99.)	Cracks	Not allowed. Replace.

Table 5-97. Inspection of Power Turbine Rotor and Rear Bearing Housing Assembly (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-259 20 (Cont)	Nut (Cont)	Visual and magnetic particle (Refer to table 5-99.) (Cont)	Nicks, burrs, scratches, damaged threads, or damaged surface coating	Repair. (Refer to paragraph 5-313.)
WARNING **FLIGHT SAFETY PART** **Verification that there is no loss of silver plate on ID threads is flight safety critical.**				
		Visual	Damaged silver plate on ID threads	None allowed. Replace.
23	Impeller Cover	Visual	Cracks	Not allowed. Replace.
24	Second Stage Turbine	Visual	Cracks	Not allowed. Replace.
			Loss of protective surface finish (phosphate coating)	Repair. (Refer to SP No. 6012 in Appendix E.)
		SIE and Visual	Distortion or warpage. (Refer to table 5-98.)	Repair. (Refer to paragraph 5-313). If limit cannot be met, then replace.
			Evidence of chipped silver plating	Repair by stripping silver plate and phosphate coal as outlined in SP No. 6012 in Appendix E.)
25	Key Washer	Visual	Cracks	Not allowed. Replace.
			Damaged lug	Not allowed. Replace.
			Loss of protective surface finish (black oxide)	Repair. (Refer to SP No. 6002 in Appendix E.)
		Visual	Sharp protrusions and/or rolled over metal in worn areas	Blend-repair. (Refer to SP No. 5000 in Appendix E.)
		SIE and Visual	Warped or distorted rings. (Refer to table 5-98.)	Replace if limits cannot be met.
			Wear on lug ends in excess of 0.004 inch (0.010 cm) in total on sets of opposite lugs. (Refer to table 5-98).	Replace if limits cannot be met.
			Wear on sides of lugs in excess of 0.006 inch (0.015 cm total on both sides. (Refer to tables 5-98).	Replace if limits cannot be met.

Table 5-97. Inspection of Power Turbine Rotor and Rear Bearing Housing Assembly (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-259				
27	Rear Bearing Retainer Ring	Visual	Scoring or fretting on chrome-plated areas	Repair. (Refer to paragraph 5-313).
			Cracks	Not allowed. Replace.
			Crossed, stripped, or damaged threads	Repair. (Refer to SP No. 5007 in Appendix E).
			Loss of protective surface finish (chrome-plating and black oxide)	Repair. (Refer to SP Nos. 6014 and 6002 in Appendix E).
		SIE and Visual	Wear. (Refer to table 5-98).	Repair. (Refer to paragraph 5-313).
	WARNING FLIGHT SAFETY PART Fluorescent Penetrant Inspection and Magnetic Particle Inspection is required to ensure that the following part is crack-free this is flight safety critical.			
30	Second Stage Power Turbine Rotor	Visual	Metalization deposits	Clean. (Refer to paragraph 5-311).
			Thinned out or sharp edge on blade shroud trailing edge	Repair. (Refer to paragraph 5-313).
			Unusual heat discoloration of disk and blades following over-temperature conditions	Not allowed. Replace.
			Heat discoloration and burning of blades	Refer to table 5-102.
		SIE and Visual	Nicks, dents, or burrs in blades	Repair. (Refer to paragraph 5-313.) If limits cannot be met, replace.
			Thickness of blade tip shroud (Refer to table 5-98).	Replace if limits cannot be met.
			Blade axial movement beyond 0.017 inch (0.043 cm) flushness	Remove, repair, and stake blades. (Refer to paragraph 5-314.)
			Corrosion pitting in disk face and disk tenon face areas. (T53-L-13B, -15, -701, -701A)	Refer to table 5-102.
			Rub marks on disk which exceed 0.100 inch wide by 0.003 inch deep	Blend rub marks per SP No. 5000 or replace if limits of figure 5-262 are exceeded.

Table 5-97. Inspection of Power Turbine Rotor and Rear Bearing Housing Assembly (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-259				
30 (Cont)	Second Stage Power Turbine Rotor (Cont)	SIE and Visual (Cont)	Nicks, dents, or burrs on "FIN" at outer diameter edge of disk tenon face.	Repair. (Refer to paragraph 5-313.) If limits cannot be met, replace.
			Rub damage or scoring in blade tip shroud beyond acceptable limits. (Refer to table 5-98)	Replace if limits cannot be met. (Refer to paragraph 5-313.)
			Worn 4.9190 to 4.9205 inch diameter	Repair. (Refer to paragraph 5-313.)
			Worn or damaged 1.9683 to 1.9686 inch or 2.1655 or 2.1658 bearing journal diameter. (Refer to table 5-98).	Repair. (Refer to paragraph 5-313.)

WARNING

FLIGHT SAFETY PART

The total gap and minimum and maximum individual gap limits are flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
			Proper blade shroud gap	Refer to table 5-102
			Wear. (Refer to table 5-98.)	Repair or replace. (Refer to paragraph 5-313.)
		Visual and LTCT14679	Damage and wear in splined area. (Refer to SP No. 3009 in Appendix E.)	Repair. (Refer to SP No. 5013 in Appendix E.)
		Visual and Magnetic Particle. For disk 1-140-272-02 (Refer to table 5-99) or fluorescent particle for disk 1-140-272-04	Cracks in disk blade grooves	Not allowed. Replace.
			Cracks in disk	Not allowed. Replace.
		Visual	Cracks in and distortion and bending of blades	Not allowed. Replace.

Table 5-98. Dimensional Inspection of Power Turbine Rotor and Bearing Housing Assembly.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-259								5-263
Seal Ring	6	OD	2.824 (7.173)	2.825 (7.176)					A
		ID	2.1685 (5.5011)	2.1668 (5.5088)					B
		Axial	0.297 (0.754)	0.300 (0.762)					C
Seal	7	OD	3.6415 (9.2491)	3.6425 (9.2520)					D
		Width	0.428 (1.087)	0.438 (1.113)					E
Seal Housing	9	ID	3.640 (9.246)	3.641 (9.248)	3.640 (9.246)	3.641 (9.248)			F
Turbine Forward Impeller	11	OD	3.898 (9.901)	3.900 (9.906)					G
Paddle Thickness Slot Width		Axial	0.199 (0.505)	0.203 (0.516)					H
		Radial	0.205 (0.521)	0.207 (0.526)					I
Forward Ring Lugs	12	Width	0.199 (0.505)	0.201 (0.511)	0.193 (0.490)	0.201 (0.511)			J
		OD	2.5395 (6.4503)	2.5405 (6.4529)	2.5355 (6.4402)	2.5405 (6.4529)			K
Forward Bearing Retaining Ring	14	Axial	0.449 (1.140)	0.451 (1.146)					L

Table 5-98. Dimensional Inspection of Power Turbine Rotor and Bearing Housing Assembly (Continued).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-259 (Cont)								5-263
Bearing Spacer Forward	16	ID	2.1670 (5.5042)	2.1680 (5.5067)					M
Rear		ID	1.9650 (5.0013)	1.9700 (5.0038)					N
Length		Axial	3.171 (8.054)	3.173 (8.059)					O
(Face to Face) Depth to Shoulder (Forward)		Axial		0.63 (1.60)					P
WARNING FLIGHT SAFETY PARTS Verification of the following two dimensions is flight safety critical.									
Bearing Housing	19	ID	3.5430 (8.9992)	3.5434 (9.0002)	3.5430 (8.9992)	3.5434 (9.0002)			Q
		ID	3.5432 (8.9997)	3.5436 (9.0007)	3.5432 (8.9997)	3.5438 (9.0013)			R
		OD	6.312 (16.032)	6.313 (16.035)					S
		OD	5.936 (15.077)	5.937 (15.080)					T
Second Stage Turbine Impeller	24	OD	3.898 (9.901)	3.900 (9.906)					U

Table 5-98. Dimensional Inspection of Power Turbine Rotor and Bearing Housing Assembly (Continued).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-259 (Cont)								5-263
Paddle Thickness Slot Width		Axial	0.199 (0.505)	0.203 (0.516)					V
		Radial	0.205 (0.521)	0.207 (0.526)					W
Key Washer	25	OD	2.5395 (6.4503)	2.5405 (6.4529)	2.5355 (6.4402)	2.5405 (6.4529)			X
Tab Width		Radial	0.199 (0.505)	0.201 (0.511)	0.193 (0.490)	0.201 (0.511)			Y
Rear Bearing Retainer Ring	27	Axial	0.440 (1.118)	0.445 (1.130)					Z
Second Stage Power Turbine Rotor	30								
Forward	30	OD	13.307 (33.800)	13.309 (33.805)	13.305 (33.800)	13.315 (33.820)			AA
Rear		OD	13.397 (34.029)	13.399 (34.033)	13.395 (34.023)	13.405 (34.049)			AB
Rear Bearing Journal		OD	1.9683 (4.9995)	1.9686 (5.0002)	1.9681 (4.9990)	1.9686 (5.0002)			AC
Forward Bearing Journal		OD	2.1655 (5.5004)	2.1658 (5.5001)	2.1653 (5.4999)	2.1658 (5.5011)			AD
Bore		ID	1.186 (3.012)	1.188 (3.018)	1.186 (3.012)	1.191 (3.025)			AE

Table 5-98. Dimensional Inspection of Power Turbine Rotor and Bearing Housing Assembly (Continued).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-259 (Cont)								5-263
WARNING **FLIGHT SAFETY PARTS** **Verification of the 4.9190–4.9205 blueprint (4.9190–4.9210 overhaul) dimension is flight safety critical.**									
Turbine Rotor Disk to	33	ID	4.9190 (12.4943)	4.9205 (12.4981)	4.9190 (12.4943)	4.9210 (12.4993)	0.0000	0.0015T (0.0038)	AF
	5–136								
Spacer	8	OD	4.9210 (12.4993)	4.9215 (12.5006)	4.9210 (12.4993)	4.9215 (12.5006)			AG
	5-259								
Turbine Rotor Disk	33								
Q Point*			See figure 5-265						

* Q point check need only be performed every 45 degrees. Remove blades, as necessary, as close as possible to the 45 degree interval to take measurements.

CAUTION

If any of the four turbines indicate a growth beyond acceptable limits in the pilot and point "Q" dimensions, over–temperature is suspected. Check remaining three rotors closely. If either gas producer turbine indicates a growth beyond acceptable limits in the pilot and bore dimensions, overspeed is suspected. Check mating power turbine rotor closely.

** The "Q" point position can be determined by either of two methods: Set up turbine disk with radial line vertical, and measure the "Q" point vertical dimension to center line; or set up in turbine disk bore and measure the "Q" point radius. The dimensional requirements for both methods of measurement are provided in figure 5-265.

Table 5-99. Magnetic-Particle Inspection of Power Turbine Rotor and Bearing Housing Assembly.

Figure and Index No.	Nomenclature	Method of Magnetization
5-259, 9	Seal Housing	Circular, use central conductor at 1000 amperes
5-259, 20	Nut, plain, round	Circular, use central conductor at 800 amperes
5-259,33	Turbine, Rotor Disk	Circular, use central conductor at 1000 amperes for shaft area and 2500 amperes for disk blade grooves. Longitudinal at 12,500 ampere-turns

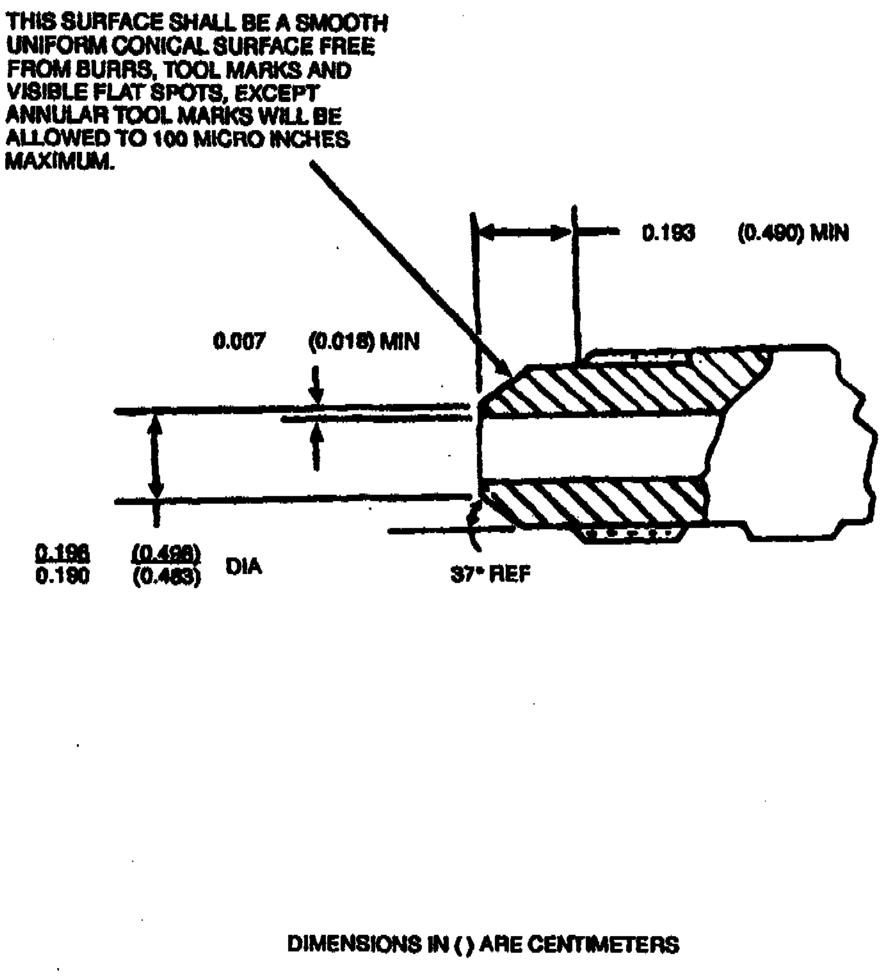


Figure 5-260. Oil Strainer Housing Adapter Inspection and Repair.

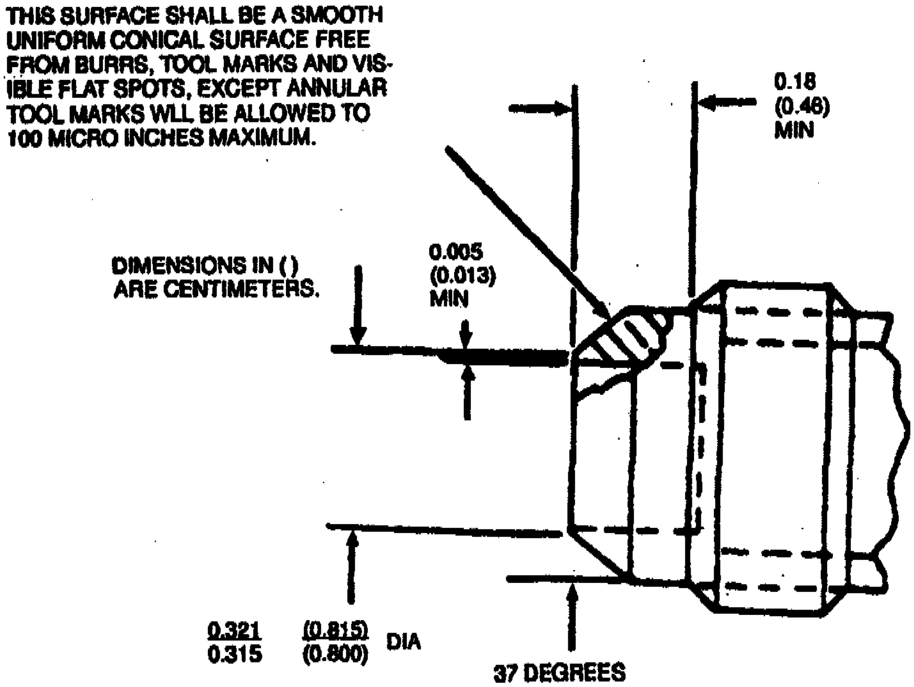


Figure 5-261. Connector Inspection and Repair.

5-313. REPAIR. (See figure 5-259.) Proceed as follows:

a. Repair oil strainer housing adapter (30, figure 5-135) conical seat as follows:

(1) Blend-repair all raised material.

(2) If defects specified in figure 5-260 are noted, remachine a new 37-degree conical seat.

NOTE

Machining data is shown in figure 5-260.

b. Repair connector (41, figure 5-135) conical seat as follows:

(1) Blend-repair all raised material.

(2) If defects specified in figure 5-261 are noted, remachine a new 37-degree conical seat.

NOTE

Machining data is shown in figure 5-261.

Table 5-100. Dimensional Inspection of Power Turbine Rotor and Bearing Housing Assembly Bearings.

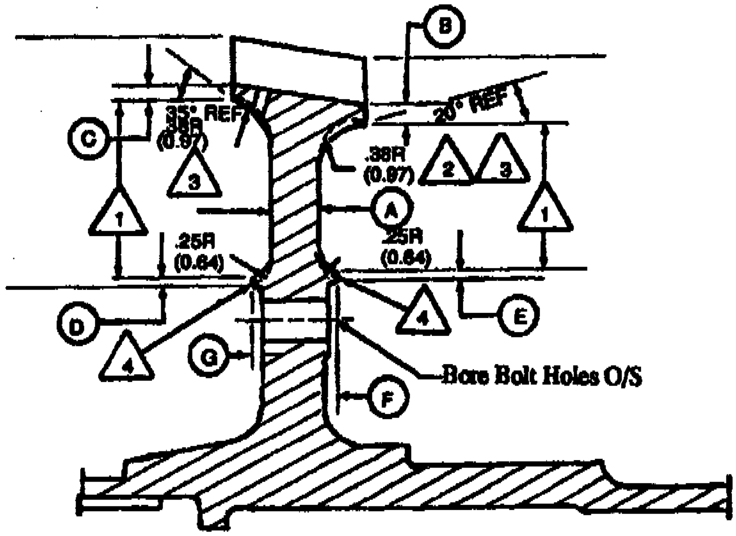
BEARING TYPE & PART NO.	FIG & INDEX	DIM. MEAS	BLUEPRINT DIMENSIONS MIN	BLUEPRINT DIMENSIONS MAX	INTERNAL CLEARANCE	END PLAY	HARDESS RC	CONTACT ANGLE	LYCOMING PART NUMBER
WARNING **FLIGHT SAFETY PART** **Inspection of 2.1651-2.1654 dimensions is flight safety critical.**									
	5-259								
Roller 46242 (T53-L-13B,	15	ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0034 (0.0086)	N/A	60-64	N/A	1-300-176-03
-15, -701, -701A) or		OD	3.5430 (8.9992)	3.5432 (9.0000)	0.0039* (0.0099)				
HU1011EARS5728 (T53-L-13B, -15,		ID	2.1651 (5.4994)	2.165 4 (5.5001)	0.0034 (0.0080)	N/A	60-64	N/A	1-300-176-04
-701, -701A) or		OD	3.5430 (8.9992)	3.5433 (9.0000)	0.0039* (0.0099)				
462986 (T53-L-703)		ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0034 (0.0086)				
or		OD	3.5430 (8.9992)	3.5433 (9.0000)	0.0039* (0.0099)	N/A	60-64	N/A	1-300-584-01
HU1011EARS5735 (T53-L-703)		ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0034 (0.0086)				
5RNH111-101		ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0031 (0.0079)	N/A	60-64	N/A	1-300-665-01
		OD	3.5430 (8.9992)	3.5433 (9.0000)	0.0039* (0.0099)				

Table 5-100 Dimensional Inspection of Power Turbine Rotor and Bearing Housing Assembly Bearings. (Continued)

BEARING TYPE & PART NO.	FIG & INDEX	DIM. MEAS	BLUEPRINT DIMENSIONS		INTERNAL CLEARANCE	END PLAY	HARNESS RC	CONTACT ANGLE	LYCOMING PART NUMBER
			MIN	MAX					
WARNING FLIGHT SAFETY PART Inspection of 1.9683-1.9685 dimensions is flight safety critical.									
Ball	5-259 28	ID	1.9683 (4.9995)	1.9685 (5.000)	0.0021 (0.0053)	0.013 (0.033)	58-62	N/A	1-300-119-01
3210APS5470		OD	3.5430 (8.9992)	3.5433 (9.000)	0.0028* (0.0071)	Max*			
or									
MM210VM2		ID	1.9683 (4.9995)	1.9685 (5.000)	0.0037 0.0094)	0.016 (0.041)			
SMBRE7730		OD	3.5430 (8.9992)	3.5433 (9.000)	0.0043* (0.0109)	Max*	58-62	N/A	1-300-015-04
or									
V3210RS5470		ID	1.9683 (4.9995)	1.9685 (5.000)	0.0020- (0.0051)	0.008 to 0.0	58-62	N/A	1-300-015-02
		OD	3.5430 (8.9992)	3.5433 (9.000)	0.0024 (0.0061)	12**(0.020 to 0.030)			
or									
MM21DVM6		ID	1.9683 (4.9995)	1.9685 (5.000)	0.0020- (0.0051)	0.013 (0.033)	58-62	N/A	1-300-119-02
MBRE9098 (T53-L-13B, -15, -701,-701A)		OD	3.5430 (8.9992)	3.5433 (9.000)	0.0024 (0.0061)	Max*			
3210ACS5470		ID	1.9683 (4.9995)	1.9685 (5.000)	0.0021- (0.0053)	0.013 (0.033)	58-62	N/A	1-300-119-03
		OD	3.5430 (8.9992)	3.5433 (9.000)	0.0028* (0.0071)	Max*			

* Under 11.0 pound gage load.

** Under 13.0 to 17.0 pound gage load.



1 MACHINE THESE AREAS ONLY AS NECESSARY TO REDUCE PITTING TO WITHIN LIMITS

2 IF SIGNIFICANT AMOUNT OF BALANCE STOCK HAS BEEN REMOVED, CHECK BALANCE DISC PRIOR TO BLADING. SELECT BLADES(BY WEIGHT) TO REDUCE RESIDUAL UNBALANCE AND TO CONTROL THE DIRECTION OF SUCH.

3 LOCALIZED BLENDING IS AUTHORIZED. NO SHARP EDGES ARE ALLOWED.

4 PITTING DEPTH LIMITS DO NOT APPLY TO THESE SURFACES. DO NOT MACHINE. BREAK SHARP EDGES ONLY. GENERAL CORROSION LIMITS (F & G): .045 (0.114) MIN. FOR CUMULATIVE 1/4; CIRCUMFERENCE, 0.055 (0.014) MIN. FOR REMAINDER OF CIRCUMFERENCE.

ITEM	DRAWING DIMENSIONS	REPAIR LIMITS (MIN)
A	.356/.344 (0.904/0.873)	0.339 (0.861)
B	.1435/.1195 (.3645/.3035)	.090 (.0229)
C	.1175/.0835 (.2985.0.2121)	0.835 (0.2121)
D	.0850/.0648 (.2159/1.646)	.050 (.127)
E	.0850/.0640 (.2159/1.656)	.050 (.127)
F & G	.070/.080 (.177/.203)	4

Figure 5-282. Turbine Disc (P/N 1-140-272-01).

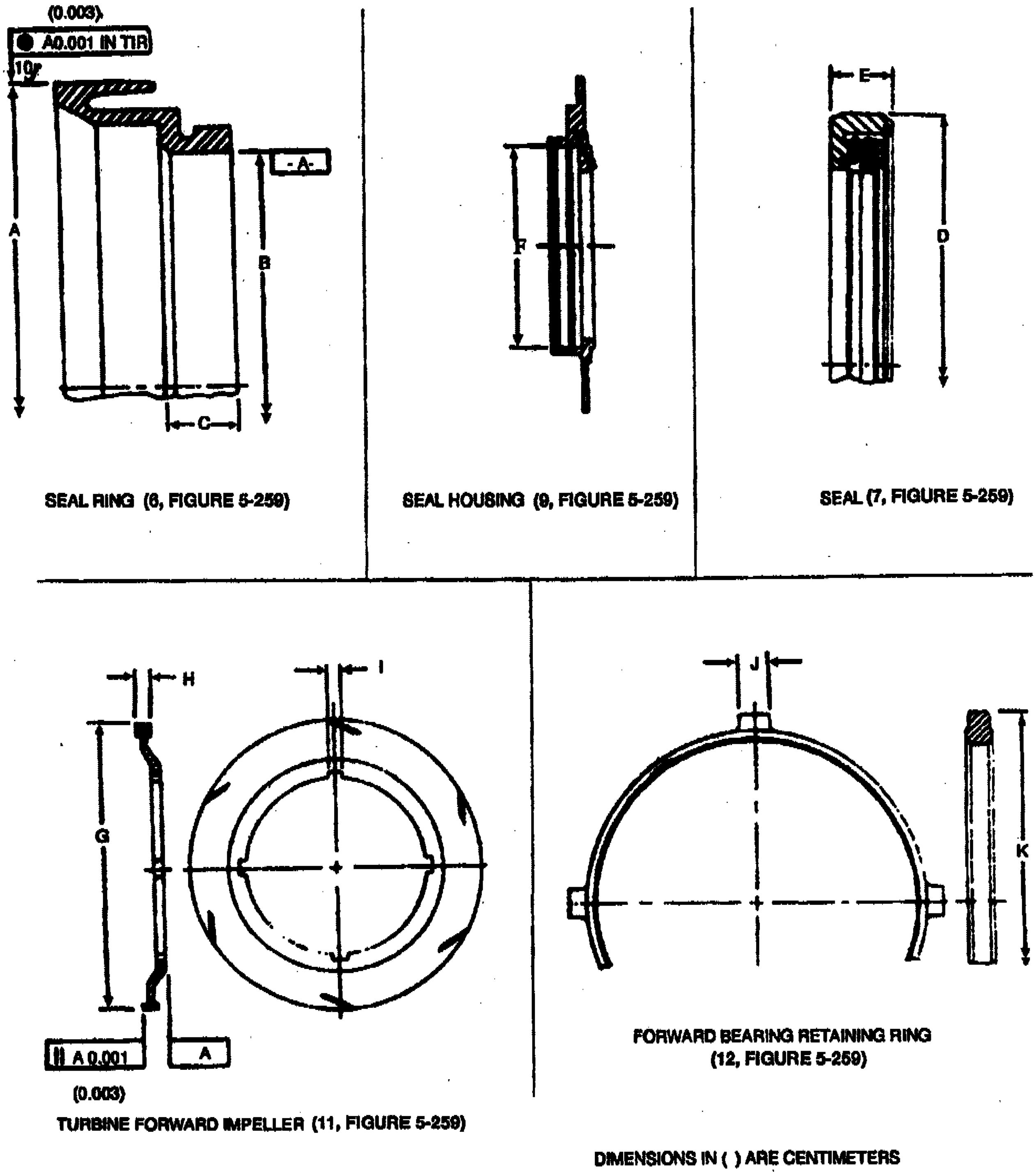
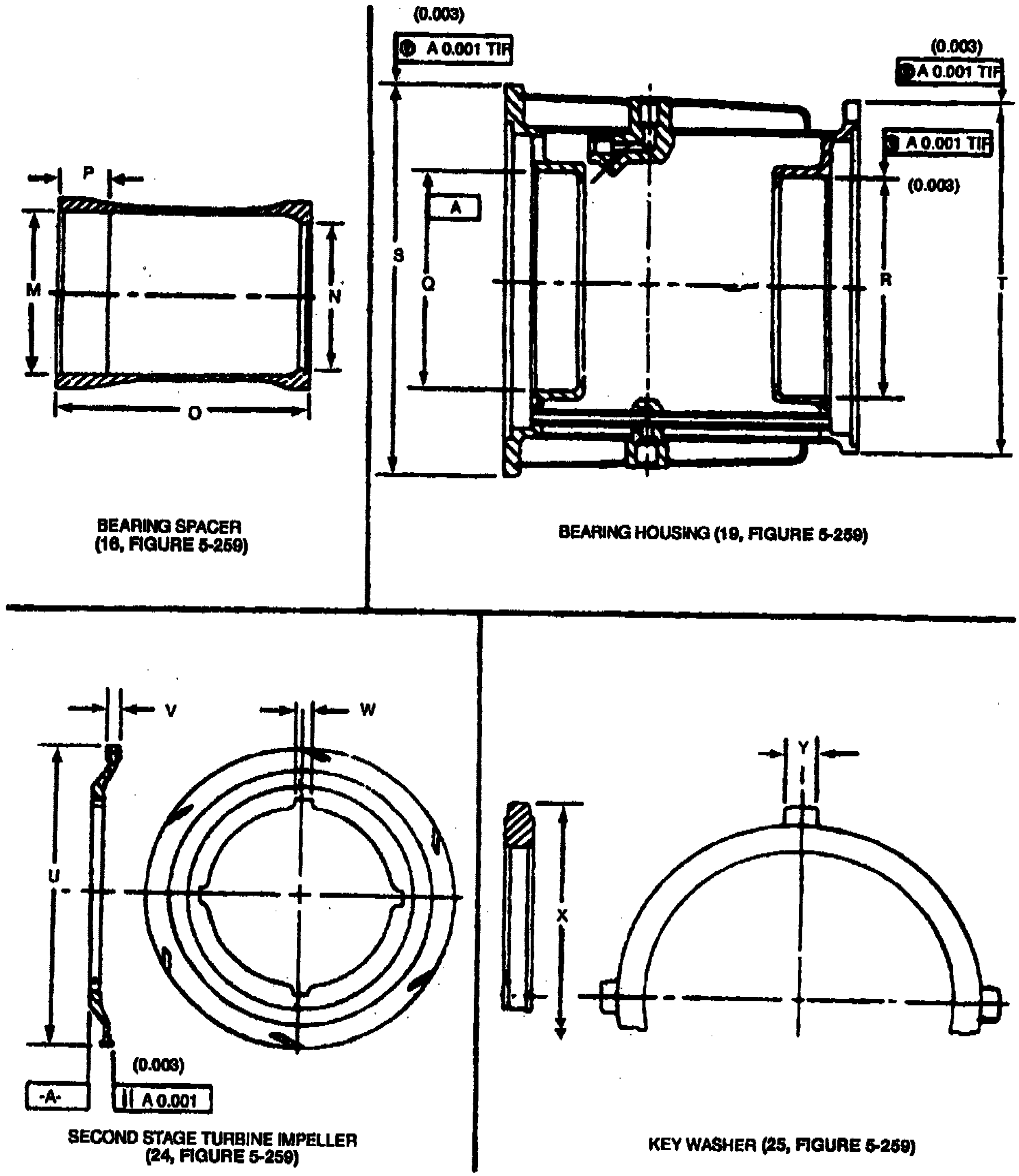
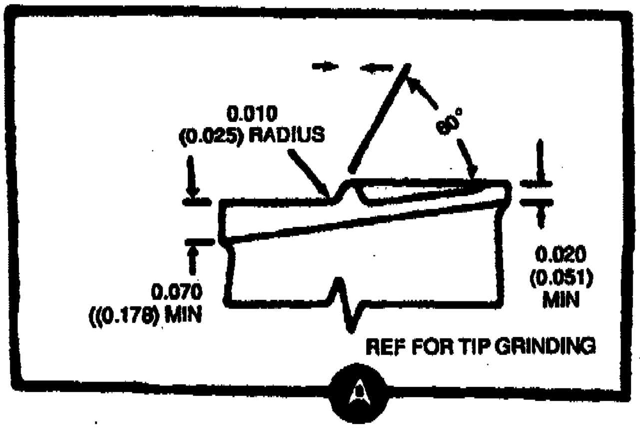


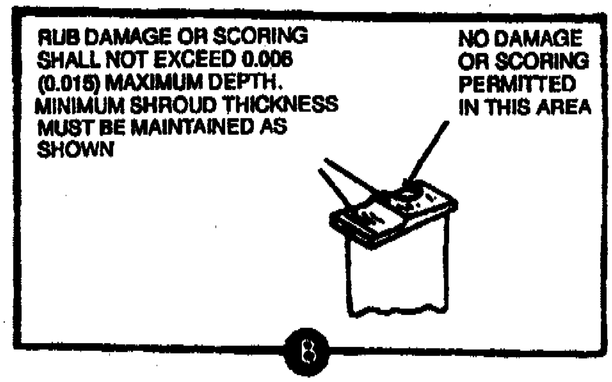
Figure 5-263. Power Turbine Rotor and Bearing Housing Assembly Inspection Locations (Sheet 1 of 4).



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-263. Power Turbine Rotor and Bearing Housing Assembly Inspection Locations (Sheet 2 of 4).





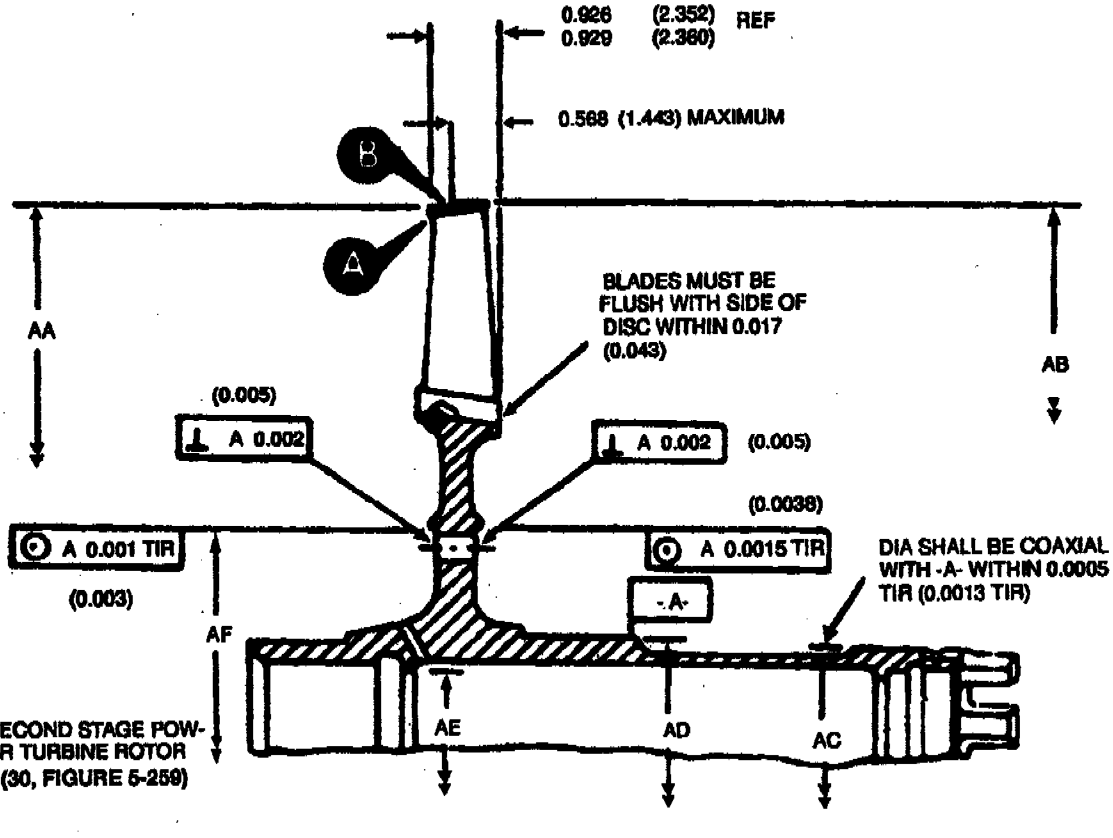
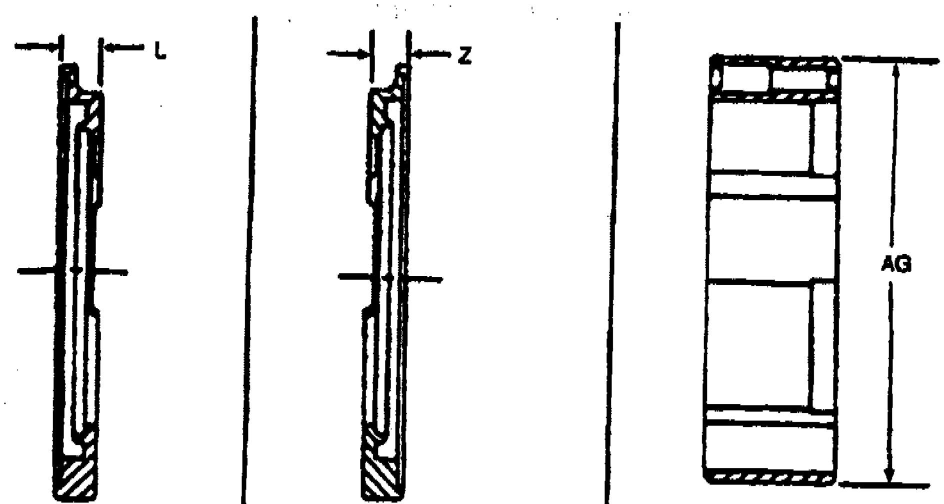


Figure 5-263. Power Turbine Rotor and Bearing Housing Assembly Inspection Locations (Sheet 3 of 4).



FORWARD BEARING RETAINER RING (14, FIGURE 5-259)

REAR BEARING RETAINING RING (27, FIGURE 5-259)

SPACER (8, FIGURE 5-135)

Figure 5-263. Power Turbine Rotor and Bearing Housing Assembly Inspection Locations (Sheet 4 of 4).

Table 5-101. Bearing Housing Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**		
Baffle Dents and Cracks		Dents up to 0.125 inch (0.318 cm) in depth are acceptable. Cracks exceeding 0.125 inch (0.318 cm) in depth shall be repaired as outlined in paragraph 5-313. Cracks, with exception of cracks in forward 0.500 inch (1.270 cm) of baffle, shall be repaired as outlined in paragraph 5-313. Cracks in forward 0.500 inch (1.270 cm) area of baffle are not acceptable and require baffle replacement. New cracks resulting in material loss up to 4 square inches in area may be repaired as outlined in paragraph 5-313. Material loss exceeding 4 square inches in area shall require baffle replacement.
Cracks, incomplete fusion or penetration porosity and voids in stainless steel baffle weld joints.		No cracks or crack like indications are allowed. Incomplete fusion or penetration is allowed for a total accumulated length of 2 inches for the full circumference. Surface porosity and/or voids are acceptable up to 0. 100 inch diameter in size with a minimum length between porosity (or void) equal to its diameter. The total accumulated length of porosity (or voids) around the full circumference is limited to 3 inches.

Table 5-102. Second Stage Power Turbine Rotor Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
		WARNING **FLIGHT SAFETY PART** **The total gap and minimum and maximum individual gap limits are flight safety critical.**
Blade Shroud Gap	5-266	a. There shall be no clearance between the A and B blades on rotors which were rebladed (figure 5-266). Clearance between A and B blades on rotors which were not rebladed shall be 0.000 to 0.005 inch (0.013 cm) (figure 5-266). These blades are designed to operate with an interference fit. b. On rotors which are completely rebladed, the maximum cumulative gap between all tip shrouds shall not exceed 0.210 inch (0.533 cm). No individual gap between pairs of A and B blades shall exceed 0.010 inch (0.025 cm). The minimum cumulative gap shall not be less than 0.016 inch (0.041 cm). c. On rotors which are not completely rebladed, the maximum cumulative gap between all tip shrouds shall not exceed 0.210 inch (0.533 cm). No individual gap between pairs of A and B blades shall exceed 0.020 inch (0.051 cm). The minimum cumulative gap shall not be less than 0.016 inch (0.041 cm). If individual gap exceeds 0.020 inch (0.051 cm) or the total cumulative gap exceeds 0.210 inch (0.533 cm), replace blades as necessary to obtain proper gap. (Refer to paragraph 5-316). If individual gap is less than 0.0005 (13 cm), determine accumulated gap. If gap is greater than 0.016 inch (0.041 cm), or greater no rework is required. If accumulated gap is below 0.016 inch (0.041 cm), repair as outlined in paragraph 5-313.
Pilot Diameter Exceeds Maximum Overall Dimensional Limits		a. Measure bore diameter only if pilot diameter exceeds the maximum overhaul limits. (Refer to table 5-98). b. If bore diameter exceeds maximum overhaul limits in table 5-98, replace disc assembly. c. Discs that exhibit acceptable bore diameters shall have a point Q (ball root) dimensional check performed. (Refer to table 5-98 and figure 5-265). d. Discs that indicate a point Q equal to or less than maximum overhaul dimensions are acceptable for repair. If tip diameter exceeds overhaul limits, tip-grind as outlined in paragraph 5-314. If pilot diameter exceeds overhaul limits repair as outlined in paragraph 5-313. e. Replace discs that fail to meet requirements of the point Q dimensional inspection.
Heat Discoloration and Burning of Blades		a. Discoloration of blades caused by normal operation is allowed. b. Any loss of material caused by burning is cause to replace blades. c. Visual distortion and deformation caused by excessive heat is reason to reject blades.

Table 5-102 . Second Stage Power Turbine Rotor Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Disc for Corrosion Pitting in Face and Tenon Face Areas (1-140-272-01)		a. Inspect disc for corrosion pitting in face and tenon face areas. Pitting on upper forward disc face between the 4.920 diameter and the tenon face is allowed up to a maximum depth of 0.020 inch. In the tenon face areas and lower forward disc area, below the 4.920 diameter, a maximum depth of 0.015 inch is acceptable. In the aft disc face pitting up to a maximum depth of 0.020 is allowed. Measure several of the deeper pits for depth using dial indicator having a 0.031 to 0.035 inch diameter contact ball point. Select an unworn area of disc as a reference point (Refer to figure 5-264.) b. If heavy corrosion pitting is observed in tenon face areas adjacent to blade slots, remove two blades and inspect slots. If pitting is evident, remove all blades and proceed as follows: (1) Clean disc by dry cleaning solvent method. (Refer to SP. No. 3002 in Appendix E.) If this method is not adequate, use vapor-blasting method. (Refer to SP No. 3003 in Appendix E). (2) Using suitable probe or dial indicator where access permits, check several pits for depth. Pitting up to a maximum depth of 0.010 inches (0.025 cm) is acceptable in all slots. c. If above limits are exceeded, replace disc. If within above limits, repair disc. (Refer to paragraph 5-313).
Nicks, Burrs, and Raised Metal in Disc Locking Pin Holes		Nicks, burrs, and raised metal in locking pin holes shall be blend-repaired to parent metal using carborundum stone or equivalent.

c. Remove positive contact seal tracking and residual deposits of coke, varnish, and carbon that project above seal ring (6, figure 5-259) journal surface (2.824 to 2.825 inch (7.173 to 7.176 cm) diameter) by lightly polishing journal with crocus cloth (item 125, table C–1). (See figure 5-263.)

NOTE

It is not necessary to remove carbon deposits that are imbedded below journal surface. All polishing shall be accomplished in a circumferential direction.

d. Repair worn journal surface (2.824 to 2.825 inch (7.173 to 7.176 cm) diameter) of seal ring (6, figure 5-259) by chrome plating as outlined in SP No. 6014 in Appendix E. (See figure 5-263.)

e. Repair worn surfaces on 3.640 to 3.641 inch (9.246 to 9.248 cm) diameter of seal housing (9, figure 5-259) where up to 0.005 inch (0.013 cm) maximum plate thickness is required. (See figure 5-267.)

(1) Machine, if necessary, to obtain a 0.002 inch (0.005 cm) minimum plate thickness after final machining.

(2) Chrome-plate as outlined in SP No. 6014 in Appendix E.

(3) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Machine to dimensions given.

f. Repair scoring, fretting, or wear on 0.440 to 0.445 inch (1.118 to 1.146 cm) surface of rear bearing retainer ring (27, figure 5-259) or 0.449 to 0.451 inch (1.140 to 1.146 cm) surface of forward bearing retaining ring (14) by either chrome-plating or plasma flame spraying as follows: (See figure 5-268).

(1) Repair ring by chrome plating as follows:

(a) Machine surface, if necessary, to obtain a 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final grind.

(b) Chrome-plate as outlined in SP No. 6014 in Appendix E.

(c) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(d) Finish-grind to dimensions shown in figure 5-268.

(2) Repair ring by plasma flame spraying as follows:

(a) Machine or strip surface, if necessary, to obtain a 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup thickness after final machining.

(b) Plasma flame spray as outlined in SP No. 5006 in Appendix E, using molybdenum powder (item 219, table C–1).

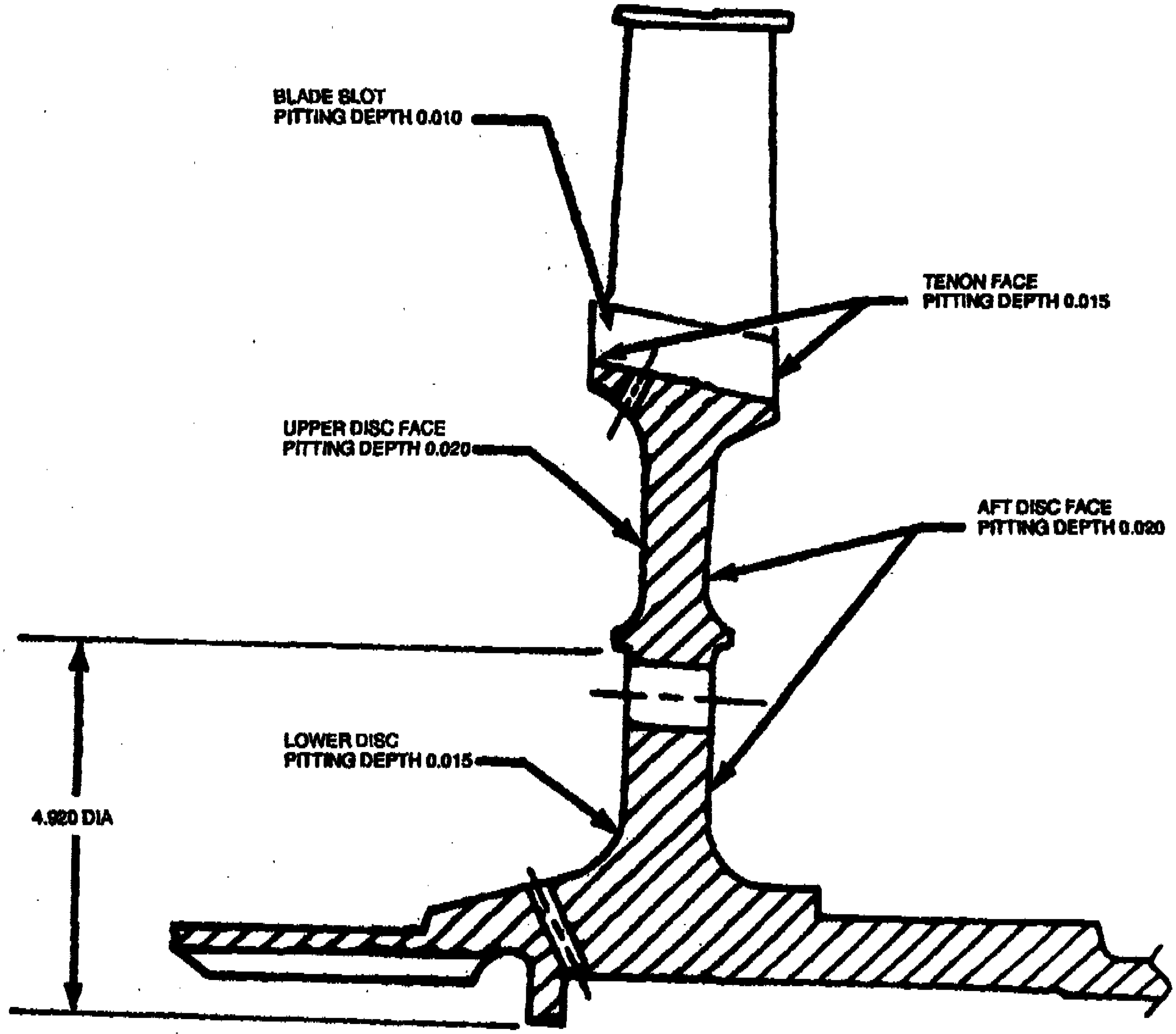
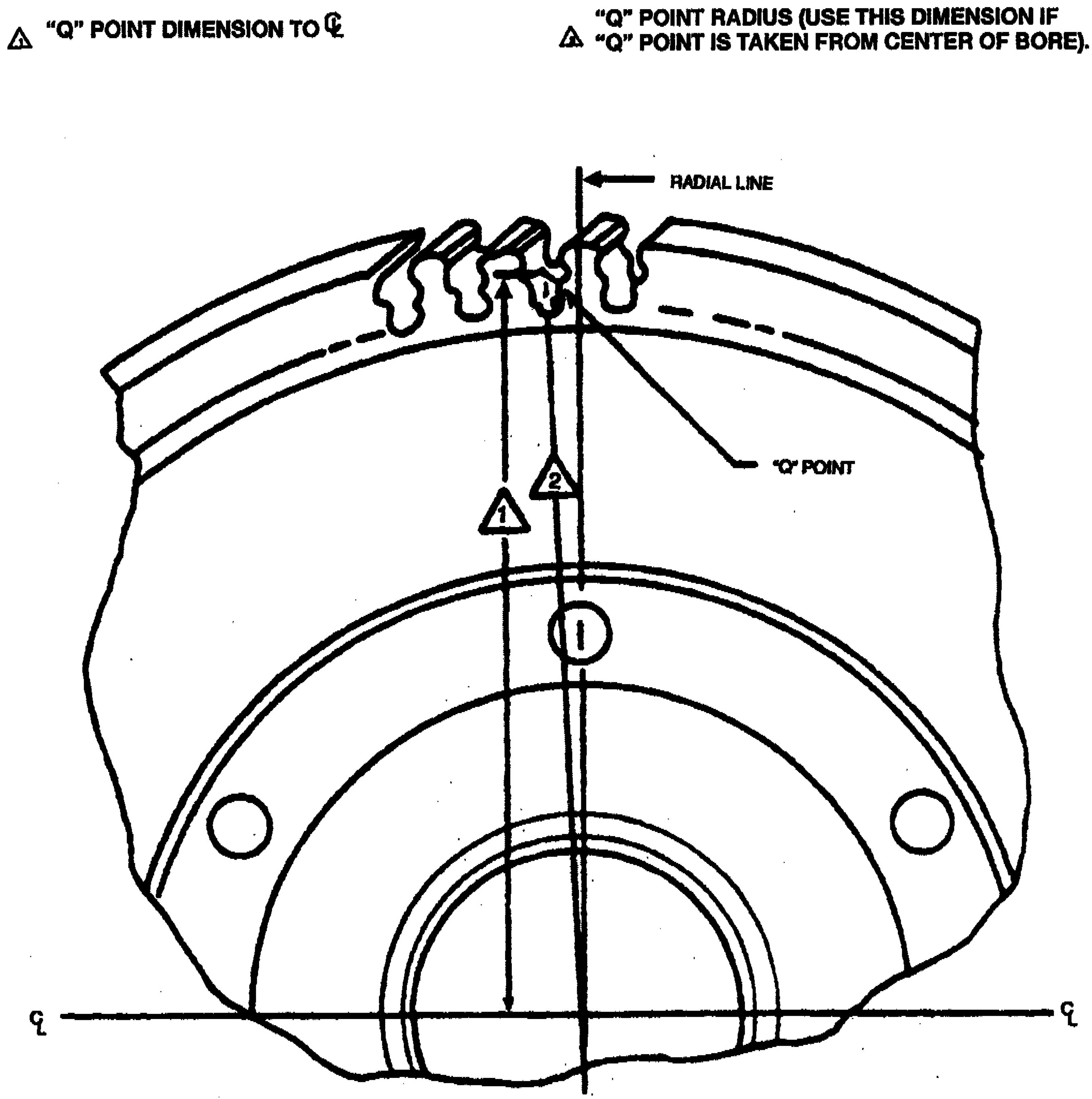
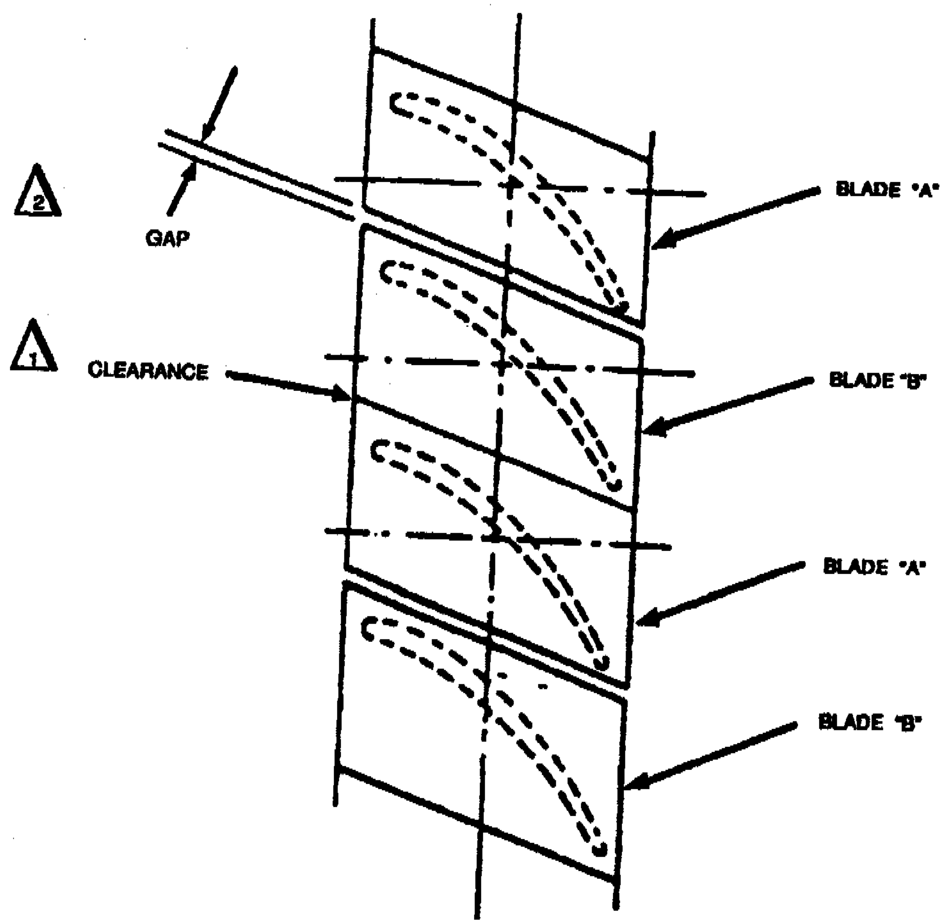


Figure 5-264. Corrosion and Pit Limits for Second Stage Power Turbine Rotors.



"Q" POINT DIM TO CENTER LINE 1		"Q" POINT RADIUS TO CENTER BORE 2	
DRAWING DIM.	O/H SVC. DIM	DRAWING DIM	O/H SVC. DIM
4.018/4.022 (10.206/10.216)	4.023 (10.218)	4.019/4.023 (10.208/10.218)	4.024 (10.221)

Figure 5-265. Second Stage Power Turbine Disk "Q" Point Dimension.



WARNING

FLIGHT SAFETY PART

The total gap and minimum and maximum individual gap limits are flight safety critical

1. NO CLEARANCE ON ROTORS WHICH ARE REBLADED. 0.000 TO 0.005 INCH CLEARANCE ON ROTORS WHICH WERE NOT REBLADED.

2. MAXIMUM TOTAL GAP WITHIN ASSEMBLY MUST NOT EXCEED 0.210 INCH. TOTAL GAP SHALL NOT BE LESS THAN 0.016 INCH

   INDIVIDUAL GAP SHALL BE 0.0005 TO 0.010 INCH ROTORS WHICH ARE REBLADED

   INDIVIDUAL GAP SHALL BE 0.0005 TO 0.020 INCH ROTOR WHICH ARE NOT REBLADED

Figure 5-266. Second Power Turbine Rotor Blade Shroud Gap.

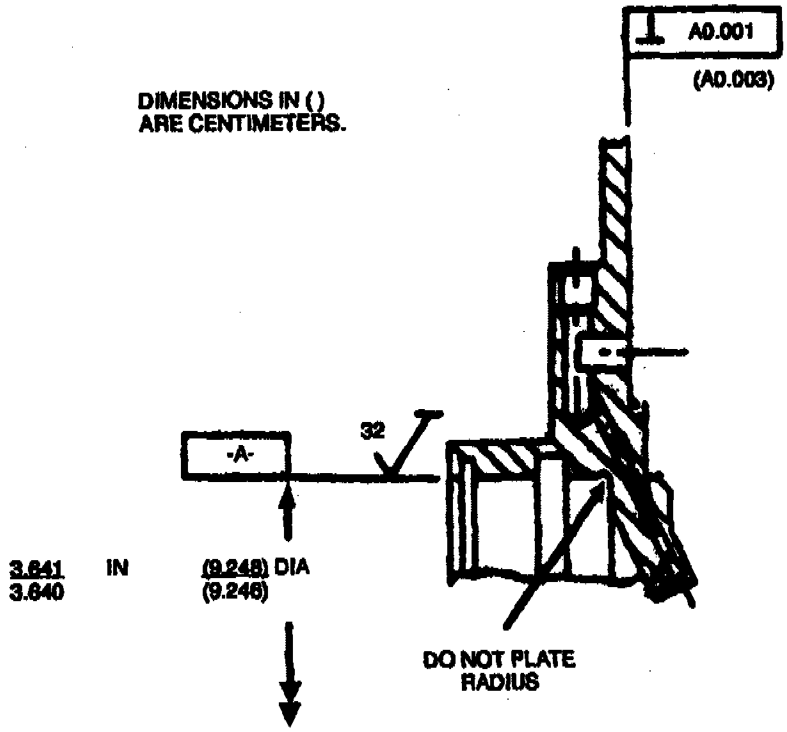


Figure 5-267. Seal Housing - Repair Area.

NOTE

Ensure adequate masking in order to confine plasma flame spray to desired surface.

(c) Finish-machine to dimensions shown in figure 5-268.

(d) Touch up reworked area, if required, with black oxide coating as outlined in SP No. 6002 in Appendix E.

g. Repair cracks in bearing spacer (16, figure 5-259), using tungsten inert gas or Linde pencil arc with welding wire (item 354, table C–1). Refinish bearing housing as outlined in SP No. 6002 in Appendix E. Pressure-test bearing housing. (Refer to paragraph 5-314.)

CAUTION

Ensure bearing housing spacer is stress-relieved following weld-repair.

h. Repair bosses of bearing housing (19, figure 5-259) as follows:

(1) Repair worn or stripped threads in connectors as follows:

NOTE

The following may be accomplished provided the hole is centered in boss and repair will leave 0.125 inch (0.318 cm) solid wall (minimum) after tapping for threaded plug.

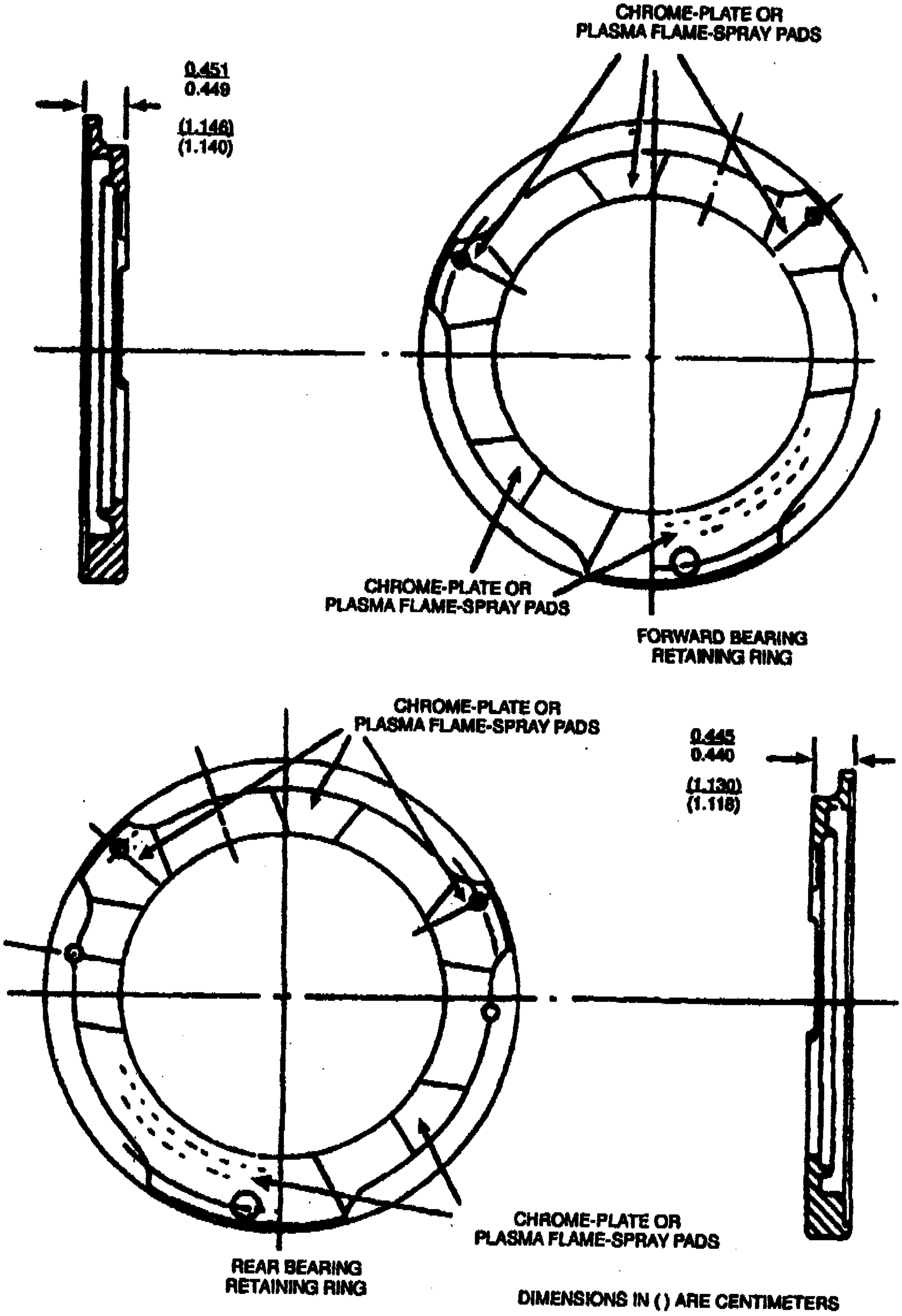


Figure 5-268. Forward and Rear Bearing Retaining Rings - Inspection and Repair.

(a) Manufacture plug from steel (item 305 or 306, table C–1) as shown figure 5-269.

NOTE

Threads shall be cut 0.0005 to 0.0010 inch (0.0013 to 0.0025 cm) oversize.

(b) Drill out damaged threads to a depth of 0.032 inch (0.081 cm), using bottom drill with 0.4459 to 0.4537 inch (1.1326 to 1.1524 cm) diameter.

(c) Using 0.50-20UNF-3B tap, tap hole to depth of 0.30 inch (0.76 cm).

(d) Apply sealing, locking, and retaining compound (item 269, table C–1) to thread of hole.

(e) Install plug into hole, 0.0005 to 0.0010 (0.0013-0.0025 cm) inch tight on threads.

(f) Machine plug flush to top of boss.

(g) Stake plug in two places.

(h) Drill plug to 0.3299 to 0.3372 inch (0.8379 to 0.8565 cm) diameter and 0.376 inch (0.955 cm) depth as shown in figure 5-270. Countersink 90 degrees to 0.39 inch (0.99 cm) diameter.

(i) Using a 0.375-24UNF-3B tap, tap hold to a depth of 0.30 inch (0.76 cm).

(j) Pressure-test at 15 psig (1055 gm sq cm). No leakage is allowed.

(2) Repair damaged threads by retapping with proper size tap.

CAUTION

During repair, use light pressure on cutter.

(3) Repair damaged tube seats by filing, use a suitable ball-shaped rotary file (edges ground off at sides) mounted in a drill press.

(4) Replace mutilated and distorted bosses as follows:

(a) Remove damaged boss or bosses.

(b) Clean areas to be brazed with acetone (item 13, table C–1)

(c) Torch-braze new boss or bosses to bearing housing in accordance with Military Specification MIL-B-7883, using brazing alloy (item 58, table C–1).

NOTE

As an alternate to preceding braze procedure, vacuum braze using brazing alloy (item 64, table C–1). Vacuum brazing requires removal of all hard chrome prior to repair.

NOTE

Part must be placed on ceramic plate that is flat within 0.002 inch (0.005 cm) TIR.

(d) Refinish bearing housing as outlined in SP No. 6012 in Appendix E.

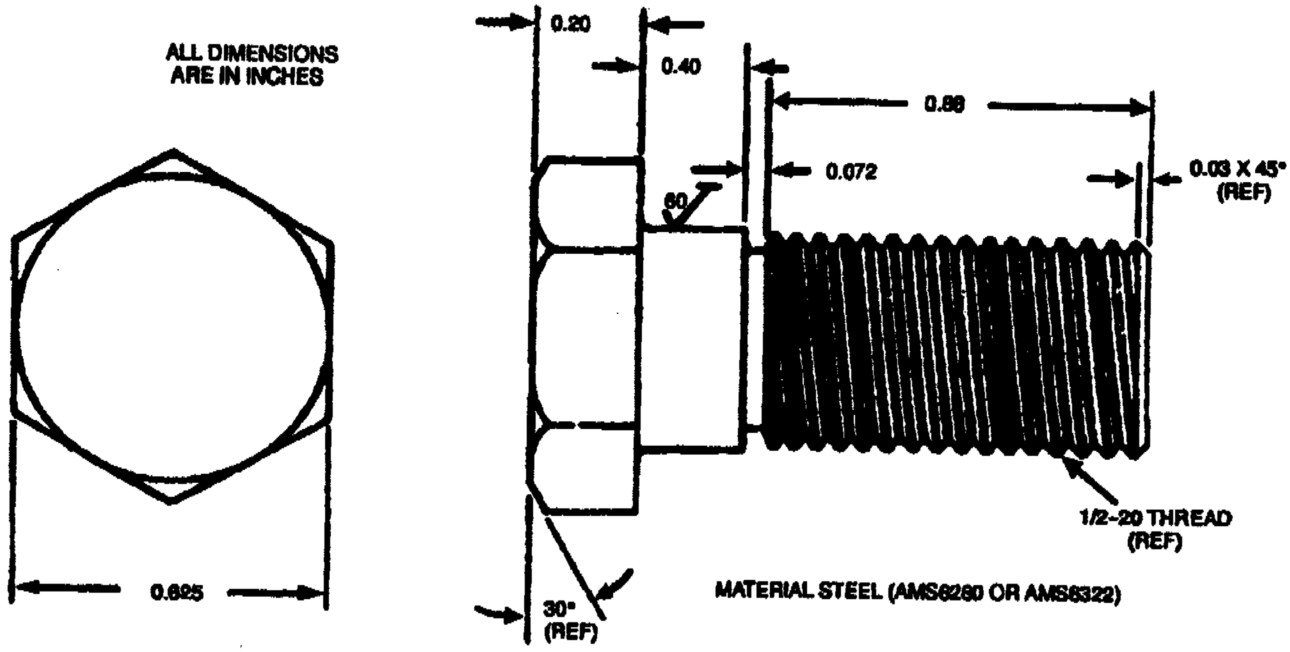


Figure 5-269. Fabrication of Plug.

(e) If part was vacuum brazed, prepare surface and chrome plate as outlined in SP No. 6014 in Appendix E.

(f) Pressure-test bearing housing as outlined in paragraph 5-314.

(5) Bent scavenge oil tube may be straightened provided deformation does not exceed 0.125 inch (0.318 cm). If deformation exceeds 0.125 inch (0.318 cm). or if scavenge oil tube is mutilated, replace oil tube as follows:

(a) Using an electric discharge machine, Type H1RP103, or equivalent, with an 0.189 to 0.192 inch (0.480 to 0.488 cm) diameter electrode, remove tube from both ends of housing and tee.

(b) Clean areas to be brazed with acetone (item 13, table C–1)

(c) Using stainless steel wire brush, brush rework area.

CAUTION

In following step (d), to minimize distortion, minimize heat input to flanges.

(d) Install replacement tube and, using brazing alloy (item 57, table C–1), torch brace joints in accordance with SP No. 5003 in Appendix E. (See figure 5-271).

(e) Dry with clean, dry air.

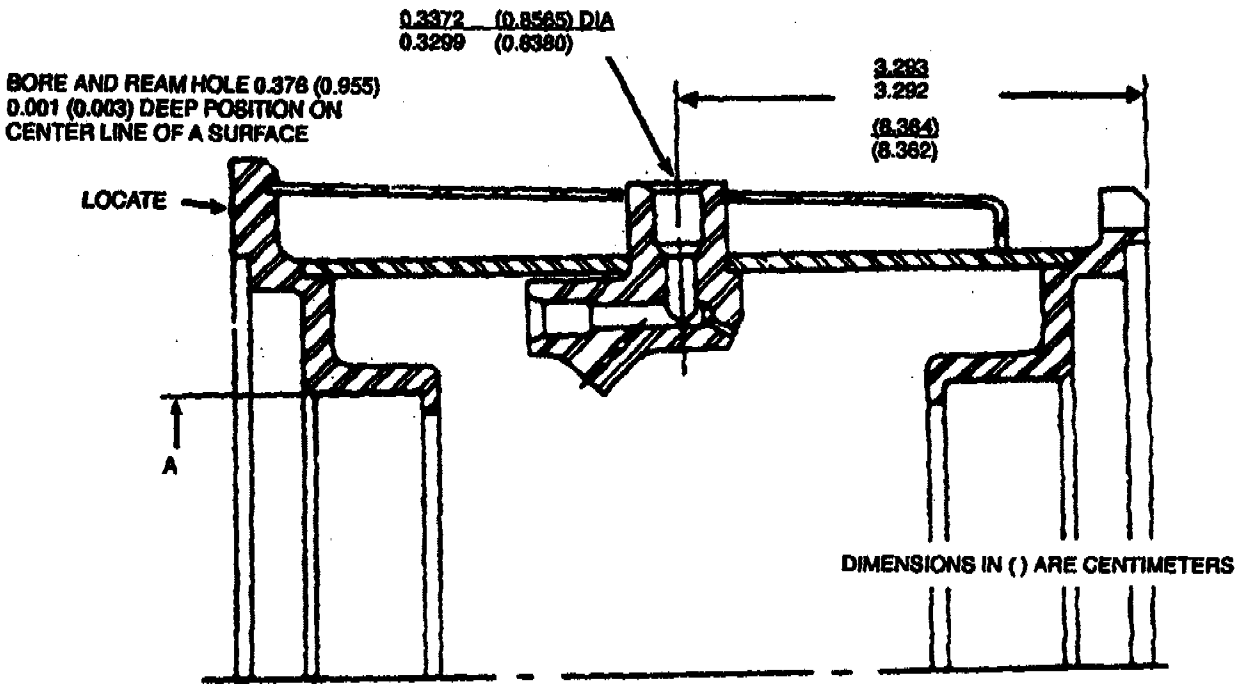


Figure 5-270. Installation of Fabricated Plug.

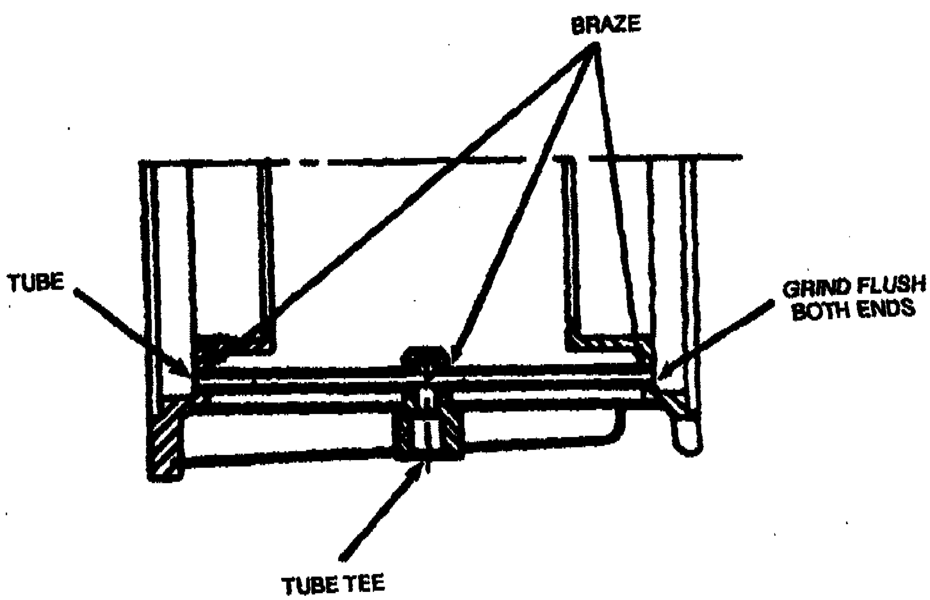


Figure 5-271. Bearing Housing Tube Replacement.

(f) Machine ends of tube flush with bearing housing. (See figure 5-271.)

(g) Pressure-test housing at 15 psig (1055 gm sq cm). If leakage is evident, repeat braze repair.

(h) Refinish brazed areas as outlined in SP No. 6012 in Appendix E.

(i) Pressure-test bearing housing as outlined in paragraph 5-314.

(6) Repair braze joints in accordance with one of the following methods:

(a) Defects around bosses may be torch-brazed in accordance with Military Specification MIL-B-7883, using brazing alloy (item 58, table C–1).

(b) Defects in all other joints shall be repaired using vacuum-braze method and braze alloy (item 64, table C–1).

NOTE

Prior to vacuum brazing, all hard chrome must be removed and bearing housing must be placed on ceramic plate that is flat within 0.002 inch TIR.

(c) After braze repair, refinish brazed areas as outlined in SP No. 6012 in Appendix E.

(d) Prepare surface and chrome-plate as outlined in SP No. 6014 in Appendix E.

(e) Pressure-test bearing housing as outlined in paragraph 5-314.

i. Repair misaligned retainer screw holes in bearing housing (19, figure 5-259) as follows:

(1) Coat threads of screw, MS16995-11, with sealant (item 263, table C–1). Install screw in retainer screw hole and tighten.

NOTE

A similar screw (plug) may be made from steel rod (item 307, table C–1).

(2) Machine head of screw flush with bearing housing flange surface.

(3) Reform both ends of screw threads.

(4) Relocate screw holes to manufacturer's specifications.

NOTE

When relocating new screw holes, if half or more of the installed plug will be removed, reject bearing housing.

j. Repair bearing housing (19) as follows: (See figure 5-263.)

(1) Repair damaged phosphate coating by touching up with MIL-C-13924, Type 1 coating (item 106, table C–1).

(2) Repair damaged plating as follows:

(a) Chrome-plate bearing bores (3.5430 to 3.5434 inch (8.9992 to 9.0002 cm) and 3.5432 to 3.5436 inch (8.9997 to 9.0007 cm diameters) to obtain a 0.002 to 0.010 inch (0.005 to 0.025 cm) thickness after final machining. (Refer to SP No. 6014 in Appendix E.)

(b) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(c) Machine to dimensions given.

k. Repair baffle on bearing housing (19, figure 5-259) as follows:

(1) Dents exceeding 0.125 inch (0.318 cm) in depth may be reformed to approximate contour by cold-forming.

(2) Repair cracks as follows:

(a) Cracks in baffle, excluding area in forward 0.500 inch (1.270 cm) of baffle, may be repaired by tungsten inert gas welding, using welding wire (item 354 or 355, table C–1) in accordance with Military Specification MIL-W-8611.

NOTE

No pre-heat or stress-relieving is necessary.

(b) Converging cracks that have resulted in material loss, not exceeding an area of 4 square inches, may be repaired by fabrication of a lap-type patch from old baffle or patch from steel sheet (item 308, table C–1). Weld as specified in preceding step (a).

(c) Refinish bearing housing as outlined in SP No. 6012 in Appendix E.

(3) If baffle cannot be repaired as outlined in preceding steps (1) and (2), replace baffle as follows:

NOTE

Prior to brazing, ensure that all hard chrome is removed from parts.

(a) Clean areas to be welded with acetone (item 13, table C–1).

(b) Remove baffle as shown in figure 5-272 and prepare groove for new baffle to dimensions shown in figure 5-273.

NOTE

If connectors are damaged, repair prior to replacing baffle.

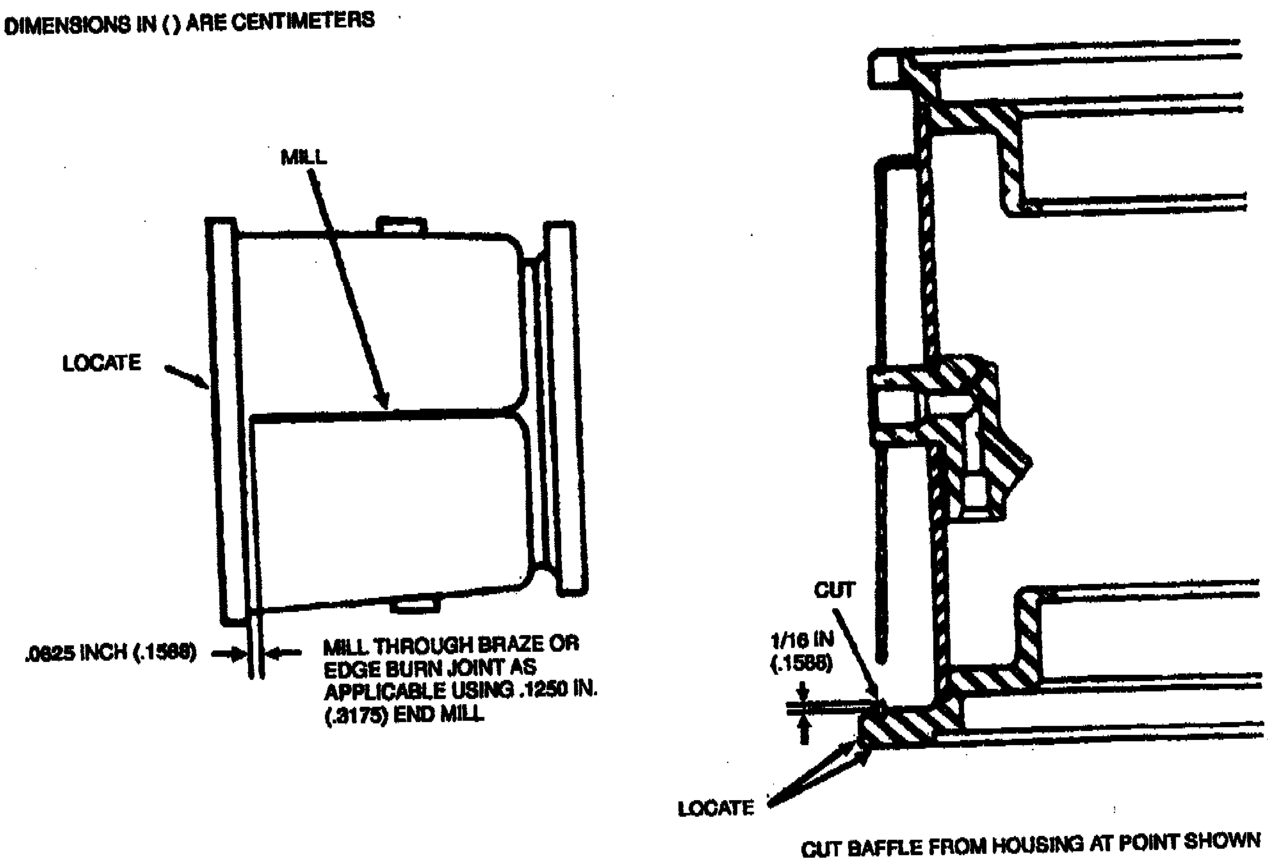


Figure 5-272. Removing Bearing Housing Baffle.

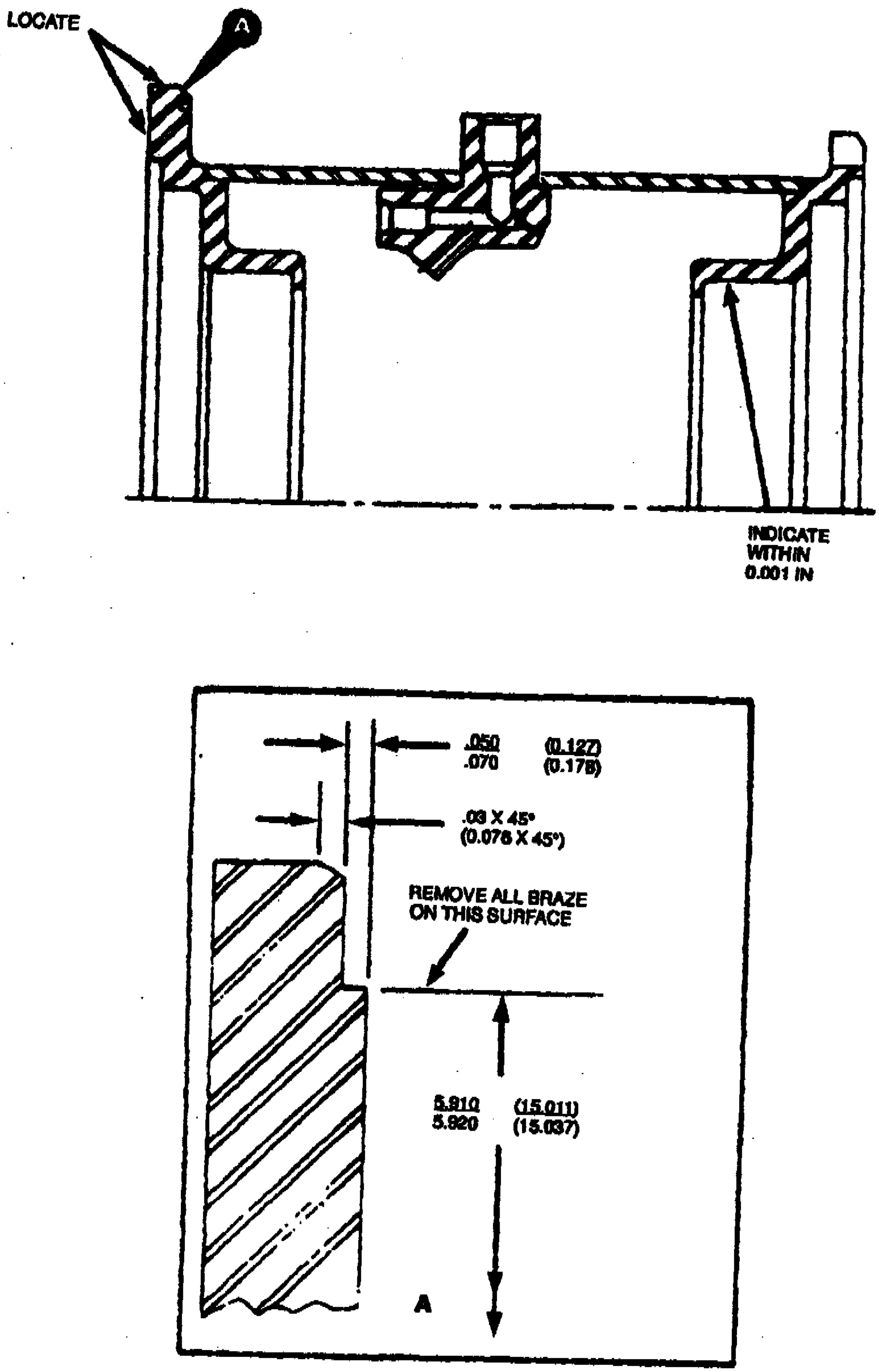


Figure 5-273. Groove Preparation For New Baffle.

(c) Install baffle to bearing housing as shown in figure 5-274, and tack-weld in place in accordance with Military Specification MIL-W-8611, using steel welding wire (item 352, table C–1).

(d) Brush tack-welds with stainless steel wire brush.

(e) Complete welding process on remaining baffle flanges in accordance with MIL-W-8611.

(f) Prepare a 4.746 to 4.748 (12.055 to 12.060 cm) diameter plug from .250 inch (6.35mm), thick steel material (item 296 or 297, table C–1) for an induction brazing stiffener, and insert stiffener into bearing housing as shown in figure 5-275.

(g) Induction-braze the assembly, using brazing alloy (item 60, table C–1). Rotate assembly slowly until brazing is accomplished. See figure 5-275 for induction coil configuration and power requirement.

(h) Rinse the brazed assembly in hot water 180 to 212°F (82 to 100°C), to remove all traces of brazing flux. Air-blast dry.

(i) Repair worn or stripped threads in connectors of power turbine bearing housing assembly as follows:

1 Drill and ream out stripped or worn threads of connectors to a diameter and depth as shown in figure 5-276.

2 Machine a round plug of steel alloy (item 300, table C–1) to a diameter of 0.4540 to 0.4545 inch (1.029 to 1.041 cm), and to a thickness of 0.405 to 0.410 inch (1.1532 to 1.1544 cm).

(j) Place bearing housing, with installed baffle, onto a ceramic plate that is flat within 0.002 inch (0.005 cm) TIR.

(k) Braze baffle to bearing housing at 1,850°F (1,010°C) using brazing alloy (item 64, table C–1).

(l) Refinished brazed areas as outlined in SP No. 6012, in Appendix E.

(m) Prepare surface and chrome-plate as outlined in SP No. 6014 in Appendix E.

(4) Baffle replacement alternate procedure:

(a) Remove old baffle by machining as shown in figure 5-277.

(b) Baffle replacement alternate material for electron beam welding, is SAE 410 stainless steel. The lip specified on the baffle where the ends join together (split line) and a 1/8 inch shorter aft end curl are optional when using the SAE 410 stainless steel only.

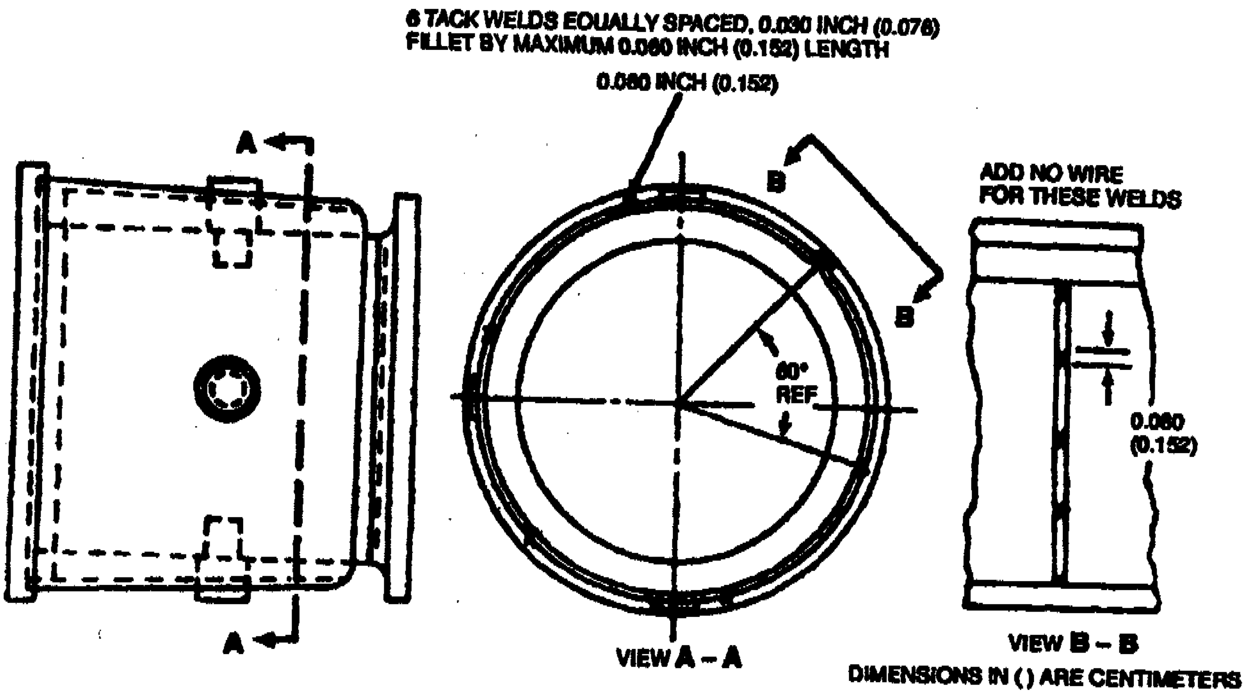


Figure 5-274. Assembly and Tack-Welding of Baffle onto Bearing Housing.

1 Position new baffle per figure 5-274 and clamp into place. It is permissible to cold work baffle split lines in order to obtain required fit. Remove excess material or overlap before tack welding.

2 Maintain 0.15 inch minimum clearance between unrestrained baffle aft end curl and spacer sleeve after baffle replacement. The minimum allowable clearance between the rest of the baffle and spacer shall be 0.30 inch after baffle replacement.

(c) Electron beam weld baffle a full 360° circumference onto bearing housing (figure 5-278) using the following parameters for a full joint penetration.

1 Sharp focus on surface of joint.

2 Approximate energy requirement of 660 joules/inch.

3 Sufficient beam current decay rate with part at travel speed to alleviate any cracking, undercutting, or porosity.

(d) Examples of possible detailed electron beam welding parameters include:

1 Accelerating voltage = 150 Kilovolts

2 Beam current = 7 milliamps

3 Welding speed = 96 inches/minute

4 Beam slope in time = 0.55 seconds

5 Beam slope out time = 5.5 seconds.

(e) Visual and fluorescent penetrant inspect the electron beam weld joint per the following criteria:

1 No cracks or crack like indications are allowed.

2 Incomplete fusion or penetration is allowed for a total accumulated length of two inches for the full circumference.

3 Surface porosity and/or voids are acceptable up to 0.100 inch diameter in size with a minimum length between porosity (or void) equal to its diameter. The total accumulated length of porosity (or voids) around the full circumference, is limited to three inches.

4 Maximum allowable undercut is 0.040 inch and no more than two inches long in a six inch length of circumference.

l. Repair worn surfaces to 0.709 to 0.712 inch (1.801 to 1.808 cm) dimension or 0.806 to 0.812 inch (2.047 to 2.062 cm) dimension of bearing housing (19, figure 5-259), where up to 0.015 inch (0.038 cm) maximum plate thickness is required. (See figure 5-279).

CAUTION

Prior to plating, a minimum parent metal wall thickness of 0.050 inch (0.127 cm) is required.

(1) Machine, if necessary, to obtain a 0.002 inch (0.005 cm) minimum plate thickness after final machining.

(2) Chrome-plate as outlined in SP No. 6014 in Appendix E.

(3) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Machine to dimensions given.

WARNING

FLIGHT SAFETY PART

Dimensional inspection after the following repair is flight safety critical.

m. Repair worn or damaged 3.5430 to 3.5432 inch (8.9992 to 8.9997 cm) or 3.5432 to 3.5436 inch (8.9997 to 8.0007 cm) diameter on bearing housing (19, figure 5-259), where up to 0.015 inch (0.038 cm) maximum buildup is required, by plasma flame-spraying. (See figure 5-263.)

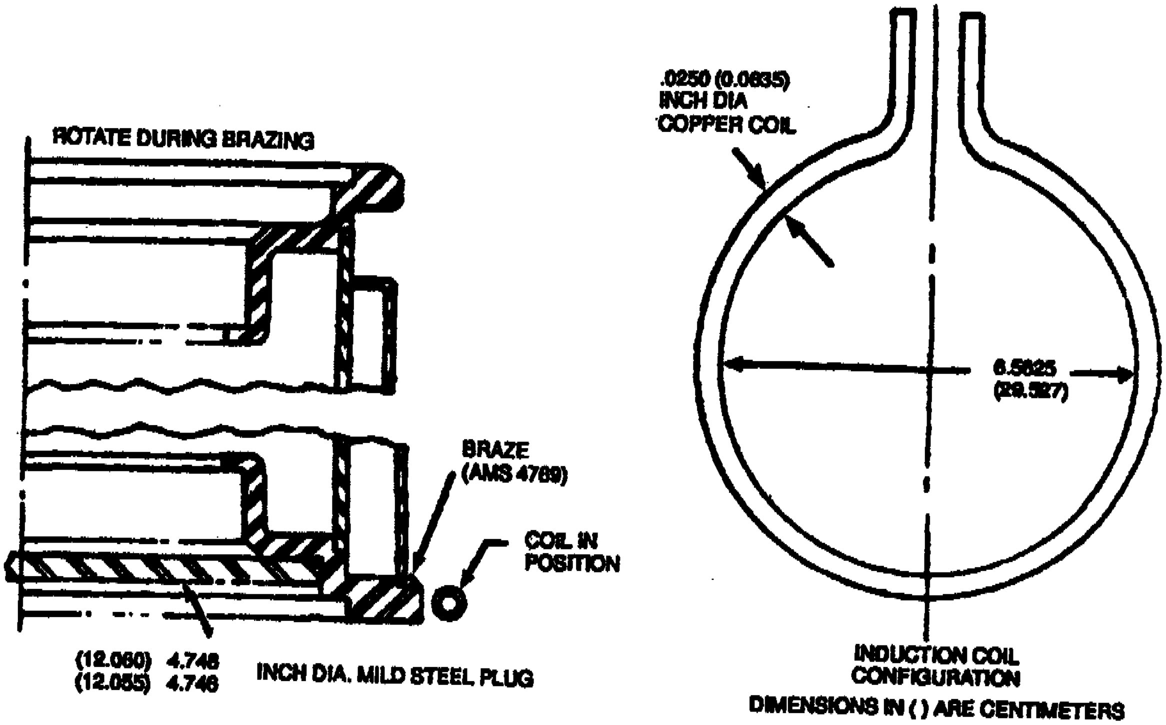


Figure 5-275. Location of Stiffening Plug and Induction Coil For Brazing Baffle Housing.

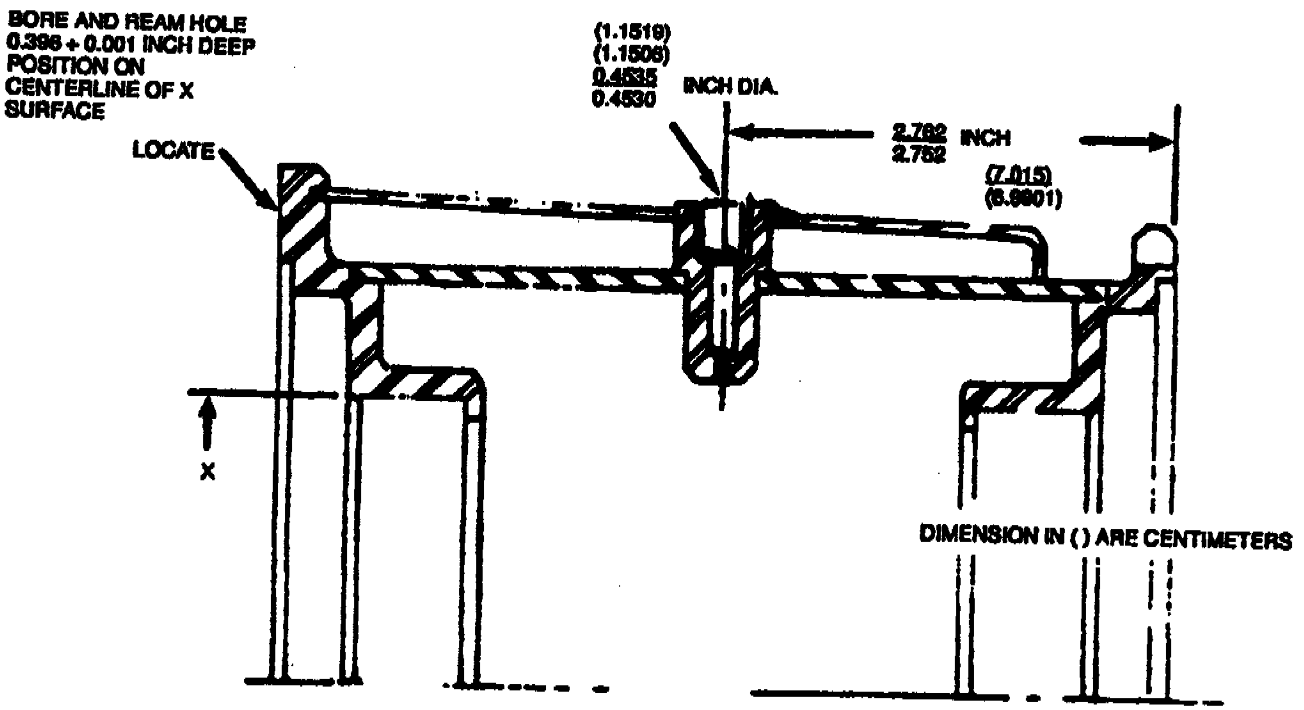


Figure 5-276. Machining of Oil Line Connector In Preparation for Electron-Beam Weld-Repair of Stripped Threads.

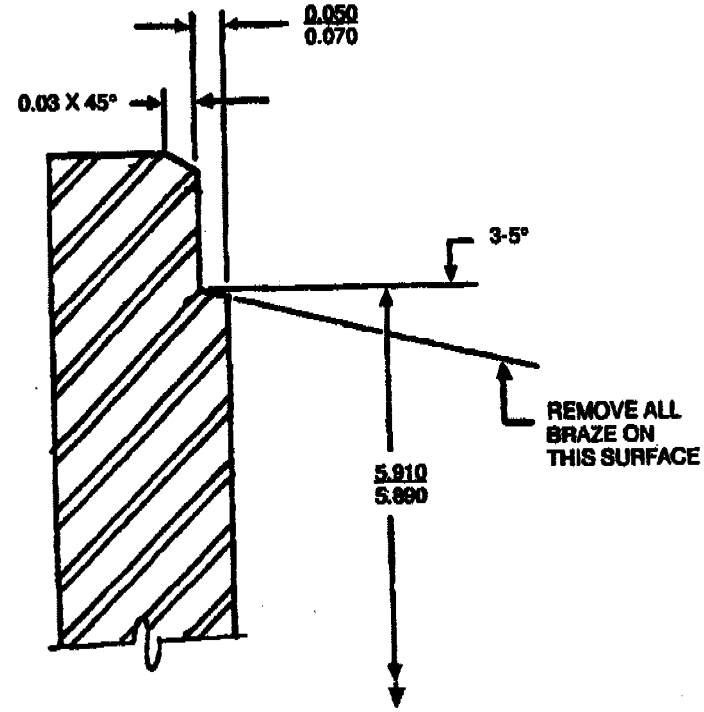


Figure 5-277. Baffle (P/N 1-140-590-04/07) Machining.

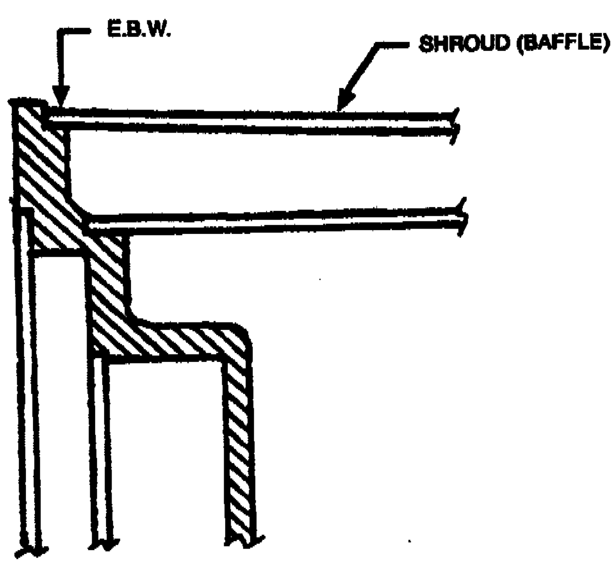


Figure 5-278. Electron Beam Welding of Baffle onto Bearing Housing.

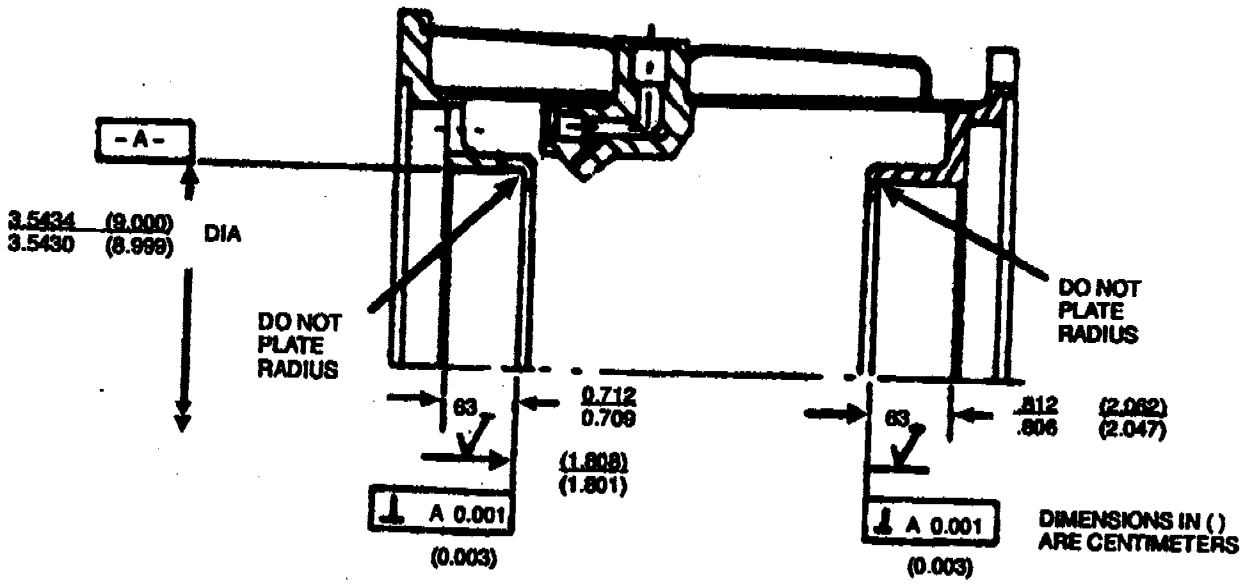


Figure 5-279. Bearing Housing - Repair Areas.

(1) Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup thickness after final machining.

(2) Plasma flame-spray using molybdenum powder (item 219, table C–1), as outlined in SP No. 5006 in Appendix E.

(3) Machine to dimensions given.

n. Repair cracks (silver-brazed) (i.e., power turbine bearing housing brazed joints) as follows:

(1) Silver-braze repair as outlined in SP No. 5003 in Appendix E. (Refer to table 5-103).

(2) Inspect repairs as outlined in SP No. 5003 in Appendix E.

o. Repair damaged or oversized oil jet holes in bearing housing (19, figure 5-259) as follows:

(1) Clean areas to be welded with acetone (item 13, table C–1).

(2) Lightly abrade around repair area to remove surface treatment.

(3) Using welding wire (item 347, table C–1), weld at the two oil jet locations. (See figure 5-280). Direct weld material to flow into the oil jet holes.

(4) Inspect weld as outlined in SP No. 5001 in Appendix E.

(5) Machine excess weld from outer surface per figure 5-280.

(6) Using a 0.12 inch (0.30 cm) diameter drill, drill internal oil passage to a depth of 1.95 to 1.98 inches (4.95 to 5.03 cm).

(7) Redrill 0.036 to 0.041 inch (0.091 to 0.104 cm) diameter oil jet holes as shown in figure 5-281. Holes must be free of burrs.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(8) Perform fluorescent penetrant inspection of rework area.

(9) Flush oil passages thoroughly.

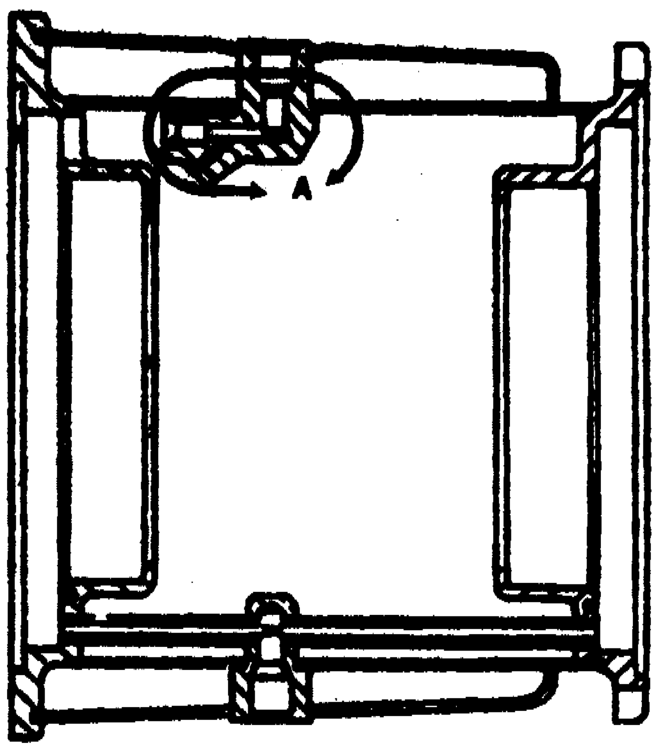
(10) Pressure-test bearing housing as outlined in paragraph 5-314.

p. Correct condition that is causing leakage between tube and mating boss of bearing housing (19, figure 5-259) as follows:

(1) Repair-blend 0.172 to 0.173 inch (0.437 to 0.440 cm) spherical radius on end of tube. Break and blend sharp corners.

NOTE

After blending, the 0.172 to 0.173 inch (0.437 to 0.440 cm) spherical radius must be maintained.



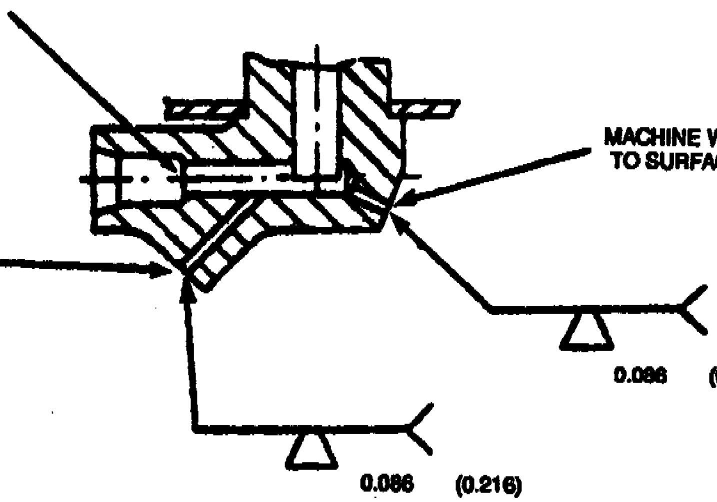


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Figure 5-280. Preparation for Damaged or Oversized Oil Jet Repair.

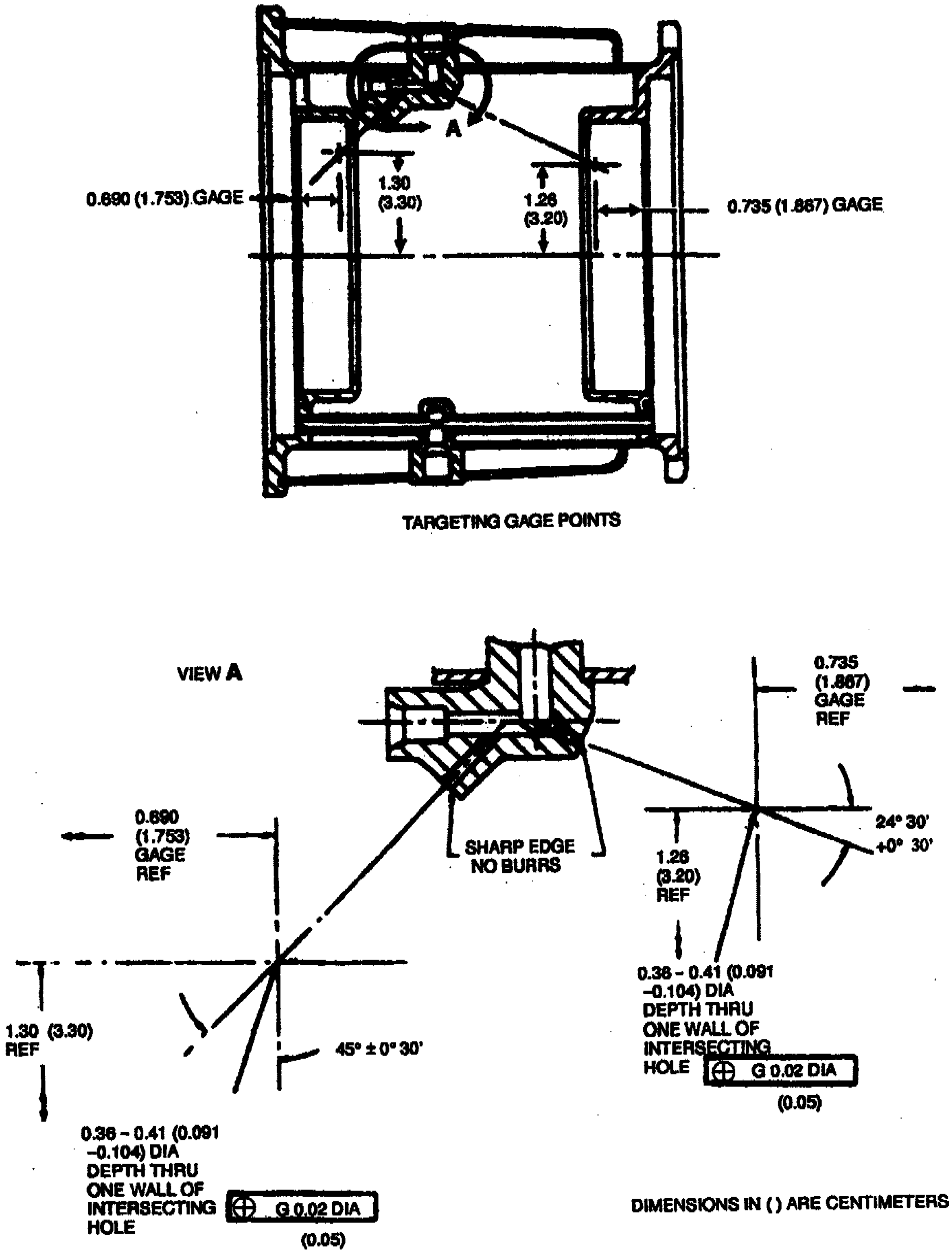


Figure 5-281. Redrilling of Oil Jets.

Table 5-103. Second Stage Turbine Rotor Assembly - Weld and Braze Instructions.

Rework	Process	Preheat	Postheat	Material	Inspection	Pressure Test
Repair for Bearing Housing Braze Defects (Silver Brazed)	Torch-Braze	–	–	Brazing Alloy (item 60, table C–1)	Visual, Fluorescent Penetrant	–
Repair of Bosses, Connect or, and Tube	Fusion-Weld	–	–	Steel Wire (item 315, table C–1)	Visual, Fluorescent Penetrant	–
Repair of Parent Metal and Weld Defects in Cooling Air Deflect or	Fusion-Weld	–	–	Steel Wire (item 317, table C–1)	Visual, Fluorescent Penetrant	–

(2) Add one extra thread (0.375-24UNF-3A) to tube to offset material removed in preceding step (1).

(3) If leak still exists, lap bearing housing boss with lapping compound (item 178, table C–1). Use serviceable unthreaded tube to form a new seat.

(4) Remove all traces of lapping compound by cleaning with dry cleaning solvent (item 134, table C–1).

q. Repair nut (20, figure 5-259) as follows:

(1) Blend-repair nicks, burrs, and scratches as outlined in SP No. 5000 in Appendix E. If, during repair, surface coating has been disturbed, repair as outlined in SP No. 6019 in Appendix E.

(2) Repair damaged threads as outlined in SP No. 5007 in Appendix E. If, during repair, surface coating has been disturbed, repair as outlined in SP No. 6019 in Appendix E.

WARNING

FLIGHT SAFETY PART

Verification that there is no loss of silver plate on ID threads is flight safety critical.

(3) Repair damaged surface coating as outlined in SP No. 6019 in Appendix E.

r. Remove metalization, that cannot be removed by normal cleaning procedures, from turbine rotor blades (31 and 32, figure 5-259) by using 220-grit aluminum oxide powder (item 36, table C–1) applied as a dry blast with 30 to 40 psi (2109 to 2812 gm sq cm) air pressure.

s. Repair thinned out (sharp edge) on trailing edge of blade shroud by blending area to maximum depth of 1/16 inch. (See figure 5-282).

t. Observe the following rules during repair of turbine rotor blades (31 and 32, figure 5-259). (See figure 5-283.)

(1) Use portable power drill or rotary file equipped with carbide burr. If these are not available, small diesinker-type file or India or carborundum stone may be substituted.

(2) Finish strokes shall be parallel to leading and trailing edges of blades.

(3) Final polishing of area shall be made with crocus cloth (item 125, table C–1). All repairs shall be blended and finished smoothly.

(4) Leading or trailing edge repairs shall be blended to smooth radius as part of repair. (See figure 5-283.)

(5) Finish-repair length shall be blended to minimum of three times depth of damage.

u. Repair leading and/or trailing edges of turbine rotor blades (31 and 32, figure 5-259) as follows:

(1) Round bottom dents, 0.010 inch (0.025 cm) or less deep, require removal of sharp edges only.

(2) When distance between two damaged areas is less than twice the depth of the deeper damage, make one repair area. When distance between two damaged areas is greater than twice the depth of the deeper damage, make separate repair areas. (See figure 5-283.)

(3) The maximum permissible finished-repair depth of 0.031 inch (0.79 cm) from leading edge and 0.023 inch (0.058 cm) from trailing edge. (See figure 5-284.) Allowable depths decrease as distance between damage and Point A, figure 5-284, on leading edge, or Point B, on trailing edge, decreases.

(4) No repair is allowed within 0.500 inch (1.270 cm) of blade platform.

(5) Cracks are cause for blade replacement. Damage that cannot be completely eliminated by allowable blade repairs shall be cause for blade replacement.

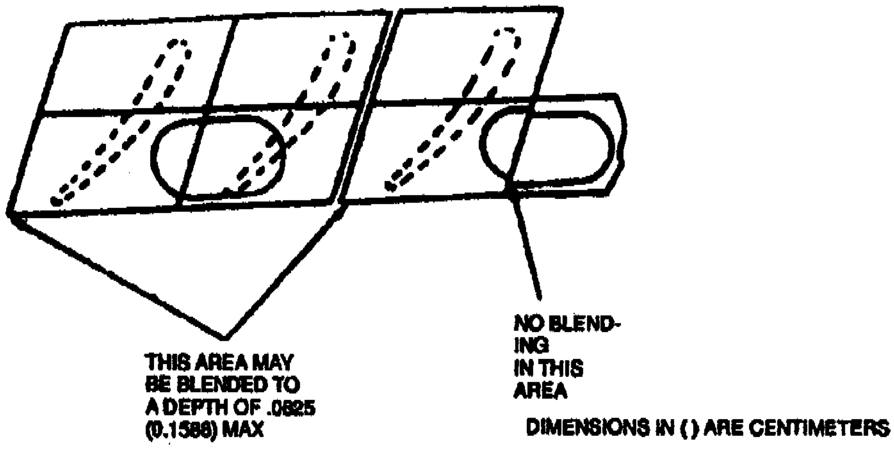


Figure 5-282. Repair of Power Turbine Rotor Blade Shroud.

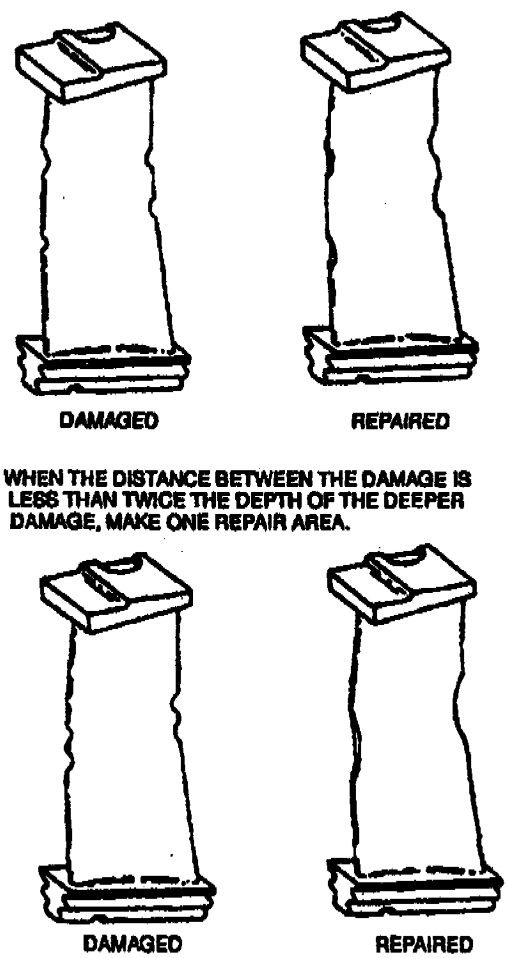
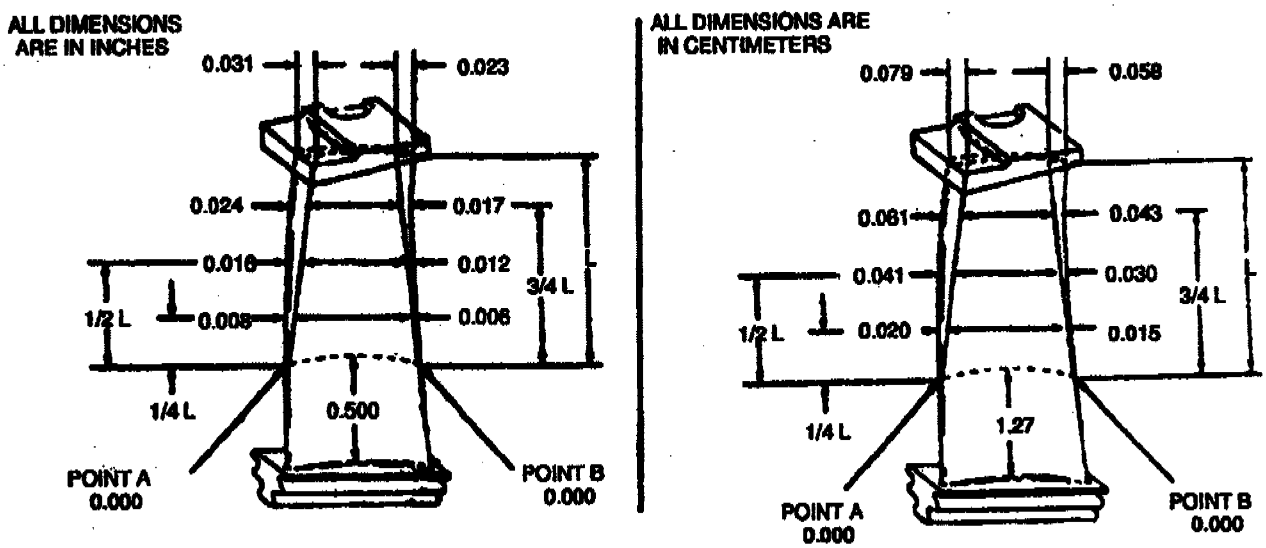


Figure 5-283. Power Turbine Rotor Blade Damage - Before and After Repair.



WARNING

FLIGHT SAFETY PART

The 0.500 inch area is Flight Safety Critical

Figure 5-284. Power Turbine Rotor Blade Maximum Repair Depth.

v. Repair surfaces of blades (31and 32, figure 5-259) as follows:

(1) Maximum permissible decrease in thickness at any point on the blade shall be 0.010 inch (0.025 cm).

(2) Maximum permissible finished single repair on blade surface shall be 0.200 square inch on either concave or convex side.

(3) Repairs shall be blended to a minimum of twice the depth of the damage.

(4) Total repaired surface area shall not exceed 10 percent of blade surface.

(5) When distance between two damaged areas is less than twice the depth of the deeper damage, make one repair area. When distance between two damaged areas is greater than twice the depth of the deeper damage, make separate repair areas. (See figure 5-283.)

WARNING

FLIGHT SAFETY PARTS

The .500 inch area is flight safety critical.

(6) No repair is allowed within 0.500 inch (1.270 cm) of blade platform. (See figure 5-284.)

(7) Cracks are cause for blade replacement. Damage that cannot be completely eliminated by allowable blade repairs shall be cause for blade replacement.

w. Repair nicks, dents, or burrs on "FIN" at outer diameter edge of turbine rotor disc tenon face (33, figure 5-259) per SP No. 5000. Fifty percent of the original FIN length must remain after rework.

x. Remove corrosion pitting on surfaces of turbine rotor disc, PN 1-140-272-01.

(1) Remove blades as outlined in paragraph 5-316.

(2) Strip paint in hot-alkali-soak. (Refer to SP Nos. 3004 and 3005 in Appendix E.)

(3) Remove corrosion using periodic reverse cleaning method. (Refer to SP No. 3006 in Appendix E.)

WARNING

FLIGHT SAFETY PARTS

The 63 RMS finish on bolt hole bores and the 0.03/0.06 inch radius at ends are flight safety critical.

(4) Rotor discs shall be painted with aluminum paint, (item 37, 38, or 39, table C–1) at overhaul after reworking the bolt holes to the following oversized dimensions:

Ream the six (6) 0.342 - 0.349 inch (0.869 to 0.886 cm) diameter holes oversize to remove corrosion; do not exceed 0.20 inch (0.050 cm) oversize.

Ream the three (3) 0.220 inch (0.559 cm) diameter holes oversize to remove corrosion; do not exceed 0.20 inch (0.050 cm) oversize.

Increase corner radius at all nine holes, on both sides, to 0.030 to 0.050 inches (0.076 to 0.852 cm).

NOTE

Any evidence of corrosion pitting noted in the hole area after rework is cause for rejection of this part.

(a) Painting procedure:

1 Surface preparation:

a Clean surfaces with acetone (item 13, table C–1)

b After cleaning, plug bleed air holes and mask all surfaces not requiring grit blasting and painting as shown in figure 5-285. DO NOT attempt to grit-blast bolt holes. Use fine aluminum oxide paper (300 to 400 grit) (item 35, table C–1) to clean out bolt holes in preparation for applying the coating.

c Dry grit-blast surfaces of part with aluminum oxide grit (item 8, table C–1, or equivalent coarse to medium abrasive). Use a pressure of 35 to 45 psi (2461 to 3164 gm sq cm) with clean dry air, and use clean sharp (new) grit for blasting surfaces. Grit blasted surfaces should be uniform in appearance and no metallic luster of the parent metal should be observed.

NOTE

Dry air for abrasive blasting should have a maximum dewpoint of +32°F (0°C).

d Remove residual grit from the blasted surfaces with clean dry air.

e After the cleaning and grit blasting operations have been completed, do not handle the part with bare hands. If it is necessary to handle the part, use clean gloves or a clean cloth.

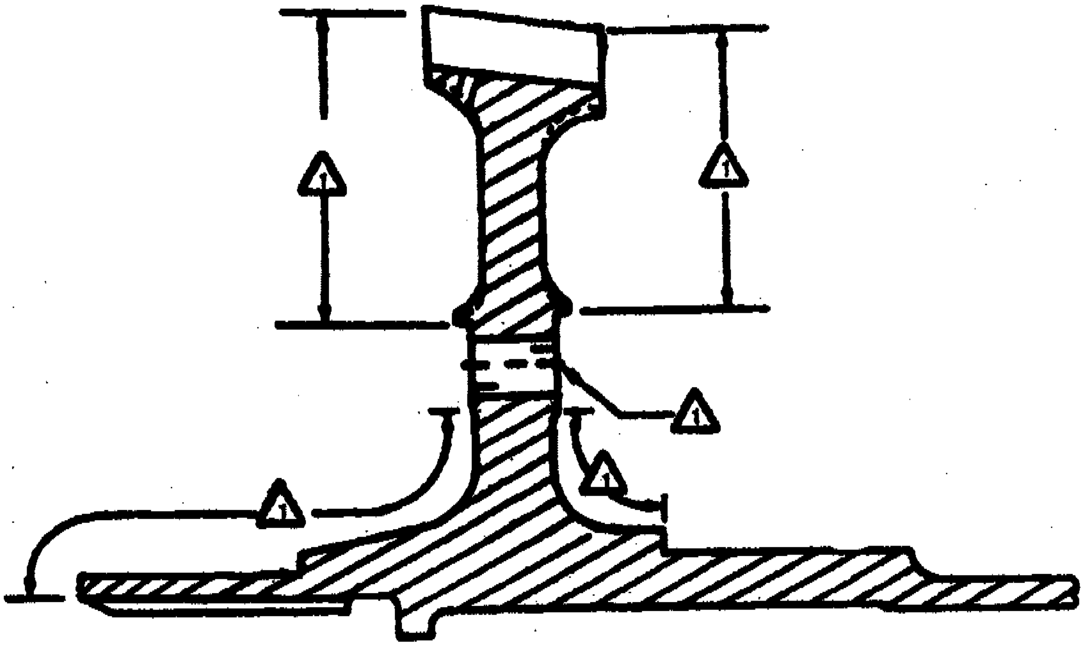


Figure 5-285. Second Stage Power Turbine Rotor Disc - Repair Area.

f The time interval between surface preparation and application of this aluminum coating should be kept to a practical minimum. If a part is not coated within two (2) hours after surface preparation, it should be protected by any suitable means to prevent surface contamination.

2 Application of coating.

a Mix aluminum paint per manufacturer's instructions.

b Apply this aluminum paint to the inside of bolt holes of subject part (see figure 5-285) with a cotton swab, small paint brush, artist air brush or touch-up gun. No requirement for thickness of coating is established because a controlled thickness cannot be obtained under normal application techniques.

c Apply a uniform coating of this aluminum paint to other areas shown in figure 5-285. This paint should be applied to a required thickness of .0015 to .0025 inch (.0038 to .0063 cm) in two separately applied coats with curing between each coat.

NOTE

If after applying two coats of aluminum paint, if it is found that total thickness is less than .0015 inch (.0038 cm), a third coat should be applied.

3 Curing of coating.

a Dry the applied first layer of aluminum coating at 175°±25°F (79.4°±13.9°C) for at least 15 minutes.

b Cure by heating coating to 650°±15°F (343.3°±8.4°C), holding heat for at least 30 minutes, and cool to room temperature.

c Repeat processes 3a and 3b for second coat and for third coat, if a third coat is necessary to meet the required thickness specified in paragraph 2c.

4 Rework of defective coating areas:

a Clean surfaces with acetone (item 13, table C-1) or cleaning solvent (item 311, table C-1)

b Dry part in air for five (5) to ten (10) minutes.

c Abrade an area slightly larger than the damaged area, feathering out the edges of the abraded area.

d Thoroughly clean the abraded area as in paragraph 4a. Dry thoroughly using blast of clean compressed air.

e Apply coating to rework areas and cure as in paragraph 3.

5 Removal of defective coatings: Unsatisfactory coatings may be removed by immersion in hot caustic solution or by blasting.

6 Touch-up after balancing operation:

a After completion of the balancing of this part, touch-up with aluminum paint, those areas where paint was removed during the balancing operation.

b Touch-up the aforementioned areas with a cotton swab.

c Let paint air dry but do not cure.

7 Quality: Coatings shall be smooth, adherent, and free from bubbles, beads, drips, nodules, cracking, and other imperfections detrimental to coating performance.

a Color shall not be cause for rejection of the coating.

b Coatings cured as in paragraph 3a when swabbed with cotton dampened with water shall show no green color on the cotton. The presence of a green color is indicative of an improperly cured coating.

c Irregular coating edges due to masking is permissible.

8 Marking of reworked part: Using a vibropeen marking tool, add TED number after assembly part number, i.e. 1-140-272-01, "TED T53-T0020". Depth of mark should be within 0.001 to 0.006 inches (0.003 to 0.015 cm).

(5) Apply dry-film lubricant coating to internal spines as outlined in SP No. 6010 in Appendix E.

(6) Reblade disc as outlined in paragraph 5-316.

y. Machining of disc surfaces to reduce the depth of pitting.

(1) The depth of pitting shall be established by the surface adjacent to the pit. Inspect △4 surfaces per figure 5-286.

(2) Discs which are pitted beyond limits may be repaired by machining per figure 5-286. Machine only as necessary to reduce pitting depth to within limits. Localized blending is authorized in tenon radii. (See △3 in figure 5-286.

(3) Bore bolt holes oversized, and paint as in paragraph 5-313 x(4)(a).

WARNING

FLIGHT SAFETY PART

Dimensional inspection after the following repair is flight safety critical.

z. Repair worn surfaces on 4.9190 to 4.9205 inch (12.4942 to 12.4981 cm) diameter of rotor disc (33, figure 5-259) where 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup is required by thermo flame spraying or plasma flame spraying as follows: (See figure 5-287.)

(1) Machine, if necessary, to obtain a 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup thickness after final machining.

(2) Plasma spray rotor disc with Metco 450 (item 218, table C–1). (Refer to SP No. 5006 in Appendix E.)

(3) Machine to dimensions given.

aa. Repair 2.1655 to 2.1658 inch (5.5004 to 5.5011 cm) and 1.9683 to 1.9685 inch (4.9995 to 5.000 cm) bearing journal diameters on rotor disc (33, figure 5-259) as follows (see figure 5-288):

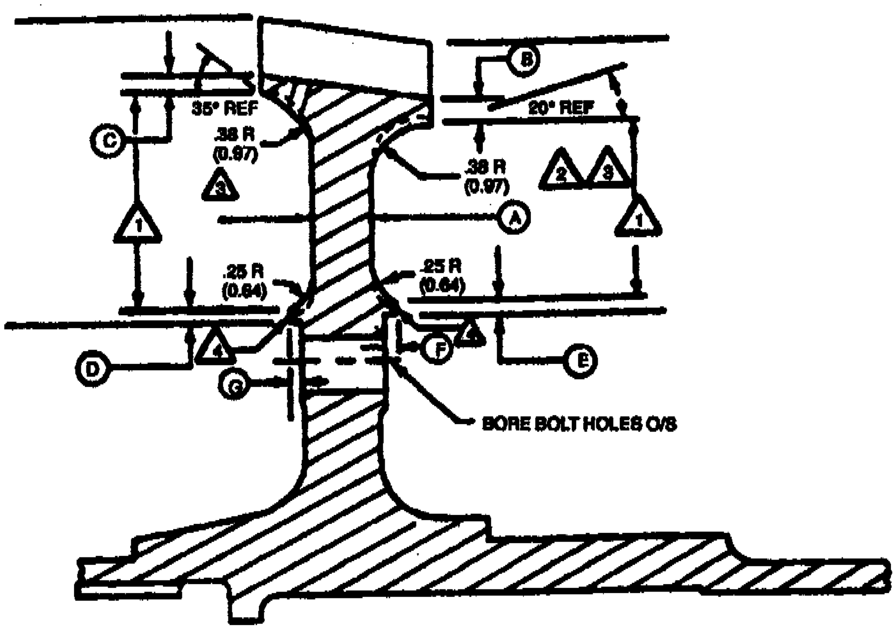
(1) Prepare surface and chrome plate as outlined in SP No. 6014 in Appendix E.

(2) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(3) Finish-machine part to dimensions shown in figure 5-288.

NOTE

Plate thickness shall not be less than 0.002 inch (0.005 cm) after final machining.



1. MACHINE THESE AREAS ONLY AS NECESSARY TO REDUCE PITTING TO WITHIN LIMITS.

2. IF SIGNIFICANT AMOUNT OF BALANCE STOCK HAS BEEN REMOVED, CHECK BALANCE DISC PRIOR TO BLADING. SELECT BLADES(BY WEIGHT) TO REDUCE RESIDUAL UNBALANCE AND TO CONTROL THE DIRECTION OF SUCH.

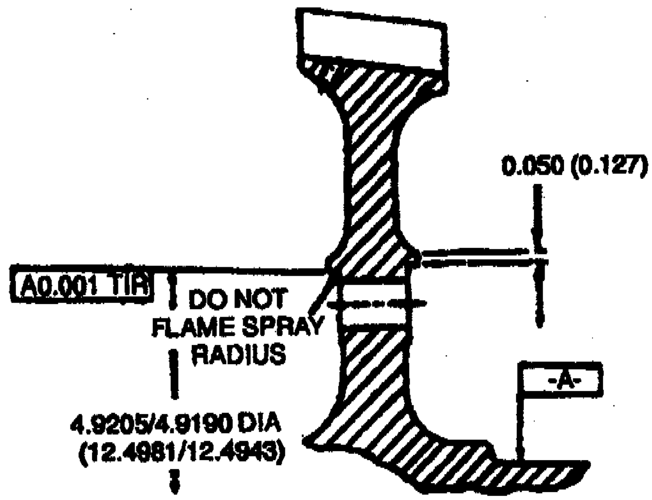
3. LOCALIZED BLENDING IS AUTHORIZED. NO SHARP EDGES ARE ALLOWED.

4. PITTING DEPTH LIMITS DO NOT APPLY TO THESE SURFACES. DO NOT MACHINE. BREAK SHARP EDGES ONLY. GENERAL CORROSION LIMITS F & G: 0.045 (0.114 MIN. FOR CUMULATIVE 1/4 CIRCUMFERENCE, 0.055 (0.014 MIN. FOR REMAINDER OF CIRCUMFERENCE.)

DIMENSIONS IN ( ) ARE CENTIMETERS

ITEM	DRAWING DIMENSIONS	REPAIR LIMITS (MIN)
A	.356/.344 (0.904/0.873)	.339 (0.861)
B	.1435/.1195 (.3645/.3035)	.090 (0.229)
C	.1175/.0835 (.2985/0.2121)	0.835 (0.2121)
D	.0850/.0648 (.2159/1.646)	.050 (0.127)
E	.0850/.0640 (.2159/1.656)	.050 (.0127)
F & G	.070/.080 (.177/.203)	4

Figure 5-286. Turbine Disc (P/N 1-140-272-01).



WARNING

FLIGHT SAFETY PART

Dimensional inspection after the following repair is flight safety critical.

Figure 5-287. Second Stage Power Turbine Rotor Disc - Repair Area (P/N 1-140-272-01).

NOTE

Chrome plating optional minimum plating thickness is 0.002 (0.005)

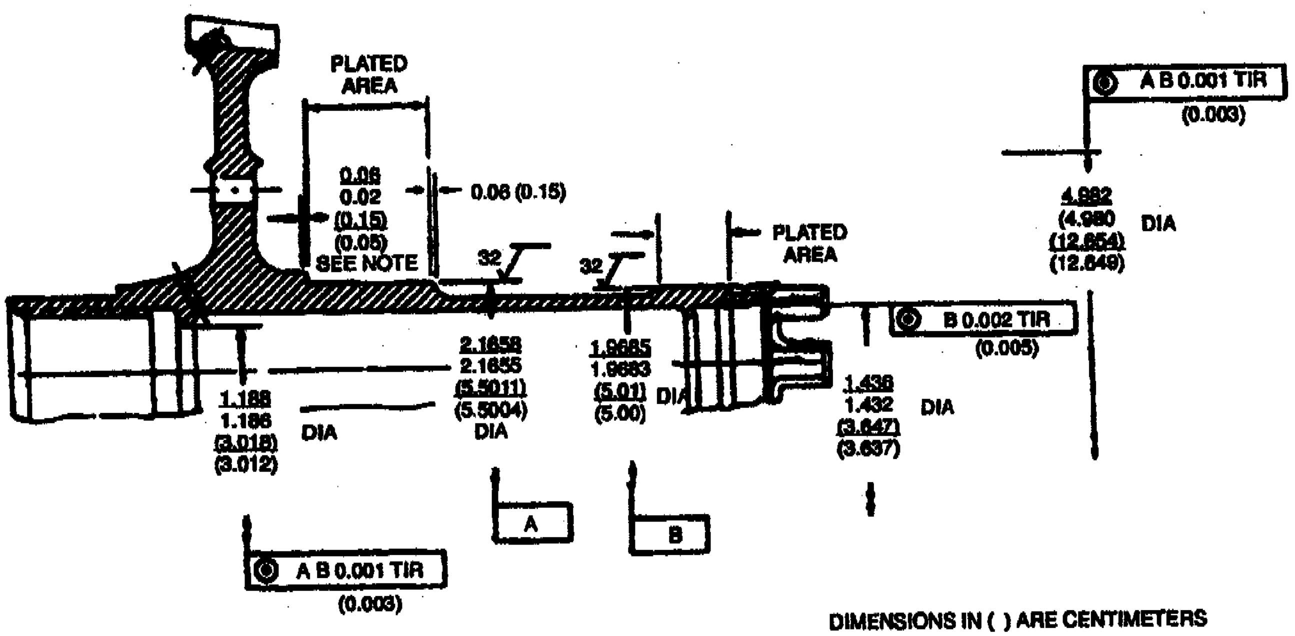


Figure 5-288. Power Turbine Rotor Bearing Journal Diameter - Plating Inspection Area.

WARNING

FLIGHT SAFETY PART

The total gap and minimum and maximum individual gap limits are flight safety critical

ab. Repair turbine rotor blade shroud gap as follows:

(1) Using a nylon wedge, spread blades enough to allow polishing with crocus cloth (item 125, table C–1).

(2) If accumulated gap is still below 0.016 inch (0.041 cm), replace blades (31 and 32, figure 5-259) as necessary. (Refer to paragraph 5-316.)

ac. Replace blades (31 and 32) if rubs on blade tips exceed inspection limits. (Refer to paragraph 5-316.)

NOTE

Discs that have blades replaced due to rubs beyond limits, shall have a broach slot inspection performed between 0.0810 inch (0.2057 cm) diameter gage rolls on every other slot. (See figure 5-265.) Dimensions shall be 0.1010 to 0.1036 inch (0.2565 to 0.2631 cm).

ad. Supplement to repair and testing of power turbine bearing housing.

(1) Inspection:

(a) Subject bearing housings shall be inspected per applicable Work Requirement and the following:

1 Bearing bore, Number 3 position.

a Manufacturer's drawing dimensions - 3.5430 min (8.9992 cm) - 3.5434 max (9.0002 cm).

b Maximum overhaul rework dimension - 3.5433 (8.9999 cm), without rechrome or metal spray.

2 Diametrical pinch limits for No. 3 position main bearing outer race in housing will be 0.0000 to 0.0006T (0.0000 cm to 0.0015 cm) for all acceptable used housings and all new housings having No. 3 position bore of 3.5433 inches (8.9999 cm) diameter or less.

3 All new or used housing exceeding 3.5433 min (8.9999 cm) diameter shall require rework.

(b) Bearing bore No. 4 position.

1 Manufacturer's drawing dimension - 3.5432 min (8.9997 cm) - 3.5436 max (9.0007 cm).

2 Maximum overhaul rework dimension - 3.5438 (9.0013 cm).

(c) Bearing housings that do not meet the above requirements shall be reworked per paragraph (2)(a) thru (2) (c) below and figure 5-289 and 5-290.

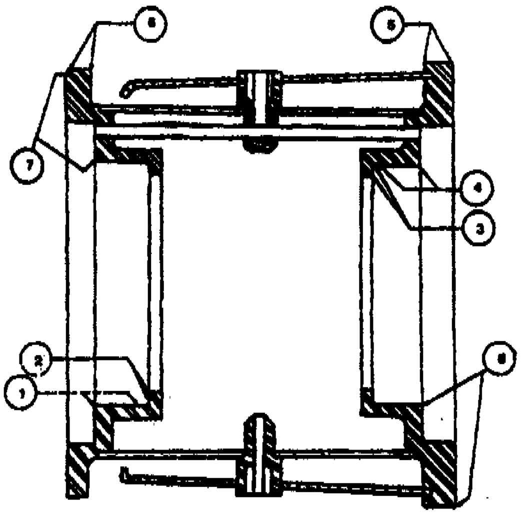


Figure 5-289. Bearing Housing Repair Surfaces.

(d) Inspect bearing housing for misaligned retainer screw holes. Repair housing as paragraph (2)(d).

(e) Cooling air shroud.

1 Dents.

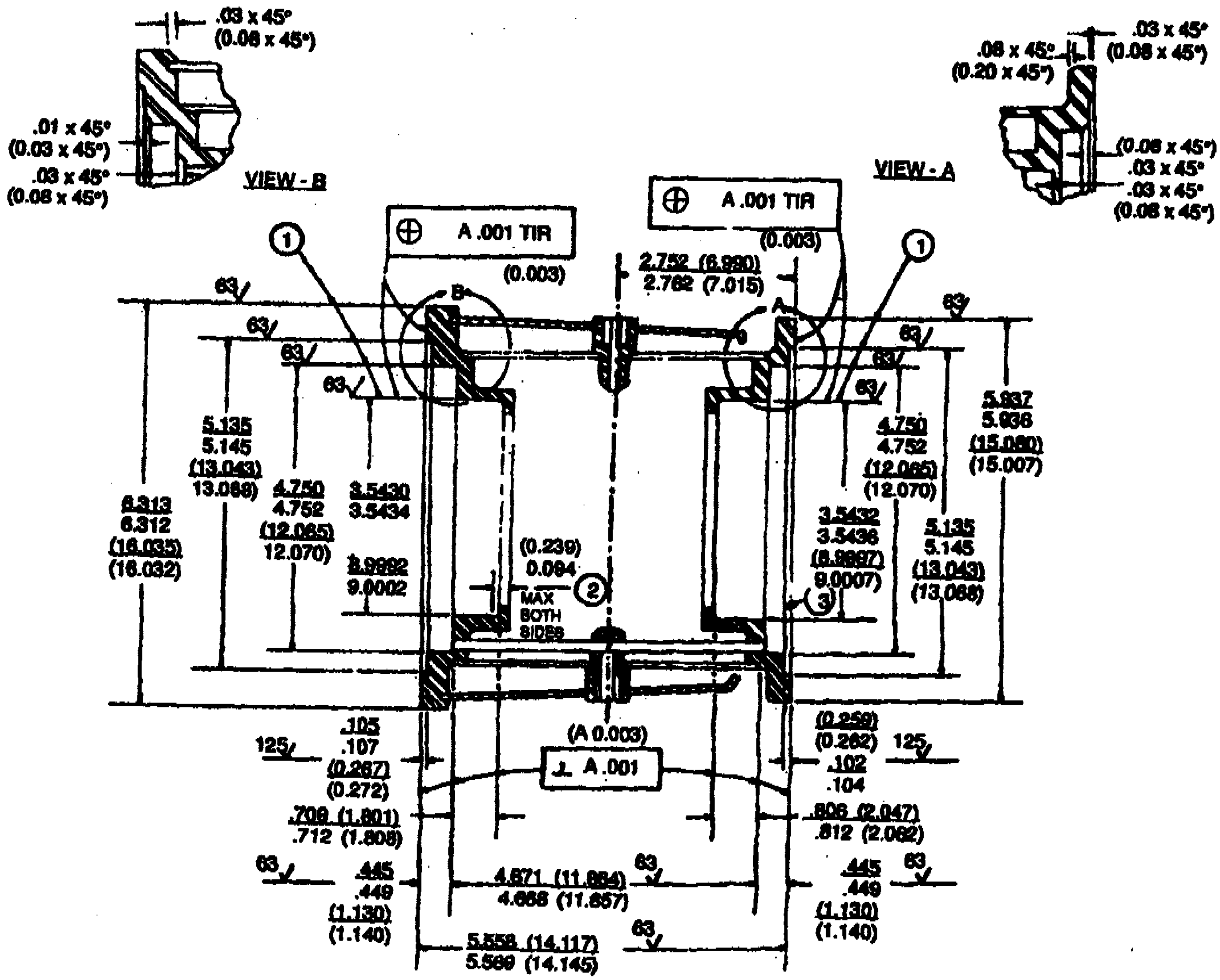
a Not exceeding 0.125 (0.318 cm) in depth are acceptable.

b Exceeding 0.125 (0.318 cm) in depth shall be repaired per paragraph (2)(e)1.

2 Cracks.

a Cracks not in the forward 0.500 (1.270 cm) of cooling air shroud shall be repaired per paragraph (2)(e)2.

b Cracks resulting in material loss not exceeding 4 square inches in area may be repaired per paragraph (2)(e)2e. Those exceeding 4 square inches shall require cooling air shroud replacement per paragraph (2)(e)2e.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-290. Power Turbine Bearing Housing Rework.

(f) Inlet and outlet bosses.

1 Stripped and damaged threads shall be repaired per paragraph (2)(g)1 and 2.

2 Damaged tube seats shall be repaired per paragraph (2)(g)3.

3 Mutilation and distortion - replace per paragraph (2)(g)4.

(g) Scavenge oil tube.

Bends, dents and mutilization shall be repaired per paragraph (2)(g).

(h) Braze joints.

Cracks, lack of braze and porosity shall be repaired per paragraph (2)(h).

(2) Repair.

(a) Chrome plating: The repair surface shown in figure 5-289 may be repaired by chrome plating as follows.

1 Grind only as necessary to remove previous chrome plating, and to insure the required finish plating thickness. Grind per paragraph (2)(c).

2 Chrome plate per QQ-C-320, Class 2a.

3 Finish grind Drawing Specifications and Dimensions shown in figure 5-290. Plating finish thickness shall be 0.002 to 0.010 (0.005 to 0.025 cm).

NOTE

Grind per paragraph (2)(c).

(b) Metal spray: The repair surfaces shown in figure 5-289 may be metal spray repaired as follows:

1 Metal spray shall be applied using the plasma flame spray process.

NOTE

Housing shall have oil discharge holes masked prior to any grit blasting operation.

2 Repair surfaces 1, 2, 3, 4, 5, 6, 7, and 8 (Ref: figure 5-289) shall be repaired using Metco 63 Molydenum Material and material shall be applied as per SP No. 5006 in Appendix E.

NOTE

DO NOT exceed minimum wall thickness of 0.090 (0.229 cm) on bearing bore I.D. (Ref 1 and 4, figure 5-289) and 0.040 (0.102 cm) on bearing bore lip (Ref 2 and 3, figure 5-289).

3 Finish grind per Manufacturer's Drawing Specifications and paragraph (2)(c).

(c) Grinding method of:

1 Bearing bores requiring rework shall be repaired as follows: (Ref: figure 5-290) since it is essential to maintain the proper relationship between the two outside pilot diameters, the two bearing bores and the two end faces. The following procedure shall be followed to assure proper rework of part with a minimum machining.

a Before mounting bearing housings on fixture, both end faces shall be flat within 0.001 (0.0025 cm) TIR. Minor irregularities can be removed with an India Stone.

b If required, faces shall be ground, providing 0.445 - 0.449 (1.130 - 1.140 cm) dimension is not exceeded. A 75% cleanup is acceptable if further grinding would reduce depth below 0.445 (1.130 cm) dimension.

c Housings, requiring rework of only one bearing bore, shall be processed as follows:

(1) Mount housing on fixture with defective bore out. Locate housing on good bearing, here within 0.0005 (0.0012 cm) TIR (good bearing bore becomes "X" surface).

(2) Check run out of both O.D.'s. If not within 0.001 (0.0025 cm) TIR, O.D.'s shall be ground providing minimum diameters are not exceeded. A 75% cleanup shall be acceptable if further grinding would reduce diameter below minimum shown in figure 5-290.

(3) Grind bearing bore (and O.D.'s if paragraph (b)above cannot be met) and plate or metal spray to provide finish dimensions per figure 5-290.

(4) Locate housing on good bearing bore as in paragraph (a) above for final grinding.

d Housing requiring rework of both bearing bores shall be processed as follows:

(1) Mount housing on fixture and locate 6.312 - 6.313 (16.032 - 16.035 cm) diameter within 0.001 (0.0025 cm) TIR or less, if possible. This becomes "X" surfaces.

(2) If housing cannot be located within 0.001 (0.0025 cm) TIR, locate as close as possible and rework both O.D's per paragraph (2)(c)1d(2). Grind bearing bore for plating, reverse housing, locate on 6.312 - 6.313 diameter (16.032 - 16.035 cm) and grind other bearing bore for plating.

(3) Locate housing on 6.312 - 6.313 (16.032 - 16.035 cm) diameter for final grinding of one bearing bore. Reverse housing and locate on fixture pilot when grinding other bearing bore.

e Minor chipping on end faces between holes and I.D. shall be accepted.

(d) Bearing housing with misaligned retainer screw holes shall be repaired as follows:

1 Install screw, P/N MS16995-11, with Locktite, tighten screw.

2 Machine head of screw until flush with bearing housing, flange surface.

3 Deform both ends of screw threads.

NOTE

A similar plug may be made from AMS6370 (4130 Steel).

4 Relocate screw holes as per Work Requirement or applicable Manufacturer's Drawings and Specifications.

(e) Cooling air shroud.

1 Dents exceeding 0.125 (0.318 cm) in depth may be reformed to approximate contour by cold forming.

2 Cracks.

a Cracks in forward 0.500 (1.27 cm) of shroud shall be cause for replacement of shroud.

b Cracks elsewhere in shroud, may be repaired by TIG welding per MIL-W-8611, or Linde Pencil Arc (Linde Div of Union Carbide), using welding rod AWS A5.18 (American Welding Society). No preheat or stress relieving is required.

c Cracks (converging) that have resulted in material loss not exceeding 4 square inches may be repaired by fabrication of lap type patch from old housings or AMS-5042 material and weld per paragraph (2)(e)2b above.

d Cracks (converging) that have resulted in material loss exceeding 4 square inches shall be cause for replacement of entire cooling air shroud. See paragraph (2)(e)2e.

e Remove and replace cooling air shroud.

(f) Spacer: Crack in spacer may be welded using TIG or Linde Pencil Arc using welding rod AWS A5.18, providing part is stress relieved following welding.

(g) Inlet and outlet bosses.

1 Stripped threads shall be repaired providing the hole is centered in the boss and will leave 0.125 (0.318 cm) solid wall (minimum after tapping for threaded bushing).

2 Damaged threads may be repaired by chasing with proper tap.

3 Damaged tube seats may be repaired by using a ball shaped rotary file (with cutting edges grounded off the sides) mounted in a drill press. Use light pressure on cutter.

4 Mutilated and distorted inlet and outlet bosses may be replaced using new boss.

(h) Scavenge oil tube.

1 Bends not exceeding 0.125 (0.318 cm) deformation, dents, and mutilation shall be cause for replacement of scavenge tube.

(i) Braze joints.

1 Defects, (such as cracks), occurring around inlet and outlet bosses may be torch-brazed as per SP No. 5012 in Appendix E, using silver alloy filler material (brazing alloy) conforming to American Welding Society (AWS) Specification AWS A5, 8-69, Class BAG.7. The technical requirements for this class of filler material are as follows:

a Minimum tensile strength of 85,000 psi (59,755.0 kg sq cm).

b Flux conforming to Federal Specification O-F-499, Type B.

c Solidus of 1145°F (6183°C).

d Liquidus of 1205°F (6567°C).

NOTE

Solidus (or melting point) - temperature at which melting of filler material starts on heating.

Liquidus (or flow point) - temperature at which filler material starts to freeze on cooling.

2 The recommended brazing temperature range for this class of silver brazing alloy is 1205° to 1400°F (651.7° to 760°C).

3 The recommended joint clearance for this class of silver brazing alloy at brazing temperatures is 0.002 - 0.005 inches (0.005 - 0.013 cm).

(j) Phosphate coating (MIL-P-16232, Type M, Class 4B):

1 Unless otherwise specified, phosphate coatings shall be applied after all machining, forming, brazing, welding, chrome plating, and heat treatment operations have been completed on subject bearing housing.

NOTE

Phosphate treatment attacks some metal spray coatings and tends to surface-treat the base metal under the metal spray, deteriorating the bond. Phosphate treatment should be accomplished prior to metal spray processing. Housings which have been previously spray repaired, must have metal spray coating masked off before phosphate treatment.

2 If housing is to be repaired by metal spraying, apply phosphate coating MIL-P-16232, Type M, Class 4B, using MIL-P-50002 materials before bearing housing is metal sprayed.

(3) Inspection and rework: Parts which have been repaired per paragraph (2)(a) through (2)(c) and have since experienced engine operation shall be dimensionally inspected and reworked as follows:

(a) Repair surfaces shall be cleaned to facilitate inspection.

(b) Dimensionally inspect repair surfaces to wear limits and paragraph (1) above.

(c) Repair-surfaces which do not meet dimensional requirements shall be ground to remove metal spray or plating and reworked per paragraph (2).

(4) Pressure testing:

(a) Check power turbine oil tubes for leakage at overhaul as follows:

1 Place the rear packing between the rear bearing housing and rear bearing cover, or use a locally fabricated plate.

2 Place forward packing between bearing housing and air tight locally fabricated cover plate.

3 Install the power turbine tube and torque to 50 inch-pounds (57,607 cm gms).

4 Plug one (1) of the power turbine oil tubes and connect the other power turbine oil tube, by use of an adapter, to a compressed air supply. Regulate air supply at 30 psig (2109.3 gm/sq cm).

5 Submerge bearing housing in water and check power turbine oil tubes and all vacuum braze joints for leakage. No leakage is allowed.

6 Leaks around power turbine oil tubes may be repaired by adding an extra thread to the tube and if necessary, adding an extra thread to power turbine oil tube boss on the bearing housing. If leakage is still present, resurface seat per paragraph (2)(g)3.

7 Other leaks in braze joints may be repaired by applicable method per paragraph (2)(i).

(b) Check power turbine oil tubes on minor repair engines as follows:

1 Apply Prussian Blue (item 172, table C–1), to seating surface of tube.

2 Install and torque tube to 50 inch-pounds (57,607 cm gms). Remove and inspect. Subject tube must show contact of 360° around seating surface.

3 Tubes that do not show evidence of seating 360° may be repaired per paragraph (4)(a)6.

(c) Marking.

1 Upon completion of the pressure test, identify the turbine oil tubes, so that at final assembly, these tubes may be placed at the same location they occupied during the pressure test.

a The pressure oil tube in the 12 o'clock position (looking up stream), shall be identified with the number 1.

b The scavenge oil tube in the 6 o'clock position (looking up stream), shall be identified with the number 2.

(5) Oil impingement and oil flow limits:

(a) Test housing for oil impingement with fixture number LTCT 4807. If housing fails test in the number 4 bearing area, remove fixture and install a dummy number 4 bearing. Housing is acceptable for use if oil stream impinges within the radial width of the bearing retainer. Oil stream impingement test pressure shall be 50 ± 2 psig (3516 ± 141 gm sq cm) gage.

(b) The oil flow requirements for power turbine bearing housing is 215 - 325 pph (97,524 - 147, 420 gm/hr) if lubricating oil (item 189, table C–1) is used or 226 to 351 pph (102,513 - 159,214 gm/hr) if lubricating oil (item 190, table C–1) is used.

5-314. REASSEMBLY. Proceed as follows:

a. Select shim (29, figure 5-259) to maintain 0.003 to 0.006 inch (0.008 to .015 cm) axial pinch on outer race of ball bearing (28) as follows:

CAUTION

Do not use bearing (1-300-119-04).

(1) Using vernier depth gage, measure depth of bearing housing (dimension A, figure 5-291).

(2) Using micrometer, determine axial dimension of bearing outer race (dimension B, figure 5-291).

(3) Subtract dimension B from dimension A.

(4) Add nominal 0.005 inch (0.013 gm) to result of preceding step (3) to determine thickness of shim.

b. Pressure-test bearing housing (19, figure 5-259) and power turbine tubes (24, figure 5-135) as follows:

(1) Install pressure-test fixture (LTCT3694) on bearing housing.

(2) Screw in two tubes (24) and tighten to 50 to 60 pound-inches (8930 to 10716 gm cm) torque. To prevent air leakage, plug one tube with packing, NAS 617-6, and plug (1-150-001-01).

(3) Install packing (25), strainer (31), and oil strainer housing adapter (30).

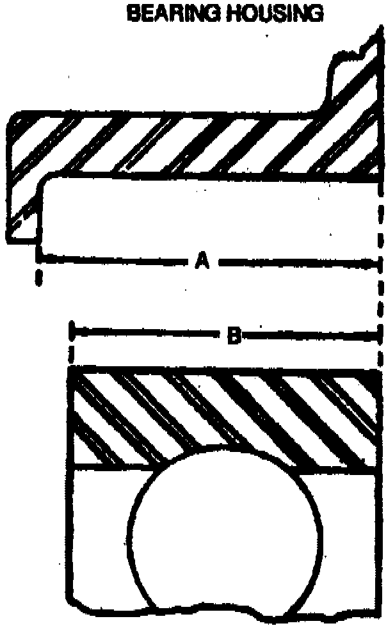


Figure 5-291. Establishing Shim Thickness.

(4) Apply 30 psig (2109 gm sq cm) air pressure to adapter (30). Check for leakage by submerging housing into water or oil.

(5) If pressure-test indicates leakage, repair tubes (24) and/or bearing boss. (Refer to paragraph 5-313.) Mark tube and bearing boss to ensure proper location at next higher assembly.

NOTE

Power turbine tube at 12-o'clock position shall be numbered 1. Power turbine tube at 6-o'clock position shall be numbered 2.

(6) After repair, repeat pressure-test. No leakage is allowed.

(7) Alternate procedure for checking or replacing the power turbine tubes is in paragraph 5-246.

c. Perform oil flow and impingement check of bearing housing (19, figure 5-259) as follows:

(1) Install packing (17) on oil transfer tube (18) and insert tube into bearing housing (19).

(2) Install new seal (10) into forward groove of bearing housing (10). Align screw holes in forward bearing retaining ring (14), with screw holes in bearing housing, and insert ring into bearing housing. Secure ring to bearing housing with capscrews (13). Ensure that ring (14) is not cocked.

NOTE

Ensure that seal groove in bearing housing is clean. Coat groove with shortening compound (item 270, table C–1) to facilitate holding seal in groove during assembly.

(3) Install packing (17) on bearing housing forward face.

(4) Position seal housing (9) on bearing housing so that oil transfer tube (18) is properly seated in seal housing. Secure seal housing assembly with bolts (3). Tighten bolts to 70 to 75 pound-inches (12502 to 13395 gm cm) torque.

(5) Using oil flow check stand (LTCT313), or equivalent, supply lubricating oil (item 189 or 190, table C–1), heated to 95° to 100°F (35° to 38°C) and at a pressure of 68 to 70 psig (4781 to 5062 gm sq cm) to the bearing housing and check oil flow as follows:

Oil flow shall be 215 to 325 phr if lubricating oil (item 189, table C–1) is used or 226 to 351 phr if lubricating oil (item 190, table C–1) is used. Remove test fixture (LTCT3694).

(6) Install test fixture (LTCT4807) on bearing housing. Using lubricating oil (item 189 or 190, table C–1) and oil flow check stand (LTCT313), or equivalent, at a pressure of 25 psig (1758 gm sq cm) perform impingement check of bearing housing.

(7) Increase pressure to 40 psig (28212 gm sq cm), and perform impingement check of bearing housing.

(8) If bearing housing fails test in the No. 4 bearing area, remove test fixture (LTCT4807) and install a dummy No. 4 bearing.

(9) Bearing housing is acceptable if oil stream impinges within the radial width of the bearing retainer. Impingement test pressure shall be within 48 to 52 psig (3345 to 3656 gm sq cm).

(10) Remove parts from bearing housing installed in preceding steps (2) through (6), with the exception of oil transfer tube (18), which should remain in the bearing housing.

CAUTION

In following step d, to prevent leakage, ensure seal (7) is installed properly.

d. Install packing (8) into seal housing (9). Lubricate seal (7) with shortening compound (item 270, table C–1) and, using arbor press, base and bushing assembly (LTCT4947), press seal into seal housing (9).

CAUTION

In following step e, to prevent possible axial seal movement ensure that retaining ring (5) is seated properly.

e. Install retaining ring (5) into seal housing assembly.

CAUTION

Ensure that pin in outer race of roller bearing (15) engages slot in bearing housing (19).

f. Using arbor press and sleeve bushing (LTCT3494), press outer race of roller bearing (15) into bearing housing (19).

CAUTION

In following step g, to prevent leakage, ensure packing (17) is installed.

g. Align screw holes in forward bearing retaining ring (14) with screw holes in bearing housing (19), and insert ring into bearing housing. Secure ring to bearing housing with capscrews (13). Install seal (10) into forward groove of bearing housing (19).

NOTE

Ensure that seal groove in bearing housing is clean. Coat groove with shortening compound (item 270, table C–1) to facilitate holding seal in groove during assembly.

h. Place turbine forward impeller (11) in forward bearing retaining ring (14). Position seal housing (9) over impeller, making sure that oil transfer tube (18) is properly seated in seal housing.

i. Position deflector support (4) on seal housing (9) so that cutout in deflector is aligned with boss on seal housing.

j. Coat threads of bolts (3) with Anti-Seize Compound, (item 47, table C–1). Thread bolts into bearing housing (19) and tighten to 70 to 75 pound-inches (12502 to 13395 gm cm) torque. Lockwire bolts.

NOTE

In following step k, do not lubricate bolts.

k. Position clamping plate (2) on second stage power turbine rotor (30) and secure plate with bolts (1). Tighten bolts to 25 to 30 pound-inches (4465 to 5358 gm cm) torque.

NOTE

Bearing housing can be preassembled prior to installing onto turbine rotor shaft.

l. Using arbor press and suitable brass bushing, press seal ring (6) onto turbine rotor shaft.

m. Using arbor press and suitable bushing, press forward ring (12) onto power turbine shaft.

n. Install power turbine rotor in suitable holding fixture. Using suitable installing tool, install bearing housing assembly on turbine rotor, ensuring tangs on ring (12) align in slots of impeller.

CAUTION

In following step o, be careful not to damage rollers.

o. Using arbor press and sleeve bushing (LTCT3492), press liner race and roller bearing (15) onto turbine shaft.

p. Place bearing spacer (16) on power turbine shaft.

NOTE

In following step q, use shim having correct thickness as determined in preceding step a.

q. Install shim (29) into bearing housing (19).

CAUTION

In following step r, do not use bearing (1-300-119-04).

r. Using arbor press and sleeve bushing (LTCT3493), press ball bearing (28) onto power turbine shaft and into bearing housing.

s. Install rear bearing retainer ring (27) into bearing housing and align screw holes. Secure ring to bearing housing with cap-screws (26).

NOTE

Ensure that ring (27) is seated properly.

t. Install keywasher (25). Install second stage turbine impeller (24) and align slots in impeller with tangs on washer.

u. Install impeller cover (23). Secure cover to ring (27) with screws (22).

NOTE

In following step v, do not lubricate nut.

v. Install lock cup (21) and nut (20). Using wrench (LTCT915), tighten nut to 225 to 250 pound-feet (335 to 372 kg cm) torque.

w. Secure nut (20) by deforming lock cup (21) into nut slot at two locations.

5-315. FUNCTIONAL TEST. Functional test is not required.

5-316. REPLACEMENT OF SECOND STAGE POWER TURBINE ROTOR ASSEMBLY BLADES. (See figure 5-292.) Proceed as follows:

a. Remove blades as follows:

NOTE

This procedure is for total reblading only. Replacement of individual blades is accomplished in the same manner; in sets. Matched blade sets must be used as specified in the following step b.

(1) Using a vibropeen etching tool, number forward face of blade roots clockwise from 1 through 62, starting at the balancing "0" mark.

(2) Position second stage power turbine rotor (2), forward faceup, on table (LTCT13369), detail of LTCT13367.

(3) Align blade to be removed under punch assembly (LTCT13368, detail of LTCT13367), and, using press (LTCT6073), drive against blade (1) to shear locking pin (3), and remove blade.

(4) Repeat preceding step (3) for remaining blades.

(5) Using a suitable drift, drive pins from the holes.

(6) Using 0.093 inch diameter reamer mounted in a T-handle, ream out pin hole from groove side.

b. Install blades as follows: (See figure 5-292).

(1) Select required replacement blades.

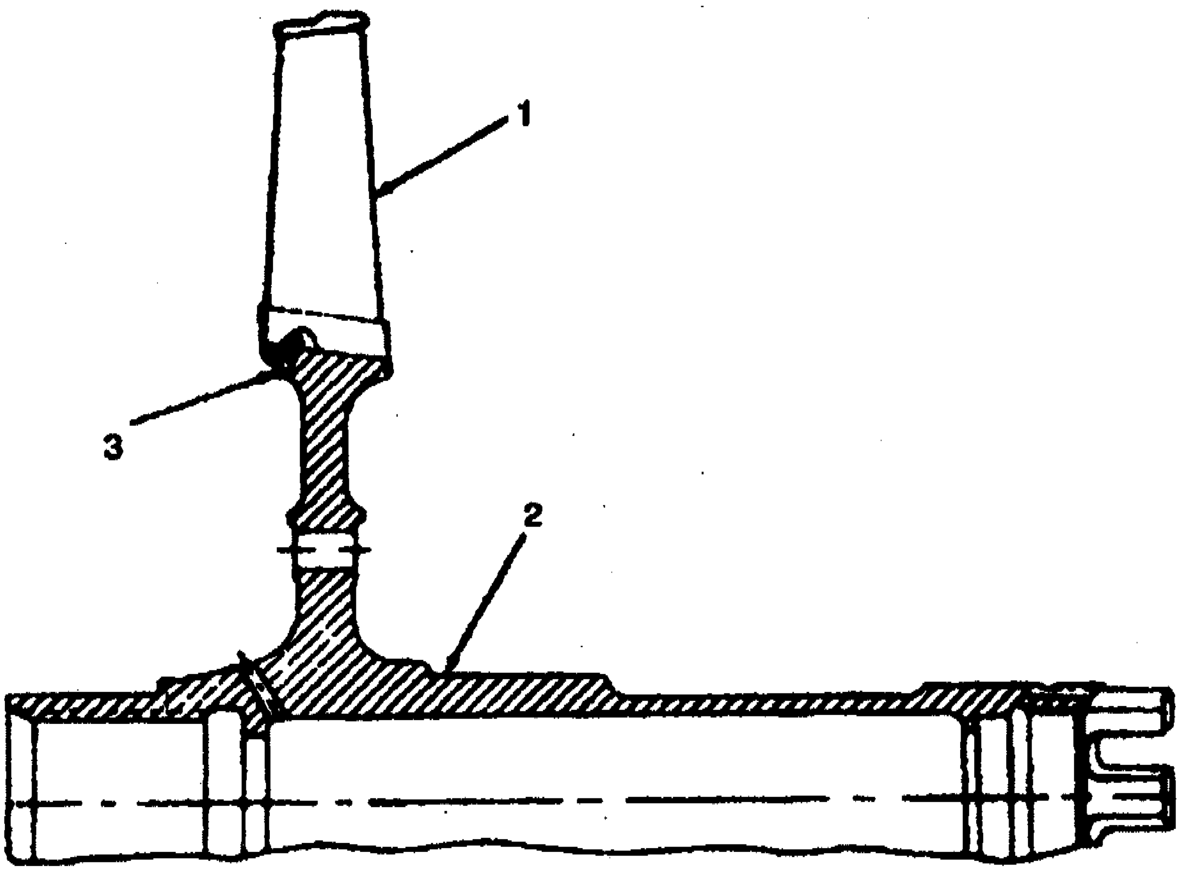
(2) Position second stage power turbine rotor (2) on a suitable fixture, with forward face up.

(3) Install blades (1) into disc so that each A blade is 180 degrees from its matching B blade.

NOTE

Every other blade will be a B blade. Blade sets are to be chosen in random order. No systematic grouping is required.

(4) Repeat step (3) for remaining blades.



1. BLADE
2. SECOND STAGE POWER TURBINE ROTOR
3. LOCKING PIN

Figure 5-292. Second Stage Power Turbine Rotor Assembly Blade Removal.

(5) Remove turbine rotor from fixture.

(6) With forward face of turbine rotor up, insert old or new locking pins (3) (1-140-285-01) into holes of disc. If the blades are replaced, use new locking pins.

(7) Using pin driver fixture (LTCT6646) and pin drive fixture power supply (LTCT6616), drive pins as follows: (See figure 5-293.)

(a) Install fixture (1) on table (15) of power supply.

(b) Connect shop air supply to power supply. Using pressure regulator (4), regulate inlet air pressure to approximately 40 psi (2812 gm sq cm) as indicated on inlet pressure gage (3).

(c) Using pressure regulator (5), regulate piston return pressure to 20 to 30 psi (1406 to 2109 gm sq cm) as indicated on pressure gage (6).

WARNING

Control buttons must be actuated simultaneously as a safety precaution to ensure the operator's hands are clear of driver.

(d) Simultaneously actuate control buttons (16) and readjust inlet air pressure, as required, to produce a reading of 990 to 1,010 psi (696 to 710 kgm cm) on high pressure gage (2).

NOTE

A 990 to 1,010 psi (696 to 710 kg sm cm) reading on high pressure gage provides 2,375 to 2,425 pounds of force for driving the blade retaining pin.

(e) Release buttons and reactuate to confine proper inlet pressure adjustment. Slight readjustments of inlet air pressure may be required during daily use.

(f) Position second stage turbine rotor on fixture with pin face up.

(g) Install driver sleeve (7) (LTCT6809, detail of LTCT6646), with driver (8) installed, into slide assembly (11).

(h) Mount driving cylinder (14) on bracket (13).

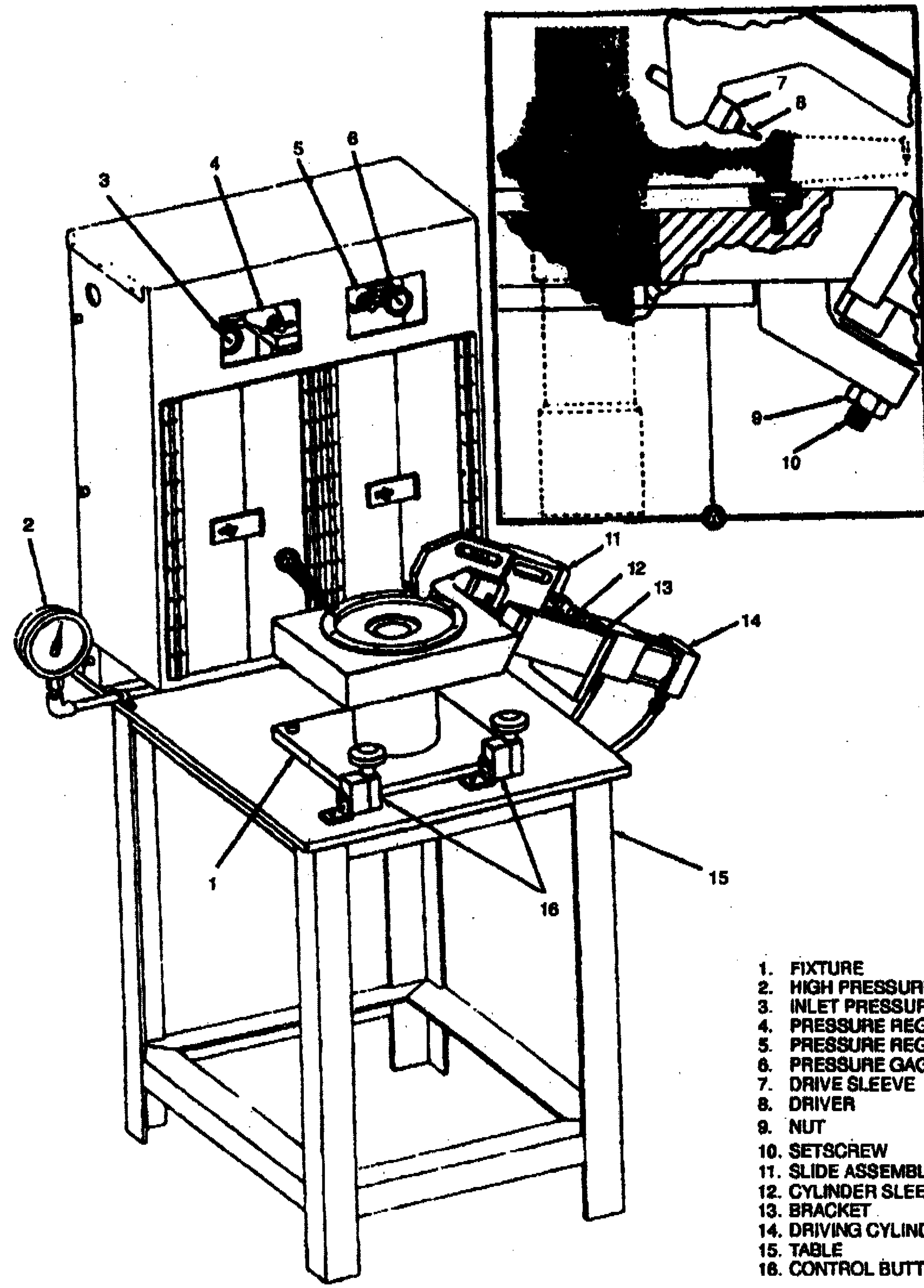
NOTE

Cylinder must be mounted on side of fixture designated for use with turbine rotor (1-140-550-02).

(i) Install slide assembly (11) on fixture (1). Ensure that slide assembly engages cylinder sleeve (12).

NOTE

Ensure that vertical adjustment of driver (8) is made when pin driver fixture is used for first time or whenever drive (8) has become misaligned with pin hole of disc. Make adjustments as outlined in following step (j).



1. FIXTURE
2. HIGH PRESSURE GAGE
3. INLET PRESSURE GAGE
4. PRESSURE REGULATOR
5. PRESSURE REGULATOR
6. PRESSURE GAGE
7. DRIVE SLEEVE
8. DRIVER
9. NUT
10. SETSCREW
11. SLIDE ASSEMBLY
12. CYLINDER SLEEVE
13. BRACKET
14. DRIVING CYLINDER
15. TABLE
16. CONTROL BUTTON

Figure 5-293. Power Assembly and Fixture Setup.

(j) Loosen nut (9) and turn setscrew (10) to raise or lower slide assembly (11) and align driver (8) with pin hole in disc. To ensure correct adjustment, rotate rotor and align driver with several other pin holes. When satisfactory adjustment is made, tighten nut (9).

(k) Starting with number 1 blade, align driver with pin hole. Insert driver into hole until it contacts top of blade retaining pin.

WARNING

Control buttons must be actuated simultaneously as a safety precaution to ensure the operator's hands are clear of driver.

(l) Simultaneously actuate control buttons (16) and observe high pressure gage (2). A reading of 1,000 psi (703 kg sq cm) maintained for a minimum of one second, provides the required pin installation force. Release buttons.

(m) Inspect blade retaining pin for proper installation as follows:

NOTE

This inspection is required only on first rotor of run or after change-over of fixture.

1 Remove number 1 blade.

2 Examine the blade and of the sheared retaining pin for evidence of mushrooming to partially fill the slot in blade.

3 Mushrooming is evidence of proper pin installation. Recheck fixture installation or pressure adjustment if pin is not properly installed.

(n) Reinstall number 1 blade and pin, and repeat preceding steps (k) and (l).

(o) Shift turbine rotor to align driver with next blade remaining pin hole and repeat step (l).

(p) Repeat step (o) until all pins are driven.

(q) Remove turbine rotor from fixture.

(8) Tip-grind blades to dimension shown in figure 5-263.

(9) Using dial indicator, check that blade root does not protrude beyond face of disc more than 0.012 inch (0.030 cm).

(10) If new locking pins were installed, place a delta (Δ) after turbine rotor part number.

c. Balancing second stage power turbine rotor (30, figure 5-259).

(1) Assemble second stage power turbine for balancing as follows:

(a) Position second stage power turbine rotor (forward face down).

(b) Place seal ring (6, figure 5-259) on shaft.

(c) Using an arbor press and suitable brass bushing, press forward ring (12) onto power turbine shaft.

(d) Using an arbor press and suitable brass bushing, press roller bearing (15) onto power shaft.

(e) Place bearing spacer (16) on power shaft.

(f) Using an arbor press and suitable brass bushing, press ball bearing (28) on power shaft.

NOTE

Ensure scribe match lines ("V" mark) across the bearing bore are aligned.

(g) Install key washer (25).

(h) Install lock cup (21) and nut (20). Tighten nut to 225 to 250 pound-feet (334.8 to 372.0 kgm) torque.

NOTE

Do not deform lock cup at this time.

(2) Install balancing cradle (LTCT123) and balance shroud (LTCT499) in balancing machine, Model 35 (Gisholt Machine Co.), or equivalent.

(3) Install second stage turbine rotor in cradle.

(4) Using a dial indicator, check runout of second stage power turbine rotor. The radial runout shall not exceed 0.001 inch (0.003 cm) TIR and the face runout must not exceed 0.004 inch (0.010 cm) TIR. (Refer to figure 5-294 for runout locations.)

(5) Close balance shroud and secure.

(6) Dynamically balance second stage turbine rotor.

NOTE

To ensure sufficient balancing accuracy, rotate the second stage power turbine rotor between 1,000 and 2,000 rpm.

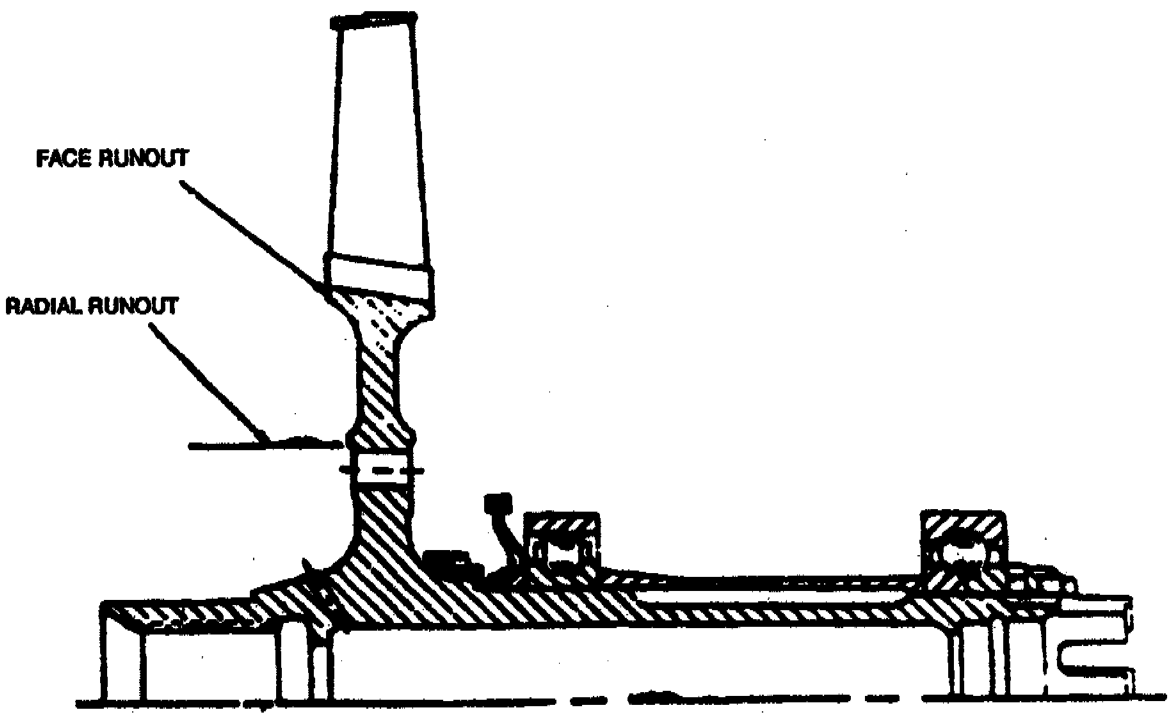


Figure 5-294. Second Stage Power Turbine Rotor Assembly - Runout Locations.

(7) Record unbalance and mark its location (clock position) on second stage power turbine rotor. Unbalance shall not exceed 0.5 gram-inch.

WARNING

FLIGHT SAFETY PARTS

Material removal limits are flight safety critical.

(8) Correct unbalance as follows:

(a) To remove material, use hand grinder and grinding disk or sander.

(b) Correct unbalance to within 0.5 gram-inch of true balance by removing material from underside of shoulder, adjoining ball-root area, at rear side of disc only. (See figure 5-295.)

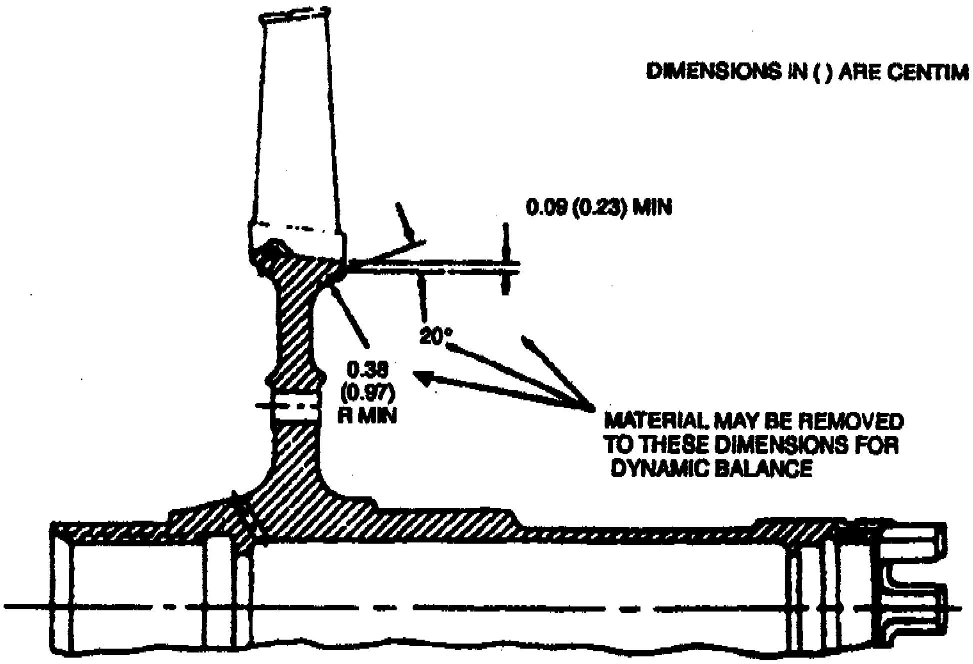
NOTE

When removing material to correct unbalance, maintain a dimension of 0.090 inch (0.229 cm) between the base of ballroot and underside of shoulder.

(9) Clean surface of ground area.

(10) After correcting unbalance, repeat preceding step c(2), through (7) to check balance of second stage power turbine rotor. If check balance indicates 0.5 gram-inch or less, remove rotor from balancing machine.

(11) Remove second stage power turbine rotor from balance machine.



WARNING

FLIGHT SAFETY PART

Material Removal Limits are Flight Safety Critical.

Figure 5-295. Second Stage Power Turbine Rotor Assembly - Grinding Area.

NOTE

Designate heavy point with an "H", using RED opaque ink No. 9 (item 234, table C–1) or Marks-A-Lot (item 238, table C–1).

(12) Install spacer (8, figure 5-135) and first stage power turbine rotor assembly (7).

NOTE

Ensure that First Stage Power Turbine Rotor has been balanced.

Install heavy points, designated by RED "H", 180 degrees apart.

(13) Install sealing flange (6) with bolt (4) and locking plate (5). Tighten bolts but do not lock tabs at this time.

(14) Balance power turbine assembly as follows:

(a) Install assembly cradle in balance machine.

(b) Using a dial indicator, check runout of power turbine assembly. The radial runout shall not exceed 0.001 inch (0.003 cm) TIR on spacer and 0.004 inch TIR (0.010 cm) on sealing flange. Face runout shall not exceed 0.0015 inch (0.0038 cm) TIR. (See figure 5-296 for runout locations).

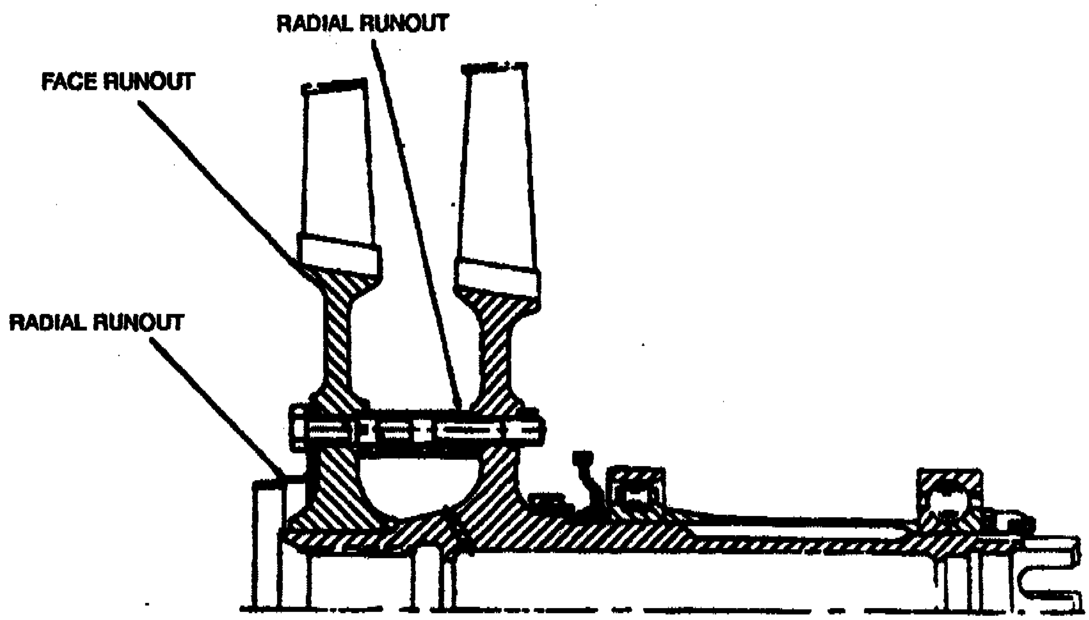


Figure 5-296. Second Stage Power Turbine Assembly - Runout Locations.

NOTE

The combination of first stage power turbine wheel face runout and air seal flange radial runout shall not exceed 0.005 inch (0.012 cm) TIR.

(15) If runouts exceed values, break torque on capscrews, reposition wheel on spacer, and repeat preceding step (14).

(16) Close balance shroud and secure.

CAUTION

In following step, do not remove material from any part of the assembly. As an aid to determine location and amount of unbalance, wax (item 342, table C–1) may be used.

(17) Perform check balance of power turbine assembly. Unbalance is not to exceed 3.0 gram-inches.

(18) If unbalance exceeds 3.0 gram-inches, loosen bolts and reposition wheel. Repeat preceding step (17). Paint matchmarks on turbine rotor assembly before proceeding to following step (20).

(19) Mark heavy point on turbine rotor shaft with red opaque ink (item 232, table C–1) or white marking ink (item 209, table C–1) or Marks-A-Lot (item 238, table C–1).

(20) Remove power turbine assembly from balancing machine and disassemble as follows:

(a) Remove bolts (4, figure 5-135) and locking plates (5).

(b) Remove sealing flange (6), first stage power turbine rotor assembly (7), and spacer (8).

(21) Disassemble second stage power turbine rotor assembly after balance as follows:

(a) Remove nut (20, figure 5-259) and lock cup (21).

(b) Remove key washer (25).

(c) Using suitable puller, remove ball bearing (28).

(d) Remove bearing spacer (16).

(e) Using suitable puller, remove roller bearing (15).

(f) Remove retaining ring (5) and seal ring (6).

NOTE

Where protective finish has been removed by grinding, use spot-paint procedure to touch up affected area.

5-317. REPLACEMENT OF SECOND STAGE GAS PRODUCER ROTOR ASSEMBLY BLADES. Proceed as follows:

NOTE

Equivalent tooling may be used in lieu of designated manufacturer's tooling for replacing blades.

a. Remove blades as follows: (See figure 5-297).

CAUTION

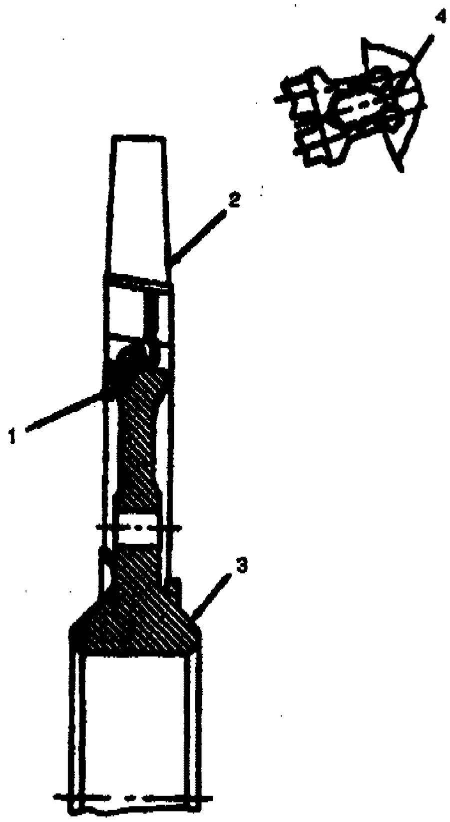
Remove blades, only as required, to replace defective blades.

(1) Position second stage gas producer rotor assembly, with forward face up, on table (LTCT13347, detail of LTCT13345).

(2) Using a vibropeen etching tool, number forward face of blade roots clockwise from 1 through 66, starting at the balancing "0" mark.

CAUTION

In following step (3), ensure rotor is secure in position by hand-tightening clamp assembly (LTCT13355, detail of LTCT13345).



1. SHEAR LOCKING PIN
2. BLADE
3. SECOND STAGE GAS PRODUCER ROTOR
4. PLATE

Figure 5-297. Second Stage Gas Producer Rotor Assembly Blade Removal.

(3) Align blade to be removed under punch assembly (LTCT13346, detail of LTCT13345) and, using press (LTCT6073), drive against the blade to shear locking pin (1).

(4) Using suitable drift, remove the blade (2) and plate (4). Discard plate.

(5) From the groove side, use a suitable drift to unseat the locking pin. Using drift, drive the pin from the hole.

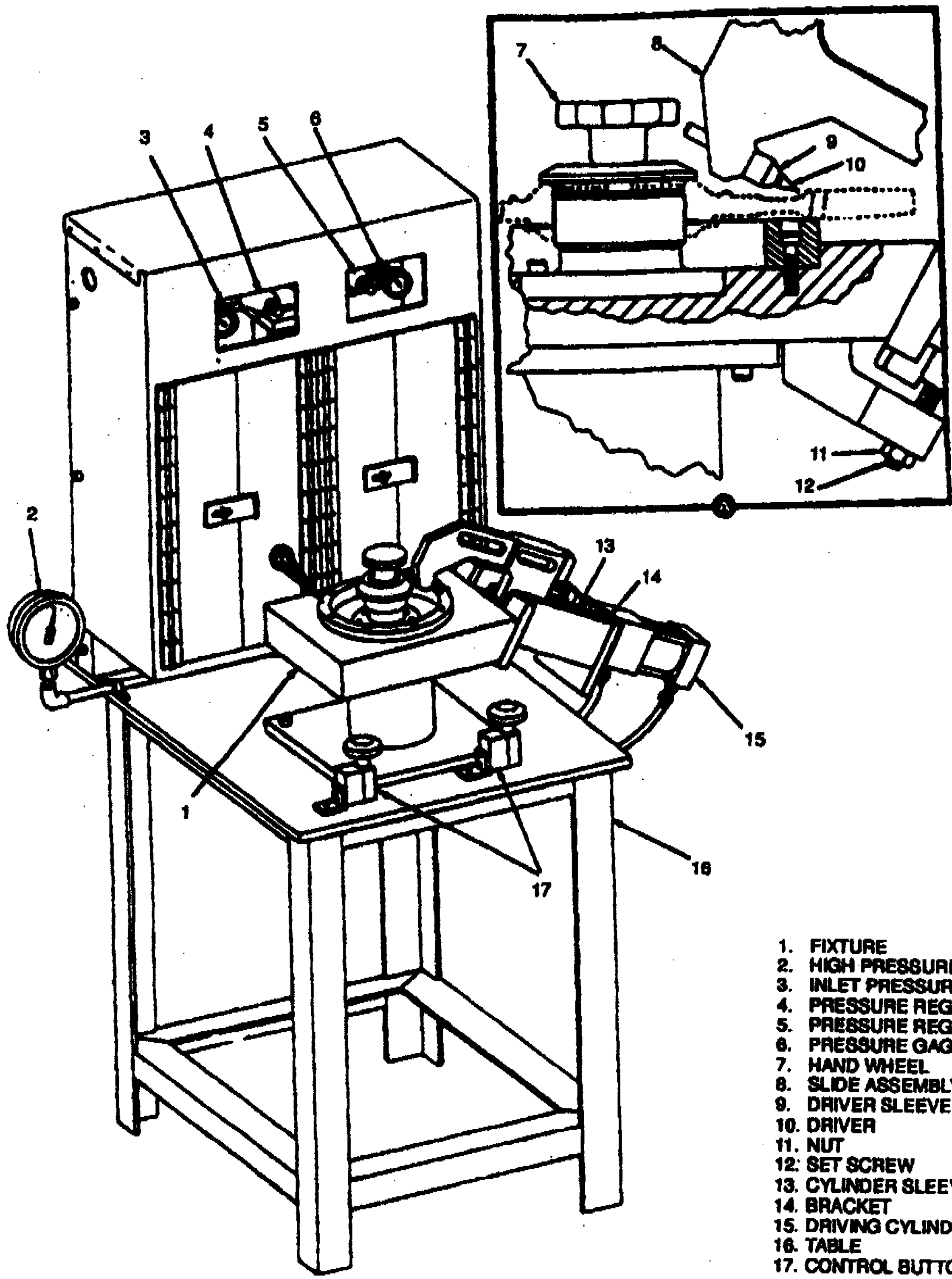
(6) Using 0.093 inch (0.236 cm) reamer in a tap wrench, ream out pin hole from the groove side.

b. Install blades as follows: (See figure 5-298).

NOTE

Install blades in sets of same length (within 0.002 inch) (0.005 cm, TIR) and weight (within 0.1 gram) (0.004 ounce) 180 degrees apart. All runouts shall be taken during blade installation and not after rotor is completely assembled.

(1) Place disc, inlet side down, on baffle peening fixture (LTCT6203) and install all sealing plates (1-100-144-01), convex side up, in the disc.



1. FIXTURE
2. HIGH PRESSURE GAGE
3. INLET PRESSURE GAGE
4. PRESSURE REGULATOR
5. PRESSURE REGULATOR
6. PRESSURE GAGE
7. HAND WHEEL
8. SLIDE ASSEMBLY
9. DRIVER SLEEVE
10. DRIVER
11. NUT
12. SET SCREW
13. CYLINDER SLEEVE
14. BRACKET
15. DRIVING CYLINDER
16. TABLE
17. CONTROL BUTTON

Figure 5-298. Power Assembly and Fixture Setup.

(2) Assemble blades into the disc.

NOTE

During installation of blades, forward end of blade root edge may become burred due to shearing sealing plate ear. If this condition should occur, remove burr, after installation of blades, by dressing with a stone. Coated and uncoated blades may be mixed. Coated blade length, by dash number, is optional since all blades can be tip ground.

(3) Clamp turbine rotor, inlet side up, on pin driver fixture (LTCT6645).

(4) Insert new locking pins (1-140-285-01) in disc.

(5) Using pin driver fixture (LTCT6455) and pin driver fixture power supply (LTCT6616), drive pins as follows: (See figure 5-298.)

(a) Install fixture (1) on table (16) of power supply and mount driving cylinder (15) on bracket (14).

(b) Connect shop air supply to power supply. Using pressure regulator (5), regulate inlet air pressure to approximately 40 psi (2812 gm sq cm) as indicated on pressure gage (6).

(c) Using pressure regulator (4), regulate piston return pressure to 20 to 30 psi (1406 to 2109 gm sq cm) as indicated on inlet pressure gage (3).

WARNING

Control buttons must be actuated simultaneously as a safety precaution to ensure the operator's hands are clear of the driver.

(d) Actuate control buttons (17) simultaneously and readjust inlet air pressure, as required, to produce a reading of 990 to 1,010 psi (696 to 710 kg sq cm) on high pressure gage (2).

NOTE

A 990 to 1,010 psi (696 to 710 kg sq cm) reading on the high pressure gage provides 2,375 to 2,425 pounds of force for driving the blade retaining pin.

(e) Release buttons and reactuate to conform proper inlet pressure adjustment. Slight readjustments of inlet air pressure maybe required during daily use.

(f) Position second stage gas producer rotor on fixture, with pin face up, and secure to fixture, using hand wheel (7).

NOTE

Hand wheel (7) is used in conjunction with hub (LTCT6876, detail of LTCT6645) and plate (LTCT6808-02, detail of LTCT6645).

(g) Install driver sleeve (LTCT6874, detail of LTCT6645) (9), with driver (10) installed, into slide assembly (8). Ensure that slide engages cylinder sleeve (13).

NOTE

Ensure that vertical adjustment of driver (10) is made when pin driver fixture is used for the first time or whenever driver (10) has become misaligned with pin hole of disc. Make adjustments as outlined in the following step (b).

(h) Loosen nut (11) and turn setscrew (12) to raise or lower slide assembly (8) and align driver(10) with pin hole in disc. To ensure correct adjustment, rotate rotor and align driver with several other pin holes. When satisfactory adjustment is made, tighten nut (11).

(i) Starting with number 1 blade, align driver with pin hole. Insert driver into hole until it contacts top of blade retaining pin.

WARNING

Control buttons must be actuated simultaneously as a safety precaution to ensure the operator's hands are clear of the driver.

(j) Actuate control buttons (17) and observe high pressure gage (2). A reading of 1,000 psi, (703 kg sq cm) maintained for a minimum of one second, provides the required pin installation force. Release buttons.

(k) Inspect blade retaining pin for proper installation as follows:

NOTE

This inspection is required only on the first rotor of the run or after changeover of the fixture.

1 Remove number 1 blade.

2 Examine the blade end of the sheared retaining pin for evidence of mushrooming to partially fill the slot in blade.

3 Mushrooming is evidence of proper pin installation. Recheck fixture installation or pressure adjustment if pin is not properly installed.

(l) Reinstall number 1 blade and pin, and repeat preceding steps (i) and (j).

(m) Shift gas producer rotor 180 degrees to align driver with blade retaining pin hole and repeat step (j).

(n) Using outside micrometer, measure OD at various points on blade ends; record maximum reading. Ensure diameter is within limits specified in table 5-69.

(o) Install remaining blade sets, maintaining 0.006 inch (0.015 cm) TIR runout; weight range of blade sets shall not vary more than 0.3 gram. (Refer to step b(5)(a) through (n).)

NOTE

Uncoated turbine blades (1-100-127), used in second stage gas producer rotor assembly, are manufactured "long" and are not categorized by weight and installed in mated sets (within 0.1 gram). Weight range of blade sets must not vary more than 0.3 gram and shall be ground to size as an assembly.

Installation of mismatched turbine blades (by weight) is an acceptable method of reducing the unbalance of the turbine wheel assemblies or relocating the direction of the unbalance to facilitate "balance" grinding. Dimensional requirements must be maintained. This procedure allows use of the "old" turbine discs that have a significant amount of balance stock already removed. By check balancing the disc before reblading, the location and amount of unbalance can be identified. Selective reblading (by weight) can locate the remaining unbalance (in an area where balance stock is available). The weight variation requirement, between mating blades and blade sets, does not apply for this procedure; however, dimensional requirements must be maintained.

(p) Repeat step (m) after each blade is installed.

(q) Remove rotor from fixture.

(6) Using dial indicator, check that blades do not protrude beyond face of disc more than 0.012 inch (0.030 cm).

(7) Place turbine rotor, inlet side up, onto baffle peening fixture (LTCT6203) with anvil located under the plate to be spread.

(8) Using a hammer and seal plate punch (LTCT6905), spread sealing plate until clearance around perimeter is 0.001 inch (0.003 cm).

(9) Repeat steps (7) and (8) until all sealing plates are spread.

(10) Using grinding fixture (LTCT13007) with a suitable OD grinder (14 x 36), grind the turbine rotor blades to 12.103 to 12.128 inch (30.742 to 30.805 cm) diameter. (See figure 5-299.)

NOTE

Do not break corners when grinding; sharp corners are desired.

(11) If new locking pins are used, place a delta (δ) after turbine rotor part number.

c. Replace individual blades as follows:

NOTE

Use the procedures given in steps a and b with the following exceptions:

(1) When removing damaged blades, also remove blade180 degrees opposite damaged blade and weigh.

(2) Reinstall serviceable blade; then choose a replacement for the damaged blade of same weight (within 0.1 gram) and the proper length to obtain 0.002 inch (0.005 cm) TIR runout, with respect to mating blade, when installed. A new blade may be ground to meet this runout requirement.

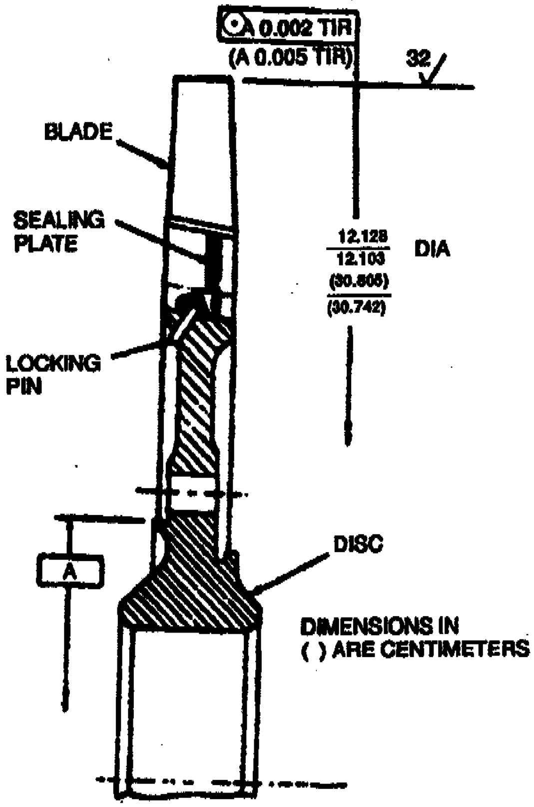


Figure 5-299. Second Stage Gas Producer Turbine Rotor - Reblading.

NOTE

There is no restriction on the number of blades that may be replaced or tip ground in this manner.

(3) When both mating blades, 180 degrees apart, are damaged, replace with two serviceable blades of same weight (within 0.1 gram) and of suitable length to maintain the diametric requirement, and within 0.002 inch (0.005 cm) TIR runout with respect to each other.

WARNING

FLIGHT SAFETY PART

Verification that balance is within limits is flight safety critical.

d. Balancing second stage gas producer rotor assembly.

(1) Mount second stage gas producer rotor assembly on balancing arbor (LTCT456) with collet (LTCT2120), sleeve bearing (LTCT2712-39, detail of LTCT2712), and bearing holder (LTCT4029), and torque arbor nut to 100 pound-inches (17860 gm cm).

(2) Using dial indicator, check runout of gas producer rotor. The radial runout shall not exceed 0.001 TIR and the face runout shall not exceed 0.002 TIR. (See figure 5-300 for runout locations.)

(3) If runouts exceed values, loosen capscrews, reposition wheel on arbor, and repeat procedure as outlined in preceding step a.

(4) Install second stage gas producer rotor assembly and arbor in balance machine cradle.

(5) Close balance shroud (LTCT499) and secure.

(6) Balance second stage gas producer rotor as follows:

(a) Using running static balance as outlined in the balancing machine instruction manual, balance the rotor.

NOTE

To ensure sufficient balancing accuracy, rotate the second stage gas producer rotor assembly between 1,000 and 2,000 rpm.

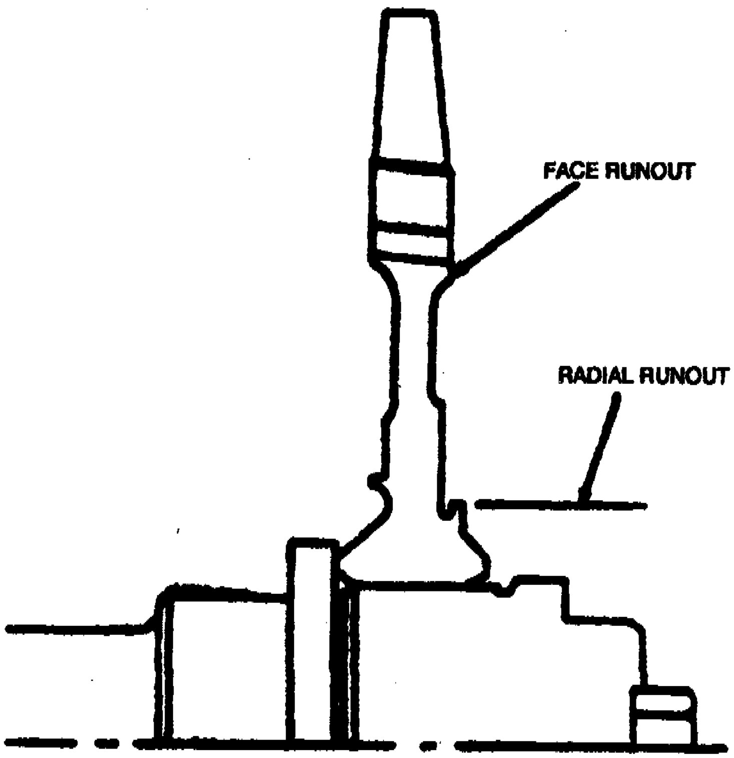


Figure 5-300. Runout of Second Stage Gas Producer Rotor Assembly.

(b) Record unbalance and mark its location (clock position) on the second stage gas producer. Unbalance shall not exceed 0.5 gram-inch.

NOTE

Designate heavy point with an "H", using white opaque ink (No. 9) (item 233, table C–1) or Marks-A-Lot (item 238, Table C–1).

(7) Correct unbalance as follows:

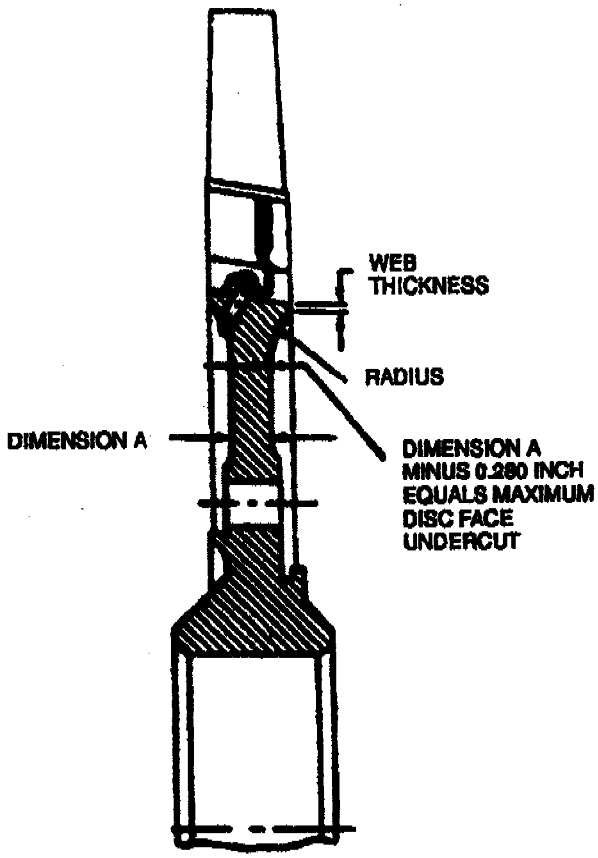
(a) To remove material, use hand grinder and grinding disc or sander.

(b) Correct unbalance to within 0.5 gram-inch of true balance by removing material from the underside of the shoulder, adjoining the ball-root area, at the rear side of the disc only. (See figure 5-301.)

NOTE

When removing material to correct unbalance, maintain a minimum thickness between base of ball route and shoulder as shown in figure 5-301. If possible, avoid undercutting the disc face area.

(c) Inspect the ground area. If disc face area exhibits any amount of grinding, measure an unaffected portion of disc web section not in undercut and radius areas. Record measurement as Dimension A. (See figure 5-301.)



<u>USED DISCS</u>

WEB <u>THICKNESS</u>	MINIMUM <u>RADIUS</u>
0.060 IN	0.29 IN.
0.065	0.28
0.070	0.27
0.075	0.26
0.080	0.25

<u>NEW DISCS</u>

WEB <u>THICKNESS</u>	MINIMUM <u>RADIUS</u>
0.060 IN.	0.38 IN.

WARNING

FLIGHT SAFETY PART

Material removal limits for balancing are flight safety critical.

Figure 5-301. Second Stage Gas Producer Rotor Assembly Disc Grinding Area.

(d) Subtract 0.280 inch (0.711 cm) from Dimension A.

NOTE

Maximum allowable face undercut for each disc is the result of subtracting 0.280 inch (0.711 cm) from Dimension A. (See figure 5-301.)

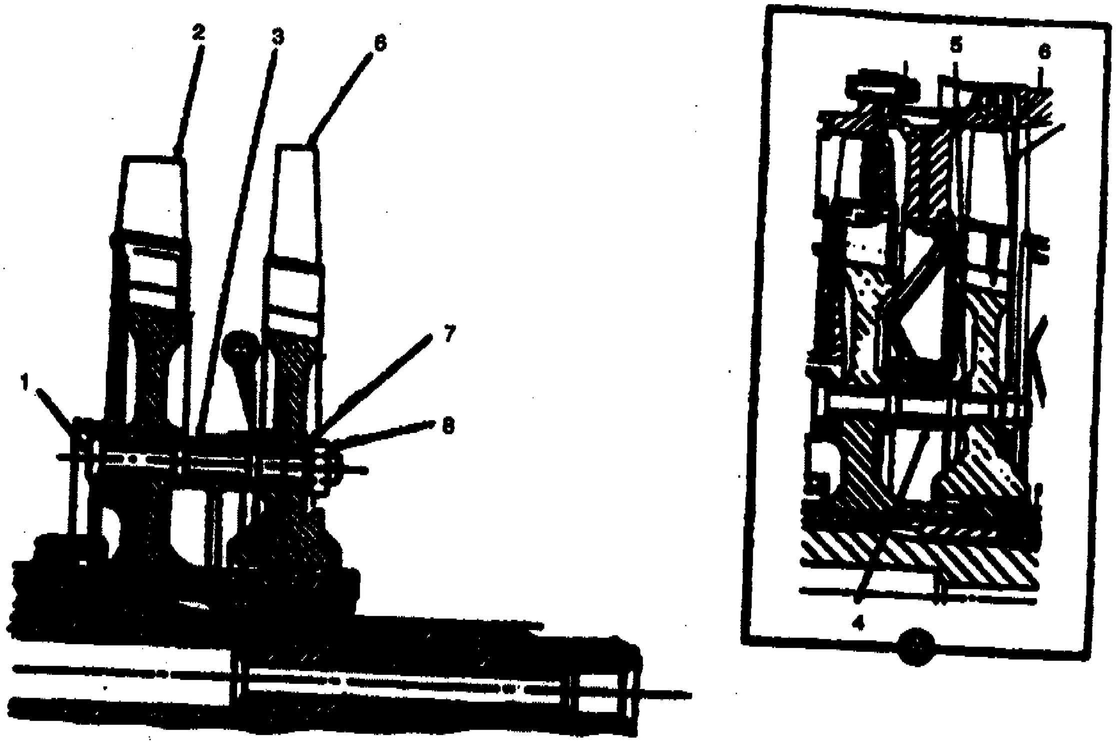
(8) Clean surface of ground area.

(9) After grinding unbalanced area, repeat step (6)(a) to check-balance second stage gas producer rotor assembly. If check-balance indicates 0.5 gram-inch or less, remove rotor assembly from balancing machine.

(10) Remove second stage gas producer rotor assembly from arbor.

(11) Assemble the first stage gas producer rotor assembly (2, figure 5-302), gas producer spacer (3) (T53-L-I3B, -15, -701,-701A), or spacer (4) (T53-L-703), sealing disc (5) (T53-L-703), and the second stage gas producer rotor assembly (6).

(12) Install three locking plates (7), bolts (1), and six nuts (8), to axially clamp the assembly together. Torque nuts to 100 pound-inches (17860 gm/cm).



1. Bolts
2. First stage gas producer rotor assembly.
3. Gas producer spacer (T53-L-13B, -15, -701, -701A).
4. Spacer (T53-L-703).
5. Sealing Disc (T53-L-703).
6. Second stage gas producer rotor assembly.
7. Locking plates.
8. Nut

Figure 5-302. Assembly of First and Second Stage Gas Producer Rotor Assemblies and Spacer.

NOTE

The first stage gas producer rotor assembly must be balanced prior to balancing of assembled first and second stage gas producer rotor assemblies.

(13) Mount the entire assembly on balancing arbor assembly (LTCT4014), using sleeve bearing (LTCT2712-03, detail of LTCT2712), bearing holder (LTCT4028), and balance shroud (LTCT499), and torque arbor nut to 100 pound-inches (17860 gm cm).

(14) Using dial indicator, check runout of the assembly. The radial runout must not exceed 0.001 TIR and face runout must not exceed 0.002 TIR (See figure 5-303 for runout locations.)

(15) If runouts exceed values as outlined in step (14), release torque on arbor nut and reposition second stage gas producer rotor assembly, retorque, and check runouts.

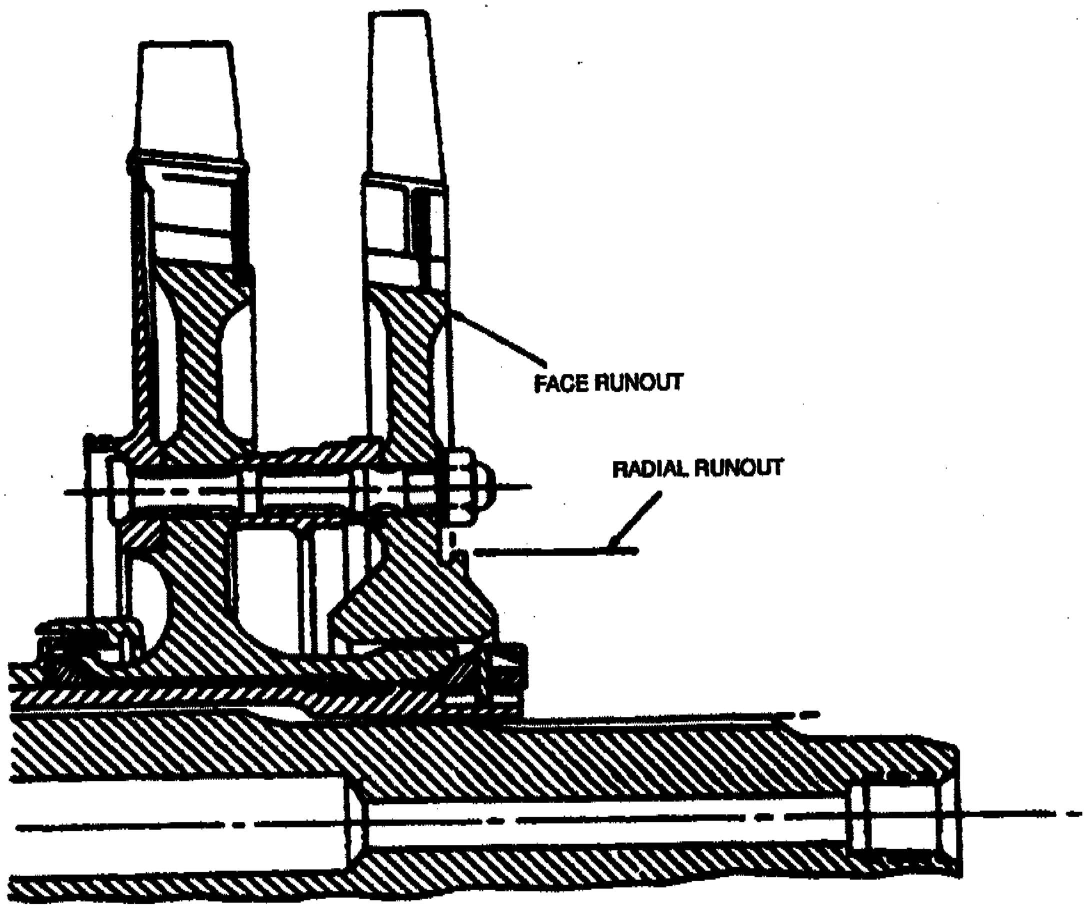


Figure 5-303. Runout of First and Second Stage Gas Producer Rotor Assemblies and Spacer.

(16) Install assembly and arbor on balance machine and check balance.

CAUTION

Do not damage any part of the assembly, during material removal for balancing.

NOTE

To ensure sufficient balancing accuracy, rotate the second stage gas producer rotor assembly between 1,000 and 2,000 rpm. Unbalance shall not exceed 3.0 gram-inches.

(a) Turbine assembly balancing:

1 Gas producer turbine assembly.

a Balance first stage G.P. rotor per Depot Maintenance Work Requirement..

b Assemble the second stage G.P. rotor to the first stage G.P. rotor.

c Balance the G.P. turbine assembly by removing material from the second stage G.P. rotor per Work Requirement.

2 Power turbine assembly.

a Balance second stage P.T. rotor per Work Requirement.

b Assemble the first stage P.T. rotor to the second Stage P.T. rotor.

c Balance the P.T. assembly by removing material from the first stage P.T. rotor per Work Requirement.

(b) Rotor assembly individual balancing. Individual balancing of the second stage G.P. and first stage P.T. rotor assemblies is not required unless:

1 A complete set of blades has been installed.

2 Turbine assembly cannot be satisfactorily balanced per paragraph (a) above.

(17) After balancing, matchmark rotor assemblies and spacer for further reassembly, using a suitable marking pencil.

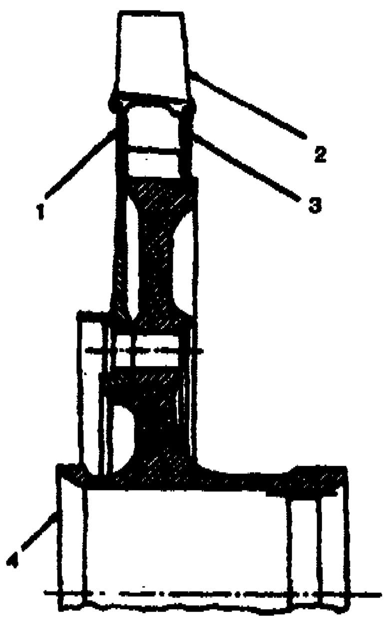
(18) Remove arbor nut and disassemble second stage gas producer rotor assembly from arbor. Remove spacer and first stage gas producer rotor assembly.

5-318. REPLACEMENT OF FIRST STAGE GAS PRODUCER TURBINE ROTOR BLADES. When a complete set of turbine blades are installed they shall be ground to an O.D. of 11.686 to 11.689 inch (29.682 to 29.690 cm). Proceed as follows:

a. Using details of removal kit (LTCT4726), remove blades. (See figure 5-304.)

CAUTION

To avoid mixing of blades and damage to surface coating, remove blades only as required to replace defective blades.



1. SEALING DISC
2. BLADE
3. RETAINING RING
4. FIRST GAS PRODUCER TURBINE DISC

Figure 5-304. First Stage Gas Producer Turbine Rotor Assembly - Blade Removal.

(1) Using an approved marker, number the blades 1 through 66, in clockwise direction, starting with number one of the balancing "0".

(2) Position first stage gas producer rotor with forward face up.

(3) Using drift (LTCT4731), lightly tap sealing disc (1) to misalign bolt holes in first gas producer turbine disc (4).

NOTE

Apply penetrating oil (item 190, table C–1), or equivalent, to sealing disc (1) and let soak in as long as possible.

(4) Turn first stage gas producer rotor over and position on support (LTCT4728) to hold rotor assembly above work areas and allow further disassembly.

(5) Insert drift (LTCT4731) into bolt hole, and using removal tool (LTCT4734), remove retaining ring (3) by lightly tapping drift until disc (4)is lowered sufficiently to remove ring and blades (2).

b. Install blades as follows: (See figure 5-304.)

NOTE

Install blades in sets of same length (within 0.002 inch (0.005 cm) TIR) and weight (within 0.1 gram), 180 degrees apart. Weight range of blade sets shall not vary more than 0.3 gram and runouts shall be maintained to 0.006 inch (0.015 cm) TIR. All runouts shall be taken during blade installation and not after rotor is completely assembled.

(1) Select required replacement blades.

NOTE

Installation of mismatched turbine blades (by weight) is an acceptable method of reducing the unbalance of turbine wheel assemblies or relocating the direction of unbalance to facilitate "balance" grinding. Dimensional requirements must be maintained. This procedure allows use of "old" turbine discs that have a significant amount of balance stock already removed. By check balancing the disc before reblading, the locations and amount of unbalance can be identified. Selective reblading (by weight) can locate the remaining unbalance (in an area where balance stock is available). The weight variation requirement, between mating blades and blade sets, does not apply for this procedure; however, dimensional requirements must be maintained.

(2) Assemble retaining ring (3) into the groove on aft face of rotor with anti-rotation knob located adjacent to "0" mark on disc (4), and facing forward.

(3) Compress ring (3) with blade removal tool (LTCT4734)

(4) Assemble blades (2) into wheel.

(5) Align "0" mark on forward inner flange of sealing disc (1, figure 5-304) with "0" mark on 4.1200 to 4.1205 inch (10.4648 to 10.4661 cm) diameter flange of turbine disc (4). Position sealing disc against forward surface of blade shanks, with the blades extending over the face of the rotor approximately one-half the length of the blade shank.

(6) Apply pressure to the forward sealing disc (1) so that the full complement of blades move axially rearward. As the sealing disc and blades move, all internal grooves on the face of the blades must hook over and tap the outside diameter of the sealing disc.

(7) Move the sealing disc (1) and blades (2), as a unit, until the rear faces of the blades contact the retaining ring (3). Bolt holes in sealing disc must align with the holes in turbine disc (4).

(8) Remove the restraint from the retaining ring to expand into the internal groove of blades (2).

(9) Press the sealing disc (1) against the turbine disc (4), until the disc contacts the rotor.

(10) Tip-grind first stage gas producer turbine rotor blades as follows:

(a) Mount first stage gas producer turbine rotor on grinding fixture (LTCT13007) or a suitable arbor.

(b) Install turbine rotor and grinding fixture on an OD grinder, or a lathe that has a grinding attachment on a movable carriage.

NOTE

The grinding wheel should be capable of approximately 6,000 surface feet per minute to acquire a smooth finish on blade tip. Use a grinding wheel, Macklin 29A60-K-5-V6 (Macklin Co.), or equivalent.

(c) To grind blade tips, ensure that grinding wheel is properly centered, and oscillate wheel across blade tips until wheel has passed beyond blade tips.

(d) Using an 11 to 12-inch micrometer, check OD of turbine rotor. Outside diameter must be within 11.686 to 11.689 inches (29.682 to 29.690 cm).

(e) Check turbine rotor for concentricity of OD within 0.002 inch total indicator reading (TIR).

(f) Remove turbine rotor and fixture from lathe. Remove turbine rotor from fixture.

(11) Grind first stage gas producer turbine rotor blade base shrouds as follows:

(a) Install turbine rotor in a suitable holding fixture.

(b) Using a suitable grinding fixture (1,500-grit), grind over maximum blade shrouds to dimensions shown in figure 5-305.

(c) Re-inspect shroud extensions with a depth micrometer to ensure proper dimensions. Remove rotor from holding fixture.

c. Replace individual blades as follows:

NOTE

Use the procedure given in preceding steps a and b with the following exceptions.

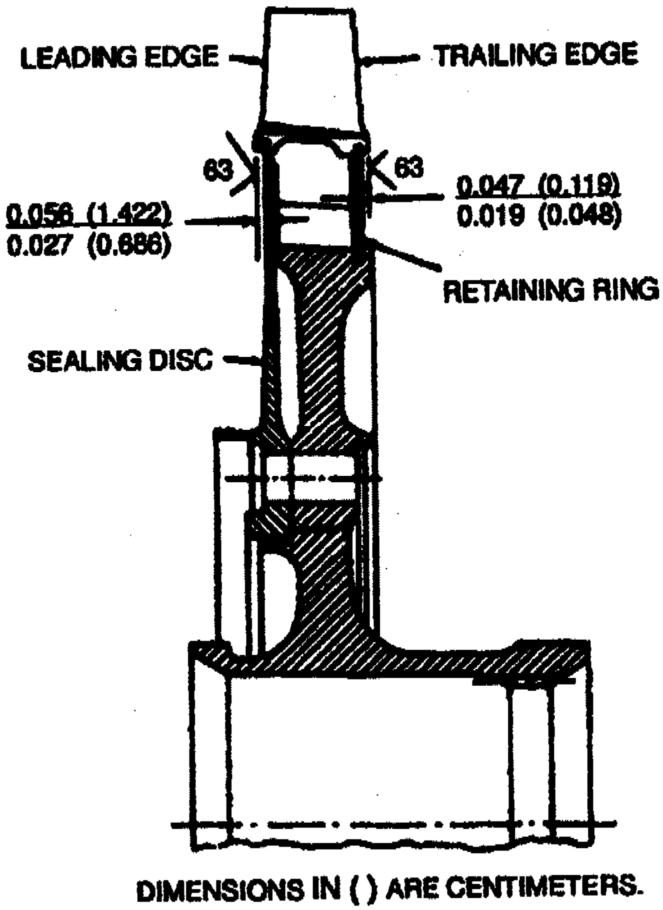


Figure 5-305. Blade Base Shroud Dimensions Following Grinding.

(1) When removing damaged blade, also remove blade180 degrees opposite damaged blade and weigh.

(2) Reinstall serviceable blade; then choose a replacement for the damaged blade of same weight (within 0.1 gram) and the proper length to obtain 0.002 inch (0.005 cm) TIR runout, with respect to mating blade, when installed. A new blade may be ground to meet the runout requirement.

NOTE

There is no restriction on the number of blades that may be replaced or tip ground in this manner.

(3) When both mating blades, 180 degrees apart, are damaged, replace with two serviceable blades of same weight (within 0.1 gram) and of suitable length to maintain the diameter requirement, and within 0.002 inch (0.005 cm) TIR runout with respect to each other.

WARNING

FLIGHT SAFETY PART

Verification that balance is within limits is flight safety critical.

d. Balancing first stage gas producer rotor assembly.

(1) Prior to balancing the first stage gas producer rotor, ensure that the following equipment is available:

(a) Balancing arbor assembly (LTCT4014), sleeve bearing (LTCT2712-03, detail of LTCT2712), and bearing holder (LTCT4028).

(b) Hand grind with a mounted grinding disc, P/N WAGONB (Sterling Grinding Wheel Co.), or equivalent.

(c) Hand dressing stone.

(d) Suitable weighing device.

(e) Balance shroud (LTCT499).

(f) Balancing machine, Model 35 (Gisholt Machine Co.), or equivalent.

(2) Install the required accessories and adjust the balancing machine for running the static balance in accordance with the balancing machine instruction manual.

(3) Install first stage gas producer rotor assembly on arbor and check runout on rotor. The radial runout shall not exceed 0.001 TIR and face runout shall not exceed 0.002 TIR. (See figure 5-307). Place both in balancing machine cradle.

(4) Close balance shroud and secure.

(5) Balance first stage gas producer rotor assembly as follows:

(a) Using a running static balance, as outlined in balancing machine instruction manual, balance the first stage gas producer rotor assembly.

NOTE

To ensure sufficient balancing accuracy, rotate first stage gas producer rotor assembly between 1000 and 2000 rpm.

(b) Record unbalance and mark its location (clock position) on the first stage gas producer rotor.

NOTE

Designate heavy point with a yellow "H", using Colorbrite pencil (item 239, table C–1), or Marks-A-Lot (item 238, table C–1).

WARNING

FLIGHT SAFETY PART

Material removal limits for balancing are flight safety critical.

WARNING

FLIGHT SAFETY PART

Verification that metal removal is within limits is flight safety critical.

(6) Correct unbalance as follows:

(a) To remove material, use hand grinder and grinding disc or sander.

(b) Correct unbalance to within 0.5 gram-inch of true balance, by removing material from the underside of the shoulder adjoining the ball-root area at the rear side of the disc only. (See figure 5-306.)

WARNING

FLIGHT SAFETY PART

Material removal limits for balancing are flight safety critical.

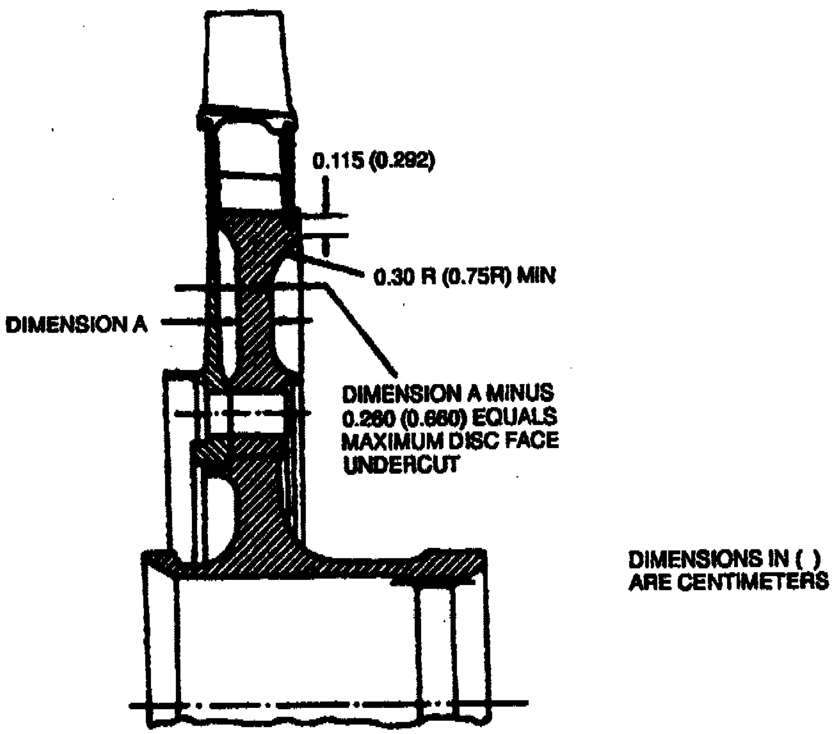


Figure 5-306. First Stage Gas Producer Rotor Assembly Disc - Grinding Area.

WARNING

FLIGHT SAFETY PART

Dimensional inspection after the following repair is flight safety critical.

NOTE

When removing material to correct unbalance, maintain a minimum dimension of 0.115 inch (0.292 cm) between the base of ball-root and underside of shoulder. If possible, avoid undercutting the disc face area.

(c) Inspect the ground area. If disc face area exhibits any amount of grinding, measure an unaffected portion of disc web section not in undercut and radius areas. Record measurement as Dimension A. (See figure 5-306.)

(d) Subtract 0.260 inch (0.6670 cm) from Dimension A.

NOTE

Maximum allowable face undercut for each disc is the result of subtracting 0.260 inch (0.660 cm) from Dimension A. (See figure 5-306.)

(e) Clean surface of ground area.

(7) After grinding unbalanced area, repeat step (5) to check balance of first stage gas producer rotor. If check balance indicates 0.5 gram-inch or less, remove rotor assembly from balancing machine.

(8) Remove first stage gas producer rotor from arbor.

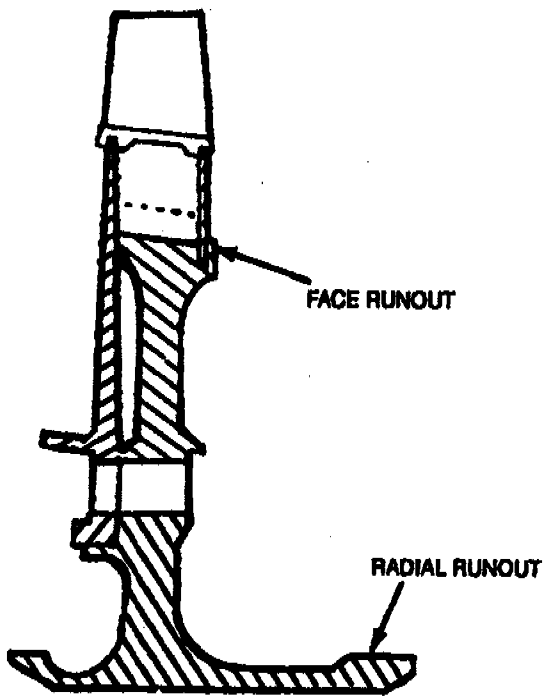
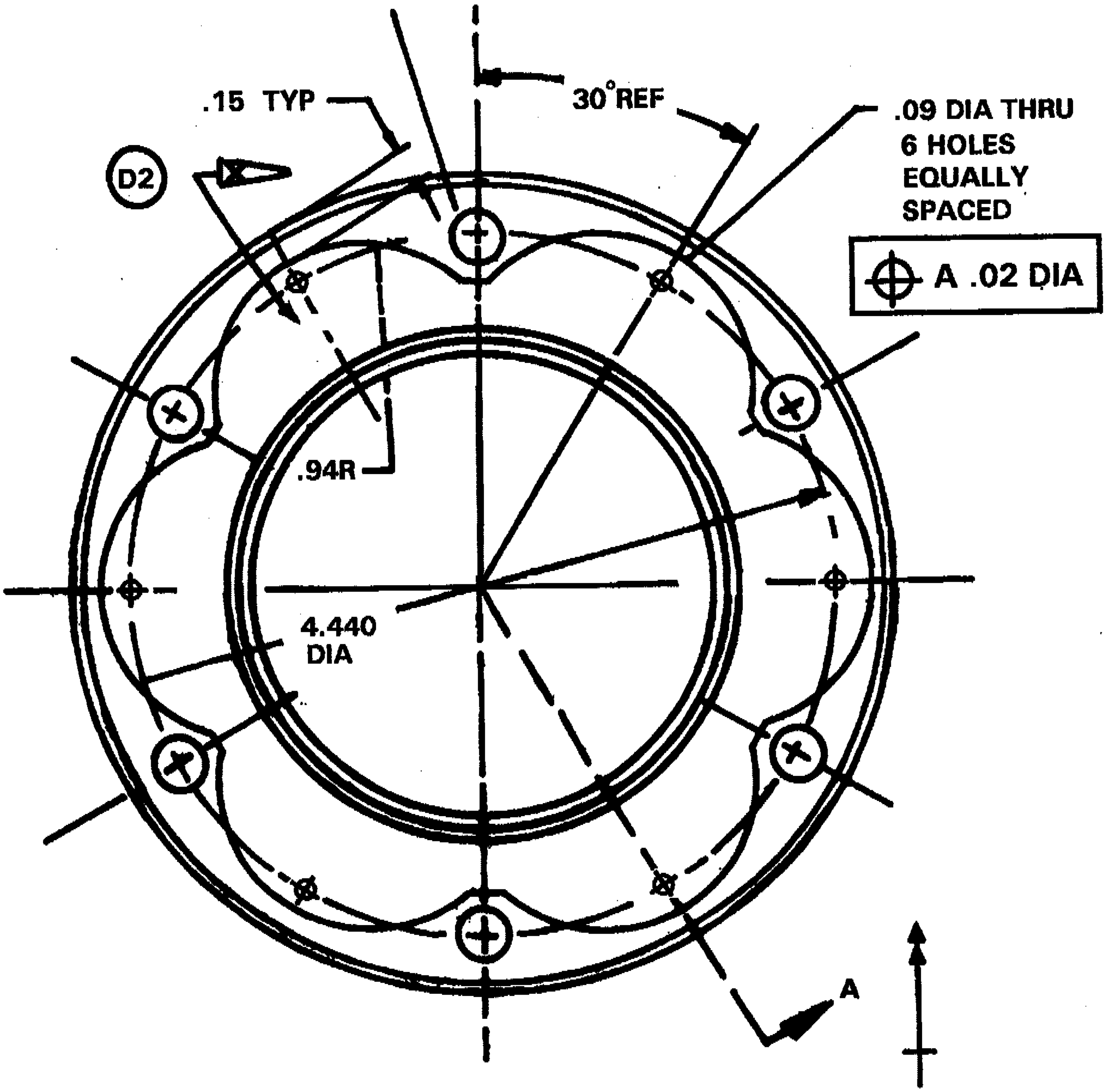


Figure 5-307. Runout of First Stage Gas Producer Rotor Assembly.

5-319. MODIFICATION OF FIRST STAGE SEALING FLANGE

a. Inspect the first stage nozzle flange (figure 5-135 index no. 6 and table 5-81 index no. 6) for incorporation of the 6 bleed holes, shown in figure 5-308.

b. If the sealing flange has 3 cooling holes, proceed as follows before performing the penetrant inspection: locate and drill three (3) additional .09 inch holes thru equally spaced to provide a total of six (6) equally spaced holes in accordance with figure 5-308



NOTE

Add three holes .09 Dia equally spaced between existing holes.

Figure 5-308. Rework of First Stage Sealing Flange

5-320. EXHAUST DIFFUSER ASSEMBLY, REAR BEARING COVER AND POWER SHAFT THROUGH BOLT.

5-321. DISASSEMBLY. Disassembly is not required.

5-322. CLEANING.

a. Clean all parts by the dry cleaning solvent method. (Refer to SP. No. 3002 in Appendix E.) Clean the exhaust diffuser using hot Alkali Soak No. 2 for parts with metal spray (refer to SP No. 3005 in Appendix E) or Hot Alkali Soak No. 3 (refer to SP No. 3012 in Appendix E). If procedures are inadequate for carbon removal, use Vapor Blasting (refer to SP No. 3000 in Appendix E) or Glass Bead Blasting. Mask metal spray areas and critical surfaces with tape (item 327, table C–1 or equivalent). Perform glass bead blasting at the lowest acceptable pressure. Start at 20 psi and do not exceed 35 psi.

b. The exhaust diffuser housing assembly may be cleaned and treated after rework by passivation (refer to SP No. 6024 in Appendix E) as an optional procedure.

(1) All heat treatment, machining, welding, and work procedures must be completed prior to passivation.

(2) Passivation shall not be performed on stainless steel parts that have been previously plasma- or thermal-flame sprayed. Sprayed parts should have an S prefix to the serial number and the sprayed surface will be revealed by a roughened edge or a darker hue during the cleaning process.

(3) Limited superficial corrosion and staining on plasma- or thermal-flame sprayed diffuser housings may be removed using bead blasting.

5-323. INSPECTION. Perform specific inspections listed in table 5-104.

5-324. REPAIR. (See figures 4-36 and 5-135.) Proceed as follows:

a. Repair worn or damaged 6.0585 to 6.0600 or 3.884 to 3.887 inch diameters of the rear bearing cover. (Refer to figure 5-314).

(1) Nickel, chrome-plate or plasma spray the 6.0585 to 6.0600 inch diameter, depending upon the thickness required.

(a) If plating thickness after final grind is 0.001 inch or less, nickel-plate as outlined in SP No. 6018 in Appendix E.

(b) If plating thickness after final grind is 0.002 to 0.010 inch, chrome-plate as outlined in SP No. 6014 in Appendix E.

(c) Plasma spray repair as follows:

1 Machine as necessary to obtain 0.003 to 0.010 inch maximum deposit build-up thickness after final machining. Do not machine off more than is required.

2 Clean parts with acetone (item 13, table C–1) or cleaning solvent (item 311, table C–1) .

3 Grit blast using silicon carbide particles (MIL-A-21380 No. 80 grit size at 40 psi) (item 273, table C–1).

4 Plasma spray (item 215, table C–1).

(2) Chrome-plate the 3.884 to 3.887 inch diameter to obtain 0.002 to 0.010 inch thickness after final grind.

(3) Bake part if plated at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Machine to given dimensions. See figure 5-314.

b. Repair power shaft through bolt (5, figure 4-36) as follows:

(1) Remove rust by immersing in rust remover (item 337, table C–1) for 1 hour. Remove and rinse thoroughly. Immerse in alkaline permanganate (item 241, table C–1) for 1 hour and rinse. Immerse in alkaline rust remover solution again for 1 hour. Rinse and dry.

(2) Machine bearing surfaces as necessary to obtain perpendicularity requirements. (See figure 5-310.) The 0.335 to 0.365 dimension must be maintained.

(3) Reapply electrofilm coating (item 193, table C–1) on threads and phosphate coat remainder. (Refer to SP No. 6012, Appendix E.)

c. Repair center cover of cover (8, figure 4-36) that exhibits minor dents (0.25 inch (0.64 cm) or less in depth) as follows:

(1) Manually straighten dents to the surrounding contour.

(2) Perform fluorescent-penetrant inspection of reformed area to determine if cracks have been generated by rework. No cracks are allowed.

(3) Ensure that centerline of threaded hole in plug is parallel to the cover OD.

Table 5-104. Inspection of Exhaust Diffuser Assembly, Rear Bearing Cover, and Power Shaft Through Bolt.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-36				
		WARNING **FLIGHT SAFETY PART**		
		Magnetic particle inspection to ensure that the following part is crack-free is flight safety critical.		
-5	Power Shaft Through Bolt	Visual	Crossed, stripped, or damaged threads	Not allowed. Replace.
		Visual and SIE	Measure power turbine bolt as outlined in table 5-105.	If limits are not exceeded, repair. Refer to paragraph 5-324.
		Visual and Magnetic-Particle (Refer to table 5-106)	Cracks	Not allowed. Replace.
-6	Nut	Visual	Cracks	Not allowed Replace.
			Damaged threads	Not allowed. Replace.
			Nicks, burrs, or scratches	Blend-repair. (Refer to SP No. 5000, Appendix E).
			Damaged surface coating	Repair. (Refer to SP No. 6012 in Appendix E).
-8	Cover	Visual	Damaged threads in plug or cover	Not allowed. Replace.
		SIE and Visual	Wear or damage on 6.0585 to 6.0600 inch (15.389 to 15.392 cm) or 3.884 to 3.887 inch (9.865 to 9.873 cm) diameter. (Refer to table 5-107)	Repair. (Refer to paragraph 5-324.)
			Dents in center cover in excess of 0.250 inch (0.635 cm) in depth. (See figure 5-311).	Replace if limits are exceeded (Refer to paragraph 5-324).
			Parallelism of cover OD to center line of threaded hole in plug. (See figure 5-311).	Not allowed. Replace.
		Visual and Fluorescent-Penetrant	Cracks in cover and brazed joint areas. (See figure 5-311).	Repair. (Refer to paragraph 5-324).

Table 5-104. Inspection of Exhaust Diffuser Assembly, Rear Bearing Cover, and Power Shaft Through Bolt (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-36 -10	Cover	Visual	Cracks.	Not allowed. Replace.
WARNING FLIGHT SAFETY PART Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.				
5-125 -43	Exhaust Diffuser	Visual	Burned areas in strut fairing	Not allowed. Replace.
			Broken or damaged studs or pins.	Replace. (Refer to paragraph 5-324).
			Stripped, crossed, or damaged retaining nuts	Replace. (Refer to paragraph 5-324).
			Nicks, dents, scoring in mounting flanges	Not allowed. Replace.
			Nicks or dents in strut fairing	Not allowed. Replace.
		SIE and Visual	Wear. (Refer to table 5-107).	Repair or replace (Refer to paragraph 5-324).
		Visual and Fluorescent-Penetrant	Cracks in strut fairing	Repair. (Refer to paragraph 5-324).
			Cracks in strut flanges, inner and outer perimeter, support and outer cone	Refer to table 5-108.
			Separation in forward and aft flange seam welds.	Repair. (Refer to paragraph 5-324).
			Cracks in forward face of inner cone and outer strut trailing edge to inner cone fairing (flange) area.	Repair. (Refer to paragraph 5-324).
		Visual	Gaps between outer strut and outer strut fairing	Repair if gaps between outer strut and outer strut fairing exceed 0.061 inch in the area between 1/2 inch of each strut end. Repair if the gap exceeds 0.08 inch on either end of strut or 0.12 inch on both ends. Repair per paragraph 5-324.
	Thermocouple Boss	Visual	Damage thermocouple bosses.	Repair. (Refer to paragraph 5-324).

Table 5-105. Power Shaft Through Bolt Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Concentricity and Perpendicularity	5-309	a. Using gage similar to that shown in figure 5-309 proceed as follows: (1) Center and chuck gage to a suitable fixture. (2) Ensure that bolt is clean and free of carbon buildup. (3) Install bolt into gage and hand-tighten to snug bolt as securely as possible against shoulder. b. Using dial indicator, check limits as follows: Position No. 1 - 0.002 in. TIR maximum Position No. 2 - 0.003 in. TIR maximum
Concentricity and Perpendicularity (P/N 1-140-067-14)	5-310	a. Mount bolt on centers. b. Check with dial gage. c. Using dial gage, check for limits as follows: (1) If concentricity exceeds 0.005 inches (0.013 cm) reject bolt. (2) Perpendicularity - Repair per figure 5-310.

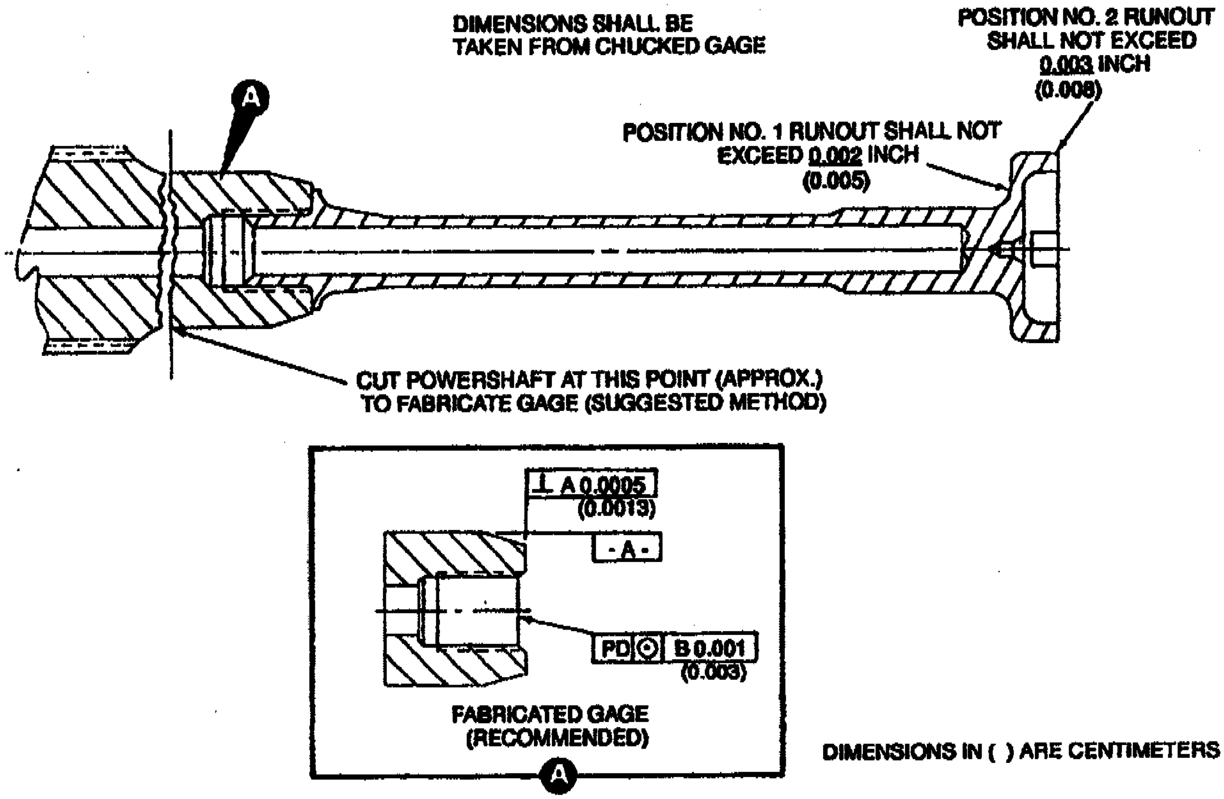
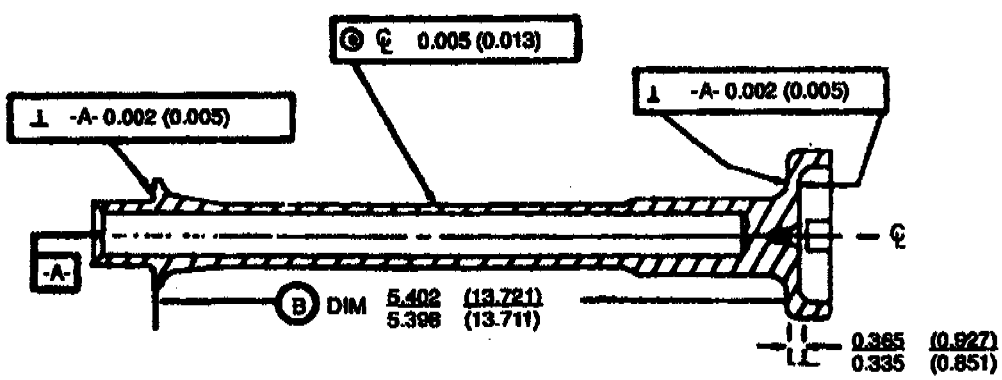


Figure 5-309. Measuring Runout of Power Shaft Through Bolt.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-310. Power Shaft Through Bolt Inspection.

d. Replace center cover of cover (8, figure 4-36), that exhibits major dents (greater than 0.25 inch (0.64 cm) in depth) or cracks, as follows: (See figure 5-311.)

(1) Machine damaged center cover from support.

(2) Clean up braze residue from support.

(3) Position new cover (1-140-179-03) on support and tack weld in four places using welding wire (item 345, table C–1). Maintain radial gap of 0.002 to 0.010 inches (0.005 to 0.025 cm) for brazing.

(4) Position new plug (1-140-181-02) in cover and tack weld in two places using welding wire (item 345, table C–1). Maintain radial gap of 0.002 to 0.010 inches (0.005 to 0.025 cm) for brazing.

NOTE

Strip chrome plating (if any) on parts prior to furnace braze cycle.

(5) Using brazing alloy (item 64, table C–1), vacuum-braze plug and cover as outlined in SP No. 5004 in Appendix E.

(6) Temper cover as follows:

(a) Cool from brazing temperature to 1,000°F (538°C) within one hour.

(b) Cool from 1,000°F (538°C) to 400°F (204°C) within 1 to 2 hours.

(c) Inspect brazement and rebraze, if necessary.

(d) Cool at -90° to -110°F (-68° to -78°C) for 3 hours.

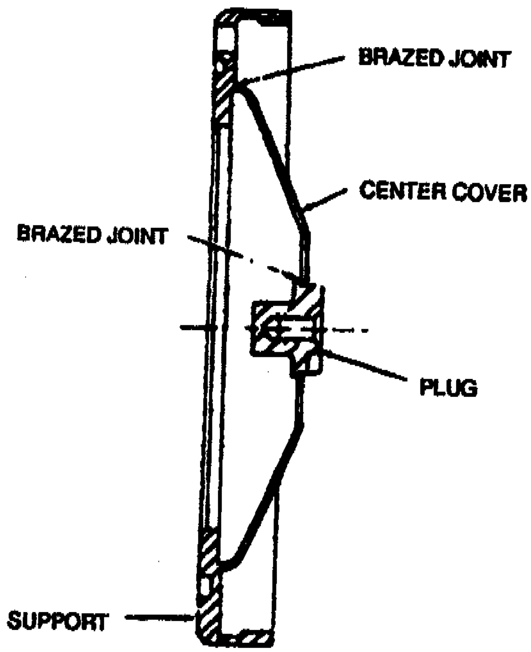


Figure 5-311. Rear Bearing Cover Crack and Damage Inspection.

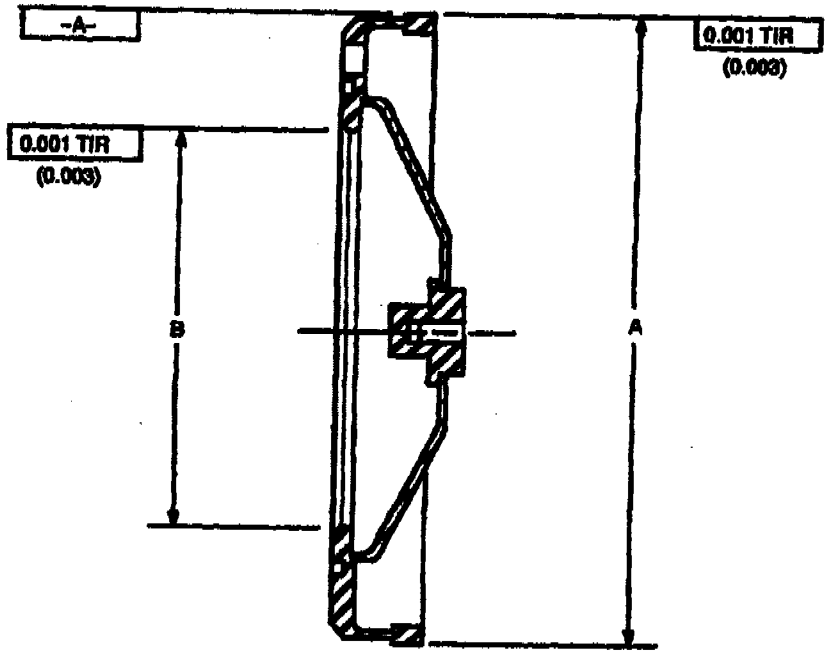
Table 5-106. Magnetic Particle Inspection of Power Shaft Through Bolt.

FIGURE & INDEX	NOMENCLATURE	METHOD OF MAGNETIZATION
4-36, 5	Power Shaft, Bolt	Circular, use direct contact at 800 amperes. Longitudinal at 4000 ampere-units.

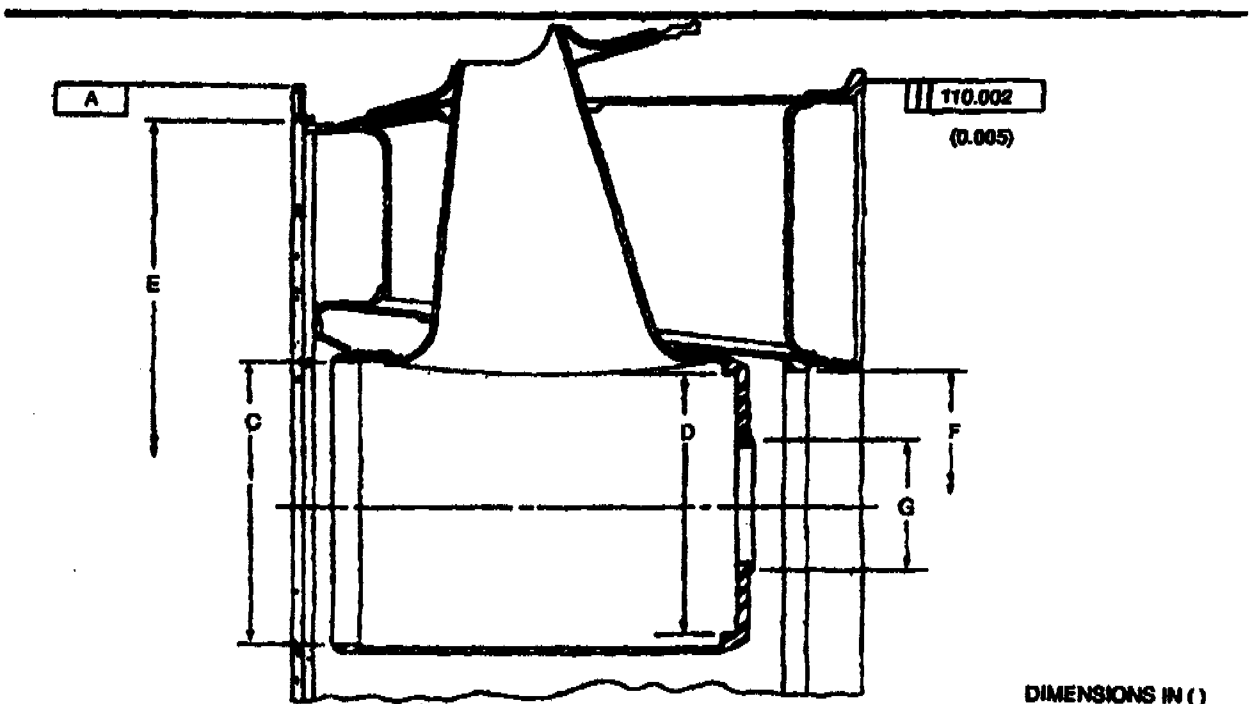
Table 5-107. Dimensional Inspection of Exhaust Diffuser Assembly, and Rear Bearing Cover.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINTS DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG & DIM
			MIN	MAX	MIN	MAX	MIN	MAX	
	4-36								5-312
Cover	-8	OD	6.0585 (15.389)	6.0600 (15.392)	6.056 (15.382)	6.060 (15.392)			A*
		ID	3.884 (9.865)	3.887 (9.873)	3.884 (9.865)	3.889 (9.878)			B*
	5-135								
Exhaust Diffuser	-43	ID	6.314 (16.038)	6.315 (16.040)	6.314 (16.038)	6.317 (16.045)			C
		ID	5.938 (15.083)	5.939 (15.085)	5.938 (15.083)	5.941 (15.090)			D
		ID	13.645 (34.658)	13.655 (34.684)					E
		ID	6.062 (15.397)	6.064 (15.403)	6.060 (15.392)	6.066 (15.408)			F*
			3.877 (9.848)	3.879 (9.853)	3.875 (9.843)	3.879 (9.853)			G*

* Dimensional inspection is not required unless final assembly clearances/fits cannot be met.



COVER (8, FIGURE 4-36)



EXHAUST DIFFUSER (43, FIGURE 5-135)

DIMENSIONS IN ()
ARE CENTIMETERS

Figure 5-312. Exhaust Diffuser Assembly and Rear Bearing Cover Inspection Locations.

Table 5-108. Exhaust Diffuser Assembly Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**		
Cracks in Strut Flanges	5-313	Two cracks of 2-inch (5.08 cm) maximum length per flange, or a larger number with a total length not exceeding 4 inches (10.16 cm) are acceptable for repair. (Refer to paragraph 5-324.) If limits are exceeded replace exhaust diffuser assembly.
Cracks in Strut and Inner and Outer Perimeter	5-313	Cracks not exceeding 3 inches (7.62 cm) in length are acceptable for repair, provided there are not more than two cracks per strut. Repairs are limited to two struts at any one overhaul unless equipment is available to maintain the required dimensions. (Refer to paragraph 5-324.) If limits are exceeded, replace exhaust diffuser assembly.
Cracks in Support		Two cracks of 2-inch (5.08 cm) maximum length are acceptable for repair. (Refer to paragraph 5-324.)
Cracks in Outer Cone		Two cracks of 3-inch (7.62 cm) maximum length are acceptable for repair. (Refer to paragraph 5-324).
Gap Between Outer Strut and Outer Strut Fairing		Gaps between outer strut and outer strut fairing are acceptable up to 0.06 inch without repair in the area between 1/2 inch of each strut end. Gaps on either end are acceptable up to 0.08 inch. The total of the end gaps must not exceed 0.12 inch. Repair per paragraph 5-324.

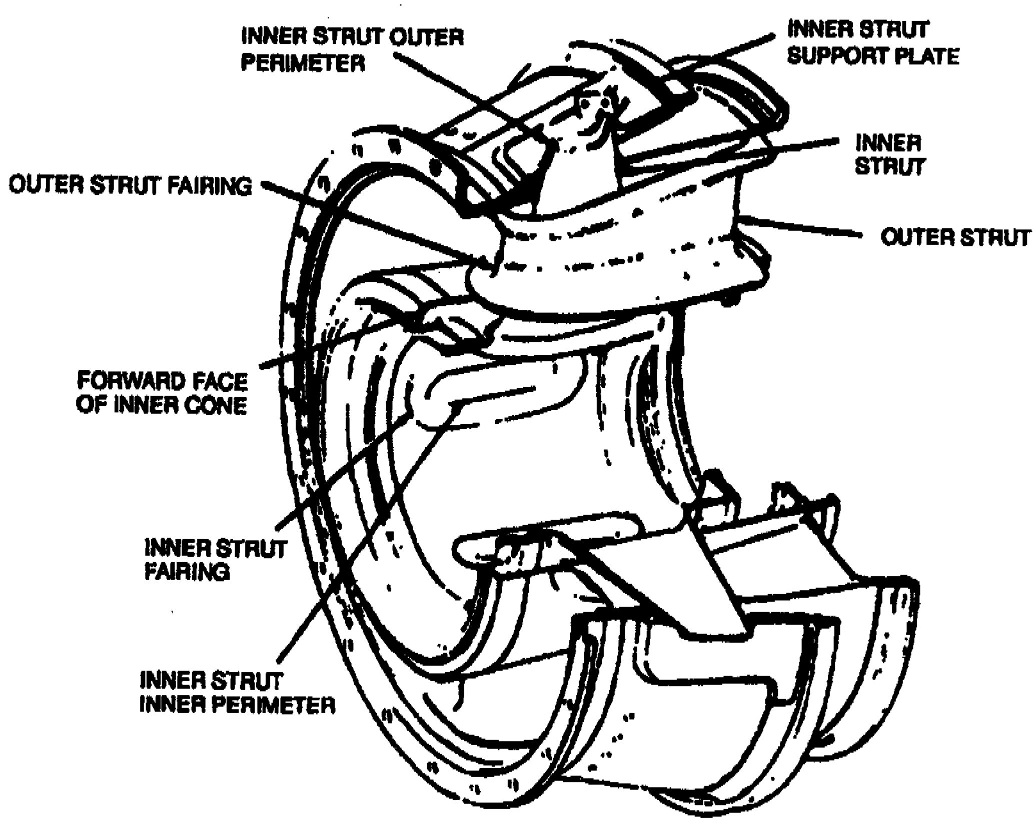


Figure 5-313. Exhaust Diffuser Inspection Areas.

(e) Perform fluorescent-penetrant inspection of brazement.

(f) Proceed to paragraph "a," for restoration of chrome plating, if needed.

e. Repair cracks in brazed joint areas of rear bearing cover as follows: (See figure 5-311.)

(1) Using brazing alloy (item 58, table C–1), torch-braze cracks in accordance with SP No. 5003 in Appendix E.

(2) Inspect repaired areas per SP No. 5003 in Appendix E.

f. Covers rejected for cracks in the brazement and/or parent metal shall be repaired as outlined below.

(1) Cracks in the parent metal shall be repaired by TIG welding per MIL-W-8611 using Welding Wire AMS5786 (item 348, table C–1).

NOTE

Strip chrome plating (if any) on parts prior to furnace braze cycle.

(2) To repair cracks in braze material, clean the defective area and apply brazing alloy AMS4777 (item 64, table C–1). Mark the cover assembly with braze stop-off (item 213, table C–1), as necessary. Place part on a flat ceramic plate in a vacuum furnace and process in accordance with SP No. 5004 in Appendix E.

(3) Part shall be fluorescent-penetrant inspected per MIL-STD-6866 and dimensionally inspected (per Drawing 1-140-640-03) for warpage on "mating face."

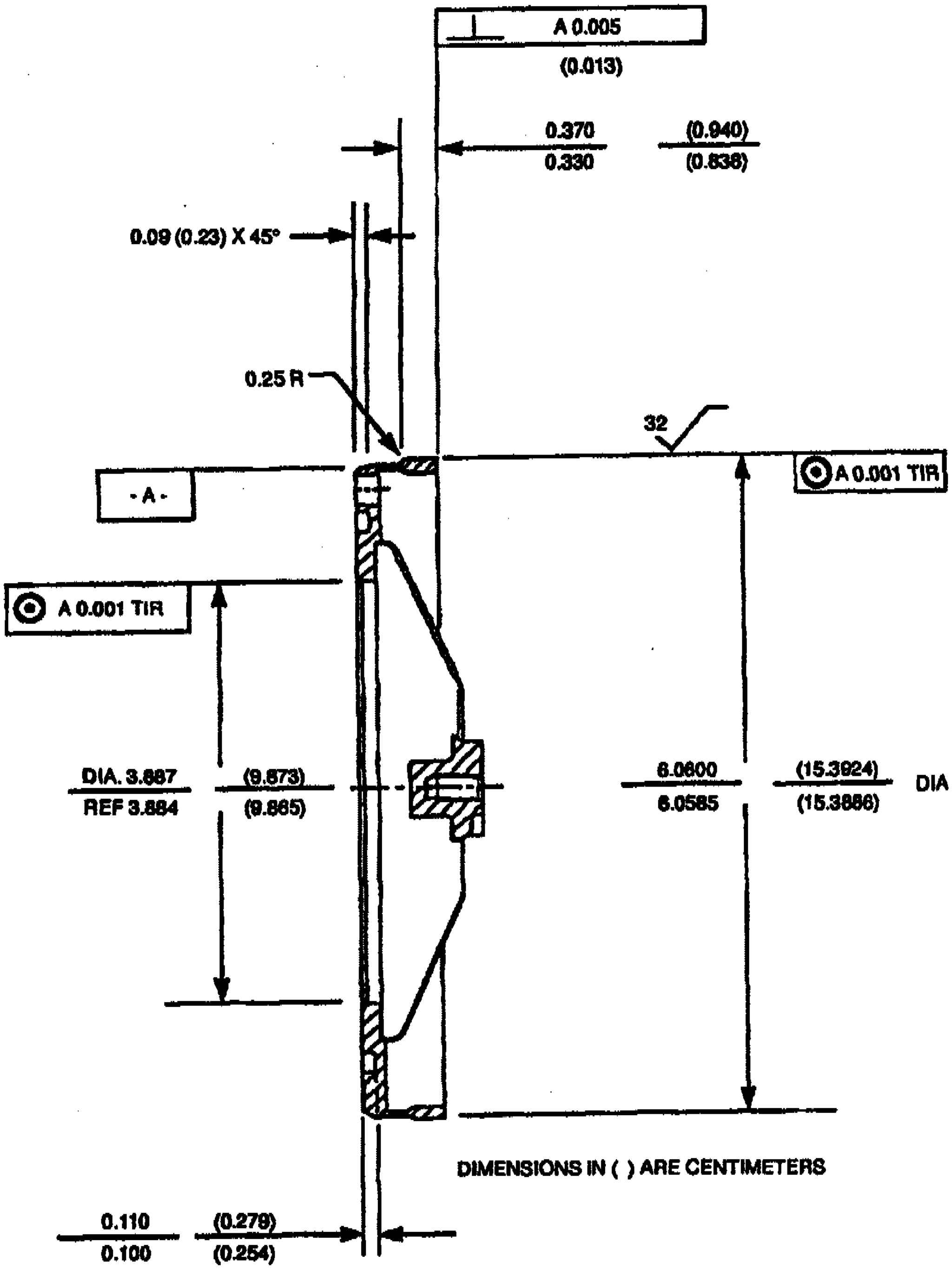


Figure 5-314. Plating Area - Rear Bearing Cover.

g. Replace damaged studs of exhaust diffuser (43, figure 5-135) as follows: (See figure 5-315.)

(1) Cut off stud flush to surface of boss.

(2) Using a center drill, start a hole in remainder of stud.

(3) Using a No. 8 carbide drill, drill into stud approximately 0.150 inch (0.381 cm) below face of boss.

(4) Using a punch, drive remainder of pin into the stud hole.

(5) Using a No. 43 carbide drill, drill through the pin hole and through the remainder of the stud to a depth of approximately 0.38 inch (0.97 cm).

(6) Using a suitable stud extractor, remove remainder of stud.

(7) Using a 0.25-28UNF-3B bottom tap, retap stud hole, and clean threads with compressed air.

(8) Install new stud (1-150-007-02) and ensure that the stud bottoms against the cone.

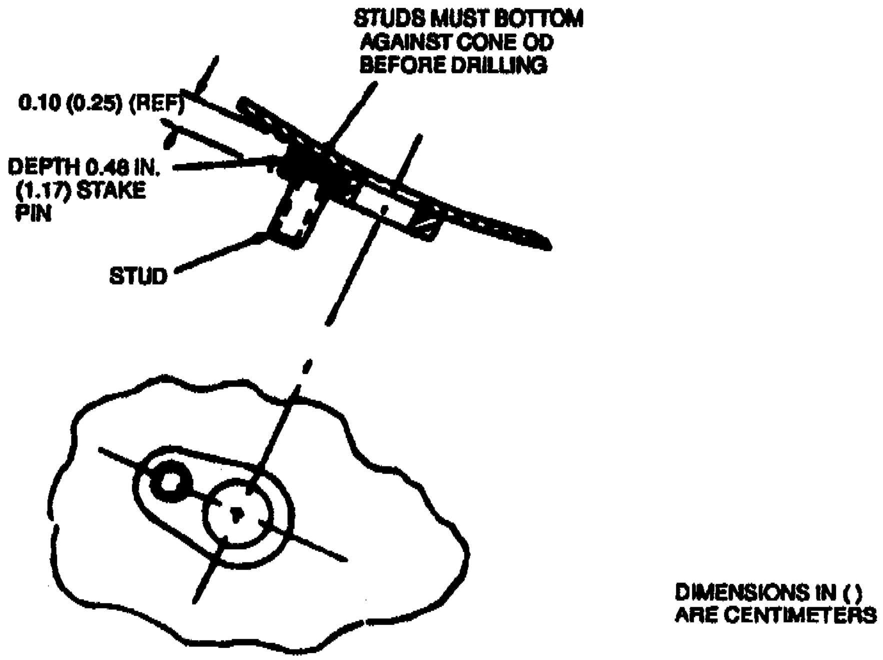


Figure 5-315. Thermocouple Mounting Stud Replacement.

(9) Using a No. 43 Carbide drill, drill through the existing pin hole, located approximately 0.10 inch (0.25 cm) below stud surface, to a depth of 0.45 inch (1.17 cm).

(10) Install new pin (1-140-023-06) flush with boss, and stake.

CAUTION

Use care not to grind into parent metal.

(11) Remove damaged bosses by hand tool grinding or, when desirable, by machining.

(12) Install new boss, (1-150-077-03), completely welding around base of boss using welding wire (item 345, table C–1).

h. Replace damaged or missing nuts located on front mounting flange of exhaust diffuser (43, figure 5-135), using installation tool LTCT6000 or LTCT4874.

i. Plasma flame-spray repair may be accomplished on those surfaces shown in figure 5-317 that do not meet visual or dimensional inspection requirements.

CAUTION

Plasma flame-spray repair shall not be used to restore flange thickness.

(1) Clean parts with acetone (item 13, table C–1).

NOTE

The surface 6.062 to 6.064 inch diameter surface may be machined to obtain a surface roughness of 100 to 125 RMS instead of grit blasting to prepare the surface for metal spray.

(2) Plasma flame spray surfaces. The 6.062 to 6.064 inch (15.397 to 15.403 cm) diameter shall be sprayed with Metco 443NS Powder (item 215, table C–1) and all other repair surfaces shall be sprayed with nickel aluminide powder (item 218, table C–1) as outlined in SP No. 5006 in Appendix E. Refer to figure 5-316.

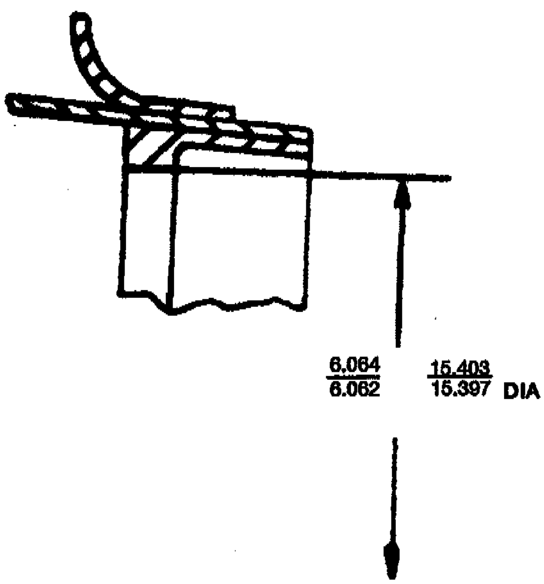


Figure 5-316. Exhaust Diffuser Spray Repair Surfaces.

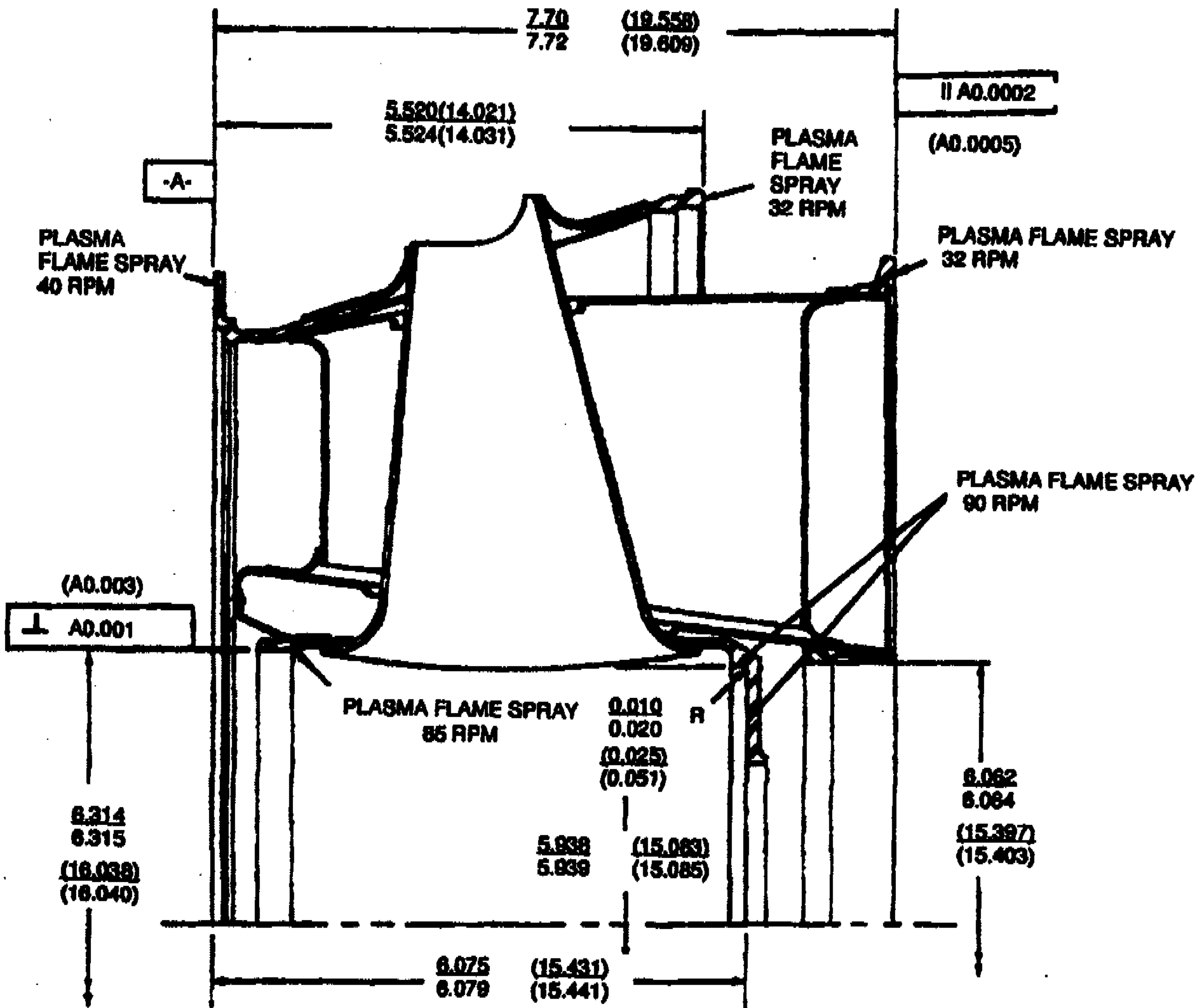


Figure 5-317. Exhaust Diffuser - Metal Spray Areas.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

j. Repair cracks in outer strut fairings of exhaust diffuser (43, figure 5-135) as follows: (See figure 5-313).

(1) Weld-repair cracks in accordance with SP No. 5001 in Appendix E, using welding wire (item 347, table C-1). No preheat or postheat is required.

(2) Inspect weld-repaired areas for cracks visually and by fluorescent-penetrant method.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

k. Repair cracks in exhaust diffuser strut outer perimeter as follows: (See figure 5-313).

(1) Using an air drill and a rotary file or carbide burr, rout all cracks.

NOTE

If power equipment is not available, routing may be accomplished using a small diesinker type file or India stone.

(2) Clean area to be welded with acetone (item 13, table C–1).

(3) Using welding wire (item 345, table C–1), weld-repair routed areas in accordance with SP No. 5001 in Appendix E.

CAUTION

In following step (4), do not remove any base metal or grind welds below the surface of the base metal. Excessive removal of metal may weaken the repair.

(4) Using sanding cartridge rolls (item 292, table C–1), blend-repair welds flush with base metal.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(5) Perform a fluorescent-penetrant inspection of repaired areas. Cracks or cracklike indications are cause for rejection.

l. Repair cracks in outer cone of exhaust diffuser (43, figure 5-135) as follows: (See figure 5-318.)

(1) Clean area to be welded with acetone (item 13, table C–1).

(2) Using an air-drill and a rotary file or carbide burr, rout all cracks, to remove foreign material.

NOTE

If power equipment is not available, routing may be accomplished using a small diesinker type file or India stone.

(3) Using welding wire (item 345, table C–1), weld-repair cracks as outlined in SP No. 5001 in Appendix E.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(4) Perform a fluorescent-penetrant inspection.

m. Repair cracks in strut flanges of exhaust diffuser (43, figure 5-135) as follows:

(1) Clean area to be welded with acetone (item 13, table C–1).

(2) Using an air drill and a rotary file or carbide burr, rout cracks to remove foreign material.

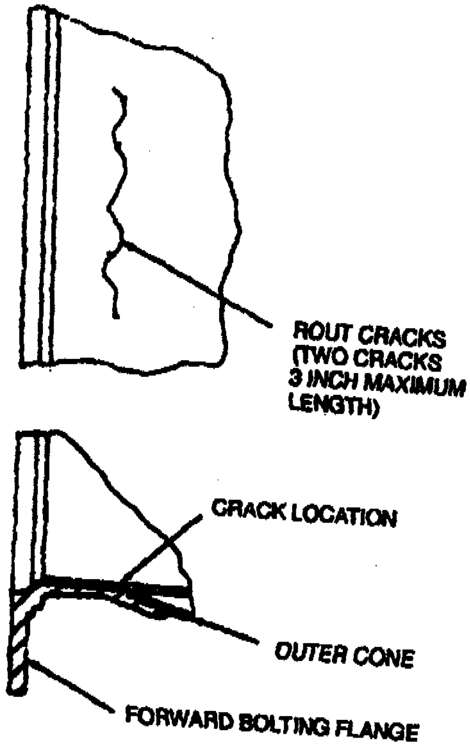


Figure 5-318. Exhaust Diffuser Outer Cone Crack Locations.

NOTE

If power equipment is not available, routing may be accomplished using a small diesinker type file or India stone.

(3) Using welding wire (item 345, table C–1), weld-repair cracks as outlined in SP No. 5001 in Appendix E. No preheat or post heat treatment is required.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(4) Perform a fluorescent-penetrant inspection. Cracks are not acceptable.

n. Repair cracks in strut support of exhaust diffuser (43, figure 5-135) as follows:

(1) Clean area to be welded with acetone (item 13, table C–1).

(2) Using an air drill and a rotary file or carbide burr, rout to cracks to remove foreign material.

NOTE

If power equipment is not available, routing may be accomplished using a small diesinker type file or India stone.

(3) Using welding wire (item 345, table C–1), weld-repair cracks as outlined in SP No. 5001 in Appendix E. No preheat or post heat treatment is required.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(4) Perform fluorescent-penetrant inspection. Cracks are not allowed.

o. Repair separation of seam welds in forward or aft flange of exhaust diffuser assembly (43, figure 5-135) by spot or fusion welding.

(1) Spot-weld as outlined in SP No. 5002 in Appendix E.

(2) Fusion weld as follows:

(a) Using a grinding disc, cut a circumferential slot (3/16±1/16 inch wide) in the separated seam weld center, through the exhaust diffuser inside wall.

(b) Clean surfaces to be welded with acetone (item 13, table C–1).

(c) Clamp the separated area together.

(d) Using welding wire (item 345, table C–1), rosette weld the two walls through the slot in the separated area. Back up area to be welded with copper or inert gas. No preheat or postheat treatment is required.

(e) Blend raised areas of weld repair to original contour.

(f) Perform a fluorescent inspection. Cracks are not allowed.

p. Repair cracks in forward face of inner cone and outer strut trailing edge to inner cone fairing (flange) area of exhaust diffuser (43, figure 5-135) as follows: (See figure 5-319.)

(1) Using welding wire (item 345, table C–1), weld-repair cracks as outlined in SP No. 5001 in Appendix E.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(2) Perform a dye-penetrant inspection. Cracks are not acceptable.

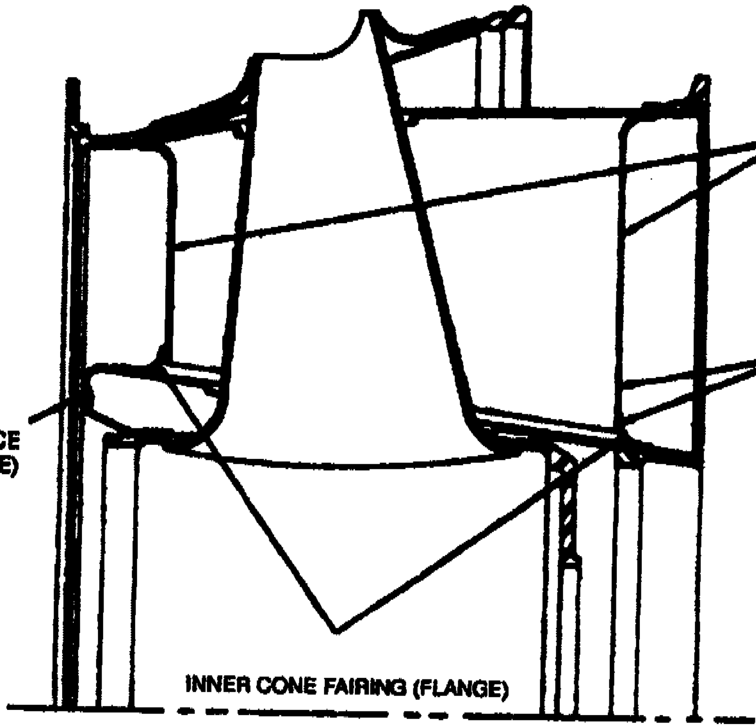


Figure 5-319. Exhaust Diffuser - Repair Area.

q. Repair gaps between outer strut and outer strut fairing as follows:

(1) Using a rubber or leather-headed mallet, deform outer strut fairing to strut fairing within 1/16 inch gap or as close as possible. Proceed to next steps if not within limits.

(2) Using welding wire AMS5774, (item 345, table C–1), tack-weld threaded end of a 1/4-inch diameter by one inch long low-alloy steel hex head bolt to center of dent. Tack-weld two places 180 degrees apart, 0.045 inch (0.114 cm) long.

(3) Apply an outward pressure under the head of bolt until dented area conforms to contour of undamaged strut and strut fairing areas adjacent to dent or gap is within 1/16 inch.

(4) Remove bolt by grinding away tack welds and blend area flush.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(5) Inspect area for cracks per MIL-STD-6866. No cracks are allowed.

r. Repair the machine bearing surface as necessary to obtain perpendicularity requirements. Refer to figure 5-310.

5-325. REASSEMBLY. Reassembly is not required.

5-326. FUNCTIONAL TEST. Functional test is not required.

5-327. V-BAND, FIRE SHIELD ASSEMBLY, AND DIFFUSER AFT SUPPORT CONE.

5-328. DISASSEMBLY. Proceed as follows:

a. Disassembly of V-band and fire shield assembly is not required.

b. Disassemble diffuser aft support cone as follows:

(1) Cut and remove lockwire from screws (1, figure 5-320).

(2) Remove screws securing retainers (2 and 5).

(3) Remove pins (3) from support (8). Remove support from flanges (7 and 9).

NOTE

Support must be tagged and flanges indexed for support location. Supports are not interchangeable.

(4) In a similar manner remove remaining supports (4, 6, and 10).

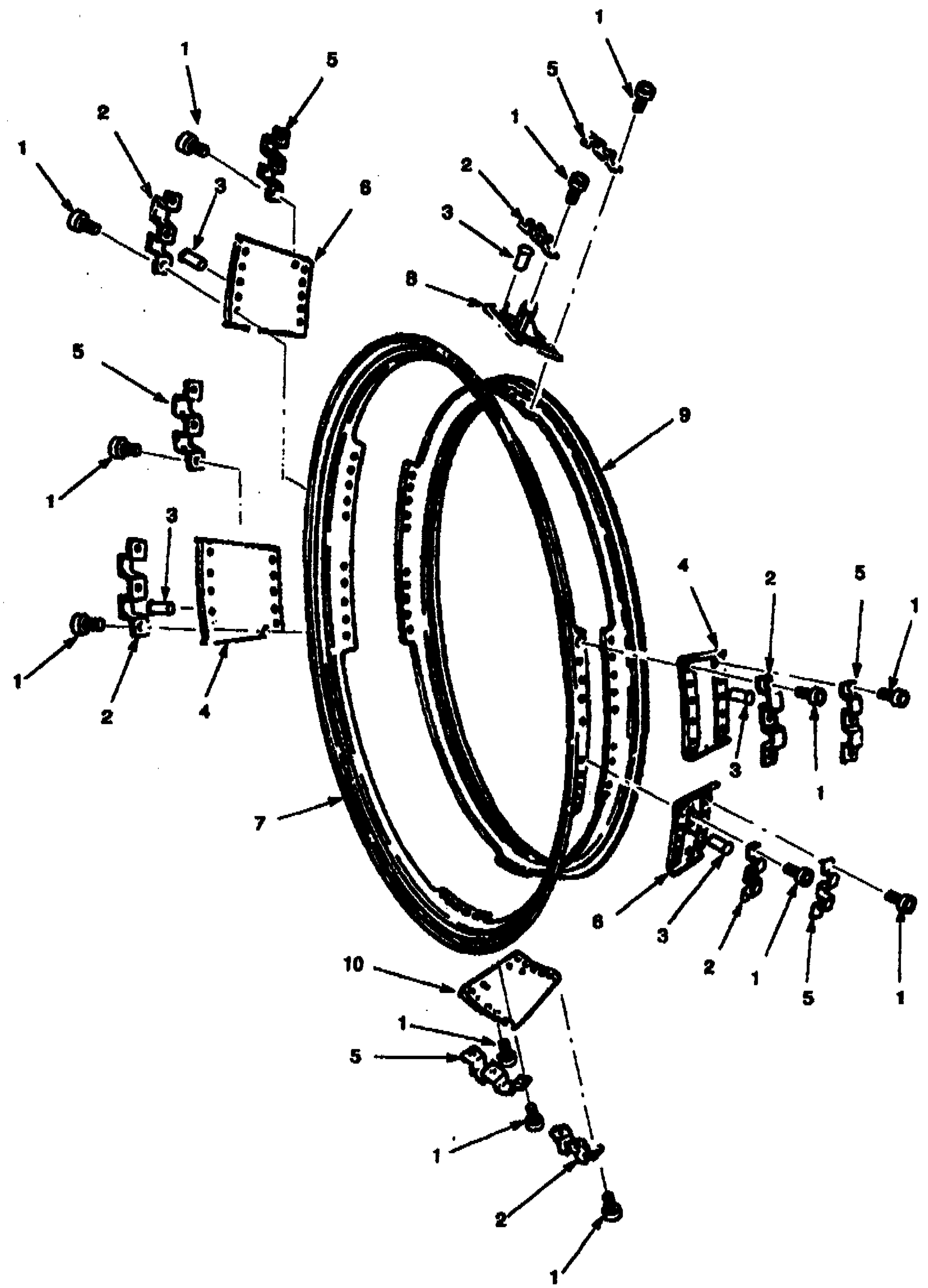


Figure 5-320. Diffuser Aft Support Cone.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-320	No Number	V-BAND, FIRE SHIELD ASSEMBLY AND DIFFUSER AFT SUPPORT CONE (NHA 1-130-630-08)	Ref	
	TS5210S4	. V-BAND, Special latch (94581) (Lycoming Source Cont Dwg 1-300-239-01)	Ref	
	56454	. V-BAND, Special latch (97625) (Alternate) (Lycoming Source Cont Dwg 1-300-239-02)	Ref	
	1-150-260-02	. CONE ASSEMBLY, Support, exhaust diffuser	Ref	
1	MS24673-9	. . SCREW, Cap, socket head	36	
2	1-150-119-01	. . RETAINER, Pin, outer	6	
3	1-150-123-02	. . PIN, Straight, headed	24	
4	1-150-280-05	. . SUPPORT, Side	2	
5	1-150-122-01	. . RETAINER, Pin, outer	6	
6	1-150-280-07	. . SUPPORT, Side	2	
7	1-150-116-03	. . FLANGE, Front, outer cone	1	
8	1-150-280-06	. . SUPPORT	1	
9	1-150-117-03	. . FLANGE, Rear, outer cone	1	
10	1-150-280-03	. . SUPPORT, Side	1	

5-329. CLEANING. Clean all parts by dry-cleaning solvent method. (Refer to SP No. 3002 in Appendix E.)

5-330. INSPECTION. Perform specific inspections listed in table 5-109.

5-331. REPAIR. (See figure 5-135.) Proceed as follows:

a. Repair fire shield (29 or 40, figure 5-135) as follows:

(1) Weld-repair cracks in weldment and parent metal of flange, fire shield, lock plate, and cover in accordance with SP No. 5001 in Appendix E and table 5-111.

(2) Reshape dented and distorted areas of flange and fire shield to adjacent contours. Reshape lock plate when distortion is minor. Use leather mallet or plastic hammer with aluminum backup bar. Inspect for cracks using magnetic-particle inspection.

(3) Remove damaged cover or lock plate by grinding spot-welded areas flush with parent metal. Clean area with stainless steel wire brush. Clean area to be welded with acetone (item 13, table C–1). Position lock plate, or cover, on fire shield. Spot-weld lock plate at eight places and cover at four places. (Refer to SP No. 5002 in Appendix E.) Inspect for cracks by magnetic-particle inspection method.

b. Repair damaged threads as outlined in SP No. 5007 in Appendix E.

c. Repair damaged fire shield (29 or 40, figure 5-135) in areas of lock plate as follows:

CAUTION

In following step (1), do not reduce thickness of shield.

(1) Remove lock plate by grinding or remove lock plate and cut hole in the same step by punching, boring, or cutting operation. Refer to step (6) for hole requirements.

(2) Rout out all cracks in fire shield.

(3) Clean area to be welded with acetone (item 13, table C–1).

(4) Using welding wire (item 347, table C–1), weld-repair routed cracks in accordance with SP No. 5001 in Appendix E and table 5-111.

CAUTION

In following step (5) do not reduce thickness of welds to less than that of parent metal.

NOTE

When welding cracks, use argon backup. Weld to obtain full penetration.

(5) Using No. 80-grit sanding cartridge roll (item 292, table C–1), blend-repair welds flush with base metal.

(6) Bore a 1.116 to 1.130 inch (2.835 to 2.870 cm) hole in areas where lock plates were removed. (See figure 5-322.)

(7) Using drill jig (LTCT11329), drill rivet holes. (See figure 5-322.)

Table 5-109. Inspection of V-Band, Fire Shield Assembly, and Diffuser Aft Support Cone.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-135				
15	V-Band Retainer and Trunnion	Visual	Cracks.	Not allowed. Replace.
29 or 40	Fire Shield	Visual	Cracks.	Repair. (Refer to paragraph 5-331.)
			Nicks, dents, or burrs.	Blend-repair nicks and burrs. (Refer to SP No. 5000 in Appendix E.). Repair dents. (Refer to paragraph 5-331).
			Damage in area of lock-plate.	Repair. (Refer to paragraph 5-331).
37	Diffuser Support Cone Assembly *	SIE and Visual	Wear. (Refer to table 5-110).	Replace if limits cannot be met.
5-320				
2 and 5	Retainers	Visual	Cracks.	Not allowed. Replace.
4, 6, 8 and 10	Supports	Visual	Cracks.	Not allowed. Replace.
			Crossed, stripped, or damaged threads.	Not allowed. Repair or replace (Refer to paragraph 5-331, step b.)
7	Flange (Front)	Visual	Cracks	Not allowed. Replace.
			Crossed, stripped, or damaged threads.	Not allowed. Repair or replace (Refer to paragraph 5-331, step b.)
9	Flange (Front)	Visual	Cracks.	Not allowed. Replace.
			Distortion	Not allowed. Replace.
			Crossed, stripped, or damaged threads	Not allowed. Repair or replace. (Refer to paragraph 5-331, step b.)

* Dimensional inspection is not required unless visual inspection indicates obvious damage, fretting, corrosion, or wear.

Table 5-110. Dimensional Inspection of Diffuser Aft Support Cone.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-135								5-321
Diffuser Support Cone Assembly	37	ID*	21.797 (55.364)	21.803 (55.380)					A
		ID*	16.950 (43.053)	16.960 (43.078)					B
		OD*	16.451 (41.786)	16.453 (41.791)					C

* All dimensions shall be taken in a restrained position.

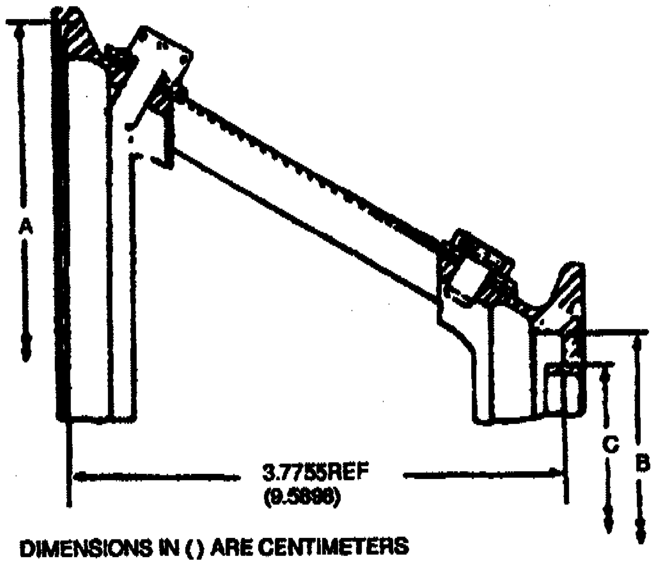


Figure 5-321. Diffuser Aft Support Cone Inspection Locations.

Table 5-111. Fire Shield - Weld Instruction.

Rework	Process	Preheat	Postheat	Material	Inspection	Pressure Test
Repair of Parent Metal and Weldment	Fusion-Weld			Welding wire (item 347, table C–1).	Visual Magnetic Particle	–
Repair of Damage in Areas of Lock Plates	Fusion-Weld			Welding Wire (item 347, table C–1).	Visual, Fluorescent Penetrant	–

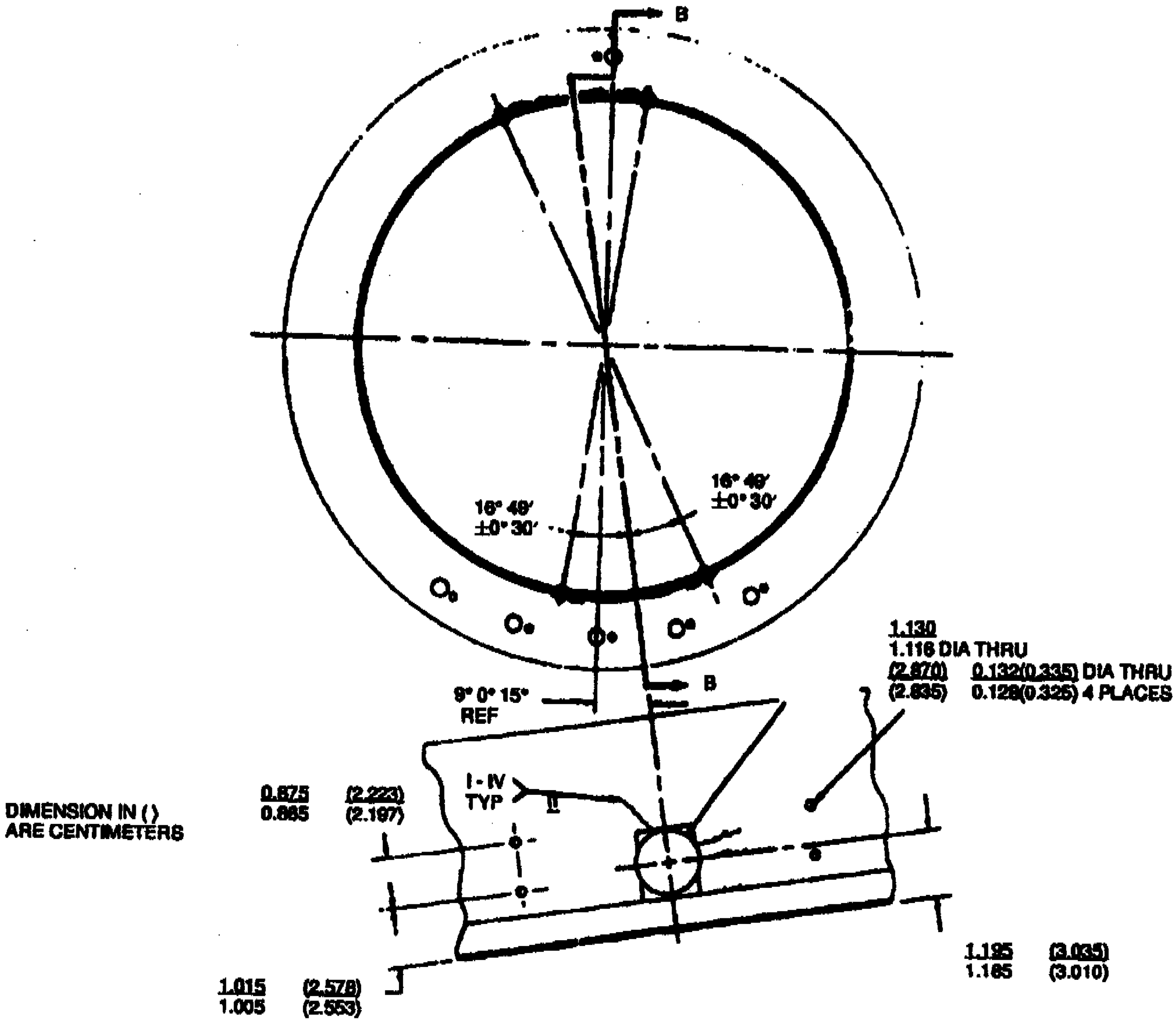


Figure 5-322. Fire Shield Weld Repairs and Hole Positioning for Lock Plate Replacement.

(8) Perform a visual and fluorescent-penetrant inspection of repaired areas for cracks. Cracks are not acceptable.

(9) Clean parts with acetone (item 13, table C–1) or cleaning solvent (item 311, table C–1).

(10) Install retainers (1-150-138-01 and 1-150-137-01) with rivets (2-300-322-01) on fire shield, using pop rivet gun, P/N PRG402, or equivalent. (See figures 5-323 and 5-324.)

(11) Insert plate assembly (1-150-390-01) between fire shield and retainers. (See figure 5-324.)

CAUTION

In following step (12), do not bend plate assembly tab.

(12) Bend down retainer tabs over plate assembly to secure assembly. (See figure 5-323.) Use brass bar or aluminum bar to ford bend.

(13) Inspect for conformity of repair. (See figure 5-323 and 5-324.)

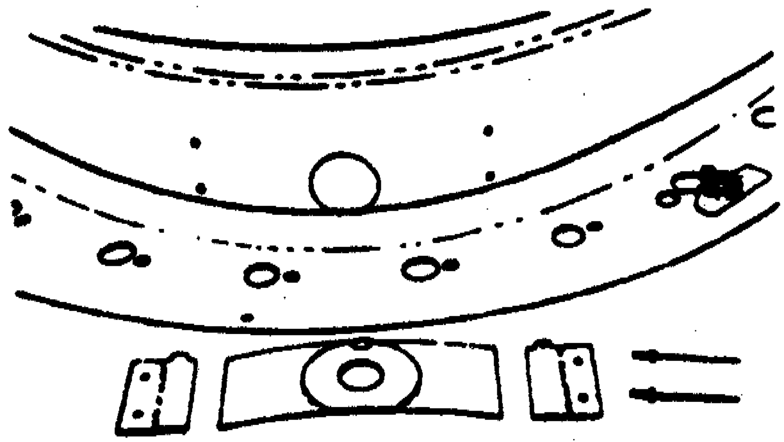


Figure 5-323. Fire Shield and Lock Plate Components.

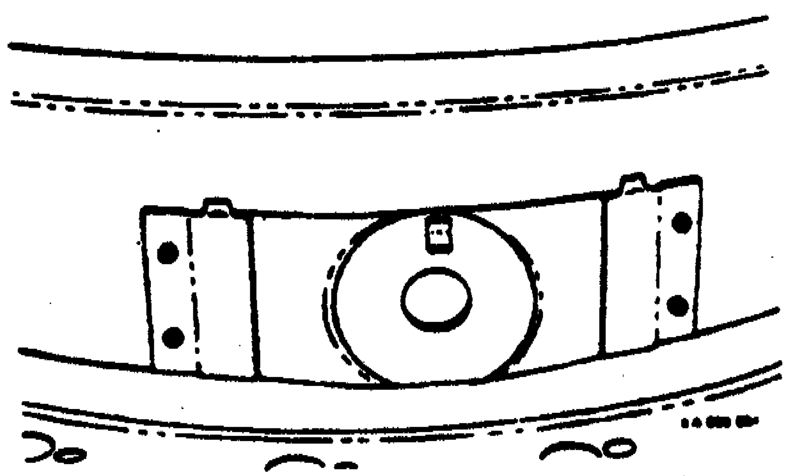


Figure 5-324. Fire Shield - Repairs Completed.

(14) Passivate and inspect fire shield as outlined in SP No. 6024 in Appendix E.

(15) Parts not conforming to inspection in SP No. 6024 in Appendix E should be repassivated and reinspected, as required.

(16) Replace cracked or broken off lock tab on lockplate as follows: Fabricate a tab, drill the hole and weld it to the lockplate. Weld as specified in table 5-111. Use same material as lockplate.

d. Replace diffuser support cone assembly (37, figure 5-135) if severely distorted or damaged.

e. Fabricate bracket as shown in A of figure 5-325. Vibropeen P/N T53-E0006-2 and rivet as shown in B and C of figure 5-325.

5-332. REASSEMBLY. Proceed as follows:

a. Reassemble exhaust diffuser support cone assembly as follows:

NOTE

Refer to tags for support location.

(1) Position support (8, figure 5-320) on flanges (7 and 9).

(2) Install pins (3) into support.

(3) Position retainers (2 and 5) on support (8) and secure with screws (1).

(4) Lockwire screws.

(5) In a similar manner, reinstall remaining supports (4, 6, and 10).

b. Reassembly of V-band and fireshield assembly is not required.

5-333. FUNCTIONAL TEST. Functional test is not required.

5-334. MODIFICATION OF COMBUSTOR TURBINE ASSEMBLY (HOT-END). Proceed as follows:

NOTE

The following rework procedures are required for incorporation of the new thermocouple harness (T_t7) (1-300-563-01).

a. Using the standard alignment pins (1-190-021-01) and bolts (1-130-245-01) with standard 1/4-28 nuts (locking plates are not required), remount the spacers (1-140-276-01, -02, -03) and the mounting ring (1-140-275-01) to the combustion chamber housing (1-130-610-05) in their normal order. (See figure 5-326.)

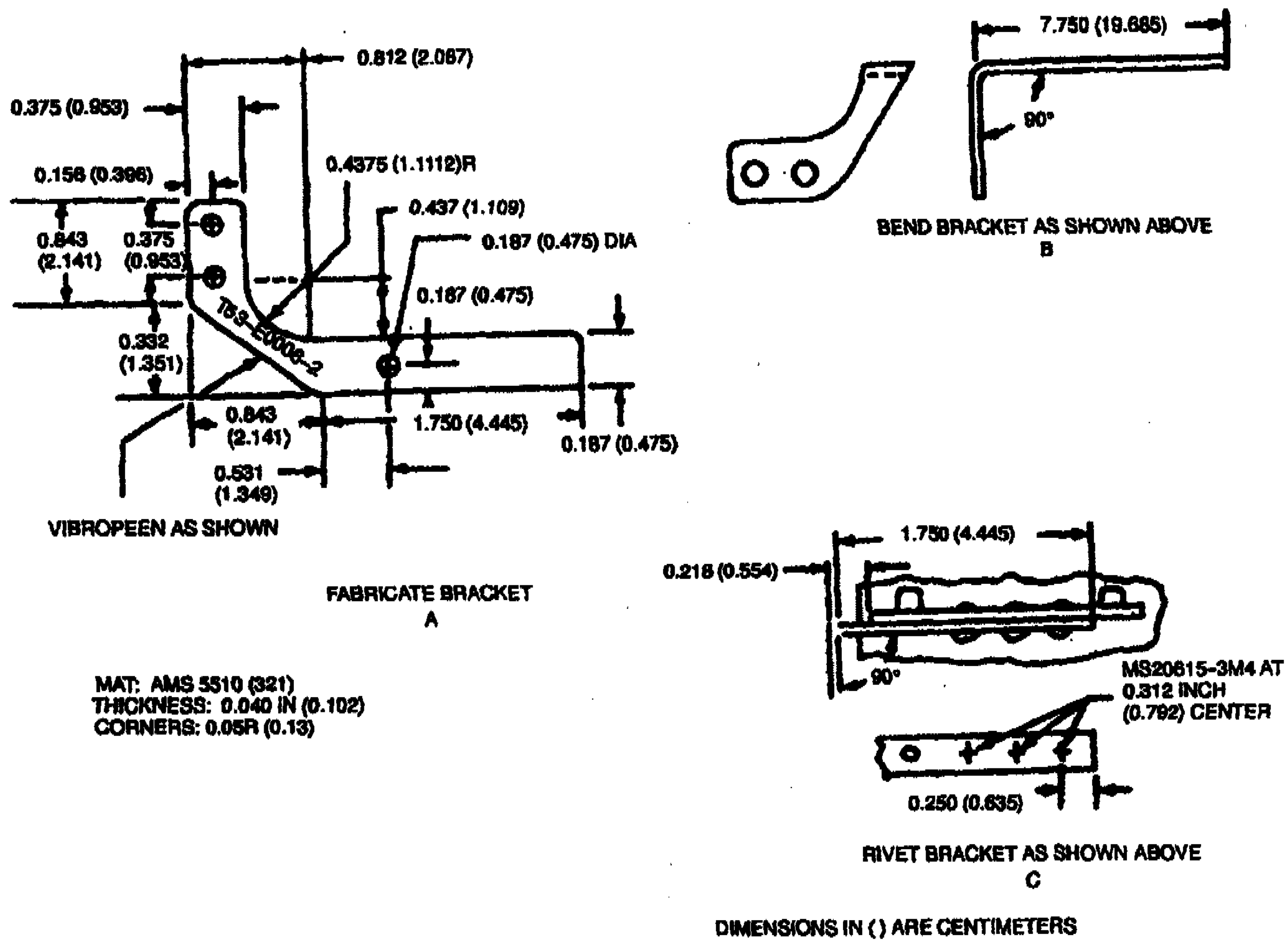


Figure 5-325. Thermocouple Connector Mounting Bracket.

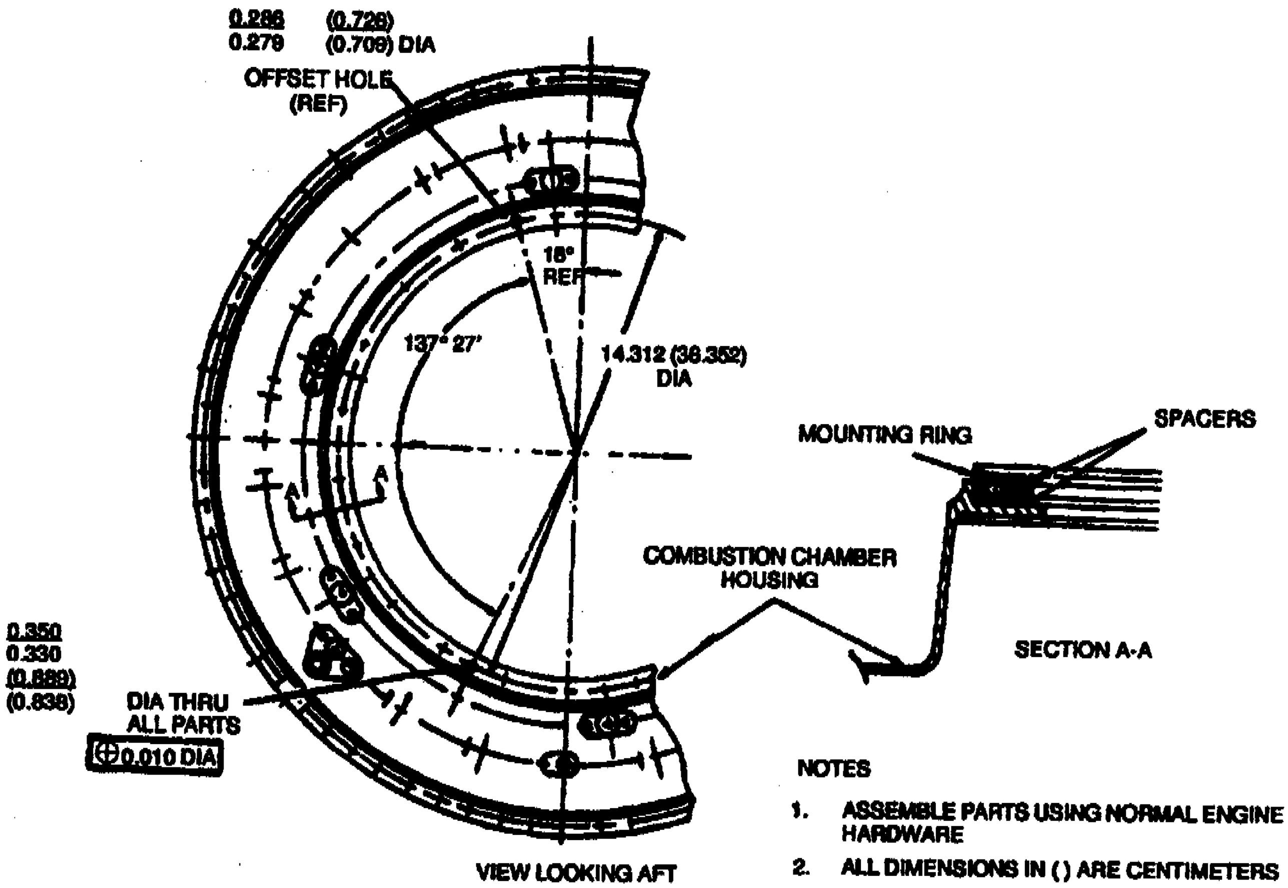


Figure 5-326. Rework of Combustion Chamber Housing, Mounting Ring, and Spacers.

CAUTION

In following step b, use care that parts do not distort.

b. With combustion chamber housing resting on its aft flange, line bore a 0.330 to 0.350 inch (0.838 to 0.889) diameter hole through housing, mounting ring, and shims as shown in figure 5-326.

c. Disassemble and then deburr both sides of hole on each piece.

NOTE

For production purposes, drilling the hole individually in each part, with the use of a specially designed fixture, may be a more desirable procedure.

d. Reidentify combustion chamber housing from 1-130-610-05 to 1-130-610-12; mounting ring from 1-140-275-01 to 1-140-275-06; and spacers from 1-140-276-01/02/03 to 1-140-303-01/02/03.

e. Reidentify combustion chamber assembly from 1-130-630-08 to 1-130-630-19.

f. Rework exhaust diffuser assembly 1-150-240-03 to exhaust diffuser assembly 1-150-240-06 as follows:

(1) With the exhaust diffuser assembly (1-150-240-03) resting on its aft flange, drill a 0.309 to 0.317 inch (0.785 to 0.805) diameter hole through the forward flange as shown in figure 5-327.

(2) Deburr the hole on both sides.

(3) Using the old T_9 thermocouple mounting nuts, MS21043-4, install six cover plates (1-160-051-03) on the six T_9 thermocouple mounting bosses. Ensure surfaces are clean and cover is properly aligned. Tighten nuts to 35 to 45 lb-in. (6251 - 8037 gm cm) torque.

(4) Reidentify the exhaust diffuser assembly from 1-150-240-03 to 1-150-240-06.

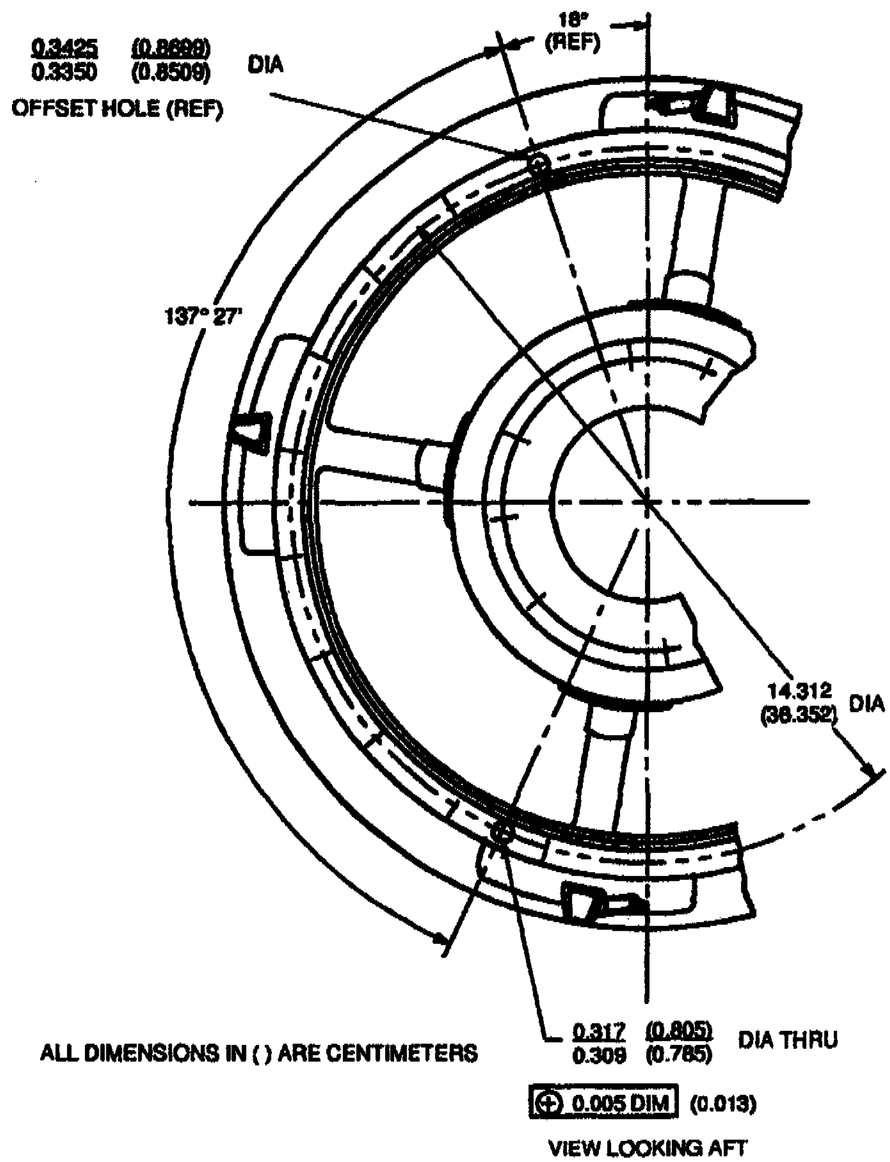


Figure 5-327. Rework of Exhaust Diffuser Assembly.

g. Rework the fire shield (1-150-250-02) as follows: (Refer to figure 5-328 for all steps.)

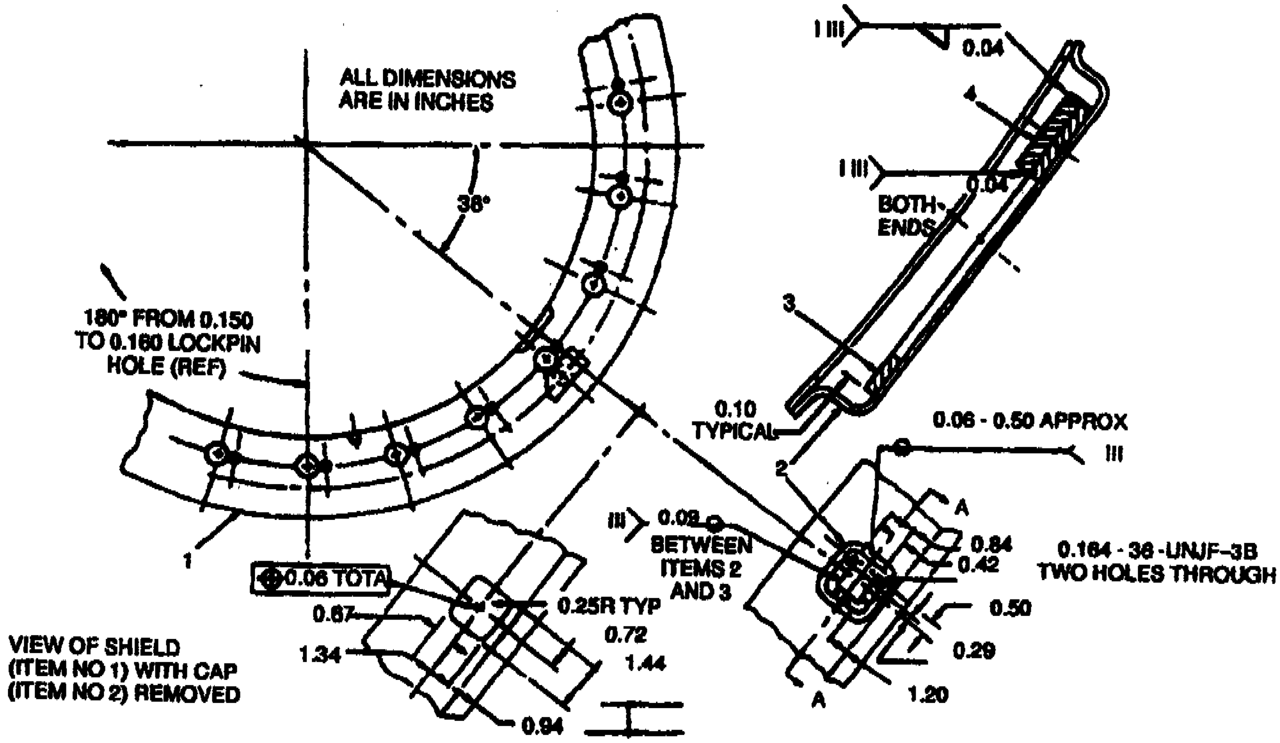
(1) Using appropriate hand tools, make a 1.44 x 1.34 cutout in the fire shield axial wall as shown. Remove sharp edges and burrs.

(2) Position the plate support (1-150-142-02) to the cap (1-150-148-02) and spot weld in eight places as outlined in SP No. 5002 in Appendix E.

(3) Position the plate (1-150-143-02) to the cap and support plate subassembly and weld, using welding wire (item 345, table C-1). Weld as outlined in SP No. 5002 in Appendix E.

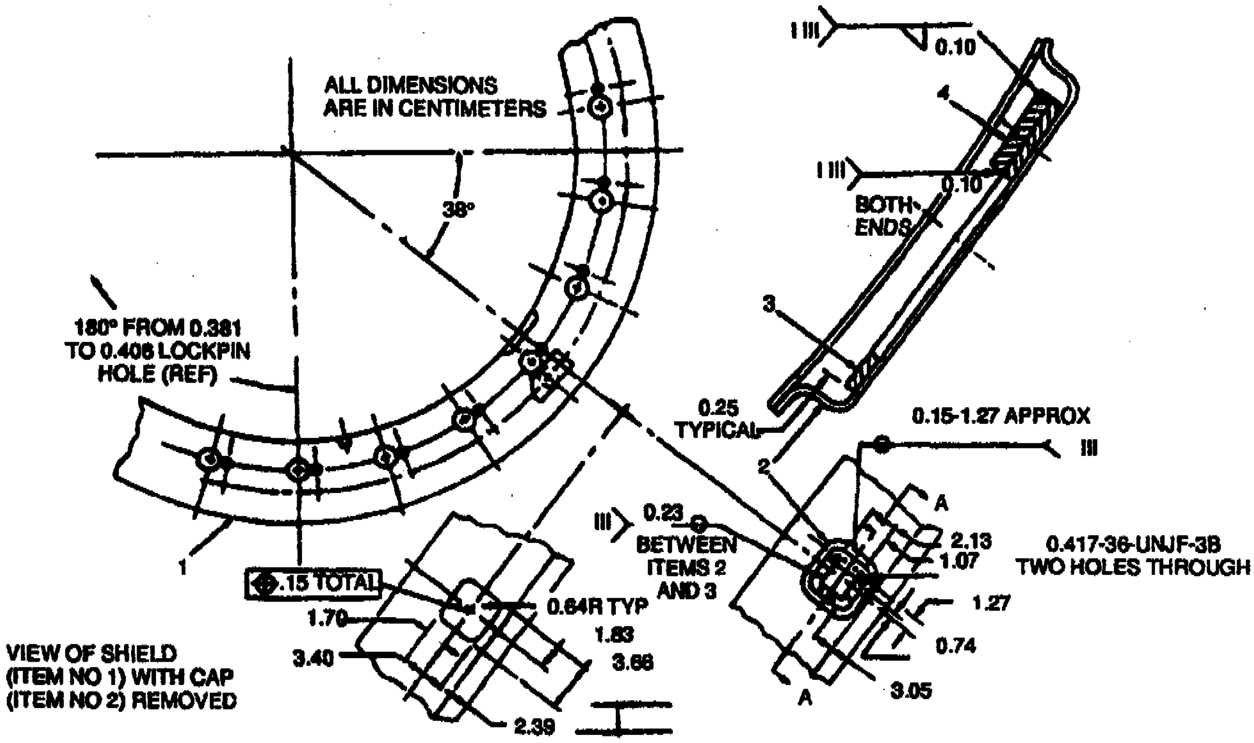
(4) Inspect the completed cap subassembly in accordance with SP No. 5001 in Appendix E and by fluorescent-penetrant inspection.

(5) Position the cap subassembly to the fire shield as shown and spot weld in accordance with SP No. 5002 in Appendix E.



1. FIRESHIELD ASSEMBLY (1-150-250-02)
2. CAP (1-150-148-02)
3. PLATE, SUPPORT (1-150-142-02)
4. PLATE, (1-150-143-02)

Figure 5-328. Rework of Fire Shield Assembly (English).



1. FIRESHIELD ASSEMBLY (1-150-250-02)
2. CAP (1-150-148-02)
3. PLATE, SUPPORT (1-150-142-02)
4. PLATE, (1-150-143-02)

Figure 5-329. Rework of Fire Shield Assembly. (Metric).

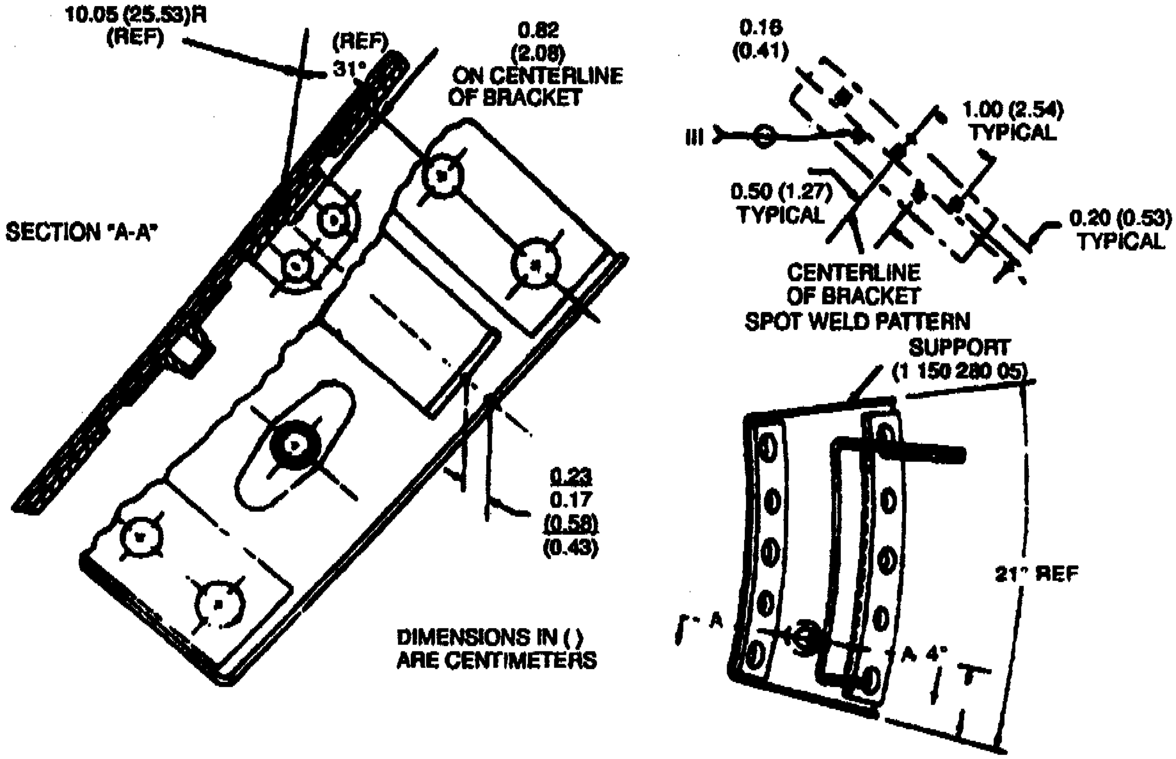
(6) Drill and tap two holes in cap as shown, and remove sharp edges and burrs.

(7) Inspect completed fire shield assembly in accordance with SP No. 5002 in Appendix E.

(8) Reidentify the fire shield assembly from a 1-150-250-02 to a 1-150-250-08.

h. Rework support cone (1-150-260-03) as follows: (Refer to figure 5-330 for all instructions.)

(1) Position the bracket assembly (1-150-410-02) to the cone support plate (1-150-280-05), located at the 4-o'clock position when viewed from the rear, and spot weld as shown. (Refer to SP No. 5002 in Appendix E.)



1. SUPPORT (1-150-280-05)

2. BRACKET (1-150-410-02)

Figure 5-330. Rework of Support Cone Assembly.

(2) Inspect in accordance with SP No. 5002 in Appendix E and by fluorescent-penetrant inspection.

(3) Reidentify support plate assembly, to which the bracket has been welded, from 1-150-280-05 to 1-150-280-03.

(4) Reidentify support cone assembly from 1-150-260-03 to 1-150-260-08.

(5) Using two bolts, M535276-243; two nuts, MS21043-08; and three screws, MS35276-212; mount the thermocouple connector (1-300-564-01) to the newly mounted bracket. Lockwire the three screws.

l. Table 5-112 lists the combustor turbine assembly parts that are added or removed to convert a T53-L-13B engine to a T53-L-703 engine.

Table 5-112. Parts Additions and Replacements.

Nomenclature	Part Number	Quantity
	Add	
Cover Assembly	1-150-400-02	1
Screws	MS9564-02	2
T7 Harness Assembly	1-300-563-01	1
Connector Housing	1-300-564-01	1
T7 Lead Assembly	1-300-599-01	1
Screws	STD3061-12	2
Retaining Plates	1-190-036-01	12
Bolts	MS9565-05	12
First Stage Power Turbine Nozzle	1-190-050-06	1
Cone Assembly	1-150-260-08	1
	Remove	
T9 Harness Assembly	1-300-177-02/03	1
Adapter	1-300-178-01/02	1
First Stage Power Turbine Nozzle	1-190-000-09	1
Cone Assembly	1-150-260-02	1

5-335. ESTABLISHING SECOND STAGE POWER TURBINE ROTOR TIP CLEARANCE. Proceed as follows:

a. Measure diameters (A and D, figure 5-331) of second stage power turbine nozzle assembly (11, figure 5-135). Measure nozzle assembly in four equally spaced locations for each diameter. Record smallest diameters.

b. Note diameters (B and C, figure 5-331) of second stage power turbine rotor (30, figure 5-259) recorded in paragraph 5-246.

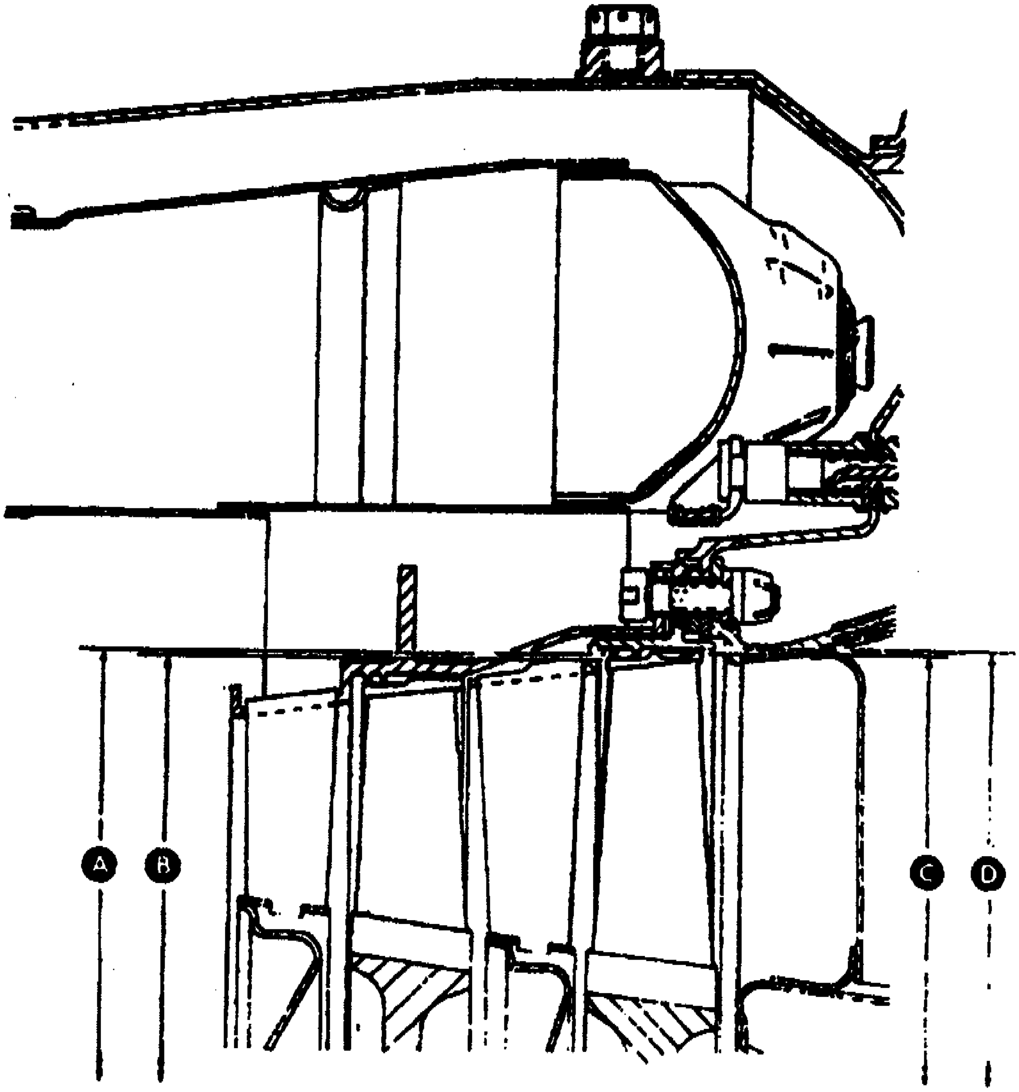


Figure 5-331. Determining Second Stage Power Turbine Rotor Tip Clearance.

c. Subtract diameter B from diameter A, and diameter C from diameter D. (Refer to figure 5-331). Record dimensions. When a used nozzle or a used rotor are utilized, the tip clearance shall be 0.040 inch (0.102 cm) minimum to 0.063 inch (0.160 cm) maximum. When both a new nozzle and a new rotor are utilized, the tip clearance shall be 0.048 inch (0.122 cm) minimum to 0.059 inch (0.150 cm) maximum.

NOTE

Steps "d " through "o" are an alternate procedure.

d. Select copper wire (item 118, table C–1) and tape (item 326, table C–1) to obtain 0.035 inch (0.089 cm).

e. Secure copper wire and tape on tips of power turbine blades at three locations, 120° apart.

NOTE

Place the one short length of wire on the forward tip, and one on the aft tip of the same blade.

f. Paint tape with iron-blue pigment (item 172, table C–1).

g. Place ring spacer (13, figure 5-135) of nominal thickness (0.032 inch) (0.081 cm) and mounting ring (12) on combustion chamber flange and align bolt holes. Install three pins (9). Select pins that can be tapped in by drift or wooden mallet (or equivalent).

h. Carefully position second stage power turbine nozzle assembly (11) over power turbine rotor and into mounting ring (12).

i. Secure nozzle with four equally spaced bolts (2) and suitable spacers. Tighten bolts 70 to 95 pound-inches (81 to 109 cm kgs) torque.

NOTE

Use care not to rub against tape.

j. While maintaining downward pressure on nozzle, use hand crank (LTCT4650) and rotate power turbine rotor one revolution.

k. Remove bolts and spacers. Carefully remove nozzle and check tape for signs of rubbing. If rubbing is not evident, refer to step 5-246l, paragraph 5-246. If rubbing is noted, proceed to step l.

l. If rubbing is evident, determine tip clearance as follows:

(1) Select tape from each diameter that has greatest rub.

(2) If iron-blue pigment has been removed, but tape has not been cut, tip clearance is equal to diameter of wire plus total thickness of tape used at that position.

(3) If tape has been partially cut through, tip clearance is equal to diameter of wire plus total thickness of undamaged tape used at that position.

(4) If tape has been cut completely through, but wire has not been damaged, tip clearance is equal to diameter of wire.

(5) If tape has been cut completely through and wire appears damaged, measure diameter of wire. The tip clearance is equal to the minimum wire diameter.

m. Tip clearance determined in preceding step l, shall be 0.035 inch (0.089 cm) minimum. If desired clearance is not obtained, rework cylinder to obtain a minimum clearance of 0.040 inch (0.102 cm). (Refer to paragraph 5-291.)

n. If cylinder is reworked, perform tip clearance check in accordance with preceding steps d through k.

o. Remove all installed tapes and wire.

5-336. ESTABLISHING FIRST STAGE POWER TURBINE ROTOR TIP CLEARANCE. Proceed as follows:

a. Measure diameters (A and D, figure 5-332) of first stage power turbine nozzle assembly (1, figure 5-135). Measure nozzle in equally spaced locations for each diameter. Record smallest diameters.

b. Note diameters (B and C, figure 5-332) of first stage turbine rotor recorded in paragraph 5-246.

c. Subtract diameter B from diameter A, and diameter C from diameter D. (Refer to figure 5-332). Record dimensions. When a used nozzle or a used rotor are utilized, the tip clearance shall be 0.035 inch (0.089 cm) minimum to 0.058 inch (0.147 cm) maximum. When both a new nozzle and a new rotor are utilized, the tip clearance shall be 0.043 inch (0.109 cm) minimum to 0.059 inch (0.150 cm) maximum.

NOTE

Steps "d" through "q" are an alternate procedure.

d. Select copper wire (item 118, table C–1) and tape (item 326, table C–1) to obtain 0.035 inch (0.089 cm).

e. Secure copper wire and tape on tips of power turbine blades at three locations, 120 degrees apart.

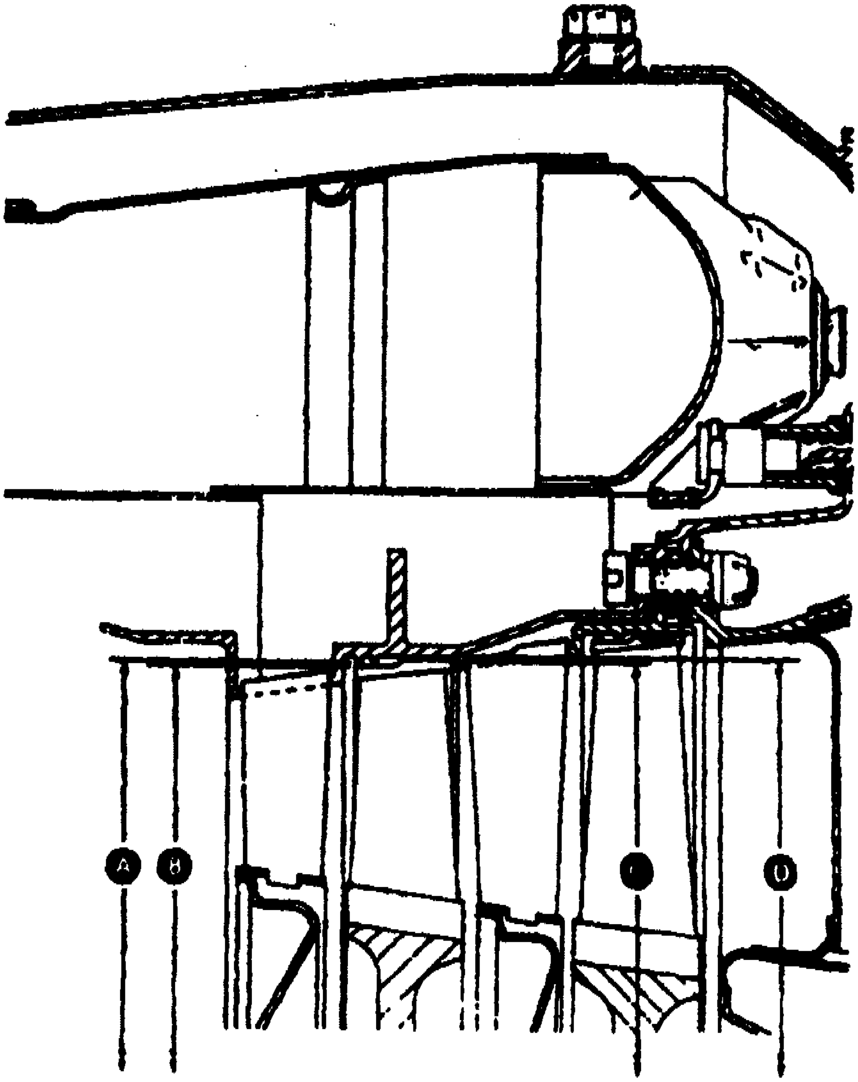


Figure 5-332. Determining First Stage Power Turbine Rotor Tip Clearance.

NOTE

Place one short length of wire on the forward tip. and one length of wire on the aft tip of the same blade.

f. Paint tape with iron-blue pigment (item 172, table C–1).

g. Remove locking plate from aft end of exhaust diffuser.

h. Remove four bolts (2, figure 5-135), installed in mounting ring (12), and remove pins (9).

i. Install ring spacer (13), of thickness determined in step 5-246k., paragraph 5-246, on combustion chamber flange and align bolt holes. Install three pins (9).

j. Carefully position first stage power turbine nozzle assembly (1) over first stage power turbine rotor assembly (7), and align bolt holes.

NOTE

Use care not to rub against tape.

k. Secure nozzle to exhaust diffuser with four equally spaced bolts. Tighten bolts evenly and sufficiently to insure complete parts contact for checking clearances.

l. While maintaining downward pressure on nozzle, use hand crank (LTCT4650) and rotate power turbine rotor one revolution.

m. Remove bolts that secure first stage turbine nozzle and carefully remove nozzle.

n. Check tape for signs of rubbing. If rubbing is not evident, refer to step 5-246s, paragraph 5-246. If rubbing is noted, proceed to step o.

o. If rubbing is evident, determine tip clearance as follows:

(1) Select tape from each diameter that has greatest rub.

(2) If iron-blue pigment has been removed, but tape has not been cut, tip clearance is equal to diameter of wire plus total thickness of tape used at that position.

(3) If tape has been partially cut through, tip clearance is equal to diameter of wire plus total thickness of undamaged tape used at that position.

(4) If tape has been cut completely through, but wire has not been damaged, tip clearance is equal to diameter of wire.

(5) If tape has been cut completely through and wire appears damaged, tip clearance is equal to the minimum wire diameter.

p. Tip clearance determined in preceding step o shall be 0.035 inch (0.089 cm) minimum. If desired clearance is not obtained, rework cylinder to obtain a minimum clearance of 0.040 inch (0.102 cm). (Refer to paragraph 5-291.) If cylinder is reworked, perform tip clearance in accordance with preceding steps d through n.

q. Remove all installed tapes and wires.

SECTION X. OUTPUT REDUCTION CARRIER AND GEAR

5-337. OUTPUT REDUCTION CARRIER, GEAR ASSEMBLY AND SUN GEARSHAFT (T53-L-13B, -703).

5-338. DISASSEMBLY (1-030-350-08/-12/-18). Disassemble as follows:

NOTE

During the following disassembly procedure, note the bearing and gear position numbers for ease in reassembling. While viewing carrier aft looking forward, locate match marks (matching serial numbers) on sides of front and rear carrier. Gear position will then be identified 1, 2, and 3 counterclockwise from the match marks.

a. Remove bolts (5, figure 5-333) and washer (4).

NOTE

In following step b, if inner races of roller bearing (7) hang up as the rear carrier (3) is separated, gently tap them, using a fiber drift and soft-faced mallet.

b. Using three internal wrenching bolts (LTCT718), remove rear carrier (3).

c. Using removing tool (LTCT2086), remove outer races of bearing (7) from rear carrier (3). Tag races with gear, according to position number.

d. Straighten tabwashers (2). Remove bolts (1) and tabwashers (2) that secure oil deflector (6) to rear carrier (3). Discard tabwashers (2).

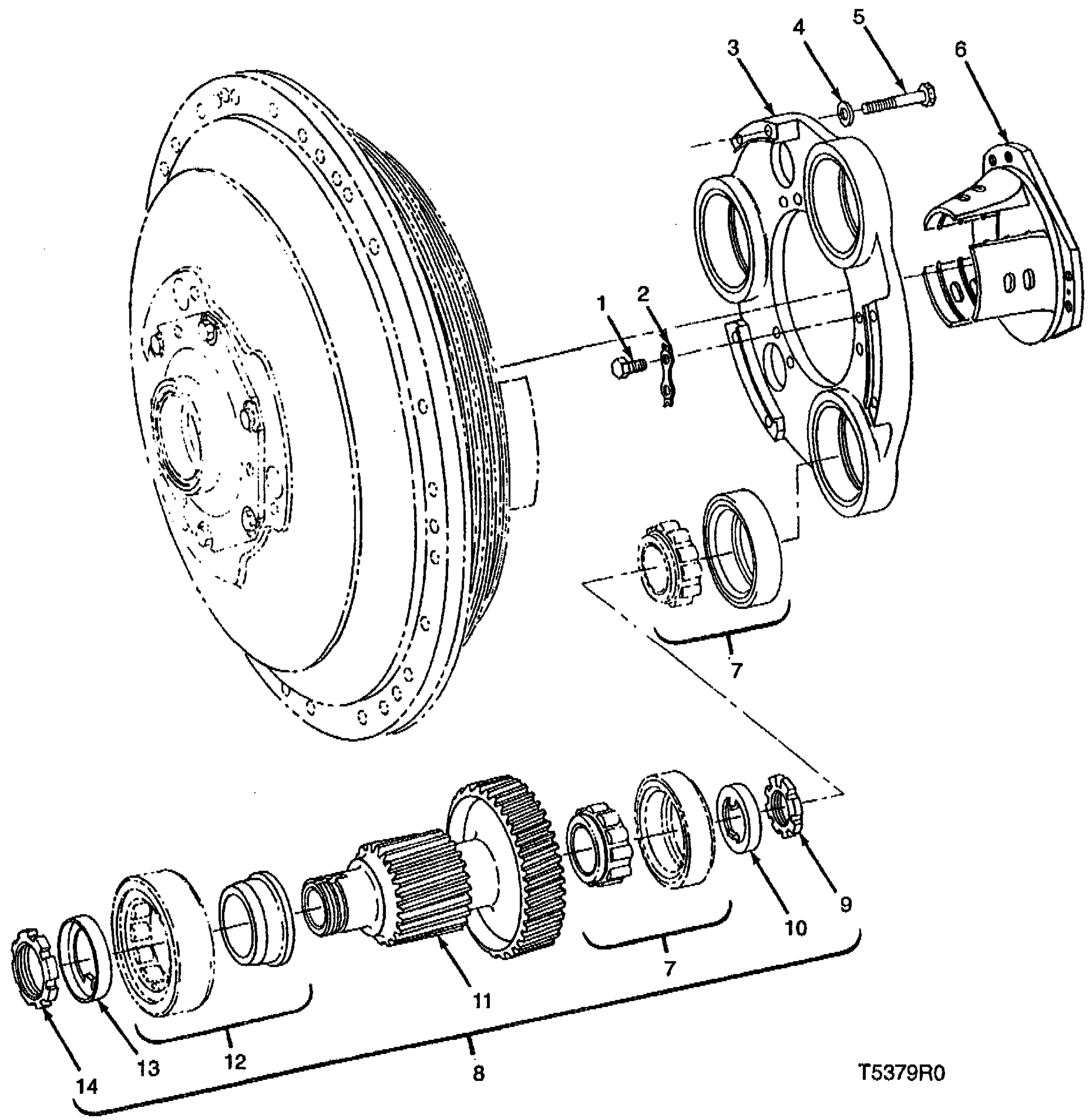


Figure 5-333. Output Reduction Carrier and Gear Assembly (1-030-350-08/-12/-18) (T53-L-13B, -703) (Sheet 1 of 2).

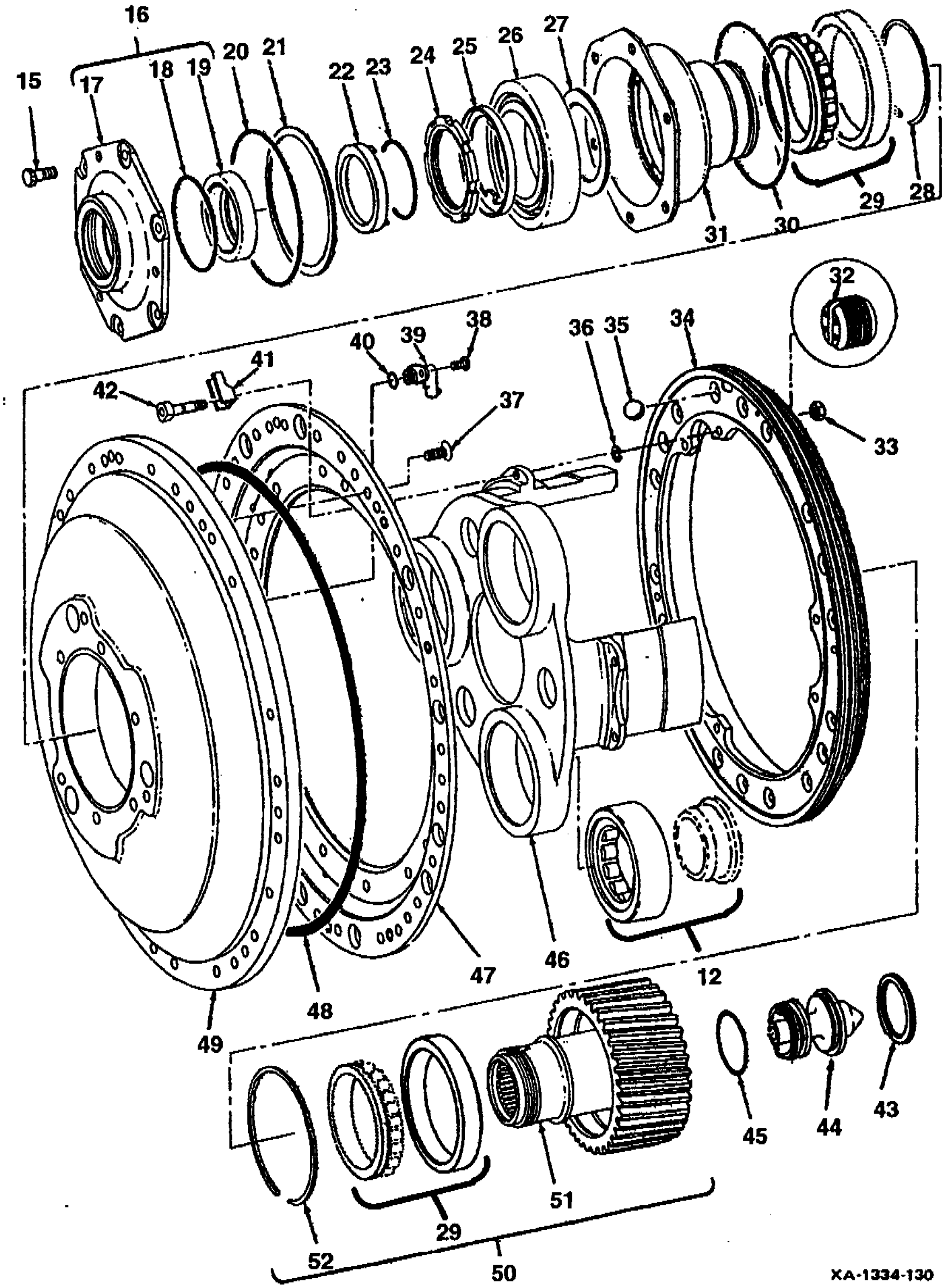


Figure 5-333. Output Reduction Carrier and Gear Assembly (1-030-350-08/-12/-18) (T53-L-13B, -703) (Sheet 2 of 2).

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-333	No Number	OUTPUT REDUCTION CARRIER AND GEAR ASSEMBLY AND RELATED PARTS (NHA 1-000-060-10, 1-000-060-22, and 1-000-060-23)	Ref	
	1-030-350-08	. CARRIER AND GEAR ASSEMBLY, Output reduction	1	A,B
	1-030-350-12	. CARRIER AND GEAR ASSEMBLY, Output reduction (Replace with 1-030-350-18 or 1-030-350-19, figure 5-333A)	1	A,B
	1-030-350-18	. CARRIER AND GEAR ASSEMBLY, Output reduction (Replaced 1-030-350-12)	1	A,B
-1	AN104706	. . BOLT, Hex head	6	A,B
-2	1-100-069-01	. . TABWASHER	3	A,B
-3	1-030-181-01	. . CARRIER, Rear	1	A,B
-4	AN960C516L	. . WASHER, Flat	6	A,B
-5	AN107520	. . BOLT, Drilled hex head	6	A,B
-6	1-030-450-01	. . DEFLECTOR, Oil	1	A,B
	1-030-450-02	. . DEFLECTOR, Oil	1	A,B
-7	R305D301	. . BEARING, Roller (43991) (Lycoming Source Cont Dwg 1-300-032-01)	3	A,B
	456792	. . BEARING, Roller (52676) (Alternate) (Lycoming Source Cont Dwg 1-300-032-03)	3	A,B
	26RFH305-69	. . BEARING, Roller (78118) (Alternate) (AlliedSignal Source Cont Dwg 1-300-667-01)	3	A,B
-8	No Number	. . PLANETARY GEAR ASSEMBLY (NHA 1-030-350-08/-12/-18)	3	A,B
-9	MS172241	. . . NUT, Spanner	3	A,B
-10	1-030-211-01	. . . CUP, Locking, bearing retaining	3	A,B
-11	1-030-193-01	. . . GEARSHAFT, Helical planet	3	A,B
	1-030-193-05	. . . GEARSHAFT, Helical planet (Component of 1-030-350-18)	3	A,B
-12	R307G301	. . . BEARING, Roller (43991) (Lycoming Source Cont Dwg 1-300-031-01)	3	A,B
	460988	. . . BEARING, Roller (52676) (Alternate) (Lycoming Source Cont Dwg 1-300-031-03)	3	A,B
	26RJH307-72	. . . BEARING, Roller (78118) (Alternate) (AlliedSignal Source Cont Dwg 1-300-666-01)	3	A,B
-13	1-030-195-01	. . . CUP, Locking, gearshaft bearing	3	A,B
-14	1-030-194-02	. . NUT, Plain, round	3	A,B
-15	AN106508	. . BOLT, Drilled hex head	6	A,B
-16	No Number	SEAL HOUSING AND RETAINER ASSEMBLY (NHA 1-030-350-08/-12/-18)	1	A,B

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-333-17	1-030-229-03	. . . RETAINER, Oil seal, output shaft	1	A,B
	1-030-229-06	. . . RETAINER, Oil seal, output shaft (Alternate)	1	A,B
-18	M83248/1-144	. . . PACKING	1	A,B
-19	A37318	. . . SEAL, Plain encased (77842) (Lycoming Source Cont Dwg 1-300-334-01)	1	A,B
	B30-800614	. . . SEAL, Plain encased (24981)	1	A,B
	91-175-933-001	. . . SEAL, Plain encased (77842) (Alternate) (Lycoming Source Cont Dwg 1-300-334-03)	1	A,B
	2-1875-3	. . . SEAL, Plain encased (91547) (Alternate) (Lycoming Source Cont Dwg 1-300-334-04)	1	A,B
-20	M83248/1-045	. . PACKING	1	A,B
-21	1-030-212-01	. . SPACER, Ring, output gearshaft bearing	AR	A,B
	1-030-212-02	. . SPACER, Ring, output gearshaft bearing	AR	A,B
	1-030-212-03	. . SPACER, Ring, output gearshaft bearing	AR	A,B
	1-030-212-04	. . SPACER, Ring, output gearshaft bearing	AR	A,B
-22	1-030-067-02	. . PLATE, Face, output gearshaft	1	A,B
-23	M83248/1-135	. . PACKING	1	A,B
-24	1-030-023-02	. . NUT, Plain, round	1	A,B
-25	1-030-165-03	. . LOCKING CUP, Bearing retaining cup	1	A,B
-26	MM211VM6MBR E9266	. . BEARING, Ball (21335) (Lycoming Source Cont Dwg 1-300-329-01)	1	A,B
	460920	. . BEARING, Ball (52676) (Alternate) (Lycoming Source Cont Dwg 1-300-329-02)	1	A,B
	26HTH211-61	. . BEARING, Ball (78118) (Alternate) (AlliedSignal Source Cont Dwg 1-300-669-01)	1	A,B
-27	1-030-217-01	. . SPACER, Ring, bearing output	1	A,B
-28	1-300-338-01	. . RING, Retaining, external (80756) (Lycoming Spec Cont Dwg 1-300-338-01)	1	A,B
-29	HU1913LAR3506	. . BEARING, Roller (51600) (Lycoming Spec Cont Dwg 1-300-335-02)	1	A,B
	460667	. . BEARING, Roller, cylindrical (52676) (Alternate) (Lycoming Source Cont Dwg 1-300-335-01)	1	A,B
	26PFH013-A47	. . BEARING, Roller, cylindrical (78118) (AlliedSignal Source Cont Dwg 1-300-682-01) (Component of 1-030-350-18)	1	A,B

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-333-30	STD3019C62	. . PACKING	1	A,B
-31	1-030-187-03	. . LINER, Bearing support	1	A,B
-32	1-020-157-02	. . FILTER, Bleed torquemeter (Use on torque system using rubber sealing rings)	1	A,B
-33	1-030-129-01	. . NUT, Slotted hexagon	6	A,B
-34	1-030-183-03	. . PLATE, Rear torquemeter	1	A,B
-35	1-020-015-01	. . BALL, Bearing torquemeter	18	A,B
-36	STD3033B101	. . RING, Snap	6	A,B
-37	AN510C10-6	. . SCREW, Machine	3	A,B
-38	AN106408	. . BOLT, Drilled hex head	2	A,B
-39	1-030-460-01	. . FITTING, Front cover	1	A,B
-40	MS29561-009	. . PACKING	1	A,B
-41	1-030-185-01	. . RETAINER, Ball	6	A,B
-42	1-030-203-01	. . BOLT, Plate, retaining	6	A,B
-43	RR181L	. . RING, Retaining (80756) (Lycoming Spec Cont Dwg 1-300-201-01)	1	A,B
-44	1-030-234-01	. . PLUG, Output gear (Component of 1-030-350-08)	1	A,B
	1-030-265-01	. . PLUG, Output gear (Component of 1-030-350-12/-18)	1	A,B
-45	M83248/1–222	. . PACKING	1	A,B
-46	1-030-182-03	. . CARRIER, Front reduction gear	1	A,B
-47	1-030-240-02	. . PLATE ASSEMBLY, Torquemeter	1	A,B
-48	1-020-017-01	. . PACKING, Front bearing support	1	A,B
-49	1-030-390-05	. . HOUSING ASSEMBLY, Front cover	1	A,B
	1-030-390-08	. . HOUSING ASSEMBLY, Front cover (Alternate for 1–030–350–05) (NHA 1–030–350–18)	1	A,B
-50	No Number	. . GEARSHAFT AND BEARING ASSEMBLY (NHA 1-030-350-08/-12/-18)	1	A,B
-51	1-030-191-06	. . . GEARSHAFT, Helical, output	1	A,B
	1-030-191-R09	. . . GEARSHAFT, Helical, output	1	A,B
	1-030-191-R10	. . . GEARSHAFT, Helical, output	1	A,B
	1-030-191-11	. . . GEARSHAFT, Helical, output	1	A,B
	1-030-191-14	. . . GEARSHAFT, Helical, output (Component of 1-030-350-18)	1	A,B
-52	XURC3696X	. . RING, Retaining, internal (80756) (Lycoming Spec Cont Dwg 1-300-337-01)	1	A,B
	1-030-273-02	. . RING, Retaining, internal (Component of 1-030-350-18)	1	A,B

CAUTION

Control of planetary and output gear tooth meshing is a mandatory requirement. Prior to removal of any planetary or output gear, ensure that previous or new paint marks identify meshing location on all gears.

e. Mark and remove each planetary gear assembly (8), as a complete unit, and disassemble as follows:

(1) Three tooth spaces on output gear should be marked by paint on teeth on side of each space. Each space should have a 1, 2, or 3 character painted onto output gear web area adjacent to interfacing planetary gear of numeric position.

(2) Each planetary gear should have paint mark on specific tooth which meshes into output gear space.

(3) Place planetary gear assembly (8) in base plate (LTCT4018) and ring assembly (LTCT4019), large diameter gear up.

(4) Straighten locking cup (10). Using wrench (LTCT2079), remove nut (9) and locking cup (10).

(5) Using puller (LTCT752), remove inner race of roller bearing (7). Tag races with gear by position number.

NOTE

Nut (14) has left hand threads.

(6) Invert gear in holding fixture.

(7) Straighten rim of locking cup (13). Using wrench (LTCT2080), remove nut (14) and locking cup (13).

CAUTION

Ensure gearshafts (11, 51) are maintained as a matched set. If any individual gearshaft is found unserviceable, the entire set must be replaced with a new set.

(8) Using puller (LTCT2073), remove inner race of roller bearing (12) from gearshaft (11). Tag races with gear by position number.

f. Remove bolts (15) that secure seal housing and retainer assembly (16) to front cover housing assembly (49).

g. Using bolts (15) or jackscrews, remove seal housing and retainer assembly (16), packing (20), and spacer (21) from front cover housing assembly (49).

h. Using installation tool (LTCT3638), remove seal (19) and packing (18) from oil seal retainer (17). Discard seal (19).

i. Remove face plate (22) and packing (23).

j. Remove retaining ring (43).

CAUTION

Ensure gearshafts (11, 51) are maintained as a matched set. If any individual gearshaft is found unserviceable, the entire set must be replaced with a new set.

k. Using fiber punch and soft-faced mallet, drive output gear plug (44) and packing (45) from gearshaft (51).

l. Position carrier assembly, front end up, on holding fixture (LTCT496).

m. Straighten rim of locking cup (25). Using spanner wrench assembly (LTCT4190), remove nut (24) and locking cup (25). Discard locking cup (25).

n. Press gearshaft and bearing assembly (50) from front cover housing assembly (49).

o. Using a suitable drift and soft-faced mallet, tap ball bearing (26) and spacer (27) from liner (31).

p. Remove retaining ring (52) and using mechanical puller (LTCT4670), remove outer race of roller bearing (29) from gearshaft (51).

q. Remove retaining ring (28) and using mechanical puller (LTCT2142), remove inner race of bearing (29) from liner (31).

r. Using a soft-faced mallet, remove liner (31) and packing (30) from front cover housing assembly (49).

s. Place output reduction carrier and gear assembly on clean bench with front cover housing assembly (49) face down.

NOTE

In following step t, do not remove filter (32) from rear torquemeter plate (34).

t. Remove six nuts (33) and carefully lift off rear torquemeter plate (34), exposing torquemeter balls (35).

CAUTION

In following step u, to prevent any damage to surface of torquemeter balls (35), use extreme care when handling balls.

u. Remove torquemeter balls (35) and place in a plastic bag.

v. Remove three screws (37) that secure torquemeter plate assembly (47) to front cover housing assembly (49). Using three bolts (15) as jackscrews, remove torquemeter plate assembly (47) from front cover housing assembly (49). Remove and discard packing (48).

w. Remove snap ring (36) from six bolts (42). Remove bolts (42) and ball retainers (41).

x. Separate torquemeter plate assembly (47) from front carrier (46).

y. Using a soft-faced mallet and removing tool (LTCT2086), remove outer races of roller bearing (12) from front carrier (46).

z. Remove bolts (38) that secure fitting (39) in front cover housing assembly (49).

aa. Remove fitting (39) and packing (40).

5-338A. DISASSEMBLY (1-030-350-19). Disassemble as follows:

NOTE

During the following disassembly procedure, note the bearing and gear position numbers for ease in reassembling. While viewing carrier aft looking forward, locate match marks (matching serial numbers) on sides of front and rear carrier. Gear position will then be identified 1, 2, and 3 counterclockwise from the match marks.

a. Remove bolts (5, figure 5-333A) and washers (4).

NOTE

In following step b, if inner races of roller bearing (7) hang up as the rear carrier (3) is separated, gently tap them using a fiber drift and soft-faced mallet.

Mark position of rear carrier to front carrier for ease at reassembly.

b. Using three internal wrenching bolts (LTCT718), remove rear carrier (3).

c. Using removing tool (LTCT2086), remove outer races of roller bearing (7) from rear carrier (3). Tag races with gear, according to position number.

d. Straighten tabwashers (2). Remove bolts (1) and tabwashers (2) that secure oil deflector (6) to rear carrier (3). Discard tabwashers (2).

CAUTION

Control of planetary and output gear tooth meshing is a mandatory requirement. Prior to removal of any planetary or output gear, ensure that previous or new paint marks identify meshing location on all gears.

e. Mark and remove each planetary gear assembly (8), as a complete unit, and disassemble as follows:

(1) Three tooth spaces on output gear should be marked by paint on teeth on side of each space. Each space should have a 1, 2, or 3 character painted onto output gear web area adjacent to interfacing planetary gear of numeric position.

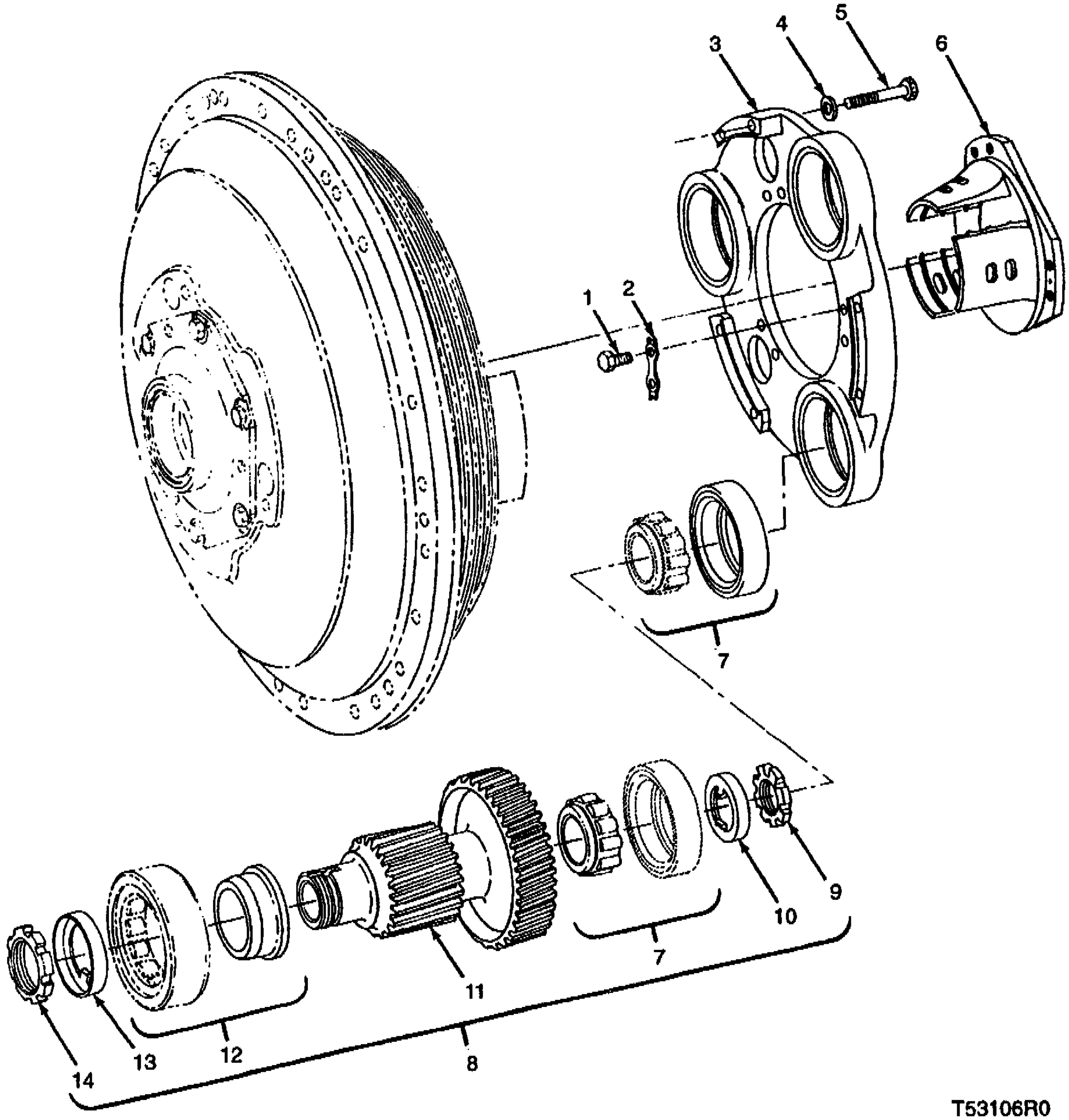


Figure 5-333A. Output Reduction Carrier and Gear Assembly (1-030-350-19) (T53-L-13B, -703) (Sheet 1 of 2).

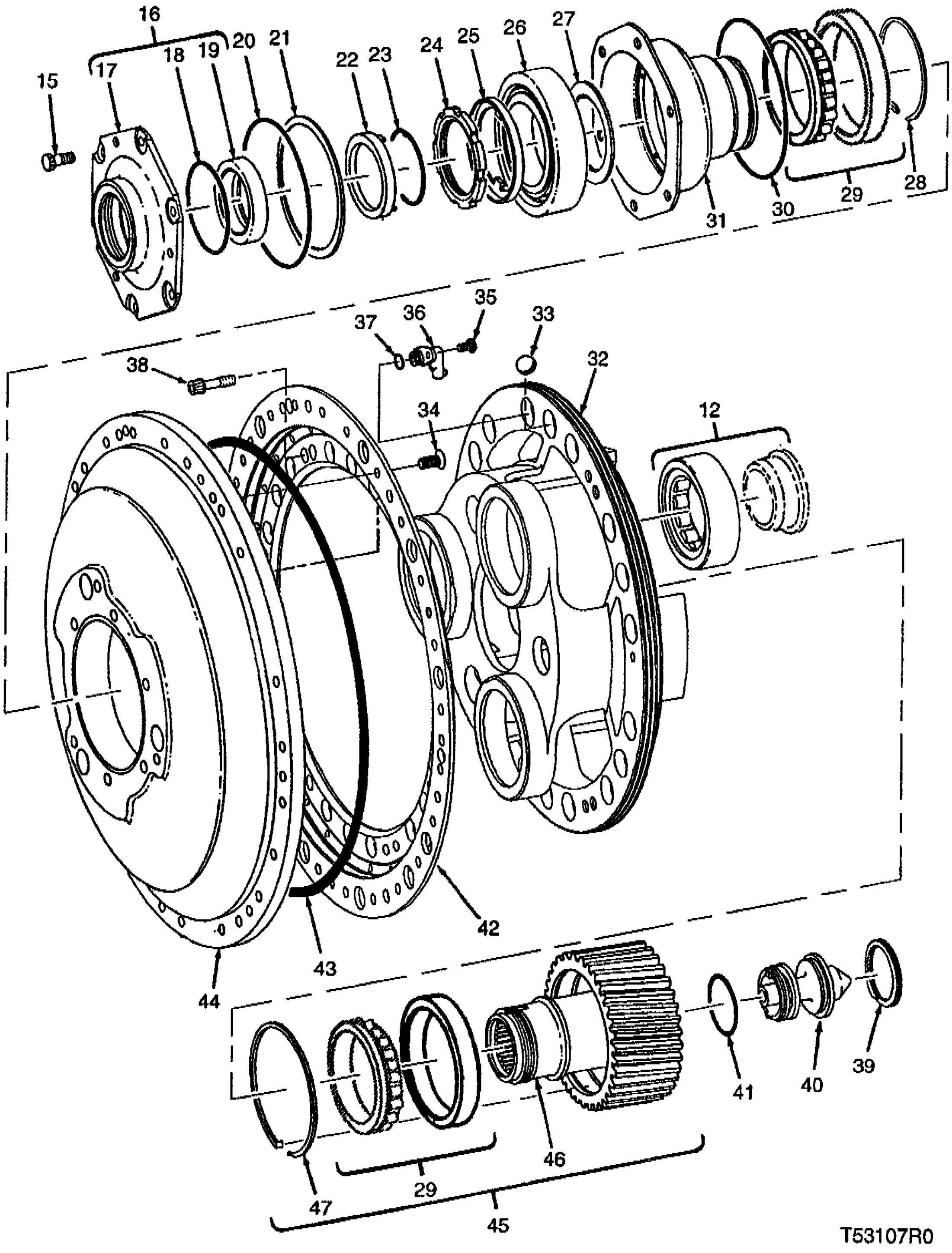


Figure 5-333A. Output Reduction Carrier and Gear Assembly (1-030-350-19) (T53-L-13B, -703) (Sheet 2 of 2).

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-333A	No Number	OUTPUT REDUCTION CARRIER AND GEAR ASSEMBLY AND RELATED PARTS (NHA 1-000-060-22 and 1-000-060-23)	Ref	
	1-030-350-19	. CARRIER AND GEAR ASSEMBLY, Output reduction (Replaced 1-030-350-12 and will replace 1-030-350-18 when available)	1	A,B
-1	AN104706	. . BOLT, Hex head	6	A,B
-2	1-100-069-01	. . TABWASHER	3	A,B
-3	1-030-181-01	. . CARRIER, Rear	1	A,B
-4	AN960C516L	. . WASHER, Flat	6	A,B
-5	AN107520	. . BOLT, Drilled hex head	6	A,B
-6	1-030-450-02	. . DEFLECTOR, Oil	1	A,B
-7	26RFH305-69	. . BEARING, Roller (78118) (AlliedSignal Source Cont Dwg 1-300-667-01)	3	A,B
-8	No Number	. . PLANETARY GEAR ASSEMBLY (NHA 1-030-350-19)	3	A,B
-9	MS172241	. . . NUT, Spanner	3	A,B
-10	1-030-211-01	. . . CUP, Locking, bearing retaining	3	A,B
-11	1-030-193-05	. . . GEARSHAFT, Helical planet	3	A,B
-12	26RJH307-72	. . . BEARING, Roller (78118) (AlliedSignal Source Cont Dwg 1-300-666-01)	3	A,B
-13	1-030-195-01	. . . CUP, Locking, gearshaft bearing	3	A,B
-14	1-030-194-02	. . NUT, Plain, round	3	A,B
-15	AN106508	. . BOLT, Drilled hex head	6	A,B
-16	No Number	. . SEAL HOUSING AND RETAINER ASSEMBLY (NHA 1-030-350-19)	1	A,B
-17	1-030-229-03	. . . RETAINER, Oil seal, output shaft	1	A,B
	1-030-229-06	. . . RETAINER, Oil seal, output shaft (Alternate)	1	A,B
-18	M83248/1-144	. . . PACKING	1	A,B
-19	A37318	. . . SEAL, Plain encased (77842) (Lycoming Source Cont Dwg 1-300-334-01) (Alternate)	1	A,B
	B30-800614	. . . SEAL, Plain encased (24981) (Alternate)	1	A,B
	91-175-933-001	. . . SEAL, Plain encased (77842) (Alternate) (Lycoming Source Cont Dwg 1-300-334-03)	1	A,B
	2-1875-3	. . . SEAL, Plain encased (91547) (Alternate) (Lycoming Source Cont Dwg 1-300-334-04)	1	A,B
-20	M83248/1-045	. . PACKING	1	A,B

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-333A-21	1-030-212-01	. . SPACER, Ring, output gearshaft bearing	AR	A,B
	1-030-212-02	. . SPACER, Ring, output gearshaft bearing	AR	A,B
	1-030-212-03	. . SPACER, Ring, output gearshaft bearing	AR	A,B
	1-030-212-04	. . SPACER, Ring, output gearshaft bearing	AR	A,B
-22	1-030-067-02	. . PLATE, Face, output gearshaft	1	A,B
-23	M83248/1-135	. . PACKING	1	A,B
-24	1-030-023-02	. . NUT, Plain, round	1	A,B
-25	1-030-165-03	. . CUP, Locking, bearing retaining	1	A,B
-26	26HTH211-61	. . BEARING, Ball (78118) (AlliedSignal Source Cont Dwg 1-300-669-01)	1	A,B
-27	1-030-217-01	. . SPACER, Ring, bearing output	1	A,B
-28	1-300-338-01	. . RING, Retaining, external (80756) (Lycoming Spec Cont Dwg 1-300-338-01)	1	A,B
-29	26PFH013-A47	. . BEARING, Roller (78118) (AlliedSignal Spec Cont Dwg 1-300-682-01)	1	A,B
-30	STD3019C62	. . PACKING	1	A,B
-31	1-030-187-03	. . LINER, Bearing support	1	A,B
-32	1-030-271-02	. . CARRIER, Reduction gear, front	6	A,B
-33	1-020-015-01	. . BALL, Bearing torquemeter	18	A,B
-34	AN510C10-6	. . SCREW, Machine	3	A,B
-35	AN106408	. . BOLT, Drilled hex head	2	A,B
-36	1-030-460-01	. . FITTING, Front cover	1	A,B
-37	MS29561-009	. . PACKING	1	A,B
-38	MS9566-10	. . BOLT, Machine	6	A,B
-39	RR181L	. . RING, Retaining (80756) (AlliedSignal Source Cont Dwg 1-300-201-01)	1	A,B
-40	1-030-265-01	. . PLUG, Output gear	1	A,B
-41	M83248/1–222	. . PACKING	1	A,B
-42	1-030-123-06	. . PLATE ASSEMBLY, Torquemeter	1	A,B
-43	1-020-017-01	. . PACKING, Front bearing support	1	A,B
-44	1-030-390-08	. . HOUSING ASSEMBLY, Front cover	1	A,B
-45	No Number	. . GEARSHAFT AND BEARING ASSEMBLY	1	A,B
-46	1-030-191-14	. . . GEARSHAFT, Helical, output	1	A,B
-47	1-030-273-02	. . . RING, Retaining, internal	1	A,B

(2) Each planetary gear should have paint mark on specific tooth which meshes into output gear space.

(3) Place planetary gear assembly (8) in base plate (LTCT4018) and ring assembly (LTCT4019), large diameter gear up.

(4) Straighten locking cup (10). Using wrench (LTCT2079), remove nut (9) and locking cup (10).

(5) Using puller (LTCT752), remove inner race of roller bearing (7). Tag races with gear by position number.

(6) Invert gear in holding fixture.

NOTE

Nut (14) has left hand threads.

(7) Straighten rim of locking cup (13). Using wrench (LTCT2080), remove nut (14) and locking cup (13).

CAUTION

Ensure gearshafts (11, 46) are maintained as a matched set. If any individual gearshaft is found unserviceable, the entire set must be replaced wtih a new set.

(8) Using puller (LTCT2073), remove inner race of roller bearing (12) from gearshaft (11). Tag races with gear by position number.

f. Remove bolts (15) that secure seal housing and retainer assembly (16) to front cover housing assembly (44).

g. Using bolts (15) or jackscrews, remove seal housing and retainer assembly (16), packing (20), and spacer (21) from front cover housing assembly (44).

h. Using installation tool (LTCT3638), remove seal (19) and packing (18) from oil seal retainer (17). Discard seal (19).

i. Remove face plate (22) and packing (23).

j. Remove retaining ring (39).

CAUTION

Ensure gearshafts (11, 46) are maintained as a matched set. If any individual gearshaft is found unserviceable, the entire set must be replaced with a new set.

k. Using fiber punch and soft-faced mallet, drive output gear plug (40) and packing (41) from gearshaft (46).

l. Position carrier assembly, front end up, on holding fixture (LTCT496).

m. Straighten rim of locking cup (25). Using spanner wrench assembly (LTCT4190), remove nut (24) and locking cup (25). Discard locking cup (25).

n. Press gearshaft and bearing assembly (45) from front cover housing assembly (44).

o. Using a suitable drift and soft-faced mallet, tap ball bearing (26) and spacer (27) from liner (31).

p. Remove retaining ring (47) and using mechanical puller (LTCT4670), remove outer race of roller bearing (29) from gearshaft (46).

q. Remove retaining ring (28) and using mechanical puller (LTCT2142), remove inner race of roller bearing (29) from liner (31).

r. Using a soft-faced mallet, remove liner (31) and packing (30) from front cover housing assembly (44).

s. Place output reduction carrier and gear assembly on clean bench with front cover housing assembly (44) face down.

t. Remove three screws (34) that secure torquemeter plate assembly (42) to front cover housing assembly (44). Using three bolts (15) as jackscrews, remove assembled torquemeter plate assembly (42) and reduction gear carrier (32) from front cover housing assembly (44). Remove and discard packing (43).

u. Remove six bolts (38) and carefully lift off torquemeter plate assembly (42), exposing bearing torquemeter balls (33).

CAUTION

In following step v, to prevent any damage to surface of bearing torquemeter balls (33), use extreme care when handling balls.

v. Remove bearing torquemeter balls (33) and place in a plastic bag.

w. Using a soft-faced mallet and removing tool (LTCT2086), remove outer races of roller bearing (12) from reduction gear carrier (32).

x. Remove bolts (35) that secure fitting (36) in front cover housing assembly (44).

y. Remove fitting (36) and packing (37). Remove and discard packing (37).

5-339. CLEANING. Proceed as follows:

a. Clean all gears as outlined in SP No. 3009 in Appendix E.

b. Clean all bearings as outlined in SP No. 3010 in Appendix E.

c. Clean strainers, located in oil transfer tubes (3, figure 4-39), as follows:

(1) Immerse strainer in tank containing dry cleaning solvent (item 134, table C-1) and clean using a short bristle brush.

(2) Remove strainer from tank and pressure-flush using dry cleaning solvent (item 134, table C-1).

d. Using dry cleaning solvent (item 134, table C-1), remove foreign material clogging oil transfer tube (3) by pressure-flushing.

e. Clean all other parts by dry cleaning solvent method. (Refer to SP No. 3002 in Appendix E.)

5-340. INSPECTION.

a. Perform specific inspections listed in table 5-113.

WARNING

FLIGHT SAFETY PART

Alignment of the front and rear bearing bores is flight safety critical.

b. Inspect alignment of front and rear bearing bores. Bores must be as specified in figures 5-339, 5-340, 5-340A and 5-340B.

5-341. REPAIR. (See figure 5-333 or 5-333A.) Proceed as follows:

CAUTION

Rear carrier (3, figure 5-333), torquemeter plate (34), and front carrier (46) are a matched set. If any of these parts must be replaced, all parts shall be replaced with parts having the same serial number. If the rear carrier (3) is replaced, the matched set gearshafts (11, 51) must also be replaced with a new set of gearshafts (11, 51).

Rear carrier (3, figure 5-333A) and front carrier (32) are a matched set. If any of these parts must be replaced, all parts shall be replaced with parts having the same serial number. If the rear carrier (3) is replaced, the matched set gearshafts (11, 46) must also be replaced with a new set of gearshafts (11, 46).

a. Repair nicks or chipping on teeth of sun gearshaft (1-030-192-04) (14, figure 4-39) as follows:

NOTE

Do not repair gear that exhibits pitting or spalling at either end of teeth.

(1) Using a hand stone, blend damaged teeth the minimum amount required to remove nicks. (See figure 5-338.) Sharp edges are not allowed.

(2) Reworked surfaces shall be polished to a 32 microinch finish.

WARNING

FLIGHT SAFETY PART

Magnetic particle inspection is flight safety critical.

(3) Perform a magnetic particle inspection. (Refer to table 5-114.)

b. Blend repair fretted areas on rear and front carriers (3, 46, figure 5-333) as follows:

NOTE

Repair shall be limited to the blending of sharp protrusions or rough areas to obtain a smooth finish with the absence of surface projections. Do not attempt to enlarge bore.

Table 5-113. Inspection of Output Reduction Carrier and Gear Assembly and Sun Gearshaft (T53-L-13B, -703).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-39				
-3	Oil Transfer Tube	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
			Clogging	Clean. (Refer to paragraph 5-339.)
		Visual and Fluorescent-Penetrant	Cracks	Not allowed. Replace.
			Proper size of jets	Repair. (Refer to paragraph 5-343.)
-11 and -12	Seal Rings	Visual	Nicks or burrs on OD	Repair. (Refer to SP No. 5000 in Appendix E.)
			Distortion	Not allowed. Replace.

WARNING

FLIGHT SAFETY PART

Magnetic-particle inspection to ensure that the following part is crack-free is flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
-14	Sun Gearshaft	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5013 in Appendix E.)
		Visual and SIE	Nicks or chipping on teeth	Repair. (Refer to paragraph 5-341.)
			Wear or damage to gear teeth or splines	Repair or replace if limits are not met. (Refer to SP No. 3009 in Appendix E.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
-17	Bolt	Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.

Table 5-113. Inspection of Output Reduction Carrier and Gear Assembly and Sun Gearshaft (T53-L-13B, -703) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-333 or 5-333A				
	WARNING **FLIGHT SAFETY PART** **Magnetic-particle inspection to ensure that the following part is crack-free and verification of the 2.4407 – 2.4412 diameter bores are flight safety critical.**			
-3	Rear Carrier*, **	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Fretting, scoring, or damaged chrome plating in bearing bores. (Refer to table 5-115)	Repair. (Refer to paragraph 5-341.)
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-116)	Repair per pargraph 5-341.
-7	Roller Bearing (Part No. R305D301, 456792)	Visual	Damaged bearing	Replace if limits are not met.
		Dimensional	Wear. (Refer to table 5-117)	
	or			
	Roller Bearing (Part No. 26RFH305-69)	Visual	Damaged bearing	Replace if limits are not met.
		Dimensional	Wear. (Refer to table 5-117)	
-9, -14, and -24	Nut	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
			Cracks	Not allowed. Replace.

Table 5-113. Inspection of Output Reduction Carrier and Gear Assembly and Sun Gearshaft (T53-L-13B, -703) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-333 or 5-333A (Cont)				
WARNING **FLIGHT SAFETY PART** **Magnetic-particle inspection to ensure that the following part is crack-free is flight safety critical.** **NOTE** Wear through of silver coating is acceptable in contact areas.				
-11	Gearshaft***	Visual	Nicks, burrs, and scratches	Repair. (Refer to SP No. 5013 in Appendix E.)
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
		Visual and SIE	Nicks or chipping on teeth	Repair. (Refer to paragraph 5-341.)
			Worn 3.444 to 3.452 inches (8.748 to 8.768 cm) dimension	Repair. (Refer to paragraph 5-341.)
			Wear or damage to gear teeth or splines	Repair or replace if limits are not met (SP No. 3009).
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-116)	Replace if limits are not met.
		Visual	Punch marks on timing mark on aft side of primary (large) gears. (Gears with FSCM 21540)	Repair or replace if limits are not met. (Refer to table 5-115.)
-12	Roller Bearing (Part No. R3076301, 460998)	Visual	Damaged bearing	Replace if limits are not met.
		Dimensional	Wear. (Refer to table 5-117)	Replace if limits are not met.
	or			
	Roller Bearing (Part No. 26RJH307-72)	Visual	Damaged bearing	Replace if limits are not met.
		Dimensional	Wear. (Refer to table 5-117)	Replace if limits are not met.

Table 5-113. Inspection of Output Reduction Carrier and Gear Assembly and Sun Gearshaft (T53-L-13B, -703) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-333 or 5-333A (Cont)				
-17	Oil Seal Retainer	Visual	Nicks, burrs, and scratches	Repair. Refer to SP No. 5000 in Appendix E.)
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
		Visual	Worn or damaged plating (1-030-229-06)	Repair. (Refer to paragraph 5-341.)
		Visual and SIE	Expanded radius. (Refer to table 5-115)	Repair. (Refer to paragraph 5-341.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-116)	Replace if limits are not met.
-22	Face Plate	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Coking, varnish discoloration, marring, or damaged chromium plate	Repair. (Refer to paragraph 5-341.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
-26	Ball Bearing (Part No. MM221VM6MBRE9 266, 460920, 26HTH211-61)	Visual	Damaged bearing	Replace if limits are not met.
		Dimensional	Wear. (Refer to table 5-117)	Replace if limits are not met.
-27	Spacer	Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
-29	Roller Bearing (Part No. HU1913LAR3506, 460667, 26PFH013-A47)	Visual	Damaged bearing	Replace if limits are not met.
		Dimensional	Wear. (Refer to table 5-117)	Replace if limits are not met.

Table 5-113. Inspection of Output Reduction Carrier and Gear Assembly and Sun Gearshaft (T53-L-13B, -703) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-333 or 5-333A (Cont)				
-31	Liner	Visual	Nicks, burrs, and scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
		Visual and SIE	Wear or scoring on 3.9370 to 3.9374 inches (9.9999 to 10.0010 cm) diameter or 1.079 to 1.081 inches (2.741 to 2.746 cm) surface area	Repair. (Refer to paragraph 5-341.)
			No chamfer on the 3.9370 to 3.9374 inches (10.000 to 10.0010 cm) diameter surface	Repair. (Refer to paragraph 5-341.)
			Wear on 4.1770 to 4.1775 inches (10.610 to 10.611 cm) diameter 1.325 to 1.327 inches (3.366 to 3.371 cm) diameter or 0.098 to 0.0102 inch (0.249 to 0.259 cm) surface area	Repair. (Refer to paragraph 5-341.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
	WARNING **FLIGHT SAFETY PART** **Magnetic-particle inspection to ensure that the following part is crack-free and verification of the 3.1494 – 3.1499 diameter bores are flight safety critical.**			
		Dimensional	Wear. (Refer to table 5-116)	Replace if limits are not met.
5-333A-32	Reduction Gear Front Carrier**	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Nicks, burrs, or sharp edges on ball sockets	Repair. (Refer to SP No. 5000 in Appendix E.)
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-116)	Replace per paragraph 5-341.

Table 5-113. Inspection of Output Reduction Carrier and Gear Assembly and Sun Gearshaft (T53-L-13B, -703) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-333 or 5-333A (Cont)				
-33 or 5-333-35	Torquemeter Balls	Visual	Scratches and wear patterns	Not allowed. Replace.
-34	Torquemeter Plate*	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Nicks, burrs, or sharp edges on ball sockets	Repair. (Refer to SP No. 5000 in Appendix E.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
-41	Ball Retainers	Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
5-333A-40 or 5-333-44	Output Gear Plug	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
		Dimensional	Wear on forward face. If wear exceeds 0.025, replace plug. If wear is less than 0.025, blend-repair to remove any raised material. Broken or mutilated antirotation tang not allowed. Wear depressions up to 0.010 allowed	Reblack oxide worn areas per SP No. 6002.

WARNING

FLIGHT SAFETY PART

Magnetic-particle inspection to ensure that the following part is crack-free and verification of the 3.1494 – 3.1499 diameter bores are flight safety critical.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
-46	Front Carrier*	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Fretting, scoring, or damaged chrome plating in bearing bores. (Refer to table 5-115)	Repair. (Refer to paragraph 5-341.)

Table 5-113. Inspection of Output Reduction Carrier and Gear Assembly and Sun Gearshaft (T53-L-13B, -703) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-333 or 5-333A (Cont)				
-46 (Cont)	Front Carrier* (Cont)		Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
		Visual and Magnetic-Particle. (Refer to table 5-114)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-116)	Repair per paragraph 5-341.
5-333A-42 or 5-333-47	Torquemeter Plate Assembly	Visual	Nicks, burrs, and scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Cracks	Not allowed. Replace.
5-333A-44 or 5-333-49	Front Cover Housing Assembly	Visual	Nicks, burrs, and scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E.)
			Loss of surface coating	Repair. (Refer to SP No. 6021 in Appendix E.)
		Visual	Nicks, gouges, and grooves on front face near oil tube mounting locations	Repair. (Refer to paragraph 5-341.)
		Visual and SIE	Scoring or grooving in oil transfer tube holes beyond 0.005 inch (0.013 cm) in depth	Repair. (Refer to paragraph 5-341.)
			Corrosion or pitting. (Refer to table 5-115)	Repair or replace. (Refer to paragraph 5-341.)
		Visual and Fluorescent-Penetrant	Cracks	Not allowed. Replace.
	WARNING **FLIGHT SAFETY PART** **(Part No. 1-030-191-06/-R9/-R10/-R11/-14) Magnetic-particle inspection to ensure that the following part is crack-free is flight safety critical.** **NOTE** Wear through of silver coating is acceptable in contact areas.			
5-333A-46 or 5-333-51	Gearshaft***	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5013 in Appendix E.)

Table 5-113. Inspection of Output Reduction Carrier and Gear Assembly and Sun Gearshaft (T53-L-13B, -703) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-333 or 5-333A (Cont)				
5-333A-46 or 5-333-51 (Cont)	Gearshaft*** (Cont)		Nicks or chipping on gear teeth (1-030-191-06, 1-030-191-R9, 1-030-191-R10, 1-030-191-R11, and 1-030-191-14)	Repair. (Refer to paragraph 5-341.)
		Visual and SIE	Wear or damage to gear teeth or splines	Repair or replace. (Refer to SP No. 3009 in Appendix E.)
			Runout of face plate area exceeding 0.001 inch TIR	Repair. (Refer to paragraph 5-341.)
			Fretting, scoring, or loss of plating on 3.5423 to 3.5429 inches (8.9974 to 8.9990 cm) diameter	Repair. (Refer to paragraph 5-341.)
		Visual	Helical gear shaft on portion of internal spline face for wear damage caused by plug impact	Steps up to 0.010 deep are allowed with blend-repair per SP No. 5000 in Appendix E.
		(Part No. 1-030-191-06/ -R9/-R10/ -R11/-14) Visual and Magnetic-Particle. (Refer to table 5-114)	Cracking or chipping on forward and aft internal splines	Repair. (Refer to paragraph 5-341.)
		Dimensional	Wear. (Refer to table 5-116)	Replace if limits are not met.
-6	Oil Deflector	Visual	Severe damage or distortion	Not allowed. Replace.
			Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E.)
			Damaged threads	Repair. (Refer to SP No. 5007 in Appendix E.)
		Visual and SIE	Cracks	Not allowed. Replace.

*Rear carrier (3, figure 5-333), torquemeter plate (34), and front carrier (46) are a matched set. If any of these parts must be replaced, all parts shall be replaced with parts having the same serial number.

**Rear carrier (3, figure 5-333A) and front carrier (32) are a matched set. If any of these parts must be replaced, all parts shall be replaced with parts having the same serial number.

***Planetary gears (11, figure 5-333 or 5-333A) and output gear (51, figure 5-333 or 46, figure 5-333A) are considered matched set gearshafts once operated together. If a used gear must be replaced, the entire set must be replaced.

Table 5–114. Magnetic-Particle Inspection of Output Reduction Carrier, Gear Assembly and Sun Gearshaft (T53-L-13B, -703).

FIGURE AND INDEX NO.	NOMENCLATURE	METHOD OF MAGNETIZATION
4-39, 14	Sun Gearshaft	Circular, use central conductor at 1200 amperes. Longitudinal at 5000 ampere-units
4-39, 17	Bolt	Longitudinal at 5000 ampere-units
5-333 or 5-333A, 3	Rear Carrier	Circular, use central conductor at 2000 amperes
5-333 or 5-333A, 11	Gearshaft, Helical Planetary	Circular, use central conductor at 2500 amperes. Longitudinal at 10,000 ampere turns
5-333 or 5-333A, 17	Oil Seal Retainer	Circular, use central conductor at 1200 amperes
5-333 or 5-333A, 22	Faceplate	Circular, use central conductor at 500 amperes
5-333 or 5-333A, 27	Spacer	Circular, use central conductor at 500 amperes
5-333 or 5-333A, 31	Liner	Circular, use central conductor at 1000 amperes
5-333A, 32	Reduction Gear Front Carrier	Circular, use central conductor at 2000 amperes. Longitudinal at 10,000 ampere-turns
5-333, 34	Rear Torquemeter Plate	Circular, use central conductor at 1800 amperes
5-333A, 40 or 5-333, 44	Output Gear Plug	Longitudinal at 5000 ampere-turns
5-333, 41	Ball Retainer	Longitudinal at 4000 ampere-turns
5-333A, 42 or 5-333, 47	Torquemeter Plate Assembly	Circular, use central conductor at 1800 amperes
5-333, 46	Front Reduction Gear, Carrier	Circular, use central conductor at 2000 amperes. Longitudinal at 10,000 ampere-turns
5-333A, 46 or 5-333, 51	Gearshaft, Helical Output	Circular, use central conductor at 1500 amperes

Table 5-115. Output Reduction Carrier and Gear Assembly Inspection Limits (T53-L-13B, -703).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Fretting, Scoring or Damaged Plating on Front and Rear Carrier Bearing Bores		a. Fretting is not acceptable if it exceeds 20 percent of each bore circumference. b. Fretting must be well distributed and in no case concentrated in one particular area. c. If fretted area is within above limits, blend-repair as outlined in paragraph 5-341. If above limits are exceeded, repair by chrome-plating as outlined in paragraph 5-341.
Radius on Oil Seal Retainer	5-334	If radius does not conform to limit shown in figure 5-334, rework to radius specified to eliminate possible interference with mating bearing support liner. (Refer to paragraph 5-341.)
Corrosion Pitting on Front Cover Housing Assembly	5-335	a. Any number of random pits are acceptable with rework provided that depth of pits is not greater than 0.030 inch (0.076 cm) except as noted in step c. Repair as outlined in paragraph 5-341. If limits are exceeded, replace front cover housing assembly. b. Pitting in area A of figure 5-335 up to 0.100 inch (0.254 cm) deep is acceptable provided that the total area does not exceed one square inch and limits in step c are adhered to. Additional pitting in area B of figure 5-335 is acceptable provided that depth is less than 0.150 inch (0.381 cm) and total area is less than one square inch. Repair as outlined in paragraph 5-341, step m. If limits are exceeded, replace front cover housing assembly. c. Pitting is not acceptable in areas that would interfere with sealing of mating parts of functional test requirements. Pitting is not acceptable on the unpainted front sealing surface. Replace front cover housing assembly if limits are exceeded.
Punch Mark on Planetary Gear Timing Mark (aft side of primary/ large rear)	5-336	d. Gears FSCM 21540 with punch mark below pitch diameter and on or tangent to centerline are acceptable for use. If punch mark is not in this area, rework per paragraph 5-341.

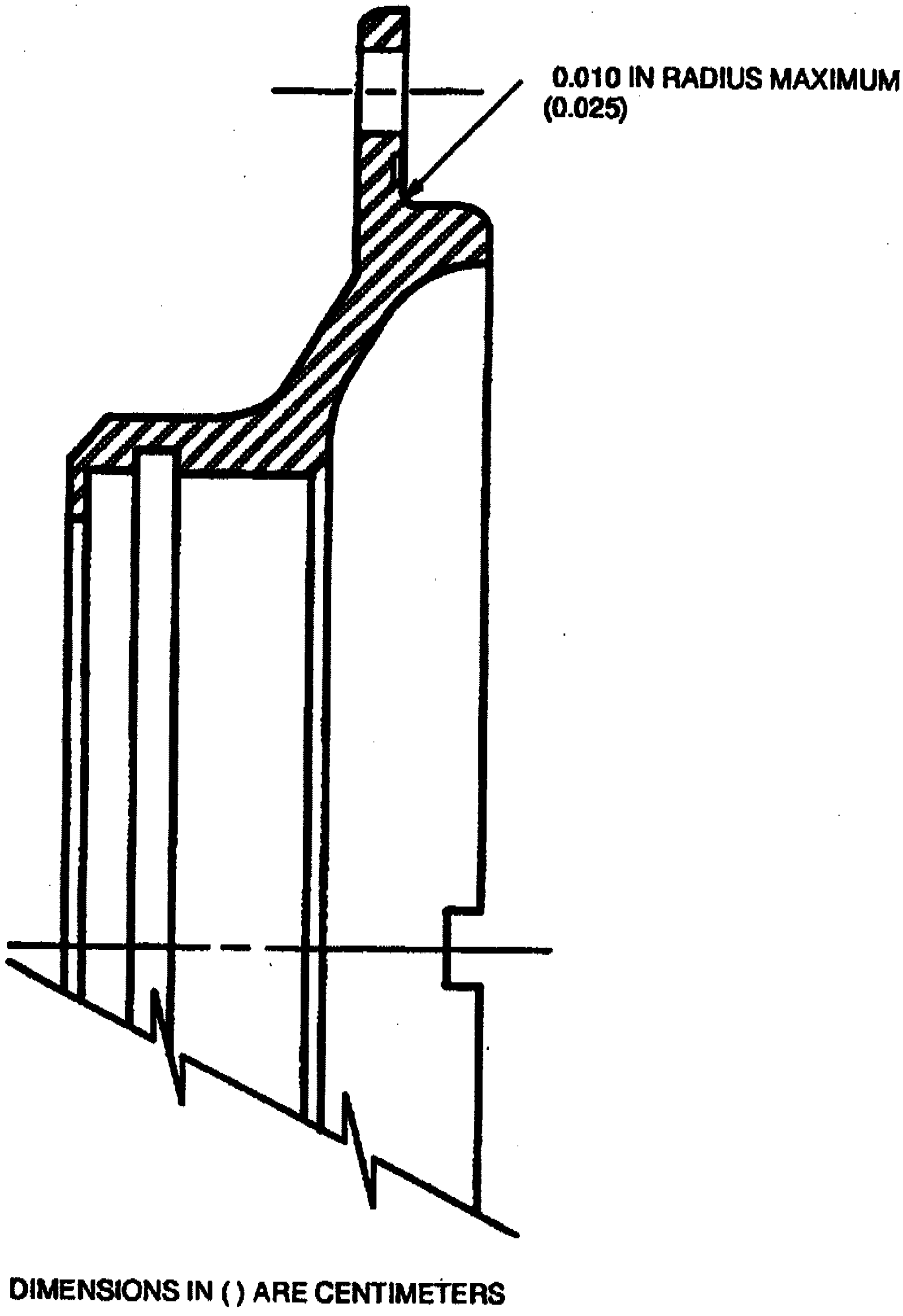


Figure 5-334. Oil Seal Retainer Inspection Area (T53-L-13B, -703).

Table 5–116. Dimensional Inspection of Output Shaft Reduction Carrier and Gear Assembly (T53-L-13B, -703).

NOMENCLATURE	FIG & DIR		BLUEPRINTS DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM
	INDEX	MEAS	MIN	MAX	MIN	MAX	MIN	MAX	
	5-333 or 5-333A								5-337
Rear Carrier	3**	ID	2.4407 (6.1994)	2.4412 (6.2006)					A
Gearshaft	11*	OD	1.3781 (3.5004)	1.3784 (3.5011)					B
		OD	0.9844 (2.5004)	0.9848 (2.5014)					C
		Axial	3.444 (8.748)	3.452 (8.768)					L
Oil Seal Retainer	17*	OD	3.9355 (9.9962)	3.9365 (9.9988)					D
Liner	31*	ID	3.9370 (10.0000)	3.9374 (10.0010)					E
		OD	2.5593 (6.5006)	2.5598 (6.5019)					F
		OD	4.1770 (10.6096)	4.1775 (10.6109)					G
		Axial	1.079 (2.741)	1.081 (2.746)					H
Front Carrier	5-333A, 32 or 5-333, 46**	ID	3.1494 (7.9995)	3.1499 (8.0007)					I
Gearshaft	5-333A, 46 or 5-333, 51*	ID	3.5423 (8.9974)	3.5429 (8.9990)					J
		OD	2.1651 (5.4994)	2.1654 (5.5001)					K

* Dimensional inspection not required unless visual inspection indicates obvious damage, fretting corrosion, or wear.

WARNING

FLIGHT SAFETY PART

The alignment of front and rear bearing bores is flight safety critical.

** The alignment of the front and rear bearing bores must be within 0.0005. (Refer to figures 5-339 and 5-340A.)

Table 5–117. Dimensional Inspection of Output Shaft Reduction Carrier and Gear Assembly Bearings (T53-L-13B, -703).

BEARING TYPE PART NO.	FIG & DIM.		BLUEPRINT DIMENSIONS		INTERNAL CLEARANCE	END PLAY	HARDNESS RC	CONTACT ANGLE	ALLIEDSIGNAL PART NUMBER
	INDEX	MEAS	MIN	MAX					
	5-333 or 5-333A								
Roller R305D301	7	ID	0.9841 (2.4996)	0.9843 (2.5001)	0.0012 (0.0030) to 0.0017* (0.0043)	N/A	58 to 61	N/A	1-300-032-01
		OD	2.4405 (6.19289)	2.4409 (6.1999)					
Roller 456792		ID	0.9841 (2.4996)	0.9843 (2.5001)	0.0012 (0.0030) to 0.0017* (0.0043)	N/A	58 to 61	N/A	1-300-032-03
		OD	2.4405 (6.1989)	2.4409 (6.1999)					
Roller 26RFH305-69		ID	0.9841 (2.4996)	0.9843 (2.5001)	0.0012 (0.0030) to 0.0020* (0.0051)	N/A	58 to 62	N/A	1-300-667-01
		OD	2.4405 (6.1989)	2.4409 (6.1999)					
Roller R3076301	12	ID	1.3777 (3.4994)	1.3780 (3.5001)	0.0012 (0.0030) to 0.0017* (0.0043)	N/A	58 to 61	N/A	1-300-031-01
		OD	3.1492 (7.9990)	3.1496 (8.0000)					
Roller 460998		ID	1.3777 (3.4994)	1.3780 (3.5001)	0.0012 (0.0030) to 0.0017* (0.0043)	N/A	58 to 61	N/A	1-300-031-03
		OD	3.1492 (7.9990)	3.1496 (8.0000)					
Roller 26RJH307-72		ID	1.3777 (3.4994)	1.3780 (3.5001)	0.0012 (0.0030) to 0.0020* (0.0051)	N/A	58 to 62	N/A	1-300-666-01
		OD	3.1492 (7.9990)	3.1496 (8.0000)					

Table 5–117. Dimensional Inspection of Output Shaft Reduction Carrier and Gear Assembly Bearings (T53-L-13B, -703) (Continued).

BEARING TYPE PART NO.	FIG & DIM.		BLUEPRINT DIMENSIONS		INTERNAL CLEARANCE	END PLAY	HARDNESS RC	CONTACT ANGLE	ALLIEDSIGNAL PART NUMBER
	INDEX	MEAS	MIN	MAX					
Ball MM221VM6MB RE9266	26	ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0020 (0.0051) to 0.0028** (0.0071)	0.013*	58 to 62	N/A	1-300-329-01
		OD	3.9367 (9.9992)	3.9370 (10.0000)					
Ball 460920		ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0020 (0.0051) to 0.0028** (0.0071)	0.013*	58 to 62	N/A	1-300-329-02
		OD	3.9367 (9.9992)	3.9370 (10.0000)					
Ball 26HTH211-61		ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0032 (0.0081) to 0.0043** (0.0109)	0.0165*	58 to 62	N/A	1-300-669-01
		OD	3.9367 (9.9992)	3.9370 (10.0000)					
Roller 460667	29	ID	2.5587 (6.49910)	2.5591 (6.5001)	0.0020 (0.0051) to 0.0028** (0.0071)	N/A	58 to 61	N/A	1-300-335-01
		OD	3.5429 (8.9990)	3.5433 (9.0000)					
Roller R1913G301		ID	2.5587 (6.49910)	2.5591 (6.5001)	0.0020 (0.0051) to 0.0028** (0.0071)	N/A	58 to 61	N/A	1-300-335-02
		OD	3.5429 (8.9990)	3.5433 (9.0000)					

Table 5–117. Dimensional Inspection of Output Shaft Reduction Carrier and Gear Assembly Bearings (T53-L-13B, -703) (Continued).

BEARING TYPE PART NO.	FIG & DIM.		BLUEPRINT DIMENSIONS		INTERNAL CLEARANCE	END PLAY	HARDNESS RC	CONTACT ANGLE	ALLIEDSIGNAL PART NUMBER
	INDEX	MEAS	MIN	MAX					
Roller HU1913LAR35 06	29 (Cont)	ID	2.5587 (6.49910)	2.5591 (6.5001)	0.0020 (0.0051) to 0.0028** (0.0071)	N/A	58 to 61	N/A	1-300-335-02
		OD	3.5429 (8.9990)	3.5433 (9.0000)					
Roller 26PFH013-A47		ID	2.5587 (6.49910)	2.5591 (6.5001)	0.0020 (0.0051) to 0.0028** (0.0071)	N/A	58 to 62	N/A	1-300-682-01
		OD	3.5429 (8.9990)	3.5433 (9.0000)					

* Under a 11.0 pound gage load.

** Under a 33.0 pound gage load.

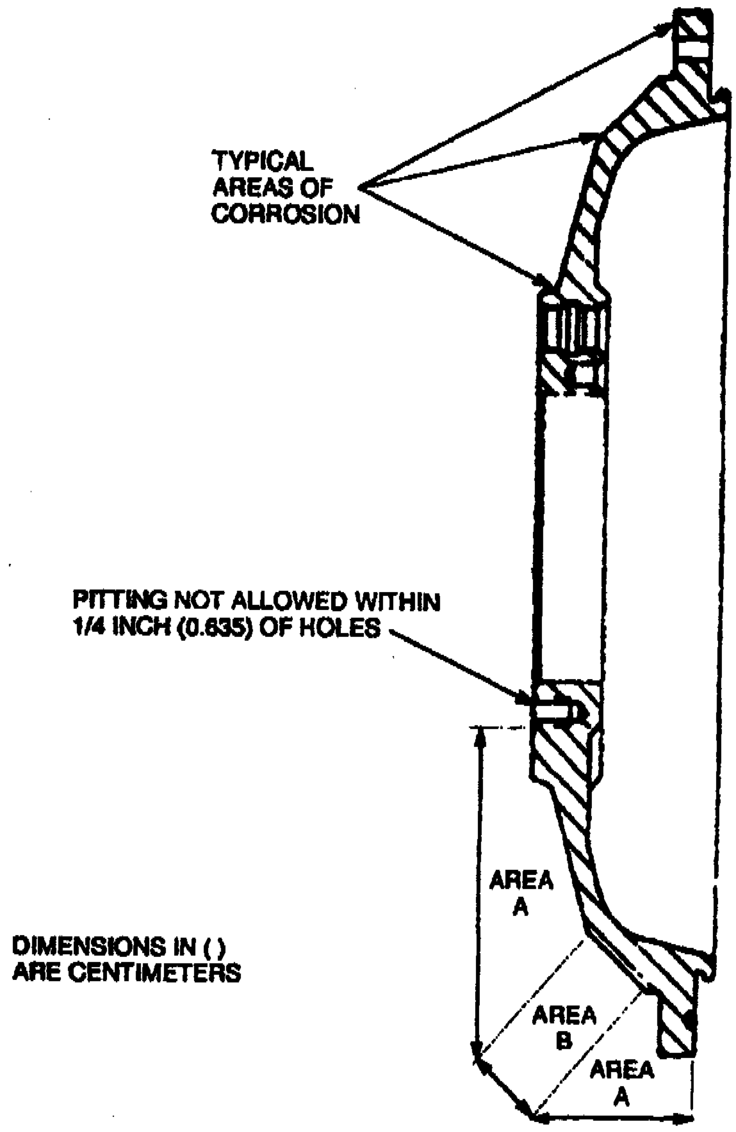


Figure 5-335. Front Cover Housing Assembly Inspection Areas (T53-L-13B, -703).

(1) Using abrasive paper No. 400 (item 11, table C–1), blend sharp protrusions.

(2) Finish repair using crocus cloth (item 125, table C–1).

(3) Dimensionally reinspect ID to determine if bore is within specified limits.

NOTE

If bore ID is not within specified limits, repair by chrome plating.

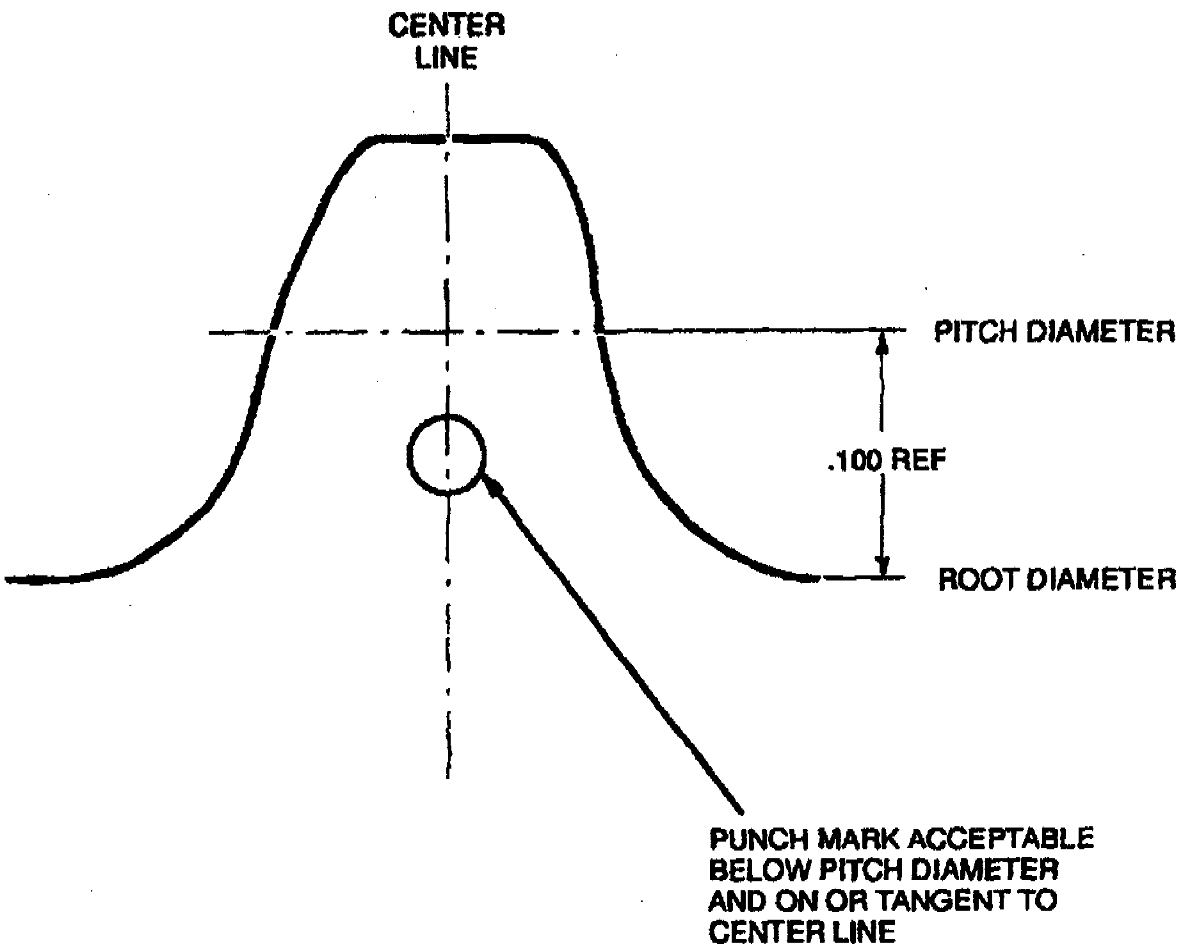


Figure 5-336. Inspection of Punch Mark Location on Planetary Gears (FSCM 21540).

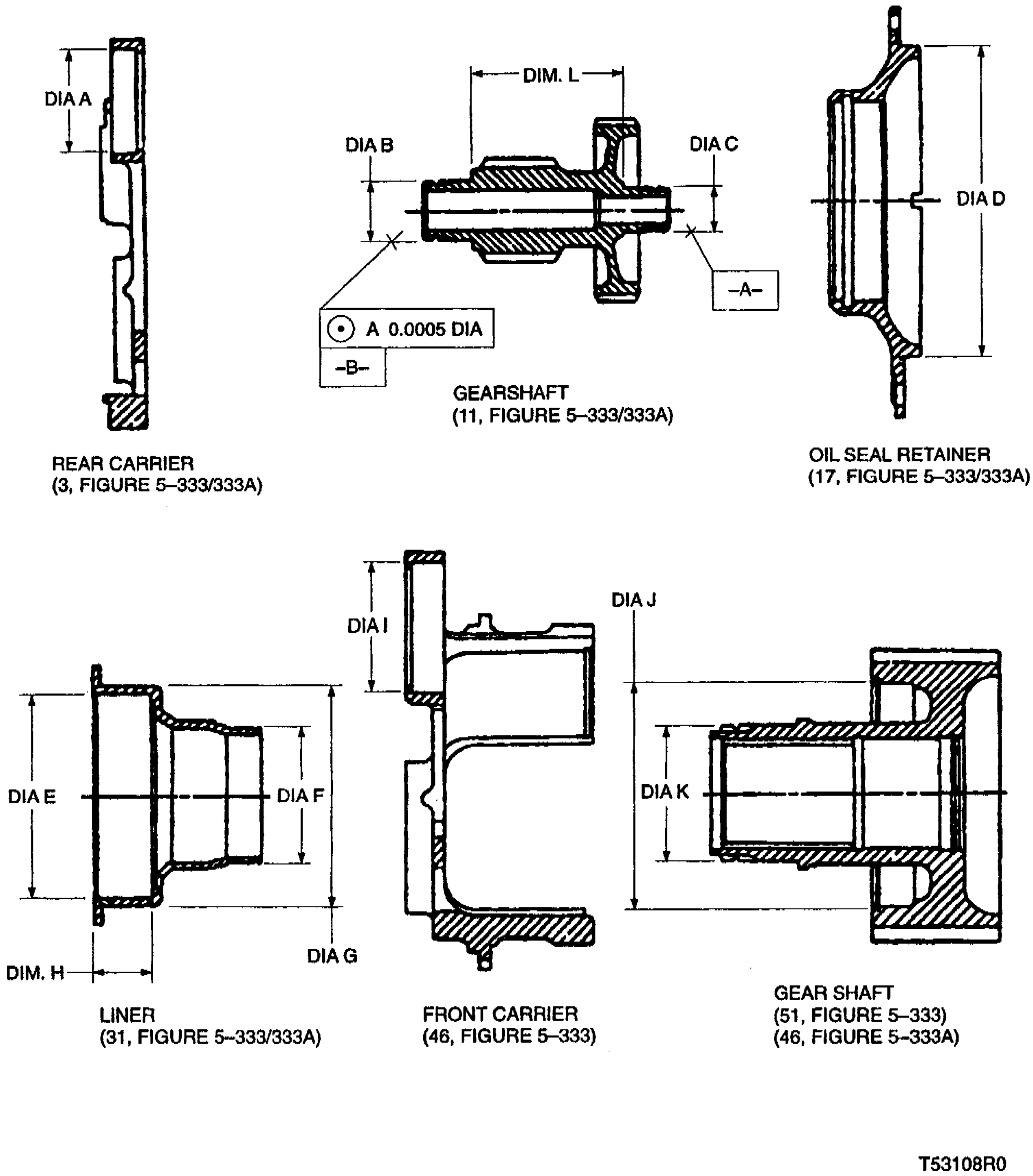


Figure 5–337. Output Shaft Reduction Carrier and Gear Assembly (T53-L-13B, -703).

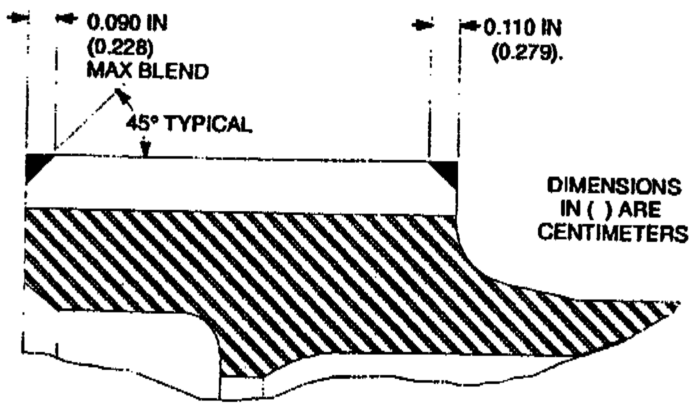


Figure 5–338. Sun Gearshaft - Repair Area (T53-L-13B, -703).

c. Blend repair fretted areas on rear and front carriers (3, 46, figure 5-333, 3, 32, figure 5-333A) as follows:

NOTE

If any bearing bore must be plated, plate the mating bearing bore on the opposite carrier.

(1) Install front carrier (46, figure 5-333) on rear carrier (3) or front carrier (32, figure 5-333A) on rear carrier (3) by aligning vibropeened identification marks (which appear on the sides of front and rear carriers) with each other.

(2) Using grinding fixture (LTCT11201), grind away the damaged plating, or mask and chemical strip, using sodium hydroxide (Item 283, Appendix C). After stripping, rinse with cold water, dry, and examine to verify complete stripping.

(3) Remove front carrier.

(4) Chrome-plate bearing bore as outlined in SP No. 6014 in Appendix E.

(5) Plating thickness after grind is to be 0.002 to 0.015 inch (0.005 to 0.038 cm).

NOTE

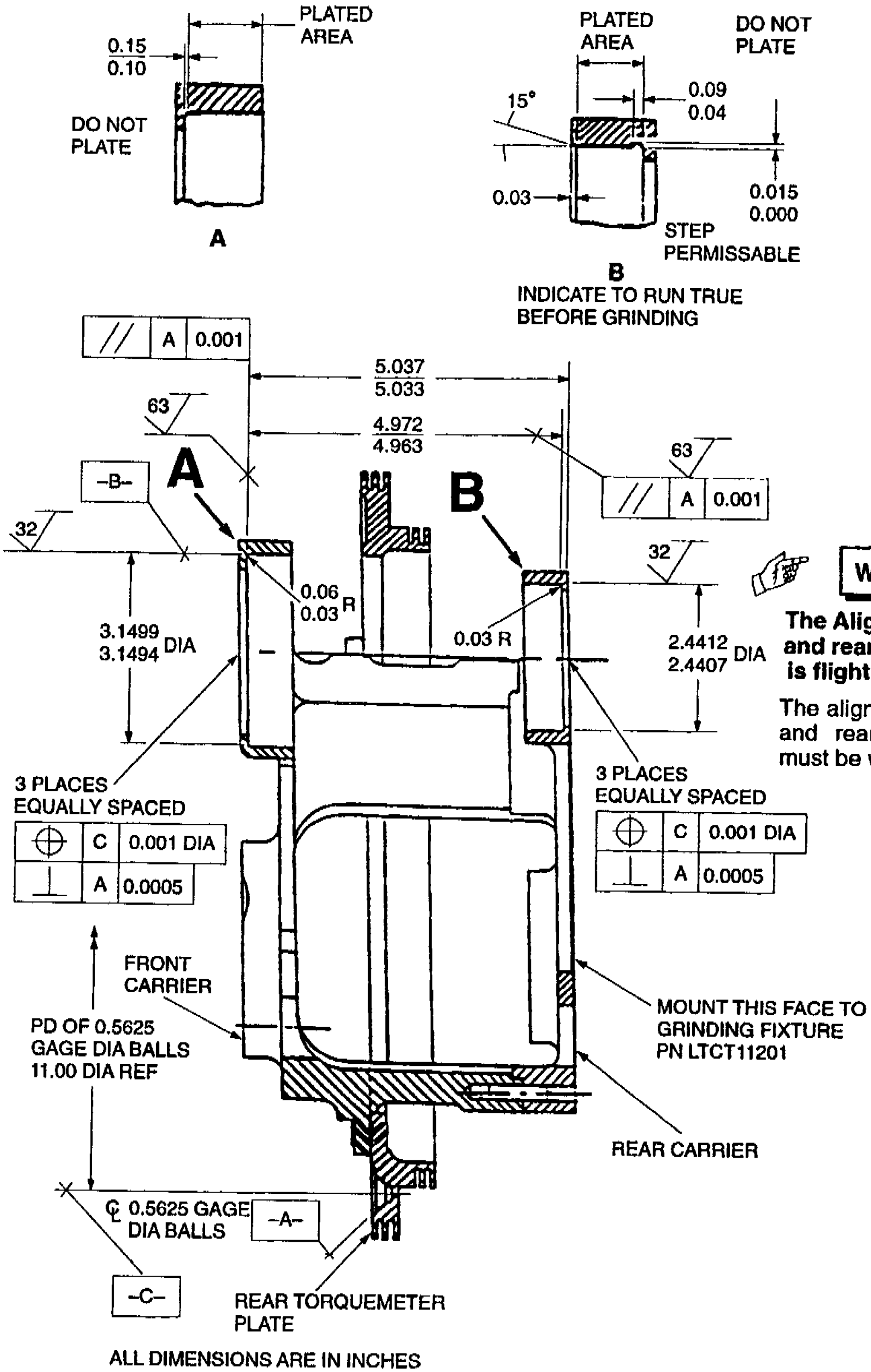
After plating, bake carrier for 3 hours at 365 to 385°F (185 to 196°C).

(6) Reinstall front carrier onto rear carrier. (Refer to preceding step (1)).

(7) Finish grind to dimensions shown in figure 5-339 or 5-340A.

(8) Bearing bore must be square with the A surface within 0.0005 inch (0.0013 cm). (Refer to figures 5-339 and 5-340A.)

(9) Bearing bores must have position within 0.001 (0.003) of C diameter. (Refer to figures 5-339 and 5-340A.)

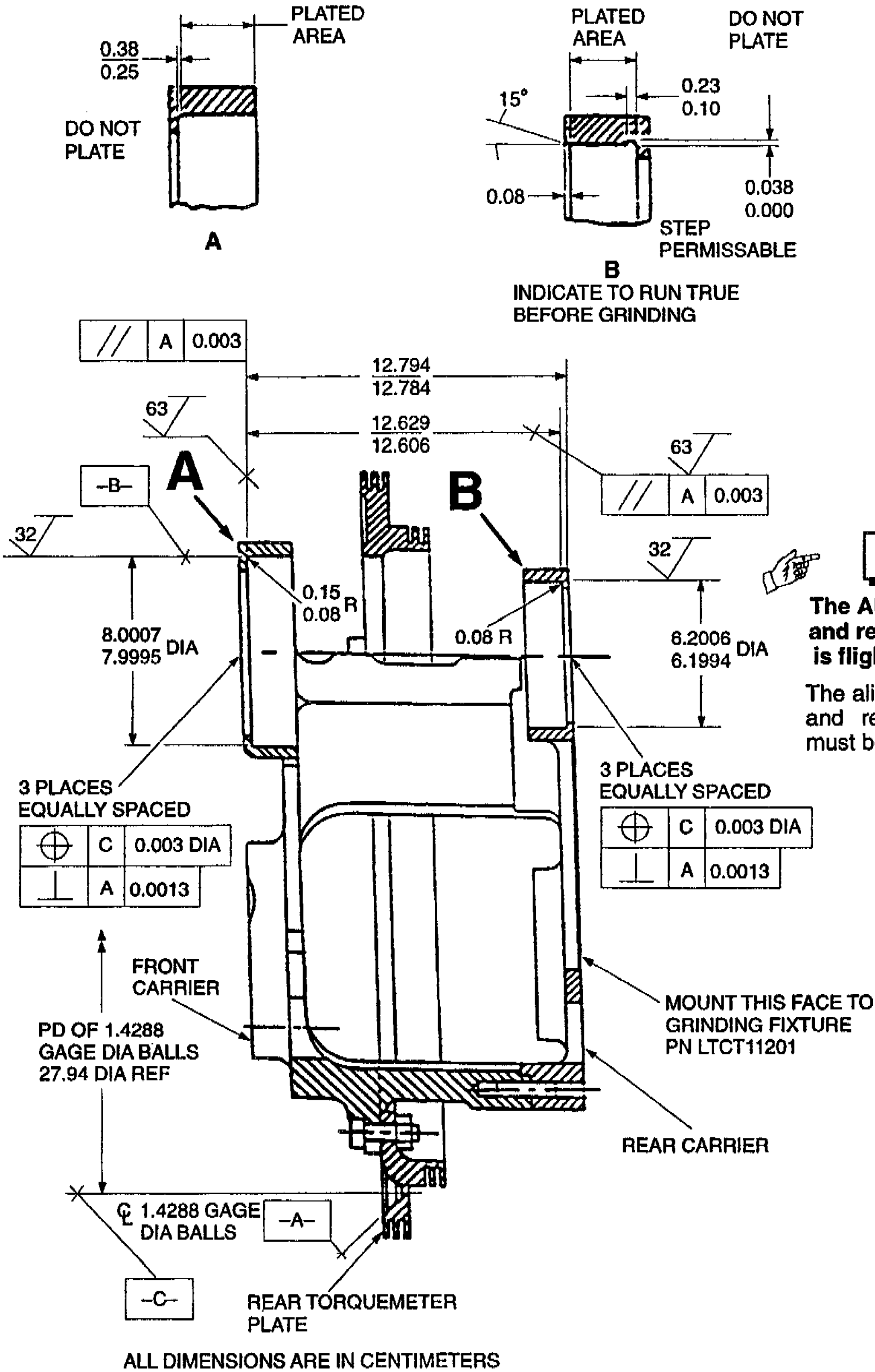


WARNING

The Alignment of front and rear bearing bores is flight safety critical.

The alignment of the front and rear bearing bores must be within 0.0005.

Figure 5–339. Carrier Assembly (1–030–340–04) - Plating Area (T53-L-13B, -703) (English).

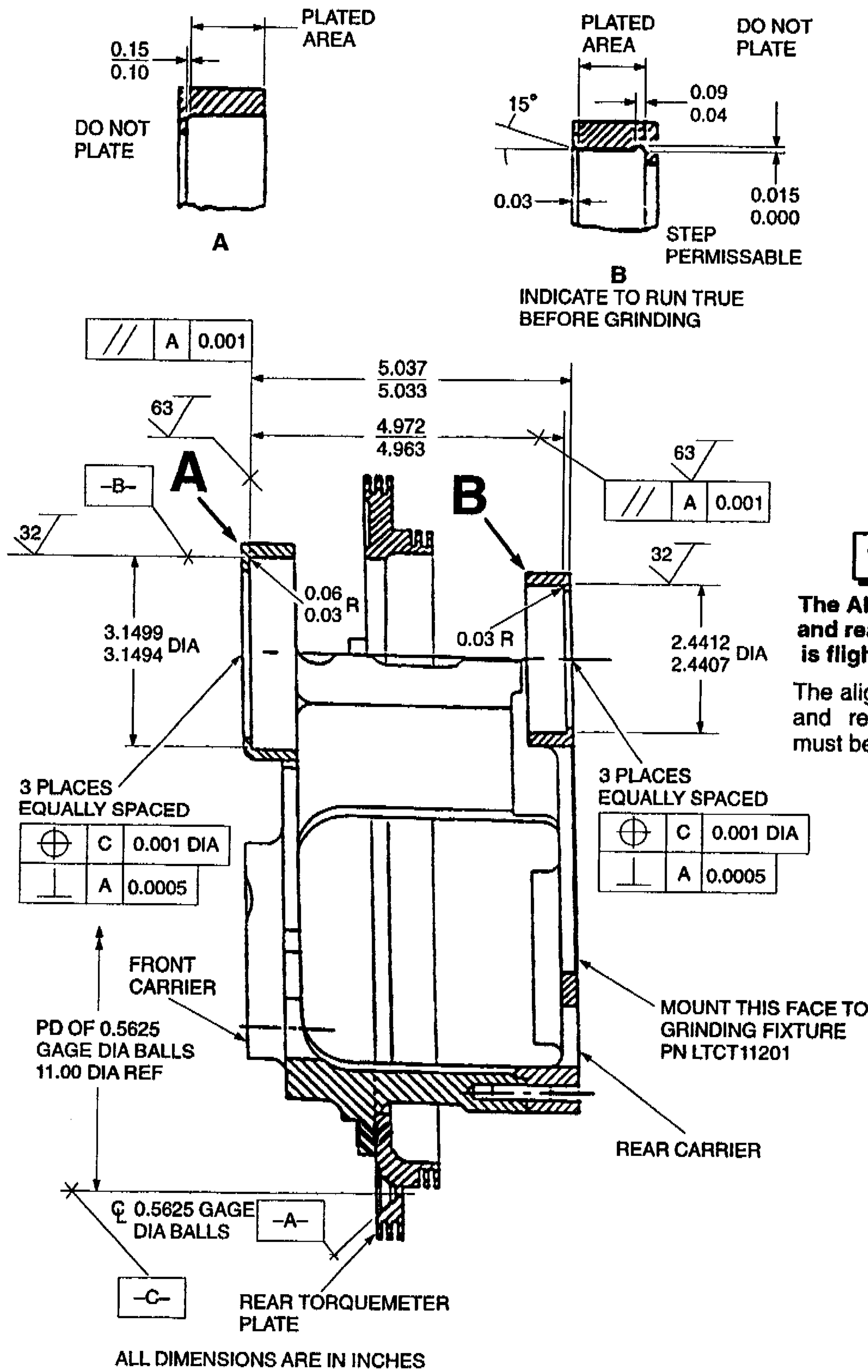


WARNING

The Alignment of front and rear bearing bores is flight safety critical.

The alignment of the front and rear bearing bores must be within 0.0013.

Figure 5–340. Carrier Assembly (1–030–340–04) - Plating Area (T53-L-13B, -703) (Metric).

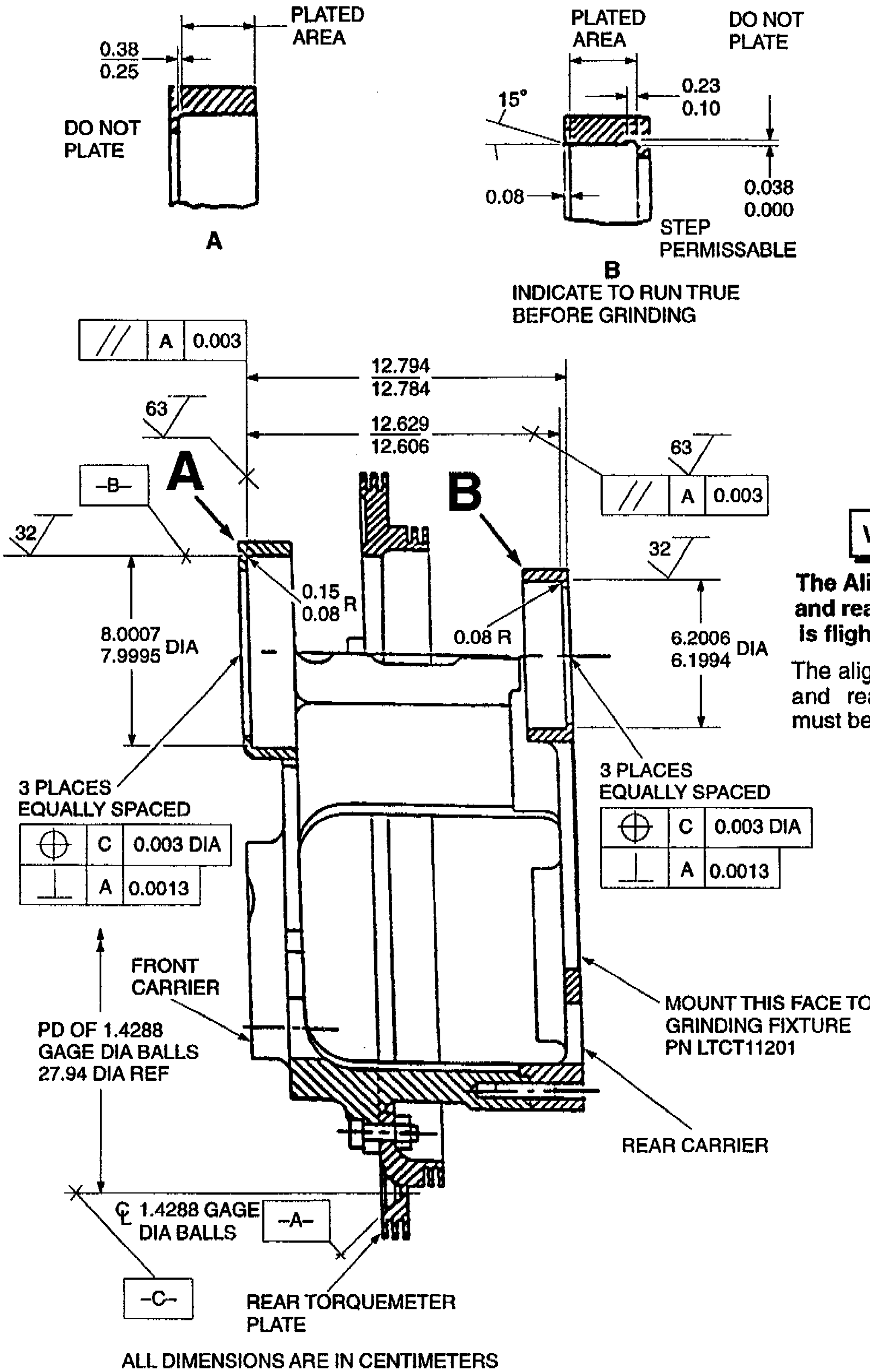


WARNING

The Alignment of front and rear bearing bores is flight safety critical.

The alignment of the front and rear bearing bores must be within 0.0005.

Figure 5–340A. Carrier Assembly (1–030–340–05) - Plating Area (T53-L-13B, -703) (English).



WARNING

The Alignment of front and rear bearing bores is flight safety critical.

The alignment of the front and rear bearing bores must be within 0.0013.

Figure 5–340B. Carrier Assembly (1–030–340–05) - Plating Area (T53-L-13B, -703) (Metric).

d. Remove nicks, tool marks, or other obvious damage from gear-shaft (11, figure 5-333) as follows:

NOTE

This repair procedure is not permitted on gears that exhibit pitting or spalling at either end of teeth.

(1) Grind teeth only the minimum amount required. Refer to figure 5-341 for repair limits. Hand stoning of nicks is permitted.

CAUTION

In following step (2), sharp edges are not allowed.

NOTE

Blending may carry into root area, if required, but must be smooth and continuous.

(2) Reworked surfaces are to be polished to 32 micro-inches.

WARNING

FLIGHT SAFETY PART

Magnetic particle inspection is flight safety critical.

(3) Perform magnetic-particle inspection on gearshaft. Refer to table 5-114.

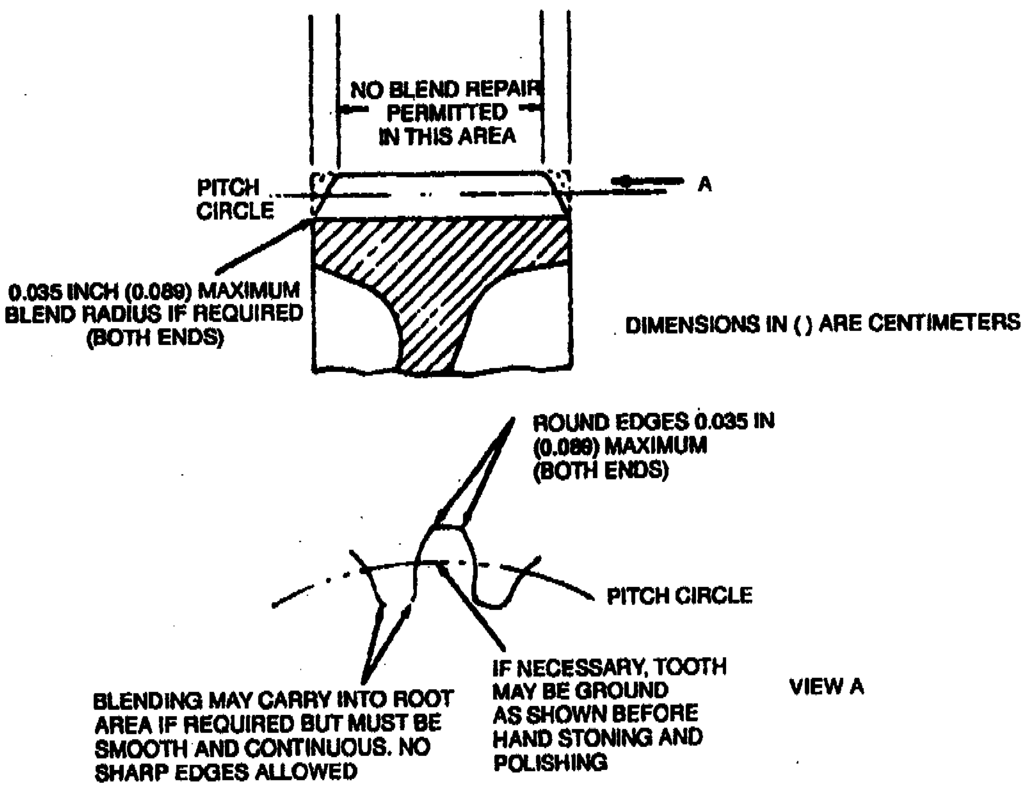


Figure 5-341. Helical Planet Gearshaft- Repair Limits (T53-L-13B, -703).

e. Repair planetary gears (11) FSCM 21540 with discrepant punch marks, on aft side of primary (large gear), as follows:

(1) Visually inspect with 10X magnification for cracks emanating from the punch mark on the timing mark. Locally (only in affected area) fluorescent penetrant inspect for cracks in accordance with MIL-STD-6866, Type I Method D, Penetrant Sensitivity (High) Level 3.

(2) Machine chamfer on tooth with punch mark on or above pitch diameter as shown on figure 5-336. Machine chamfer on gears with punch marks below pitch diameter and not on or tangent to tooth centerline as shown on figure 5-336. Figure 5-342 shows required dimensions for machined chamfer. The machined chamfer is to have break edge of 0.005 to 0.030 inch. Timing mark may be vipropeened (per blueprint requirements) below root diameter.

(3) Chipped or cracked teeth may be blend repaired per SP No. 5000, Appendix E. Blend up to 0.10 inch along face of gear tooth with relief above and below the repaired chip area. Depth of repair from tooth not to exceed 0.03 inch maximum. See figure 5-342.

(4) Magnetic particle inspect all repaired teeth. If cracks or chips remain following above repairs, parts are not acceptable for use. Locally (only in affected area) fluorescent penetrant inspect for cracks in accordance with MIL-STD-6866, Type I Method D, Penetrant Sensitivity (High) Level 3.

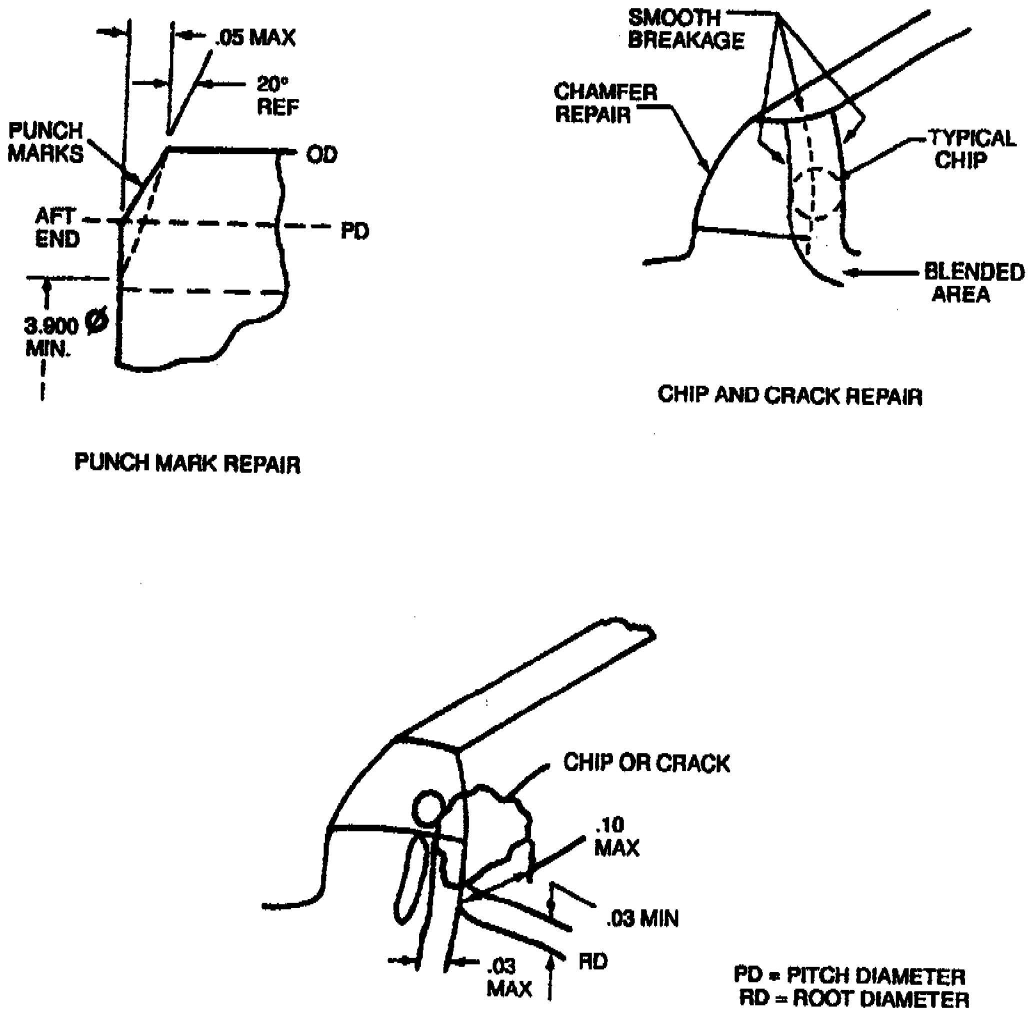


Figure 5-342. Repair of Planetary Gears (FSCM 21540).

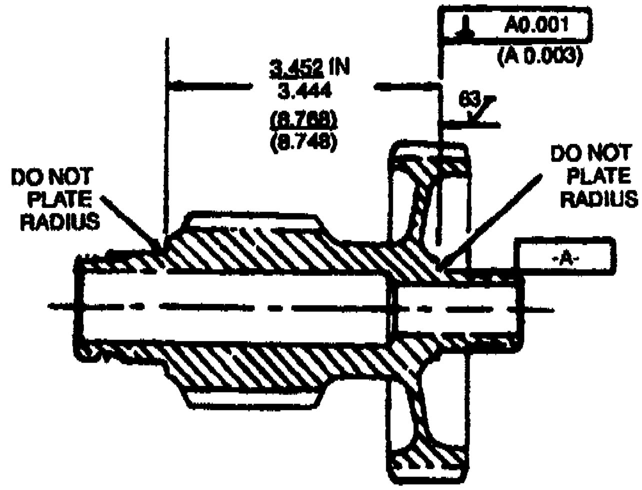
f. Repair worn surfaces on 3.444 to 3.452 inch (8.458 to 8.768 cm) dimension (either side) of gearshaft (11, figure 5-333) where up to 0.010 inch (0.025 cm) maximum plate thickness is required. (See figure 5-343).

(1) Machine, if necessary, to obtain a 0.002 inch (0.005 cm) minimum plate thickness after final machining.

(2) Chrome plate as outlined in SP No. 6014 in Appendix E.

(3) Bake at 255° to 274°F (124° to 135°C) for 5 hours.

(4) Machine to dimensions given.



DIMENSIONS IN ( ) ARE CENTIMETERS.

Figure 5-343. Helical Planet Gearshaft - Repair Area (T53-L-13B, -703).

g. Rework oil seal retainer (17, figure 5-333) to obtain 0.010 inch (0.025 cm) maximum radius. (See figure 5-345)

h. Repair worn or damaged plating on 1-030-229-06 Oil seal retainer (17, figure 5-333) per SP No. 6015 in Appendix E. (See figure 5-345)

i. Remove coke or varnish from faceplate (22, figure 5-333) as follows:

(1) Use aluminum oxide cloth (No. 400 or finer (item 35, table C–1) to remove light deposits.

CAUTION

In following step (2), when scraping, be careful not to damage chrome finish.

(2) Use smooth edge steel scraper to remove heavier deposits.

(3) If chrome finish is damaged, replace as specified in following steps (4) through (7).

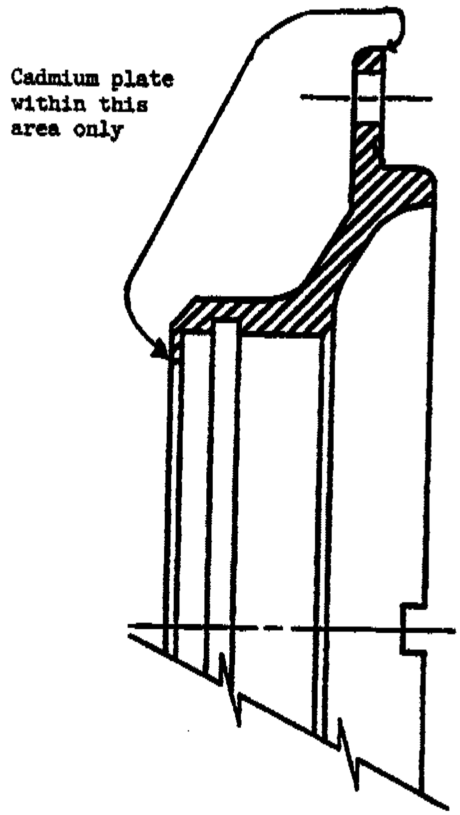
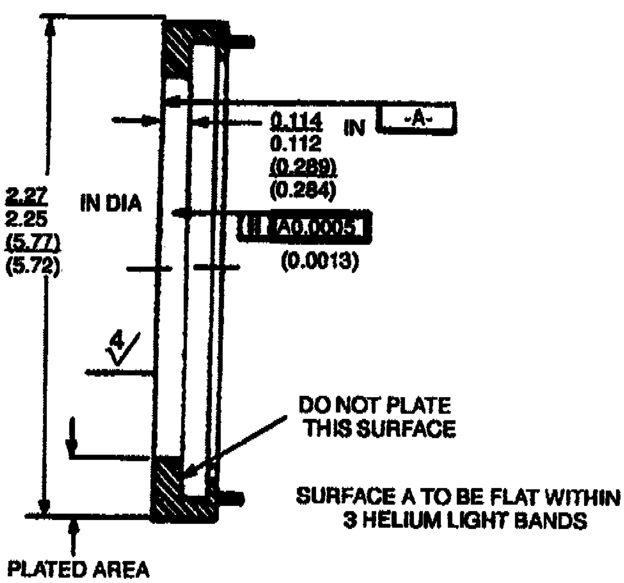


Figure 5-344. Plating Area - Oil Seal Retainer (P/N 1-030-229-06)



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-345. Plating Area - Faceplate (T53-L-13B, -703).

(4) Chrome-plate faceplate to required thickness as follows: (See figure 5-345.)

(a) Chrome-plate as outlined in SP No. 6014 in Appendix E. Required plate thickness is 0.002 to 0.010 inch (0.005 to 0.025 cm) after final grind. Bake at 365° to 385°F (185° to 196°C) for 3 hours. Refinish to given dimensions.

(b) After replating, lightly polish chromed face, using mixture of light machine oil (item 200, table C–1) and valve grinding compound (item 339, table C–1) until surface finish is 4 RMS or better.

(5) After polishing, using monolight and optical plate tester, inspect flatness of chrome plate. Surface A (figure 5-345) must be flat within three helium light bands.

(6) Check parallelism (figure 5-345).

(7) Handle plate as little as possible. Place in plastic bag until ready for reassembly.

j. Repair liner (31, figure 5-333) as follows: (See figure 5-346.)

(1) Repair worn or scored 3.9370 to 3.9374 inch (10.0000 to 10.0010 cm) diameter, where up to 0.010 inch (0.025 cm) maximum plate thickness is required, by chrome plating; or where up to 0.015 inch (0.038 cm) buildup is required, by plasma flame spraying.

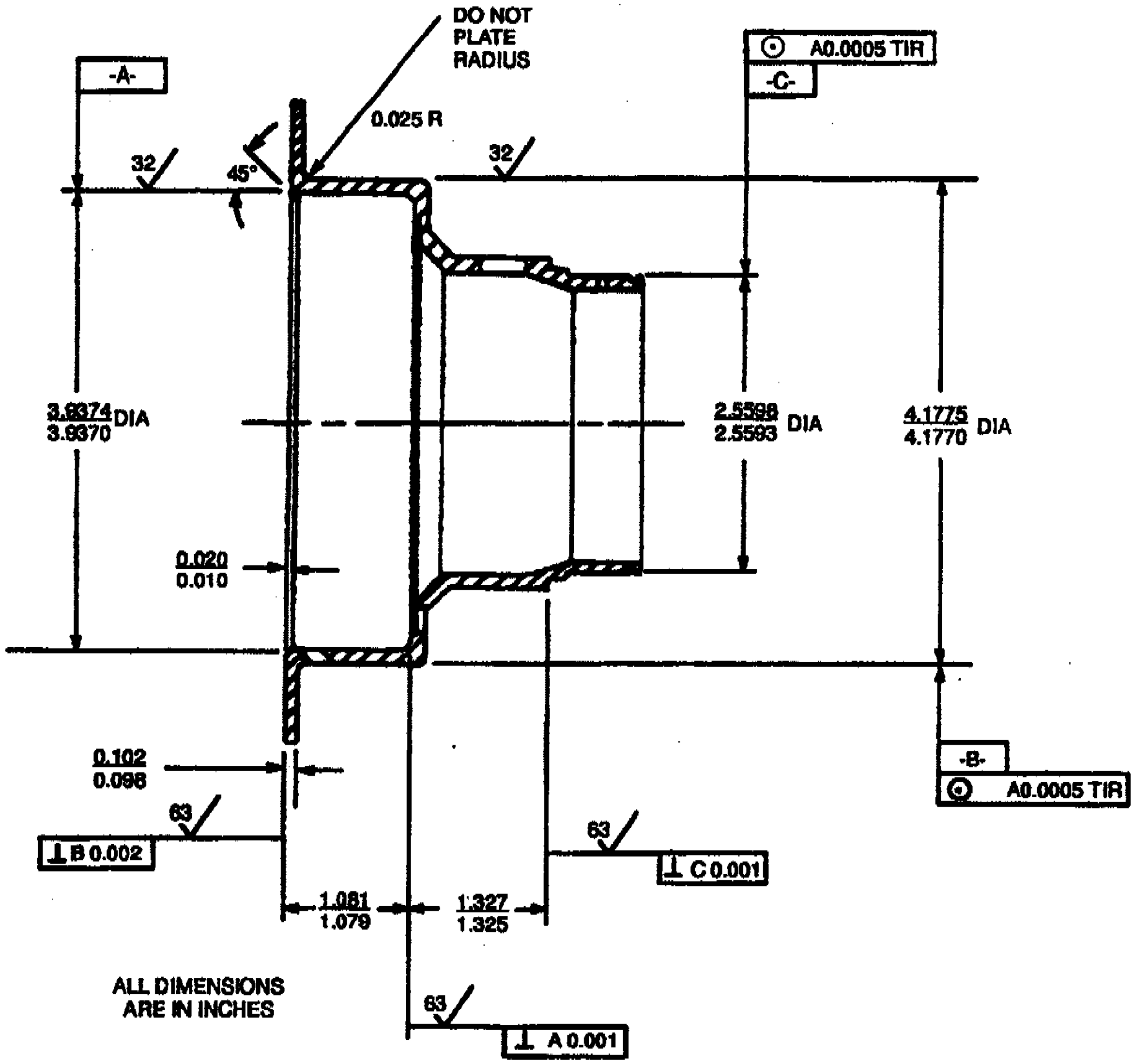


Figure 5-346. Bearing Support Liner - Repair Area (English).

(a) Repair liner by chrome plating as follows:

1 Machine, if necessary, to obtain a 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final machining.

2 Chrome-plate as outlined in SP No. 6014 in Appendix E.

3 Bake at 365° to 385°F (185° to 186°C) for 3 hours.

4 Machine to given dimensions.

NOTE

The 3.9370 to 3.9374 inch (10.0000 to 10.0010 cm) diameter must be free of material buildup.

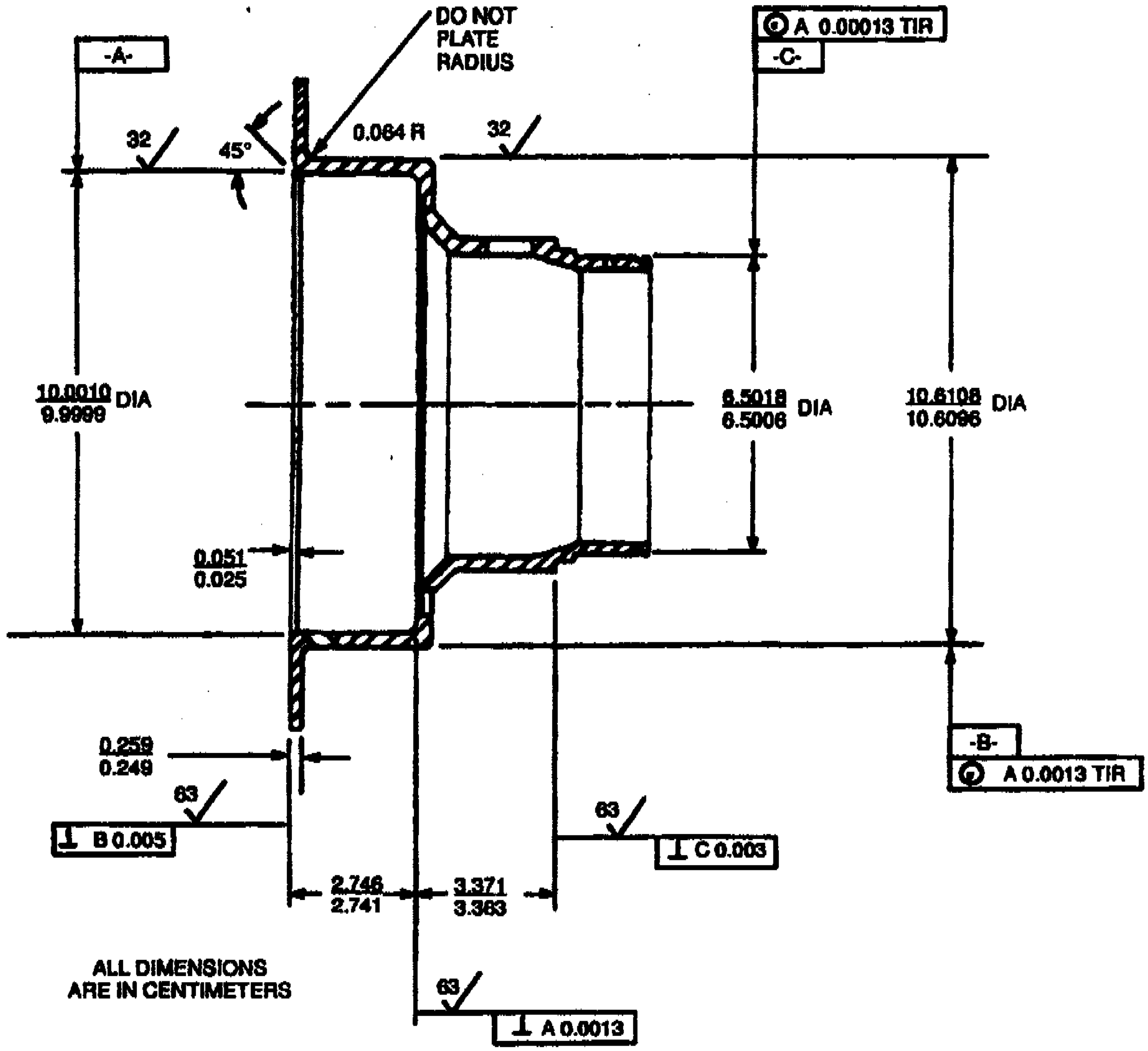


Figure 5-347. Bearing Support Liner - Repair Area (Metric).

(b) Repair liner by flame spraying as follows:

1 Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup thickness after final machining.

2 Flame-spray liner, using molybdenum powder (item 219, table C–1). (Refer to SP No. 5006 in Appendix E.)

3 Machine to given dimensions.

NOTE

The 3.9370 to 3.9374 inch (10.0000 to 10.0010 cm) diameter must be free of material buildup.

(2) Repair worn or scored 1.079 to 1.081 inch (2.741 to 2.746 cm) dimensions, where up to 0.015 inch (0.038 cm) maximum plate thickness is required, by chrome plating or plasma flame spraying.

NOTE

This repair is not mandatory unless repair of bearing pinch dimension is required.

(a) Repair liner by chrome plating as follows:

1 Machine, if necessary, to obtain 0.002 to 0.010 inch (0.008 to 0.025 cm) plate thickness after final machining.

NOTE

The 1.079 to 1.081 inch (2.741 to 2.746 cm) diameter must be free of material buildup.

2 Chrome plate as outlined in SP No. 6014 in Appendix E.

3 Bake at 365° to 385°F (185° to 196°C) for 3 hours.

4 Machine to given dimensions.

(b) Repair liner by flame spraying as follows:

1 Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup thickness after final machining.

NOTE

The 1.079 to 1.081 inch (2.741 to 2.746 cm) diameter must be free of material buildup.

2 Flame-spray liner using molybdenum powder (item 219, table C–1). (Refer to SP No. 5006 in Appendix E.)

3 Machine to given dimensions.

(3) Repair worn 4.1770 to 4.1775 inch (10.6096 to 10.6109 cm) diameter, where up to 0.010 inch (0.025 cm) maximum plate thickness is required, by chrome plating; or where up to 0.015 inch (0.038 cm) buildup is required, by plasma flame spraying.

(a) Repair liner by chrome plating as follows:

1 Machine, if necessary, to obtain 0.002 to 0.010 inch (0.005 to 0.025) plate thickness after final machining.

NOTE

The 4.1770 to 4.1775 inch (10.6096 to 10.6109 cm) diameter must be free of material buildup.

2 Chrome plate as outlined in SP No. 6014 in Appendix E.

3 Bake at 365° to 385°F (185° to 196°C) for 3 hours.

4 Machine to given dimensions.

(b) Repair liner by flame spraying as follows:

1 Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup thickness after final machining.

NOTE

The 4.1770 to 4.1775 inch (10.6096 to 10.6109 cm) diameter must be free of material buildup.

2 Flame-spray liner, using molybdenum powder (item 219, table C–1). (Refer to SP No. 5006 in Appendix E).

3 Machine to given dimensions.

(4) Repair worn 1.325 to 1.327 inch (3.366 to 3.371 cm) dimension, where up to 0.015 inch (0.038 cm) maximum plate thickness is required, by chrome plating or plasma flame spraying.

(a) Repair liner by chrome plating as follows:

1 Machine, if necessary, to obtain a 0.002 to 0.015 inch (0.005 to 0.038 cm) plate thickness after final machining.

2 Chrome-plate as outlined in SP No. 6014 in Appendix E.

3 Bake at 365 to 385°F (185 to 196°C) for 3 hours.

4 Machine to given dimensions.

(b) Repair liner by flame-spraying as follows:

1 Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup thickness after final machining.

2 Plasma flame-spray liner using molybdenum powder (item 219, table C-1). (Refer to SP No. 5006 in Appendix E.)

3 Machine to given dimensions.

(5) Repair worn 0.098 to 0.102 inch (0.249 to 0.259 cm) dimension, where up to 0.010 inch (0.025 cm) maximum plate thickness is required, by chrome-plating, or where up to 0.015 inch (0.038 cm) buildup is required, by flame-spraying.

(a) Repair liner by chrome-plating as follows:

1 Machine, if necessary, to obtain 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final machining.

2 Chrome plate as outlined in SP No. 6014 in Appendix E.

3 Bake at 365 to 385°F (185 to 196°C) for 3 hours.

4 Machine to given dimensions.

(b) Repair liner by flame-spraying as follows:

1 Machine, if necessary, to obtain 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup thickness after final machining.

2 Flame-spray liner using molybdenum powder (item 219, table C-1). (Refer to SP No. 5006 in Appendix E.)

3 Machine to given dimensions.

(6) Add a 0.010 to 0.020 inch (0.025 to 0.051 cm) by 45 degrees chamfer to the 3.9370 to 3.9374 inches (10.0000 to 10.0010 cm) diameter surface. (See figure 5-346.)

k. Repair nicks, gouges, or grooves on front face of front cover housing assembly (49, figure 5-33 or 44, figure 5-333A) as follows:

(1) Mask housing and sand blast the area to be repaired.

(2) Within 30 minutes after sand blasting, touch up area in accordance with MIL-M-3171, Type VI, and apply epoxy putty (item 149, table C-1). Air cure for 24 hours.

(3) Machine flat in accordance with figure 5-348.

(4) Touch up bare metal in accordance with MIL-M-3171, Type VI.

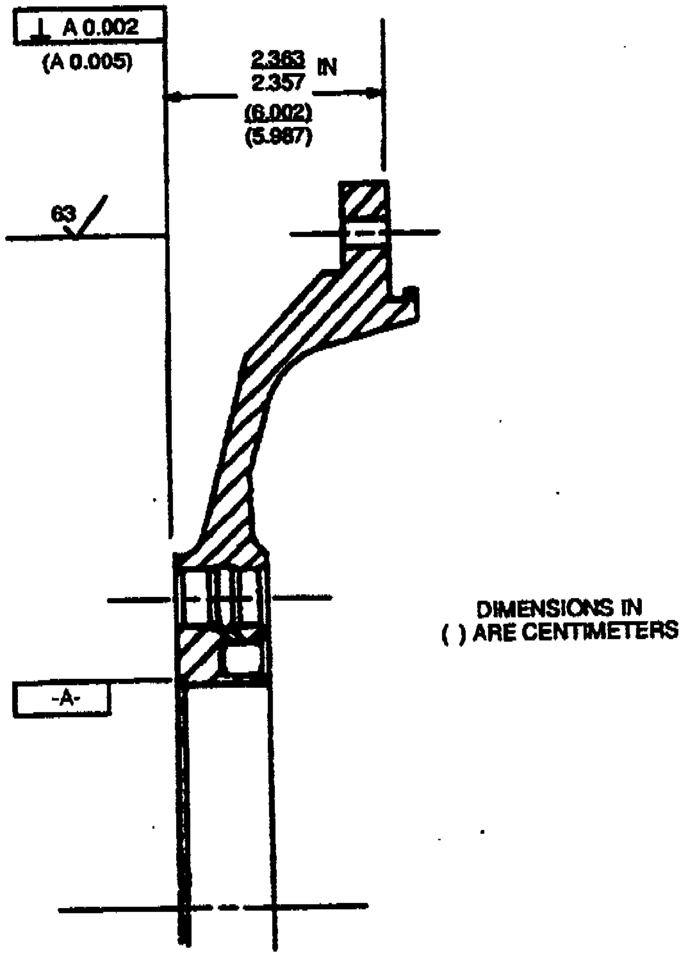


Figure 5-348. Rework of Front Cover Housing Assembly Front Face.

l. Repair scoring or grooving in oil transfer tube holes in front cover housing assembly (49, figure 5-333) that exceeds 0.005 inch (0.013 cm) in depth as follows:

(1) Using crocus cloth (item 125, table C–1) blend out all sharp edges.

(2) Touch up reworked areas as outlined in SP No. 6027 in Appendix E.

m. Repair minor corrosion pitting on front cover housing assembly (49) as follows:

(1) Remove corrosion as outlined in SP No. 6028 in Appendix E.

(2) Refinish front cover housing assembly as outlined in SP No. 6021 or 6028 in Appendix E, depending upon particular area surface requirements.

n. Repair corrosion pitting on front cover housing assembly (49) as follows:

(1) Remove corrosion, and touch up front cover housing assembly as outlined in SP No. 6021 or 6028 in Appendix E.

(2) Apply epoxy putty (item 149, table C–1) to discrepant areas, and cure immediately at 200°F (93°C) for 3 hours.

(3) Finish to original contour.

o. When pressure checking sleeve repaired housing, inspect for leakage at the sleeve to cover interface. If leakage is evident, repair as follows:

(1) Remove steel sleeve by boring 4.250 to 4.251 diameter through cover. Ensure 100% cleanup is achieved.

(2) Fluorescent penetrant inspect for cracks; none are allowed.

(3) Manufacture a replacement steel sleeve from AMS6381or AMS638a (refer to figure 5-349 (Sheet 1 of 3).)

(4) Apply black oxide coating to sleeve and dichromate touchup cover (refer to Appendix E).

(5) Apply Loctite Primer "T" or equivalent to cover bore and O.D. of sleeve.

(6) After allowing 5 to 10 minutes for evaporation of primer, apply Loctite RC/620 (item 186, table C–1) to O.D. of sleeve. Press install sleeve while still wet. Allow at least four hours for curing of Loctite before proceeding with step (7), or bake at 200°F for 1 hour.

(7) Drill three lockpin holes as shown in figure 5-349(Sheet 2 of 3).

(8) Press install lockpins (MS9105-03) until bottomed.

(9) Machine sleeve flush with surface "B" and if necessary with surface "A". Refer to figure 5-349 (Sheet 2 of 3).

(10) Machine finish 4.1770 to 4.1780 diameter bore, 4.368 to 4.358 diameter counterbore, and five 0.123 to 0.128 diameter holes as shown in figure 5-349 (Sheet 3 of 3).

(11) If necessary, dichromate touch-up per Appendix E.

(12) Repeat overhaul inspection in accordance with DMWR instructions.

p. Rework face plate area of output helical gearshaft (51) to restore runout as follows: (Refer to figure 5-350.)

(1) Grind faceplate area until runout is 0.001 inch (0.003 cm) TIR.

(2) The 1.352 to 1.350 inch (3.434 to 3.429 cm) dimension shall not be reduced to less than 1.345 inch (3.416 cm).

(3) Regrind only as required to clean up faceplate area surface.

WARNING

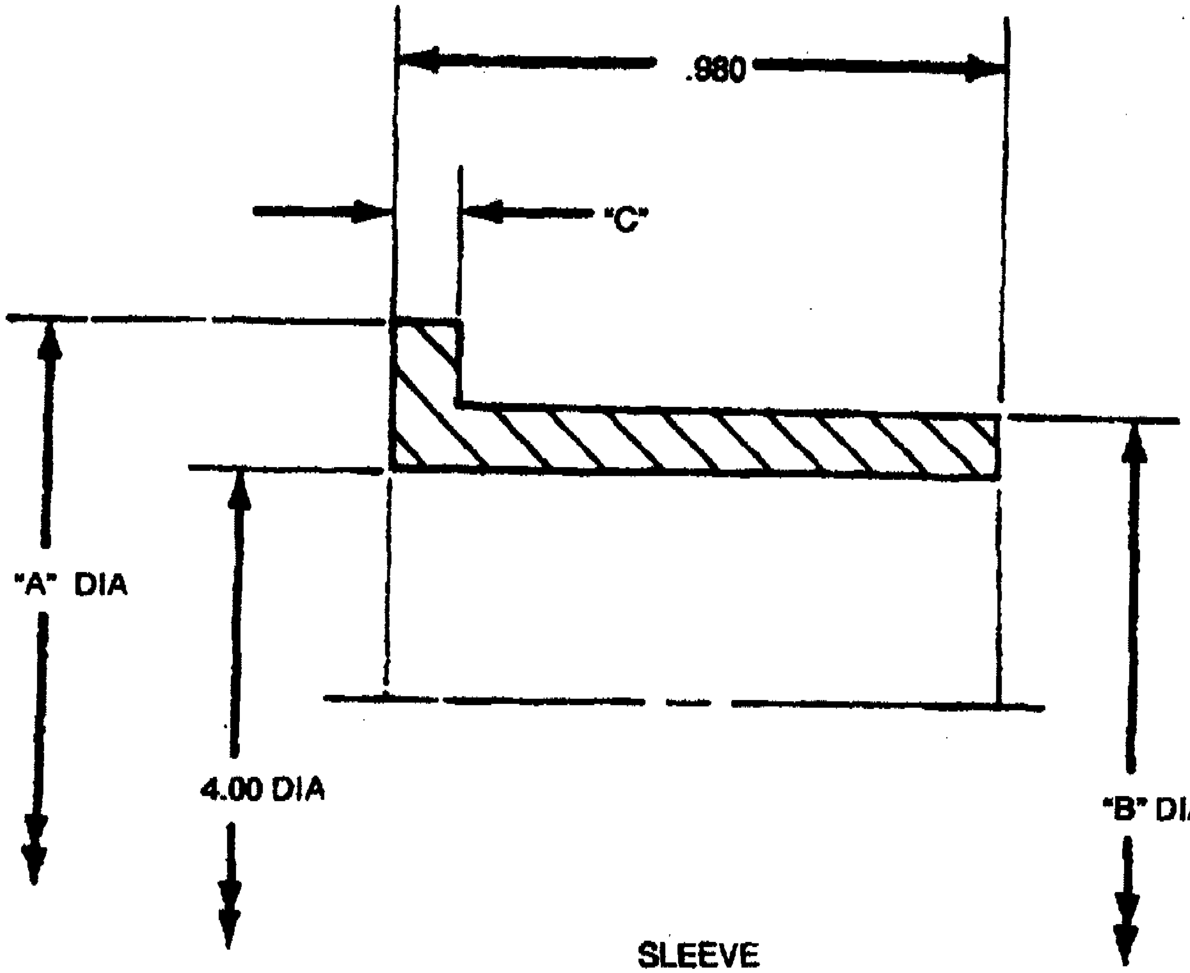
FLIGHT SAFETY PART

Dimensional inspection after the following repair is flight safety critical.

q. Chrome-plate fretted, scored, or loss of plate on 3.5423 to 3.5429 inch (8.9975 to 8.9990 cm) diameter of output helical gearshaft (51, figure 5-333). (Refer to figure 5-350.)

(1) Grind diameter to obtain a 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final grind.

(2) Chrome-plate as outlined in SP No. 6014 in Appendix E.

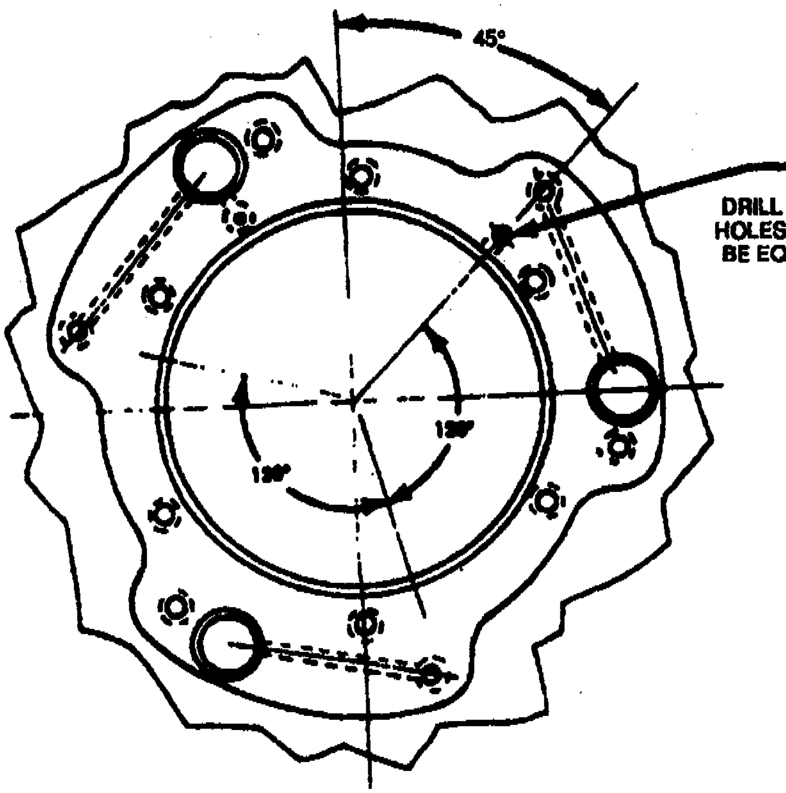


"A" DIAMETER TO PROVIDE .000 - .001 LOOSE FIT WITH 4.458 - 4.468 COUNTERBORE IN COVER

"B" DIAMETER TO PROVIDE .006 - .008 TIGHT FIT WITH 4.250 - 4.251 BORE DIAMETER

"C" DIMENSION IS NOT MANDATORY BUT SHALL PROVIDE FOR FLUSH FIT WITH COVER SURFACE "A" (REFER TO FIG. 5-349 SHEET 2 OF 3)

Figure 5-349. Housing Assembly, Front Cover (P/N 1-030-390-05) (Sheet 1 of 3).



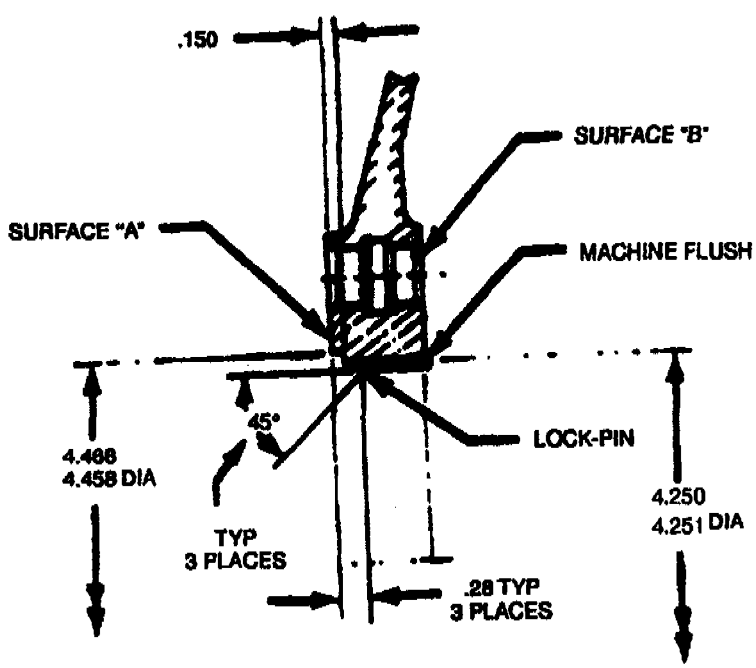
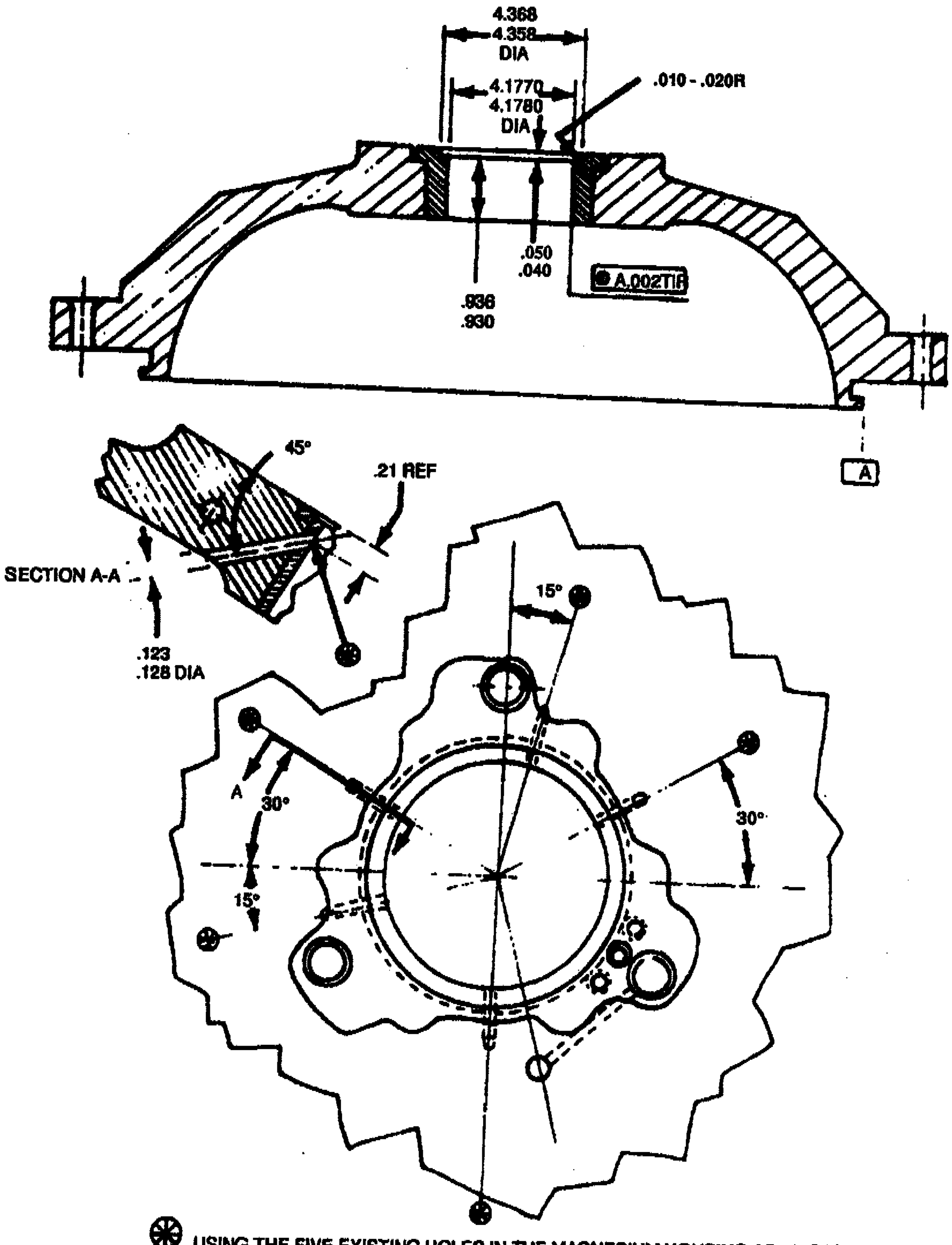


Figure 5-349 Housing Assembly, Front Cover (P/N 1-030-390-05) (Sheet 2 of 3).



USING THE FIVE EXISTING HOLES IN THE MAGNESIUM HOUSING AS PILOTS, RE-DRILL THE .123 - .128 DIAMETER HOLES THROUGH THE STEEL SLEEVE AS SHOWN.

Figure 5-349 Housing Assembly, Front Cover (P/N 1-030-390-05) (Sheet 3 of 3).

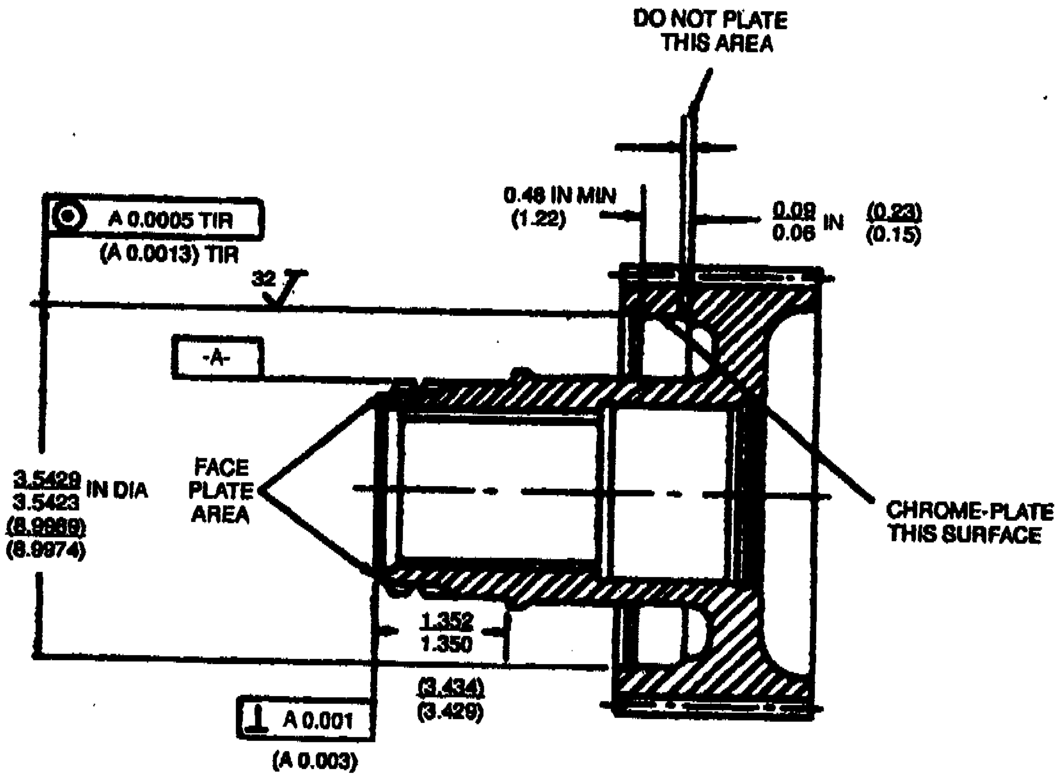


Figure 5-350. Plating Area - Output Helical Gearshaft (T53-L-13B, -703).

(3) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Grind to dimensions given.

r. Repair cracked or chipped forward and aft internal splines of gearshaft (51, figure 5-333) as follows:

(1) Grind teeth only the minimum amount required to remove nicks. Round edges 0.005 to 0.015 inch (0.013 to 0.038 cm) radius. Hand stoning of nicks is permitted. (See figure 5-351.)

(2) Reworked surfaces are to be polished to 32 micro-inches.

WARNING

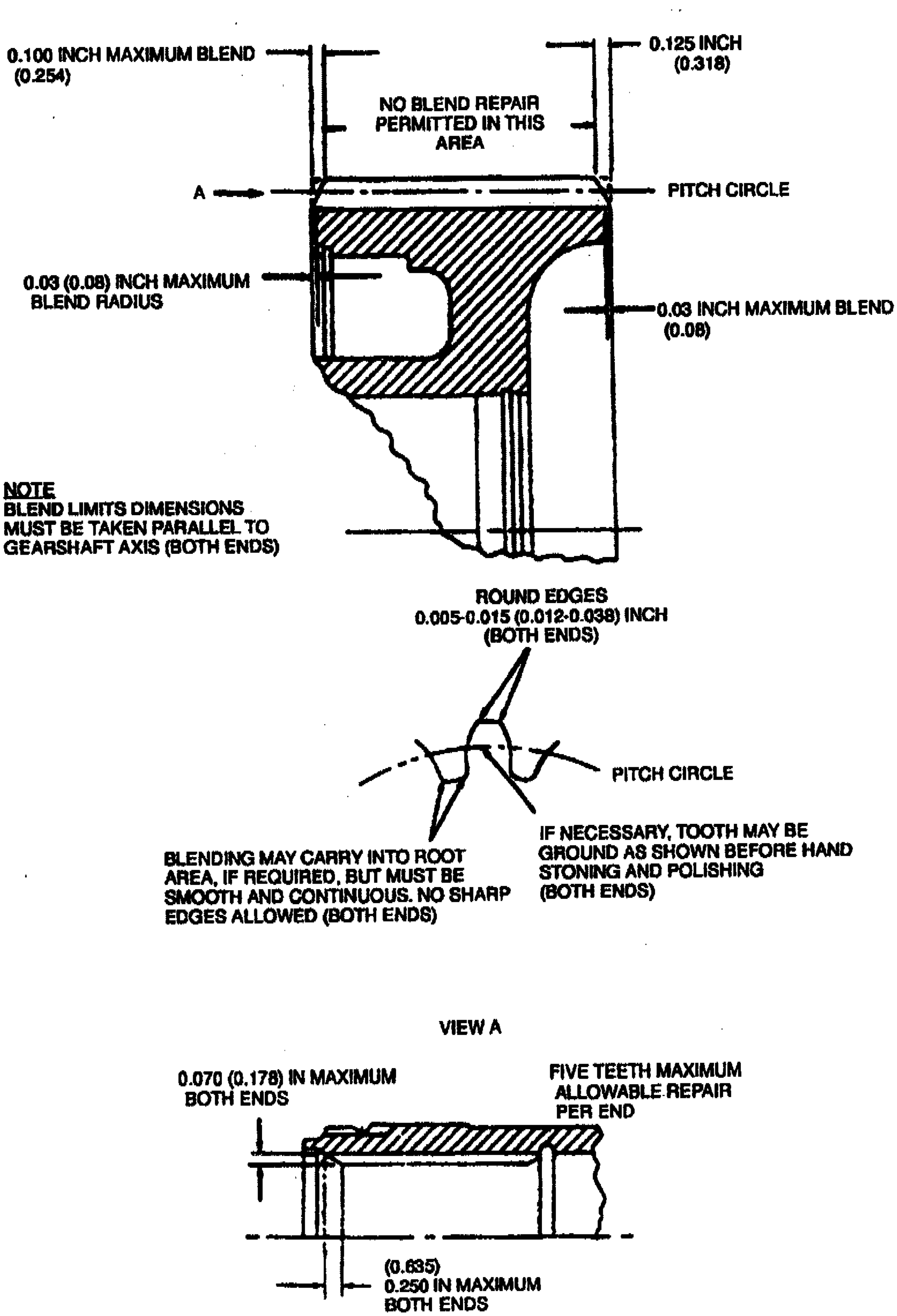
FLIGHT SAFETY PART

Magnetic particle inspection is flight safety critical.

(3) Perform magnetic-particle inspection on gearshaft (Refer to table 5-114.)

(4) Ultrasonically clean gearshaft. (Refer to SP No. 3009 in Appendix E.)

(5) Touch up black oxide coating as required. (Refer to SP No. 6002 in Appendix E.)



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-351. Helical Output Gearshaft- Repair Limits (T53-L-13B, -703).

s. Repair nicks or chipping on gearshaft (1-030-191-05) (51, figure 5-333) as follows:

NOTE

Do not repair gear that exhibits pitting or spalling at either end of teeth.

(1) Grind damaged teeth only the minimum amount required to remove nicks or chipping. (Refer to figure 5-351 for repair limits.) Hand-stoning of nicks is permitted.

CAUTION

In following step (2), sharp edges are not allowed.

NOTE

Blending may carry into root area, if required, but must be smooth and continuous. Blend repairs within the specified limits but showing overlap into mating gear contact pattern is not acceptable. Gears having this condition shall be rejected.

(2) Rework surfaces are to be polished to 32 micro-inches.

WARNING

FLIGHT SAFETY PART

Magnetic particle inspection is flight safety critical.

(3) Perform magnetic-particle inspection on gearshaft. (Refer to table 5-114.)

(4) Ultrasonically clean gearshaft. (Refer to SP No. 3009 in Appendix E.)

(5) Touch up black oxide coating, as required. (Refer to SP No. 6002 in Appendix E.)

5-342. REASSEMBLY. Proceed as follows:

NOTE

During reassembly, note the bearing and gear positions by position numbers. Position carrier and matchmarks so that the gear adjacent to the marks is at the top, looking forward. Positions will then be one-through-three counter-clockwise, with position one at the top. Ensure that the rear torquemeter plate (34, figure 5-333), rear carrier (3), and front carrier (46) have the same serial number.

a. Install packing (40) on fitting (39) and install in front cover housing assembly (49). Secure with bolts (38). Tighten bolts, as required, and lockwire.

CAUTION

During reassembly, ensure that the inner and outer races of bearings are not intermixed.

NOTE

If bearings that were removed are to be reused, install bearings into the same bores from which they were removed, and note positon numbers.

b. Using removing tool (LTCT2086), tap outer races of roller bearings (12) into front carrier (46) in the same positions from which they were removed.

c. Position packing (30) on liner (31). Using a soft-faced mallet, tap liner (31) into front cover housing assembly (49), aligning bolt holes in front cover housing assembly (49) and liner (31).

d. Position front carrier (46) on bench with bearing bosses up. Position bolts (42) through ball retainers (41) and front carrier (46). Secure bolts (42) with snaprings (36).

e. Position front cover housing assembly (49), face down, on a clean surface. Install packing (48) in groove of front cover housing assembly (49). Invert front carrier and place on front cover housing assembly (49). Position front carrier so that fitting (39) is between bearing boss numbers 1 and 3. Install torquemeter plate assembly (47) in front cover housing assembly (49). Align the three screw holes in front cover housing assembly (49) with three countersunk screw holes in the torquemeter plate assembly. Secure with screws (37). Tighten screws (37) as required.

CAUTION

To prevent damage to surface of balls, use extreme care when handling the balls.

f. Place the torquemeter balls (35) in their respective sockets.

g. Position rear plate (34) over torquemeter balls (35) and bolts (42). Lubricate nuts (33) using lubricant dry film (item 48, table C–1) and install on bolts (42). Tighten nuts (53), as required, and lockwire.

CAUTION

If removed gearshafts (11, 51) are to be reused, ensure that gearshafts (11, 51) have been maintained as a matched set.

h. Position output gearshaft (46) with the gear up.

NOTE

Tooth space identified by radial marks on consecutive teeth is to be counted as number one space, each time.

h1. Mark every 19th tooth space with yellow opaque ink No. 9 (item 234, table C–1 or equivalent). Identified tooth spaces shall be 120 degrees apart. Mark tooth spaces number 1, 2, and 3 counterclockwise with yellow ink.

NOTE

Remove any excess lubricant dry film that may protrude and be exposed to lubrication system. Small areas of residual film are acceptable.

i. Using sleeve bushing (LTCT3664) and arbor press, press outer race of bearing (29) into gearshaft (51) and secure with retaining ring (52).

j. Using sleeve bushing (LTCT3663) and arbor press, press inner race of bearing (29) onto liner (31) and secure with retaining ring (28).

k. Support gearshaft (51) on arbor press base with a suitable sleeve. Position front cover and carrier assembly over gearshaft (51). Ensure that bearing inner and outer races are properly engaged.

l. Install spacer (27) onto gearshaft (51).

m. Using sleeve bushing (LTCT3661) and arbor press, start rear inner race of ball bearing (26) on gearshaft. Then install outer race, ball, and forward inner race of ball bearing (26). Using arbor press and sleeve bushing (LTCT3661), press ball bearing (26) onto gearshaft until ball bearing (26) is seated.

CAUTION

In following step n, when deforming cup into nut, do not shear cup.

n. Position front cover and carrier assembly, front cover up, on holding fixture (LTCT496). Lubricate nut (24) with lubricating oil (item 189, or 190, table C–1). Install locking cup (25) and nut (24), using wrench (LTCT4190). Tighten nut to 200 - 225 pound-feet (297.632 - 334.836 Kg/m) torque. Lock nut by deforming cup in two places into the slots of nut, 180 degrees apart.

o. Place packing (18) in ID of oil seal retainer (17). Using installation tool (LTCT3638), press seal (19) into retainer.

p. Calculate thickness of spacer (21) as follows:

CAUTION

Ensure bearing outer race is bottomed in liner.

(1) Using a depth micrometer, measure from face of bearing liner to bearing outer race and determine dimension A. (Refer to figure 5-352.)

(2) Using depth micrometer, measure from lip to rear surface of seal housing flange to determine dimension B.

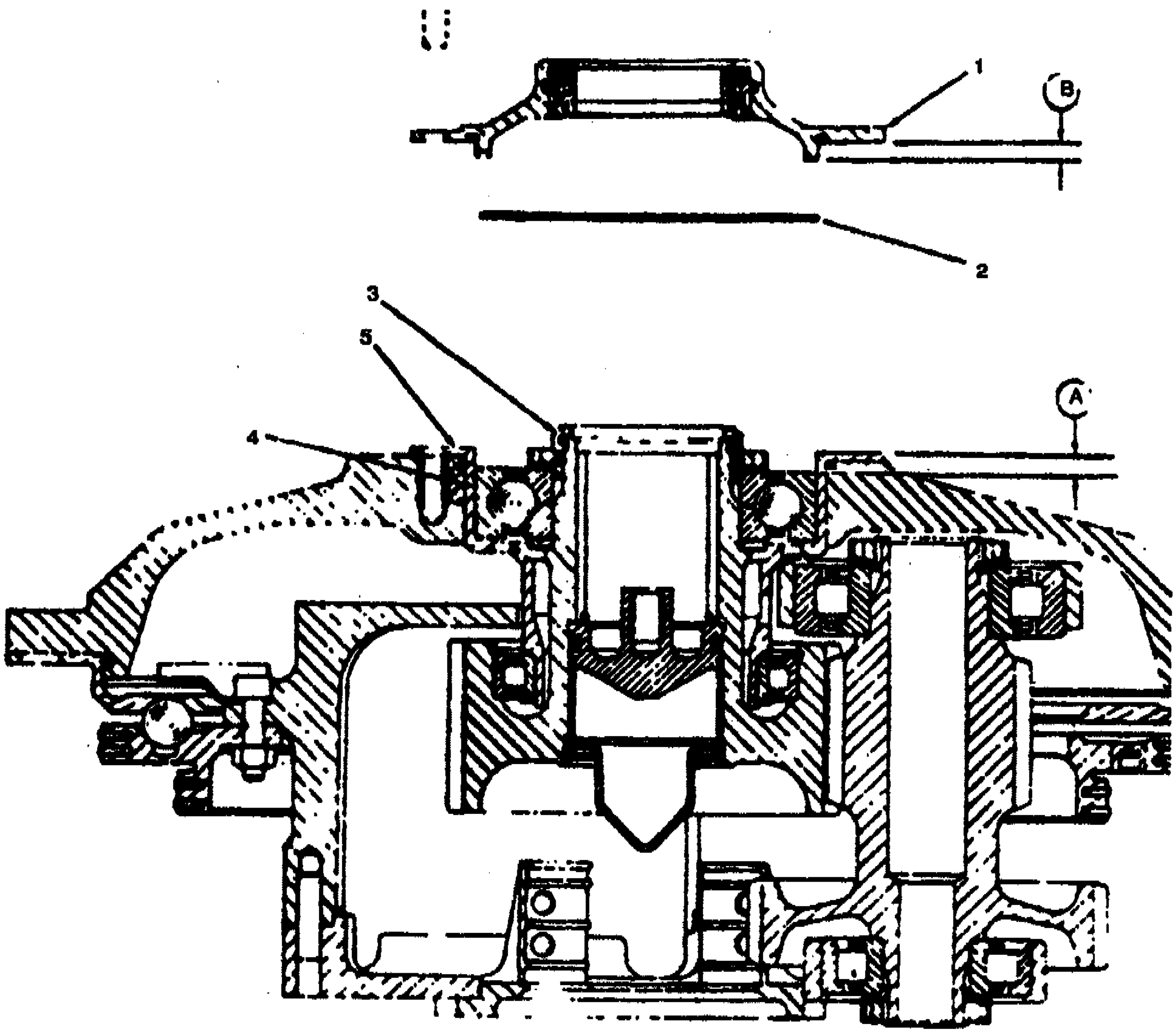
(3) Subtract dimension B from dimension A and add 0.003 to 0.006 inch (0.008 to 0.015 cm). Result will be thickness of spacer desired. Select proper spacer part number from table 5-118.

q. Place spacer (21, figure 5-333), of thickness determined in preceding step p(3), against outer race of ball bearing (26).

r. Place packing (20) on OD of seal housing and retainer assembly (16).

s. Install packing (23) in ID of faceplate (22), and reinstall faceplate on gearshaft (51).

t. Lubricate seal (19) with lubricating oil (item 189, or 190, table C–1). Install seal housing and retainer assembly (16) on front cover assembly, and secure with bolts (15). Tighten bolts, as required, and lockwire.



1. SEAL HOUSING
2. SPACER
3. PLATE
4. BEARING
5. LINER

Figure 5-352. Determining Bearing Pinch Fit and Spacer Thickness (T53-L-13B, -703) .

Table 5-118. Spacer Thickness.

Part Number	Shim Thickness
1-030-212-01	0.035 to 0.037 inch (0.089) (0.094)
1-030-212-02	0.038 to 0.040 inch (0.097) (0.102)
1-030-212-03	0.041 to 0.043 inch (0.104) (0.109)
1-030-212-04	0.044 to 0.046 inch (0.112) (0.117)
DIMENSIONS IN ( ) ARE CENTIMETERS	

u. Position the rear face of helical gearshaft (51) upward, install new packing (45) on gearshaft plug (44), position gearshaft plug into gearshaft bore with threaded hole end down and press into position, ensuring that plug engages into splines. Secure with retaining ring (43).

NOTE

Any three planetary gears FSCM 57152, Serial Numbers A001 through A790 may be matched with each other in a set, but cannot be used with any other planetary gears. If any mixed assemblies are received, the gears and associated bearings are not acceptable for re-use.

Planetary gears with FSCM 07749 shall be removed from service and are not acceptable for use.

v. Reassemble each planetary gear assembly (8) as follows:

NOTE

Tag gearshaft assemblies to position numbers. If same gearshafts (11) that were removed are to be reused, they will be reinstalled into same positions from which they were removed.

(1) Using sleeve bushing (LTCT3658) and arbor press, press inner race of roller bearing (12) onto gearshaft (11).

NOTE

Ensure that serial number of bearing inner race matches those of the outer race.

(2) Using sleeve bushing (LTCT3660) and arbor press, press inner race of roller bearing (7) onto gearshaft (11). Record serial number and position.

(3) Place gearshaft (11) in ring assembly (LTCT4019, used in conjunction with LTCT4018), small diameter gear up.

NOTE

In following step (4), do not shear cup when deforming it.

(4) Lubricate threads on gear with lubricating oil (item 188, table C–1). Install locking cup (13) and nut (14). Using wrench (LTCT2080), tighten nut to 975 to 1000 pound-inches (174135 to 178600 gm/cm) torque. Deform cup into gear at two places, 180° apart.

(5) Invert gear assembly in holder.

(6) Using sleeve bushing LTCT 3660 and arbor press, press inner row of roller bearing (7) onto gearshaft (11).

NOTE

In following step (6), do not shear cup when deforming it.

(7) Lubricate threads on gear with lubricating oil (item 188, table C-1). Install cup (10) and nut (9). Using wrench (LTCT2079), tighten nut (9) to 975 to 1000 pound-inches (174135 to 178600 gm/cm) torque. Deform cup (10) into gear at two places, 180 degrees apart.

(8) Repeat preceding step v.(1) through (6) for remaining two gearshaft assemblies.

w. Identify gearshaft assemblies for timing as follows:

(1) Position number one gearshaft assembly so the smaller diameter gear is up.

(2) Locate number one tooth. Number one tooth will be identified by a radial scribe mark on face of tooth. Paint number one tooth with yellow opaque ink No. 9 (item 234, table C-1 or equivalent).

(3) Position number two gearshaft assembly so the smaller diameter gear is up.

(4) Locate number one tooth. Counting the number one tooth as one, count clockwise to tooth number ten. Paint number ten tooth with yellow opaque ink No. 9 (item 234, table C-1 or equivalent).

(5) Position number three gearshaft assembly so the smaller diameter gear is up.

(6) Locate number one tooth. Counting the number one tooth as one, count counterclockwise to tooth number ten. Paint number ten tooth with yellow opaque ink No. 9 (item 234, table C-1 or equivalent).

x. Position output reduction carrier and gear assembly so the number two tooth will be at 8 o'clock and the number three position will be at 4 o'clock.

y. Position number one gearshaft assembly into number one position. Ensure that tooth indicated with yellow paint is meshed between two teeth of gearshaft (51) that have the painted marks.

z. Repeat preceding step w for position two and three gearshaft assemblies.

NOTE

Ensure that the serial number of the bearing outer race matches those of the inner race.

aa. Using sleeve bushing (LTCT3661) and arbor press, press outer races of bearings (7) into their proper positions.

ab. Install oil deflector (6) into rear carrier (3) and secure with three tabwashers (2) and six bolts (1). Tighten bolts (1), as required, and secure by bending tabs of tabwashers (2).

ac. Carefully position rear carrier (3) over gearshaft assemblies. Ensure that the matchmarks on the front and rear carrier (3) align. Secure with bolt (5) and washers (4). Tighten bolts (5) to 155 to 165 pound-inches (27683 to 29469 gm cm) torque.

ad. Position dial indicator on nut (9). Push gearshaft assembly as far forward as it will go. Set dial indicator to zero. Pull up on gearshaft assembly until all end play has been used. End play shall be within 0.013 to 0.048 inch (0.033 to 0.122 cm) for each assembly.

ae. Using gear alignment fixture (LTCT4560), check gears for correct timing. If gear alignment fixture does not mesh smoothly with gears, reset timing. Check for clearance between deflector (6) and gearshaft (11).

af. Lockwire bolts (5).

ag. Install seal rings (11, 12, figure 4-39).

ah. Pressure-check the output reduction carrier and gear assembly as follows:

NOTE

This check is an optional requirement. If check is performed, it shall not be used as a criteria for rejection.

(1) Position packing (10) around output reduction carrier and gear assembly and place into test fixture (LTCT2029). Secure with bolts, nuts, and washers.

(2) Install dummy oil transfer tubes in front cover.

(3) Apply lubricating oil (item 189 or 190, table C–1) to sealing surfaces, and apply 15 to 20 psi (1055 to 1406 gm sq cm) air pressure to fixture. No leakage is allowed.

NOTE

It may be necessary to rotate gearshaft (51, figure 5-333) a few revolutions to seat seal (19).

(4) Release air pressure, and remove output reduction carrier and gear assembly from test fixture. Remove packing and dummy oil transfer tubes.

ai. Buildup oil transfer support assembly, (refer to paragraph 5-350).

aj. Check oil flow of output reduction carrier and gear assembly as follows:

NOTE

This check is an optional requirement. If check is performed, it shall not be used as a criteria for rejection.

(1) Install packings (4 and 5, figure 4-39) on oil transfer tubes (3).

(2) Install oil transfer tubes through front cover and secure with bolts (1) and tabwashers (2).

(3) Install suitable test fixture on oil transfer support assembly.

(4) Place output reduction carrier and gear assembly, face down, in oil flow check stand (LTCT313), or equivalent.

(5) Install oil transfer support assembly on the three oil transfer tubes, and connect oil supply line.

(6) Set test stand pressure at 58 to 62 psig (4078 to 4359 on sq cm) and oil temperatures at 90° to 110°F (32° to 43°C). The indicated oil flow shall be within 1900 to 2300 phr (item 190, table C–1) or 1805-2188 phr (item 189, table C–1).

(7) Disconnect oil flow check stand. Remove test fixture. Remove oil transfer support assembly and oil transfer tubes.

5-343. FUNCTIONAL TEST OF OUTPUT REDUCTION CARRIER, GEAR ASSEMBLY AND OIL TRANSFER TUBE (T53-L-13B, -703). (See figure 4-39.) Proceed as follows:

a. Oil flow limits. The indicated oil flow (with transfer tubes installed) on reduction carrier and gear assembly, shall be within 1805 to 2188 phr (item 189, table C–1), or 1900-2300 phr (item 190, table C–1) at a pressure of 58 to 62 psig (4077.8 to 4359.0 gm sq cm) and oil temperature of 90° to 110°F (32.2°C to 43.3°C).

NOTE

Check rear of test stand (LTCT422), or equivalent, for proper internal test connections. (See figure 5-353.) Perform the following test, using lubricating oil (item 189 or 190, table C–1.)

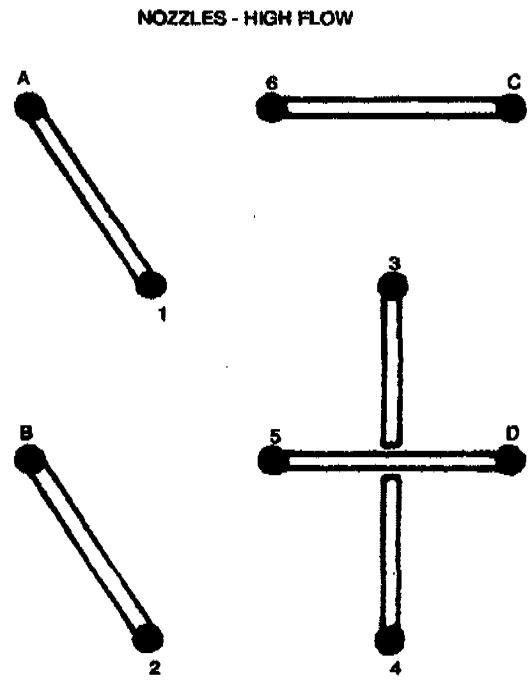


Figure 5-353. Internal Connections for Test Stand (T53-L-13B, -703).

b. Mount test fixture (LTCT2052) to test stand (LTCT422), or equivalent, and secure with screws. (See figure 5-354.)

c. Connect hose between MAIN ELEMENT INLET port on test stand and holding fixture connector.

d. Connect hose from top of pressure gage on holding fixture to MAIN ELEMENT DISCHARGE PRESSURE gage.

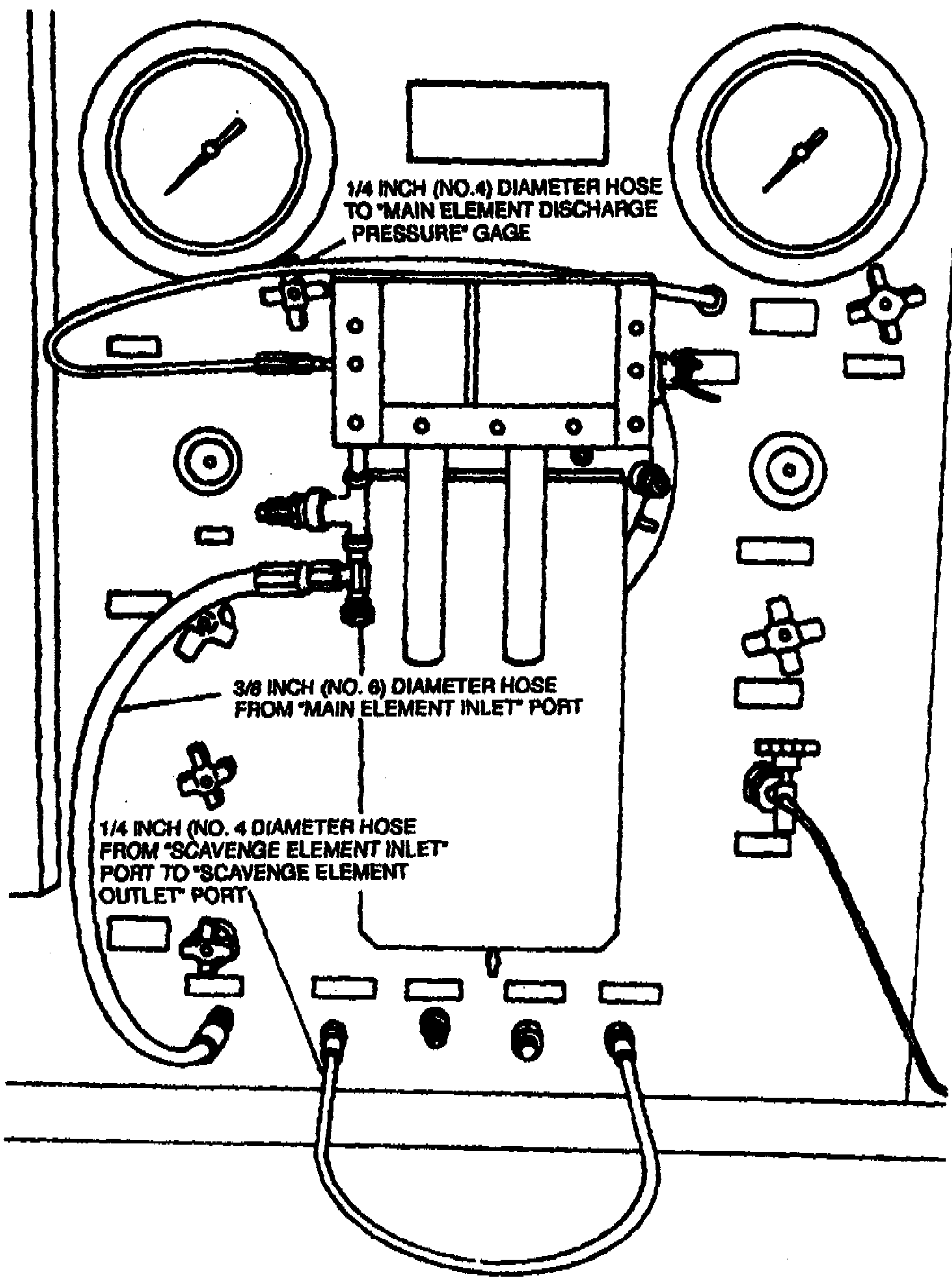


Figure 5-354. Oil Transfer Tube Test Setup (T53-L-13B, -703).

e. Remove oil transfer tube (3) and install new packings (4 and 5, figure 4-39); then install oil transfer tube into holding fixture (secure oil transfer tube).

f. Close all valves on scavenge side of test stand.

g. Press STAND POWER and BOOST CIRCUIT PUMP switches oil.

h. Open MAIN ELEMENT INLET THROTTLE valve, and observe that a pressure indication appears on MAIN ELEMENT DISCHARGE PRESSURE gage.

i. Adjust PUMP BYPASS VALVE until MAIN ELEMENT DISCHARGE PRESSURE gage indicates 25 psi (1758 gm sq cm).

j. Run test stand to bring temperature of test stand lubricating oil to 90° to 110°F (32° to 43°C).

k. Adjust PUMP BYPASS VALVE until MAIN ELEMENT DISCHARGE PRESSURE gage indicates 58 to 62 psi (4078 to 4359 gm sq cm).

l. Position graduated liter beakers beneath drain ports of holding fixture.

m. Permit oil from each set of two holes to drain into beakers for 20 seconds; then ensure that fluid level in beakers is within 690 to 770 cc.

NOTE

Jets may be enlarged if required (to maximum blueprint dimension).

n. If fluid level is below 690 cc, rework the sets of holes in oil transfer tube until acceptable fluid level is obtained. If fluid level exceeds 770 cc, or cannot be increased to 690 cc, reject oil transfer tube.

o. Permit flow from the single hole to drain into beaker for 20 seconds; then ensure that fluid level in beakers is within 92 to 110 cc.

p. If fluid level is below 92 cc, rework the single hole in oil transfer tube until acceptable fluid level is obtained. If fluid level exceeds 110 cc, or cannot be increased to 92 cc, reject oil transfer tube.

5-344. FUNCTIONAL TEST OF SUN GEARSHAFT (T53-L-13B,-15, and -703). Functional test is not required.

5-345. OIL TRANSFER SUPPORT ASSEMBLY (T53-L-13B, -703).

5-346. DISASSEMBLY. Proceed as follows:

a. Remove retaining ring (4, figure 5-355).

b. Using fiber drift and soft faced mallet, press sleeve (1) from support (3).

c. Remove packings (2).

5-347. CLEANING. Clean all parts by dry cleaning solvent method. (Refer to SP No. 3002 in Appendix E)

5-348. INSPECTION. Perform specific inspections listed in table 5-120.

5-349. REPAIR. Repair scoring or grooving in oil transfer tube holes in the oil transfer support that exceeds 0.005 inch (0.013 cm) in depth as follows: (See figure 5-356.)

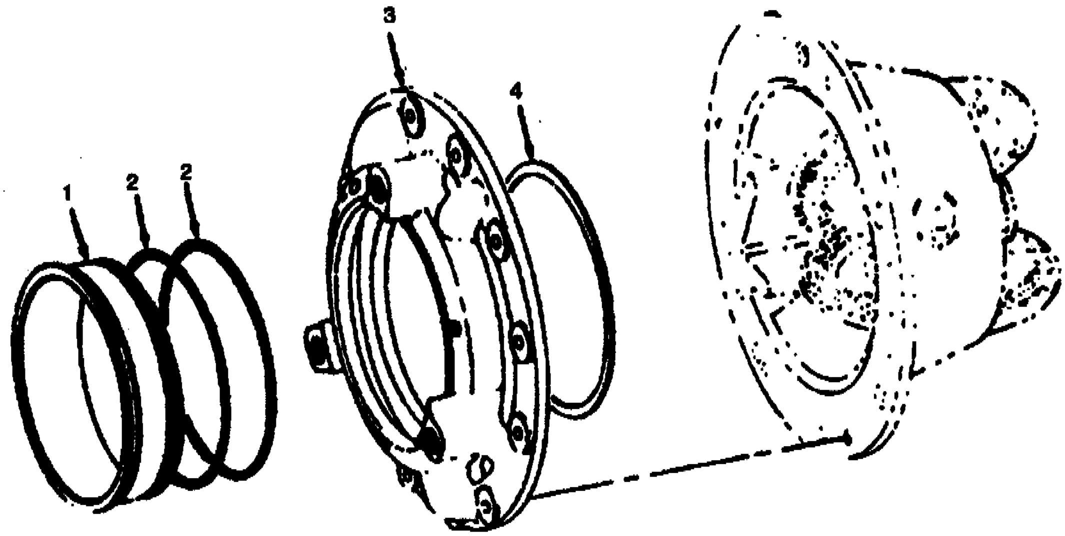


Figure 5-355. Oil Transfer Support Assembly (T53-L-13B, -703).

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-355	No Number	OIL TRANSFER SUPPORT ASSEMBLY AND RELATED PARTS (NHA 1-000-060-10 and 1-000-060-23)	Ref	A, B
	1-030-400-01	. SUPPORT ASSEMBLY, Oil Transfer	1	A, B
-1	1-030-214-01	. . SLEEVE, Seal, oil transfer	1	A, B
-2	STD3019C166	. . PACKING	2	A, B
-3	1-030-213-01	. . SUPPORT, Oil transfer	1	A, B
-4	US487L	. . RING, Retaining (80756) (Lycoming Spec Cont DWG 1-300-326-01)	1	A, B

a. Using crocus cloth (item 125, table C–1), blend out all sharp edges.

b. Touchup reworked area as outlined in SP No. 6027 in Appendix E.

5-350. REASSEMBLY. Proceed as follows:

a. Install packings (2, figure 5-355) and sleeve (1).

b. Using fiber drift and sort faced mallet, install sleeve (1) into support (3) and secure with retaining ring (4).

Table 5-119. Inspection of Oil Transfer Support Assembly (T53-L-13B, -703).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-355				
1	Sleeve	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E).
			Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-121.)	Replace if limits are not met.
3	Support	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E).
			Damaged threads	Repair or replace. (Refer to SP No 5007 in Appendix E).
			Damaged packing seating area	Not allowed. Replace.
		Visual and SIE	Scoring or grooving in oil transfer tube hole beyond 0.005 inch (0.013 cm) depth	Repair. (Refer to paragraph 5-349).
		Visual and Fluorescent-Penetrant	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-121).	Replace if limits are not met.

Table 5-120. Dimensional Inspection of Oil Transfer Support Assembly (T53-L-13B, -703).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-355								5-356
Sleeve	1	OD	5.059 (12.850)	5.060 (12.852)	5.058 (12.847)	5.060 (12.852)			A
Support	3*	OD	8.918 (22.652)	8.920 (22.657)	8.917 (22.649)	8.920 (22.657)			B
		ID	5.061 (12.855)	5.063 (12.860)	5.061 (12.855)	5.064 (12.863)			C

* Dimensional inspection not required unless visual inspection indicated obvious damage, fretting, corrosion, or wear.

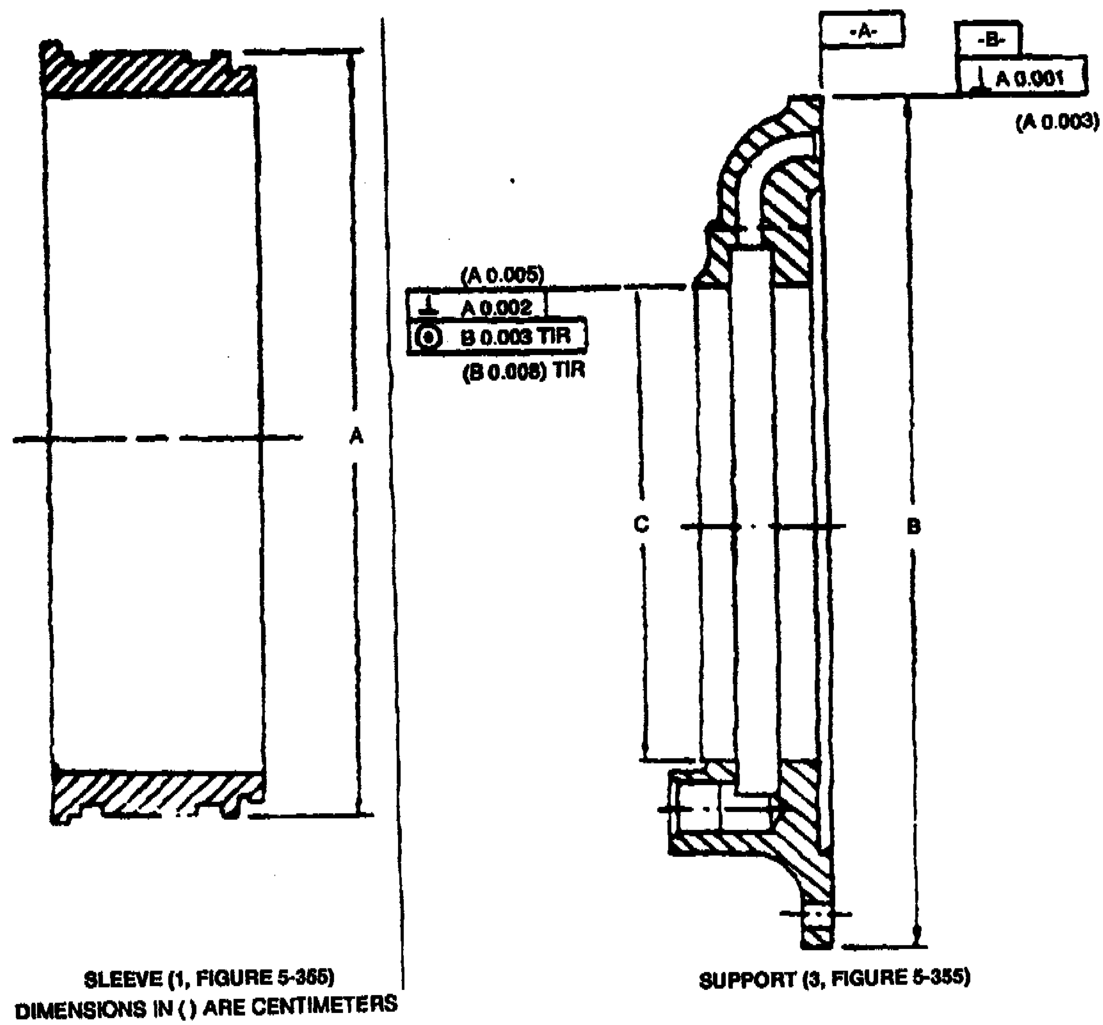


Figure 5-356. Oil Transfer Support Assembly Dimensional Inspection (T53-L-13B, -703).

c. Using oil flow check stand (LTCT313), or equivalent, and support assembly fixture (LTCT14240), flow-check support assembly with lubricating oil (item 189, or 190, table C–1) at a temperature of 95° to 100°F (35° to 38°C) and at a pressure of 68 to 72 psig (4781 to 5062 gm sq cm). Check flowmeter for 255 to 375 phr if lubricating oil (item 190, table C–1) is used, or 242-356 phr if lubricating oil (item 189, table C–1) is used.

5-351. FUNCTIONAL TEST. Functional test refer to paragraph 5-343.

5-352. REDUCTION GEAR ASSEMBLY AND SUN GEARSHAFT (T53-L-15).

5-353. DISASSEMBLY. Proceed as follows:

a. Install reduction gear assembly, propeller shaft down, in holding fixture (LTCT247).

b. Position handle (LTCT182), or wrench assembly (LTCT2019) and secure by screwing on propeller shaft cap, AN5012-50. Brace or secure handle to prevent propeller shaft from turning.

c. Straighten tangs of key washer (6, figure 5-357). Using socket and pilot assembly (LTCT557), remove nut (5) and key washer (6).

d. Remove keyway washer (7) and shim (8). Record thickness of shim (8).

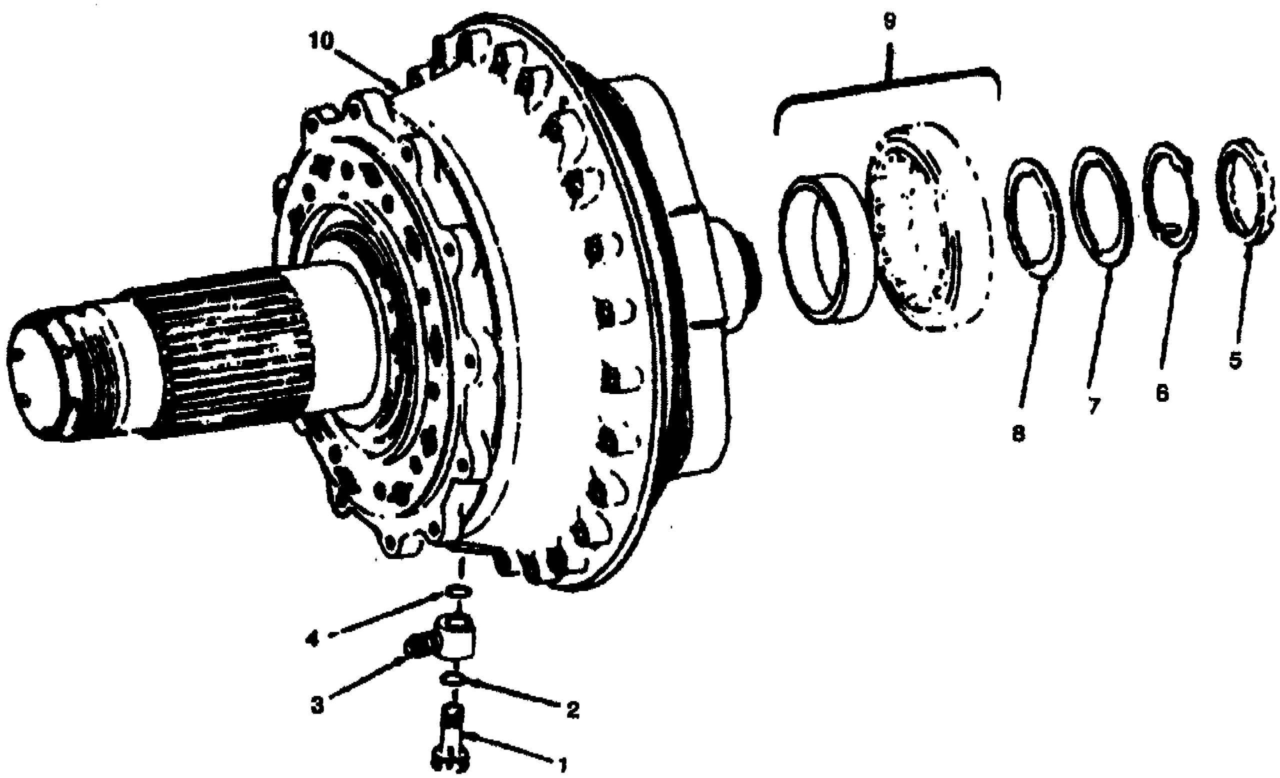


Figure 5-357. Reduction Gear Assembly (T53-L-15) (Sheet 1 of 2).

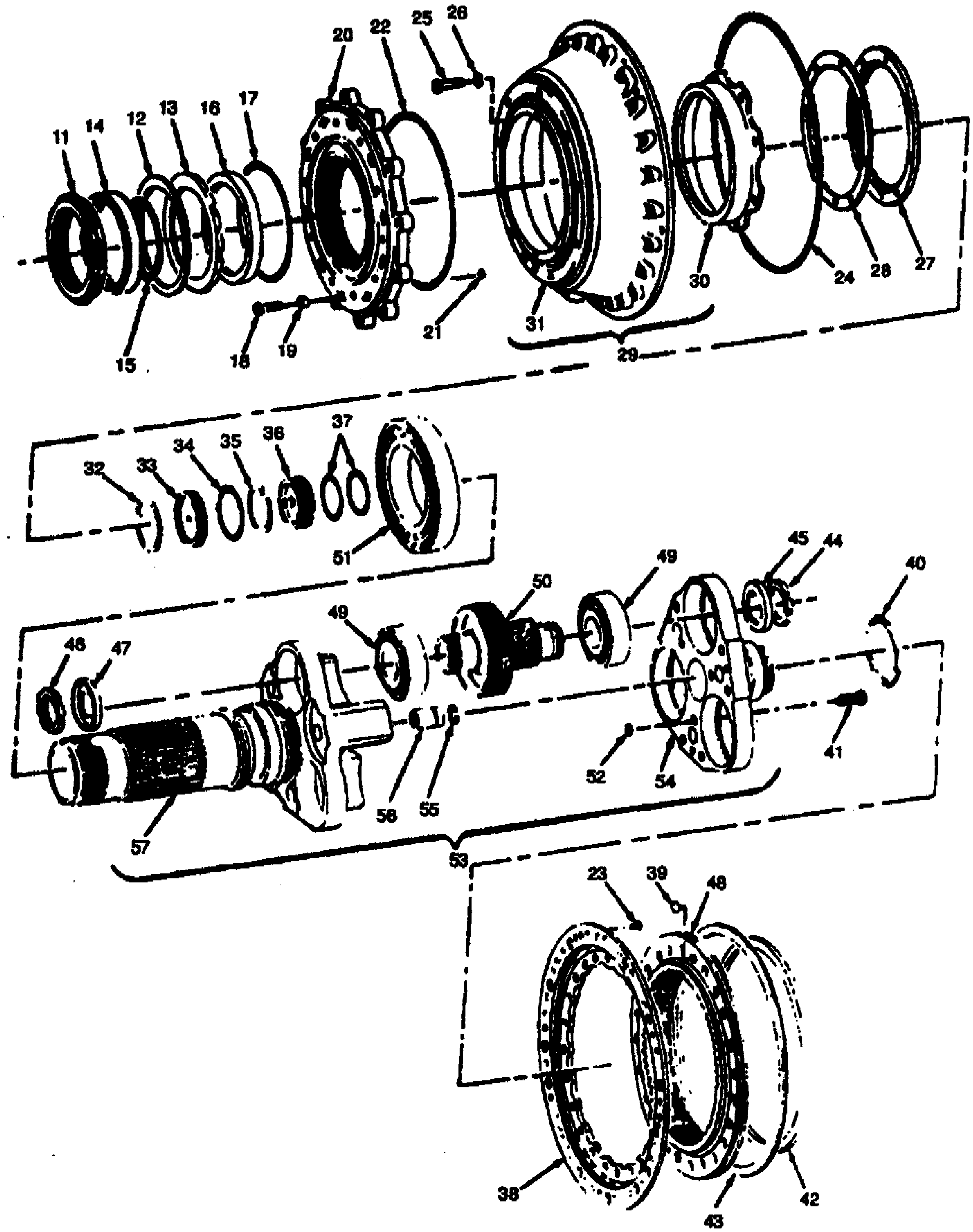


Figure 5-357. Reduction Gear Assembly (T53-L-15) (Sheet 2 of 2).

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-357	No Number	REDUCTION GEAR ASSEMBLY AND SUN SHAFT-GEAR AND RELATED PARTS (NHA 1-000-100-01)	Ref	C
-1	1-020-151-01	. BOLT, Fluid passage	1	C
-2	1-020-152-01	. WASHER, Flat	1	C
-3	1-020-149-01	. CONNECTOR, Multiple, fluid pressure line	1	C
-4	1-020-152-01	. WASHER, Flat	1	C
-5	1-020-012-01	. NUT, Spanner	1	C
-6	1-020-019-01	. WASHER, Key, bearing	1	C
-7	1-020-159-01	. WASHER, Keyway	1	C
-8	1-020-016-01	. SHIM, Gearshaft, lower driver	AR	C
-9	455946	. BEARING, Roller, cylindrical (52676) (Lycoming Source Cont Dwg 1-300-028-01)	1	C
-10	1-020-200-02	. GEAR ASSEMBLY, Reduction	1	C
-11	1-020-006-01	. . NUT, Plain, round	1	C
-12	URA595CD	. . RING, Retaining (80756) (Lycoming Spec Cont Dwg 1-300-217-01)	1	C
-13	1-020-136-01	. . SHIELD, Seal, propeller shaft	1	C
-14	1-020-127-01	. . SPACER, Bearing propeller shaft	1	C
-15	MS29561-243	. . PACKING	1	C
-16	4078	. . SEAL, Plain encased (91251) (Lycoming Source Cont Dwg 1-300-218-01)	1	C
	510370	. . SEAL, Plain encased (24981) (Alternate) (Lycoming Source Cont Dwg 1-300-218-02)	1	C
-17	STD3019C75	. . PACKING	1	C
-18	1-020-147-01	. . BOLT, Machine, seal housing	10	C
-19	1-080-028-02	. . RETAINER, Bolt	10	C
-20	1-020-260-01	. . HOUSING ASSEMBLY, Seal	1	C
-21	MS29561-010	. . PACKING	1	C
-22	STD3019C87	. . PACKING	1	C
-23	MS51958-60	. . SCREW	3	C
-24	1-020-017-01	. . PACKING, front bearing support	1	C
-25	AN104720	. . BOLT, Hex head	8	C
-26	STD3023K2	. . TABWASHER	8	C
-27	1-020-135-01	. . PLATE, Retaining, front bearing	1	C

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-357-28	1-020-146-01	. . SHIM, Front bearing	AR	C
-29	1-020-190-01	. . SUPPORT ASSEMBLY, Front bearing	1	C
-30	1-020-124-01	. . . LINER, Front Bearing	1	C
-31	No Number	. . . FRONT BEARING SUPPORT (NHA 1-000-100-01)	1	C
-32	1-020-021-02	. . RING, Retaining, propeller plug	1	C
-33	1-020-072-02	. . PLUG, propeller shaft	1	C
-34	MS29561-147	. . PACKING	1	C
-35	1-020-129-01	. . RING, Retaining, rear propeller shaft plug	1	C
-36	1-020-156-01	. . PLUG, Thrust	1	C
-37	STD3019C38	. . PACKING	2	C
-38	1-020-220-01	. . PLATE ASSEMBLY, Torquemeter	1	C
-39	1-020-015-01	. . BEARING, Ball Torquemeter	24	C
-40	1-020-131-01	. . SEAL RING, Metal, rear propeller shaft support	4	C
-41	STD3053-30	. . BOLT, Drilled hex head	9	C
-42	1-020-155-01	. . SEAL RING, Metal, rear torquemeter	2	C
	1-020-155-02	. . SEAL RING. Metal, rear torquemeter (Alternate)	2	C
	1-020-155-03	. . SEAL RING, Metal, rear torquemeter (Alternate)	2	C
	1-020-155-04	. . SEAL RING, Metal, rear torquemeter (Alternate)	2	C
-43	1-020-154-01	. . SEAL RING, Metal, front torque meter	2	C
	1-020-154-02	. . SEAL RING, Metal, front torque meter (Alternate)	2	C
	1-020-154-03	. . SEAL RING, Metal, front torque meter (Alternate)	2	C
	1-020-154-04	. . SEAL RING, Metal, front torque meter (Alternate)	2	C
-44	1-020-133-01	. . NUT, Plain, round reduction gear, R. H. thread	3	C
-45	1-020-144-01	. . CUP, Locking, bearing, retaining	3	C
-46	1-020-134-01	. . NUT, Plain, round reduction gear L. H. thread	3	C
-47	1-020-144-01	. . CUP, Locking, bearing retaining	3	C
-48	1-020-1220-3	. . GEAR, Internal	1	C

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-357-49	KU13090AJAS188	. . BEARING, Roller (08162) (Lycoming Source Cont Dwg 1-300-027-01)	6	C
	455945	. . BEARING, Roller (52676) (Alternate) (Lycoming Source Cont Dwg 1-300-027-02)	6	C
-50	1-020-119 -01	. . GEARSHAFT, Planet, helical	3	C
-51	456550	. . BEARING, Ball, annular (52676) (Lycoming Source Cont Dwg 1-300-026-01)	1	C
-52	MS9371-05	. . SEAL	3	C
-53	1-020-180 -01	. . SHAFT ASSEMBLY	1	C
-54	1-200-116 -01	. . . CARRIER, Propeller shaft	1	C
-55	1-020-067 -01	. . . RING, Retaining dowel	3	C
-56	1-020-066 -02	. . . DOWEL, Ring, propeller shaft carrier	3	C
-57	1-020-117 -01	. . . SHAFT, Propeller	1	C

e. Position legs of mechanical puller (LTCT2013 or LTCT186) in slots of carrier (54) and under inner race of roller bearing (9). Remove inner race or roller bearing from carrier.

f. Remove seal rings (40) from slots in carrier (54).

CAUTION

In following step g, turn jackscrews evenly to prevent cocking of the carrier. Do not drop the outer races of the three aft roller bearings (49, figure 5-357) when lifting the carrier. The outer races of the roller bearing may remain in the carrier when the carrier is removed. To prevent accidental interchanging of parts, remove the outer races. using suitable drift and soft faced mallet if necessary. Tag for identification (planet gear assembly, part number, and/or serial number) and place in a suitable container.

NOTE

To facilitate reassembly, record location of the number 1, number 2, and number 3 gear assemblies in the carrier. Viewed from the rear, number 1 planet gear assembly is at the top; number 2 and 3 are located in clockwise order. The bottom of the carrier is identified by match marks on both the carrier and propeller shafts. (See figure 5-358.)

g. Remove bolts (41) and using three 1/4 x 28 jackscrews, remove carrier (54) and seals (52). (See figure 5-357.)

h. To facilitate reassembly, use a Colorbrite pencil (239, table C–1) to index torquemeter plate assembly (38, figure 5-357) to flange of front bearing support(29).

i. Remove three screws (23) that secure torquemeter plate assembly (38) to flange of front bearing support (29).

j. Using three 1/4 x 28 jackscrews, remove internal gear (48) and torquemeter plate assembly (38). When jacking assembly, tilt planet gearshafts (50) inboard to clear planet gear aft bearings and to free planet gearshafts from internal gear. (See figure 5-360.)

k. Continue to tighten jackscrews evenly until internal gear (48, figure 5-357) and torquemeter plate assembly (38) are clear of planet gear and bearings.

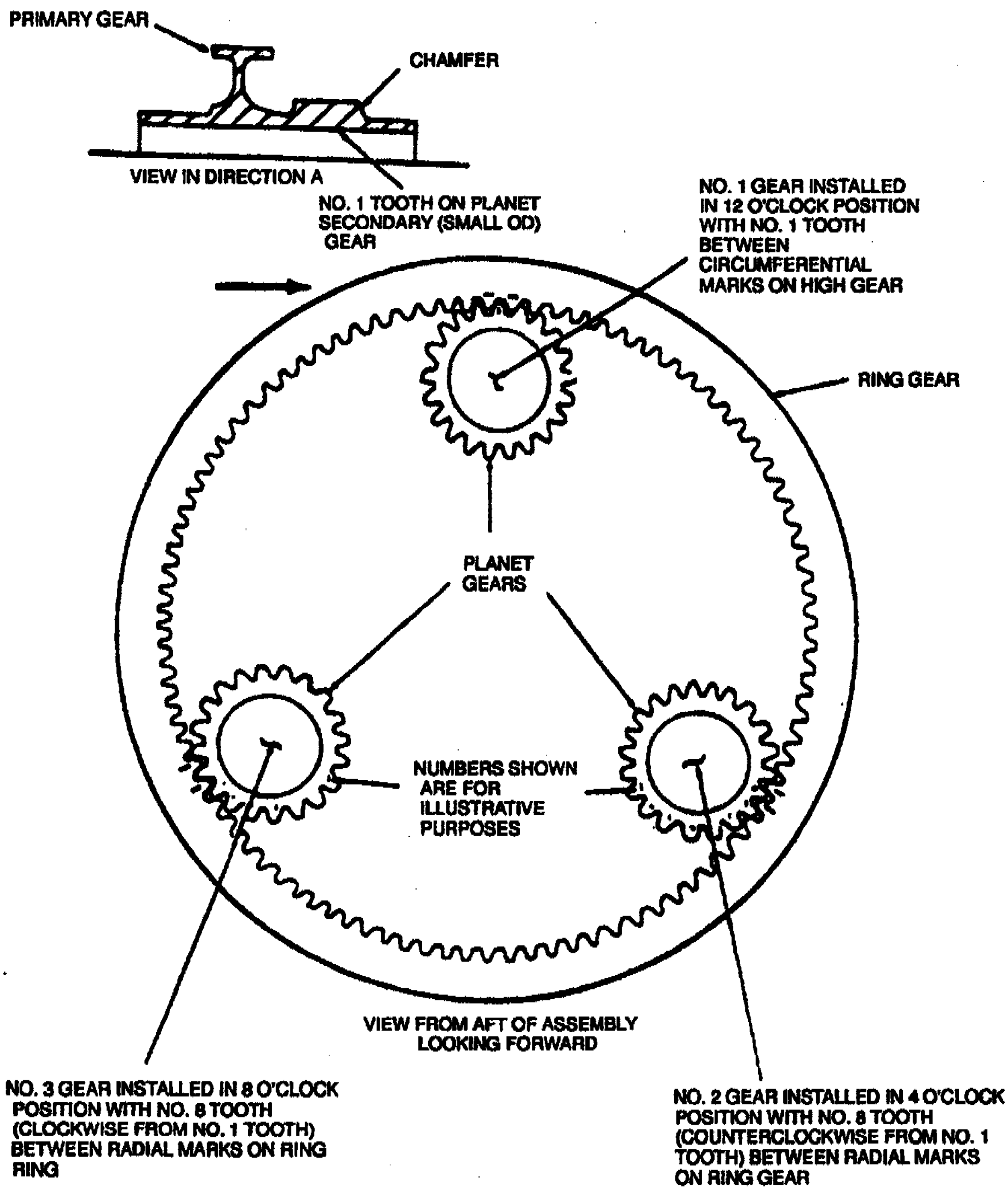


Figure 5-358. Planetary Gears - Assembly Locations (T53-L-15).

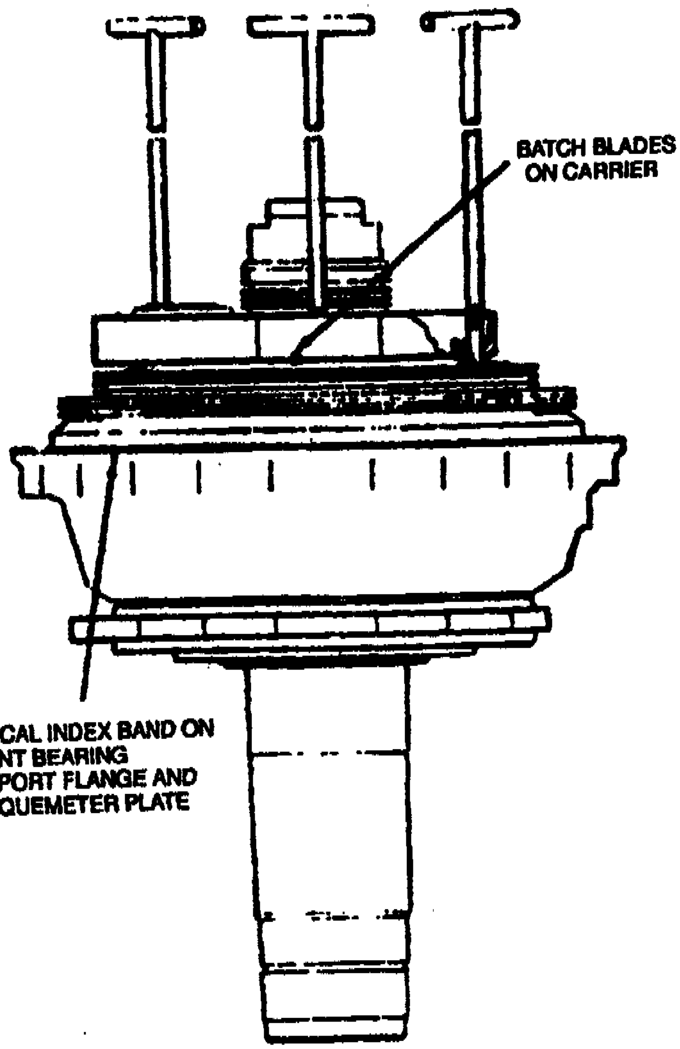


Figure 5-359. Removal of Propeller Shaft Carrier (T53-L-15).

CAUTION

In following step l, hold internal gear and torque-meter plate assembly firmly together when lifting to prevent dropping torquemeter balls. Damaged balls must be rejected.

l. Place internal gear and torquemeter plate assembly on a clean dry work surface. Gently lift internal gear (48) making sure that 24 torquemeter balls (39) are retained in torquemeter plate assembly (38). Remove torquemeter balls (39) and place in a suitable retainer.

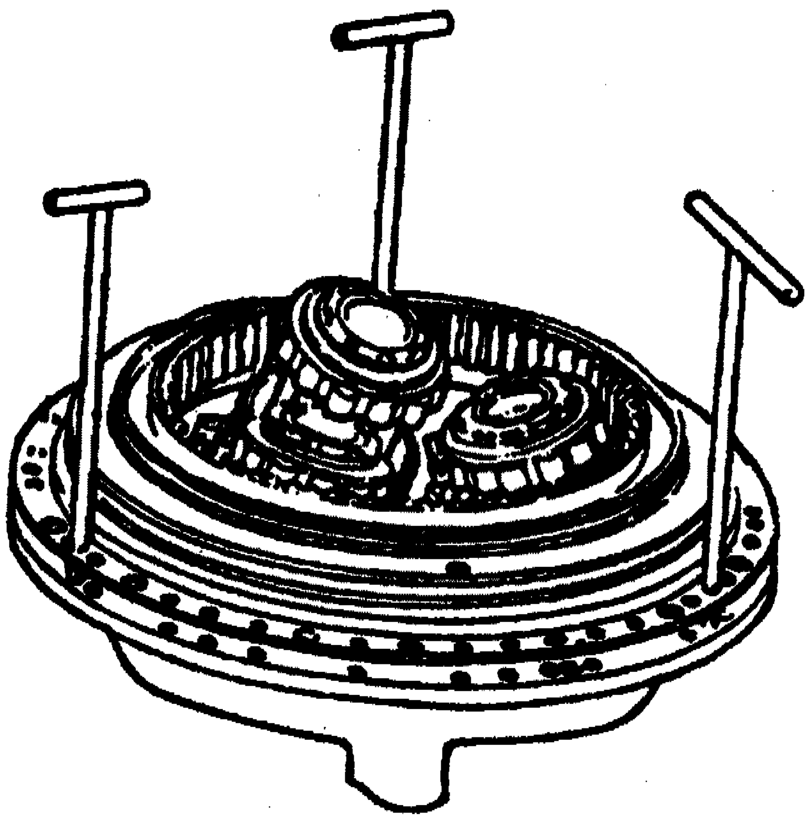


Figure 5-360. Removal of Internal Reduction Gear and Torquemeter Plate Assembly (T53-L-15).

NOTE

In following step m, the outer races of the forward roller bearing (49) will remain in the propeller shaft.

m. Remove three planet gearshafts (50) from propeller shaft (57). Remove seals (52).

NOTE

In following step n, if the outer race of roller bearing (49) cannot be removed by hand, use a suitable drift and soft-faced mallet.

n. Remove outer races of roller bearing (49) from propeller shaft (57), using a slight twisting motion. Tag and place with corresponding bearing.

o. Place planet gearshaft (50) in holding fixture (LTCT645) or ring assembly (LTCT4016).

p. Using a suitable drift and soft-faced mallet, straighten locking cup (45).

NOTE

In following step q, nut (44) has a right hand thread.

q. Using socket wrench (LTCT569), remove nut (44) and locking cup (45).

CAUTION

In following step r, place tagged bearing outer race (removed in preceding step n) with inner race of bearing (49), making certain that serial numbers on the outer races match those of the inner race. To facilitate reassembly, identify the assembled bearing as to planet gear part number and position (forward or aft) from which it was removed.

r. Using bearing puller (LTCT568), remove inner race of bearing (49).

s. Remove planet gear assembly from fixture. Turn assembly over and replace in fixture.

NOTE

In following step t, nut (46) has a left hand thread.

t. Repeat preceding steps p through r to remove nut (46), locking cup (47), and inner race of bearing (49).

u. Repeat preceding steps o through t for remaining two planetary gear assemblies.

v. Remove thread protector MS27417-50 and handle (LTCT182) or wrench assembly (LTCT2019) from propeller shaft (57).

w. Remove nut (11).

x. Using soft-faced mallet and drift, straighten bolt retainers (19). Remove bolts (18) and bolt retainers (19).

y. Remove seal housing assembly (20).

z. Remove retaining ring (12) and shield (13).

aa. Using arbor press and suitable adapter to contact seal OD, press seal (16) from seal housing assembly (20). Remove and discard packing (17).

ab. Remove spacer (14). Remove and discard packing (15).

ac. Remove and discard packings (22 and 24).

ad. Using needle-nose pliers, remove retaining ring (32).

ae. Thread shaft of removal and installation tool (LTCT4510 or LTCT2022 or LTCT177) into propeller shaft plug (33) and remove plug. Remove and discard packing (34).

af. Using looped length of lockwire, snap tangs of retaining ring (35). Remove ring (35).

ag. Thread shaft of removal and installation tool (LTCT4510 or LTCT2022 or LTCT177) into thrust plug (36) and remove plug (36). Remove and discard packings (37).

ah. Remove bolt (1) that secures the connector (3) to front bearing support (31). Remove connector (3) and washers (2).

CAUTION

In following step al, to prevent damage do not drop propeller shaft.

ai. Place propeller shaft assembly on support ring (LTCT179) with propeller shaft up. Place phenolic block over end of propeller shaft. Place propeller shaft along with support ring in arbor press, and press propeller (57) from front bearing support(31).

aj. Straighten tabwashers (26) and remove bolts (25) and tabwashers.

ak. Remove retaining plate (27) and shim (28). Record thickness of shim and attach shim to retaining plate with lockwire.

al. Using arbor press and suitable adapter to contact OD of ball bearing (51), press bearing from bearing support.

CAUTION

Do not remove seal rings (42 and 43) unless they are damaged.

am. Remove seal rings (42 and 43) from internal gear (48).

5-354. CLEANING. Proceed as follows:

a. Clean all gears and splined parts as outlined in SP No. 3009 in Appendix E.

b. Clean all bearings as outlined in SP No. 3010 in Appendix E.

c. Clean all other parts by dry cleaning solvent method. (Refer to SP No. 3002 in Appendix E.

5-355. INSPECTION. Perform specific inspections listed in table 5-121.

5-356. REPAIR. (See figure 4-42 and 5-357.) Repair nicked sun gearshaft (9, figure 4-42) and internal gear (48, figure 5-357) as follows:

a. Blend-repair as outlined in SP No. 5000 in Appendix E. (See figures 5-362 and 5-363.)

Table 5-121. Inspection of Reduction Gear Assembly and Sun Gearshaft (T53-L-15).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-42				
4	Reduction Gear Assembly	Visual	Nicks, burrs, or scratches	Repair (Refer to SP No. 5000 in Appendix E).
			Damaged threads	Repair or replace. (Refer to SP No. 5007, Appendix E).
		Visual and SIE	Wear or damage to gear teeth or splines.	Repair or replace if limits are not met.
		Visual and Magnetic Particle (Refer to table 5-122)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-123.)	Replace if limits are not met.
9	Sun Gearshaft	Visual	Nicks, burrs, and scratches	Repair. (Refer to paragraph 5-356).
		Visual and SIE	Wear or damage to gear teeth or splines.	Repair or replace if limits are not met.
		Visual and Magnetic Particle. (Refer to paragraph 5-124)	Cracks	Not allowed. Replace.
5-357				
9, 51 and 49	Bearings	Visual	Damaged bearing	
		Dimensional	Wear. (Refer to table 5-124)	Replace if limits are not met.
13	Shield	Visual	Cracks	Not allowed. Replace.
39	Torquemeter Ball	Visual	Worn, pitted, or scratched torquemeter balls	Not allowed. Replace.
			Burrs or sharp edges on torquemeter plate ball socket	Repair. (Refer to SP No. 5000 in Appendix E).
48	Internal Gear	Visual	Nicks, burrs and scratches	Repair. (Refer to paragraph 5-356).
		Visual and SIE	Wear or damage to gear teeth or splines.	Repair or replace if limits are not met.
		Visual	Loss of surface coating	Repair. (Refer to SP No. 6003 in Appendix E).
		Visual and Magnetic Particle (Refer to table 5-122)	Cracks	Not allowed. Replace.
42 and 43	Sealing Ring	Visual	Distortion	Not allowed. Replace.

Table 5-122. Magnetic-Particle Inspection of Reduction Gear Assembly (T53-L-15).

FIGURE AND INDEX NO.	NOMENCLATURE	METHOD OF MAGNETIZATION
4-42, 6	Bolt	Longitudinal at 5000 ampere-turns
4-42, 9	Gearshaft, Helical Sun	Circular, use central conductor at 5000 ampere-turns
5-357, 27	Retaining Plate	Circular, use central conductor at 600 amperes
5-357, 30	Front Bearing Liner	Circular, use central conductor at 800 amperes
5-357, 33	Propeller Shaft Plug	Longitudinal at 4000 ampere-turns
5-357, 48	Internal Gear	Circular, use central conductor at 1200 amperes
5-357, 50	Gearshaft, Helical Planetary	Circular, use central conductor at 2500 amperes. Longitudinal at 10,000 ampere-turns
5-357, 54	Carrier, Propeller Shaft	Circular, use central conductor at 2000 amperes. Longitudinal at 10,000 ampere turns
5-357, 57	Propeller Shaft	Circular, use central conductor at 1500 amperes for shaft area and 2500 ampere for flange. Longitudinal at 10,000 ampere-turns

Table 5-123. Dimensional Inspection of Reduction Gear Assembly (T53-L-15).

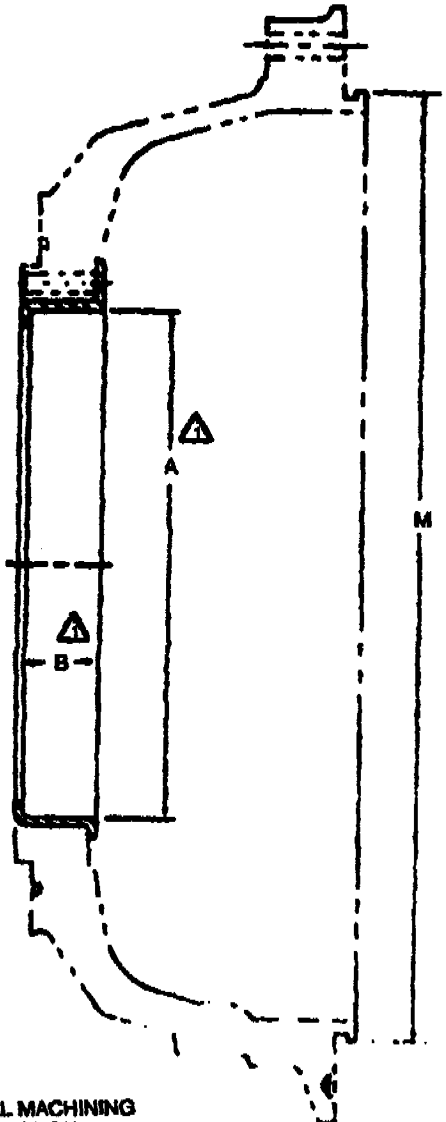
NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-357								5-361
Front Bearing Support	31	ID	6.6923 (16.9984)	6.6930 (17.0002)	6.6923 (16.9984)	6.6932 (17.0007)			A
		Axial	0.978 (2.484)	0.982 (2.494)	0.978 (2.484)	0.984 (2.499)			B
Planet Gearshaft (Fwd) (3 Places)	50	OD	1.7721 (4.5011)	1.7727 (4.5027)	1.7719 (4.5006)	1.7727 (4.5027)			C
Planet Gearshaft (rear) (3 Places)	50	OD	1.7721 (4.5011)	1.7727 (4.5027)	1.7719 (4.5006)	1.7727 (4.5027)			D
Carrier	54	OD	3.1496 (8.0000)	3.1500 (8.0010)	3.1494 (7.9995)	3.1500 (8.0010)			E
Carrier (3 Places)	54	ID	3.9371 (10.0002)	3.9375 (10.0013)	3.9371 (10.0002)	3.9377 (10.0018)			F
Propeller Shaft (3 Places)	57	ID	3.9371 (10.0002)	3.9375 (10.0013)	3.9371 (10.0002)	3.9377 (10.0018)			G
Propeller Shaft	57	OD	4.3308 (11.0002)	4.3315 (11.0020)	4.3306 (10.9997)	4.3315 (11.0020)			H
Internal Gear	48	OD	12.478 (31.694)	12.488 (31.720)	12.473 (31.681)	12.488 (31.720)			I
		OD	10.741 (27.282)	10.751 (27.308)	10.736 (27.269)	10.751 (27.308)			J
Torquemeter Plate Assembly	38	OD	12.746 (32.375)	12.748 (32.380)	12.745 (32.372)	12.748 (32.380)			K
Torquemeter Plate Assembly to Front Support	38	ID	12.503 (31.758)	12.505 (31.763)	12.503 (13.758)	12.506 (31.765)			L
	38	OD	12.498 (31.745)	12.502 (31.755)	12.497 (31.742)	12.502 (31.755)	0.001L (0.003)	0.009L (0.023)	M

Table 5-124. Dimensional Inspection of Reduction Gear Assembly Bearings.

BEARING TYPE PART NO.	FIG & DIM.		BLUEPRINT DIMENSIONS		INTERNAL CLEARANCE	END PLAY	HARDNESS RC	CONTACT ANGLE	LYCOMING PART
	INDEX	MEAS	MIN	MAX					
	5-357								
Roller 455946	9	ID OD	3.1492 4.9208 (7.9990) (12.4988)	3.1496 4.9213 (8.0000) (12.5001)	0.0016 to 0.0030 (0.0041 to (0.0076)	N/A	58 To 61	N/A	1-300-028-01
Ball 456550	51	ID OD	4.3304 6.6924 (10.9992) (16.9987)	4.3307 6.6929 (11.0000) (17.0000)	0.0011 to 0.0017* (0.0028 to (0.0043)	0.018* (0.046)	58 To 61	N/A	1-300-026-01
Roller, KU13O9DJAS1 88	49	ID OD	1.7714 3.9366 (4.4994) (9.9990)	1.7717 3.9370 (4.5001) (10.0000)	0.0019 to 0.0024** (0.0048 to (0.0061)	N/A	58 To 61	N/A	1-300-027-01
Roller 455945	49	ID OD	1.7714 3.9366 (4.4994) (9.9990)	1.7717 3.9370 (4.5001) (10.0000)	0.0019 to 0.0024** (0.0048 to (0.0061)	N/A	58 To 61	N/A	1-300-027-02

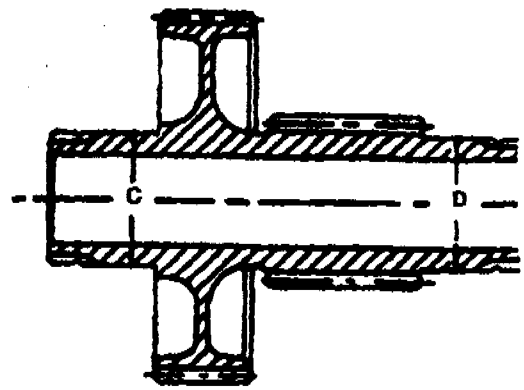
* Under a 22.0 pound gage load.

** Under a 11.0 pound gage load.

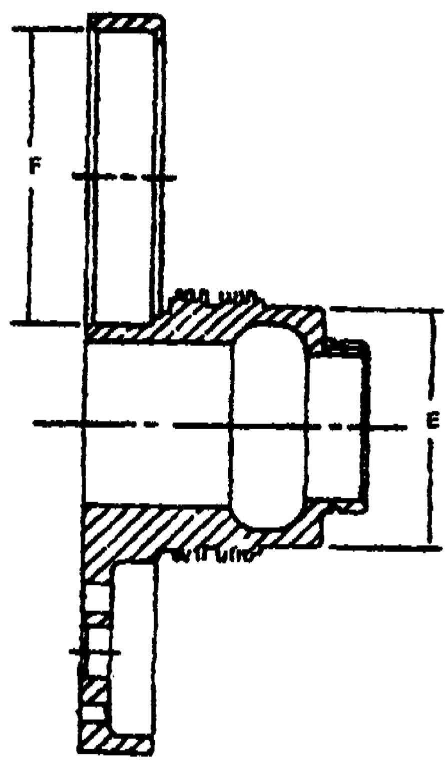


FINAL MACHINING DIMENSION

FRONT BEARING SUPPORT
(31, FIGURE 5-357)



PLANET GEARSHAFT (50, FIGURE 5-357)



CARRIER (54, FIGURE 5-357)

Figure 5-361. Reduction Gear Assembly Dimensional Inspection Locations (T53-L-15) (Sheet 1 of 2).

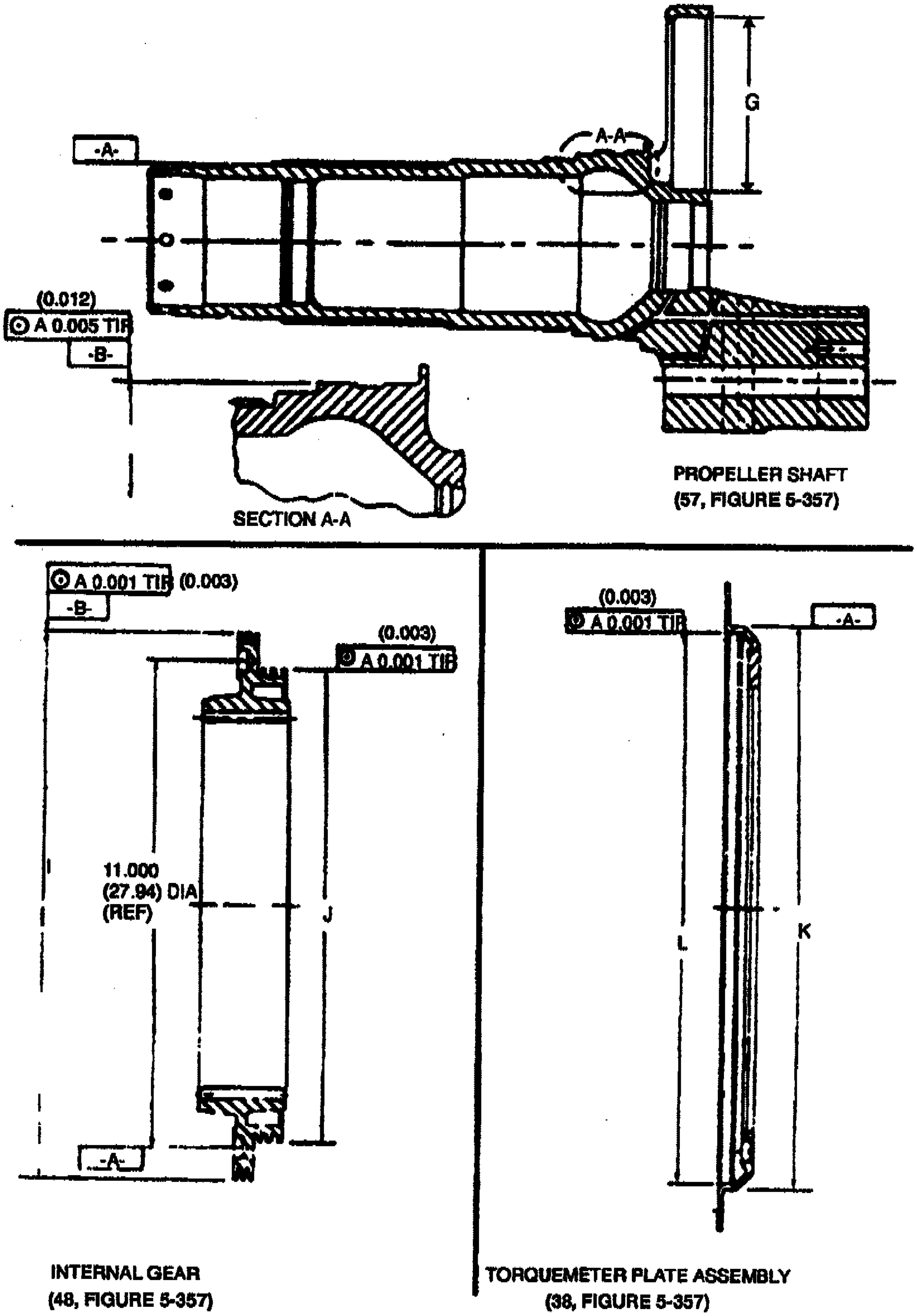
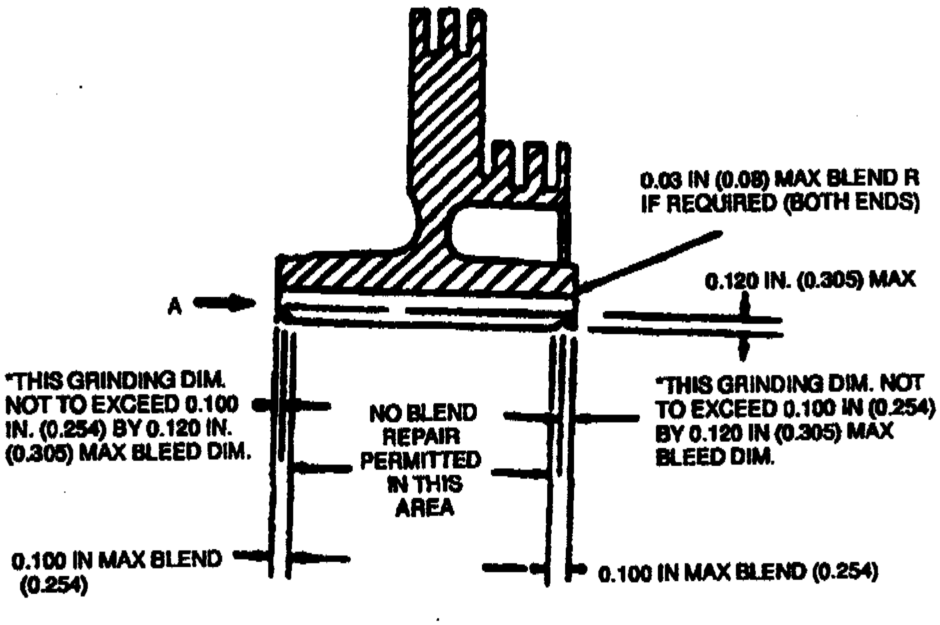


Figure 5-361. Reduction Gear Assembly Dimensional Inspection Locations (T53-L-15) (Sheet 2 of 2).



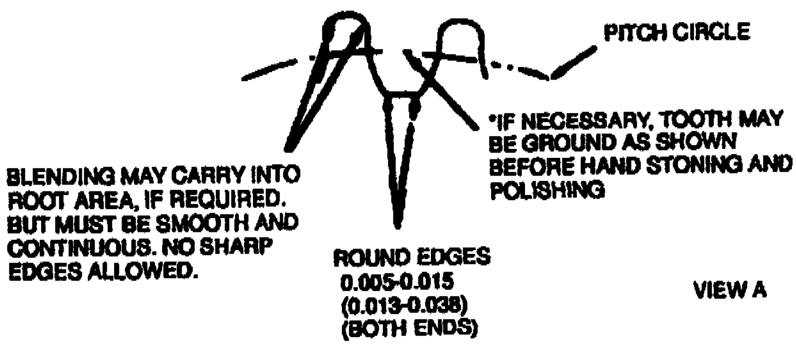


Figure 5-362. Nicked Internal Gear Teeth (T53-L-15).

b. Inspect for wear or damage.

c. Clean parts with acetone (item 13, table C–1) or cleaning solvent (item 101, table C–1).

d. Touch up black oxide coating on internal gear (48, figure 5-357) as outlined in SP No. 6003 in Appendix E.

5-357. REASSEMBLY. Reassembly of the Sun Gearshaft is not required. Proceed as follows:

a. Install washer (4, figure 5-357) and connector (3) into front bearing support (31). Secure with bolt (1). Tighten bolt, as required, and lockwire.

b. Generously lubricate packings (37) with shortening compound (item 270, table C–1) and install on thrust plug (33).

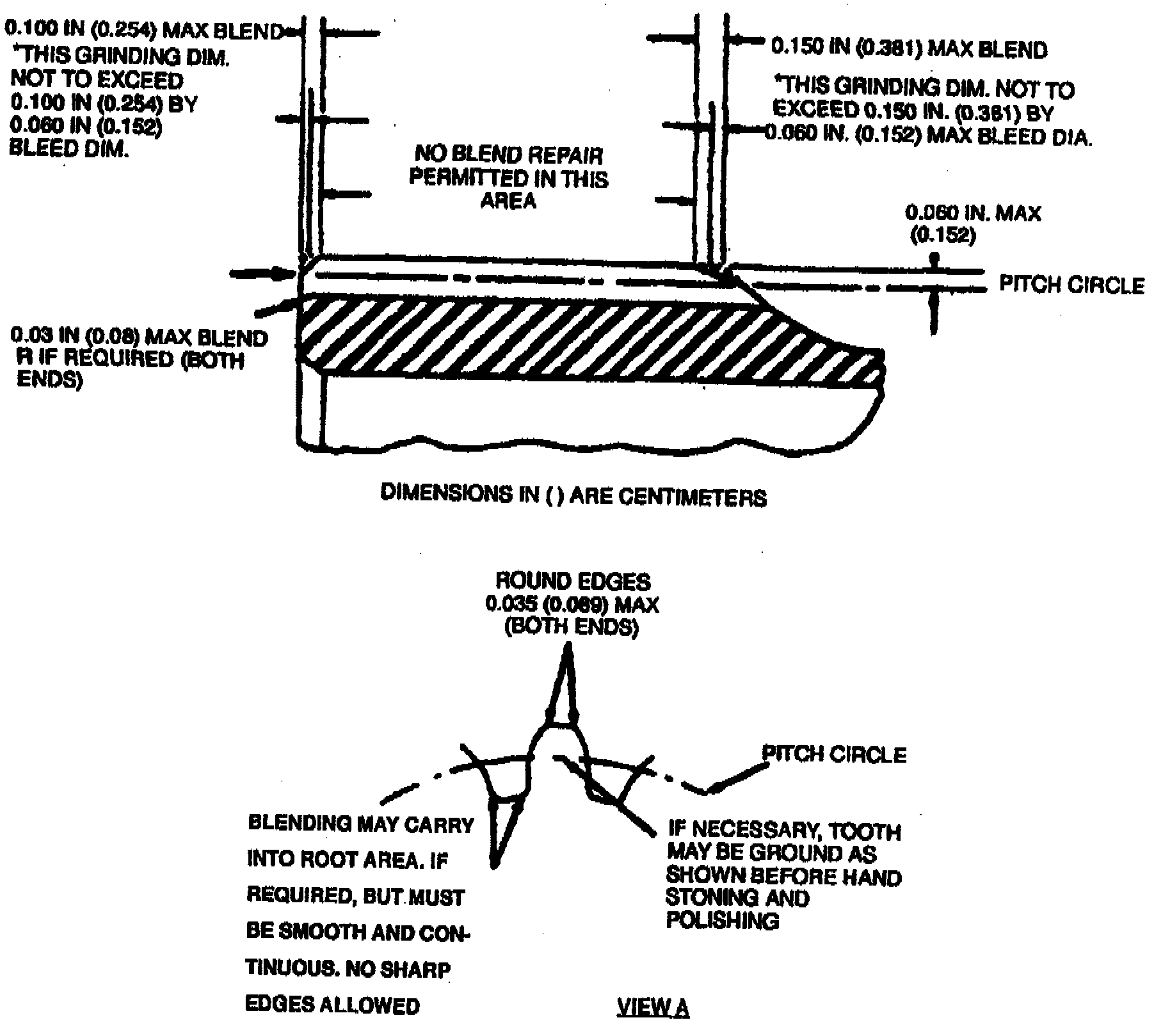


Figure 5-363. Nicked External Gear Teeth (T53-L-15).

CAUTION

Propeller shaft (1-020-117-01), revision 1 or earlier, shall not be used. These shafts can be identified by three 2.70 inch (6.86 cm) wide slots cut in the forward carrier face.

c. With propeller shaft end up, carefully install thrust plug, using removal and installation tool (LTCT4510 or LTCT2022 or LTCT177). Secure thrust plug with retaining ring (35).

NOTE

The thrust plug shall be installed so that the puller threads are facing forward. Manipulate retainer into position, using looped safety wire and a long screwdriver.

d. Check installed thrust plug for damaged packings as described in following steps e through g.

e. Apply shop air into the propeller shaft rear on passage, as shown in figure 5-364, and check for air pressure at rear face of thrust plug.

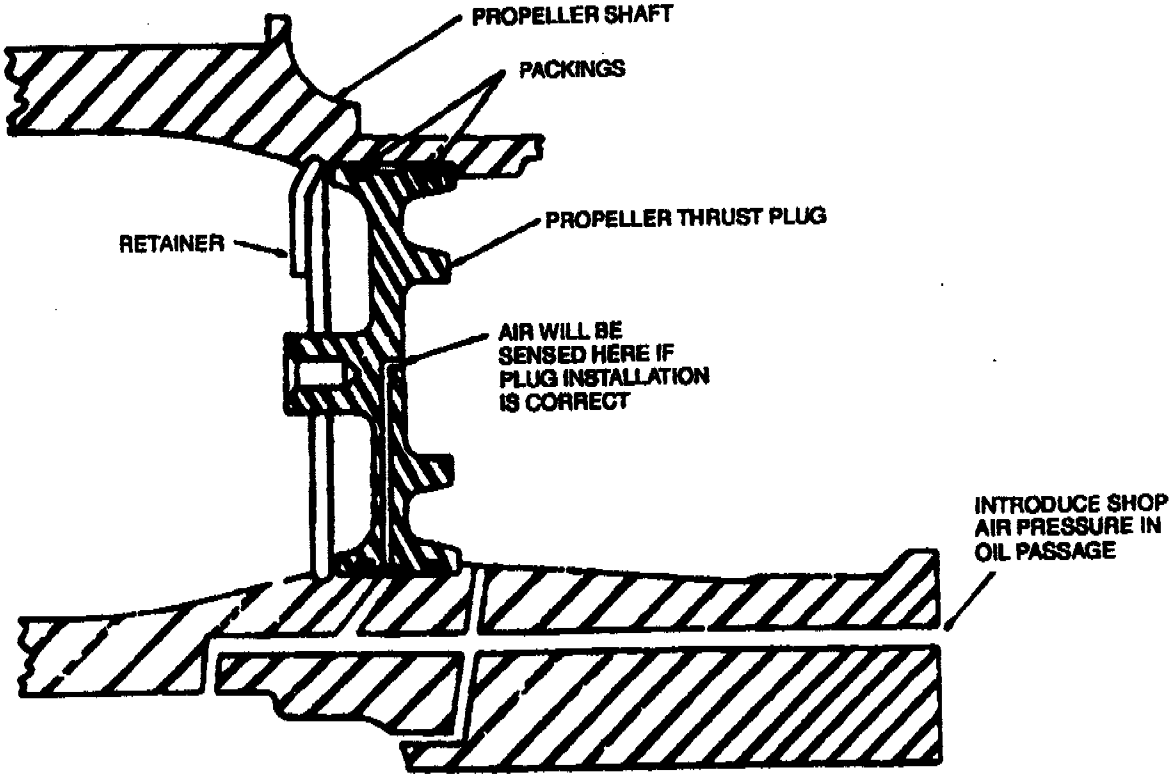


Figure 5-364. Propeller Thrust Plug Installation (T53-L-15).

f. If no air is felt, packings are not positioned properly. The thrust plug must be removed, packings replaced, if necessary, and then reinstalled as described in preceding steps a through c. Repeat check in preceding step e.

g. If air is felt, packings and thrust plug are properly positioned and further reassembly is possible.

h. Generously lubricate packing (34, figure 5-357) with lubricant (item 197, table C–1) and install on propeller shaft plug (33).

i. Using removal and installation tool (LTCT4510 or LTCT2022 or LTCT177), carefully install propeller shaft plug into propeller shaft and secure with retaining ring (32).

NOTE

The propeller shaft plug shall be installed so that the puller threads are facing forward.

Following step j is necessary only if the bearing is replaced. If the same bearing is used, install a shim of the same thickness as recorded during disassembly.

j. Determine thickness of shim (28) to obtain 0.004 to 0.006 inch (0.010 to 0.015 cm) pinch on ball bearing (51), as described in the following steps k through o. (See figure 5-365.)

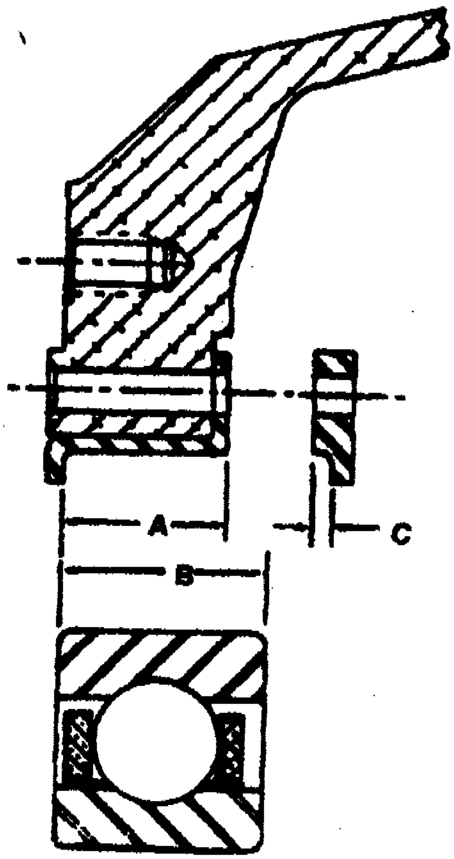


Figure 5-365. Determining Thrust Bearing Shim Thickness (T53-L-15).

k. Measure from rear face of front bearing liner to liner lip (dimension A, figure 5-365).

l. Measure thickness of outer race of bearing (dimension B).

m. Measure from forward face of retaining plate to face of lip (dimension C).

n. Add dimension C to dimension A, and subtract total from dimension B.

o. The resulting dimension, minus 0.006 inch (0.015 cm) is the required shim thickness.

p. Lubricate the outer race of the bearing (51, figure 5-357) with lubriplate (item 199, table C-1), and press bearing firmly into front bearing support (31). Use arbor press and suitable sleeve to contact bearing OD when pressing.

q. Install shim (28) of thickness determined in preceding step o, and retaining plate (27). Secure with bolts (25) and tabwashers (26). Tighten bolts, as required, and lock by bending tangs of tabwasher.

r. Measure ID of bearing (51).

s. Measure OD of bearing journal on propeller shaft (57).

t. Subtract dimension obtained in preceding step r, from dimension obtained in step s. If difference indicates low interference fit 0.005 inch (0.0013 cm.) tight or less, use arbor press and suitable sleeve to contact bearing inner race and firmly seat bearing against shoulder on propeller shaft. If high interference fit is indicated, assemble propeller shaft and bearing support housing as outlined in following steps u and v.

u. Heat front bearing support (31) with bearing (51) installed, to 160°F (71°C), using an oven, hot oil, or bench-type cylindrical heating unit.

NOTE

Do not use an open flame.

v. Remove support assembly from heat source and quickly install on propeller shaft. Using arbor press and suitable sleeve to contact bearing inner race, firmly seat bearing against shoulder on propeller shaft.

w. Select and identify three planet gearshafts (50). Tag gearshafts as numbers 1, 2, and 3, in ascending order of serial number. Number 1 gearshaft (with lowest serial number) is installed in the 12-o'clock position in the propeller shaft. Number 2 gearshaft is installed in the 4-o'clock position. Number 3 gearshaft is installed in the 8-o'clock position.

NOTE

The number 1 tooth on all planet secondary gearshaft is identified by a chamfer.

(1) Locate number 1 tooth on the secondary (small) gear of number 1 planet gearshaft. Using yellow opaque ink No. 9 (item 234, table C–1), paint line along length of outer edge of tooth.

(2) On number 2 gearshaft, paint the number 8 tooth counterclockwise from number 1 tooth (chamfered),

(3) On number 3 gearshaft, paint number 8 tooth clockwise from number 1 tooth (chamfered).

NOTE

Disregard numbers scribed on gear shaft teeth.

x. Select six bearings, and with arbor press and sleeve, install inner races and rollers of bearings (49) on planet gearshafts. If tight fit is indicated, inner race may be heated to approximately 160°F (71°C) for ease of installation.

CAUTION

Do not mix outer races during assembly . They must mate with their intended inner race and roller assembly. Bearing inner and outer race serial numbers shall be installed on the same side.

NOTE

It is recommended that the bearings be installed in ascending serial number order; the three lower serial numbers on the forward journals of the planet gears, and the three higher serial numbers on the rear journals.

y. Install number one planet gearshaft (50) in holding fixture (LTCT645), forward face up.

CAUTION

In following step z, use care to prevent shearing cup.

z. Install locking cup (47) and left-hand threaded nut (46). Using socket wrench (LTCT569) and torque handle, tighten nut to 1,400 to 1,600 pound-inches (250040 to 285760 gm cm). Lock the nut by deforming lock cup in four places.

aa. Insert gearshaft (50) in holding fixture and repeat preceding step x, using right-hand threaded nut (44) and locking cup (45).

ab. Repeat preceding steps y, z, and aa for number 2 and 3 gearshafts.

ac. Position assembled propeller front bearing support (31) and propeller shaft (57) in holding fixture (LTCT247), with propeller shaft serial number and matchmarks at 6-o'clock position. Install packing (24) on front bearing support (31), and rotate support until scavenge port is at 6-o'clock position. Block assembly to prevent rotation.

NOTE

The propeller shaft and carrier are matched parts and must be kept together. The serial numbers must be identical.

ad. Install bearing outer races (49) into propeller shaft, using soft-faced mallet if necessary. Place three planet gearshafts on propeller shaft in their respective locations, but do not seat (Refer to preceding step w). Tilt aft ends inward to allow ring gear and torquemeter plate assembly (38) to be installed.

ae. Install seal ring (42 and 43) on internal gear (48).

af. Lubricate 24 torquemeter balls (50) with shortening compound (item 270, table C–1), and install into ball sockets of torquemeter plate assembly (38). Align ball sockets and position ring gear on plate.

NOTE

Check for correct positioning of the alignment pin between the propeller reduction internal gear and the torquemeter plate.

ag. Place three equally spaced 3/4 inch high spacer blocks on support flange to maintain gap between torquemeter plate and support assembly. Hold torquemeter plate and ring gear together and place onto spacer blocks with circumferentially marked teeth at 12-o'clock position. (See figures 5-358 and 5-359.)

ah. Lift number 1 gear to vertical position and align yellow tooth between tooth with circumferential marks at 12-o'clock position on ring gear. Gently work forward inner race and rollers downward into bearing outer race in propeller shaft.

(1) Repeat procedure for number 2 gearshaft, aligning yellow tooth between teeth within radial marks at 4-o'clock position on ring gear.

(2) Repeat procedure for number 3 gearshaft, aligning yellow tooth between tooth within radial marks at 8-o'clock position in ring gear.

ai. Remove spacer blocks and lower lock plate and ring gear gently to avoid cutting packing. The gears will fall into place. Check alignment of gear and support by inserting pin (1-060-037-01)and secure ring gear to support with three bolts (41, figure 5-357).

aj. Recheck alignment by lifting gears slightly to check if yellow tooth on each gear is between marks on the ring gear. If all marks on gears are not aligned, repeat preceding steps ag, ah, and ai.

ak. To check timing, turn support exactly four revolutions. All timing marks should have returned to original alignment position. If any of the timing marks fail to align, gear is not installed properly: repeat preceding steps ag, ah, and ai.

al. Using soft-faced mallet, if necessary, install aft races of bearing (49) in carrier (54) position. (Refer to serial numbers or tabs.)

am. Coat seals (52) with shortening compound (item 270, table C–1) and install into propeller shaft.

NOTE

Matchmarks on carrier must align with marks on shaft. Serial numbers must be identical.

an. Position carrier over planet gear assemblies, align matchmarkers (figure 5-359), and secure with bolts. Tighten bolts (41, figure 5-357 progressively to 250 to 350 pound-inches (44650 to 62510 gm cm) torque.

ao. Using dial indicator, check end play of planet gear assemblies. End play shall be 0.012 to 0.038 inch (0.030 to 0.097 cm). If end play is not within limits, bearing (49) must be replaced.

CAUTION

In following step ap, use care to ensure that cut ends of the lockwire do not fall into the reduction gear assembly.

ap. After establishing correct end play, lockwire bolts (41).

aq. Carefully install seal rings (40) in grooves of carrier (44). Rotate rings to ensure that there is no binding.

ar. Using thickness gage, check side clearance. Clearance shall be between 0.0015 to 0.0045 inch (0.0038 to 0.0114 cm). If clearance is not obtained, replace seal rings. Space joints 90 degrees apart around journal.

as. Carefully slide ring assembly (LTCT571) over seal rings on propeller shaft rear carrier.

at. Position reduction carrier assembly on oil flow check stand (LTCT313), or equivalent.

au. Attach 1/2-inch hose from within oil flow stand cover to fitting on test fixture.

av. Turn on oil flow check stand. Oil temperature shall be 95° to 100°F (35° to 38°C)

aw. Turn oil pressure valve knob until SUPPLY PRESSURE gage indicates 70 psi (4921 gm sq cm).

ax. Visually inspect that there is oil flowing from thrust plug (36) and that oil is flowing through all bearings.

ay. Read oil flow on rotometer mounted on oil flow check stand. Oil flow shall be 1,675 to 2,075 pounds per hour if lubricating oil (item 190, table C–1) is used, or 1,591 to 1,973 pounds per hour if lubricating oil mounted (item 189, table C–1) is used.

az. If required oil flow cannot be met, remove oil flow test fixtures and disassemble reduction gear assembly. Inspect all oil ports and bearings.

ba. If required oil flow is met, remove oil flow test fixture and continue with reassembly.

bb. Install packing (17) into seal housing assembly (20).

NOTE

In following step bc, lubricate seal (14) with lubricating oil (item 189, or 190, table C–1) before installing into housing.

bc. Using arbor press and suitable adapter to contact seal (16) OD, press seal into seal housing.

bd. Install shield (13) into seal housing assembly (20) and secure with retaining ring (12).

be. Position packing (15) on propeller shaft (57).

bf. Install spacer (14) on propeller shaft.

bg. Install packing (24) in groove on face of bearing housing.

CAUTION

In following step bh, use care to prevent shearing the retainer.

bh. Position seal housing assembly and packing (21 and 22) on the bearing support housing and secure with bolts (18) and retainers (19). Tighten bolts, as required, and lock bolts by deforming retainers into seal housing and into slot of bolts.

bi. Install nut (11) but do not tighten to full torque at this time.

bj. Measure ID of inner race of roller bearing (9).

bk. Measure OD of bearing journal on carrier.

bl. Subtract dimension obtained in preceding step bj from dimension obtained in step bk. If difference indicates low interference fit (0.0005 inch (0.0013 cm) tight or less), use arbor press and suitable sleeve to contact bearing inner race, and firmly seat support bearing inner race against shoulder on propeller shaft rear carrier. If high interference fit is indicated, assemble carrier and bearing as outlined in following steps bm and bn.

bm. Heat inner race of bearing (9) to 160° (71°C), using oven, not oil, or bench-type cylindrical heating unit.

NOTE

Do not use an open flame.

bn. Remove bearing inner race from heat source and quickly install on propeller shaft rear carrier. Using arbor press and suitable sleeve to contact bearing inner race, firmly seat support bearing inner race, bearing serial number up, against shoulder on propeller shaft rear carrier.

bo. Measure distance from edge of support bearing inner race to face of hub of the carrier (54). (See dimension A, figure 5-366).

bp. Subtract 0.006 to 0.008 inch (0.015 to 0.020 cm) from this dimension. The result is the thickness of shim (8, figure 5-357). Shim (8) (1-020-016-01) is laminated shim 0.020 inch (0.051 cm) thick that can be reduced in increments of 0.002 inch (0.005 cm).

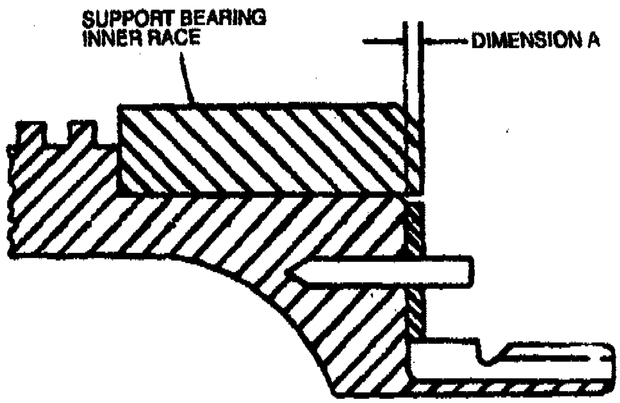


Figure 5-366. Determining Rear Support Bearing Shim Thickness (T53-L-15).

bq. Install shim (8).

br. Install new key washer (6) with tabs in journal slots.

bs. Install nut (5) and tighten to 90 to 100 pound-feet (134 to 149 kg cm). Release torque and retighten to 45 to 55 pound-feet (66 to 82 kg cm) torque.

NOTE

If the tab on the key washer (6) does not line up with the slot in the nut, use a washer of a different thickness or another nut. If spare washers and nuts are not available, the nut (5) may be lapped on a lapping stone.

bt. Do not bend tab of key washer (6) at this time.

bu. Using adapter (LTCT2029), test front seals for leakage as follows:

(1) Place packing (5, figure 4-2) around the reduction gear assembly.

(2) Position reduction gear assembly on adapter (LTCT2029) with propeller shaft up. Secure with nut, washers, and bolts, which are part of fixture.

(3) Install pressure gage into one of fittings on test fixture.

(4) Attach metered supply of dry, filtered air to test fixture.

(5) Using suitable pressure cap, close off third opening of test fixture.

(6) Pressurize test fixture to 20 psig (1406 gm sq cm) test fixture at this pressure.

(7) Inspect for leakage through propeller shaft seal. No leakage is allowed.

(8) If leakage is noted, disassemble reduction gear cover and, replace packing (15, figure 5-357).

5-358. FUNCTIONAL TEST. Functional test is not required.

5-359. PRIMARY REDUCTION GEAR ASSEMBLY AND SUN GEAR ASSEMBLY (T53-L-701, -701A). Proceed as follows:

5-360. DISASSEMBLY. Disassembly of Sun Gear Assembly is not required.

a. Straighten locking cup (27, figure 5-367) on nut (26) that secures rear support bearing inner race.

b. Using wrench assembly (LTCT2019), secure propeller shaft. Using spanner wrench (LTCT6605), break torque of nut (26). Remove nut. Remove and discard locking cup (27).

c. Using mechanical puller (LTCT6723), remove inner race of roller bearing (28).

d. Withdraw spacer and seal ring assembly (29). Remove two oil seal rings (30) from spacer (31).

e. Carefully slide retainer and gear assembly (32) straight up. over shaft to remove. Install thread protector on end of shaft.

f. Straighten tabwashers (34), and remove eight bolts (33). Discard tabwashers.

g. Remove retainer (35).

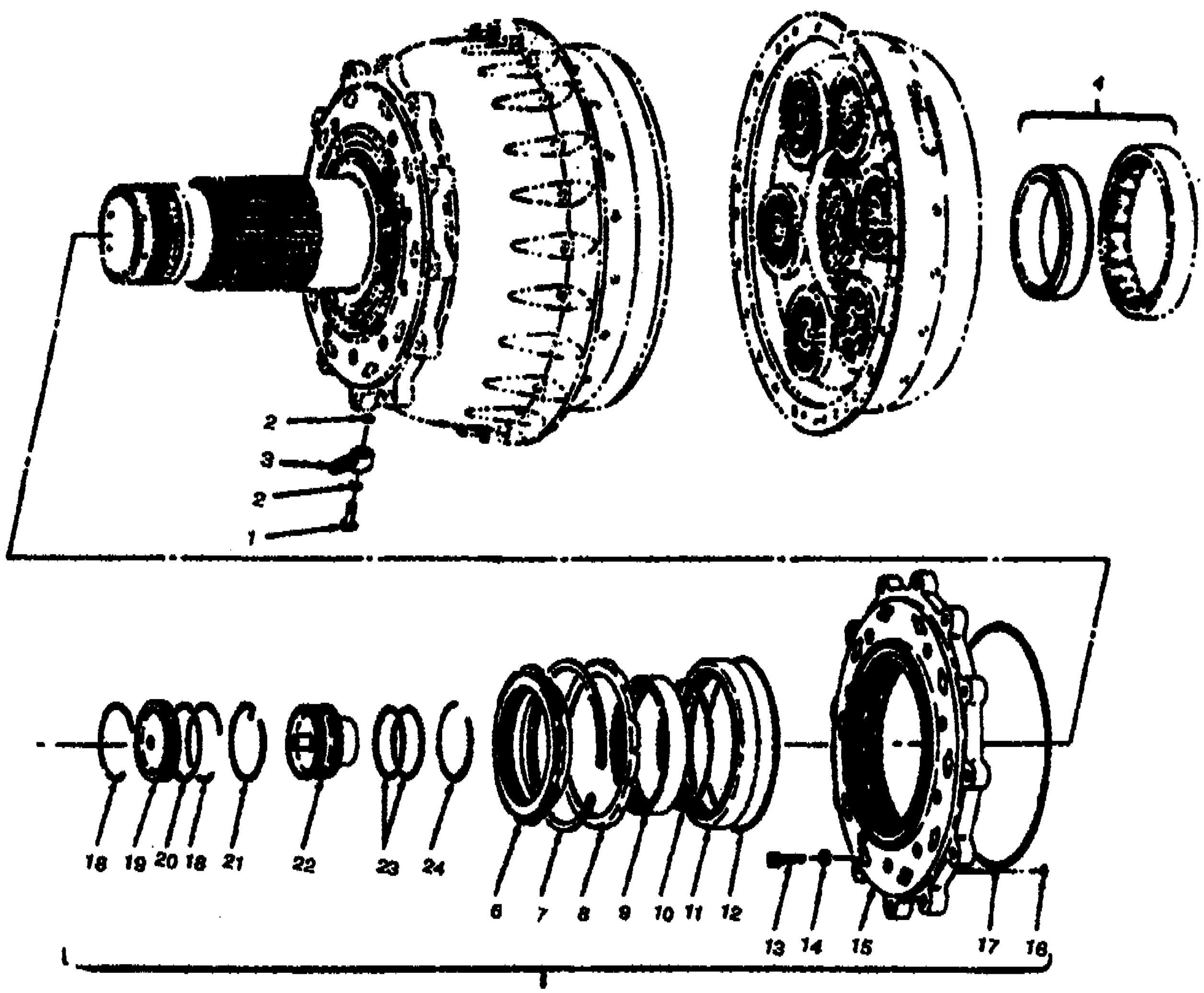


Figure 5-367. Primary Reduction Gear Assembly (T53-L-701, -701A) (Sheet 1 of 2).

h. Carefully extract the secondary sun gear (36) from the power gear (38). Remove bushing assembly (37).

i. Remove support assembly from holder, invert, and remove nut (6).

j. Open retainer (14) on bolts (13). Remove bolts and retainer. Discard retainers.

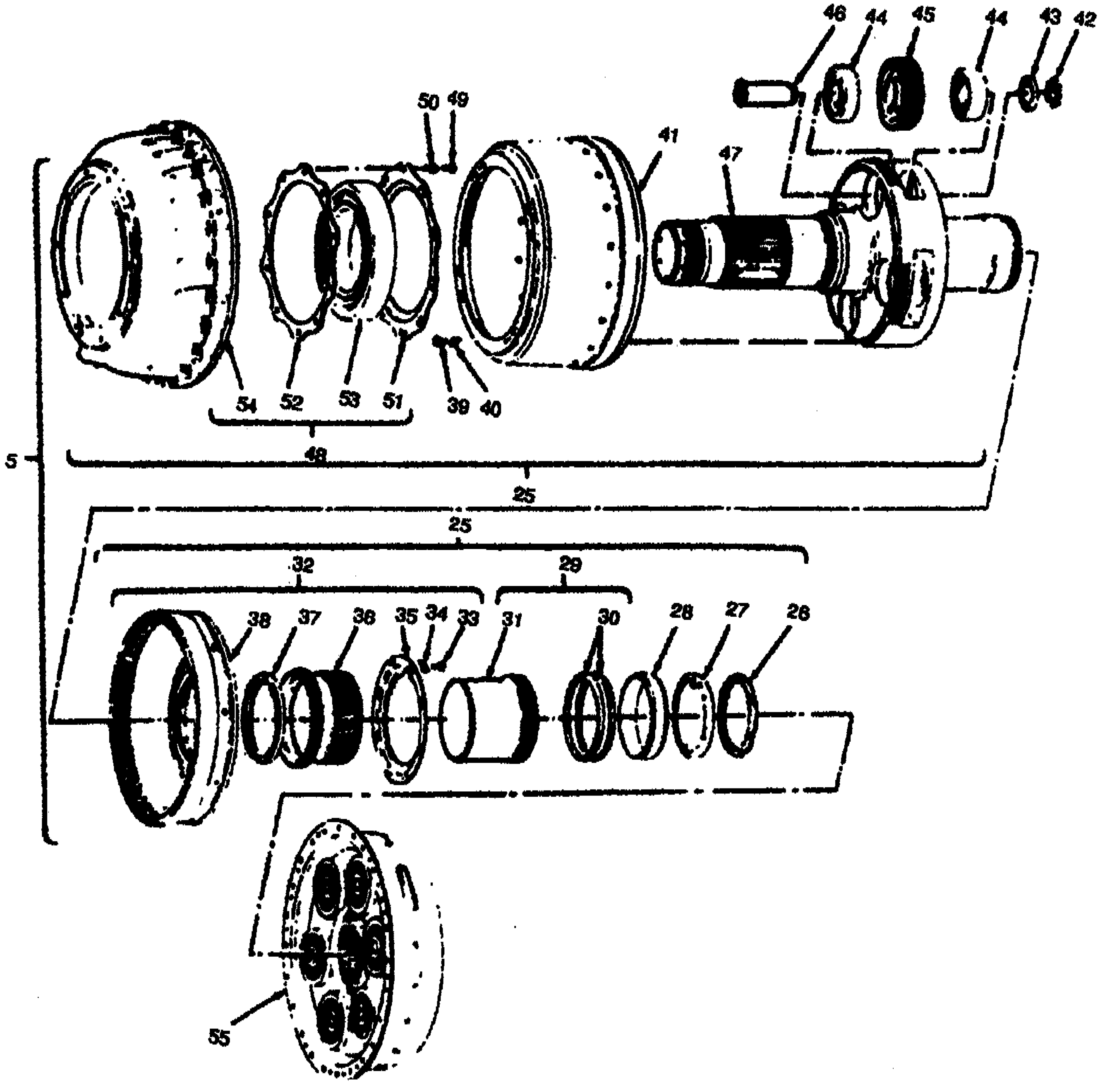


Figure 5-367. Primary Reduction Gear Assembly (T53-L-701, -701A) (Sheet 2 of 2).

k. Slip seal housing assembly (15) off over propeller shaft. Remove and discard packings (17 and 16) from front face of support assembly.

l. Remove retaining ring (7) from groove in ID of seal housing. Extract seal shield (8) and (11). Discard seal. Remove and discard packing (12).

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-367	No Number	REDUCTION GEAR ASSEMBLY and SUN SHAFT GEAR and RELATED PARTS (NHA 1-000-110-01)	Ref	D, E
-1	1-020-151-01	. BOLT, Fluid passage	1	D, E
-2	1-020-152-01	. WASHER, Flat	2	D, E
-3	1-020-149-01	. CONNECTOR, Multiple, fluid pressure line	1	D, E
-4	E1020UHAR3506	. BEARING, Roller, cylindrical (51600) (Lycoming Source Cont Dwg 1-300-408-02)	1	D, E
	1-020-500-01	. GEAR ASSEMBLY, Full reduction	1	D, E
	1-020-500-04	. GEAR ASSEMBLY, Full reduction	1	D, E
-5	1-020-300-01	. . GEAR ASSEMBLY, Reduction primary	1	D, E
-6	1-020-006-01	. . . NUT, Plain, round	1	D, E
-7	URA595CD	. . . RING, Retaining (80756) (Lycoming Source Cont Dwg 1-300-217-01)	1	D, E
-8	1-020-136-01	. . . SHIELD, Seal, propeller shaft	1	D, E
-9	1-020-127-02	. . . SPACER, Bearing, propeller shaft	1	D, E
-10	MS29561-243	. . . PACKING	1	D, E
-11	4078	. . . SEAL, Plain encased (91251) (Lycoming Source Cont Dwg 1-300-218-01)	1	D, E
	510370	. . . SEAL, Plain encased (24981) (Alternate) (Lycoming Source Cont Dwg 1-300-218-02)	1	D, E
-12	STD3019C75	. . . PACKING	1	D, E
-13	1-020-147-01	. . . BOLT, Machine, seal housing	10	D, E
-14	1-080-028-02	. . . RETAINER, Bolt	10	D, E
-15	1-020-260-01	. . . HOUSING ASSEMBLY, Seal	1	D, E
-16	MS29561-010	. . . PACKING	1	D, E

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-367-17	STD3019C87	. . . PACKING	1	D, E
-18	1-020-021-02	. . . RING, Retaining, propeller plug	2	D, E
-19	1-020-072-04	. . . PLUG, Propeller shaft	1	D, E
-20	MS29561-147	. . . PACKING, Propeller shaft	1	D, E
-21	1-020-186-01	. . . RING, Retaining, forward propeller shaft plug	1	D, E
-22	1-020-184-01	. . . PLUG, Thrust, propeller shaft	1	D, E
-23	STD3019C44	. . . PACKING	2	D, E
-24	1-020-209-01	. . . RING, Retaining, rear, propeller shaft plug	1	D, E
-25	No Number	. . . PRIMARY REDUCTION GEAR ASSEMBLY (NHA 1-020-300-01)	1	D, E
-26	1-020-181-01	. . . NUT, Spanner	1	D, E
-27	1-020-179-01	. . . CUP, Locking, bearing retainer	1	D, E
-28	No Number	. . . INNER RACE	1	D, E
-29	No Number	. . . . SPACER and SEAL RING ASSEMBLY	1	D, E
-30	1-020-188-01	. . . . . SEAL RING, Metal, spacer	2	D, E
-31	1-020-173-01	. . . . . SPACER, Reduction gear, oil transfer	1	D, E
-32	No Number	. . . . RETAINER and GEAR ASSEMBLY (NHA 1-020-300-01)	1	D, E
-33	STD3053-1	. . . . . BOLT, Drilled hex head	8	D, E
-34	STD3023K1	. . . . . TABWASHER	8	D, E
-35	1-020-178-01	. . . . . RETAINER, Secondary sun gear	1	D, E
-36	1-020-171-01	. . . . . GEAR, Secondary sun	1	D, E
-37	1-020-370-03	. . . . . BUSHING ASSEMBLY, Primary reduction gear	1	D, E

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-367-38	1-020-187-01	. . . . . GEAR, Primary ring split power	1	D, E
-39	STD3053-3	. . . . BOLT Hex head	8	D, E
-40	STD3023K1	. . . . TABWASHER	8	D, E
-41	1-020-169-01	. . . . GEAR, Secondary ring	1	D, E
-42	1-020-203-01	. . . . NUT, Spanner	4	D, E
-43	1-020-176-01	. . . . CUP, Locking. bearing retaining	4	D, E
-44	MR306G303	. . . . BEARING, Roller, cylindrical (38443) (Lycoming Source Cont Dwg 1-300-406-01)	8	D, E
-45	1-020-166-01	. . . . GEAR, Primary planet	4	D, E
-46	1-020-174-02	. . . . SHAFT, Planet gear, primary	4	D, E
-47	1-020-290-01	. . . . SHAFT, Propeller, subassembly	1	D, E
-48	No Number	. . . . BEARING and SUPPORT ASSEMBLY (NHA 1-020-300-01)	1	D, E
-49	STD3053-10	. . . . BOLT, Drilled hex head	10	D, E
-50	STD3023K2	. . . . . TABWASHER	10	D, E
-51	1-020-164-01	. . . . . PLATE, Bearing retaining	1	D, E
-52	1-020-163-01	. . . . . SHIM, Front bearing, propeller shaft	1	D, E
-53	XJ116	. . . . . BEARING, Ball, annular (43991) (Lycoming Source Cont Dwg 1-300-407-01)	1	D, E
-54	1-020-280-01	. . . . . SUPPORT ASSEMBLY, Front bearing	1	D, E
-55	1-020-310-01	. . CARRIER ASSEMBLY, Secondary	1	D, E

m. Remove spacer (9) from shaft. Remove packing (10) from spacer and discard packing.

n. Install reduction gear support assembly in plate (LTCT13186, detail of LTCT13095). Using suitable press, carefully remove reduction gear assembly from support assembly. Install thread protector on propeller shaft.

o. Straighten tabwashers (50) and remove bolts (49). Remove bearing retaining plate (51) and shim (40).

p. Install support assembly in thrust bearing support ring (LTCT179). Using suitable press and fixture, remove propeller thrust ball bearing (53).

q. With remainder of primary reduction gearing on bench, straighten tabwashers (40), and remove eight bolts (33). Discard tabwashers. Carefully remove secondary ring gear (41).

r. Assemble assembly and disassembly fixture (LTCT13095) with plate (LTCT13185), detail of (LTCT13095) and sleeve (LTCT13187, detail of LTCT13095). (Sleeve mounts in seat nearest to center of fixture bottom plate.)

s. Install primary gear assembly in fixture, propeller shaft end down with a planet gear shaft head positioned over the sleeve. Rotate applicable planet gear, as necessary, to mate shaft head splines with sleeve splines; seat in fixture.

t. Straighten locking cup (43) and, using wrench (LTCT6608, detail of LTCT13095), break torque of nut (42). Remove nut and locking cup. Discard locking cup.

u. Repeat steps s and t for remainder of planet gear assemblies.

v. Install assembly and disassembly fixture (LTCT13095) in suitable press with sleeve centered under ram.

w. Install primary gear assembly in fixture described in preceding step s. Using guide mandrel (LTCT13183, detail of LTCT13095), press planet gear primary shaft (46) from bearings and gear. Remove gear shaft from sleeve. Repeat procedure for removal of remaining shafts.

x. Slide planet gears (45) from between bearing pairs, extract bearing inner races, and remove roller bearings (44).

y. With suitable tool, remove retaining ring (18) from groove.

z. Thread shaft of removal and installation tool (LTCT4510) into propeller shaft plug (19). Remove plug. Remove and discard packing (20).

aa. Remove rear retaining ring (18) from groove.

ab. Using looped length of lockwire, remove retaining ring (21).

ac. Using puller described in preceding step z, remove plug (22). Remove and discard packings (23).

ad. Remove retaining ring (24) from groove.

5-361. CLEANING. Refer to paragraph 5-354.

5-362. INSPECTION. Perform specific inspections listed in table 5-125.

a. Perform inspections listed in table 5-125.

b. Visually inspect nut (6), seal housing (15), plug (19), plug (22) and support assembly (54) for nicks, burrs, damaged surface coatings and other discrepancies. FPI these parts. No cracks allowed.

5-363. REPAIR. (See figure 5-367). Proceed as follows:

a. Repair nicks or chipping on teeth of secondary ring gear (41), figure 5-366) as follows:

(1) Dimensional Inspection:

(a) Mark the ring gear at 16 places (22.5 equidistant) on the aft edge adjacent to outer diameter using an approved marking pencil.

NOTE

All dimensions must be taken 0.700 inch (1.778 cm) forward of ring gear aft face.

(b) Diametrically measure and record the outer diameter. (Reference 12.56 inches (31.90 cm) as shown in figure 5-372 at eight (8) places identified above.)

(c) Measure the wall thickness between the outer diameter and helical gear tooth root with a blade micrometer.

(2) Visually inspect the 0.03 x 45° diameter aft edge of forward flange (reference 9.34 diameter-see detail B of figure 5-372).

(3) Magnetic particle inspect ring gear. (Refer to MIL-STD-1949.)

(4) Gears whose dimensions fall within the shaded area in triangle of figure 5-371 are dimensionally acceptable. A total thickness measurement variation may not exceed 0.006 inch (0.015 cm) on any one gear.

(5) Visual Inspection: Chamfer (detail B of figure 5-372) must exhibit an appreciable, noticeable break-edge with no sharp corners.

WARNING

FLIGHT SAFETY PART

Magnetic particle inspection is flight safety critical.

(6) Magnetic Particle Inspection: No crack-like indications are allowed in any area. Pay particular attention to the root area.

(7) If chamfer (detail B of figure 5-372) does not exhibit an appreciably noticeable break-edge with no sharp corners, break edges by bending, and touch-up with black oxide per DMWR.

Table 5-125. Inspection of Primary Reduction Gear Assembly and Sun Gear Assembly (T53-L-701, -701A).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-45				
WARNING **FLIGHT SAFETY PART** **Magnetic particle inspection is flight safety critical.**				
-14	Sun Gear Assembly	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E).
		Visual and SIE	Wear or damage to gear teeth or splines	Repair or replace if limits are not met.
		Visual and Magnetic Particle (Refer to table 5-126)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-127)	Replace if limits are not met.
		Visual	Axial and circumferential scratches on sleeve	Acceptable. Replace sleeve if functional test fails. (Refer to paragraph 5-363).
			Minor nicks and dents in sleeve	Acceptable with blend repair. (Refer to SP 5000 in Appendix E). Replace sleeve if functional test fails. (Refer to paragraph 5-363).
			Pitting and corrosion on sleeve	Acceptable.
5-367				
-5	Primary Reduction Gear Assembly	Visual	Nicks, burrs, and scratches	Repair. (Refer to SP No. 5000 in Appendix E).
			Damaged threads	Repair or replace. (Refer to SP No. 5007 in Appendix E).
			Cracks	Not allowed. Replace.
		Visual and SIE	Wear or damage to gear teeth or splines	Repair or replace if limits are not met.
		Dimensional	Wear. (Refer to table 5-127)	Replace if limits are not met.
WARNING **FLIGHT SAFETY PART** **Verification of the bore diameter of the following part(s) is flight safety critical.**				
-4 and -44	Roller Bearing	Visual	Damaged bearing	
		Dimensional	Wear. (Refer to table 5-128)	Replace if limits are not met.

Table 5-125. Inspection of Primary Reduction Gear Assembly and Sun Gear Assembly (T53-L-701, -701A) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-367				
19	Plug	Visual and Magnetic-Particle. (Refer to table 5-126)	Cracks	Not allowed. Replace.
8	Shield Reduction	Visual	Cracks	Not allowed. Replace.
9	Spacer	Visual and Magnetic-Particle. (Refer to table 5-126)	Cracks	Not allowed. Replace.
	WARNING FLIGHT SAFETY PART Magnetic particle inspection to ensure that the following part is crack-free is flight safety critical.			
41 and 38	Secondary and Primary Ring Gears	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E).
		Visual and SIE	Nicks or chipping on teeth (More than 5 teeth per gear)	Replace.
			(Less than 5 teeth per gear)	Repair. (Refer to paragraph 5-363).
		Visual and Magnetic Particle. (Refer to table 5-126)	Cracks	Not allowed. Replace.
	WARNING FLIGHT SAFETY PART Magnetic particle inspection to ensure that the following part is crack-free is flight safety critical.			
47	Propeller Shaft	Visual and SIE	Scoring and fretting corrosion. (Refer to table 5-129).	Repair. (Refer to paragraph 5-363).
		Visual and Magnetic-Particle (Refer to table 5-126)	Cracks	Not allowed. Replace.

Table 5-125. Inspection of Primary Reduction Gear Assembly and Sun Gear Assembly (T53-L-701, -701A) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-367				
46	Planet Gear Primary Shaft	Visual and Magnetic Particle (Refer to table 5-126)	Cracks	Not allowed. Replace.
WARNING **FLIGHT SAFETY PART** **Magnetic particle inspection to ensure that the following part is crack-free is flight safety critical.**				
45	Primary Planet Gear	Visual and Magnetic Particle (Refer to table 5-126)	Cracks	Not allowed. Replace.
		Dimensional	Inspect for wear. (Refer to table 5-127)	Repair or replace. (Refer to paragraph 5-363).
42	Nut	Visual and Magnetic Particle (Refer to table 5-126)	Cracks	Not allowed. Replace.
51	Retaining Plate	Visual and Magnetic Particle (Refer to table 5-126.)	Cracks	Not allowed. Replace.
WARNING **FLIGHT SAFETY PART** **Verification of the bore diameter of the following part is flight safety critical.**				
53	Ball Bearing	Visual	Damaged bearing.	Replace if limits are not met.
		Dimensional	Wear. (Refer to table 5-128)	

Table 5-125. Inspection of Primary Reduction Gear Assembly and Sun Gear Assembly (T53-L-701, -701A) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-367				
	WARNING **FLIGHT SAFETY PART** **Magnetic particle inspection to ensure that the following part is crack-free is flight safety critical.**			
36	Secondary Sun Gear	Visual and Magnetic Particle (Refer to table 5-126)	Cracks	Not allowed. Replace.
35	Retainer	Visual and Magnetic Particle (Refer to table 5-126)	Cracks	Not allowed. Replace.
31	Spacer	Visual and Magnetic Particle (Refer to table 5-126)	Cracks	Not allowed. Replace.
		Dimensional	Inspect for wear. (Refer to table 5-127)	Repair or replace. (Refer to paragraph 5-363).

Table 5-126. Magnetic Particle Inspection of Primary Reduction Gear Assembly and Sun Gear Assembly (T53-L-701, -701A).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD OF MAGNETIZATION
4-45, 14	Sun Gear Assembly	Circular, use central conductor at 1500 amperes. Longitudinal at 7500 ampere-turns.
5-367, 9	Spacer	Circular, use central conductor at 600 amperes.
5-367, 19	Plug	Longitudinal at 4000 ampere-turns.
5-367, 31	Spacer	Circular, use central conductor at 800 amperes.
5-367, 35	Retainer	Circular, use central conductor at 800 amperes.
5-367, 36	Secondary Sun Gear	Circular, use central conductor at 1000 amperes.
5-367, 38	Power Gear	Circular, use central conductor at 2500 amperes.
5-367, 41	Secondary Ring Gear	Circular, use central conductor at 1800 amperes. Longitudinal at 9000 ampere-turns.
5-367, 42	Nut	Circular, use central conductor at 500 amperes.
5-367, 45	Primary Planet Gearshaft	Circular, use central conductor at 1500 amperes.
5-367, 46	Planet Primary Gearshaft	Circular, use central conductor at 600 amperes.
5-367, 47	Propeller Shaft	Circular, use central conductor at 1500 amperes for shaft area and 2500 amperes for flange. Longitudinal at 20,000 ampere-turns.
5-367, 51	Retaining Plate	Circular, use central conductor at 800 amperes.

Table 5-127. Dimensional Inspection of Primary Reduction Gear Assembly.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-367								5-368
Propeller Shaft Carrier (Forward)	-47	ID	2.8339 (7.1981)	2.8342 (7.1989)					A
Carrier (Rear)		ID	2.8339 (7.1981)	2.8342 (7.1989)					B
WARNING **FLIGHT SAFETY PART** **The following dimensional inspection is flight safety critical.**									
Shaft (Forward)		OD	4.1340 (10.5004)	4.1345 (10.5011)					C
Shaft (Rear)		OD	3.9370 (10.00 00)	3.9375 (10.0013)					D
Planet Gear Primary Shaft	-46	OD	1.1813 (3.0005)	1.1816 (3.0013)					E
WARNING **FLIGHT SAFETY PART** **The following dimensional inspection is flight safety critical.**									
Primary Planet Gear	-45	ID	1.1806 (2.998 7)	1.1811 (3.000 0)	1.1806 (2.9987)	1.1811 (3.0000)			F
Front Bearing Support Assembly	-54	ID	7.4797 (18.9984)	7.4802 (18.9997)					G
Spacer	-31	Axial	3.678	3.680					X
	4-45								
Sun Gear Assembly	-14	ID	0.239	0.245	0.226	0.245			H

Table 5-128. Dimensional Inspection of Primary Reduction Gear Assembly Bearings (T53-L-701, -701A).

BEARING TYPE PART NO.	FIG & INDEX	DIM MEAS	BLUEPRINT DIMENSIONS MIN	BLUEPRINT DIMENSIONS MAX	INTERNAL CLEARANCE	END PLAY	HARD-NESS RC	CON-TACT ANGLE	LYCOM-ING PART NO.
	5-367								
WARNING FLIGHT SAFETY PART The following dimensional inspection is flight safety critical.									
Roller MR3066303	44	ID	1.1809 (2.9995)	1.1811 (3.0000)	0.0020 to 0.0025* (0.0051 to 0.0064	N/A	58 TO 61	N/A	1-300-406-01
		OD	2.8342 (7.1989)	2.8346 (7.199 9)					
WARNING FLIGHT SAFETY PART Inspection of 3.9365 - 3.9370 dimensions is flight safety critical.									
Roller, E1029UHAR350 3 (Inner Race)	4	ID	3.9365 (9.9987)	3.9370 (10.0000)	0.0030 to 0.0039**** (0.0076 to 0.0099)	N/A	58 TO 61	N/A	1-300-408-01
Roller, E1020UHAR350 9 (Inner Race)		ID	3.9365 (9.998 7)	3.9370 10.000 0)	0.0030 to 0.0039**** (0.0076 to 0.0099)	N/A	58 TO 61	N/A	1-300-408-03
Roller, E1029UHAR350 6 (Inner Race)		ID	3.9365 (9.9987)	3.9370 (10.00 00)	0.0030 to 0.0039**** (0.0076 to 0.0099)	N/A	58 TO 61	N/A	1-300-408-02
WARNING FLIGHT SAFETY PART Inspection of 4.1336- 4.1339 dimensions is flight safety critical.									
Ball XJ116	53	ID	4.1336 (10.4993)	4.1339 (10.5001)	0.0015 to 0.0023*** (0.0038 to (0.0058)	0.014 to 0.022*** (0.036 to 0.056)	58 TO 61	N/A	1-300-407-01
		OD	7.4796 (18.9982)	7.4803 (19.000)					

* Under a 11.0 gage load.

** Under a 22.0 gage load.

*** Before mounting under a 22.0 pound load

**** Before mounting under a 11.0 pound load

***** Dimensions acceptable at overhaul are 4.1336 to 4.1342 inch (10.4993 to 10.5009 cm) ID and 0.0015 to 0.0030 inch (0.0038 to 0.0076 cm) internal clearance.

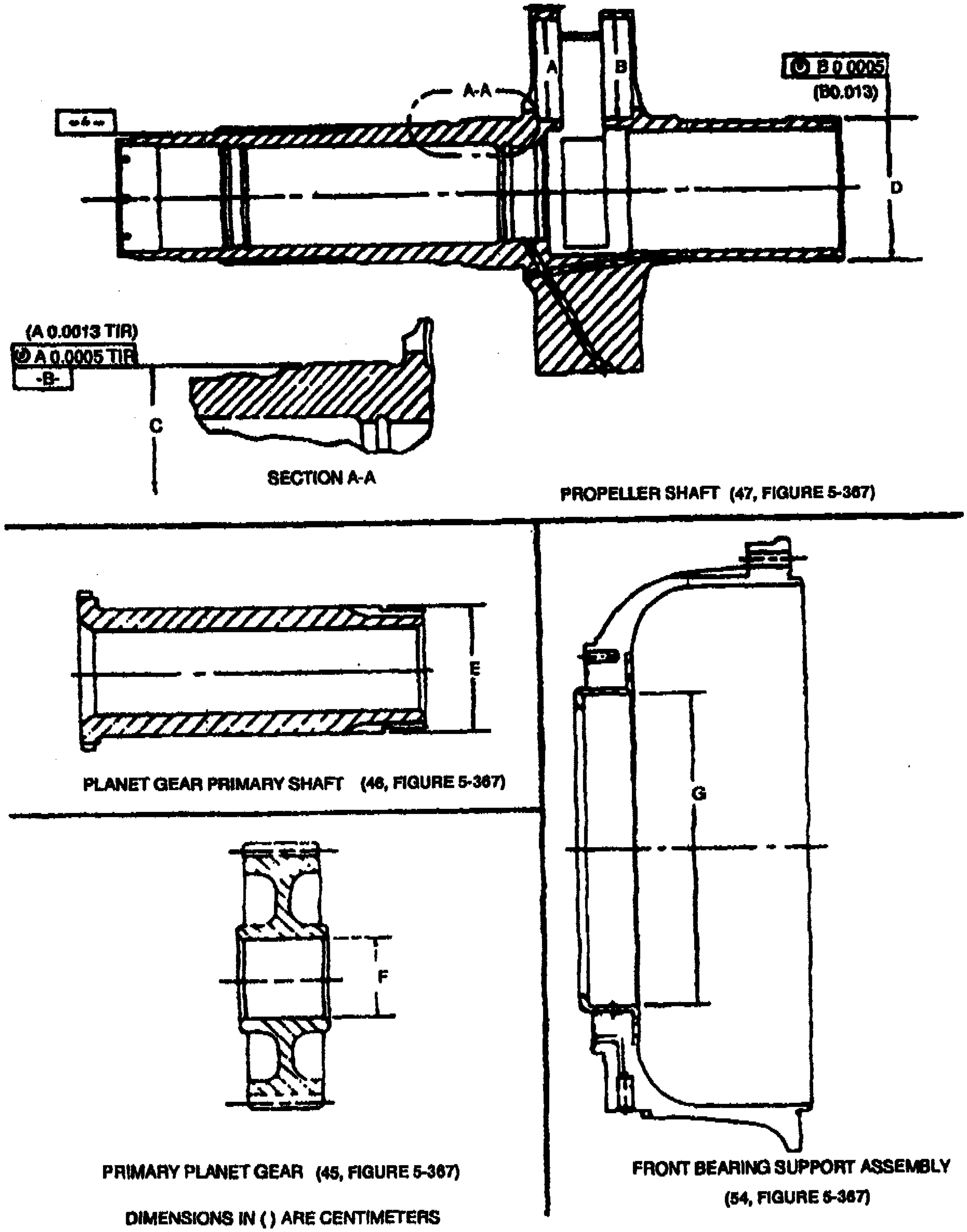


Figure 5-368. Primary Reduction Gear Assembly Dimensional Inspection Locations (T53-L-701, -701A) (Sheet 1 of 3).

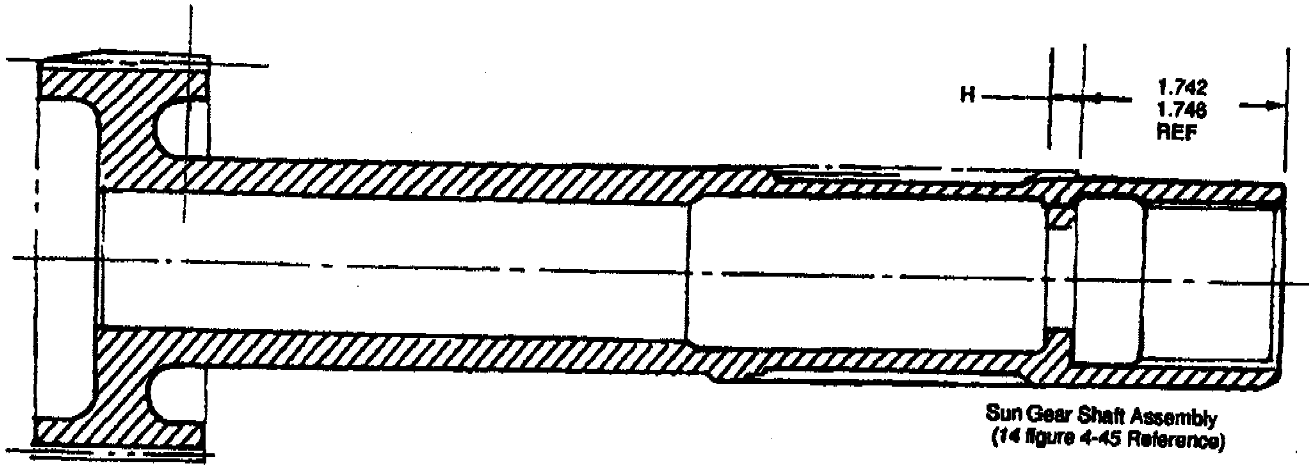


Figure 5-368. Primary Reduction Gear Assembly Dimensional Inspection Locations (T53-L-701, -701A) (Sheet 2 of 3).

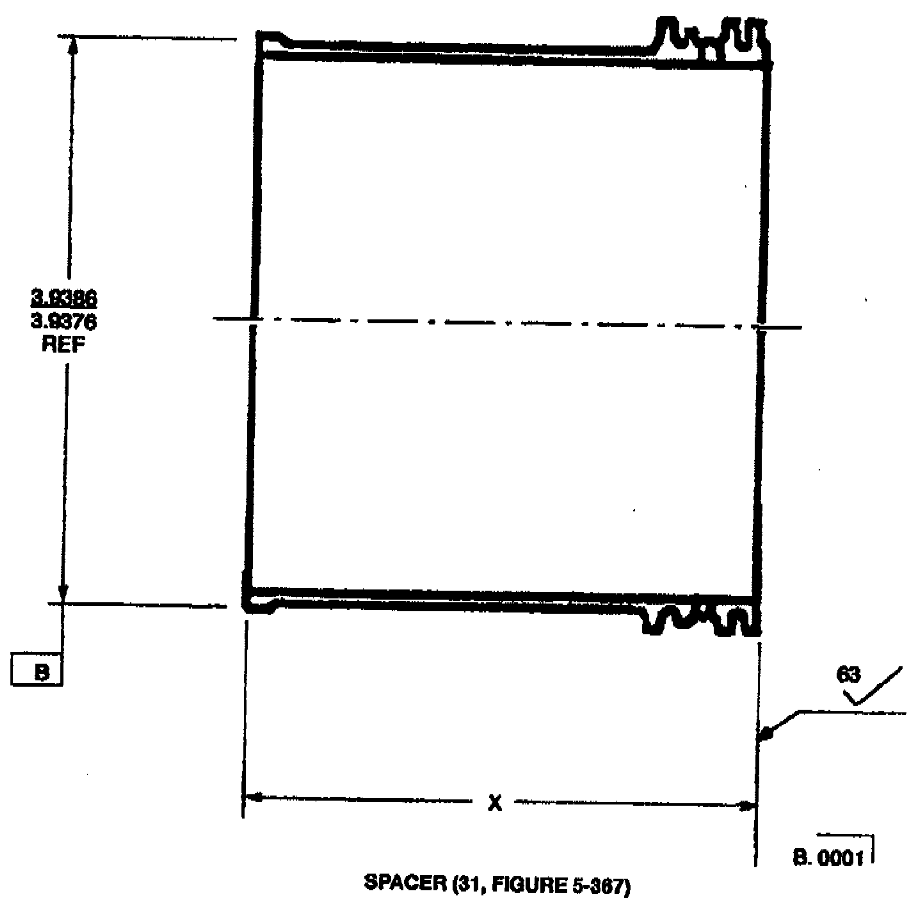
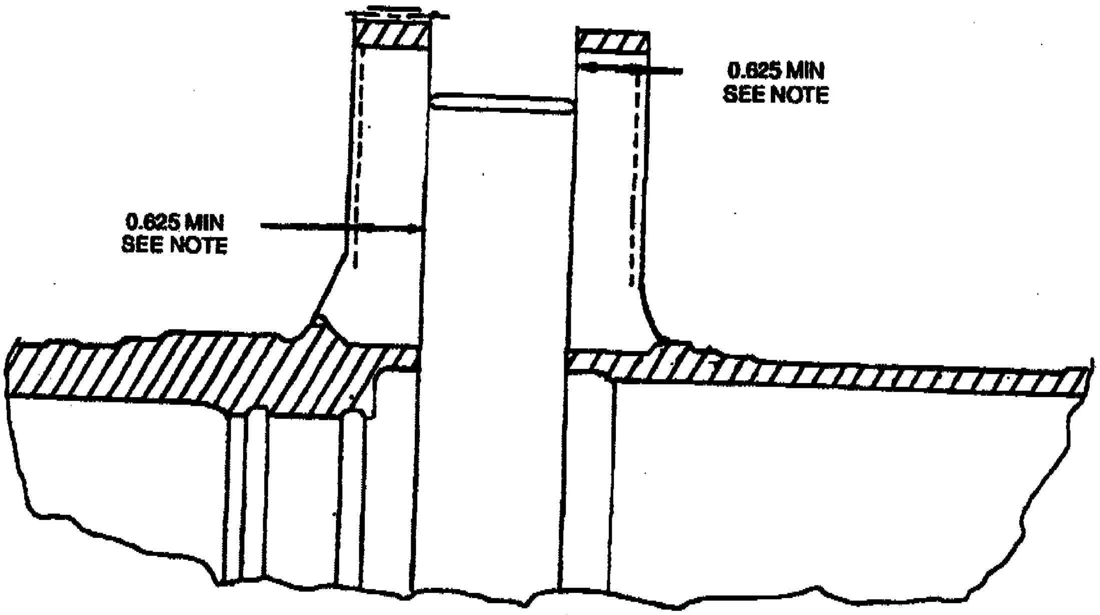


Figure 5-368. Primary Reduction Gear Assembly Dimensional Inspection Locations (T53-L-701, -701A) (Sheet 3 of 3).

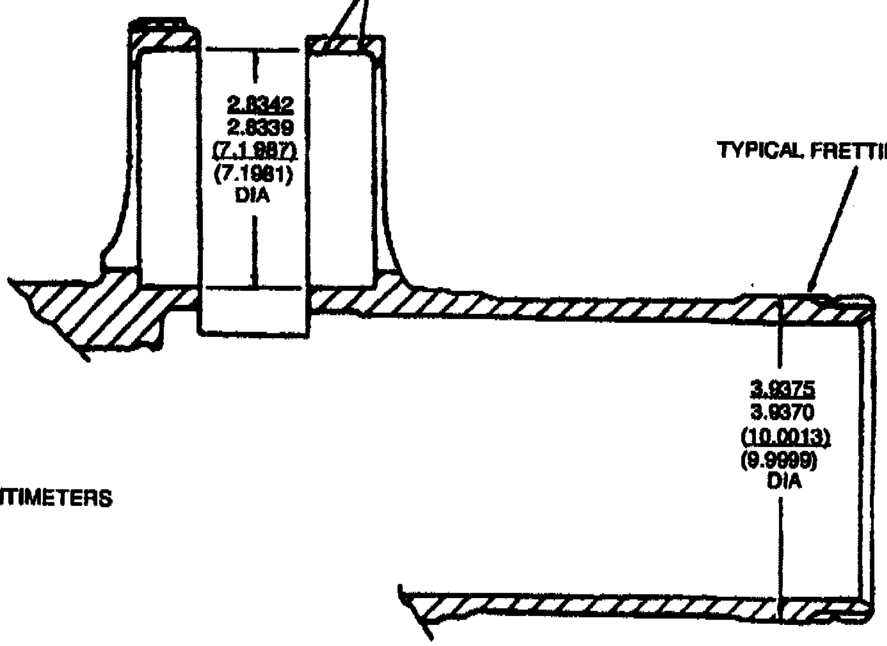
Table 5-129. Propeller Shaft Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Circumferential Scoring	5-369	Circumferential scoring on 3.9370 to 3.9375 inch (10.0000 to 10.0013 cm) OD bearing bores is acceptable provided dimensional inspection requirements given in table 5-128 can be maintained and local scoring resulting in gouges greater than 0.005 inch (0.013 cm) in depth is not evident. (Measure ID across top of scored area.) If limits are exceeded, repair as outlined in paragraph 5-363.
Fretting Corrosion	5-369	Fretting corrosion is allowed around entire circumference of the 3.9370 to 3.9375 inch (10.0000 to 10.0013 cm) OD in one area as viewed axially provided dimensional inspection requirements given in table 5-128 call be maintained, and depth is not greater than 0.010 inch (0.025 cm). (Measure across top of fretted area.) If defects are within limits, blend-repair sharp protrusions or rough surface to obtain smooth finish. If limits are exceeded, repair as outlined in paragraph 5-363. **NOTE** Light axial scratches on 3.9370 to 3.9375 inch (10.0000 to 10.0013 cm) OD are allowed to a depth of 0.002 inch (0.005 cm).
Grooved Bearing Bores	5-370	Circumferential scoring or grooving resulting from incomplete cleanup, during modification from 1-120-165-01 to -07, is acceptable except on those areas noted on figure 5-369. Grooving shall not exceed 0.015 inch in depth.



NOTE: 100% CLEAN UP REQUIRED IN THIS AREA. NO GROOVING ALLOWED.

Figure 5-369. Areas of Acceptable Grooving.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-370. Propeller Shaft Inspection Limits.

(8) Gear teeth may be ground to remove nicks, cracks, or crack like indications. Rework shall be accomplished by grinding in 0.025 inch (0.064 cm) increments from the rear face of the gear. Do not grind beyond 6.178 inch (15.692 cm) minimum (see detail C of figure 5-372).

(a) Reworked surfaces shall have finish.

(b) Hand stoning of nicks is permitted.

(c) The grinding is to be accomplished on 360° of the aft edge.

WARNING

FLIGHT SAFETY PART

Magnetic particle inspection is flight safety critical.

(d) Magnetic particle inspection. (Refer to MIL-STD-1949.)

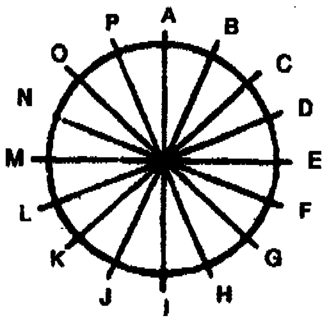
(e) Recoating by black oxide process is not necessary.

(9) Gears accepted per paragraph (4) shall be identified by vibropeening an asterisk (*) after the serial number of the gear.

(10) Gears that have been reworked by grinding teeth shall have a dash number after the part number as follows:

(a) Removal of 0.025 inch (0.064 cm), -1.

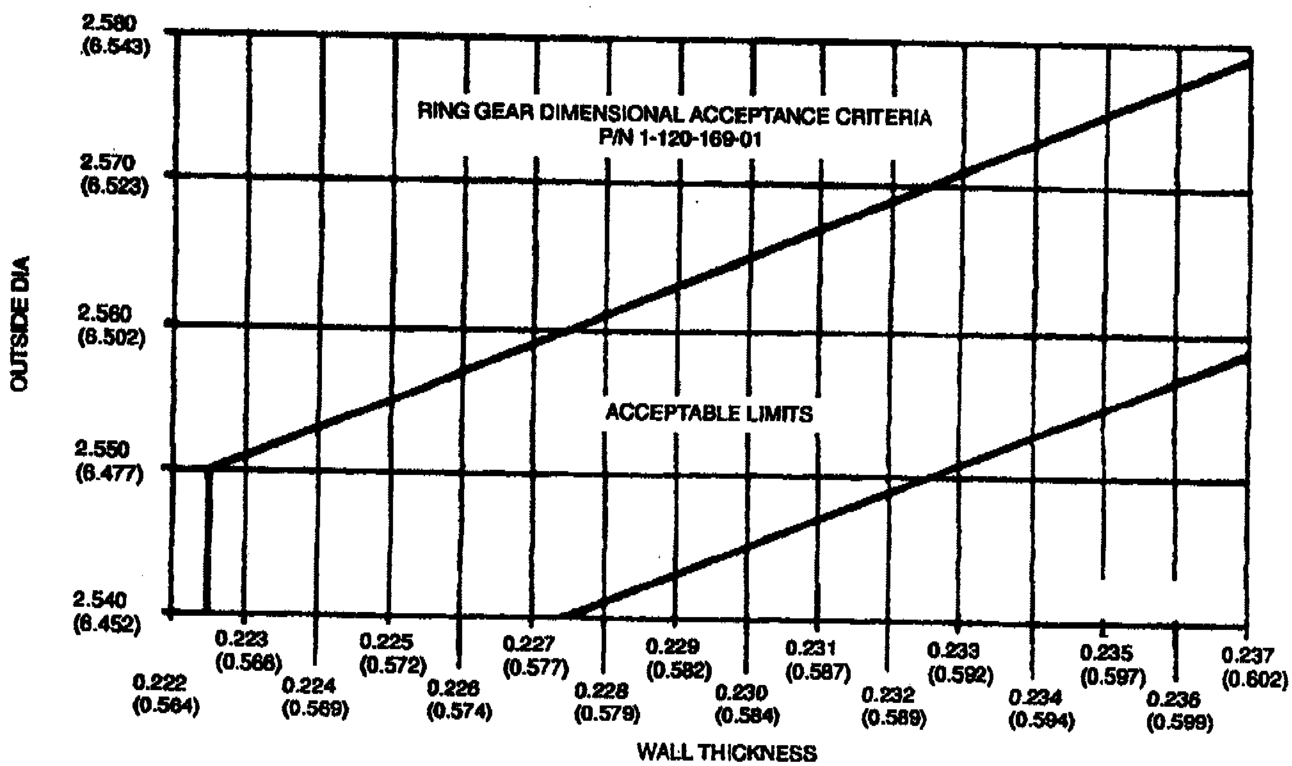
(b) Removal of 0.050 inch (0.127 cm), -2.



GEAR S/N__________ HRS__________
ENG S/N______
SEQ NO ______
READ GEAR ASSY S/N__________

INDEX 0° (AT S/N OR CLOSE TO IT)
INDICATE 22.5°
8 DIAMETERS 16 WALL THICKNESS

LOCATION	DIA	WALL THICKNESS	
A-I		A	I
B-J		B	J
C-K		C	K
D-L		D	L
E-M		E	M
F-N		F	N
G-O		G	O
H-P		H	P



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-371. Ring Gear Inspection (P/N 1-020-169-01).

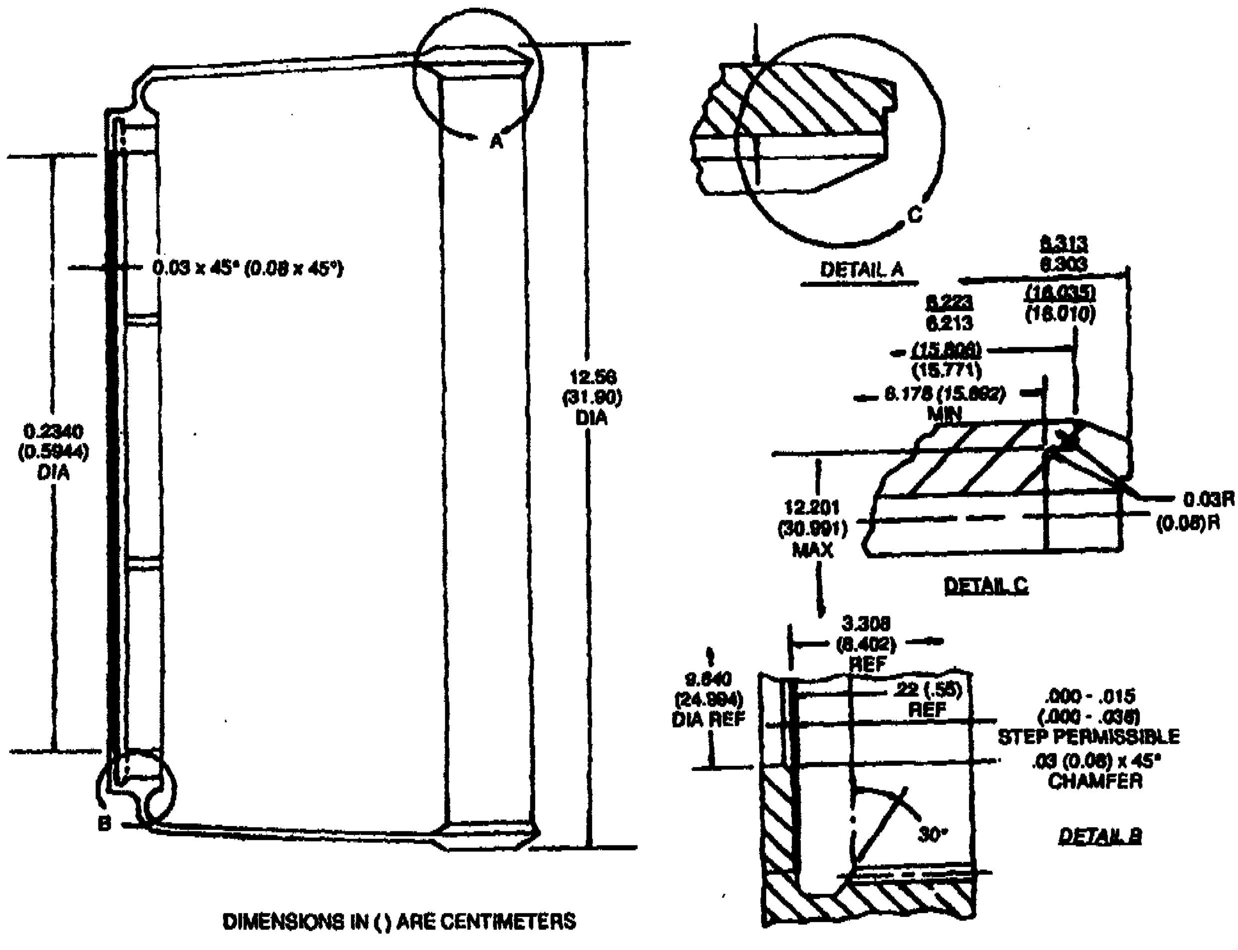


Figure 5-372. Secondary Ring Gear- Repair Area (T53-L-701, -701A).

(c) Removal of 0.075 inch (0.191 cm), -3.

(d) Removal of 0.100 inch (0.254 cm), -4.

(e) Removal greater than 0.100 inch (0.254 cm) but not less than the referenced 6.178 inch (15.692 cm) minimum dimension, -5.

b. Repair nut (6), seal housing (15), plug (19), plug (22) and support assembly (54) as required as follows: blend repair (refer to SP No. 5000), repair threads (refer to SP Nos. 5007 and 5004), and repair surface coating (refer to SP No. 6021).

c. Repair nicks or chipping on teeth of power gear (43, figure 5-367) as follows:

(1) Using a hand stone, blend damaged teeth the minimum amount required to remove nicks. (See figure 5-373.)

(2) Reworked surfaces shall be polished to a 32 micro-inch finish.

(3) Perform a magnetic-particle inspection. (Refer to table 5-110).

(4) Clean gear. (Refer to SP No. 3009 in Appendix E.)

(5) Touch up with black oxide coating. (Refer to SP No. 6003 in Appendix E.)

d. Repair 1.1806 to 1.1810 inch (2.9987 to 2.9997 cm) diameter of primary planet gear (45, figure 5-367), that exhibits wear beyond acceptable limits, as follows:

(1) Machine oversize to obtain 0.002 inch maximum buildup after final machining. Clean parts with dry cleaning solvent (item 134, table C–1) or cleaning solvent (item 101, table C–1).

(2) Electroless nickel plate per MIL-C-26074.

(3) Rinse part in cold water (room temperature) and then hot water (180°F) and then blow dry.

(4) Bake at 365° to 385°F for 3 hours.

(5) Visually inspect plated area for cracking, peeling or blistering of plating. None allowed.

(6) Machine to blueprint dimensions (refer to table 5-127).

e. Repair 2.8339 to 2.8342 inch (7.1981 to 7.1989 cm) ID of propeller shaft (47, figure 5-357), that exhibits scoring beyond acceptable limits as follows: (see figure 5-374.)

(1) Using a suitable grinding fixture, grind away all plating from the damaged surface.

NOTE

Ensure all chrome plating has been removed.

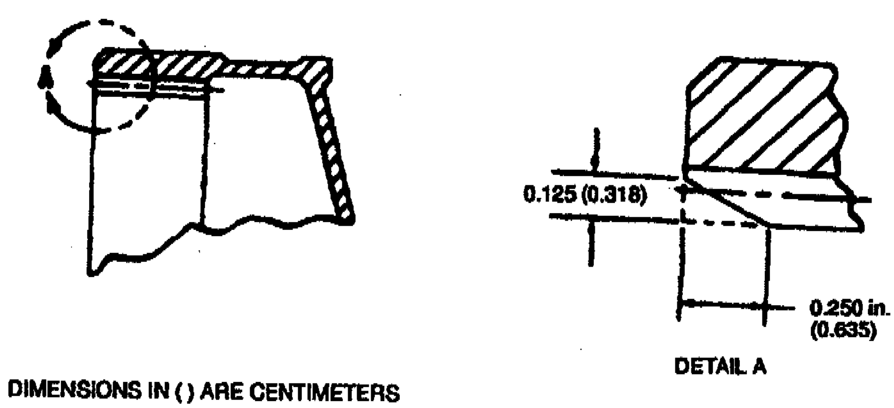
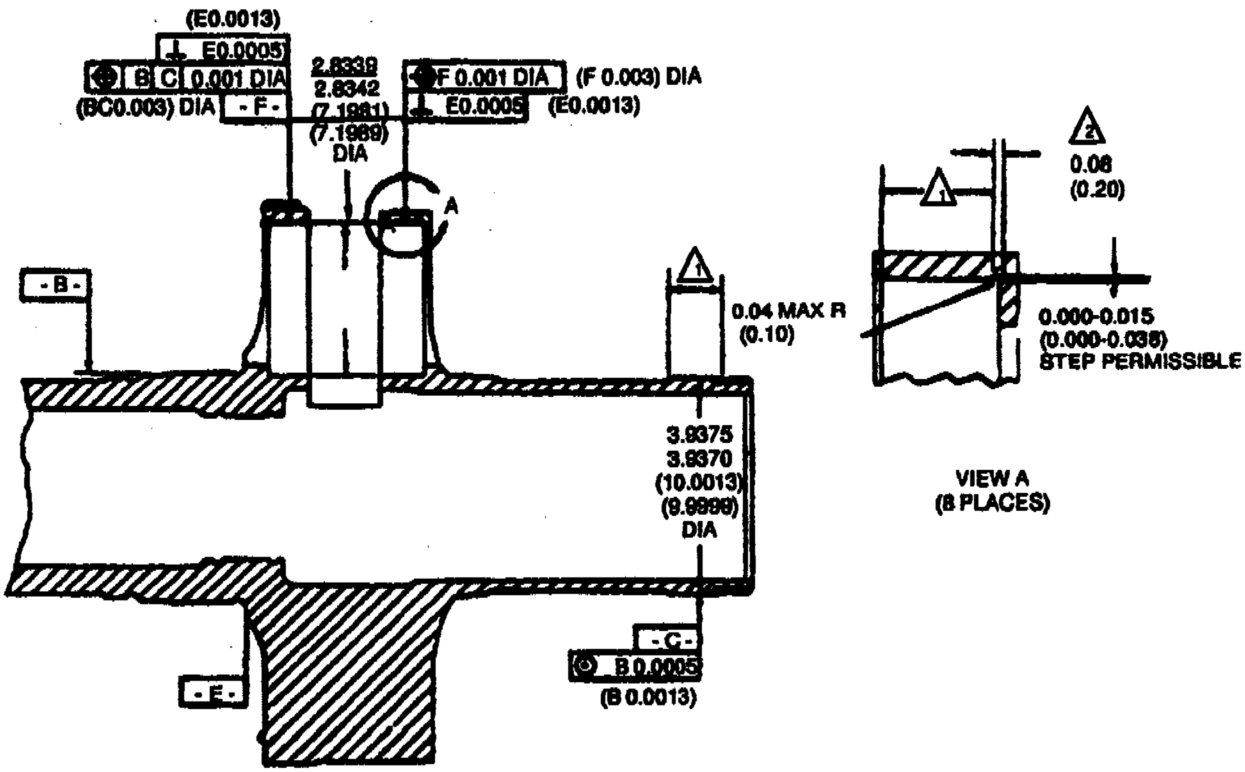


Figure 5-373. Power Gear - Repair Area (T53-L-701, -701A).



1 NO CHROME PLATE PERMISSIBLE IN RADIUS

2 CHROME PLATE AREAS

Figure 5-374. Scoring and Fretting Repair - Propeller Shaft (T53-L-701, -701A).

(2) Rinse with water and buff the bearing bore surface.

(3) Grind area shown in figure 5-375 to remove material for a final chrome plate of 0.002 to 0.010 inch (0.005 to 0.025 cm) thickness.

(4) Ensure that all chrome plating has been removed.

(5) Chrome plate for a 0.002 to 0.010 inch (0.005 to 0.025 cm) thickness after final grind per QQ-C-320, Class 2.

(6) Bake at 635° to 665°F (352° to 355°C) for 2 hours.

(7) Machine to dimensions per figure 5-375.

f. Repair 3.9370 to 3.9375 inch (10.0000 to 10.0013 cm) shaft (47, figure 5-367) that exhibits scoring or fretting corrosion beyond acceptable limits as follows: (See figure 5-374.)

(1) Using a suitable grinding fixture, grind away all plating from the damaged surface.

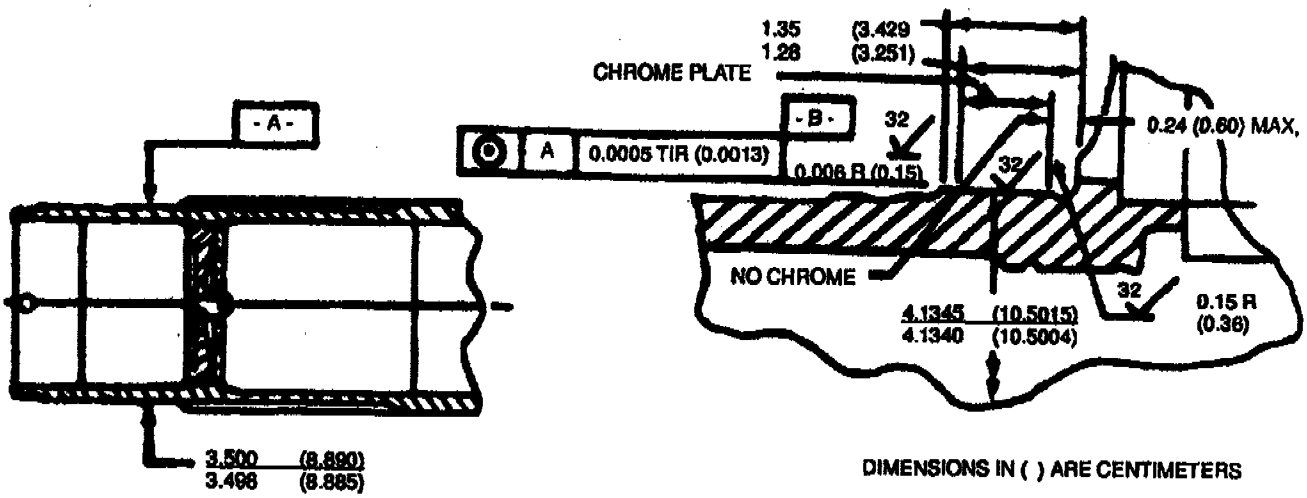


Figure 5-375. Propeller Shaft Rework - (P/N 1-020-290-01).

(2) Chrome-plate for a 0.002 to 0.015 inch (0.005 to 0.038 cm) thickness after final grind as outlined in SP No. 6014 in Appendix E.

(3) Bake at 635° to 665°F (335° to 352°C) for 2 hours.

WARNING

FLIGHT SAFETY PART

Dimensional inspection after the following repair is flight safety critical.

(4) Machine to dimension given in figure 5-374.

g. Replace sun gear sleeve (14, figure 4-45) as follows:

(1) Machine off sleeve from gearshaft to dimensions of figure 5-376, sheet 1 of 3.

CAUTION

Sleeves are manufactured from a metal having specified magnetic properties. The manufacturer performs a special heat treatment on the sleeves.

(2) Obtain special sleeve from manufacturer, same as P/N 1-020-192-01, except as noted in figure 5-376, sheet 1 of 3. Ensure the associated heat lot number is marked on sleeve.

(3) Clean surfaces to be welded using No. 600 silicone grit paper (item 274, Appendix C–1, or equivalent).

(4) Clean surfaces to be welded with acetone (item 13, table C–1).

(5) Demagnetize the sleeve and shaft prior to welding. Residual field must be below 3 gauss.

(6) Assemble sleeve to shaft and inspect fit.

(a) Butt joint - Mismatch between shoulder of sleeve and shaft shall not exceed the requirements of SP No. 5005, in Appendix E.

(b) Plug weld - Gaps between mating surfaces of joint to be slip fit at room temperature and shall not exceed 0.0015 inch maximum.

NOTE

Welding parameters (i.e. voltage, amperage, surface feed, focal distance, etc.) shall be established using test pieces of the same material and joint geometrics as the assemblies being welded.

(7) Electron beam weld per SP No. 5005, Appendix E, as specified in figure 5-376, sheet 2 of 3.

(a) Weld butt joints first and then do the plug welds. Up to three overlap welds are permissible if 0.040 inch accumulative weld width can be obtained.

(b) Permit the assembly to cool, below 300°F (149°C) between each pass.

(8) Inspect joint to class criteria contained in SP No. 5005, Appendix E.

(a) Undercutting shall be acceptable provided the depth does not exceed 0.005 inch.

(b) The edges of the undercut shall blend smoothly into the surrounding area.

(c) The plug weld should penetrate a maximum of 0.040 inch into output shaft. Each lot shall be verified by micro analysis of test piece of both butt and plug weld requirements.

(9) Finish grind, to dimensions in figure 5-376, sheet 3 of 3, as follows:

(a) Wheel speed shall be 5000 to 6000 surface feet per minute.

(b) The work speed shall be 70 to 90 surface feet per minute.

(c) Rate of stock removal on assembly sleeve shall be 0.002 inch per minute.

(d) Wheel type should be JA601-J07-V25.

(10) Stress relieve the assembly at 270° - 280°F for 72 hours.

(11) Functional test per paragraph 5-202.

(12) Assemblies that do not meet the functional test requirements may be reworked as follows:

(a) Low electrical output: Re-stress relieve as per step (10) and retreat.

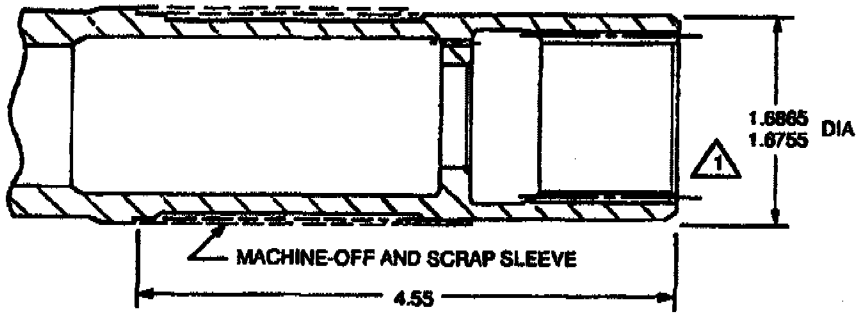
(b) High electrical output: Glass bead peen the sleeve area with glass beads per MIL-G-9954, Size 4, using approximately 20 to 30 psi air pressure producing a 6 to 10 N peening intensity with 150% coverage. Stress relieve as per step (10)and retest.

(13) Assemblies which fail functional test, can be repaired by replacing the defective sleeve again, providing the following procedures are done.

(a) Obtain a replacement sleeve and note the associated sleeve heat lot number.

(b) If heat lot number is different, proceed to replace defective sleeve.

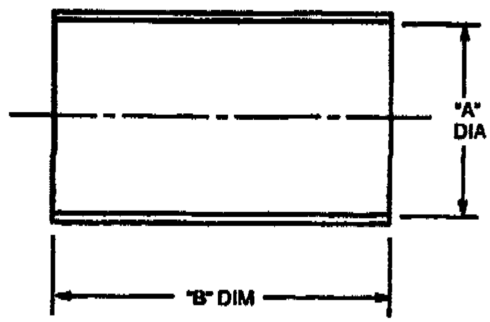
(c) If heat lot number is the same, contact Textron Lycoming for revised heat treatment parameters to correct sleeve magnetic properties, then proceed to replace defective sleeve.



1 MACHINE THIS DIAMETER FOR SPECIFIED LENGTH

NOTE: *DIAMETER PRIOR TO CHROME PLATE

PRELIMINARY MACHINE TO REMOVE SLEEVE



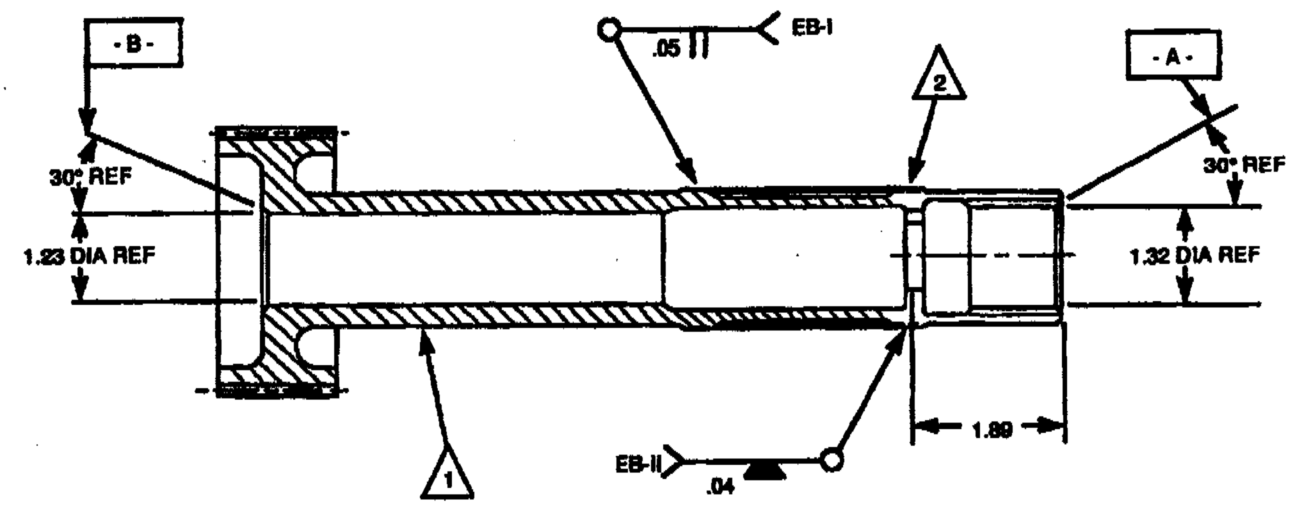
1. SAME AS 1-020-192-01 EXCEPT

A DIAMETER TO BE 0.0005 - 0.0015 LOOSE FIT WITH 1.6755 - 1.6865 DIA.

B DIMENSION TO BE 2.83 INCHES

SPECIAL SLEEVE DETAIL

Figure 5-376. Sun Gear Sleeve Replacement (Sheet 1 of 3).

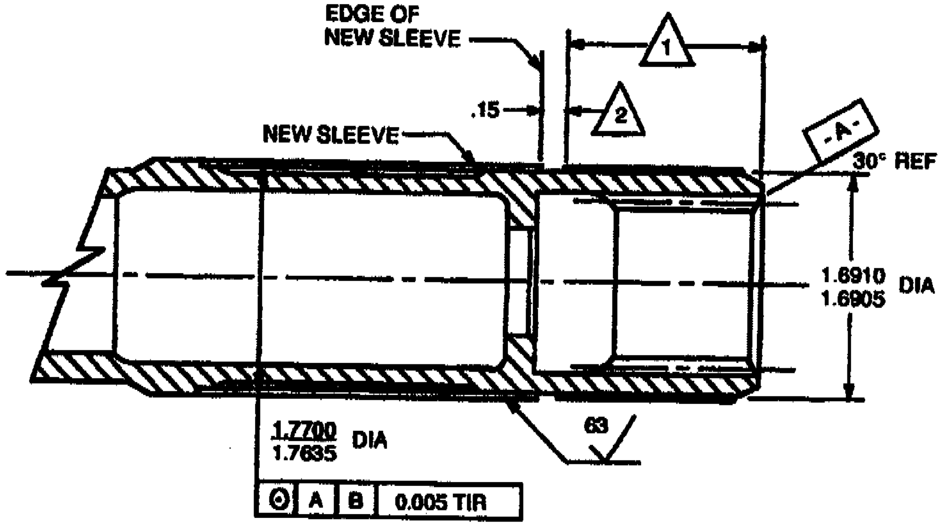


WELDING OF SLEEVE TO SUN GEARSHAFT

1. TRANSFER LYCOMING RAW MATERIAL LOT NUMBER FROM SLEEVE TO GEARSHAFT BEFORE MACHINING. MARK BY SHALLOW PEENING.

2. ASSEMBLE SLEEVE TO GEARSHAFT WITH RAW MATERIAL LOT NUMBER IN THIS POSITION. AFTER WELDING AND MACHINING, EVIDENCE OF MARKING PERMISSABLE IN THIS AREA.

Figure 5-376. Sun Gear Sleeve Replacement (Sheet 2 of 3).



FINAL MACHINING OF SLEEVE

1 CHROME PLATE THIS LENGTH TO ACHIEVE FINISH DIAMETER

2 CHROME PLATE OPTIONAL THIS AREA

Figure 5-376. Sun Gear Sleeve Replacement (Sheet 3 of 3).

(14) Steel shot peen remaining rework area per MIL-S-13165 using last shot number 170 (nominal diameter 0.0165 inches) peening intensity to be 5-8A with a minimum coverage of 150%.

(15) Chrome plate per federal specification QQ-C-320, Class 2. Refer to figure 5-377, sheet 3 of 3.

(16) Bake at 265° ± 10°F for 5 hours.

h. Repair wear on forward end face of spacer (31) as follows:

(1) Machine to 3.678. If scoring/wear is cleaned up, parts are acceptable for use as is.

(2) If scoring/wear is still evident, machine to obtain a 0.002 to 0.015 inch thickness after chrome plate and final grind.

(3) Chrome plate as outlined in SP No. 6014, Appendix E, at 635° to 665°F for 2 hours.

(4) Machine to 3.678 to 3.680. (See figure 5-368.)

5-364. REASSEMBLY. Reassembly of Sun Gear Assembly is not required. Proceed as follows:

a. Install retaining ring (24, figure 5-367) in rearmost internal groove of propeller shaft.

b. Lubricate packings (23) and install in grooves of rear thrust plug (22). Using removal and installation tool (LTCT4510), install rear oil jet plug in propeller shaft. Ensure plug is seated firmly against retaining ring.

c. Insert retaining ring (21), ensuring it seats in groove.

d. Install aft retaining ring (18) followed by forward propeller shaft plug (19), with lubricated packing (20) installed, and final retaining ring (18). Use propeller shaft plug puller to facilitate positioning of plug.

e. Install bushing assembly (37) on rear of propeller shaft.

f. Mount seal rings (30) in grooves of spacer (31). Check and record side clearance and end gap of the oil seal rings.

g. Slip spacer on end of propeller shaft.

h. Position oil flow fixture assembly (LTCT6604) on propeller shaft assembly and retain with rear bearing spanner nut (26) and locking cup (27). Nut must be only hand-tight.

NOTE

For ease in handling, hoisting adapter (LTCT181) may be used.

i. Using lubricating oil (item 189or 190, table C–1) heated to 90° to 110°F (32° to 43°C), apply 48 to 52 psig (3375 to 3656 gm sq cm) pressure and check for free oil flow at each of the following points.

(1) Planet gear bearing bores (one each).

(2) Bushing assembly (six places).

(3) Rear propeller shaft plug (one).

(4) Thrust bearing inner race location (one).

(5) Planet gear impingement (two each).

NOTE

Oil flow shall be a steady stream of oil 3 inches minimum along centerline of each orifice.

j. Remove flow fixture, spacer and bushing from rear of propeller shaft.

k. Assemble assembly and disassembly fixture (LTCT13095) with plate (LTCT13185, detail of LTCT13095) and sleeve (LTCT13188, detail of LTCT13095). (Sleeve mounts in seat nearest center of fixture bottom plate.)

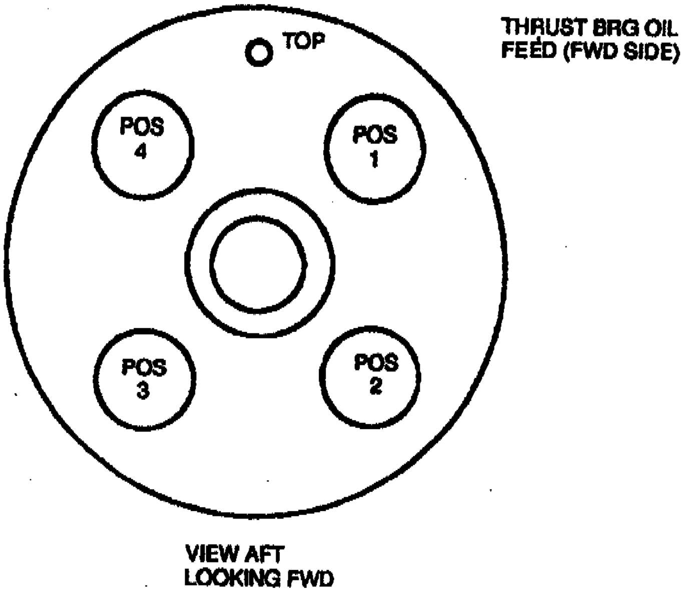
l. Mount propeller shaft (47), forward end down, in fixture.

m. Install outer races of roller bearings (44), marked 1F through 4F, in corresponding counterbores in propeller shaft assembly. (See figure 5-377 to determine proper location.) Use spacer (LTCT13339, detail of LTCT13095) and guide mandrel (LTCT13183, detail of LTCT13095) with soft-faced mallet to ensure bearing race seats in counterbore.

NOTE

All planet gear bearings are installed with their serial numbers facing gear.

n. Invert assembly in fixture and install bearing outer races, marked 1R through 4R, in the same manner (step m).



USE THRUST BEARING OIL FEED HOLE ON FORWARD SIDE OF CARRIER AS REFERENCE POINT FOR THE TOP OF THE CARRIER.

POSITION NUMBERS ARE ETCHED ON SHAFTS, GEARS, and BEARINGS.

Figure 5-377. Positioning Planet Gear Assemblies Primary Carrier (T53-L-701, -701A).

o. Remount oil flow fixture assembly (LTCT6604) as in steps e, g, and h.

p. Obtain and record pressure 48 to 52 psig (3375 to 3656 gm sq cm), temperature 90° to 110°F (32° to 43°C), and check for free oil flow through the outer races of the bearings.

q. Remove flow fixture, spacer assembly, and bushing assembly.

r. Prepare planet gear primary shaft (46, figure 5-367) for insertion by chilling in a mixture of crushed dry ice and engine oil. (Minimum exposure time - 30 minutes.)

s. Again, mount propeller shaft assembly in assembly fixture propeller shaft end up. Align a planet gear assembly position concentrically over the fixture sleeve. Ensure spring (LTCT13182, detail of LTCT13095) is in sleeve.

t. Install inner races of roller bearings (44), 1R through 4R, with flanges (serial number side) up. Ensure inner race serial number matches that of mating outer race.

u. Insert inner races, 1F through 4F, and planet gears 1 through 4. in the following manner: With flanged end (marked side) down, insert inner race in its proper position and, while holding race up in position, insert the corresponding primary planet gear (45) with its marked face up. Insert coiled file card, or equivalent, through shaft opening to maintain assembly integrity until shaft is installed.

v. Install assembly fixture on table of suitable press and locate so sleeve is centered under ram.

w. Ensure gear assembly is positioned in fixture, forward end up, and with applicable lower bearing centered over fixture sleeve.

x. Remove coiled card and replace with guide mandrel (LTCT13183. detail of LTCT13095).

y. When assured mandrel fits loosely in stackup, carefully remove mandrel without disturbing stackup.

NOTE

Do not leave mandrel in stackup. Pressing shaft against mandrel will compress spring. If arbor is removed before frozen shaft expands, spring will push shaft back through stack up.

z. Select correct shaft (46), quickly insert in stackup, and using spacer (LTCT13339, detail of LTCT13095), press shaft to its seated position.

aa. Repeat preceding steps w through z for remaining subassemblies.

ab. Remove primary gear assembly from assembly and disassembly fixture and replace sleeve (LTCT13188, detail of LTCT13095) with sleeve (LTCT13187, detail of LTCT13095).

ac. Install primary gear assembly in fixture, forward end down, with planet gearshaft head positioned over fixture sleeve. Rotate applicable planet gear, as necessary, to mate shaft head splines with sleeve splines, enabling gear assembly to seat in fixture.

ad. Install locking cup (43) and nut (42). Torque nut to 160 to 170 foot-pounds (228 to 253 kgm) release and retighten 145 to 150 foot-pounds (216 to 223 kgm). Do not lock at this time.

ae. Repeat preceding steps ac and ad for remaining planet gear assemblies.

af. Check end float of shafts. Readings should fall between 0.0156 to 0.0344 inch (0.0396 to 0.0874 cm).

ag. Lock gear shaft nuts. Deform cup into slots in two places, 180 degrees apart. Do not shear. Remove assembly from fixture and stand on bench.

ah. Install the secondary ring gear (41) (outer) on the primary carrier assembly with 8 bolts (39) and tabwashers (40). Torque bolts and lock tabs.

NOTE

Following step ai is necessary only if bearing is replaced. If the same bearing is used, install shim of same thickness as recorded during disassembly.

ai. Install bearing (53) in support assembly (54). Determine thickness of shim (52) to obtain 0.004 to 0.006 inch (0.010 to 0.015 cm) pinch on bearing as described in following steps aj through al.

aj. Measure from bearing race (53) to front bearing support assembly.

ak. Measure thickness of inner flange lip of retaining plate (51).

al. Subtract measurement of step ak from measurement of step aj. The resulting dimension, minus 0.004 to 0.006 inch (0.010 to 0.015 cm) is thickness of shim (52).

am. Lubricate outer race of the bearing (53) with shortening compound (item 270, table C–1), and press bearing firmly into front bearing support assembly (54). Use an arbor press and a suitable sleeve to contact bearing OD while pressing.

an. Install shim (52) of thickness determined in preceding step al, and retaining plate (51). Secure with bolts (49) and tabwashers (50). Lock bolts by bending tabs of tabwashers.

ao. Using heater (LTCT6354) and control unit (LTCT6729), heat ID of bearing for 2 minutes. Remove from heat and quickly install bearing and support assembly (48) on propeller shaft. Using an arbor press and a suitable sleeve, ensure bearing inner race bottoms on shoulder of the propeller shaft.

ap. Install packing (10) on propeller shaft and install spacer (9).

aq. Install packing (12) in seal housing assembly (15), seal (11), shield (8), and retaining ring (7).

ar. Install packings (17 and 16) in face of front bearing support assembly (54); position seal and housing assembly against support assembly, using care not to damage seal as it mates with spacer. Secure with bolts (13) and retainers (14). Torque bolts 75 to 80 inch-pounds (86.4 to 92.2 cm Kgs). Do not lock retainers at this time.

as. Install nut (6), hand-tight only.

at. Place assembly in test fixture (LTCT2029), using ring assembly (LTCT6610). Pressure-check assembly with air at 8 to 12 psig (562 to 844 gm sq cm).

au. Lock seal housing retaining bolts by deforming retainers (14) into slots. Do not shear.

av. Install assembly in holding fixture (LTCT247) with propeller shaft down.

aw. Install power gear (38), bushing assembly (37), and secondary sun gear (36). Install retainer (35), and secure with bolts (33) and tabwashers (34).

ax. Install spacer (31) with installed seal rings (30).

ay. Install packing (5, figure 4-45) in groove in primary support assembly.

az. Position secondary carrier assembly (18) on primary carrier assembly, making certain all mating holes are aligned and gears are carefully meshed. Secure this assembly with three flat heat screws (19).

ba. Heat rear support bearing inner race (4, figure 5-367) to 160°F (71°C) using oven, hot oil, or bench-type cylindrical heating unit.

NOTE

Do not use open flame.

bb. Remove bearing inner race from heat source and quickly install on propeller shaft rear carrier. Using arbor press and suitable sleeve to contact bearing inner race, firmly seat support bearing inner race, bearing serial number up, against rear face of spacer.

bc. Reinstall locking cup (27) with tabs in journal slots.

bd. Install nut (26) and, using wrench assembly (LTCT2019) to secure propeller shaft, torque to 120 to 140 pound-feet (178 to 198 kgm) using spanner wrench (LTCT6605) with torque wrench. Stake lock cup in nut slot in two places.

be. Install washers (2) and connector (3) into front bearing support assembly (54). Secure with bolt (1). Tighten bolts, as required, and lockwire.

5-365. FUNCTIONAL TEST. Functional test is not required.

5-366. SECONDARY CARRIER ASSEMBLY (T53-L-701, -701A).

5-367. DISASSEMBLY. Proceed as follows:

a. Place secondary carrier assembly on plate (1 inch thick and 6 to 8 inches in diameter), forward end down.

b. Bend tabs of locking plates (2, figure 5-378) away from bolt heads. Remove 12 bolts (1) and six locking plates.

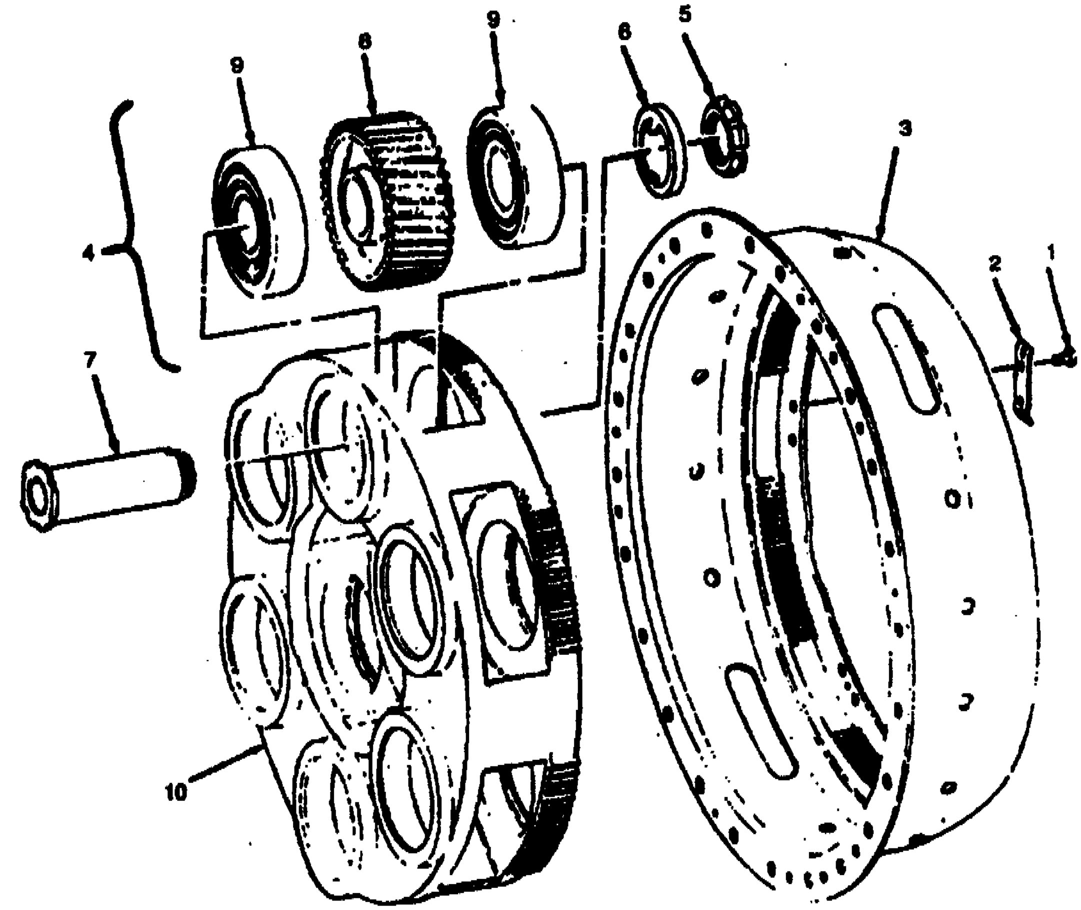


Figure 5-378. Secondary Carrier Assembly (T53-L-701, -701A).

c. Using soft-faced mallet, separate support from carrier subassembly.

d. Assemble assembly and disassembly fixture (LTCT13095) with plate (LTCT13184, detail of LTCT13095) and sleeve (LTCT13186, detail of LTCT13095). (Sleeve mounts in seat farthest from center of fixture bottom plate.)

e. Install secondary carrier subassembly in fixture, forward end down, with a planet gear shaft head positioned over fixture sleeve. Rotate applicable planet gear as necessary to mate shaft head splines with sleeve splines, and seat fixture.

f. Straighten locking cup (6) and, using wrench (LTCT6608, detail of LTCT13095), break torque of nut (5). Remove nut and locking cup. Discard locking cup.

g. Repeat steps e and f for remaining planet gear assemblies.

NOTE

Keep components of each planet gear assembly together. Do not mix them.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-378	1-020-310-01	CARRIER ASSEMBLY SECONDARY (NHA 1-000-110-01)	REF	D, E
-1	STD3053-3	. BOLT, Drilled hex head	12	D, E
-2	1-020-183-01	. PLATE, Locking	6	D, E
-3	1-020-182-01	. SUPPORT, Carrier	1	D, E
-4	No Number	. CARRIER ASSEMBLY, Secondary (NHA 1-020-310-01)	1	D, E
-5	1-020-203-01	. . NUT, Spanner	6	D, E
-6	1-020-176-01	. . CUP, Locking, bearing retaining	6	D, E
-7	1-020-174-01	. . SHAFT, Planet gear, secondary	6	D, E
-8	1-020-167-01	. . GEAR, Secondary planet	6	D, E
-9	MR306G303	. . BEARING, Roller, cylindrical (38443) (Lycoming Source Cont Dwg 1-300-406-01)	12	D, E
	5RJH306-B31	. . . BEARING, Roller, cylindrical (21535) (Lycoming Source Cont Dwg 2-300-041-05)	12	D, E
	R12306-20	. . . BEARING, Roller, cylindrical (78118) (Lycoming Source Cont Dwg 1-300-406-02)	12	D, E
-10	1-020-380-01	. . CARRIER, Subassembly, secondary	1	D, E

h. Install assembly and disassembly fixture in suitable press with sleeve centered under ram.

i. Install secondary carrier subassembly in fixture as described in preceding step e. Using guide mandrel (LTCT13183, detail of LTCT13095), press planet gear shaft (7) from bearings and gear. Repeat procedure for removal of remaining shafts.

j. Slide planet gears (8) from between bearing pairs, extract bearing inner races, and remove roller bearings (9) using spacer (LTCT1339, detail of LTCT13095) and lighter hammer.

5-368. CLEANING. Refer to paragraph 5-354.

5-369. INSPECTION. Perform specific inspections listed in table 5-130. (See figure 5-379).

5-370. REPAIR. (See figure 5-378.) Proceed as follows:

a. Repair scored chrome plating on 2.8339 to 2.8342 inch (7.1981 to 7.1989 cm) bearing bore diameters as follows: (see figure 5-380.)

(1) Using a suitable grinding fixture, grind away all plating from the damaged bore.

NOTE

Ensure all chrome plating has been removed.

(2) Rinse with water and buff the bearing bore surface.

(3) Chrome plate for a 0.002 to 0.010 inch (0.005 to 0.025 cm) thickness after final grind as outlined in SP No. 6014 in Appendix E.

(4) Bake at 635° to 665°F (352° to 355°C) for 2 hours.

(5) Machine to dimensions given in figure 5-380.

b. Repair damaged area (4.463 - 4.470 inch DIA) as follows:

(1) Grind to remove all plating.

(2) Ensure that all chrome plate has been removed.

(3) Rinse with water and buff the area to be plated.

(4) Chrome-plate for a .002 to .010 inch chrome plate thickness after final grind per SP No. 6014 in Appendix E.

Table 5-130. Inspection of Secondary Carrier Assembly (T53-L-701, -701A).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-378				
7	Planet Gear Shaft	Visual and Magnetic Particle. (Refer to table 5-131)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-132).	Replace if limits are not met.
	WARNING FLIGHT SAFETY PART Verification of the 1.811 - 1.809 bore diameter is flight safety critical.			
9	Roller Bearing	Visual	Damaged bearing	
		Dimensional	Wear. (Refer to table 5-133).	Replace if limits are not met.
	WARNING FLIGHT SAFETY PART Magnetic particle inspection to ensure that the following part is crack-free is flight safety critical.			
8	Planet Gear	Visual	Nicks burrs and scratches	Repair. (Refer to SP No. 5000 in Appendix E).
		Visual and SIE	Damaged beyond acceptable limits.	Replace if limits are not met.
		Visual and Magnetic Particle (Refer to table 5-131)	Cracks	Not allowed. Replace.
		Dimensional	Wear. (Refer to table 5-132).	Replace if limits are not met.
5	Nut	Visual and Magnetic Particle (Refer to table 5-131)	Cracks	Not allowed. Replace.

Table 5-130. Inspection of Secondary Carrier Assembly (T53-L-701, -701A) (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-378				
3	Carrier Support	Visual and Magnetic Particle. (Refer to table 5-131)	Cracks	Not allowed. Replace
10	Secondary Carrier	Visual	Nicks, burrs and scratches	Repair. (Refer to SP No. 5000 in Appendix E).
		Visual and SIE	Defective gears or splines.	Repair or replace. (Refer to SP No. 5007 in Appendix E) Replace if limits are not met.
			Circumferential scoring in chrome plating on 4.468 to 4.470 diameter.	Repair. (Refer to paragraph 5-370).
			Circumferential scoring in chrome plating on 2.8339 to 2.8342 inch (7.1981 to 7.1989 cm) bearing bore diameter in excess of 0.005 inch (0.013 cm) in depth	Repair. (Refer to paragraph 5-370).
		Visual and Magnetic Particle (Refer to table 5-131)	Cracks	Not allowed. Replace.

Table 5-131. Magnetic Particle Inspection of Secondary Carrier Assembly (T53-L-701, -701A).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD OF MAGNETIZATION
5-378, 3	Carrier Support	Circular, use central conductor at 1000 amperes. Longitudinal at 5000 ampere turns.
5-378, 5	Nut	Circular, use central conductor at 500 amperes.
5-378, 7	Planet Gear Shaft	Circular, use central conductor at 600 amperes.
5-378, 8	Planet Gear	Circular, use central conductor at 1500 amperes.
5-378, 10	Secondary Carrier	Circular, use central conductor at 2500 amperes. Longitudinal at 10,000 ampere turns.

Table 5-132. Dimensional Inspection of Secondary Carrier Assembly (T53-L-701, -701A).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-378								5-379
Planet Gear Shaft	7	OD	1.1813 (3.0005)	1.1816 (3.0013)					A
Planet Gear	8	ID	1.1809 (2.9995)	1.1813 (3.0005)					B
Secondary Carrier (Fwd) (6 Places)	10	ID	2.8339 (7.1981)	2.8342 (7.1989)					C
(Rear) (6 Places)		ID	2.8339 (7.1981)	2.8342 (7.1989)					D

Table 5-133. Dimensional Inspection of Secondary Carrier Assembly Bearings (T53-L-701, -701A).

BEARING TYPE & PART NO.	FIG & INDEX	DIM. MEAS	BLUEPRINT DIMENSIONS MIN	BLUEPRINT DIMENSIONS MAX	INTERNAL CLEARANCE	END PLAY	HARD-NESS RC	CONTACT ANGLE	LYCOMING PART NUMBER
	5-378								
		WARNING **FLIGHT SAFETY PART** **Dimensional inspection of the following diameter is flight safety critical.**							
Roller	9	ID	1.1809 (2.9995)	1.1811 (3.0000)	0.0020 to (0.0051)	N/A	58 to 61	N/A	1-300-406-01
		OD	2.8342 (7.1989)	2.8346 (7.1999)	0.0025* (0.0064)				
Roller RJ2306-20		ID	1.1809 (2.9995)	1.1811 (3.000)	0.0020 to (0.0051)	N/A	58 to 61	N/A	1-300-406-02
		OD	2.8342 (7.1989)	2.8346 (7.19 99)	0.0025* (0.0064)				
Roller 5RJH306-B31		ID	1.1809 (2.9995)	1.1811 (3.0000)	0.0017 to (0.0043)	N/A	60 to 64	N/A	2-300-041-05
		OD	2.8343 (7.1992)	2.8346 (7.1999)	0.0023* (0.0058)				

* Under a 11.0 pound gage load.

(5) Bake at 635° to 665°F for 2 hours.

(6) Finish machine to dimensions, finish, etc, specified in manufacturer's drawings specification P/N 1-020-185-01.

c. Repair remaining damaged parts in accordance with repair procedures referenced in table 5-130.

5-371. REASSEMBLY. Proceed as follows:

a. Flow-check secondary carrier (10, figure 5-378) as follows:

(1) Install oil flow fixture (LTCT13270) on carrier.

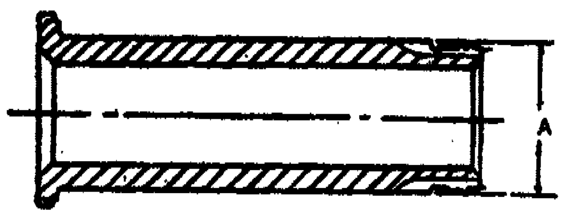
(2) Install hub (LTCT13329, detail of LTCT13270) through center of carrier and secure with nut (54, figure 5-367). (See figure 5-381.)

(3) Using a suitable flow bench, supply lubricating oil (item 189 or 190, table C–1) heated to 90° to 110°F (32° to 43°C) to flow fixture at 48 to 52 psig (3375 to 3656 gm sq cm). Check for steady oil streams of 3 inches minimum flowing from carrier orifices.

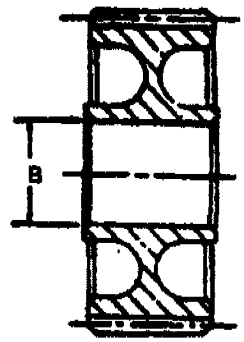
(4) Reject carrier which cannot meet requirements.

b. Assemble assembly and disassembly fixture (LTCT13095) with plate (LTCT13184, detail of LTCT13095) and sleeve (LTCT13188, detail of LTCT13095). (Sleeve mounts in seat farthest from center of fixture bottom plate.)

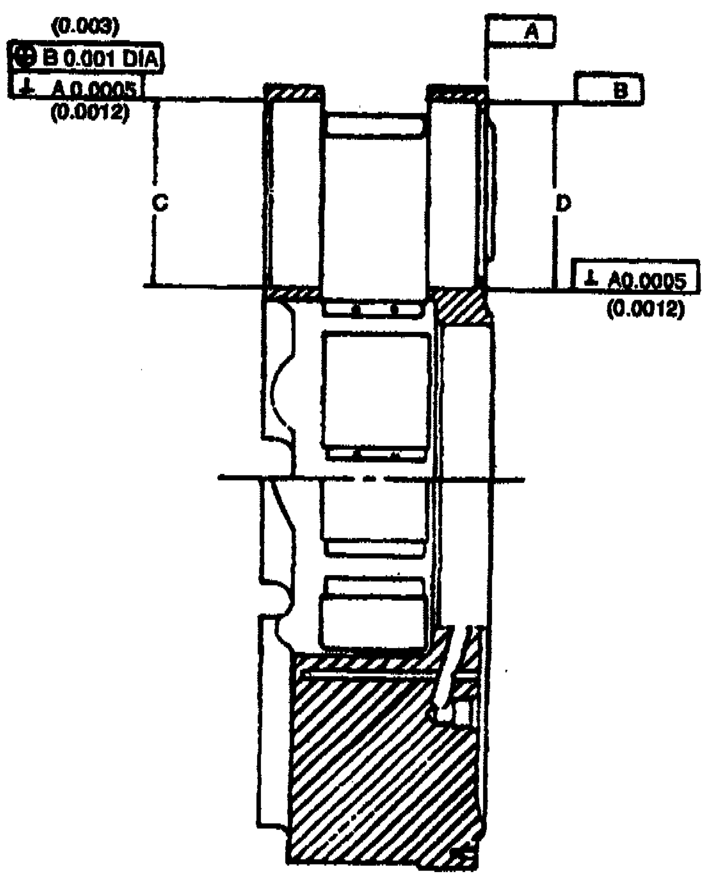
c. Mount secondary carrier (10, figure 5-378), forward end down, in fixture.



PLANET GEARSHAFT (7, FIGURE 5-378)

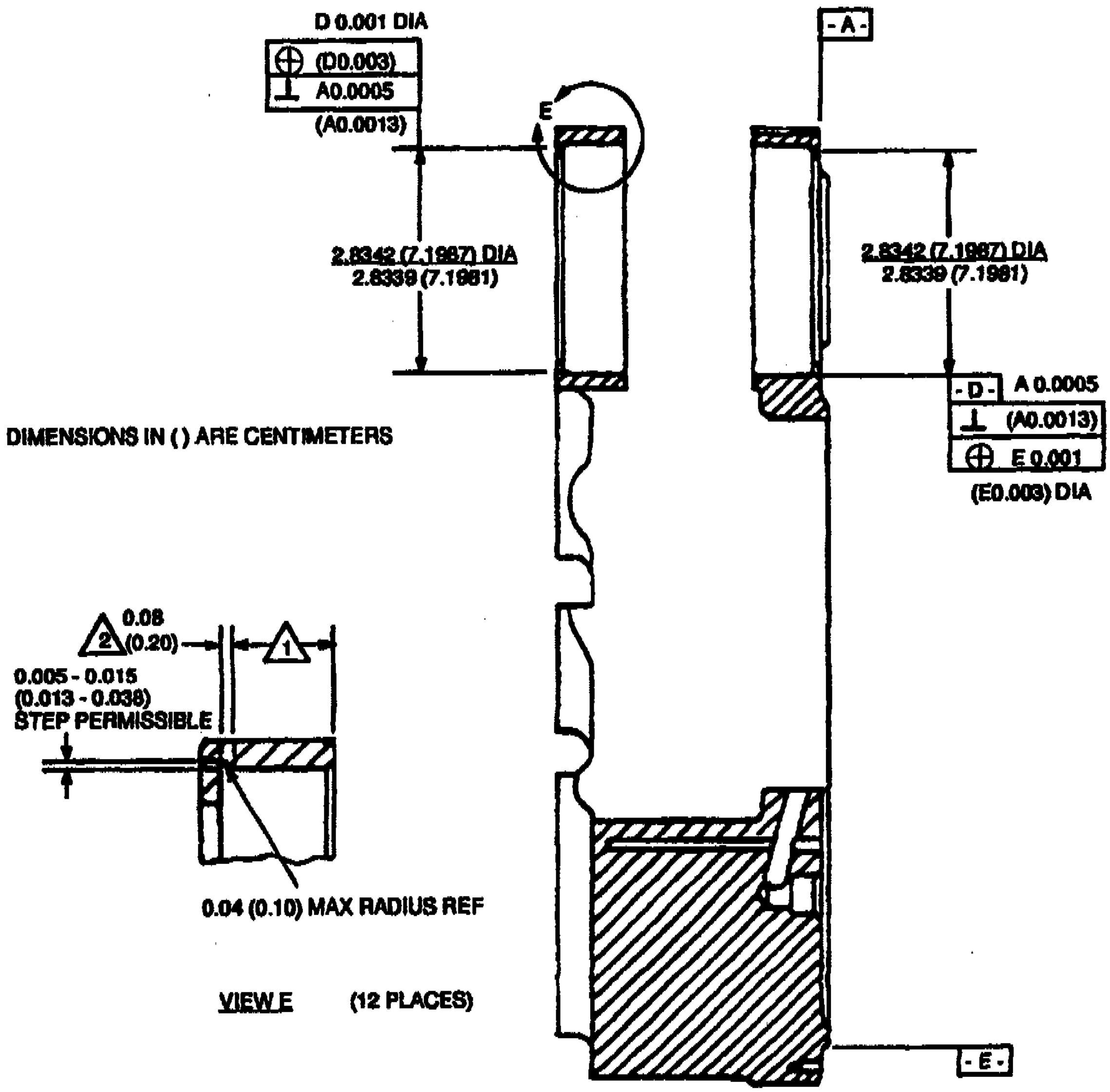


PLANET GEAR (8, FIGURE 5-378)



SECONDARY CARRIER (10, FIGURE 5-378)

Figure 5-379. Secondary Carrier Assembly Dimensional Inspection Locations (T53-L-701, -701A).



1 CHROME PLATED AREA

2 NO CHROME PLATE PERMITTED FOR DISTANCE SHOWN

Figure 5-380. Secondary Carrier Chrome Plating Area.

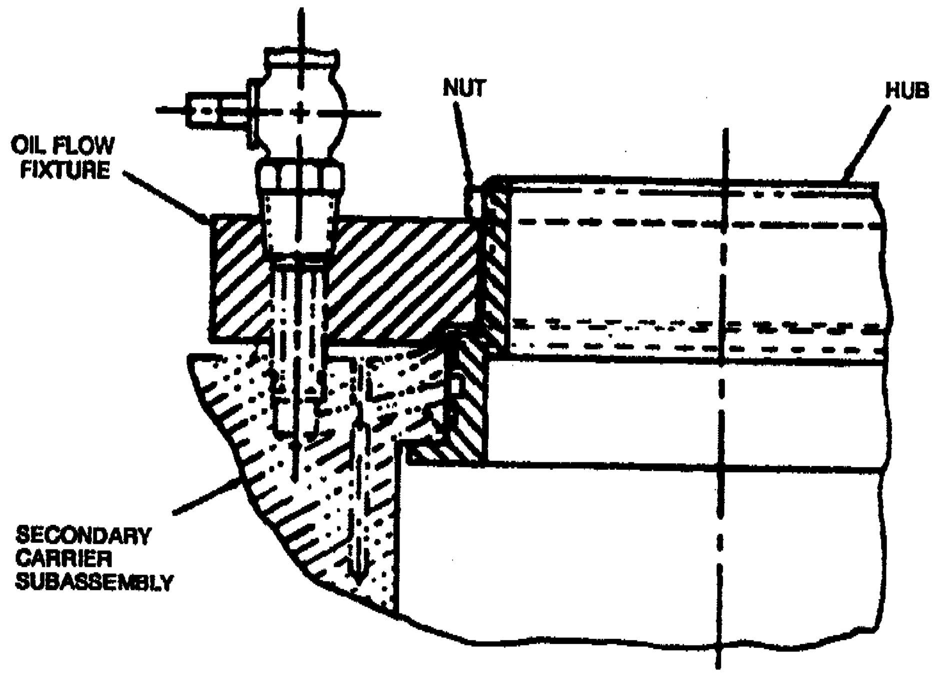
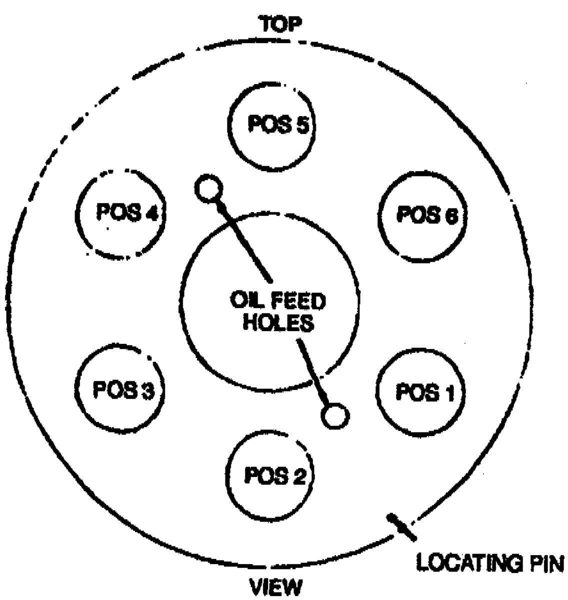


Figure 5-381. Oil Flow Fixture Installed on Secondary Carrier (T53-L-701, -701A).



USE OIL FEED HOLES and LOCATING PIN ON REAR SIDE OF CARRIER AS REFERENCE FOR LOCATING TOP OF CARRIER.

POSITION NUMBERS ARE ETCHED ON SHAFTS, GEARS, and BEARINGS.

Figure 5-382. Positioning Planet Gear Assemblies - Secondary Carrier (T53-L-701, -701A).

d. Install outer races of roller bearings (9), 1F through 6F, in lower bearing counterbores, serial number side up. Use spacer (LTCT13339, detail of LTCT13095) and mandrel (LTCT13183, detail of LTCT13095) to ensure race is seated. (See figure 5-382 to determine location.)

e. Invert carrier and install outer races of roller bearings (9, figure 5-378), 1R through 6R, in the manner described in preceding step d.

NOTE

Ensure that dowel pin is in groove in plate.

f. Install inner races of bearings (9), 1R through 6R, with flanges (serial number side) inward. Ensure inner race serial number matches that of mating outer race.

g. Insert inner races of bearing (9). 1F through 6F, and planet gears, 1 through 6, in the following manner. With flanged end down (marked side), insert inner race in its proper position and, while holding inner race in position, insert the corresponding planet gear (8) with its marked face up. Insert coiled file card, or equivalent, through shaft opening to maintain assembly integrity until shaft is installed.

h. Prepare the planet gear shafts (7) for installations by soaking in dry cleaning solvent (item 134, table C–1) and crushed dry ice for 30 minutes.

i. Install fixture on table of suitable press, and locate so sleeve is centered under ram. Clamp fixture in position on table.

j. Ensure gear assembly is positioned in fixture, forward end up, and with applicable lower bearing centered over fixture sleeve.

k. Remove coiled card and replace with mandrel (LTCT13183, detail of LTCT13095).

l. When assured mandrel fits loose in stackup, carefully remove mandrel without disturbing stackup.

NOTE

Do not leave mandrel in stackup. Pressing shaft against mandrel will compress spring. If arbor is removed before frozen shaft expands, spring will push shaft back through stack up.

m. Select correct shaft (7), quickly insert, and press in to its seated position.

n. Repeat steps j through m for the remaining subassemblies.

o. Remove carrier assembly from assembly and disassembly fixture and replace sleeve (LTCT13188, detail of LTCT13095) with sleeve (LTCT1187, detail of LTCT13095).

p. Install secondary carrier subassembly in fixture, forward end down (threaded ends of planet gear shafts up), with planet gear shaft head positioned over fixture sleeve. Rotate applicable planet gear, as necessary, to mate shaft head splines with sleeve splines, and seat in fixture.

q. Install locking cup (6) and nut (5). Tighten nut to 160 to 170 foot-pounds torque, (238 to 253 kg/m) release, and retighten to 145 to 150 foot-pounds (216 to 223 kg/m) torque. Do not lock at this time.

r. Repeat preceding steps p and q for remaining planet gear assemblies.

s. Check end float of shafts. Readings should fall between 0.0156 and 0.0344 inch (0.0396 to 0.0874 cm).

t. Lock gear shaft nuts. Deform lock cup into slots in two places, 180 degrees apart. Do not shear.

NOTE

In following step u, support may be assembled to carrier subassembly one way only. The pin projecting from carrier mates with hole support located at about the 5-o'clock position between an assembly bolt repair. Ensure pin fits in mating hole, and not pressed flush.

u. Assemble carrier support (3) to carrier with six locking plates (2) and 12 bolts (1). Tighten bolts and lockwire tabs of lock plates.

5-372. FUNCTIONAL TEST. Functional test is not required.

5-373. PROPELLER SHAFT REAR BEARING SUPPORT ASSEMBLY (T53-L-15).

5-374. DISASSEMBLY. Proceed as follows:

a. Straighten tabwashers (2, figure 5-383) and remove six bolts (1) and tabwashers (2).

b. Remove plate (3) and shim (4).

c. Remove outer race of roller bearing (5) from rear bearing support assembly (6), using fiber drift and mallet, if necessary.

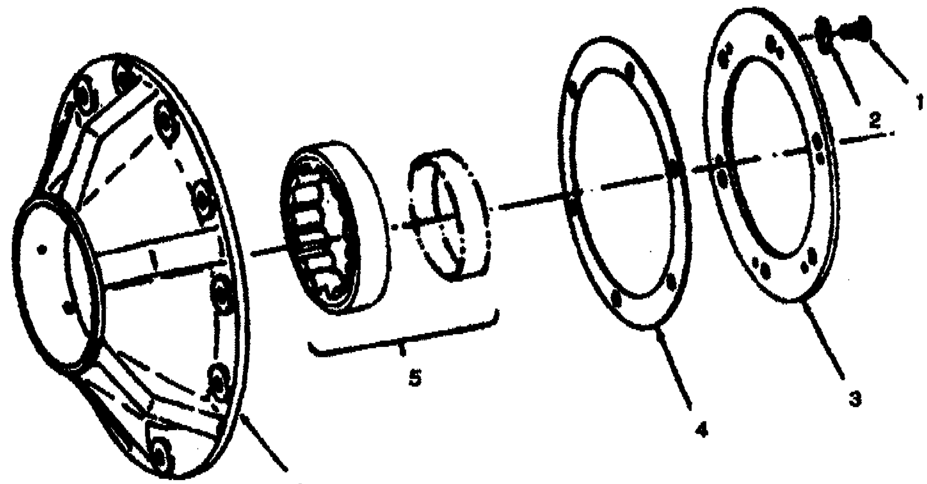


Figure 5-383. Propeller Shaft Rear Bearing Support Assembly (T53-L-15).

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-383	No Number	PROPELLER SHAFT REAR BEARING SUPPORT AND RELATED PARTS (NHA 1-000-100-01)	REF	C
-1	MS9490-07	. BOLT, Hex head	6	C
-2	STD3023K2	. TABWASHER	6	C
-3	1-020-141-01	. PLATE, Retaining, rear bearing	1	C
-4	1-020-142-01	. SHIM, Rear bearing	AP	C
-5	455946	. BEARING, Roller (52676) (Lycoming Source Cont Dwg 1-300-028-01)	1	C
-6	1-020-270-04	. SUPPORT ASSEMBLY, Rear bearing	1	C

5-375. CLEANING. Proceed as follows:

a. Clean roller bearings (5, figure 5-383, and 4, figure 5-385) as outlined in SP No. 3010 in Appendix E.

b. Clean all other parts by dry cleaning solvent method, (Refer to SP No. 3002 in Appendix E.)

5-376. INSPECTION. Perform specific inspections listed in table 5-134.

5-377. REPAIR. (See figure 5-383.) Replace sleeve bearing in propeller shaft rear bearing support assembly (6) as follows:

CAUTION

In following step a, do not nick or score bore of support housing.

a. Machine bearing wall to thickness of 0.012 to 0.014 inch (0.030 to 0.036 cm) or until wall is thin enough to buckle, and peel from support housing.

b. Grind three pins in housing flush with bore.

c. Place housing in temperature-controlled oven at 200°F (93°C) for 30 minutes.

d. Remove housing from oven and apply a thin coat of epoxy primer (item 253, table C–1) on the surface which will mate with the bearing.

e. Place bearing over support. Ensure that pin holes in liner will not locate over existing pin holes in housing.

NOTE

A minimum of 0.250 inch (0.635 cm) should separate the two.

f. Using arbor press and driver, press sleeve bearing into bore of housing.

g. Drill through three existing holes in bearing to depth of 0.29 inch (0.74 cm). Ream 0.1235 to 0.1240 inch (0.3137 to 0.3150 cm) 0.26 inch (0.66 cm) deep.

h. Using driver, drive pins flush with ID of bearing.

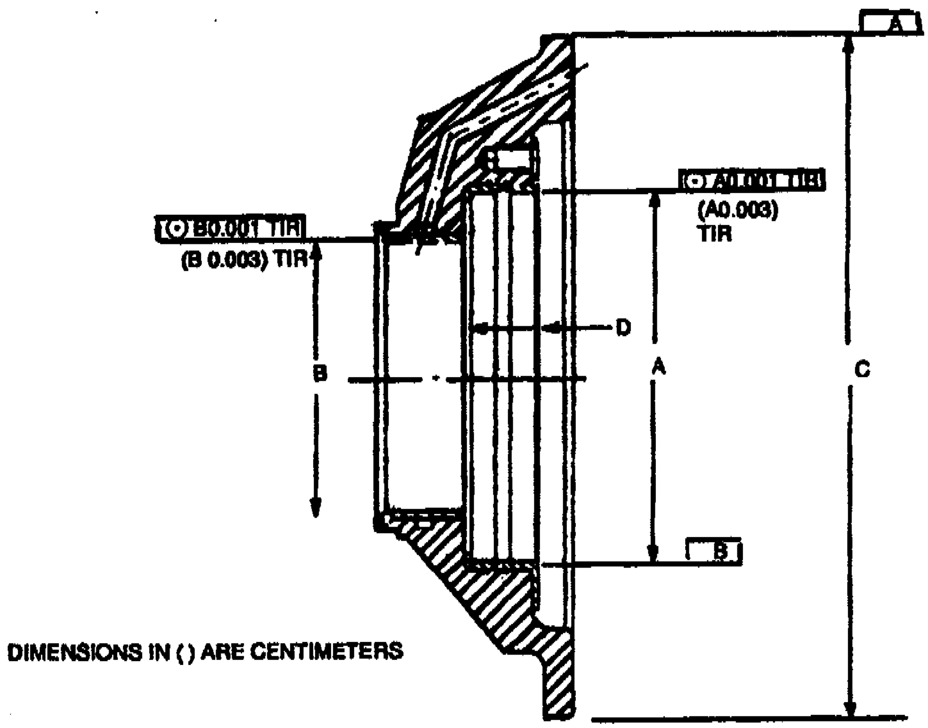
i. Finish-grind sleeve bearing ID to 3.623 to 3.625 inches (9.202 to 9.208 cm) and maintain concentricity with liner forward face within 0.001 inch (0.003 cm) TIR. Surface finish shall be maintained at 16 RMS.

Table 5-134. Inspection of Propeller Shaft Rear Bearing Support Assembly (T53-L-15).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-383				
3	Plate	Visual and Magnetic Particle. (Refer to table 5-135)	Cracks	Not allowed. Replace.
5	Roller Bearing	Visual	Damaged bearing.	
		Dimensional	Wear. (Refer to table 5-136)	Replace if limits are not met.
6	Rear Bearing Support Assembly	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 in Appendix E).
			Damaged threads	Repair or replace (Refer to SP No. 5007 in Appendix E).
			Crack in housing	Not allowed. Replace.
			Loss of protective surface finish (Dichromate)	Repair. (Refer to SP No. 6026 in Appendix E.)
			Scoring, fretting cracks, or loss of chrome plate.	Repair. (Refer to SP No. 6014 in Appendix E).
		Visual	Scoring, fretting or evidence of bearing rotation in liner.	Repair. (Refer to SP No. 6014 in Appendix E).
			Sleeve bearing worn or damaged. (Refer to table 5-137).	Replace if limits are not met. (Refer to paragraph 5-377.)
		Dimensional	Wear. (Refer to table 5-137).	Replace if limits are not met.

Table 5-135. Magnetic-Particle Inspection of Propeller Shaft Rear Bearing Support Assembly (T53-L-15).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD OF MAGNETIZATION
5-383, 3	Plate	Circular, use central conductor at 800 amperes.



REAR BEARING SUPPORT ASSEMBLY (8, FIGURE 5–381)

Figure 5-384. Propeller Shaft Rear Bearing Support Assembly Dimensional Inspection Locations.

Table 5-136. Dimensional Inspection of Propeller Shaft Rear Bearing Support Assembly (T53-L-15).

BEARING TYPE & PART NO.	FIG & INDEX	DIM. MEAS	BLUEPRINT DIMENSIONS		INTERNAL CLEARANCE	END PLAY	HARD-NESS RC	CON-TACT ANGLE	LYCOMING PART NUMBER
			MIN	MAX					
	5-383								
Roller 455946	5	ID	3.1492 (7.9990)	3.1496 (8.0000)	0.0016 (0.0041)	N/A	58 to 61	N/A	1-300-028-01
		OD	4.9208 (12.4988)	4.9213 (12.5001)	0.0030 (0.0076)				

Table 5-137. Dimensional Inspection of Propeller Shaft Rear Bearing Support Assembly (T53-L-15).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINTS DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-383								5-384
Rear Bearing	6	ID	4.9223 (12.5026)	4.9228 (12.5039)	4.9223 (12.5026)	4.9230 (12.5044)			A
Support Assembly		ID	3.6230 (9.2024)	3.6250 (9.2075)	3.6230 (9.2024)	3.6255 (9.208 8)			B
		OD	8.9195 (22.6555)	8.9200 (22.6568)	8.9190 (22.6543)	8.9200 (22.6568)			C
		Axial	0.842 (2.139)	0.846 (2.149)	0.842 (2.139)	0.848 (2.154)			D

5-378. REASSEMBLY. Proceed as follows:

a. Install outer race and cage of roller bearing (5, figure 5-383) into rear bearing support assembly (6), with serial number of bearing facing upward.

b. With depth gage, measure distance from outer race of bearing (5) to bearing liner flange.

c. Select shim (4) to obtain pinch of 0.004 to 0.006 inch (0.010 to 0.015 cm) on bearing.

d. Install shim (4) and plate (3), and secure with six bolts (1) and tabwashers (2). Tighten bolts to 70 to 75 pound-inches (12502 to 13395 gm cm) torque. Secure tabwashers.

5-379. FUNCTIONAL TEST. Functional test is not required.

5-380. PROPELLER SHAFT REAR BEARING SUPPORT ASSEMBLY (T53-L-701, -701A).

5-381. DISASSEMBLY. Proceed as follows:

a. Remove six bolts (1, figure 5-385) that secure plate (2) to rear bearing support assembly (5).

b. Remove plate (2) and shim (3).

c. Remove outer race of roller bearing (4) from rear bearing support assembly, using a fiber drift and mallet, if necessary.

d. Check oil impingement using oil flow check stand (LTCT313) with oil flow check fixture (LTCT6872). During impingement check, the oil pressure shall be 70 ± 0.5 psig (4921 ± 35.2 gm sq cm) and oil temperature shall be 100° ±10°F (37.7° ± 5.6°C).

(1) Secure (use "toe dog clamp" in holes provided) tool to table or work area.

(2) Install support (to be reworked) tooling.

(3) Place 1/8 inch pin in drill guide of tooling.

(4) Indicate 1/8 inch pin for centering of drill press spindle.

(5) Remove 1/8 inch pin after drill press spindle has been centered.

(6) Apply shop air to air fitting on tool.

(7) Using No. 32 drill, enlarge oil port to a depth of 1/8.

(8) Ream same hole using 0.124 inch reamer.

(9) Manufacture and install an aluminum plug (6061-T6) 0.125 inch diameter x 1/8 inch long, into port and secure using Loctite Grade A-C (item 263, or 264, table C–1). Machine plug flush with housing and peen base metal around top of plug.

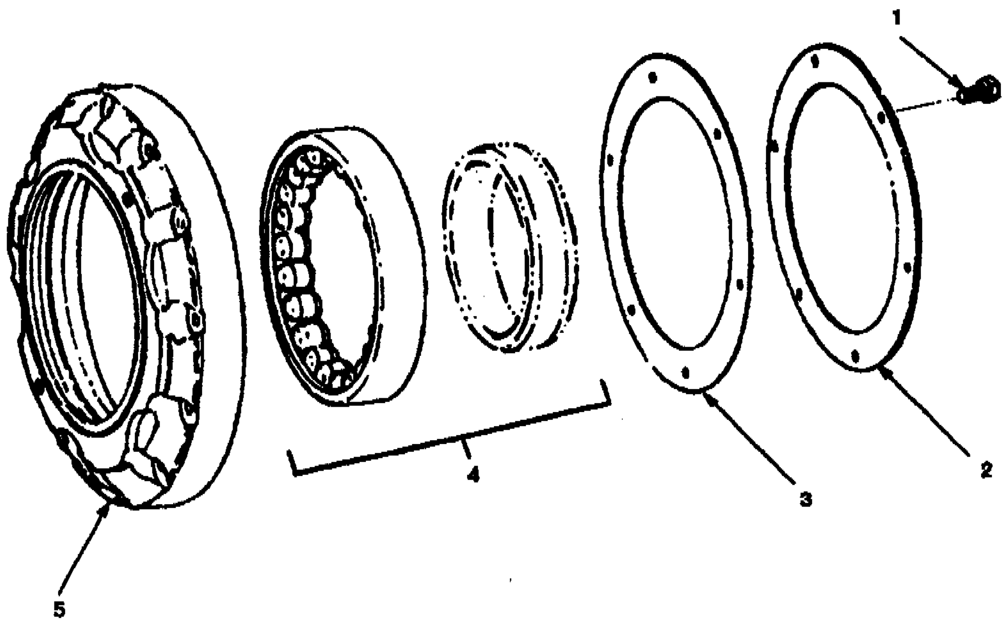
(10) Install smaller drill guide into hole in tooling. Using a No. 69 drill in drill press, drill new oil hole in plug. Deburr as necessary.

(11) Remove support from tooling. Clean part and fixture.

NOTE

Shut off air pressure before removing subject part from tooling.

(12) Perform oil impingement check.



1. BOLT
2. PLATE
3. SHIM
4. ROLLER BEARING
5. REAR BEARING SUPPORT ASSEMBLY

Figure 5-385. Propeller Shaft Rear Bearing Support Assembly (T53-L-701, -701A).

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-385	No Number	PROPELLER SHAFT REAR BEARING SUPPORT and RELATED PARTS (NHA 1-000-110-01)	Ref	D, E
1	MS9565-05	. BOLT, Drilled hex head	6	D, E
2	1-020-196-01	. PLATE, Rear bearing support	1	D, E
3	1-020-195-01	. SHIM, Rear bearing	AR	D, E
4	E1020UHAR3050 6	BEARING, Roller (51600) (Lycoming Source Cont Dwg 1-300-408-01)	1	D, E
	E1020UHAR3509	. BEARING, Roller (51600) (Lycoming Source Cont Dwg 1-300-408-02)	1	D, E
	E1020UHAR3509	. BEARING, Roller (51600) (Lycoming Source Cont Dwg 1-300-408-03)		
5	1-020-330-01	. SUPPORT ASSEMBLY, Rear bearing	1	D, E

5-382. CLEANING. Proceed as follows:

a. Clean roller bearings (5, figure 5-383, and 5, figure 5-385) as outlined in SP No. 3010 in Appendix E.

b. Clean all other parts by dry cleaning solvent method. (Refer to SP. No. 3002 in Appendix E.)

5-383. INSPECTION. Perform specific inspections listed in table 5-138.

5-384. REPAIR. (See figure 5-385). Repair damaged parts in accordance with repair procedure referenced in table 5-138, Repair of Rear Bearing Support Assembly (1-020-330-01) not meeting oil impingement check. Also increase the dimensions of the slot in the rear bearing support housing (P/N 1-020-193-01) from 0.250 ± 0.010 to 0.300 ± 0.010 (slot to remain in central position) in width and also increase the depth of this slot from 0.190 ± 0.010 to 0.200 ± 0.010 to allow for more clearance for the torquemeter head assembly wiring at final assembly.

a. Tooling (No. 75-AMXAD-D-0033) has been developed which will salvage many of these rejected parts.

b. Procedure for using this tooling:

(1) Secure (use "toe dog clamp" in holes provided) tooling to table or work area.

(2) Install support (to be reworked) tooling.

(3) Place 1/8 inch pin in drill guide of tooling.

(4) Indicate 1/8 inch pin after drill press spindle has been centered.

(5) Apply shop air to air fitting on tool.

(6) Using No. 32 drill, enlarge oil port to a depth of 1/8 inch.

(7) Ream same hole using 0.124 inch reamer.

(8) Manufacture and install an aluminum plug (6061-T6) 0.125 inch diameter by 0.125 inch long pin into port and secure using Loctite Grade A. Machine plug flush with housing and peen base metal around top of pin.

(9) Install smaller drill guide into hole in tooling. Using a No. 69 drill in drill press, drill new oil hole in plug. Deburr as necessary.

(10) Remove support from tooling. Clean part and fixture.

NOTE

Shut off air pressure before removing subject part from tooling.

c. If oil impingement check (in accordance with DMWR) is satisfactory, part is acceptable (regarding this defect).

Table 5-138. Inspection of Propeller Shaft Rear Bearing Support Assembly (T53-L-701, -701A).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-385 2	Plate	Visual and Magnetic Particle. (Refer to table 5-139)	Cracks	Not allowed. Replace.
	WARNING **FLIGHT SAFETY PART** **Verification of the bore diameter of the following part(s) is flight safety critical.**			
4	Roller Bearing	Visual and SIE	Damaged bearing.	
		Dimensional	Wear. (Refer to table 5-140).	Replace if limits are not met.
5	Rear Bearing Support Assembly	Visual	Nicks, burrs, or scratches	Repair. (Refer to SP No. 5000 Appendix E).
			Scoring, fretting, cracking or loss of chrome plate	Repair. (Refer to SP No. 6014 in Appendix E).
			Crack in housing	Not allowed. Replace.
			Damaged threads	Repair. (Refer to SP No 5007 in Appendix E).
			Loss of protective surface finish (chromate)	Repair. (Refer to SP No. 6026 in Appendix E).
		Dimensional	Wear. (Refer to table 5-141).	Replace if limits are not met.
		Dimensional	Slot on rear bearing support housing.	Increase slot dimensions as per paragraph 5-384 if necessary.

Table 5-139. Magnetic Particle Inspection of Propeller Shaft Rear Support Assembly (T53-L-701, -701A).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD OF MAGNETIZATION
5-385, 2	Plate	Circular, use central conductor at 800 amperes.

Table 5-140. Dimensional Inspection of Propeller Shaft Rear Bearing Support Assembly Bearings (T53-L-701, -701A).

BEARING TYPE & PART NO	FIG & INDEX	DIM. MEAS	BLUEPRINT DIMENSIONS		INTERNAL CLEARANCE	END PLAY	HARD-NESS RC	CONTACT ANGLE	LYCOMING PART NUMBER
			MIN	MAX					
	5-385								
WARNING **FLIGHT SAFETY PART** **Verification of the 3.9365 - 3.9370 bore diameter is flight safety critical.**									
Roller E1020UHAR3503 or	4	ID	3.9365 (9.9987)	3.9370 (10.0000)	0.0030 (0.0076)	N/A	58 to 61	N/A	1-300-408-01
E1020UHAR3506		OD	5.9050 (14.9987)	5.9055 (15.0000)	0.0039* (0.0099)				

* Before mounting under 11.0 pound load

5-385. REASSEMBLY. Proceed as follows:

a. Install outer race and cage of roller bearing (4, figure 5-385) into rear bearing support assembly (5), with serial number of bearing facing upward.

b. With depth gage, measure distance from outer race of bearing (4) to bearing liner flange.

c. Select shim (3) to obtain pinch of 0.004 to 0.006 inch (0.010 to 0.015 cm) on bearing.

Table 5-141. Dimensional Inspection of Propeller Shaft Rear Bearing Support Assembly (T53-L-701, -701A).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINTS DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-385								5-386
Rear Bearing Support Assembly	-5	OD	8.9195 (22.6555)	8.9200 (22.6568)	8.9190 (22.6543)	8.9200 (22.6568)			A
		ID	5.9053 (14.9995)	5.9060 (15.0012)					B

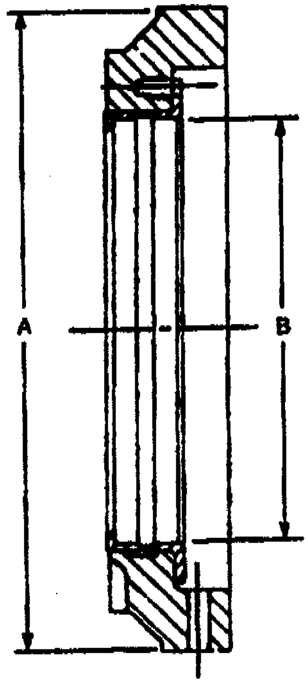


Figure 5-386. Rear Bearing Support Assembly.

d. Install shim (3) and plate (2), and secure with six bolts (1). Tighten bolts to 40 to 45 pound-inches (46 to 52 cm kgs) torque

5-386. FUNCTIONAL TEST. Functional testing is not required.

5-387. MODIFICATION OF SUN GEAR RETAINING BOLT. The purpose of this modification is to provide additional lubrication to the spherical washer in order to reduce excessive wear problems that are occurring in this location.

a. Rework bolt (1-030-139-02) as follows:

(1) Add a 0.030 to 0.035 inch (0.076 to 0.089 cm) diameter lubrication hole at location shown in figure 5-387.

NOTE

Angular relationship between the hole and slot is unimportant.

(2) Remove all burrs from drilled hole.

(3) Perform a magnetic-particle inspection on bolt.

(4) Using a vibropeen etching tool, reidentify bolt 1-030-139-02 as 1-030-139-02, Rev. A.

NOTE

Depth of marking shall be 0.001 to 0.006 inch (0.003 to 0.005 cm).

b. Replace retainer (1-030-141-03, Rev. A) with retainer (1-030-141-03, Rev. B).

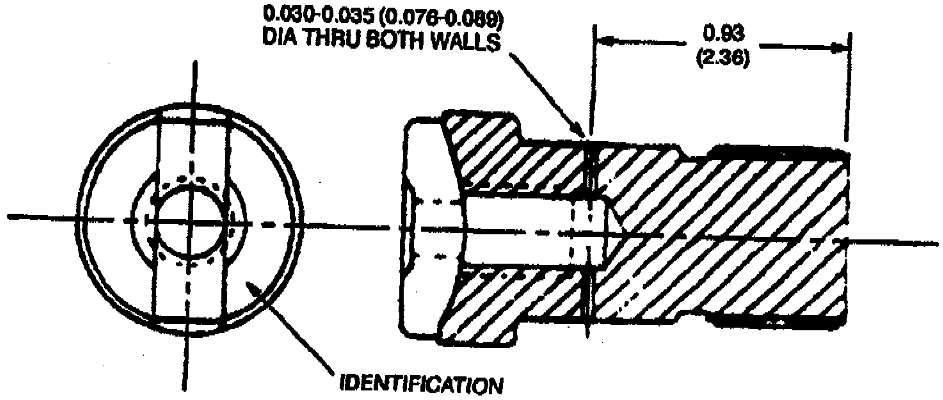


Figure 5-387. Rework of Sun Gear Retaining Bolt.

5-388. MODIFICATION OF CARRIER AND GEAR ASSEMBLY. Conversion procedure from P/N 1-030-350-08 to P/N 1-030-350-12 configuration is as follows:

a. Disassemble output reduction carrier and gear assembly per paragraph 5-338.

b. Remove output gearshaft plug P/N 1-030-360-04 or 1-030-234-01 by removing retaining ring P/N 1-300-201-01 and pressing rearward.

c. Gearshafts used in carrier and gear assembly P/N 1-030-350-12 incorporate larger plug seating area than those used in the 1-030-350-08 assembly. Gearshaft P/Ns 1-030-191-05 and 1-030-191-06 may be reworked to the new configuration or replaced with P/N 1-030-191-11.

d. Visually inspect the helical gearshaft on aft face portion of internal spline face for wear damage caused by plug impact.

(1) No conical taper or bevel allowed on spline tooth ends.

(2) Inspect aft portion of internal splines using tool as follows:

(a) Fabricate a tool as shown in figure 5-388.

(b) Insert whole bore end of depth gage (refer to figure 5-389) into aft end of output gearshaft until it seats on end of splines.

(c) Measure from web of gear to surface B and record dimension.

(d) Remove gage from gearshaft and reinstall with partial bore end into aft end of output gearshaft until it seats on end of splines. Measure from web of gear to surface C and record dimension.

(e) Using scribe line as a guide, rotate gage approximately 60 degrees, measure from rim of gear to aft surface and record dimension; rotate gage an additional 60 degrees, measure from rim of gear to aft surface and record dimension.

NOTE

If the difference between one of the three dimensions recorded in step (d) or (e) and step (c) is greater than 0.005, the gear is unacceptable.

(f) If gearshafts 1-030-191-05 or 1-030-191-06 are unacceptable per paragraph d(1) or d(2) modify gearshafts to the 1-030-191R09 or 1-030-191R10 configuration to be used in the 1-030-350-12 carrier assembly.

(g) Gearshafts which are acceptable per paragraph d(1) and d(2) can be reused in a 1-030-350-08 carrier assembly.

e. Inspection.

(1) Perform magnetic particle inspection on the following items:

(a) Output gearshaft.

(b) Planet gears.

(c) Sun gear.

(d) Carrier.

(2) Inspect Output Gear Plug Part No. 1-030-265-01 in accordance with figure 5-391. If criteria is not met, refer to step g for reclamation.

(3) Inspect all other items per paragraph 5-340.

f. If required, rework the gearshaft in accordance with the data tabulated below. Instructions required to rework the detail parts are contained in figure 5-390.

g. Rework Output Gear Plug Part No. 1-030-265-01 as follows:

(1) Machine an undercut antirotation tang radius as shown in figure 5-391.

(2) Wet residual magnetic particle inspection (4000 longitudinal turn amps) is required. No cracks or cracklike indications are allowed.

(3) Touch-up reworked area using gun glueing.

(4) Using vibropeen etching tool, reidentify reworked plug as 1-030-265-01, Revision B.

5-388A. MODIFICATION OF CARRIER AND GEAR ASSEMBLY (1-030-350-12 TO 1-030-350-18). Conversion procedure from Part No. 1-030-350-12 to 1-030-350-18 configuration is as follows:

a. Disassemble output reduction carrier and gear assembly per paragraph 5-338.

b. Reassemble output reduction carrier and gear assembly per paragraph 5-342 and table 5-141A.

Table 5-141A. Part No. 1-030-350-12 to Part No. 1-030-350-18 Conversion List.

SUPERCEDED PART NUMBER	NOMENCLATURE	SUPERCEDING PART NUMBER	QUANTITY
1-030-390-05	Front Cover Housing Assembly	1-030-390-08 (Alternate)	1
1-030-191-11	Output Helical Gearshaft	1-030-191-14	1
1-030-193-01	Helical Planet Gearshaft	1-030-193-05	3
1-300-335-01	Cylindrical Roller Bearing	1-300-682-01	1
1-300-337-01	Internal Retaining Ring	1-030-273-02	1
1-300-031-01	Cylindrical Roller Bearing	1-300-666-01	3
1-300-032-01	Cylindrical Roller Bearing	1-300-667-01	3
1-300-329-01/-02	Cylindrical Roller Bearing	1-300-669-01	1

5-388B. MODIFICATION OF CARRIER AND GEAR ASSEMBLY (1-030-350-12 TO 1-030-350-19). Conversion procedure from Part No. 1-030-350-12 to 1-030-350-19 configuration is as follows:

a. Disassemble output reduction carrier and gear assembly per paragraph 5-338.

b. The removed components listed in table 5-141B are not part of the new Carrier and Gear Assembly Part No. 1-030-350-19. These components may be inspected for serviceability and reused in some earlier carrier and gear assembly configurations.

Table 5-141B. Components No Longer Applicable to Part No. 1-030-350-19 Configuration

PART NO.	NOMENCLATURE	QUANTITY
1-030-129-01	Slotted Hexagon Nut	6
1-030-183-03	Rear Torquemeter Plate	1
STD3033B101	Snap Ring	6
1-030-203-01	Retaining Plate Bolt	6
1-030-185-01	Ball Retainer	6
1-030-182-03	Front Reduction Gear Carrier	1

c. Assemble the 1-030-350-19 output reduction carrier and gear assembly per paragraph 5-388D and table 5-141C.

5-388C. MODIFICATION OF CARRIER AND GEAR ASSEMBLY (1-030-350-18 TO 1-030-350-19). Conversion procedure from Part No. 1-030-350-18 to 1-030-350-19 configuration is as follows:

a. Disassemble output reduction carrier and gear assembly per paragraph 5-338.

b. The removed components listed in table 5-141B are not part of the new Carrier and Gear Assembly Part No. 1-030-350-19. These components may be inspected for serviceability and reused in some earlier carrier and gear assembly configurations.

c. Assemble the 1-030-350-19 output reduction carrier and gear assembly per paragraph 5-388D and table 5-141D.

5-388D. ASSEMBLE OUTPUT REDUCTION CARRIER (1-030-350-19). Proceed as follows:

NOTE

Before starting the conversion process, refer to tables 5-141C and 5-141D to make sure all required parts are available.

Table 5-141C. Part No. 1-030-350-12 to Part No. 1-030-350-19 Conversion List.

SUPERCEDED PART NUMBER	NOMENCLATURE	SUPERCEDING PART NUMBER	QUANTITY
1-030-390-05	Front Cover Housing Assembly	1-030-390-08	1
1-030-191-11	Output Helical Gearshaft	1-030-191-14	1
1-030-193-01	Helical Planet Gearshaft	1-030-193-05	3
1-300-335-01	Cylindrical Roller Bearing	1-300-682-01	1
1-300-337-01	Internal Retaining Ring	1-030-273-02	1
1-300-031-01	Cylindrical Roller Bearing	1-300-666-01	3
1-300-032-01	Cylindrical Roller Bearing	1-300-667-01	3
1-300-329-01/-02	Cylindrical Roller Bearing	1-300-669-01	1
1-030-340-04	Carrier Assembly	1-030-340-05	1
1-030-240-02	Torquemeter Plate Assembly	1-030-123-06	1 (Reworked per paragraph 5–390A)
1-030-185-01	Ball Retainer	MS9566-10	6

Table 5-141D. Part No. 1-030-350-18 to Part No. 1-030-350-19 Conversion List.

SUPERCEDED PART NUMBER	NOMENCLATURE	SUPERCEDING PART NUMBER	QUANTITY
1-030-340-04	Carrier Assembly	1-030-340-05	1
1-030-390-05	Housing Assembly	1-030-390-08	1
1-030-185-01	Retainer, Bolt	MS9566-10	6
1-030-240-02	Plate Assembly, Torquemeter	1-030-123-06	1 (Reworked per paragraph 5–390A)

NOTE

During reassembly, note the bearing and gear positions by position numbers. Position carrier and matchmarks so that the gear adjacent to the marks is at the top, looking forward. Positions will then be 1, 2, and 3 counterclockwise with position one at the top. Ensure that the rear carrier (3, figure 333A) and front carrier (32) have the same serial number.

a. Install packing (37, figure 333A) on fitting (36) and install in front cover housing assembly (44). Secure with bolt (35). Tighten bolt (35), as required, and lockwire.

CAUTION

During reassembly, ensure that the inner and outer races of bearings are not intermixed.

NOTE

If bearings that were removed are to be reused, install bearings into the same bores from which they were removed, and note position numbers.

b. Using removing tool (LTCT2086), tap outer races of roller bearings (12) into reduction gear carrier (32) in the same positions from which they were removed.

c. Position packing (30) on liner (31). Using a soft-faced mallet, tap liner (31) into front cover housing assembly (44), aligning bolt holes in front cover housing assembly (44) and liner (31).

d. Position reduction gear carrier (32) on bench with bearing bosses up.

CAUTION

To prevent damage to surface of bearing torquemeter balls (33), use extreme care when handling the bearing torquemeter balls (33).

e. Place the bearing torquemeter balls (33) in their respective sockets.

f. Position torquemeter plate assembly (42) on reduction gear carrier (32) and over bearing torquemeter balls (33). Aligning the six bolt holes in torquemeter plate assembly (42) with the six bolt holes in the reduction gear front carrier (32). Secure with bolts (38). Tighten bolts (38), as required, and lockwire.

g. Position front cover housing assembly (44), face down, on a clean surface. Install packing (43) in groove of front cover housing assembly (44). Install assembled torquemeter plate assembly (42) and reduction gear carrier (32) in front cover housing assembly (44). Position front cover housing assembly (44) so that fitting (36) is between bearing boss numbers 1 and 3 on reduction gear carrier (32). Align the three screw holes in front cover housing assembly (44) with three countersunk screw holes in the torquemeter plate assembly (42). Secure with screws (34). Tighten screws (34) as required.

CAUTION

If removed gearshafts (11, 46) are to be reused, ensure that gearshafts (11, 46) have been maintained as a matched set.

h. Position output gearshaft (46) with the gear up.

NOTE

Tooth space identified by radial marks on consecutive teeth is to be counted as number one space, each time.

i. Mark every 19th tooth space with yellow opaque ink No. 9 (item 234, table C-1 or equivalent). Identified tooth spaces shall be 120 degrees apart. Mark tooth spaces number 1, 2, and 3 counterclockwise with yellow opaque ink (item 234, table C-1 or equivalent).

CAUTION

During reassembly, ensure that the inner and outer races of bearings are not intermixed.

NOTE

Ensure that anti–rotational slot in outer race of roller bearing (29) and gearshaft (46) are aligned during installation.

j. Using sleeve bushing (LTCT3664) and arbor press, press outer race of roller bearing (29) into gearshaft (46) and secure with retaining ring (47).

k. Install retaining ring (47) so that alignment tang is fully engaged in alignment slots of roller bearing (29) and gearshaft (46).

l. Using sleeve bushing (LTCT3663) and arbor press, press inner race of roller bearing (29) onto liner (31) and secure with retaining ring (28).

m. Support gearshaft (46) on arbor press base with a suitable sleeve. Position assembled front cover housing assembly (44) and reduction gear carrier (32) over gearshaft (46). Ensure that roller bearing (29) inner and outer races are properly engaged.

n. Install spacer (27) onto gearshaft (46).

o. Using sleeve bushing (LTCT3661) and arbor press, start rear inner race of ball bearing (26) on gearshaft (46). Install outer race, ball, and forward inner race of ball bearing (26). Using arbor press and sleeve bushing (LTCT3661), press ball bearing (26) onto gearshaft (46) until ball bearing (26) is seated.

CAUTION

In following step p, when deforming cup into nut, do not shear cup.

p. Position assembled front cover housing assembly (44) and reduction gear carrier (32), front cover up, on holding fixture (LTCT496). Lubricate nut (24) with lubricating oil (item 189, or 190, table C-1). Install locking cup (25) and nut (24) using wrench (LTCT4190). Tighten nut (24) to 200 to 225 pound-feet (297.632 to 334.836 Kg/m) torque. Lock nut (24) by deforming cup in two places into the slots of nut (24), 180 degrees apart.

q. Place packing (18) in ID of oil seal retainer (17). Using installation tool (LTCT3638), press seal (19) into oil seal retainer (17).

r. Calculate thickness of spacer (21) as follows:

CAUTION

Ensure bearing outer race is bottomed in liner (31).

(1) Using a depth micrometer, measure from face of liner (31) to roller bearing (29) outer race and determine dimension A. (Refer to figure 5-352.)

(2) Using depth micrometer, measure from lip to rear surface of seal housing and retainer assembly (16, figure 5-333A) flange to determine dimension B.

(3) Subtract dimension B from dimension A and add 0.003 to 0.006 inch (0.008 to 0.015 cm). Result will be thickness of spacer (21) desired. Select proper spacer (21) part number from table 5-118.

s. Place spacer (21), of thickness determined in preceding step, against outer race of ball bearing (26).

t. Place packing (20) on OD of seal housing and retainer assembly (16).

u. Install packing (23) in ID of face plate (22) and reinstall face plate (22) on gearshaft (46).

v. Lubricate seal (19) with lubricating oil (item 189 or 190, table C-1). Install seal housing and retainer assembly (16) on front cover housing assembly (44) and secure with bolts (15). Tighten bolts (15), as required, and lockwire.

w. Position the rear face of gearshaft (46) upward, install new packing (41) on plug (40), position plug (40) into gearshaft (46) bore with threaded hole end down and press into position ensuring that plug (40) engages into splines. Secure with retaining ring (39).

x. Reassemble each planetary gear assembly (8) as follows:

CAUTION

Tag gearshaft assemblies to position numbers. If same gearshaft (11) that were removed are to be reused, they will be reinstalled into same positions from which they were removed.

(1) Using sleeve bushing (LTCT3658) and arbor press, press inner race of roller bearing (12) onto gearshaft (11).

NOTE

Ensure that serial number of roller bearing (7) inner race matches those of the outer race.

(2) Using sleeve bushing (LTCT3660) and arbor press, press inner race of roller bearing (7) onto gearshaft (11). Record serial number and position.

(3) Place gearshaft (11) in ring assembly (LTCT4019, used in conjunction with LTCT4018), small diameter gear up.

CAUTION

Ensure nut (14) is properly tightened on left–handed threads of gearshaft (11).

NOTE

In following step (4), do not shear cup when deforming it.

(4) Lubricate threads on gearshaft (11) with lubricating oil (item 189 or 190, table C-1). Install locking cup (13) and nut (14). Using wrench (LTCT2080), tighten nut (14) to 975 to 1000 pound-inches (174135 to 178600 gm/cm) torque. Deform locking cup (13) into gearshaft (11) at two places, 180 degrees apart.

(5) Invert gear assembly in holder.

NOTE

In following step (6), do not shear cup when deforming it.

(6) Lubricate threads on gearshaft (11) with lubricating oil (item 189 or 190, table C-1). Install locking cup (10) and nut (9). Using wrench (LTCT2079), tighten nut (9) to 975 to 1000 pound-inches (174135 to 178600 gm/cm) torque. Deform locking cup (10) into gearshaft (11) at two places, 180 degrees apart.

(7) Repeat preceding steps (1) through (6) for remaining two gearshaft assemblies.

y. Identify gearshaft assemblies for timing as follows:

(1) Position number one gearshaft assembly so the smaller diameter gear is up.

(2) Locate number one tooth by aligning radial scribe mark on small diameter gear with the radial scribe mark on large diameter gear. Number one tooth will be identified by a radial scribe mark on face of tooth. Paint number one tooth with yellow opaque ink No. 9 (item 234, table C-1 or equivalent).

(3) Position number two gearshaft assembly so the smaller diameter gear is up.

(4) Locate number one tooth as marked in step (2). Counting the number one tooth as one, count clockwise to tooth number ten. Paint number ten tooth with yellow opaque ink No. 9 (item 234, table C-1 or equivalent).

(5) Position number three gearshaft assembly so the smaller diameter gear is up.

(6) Locate number one tooth as marked in step (2). Counting the number one tooth as one, count counter-clockwise to tooth number ten. Paint number ten tooth with yellow opaque ink No. 9 (item 234, table C-1 or equivalent).

z. Position output reduction carrier and gear assembly so the number two tooth of the output gearshaft (46) will be at 8 o'clock and the number three position will be at 4 o'clock.

aa. Position number one gearshaft assembly into number one position. Ensure that tooth indicated with yellow paint is meshed between two teeth of gearshaft (46) that have the painted marks.

ab. Repeat preceding step aa for position two and three gearshaft assemblies.

NOTE

Ensure that the serial number of the roller bearing outer race matches those of the inner race.

ac. Using sleeve bushing (LTCT3661) and arbor press, press outer races of roller bearings (7) into their proper positions in rear carrier (3).

ad. Install oil deflector (6) into rear carrier (3) and secure with three tabwashers (2) and six bolts (1). Tighten bolts (1), as required, and secure by bending tabs of tabwashers (2).

ae. Carefully position rear carrier (3) over gearshaft assemblies. Ensure that the match-marks on the front and rear carrier (3) align. Secure with bolt (5) and washers (4). Tighten bolts (5) to 155 to 165 pound-inches (27683 to 29469 gm cm) torque.

af. Position dial indicator on nut (9). Push gearshaft assembly as far forward as it will go. Set dial indicator to zero. Pull up on gearshaft assembly until all end play has been used. End play shall be within 0.013 to 0.048 inch (0.033 to 0.122 cm) for each assembly.

ag. Using gear alignment fixture (LTCT4560), check gears for correct timing. If gear alignment fixture does not mesh smoothly with gears, reset timing. Check for clearance between oil deflector (6) and gearshaft (11).

ah. Lockwire bolts (5).

ai. Install seal rings (11, 12, figure 4-39).

aj. Pressure check the output reduction carrier and gear assembly as follows:

NOTE

This check is an optional requirement. If check is performed, it shall not be used as a criteria for rejection.

(1) Position packing (10) around output reduction carrier and gear assembly and place into test fixture (LTCT2029). Secure with bolts, nuts, and washers.

(2) Install dummy oil transfer tubes in front cover.

(3) Apply lubricating oil (item 189 or 190, table C-1) to sealing surfaces and apply 15 to 20 psi (1055 to 1406 gm sq cm) air pressure to test fixture (LTCT2029). No leakage is allowed.

NOTE

It may be necessary to rotate gearshaft (46, figure 5-333A) a few revolutions to seat seal (19).

(4) Release air pressure and remove output reduction carrier and gear assembly from test fixture (LTCT2029). Remove packing (10, figure 4-39) and dummy oil transfer tubes.

ak. Buildup oil transfer support assembly (refer to paragraph 5-350).

al. Check oil flow of output reduction carrier and gear assembly as follows:

NOTE

This check is an optional requirement. If check is performed, it shall not be used as a criteria for rejection.

(1) Install packings (4, 5) on oil transfer tubes (3).

(2) Install oil transfer tubes (3) through front cover and secure with bolts (1) and tabwashers (2).

(3) Install suitable test fixture on oil transfer support assembly.

(4) Place output reduction carrier and gear assembly, face down, in oil flow check stand (LTCT313 or equivalent).

(5) Install oil transfer support assembly on the three oil transfer tubes (3) and connect oil supply line.

(6) Set test stand pressure at 58 to 62 psig (4078 to 4359 gm sq cm) and oil temperatures at 90 to 110°F (32 to 43°C). The indicated lubricating oil (item 189 or 190, table C-1) flow shall be within 1900 to 2300 phr (item 190, table C-1) or 1805 to 2188 phr (item 189, table C-1).

(7) Disconnect oil flow check stand. Remove test fixture. Remove oil transfer support assembly and oil transfer tubes.

5-389. MODIFICATION OF REDUCTION GEAR ASSEMBLY. Modification procedure from Part No. 1-020-500-01 to 1-020-500-04:

a. Disassemble the reduction gear assembly per paragraphs 5-360 and 5-367.

b. Rework Part No. 1-020-165-01 prop shaft according to figure 5-392. Reidentify prop shaft to Part No. 1-020-165-07.

ALTERNATE PROCEDURE: Machine counterbore on inside surface of gear cavity with a 0.250 inch flat and 0.125 inch run-out radius, holding the same dimensions of basic procedure.

Eliminate machining operation, opening the flange to 12.24-2.26 (four places) at B10 on Part No. 1-020-165-07. The ends of the flange may be filed lightly to give an opening of 1.74 to 1.76 inches (eight places). File the corners of the flange (16 places) to give radii of 0.005 to 0.015 inches.

c. Install eight Pins Part No. 1-020-237-01 into reworked prop shaft as shown in figure 5-393 to a height of 0.080 to 0.100 inch above bearing mating surface.

d. Rework Part No. 1-020-185-01 secondary carrier in accordance with figure 5-394. Chrome plate the bores according to SP No. 6014 in Appendix E. Bake after plating at 375 ±15°F for 3 hours. Plate thickness after final machining is 0.002 to 0.015 inch. Reidentify secondary carrier to Part No. 1-020-185-06. Install 12 Pins Part No. 1-020-237-01 into carrier. Reidentify carrier subassembly from Part No. 1-020-310-01, reidentify to 1-020-310-05.

e. Assemble the reduction gear assembly per paragraph 5-371. Assemble the carrier using Part No. 2-300-041-05 bearings. Install bearings so that pins in carrier engage bearing through slots in bearing flange. Reidentify the reduction gear assembly to Part No. 1-020-500-04. A T53-L-701AB engine shall be reidentified as T53-L-701A.

5-390. MODIFICATION OF SEAL HOUSING ASSEMBLY (1-020-260-01). Seal Housing Part No. 1-020-260-01 shall be modified to the "REV F" configuration as follows:

a. Machine the 7.920 ref diameter to a depth of 0.330 as shown in section A of figure 5-395.

b. Vibropeen "REV F" in the area shown.

c. Fluorescent penetrant inspect. No cracks allowed.

d. Dichromate treat per SP No. 6026.

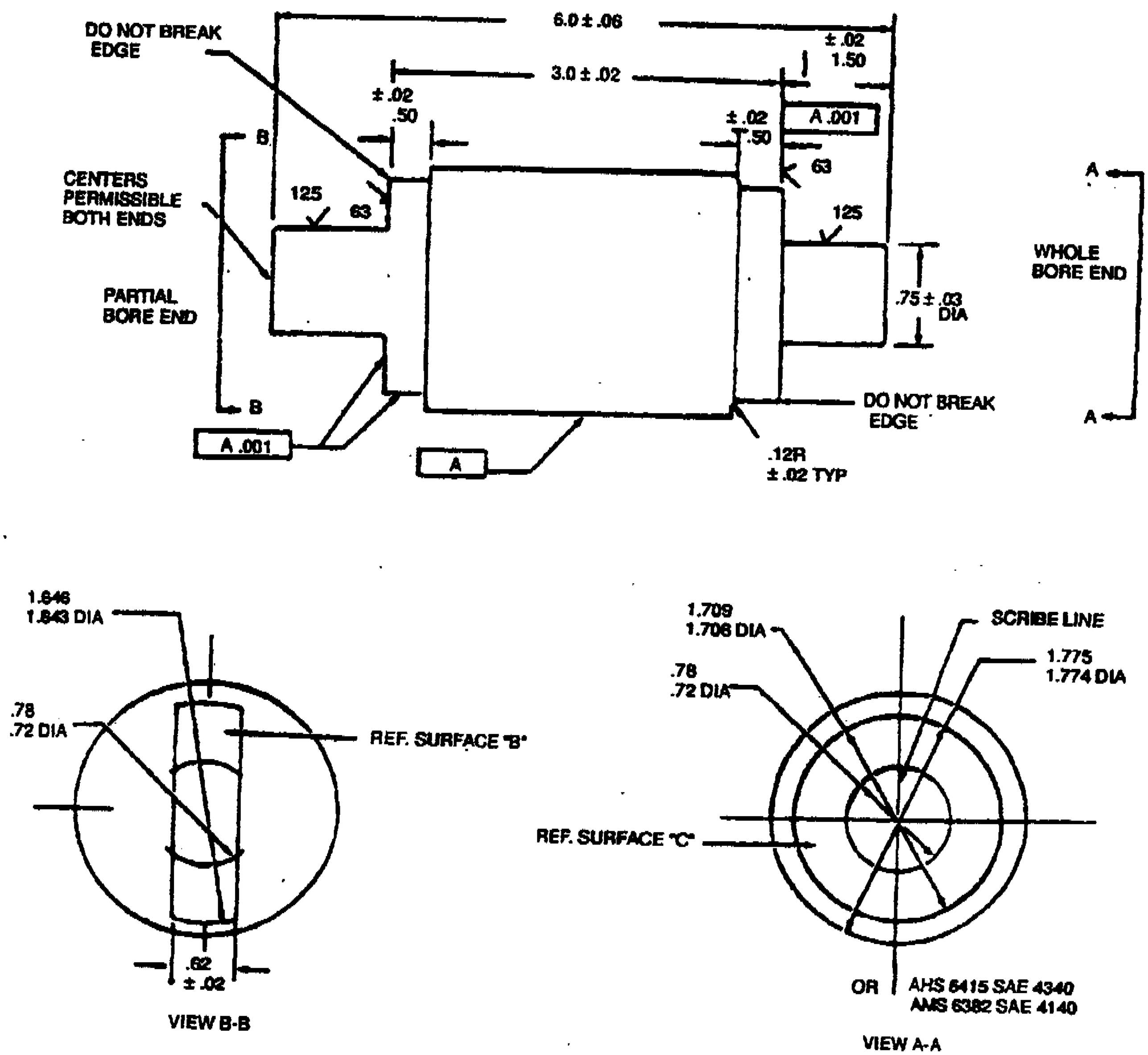


Figure 5-388. Depth Gauge for Inspection of Helical Gearshaft Internal Splines.

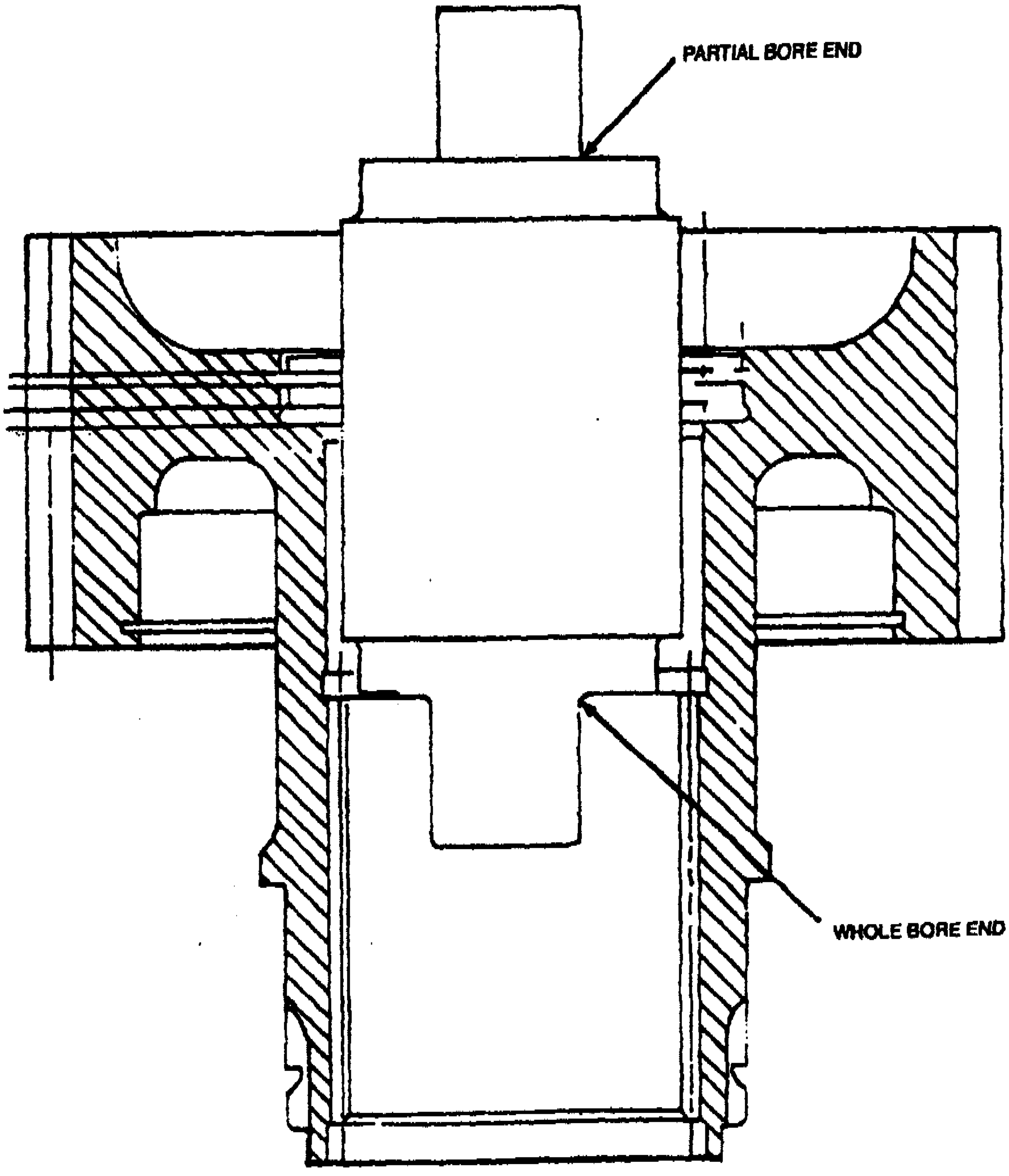


Figure 5-389. Seating of Whole Bore End of Depth Gauge Into Aft End of Output Gearshaft.

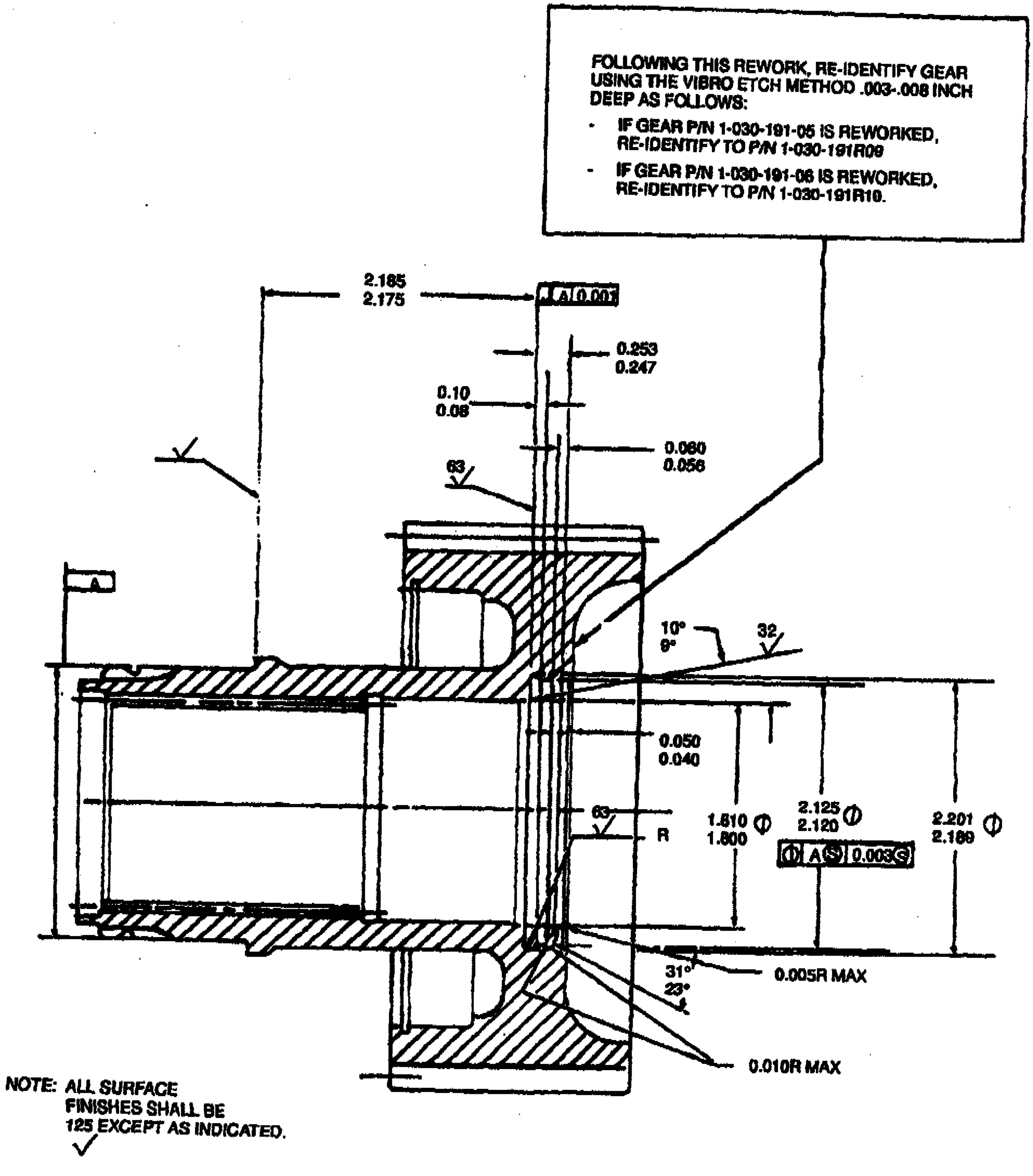


Figure 5-390. Rework of Output Gearshaft (P/N 1-030-191-05/06 to 1-030-191R09/R10).

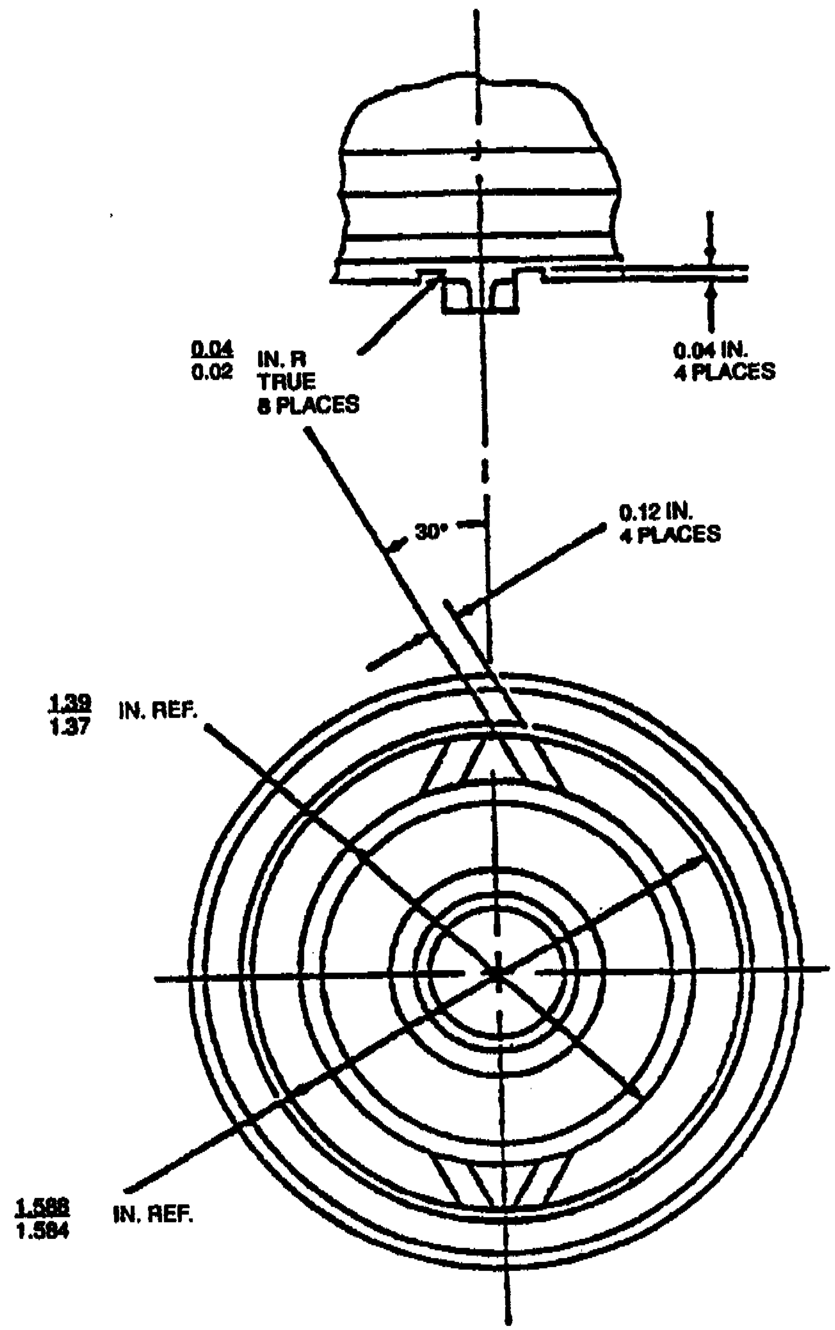


Figure 5-391. Rework of Output Gear Plug (P/N 1-030-265-01).

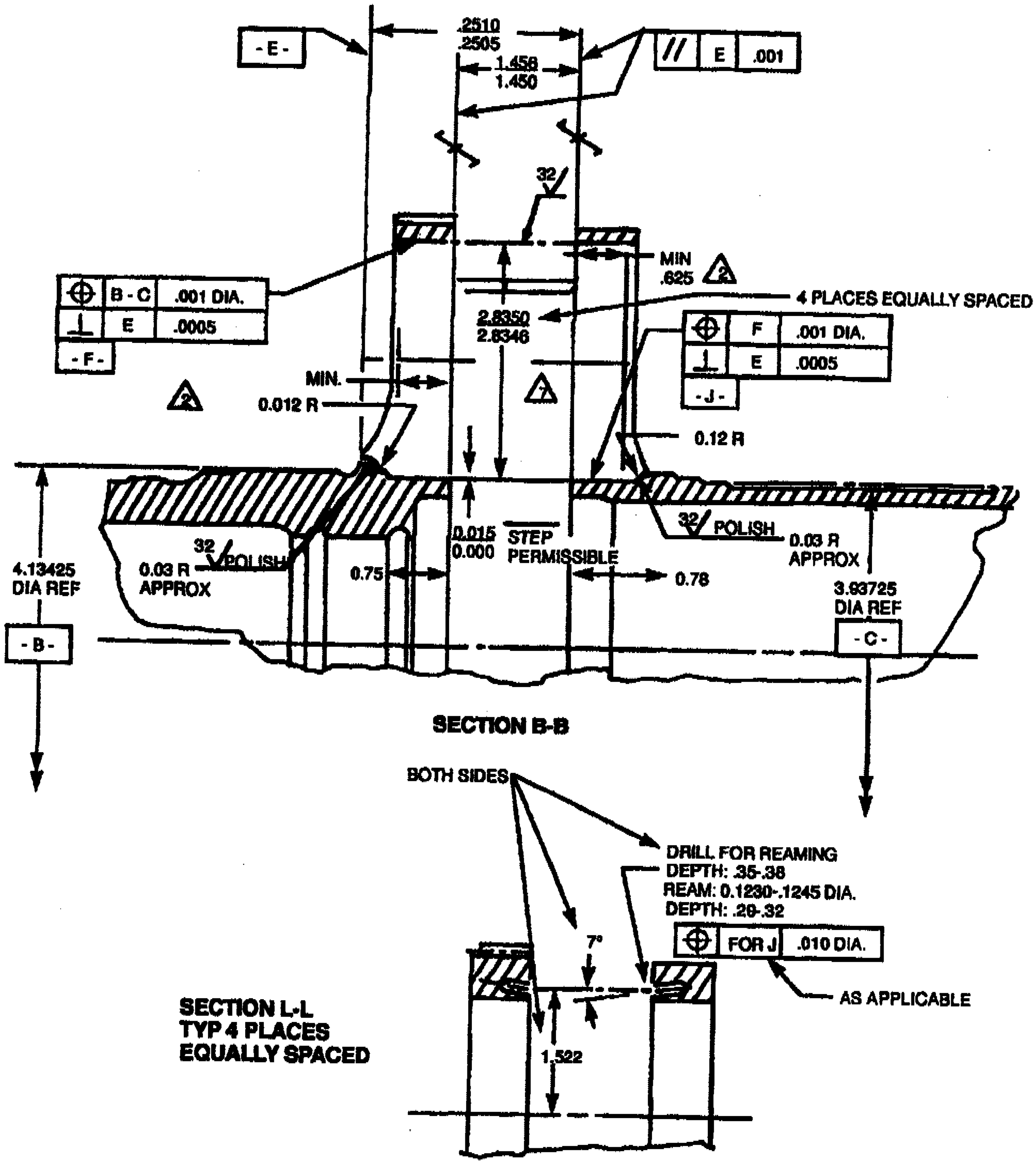
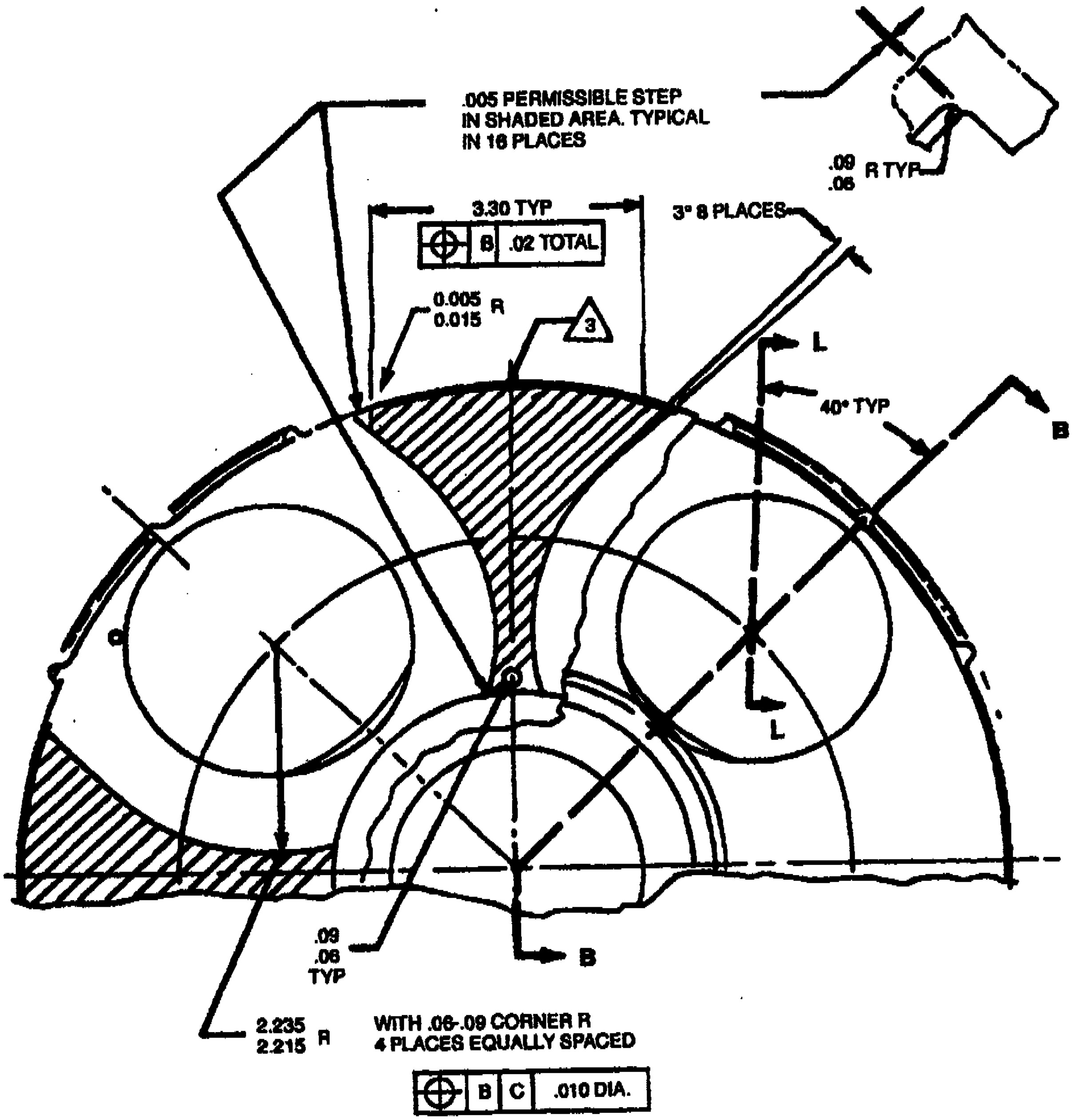


Figure 5-392. Rework of Shaft (P/N 1-020-165-01 to P/N 1-020-165-07) (Sheet 1 of 2).



MARKING PERMISSABLE ON ANY OF FOUR OUTSIDE LANDS.

CHROME PLATE PER AMS 2406. BAKE AFTER PLATING AT 375° ± 15° F FOR 3 HOURS. .002 MIN PLATE AFTER FINAL GRIND IF NECESSARY TO MEET DIM. MAX PLATE THICKNESS IS 0.015.

Figure 5-392. Rework of Shaft (P/N 1-020-165-01 to P/N 1-020-165-07) (Sheet 2 of 2).

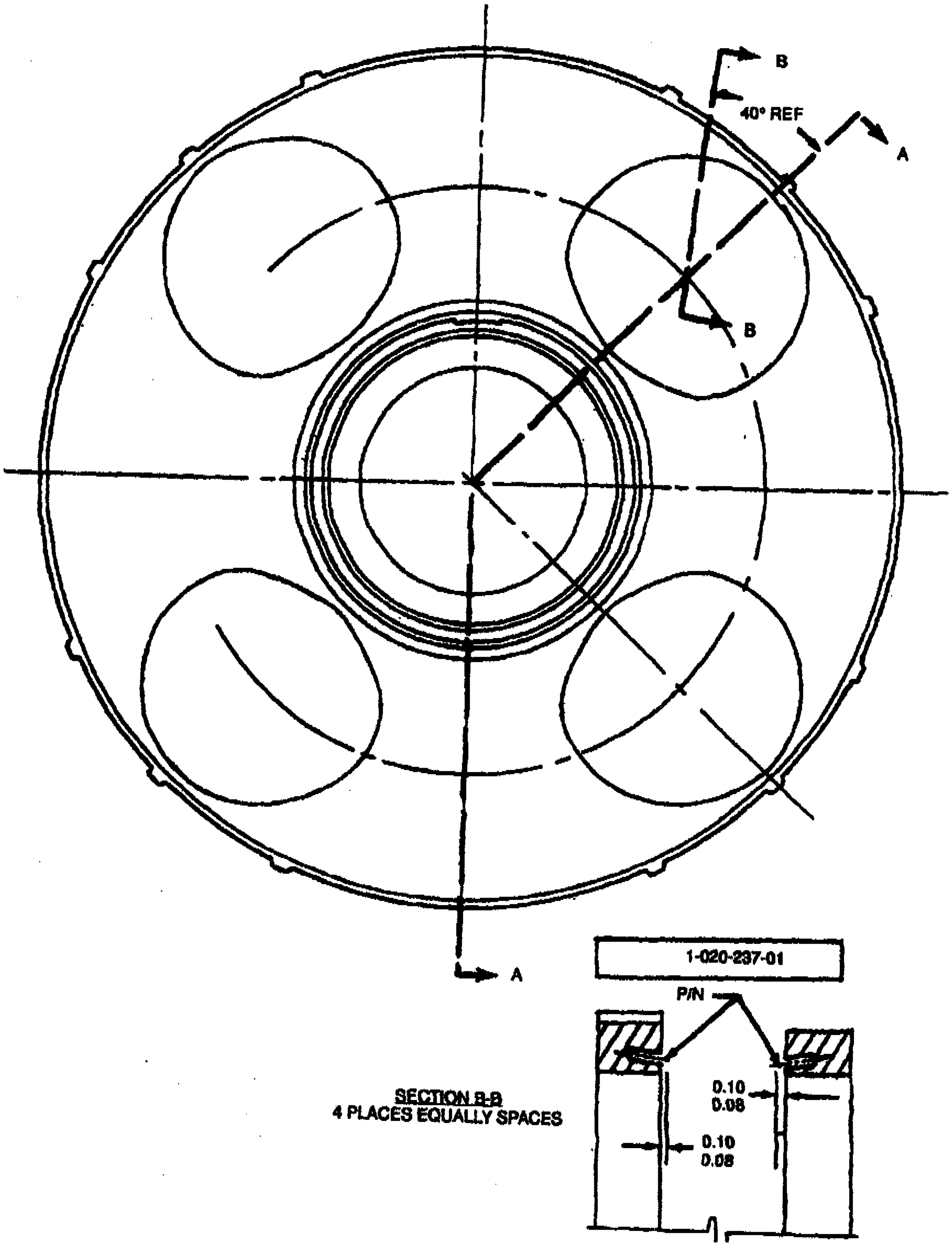


Figure 5-393. Rework of Shaft (P/N 1-020-290-01 to P/N 1-020-290-04).

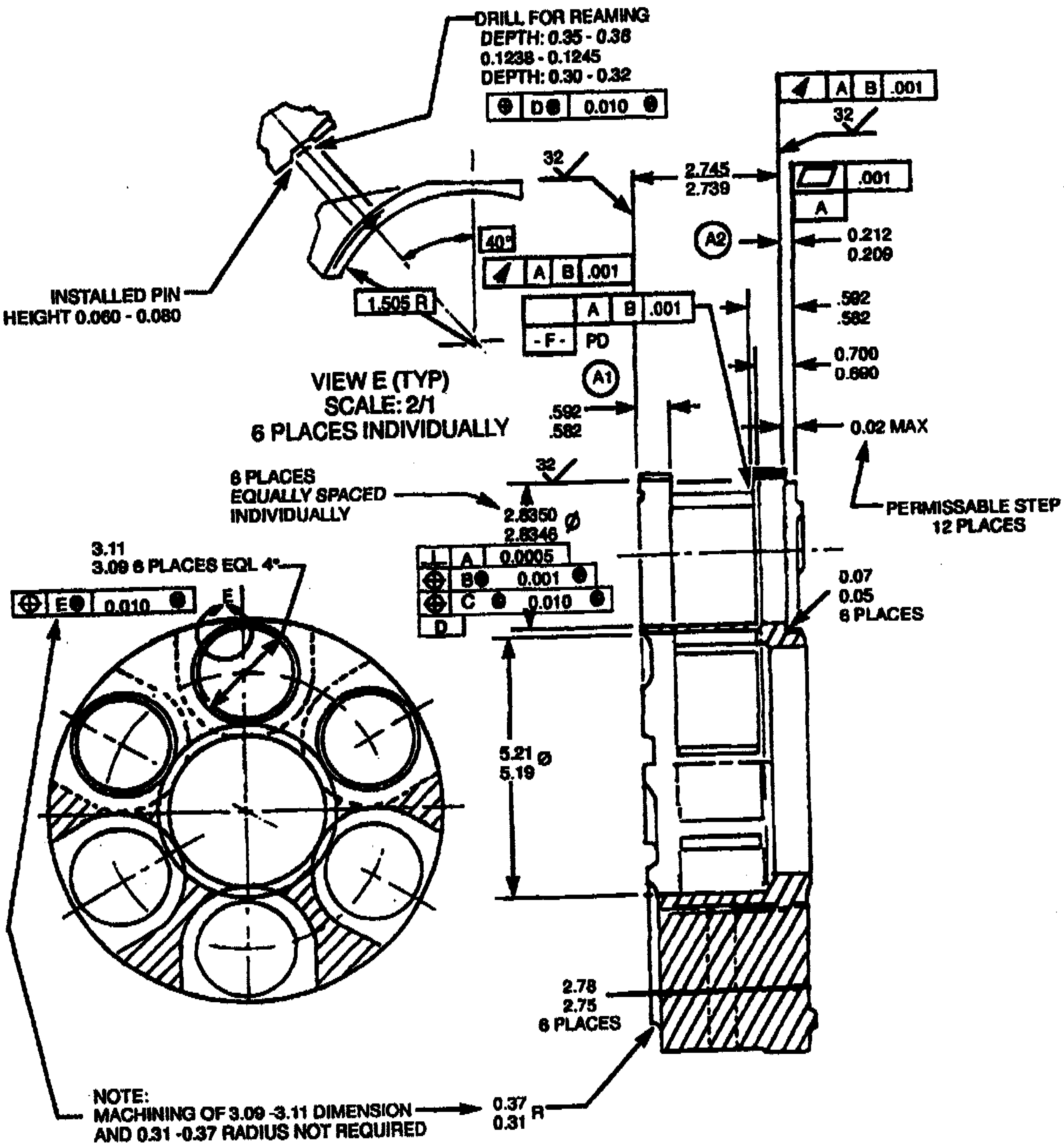


Figure 5-394. Rework of Secondary Carrier (P/N 1-020-185-01 to P/N 1-020-185-06).

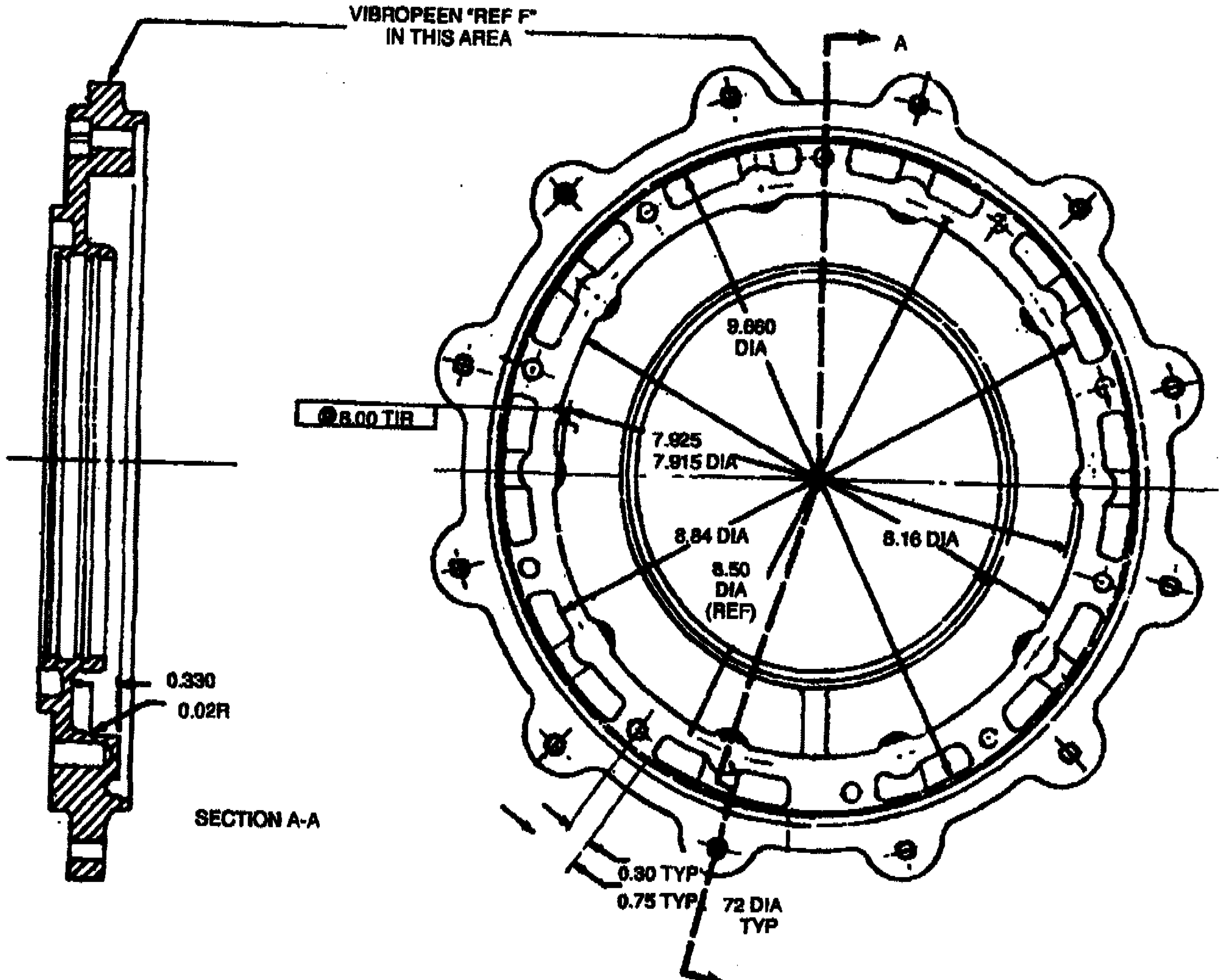


Figure 5-395. Modification of T53-L-701A Seal Housing Assembly.

5-390A. MODIFICATION OF TORQUEMETER PLATE ASSEMBLY (1-030-240-02 TO 1-030-123-06). Modification procedure from Part No. 1-030-240-02 to 1-030-123-06.

a. Rework Torquemeter Plate Assembly Part No. 1-030-240-02 as follows:

(1) Remove Alignment Pin Part No. MS9105-56 from rear face of torquemeter plate assembly.

(2) Locate and drill six new holes in the inner portion of the torquemeter plate assembly in accordance with figure 5-395A.

(3) Remove all burrs from all drilled holes.

(4) Perform magnetic particle inspection in accordance with table 5-114. No cracks allowed.

NOTE

Depth of marking shall be 0.001 to 0.006 inch (0.003 to 0.005 cm).

(5) Using a vibropeen etching tool, reidentify Torquemeter Plate Assembly Part No. 1-030-240-02 as 1-030-123-06.

NOTE

After rework, entire torquemeter plate assembly may be stripped and then recoated if desired. (Refer to SP No. 6002 in Appendix E.)

(6) Touch up black oxide coating, as required. (Refer to SP No. 6003 in Appendix E.)

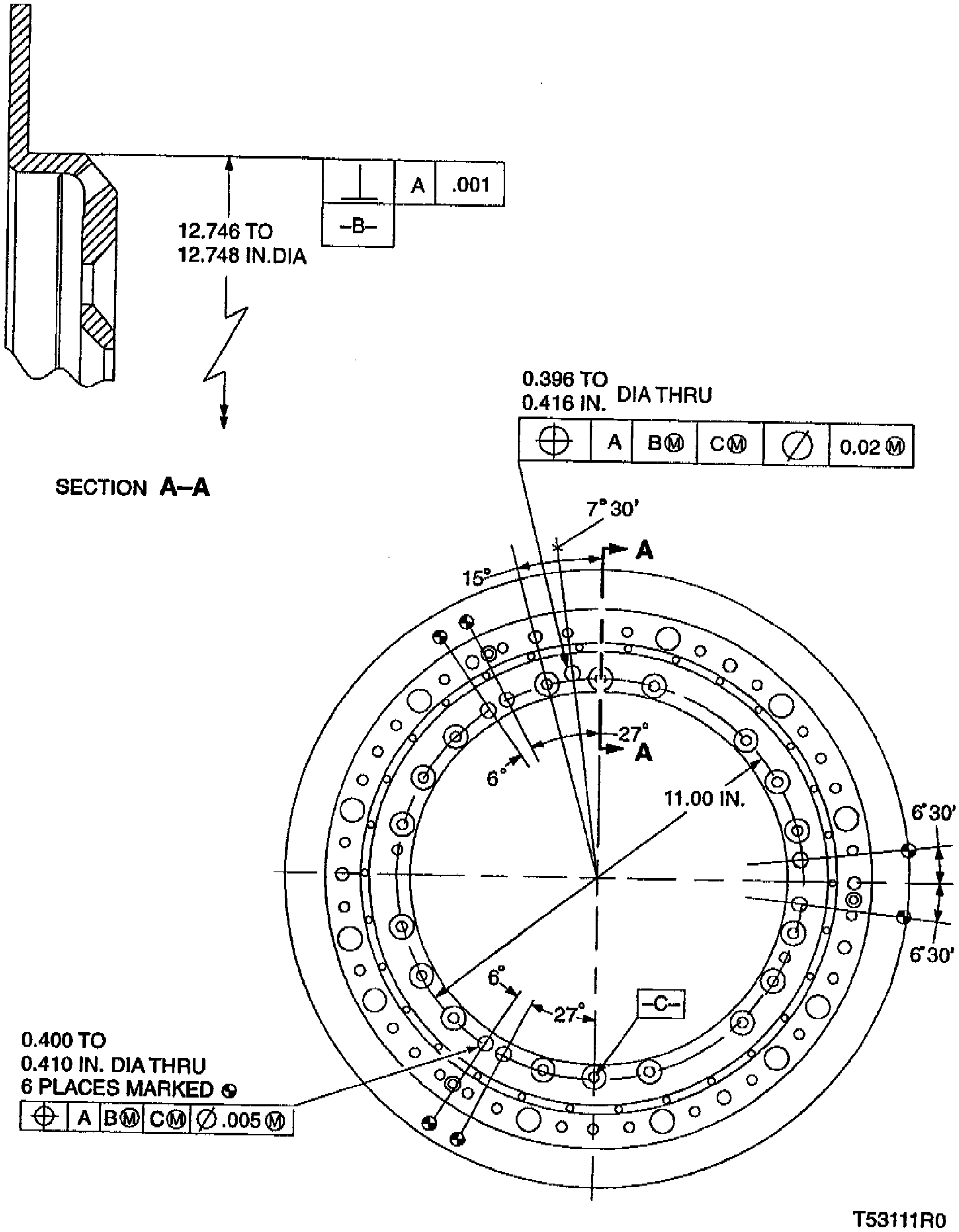


Figure 5-395A. Rework of Torquemeter Plate Assembly (1-030-240-02 to 1-030-123-06).

SECTION XI. DIFFUSER HOUSING

5-391. DIFFUSER HOUSING ASSEMBLY.

5-392. DISASSEMBLY. Proceed as follows:

a. Remove screws (2, figure 5-396), plate (3), and gasket (4) from diffuser housing assembly (1).

b. Remove strainer (6) and gasket (5) from diffuser housing assembly (1).

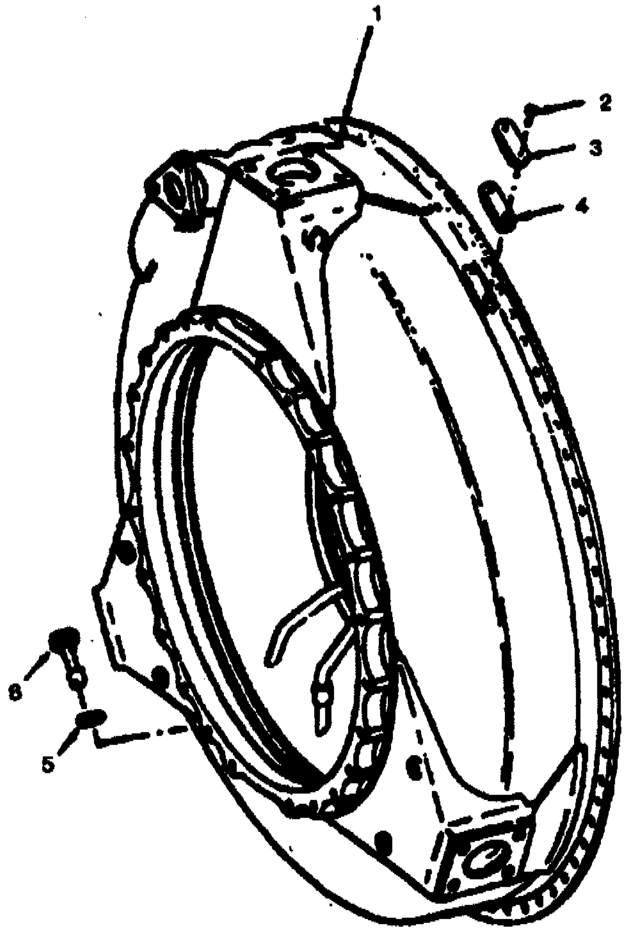


Figure 5-396. Diffuser Housing Assembly.

FIGURE & INDEX NUMBER	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	QTY PER ASSY	USABLE ON CODE
5-396	No Number	DIFFUSER HOUSING ASSEMBLY AND REAR BEARING ASSEMBLY (1-000-1000-01, 1-000-060-10, 1-000-060-10,1-000-110-01, and 1-100-060-23)	Ref	
-1	1-110-230-08	. HOUSING, Diffuser	1	A, C, D, E
	1-110-230-15	. HOUSING, Diffuser	1	B
-2	AN500AD8-6	. SCREW, Machine	4	
-3	1-110-073-01	. PLATE, Probe	2	
-4	1-110-072-01	. GASKET, Thermocouple	2	
-5	1-110-197-01	. GASKET, Strainer, oil rear bearing	1	
-6	1-110-114-08	. STRAINER, Oil, rear bearing housing	1	

5-393. CLEANING. This cleaning procedure applies to the following: DIFFUSER HOUSING ASSEMBLY, OIL RING AND SEAL, REAR BEARING, AND REAR BEARING HOUSING. Proceed as follows:

a. Clean bearing (5, figure 4-38) as outlined in SP No. 3010 in Appendix E.

b. Clean diffuser housing oil drain and oil-inlet tubes by loosening foreign material with suitable wire. Pressure-flush tubes with dry cleaning solvent (item 134, table C–1).

c. Clean strainer (6, figure 5-396) by immersing strainer in tank containing dry cleaning solvent (item 134, table C–1) and clean with soft bristle brush. Remove from tank and pressure-flush with dry cleaning solvent.

d. Clean diffuser housing assembly (1) and rear bearing housing assembly (7, figure 4-38) using dry cleaning solvent methods. (Refer to SP. No. 3002 in Appendix E.)

e. The air diffuser housing assembly may be cleaned and treated after rework by passivation (refer to SP No. 6024 in Appendix E) as an optional procedure.

(1) All heat treatment, machining, welding, and work procedures must be completed prior to passivation.

(2) Passivation shall not be performed on stainless steel parts that have been previously plasma- or thermo-flame sprayed. Sprayed parts should have a Ⓢ prefix to the serial number and the sprayed surface will be revealed by a roughened edge or a darker hue during the cleaning process.

(3) Limited superficial corrosion and staining on plasma- or thermo-flame sprayed diffuser housings may be removed using bead blasting.

5-394. INSPECTION OF DIFFUSER HOUSING ASSEMBLY, FORWARD OIL RING AND SEAL, REAR BEARING, AND BEARING HOUSING. Perform specific inspections listed in table 5-142.

5-395. REPAIR OF DIFFUSER HOUSING ASSEMBLY, FORWARD OIL RING AND SEAL, REAR BEARING, AND BEARING HOUSING. (See figures 4-38 and 5-396.) Proceed as follows:

a. Repair damaged chrome plating on forward oil ring (2, figure 4-38) 2.8825 to 2.8830 inch (7.3216 to 7.32282 cm) diameter as follows: (See figure 5-401.)

(1) Remove plating and chrome-plate. (Refer to SP No. 6014 in Appendix E.)

(2) Plating thickness after final grind is to be 0.002 to 0.010 inch (0.005 to 0.025 cm).

(3) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Finish grind to 2.8825 to 2.8830 inch (7.3216 to 7.3228 cm).

b. Repair dented or bent 5.400 to 5.402 inch (13.716 to 13.721 cm) diameter (see figure 5-402) of rear bearing housing assembly (7, figure 4-38), using one of the following methods:

(1) Method 1.

(a) Locally tap damaged areas back to original contour using suitable wood or plastic tool.

Table 5-142. Inspection of Diffuser Housing Assembly, Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38 2	Forward Oil Ring	Visual	Damage, wear, or scoring beyond 10 RMS on 2.8825 to 2.8830 inch (7.3216 to 7.3228 cm) diameter	Repair. (Refer to paragraph 5-395).
		Visual and Magnetic Particle. (Refer to table 5-143)	Cracks	Not allowed. Replace.
WARNING **FLIGHT SAFETY PART** **Verification that bearing is crack-free is flight safety critical.**				
5, 9 and 10	Roller Bearing	Visual	Damaged bearing	
			Loose fitting pins in bearings (1-300-665)	Replace by select- fitting new MS9105-52 pin to obtain 0.0002 to 0.0007 (0.0005 to 0.0018 cm) interference fit.
		Dimensional	Wear. (Refer to table 5-144).	Replace if limits are not met.
		Magnetic Particle Inspection.	Check for cracks in the outer ring. None Allowed.	Replace if limits cannot be met.
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection to ensure that the following part is crack-free is flight safety critical.**				
7	Rear Bearing Housing Assembly	Visual	Dents and bending at aft edge of 5.400 to 5.402 inch (13.716 to 13.721 cm) diameter. (Refer to table 5-145.)	Repair if not within limits. (Refer to paragraph 5-395).
			Loss of protective surface coating	Repair. (Refer to SP No. 6003 in Appendix E).
		Visual and SIE	Fretting and/or metal removal. (Refer to table 5-145)	Repair if limits are not met. (Refer to paragraph 5-395).
		Fluorescent Penetrant	Cracks in housing.	Not allowed. Replace.
			Cracks in housing to-shroud braze joints and shroud parent metal and dents in shroud. (Refer to table 5-145).	Repair. (Refer to paragraph 5-395).

Table 5-142. Inspection of Diffuser Housing Assembly, Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38				
7 (Cont)	Rear Bearing Housing Assembly (Cont)			
		Dimensional	Wear and fits. (Refer to table 5-146).	Repair if limits are not met. (Refer to paragraph 5-395).
8	Bearing Housing Stud	Visual and Magnetic Particle. (Refer to table 5-143)	Cracks.	Not allowed. Replace.
21	Retaining Ring	Visual	Cracks.	Not allowed. Replace.
			Distortion. (Refer to table 5-146).	Replace if limits are not met.
23	Seal Retainer	Visual and SIE	Wear. (Refer to table 5-146).	Replace if limits are not met.
5-396				

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection to ensure that the following part (to ensure that cracks are within limits) is flight safety critical.

1	Diffuser Housing Assembly	Visual	Nicks, dents, or burrs.	Repair. (Refer to SP No. 5000 in Appendix E).
			Clogged or foreign material in oil tubes.	Clean. (Refer to paragraph 5-395).
			Rubbing. (Indicated by shining patches or holes in parent metal.	Repair. (Refer to paragraph 5-395).
			DIA "C" area for minimum wall thickness of 0.040 inch. (Refer to figure 5-402).	Repair. Refer to paragraph 5-395 if limit is exceeded.
			Damaged or stripped threads on interstage bleed boss	Repair. (Refer to paragraph 5-395).
			Cracks and dents on inner support in region of conical section. (Refer to table 5-145)	Repair if limits are not met. (Refer to paragraph 5-395).
			Dents and punctures on third row of vanes. (Refer to table 5-145).	Repair if limits are not met. (Refer to paragraph 5-395).

Table 5-142. Inspection of Diffuser Housing Assembly, Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-396				
1 (Cont)	Diffuser Housing Assembly (Cont)	Visual (Cont)	Surface nicks, and burrs on third row of vanes. (Refer to table 5-145).	Repair. (Refer to SP No. 5000 in Appendix E).
			Less than 0.080 inch (0.203 cm) clearance between diffuser and curl on previously required rub areas. (See figure 5-399).	Repair. (Refer to paragraph 5-395).
			Crossed, stripped, or worn threads	Repair. (Refer to SP No. 5007 in Appendix E).
			Nicks, dents, scratches and rub grooves on oil pressure tubes and oil scavenge tubes. (Refer to table 5-145).	Repair or replace if limits are not met.
			Minor foreign object damage on first row of vanes	Repair. (Refer to paragraph 5-395).
			Punctures in vane parent metal on third row of vanes. (Refer to table 5-145).	Repair or replace if limits are not met. (Refer to paragraph 5-395).
			Nicks, dents, or burrs, on leading and trailing edges and airfoil areas on first row of vanes. (Refer to table 5-145).	Repair. (Refer to SP No. 5000 in Appendix E).
			Leakage in probe plate boss area. (Refer to table 5-145).	Repair. (Refer to paragraph 5-395).

Table 5-142. Inspection of Diffuser Housing Assembly, Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-396				
1 (Cont)	Diffuser Housing Assembly (Cont)	Visual and oil flow check stand (LTCT313, or equivalent, and test fixture LTCT4535)	Pressure-test failure of oil tubes and main flow channel. (Refer to paragraph 5-396).	Repair. (Refer to paragraph 5-395).
		Visual and Fluorescent Penetrant	Cracks in weld or braze areas on tubes and fittings.	Repair. (Refer to paragraph 5-395).
			Cracks in vane brazement on third row of vanes. (Refer to table 5-145)	Repair. (Refer to paragraph 5-395.)
			Erosion on leading edge of first row of vanes beyond acceptable limits. (Refer to table 5-145)	Repair. (Refer to paragraph 5-395.)
			Minor air leaks in brazement on third row of vanes during engine test. (Refer to table 5-145.)	Repair if limits are not met. (Refer to paragraph 5-395,)
			Accessible cracks in first row of vane brazed joints.	Repair. (Refer to paragraph 5-395.)

Table 5-142. Inspection of Diffuser Housing Assembly, Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing (Continued).

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
5-396				
1 (Cont)	Diffuser Housing Assembly (Cont)	Visual and Fluorescent Penetrant (Cont)	Inaccessible cracks in first row of vane brazed joints, forward and aft of vane stub. (Refer to table 5-145.)	Repair if limits are not met. (Refer to paragraph 5-395)
		Dimensional	Warpage, distortion or wear of diffuser housing. (Refer to table 5-145.)	Repair. (Refer to paragraph 5-395). Replace if limits cannot be met.
6	Strainer	Visual	Clogging	Clean. (Refer to paragraph 5-395).
			Cracks	Not allowed. Replace.

Table 5-143. Magnetic-Particle Inspection of Diffuser Housing Assembly, Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD OF MAGNETIZATION
4-38, 2	Forward Oil Ring	Circular, use central conductor at 800 amperes.
4-38, 7	Bearing Housing Stud	Longitudinal at 4000 ampere-turns.

Table 5-144. Dimensional Inspection of Rear Housing Bearing.

BEARING TYPE & PART NO.	FIG & INDEX	DIM. MEAS	BLUEPRINT DIMENSIONS		INTERNAL CLEARANCE	END PLAY	HARD-NESS RC	CONTACT ANGLE	LYCOMING PART NUMBER
			MIN	MAX					
	4-38								
WARNING FLIGHT SAFETY PART Verification of the bore diameter of the following part(s) is flight safety critical.									
Roller 462642	5 and 9	ID OD	2.1651 (5.4994) 3.5430 (8.9992)	2.1654 (5.5000) 3.5433 (9.0000)	0.0034 (0.0086) 0.0039* (0.0099)	N/A	60 to 64	N/A	1-300-176-03
Roller	5 and 9	ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0034 (0.0086)	N/A	60 to 64		1-300-176-04
IIUIOIIEAR5728		OD	3.5430 (8.9992)	3.5433 (9.0000)	0.0039* (0.0099)				
WARNING FLIGHT SAFETY PART Verification of the bore diameter of the following part(s) is flight safety critical.									
Roller Bearing 462986	10	ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0034 (0.0086)	N/A	60 to 64	N/A	1-300-584-01
		OD	3.5430 (8.9992)	3.5433 (9.0000)	0.0039* (0.0099)				
Roller Bearing HU1011EARS5 735	10	ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0034 (0.0086)	N/A	60 to 64	N/A	1-300-584-02
		OD	3.5430 (8.9992)	3.5433 (9.0000)	0.0039* (0.0099)				
Roller Bearing 5RNH111-101	10	ID	2.1651 (5.4994)	2.1654 (5.5001)	0.0031 (0.0079)	N/A	60 to 64	N/A	1-300-665-01
		OD	3.5430 (8.9992)	3.5433 (9.0000)	0.0039* (0.0099)				

* Under an 11-pound gage load

Table 5-145. Diffuser Housing Assembly Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Fretting and/or Metal Removal	5-397	Inspect bearing housing for fretting and/or metal removal where the No. 2 bearing outer race forward face mates with the bearing housing. Fretting is acceptable at the noted area (see figure 5-397) if the 0.699 to 0.701 inch (1.775 to 1.181 cm) dimension is maintained and not more than 50 percent of the circumference of the seating area is fretted. If limits cannot be maintained, repair as outlined in paragraph 5-395.
Rear Bearing Housing for Cracks in Housing-to Shroud Brazed Joints. Cracks in Shroud Parent Metal, and Dents in Shroud	5-398	a. Cracks and voids in brazed joints are acceptable for repair as outlined in paragraph 5-395 b. Cracks in shroud parent metal, up to 1/2 inch in length, are acceptable for repair as outlined in paragraph 5-395. c. Two shallow dents up to 1/16 inch in depth are acceptable without rework. Sharp bottomed dents and punctures are not acceptable. d. If limits in preceding steps b and c are exceeded. replace shroud on rear bearing housing as outlined in paragraph 5-395.
Dents and Bending at Aft Edge of 5.400 to 5.402 Inch Diameter		Discrepancies that do not affect 5.400 to 5.402 inch (13.716 to 13.721 cm) inside diameter, are acceptable without rework. Repair discrepant inside diameter as outlined in paragraph 5-395.
Rear Bearing Housing Forward Mounting Surface for Fretting and Wear	5-402	Housing is acceptable if the flange axial dimension is not less than 0.185. If limits cannot be maintained, repair as outlined in paragraph 5-395. Inspect "C" area for minimum wall thickness of 0.040 inch.
Nicks, Dents, Scratches and Rub Grooves on Oil Pressure Tubes and Oil Scavenge Tubes		a. All minor random surface nicks, dents, and scratches are acceptable with repair. Repair shall be limited to removal of surface protrusions. (Refer to SP No. 5000 in Appendix E). b. Grooves are acceptable to a depth of one-quarter total wall thickness. Measure groove depth with outside calipers. Compare with unaffected portion. c. If limits are exceeded, replace oil tubes as outlined in paragraph 5-395. **NOTE** Scavenge tubes shall be replaced as outlined in paragraph 5-395.

Table 5-145. Diffuser Housing Assembly Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Minor FOD Damage on Third Row of Vanes		Small punctures caused by FOD are acceptable on a maximum of four vanes, provided the maximum linear dimension does not measure greater than 1/8 inch on any defect and no more than one defect per vane is evident. Repair out-of-limit punctures as outlined in paragraph 5-395.
Punctures in Vane Metal on Third Row of Vanes		a. Vanes with punctures that do not exceed 0.060 inch (0.152 cm) in width after straightening defect to general contour of vane, shall be repaired as outlined in paragraph 5-395. (1) Two punctures per vane may be repaired. (2) A maximum of 22 vanes may be repaired, with not more than four adjacent vanes being affected. b. If vane limits in preceding step a are exceeded, repair as out lined in paragraph 5-395. (1) One puncture up to 3/16-inch (0.476 cm) wide, and 1/2 in length per vane may be repaired. (2) A maximum of four vanes may be repaired. (3) Not more than two adjacent vanes shall be repaired by this method. (4) If limits in steps (1), (2), or (3) are exceeded, replace vanes. (Refer to paragraph 5-395).
Cracks in Vane Brazement on Third Row of Vanes		a. Cracks in internal number 3 row of vane brazement are acceptable, provided that cracks in brazement do not penetrate through to exterior braze. If limit is exceeded, repair vanes as outlined in paragraph 5-395. b. All other cracks in vane brazement shall be repaired per paragraph 5-395.
Minor Air Leaks in Brazement on Third Row of Vanes During Engine Test		a. Minor air leaks in brazement discovered during engine test may be repaired without engine disassembly as outlined in paragraph 5-395. b. One braze bead completely around 1 vane only and a total braze length of one inch (2.54 cm) on all other vanes.
Minor Air Leaks Through Probe Pad		a. Minor air leaks in brazements discovered during engine test may be repaired without engine disassembly as outlined in paragraph 5-395. b. One side of probe pads may be brazed.

Table 5-145. Diffuser Housing Assembly Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Erosion on Leading Edge of First Row of Vanes		Perform inspection on leading edge of first row of vanes for erosion. The radial measurement taken from the center line of the seal bore to the maximum eroded portion of the vane shall not exceed 7.088 inches.
Nicks, Dents, and Burrs on Leading and Trailing Edges and Airfoil Areas of First Row of Vanes		Inspect leading edge, trailing edge, and airfoil areas of first row of vanes for nicks, dents, and burrs. a. Nicks are acceptable on leading and trailing edges up to a depth of 3/32 inch and a width of 5/32 inch on all vanes with blend repair. Separation of defects shall be a minimum of twice the depth. One vane is allowed one defect up to 1/4 inch (0.635 cm) in depth. Random minor dents and burrs are acceptable. Blend-repair nicks and burrs. (Refer to SP No. 5000 in Appendix E). **CAUTION** Do not blend so as to exceed erosion limits except as allowed with 1/4-inch depth nick defect. **NOTE** Measure foreign object damage defects from original leading edge as noted by position of vanes to inner and outer casing brazed joints b. Minor airfoil area nicks, dents, and burrs are acceptable. Smooth dents are acceptable without repair. Blend-repair nicks and burrs in accordance with paragraph 5-395. c. If limits are exceeded, repair diffuser housing as outlined in paragraph 5-395.
Dents on Third Row Vanes		a. Random dents less than 0.010 inch (0.025 cm) in depth are allowed without repair. b. Dents greater than 0.010 inch (0.025 cm) in depth are acceptable for repair as outlined in paragraph 5-395.
Surface Nicks and Burrs on Third Row of Vanes		Minor surface nicks and burrs are acceptable for repair as outlined in paragraph 5-395.

Table 5-145. Diffuser Housing Assembly Forward Oil Ring and Seal, Rear Bearing, and Bearing Housing Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Inaccessible Cracks in First Row of Vane Brazed Joints Forward and Aft of Vane Stub		These defects are acceptable, provided all other overhaul requirements are met. If unable to meet requirements, repair as outlined in paragraph 5-395.
Cracks and Dents on Inner Support of Air Diffuser Housing		a. Dents smaller than 1/2 inch in length and 1/8 inch in depth are acceptable without repair. b. Cracks up to 2.0 inches (5.1 cm) can be welded, provided a minimum of 1.0 inch (2.5 cm) of solid parent metal exists between the crack and the brazed joint. (Refer to paragraph 5-395).
Brazement Voids on First and Second Row Vanes		Voids up to 0.250 inch (0.635 cm) diameter are acceptable for repair as outlined in paragraph 5-395.

Table 5-146. Dimensional Inspection of Diffuser Housing Assembly and Rear Bearing Housing.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	4-38								5-400
Rear Bearing Housing Assembly to	7	ID	5.400 (13.716)	5.402 (13.721)	5.4000 (13.7160)	5.4023 (13.7218)			
							0.001L (0.003)	0.0053L (0.0135)	A
Retaining Plate	18	OD (REF)	5.398 (13.711)	5.399 (13.713)	5.397 (13.708)	5.399 (13.713)			
Rear Bearing Housing Assembly to	7	ID	5.400 (13.716)	5.402 (13.721)	5.4000 (13.7160)	5.4023 (13.7218)			
							0.000	0.0053L (0.0135)	A
Seal Retainer	23	OD (REF)	5.395 (13.703)	5.400 (13.716)	5.394 (13.701)	5.400 (13.716)			
Rear Bearing Housing Assembly to	7	ID	5.400 (13.716)	5.402 (13.721)	5.4000 (13.7160)	5.4023 (13.7218)			
							0.001L (0.003)	0.0053L (0.0135)	B
Sealing Ring	24 or 38	OD (REF)	5.398 (13.711)	5.399 (13.713)	5.397 (13.708)	5.399 (13.713)			
Rear Bearing Housing Assembly to	7	ID	4.080 (10.363)	4.082 (10.368)	4.0800 (10.3632)	4.0823 (10.3690)			
							0.001L (0.003)	0.0043L (0.0109)	
	5-396								
Diffuser Housing Assembly	1	OD	4.078 (10.358)	4.079 (10.361)	4.078 (10.358)	4.079* (10.361)			C
Diffuser Housing Assembly to	1	ID	3.700 (9.398)	3.701 (9.401)	3.7000 (9.3980)	3.7015* (9.4018)			D

Table 5-146. Dimensional Inspection of Diffuser Housing Assembly and Rear Bearing Housing (Continued).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
Forward Seal	4-38 1	OD (REF)	3.703 (9.406)	3.704 (9.408)	3.703 (9.406)	3.704 (9.408)			
Diffuser Housing Assembly to	5-396 1	ID	21.875 (55.563)	21.877 (55.568)	21.875 (55.563)	21.880* (55.5752)			E
							0.000	0.010L (0.025)	
Combustion Chamber Housing	5-221 5	OD (REF)	21.873 (55.557)	21.875 (55.563)					
Diffuser Housing Assembly to	1	5-396 ID	13.375 (33.973)	13.376 (33.975)	13.375 (33.973)	13.383 (33.993)			F
							0.000	0.015L (0.04)	
Impeller Housing Assembly	5-501 5	OD (REF)	13.372 (33.970)	13.375 (33.973)					
Rear Bearing Housing Assembly	4-38 7	ID	3.220 (8.179)	3.230 (8.204)	3.220 (8.179)	3.230 (8.204)			G

WARNING

FLIGHT SAFETY PART

Verification of the 3.5430 - 3.5434 diameter of the following part(s) is flight safety critical.

		ID	3.5430 (8.9992)	3.5434 (9.0002)	3.5430 (8.9992)	3.5437 (9.0010)			H

Table 5-146. Dimensional Inspection of Diffuser Housing Assembly and Rear Bearing Housing. (Continued)

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	5-396								
Diffuser Housing Assembly Compressor "D" Clearance	1	ID	13.130 (33.350)	13.150 (33.401)	13.130 (33.350)	13.162 (33.431)			I
	4-38								
Rear Bearing Housing Assembly	7	Axial	0.699 (1.775)	0.701 (1.781)	0.699 (1.775)	0.701 (1.781)			J
	5-396								
Diffuser Housing Assembly Forward Face to Bearing Housing Face	1	Axial	4.127 (10.483)	4.131 (10.493)	4.122 (10.470)	4.136* (10.505)			K
Diffuser Housing Assembly Forward Face to Flange Rear Face	1	Axial	5.644 (14.336)	5.652 (14.356)	5.640 (14.326)	5.656* (14.366)			L
Diffuser Housing Assembly	1	Thickness	0.120 (0.305)	0.130 (0.330)	0.110 (0.279)				M
(Aft Flange)		Thickness	0.0865 (0.2197)	0.0975 (0.2477)	0.050 (0.127)				N
Large Seal Area		Thickness	0.099 (0.251)		0.085 (0.216)	0.110 (0.279)			O
Packing Area		Thickness	0.115 (0.292)		0.058 (0.147)				P
Bearing Housing Mounting Surface		Thickness			0.170 (0.432)				Q
Pilot Dial Recess		Depth	0.150 (0.381)	0.160 (0.406)	0.150 (0.381)				R

Table 5-146. Dimensional Inspection of Diffuser Housing Assembly and Rear Bearing Housing (Continued).

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
Diffuser Housing Assembly Ring Groove		Depth	0.105 (0.267)	0.110 (0.279)	0.095 (0.241)	0.112 (0.284)			S
	4-38								
Rear Bearing Housing Assembly Squareness*	7	TIR		0.001					T
Rear Bearing Housing Assembly Concentricity**	7	TIR		0.005					U
Rear Bearing Housing Assembly Concentricity***	7	TIR		0.001					V
	5-396								
Diffuser Housing Assembly Squareness**	1	TIR		0.002					W
Diffuser Housing Assembly Concentricity**		TIR		0.005					X
		TIR		0.001					Y
		TIR		0.0005					Z

* Average of six equally spaced readings
** Measured to REF SURFACE A indicated in figure 5-400.
*** Measured to REF SURFACE A and REF SURFACE B indicated in figure 5-400.

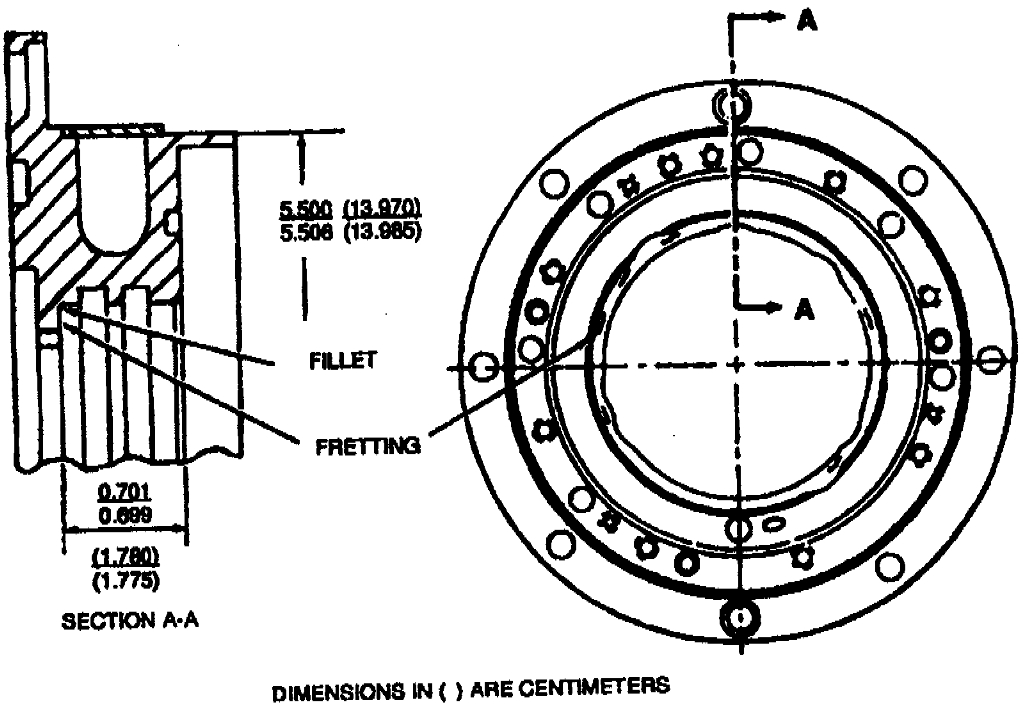


Figure 5-397. Rear Bearing Housing Inspection.

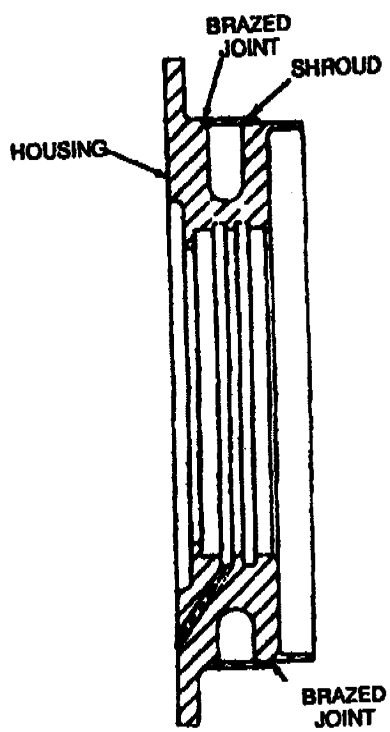


Figure 5-398. Rear Bearing Housing Inspection Areas.

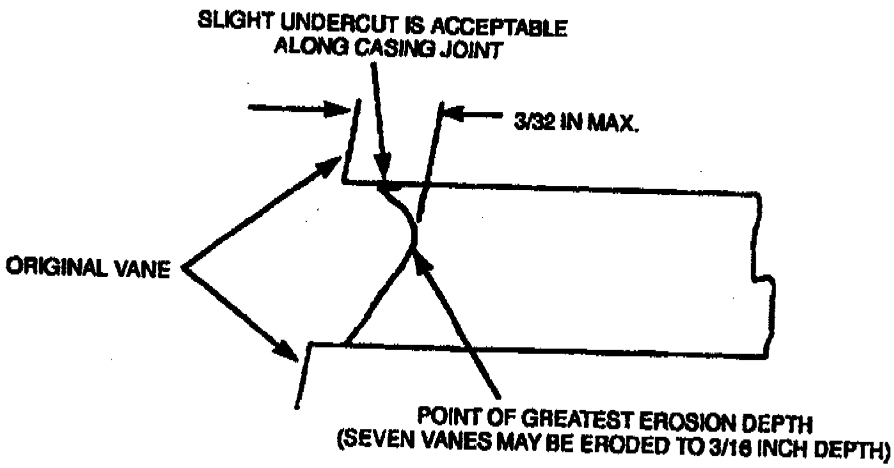


Figure 5-399. Measuring Erosion Depth.

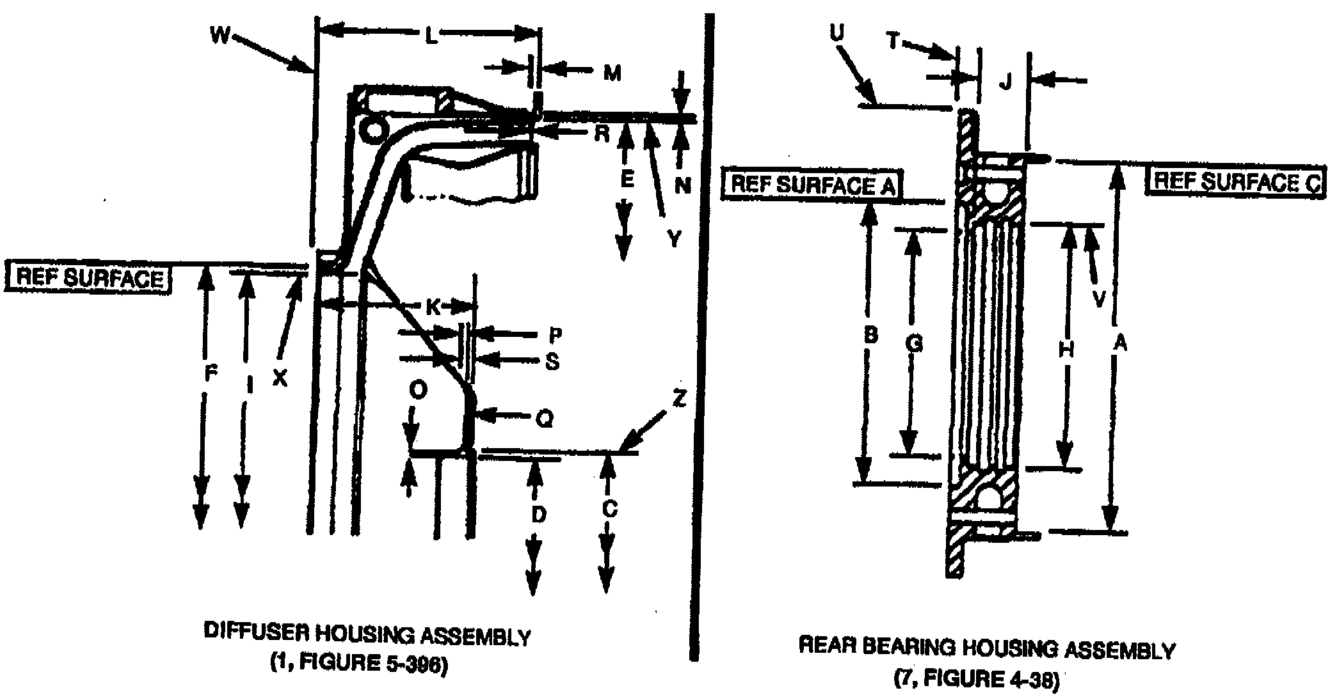


Figure 5-400. Diffuser Housing Assembly, and Rear Bearing Housing Dimensional Inspection Locations.

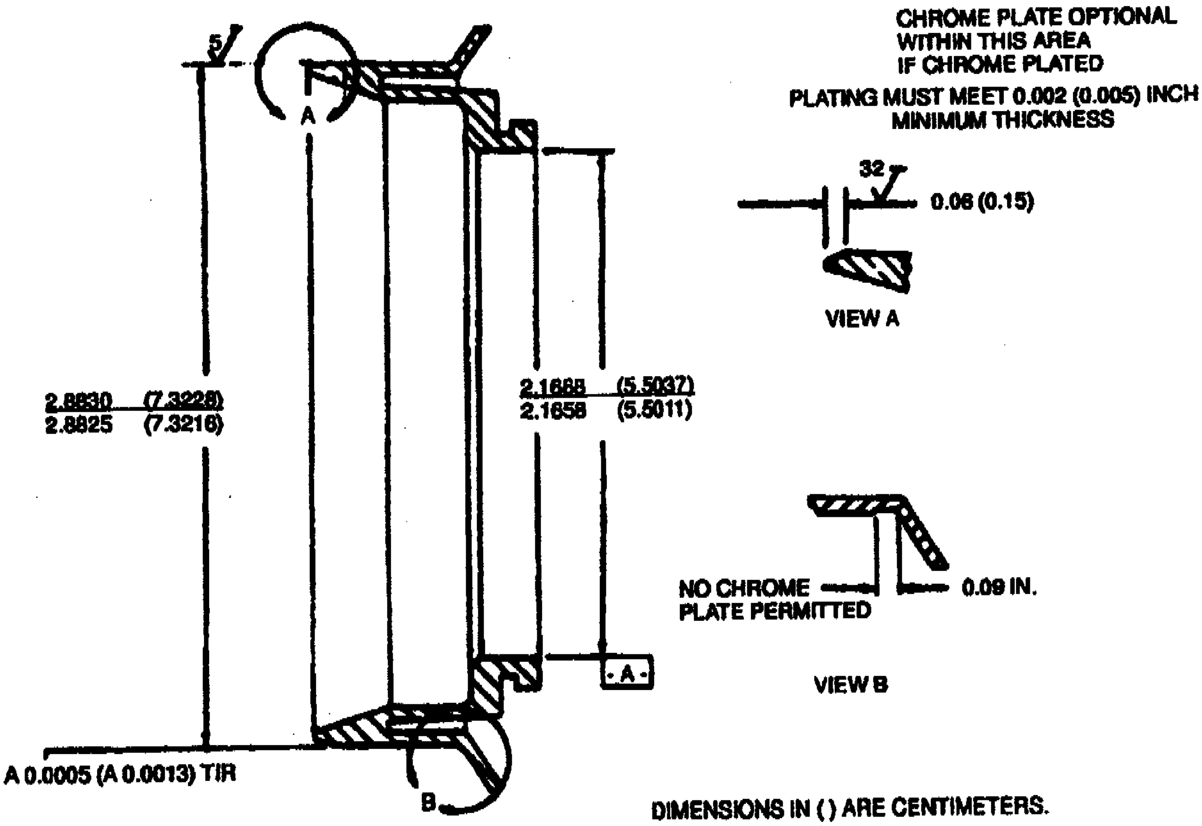


Figure 5-401. Forward Oil Ring - Plating Area.

NOTE

It is suggested that a ring of steel (item 302, table C–1) be locally fabricated and machined to outside diameter of 5.400 inches (13.716 cm). Cut ring in half and place ring in damaged areas of 5.400 to 5.402 inch (13.716 to 13.721 cm) diameter; then tap to regain original contour.

(b) Dimensionally inspect housing (including reworked area) as outlined in table 5-144.

(c) Fluorescent-penetrant inspect housing. No cracks are allowed.

(2) Method 2.

(a) Install housing in a suitable chuck and spin, using a wooden or plastic forming block to regain original inside diameter contour.

(b) Fluorescent-penetrant inspect as outlined in step (1) (c).

(c) Repair DIA "C" area that fell below the minimum wall thickness shown on figure 5-402 as follows:

1 Remove DIA "C" (5.400 to 5.402) area by machining as shown in figure 5-402, View A.

2 Fabricate a replacement ring of AMS 5613 (item 313, Appendix C–1) material as shown in figure 5-404.

3 It is permissible to weld area C of the bearing housing provided the following criteria is maintained.

a No circumferential crack allowed

b No missing seams

c No transverse cracks in the base metal area

d No air leaks.

Using a suitable welding fixture position the ring in place as shown in figure 5-404 and electron beam all around (refer to SP No. 5005, Appendix E). It is permissible, if required, to shrink fit the replacement ring on housing by heating it to 400°F and cooling housing in dry ice.

4 Perform fluorescent penetrant inspection. (Refer to MIL-STD-6866.)

5 Finish machine DIA "C" in accordance with manufacturer's drawing requirements.

c. Repair fretting and/or metal removal of 0.699 to 0.701 inch (1.775 to 1.781 cm) surface of rear bearing housing assembly (7, figure 4-38) by either chrome-plating or plasma-flame spraying as follows:

(1) Repair by chrome-plating as follows (refer to figure 5-402).

(a) Remove plating, and chrome-plate. (Refer to SP No. 6014 Appendix E.)

(b) Plating thickness after final grind shall be 0.002 to 0.010 inch (0.005 to 0.025 cm).

(c) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(d) Finish-grind face 0.699 - 0.701 inch (1.775 - 1.781 cm) dimension.

NOTE

Partial chrome-plate is allowed in fillet radii.

(2) Repair by plasma flame-spraying as follows (figure 5-402).

(a) Machine or strip surface to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup thickness after final machining.

(b) Plasma flame-spray housing using molybdenum powder (item 219, table C–1). (Refer to SP No. 5006 in Appendix E.)

NOTE

Ensure adequate masking in order to confine plasma flame spray to desired surface.

(c) Finish-machine face to 0.699 to 0.701 inch (1.775 to 1.781 cm) dimension.

NOTE

Partial plasma flame spray is allowed in fillet radii.

(d) Touch up reworked area, if required, with black oxide coating. (Refer to SP No. 6003 in Appendix E.)

d. Repair worn forward mounting surface on bearing housing (0.185 inch minimum (0.470 cm) axial dimension) by chrome plating (see figure 5-402).

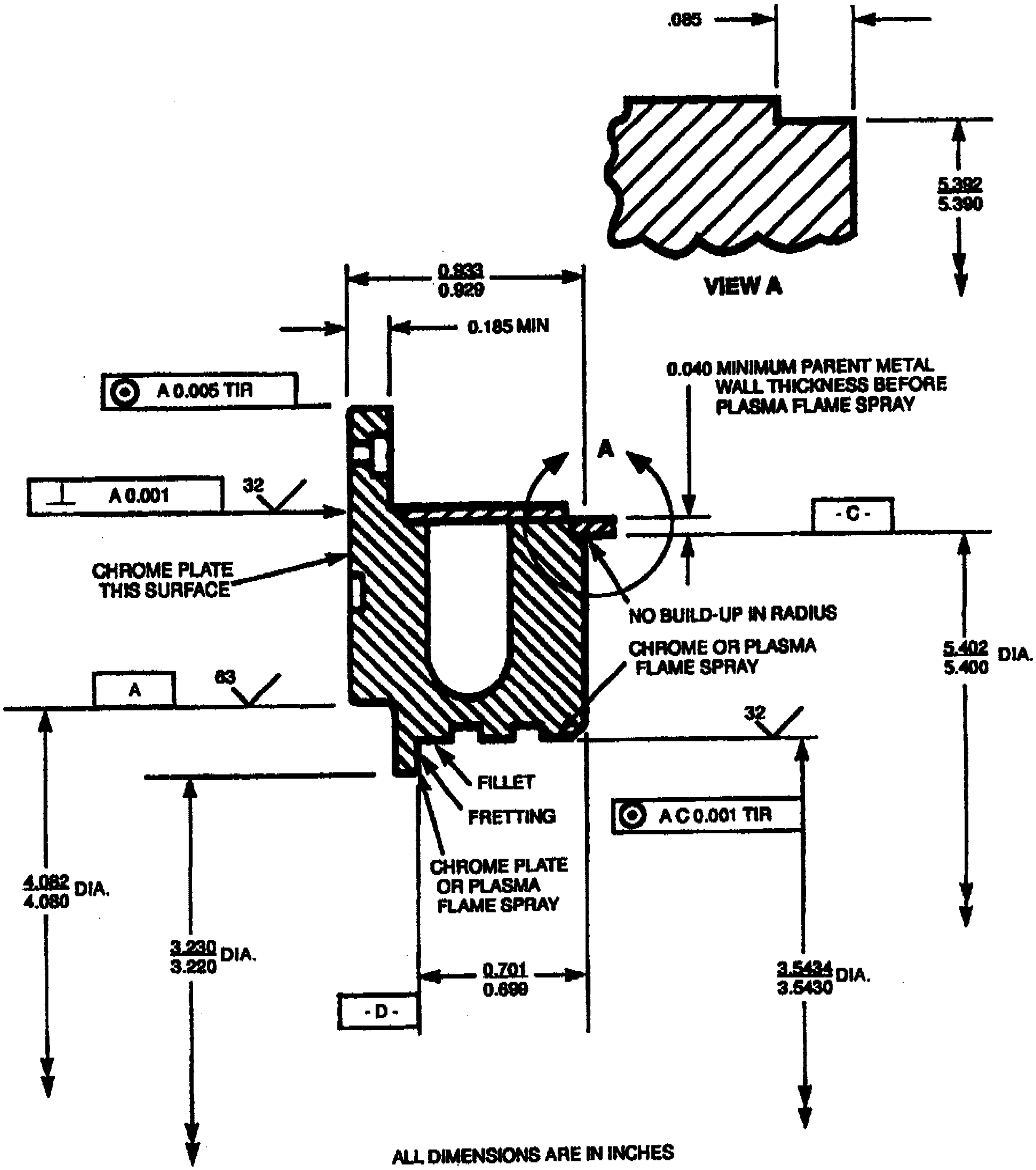


Figure 5-402. Repair of Rear Bearing Housing (English).

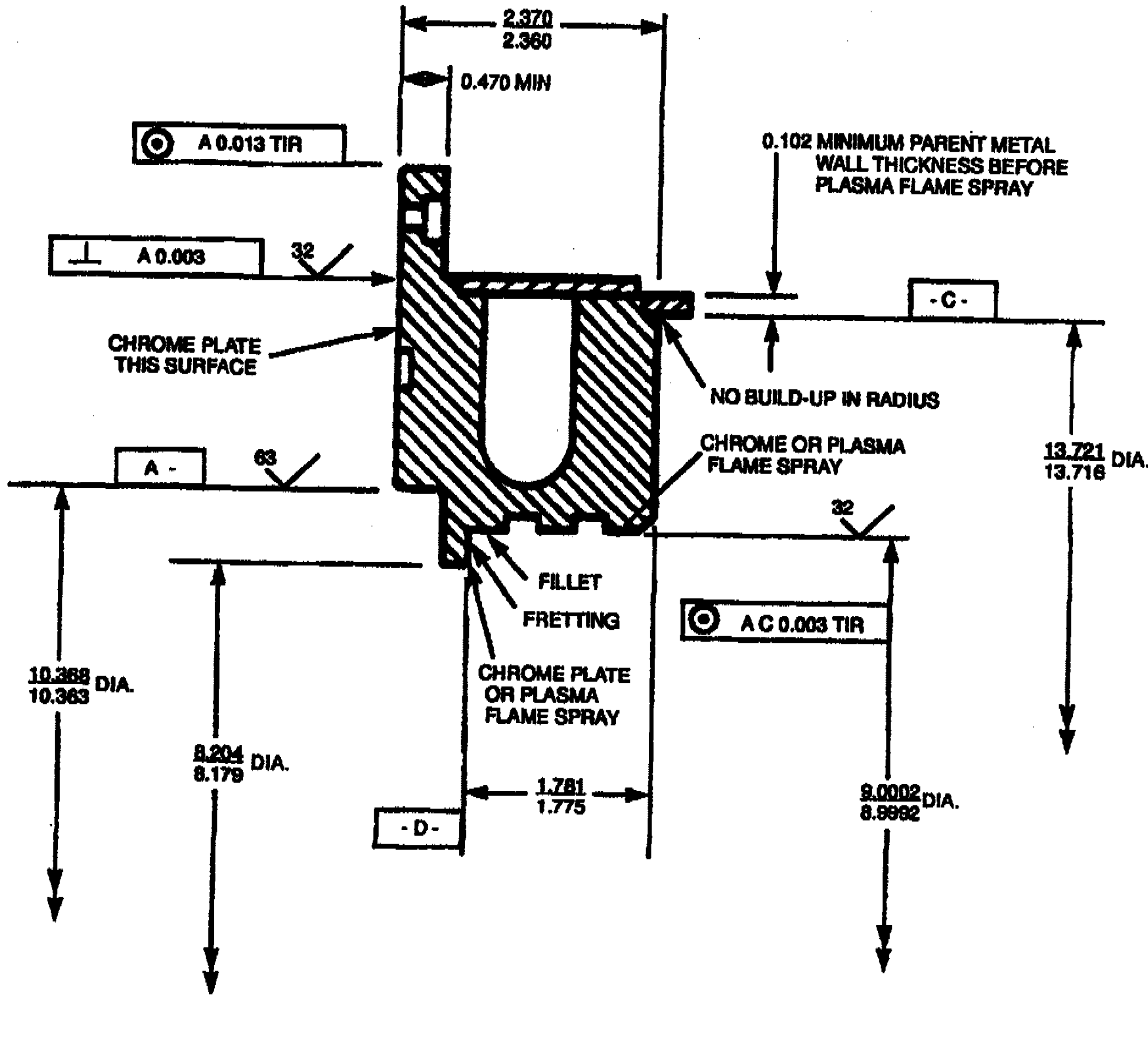


Figure 5-403. Repair of Rear Bearing Housing (Metric).

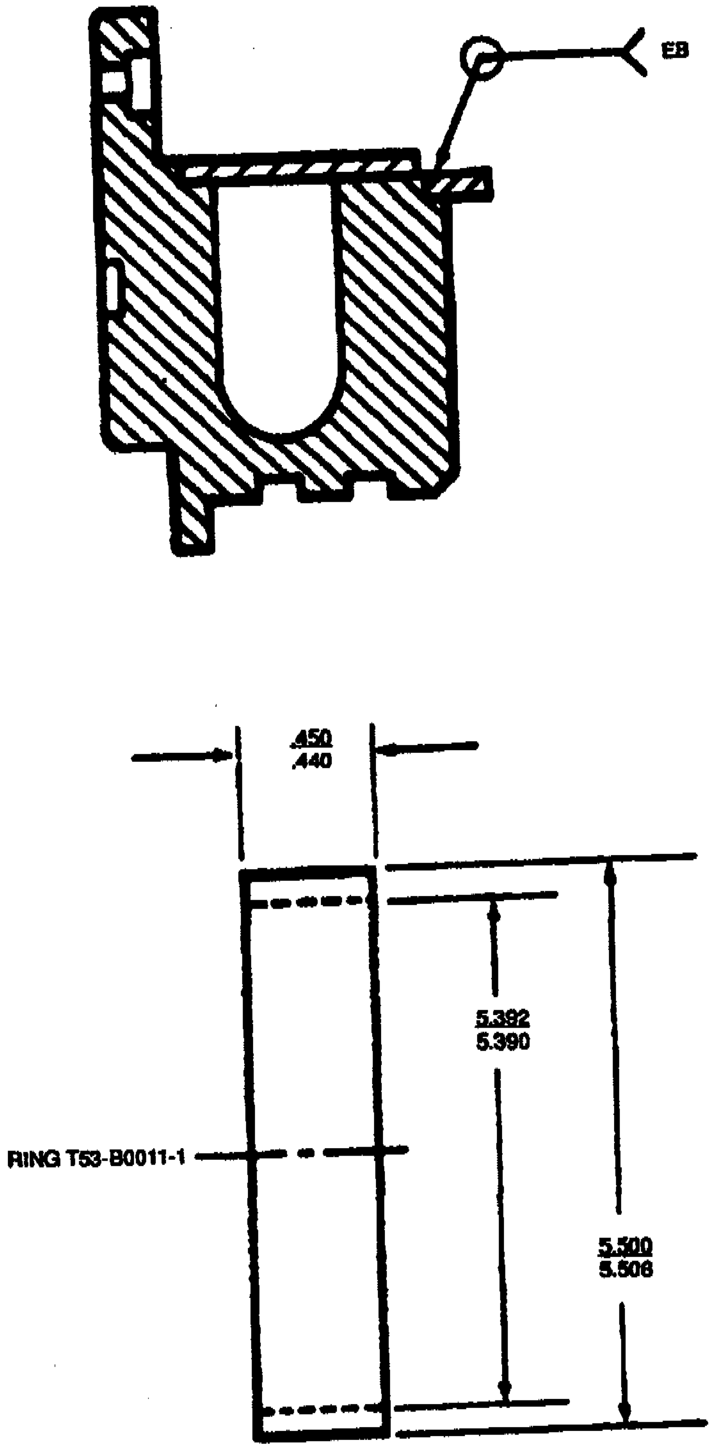


Figure 5-404. Repair of DIA "C" Area.

(1) Machine as required and chrome-plate (refer to SP No. 6014 in Appendix E).

(2) Plating thickness after final grind is to be 0.002 - 0.010 inch (0.005 - 0.025 cm)

(3) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Finish-grind to 0.187 to 0.189 inch (0.475 - 0.480 cm).

e. Installation of Spacer by Electron Beam Welding. (See figure 5-405).

(1) Machine to a depth of 0.715 - 0.717 inch (1.816 to 1.821 cm) as shown in figure 5-405.

NOTE

If oil holes are machined into, fill with weld material per AMS5030, finish-flush.

(2) Fabricate shim of 4130 material per figure 5-405.

NOTE

Break sharp edges on shim 0.005 - 0.015 (0.013 to 0.038 cm)

(3) Heat-treat shim per AMS6350 to Rc 24-31. Check for hardness of Rc 24-31.

(4) Install shim in housing and clamp sufficiently using a suitable fixture to insure that shim is held firmly in place.

(5) Electron beam-weld shim to housing, as shown in figure 5-405.

(6) Inspect per MIL-STD-6866. No cracks are allowed.

(7) Machine surface "D" and EDM oil holes (refer to figure 5-405). Magnetic particle inspect for cracks. No cracks are allowed. Cracks around oil holes may be TIG welded per MIL-W-8611, using AMS5030 weld material, and re-machined.

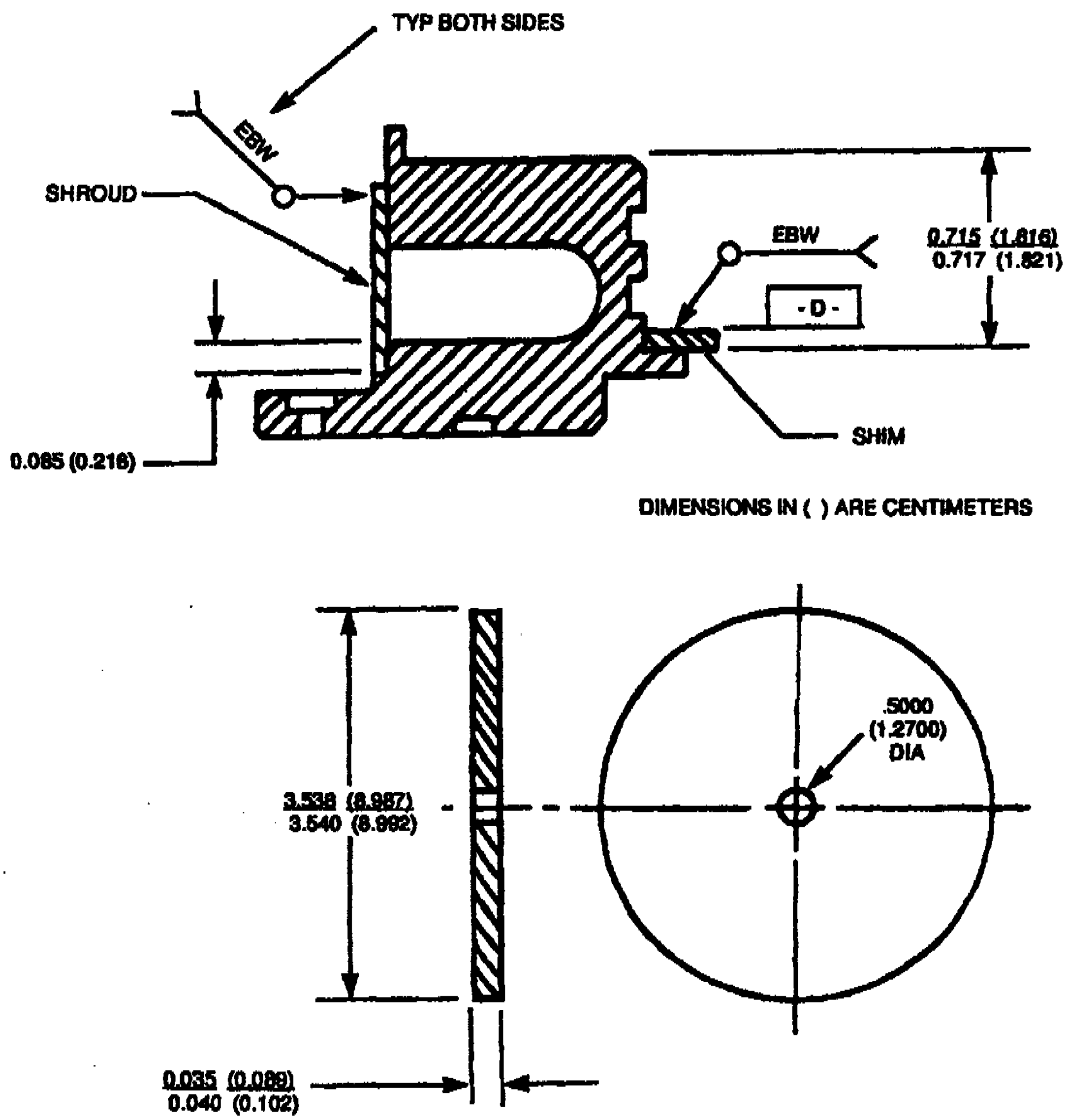


Figure 5-405. Repair of Rear Bearing Housing.

f. Repair cracks in Rear Bearing Housing Assembly (7) as follows:

(1) Repair cracks in housing-to-shroud brazed joints by torch-brazing, using brazing alloy (item 60, table C–1). (Refer to SP No. 5012 in Appendix E.)

(2) Inspect braze repairs. (Refer to SP No. 5003 in Appendix E.)

(3) Weld-repair cracks in shroud parent metal using steel wire (item 317, table C–1). No preheat or postheat is required. (Refer to SP No. 5001 in Appendix E.)

CAUTION

Do not weld into brazed joints.

(4) Inspect weld repairs. (Refer to SP No. 5001 in Appendix E.)

(5) Touch up reworked and discrepant shroud surface areas. (Refer to SP No. 6003 in Appendix E.)

(6) Perform dimensional inspection on rear bearing housing. (Refer to table 5-144.)

g. Replace shrouds on rear bearing housing assembly (7) as follows: (See figure 5-406.)

(1) Remove defective shroud from housing by grinding with a wafer wheel or other suitable means.

CAUTION

Use extreme care when grinding so as not to damage housing parent metal.

(2) Remove excess braze and foreign material from housing with a silicon carbide cartridge roll.

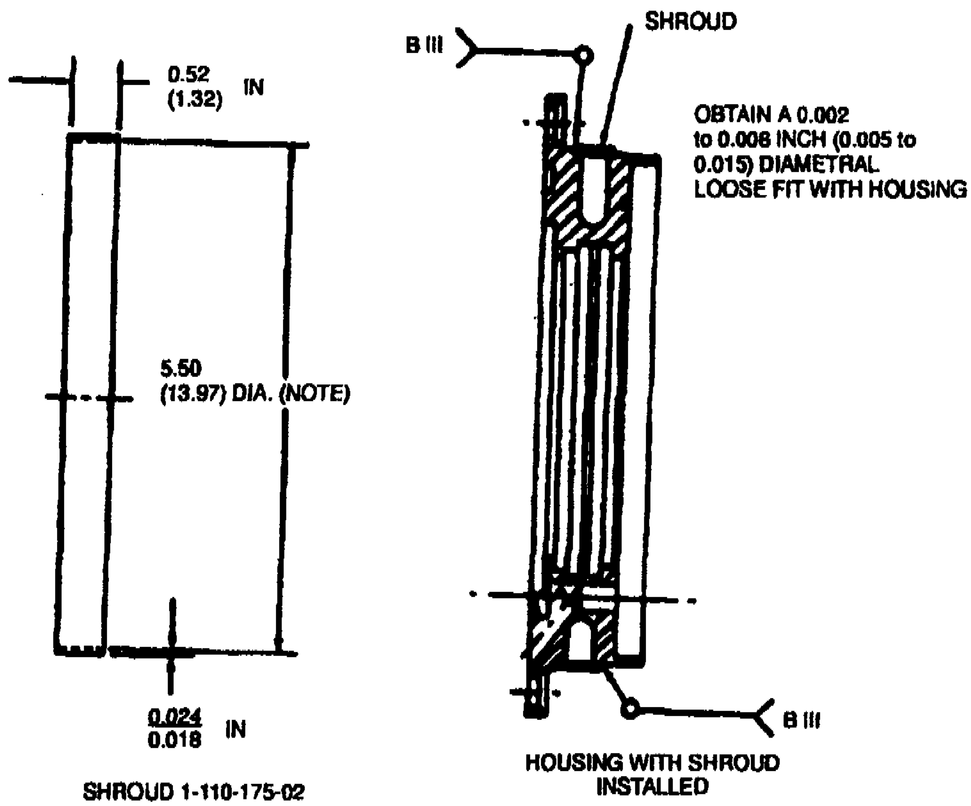
(3) Clean assembly with a stainless steel wire brush.

(4) Clean areas to be welded with acetone (item 13, table C–1)

(5) Shroud replacement may be accomplished by induction brazing, electron beam welding, or by electron beam brazing as follows:

(a) Induction Brazing Method (Refer to figure 5-406):

1 Select and install a replacement shroud (1-110-175-03) to obtain 0.002 to 0.006 inch (0.005 to 0.015 cm) (diametral) loose fit with housing. Shroud ID may be machined to obtain fit, provided minimum wall thickness requirements are maintained. (See figure 5-406.)



NOTE

Nonmandatory dimensions may be varied for process but must finally meet requirements of end product.

Figure 5-406. Rear Bearing Housing Shroud Replacement.

2 Apply brazing alloy (item 60, table C–1) to shroud housing joints, and induction braze (Lepel High Frequency Lab, Inc.), or equivalent, having a high frequency output source of 0.4 mc inch with power rating of at least 10 kw. Rotate housing slowly until brazing is accomplished,

3 Rinse assembly in hot 180° to 212°F (82° to 100°C) water to remove all traces of brazing flux. Air blast dry.

4 Inspect braze joints. (Refer to SP No. 5003 in Appendix E.)

5 Touch up reworked area with black oxide coating. (Refer to SP No. 6003 in Appendix E.)

6 Perform dimensional inspection as outlined in table 5-144.

(b) Electron Beam Welding Method (Refer to figure 5-404).

1 When removing damaged shroud, machine housing to lengthen lip to 0.075 - 0.095 inch (0.191 - 0.244 cm), as shown in figure 5-404).

2 Fabricate shroud per manufacturer's drawing P/N 1-110-175-03, using AMS5504 material, with the following exceptions: shroud width shall be 0.550 ± 0.010 (1.397 ± 0.025 cm) and ID dimension must ensure 0.000 to 0.004 inch (0.000 to 0.010 cm) tight fit with housing.

3 Position shroud and electron beam weld both ends as shown in figure 5-404. Mark shroud with "REV D" to indicate AMS5504 material used in fabrication. Inspect per MIL-STD-6866. No cracks are allowed.

4 Using a suitable fixture, apply 15 psi air pressure to shroud passage, submerge in water and inspect electron weld joints for leakage. No leakage is allowed.

5 If leakage is found, TIG weld area per MIL-W-8611 using weld material AMS5776 and recheck for leakage.

(c) Diffused Electron Beam Brazing Method (Refer to figure 5-406).

1 Select a replacement shroud (1-110-175-03) to obtain 0.002 to 0.006 inch (0.005 to 0.015 cm) (diametral) loose fit with housing. Shroud ID may be machined to obtain fit, provided minimum wall thickness requirements are maintained. (See figure 5-406).

2 If shroud is separated, TIG weld center seam of shroud in accordance with MIL-W-8611 using welding wire (item 352, table C–1) or electron beam braze.

3 Clean areas to be brazed with acetone (item 13, table C–1).

4 Apply brazing alloy (item 64, table C–1) to shroud housing joint.

5 Heat in oven at 350°F for 30 minutes to remove moisture.

6 Mount housing in electron beam welding chamber at an angle of 80 degrees between beam and joint. Electron beam braze shroud a full 360 degrees circumference onto bearing housing. Make two full passes over joints.

7 Use the following electron beam parameters for a full joint penetration:

a Defocus beam + 40 to sharp reading on surface.

b Accelerating voltage = 75 Kilovolts.

c Beam current = 410 milliamps.

d Beam slope in =-0; beam slope out = 11.0.

e Brazing speed = 6 inches per minute.

8 Inspect braze joints. (Refer to SP No. 5003 in Appendix E).

9 Perform dimensional inspection as outlined in table 5-146.

10 Using a suitable fixture, apply 15 psi air pressure to shroud passage, submerge in water and inspect braze joints for leakage. No leakage is allowed.

11 Touch up reworked area with black oxide coating. (Refer to SP No. 6003 in Appendix E).

h. Repair damaged chrome plated 3.5430 to 3.5434 inch (8.9992 to 9.0002 cm) in bearing surface of rear bearing housing assembly (7, figure 4-38) as follows: (See figure 5-402).

(1) Remove plating and chrome-plate. (Refer to SP No. 6014 in Appendix E).

(2) Plating thickness after final grind is to be 0.002 to 0.015 inch (0.005 to 0.038 cm).

(3) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Finish-grind ID to 3.5430 to 3.5434 inch (8.9992 to 9.0002 cm).

i. Repair worn surfaces on 3.5430 to 3.5434 inch (8.9992 to 9.0002 cm) diameter of rear bearing housing assembly (7, figure 4-38) by plasma flame spraying as follows: (See figure 5-402).

(1) Machine ID, if necessary, to obtain a 0.003 to 0.015 inch (0.0008 to 0.038 cm) buildup thickness after final machining.

(2) Plasma flame-spray housing using molybdenum powder (item 219, table C–1). (Refer to SP No. 5006 in Appendix E).

(3) Touch up reworked area with black oxide coating. (Refer to SP No. 6003 in Appendix E).

j. Repair over maximum 5.400 to 5.402 inch (13.716 to 13.721 cm) diameter of rear bearing housing assembly (7, figure 4-38) by plasma flame-spraying (see figure 5-402).

(1) Machine ID, if necessary, to obtain 0.003 to 0.010 inch (0.008 to 0.025 cm) buildup thickness after final machining.

(2) Clean parts with acetone (item 13, table C–1).

(3) Plasma flame-spray the ID, using metal spray molybdenum powder (item 219, table C–1). (Refer to SP No. 5006 in Appendix E).

(4) Finish machine ID to 5.400 to 5.402 inch (13.716 to 13.721 cm) diameter.

k. Repair damaged chrome plating on rear bearing housing assembly (7, figure 4-38) 0.699 to 0.701 inch (1.775 to 1.781 cm) surface as follows: (See figure 5-402).

(1) Remove plating and chrome-plate. (Refer to SP No. 6014 in Appendix E).

(2) Plating thickness after final grind is to be 0.002 to 0.010 inch (0.005 to 0.025 cm).

(3) Bake at 365° to 385°F (185° to 196°C) for 3 hours.

(4) Finish-grind to 0.699 to 0.701 inch (1.775 to 1.781 cm).

l. Repair holes in diffuser housing (1, figure 4-50), caused by rubbing, as follows:

(1) Cut away a minimum amount of metal around the affected area.

(2) Cut and shape a 0.025 inch (0.064 cm) thick piece of steel sheet and strip (item 310, table C–1) to replace section that was cut away.

(3) Using welding wire (item 345, table C–1), flush-weld fabricated patch. (Refer to SP No. 5001 in Appendix E).

CAUTION

In all cases where rub has occurred, the air diffuser must be locally deformed to prevent rub recurrence.

m. Replace interstage bleed boss as follows: (See figure 5-407).

(1) Remove defective boss by machining.

(2) Using a stainless steel wire brush, clean up braze residue.

(3) Position new interstage bleed boss (1-110-089-02) and, using welding wire (item 345, table C–1), tack-weld. (Refer to SP No. 5001 in Appendix E).

(4) Using brazing alloy (item 59, table C–1), braze boss. (Refer to SP No. 5003 in Appendix E).

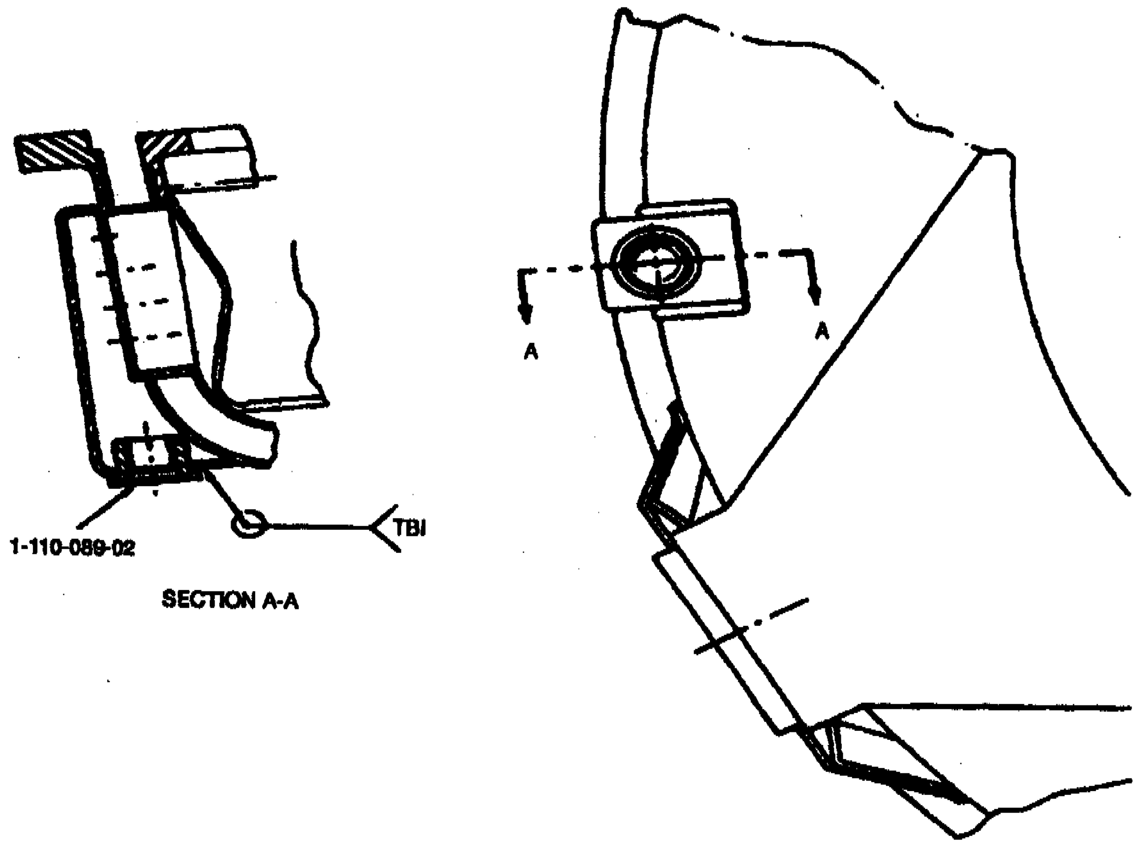


Figure 5-407. Replacement of Interstage Bleed Boss.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(5) Perform fluorescent-penetrant inspection.

n. Repair cracks on inner support of diffuser housing (1, figure 4-50) as follows:

(1) Rework area to original contour by blending.

(2) Using welding wire (item 345, table C–1), weld cracks. (Refer to SP No. 5001 in Appendix E.)

o. Repair dents and punctures on third row of vanes, and cracks on third row of vane brazements of diffuser housing (1, figure 4-50), where access does not permit, as follows:

NOTE

This procedure is effective for repair or replacement of hollow vanes (third row) so designated in figure 5-408. Vanes located adjacent to engine mounts (three places) and in other indicated areas cannot be replaced by methods provided for in this procedure. Repair is allowed on all vanes where access permits.

(1) When inspection results indicate damaged vanes, determine the area locations and boundaries of inner manifold (1-110-104-05) or cowl (1-110-610-01) that must be removed for repair or replacement access to damaged hollow vanes.

NOTE

Typical access cutouts are shown in figure 5-409. Use these as guides in determining layout dimensions.

If hollow vane repair requires access cutout in cowl (1-110-610-01), oil scavenge tube must be replaced. Refer to following steps (2) and (3). If removal of cowl is unnecessary, disregard following steps (2) and (3).

(2) Using a cutting wheel, remove and scrap oil scavenge tubes. Cut off and scrap adapter. (See figure 5-410.)

NOTE

Keep cuts approximately 1/8 to 1/4 inch away from diffuser.

(3) Using a hand grinder and suitable rotary files or No. 80 grit sanding cartridge roll (item 292, table C–1), grind the remaining tube and adapter segments flush with surfaces of the manifolds and support assembly.

CAUTION

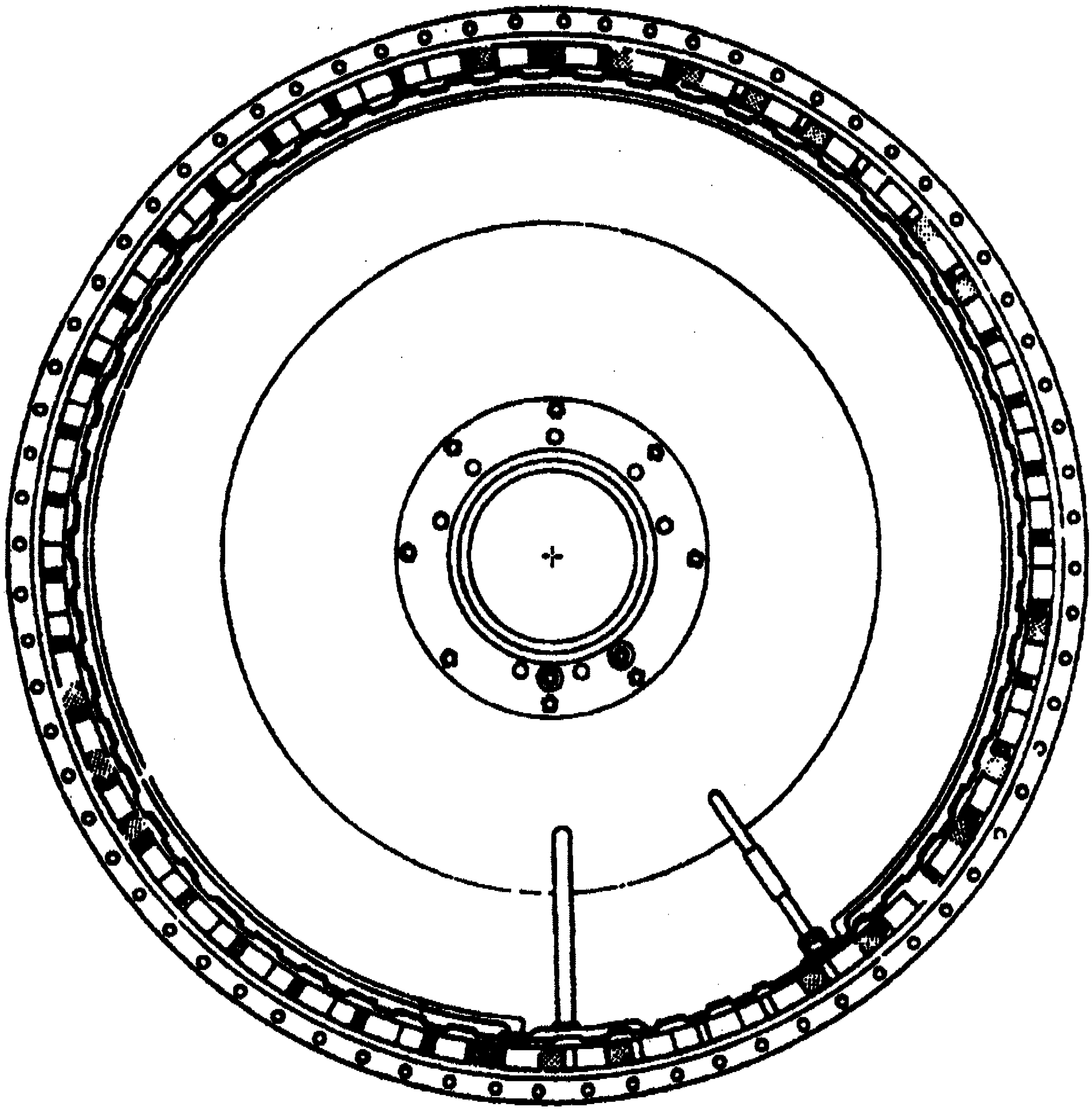
Do not undercut or reduce thickness of cowl, cone, or manifold below original thickness.

(4) Using a scribe or other suitable marking tool, outline cutout areas. Ensure that end dimensions will permit total access (vanes are curved).

(5) Using dividers set at 3/16 inch, lay out pivot point for radius in each corner.

CAUTION

Although cutouts should permit adequate access to damaged vanes, edges should be as far as possible from inner casing braze joint. Allowance must be provided for covering patch extension beyond cutout edge (0.06 inch (0.15 cm) minimum) plus its braze joint. (See figure 5-411.)

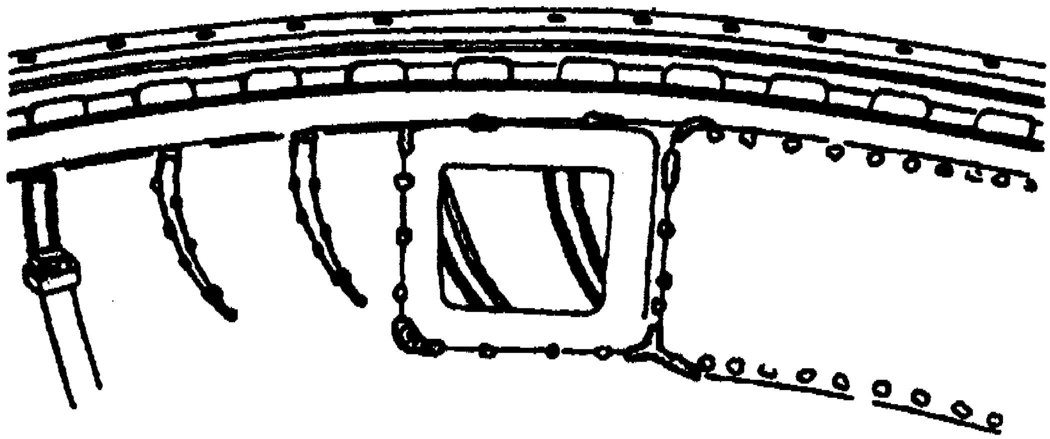


LEGEND

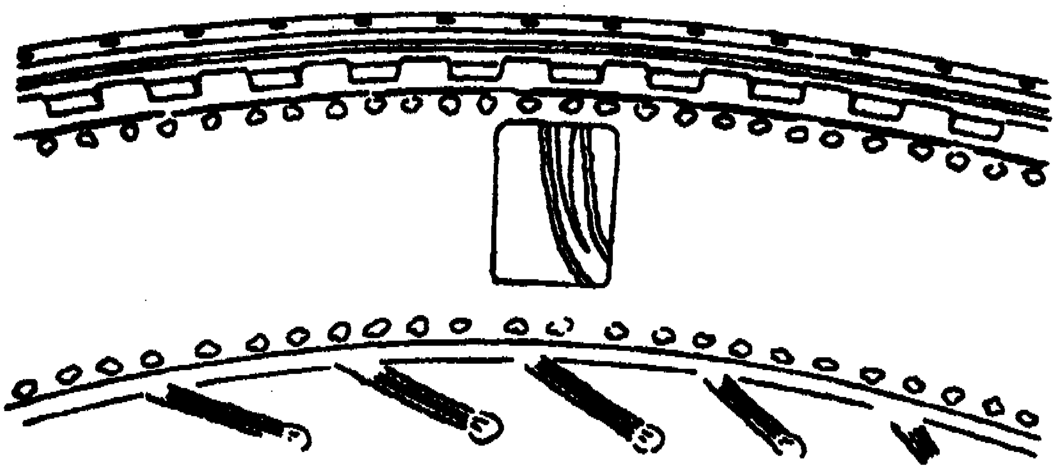
 THESE VANES MAY BE REPAIRED BUT NOT REPLACED

 ALL OTHER VANES MAY BE REPAIRED OR REPLACED

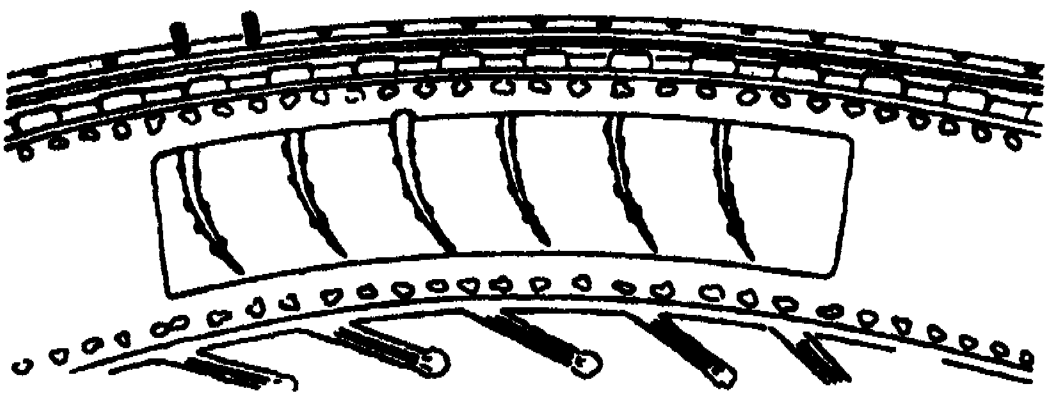
Figure 5-408. Diffuser Housing Hollow Vane Repair or Replacement Designation.



TYPICAL COWL CUTOUT



INNER MANIFOLD SMALL CUTOUT



INNER MANIFOLD LARGE CUTOUT

Figure 5-409. Typical Patch Removal Areas Providing Access for Value Repair or Replacement.

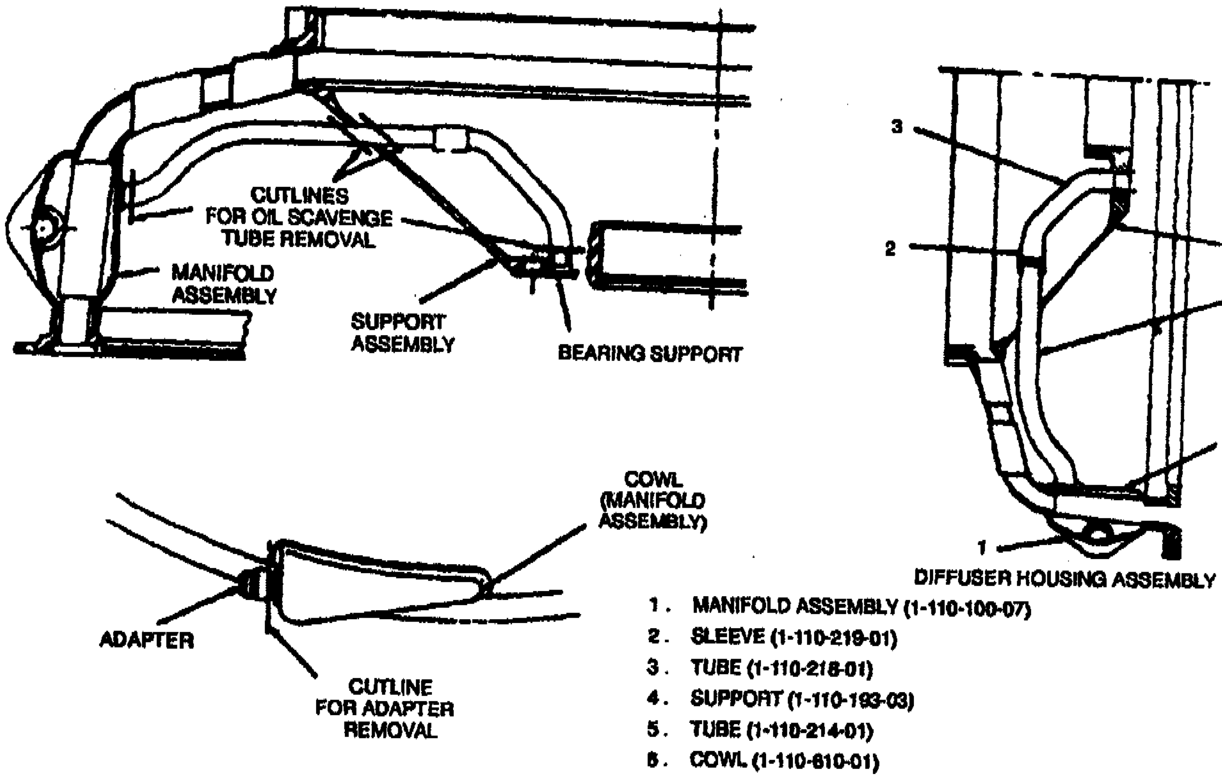


Figure 5-410. Oil Scavenge Line - Removal.

CAUTION

Use extreme care when drilling through inner manifold or cowl. Do not permit drill point to damage inner casing.

(6) Using a high-speed chucking hand tool, fitted with a thin cutoff wheel, cut out access sections to layout. Ensure cuts blend into radii at corners, and remove all burrs.

(7) Repair dents that do not exceed 0.250 inch (0.635 cm) diameter or 0.125 by 0.250 inch (0.318 by 0.635 cm) as follows:

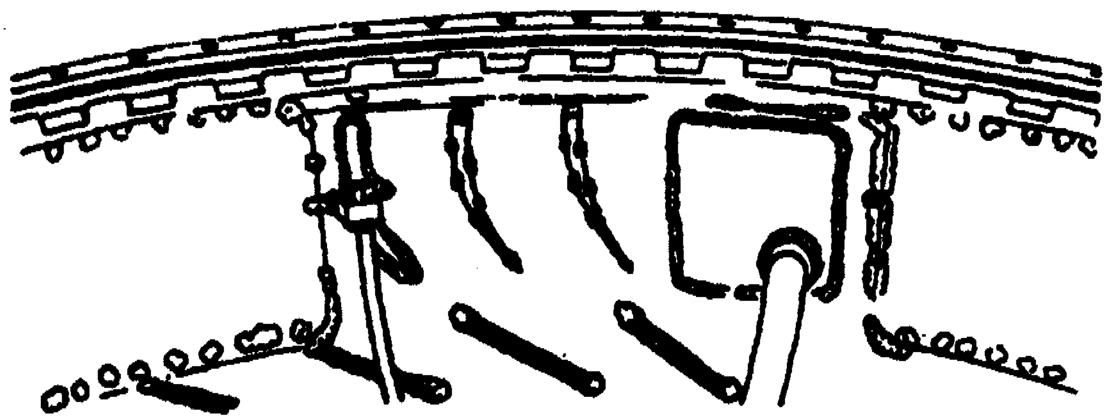
(a) Braze-fill dents using brazing alloy (item 64, table C–1). (Refer to SP No. 5003 in Appendix E.)

WARNING

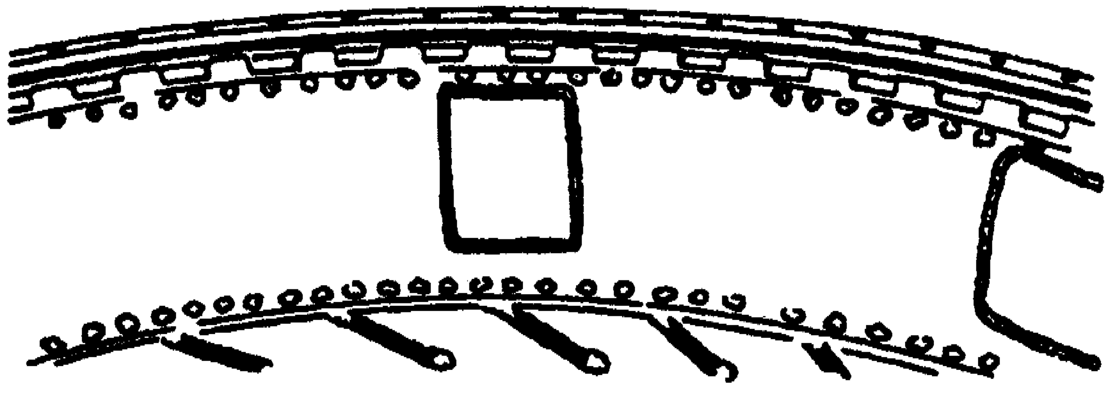
FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

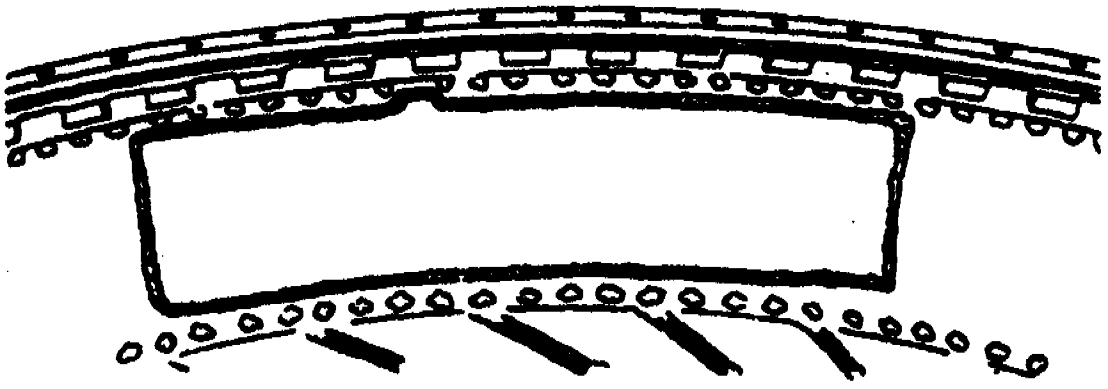
(b) Perform fluorescent-penetrant inspection.



TYPICAL COWL REPAIR



INNER MANIFOLD SMALL PATCH



INNER MANIFOLD LARGE PATCH

Figure 5-411. Typical Replacement Patch Repairs to Inner Manifold and Cowl.

(8) Vanes with dents that exceed 0.250 inch (0.635 cm) diameter or 0.125 by 0.250 inch (0.318 by 0.635 cm), and vanes with brazement cracks, shall be repaired as follows:

NOTE

Prior to repair of dents, it should be determined that original contour can be regained; if not, the vane shall be replaced as outlined in following step (9). Where access prohibits reforming of dented vanes, they may be repaired as outlined in preceding step m.

(a) Using bumping bars or other suitable tools, reform dented vanes.

CAUTION

Do not damage or deform inner or outer casing when making hollow vane repairs.

NOTE

Access for reforming operations may be gained through airflow path, the newly exposed areas of the inner casing, and, where accessible, from outside of the outer casing.

(b) When vane repairs are completed, check closeness of vane walls to edges of casing piercing to ensure sound braze repairs. Verify 0.002 to 0.005 inch (0.005 to 0.013 cm) typical gap. Reshape vane, as necessary, to meet gap tolerance.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(c) Perform a visual and fluorescent-penetrant inspection of reformed vanes for cracks, tears, or holes.

NOTE

Vanes not meeting inspection limits must be replaced. See figure 5-408 for vanes that can be replaced in accordance with this procedure. (Refer to following step (9)).

(d) Clean areas to be brazed with acetone (item 13, table C–1). Using a stainless steel wire brush, clean all areas to be brazed.

(9) Replace vanes as follows:

NOTE

Only those vanes indicated in figure 5-408 are replaceable by this procedure.

(a) Using a high-speed chucking hand tool with a thin cutoff wheel, carefully cut tack welds positioning vane(s) between inner and outer casing.

CAUTION

Cut into damaged vane, as necessary. Do not cut into casing wall.

(b) Using a light hammer and a cold chisel, or other suitable tool, break the braze joining the hollow vane to casing wall by tapping the hollow vane walls away from casing walls.

CAUTION

Although vane deformation is permissible, ensure that inner and outer casing walls are not damaged or distorted.

(c) Carefully deform vane with pliers to loosen vane and permit easy removal. Remove vane from assembly.

(d) Carefully grind and blend excess braze-alloy from local areas surrounding removed vane openings of inner and outer casings.

CAUTION

Extreme care must be exercised to ensure that only braze alloy material is removed. Do not reduce inner or outer casing wall thickness. Do not enlarge vane openings beyond limits established by good brazing practice 0.002 to 0.005 inch (0.005 to 0.013 cm) sound gap with new vane in place.

(e) Using a stainless steel wire brush, clean the areas surrounding the removed vane openings. Clean areas to be brazed with acetone (item 13, table C–1).

(f) Fit replacement vanes (1-110-121-02) into prepared vane slots. Using welding wire (item 348, table C–1), tack-weld vane into place. (Refer to SP No. 5001 in Appendix E.)

(g) Using a stainless steel wire brush, clean all tack welds.

(h) Using brazing alloy (item 58, table C–1)and flux (item 157, table C–1), torch-braze (using minimum heat) all repair and replacement joints. (Refer to SP No. 5003 in Appendix E.)

(i) Remove all traces of flux. Rinse all new joints in hot water and allow assembly to dry at ambient temperature.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(j) Perform a visual and fluorescent-penetrant inspection of repaired or replacement joint areas for cracks or crack-like indications.

(k) If inspection limits are exceeded, repeat preceding steps (h) through (j).

(10) Fabricate patches using one of the two following methods:

(a) Using material from a scrapped diffuser, proceed as follows:

1 Select a portion of scrapped diffuser most nearly corresponding to the section being patched. When cutting and trimming, ensure 0.06 to 0.10 inch (0.15 to 0.25 cm) per edge is allowed for overlap.

NOTE

In fabricating patches, ensure that overlapping edges conform closely to mating surfaces of cowl or manifold to permit good fillet weld.

2 Using a No. 80 grit sanding cartridge roll (item 351, table C–1), clean patch and manifold or cowl areas in preparation for welding.

3 Clean areas to be welded with acetone (item 13, table C–1).

(b) Using steel sheet (item 309, table C–1), proceed as follows:

1 Use material 0.022 to 0.028 inch (0.056 to 0.071 cm) thick for manifold patches or 0.029 to 0.035 inch (0.074 to 0.089 cm) thick for cowl patch. Allow for finish trim incorporating 0.06 to 0.10 inch (0.15 to 0.25 cm) per edge for overlapping cutout edges.

NOTE

In fabricating patches, ensure that overlapping edges conform closely to mating surfaces of cowl or manifold to permit good fillet weld.

2 Place patch in furnace and heat to 1,685° to 1,735°F (918° to 946°C). Hold at temperature for 30 minutes. Remove and cool to ambient temperature.

3 Cool patch to -90° to -110°F (-68° to -79°C). Hold at temperature for 3 hours; then warm to ambient temperature.

4 Heat patch to 990° to 1,010°F (532° to 543°C). Hold at temperature for 3 hours; then cool to ambient temperature.

5 Check patch for hardness. Hardness should be equivalent to RC37 to 44.

6 Using a No. 80 grit sanding cartridge roll (item 292, table C–1), clean patch and manifold, or cowl surface areas in preparation for welding.

7 Clean areas to be welded with acetone (item 13, table C–1).

(11) Using welding wire (item 345, table C–1), fillet tack-weld patch in position and ensure proper fitup. (Refer to SP No. 5001 in Appendix E.) (See figure 5-411.).

(12) Using welding wire (item 345, table C–1), complete fillet welds. (Refer to SP No. 5001 in Appendix E.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(13) Perform a visual and fluorescent-penetrant inspection of welded joints. Cracks and crack-like indications, incomplete penetration, and lack of fusion are not acceptable.

(14) If inspection requirements are not met, proceed as follows:

(a) Clean housing with acetone (item 13, table C–1).

(b) Carefully grind out unacceptable weld.

(c) Clean areas to be welded with acetone (item 13, table C–1).

(15) If hollow vane repair or replacement requires cowl patch removal, install scavenge oil tube. (Refer to following step p.)

p. Replace oil scavenge tubes as follows:

(1) Using a cutting wheel, remove and scrap oil scavenge tubes. (See figure 5-412.)

CAUTION

In following step (2), do not undercut or reduce thickness of cowl, cone, or manifold below original thickness.

NOTE

Keep cuts approximately 1/8 to 1/4 inch away from diffuser parent metal.

(2) Using a hand grinder and suitable rotary files or No. 80 grit sanding cartridge roll (item 292, table C–1), grind the remaining tube and adapter segments flush with surfaces of the manifolds and support assembly.

(3) Using welding wire (item 345, table C–1), tack-weld tubes (1 and 3, figure 5-413) in two places, 180 degrees apart, on each joint as outlined in MIL-W-8611.

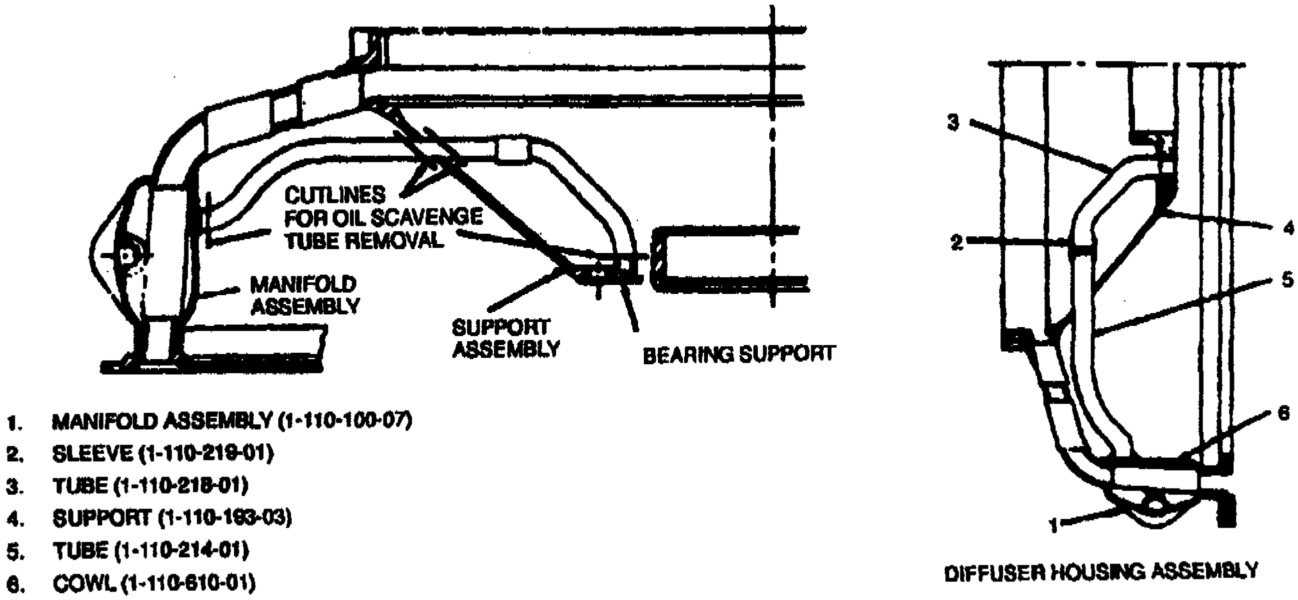


Figure 5-412. Removal of Oil Scavenge Tubes.

NOTE

Machining of the 9.745 inch (24.752 cm) dimension shall remove only enough material to effect complete removal of old deflector and facilitate installation of new deflector.

NOTE

Alternate Method: Tack-weld and weld around using item 348, table C–1, per SP No. 5001, Appendix E.

(4) Using a stainless steel brush, clean all tack welds.

(5) Using brazing alloy (item 58, table C–1) and flux (item 157, table C–1), torch-braze all tack-welded joints as outlined in SP No. 5004 in Appendix E.

(6) Rinse all joints in hot water to remove all traces of flux. Allow to air-dry.

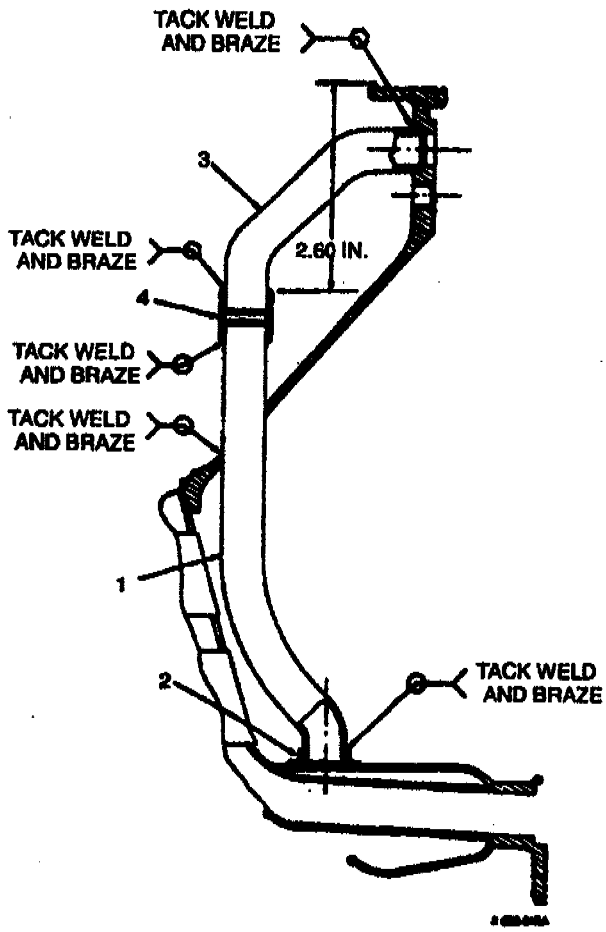
(7) Flush oil lines to remove all traces of machined chips.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(8) Inspect replacement joint welded areas visually and by fluorescent-penetrant method. Cracks and crack-like indications are not acceptable.



1. TUBE (1-110-214-01)
2. FITTING (1-110-215-01)
3. TUBE (1-110-218-01)
4. SLEEVE (1-110-219-01)

Figure 5-413. Tack-Weld and Braze Locations.

(9) Pressure-check for leakage as outlined in paragraph 5-396.

(10) Using oil flow check stand (LTCT313) or equivalent, and lubricating oil (item 189 or 190, table C–1), at a temperature of 90° to 110°F (32° to 43°C) and at a pressure of 30 psig, (2109 gm sq cm) flowcheck diffuser housing oil scavenge line. Check flowmeter for 1000 phr, if lubricating oil (190, table C–1) is used, or 950 phr, if lubricating oil (item 189, table C–1) is used.

q. Repair out-of-limit dents and punctures on third row of vanes and cracks in third row of vane brazements of diffuser housing (1, figure 4-50) as follows:

(1) Remove silver braze from all joints of tubes and bosses.

(a) Immerse diffuser housing in silver braze remover solution (item 322, table C–1) heated to 180°F (82°C) to dissolve the silver braze. An oxygen-acetylene torch may be used to melt the old silver braze in tube joint areas. When silver is melted, pull the components apart.

CAUTION

Before proceeding further, ensure that all prior silver brazing alloy is removed from the diffuser housing.

NOTE

Replace stripper solution every 36 hours after mixing.

(b) Rinse diffuser housing components thoroughly with clean water, heated to 180°F (82°C), and air-dry.

(2) Determine the area locations and boundaries of inner manifold (1-110-104-05) or cowl (1-110-610-01) that must be removed for access to vanes requiring replacement.

NOTE

Typical access cutouts are shown in figure 5-409. Use these as guides in determining layout dimensions. If vane replacement requires access beneath cowl (1-110-113-04), the cowl should be removed entirely. On diffuser housing, the large oil scavenge tube shall be reworked.

(3) Using a scribe or other suitable marking tool, outline cutout areas. Ensure that end dimensions will permit adequate access, noting that varies are curved.

(4) Using dividers set at 3/16 inch, lay out pivot point for radius in each corner.

CAUTION

Although cutouts should permit adequate access to damaged vanes, edges should be as far as possible from inner casing brazed joint. Allowance must be provided for covering patch extension beyond cutout edge (0.06 inch (0.15 cm) minimum) plus its brazed joint. (See figures 5-409 and 5-413.)

Ensure that repair weld does not extend into inner manifold brazed joint.

(5) Using a prick-punch, punch intersections of corner radius layout lines. Ensure that dimple is sufficient to prevent pilot drill from walking. Use a 1/8-inch drill to make a pilot hole and a 3/8-inch drill to obtain finish radius.

CAUTION

Use extreme care when drilling through inner manifold, Do not permit drill point to damage inner casing (1-110-045-06).

(6) Using a high-speed chucking hand tool, fitted with a thin cutoff wheel, cut out access sections to layout. Ensure that cuts blend into radii at corners, and remove all burrs.

(7) In order to allow access to damaged vanes, remove external manifold, engine mounts, manifold assembly, and pan assembly as follows:

(a) Using a high-speed chucking hand tool, fitted with a thin cutoff wheel, cut off components.

CAUTION

Use extreme care not to damage casing wall.

(b) Carefully grind and blend excess braze alloy from local areas where components were located.

CAUTION

Use extreme care to ensure that only braze alloy material and old tack welds are removed.

(8) Replace damaged vanes as follows:

(a) Using a high-speed chucking hand tool, fitted with a thin cutoff wheel, carefully cut tack welds positioning vane(s) between inner and outer casings.

CAUTION

Cut into damaged vane, as necessary. Do not cut into casing wall.

(b) Using a light hammer and a cold chisel, or other suitable tool, break the braze joining the hollow vane(s) to the casing wall, and tap the vane walls away from the casing walls.

CAUTION

Although vane deformation is permissible, ensure that inner and outer casing walls are not damaged or distorted.

(c) Carefully deform vane(s) with pliers to loosen vane(s) and permit easy removal. Remove vane(s) from assembly.

(d) Carefully grind and blend excess braze alloy from local areas surrounding removed vane openings of inner and outer casings.

CAUTION

Extreme care must be exercised to ensure that only braze alloy material is removed. Do not reduce inner or outer casing wall thickness. Do not enlarge vane openings beyond limits established by good brazing practice 0.002 to 0.005 inch (0.005 to 0.013 cm) sound gap with new vane in place.

(e) Using a stainless steel wire brush, clean areas surrounding removed vane openings. Clean areas to be welded with acetone (item 13, table C–1).

(f) Fit replacement vanes (1-110-121-02 and/or 1-110-052) into prepared vane slots. Using welding wire (item 345, table C–1), tack-weld vanes, except three transfer vanes, in place. (Refer to SP No. 5001 in Appendix E.)

(g) Using welding wire (item 345, table C–1), weld three transfer vanes in place. (Refer to SP No. 5001 in Appendix E.) (See figure 5-414, View A.) All other vanes shall be tack-welded and vacuum-brazed.

(h) Using a stainless steel wire brush, clean all tack welds. Clean areas to be brazed with acetone (item 13, table C–1).

(i) Apply brazing alloy (item 64, table C–1) to vane joints.

(j) Apply brazing alloy (item 64, table C–1) to vane brazement cracks or voids, which are evident on vanes other than those replaced, and to vane brazement cracks or voids caused by exposure to the silver braze stripper used in preceding step (1) (a).

(k) Place diffuser housing in rework fixture (LTCT11330) or flat heat resistant support, and vacuum braze in furnace at 1,890° to 1,910°F (1,032° to 1,043°C) for 5 minutes. (Refer to SP No. 5004 in Appendix E).

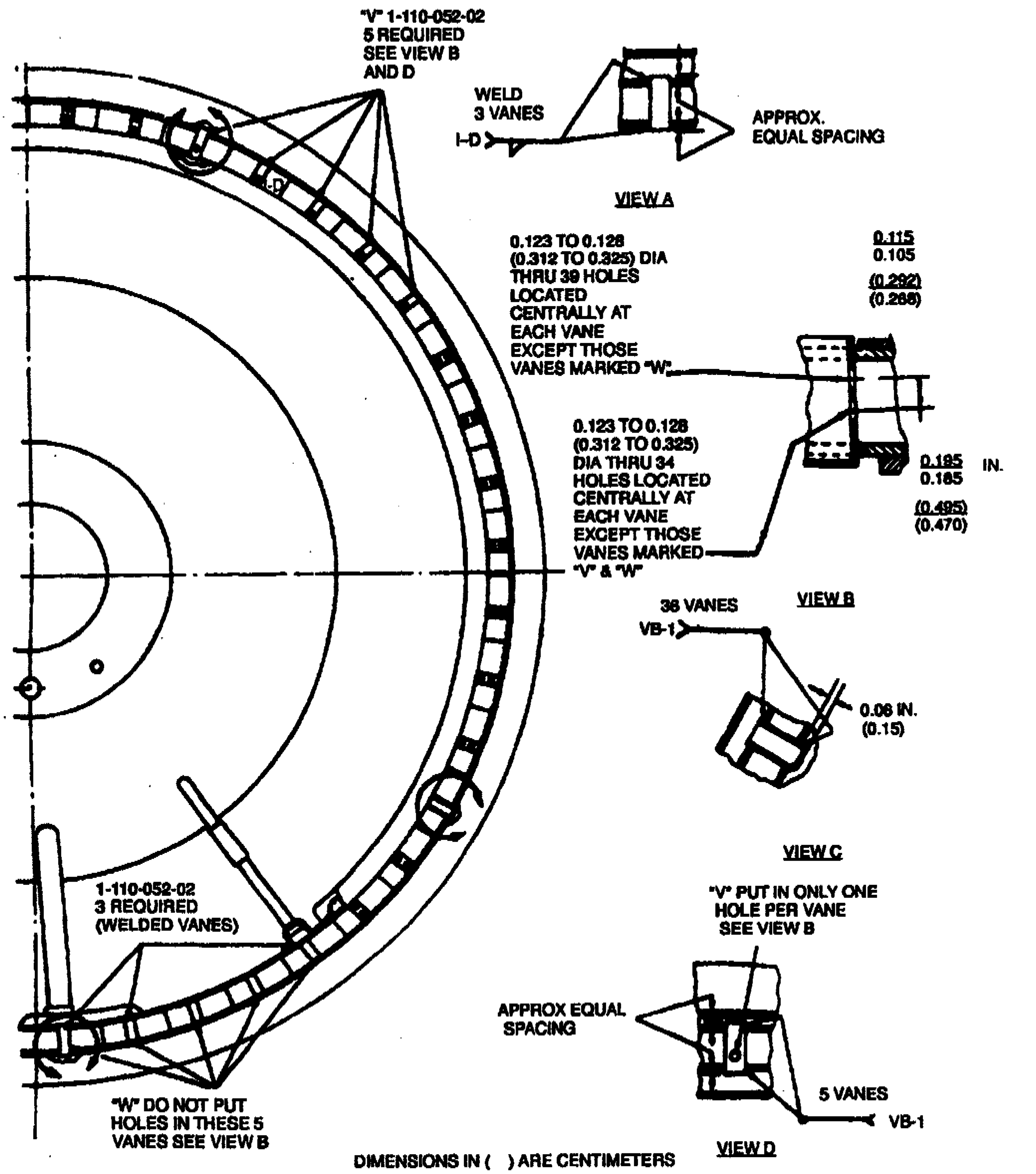


Figure 5-414. Vane Installation.

(l) Cool diffuser housing in vacuum or inert gas, as required to achieve the following cooling rate:

1 Cool from brazing temperature to 1,000°F (538°C) in 45 to 75 minutes.

2 Cool from 1,000°F (538°C) to 400°F (204°C) in 60 to 120 minutes. The rate of cooling from 400°F (204°C) to ambient temperature is not critical; however, the diffuser housing should be cooled to below 75°F (24°C).

(m) Temper the diffuser housing (mounted in fixture) at 1,050°F (566°C) for 3 hours, and cool to ambient temperature.

(n) Remove diffuser housing from fixture.

(o) Perform a visual and fluorescent-penetrant inspection of joint areas for cracks, voids, and crack-like indications. Refer to table 5-145 for inspection limits.

(9) Fabricate patches using one of the two following methods:

(a) Using material from a scrapped diffuser housing, proceed as follows:

1 Select a portion of scrapped diffuser housing most nearly corresponding to section being patched. When cutting and trimming, ensure that 0.06 to 0.10 inch (0.15 to 0.25 cm) per edge is allowed for overlap.

NOTE

In fabricating patches, ensure that overlapping edges conform closely to mating surfaces of cowl or manifold to permit good fillet weld.

2 Using a No. 80 grit sanding cartridge roll (item 292, table C–1), clean patch and manifold or cowl areas in preparation for welding.

3 Clean areas to be welded with acetone (item 13, table C–1).

(b) Using steel sheet (item 309, table C–1) proceed as follows:

1 Use material 0.022 to 0.028 inch (0.056 to 0.071 cm) thick for manifold patches, or 0.029 to 0.035 inch (0.074 to 0.089 cm) thick for cowl patch. Allow for finish trim incorporating 0.06 to 0.10 inch (0.15 to 0.25 cm) per edge for overlapping cutout edges.

NOTE

In fabricating patches, ensure that overlapping edges conform closely to mating surfaces of cowl or manifold to permit good fillet weld.

2 Place patch in furnace and heat to 1,685° to 1,735°F (918° to 946°C). Hold at temperature for 30 minutes. Remove and cool to ambient temperature.

3 Cool patch in furnace and heat to -90° to -110°F (-68° to -79°C). Hold at temperature for 3 hours; then warm to ambient temperature.

4 Heat patch to 990° to 1,010°F (532° to 543°C). Hold at temperature for 3 hours; then cool to ambient temperature.

5 Check patch for hardness. Hardness should be equivalent to RC 37 to 44.

6 Using a No. 80 grit sanding cartridge roll (item 292, table C–1) clean patch and manifold or cowl surfaces in preparation for welding.

7 Clean areas to be welded with acetone (item 13, table C–1).

(10) Position individual patches to ensure proper fitup.

(11) Using welding wire (item 345, table C–1) fillet tack-weld patch in position. (Refer to SP No. 5001 in Appendix E.) (See figure 5-411.)

(12) Using welding wire (item 345, table C–1), complete fillet tack-welds. (Refer to SP No. 5001 in Appendix E.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(13) Perform a visual and fluorescent-penetrant inspection of welded joints. Cracks and crack-like indications, incomplete penetration, and lack of fusion are not acceptable.

(14) If inspection requirements are not met, proceed as follows:

(a) Clean areas to be welded with acetone (item 13, table C–1).

(b) Carefully grind out unacceptable weld.

(c) Clean areas to be welded with acetone (item 13, table C–1).

NOTE

Braze per steps (23) through (27) is an option to welding per SP. No. 5001in steps (15) through (21). Tack welding is still required.

(15) Replace engine mounts as follows:

(a) Using a stainless steel wire brush, clean areas surrounding removed engine mounts. Clean areas to be welded with acetone (item 13, table C–1).

(b) Replace engine mounts, as required. (Old mounts may be reused. However, because of dimensional difficulties during rework, the use of new mounts is recommended.) Fit mount (1-110-120-03 or 1-110-130-04) into position as shown in figure 5-415.)

(c) Using welding wire (item 345, table C–1), tack-weld mount in place. Weld per SP No. 5001 in Appendix E.

(d) Using a stainless steel wire brush, clean all welds.

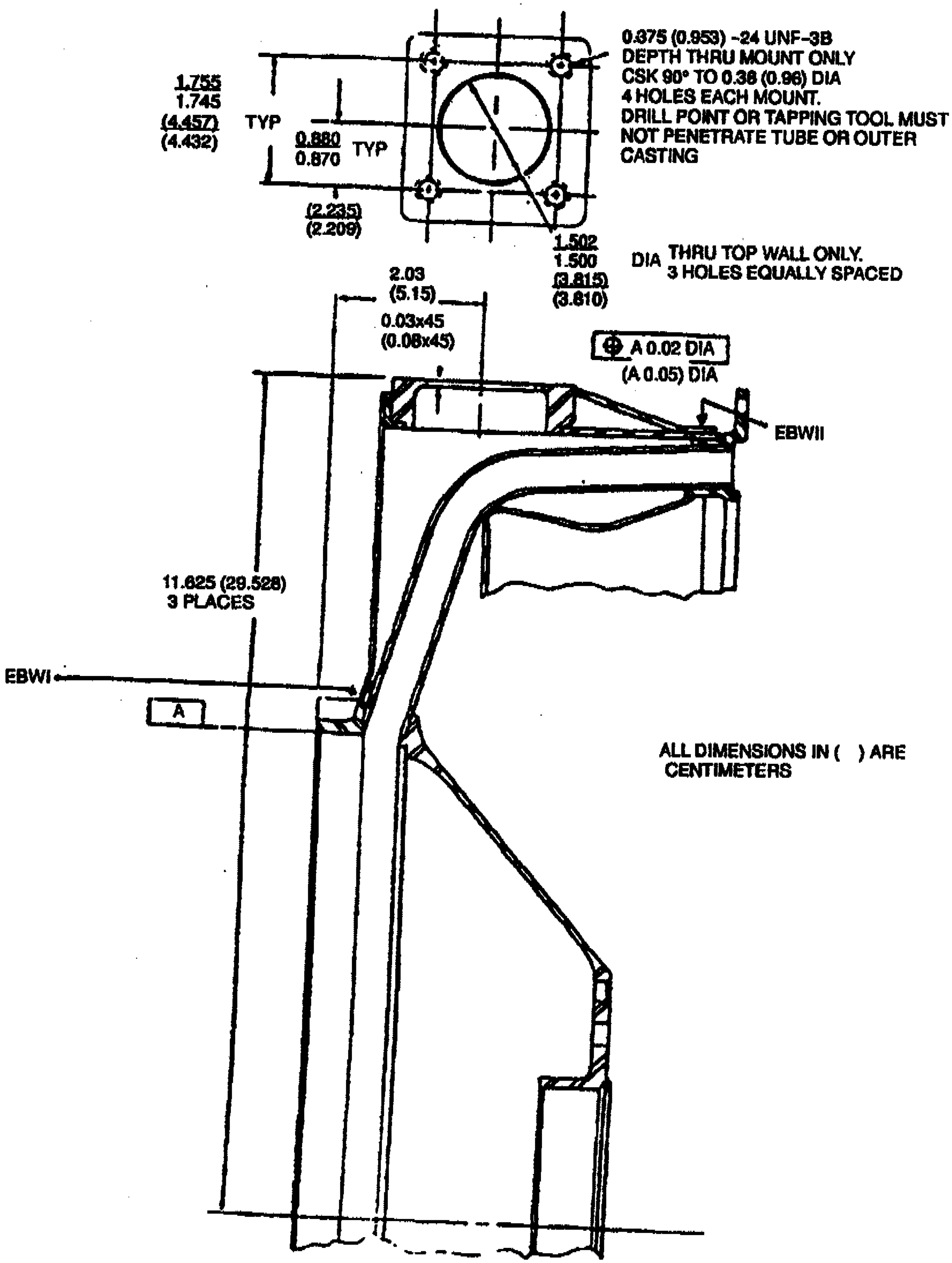


Figure 5-415. Engine Mount and External Manifold - Machining (Sheet 1 of 2).

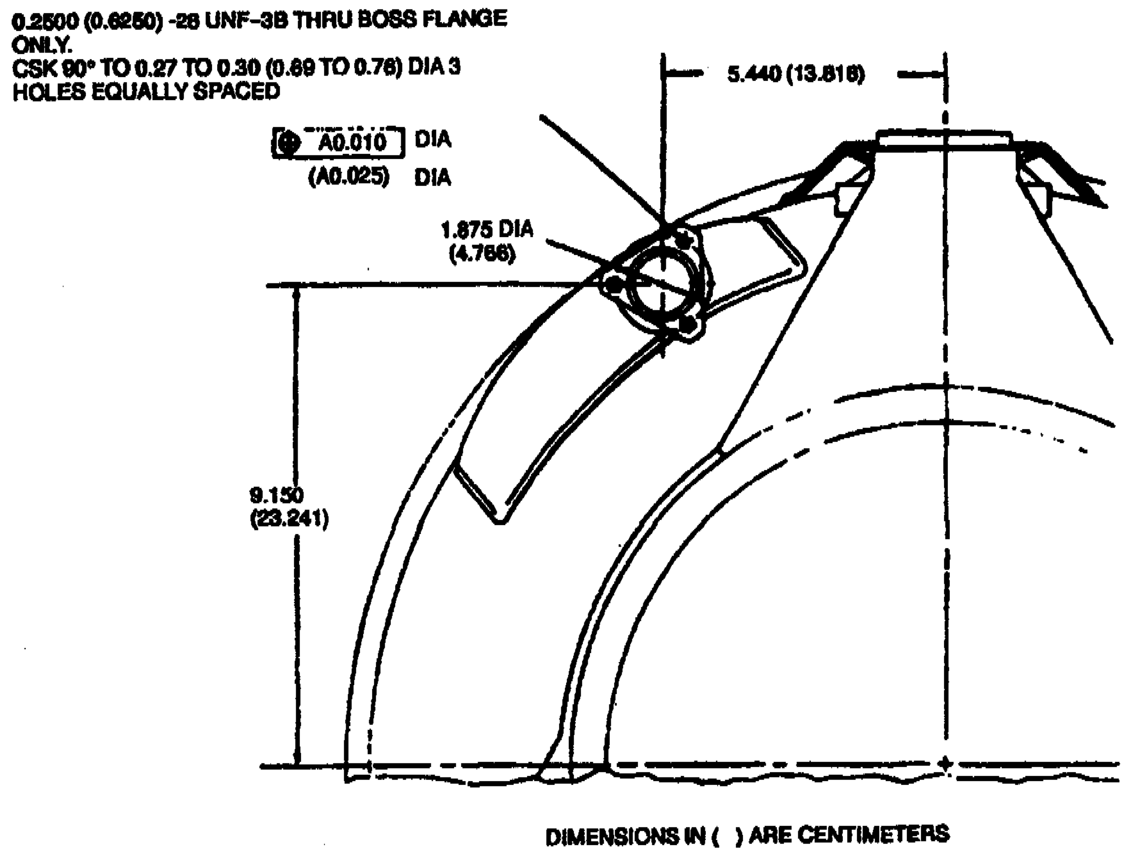


Figure 5-415. Engine Mount and External Manifold - Machining (Sheet 2 of 2).

(e) Electron beam weld may be used to replace engine mounts as follows: (Refer to SP No. 5005 in Appendix E.)

1 Position mount flush to air diffuser housing using fixture 78SDSCC-D-0024 or equivalent.

2 Tack weld the mount in three places at EBWI and three places at EBWII as shown on figure 5-415.

3 Electron beam weld mount onto housing using the following parameters for a full joint penetration:

a Sharp focus on surface of joint.

b Approximate energy requirement of 2000 joules/inch.

c Sufficient beam current decay rate with part at travel speed to alleviate any cracking, undercutting or porosity.

4 Examples of possible detailed electron beam welding parameters include:

a Accelerating Voltage = 150 kilovolts.

b Beam Current = 10 milliamps for tack weld and EBWI and 15 milliamps for EBWII.

c Welding Speed = 45 inches/minute.

d Beam Slope Out of Time = 2 seconds.

5 Machine mount per figure 5-415.

6 Visual and fluorescent penetrant inspect the electron beam weld joint. (Refer to SP No. 5005 in Appendix E.)

(16) Replace external manifold as follows:

(a) Using a stainless steel wire brush, clean area surrounding removed external manifold. Clean areas to be welded with acetone (item 13, table C-1).

(b) Place external manifold (1-110-103-04) in position as shown in figure 5-415.

(c) Using welding wire (item 345, table C–1), tack-weld external manifold in place. Weld per SP No. 5001 in Appendix E).

(d) Using a stainless steel wire brush, clean all welds.

(17) Replace manifold assembly as follows:

(a) Using a stainless steel wire brush, clean area surrounding removed manifold assembly. Clean areas to be welded with acetone (item 13, table C–1).

(b) Place manifold assembly (1-110-100-07) in position as shown in figure 5-416.

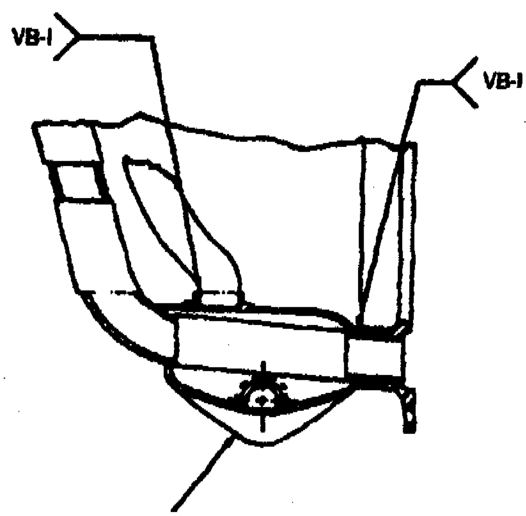


Figure 5-416. Manifold Assembly - Replacement.

(c) Using welding wire (item 345, table C–1), tack-weld manifold assembly in place. Weld per SP No. 5001 in Appendix E).

(d) Using a stainless steel wire brush, clean all welds.

(18) Replace cowl as follows:

(a) Using a stainless steel wire brush, clean areas surrounding cowl. Clean areas to be welded with acetone (item 13, table C–1).

(b) Place cowl assembly (1-110-610-01) in position as shown in figure 5-410.

(c) Using welding wire (item 345, table C–1), tack-weld cowl assembly in place. Weld per SP No. 5001 in Appendix E.

(d) Using a stainless steel wire brush, clean all welds.

(19) Replace oil transfer tube as follows:

(a) Install oil transfer tube and sleeves (1-110-309-02 or 1-110-219-01), as required, and using welding wire (item 345, table C–1), secure by tack-welding at each end. Weld per SP No. 5001 in Appendix E.

(b) Using a stainless steel wire brush, clean all tack-welds.

(20) Replace pan assembly as follows:

(a) Using a stainless steel wire brush, clean area surrounding removed pan assembly. Clean areas to be welded with acetone (item 13, table C–1).

(b) Place pan assembly (1-110-250-02) in position as shown in figure 5-417.

(c) Using welding wire (item 345, table C–1), tack-weld pan assembly in place. Weld per SP No. 5001 in Appendix E.

(d) Using a stainless steel wire brush, clean all welds.

NOTE

The following procedure is an alternate method for replacing pan assembly.

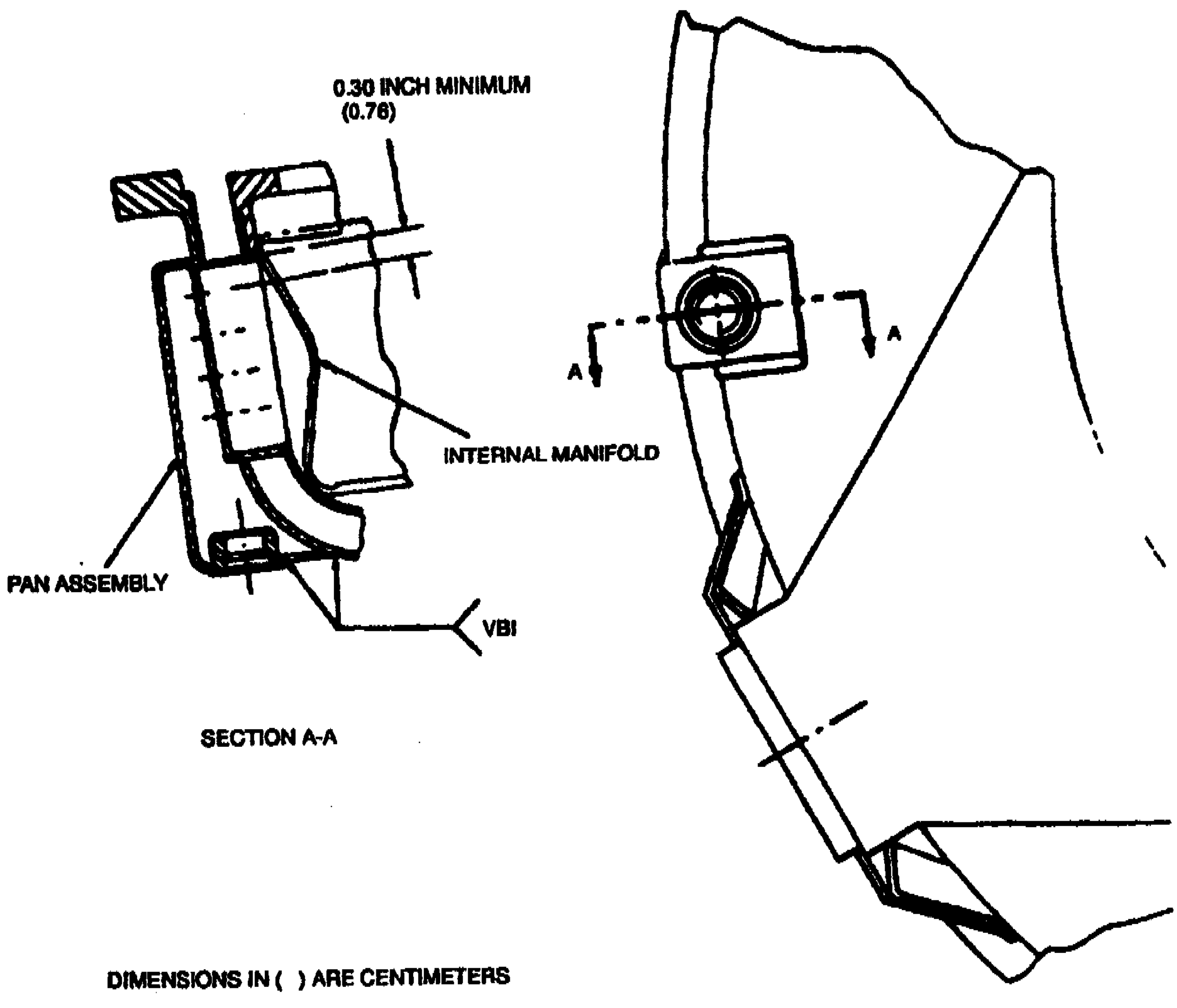


Figure 5-417. Pan Assembly - Replacement.

(21) Remove top portion of damaged pan assembly and replace it with top portion from new pan assembly as follows:

(a) Using stainless steel wire brush, clean area surrounding removed portion of pan assembly. Clean areas to be welded with acetone (item 13, table C–1).

(b) Place top portion cut from new pan assembly into position.

(c) Using welding wire (item 345, table C–1), tack-weld in place. Weld per SP No. 5001 in Appendix E.

NOTE

Replacement pieces for pan assembly may also be obtained by cannibalizing scrapped air diffuser housings.

(22) Replace oil scavenge tube as follows:

(a) Using welding wire (item 347, table C–1), tack-weld union (3, figure 5-418) in the 0.561 to 0.563 inch (1.425 to 1.430 cm) diameter hole on manifold outer diameter in two places. (Refer to SP No. 5001 in Appendix E.)

(b) Using welding wire (item 347, table C–1), tack-weld fitting (2) in the 0.751 to 0.761 inch (1.908 to 1.933 cm) diameter hole in manifold inner diameter in two places. (Refer to SP No. 5001 in Appendix E.)

(c) Using welding wire (item 347, table C–1), tack-weld tubes (1 and 4) and sleeve (5) in two places, 180 degrees apart, on each joint. (Refer to SP No. 5001 in Appendix E.)

NOTE

Insertion of tube (1) through hole in web may be facilitated by opening hole slightly by blending or reaming. Maximum hole size shall not exceed 0.515 inch (1.308 cm) diameter.

(d) Using a stainless steel brush, clean all tack-welds.

(e) Using brazing alloy (item 58, table C–1) and flux (item 157, table C–1), torch-braze all tack-welded joints. (Refer to SP No. 5003 in Appendix E.)

(f) Rinse all joints in hot water to remove all traces of flux. Allow to air-dry.

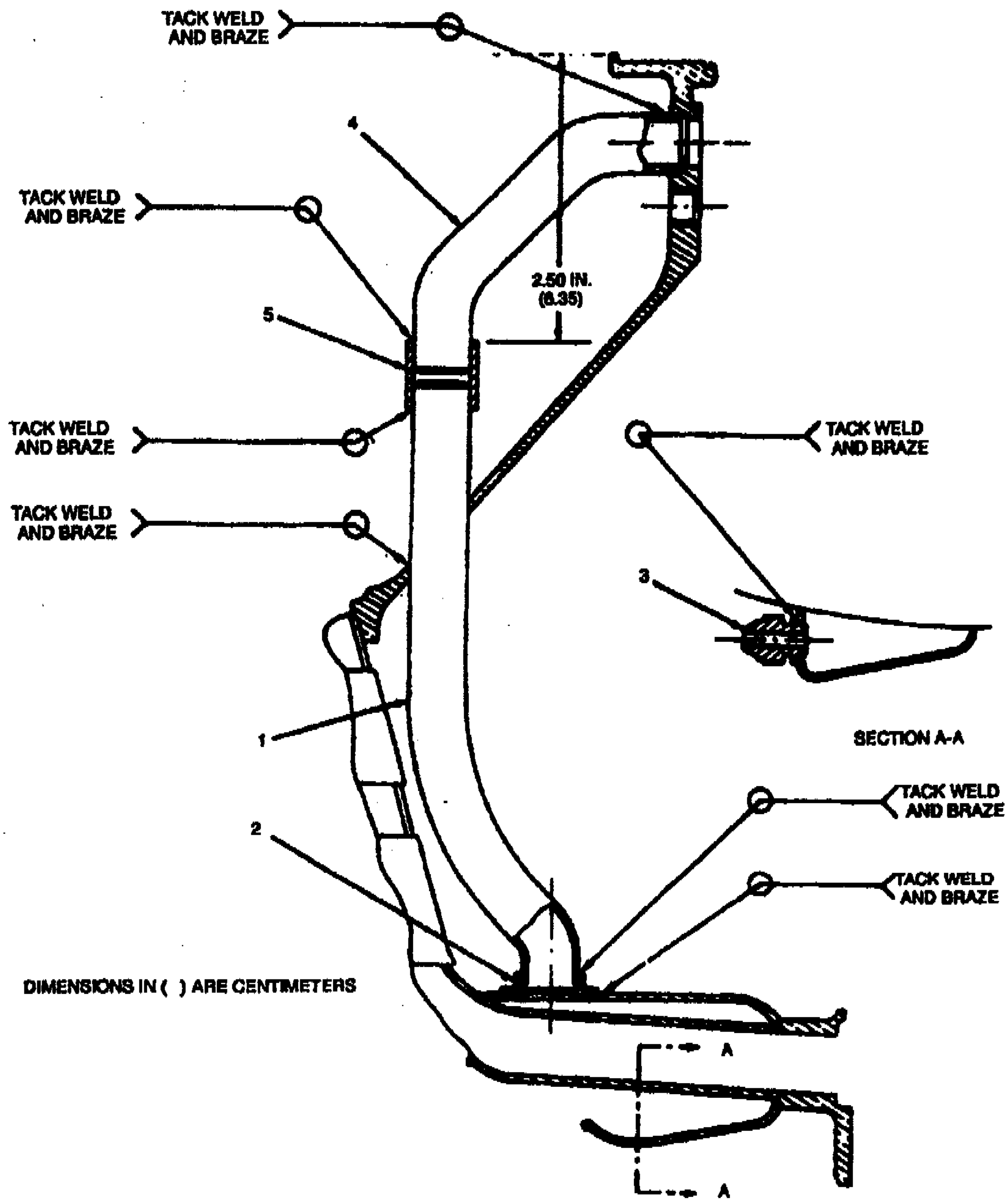
WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(g) Inspect replacement joint welded areas visually and by fluorescent-penetrant method. Cracks and crack-like indications are not acceptable.

(h) Pressure-check for leakage as outlined in paragraph 5-396.



1. TUBE (1-110-214-01)
2. FITTING (1-110-215-01)
3. UNION (1-110-216-01)
4. TUBE (1-110-218-01)
5. SLEEVE (1-110-210-01)

Figure 5-418. Tack-Weld and Braze locations.

(i) Using oil flow check stand (LTCT313), or equivalent, and lubricating oil (item 189 or 190, table C–1), at a temperature of 95° to 100°F (35° to 38°C) and at a pressure of 58 to 62 psig (40.8 to 43.6 kg sq cm), flowcheck diffuser housing oil scavenge line. Check flowmeter for 1,000 phr min, if lubricating oil (item 190, table C–1) is used, or 950 phr min, if lubricating oil (item 189, table C–1) is used.

(j) Scavenge and pressure oil tube seal ring grooves may be dimensionally repaired by welding and remachining. Welding should be accomplished prior to metal spraying adjacent support surface. TIG weld per MIL-W-8611, using AMS5774 (AM350) welding wire. Finish machine as follows:

1 Scavenge Oil Tube Seal Ring Groove.

a Locate on center line of oil tube.

b Counterbore around scavenge oil tube: 0.572 - 0.570 inch DIA (1.453 - 1.448 cm); 0.050 - 0.045 depth (0.127 - 0.114 cm); 0.02R (0.051 cm) (Max) at bottom of counterbore; seal ring surface to be parallel to support surface within 0.001 inch (0.003 cm); break sharp edges.

2 Pressure Oil Tube Seal Ring Groove.

a Locate on center line of oil tube.

b Counterbore around pressure oil tube; 0.510 - 0.505 inch DIA (1.295 - 1.283 cm); 0.050 - 0.045 depth (0.127 - 0.114 cm); 0.02R (0.051 cm) (Max) at bottom of counterbore; seal ring surface to be parallel to support surface within 0.001 inch (0.003 cm); break sharp edges.

(23) Clean areas to be brazed with acetone (item 13, table C–1).

(24) Apply brazing alloy (item 64, table C–1) to cowl, manifold assembly, pan assembly, engine mounts, external manifold, and tube joints.

(25) Place diffuser housing in rework fixture (LTCT11330), and vacuum-braze in furnace at 1,890° to 1,910°F (1,032° to 1,043°C) for 5 minutes. (Refer to SP No. 5004 in Appendix E.)

(26) Cool diffuser housing in vacuum or inert gas as required, to achieve the following cooling rate:

(a) Cool from brazing temperature to 1,000°F (538°C) in 45 to 75 minutes.

(b) Cool from 1,000°F (538°C) to 400°F (204°C) in 60 to 120 minutes. The rate of cooling from 400°F (204°C) to ambient temperature is not critical; however, the diffuser housing should be cooled to below 75°F (24°C).

(c) Rebraze if required.

(27) Perform final heat treatment as follows:

(a) Subzero cool diffuser housing (mounted in fixture) at -100°F (-73°C) for 3 hours.

(b) Temper diffuser housing at 1,000°F (538°C) for 3 hours, and cool to ambient temperature. Hardness of flanges shall conform to RC 37 to RC 44.

(c) Remove diffuser housing from fixture.

(d) Inspect brazed joints. Cracks or voids are not acceptable.

(28) Machine replaced engine mounts and external manifold to requirements of figure 5-415.

(29) Perform complete dimensional inspection of diffuser housing in accordance with tables 5-144 and 5-145. Rework discrepant dimensions, if necessary.

(30) Pressure-test diffuser housing (oil tubes and main flow channel). (Refer to paragraph 5-396.)

r. Locally deform diffuser to prevent rub recurrence as follows:

(1) Position a 10-inch C-clamp and two wooden blocks on air diffuser as shown in figure 5-419.

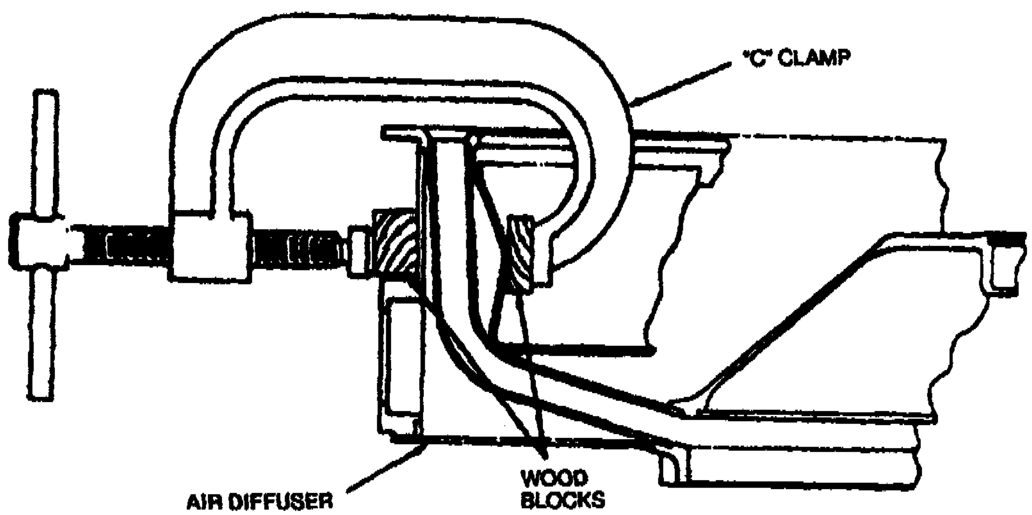


Figure 5-419. Deforming of Air Diffuser.

(2) Locally depress air diffuser pan by taking one full turn on clamp screw.

(3) Remove clamp and blocks and check clearance by temporarily positioning curl on air diffuser and inserting a 0.080 inch (0.203 cm) feeler stock between curl and diffuser.

(4) Repeat clamping procedure, as necessary, if required clearance is not obtained turning clamp screw in one-half increments.

s. Replace defective oil pressure tube (1-110-301-03) as follows:

(1) Using a hand grinder and cutting wheel, remove tube by cutting in two places as shown in figure 5-420. Keep approximately 1/8 to 1/4 inch away from diffuser support.

(2) Using a hand grinder and suitable rotary files or cartridge rolls, remove the remaining above surface tube at the support.

(3) Using a stainless steel wire brush, clean remaining tube adjacent to web portion.

(4) Drill through the remaining below surface tube at support. Select drill sizes A through D as required, to remove remaining wall.

CAUTION

Extreme care must be taken not to allow drill to walk into support bore.

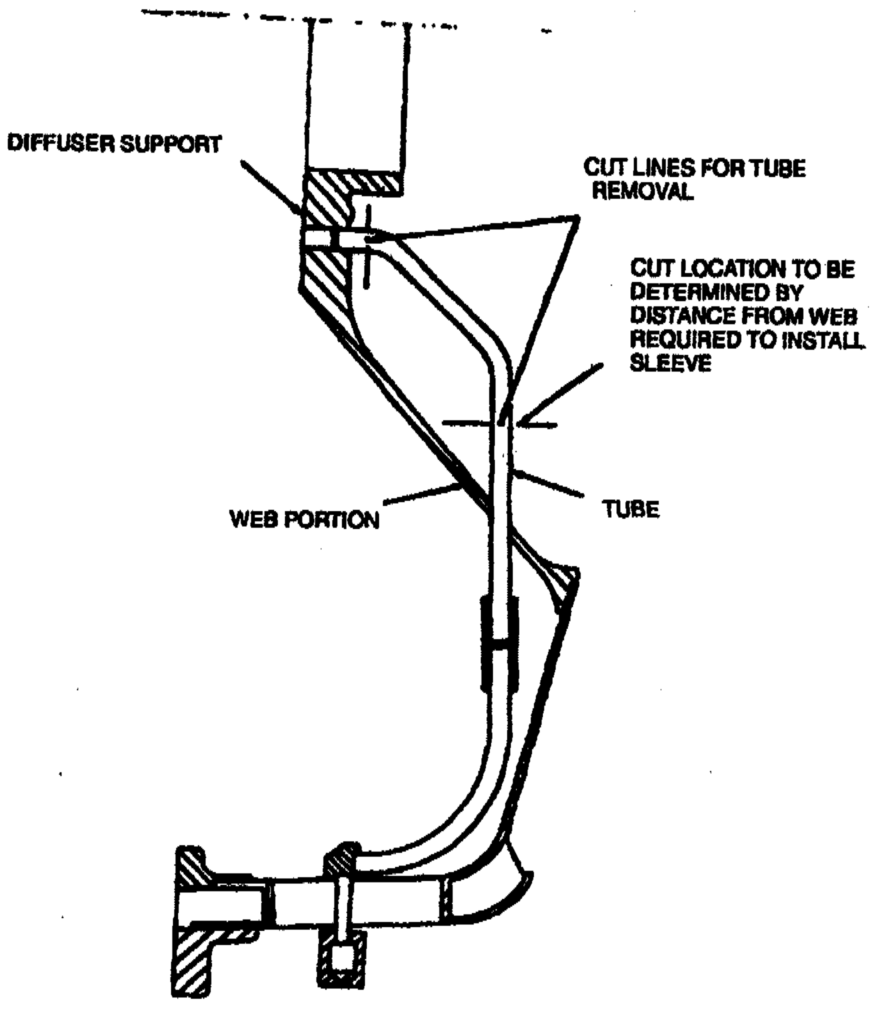


Figure 5-420. Tube Removal.

NOTE

Every effort shall be made to prevent chips from entering oil passages.

(5) Using a stainless steel wire brush, clean support area from which tube was removed.

(6) Install sleeve (1-110-309-02) on remaining portion of tube adjacent to web.

(7) Cut and install replacement tube (1-110-301-03), allowing for a maximum of 1/16 inch butt gap.

(8) Using welding wire (item 347, table C–1), tack-weld in two places, 180 degrees apart, on each joint. (Refer to SP No. 5001 in Appendix E.) (See figure 5-421.)

NOTE

Alternate Method: Tack-weld and weld around using item 348, table C–1, per SP No. 5001, Appendix E.

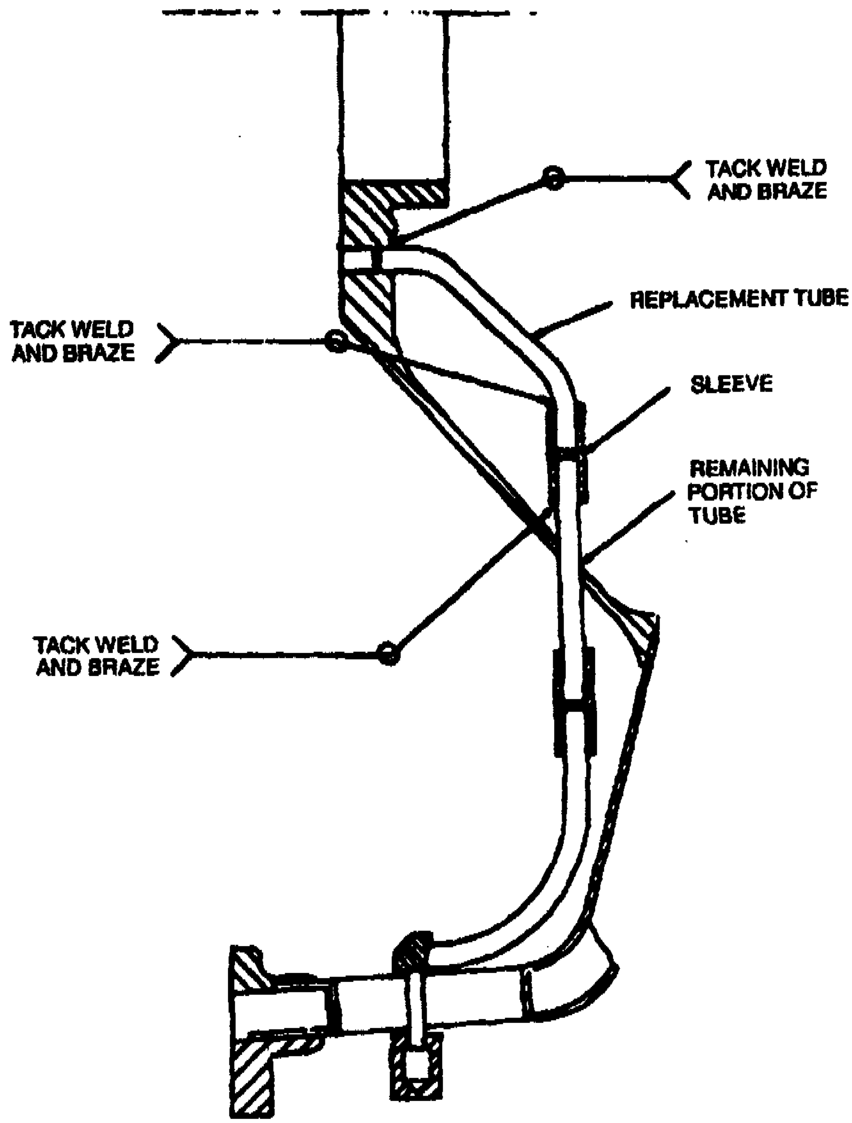


Figure 5-421. Tack-Welds and Braze Locations.

(9) Using a stainless steel wire brush, clean all tack welds.

(10) Using brazing alloy (item 58, table C–1) and flux (item 157, table C–1), torch-braze all tack welded joints. (Refer to SP No. 5003 in Appendix E.)

(11) Rinse all joints in hot water to remove all traces of flux and allow to air-dry.

(12) Flush oil tube to remove all traces of chips.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(13) Perform a visual and fluorescent-penetrant inspection of the replacement joint. Cracks and crack-like indications in the braze are not acceptable.

(14) Using oil flow check stand (LTCT313) or equivalent, and lubricating oil (item 189 or 190, table C–1) at a temperature of 95° to 100°F (35° to 38°C) and at a pressure of 28 to 30 psig (40.8 to 43.6 kg sq cm), flow-check diffuser housing inlet port. Check flowmeter for 450 phr minimum if lubricating oil (item 190, table C–1) is used or 427 phr minimum if lubricating oil (item 189, table C–1) is used.

(15) Using oil pressure fixture (LTCT4535), pressure-test oil pressure tube to 100 psig (7031 gm sq cm). No leakage is allowed.

t. Replace defective oil pressure tube (1-110-110-06) as follows:

(1) Using a thin cutoff wheel, remove bracket (1-110-093-03) by grinding flush with inner casing.

(2) Using a thin cutoff wheel, remove connector (1-110-011-04) by grinding.

(3) Using a thin cutoff wheel, remove tube (1-110-301-03) by cutting in three places as shown in figure 5-422. Keep approximately 1/4 inch away from diffuser support and web.

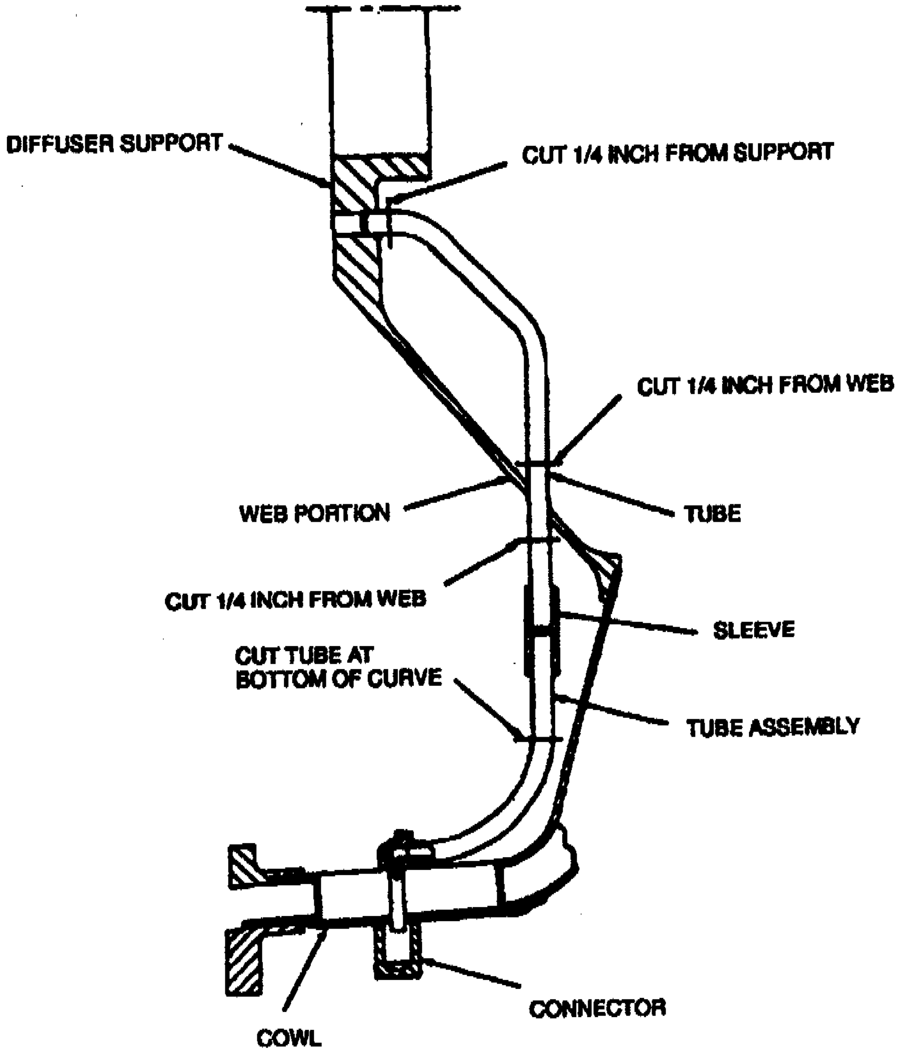


Figure 5-422. Tube Removal.

(4) Using a thin cutoff wheel, cut tube assembly (1-110-110-06) at approximately the bottom of curbed section as shown in figure 5-422.

(5) Remove remaining tube assembly as follows:

(a) Using a 5/32 inch drill, drill tube loose from cowl (1-110-119-02).

(b) Pry tube loose, using caution not to damage vane.

(6) Using a hand grinder and suitable rotary files or cartridge rolls, blend all tube removal areas flush.

(7) Remove remaining tube (1-110-301-03) at support by either eloxing or drilling. When drilling, use drill sizes A through D as required.

CAUTION

Use caution to keep chips from oil passages and to prevent drill from walking into support bore.

(8) Remove remaining tube segment from web by drilling with a 1/4 inch drill, eloxing, or milling.

(9) Clean areas to be brazed with acetone (item 13, table C–1). Using a stainless steel wire brush, clean all new parts.

(10) Fit new tube assembly (1-110-110-06) and bracket (1-110-093-03) in place and using welding wire (item 347, table C–1), weld bracket to casing and weld the small tube of the tube assembly to the cowl as outlined in SP No. 5001 in Appendix E. (See figure 5-423.)

NOTE

Alternate Method: Tack-weld and weld around using item 348, table C–1, per SP No. 5001, Appendix E.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(11) Perform a visual and fluorescent-penetrant inspection of tube weld. Cracks and crack-like indications are not acceptable.

(12) Fit new tube (1-110-301-03) in place, with sleeve (1-110-309-02) attached, allowing for a butt gap of 1/16-inch maximum between tubes, and fit opposite end into diffuser support. Tack-weld in two places, 180 degrees apart, on each joint. (Refer to SP No. 5001 in Appendix E and as shown in figure 5-423.)

(13) Place connector (1-110-011-04) by tack-welding in place with welding wire (item 347, table C–1).

(14) Using brazing alloy (item 58, table C–1) and flux (item 157, table C–1), torch-braze all tack-welded joints and bracket to top of tube assembly (1-110-110-06). (Refer to SP No. 5003 in Appendix E as shown in figure 5-423.)

(15) Rinse all joints in hot water to remove all traces of flux and allow to air-dry.

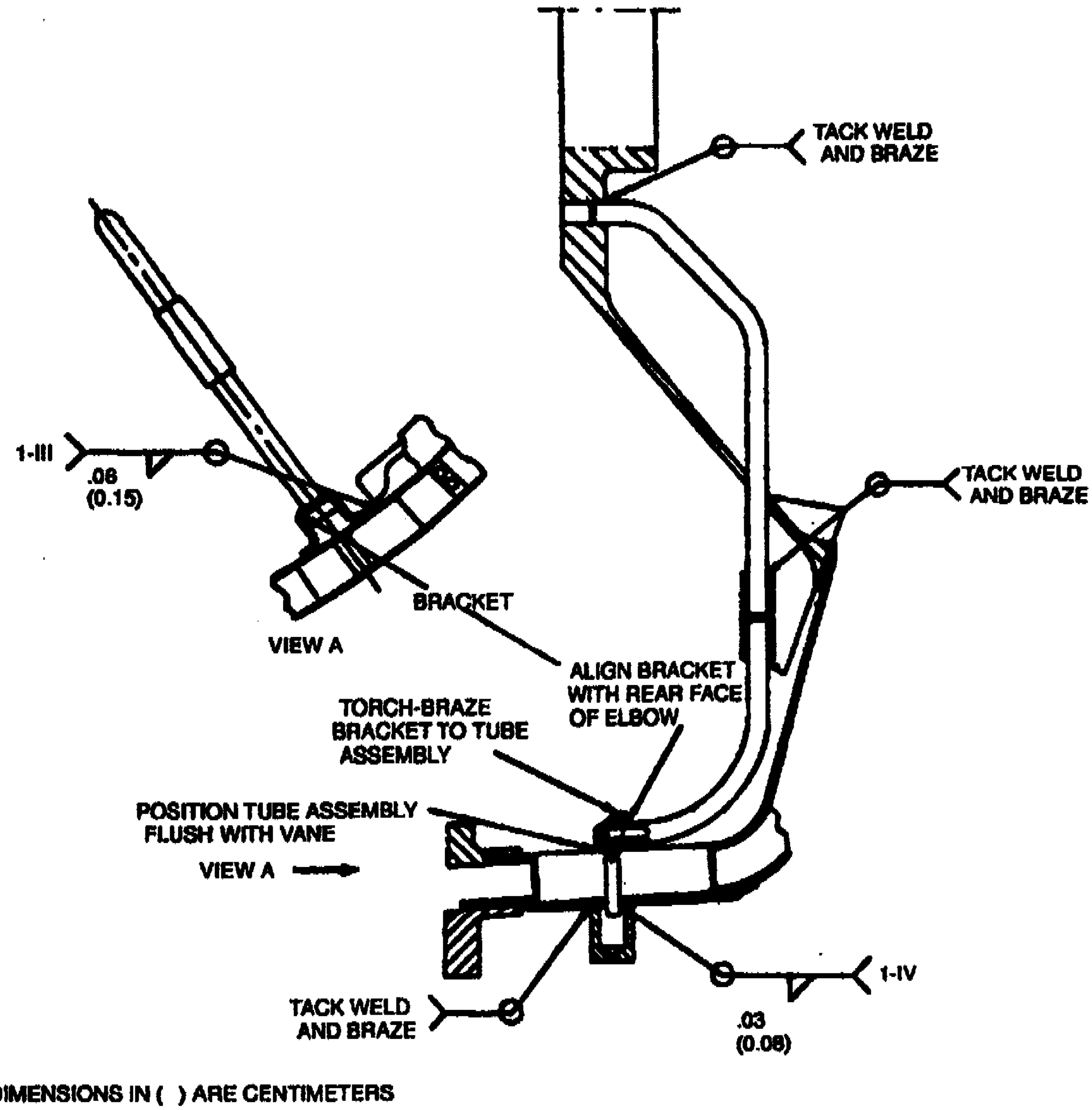


Figure 5-423. Tube Installation.

(16) Flush oil tubes to remove all traces of chips.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(17) Perform a visual and fluorescent-penetrant inspection of replacement joint areas. Cracks and cracklike indications are not acceptable.

(18) Using oil flow check stand (LTCT313) or equivalent, and lubricating oil (item 189 or 190, table C–1) at a temperature of 95° to 100°F (35° to 38°C) and at a pressure of 30 psig (2109 gm sq cm) flow-check diffuser housing inlet port. Check flowmeter for 450 phr minimum if lubricating oil (item 190, table C–1) is used, or 427 phr minimum if lubricating oil (item 189, table C–1) is used.

(19) Using oil pressure fixture (LTCT4535), pressure-test oil pressure tube to 100 psig (7031 gm sq cm). No leakage is allowed.

u. Blend-repair minor foreign object damage on first row of vanes of diffuser housing (1, figure 4-50). (Refer to SP No. 5000 in Appendix E.) Repair shall be limited to removal of raised material.

v. Punctures which do not exceed 0.060 inch (0.152 cm) diameter or 0.25 inch (0.64 cm) in length and 0.060 inch (0.152 cm) in width, on third row of vanes of diffuser housing (1, figure 4-50) shall be repaired as follows where access permits:

(1) Using brazing alloy (item 58, table C–1) and brazing flux (item 65, table C–1), torch-braze puncture. (Refer to SP No. 5003 in Appendix E.)

(2) Blend braze material to contour of parent metal.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(3) Perform a visual and fluorescent-penetrant inspection of puncture and/or crack repair. Cracks are not acceptable.

w. Punctures, which exceed limits in previous step v, shall be repaired as follows where access permits:

(1) Open downstream end of vane to permit entry of a strip of stainless steel (of appropriate width) for backup of defect to be repaired.

(2) Turn acetylene up on welder's torch to blacken the end of backup strip to prevent braze from adhering.

(3) Using brazing alloy (item 58, table C–1) and brazing flux (item 65, table C–1), torch-braze puncture (Refer to SP No. 5003 in Appendix E). Remove backup strip.

(4) Reform downstream end of vane and torch-braze as outlined in previous step (3).

NOTE

In event the parent metal vane has been blended thin in a previous repair, then the EDM slot may be increased to 0.794 inches (2.017 cm) maximum, to obtain the required fit to the replacement vane.

x. Repair erosion on leading edge of first row of vanes on diffuser housing (1, figure 4-50) as follows:

(1) Using suitable tools, remove leading edge of first row vane tips by electrical discharge machining. Dimensions for elox slots are shown in figures 5-424, 5-425, 5-426, 5-429, and 5-431.

NOTE

In order to provide access to vanes located under oil transfer tubes, remove the interfering portions of tubes as required by electrical discharge machining.

(2) Cut-off new vane tips from vanes (1-110-051-02) in accordance with figure 5-433 and 5-434.

(3) Chamfer ID of all cut surfaces of oil transfer tubes.

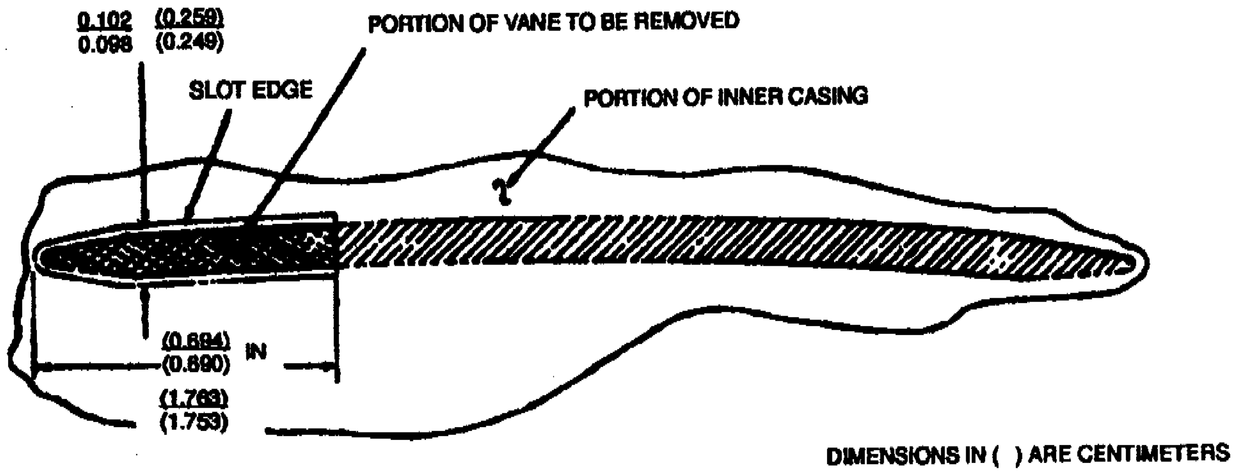


Figure 5-424. Elox Slot Dimensions.

NOTE

In event the parent metal vane has been blended thin in a previous repair, then the EDM slot may be increased to 0.794 inches (2.017 cm) maximum, to obtain the required fit to the replacement vane.

(4) Clean diffuser housing. (Refer to SP No. 6024 in Appendix E.)

(5) Remove silver braze from all joints of tubes and bosses as follows:

NOTE

Replace stripper solution every 36 hours after mixing.

(a) Immerse diffuser housing in Enstrip A, (item 322, table C–1) heated to 180°F (82°C) to dissolve the silver braze. An oxy-acetylene torch may be used to melt the old silver braze. When silver is melted, pull the components apart.

CAUTION

Before proceeding further, ensure that all prior silver brazing alloy is removed from the diffuser housing.

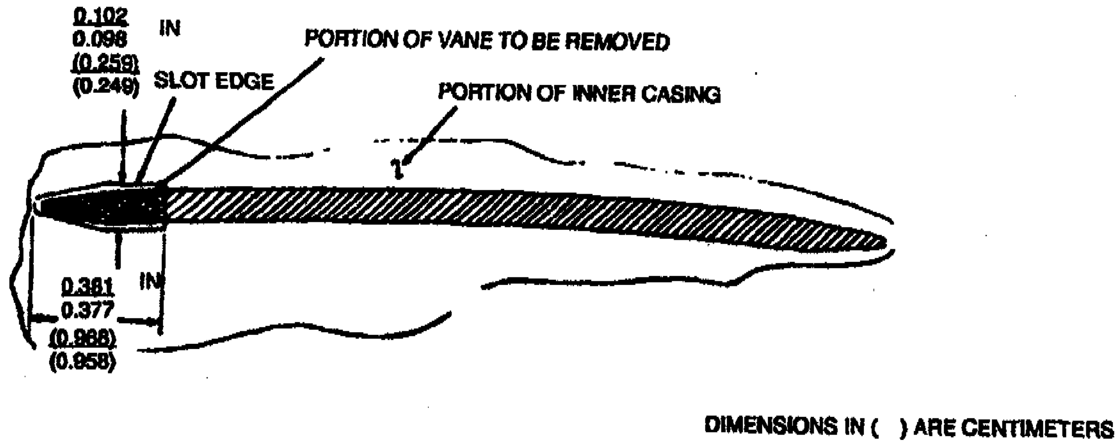
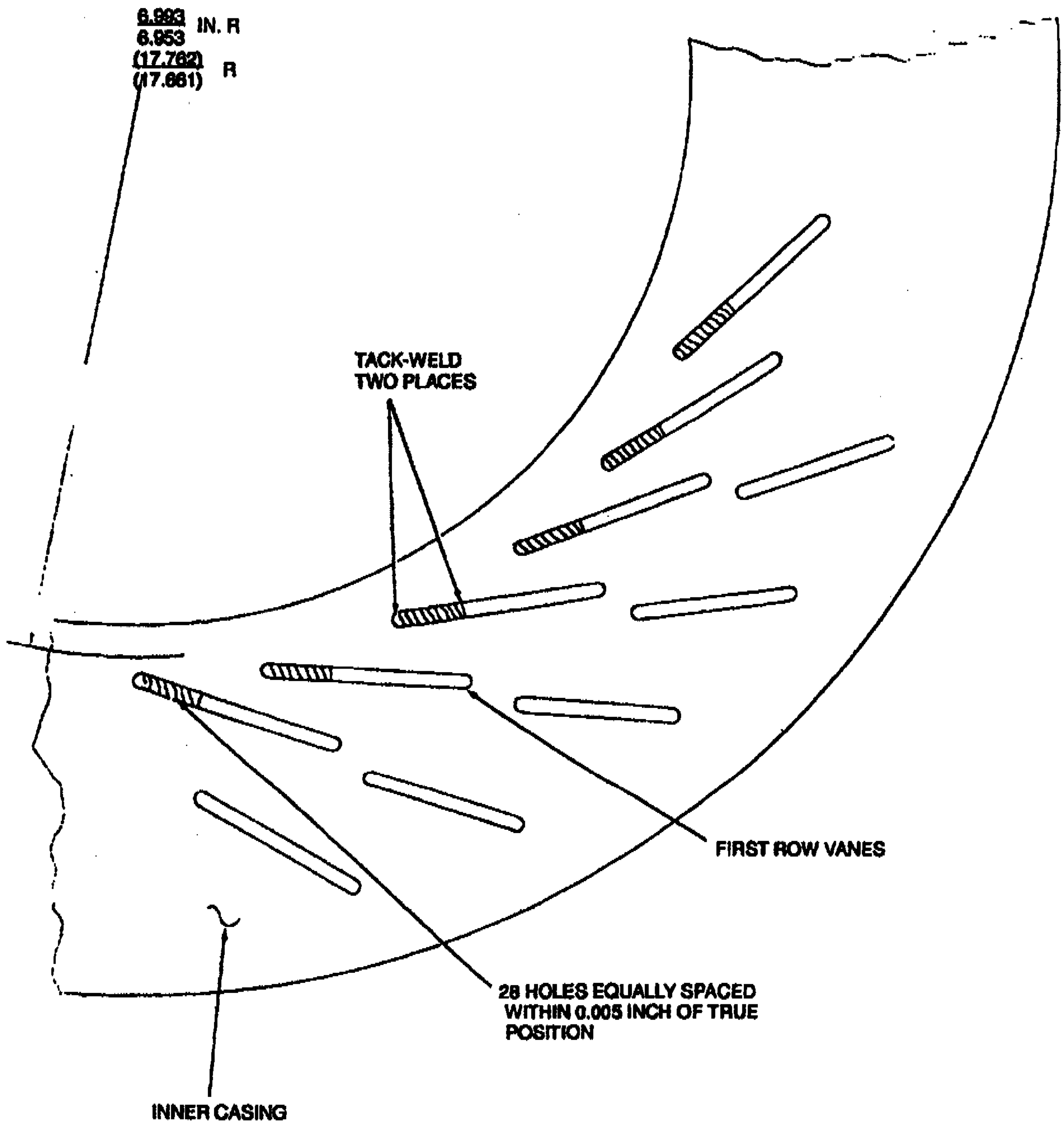


Figure 5-425. Elox Slot Dimensions - Alternate Method.

(b) Rinse diffuser housing components thoroughly with clean water heated to 180°F (82°C), and air dry.

(6) Install vane tips and, using welding wire (item 345, table C–1), tack-weld in place at each end of vane tip as shown in figure 5-426. (Refer to SP No. 5001 in Appendix E.) Vane tips shall be aligned with existing vane as shown in figure 5-427. Tip must be flush or extend outward from existing vane airfoil on both sides. Tip must not be placed at an axial angle to existing vane. Air diffuser housings that have had previous vane tip replacement but do not meet this criteria shall be repaired by removal and replacement of vane tip. Candidates for vane tip replacement must also meet dimensional requirements shown in figure 5-428.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-426. Elox Slot Dimensions and Weld Locations.

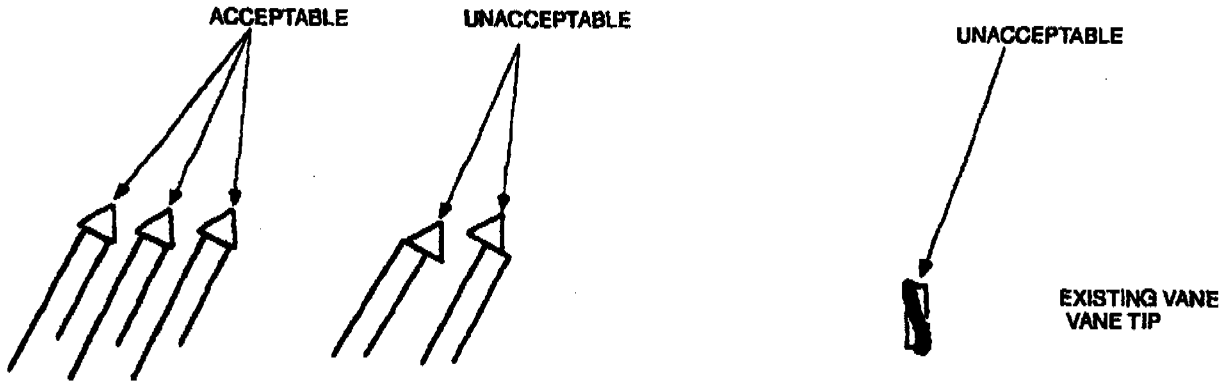


Figure 5-427. Alignment of Replacement Vane Tip.

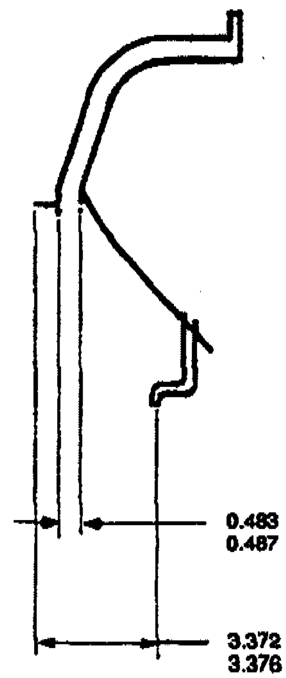
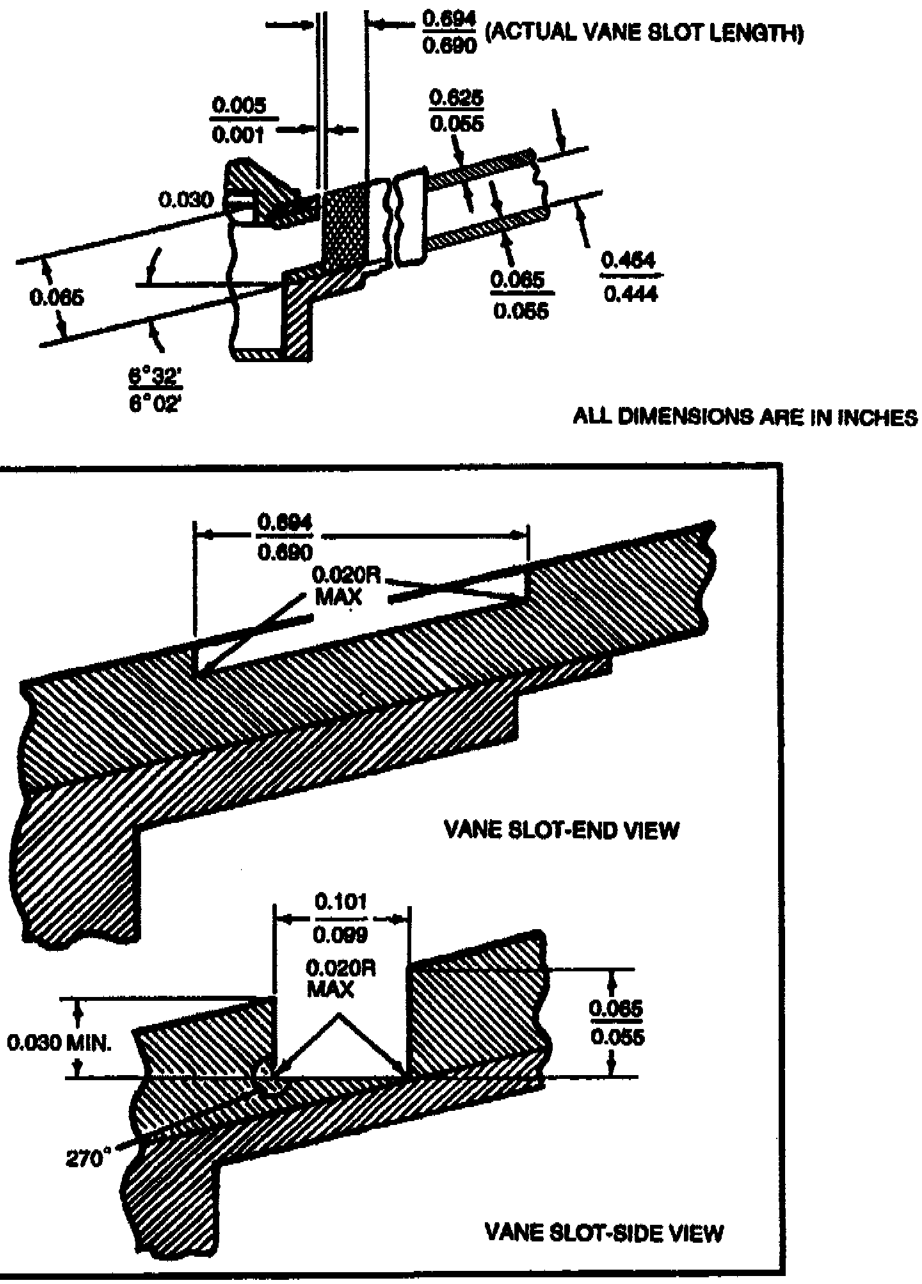


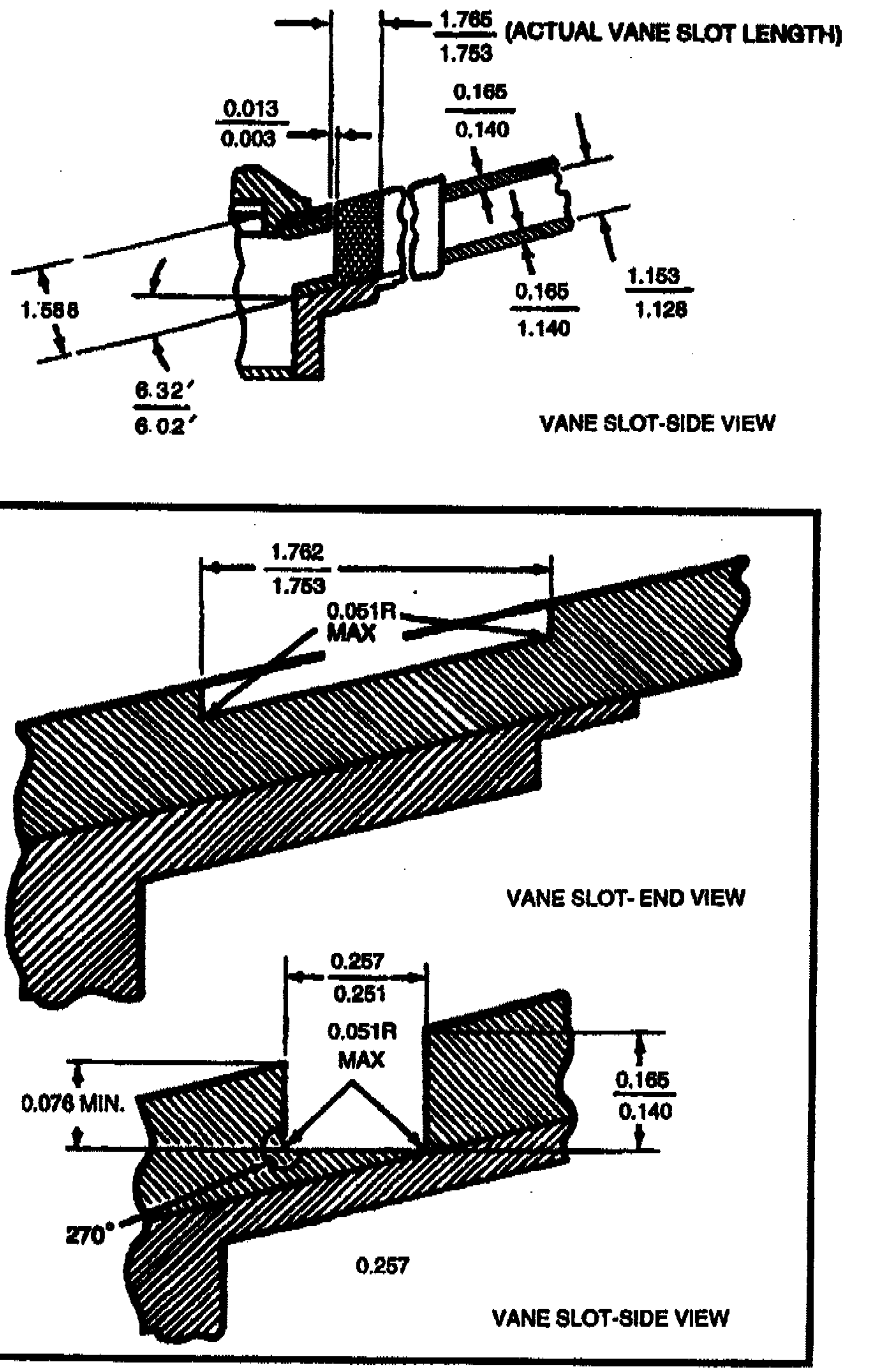
Figure 5-428. Inspection for Warpage.



NOTE

In event the parent metal vane has been blended thin in a previous repair, then the EDM slot may be increased to 0.794 inches (2.017 cm) maximum, to obtain the required fit to the replacement vane.

Figure 5-429. Vane Removal and Slot Preparation (Outer Structure) (English)

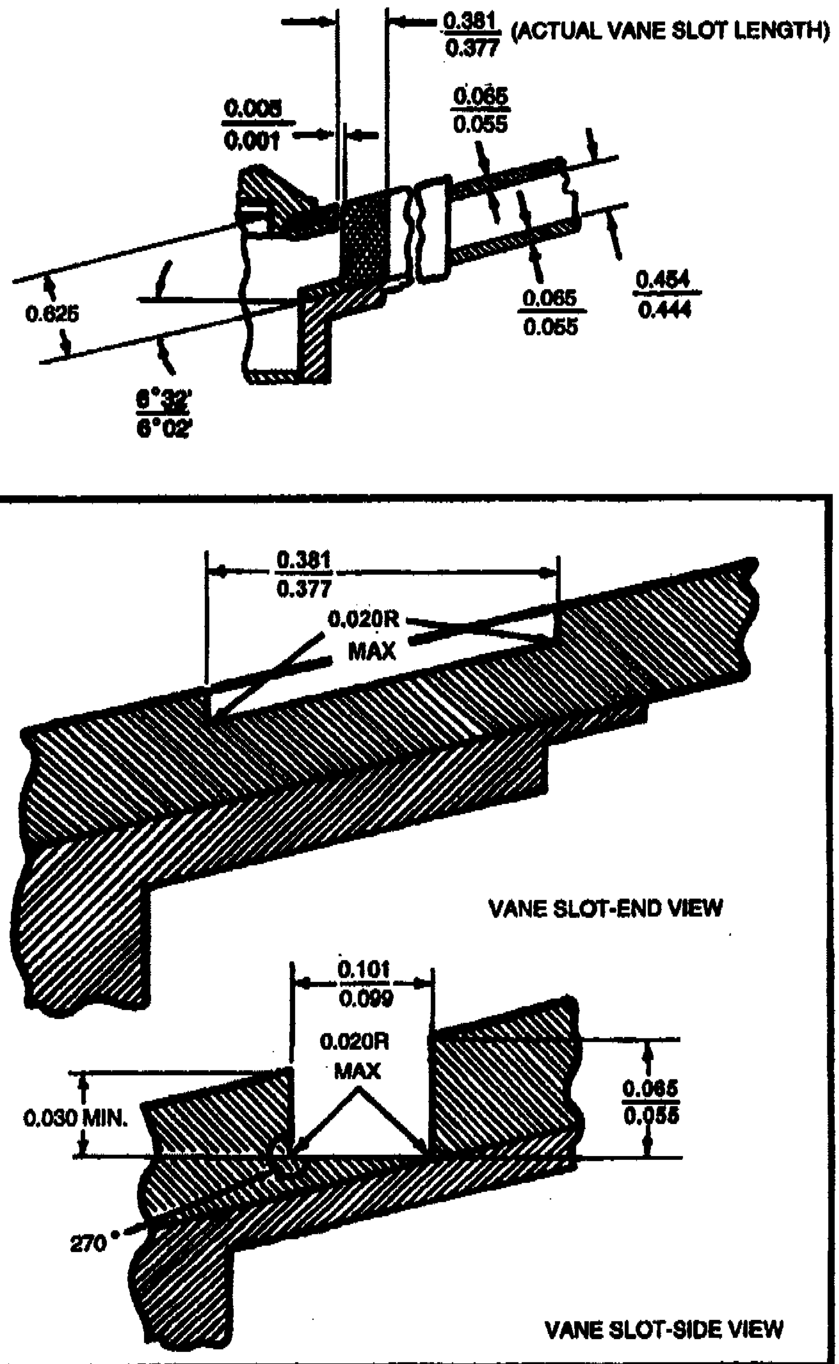


ALL DIMENSION ARE CENTIMETERS

NOTE

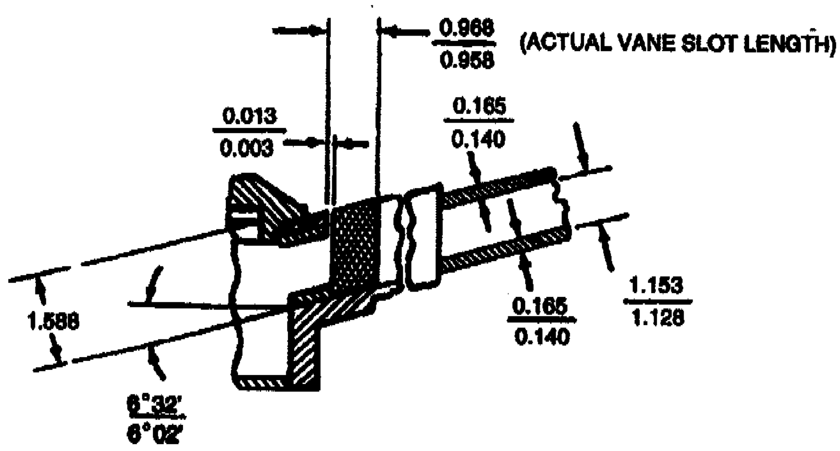
In event the parent metal vane has been blended thin in a previous repair, then the EDM slot may be increased to 0.794 inches (2.017 cm) maximum, to obtain the required fit to the replacement vane.

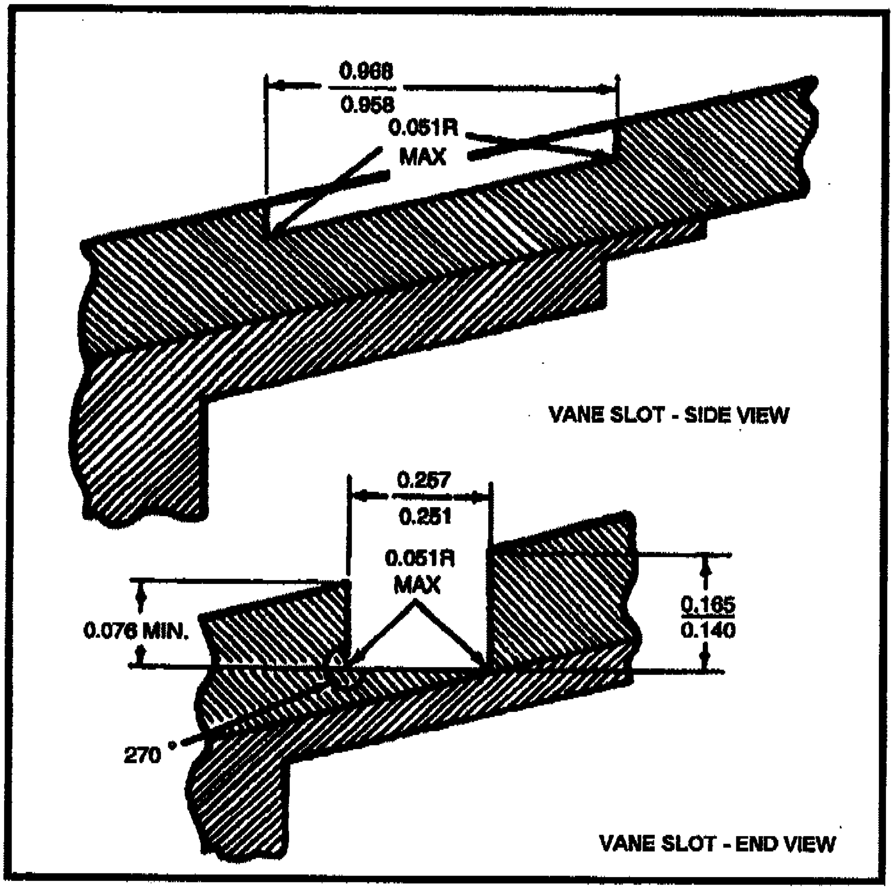
Figure 5-430. Vane Removal and Slot Preparation (Outer Structure) (Metric).



ALL DIMENSIONS ARE INCHES

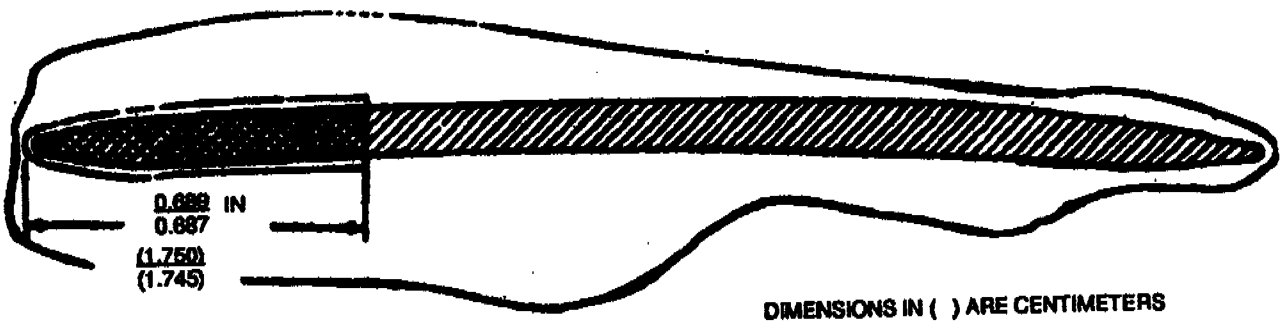
Figure 5-431. Vane Removal and Slot Preparation (Outer Structure) - Alternate Method (English).





ALL DIMENSION ARE CENTIMETERS

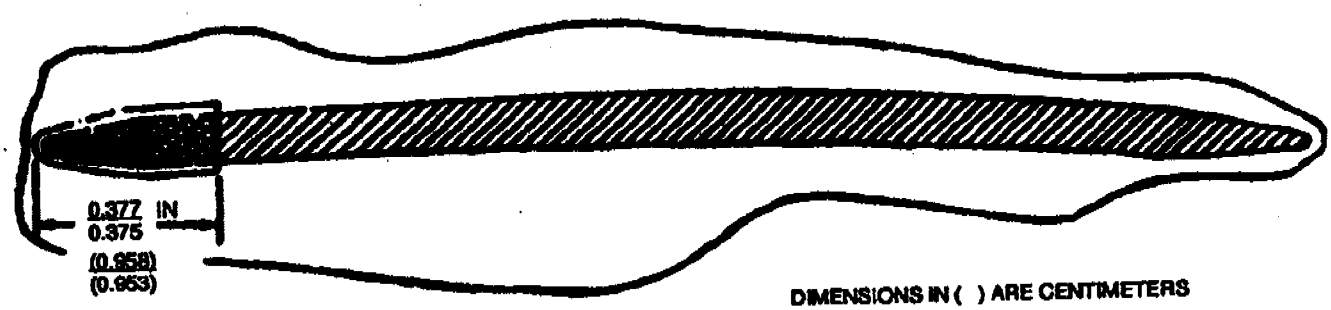
Figure 5-432. Vane Removal and Slot Preparation (Outer Structure) Alternate Method (Metric).



NOTE

In event the parent metal vane has been blended thin in a previous repair, then the EDM slot may be increased to 0.794 inches (2.017 cm) maximum, to obtain the required fit to the replacement vane.

Figure 5-433. Fabrication of Vane Tip.



NOTE

In the event ELOX removal of vanes has resulted in oversize vane slots in inner casing, weld material may be applied to replacement vanes to a height of 0.030 inch (0.076 cm) maximum (after machining to vane contour) and 0.55 inch (1.40 cm) width. Ensure that 0.002 to 0.005 inch (0.005 to 0.013 cm) gap between replacement vane and casing maintained for brazing requirement.

Figure 5-434. Fabrication of Vane Tip - Alternate Method.

NOTE

The oil tube sleeve, may be split in half and installed over the defective area.

(7) Install oil transfer tube sleeves (1-110-309-02 or 1-110-219-01), as required, and using welding wire (item 345, table C–1), secure by tack-welding at each end. (Refer to SP No. 5000 in Appendix E.)

(8) Apply brazing alloy (item 60, table C–1) to all replacement vane tips and to oil transfer tube sleeves.

(9) Apply brazing alloy (item 60, table C–1) to any brazement cracks or voids which have been repaired previously by silver brazing and which were exposed by the silver braze stripper used in preceding step (5).

CAUTION

Total time housing is at temperature above 1,000°F (538°C) shall be held to a minimum.

(10) Place air diffuser housing on flat surface (by itself), and raise temperature to 1000°F (538°C); maintain this temperature for 5 to 10 minutes to allow housing to be heated uniformly. Raise temperature as quickly as possible to the brazing temperature (not to exceed 1,230°F) (665°C) and braze from 2 to 10 minutes. Cool housing to 1,000°F (538°C), as quickly as possible.

NOTE

The brazing furnace shall be equipped with indication controllers and recorders capable of maintaining a uniform temperature in all work areas, in accordance with MIL-H-6875, introducing and circulating protective and cooling gas, and uniform heating and cooling of workload. The furnace atmosphere during low temperature brazing shall be argon, hydrogen, or inert gas. Calibrate to verify temperature reading prior to treating air diffuser.

(11) Remove all traces of flux. Rinse all brazed joints and other braze repair areas with hot water, and allow housing to dry.

(12) Check air foil surface on both sides of vane. Carefully grind away (or blend out) excess braze material or step caused by misalignment of vane tip with parent vane. Carefully grind away excess braze material from each end of vane tip and from casing adjacent to vane tip.

(13) Measure distance from center line of housing to vane tips. This radial dimension must not be less than 6.920, or more than 6.983, with maximum deviation between readings not to exceed 0.025.

(14) Dimensionally inspect air diffuser housing. (Refer to table 5-146 and figure 5-428.)

(15) Inspect braze areas around tubes and vane tips. Cracks or voids are not acceptable.

(16) Pressure-test diffuser housing (oil tubes and main flow channel). (Refer to paragraph 5-396.)

y. Repair leakage in probe plate boss area of diffuser housing (1, figure 4-50) as follows:

(1) Clean areas to be welded with acetone (item 13, table C–1).

CAUTION

Apply heat in such a manner that temperature of parent metal remains below 1,000°F (538°C).

NOTE

Solder may be applied up to 4 inches beyond probe plate boss (where space permits) if leak at seam continues excessively after initial repair.

(2) Using all oxy-acetylene torch, acid-type flux, and solder (item 286, table C–1), solder the affected area extending along seam, as required to assure sealing.

(3) Bend bead smoothly with parent metal.

(4) Pressure-test in accordance with paragraph 5-396.

z. Repair defective braze areas around diffuser housing vanes, pans, tubes, bosses, manifolds, and oil lines as follows:

(1) Clean areas to be welded with acetone (item 13, table C–1).

(2) Allow parts to air dry.

(3) Torch-braze using brazing alloy (item 60, table C–1). (Refer to SP No. 5003 in Appendix E.) Use a fine tipped torch (No. 100). Remove flux with hot water.

NOTE

Vane brazements may be repaired by TIG welding using Hastalloy W welding wire (item 348, table C–1). (Refer to SP 5001 in Appendix E.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(4) Perform visual and fluorescent-penetrant inspection of all braze joints.

NOTE

Ensure that air passages are not clogged by braze material.

(5) Cracks in first row vane-to-casing joints that are inaccessible for torch-braze repair, shall be vacuum-brazed as follows:

(a) Remove silver braze from all joints of tubes and bosses as follows:

1 Immerse diffuser housing in silver braze remover solution (item 322, table C–1), heated to 180°F (82°C), to dissolve the silver braze. An oxygen-acetylene torch may be used to melt the old silver braze in tube joint areas. When silver is melted, pull the components apart.

CAUTION

Before proceeding further, ensure that all prior silver brazing alloy is removed from the diffuser housing.

2 Rinse diffuser housing components thoroughly with clean water heated to 180°F (82°C), and air-dry.

(b) Using brazing alloy (item 64, table C–1), vacuum-braze cracks. (Refer to SP No. 5004 in Appendix E.)

(c) Place diffuser housing in rework fixture (LTCT11330) and vacuum-braze at 1,900°F (1,038°C) for 2 to 10 minutes. (Refer to SP No. 5004 in Appendix E.) Cool-in furnace from brazing temperature to 1,700° to 1,720°F (927° to 938°C) and hold for 30 minutes; cool from 1,710°F (932°C) to 1,000° (538°C) to 400°F (204°C) in 60 to 120 minutes. The rate of cooling from 400°F (204°C) to ambient temperature is not critical.

(d) Place diffuser housing and fixture in deep freeze, fixture side down, and freeze at -90° to -110°F (-68° to -79°C) for 3 hours. Warm to ambient temperature.

(e) Temper the diffuser housing at 990° to 1,010°F (532° to 543°C) for 3 hours. Cool to ambient temperature.

(f) Remove diffuser housing from fixture.

(g) Dimensionally inspect diffuser housing. (Refer to table 5-146.)

(h) Inspect braze areas around joints. Cracks or voids are not acceptable.

(i) Pressure-test diffuser housing (oil tubes and main flow channel). (Refer to paragraph 5-396.)

(6) Check oil tubes for leaks by pressure-testing oil inlet tube at 100 psig (7031 gm sq cm) air pressure and oil drain tube at 35 psig (2461 gm sq cm) air pressure. Check main channel by pressure testing. (Refer to paragraph 5-396.)

(7) Touch up reworked area. (Refer to SP No. 6000 in Appendix E.)

aa. Repair cracks in third row of vane brazements of diffuser housing (1, figure 4-50) as follows where access permits.

(1) Using brazing alloy (item 58, table C–1) torch-braze cracks. (Refer to SP No. 5003 in Appendix E.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(2) Perform a visual and fluorescent-penetrant inspection of repair area. Cracks are not acceptable.

ab. Minor air leaks in third row of vane brazements of diffuser housing (1, figure 4-50) discovered during engine test, may be repaired without engine disassembly as follows:

(1) (Using brazing alloy (item 58, table C–1), torch-braze. (Refer to SP No 5003 in Appendix E.)

(2) Perform a visual and fluorescent-penetrant inspection of repaired areas. Cracks are not acceptable

NOTE

A pressure-test of the main air flow channel, or of the hollow vanes after repair, is not required except for the hollow vanes that form part of the lubrication scavenge system.

ac. Pressure-test hollow vanes of diffuser housing that form part of the lubrication system as outlined in paragraph 5-396.

ad. Using brazing alloy (item 63, table C–1), repair brazement voids up to 0.250 inch (0.635 cm) diameter on first and second row vanes of diffuser housing (1, figure 4-50) using TIG brazing. (Refer to SP No. 5003 in Appendix E.)

NOTE

On vanes located under the mounting struts, two one-inch diameter holes may be drilled to provide access. Blend edge of holes to remove sharp edges. Holes may be formed to an elliptical or an out-of-round shape, provided that the area does not exceed the area of the two one-inch holes. (Refer to figure 5-435 for locations.)

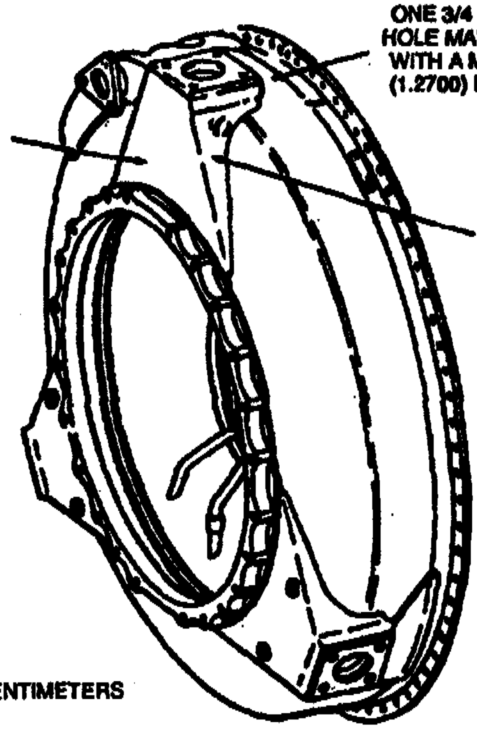


Figure 5-435. Air Diffuser Housing Braze Repair.

ae. Repair air leaks found around diffuser housing vanes under engine mount pads as follows:

(1) Pressure-test air diffuser housing as outlined in paragraph 5-396.

(2) Locate and mark any source of leaks.

(3) Drill holes as indicated in figure 5-435 and blend edges of hole to remove sharp edges or remove mount in accordance with paragraph 5-395q(15) for accessibility.

(4) Using brazing alloy (item 63, table C–1), repair leaks by TIG brazing. (Refer to SP No. 5003 in Appendix E.) All vanes under a removed mount may be brazed. Repeat above step (1).

(5) Repair air leaks in brazement of manifold 1-110-100-07, (located at NR2 bearing connector) discovered during engine test without engine disassembly as follows:

(a) Using welding wire (item 348, table C–1) weld leak area. (Refer to SP No. 5001, Appendix E.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(b) Perform visual and fluorescent penetrant inspection of repaired area. (Refer to MIL-STD-6866.)

NOTE

Oil leaks in connector or cowl brazements in above area are not acceptable for repair without disassembly of engine.

af. Inspect sealing area of air bleed flange on air diffuser for nicks, scratches, etc., that may cause air leakage.

(1) Rework surface to remove defects that may cause air leakage.

(2) Dimension 0.675 to 0.685 inches (1.715 to 1.740 cm) may be a maximum of 0.695 inch (1.765 cm) and extended into large surface (dimensions 0.002 to 0.006 inch (0.005 to 0.015 cm) need not be maintained). See Manufacturer's Drawing Specifications for reference.

(3) Large surface shall be finished per Manufacturer's Drawing Specifications.

ag. Repair worn surfaces and diameters on air diffuser housing (1, figure 4-50) as follows: (See figure 5-436.)

(1) Repair worn 3.372 to 3.376 inch (8.565 to 8.575 cm) surface where 0.003 to 0.020 inch (0.008 to 0.051 cm) buildup is required, by thermal flame spraying as follows:

(a) Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup after final machining.

(b) Thermal flame spray, using nickel aluminide material (item 218 or 224, table C–1) as outlined in following step (8).

(c) Machine to dimensions given.

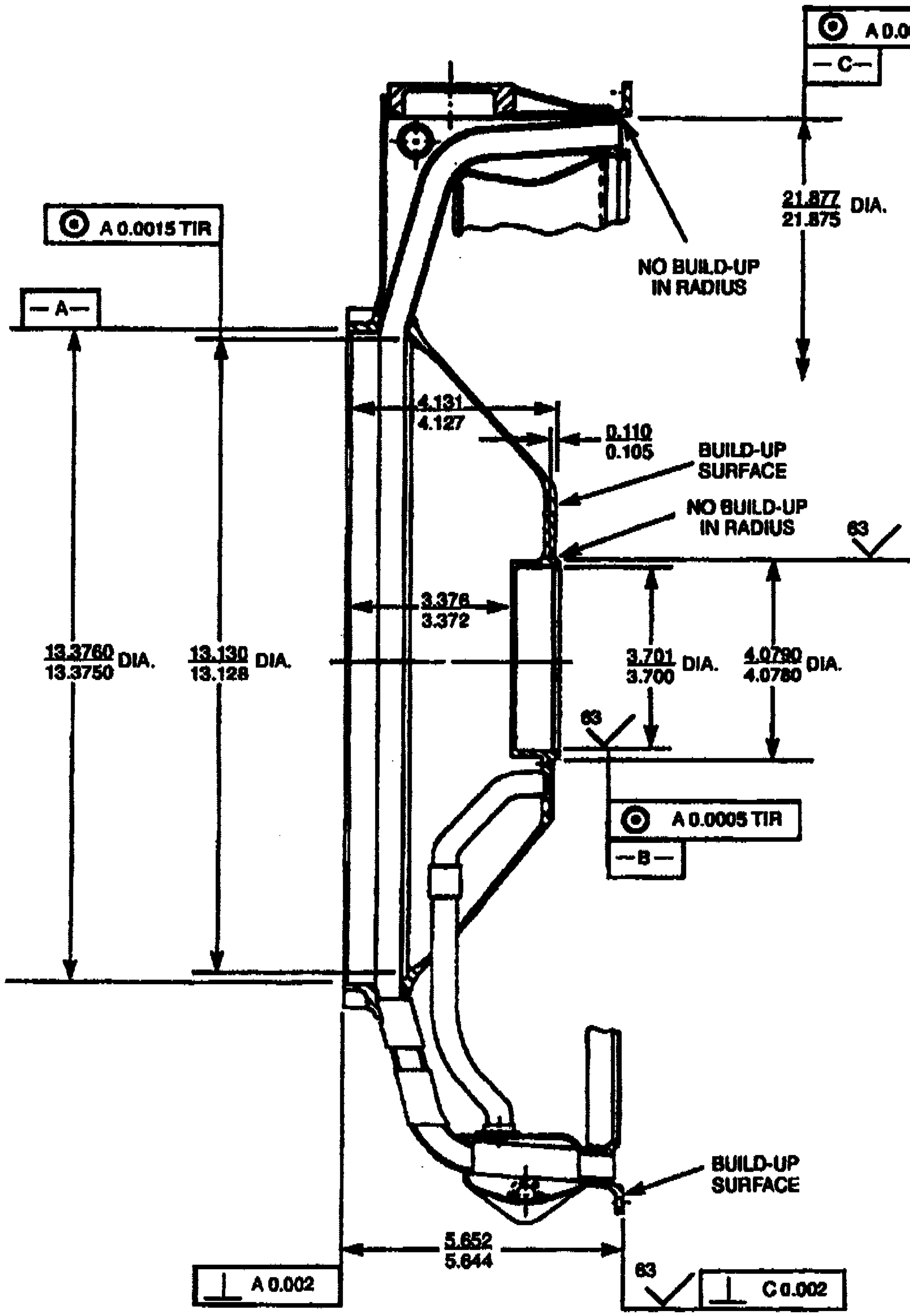
(2) Repair worn 4.127 to 4.131 inch (10.483 to 10.493 cm) surface and 4.0780 to 4.0790 inch (10.3581 to 10.3607 cm) diameter, when 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness is required, by chrome plating; or where 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup is required, by thermal flame-spraying.

(a) Repair by thermal flame-spraying as follows:

1 Machine, if necessary, to obtain a 0.002 to 0.020 inch (0.005 to 0.025 cm) plate thickness after final machining.

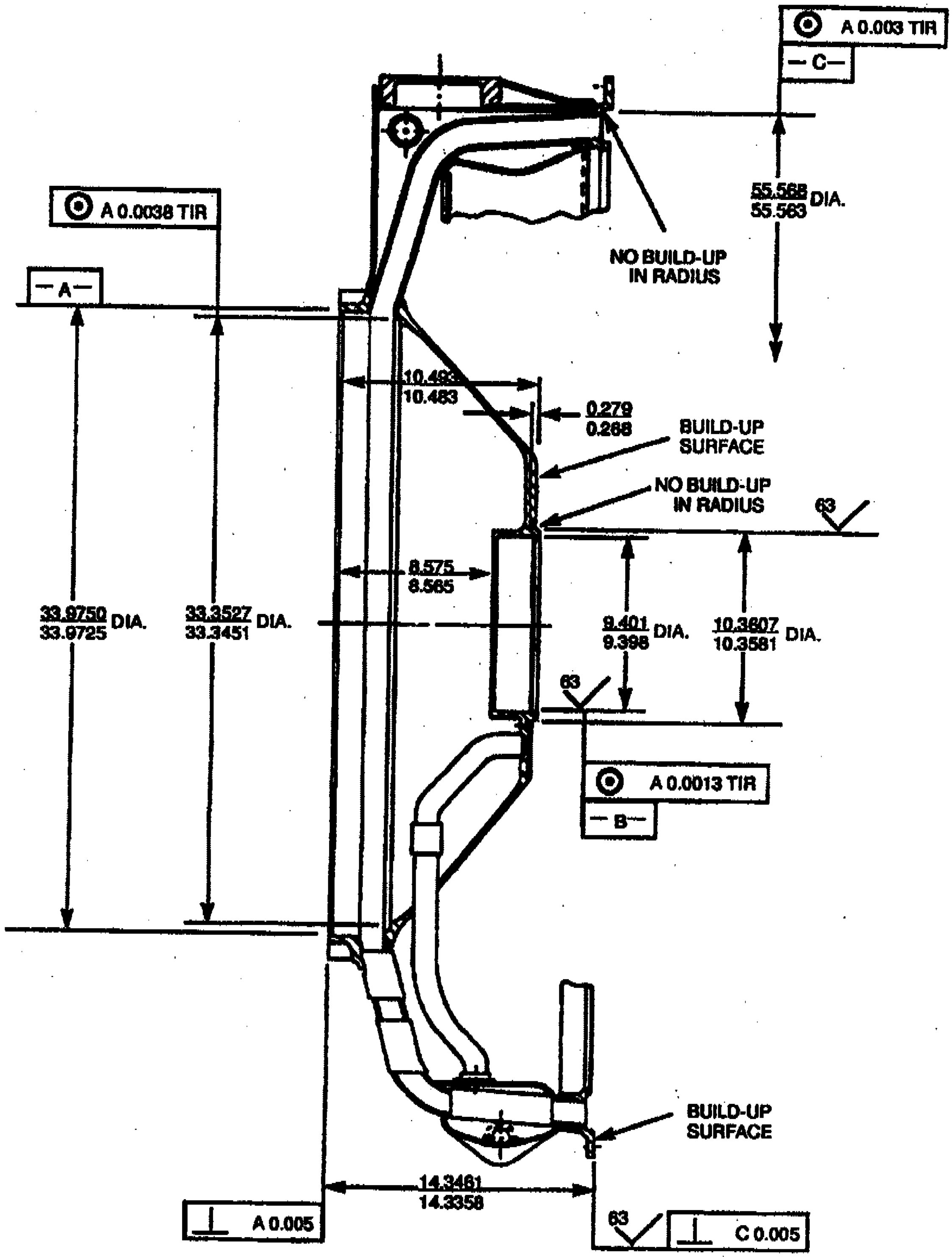
2 Thermal flame-spray, using nickel aluminide material (item 218 or 224, table C–1) as outlined in following step (8).

3 Machine dimensions given.



ALL DIMENSIONS ARE IN INCHES

Figure 5-436. Diffuser Housing - Repair Area (English).



ALL DIMENSIONS ARE IN CENTIMETERS

Figure 5-437. Diffuser Housing - Repair Area (Metric).

(3) Repair worn 0.105 to 0.110 inch (0.267 to 0.279 cm) surface and 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter, where 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness is required, by chrome plating; or where 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup is required, by thermal flame-spraying.

(a) Repair by chrome-plating as follows:

NOTE

To prevent damage when machining the air diffuser 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter, mask the inside surface of the 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter from the snapring groove outward (aft). Mask the groove also. It is not necessary to maintain the 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter in the masked area.

1 Machine, if necessary, to obtain a 0.002 to 0.010 inch (0.005 to 0.025 cm) plate thickness after final machining.

2 Chrome-plate. (Refer to SP No. 6014 in Appendix E.)

3 Bake at 365° to 385°F (185° to 196°C) for 3 hours.

4 Machine to dimensions given. Finish-machine the 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter to a bore depth of 0.753 inch (1.913 cm) minimum after machining.

(b) Repair by thermal flame-spraying as follows:

NOTE

To prevent damage when machining the air diffuser 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter, mask the inside surface of the 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter from the snapring groove outward (aft). Mask the groove also. It is not necessary to maintain the 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter in the masked area.

1 Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup after final machining.

2 Thermal flame-spray, using nickel aluminide powder (item 218 or 224, table C–1) as outlined in following step (8).

3 Machine to dimensions given. Finish machine the 3.700 to 3.701 inch (9.398 to 9.401 cm) diameter to a bore depth of 0.753 inch (1.913 cm) minimum after machining.

(4) Repair worn 5.644 to 5.652 inch (13.336 to 14.356 cm) surface, where 0.003 to 0.050 inch (0.008 to 0.127 cm) buildup is required, by a thermal flame-spraying as follows:

(a) Machine, if necessary, to obtain a 0.003 to 0.050 inch (0.008 to 0.127 cm) buildup after final machining.

NOTE

Minimum parent metal thickness of flange, after machining and prior to thermal flame-spraying shall be 0.090 inch (0.229 cm).

(b) Thermal flame-spray, using nickel aluminide powder (item 218 or 224, table C–1) as outlined in following step (8).

(c) Machine to dimensions given.

(5) Repair worn 13.130 to 13.150 inch (33.350 to 33.401 cm) diameter where 0.003 to 0.020 inch (0.008 to 0.051 cm) buildup is required, by thermal flame-spraying.

(a) Machine, if necessary, to obtain a 0.003 to 0.020 inch (0.008 to 0.051 cm) buildup after final machining.

(b) Thermal flame-spray using nickel aluminide material (item 218 or 224, table C–1) or molybdenum material (item 219, table C–1), as outlined in following step (8).

(c) Machine to dimensions given.

(6) Repair worn 21.875 to 21.877 (55.563 to 55.568 cm) diameter, where 0.003 to 0.020 inch (0.008 to 0.051 cm) buildup is required, by thermal flame-spraying as follows:

(a) Machine, if necessary, to obtain a 0.003 to 0.020 inch (0.008 to 0.051 cm) buildup after final machining.

CAUTION

Thermal flame-spray repair shall not be used to restore flange thickness.

(b) Thermal flame-spray, using nickel aluminide material (item 218 or 224, table C–1) or molybdenum material (item 219, table C–1) as outlined in following step (8).

(c) Machine to dimensions given.

(7) Repair worn 13.375 to 13.376 inch (33.973 to 33.975 cm) diameter where 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup is required, by thermal flame-spraying as follows:

(a) Machine, if necessary, to obtain a 0.003 to 0.015 inch (0.008 to 0.038 cm) buildup after final machining.

(b) Thermal flame-spray using nickel aluminide material (item 218 or 224, table C–1) or molybdenum material (item 219, table C–1) as outlined in following step (8).

(c) Machine to dimensions given.

(8) Thermal flame-spray diffuser areas specified in steps (1) through (7) as outlined in SP No. 5006 in Appendix E.

NOTE

When repairing outer flange area of diffuser, it is not necessary to mask bolt holes. Spray deposits are easily removed from bolt holes with a drill bit or tap. Also area S, figure 5-400, need not be masked when spraying area C.

5-396. REASSEMBLY OF DIFFUSER HOUSING ASSEMBLY. Proceed as follows:

a. Place gasket (5, figure 5-396) on strainer (6) and install into diffuser housing assembly (1). Tighten strainer and lockwire.

b. Pressure-test differ housing as follows:

(1) Install pressure fixture (LTCT4535) on diffuser housing. (See figure 5-438.)

NOTE

Install two packings (16, figure 4-38) on diffuser housing before installing pressure fixture (LTCT4535).

(2) Cap off flow from diffuser housing using pressure cap, MS21914-6, on scavenge oil connector.

(3) Connect air pressure line from a suitable air supply to pressure oil connector on diffuser housing.

(4) Submerge in reservoir of water.

(5) Turn air pressure valve knob until SUPPLY PRESSURE Gage indicates 25-40 psig (1758-2812 gm sq cm).

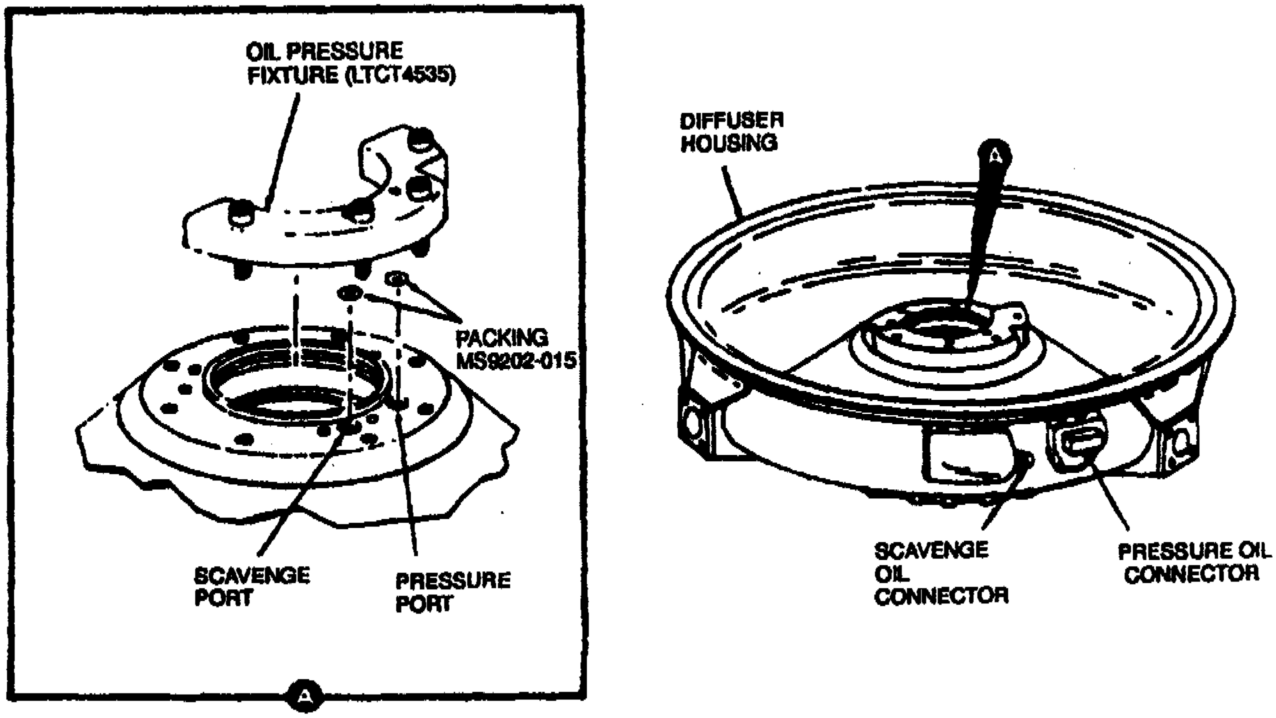


Figure 5-438. Pressure-Testing of Diffuser Housing.

(6) Visually inspect for air leaks around oil tubes, oil connectors, and rear bearing housing-to-diffuser housing mating surface (between pressure fixture (LTCT4535) and diffuser housing). No leaks are allowed.

(7) If leaks are noted between pressure fixture (LTCT4535) and diffuser housing, replace packings (16) and repeat test. If leaks are noted in any other areas, mark diffuser housing to indicate leaks and return to inspection to determine repair procedure.

(8) If leaks are noted around vanes under engine mount pads, repair as outlined in paragraph 5-395.

(9) If no leaks are evident, remove pressure fixture (LTCT4535) and pressure cap, MS21914-6.

(10) Using suitable fixture, pressure-test the main airflow channel at a recommended air pressure of 25 psi (1758 gm sq cm) and check for internal leakage around vanes and manifold joints and external leakage around probe plate area and vane brazements under engine mounts. When using high pressure, both sides of inner casing manifold shall have equalizing air pressure. Submerge diffuser housing in still water supply at ambient temperature. Using 100 cc graduated cylinder filled with water, inverted over leak or equivalent method, measure leakage rate. Internal leakage is referenced in following steps (a) through (d), and external leakage is referenced in following step (e).

NOTE

Cracklike indications in internal vane brazements are acceptable, provided that leakage requirements are within limits.

(a) First row of vanes; total leakage 50 cc/min (cumulative).

(b) Second row of vanes; total leakage 100 cc/min (cumulative).

(c) Third row of vanes; total leakage 200 cc/min (cumulative).

(d) Internal manifold joints two holes allowed. The leakage rate allowed is the same as that allowed for the third row of vanes.

(e) External leakage: Only one hole (point of leakage) is allowed, provided it does not exceed the following leakage limits:

1 First row of vanes; leakage 50 cc/min.

2 Second row of vanes; leakage 100 cc/min.

3 Third row of vanes; leakage 200 cc/min.

(11) If limits in preceding step (10) are exceeded, repair as outlined in paragraph 5-395.

5-397. FUNCTIONAL TEST. Functional test is not required.

5-398. COMBUSTION CHAMBER DEFLECTOR, FIRST STAGE GAS PRODUCER NOZZLE ASSEMBLY AND SUPPORT PLATE.

5-399. DISASSEMBLY. Disassembly of combustion chamber deflector and first stage gas producer nozzle assembly is not required.

5-400. CLEANING. Proceed as follows:

a. Clean combustion chamber deflector and support by dry cleaning method. (Refer to SP. No. 3002 in Appendix E).

b. Clean first stage turbine nozzle by dry cleaning method or hot-alkali-soak method. (Refer to SP. No. 3002 and SP. No. 3004 in Appendix E).

c. Internal cooling passages of first stage turbine nozzles that fail the water flow test may be cleaned using all ultrasonic cleaning bath using an alkaline derust solution (item 337, Appendix C–1 or equivalent). Concentration of cleaning solution should be 4 to 6 oz per gallon of water. Mechanical means can be used to assist in cleaning of internal passages.

5-401. INSPECTION. Perform inspections listed in table 5-47.

a. Airflow inspect first stage gas producer nozzles 1-110-520-19 and 1-110-710-06 using Fleming AF 36 airflow machine, adapter provided by airflow machine manufacturer, and Fleming flow test instructions. Preferable effective Flow Area measurement should be 9.95 to 10.25 sq in. with a water level to 5.0 in. Cross out any previous EFAs and vibroetch the measured EFA in the vicinity of the original GFA marking (or serial number if no GFA marked).

5-402. REPAIR. Proceed as follows:

CAUTION

In following step a, use care not to remove parent metal.

a. Repair combustion chamber deflector (11, figure 4-38) showing signs of rubbing using sandpaper (item 292, table C–1).

b. Repair combustion chamber deflector (11) if crack limits are exceeded.

(1) Cracks in or at deflector spot-weld area shall be repaired provided that cumulative cracks do not total more than 300 degrees. Repair by fusion-weld process, using material shown in table 5-149.

(2) Cracks in excess of 180 degrees, but less than 300 degrees cumulatively, shall be repaired as follows:

(a) Tack-weld each end of cracks exceeding 30 degrees.

(b) Wherever possible, additional tacks should be equally distributed to maintain alignment for welding.

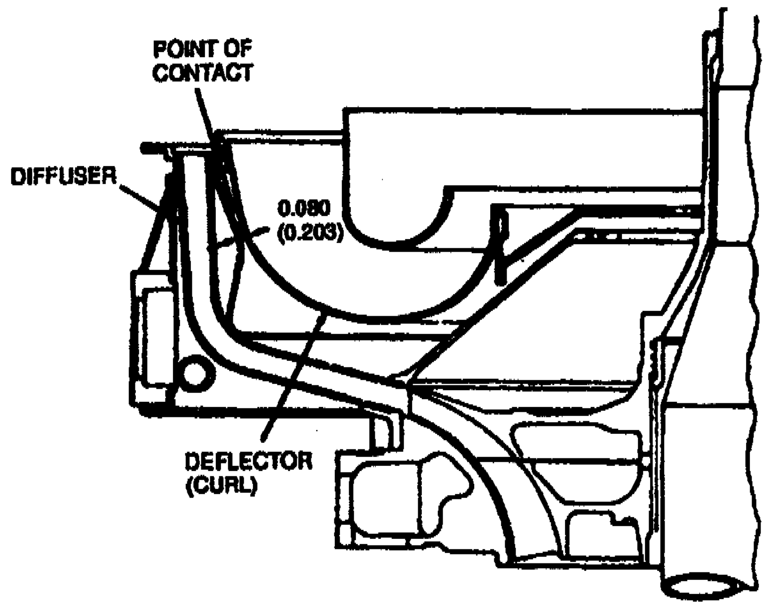
(c) Fusion-weld between tack welds.

Table 5-147. Inspection of Combustion Chamber Deflector and First Stage Gas Producer Nozzle Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38 - 11	Combustion Chamber Deflector	Visual	Rubbing (Indicated by metal pickup.) (See figure 5-439 for rub areas.)	Repair. (Refer to paragraph 5-402.)
		Visual and SIE	Wear on 20.06 inch (50.95 cm) diameter of flange caused by contact with diffuser housing tangs. (See figure 5-440 for limits.)	Repair. (Refer to SP No. 5000 in Appendix E.)
		Visual and Fluorescent-Penetrant	Circumferential cracks in or at spot weld area.	Repair. (Refer to paragraph 5-402.)
			Axial cracks at inner/aft edge that do not exceed 1.5 inches.	Repair. (Refer to paragraph 5-402.)
4-38 34	First Stage Gas Producer Nozzle Assembly	Visual	Manufacturer's Code/ Cage Code S0100	Nozzles from overhead programs, and any nozzles that need repair, shall be discarded if the manufactures Code/Cage Code is S0100
	WARNING **FLIGHT SAFETY PART** **Florescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**			
4-38 -12 and 34	First Stage Gas Producer Nozzle Assembly	Visual and Fluorescent-Penetrant.	Cracks in vane leading or trailing edge. (Refer to table 5-148 for limits.)	Replace vanes if limits are exceeded. (Refer to to paragraph 5-402.)
			Cracks in vane-to-shroud brazement (Refer to table 5-148 for limits.)	Replace vanes if limits are exceeded. (Refer to paragraph 5-402.)
			Circumferential cracks in outer shroud parent metal	Repair. (Refer to paragraph 5-402.)
			Circumferential rubs on inner shroud adjacent to deflector area. (Refer to table 5-148 for limits.)	Repair if limits ar e exceeded. (Refer to paragraph 5-402.)
			Undersized nozzle cylinder (11.750 inch (29.845 cm) diameter minimum). (Refer to table 5-148 for limits.)	Repair if limits are exceeded. (Refer to paragraph 5-402.)
			Cracks in deflector. (Refer to table 5-148 for limits.)	Replace if limits are exceeded. (Refer to paragraph 5-402.)

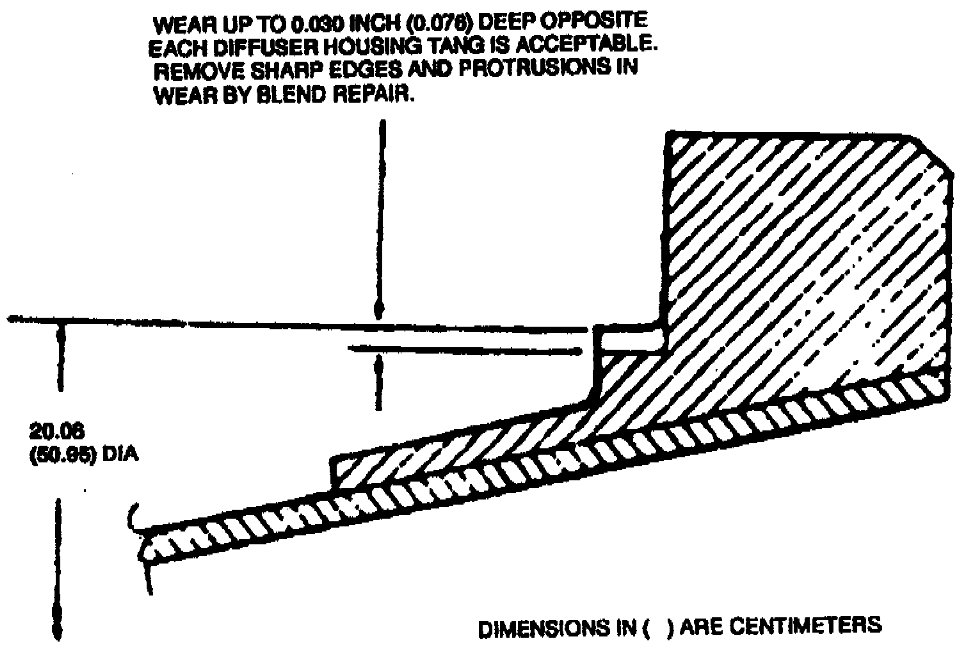
Table 5-147. Inspection of Combustion Chamber Deflector and First Stage Gas Producer Nozzle Assembly.

FIGURE & INDEX NO.	NOMENCLATURE	METHOD	INSPECT FOR	REQUIREMENTS
4-38				
-12 and 34 (Cont)	First Stage Gas Producer Nozzle Assembly(Cont)	Visual and Fluorescent-penetrant (Cont)	Cracks extending from vane trailing edge to outer shroud parent metal. (Refer to table 5-148 for limits.)	Replace vane if limits are exceeded. (Refer to paragraph 5-402.)
			Cracks in cylinder. (Refer to table 5-148 for limits.)	Replace T53-L-703 nozzle assembly (1-110-710-06) if limits are exceeded. Repair nozzle assembly (1-100-520-19.) (Refer to paragraph 5-402.)
			Cracks in support.	Not allowed. Replace support. (Refer to paragraph 5-402.)
			Cracks in support to deflector brazement. (Refer to table 5-148 for limits.)	Replace if limits are exceeded. (Refer to paragraph 5-402.)
			Axial cracks in liner (curl). (Refer to table 5-148 for limits.)	Repair. (Refer to paragraph 5-402.)
		Dimensional	Wear. (Refer to table 5-149 for limits.)	Repair if limits are exceeded, (Refer to paragraph 5-402.)
		Airflow Inspect	Effective Flow Area (EFA) per paragraph 5-401 or Geometric Flow Area (GFA) per table 5-151.	Adjust or replace.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-439. Combustion Chamber Deflector Rub Areas.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-440. Combustion Chamber Deflector Wear Limits on Flange.

Table 5-148. Combustion Chamber Deflector and First Stage Gas Producer Nozzle Assembly Inspection Limits.

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
		NOTE All inspection limits specified for first stage gas producer nozzle assembly 1-100-520-19, used on T53-L-13B, -15, -701, and -701A engines, will also apply to first stage gas producer turbine nozzle assembly 1-110-710-06, used on T53-L-703 engines, unless otherwise indicated.
	VANES	
Nicks and Dents		Minor nicks and dents are allowed on all vanes. (Repair shall be limited to removal of sharp projections. (Refer to paragraph 5-402).
Loss of Coating		Reduction in thickness of surface coating is acceptable on all vane surfaces, provided that some degree of coating remains in all areas, except as noted under chipping limits. If above limits are exceeded, repair coating or replace vane or nozzle. **NOTE** As a diffusion exists between the vane coating and base metal, a reduction in coating thickness due to erosion wear is not considered detrimental, provided that the preceding requirements are adhered to.
Chipping of Coating on Trailing Edge Areas	5-441	If limits are exceeded, repair coating or replace vanes or nozzle.
Warpage or Distortion		Not acceptable. Replace vane. (Refer to paragraph 5-402).
Erosion		Vane concave side erosion patterns in the area of the inner air-bleed hole are acceptable on all vanes, provided a minimum vane thickness of 0.020 inch (0.051 cm) remains as measured 0.200 inch (0.508 cm) forward of the trailing edge. Replace vanes if limit is exceeded. (Refer to paragraph 5-402). **NOTE** Using a suitable caliper or locally manufactured gage, measure the most obviously eroded vanes in line with the inner hole.
Metallization		Refer to metallization of nozzle cylinder and vanes under nozzle limits.

Table 5-148. Combustion Chamber Deflector and First Stage Gas Producer Nozzle Assembly Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
Vane Trailing Edge	5-442	**NOTE** First stage turbine nozzle assembly may exhibit areas of vane trailing edges which have been blend repaired and nozzle coating applied by the manufacturer. The blends are accomplished so as to allow no sharp edges in the rework area and the nozzle coating is applied after blending. Up to three blend areas on any vane may be evident. The following inspection limits shall be applied only to those defects caused by engine operation. The cracks length limits shall remain and shall be measured, using the vane trailing edge as a reference point. Do not measure cracks from any portion of the factory blend areas.
Burned Areas		Burning with resultant loss of material is not acceptable. Replace vane. (Refer to paragraph 5-402.) Normal discoloration is acceptable.
Loss of Material	5-443	Loss of material caused by other than burning or foreign object damage is acceptable, provided airfoil contour has not been affected and core has not been penetrated. If above limits are exceeded, replace vanes. (Refer to paragraph 5-402.)

Table 5-148. Combustion Chamber Deflector and First Stage Gas Producer Nozzle Assembly Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
WARNING **FLIGHT SAFETY PART** **Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.**		
Cracks, Vane Trailing Edge	5-443 5-444	Any number of cracks up to 1/8 inch in length are acceptable. Two cracks per vane up to 1/4 inch in length are acceptable. Trailing edge cracks extending from vane trailing edge into outer shroud parent metal area or radius are acceptable up to 1/4 inch in length on all vanes. If above limits are exceeded, replace vane (refer to paragraph 5-402). Converging cracks which create the possibility of material fallout are not generally acceptable. However, multiple cracks or crazes of coating in the vane/ outer shroud junction area are allowed to angle toward each other as they do not constitute a material loss problem. Cracks progressing to vane cooling holes are acceptable. If limits are exceeded, replace the vanes as outlined in paragraph 5-402.
Cracks, Vane Leading Edge	5-443 5-445	Leading edge cracks at the vane to inner shroud area are acceptable up to 1/4 inch (64 cm) in length on 15 vanes. Hairline radial cracks are acceptable, provided distortion, bulging, loss of material, and core penetration is not evident. Axial cracks up to 1/8 inch (32 cm) in length are acceptable. If above limits are exceeded, replace vane. (Refer to paragraph 5-402.)

Table 5-148. Combustion Chamber Deflector and First Stage Gas Producer Nozzle Assembly Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
VANES TO OUTER SHROUD AND CYLINDER		
Cracks	5-443 5-444 5-445 5-446	Cracks connecting with vane trailing edge cracks are acceptable. Cracks starting at vane trailing edge area and progressing through shroud radius are acceptable provided only one of this type crack per vane is noted. The second nozzle mounting flange is allowed to be cracked without associated cylinder cracking, in one place. An additional three cracks are allowed at random locations, provided they are of the hairline type and are only visible from the cylinder ID. Circumferential cracking is not acceptable. Any number of small axial cracks in radius area up to 1/8 inch in length are acceptable. Buckling and distortion are not allowed. Tight lipped cracks in outer shroud up to 1/4 inch in length emanating from vane trailing edge radius areas are acceptable in any direction without repair. Up to 10 circumferential cracks not exceeding 1/2 inch in length are repairable by braze method. (Refer to paragraph 5-402.) Cumulative length of all circumferential cracking up to 9 inches is repairable with overbridge provided vane to vane cracking is not evident in more than 6 vane to vane areas. Cracks in other areas are allowed circumferentially provided they are not vane to vane and do not exceed the cumulative 9 inch limits. (Refer to paragraph 5-402.) Crack indications in outer shroud O.D. that can be removed by a maximum .010 inch depth blend are acceptable. (Refer to SP No. 5000, Appendix E.)

Table 5-148. Combustion Chamber Deflector and First Stage Gas Producer Nozzle Assembly Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
	VANE-TO-INNER SHROUD	
Cracks	5-445	Leading edge cracks at vane-to-inner shroud are acceptable up to 1/4 inch in length on 15 vanes. If above limit is exceeded, replace vane. (Refer to paragraph 5-402).
	DEFLECTOR	
Cracks	5-443	Cracks in deflector to inner shroud brazement are not acceptable. Repair as outlined in paragraph 5-402.
	LINER (CURL)	
Cracks	5-447	Axial cracks are allowed to be repaired as outlined in paragraph 5-402. Circumferential cracks are not acceptable. Replace liner as outlined in paragraph 5-402.
Wear Caused By Combustion Chamber Liner Dimples		On first stage gas producer nozzle assembly (1-110-520-19 only), inspect parent metal of nozzle liner (curl) 15.525 to 15.540 inch (39.434 to 39.472 cm). OD (T53-L-13B, -15, -701, -701A) and 15.50 inch (39.37 cm) OD (T53-L-703) for wear depressions caused by rubbing of combustion chamber liner dimples. Wear depressions that do not break through or cause raised impressions are acceptable. If limits are exceeded, repair as outlined in paragraph 5-402.
Nicks, Dents, Ruts and Scratches in Outer Rim of Liner Area at 15.525 to 15.540 inch (39.434 to 39.472 cm) diameters (T53-L-13B, -15, -701, -701A) and 15.50 inch diameter (T53-L-703)		Nicks, dents, ruts. and scratches are acceptable, provided contours are smooth, and defects do not exceed following limits: a. Depth of 0.010 inch (0.025 cm) not to cover more than one-third of mating surface. b. Ten dents or rubs up to 0.015 inch (0.038 cm) in depth but not more than two in a 6-inch length. c. If limits are exceeded, replace liner as outlined in paragraph 5-402.

Table 5-148. Combustion Chamber Deflector and First Stage Gas Producer Nozzle Assembly Inspection Limits (Continued).

DEFECT	FIGURE REFERENCE	INSPECTION LIMITS
	INNER SHROUD	
Circumferential Rubs on Inner Shroud Adjacent to Deflector Area	5-448	a. Rubs up to 360 degrees are acceptable, provided depth does not exceed 0.060 inch (0.152 cm) and accumulated width of rub(s) does not exceed 0.100 inch (0.254 cm) across lip of shroud. b. If limits are exceeded, repair as outlined in paragraph 5-402.
Cracks in deflector to inner shroud brazement		Are not acceptable. Repair as outlined in paragraph 5-402.
Undersized Nozzle Cylinder		Dimensionally inspect nozzle cylinder 11.750 inch (29.845 cm) diameter minimum. If undersized, rework as outlined in paragraph 5-402.
Metallization of Nozzle, Cylinder, and Vanes		Light, scattered metallization that does not protrude above affected surface and does not affect geometric flow area (GFA) is acceptable. **NOTE** In event metallized scale is still evident, repeat cleaning outlined in SP No. 3005 in Appendix E. If nozzle can be brought back into limits by this method, it is acceptable. Heavy metallization that protrudes above surface and or affects GFA is not acceptable. **NOTE** Some types of metallization form a surface scale or crust that is allowed to be removed by use of a leather-type bob (small polishing wheel).

Table 5-149. Dimensional Inspection of First Stage Gas Producer Nozzle Assembly.

NOMENCLATURE	FIG & INDEX	DIR MEAS	BLUEPRINT DIMENSIONS		OVERHAUL SERVICE DIMENSIONS		OVERHAUL SERVICE FITS		REFER TO FIG. & DIM.
			MIN	MAX	MIN	MAX	MIN	MAX	
	4-38								5-449
First Stage Gas Producer Nozzle Assembly (T53-L-13B, -15, -701, -701A)	2	OD	15.525 (39.434)	15.540 (39.472)	15.525 (39.434)	15.552 (39.502)			A
		OD	0.090 (0229)						B
		ID	11.764 (29.881)	11.774 (29.906)	11.750 (29.845)	11.776 (29.911)			C
		OD	1.567 (3.980)	1.571 (3.990)	1.559 (3.960)	1.579 (4.011)			D
		Axial	0.24 (0.61)						E
First Stage Gas Producer Nozzle Assembly (T53-L-703)	34	OD		15.50 (39.37)					F
		OD	0.090 (0.229)						G
		ID	11.764 (29.881)	11.770 (29.896)	11.750 (29.845)	11.776 (29.911)			H
		OD	1.567 (3.980)	1.571 (3.990)	1.559 (3.960)	1.579 (4.011)			I
		Axial	0.24 (0.61)						J

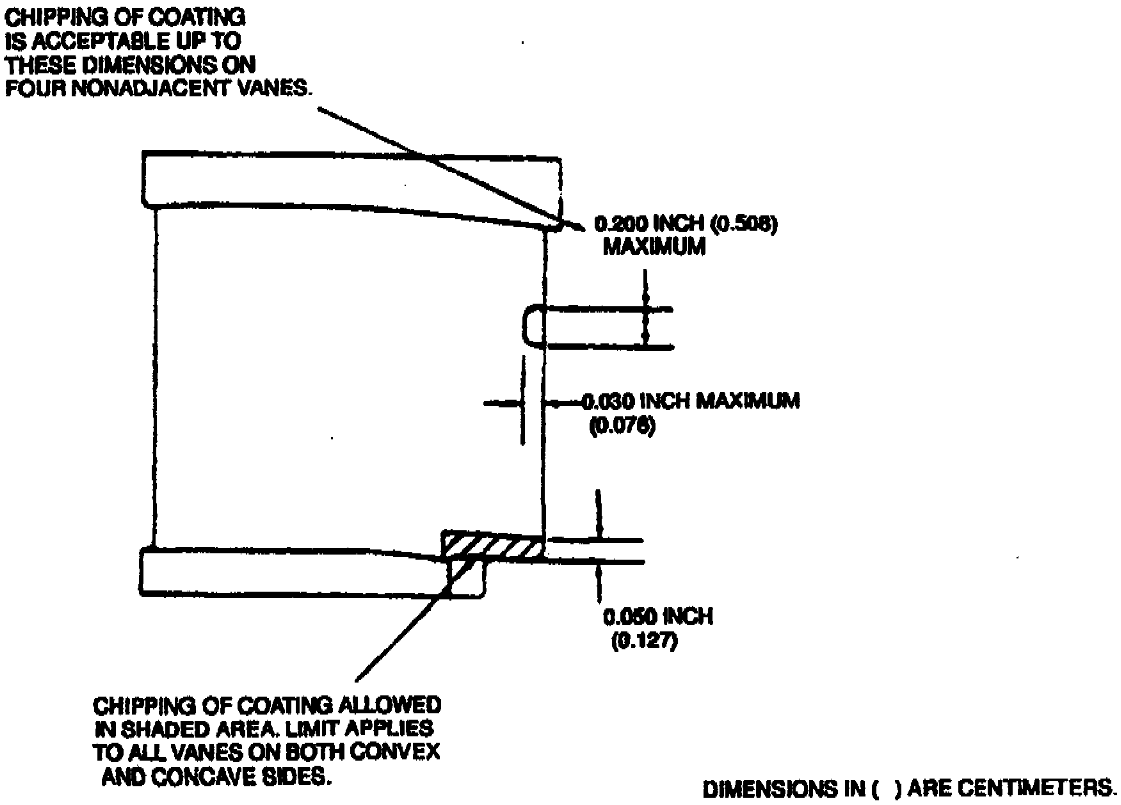
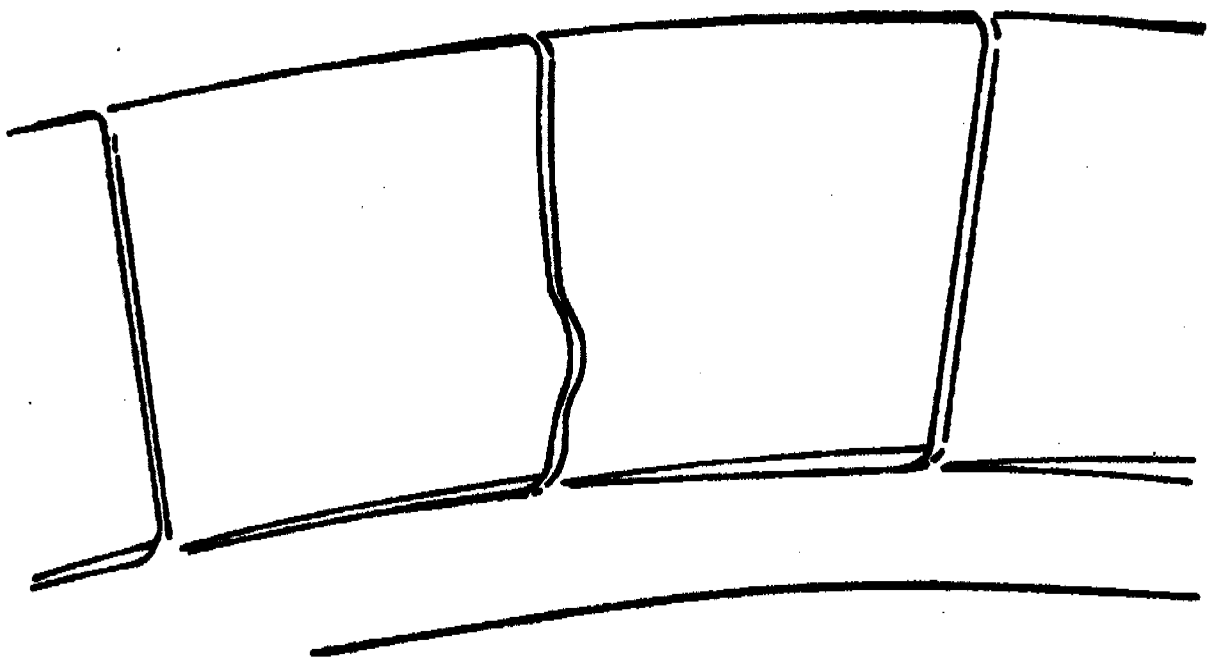


Figure 5-441. First Stage Gas Producer Nozzle Assembly Vane Trailing Edge Coating Chipping Limits.



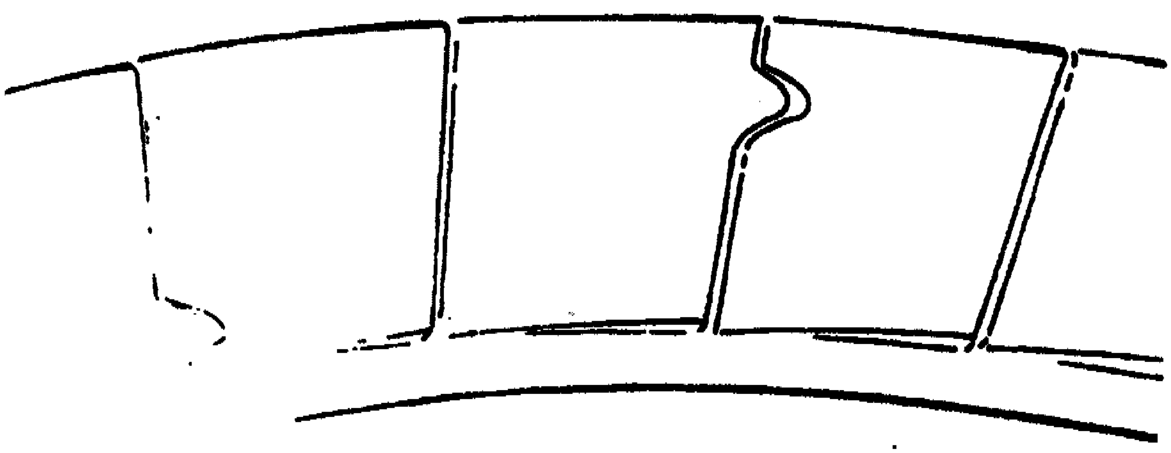
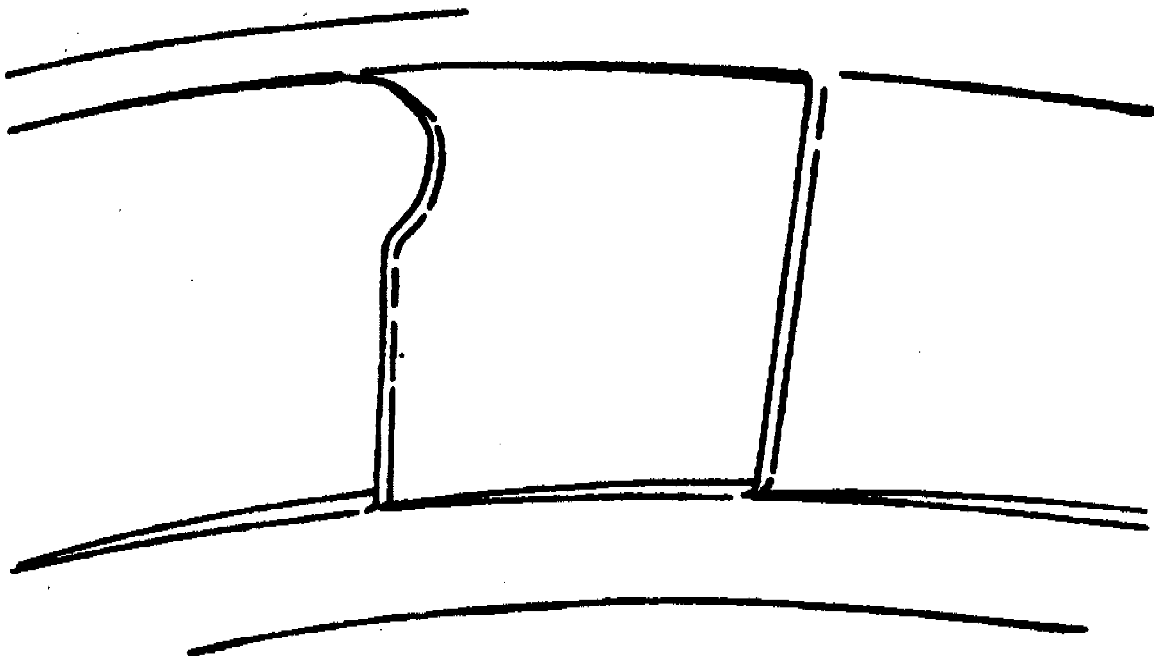


Figure 5-442. First Stage Gas Producer Nozzle Assembly; Typical Manufacturer's Blend-Repair Areas of Vane Trailing Edges (Sheet 1 of 2).



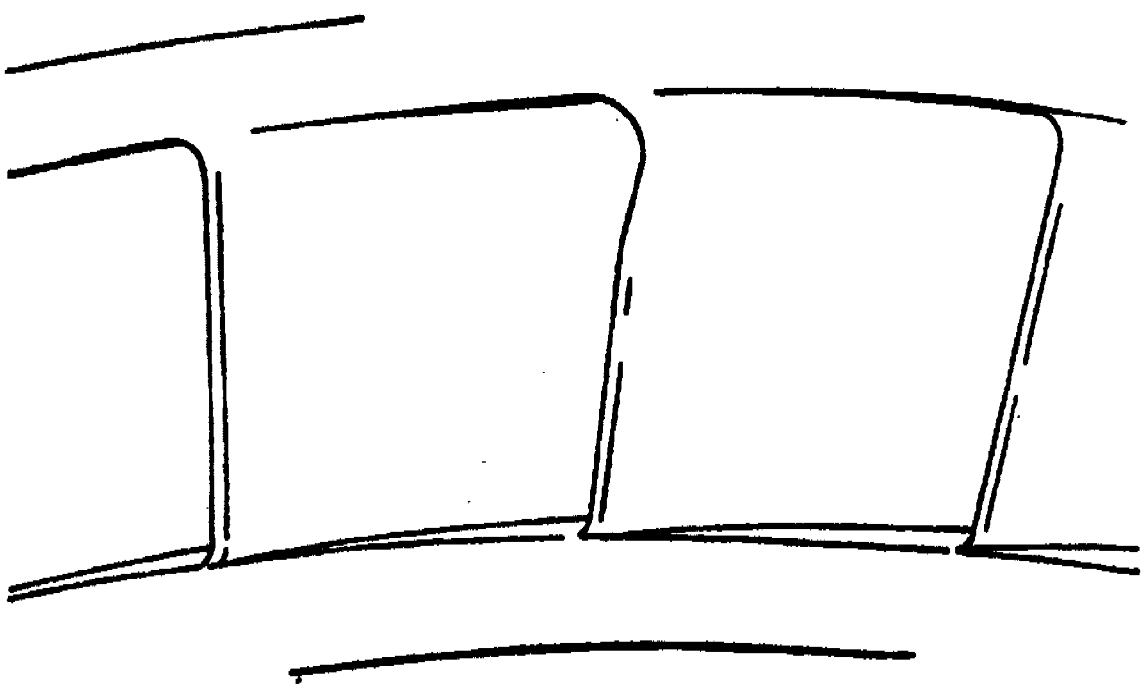


Figure 5-442. First Stage Gas Producer Nozzle Assembly; Typical Manufacturer's Blend-Repair Areas of Vane Trailing Edges (Sheet 2 of 2).

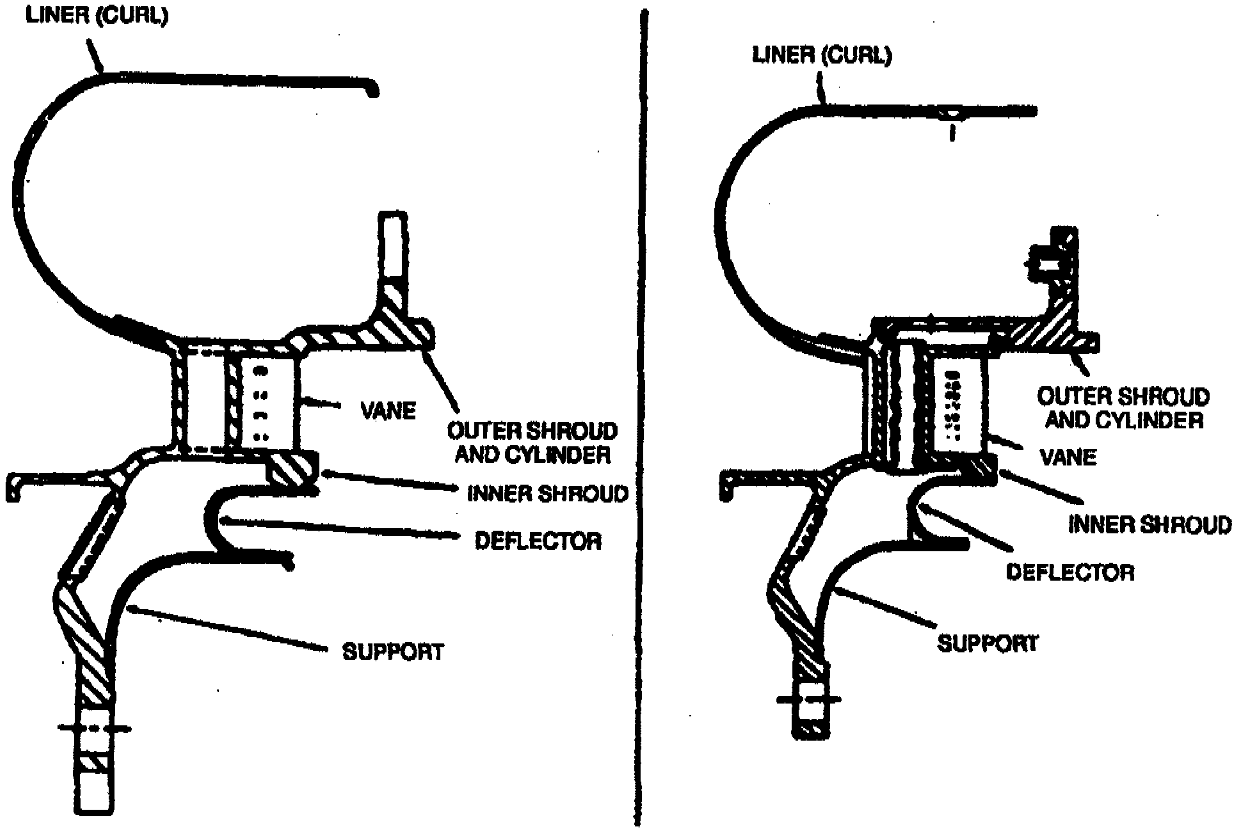


Figure 5-443. First Stage Gas Producer Nozzle Assembly Inspection Areas.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(3) Cracks in excess of 1/8 inch in width and not exceeding 180 degrees of deflector shall be repaired as follows:

(a) Tack-weld each end of crack.

(b) Close crack gap with clamps, vise or blocks, and fusion-weld.

(4) Inspect deflector spot weld area for cracks. Cracks extending around complete periphery of spot welded joint may be repaired provided there are no axial cracks, and metal is sound.

(a) Fusion-weld cracks per MIL-W-8611 with welding wire (item 348, table C–1), as outlined in SP No. 5001 in Appendix E.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(b) Fluorescent-penetrant inspect per MIL-STD-6866.

(5) Nonconverging axial cracks at inner/aft edge that do not exceed 1.5 inches may be repaired. Use fusion welding per MIL-W-8611 using welding wire (item 348, table C–1) as outlined in SP No. 5001 in Appendix E.

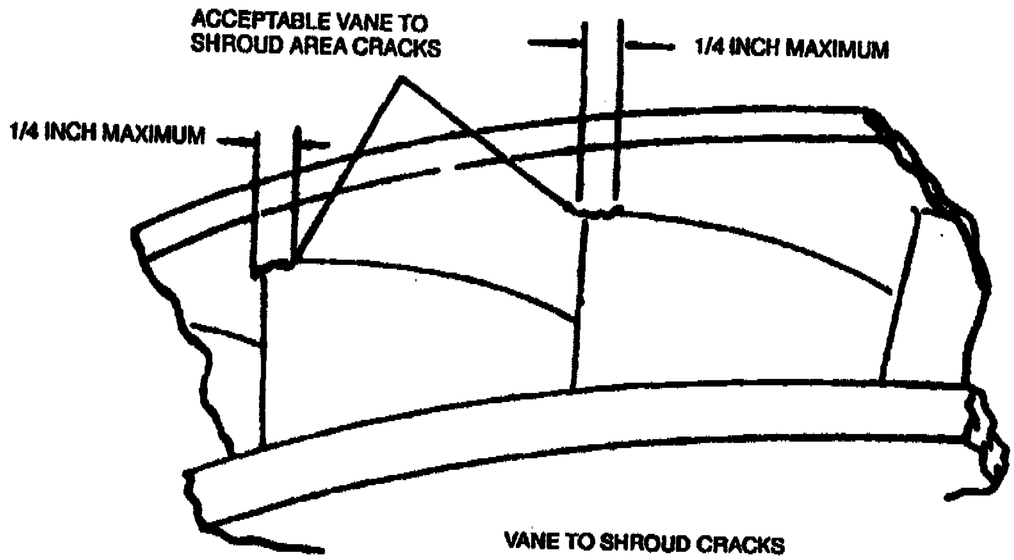
(6) Using material shown in table 5-150, repair cracks in inner flange (bolt hole ring and surrounding parent metal) by fusion welding.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(7) Inspect weld repairs by non-destructive inspection (fluorescent-penetrant) method.



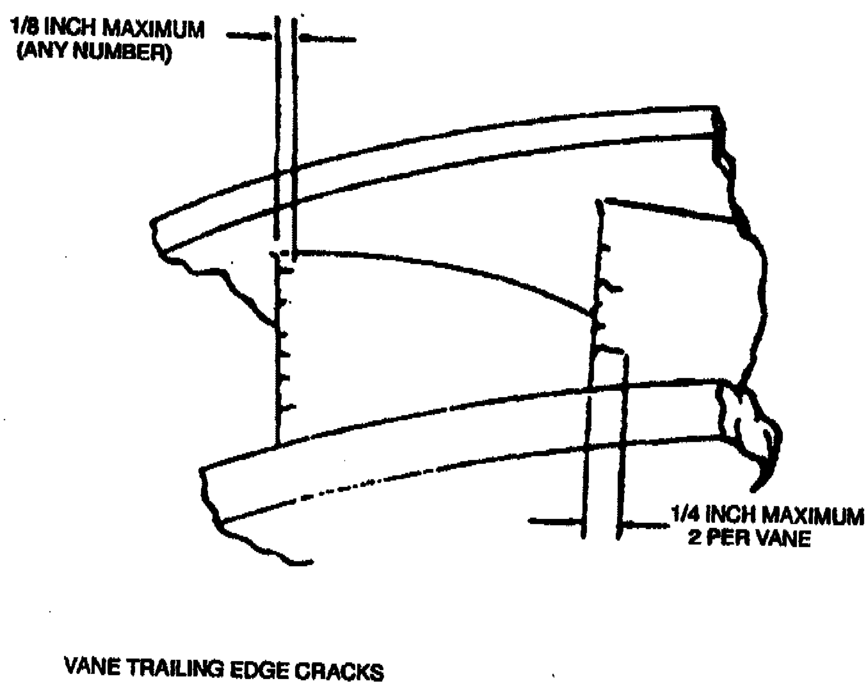


Figure 5-444. First Stage Gas Producer Nozzle Assembly Vanes Trailing Edge Inspection Limits.

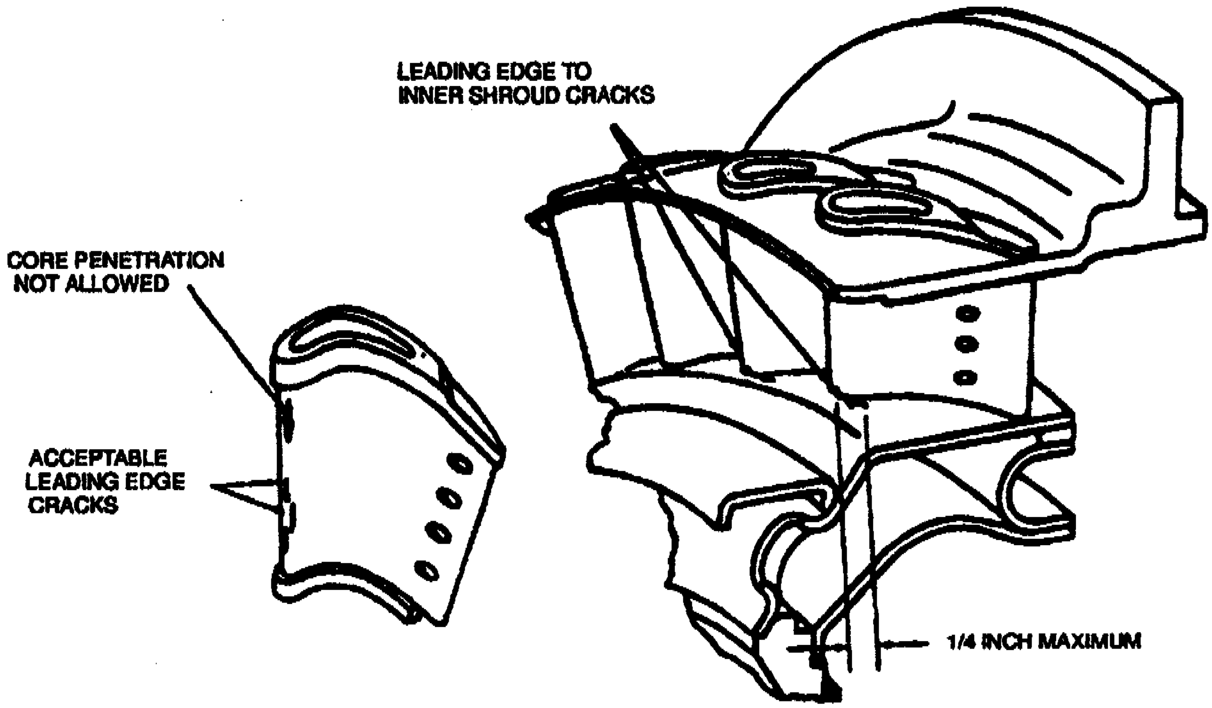


Figure 5-445. First Stage Gas Producer Nozzle Assembly Vanes Leading Edge Inspection Limits.

c. On first stage gas producer nozzle assembly (1-100-520-19) (12, figure 4-38) repair as follows:

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(1) Remove liner from assembly by machining. (See figure 5-450.) Inspect outer shroud spot weld areas for axial cracks. Weld cracks per MIL-W-8611 using welding wire (item 346, table C–1). Machine weld flush with parent metal, Perform fluorescent-penetrant inspection. If no other repair is required, replace liner per paragraph 5-460c(7).

CAUTION

In following step (2), do not reduce thickness of outer shroud.

(2) Remove remainder of liner by grinding existing spot welds.

(3) Remove deflector and support by machining. (See figure 5-451.) When deflector is removed, it is permissible to machine the shroud per manufacturer's drawing P/N 1-110-198-08, to facilitate brazing. Braze-repair voids/cracks using brazing alloy AMS4776, with a TIG torch as a source of heat.

NOTE

Machine of the 9.745 inch (24.752 cm) dimension shall remove only enough material to effect complete removal of old deflector and facilitate installation of new deflector.

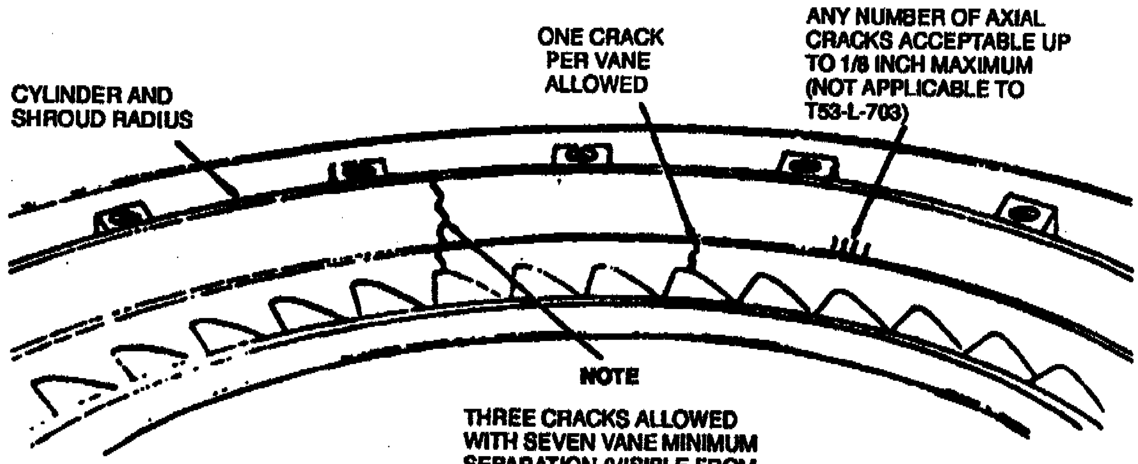


Figure 5-446. First Stage Gas Producer Nozzle Assembly Outer Shroud and Cylinder Inspection Limits.

NOTE

Mounting flange is allowed to be cracked without associated cylinder cracking, in one place.

NOTE

Alternate Method: Tack-weld and weld around using item 348, table C–1, per SP No. 5001, Appendix E.

(4) Remove damaged vanes as follows:

CAUTION

In following step (a), do not damage coating on adjacent shroud or vane surfaces.

NOTE

No more than seven adjacent vanes may be replaced in one braze cycle. If more than two adjacent vanes are replaced, position vanes per MFG DWG maintaining the required throat opening. If replacement of more than the initial seven adjacent vanes is necessary, position the next set of replacement lanes to a point farthest from the initial set of vanes. Continue this random positioning until all vanes are replaced.

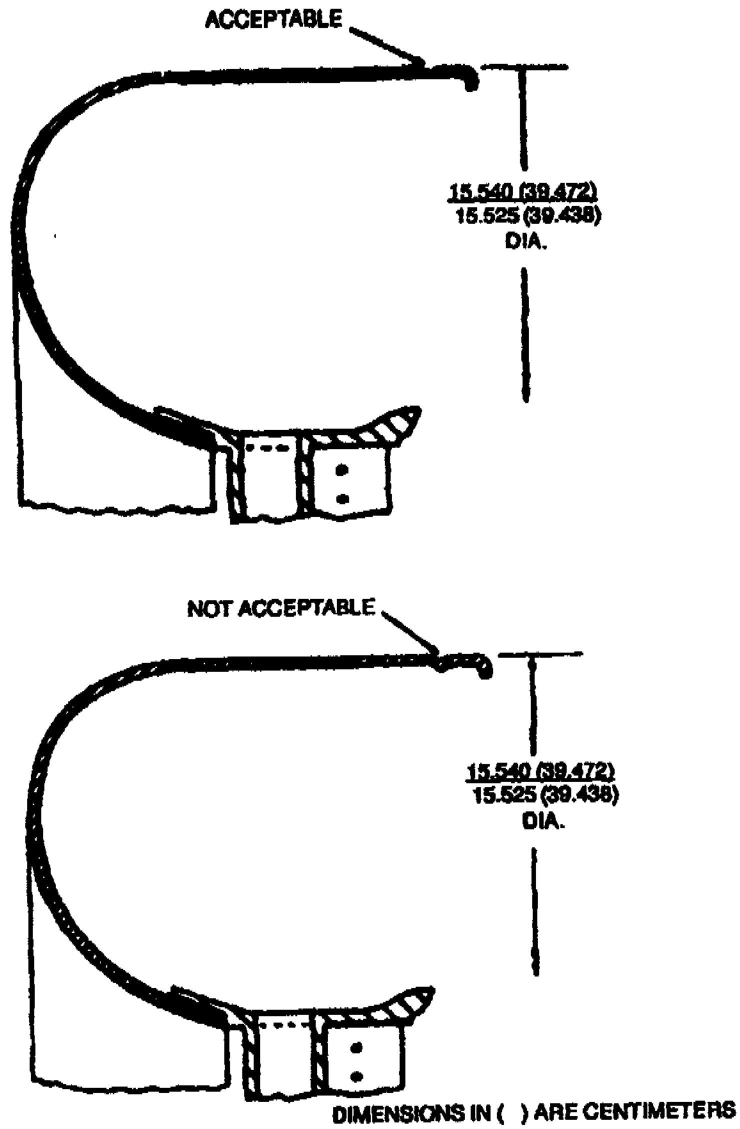


Figure 5-447. Nozzle Liner Curl Wear Inspection.

Table 5-150. Combustion Chamber Deflector- Weld Repair.

Area To Be Reworked	Material
Deflector	Welding Wire (Item 348, table C–1)
Support	Welding Wire (Item 348, table C–1)
Inner Flange	Steel Wire (Item 316, table C–1)

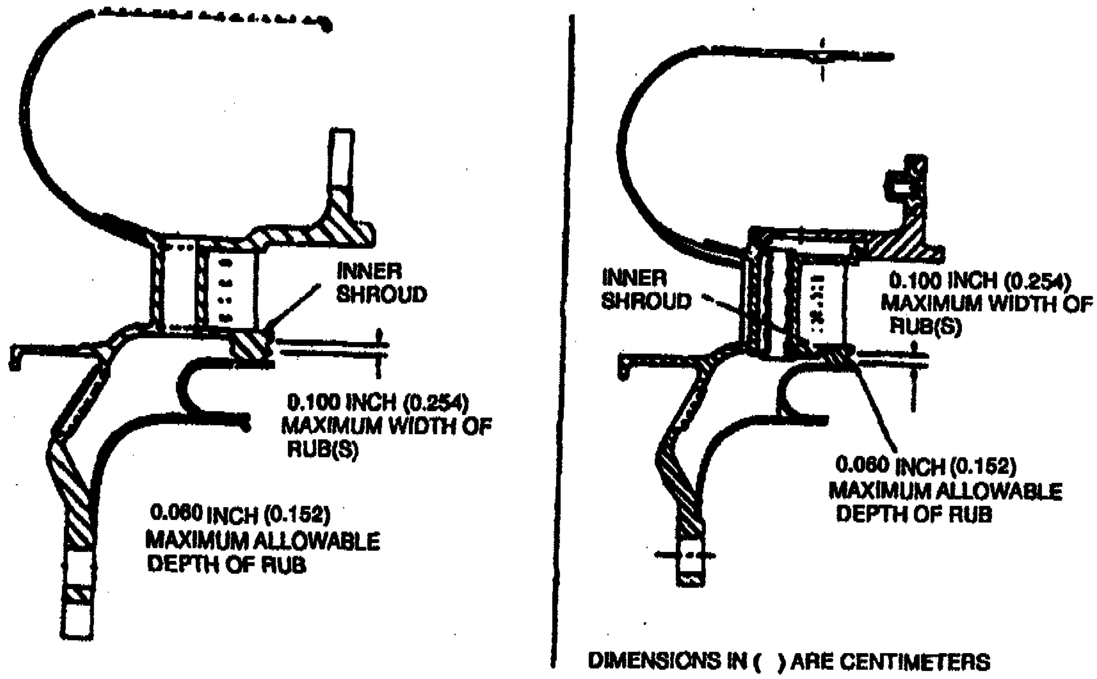


Figure 5-448. First Stage Gas Producer Nozzle Assembly Inner Shroud Rub Limits.

(a) Using an electric discharge machine and a flat copper or brass electrode, remove damaged vane(s) from flow path of nozzle. (See figure 5-452).

(b) Using an electric discharge machine and outer shroud electrode (LTCT11328), remove vane stubs from outer shroud.

(c) Using an electric discharge machine and inner shroud electrode (LTCT11327), remove vane stubs from inner shroud.

NOTE

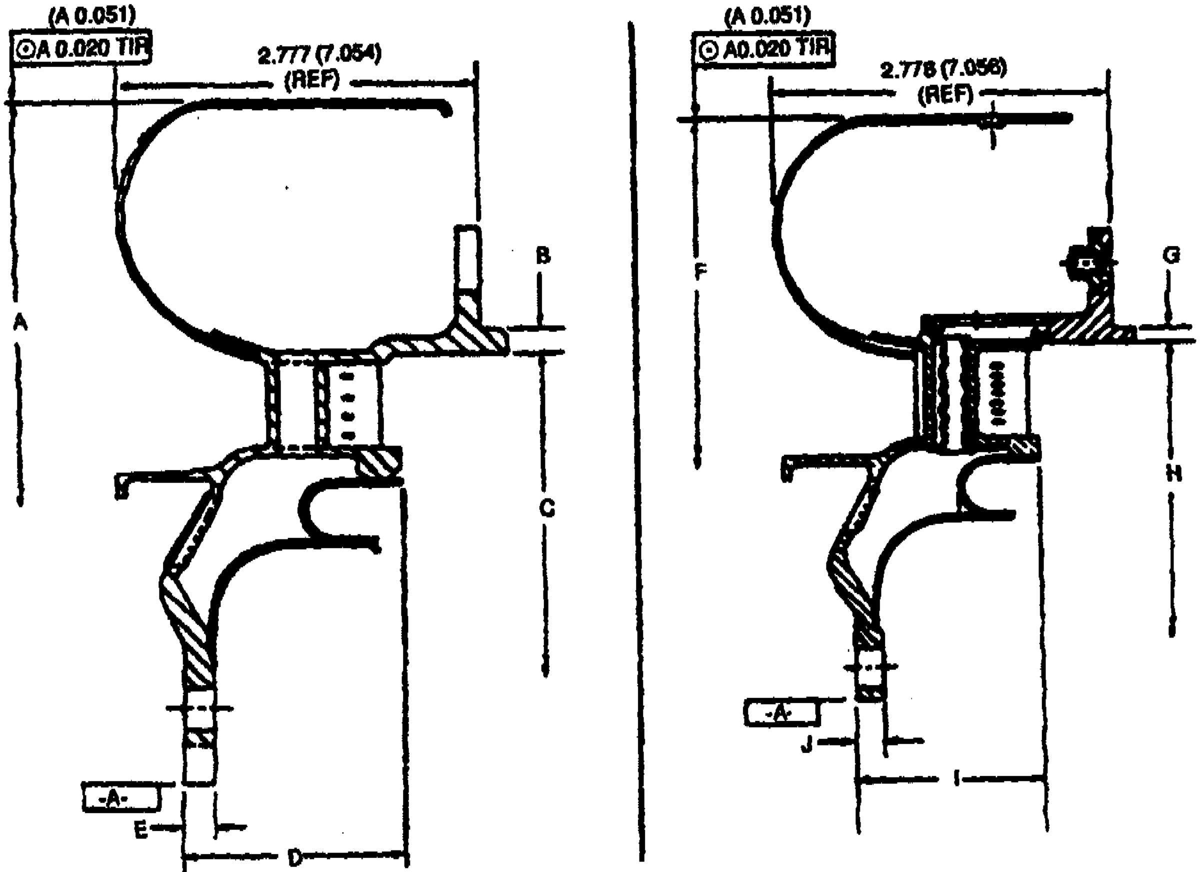
The following step is optional.

(d) Remove excess material and coating (0.004 inch (0.010 cm) minimum) for a maximum width of 0.120 inch (0.305 cm) all around vane slots on outside diameter of outer shroud and inside diameter of inner shroud.

NOTE

Holes in shrouds should provide for a clearance of 0.002 to 0.010 inch (0.005 to 0.025 cm) between replacement vane and shroud.

(e) Nickel plate inner and outer shroud braze joint area 0.0004 to 0.0008 inch just before brazing. (Refer to SP No. 6018 in Appendix E.) Bake at 255° to 275°F after plating for one hour.



DIMENSIONS IN ( ) ARE CENTIMETERS

Figure 5-449. First Stage Gas Producer Nozzle Assembly Dimensional Inspection Locations.

(5) Install vanes as follows:

(a) Clean areas to be welded with acetone (item 13, table C–1).

CAUTION

In following step (b), use care to prevent damage to coating on adjacent surfaces.

(b) Using stainless steel wire brush, clean electric discharge machine holes in shrouds and skirts or replacement vanes.

(c) Fit replacement vane(s) (1-110-192-11) into shrouds.

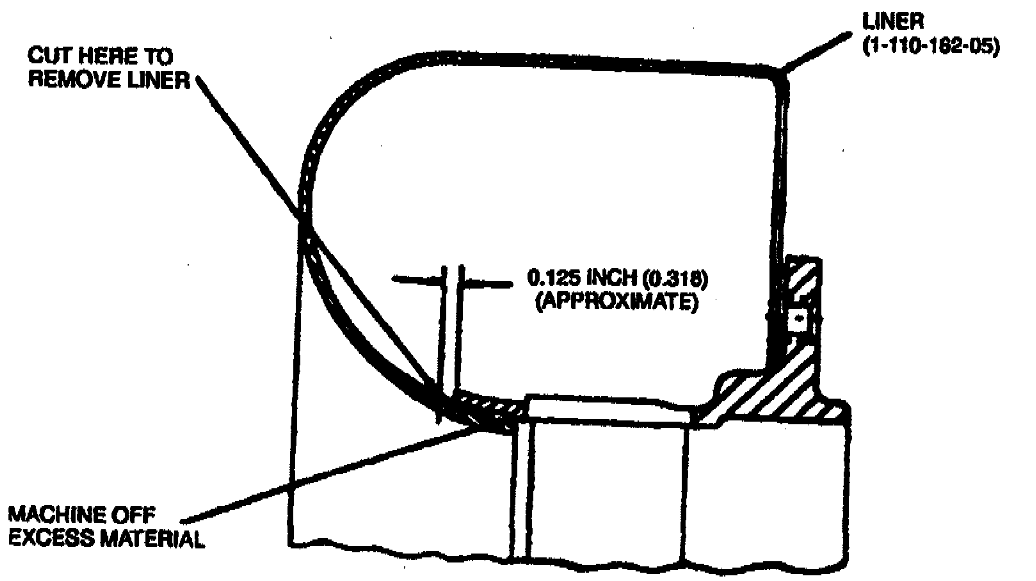


Figure 5-450. Removal of Liner (T53-L-13B, -15, -701, -701A, -703).

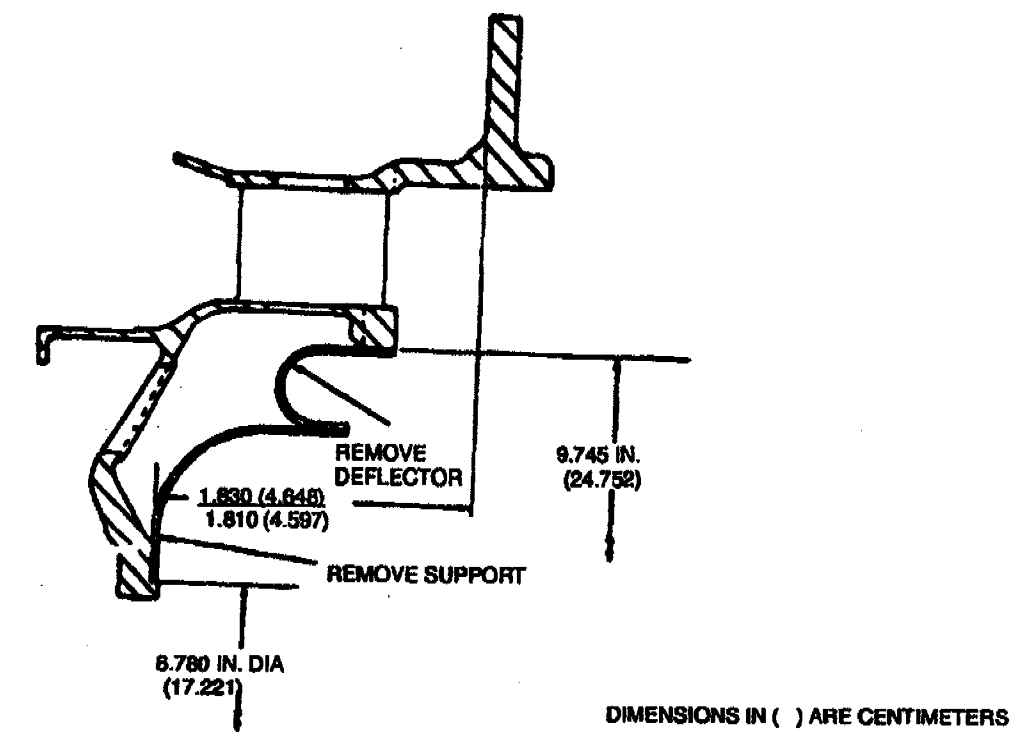


Figure 5-451. Removal of Support and Deflector (T53-L-13B, -15, -701, -701A).

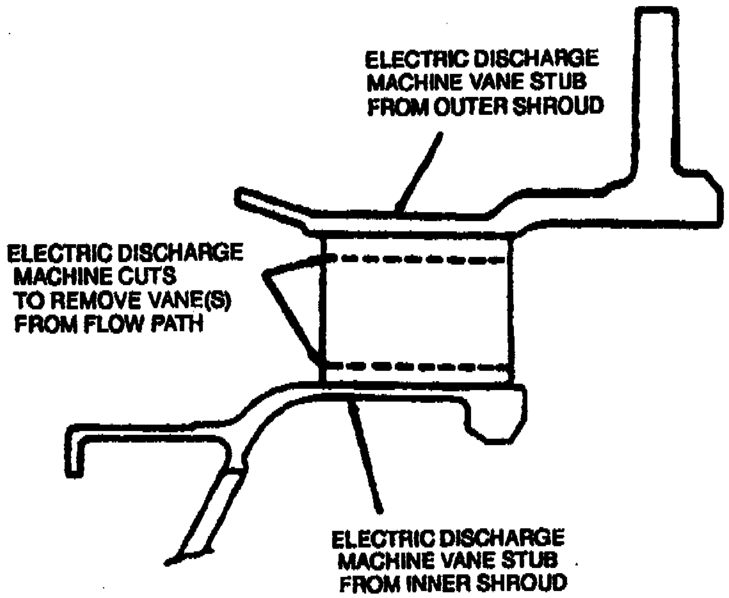


Figure 5-452. Removal of Vanes (T53-L-13B, -15, -701, -701A).

NOTE

Use stainless steel shim stock to maintain 0.002 to 0.010 inch (0.005 to 0.025 cm) clearance between the vane and shroud.

(d) Using welding wire (item 346, table C–1), tack-weld vane to shrouds as outlined in SP No. 5001, Appendix E.

(e) Clean areas to be brazed with acetone (item 13, table C–1).

(f) Apply brazing alloy (item 63, table C–1) to vane skirt (see figure 5-453).

(g) Vacuum-braze the assembly as outlined in SP No. 5004, Appendix E.

NOTE

Braze deposit at junction of shroud and vane is allowed within area cleared by 0.060 inch (0.152 cm) radius gage. Excess braze deposits shall be ground smooth. No undercutting of shroud or vane is allowed.

Table 5-151. First Stage Gas Producer Nozzle - Geometric Flow Area Inspection Limits (T53-L-13B, -15, -701, 701A).

DEFECT	INSPECTION LIMITS
Geometric Flow Area (GFA)	Nozzles may have GFA inspection as an alternative to EFA inspection. Use area flow comparator set (LTCT6483) and digital transducer (LTCT6339). a. If the GFA is within the 10.63 to 10.95 square-inch limit, eradicate the original GFA number, using a vibropreen etching tool, and mark the new GFA number approximately one inch to the right of the old GFA number. b. Overhaul nozzles that have been repaired or originally manufactured to previous GFA limit of 10.84 to 11.04 square inches may be utilized on a use-to-depletion basis. c. Any nozzle being processed for repair by vane replacement should have the vanes installed to obtain the GFA within 10.63 to 10.95 square inches. **NOTE** It may be uneconomical or not practical to revise the GFA to the desired value. In this situation, areas within the previous GFA limit of 10.84 to 11.04 square inches may be used; however, priority should be given to the new GFA values for optimum engine test requirements.

CAUTION

In following step (h), when removing excess braze material, use care to avoid damage to adjacent coated area.

(h) Remove excess braze from repair area.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(i) Perform a visual and fluorescent-penetrant inspection of the brazed areas.

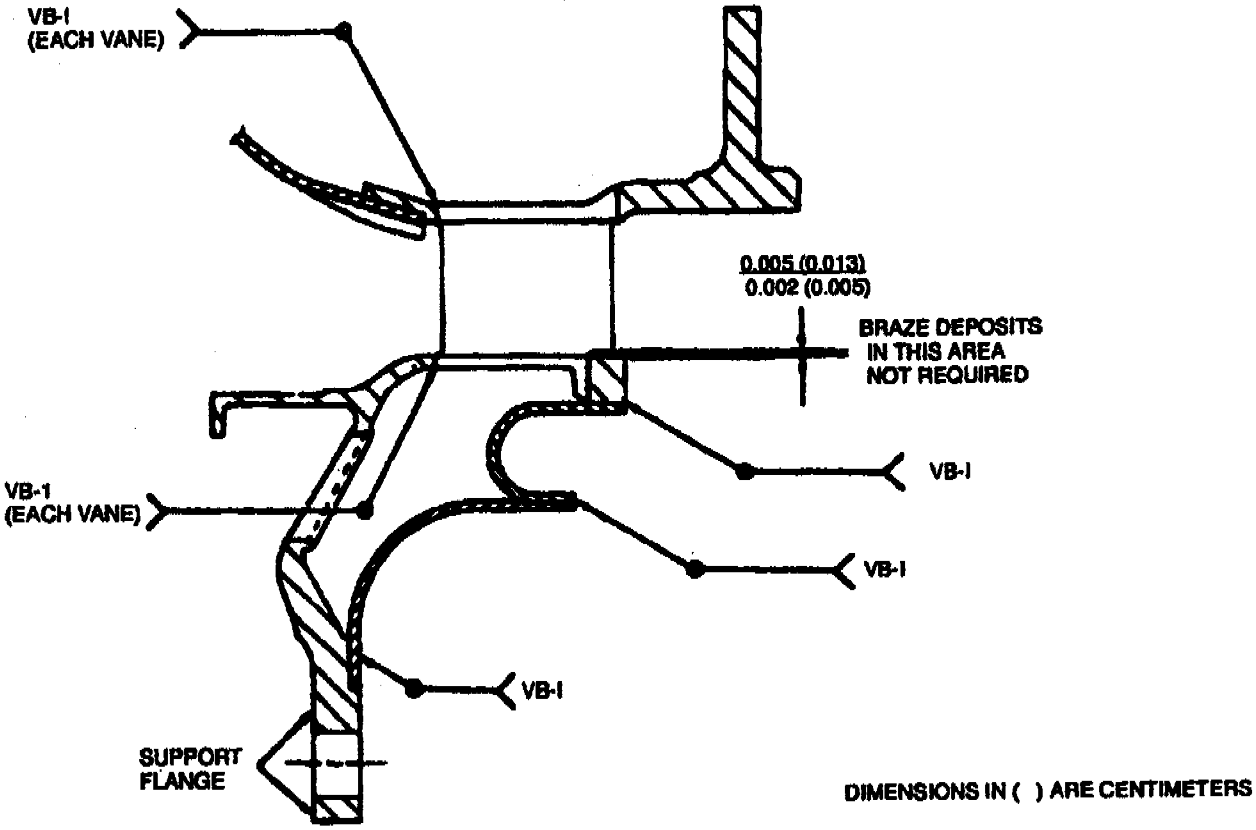


Figure 5-453. First Stage Gas Producer Nozzle - Location of Brazements (T53-L-13B, -15, -701, -701A).

NOTE

Vane-to-shroud braze joints, which do not conform to requirement in table 5-152, may be rebrazed. Brazed voids or cracks may be repaired using alloy AMS4776 with a TIG torch as a source of heat.

(6) Install deflector and support as follows:

(a) Clean nozzle, deflector (1-110-164-03), and support (1-110-165-02) with acetone (item 13, table C–1).

CAUTION

In following step (b), mask all adjacent coated surfaces.

(b) Vapor-blast all deflector and support braze joints as outlined in SP No. 3003 in Appendix E.

Table 5-152. Visual and Fluorescent-Penetrant Acceptance Limits for Brazed Joints.

Brazed Joint	Cracks	Voids	Lack of Braze	Surface Porosity	Cumulative Indications
Vane to Outer Shroud	Not allowed	0.120 inch (0.305 cm) maximum length. 0.120 inch (0.305 cm) maxmum, cumulative length per vane. 0.60 inch (1.52 cm) maximum cumulative length per assembly	0.120 inch (0.305 cm) maximum length. 0.25 inch (0.64 cm) maximum cumulative length per vane	0.120 inch (0.305 cm) maximum length 0.250 inch (0.635 cm) maximum cumulative length per vane	0.350 inch (0.889 cm) per vane
Vane to Inner Shroud	Not allowed	0.250 inch 0.635 cm) maximum length. 0.250 inch (0.635 cm) maximum cumulative length per vane. 1.50 inch (3.81 cm) maximum cumulative length per assembly	0.120 inch (0.305 cm) maximum length. 0.25 inch (0.64 cm) maximum cumulative length per vane	0.120 inch (0.305 cm) maximum length. 0.25 inch (0.64 cm) maximum cumulative length per vane	0.50 inch (1.27 cm) per vane. Not more than 15 percent of joints/assembly shall exceed 0.40 inch (1.02 cm)
Deflector to Support	Not allowed		0.25 inch (0.64 cm) maximum length. 0.25 inch (0.64 cm) cumulative length 0.25 (0.64 cm) distance be-tween indications.	5.0 inches (12.7 cm) cumulative length	
Deflector to Nozzle	Not allowed		0.50 inch (1.30 cm) maximum length. 1.0 inch (2.5 cm) maximum cumulative length	16.0 inches (40.6 cm) cumulative length	
Support to Nozzle			1.0 inches (2.5 cm) minimum distance between indications		

CAUTION

The following step (c), use care to prevent damage to coated surfaces adjacent to brazed areas.

(c) Using stainless steel wire brush, clean braze area on nozzle.

(d) Install new deflector (1-110-164-03) and support (1-110-165-02)

NOTE

Use stainless steel shim stock to maintain an optimum brazing gap 0.002 to 0.005 inch (0.005 to 0.013 cm) between shroud and deflector, deflector and support, and support and flange. Isolated areas of the braze gap may have clearances up to 0.010 inch (0.025 cm). (Refer to table 5-152.)

(e) Using welding wire (item 346, table C–1), tack-weld in 16 equally spaced places at deflector to inner shroud, 12 equally spaced places at support to deflector, and eight equally spaced places at mounting flange to support as outlined in SP No. 5001 in Appendix E.

(f) Clean areas to be brazed with acetone (item 13, table C–1).

(g) Apply brazing alloy (item 63, table C–1) to areas shown in figure 5-453.

(h) Support nozzle on mounting flange, and vacuum-braze as outlined in SP No. 5004. In Appendix E.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(i) Perform a visual and fluorescent-penetrant inspection of the brazed areas. (Refer to table 5-152.)

(j) Machine assembly to dimensions shown in figure 5-454.

(k) Perform a fluorescent-penetrant inspection of the assembly. (Refer to table 5-152.)

(7) Install liner as follows:

(a) Using cotton bob, clean tack-weld areas on outer shroud and liner (1-110-162-05).

(b) Clean areas to be welded with acetone (item 13, table C–1).

(c) Assemble liner to nozzle in weld repair fixture (LTCT11049). Maintain a 0.001 to 0.002 inch (0.003 to 0.005 cm) diametrical gap for resistance spot welding.

NOTE

Centerlines of louvers must be in line with centerlines of vanes.

(d) Spot-weld liner to outer shroud as outlined in SP No. 5002 in Appendix E. (See figure 5-455).

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection of the following part (to ensure that cracks are within limits) is flight safety critical.

(e) Perform a fluorescent-penetrant inspection of the assembly.

NOTE

Cracks are not acceptable, regardless of size or position.

(f) Inspect dimension of repaired nozzle assembly for conformance to those specified in figure 5-449.

d. Perform an overbridge repair of first stage gas producer nozzle assembly (1-100-520-19) (12, fig. 4-38) as follows:

(1) Remove liner assembly. (Refer to figure 5-450.)

(2) Remove cylinder mounting flange by machining. (Refer to figure 5-456.)

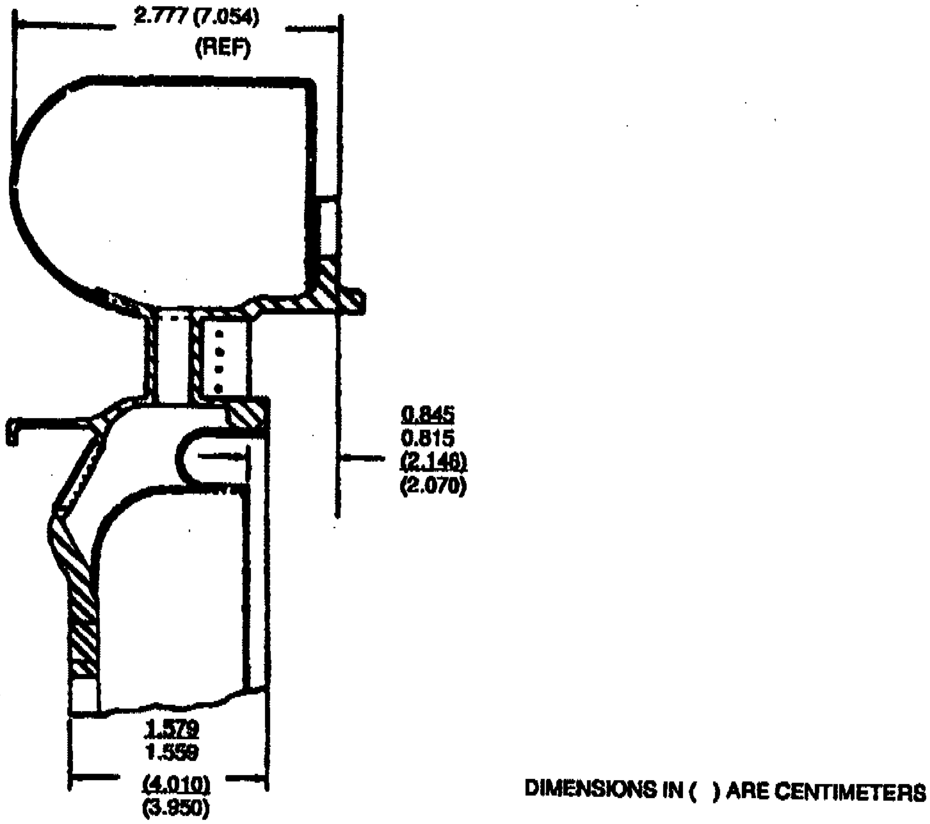


Figure 5-454. First Stage Gas Producer Nozzle - Final Machine Dimensions (T53-L-13B, -15, -701, -701A).

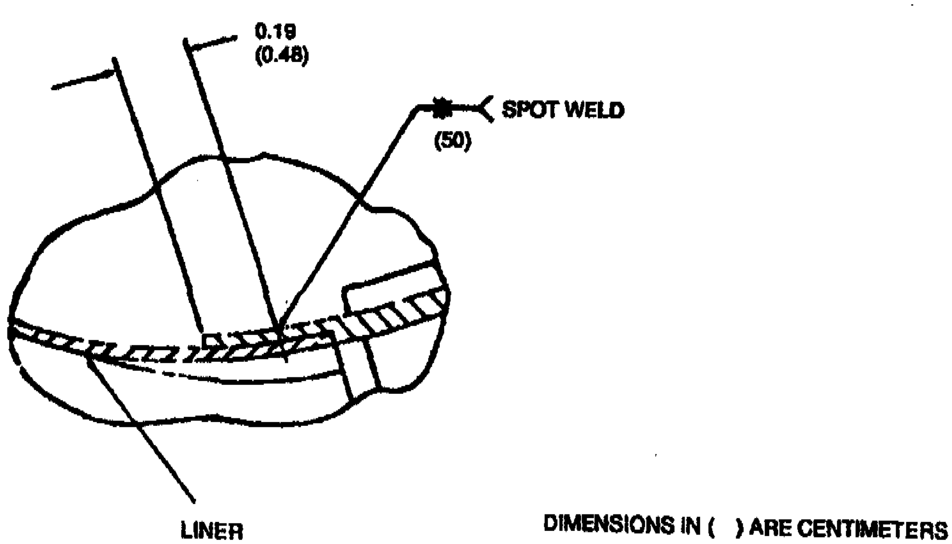


Figure 5-455. Spot Weld of Liner.

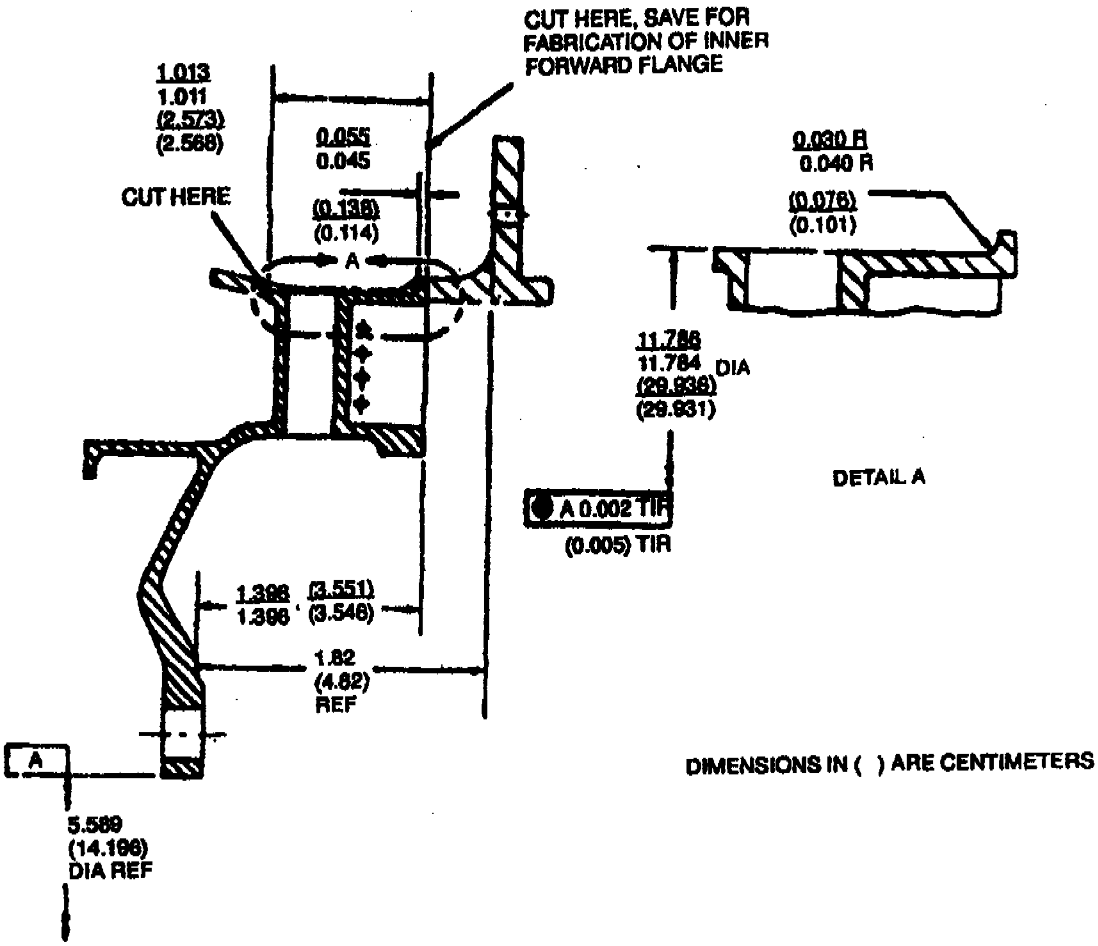


Figure 5-456. Machining of Outer Shroud and Cylinder.

(3) Remove remaining step on O.D. of shroud by machining surface to 11.860 - 11.780 inches diameter. Refer to figure 5-457.

(4) If necessary, machine forward portion of outer shroud to provide a uniform surface for brazing. Maximum depth of machining to be 0.010 inch for 0.096 inch axial length as shown in figure 5-458. Nickel plate O.D. of outer shroud for 0.096 inch and 0.050 inch reference as shown in figure 5-458. Plate thickness to be 0.0004 - 0.0008 inch. Perform plating in accordance with SP No. 6018 in Appendix E.

(5) Fabricate an overbridge ring from M3602 material. The inner diameter must allow a 0.002 - 0.005 braze gap between the nozzle and the ring itself at assembly. Outer diameter must be 12.030 - 12.031 inches at assembly for E.B. weld processing. (Refer to figure 5-463). Split ring to aid in assembly. Inner diameter and ring ends are to be nickel plated per paragraph (4) above. Plate thickness to be 0.0004 - 0.0008 inch.

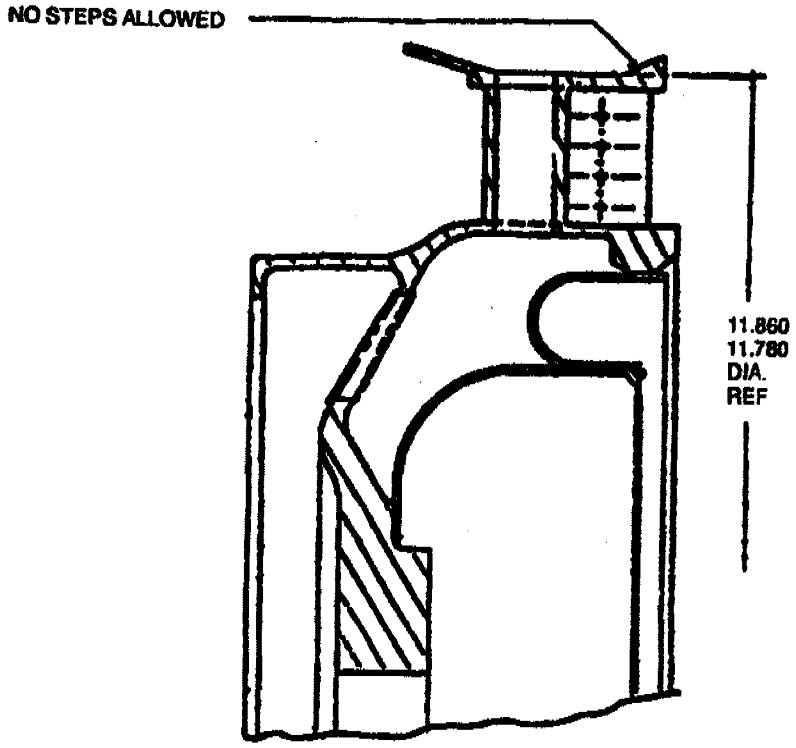


Figure 5-457. Machining of Forward Portion of Outer Shroud.

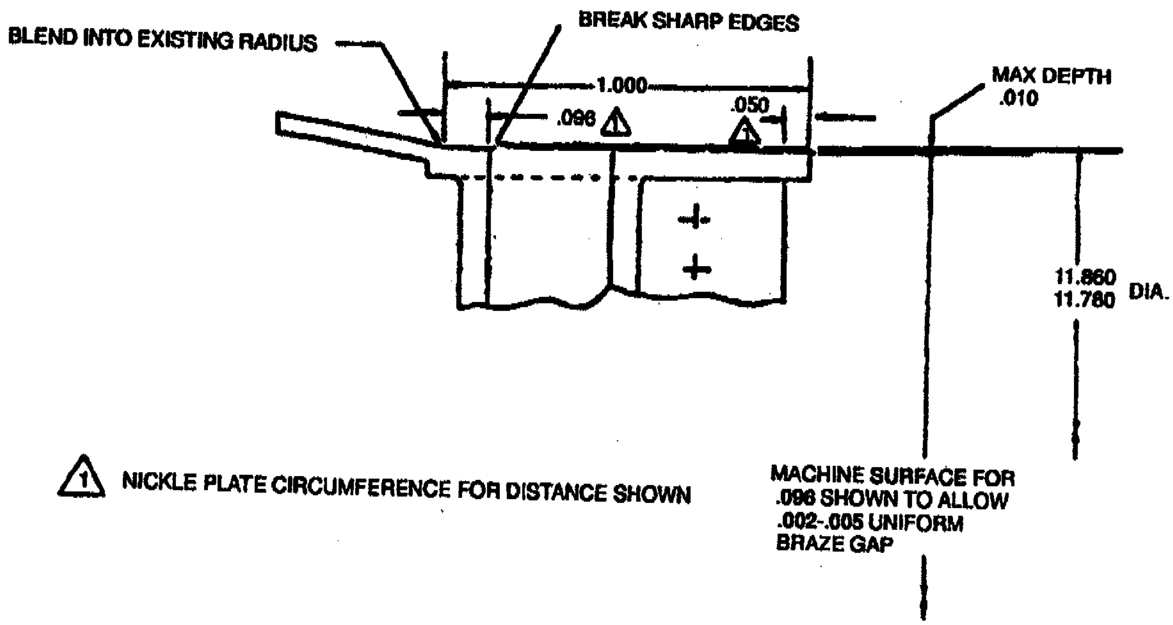


Figure 5-458. Machining and Plating of Outer Shroud.

(6) Fabricate a sealing ring from M3602 material. Inner diameter must allow a 0.002 to 0.005 braze gap between the nozzle and the ring itself at assembly. (Refer to figure 5-459.) Split ring to aid in assembly. Inner diameter and ring ends are to be nickel plated per paragraph (4).

(7) Position rings on nozzle. Maintain a 0.002 to 0.005 braze gap between I.D. of rings and O.D. of nozzle. Also maintain 0.002 to 0.005 braze gap between ends of split rings. (Refer to figure 5-459).

(8) Tack weld overbridge ring to nozzle between each vane passage. Tack weld sealing ring to nozzle at ten evenly spaced points. Use welding rod (item 348, table C–1) in accordance with SP No. 5001 in Appendix E. Refer to figure 5-465.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(9) Visual and fluorescent penetrant inspect welds. (Refer to MIL-STD-6866.) No cracks allowed.

(10) Prepare and mask nozzle for brazing. (Refer to SP No. 5004, Appendix E.) Mask vane cooling cores to prevent braze from interfering with cooling passages.

(11) Vacuum braze rings using filler material (item 57, table C–1) in accordance with SP No. 5004 in Appendix E. (Refer to figure 5-466.)

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(12) Fluorescent penetrant inspect brazements. (Refer to MIL-STD-6866.) No cracks allowed. Perform ultrasonic inspection.

(13) If necessary, machine O.D. of overbridge ring to 12.030 to 12.031 inch diameter.

(14) Fabricate a filler strip to provide a 0.000 to 0.002 diametral interference fit between nozzle and overbridge. (Refer to figures 5-469 and 5-471.)

(15) Clean and prepare overbridge (1-110-255-06), selected filler strip and nozzle for electron beam welding. (Refer to SP No. 5005, Appendix E and figures 5-470 and 5-471.)

(16) Assemble details in a suitable fixture for E.B. welding. (Refer to SP No. 5005, Appendix E.) Assemble overbridge and filler strip to nozzle with a 0.000 to 0.002 inch interference fit. Allowable gap between overbridge and trailing edge of nozzle shroud is 0.000 to 0.002 inch. (Refer to figure 5-471.)

(17) E.B. weld overbridge to nozzle. (Refer to SP No. 5005, Appendix E.)

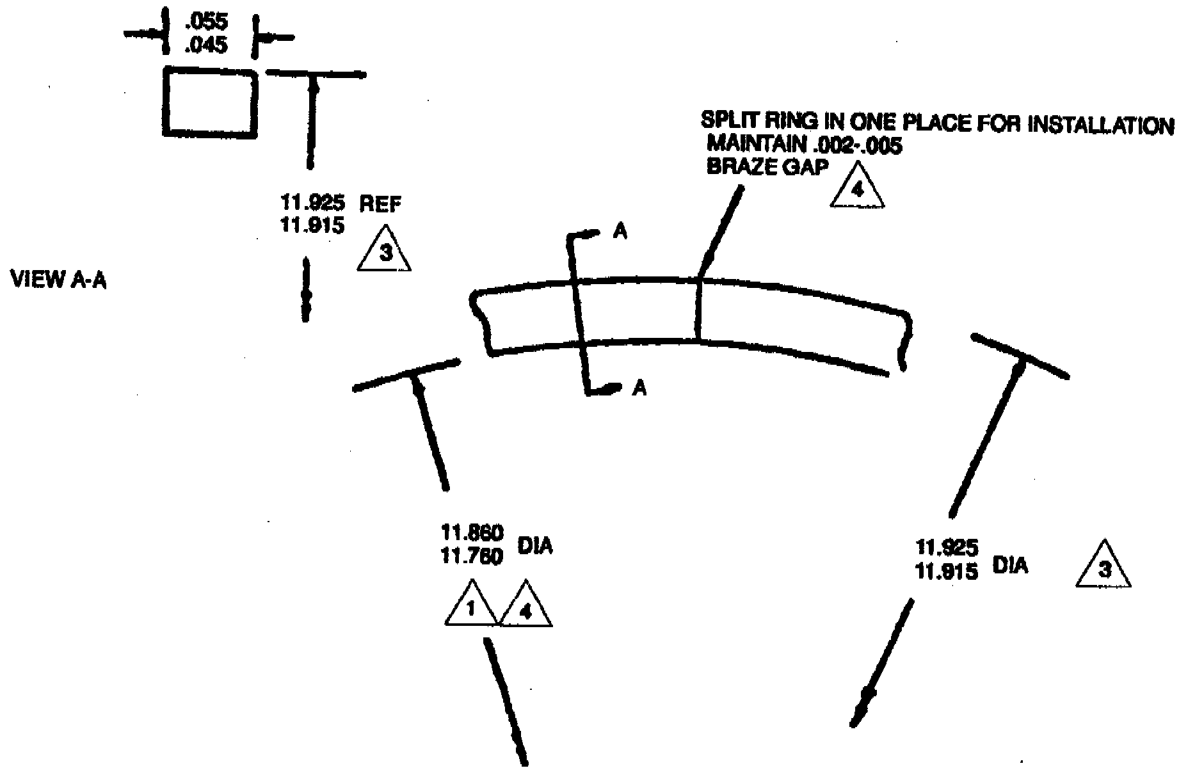
(18) Perform visual and ultrasonic inspection of weld.

(19) Finish machine overbridge mounting flange. (Refer to figures 5-470 and 5-471.)

(20) Install liner as follows:

(a) Using cotton bob, clean tack weld areas on outer shroud and liner (1-110-162-05).

(b) Clean areas to be welded with acetone (item 13, table C–1).



1 INNER DIAMETER MUST ALLOW .002-.005 BRAZE GAP BETWEEN RING AND NOZZLE O.D. AT ASSY

2 MAKE FROM M3602 MATERIAL (LYC SPEC)

3 NON MANDATORY DIMENSION MAY BE VARIED BUT, MUST FINALLY MEET REQUIREMENTS OF END PRODUCT.

4 NICKLE PLATE I.D. AND SPLIT SURFACES

Figure 5-459. Fabrication of Sealing Ring.

(c) Position replacement liner (1-110-162-05) to nozzle maintaining 0.001 to 0.020 inch diametral gap for resistance spot welding. (Refer to figures 5-470 and 5-471.)

(d) Install nozzle and liner in fixture (LTCT11049) and align liner with nozzle vanes. Centerlines of louvers in liner must be located centrally between vanes at outer shroud within 0.05 inch.

(e) Spot-weld liner to outer shroud as outlined in SP No. 5002, Appendix E. (Refer to figures 5-470 and 5-471.)

(21) Inspect spot welds as outlined in SP. No. 5002 and the following:

(a) Linear indications up to 0.250 maximum length shall be allowed in 8 spot welds.

(b) Spot welds with linear indications must be separated by a minimum of 5 spot welds without linear indications.

(22) Install serrated nuts (1-300-623-01) with installing tool (LTCT6000). (Refer to figure 5-476.) Insure that nut swaged securely in place.

(23) Using vibropeen method, identify part with "PRP1209" in close proximity existing part number.

e. Removal of old liner alternate procedure.

(1) Cut off end liner 1.488 ± 0.005 inches (3.780 ± 0.013 cm) from aft end of nozzle.(Refer to figure 5-472.) Section removed may be re-installed if dimensional criteria can be maintained.

(2) Clean area to be welded using vapor-blast process.

(3) Cut off end of replacement liner, P/N 1-110-162-05, 1.488 ± 0.005 inches (3.780 ± 0.013 cm), from AFT end. (Refer to figure 5-473.)

NOTE

It is recommended that a serviceable, used liner be used from a scrapped nozzle, or from that nozzle being repaired. Procure a new liner if this is not possible.

(4) Clean area to be welded using vapor-blast process.

f. Alternate procedure for installation of replacement liner.

(1) Position replacement end piece onto nozzle P/N 1-110-520-19.

(2) Using suitable fixture, butt the two liners together.

NOTE

Cold working of either liner may be required to maintain contour.

(3) Tack-weld in twelve (12) places using welding rod AMS5786.

(4) TIG-weld completely around liner using AMS5786.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(5) Inspect weld using fluorescent-penetrant method.

(6) Inspect TIG-weld.

(7) Dimensionally inspect the nozzle per figure 5-474.

g. Repair rub grooves on inner shroud of all nozzles adjacent to deflector area as follows:

(1) Clean nozzle using the dry cleaning solvent method (per SP. No. 3002 in Appendix E)

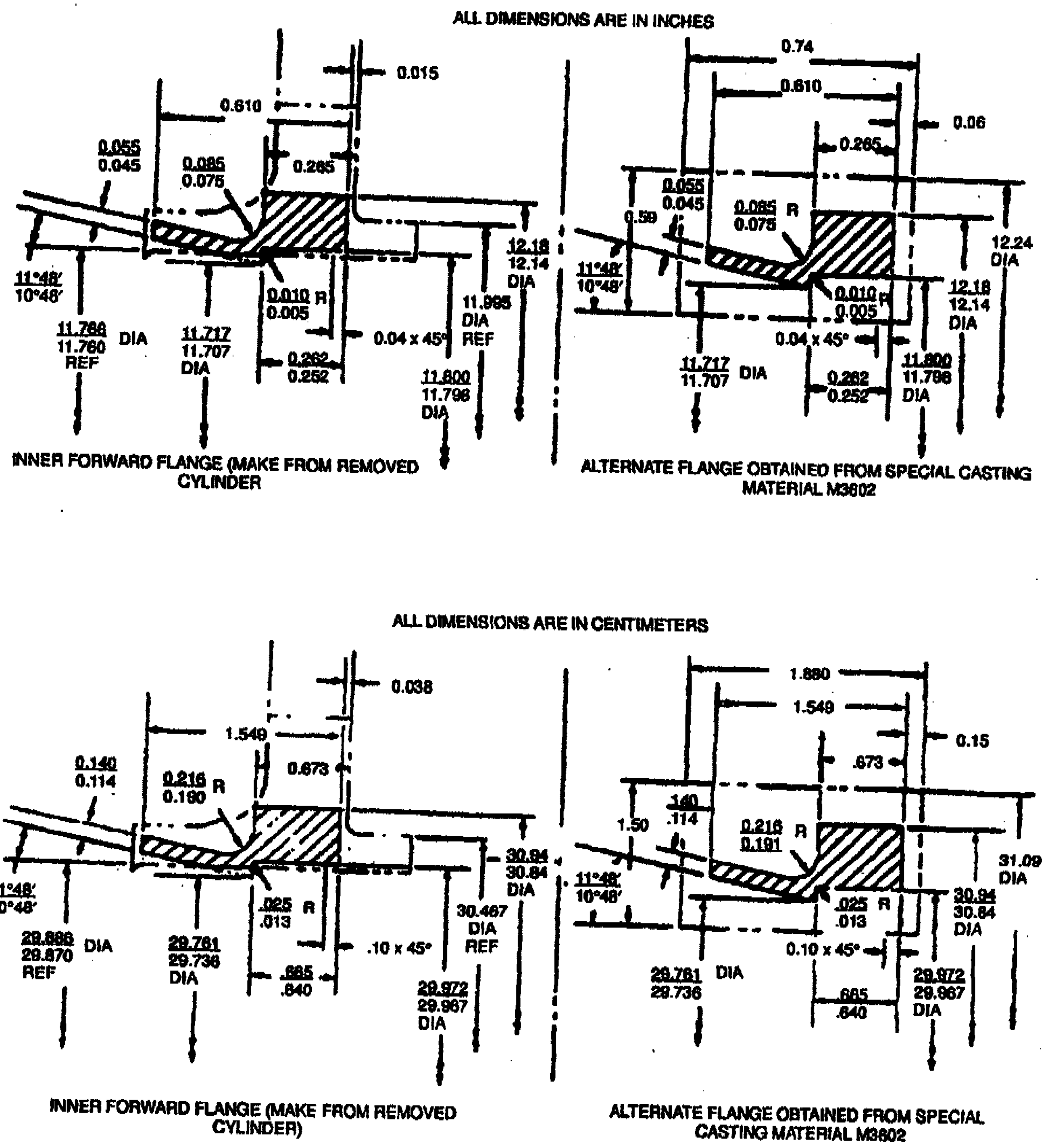


Figure 5-460. Fabrication of Inner Forward Flange.

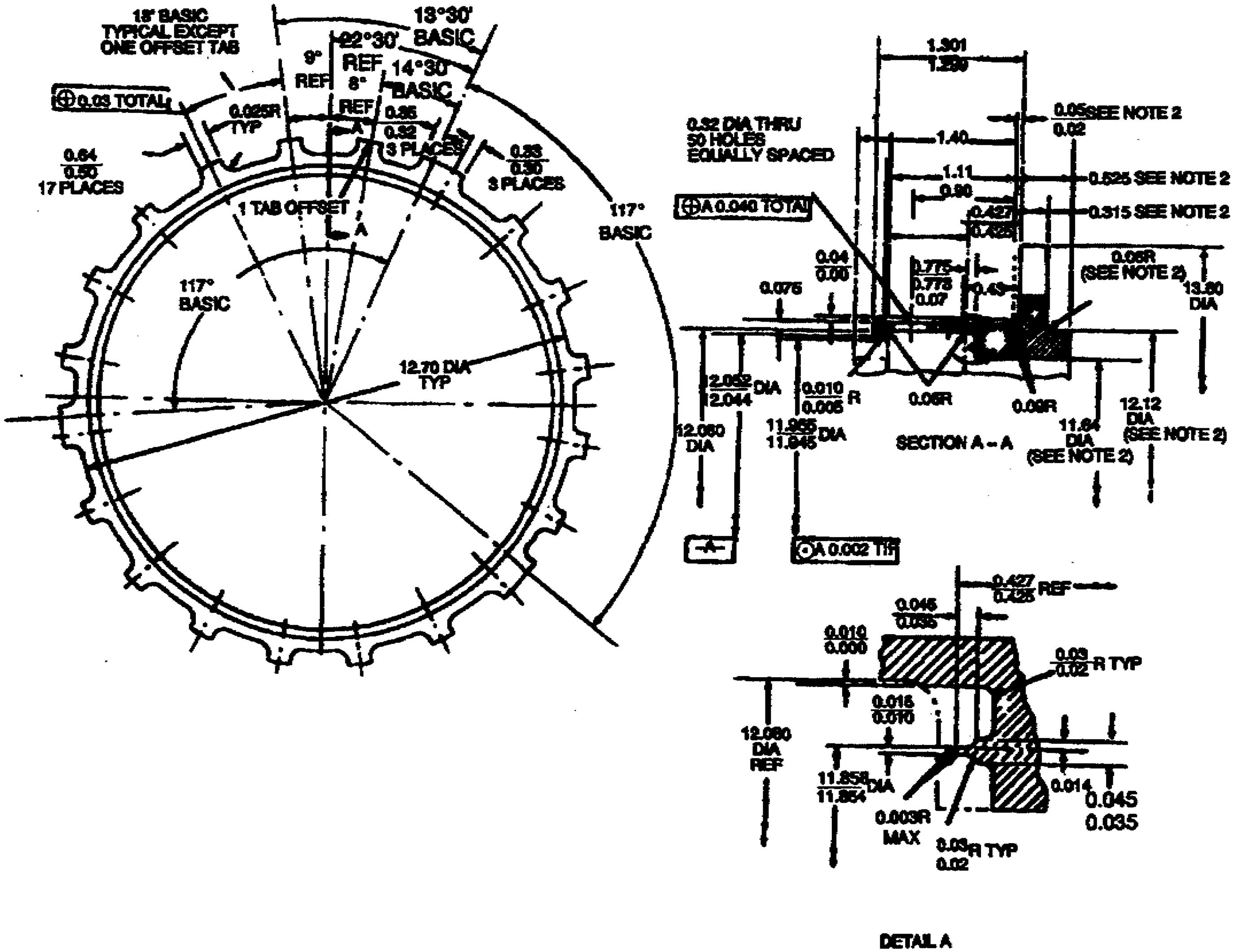


Figure 5-461. Fabrication of Overbridge Flange (English).

NOTE

1. All dimensions are in inches.
2. Non Mandatory dimensions may be varied for process and manufacturing purposes but must finally meet requriements of end product.
3. Heat treat prior to machining.

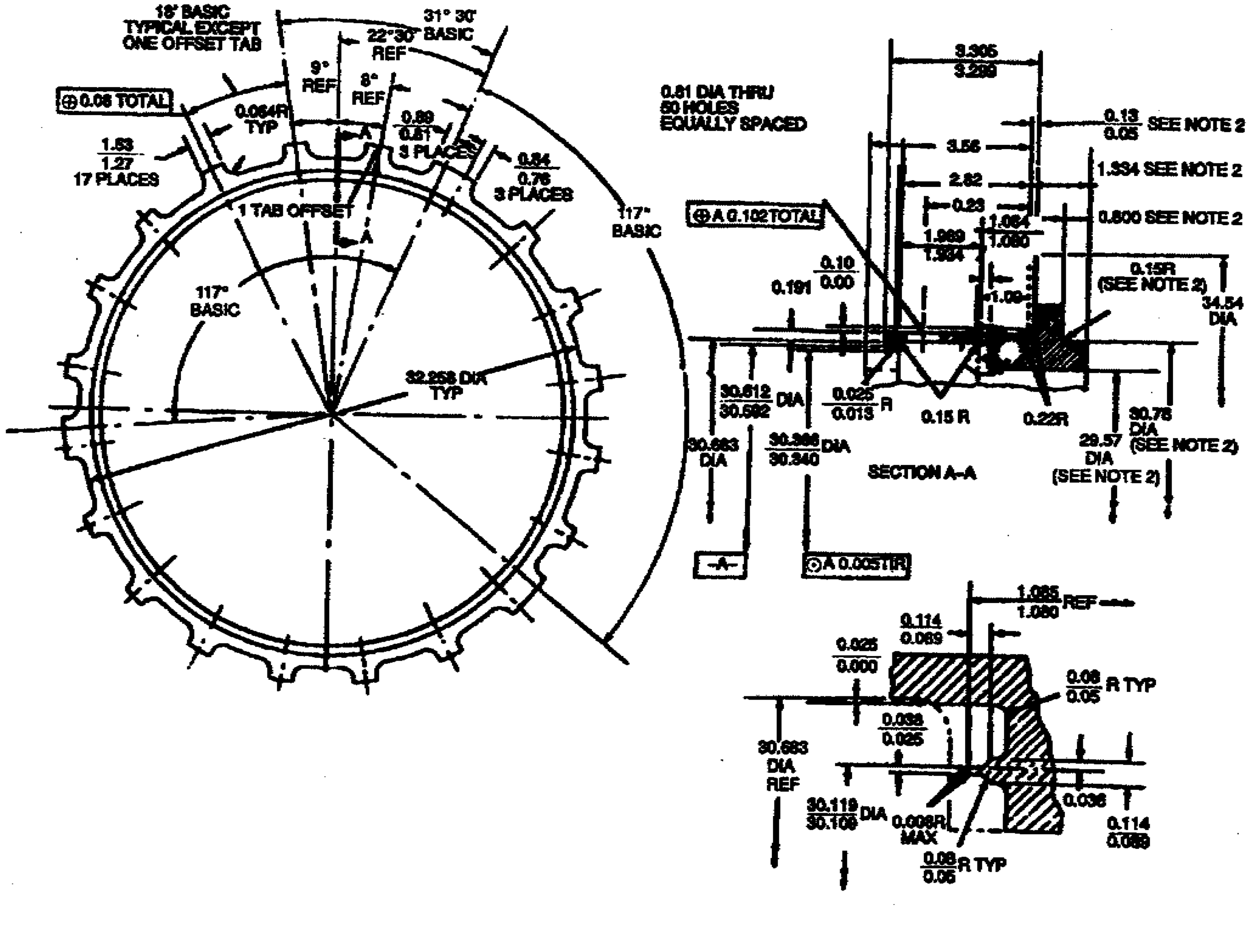
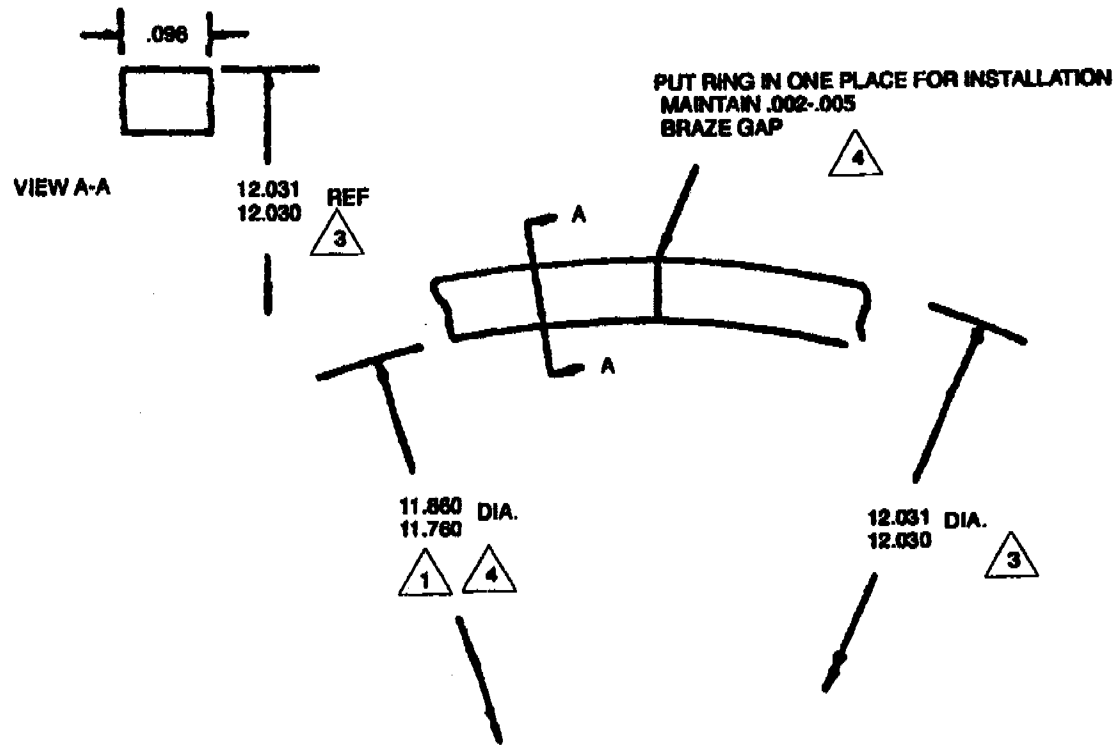


Figure 5-462. Fabrication of Overbridge Flange (Metric).

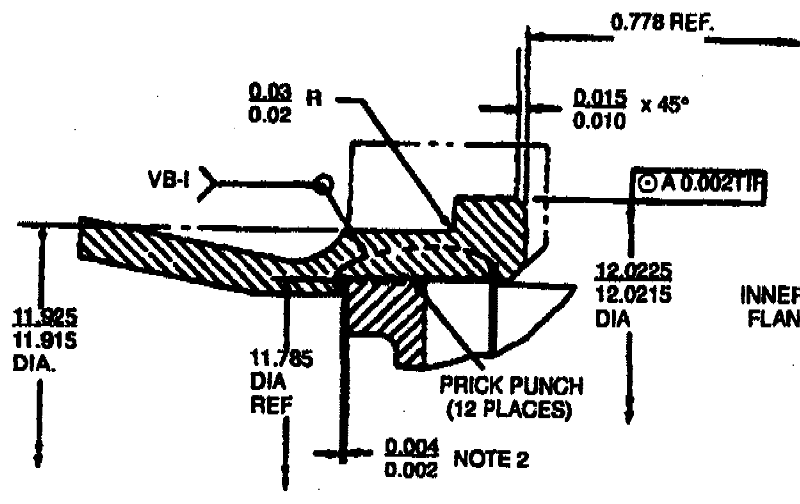
NOTE

1. All dimensions are in centimeters.
2. Non Mandatory dimensions may be varied for process and manufacturing purposes but must finally meet requriements of end product.
3. Heat treat prior to machining.

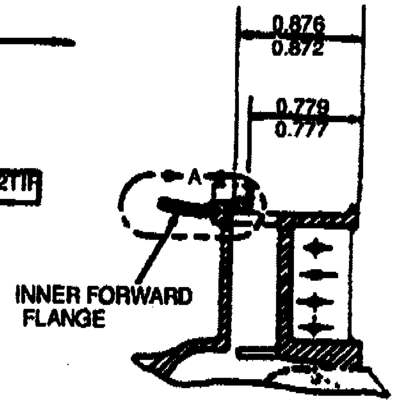


1. INNER DIAMETER MUST ALLOW .002-.005 BRAZE GAP BETWEEN RING AND NOZZLE O.D. AT ASSY
2. MAKE FROM M3602 MATERIAL (LYC SPEC)
3. NON MANDATORY DIMENSION MAY BE VARIED BUT, MUST FINALLY MEET REQUIREMENTS OF END PRODUCT.
4. NICKEL PLATE I.D. AND SPLIT SURFACES.

Figure 5-463. Fabrication of Overbridge Flange.

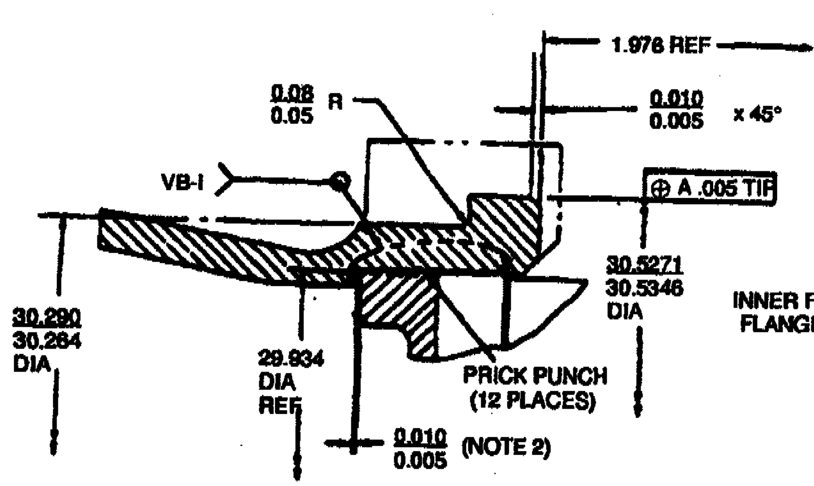


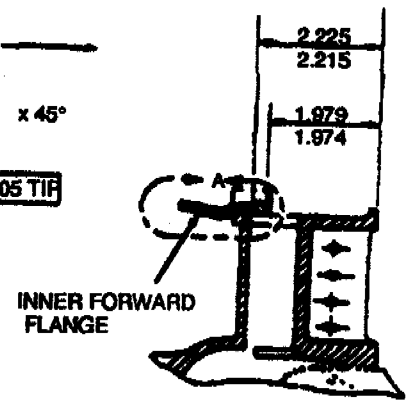
DETAIL A



NOTES

1. ALL DIMENSIONS ARE IN INCHES.
2. SHIM TO THIS DIMENSION BEFORE BRAZING.





NOTES

1. ALL DIMENSIONS ARE IN CENTIMETERS.
2. SHIM TO THIS DIMENSION BEFORE BRAZING.

DETAIL A

Figure 5-464. Installation and Final Machining of Inner Forward Flange.

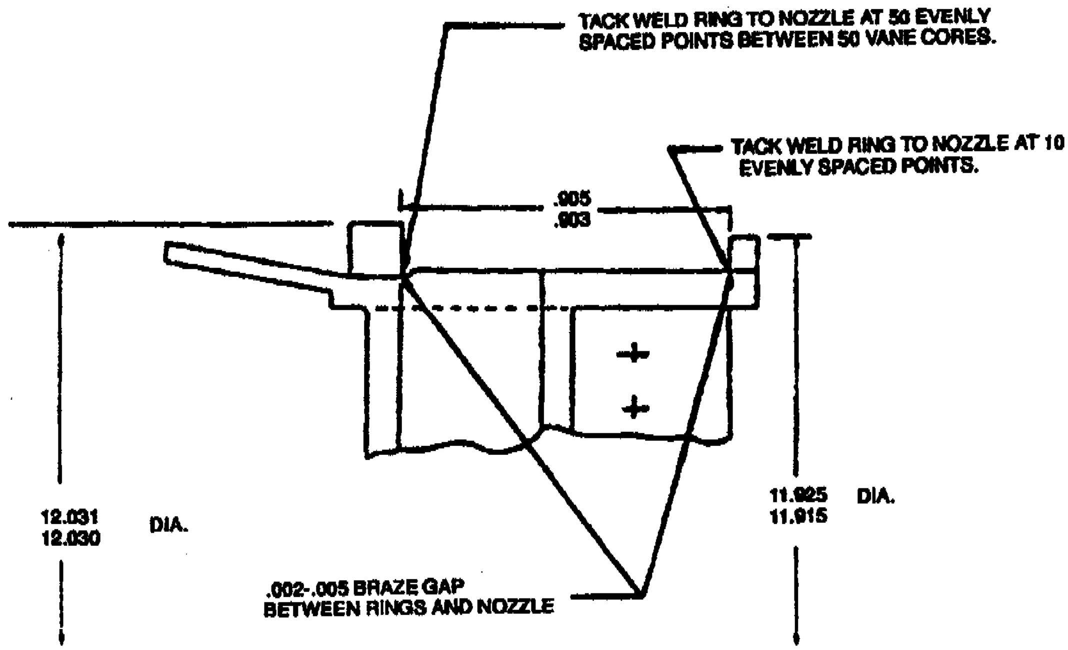


Figure 5-465. Positioning and Tack Welding of Rings to Outer Shrouds.

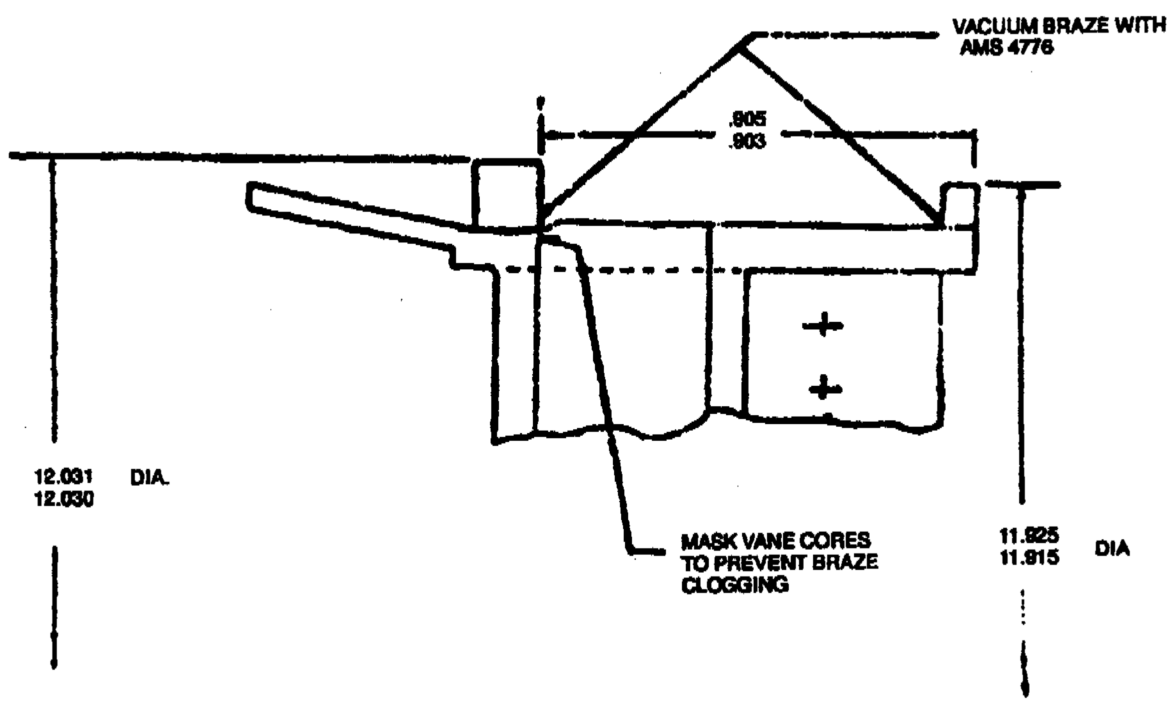
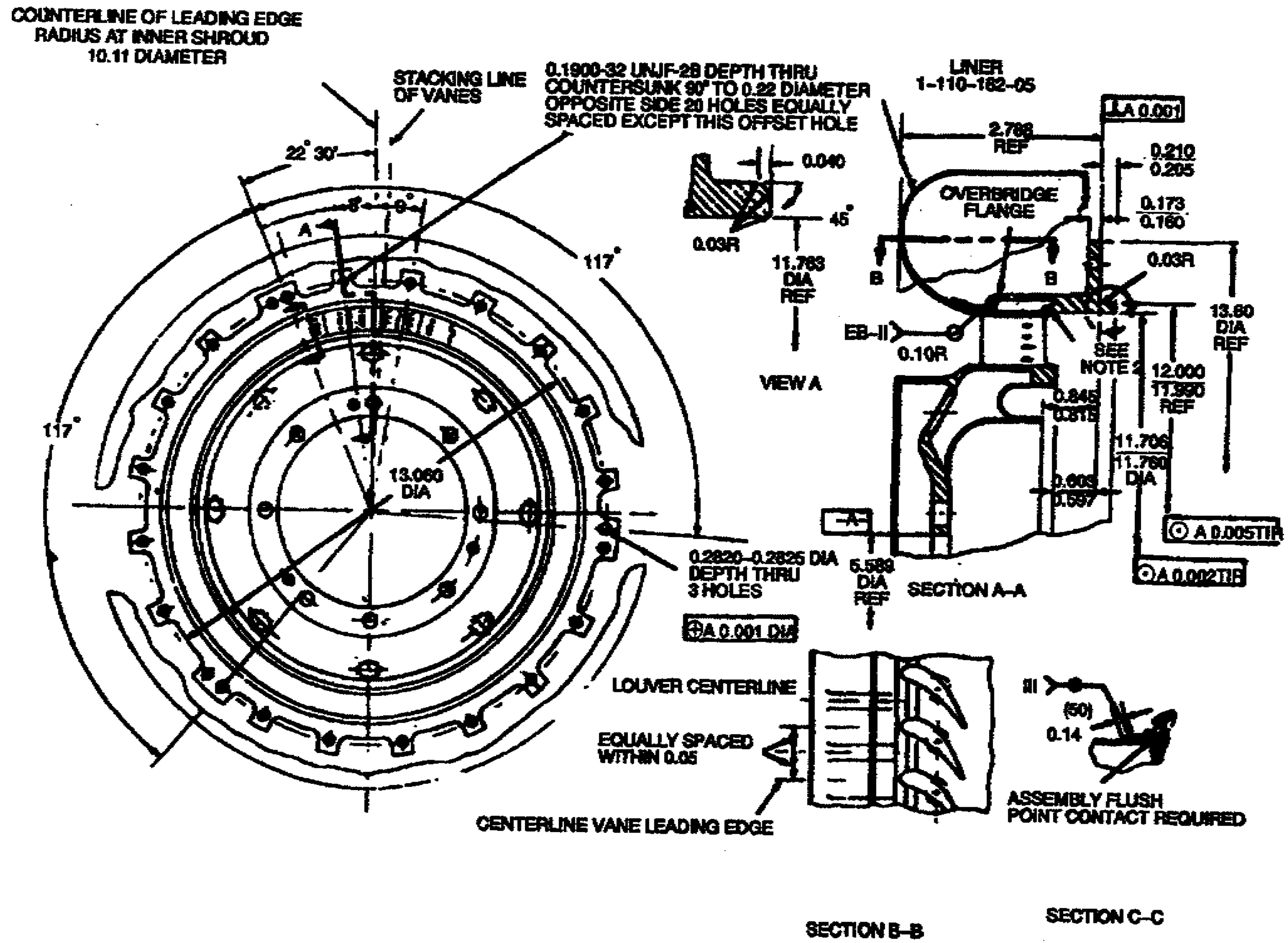


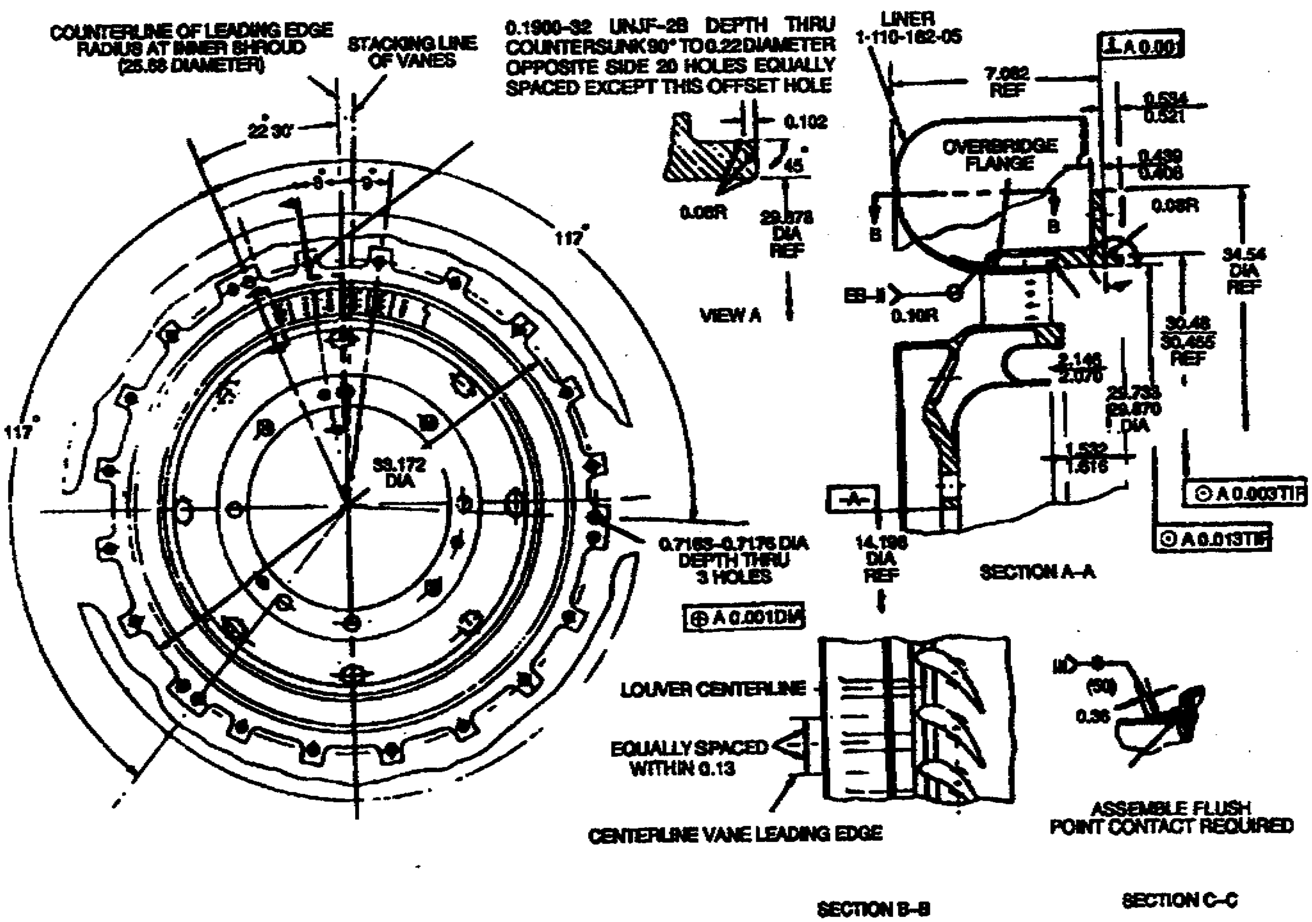
Figure 5-466. Brazing of Ring to Outer Shroud.



NOTE

1. All dimensions are in inches.
2. A 0.000 to 0.0025 inch gap is required after electron beam welding.

Figure 5-467. Installation of Overbridge Flange (English).

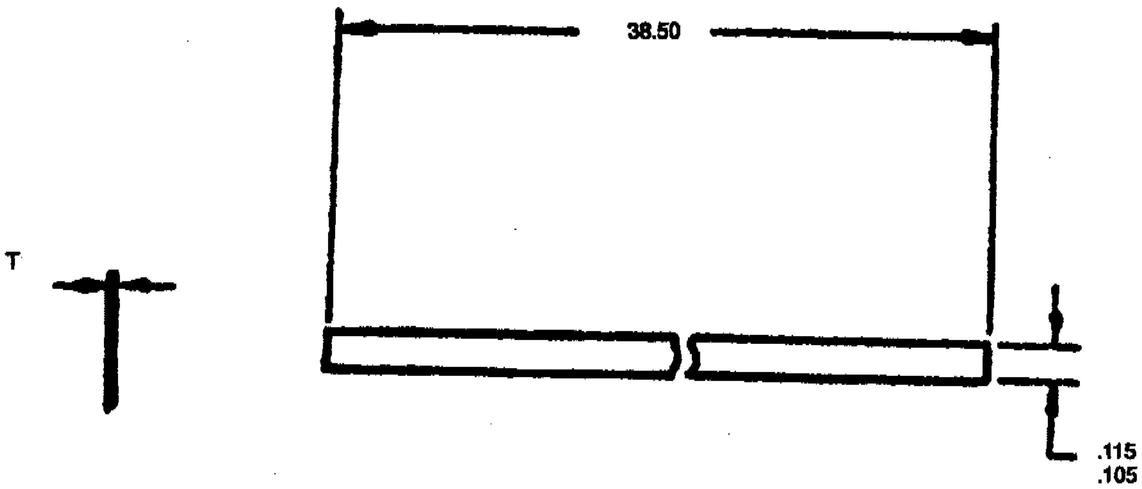


NOTE

1. All dimensions are in centimeters.
2. A 0.000 to 0.0006 gap is required after electron beam welding.

Figure 5-468. Installation of Overbridge Flange (Metric).

DASH	T DIM
-01	.011 -.013
-02	.014-.016
-03	.017-.019



MAKE FROM AMS 5599

Figure 5-469. Filler Strip.

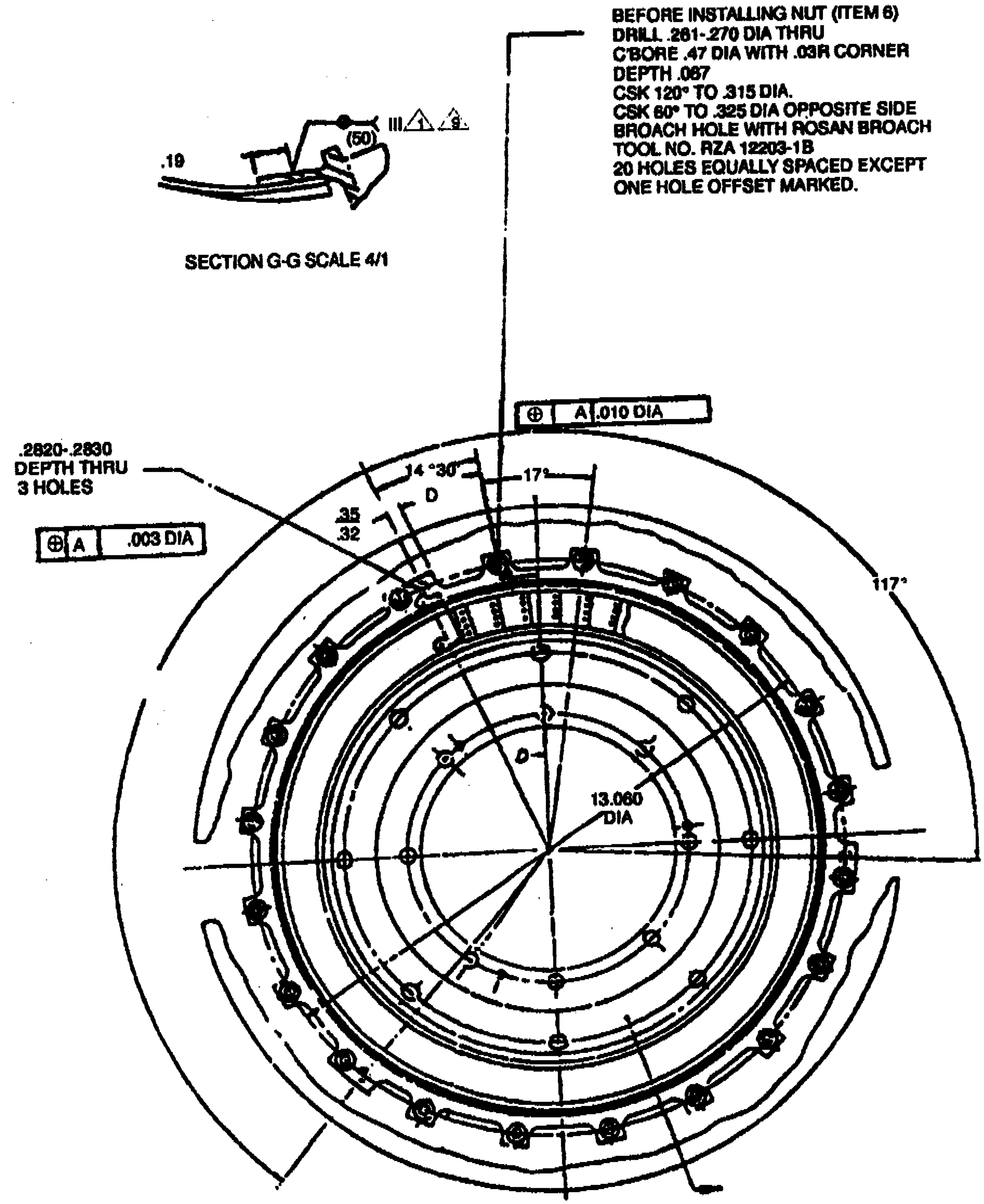


Figure 5-470. Spot Welding of Liner and Machine of Flange.

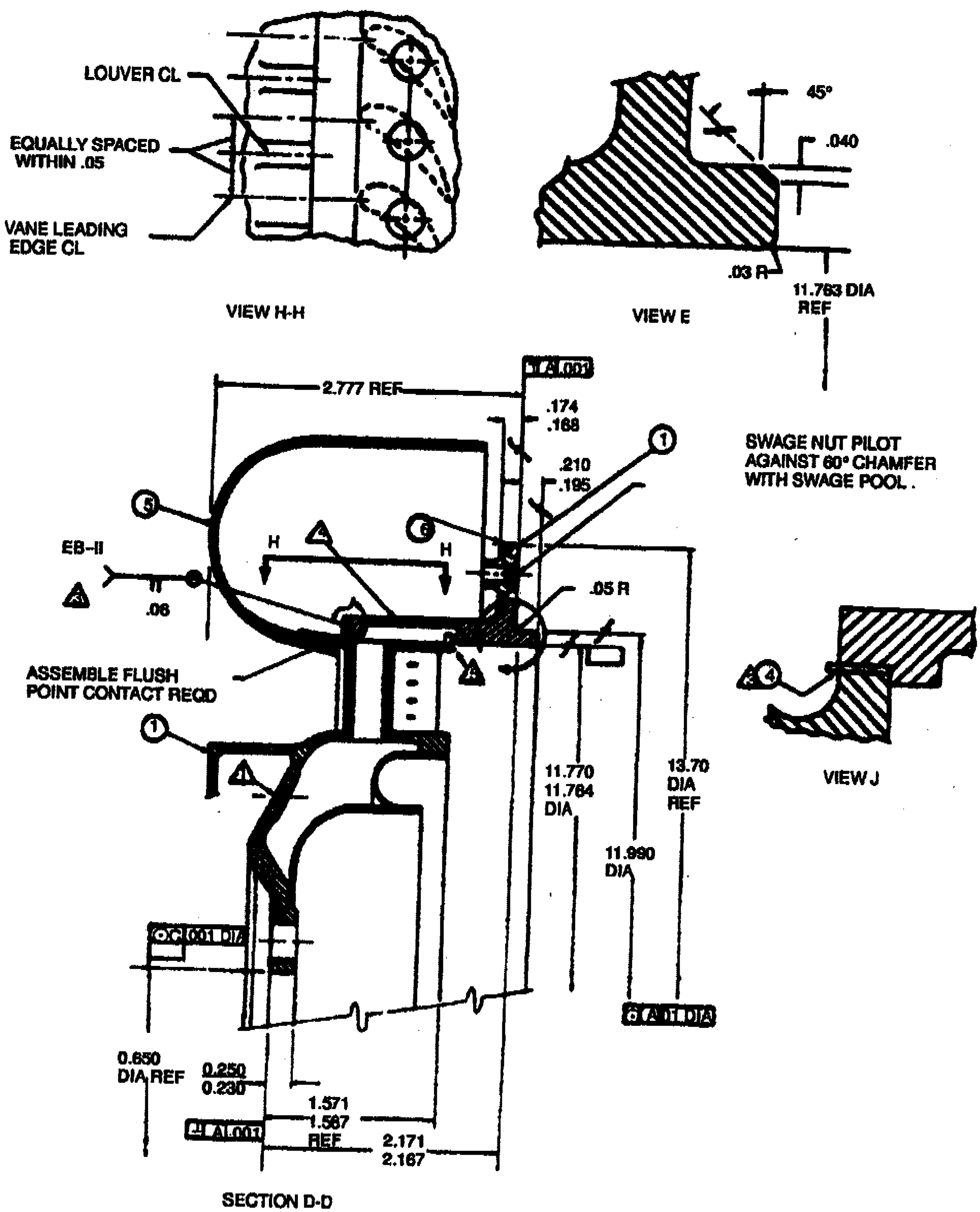


Figure 5-471. Welding and Finish Machining of Nozzle Assembly.

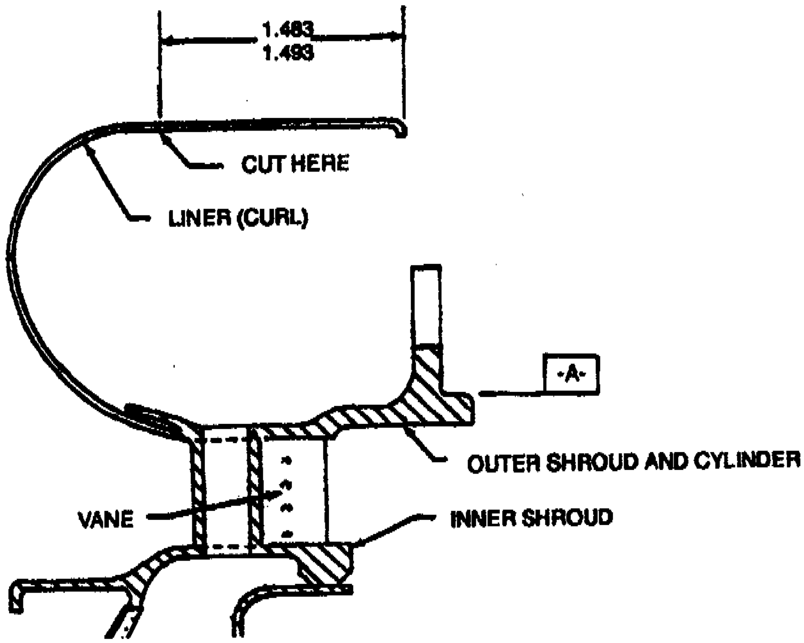


Figure 5-472. Nozzle Cut Dimensions.

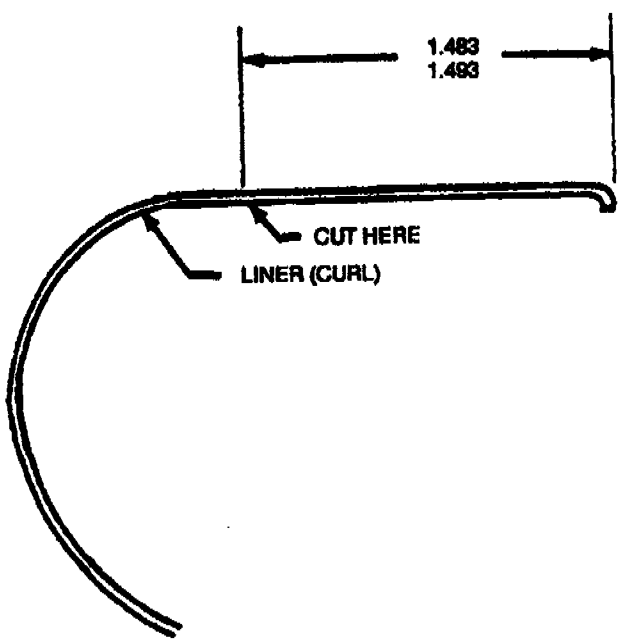
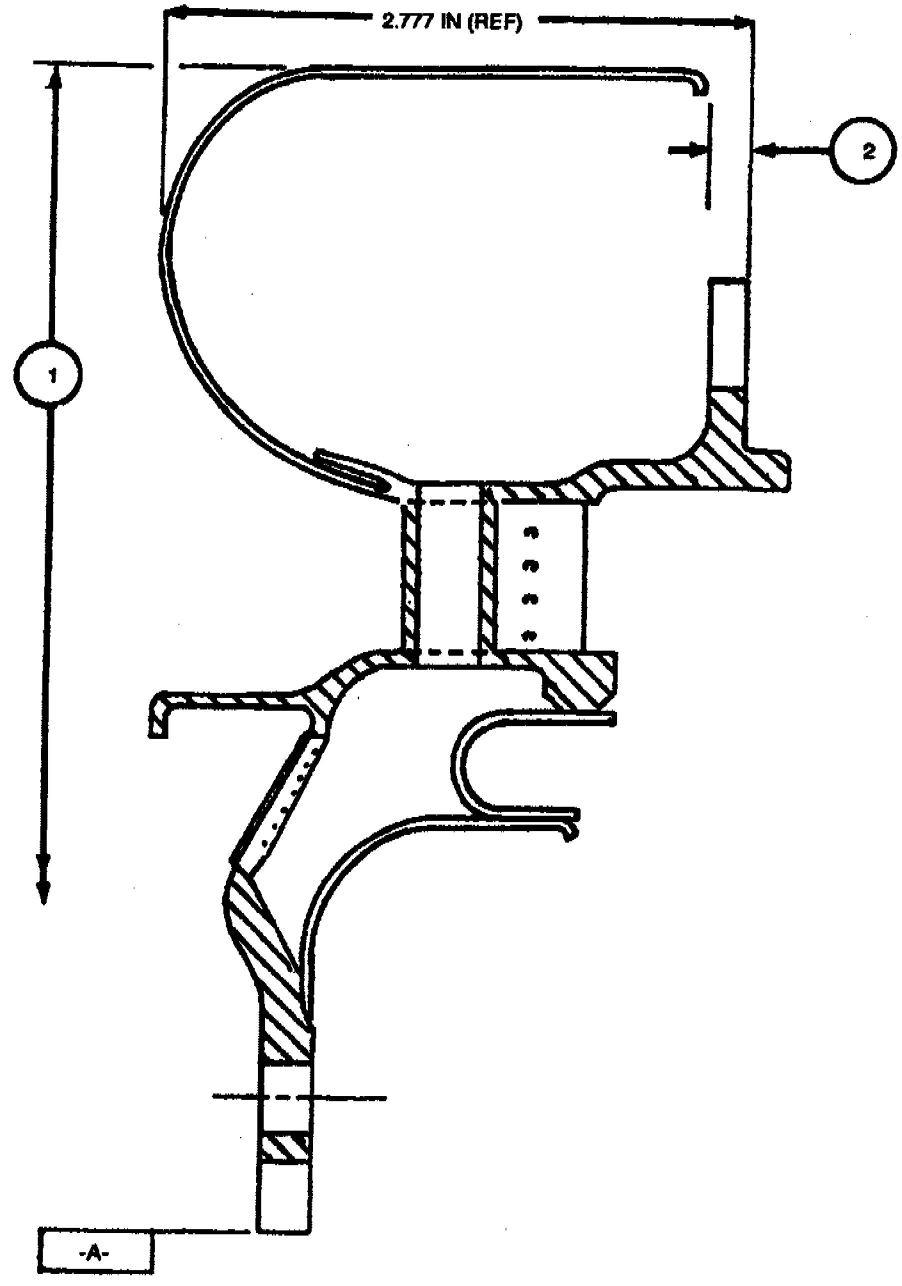


Figure 5-473. Liner Cut Dimension.



ITEM	BLUEPRINT		OVERHAUL	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
1	15.525	15.540	15.525	15.552
2	—	—	0.222	0.252

Figure 5-474. Dimensional Inspection of Liner Repair.

9 Inspect spot welds with the following exceptions:

1) Linear indications up to 0.250 max length shall be allowed in 8 spot welds

2) Spot welds with linear indications must be separated by a minimum of 5 spot welds without linear indications.

8 All dimensions apply in a restrained position. However, dimensions not affected by restraint may be inspected in free state.

7 Deleted

6 Ultrasonic inspection required. Radiographic inspection not required.

5 Select filler strip to obtain 0.000 - 0.002 diameter interference fit.

4 These 2 groups of holes as a unit may vary freely.

3 0.000 - 0.0025 gap required after E. B. weld.

1 Selectively assemble to maintain 0.001 - 0.020 gap for spot welding.

QUANTITY REQUIRED	ITEM NO.	PART NUMBER	NOMENCLATURE
20	5	1-300-623-01	NUT
1	5	1-110-162-05	LINER
1	4	1-110-259-02	STRIP
1	3	1-110-255-06	FLANGE
	2		
1	1	1-110-520-19	NOZZLE

Figure 5-475. Spot Welding Footnotes for Flange and Nozzle Assembly.

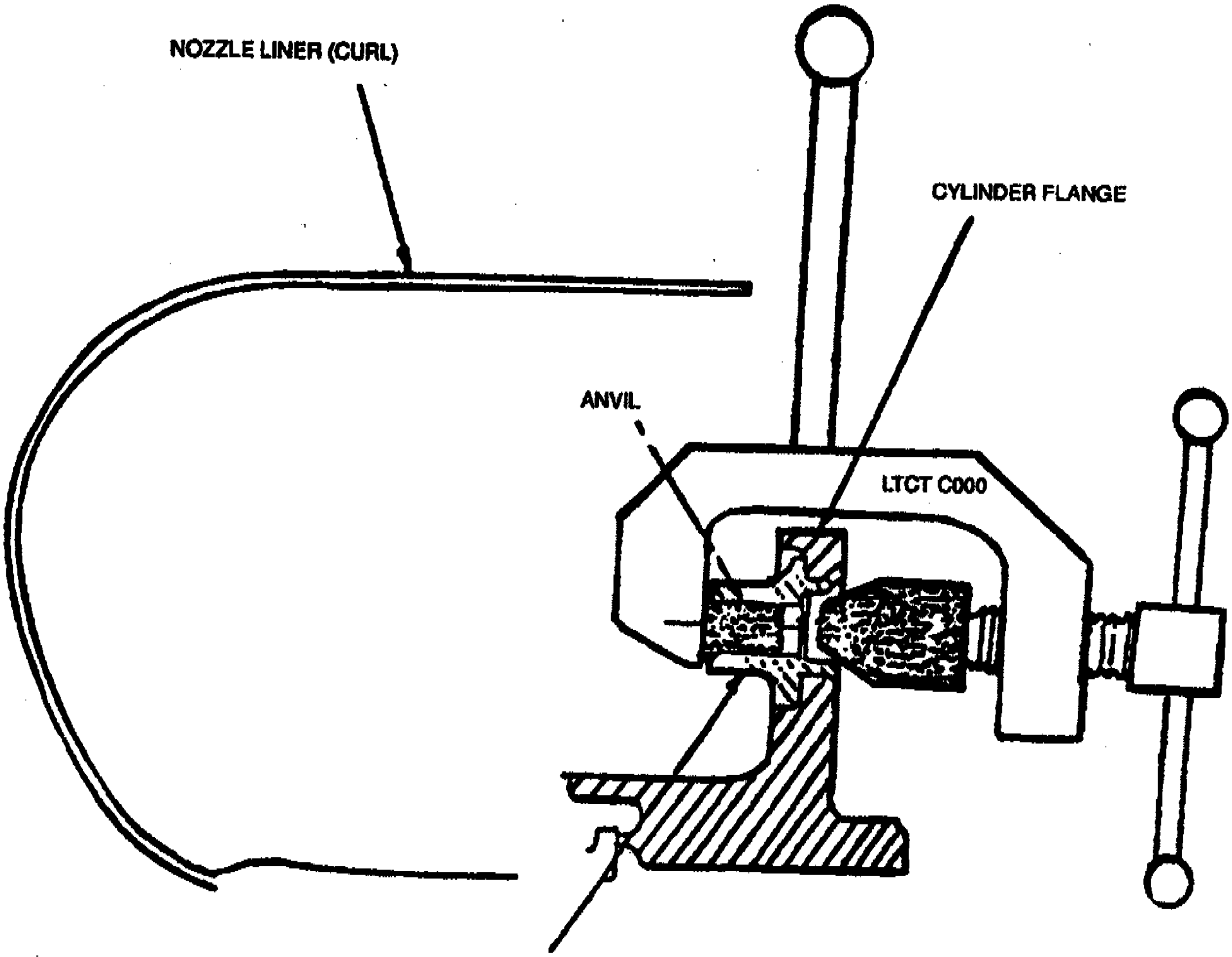


Figure 5-476. Installation of Rosan Type Serrated Nuts on Nozzles (P/N 1-110-520-19).

CAUTION

In following step (2), masking must protect all areas other than the grooves.

(2) Mask all areas adjacent to the groove with tape (item 327, table C–1)

CAUTION

In following step (3), to obtain optimum adherence, the surface to be filled must be thoroughly roughened by grit blasting. The surface should have no unblasted area in evidence.

(3) Using virgin No. 24 silicon carbide grit (item 272, table C–1), applied at 50 to 80 psi (3515 to 5625 gm sq cm), blast the defective area. Do not recycle the grit.

(4) Remove masking tape and purge the blasted area with clean, dry compressed air.

(5) Clean areas to be brazed with acetone (item 13, table C–1).

(6) Apply Nicrobraze green stop-off (item 213, table C–1) to areas adjacent to groove.

(7) With nozzle face down, apply braze alloy (item 63, table C–1) to fill groove.

(8) Place nozzle face down in a vacuum-braze oven and braze at 2,040° to 2,060°F (1,116 to 1,128°C) for 2 to 10 minutes.

(9) Machine filled in portion of inner shroud as shown in figure 5-480.

NOTE

Tungsten-inert-gas (TIG) brazing method, using brazing alloy (item 63, table C–1), may be used as an alternate for vacuum-brazing method.

h. On all first stage gas producer nozzles, repair undersized cylinder diameter (see figure 5-449) by machining to overhaul service dimension (see table 5-149) with a surface finish of 63 RMS.

i. Braze repair of circumference outer shroud cracks.

(1) Clean areas to be brazed with a wire brush. Clean areas to be brazed with acetone (item 13, table C–1).

(2) Repair by vacuum brazing with AMS 4778 braze alloy at 1850° to 1950°F. (Refer to SP No. 5004, Appendix E.)

(3) Grind brazements in the floor path flush with parent metal. Do not reduce parent metal thickness.

NOTE

When repairing out of limit cracks, repair all cracks in outer shroud.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(4) Visual and fluorescent penetrant inspect repaired areas. No cracks allowed. (Refer to MIL-STD-6866.)

j. On all first stage gas producer nozzles, repair axial cracks in liner or unacceptable wear depressions or breakthrough caused by rubbing of combustion liner dimples.

(1) Using rotary file (air drill) and carbide burr, rout out cracks indicated in fluorescent-penetrant inspection. Where breakthrough or wear depressions exist due to liner dimple rubbing, ensure that no sharp edges exist at depression on liner or outer diameter of liner.

(2) Clean areas to be welded with acetone (item 13, table C–1).

(3) Fusion-weld cracks or depressions in nozzle liner as outlined in SP No. 5001 in Appendix E using welding wire (item 348, table C–1).

(4) Blend weld beads.

NOTE

Do not reduce repaired thickness below that of adjacent sound metal.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(5) Perform through visual and fluorescent-penetrant inspection on repaired area.

(6) Cracks and crack-line indications are not acceptable. If cracks are indicated, repeat repair procedures.

k. Repair deflector to inner shroud cracks as follows: Repair cracks in the brazements by TIG brazing using alloy (item 64, table C–1). Refer to SP No. 5004, Appendix E.

l. On first stage gas producer nozzle assemblies (1-110-520-19 and 1-110-710-06) (12, figure 4-38) repair oversized cylinder diameter (see figure 5-449) as follows:

(1) Clean nozzle with acetone (item 13, table C–1).

(2) Flame spray the cylinder ID using powder (item 215, table C–1) as outlined in SP No. 5006 in Appendix E. Build up the minimum amount necessary to remachine the ID to 11.750 to 11.766 inch (29.845 to 29.870 cm) diameter (approximately 0.010 inch (0.025 cm) undersized diametrically).

(3) Machine ID to blueprint dimension (see table 5-149) using a carbide tipped bit.

(4) Dimensionally inspect nozzle. (Refer to table 5-149.)

m. First Stage Gas Producer Nozzle (P/N 1-110-710-06) Vane Replacement without Removal of Overbridge.

(1) Remove inner support and deflector from nozzle by machining. Discard support and deflector.

CAUTION

Do not damage serviceable insert washers when machining.

(2) Using a flat copper or brass electrode and an electric discharge machine or other suitable means, remove damaged vane segments from flow path. (See figure 5-477.)

(3) Using a suitable electrode, remove remaining vane stub from inner shroud. (See figure 5-478.)

CAUTION

In following step, penetration depth of machining not to exceed 0.090 inch from nozzle shroud.

(4) Using a suitable electrode, remove remaining outer vane stub from outer shroud. (See figure 5-478.)

(5) After all the vanes that are to be replaced are removed, check to ensure that no debris has fallen into the passageway between the outer shroud and the overbridge. This will help ensure clear cooling passageways.

(6) Repair skirt of replacement vane as follows:

(a) Build up inner skirt of the replacement vane using the TIG process and welding wire (item 348, table C–1).

(b) Machine the trailing edges of replacement vane skirts so they do not protrude axially beyond the trailing edge of the airfoil. (See figure 5-479.) Maintain a 0.057 radius. Further machine skirts to allow 0.002 to 0.010 braze gap between skirts and shrouds. No rework of the airfoil surfaces is allowed. Fluorescent penetrant inspect. No cracks allowed.

(c) Remove approximately 3/16-inch coating all around vane near vane skirts to be nickel plated with skirt and shroud slots to 0.0004-0.0008 thickness per SP No. 6018 in Appendix E.

(7) Trim outer retaining washer to outer skirt contour. This will facilitate installation of assembled vane. Install insert and flare ends over sealing washers using a suitable flaring tool and holding fixture (reference LTCT1149X). Cracking of insert is allowed.

(8) Insert and position vane(s) with shims. Maintain 0.002 to 0.010 inch braze gap. Then tack weld into place using welding wire (item 348, table C–1). Perform EFA check. If acceptable braze vane in place in accordance with step (9). If not acceptable, break tack welds, reposition vanes and repeat step (8). No braze slurry is allowed in the joint between the trailing edge of the outer shroud and the overbridge flange. (See figure 5-480.)

(9) Braze vane(s) in place using brazing material (item 63, table C–1). Vacuum braze in accordance with SP No. 5004 in Appendix E.

(10) Fillet radii of 0.060 inch maximum shall be maintained at vane to shroud junctures in the airstream after brazing.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(11) Perform fluorescent penetrant inspection of braze joints. No cracks allowed.

(12) TIG weld buildup inner shroud using welding wire (item 348, table C–1). (See figure 5-480.) Machine buildup to figure 5-481. Fluorescent penetrant inspect weld. No cracks allowed.

(13) Nickel plate areas specified in figure 5-481 to 0.0004-0.0008 inch thickness per SP No. 6018 in Appendix E.

(14) Position support and deflector. Use shims to maintain an optimum gap 0.002 to 0.005 inch (0.005 to 0.013 cm). Isolated areas of the braze gap may have clearances up to 0.010 inch (0.025 cm). Then braze in place per SP No. 5004 in Appendix E using braze material (item 63, table C–1).

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(15) Fluorescent penetrant inspect per SP No. 4003. No cracks allowed.

(16) Dimensionally inspect repaired nozzle per table 5-149.

PART NUMBERS OF REPAIR DETAILS.

1-110-710-06 Nozzle Assembly	1-110-223-03 Washer
1-110-192-14 Replacement Vane for -06 Nozzle	1-110-165-02 Support
1-110-620-01 Insert Assembly	1-110-164-03 Deflector

n. Repair coating on first stage gas producer nozzles that are dimensionally acceptable. Repair coating using Sermaloy "J" per SP No. 6033 in Appendix E.

5-403. REASSEMBLY. Reassembly is not required.

5-404. FUNCTIONAL TEST. All nozzles P/N 1-110-710-06 must be water flowed to ensure internal passages are free of contamination. Using fixture LTCT12061 (or equivalent) and room temperature water at a pressure of 5 to 10 psig, visually inspect to the requirements of figure 5-482.

5-405. MODIFICATION OF FIRST STAGE GAS PRODUCER NOZZLE AND COMBUSTION CHAMBER LINER. The following instructions provide data for the incorporation of an improved first stage gas producer nozzle (1-110-710-06).

NOTE

Combustion chamber liner 1-130-780-01 is reworked to a new design 1-130-780-03 to mate with the new nozzle. (See figure 5-483.)

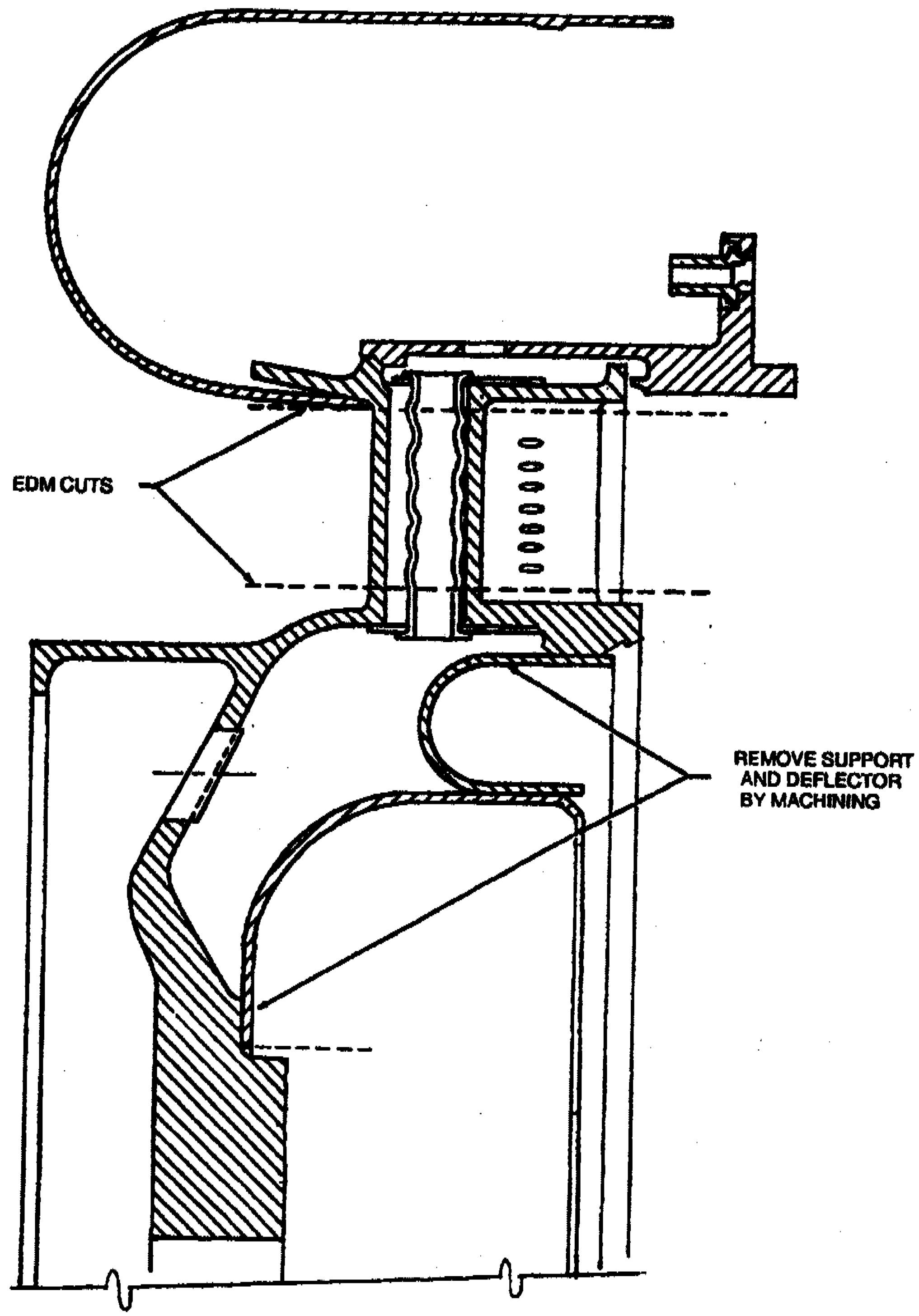


Figure 5-477. Stage 1 G.P. Nozzle (P/N 1-110-710-06) Removal of Support and Deflector.

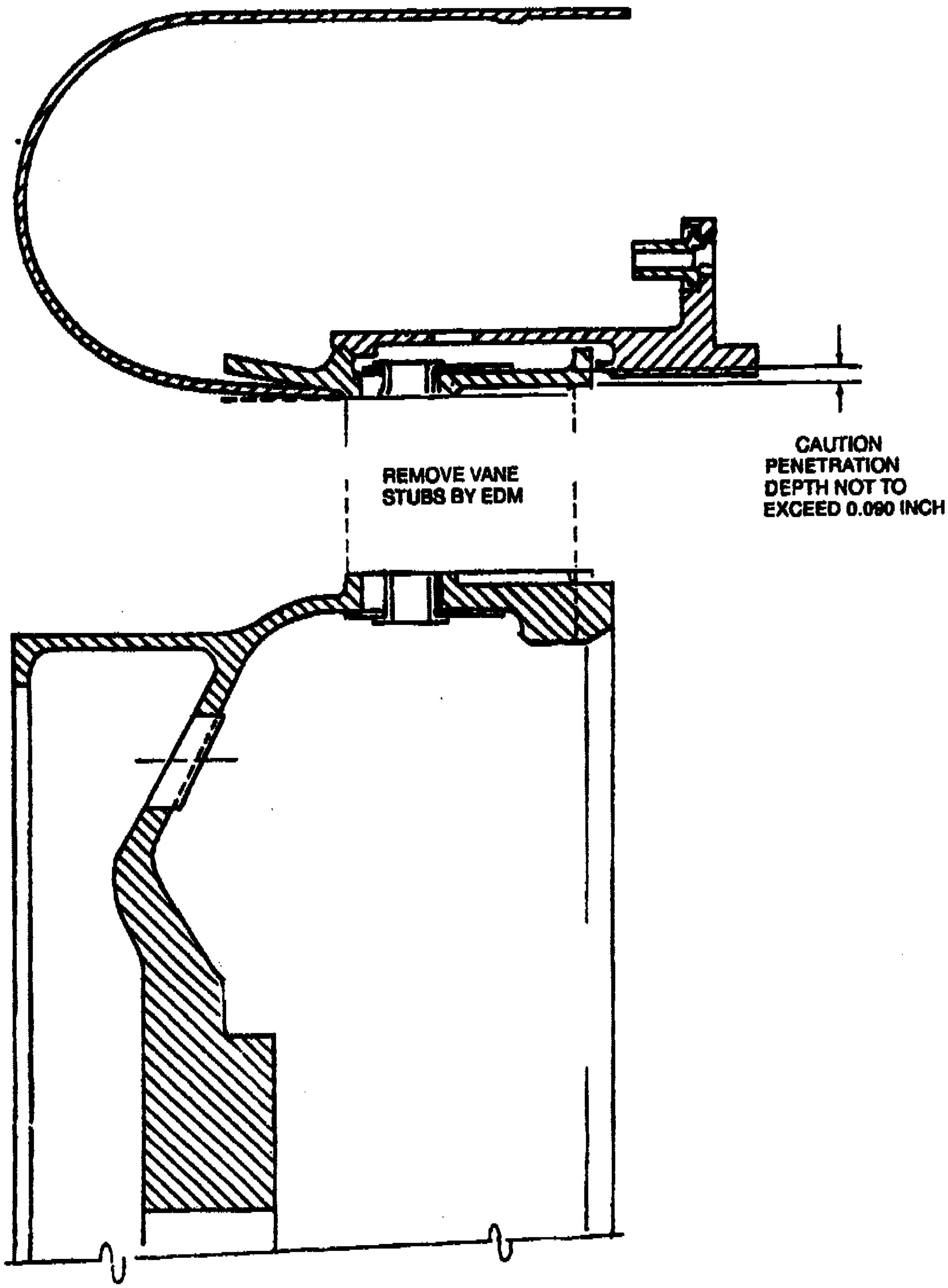


Figure 5-478. Stage 1 G.P. Nozzle (P/N 1-110-710-06) Removal of Vane Stubs.

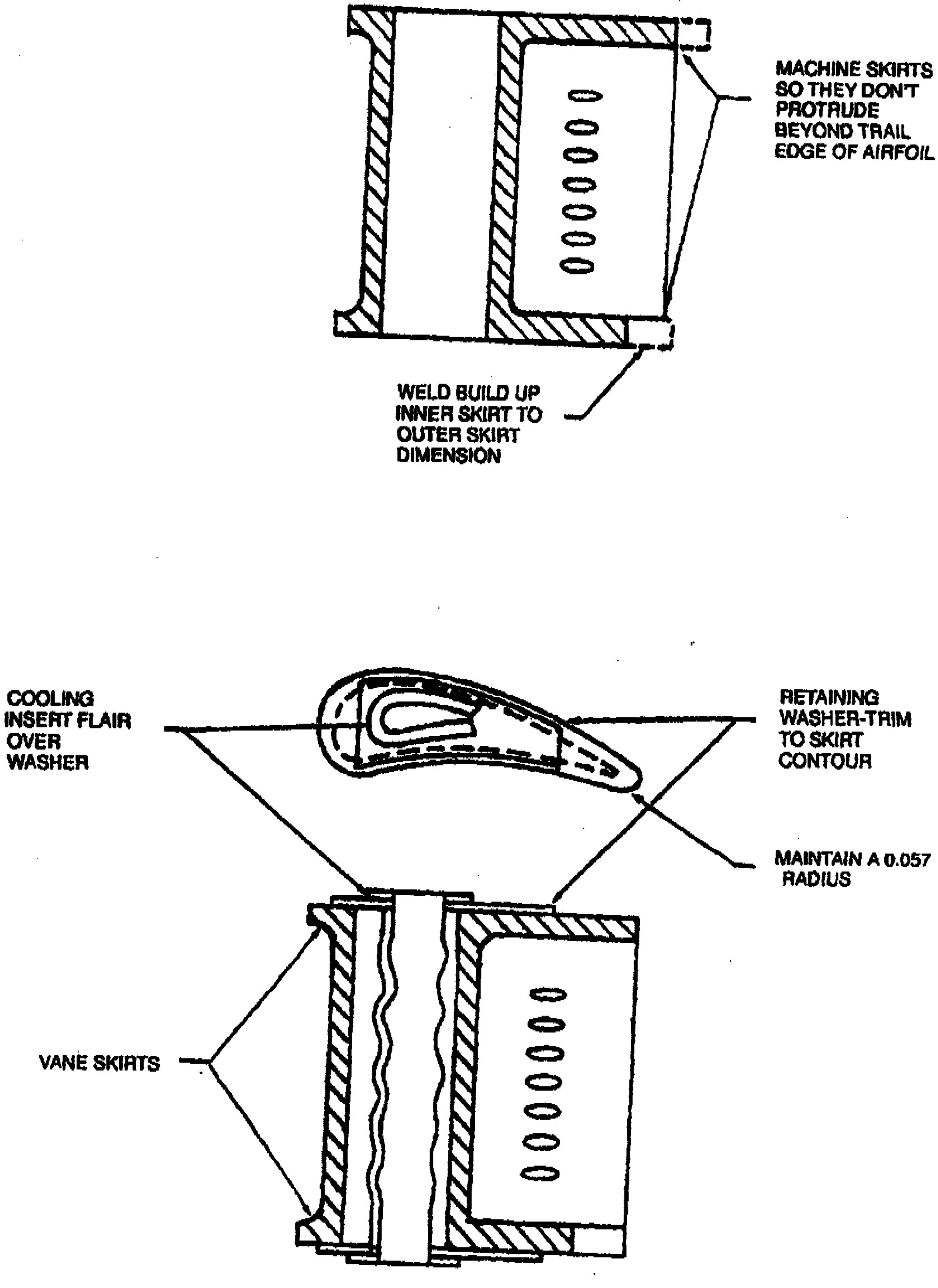


Figure 5-479. Stage 1 G.P. Nozzle (P/N 1-110-710-06) Vane Skirts Repair.

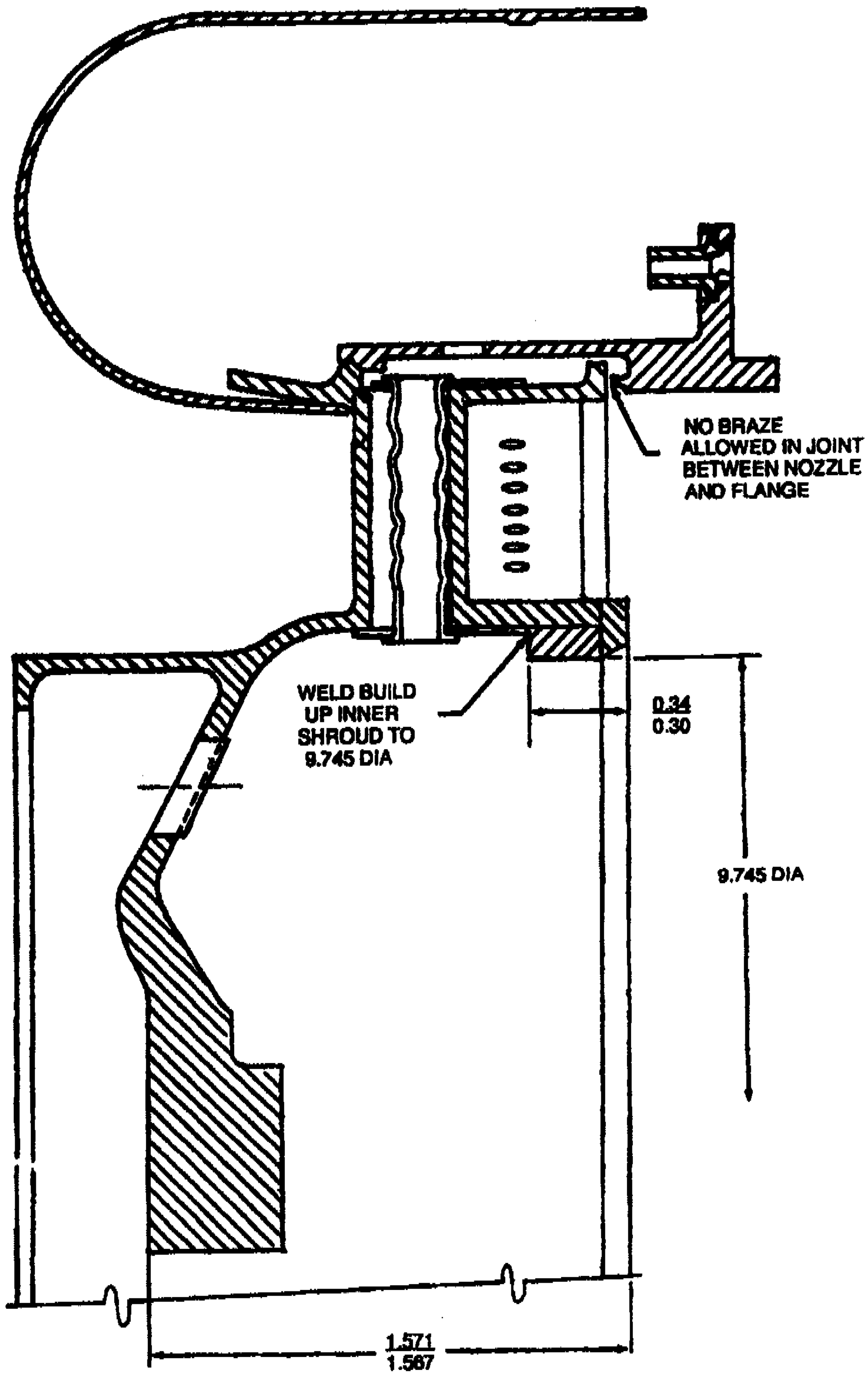


Figure 5-480. Stage 1 G.P. Nozzle (P/N 1-110-710-06) Brazing and Weld Build Up.

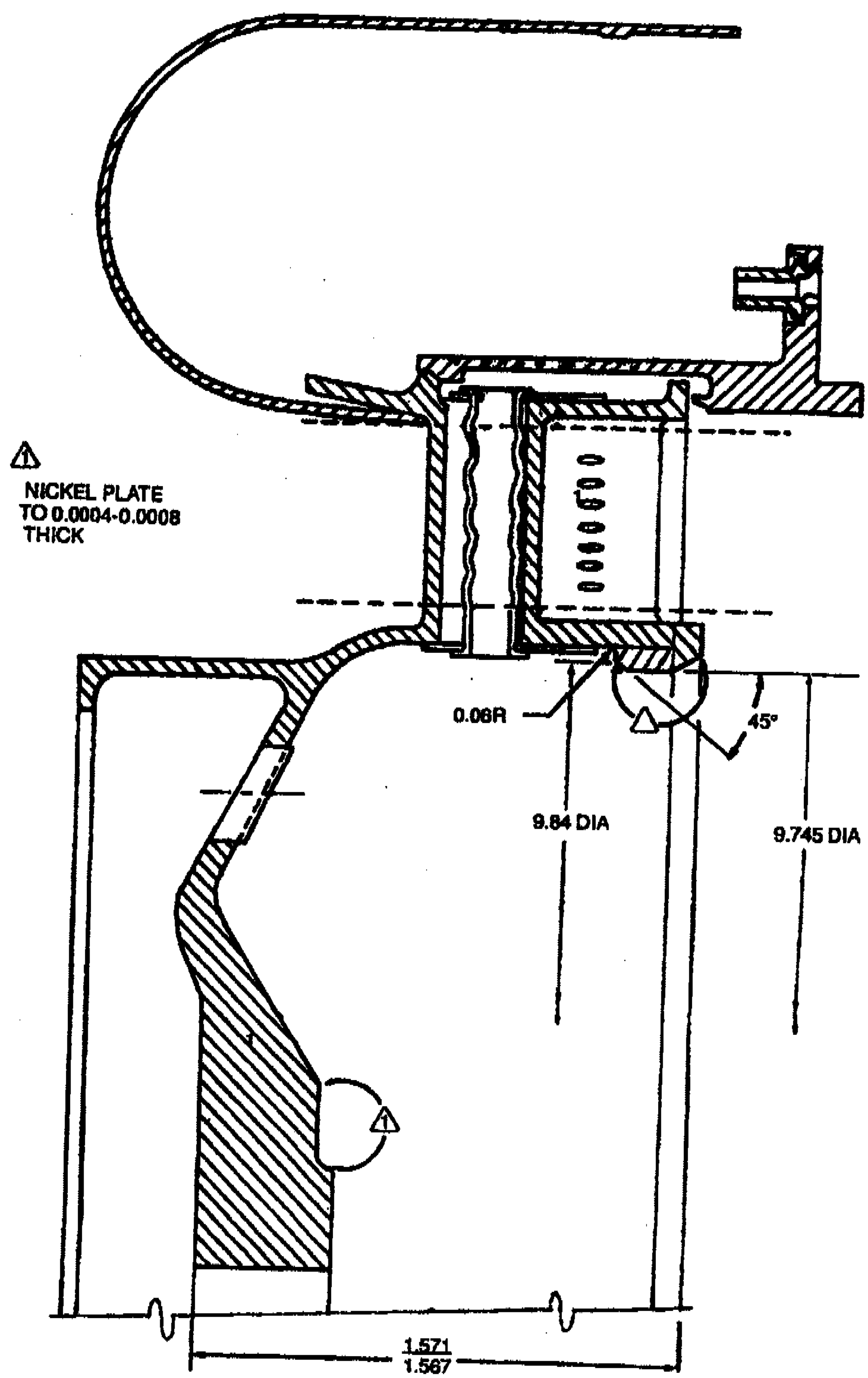


Figure 5-481. Stage 1 G.P. Nozzle (P/N 1-110-710-06) Final Machining and Plating.

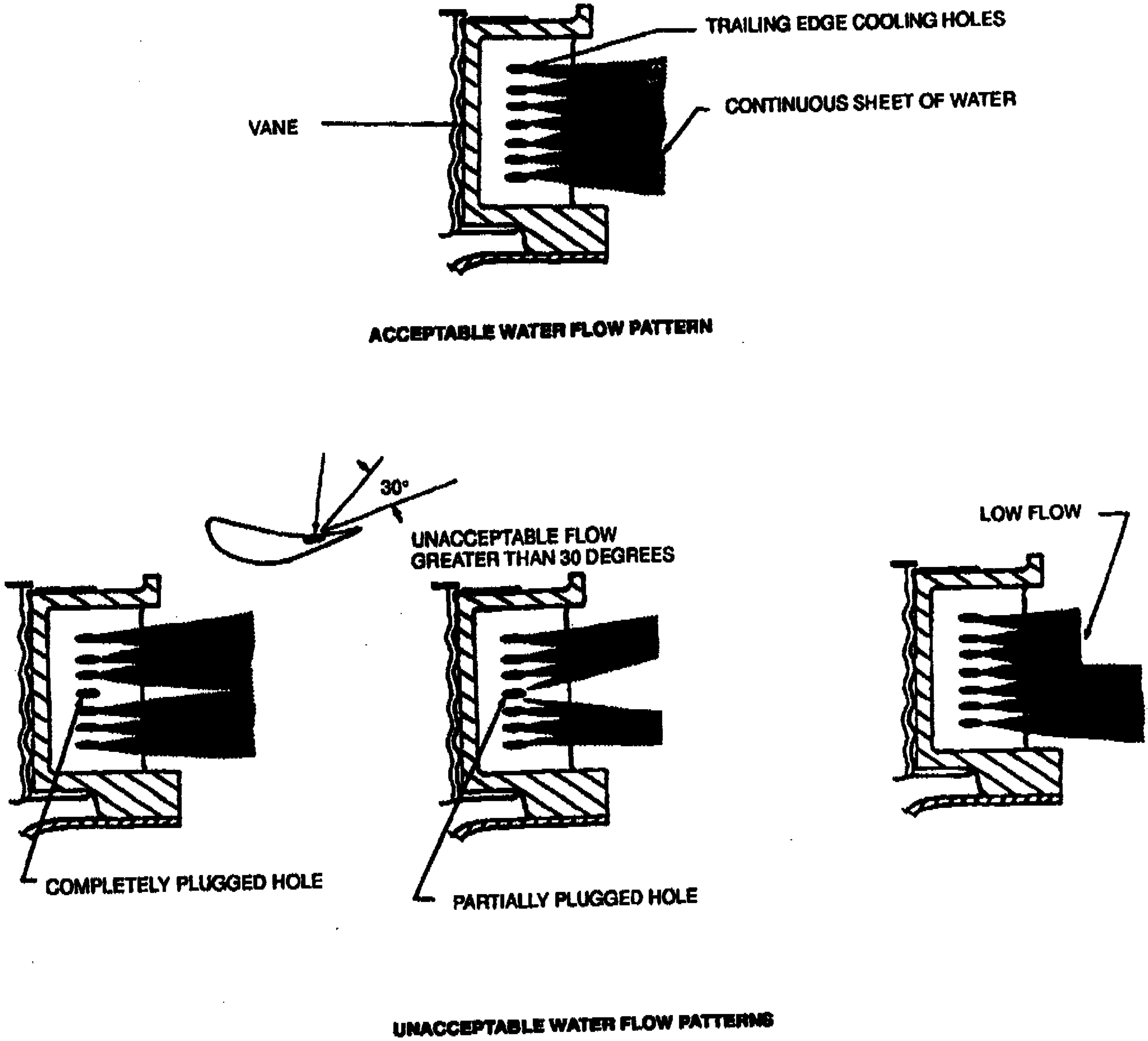


Figure 5-482. Vane Water Flow Patterns.

a. Replace first stage gas producer nozzle (1-110-520-19) with new nozzle (1-110-710-06).

b. Rework combustion chamber liner 1-130-780-01 to new design 1-130-780-03 as follows:

CAUTION

In following step (1), do not cut or damage inner rear liner.

(1) Remove inner forward liner (1-130-253-01) by grinding existing spot welds.

(2) Position guide ring (1-130-276-02) into the new inner forward liner (1-130-253-03), 1.72 inches (4.37 cm) forward of the rear lip (figure 5-484), and align cooling holes in ring with holes in inner forward liner (figure 5-484). Spot-weld in 88 places as shown in figure 5-484, and align cooling holes in ring with holes in inner forward liner (figure 5-484).

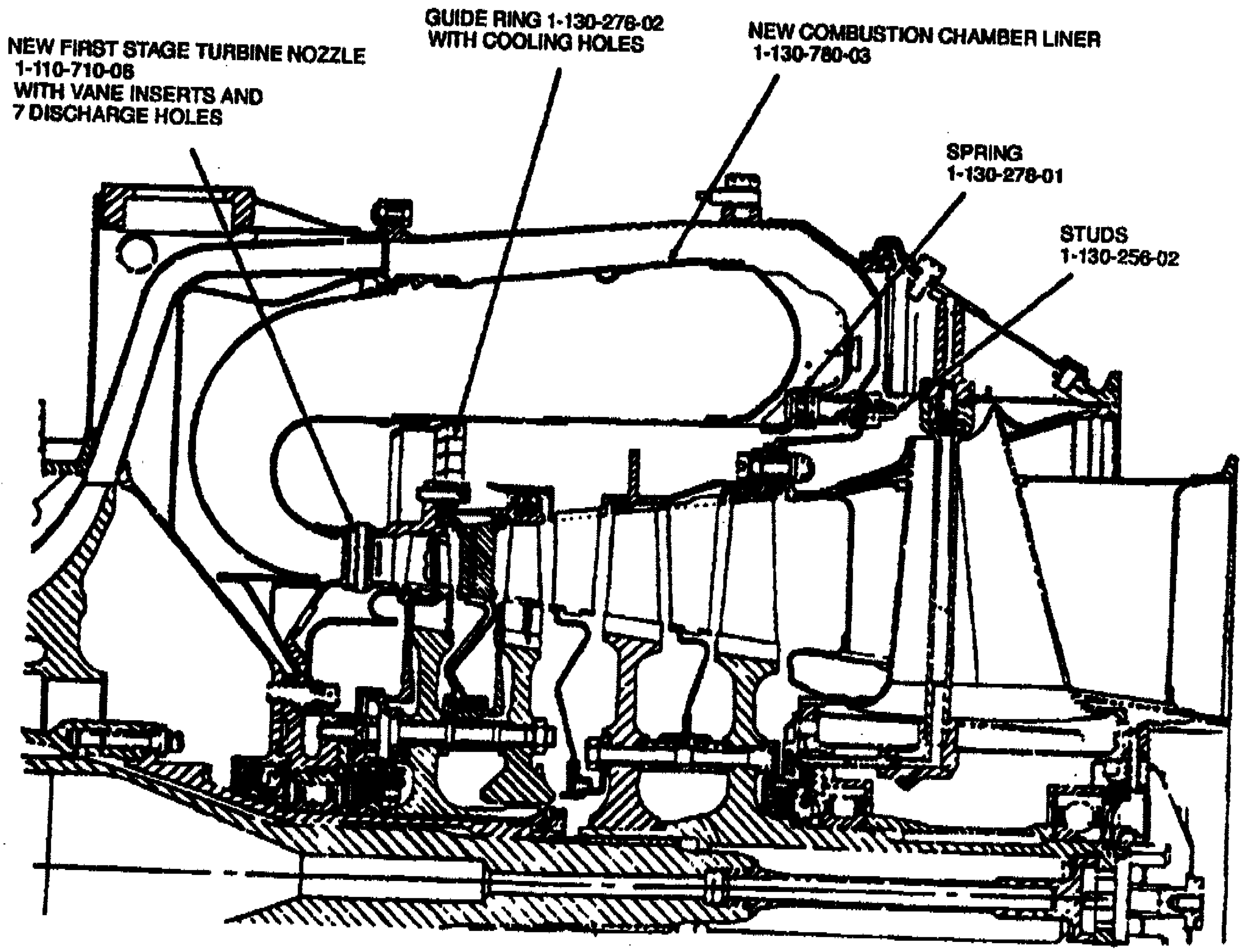


Figure 5-483. New First Stage Gas Producer Nozzle and Combustion Chamber Liner.

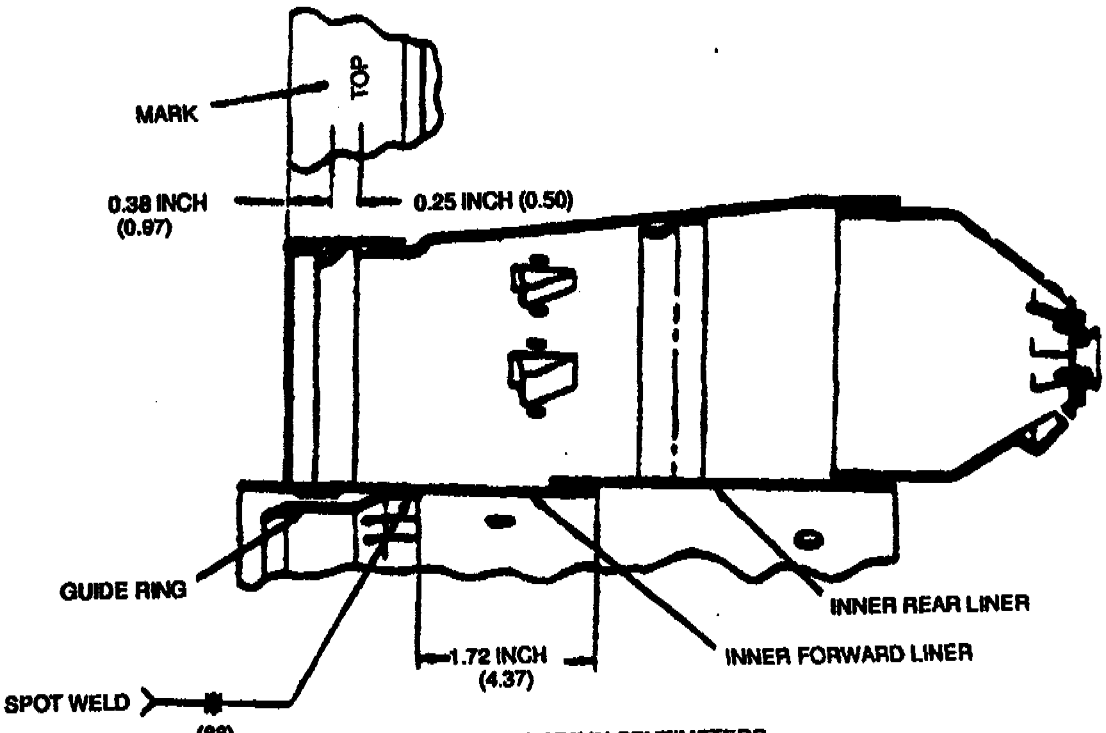


Figure 5-484. Combustion Chamber Liner.

(3) Position the new inner forward liner (with guide ring attached) into the inner rear liner assembly, 4.77 inches (12.12 cm) from the face of mounting bracket to center of the 0.145 to 0.150 inch (0.368 to 0.381 cm) diameter holes in the inner forward liner with the 0.264 to 0.271 inch (0.671 to 0.688 cm) diameter (forward) holes in the inner rear liner, as shown in figure 5-485. Assemble to obtain a 0.000 to 0.020 inch (0.000 to 0.051 cm) diametrical interference. Spot weld in 88 places as shown in figure 5-486 and SP No. 5002 in Appendix E, while establishing a 0.020 to 0.030 inch (0.051 to 0.076 cm) air gap as shown in figure 5-486.

(4) Fluorescent-penetrant inspect.

(5) Replace three shouldered mounting studs (1-130-256-01) with three shoulder-less studs (1-130-256-02), as outlined in paragraph 5-299, step 5-299a.(4); this will give a total of six studs (1-130-256-02) in the assembly.

(6) Reidentify combustion chamber liner assembly from 1-130-780-01 to 1-130-780-03.

5-406. MODIFICATION OF SECOND STAGE GAS PRODUCER ROTOR ASSEMBLY. The following instructions provide data for the incorporation of new second stage gas producer rotor blades (1-100-118-07) of new material. In conjunction with this change, a new spacer (1-100-546-02), a reworked second stage gas producer nozzle (1-120-050-03), and a new sealing disc (1-100-544-03) are introduced.

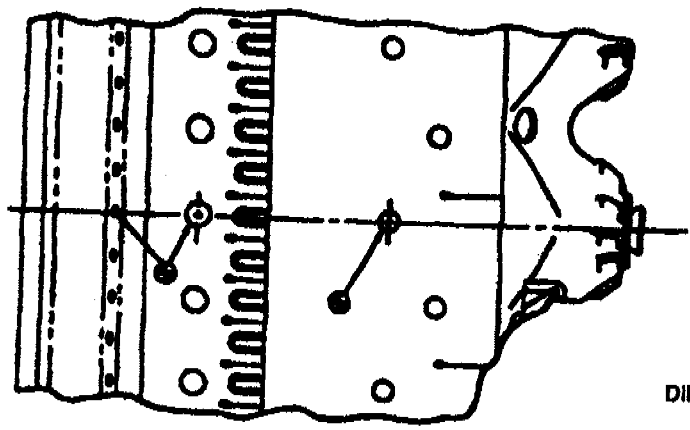


Figure 5-485. Combustion Chamber Liner Cooling Holes.

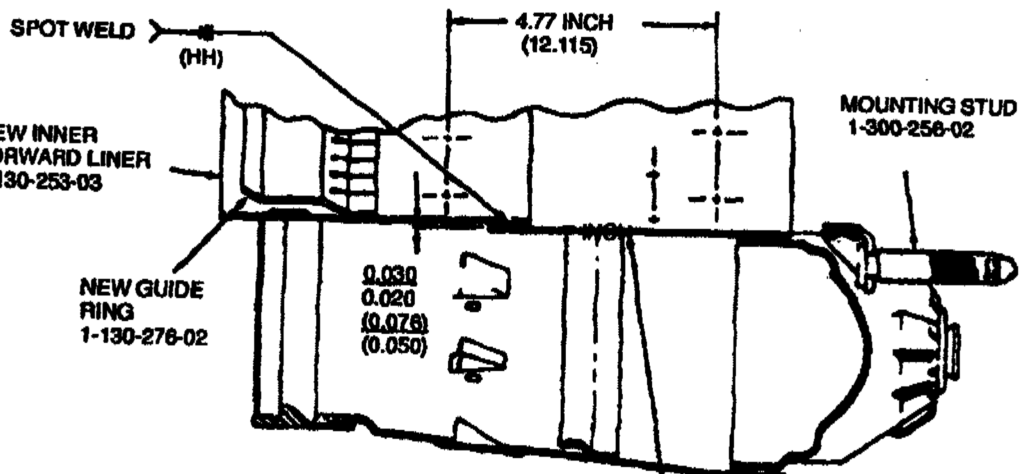


Figure 5-486. Combustion Chamber Liner Air Gap.

a. Rework the second stage gas producer turbine rotor 1-100-820-06/08 to a 1-101-360-04 configuration as follows:

(1) Using blade removal fixture (LTCT548) in conjunction with punch and drift set (LTCT552), deblade the disc assembly.

(2) Clean and inspect second stage gas producer disc (1-100-063-05) as outlined in paragraphs 5-249 and 5-250.

(3) Reblade discusing new blades (1-100-118-07) as outlined in paragraph 5-251. Use blade retention pins (1-140-285-01).

(4) Using grinding fixture (LTCT13007) in conjunction with a Norton OD Grinder (14 x 36), or equivalent, grind turbine rotor blades to the maximum overhaul service dimension. (Refer to paragraph 5-330.) Concentricity must be within 0.001 inch (0.003 cm) TIR with respect to "A" surface.

NOTE

Do not break sharp corners after grinding; sharp corners are desired.

(5) Reidentify second stage gas producer turbine rotor from 1-100-820-06/08 to 1-101-360-04.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(6) Inspect turbine rotor by fluorescent-penetrant method.

NOTE

After complying with following steps b and c, balance turbine rotor as outlined in paragraph 5-317.

b. Replace spacer (1-100-294-03) with new spacer (1-100-546-02) (See figure 5-487).

c. Add new sealing disc (1-100-544-03) (See figure 5-487).

d. Rework the second stage gas producer nozzle assembly from a 1-120-000-14 to a 1-120-050-03 configuration as follows:

(1) Remove supports (1-120-026-03 and 1-120-027-02) and seals (1-120-028-01) by machining. Machine off all support material until inner shroud cleans up (See figure 5-488).

(2) Using a hand routing tool, locally remove any excess braze material.

(3) Assemble and install new supports and seal as follows: (Refer to figures 5-489 and 5-490 and SP No. 5004 in Appendix E in conjunction with the following instructions.)

(a) Place forward support (1-120-026-05) and seal assembly (1-120-040-03) into holding fixture (LTCT11043) and clamp.

NOTE

Use shims, as necessary, between the support and seal at the clamping area as shown in figures 5-489 and 5-490.

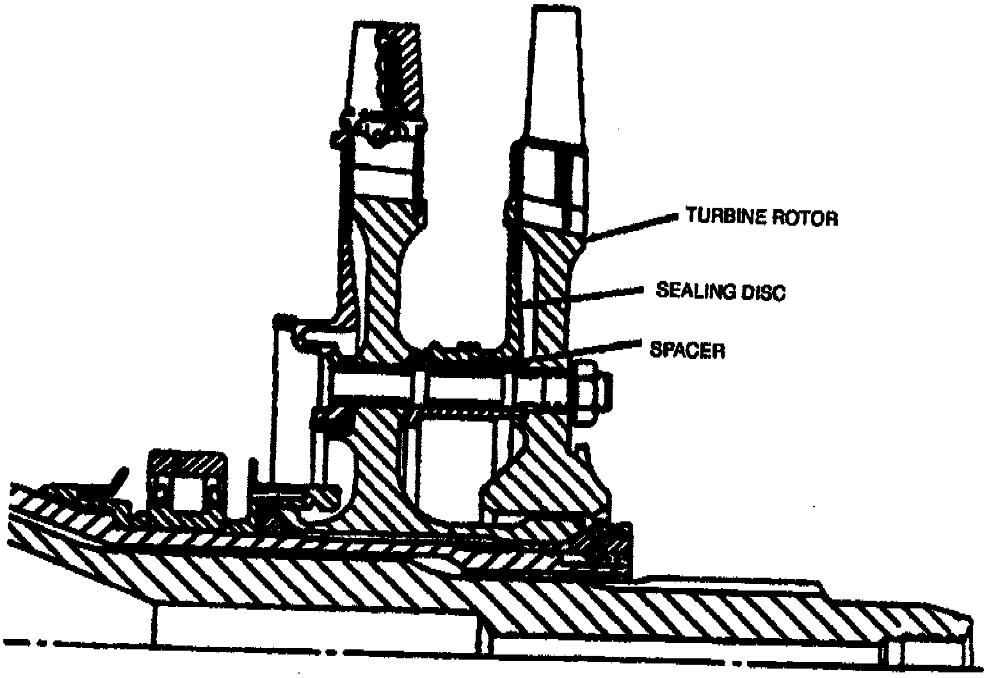


Figure 5-487. Assembled First and Second Gas Producer Turbine Rotors (New Configuration).

(b) Align support end to allow 0.020 inch (0.051 cm) axial gap between support and seal assembly as shown in referenced figures.

(c) Tack-weld forward support to seal assembly in eight places. Use tungsten inert gas (TIG) method with welding wire (item 349, table C–1)

(d) Install rear support (1-120-027-03) to the assembled forward support and seal assembly and clamp.

NOTE

Use shims, as necessary, between rear support and seal assembly as shown in figure 5-490.

(e) Align the end of the rear support with the end of the seal assembly. (See figure 5-490.)

(f) Tack-weld the rear support to the seal assembly in eight equally spaced places using tungsten inert gas (TIG) weld method with welding wire (item 349, table C–1).

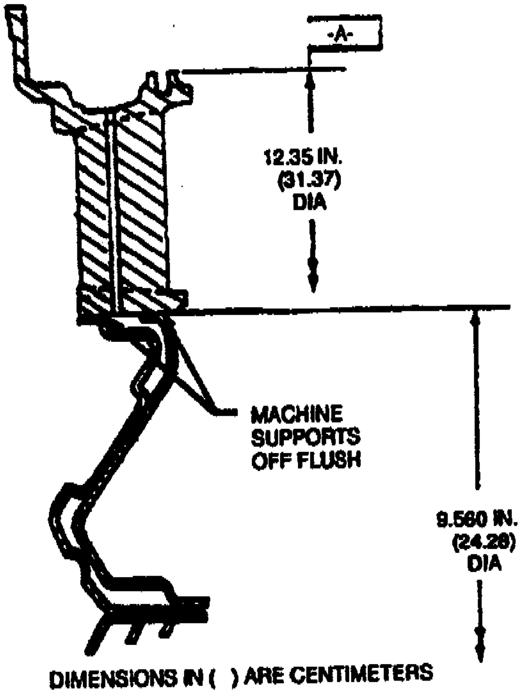


Figure 5-488. Removal of Nozzle Supports by Machining.

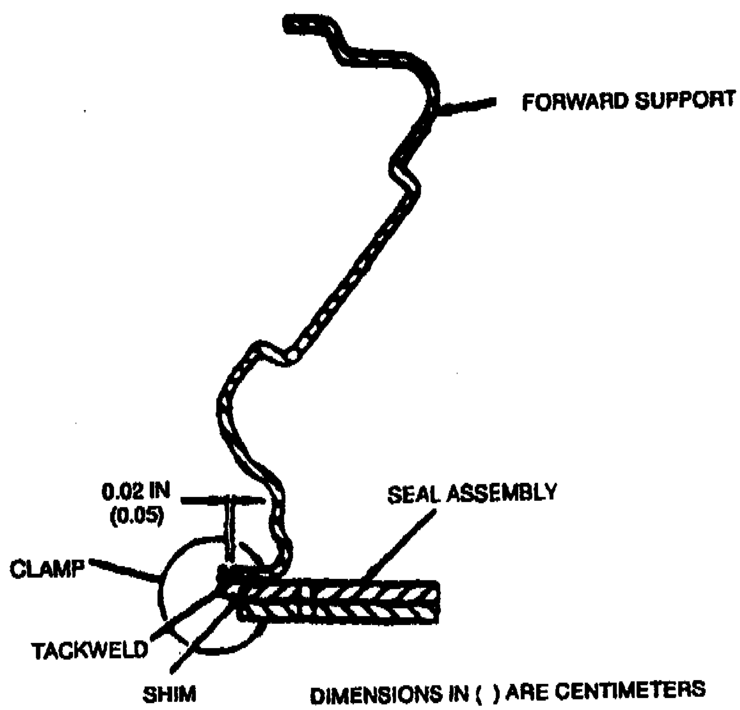


Figure 5-489. Assembly and Installation of Forward Nozzle Support to Seal Assembly.

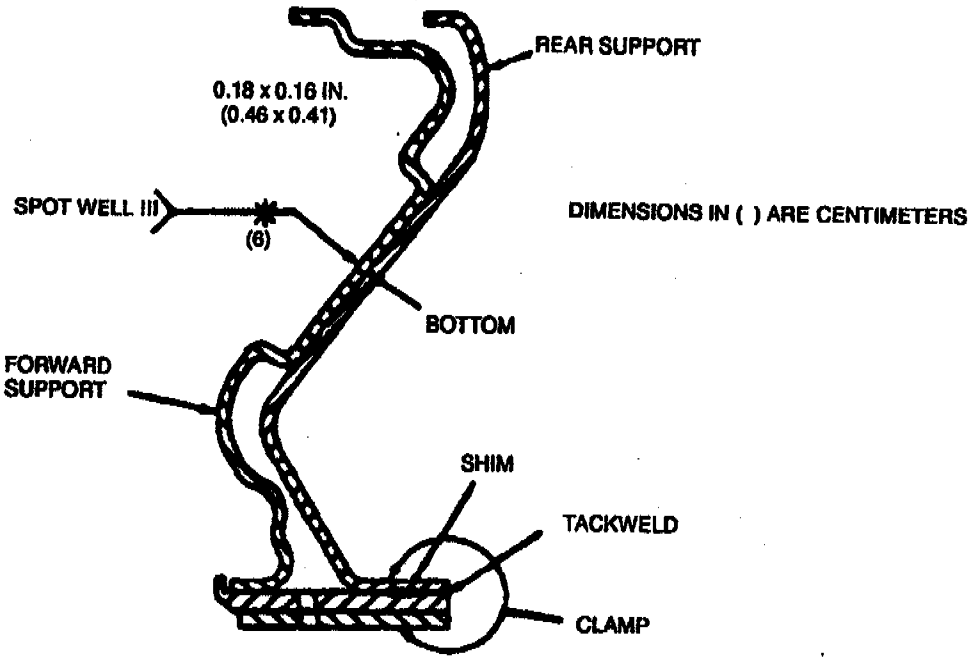


Figure 5-490. Assembly and Installation of Rear Nozzle Support to Forward Support to Seal.

(g) Remove nozzle assembly from holding fixture and remove all shims.

(h) Spot-weld rear support to forward support in six places as shown in figure 5-490. (Refer to SP No. 5002 in Appendix E.)

(4) Assemble support assembly to nozzle and reinstall in holding fixture (LTCT11043). Using shims, maintain a 0.002 to 0.005 inch (0.005 to 0.013 cm) brazing gap.

(5) Tack-weld both supports to nozzle in six equally spaced places using tungsten inert gas (TIG) weld method with welding wire (item 346, table C–1).

(6) Remove nozzle from holding fixture. Remove shims and clean all tack-welds.

(7) Apply brazing alloy (item 64, table C–1) to all joints specified in figure 5-491.

(8) Place nozzle, forward side down, on a flat stainless steel support which has been machined to provide clearance at the inner shroud forward support joints. Vacuum braze at 1,900°F (1,038°C) for 2 to 10 minutes.

(9) Inspect nozzle visually and by using fluorescent-penetrant inspection method.

NOTE

No cracks permitted in brazed joints; however, visual and fluorescent-penetrant indications within overhaul limits are acceptable.

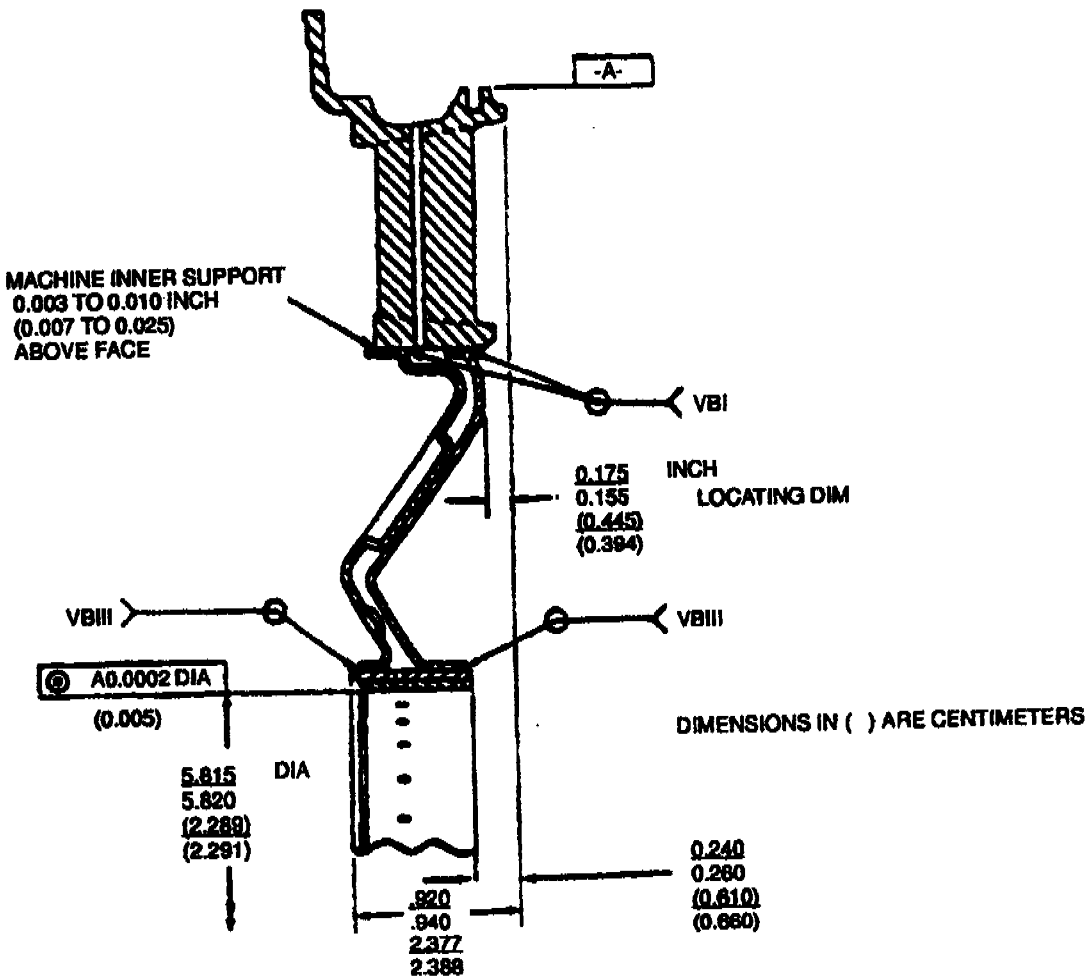


Figure 5-491. Brazing and Final Machining of Second Stage Gas Producer Nozzle Assembly.

(10) Final machine to dimensions shown in figure 5-491.

(11) Reidentify second stage gas producer nozzle from 1-120-000-14 to 1-120-050-03.

5-407. MODIFICATION OF DIFFUSER HOUSING AND GAS PRODUCER COMPONENTS. The following instructions provide data for the incorporation of new internally cooled/new material first stage gas producer rotor blades. Also included are the rework procedures for the introduction of a new No. 2 aft seal and a pinned No. 2 bearing.

a. Rework diffuser housing from a 1-110-230-08 to a 1-110-230-15 configuration as follows: (See figure 5-492).

(1) Machine scallops at seven places as shown. Remove all sharp edges and burrs.

(2) Add two holes equally spaced and tap 190-32 UNJF-3B depth through. Countersink 90 degrees to 0.220 inch (0.559 cm) diameter.

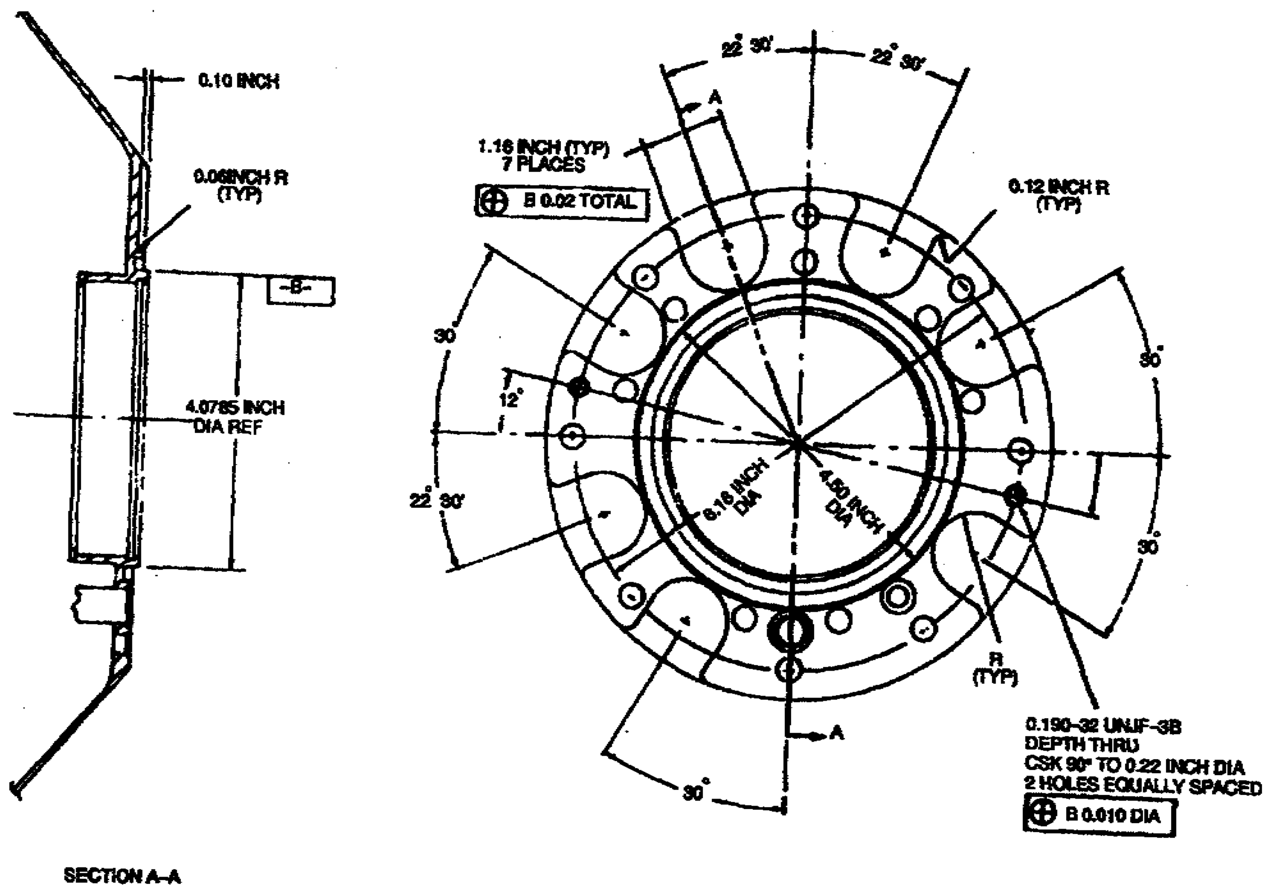
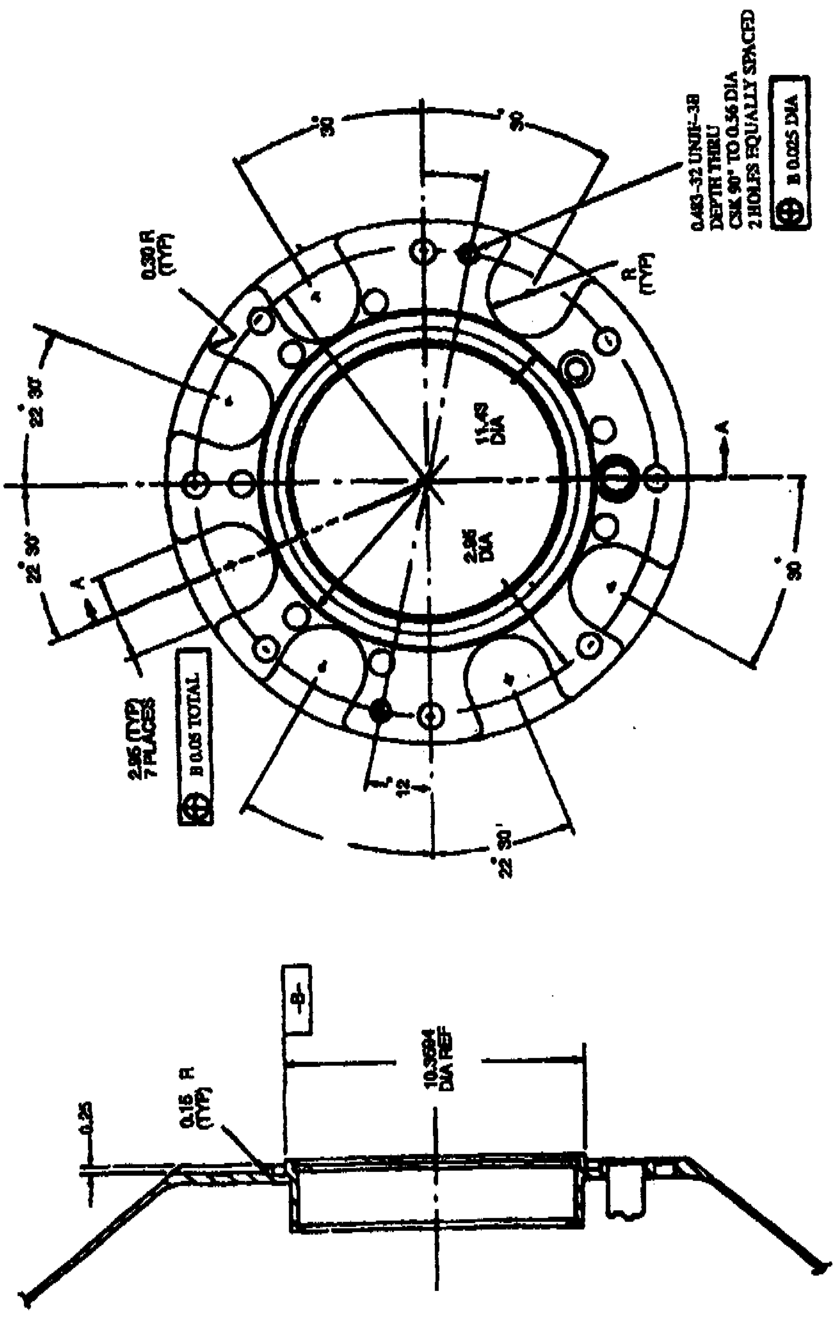


Figure 5-492. Rework of Diffuser Housing (English).



SECTION A-A

ALL DIMENSIONS ARE IN CENTIMETERS

Figure 5-493. Rework of Diffuser Housing (Metric).

(3) Flush all passages to remove machining residue. Clean housing with dry cleaning solvent (item 102, table C–1), or cleaning solvent (item 101 or 103, table C–1), followed by isopropyl alcohol (item 25, table C–1) to facilitate drying.

WARNING

FLIGHT SAFETY PART

Fluorescent penetrant inspection is flight safety critical.

(4) Perform a visual and fluorescent-penetrant inspection of reworked area.

(5) Reidentify diffuser from 1-110-230-08 to 1-110-230-15.

b. Rework the rear bearing housing from a 1-110-590-02 to a 1-110-470-13 configuration as follows: (See figure 5-494.)

(1) Using standard hand tools and an arbor press, press out four tubes and discard.

(2) Machine the housing rear surface, as required, to obtain the 0.234 to 0.236 inch (0.594 to 0.599 cm) dimension shown in figure 5-494.

(3) Perform the following on the housing front face:

(a) Remachine seven slots by milling to the dimensions and requirements shown. (See figure 5-494, View B-B.)

CAUTION

The total gap and minimum and maximum individual gap limits are flight safety critical

(b) Enlarge seven existing 0.314 inch (0.798 cm) diameter holes to a 0.466 to 0.173 inch (1.184 to 1.201 cm) diameter through one wall. Countersink each hole 45 degrees to a 0.500 inch (1.270 cm) diameter.

(c) Bore 14 new 0.310 to 0.317 inch (0.787 to 0.805 cm) diameter holes through one wall as shown. Countersink each hole 45 degrees to a 0.380 inch (0.965 cm) diameter.

(d) Plug four holes as follows:

1 Rework four holes by boring to a 0.2488 to 0.2495 inch (0.6314 to 0.6337 cm) diameter. Depths are as shown in figure 5-494.

2 Press four plugs, AN122715, into reworked holes. Stake securely.

(4) Perform the following on the housing rear face:

CAUTION

The total gap and minimum and maximum individual gap limits are flight safety critical

(a) Bore two new 0.220 inch (0.559 cm) diameter holes and counterbore as shown. (For counterbore depth, see figure 5-494, Section A-A.)

(b) Rework four holes at the locations shown in figure 5-494 to a 0.279 to 0.286 inch (0.709 to 0.726 cm) diameter through one wall only.

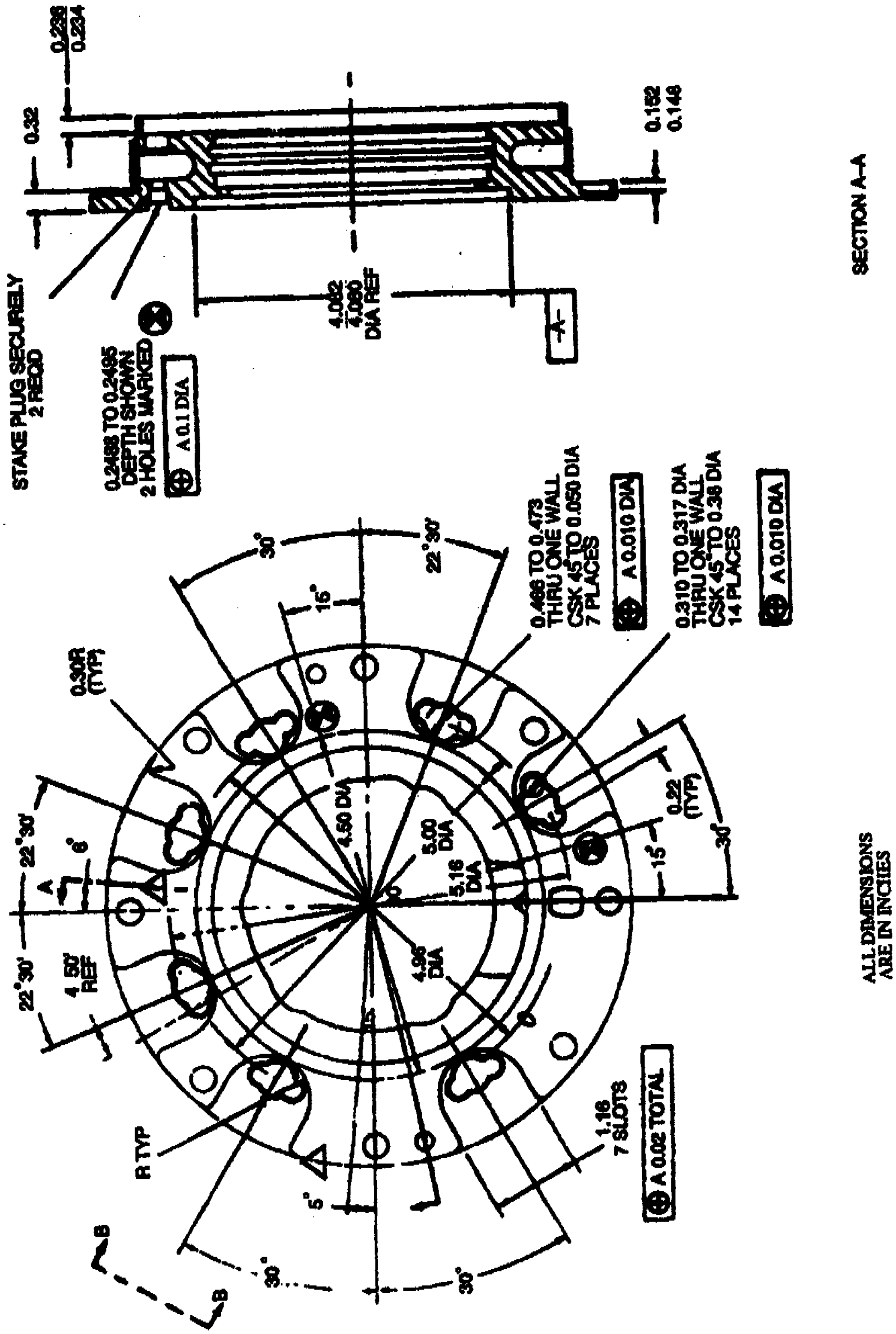
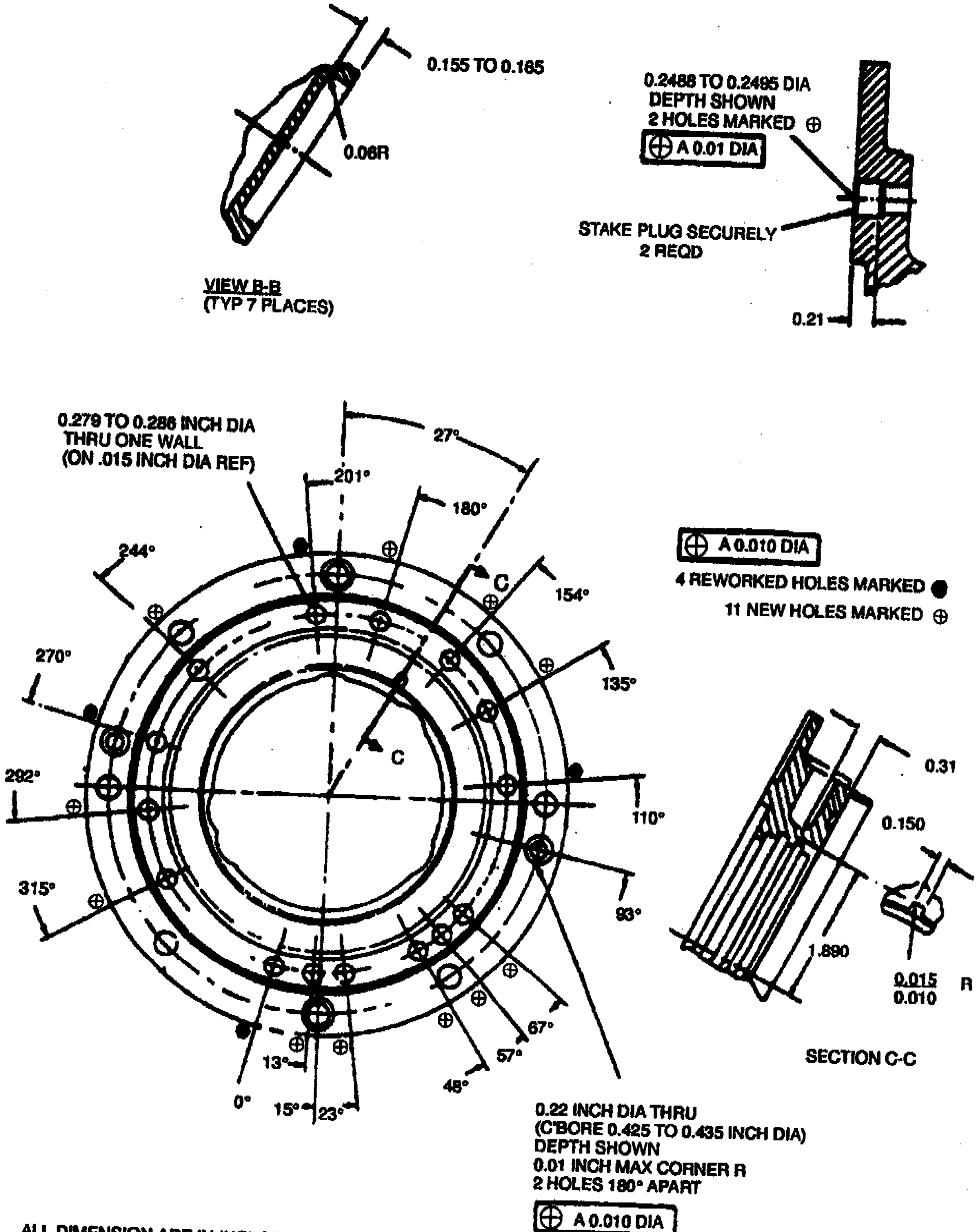


Figure 5-494. Rework of No. 2 Bearing Housing (Sheet 1 of 2) (English).



ALL DIMENSION ARE IN INCHES

Figure 5–494 Rework of No. 2 Bearing Housing (Sheet 2 of 2) (English)

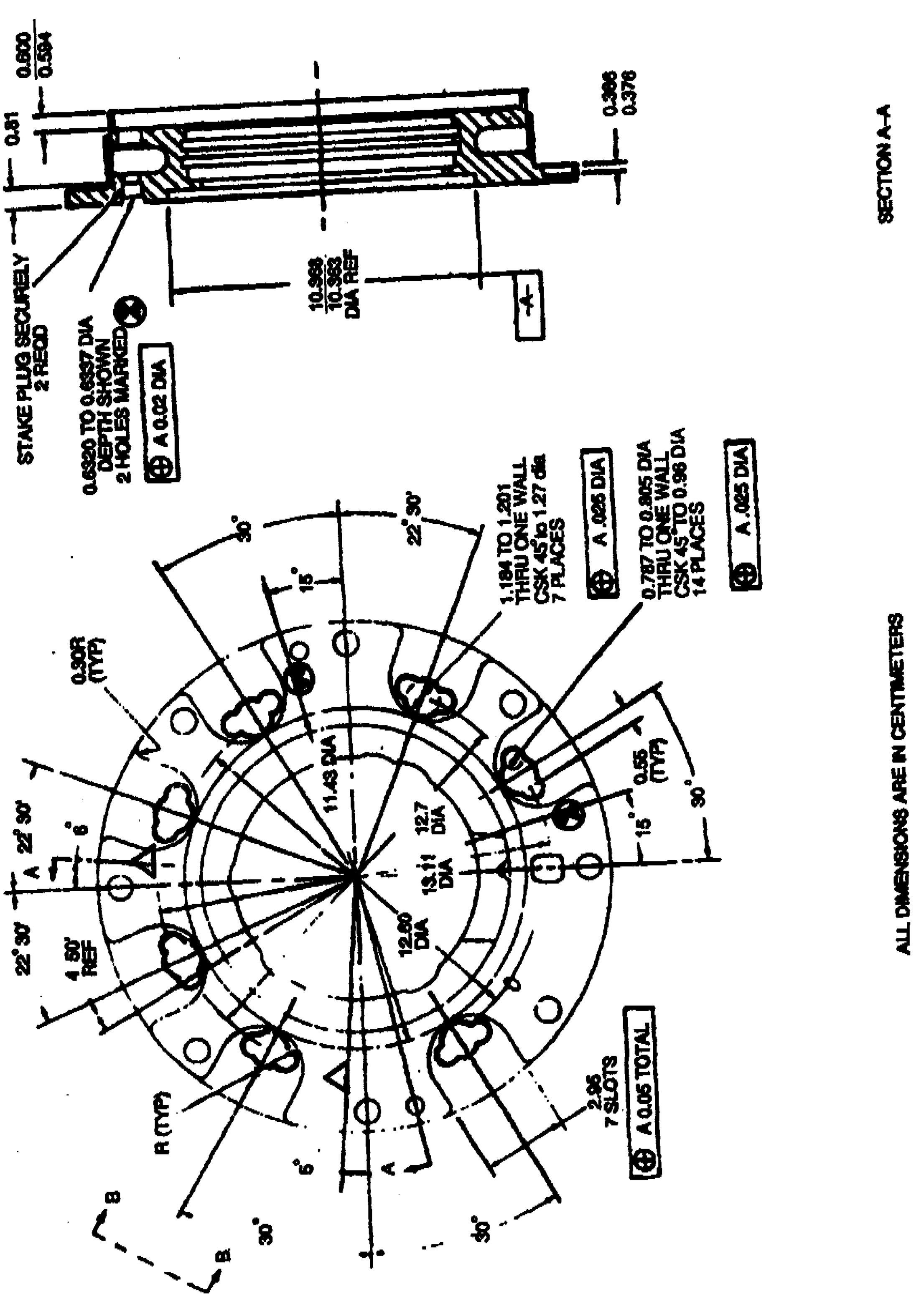


Figure 5-495. Rework of No. 2 Bearing Housing (Sheet 1 of 2) (Metric).

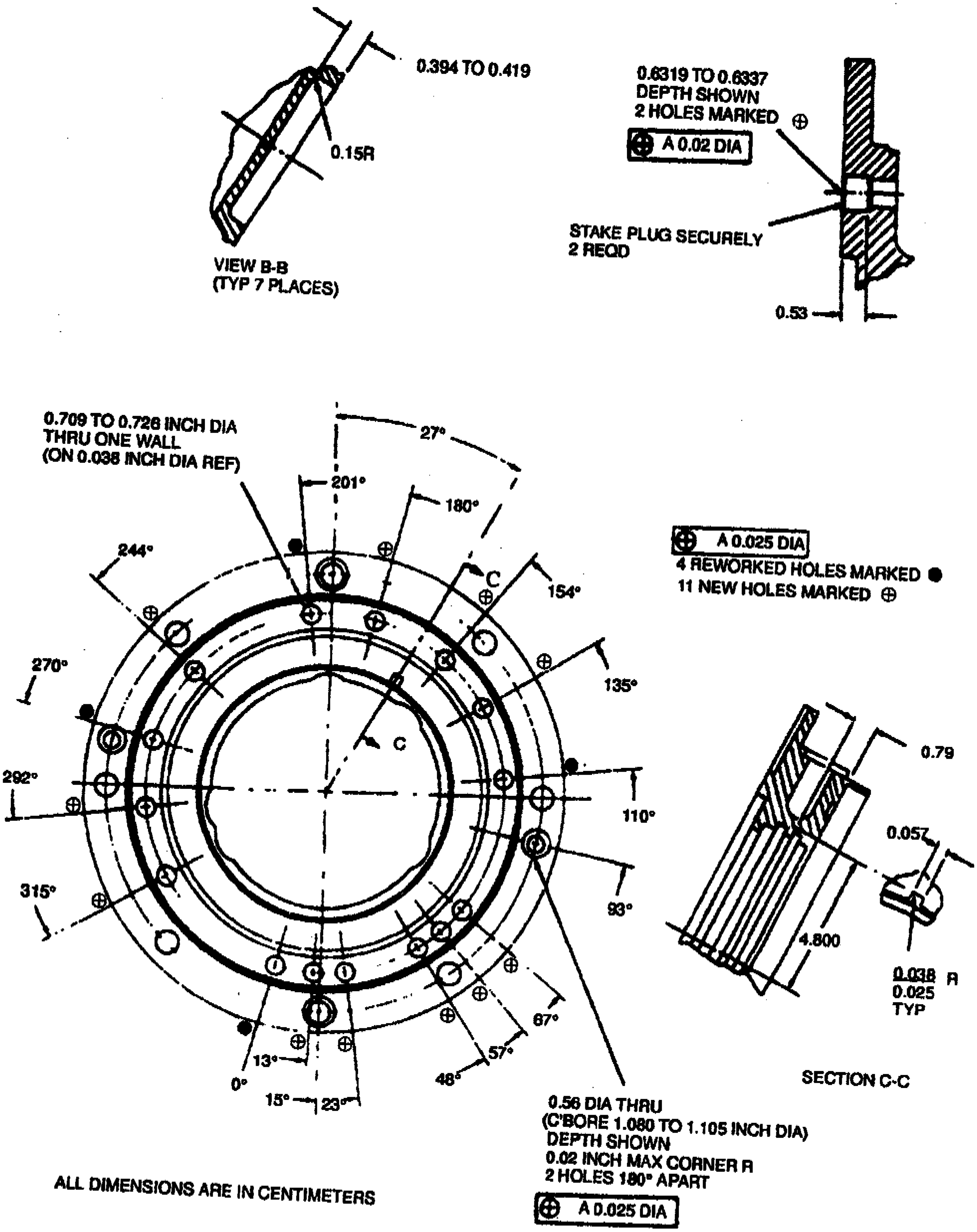


Figure 5-495. Rework of No. 2 Bearing Housing (Sheet 2 of 2) (Metric).

CAUTION

The old holes were bored on a 4.960 inch (12.598 cm) diameter circle, while the new enlarged holes are to be bored on a 5.015 inch (12.738 cm) diameter circle; therefore, do not use old holes to locate new holes.

(c) Drill 11 new 0.279 to 0.286 inch (0.709 to 0.726 cm) diameter holes through one wall only, at the locations shown. (See figure 5-494.)

NOTE

There should be a total of 21 0.279 to 0.286 inch (0.709 to 0.726 cm) diameter holes on the completed housing.

(5) Using an electric discharge machine, burn a 0.150 inch (0.381 cm) wide slot in housing as shown in figure 5-494, Section C-C.

(6) Remove sharp edges and burrs from all reworked areas.

(7) Fluorescent-penetrant inspect.

(8) Touch up black oxide surface coating in reworked areas as outlined in SP No. 6002 in Appendix E.

(9) Reidentify rear bearing housing from 1-110-590-02 to 1-110-470-13.

c. Rework the No. 2 bearing from a 1-300-176-03/04 to a 1-300-584-01 configuration as follows:

CAUTION

While performing the following steps, extreme caution must be exercised so as not to distort or crack the outer race. Pay strict attention to pin fit.

(1) Assign one of the pins, MS9105-52, to each of the bearings.

(2) Using an electrical discharge machine, burn a hole in the bearing outer races as shown in figure 5-496 in order to maintain a 0.0002 to 0.0007 inch (0.0005 to 0.0018 cm) tight fit with the pin and so that 0.095 inch (0.241 cm) of the pin protrudes.

(3) Press the MS9105-52 pin into the outer race until it bottoms.

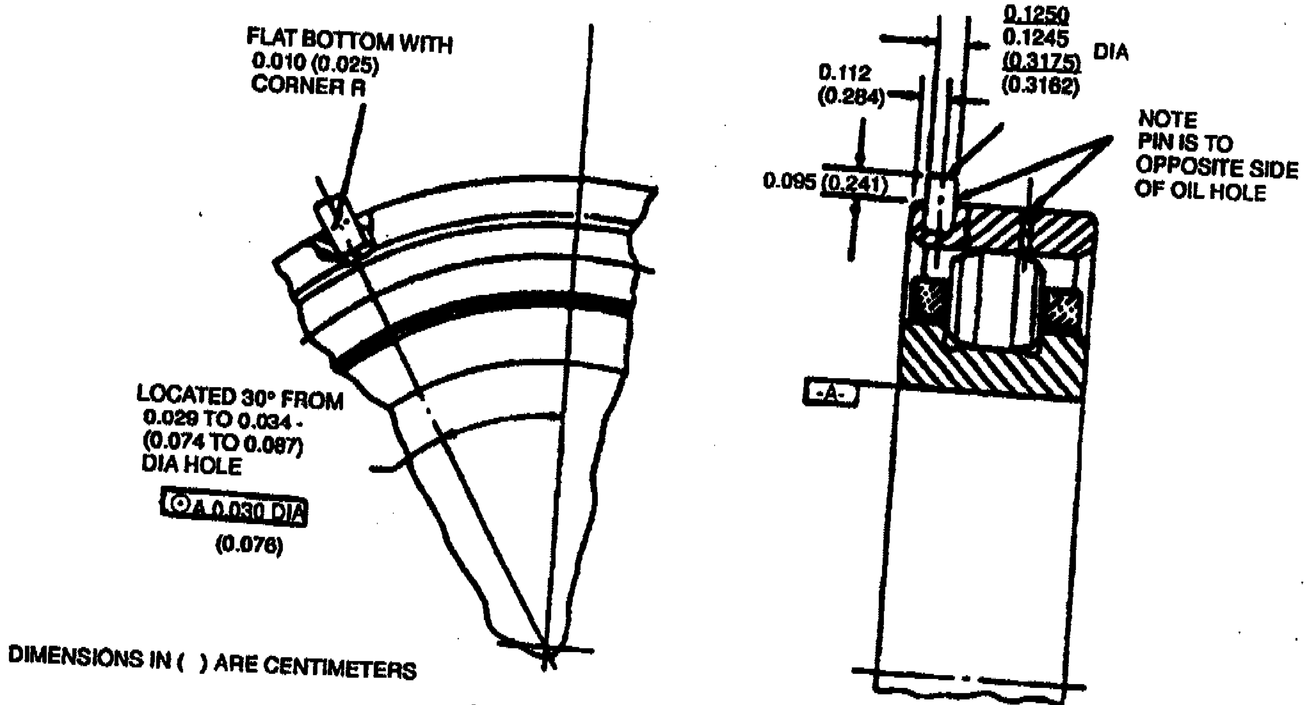


Figure 5-496. Rework of Number 2 and 3 Bearings.

(4) Inspect bearing for proper internal clearances. Inspect, using fluorescent penetrant method.

(5) Reidentify the No. 2 bearing from 1-300-176-03/04 to 1-300-584-01.

d. Rework the bearing retaining plate from a 1-110-181-06 to 1-110-181-10 configuration as follows: (See figures 5-497 and 5-498.)

(1) Rework four holes to a 0.279 to 0.286 inch (0.709 to 0.726 cm) diameter and add 11 new 0.279 to 0.286 inch (0.709 to 0.726 cm) diameter holes as shown in figure 5-497. Break all sharp edges to a 0.005 to 0.015 inch (0.013 to 0.381 cm) radius and remove all burrs.

(2) Fluorescent-penetrant inspect part.

(3) Touch up reworked areas with black oxide coating as outlined in SP No. 6002 in Appendix E.

(4) Reidentify bearing retainer plate from 1-110-181-06 to 1-110-181-10.

e. Replace outer sealing ring (1-110-161-03) with new sealing ring (1-110-376-08).

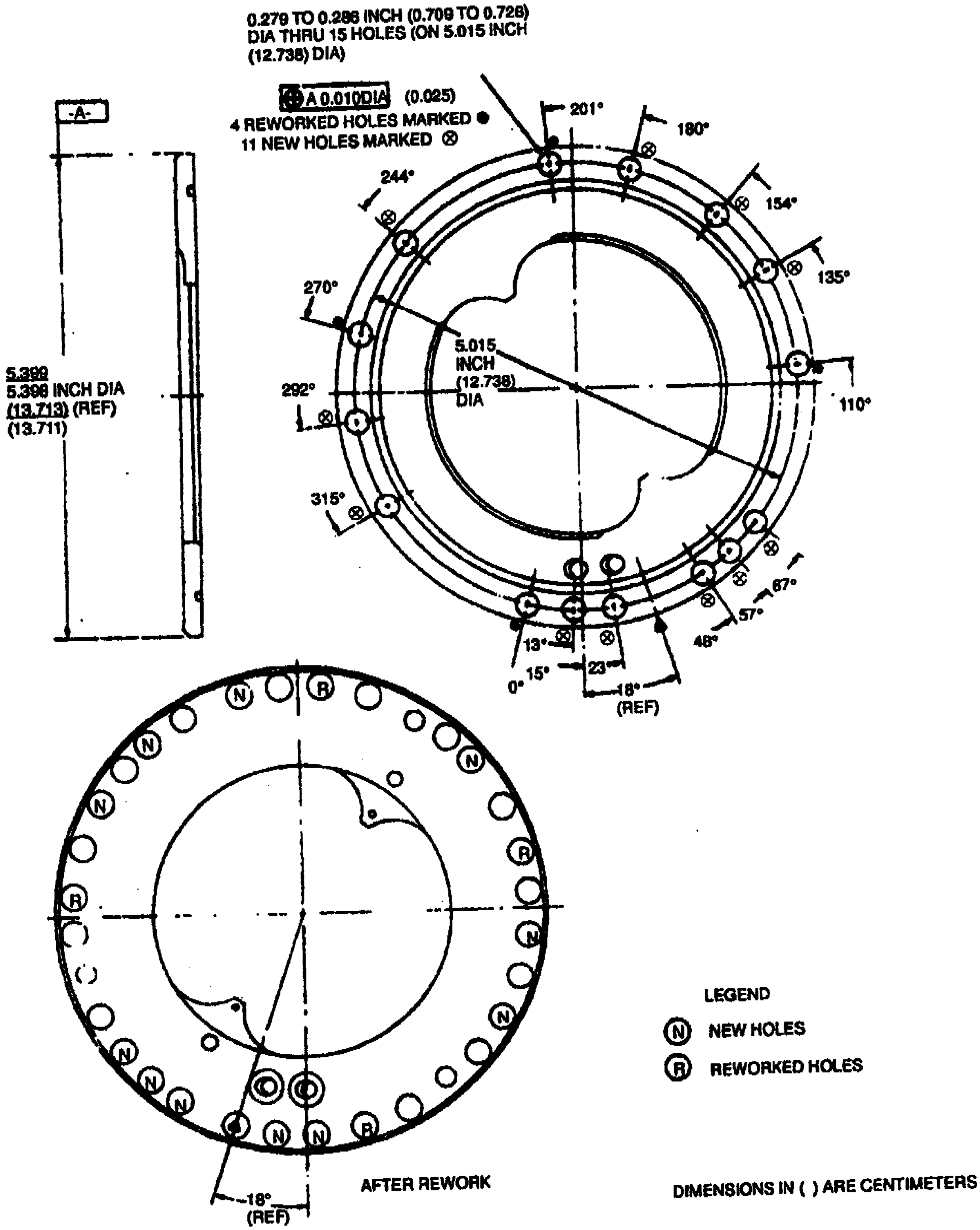


Figure 5-497. Rework of Bearing Retaining Plate.

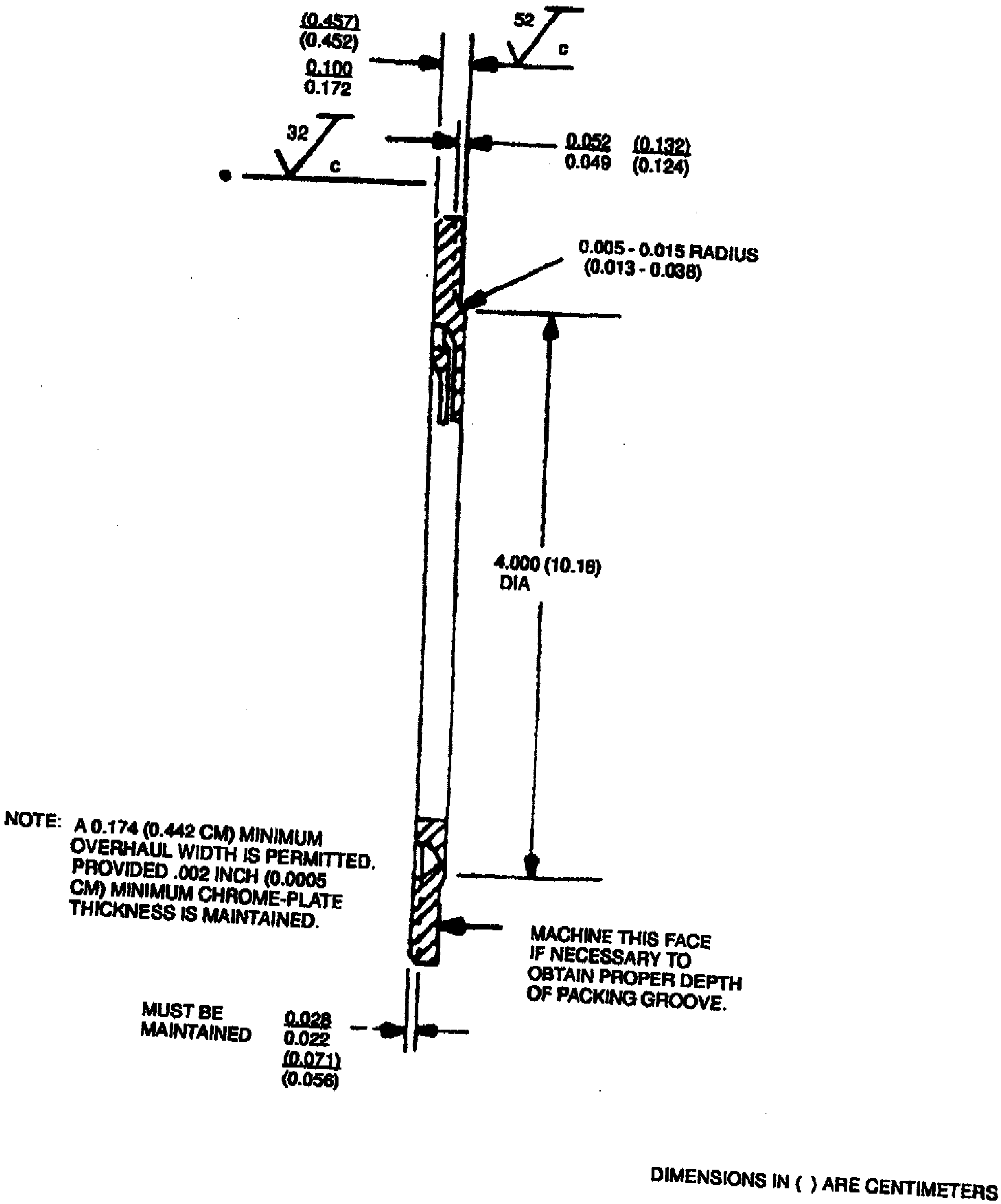


Figure 5-498. Rework of Bearing Retaining Plate (T53-L-13B, -15, -701, -701A).

f. Replace eight bolts (1-110-137-01) that secure outer sealing ring to bearing housing with eight new bolts, STD3061-08.

g. Replace two studs (1-110-131-04) and two special nuts (1-110-134-01) with two new bolts, MS9171-10, and washers, AN960-516L. This will give a total of eight bolts, MS9171-10. Bolts secure the nozzle, deflector, and bearing housing to air diffuser. (See figure 5-499.)

h. Add two new bolts, AN115408, to secure bearing housing to air diffuser during assembly. (See figure 5-499.) Discard two nuts (1-110-134-01).

i. Replace seal and retainer assembly (1-110-600-05), consisting of seal (1-300-174-02/03), seal retainer (1-300-194-04), and retaining ring (1-300-359-01) with new seal and retainer assembly (1-110-720-02).

j. Replace three bolts (1-140-157-02), that secure seal and retainer assembly to bearing housing, with new screws, AN115410.

k. Rework first stage gas producer turbine rotor from a 1-100-880-09/12 or 1-101-530-01 to a 1-101-100-08 configuration as follows: (See figure 5-500.)

(1) Deblade assembly and remove sealing disc (1-100-135-03). Clean and inspect disc.

(2) Reassemble and reblade disc with new internally cooled blades (1-100-362-06), new sealing disc (1-100-545-03), and new spacer ring (1-100-559-01).

NOTE

Follow procedures given in paragraph 5-258.

(3) After rotor is completely assembled, mount grinding fixture (LTCT13007) onto rear spacer face and mount unit in a Norton OD Grinder (14 x 36), or equivalent. Grind turbine rotor blades to maximum overhaul service dimension. (Refer to paragraph 5-258.)

NOTE

Do not break corners after grinding; sharp corners are desired.

(4) Reidentify first stage gas producer turbine rotor from 1-100-880-09/12 or 1-101-530-01 to 1-101-100-08.

(5) Clean and balance rotor as outlined in paragraph 5-256.

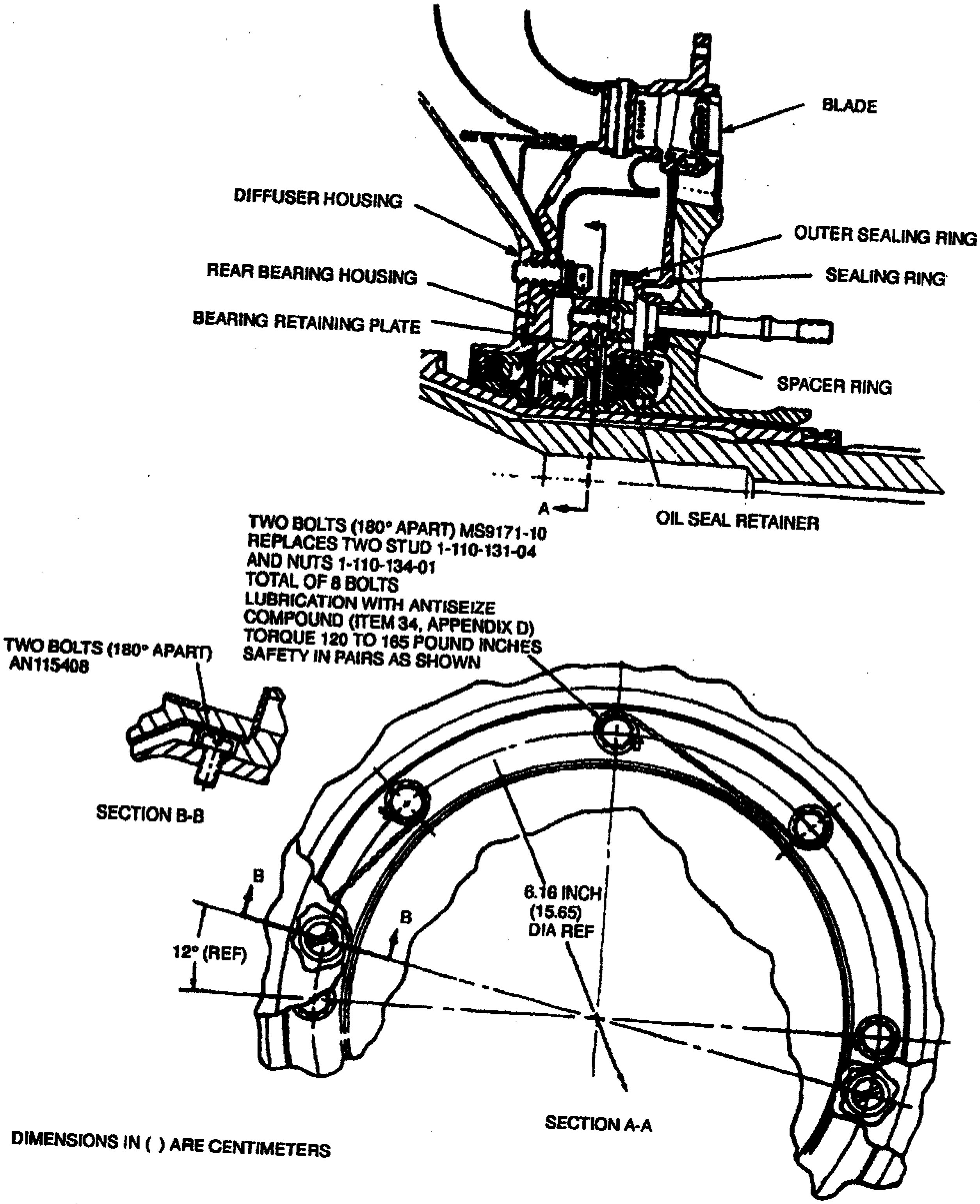


Figure 5-499. New Configuration Showing Assembly of Components.

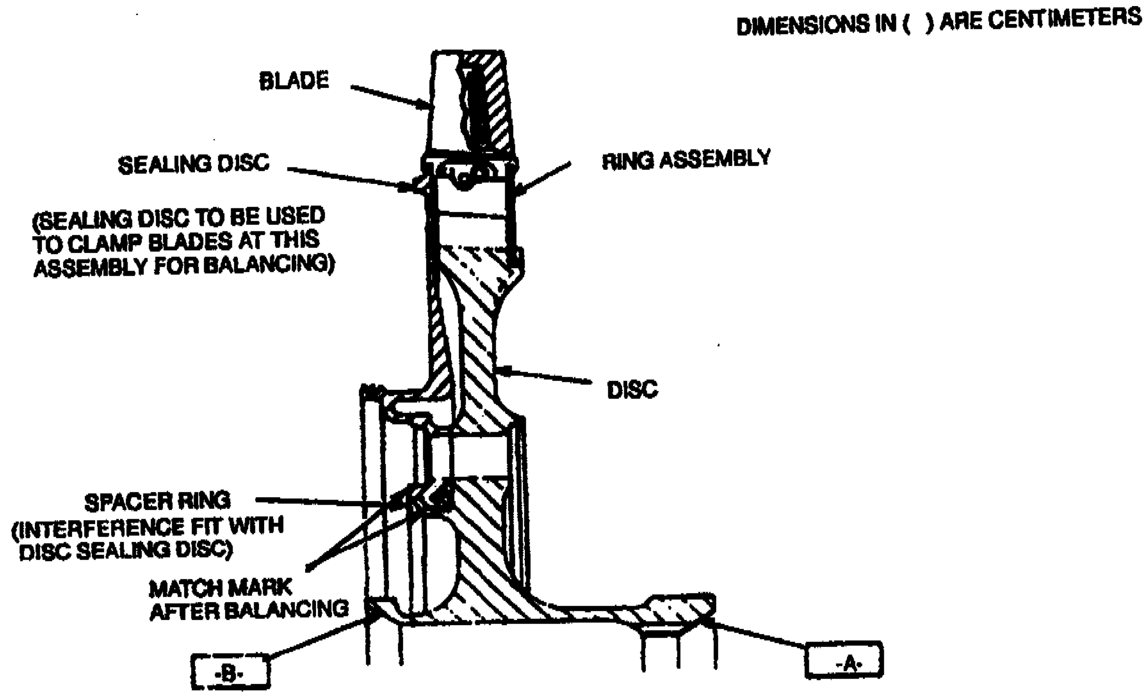


Figure 5-500. First Stage Gas Producer Turbine Rotor Assembly.

5-408. INCORPORATION OF CERTAIN T53-L-703 PARTS ON THE T53-L-13B AND T53-L-701A ENGINES. The following instructions provide data for the incorporation of T53-L-703 parts, and associated modified parts in the hot section.

a. Use air diffuser housing 1-110-230-15.

b. Use rear bearing housing 1-110-470-13.

c. Use bearing 1-300-584. Bearing 1-300-176-03/04 may be modified for use per paragraph 5-407.

d. Use bearing retaining plate 1-110-181-10 or 1-110-181-06.

e. Replace sealing ring 1-110-161-03 with sealing ring 1-110-398-01 (alternate part number "AED-P1216"). On each engine assembled with sealing ring 1-110-398-01 or "AED-P1216", annotate DA Form 2408-5, Engine Modification.

f. Replace two studs (1-110-131-04) and two special nuts (1-110-134-01) with two new bolts, MS9171-10. This will give a total of eight bolts, MS9171-I0. Bolts secure the nozzle, deflector, and bearing z to air diffuser. (See figure 5-499.)

g. Add two new bolts, AN115408, to secure bearing housing to air diffuser during assembly. (See figure 5-499.)

h. Replace seal and retainer assembly (1-110-600-05) consisting of seal (1-300-174-02/03), seal retainer (1-110-194-04) and retaining ring (1-300-359-01) with new seal and retainer assembly (1-110-720-02).

i. Use bolts 1-140-157-02, to secure seal and retainer assembly to bearing housing.

FOR THE COMMANDER:

CLIFTON J. BRODERICK
Colonel, OD
Chief of Staff

Official:

Richard E. Turner

RICHARD E. TURNER
Director
Logistics Support Directorate
Integrated Materiel Management Center

*Zero in this column indicates an original page.

REQUEST FOR DEPOT ENGINEERING SUPPORT

CONTRACT NO.	PRIORITY OF REQUEST ☐ URGENT ☐ ROUTINE	DATE OF REQUEST	

:

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COPIES:

FROM :

POINT OF CONTACT :

PUBLICATION NO.	CHANGE NO.	PUBLICATION DATE.

PUBLICATION TITLE

AREA OF PUBLICATION WHERE PROBLEM EXISTS. BE EXACT. PIN-POINT WHERE IT IS.

PAGE NO.	PARA-GRAPH	FIGURE NO	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT

(USE CONTINUATION SHEET IF NECESSARY)

TITLE	SIGNATURE	DATE

RECOMMENDED SOLUTIONS OR DISPOSITIONS

TITLE	SIGNATURE	DATE

These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@avma27.army.mil>
To: ls-lp@redstone.army.mil

Subject: DA Form 2028

28. ***From:*** Joe Smith
29. *Unit:* home
30. ***Address:*** 4300 Park
31. ***City:*** Hometown
32. ***St:*** MO
33. ***Zip:*** 77777
34. ***Date Sent:*** 19-OCT-93
35. ***Pub no:*** 55-2840-229-23
36. ***Pub Title:*** DMWR
37. ***Publication Date:*** 04-JUL-85
38. *Change Number:* 7
39. *Submitter Rank:* MSG
40. ***Submitter FName:*** Joe
41. *Submitter MName:* T
42. ***Submitter LName:*** Smith
43. ***Submitter Phone:*** 123-123-1234
44. ***Problem:*** 1
45. *Page:* 2
46. *Paragraph:* 3
47. *Line:* 4
48. *NSN:* 5
49. *Reference:* 6
50. *Figure:* 7
51. *Table:* 8
52. *Item:* 9
53. *Total:* 123
54. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

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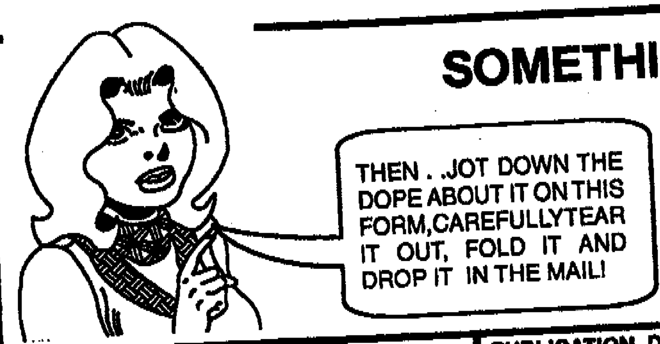

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC John DOE
CO A 3rd Engineer Bn
Ft. Leonardwood, MO 63108

DATE SENT 22 August 1992

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 1-1520-250-10	15 June 1992	Operator's manual MH60K Helicopter

BE EXACT PIN-POINT WHERE IT IS | IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.
81		4-3		Callout 16 on figure 4-3 is pointed at a bolt. In key to figure 4-3, item 16 is calle a shim. Please correct one or the other

EXAMPLE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE
JOHN DOE, PFC (268) 317-7111	JOHN DOE John Doe

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OFFICIAL BUSINESS

COMMANDER
U.S. ARMY AVIATION AND MISSILE COMMAND
ATTN: AMSAM-MMC-LS-LP
REDSTONE ARSENAL, AL 35898-5230

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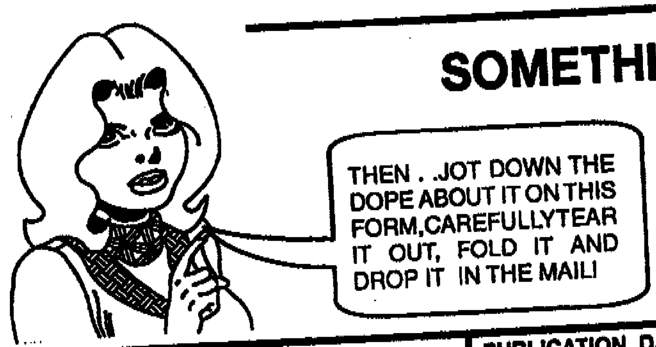

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
DMWR 1-2840-113-2	15 JANUARY 1999	DMWR FOR TURBO-PROP AND TURBOSHAFT AIRCRAFT ENGINES

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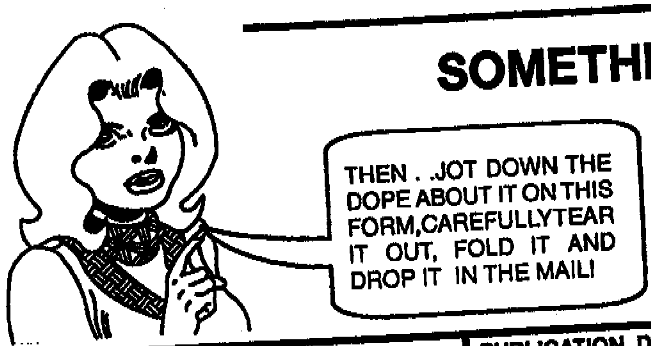

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DMWR 1-2840-113-2	15 JANUARY 1999	DMWR FOR TURBO-PROP AND TURBOSHAFT AIRCRAFT ENGINES

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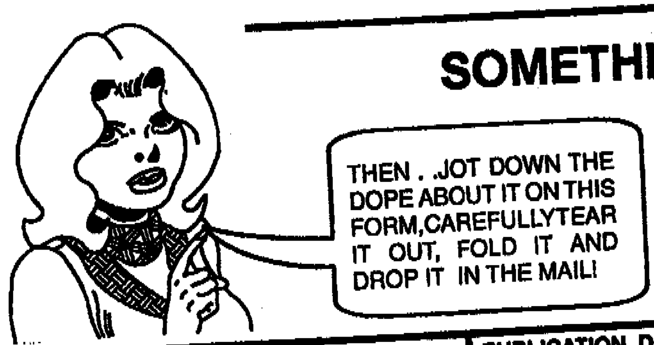

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce–inches	newton–meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound–feet	newton–meters	1.356	metric tons	short tons	1.102
pound–inches	newton–meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C