

# Section 30 FUEL AND AIR REPAIR

## CONTENTS OF THIS SECTION

	Page		Page
<b>GROUP 00 - SPECIFICATIONS AND SPECIAL TOOLS</b>		<b>GROUP 10 - DIESEL FUEL SYSTEM</b>	
Specifications		Fuel Supply Pump .....	10-1
Air Intake System .....	00-2	Fuel Check Valve .....	10-2
Diesel Fuel System .....	00-3	Fuel Filter .....	10-2
Control Linkage .....	00-4	Bleeding Fuel System .....	10-4
Special Tools .....	00-5	Fuel Injection Pump .....	10-4
<b>GROUP 05 - AIR INTAKE SYSTEM</b>		Aneroid .....	10-11
Air Cleaner .....	05-1	Hydraulic Aneroid Activator .....	10-12
AiResearch T-04B Turbo-		Injection Nozzles .....	10-13
charger .....	05-1	Overflow Valve .....	10-39
Schwitzer 3LM Turbo-		<b>GROUP 15 - CONTROL LINKAGE</b>	
charger .....	05-9	Throttle Cable .....	15-1
Intercooler and Intake Manifold .....	05-15	Starting Fuel Control Linkage .....	15-1
		Fuel Shut-Off Solenoid—	
		"D" Engines .....	15-4
		Rack Puller—"T" and "A" Engines .....	15-5

## Group 00

## SPECIFICATIONS AND SPECIAL TOOLS

## SPECIFICATIONS

## Air Intake System

ITEM	SPECIFICATION
<b>AIRESEARCH TURBOCHARGER</b>	
Total indicator reading limits for bearing clearance	0.003 to 0.006 in. (0.077-0.152 mm)
Total indicator reading limits for bearing end play	0.001 to 0.004 in. (0.025-0.101 mm)
Shaft elongation	0.0055 in. to 0.0065 in. (0.140-0.165 mm)
Backplate-to-center housing screws	75 to 90 in-lbs (8.5-10.2 Nm) (0.8-1.0 kgm)
Compressor wheel nut	18 to 20 in-lbs (2.0-2.3 Nm) (0.2 kgm)
Compressor housing-to-backplate screws	110 to 130 in-lbs (12.4-14.7 Nm) (1.2-1.5 kgm)
Turbine housing-to-center housing screws	100 to 130 in-lbs (11.3-14.7 Nm) (1.1-1.5 kgm)

## Schwitzer Turbocharger

<b>Axial end play</b>	
3LD-208 (-L0472-1)	0.003 to 0.008 in. (0.08 to 0.20 mm)
3LDA-259 (-L1872-1)	0.003 to 0.008 in. (0.08 to 0.20 mm)
3LD-208 (L0472-1-)	0.002 to 0.005 in. (0.05 to 0.13 mm)
3LDA-259 (L1872-1-)	0.002 to 0.005 in. (0.05 to 0.13 mm)
3LM-259	0.002 to 0.005 in. (0.05 to 0.13 mm)
3LM-299	0.002 to 0.005 in. (0.05 to 0.13 mm)
<b>Radial bearing movement</b>	
3LM-259	0.018 to 0.049 in. (0.46 to 1.24 mm) MAX.
3LM-299	0.021 in. (0.53 mm) MAX.
<b>Torques</b>	
Compressor wheel lock nut	156 in-lbs (17.6 Nm) (18 kgm)
Clamp band lock nut	120 in-lbs (13.5 Nm) (13.8 kgm)
Compressor cover screws	60 in-lbs (6.8 Nm) (6.9 kgm)
Lock plate screws	60 in-lbs (6.8 Nm) (6.9 kgm)
Exhaust adapter end play	1/16 in. (1.59 mm) — minimum

## INTAKE MANIFOLD

<b>Manifold pressure at 2200 engine rpm (full load)</b>	
6404T	15-17 psi (1-1.1 bar) (1.05-1.2 kg/cm <sup>2</sup> )
6404A	16-20 psi (1.1-1.3 bar) (1.12-1.41 kg/cm <sup>2</sup> )
6466T	16-19 psi (1.1-1.3 bar) (1.1-1.3 kg/cm <sup>2</sup> )
6466A	18-21 psi (1.2-1.4 bar) (1.2-1.4 kg/cm <sup>2</sup> )
Intake manifold-to-cylinder head cap screws	35 ft-lbs (47 Nm) (4.7 kgm)

**Diesel Fuel System**

ITEM	SPECIFICATION
Injection Pump Timing To Engine (All Engines) .....	TDC
4270D, 6404, and 6466D Engine Speeds and Automatic Advance (Roosa Master Pumps)	

	Engine Speeds (RPM)			Deg. Advance (Full Load)	
	Slow Idle	Fast Idle	Full Load	Set	Min. Movement
4270DR (Reg. Governor) .....	800	2750	2500	4° at 1900	4-1/2° by 2500
4270DF (3-5% Governor) .....	800	1900	1800	1° at 900	3-1/2° by 1350
6404DR and DF (Reg. Governor) (357084-499999) .....	800	2400	2200	5° at 1700	5-1/2° by 2100
(500000- ) .....	800	2400	2200	—	8-1/2° by 2100
6404DR and DF (3-5% Governor) (357084-499999) .....	800	1900	1800	4° at 1300	5-1/2° by 1650
(500000- ) .....	800	1900	1800	—	8-1/2° by 1500
6404TR-13 and AR-09 ( -357083) .....	800	2650	2500	5° at 1900	5-1/2° by 2200
6466DR and DF Regular Governor .....	800	2400	2200	—	9° ± 1/2° by 2100
3-5% Governor .....	800	1900	1800	—	8° ± 1/2 by 1500

**Torques**

Injection pump mounting nuts .....	20 ft-lbs (27 Nm) (2.7 kgm)
Fuel pipe connectors .....	20 ft-lbs (27 Nm) (2.7 kgm)
Injection pipe screws (4270D Engines) .....	35 ft-lbs (47 Nm) (4.7 kgm)
Drive gear-to-pump hub screws (6404D and 6466D Engines) .....	35 ft-lbs (47 Nm) (4.7 kgm)

Solenoid voltage (varies with throttle position) .....	Energize—5 to 7 volts Release—1 to 2 volts
--	---

6404T & A, 6466T & A Engine Speeds (Robert Bosch Pumps)	Slow Idle	Fast Idle	Full Load
6404TR-14 & AR-16 (357084-445569) .....	800	2300	2160
(445570- ) .....	800	2300	2160
6466TF (Reg. Governor) .....	800	2400	2200
6466TF & TR-09 (3-5% Governor) .....	800	2300	2200
6466AF (Reg. Governor) .....	800	2300	2100
6466AF & AR-03 (3-5% Governor) .....	800	2200	2100

**Torques**

Injection pump mounting nuts .....	35 ft-lbs (47 Nm) (4.7 kgm)
Fuel pipe connectors .....	20 ft-lbs (27 Nm) (2.7 kgm)
Drive gear-to-pump hub screws .....	35 ft-lbs (47 Nm) (4.7 kgm)



**Diesel Fuel System—Continued**

Item	Specification		
<b>Fuel Injection Nozzles</b>			
9.5 mm nozzle hold-down screw			20 ft-lbs (27 Nm) (2.7 kgm)
9.5 mm nozzle inlet connector			35 ft-lbs (47 Nm) (4.7 kgm)
21 mm nozzle identification			
6404D (500000- )			Model KDEL 5 x 0.25 nozzle size
6404T ( -445569 )			Model KDL 4 x 0.33 nozzle size
6404T (445570- )			Model KDEL 4 x 0.33 nozzle size
6404A ( -357083)			Model KDL 4 x 0.33 nozzle size
6404A (357084-445569)			Model KDL 3 x 0.40 nozzle size
6404A (445570- )			Model KDEL 4 x 0.345 nozzle size
6466D			Model KDEL 4 x 0.275 nozzle size
6466T			Model KDEL 4 x 0.33 nozzle size
6466A			Model KDEL 4 x 0.36 nozzle size
21 mm nozzle opening pressure			
6404D (500000- )			
New	3350 psi	(231 bar)	(235 kg/cm <sup>2</sup> )
Used	3200 psi	(221 bar)	(232 kg/cm <sup>2</sup> )
6404T ( -445569)			
New	3200-3350 psi	(221-231 bar)	(232-236 kg/cm <sup>2</sup> )
Used	3100 psi	(214 bar)	(218 kg/cm <sup>2</sup> )
6404T (445570- )			
New	4050 psi	(279 bar)	(285 kg/cm <sup>2</sup> )
Used	3800 psi	(262 bar)	(267 kg/cm <sup>2</sup> ) Minimum
6404A ( -445569)			
New	3200-3350 psi	(221-231 bar)	(232-236 kg/cm <sup>2</sup> )
Used	3100 psi	(214 bar)	(218 kg/cm <sup>2</sup> )
6404A (445570- )			
New	4050 psi	(279 bar)	(285 kg/cm <sup>2</sup> )
Used	3800 psi	(262 bar)	(267 kg/cm <sup>2</sup> ) Minimum
6466D			
New	3800 psi	(262 bar)	(267 kg/cm <sup>2</sup> )
Used	3600 psi	(248 bar)	(254 kg/cm <sup>2</sup> )
6466T			
New	4050 psi	(279 bar)	(285 kg/cm <sup>2</sup> )
Used	3800 psi	(262 bar)	(267 kg/cm <sup>2</sup> ) Minimum
6466A			
New	4050 psi	(279 bar)	(285 kg/cm <sup>2</sup> )
Used	3800 psi	(262 bar)	(267 kg/cm <sup>2</sup> ) Minimum
Nozzle retaining nut			44-58 ft-lbs (60-79 Nm) (6.0-7.9 kgm)
Nozzle gland nut			
KDL Nozzles			35 ft-lbs (47 Nm) (4.7 kgm)
KDEL Nozzles			65 ft-lbs (88 Nm) (8.8 kgm)
Fuel delivery pipe connectors			20 ft-lbs (27 Nm) (2.7 kgm)

**Control Linkage**

**STARTING FUEL CONTROL LINKAGE**

Bell crank bracket pivot pins (center-to-center) . . . . .	1.22 in. (31 mm)
Governor control lever-to-fast idle stop screw clearance . . . . .	0.09-0.11 in. (2.3-2.8 mm); collar locked against swivel
Control rod protrudes from rear collar (late linkage) . . . . .	0.10 in. (2.5 mm)

**SHUT-OFF SOLENOID**

Current draw at 12 volts . . . . .	2.5 amps
------------------------------------	----------

**RACK PULLER**

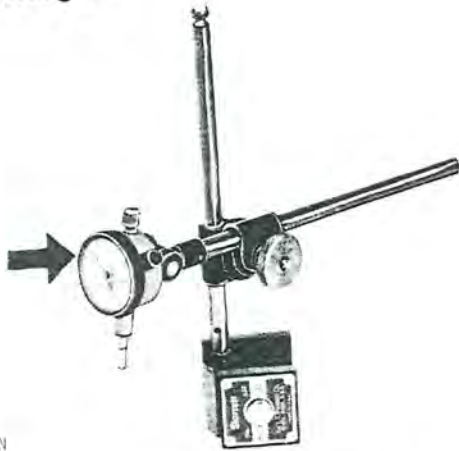
Current draw at 12 volts . . . . .	2.4 amps
Guide rod protrusion from bottom of housing . . . . .	0.75 in. (19 mm)

**SPECIAL TOOLS**

**Turbocharger**

**TOOL**

**USE**

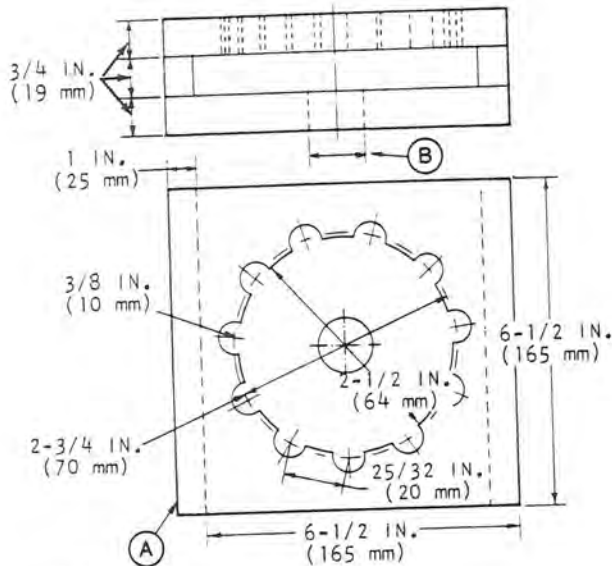


R 26750N

Fig. 1-Dial Indicator With Magnetic Base

D-17508C1 Dial Indicator Set with Magnetic Base

Measuring turbocharger shaft end play and radial movements.



R 26751N

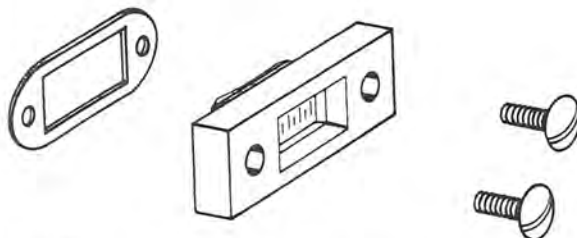
Fig. 2-Holding Fixture\* For AiResearch Turbocharger

Holding Fixture  
\*Fabricate in your shop

Hold turbine wheel for removal and installation of shaft nut

A—Wood or Aluminum Material

B—Bore To Clear Wheel Hub



R 29064N

Fig. 3-Timing Window

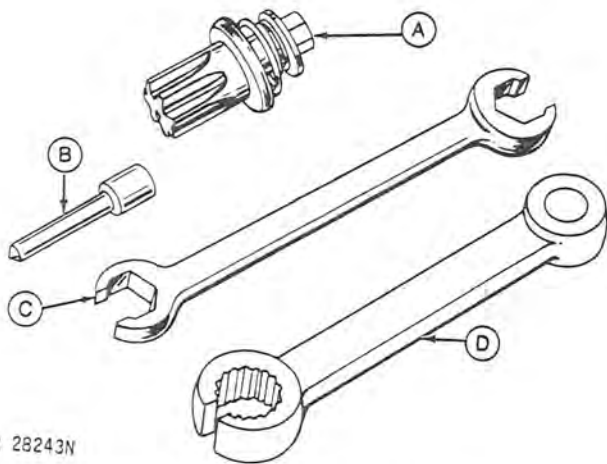
No. 19918 Timing Window

Check degrees of advance on 6404D and 6466D engines.

JD-259 or No. 13366 Timing Window

Check degrees of advance on 4270D engines

**Injection Pump**



R 28243N

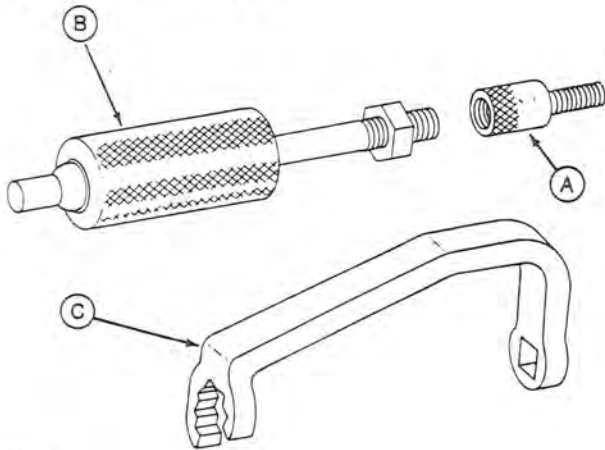
Fig. 4-Tools for Injection Pump Service

**TOOL**

**USE**

- A—JDE-81-1 Engine Rotation Tool  
Timing injection pump to engine (6-cylinder engines)
- B—JDE-81-4 Timing Pin  
Used in conjunction with JDE-81-1 to time injection pump
- C—CS-2428 Line Wrench  
Loosening & tightening injection pump and nozzle fuel pipe connectors (6404T, A; 6466T, A)
- D—JDE-90 Open Serrated Wrench  
Holding pump fuel outlet fitting from turning while loosening or tightening fuel pipe connectors (6466A)

**Injection Nozzles**



R 26840N

Fig. 5-KDL Nozzle Removal Tools

A—JDE-95 Nozzle Puller Adapter

Removal of KDL nozzles. Use with JDE-38 Puller.

B—JDE-38 Nozzle Puller

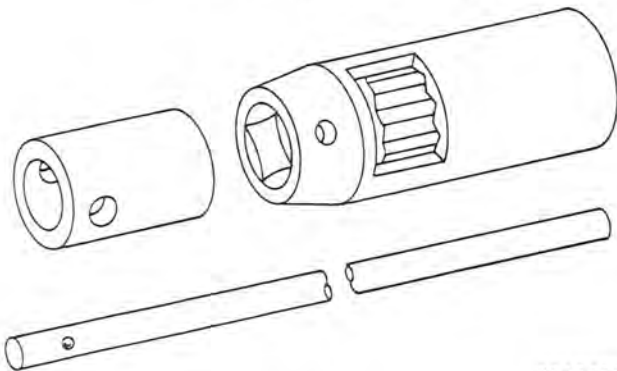
Removal of both 9.5 mm and KDL nozzles.

C—JDE-69 or 69A Wrench

Remove and install KDL nozzles.

JDE-92 Nozzle Socket Wrench

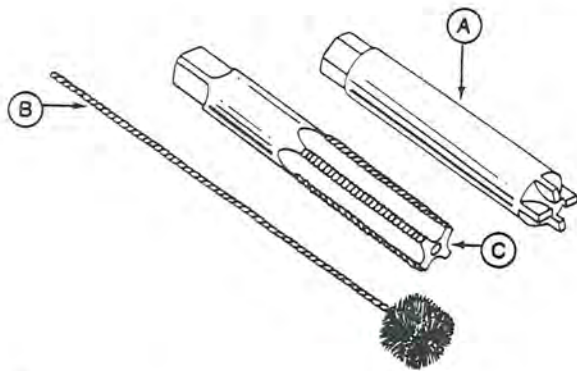
Installing Robert Bosch KDEL injection nozzles



R28362N

Fig. 6-Nozzle Socket Wrench





R 28244N

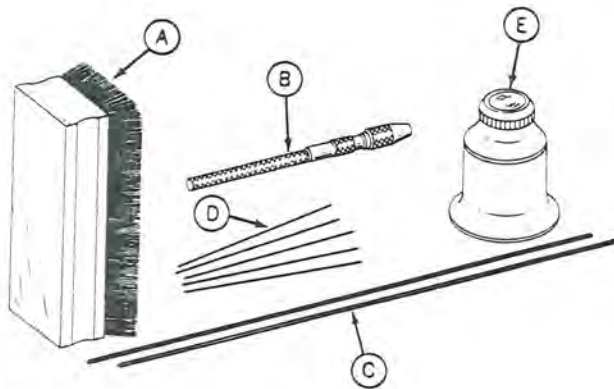
Fig. 7-Tools for Reconditioning Nozzle Seat and Threads In Cylinder Head

- A—JDE-99 Nozzle Seat Reamer
- B—Thread Cleaning Brush (D-17029BR for KDL) (D-17030BR for KDEL)
- C—Taps (JDF-4; M24 x 1.5 for KDL) (JDF-5; M28 x 1.5 for KDEL)
- Not shown - JDE-39 Nozzle Bore Cleaning Tool

Removing carbon from nozzle gasket seat in head.  
Cleaning nozzle threads in cylinder head.

Restoring nozzle threads in cylinder head.

Clean bores in cylinder head for 9.5 mm nozzles.



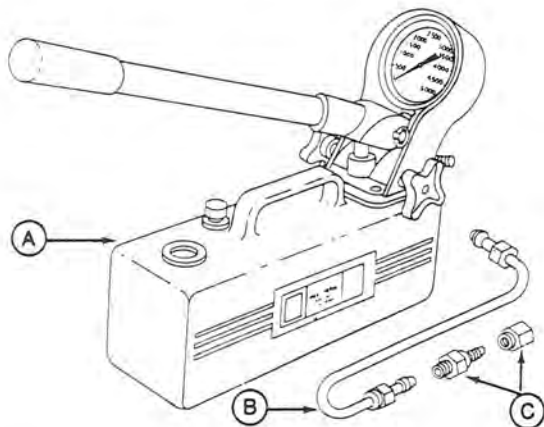
R28363N

Fig. 6-JDE-105 Nozzle Cleaning Kit

JDE-105 Nozzle Cleaning Kit

Cleaning injection nozzles

- A—Brass Wire Brush
- B—Pin Vise
- C—Sac Hole Cleaning Drill
- D—Cleaning Needles
- E—Inspection Magnifier



R 28245N

Fig. 7-Nozzle Testing Equipment

- A—D-01109AA Nozzle Tester (Y-900)
- B—Y-900-2 Fuel Line\*
- C—Adapters Y-900-3\* (KDL) Y-900-7\* and Y-900-15\* (KDEL) Y-900-3\*, Y-900-5\* and Y-900-9\* (9.5 mm nozzles)

Testing operational performance  
Connecting adapters to tester  
Connection nozzles to fuel line

\*-Included in D-01110AA Adapter Set (Y-910A)





## Group 05 AIR INTAKE SYSTEM

### AIR CLEANER

*NOTE: Removal of the air cleaner assembly is not normally required unless necessary to gain access to an adjacent component, or to make a repair on the air cleaner body.*

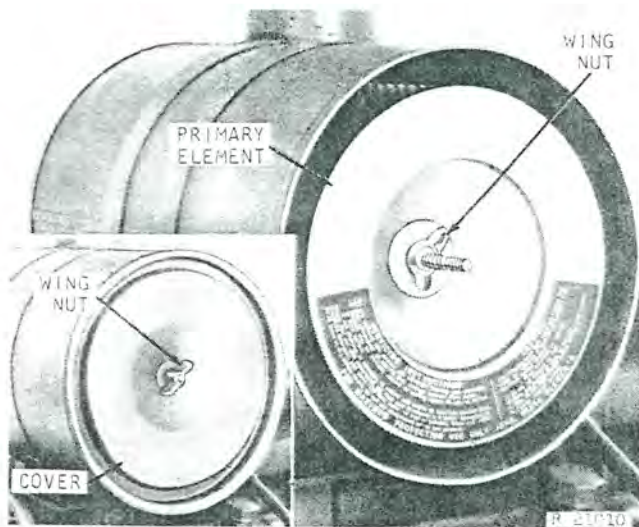


Fig. 1-Air Cleaner (Typical)

1. Inspect air cleaner and entire air intake system for cracks or holes. Repair or replace as necessary.
2. Service filter elements as directed in Group 10 of Section 10.

**IMPORTANT:** To prevent possible severe engine damage caused by ingestion of dirt, all connections between the air cleaner outlet and turbocharger must be tight.

### AIRESEARCH T-04B TURBOCHARGER Removal

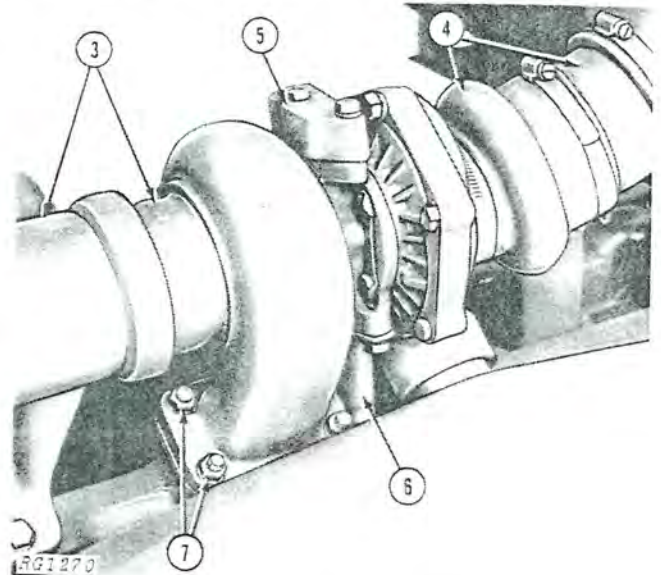


Fig. 2-Turbocharger Removal Procedure

1. Remove muffler (Not shown).
2. Clean the exterior of turbocharger and surrounding areas to prevent entry of dirt into the engine during removal (Not shown).
3. Remove exhaust elbow and adapter.
4. Disconnect air intake hoses at turbocharger and at air cleaner canister.
5. Disconnect lubricating oil inlet manifold.
6. Disconnect lubricating oil return line.
7. Remove four turbocharger-to-exhaust manifold mounting nuts.

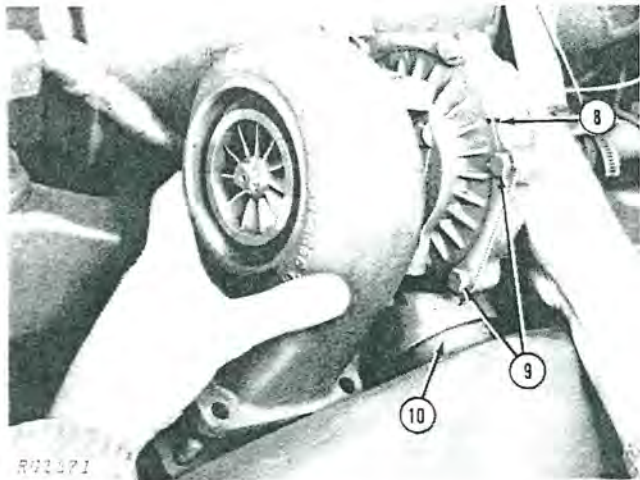
**AIRESEARCH T-04B TURBOCHARGER****Removal—Continued**

Fig. 3-Removing Turbocharger

8. Place locating marks on compressor cover and backplate.

9. Straighten ears on lock plates and loosen cap screws which secure compressor plates cover to backplate.

*NOTE: The locating marks will insure correct alignment when turbocharger is installed. Loosening the compressor cover to backplate cap screws permits easier removal of the turbocharger from mounting studs and intake manifold coupling.*

10. Disengage turbocharger from coupling and remove.

**Tests****General Information**

The Radial Bearing Test and the Axial End Play Bearing Test enables one to determine the general condition of the turbocharger. These tests should be made before beginning disassembly.

**Radial Bearing Test**

Perform this test to determine whether it is necessary to replace the thrust bearing, radial bearing, and/or rotating assembly of the center rotating assembly.

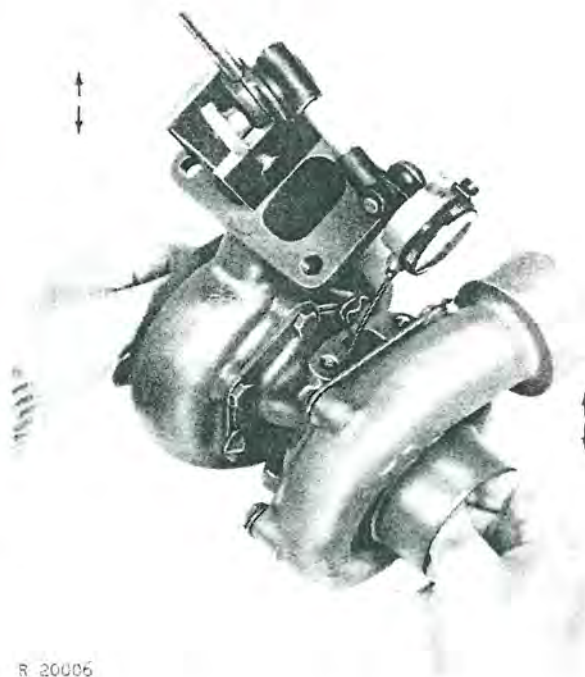


Fig. 4-Radial Bearing Test

Fasten a plunger-type dial indicator (having one-inch [25 mm] travel) to the turbocharger mounting base (Fig. 4). Attach a two-inch (50 mm) extension rod to dial indicator.

Insert indicator rod into the lubricating oil return outlet of center housing with tip of rod contacting the turbocharger shaft. Lock indicator in position and set dial at "0".

Apply side pressure at both ends of the shaft, first toward the dial indicator, then away from the indicator. Equal pressures should be applied simultaneously to both ends of the shaft.

Check the total dial indicator movement to see that the range of travel is limited to 0.003-0.006 in. (0.077-0.152 mm).

If the indicator movement is not within specifications repair is necessary.



### Axial End Play Bearing Test

Perform this test to determine if the rotating assembly must be repaired or replaced.

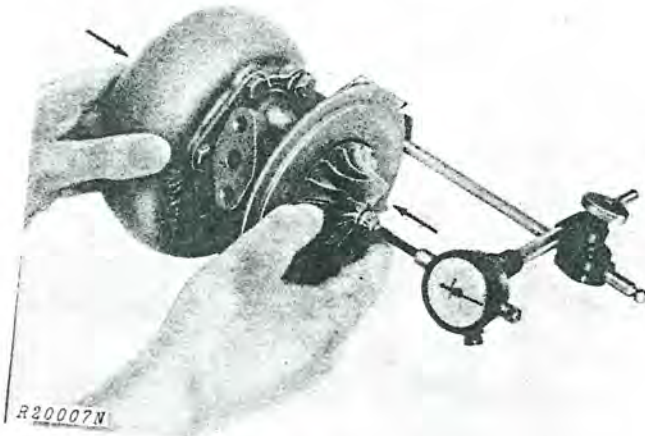


Fig. 5-End Play Bearing Test

Referring to Fig. 7, remove the compressor cover-to-backplate cap screws (7), and pull-off compressor housing (1).

Position dial indicator as shown in Fig. 5, with indicator tip resting on end of shaft.

Move shaft axially back and forth by hand. Total movement must be within 0.001-0.004 in. (0.025-0.101 mm).

If axial movement is not within specifications, repair of rotating assembly is necessary.

### Repair

#### General Information

Clean the exterior with a pressure spray of cleaning solvent before disassembly.

Provide a clean, protected location for each part as it is removed. Care must be exercised to prevent damage to turbine and compressor wheels, shaft, and other rotating parts.

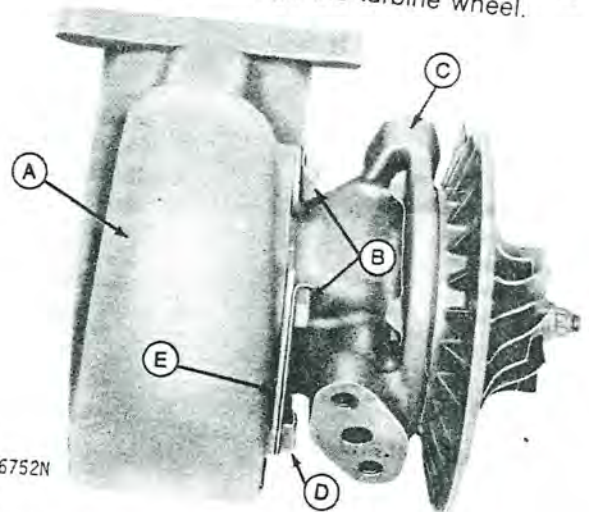
Refer to Fig. 7 and the illustrations which follow to assist in repair of turbocharger.

### Disassembly

Disassemble turbocharger as follows:

**NOTE:** If compressor cover (1, Fig. 7) has not been removed, refer to the right-hand column on previous page and remove housing.

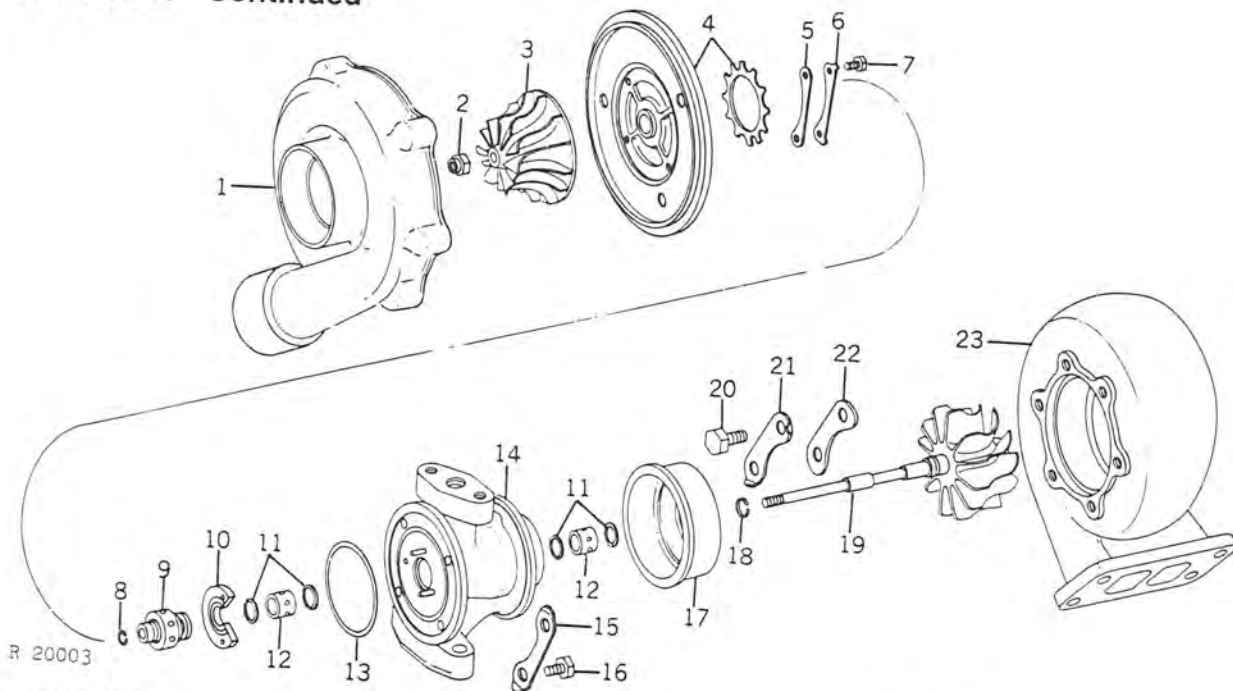
1. Remove Turbine Housing (Fig. 6).
  - a. Use a scribe or punch and place location marks on turbine housing (A) and center housing (C) to assist indexing of housing when turbocharger is assembled.
  - b. Straighten tabs on lock plates (B). Remove cap screws (D), lock plates, and clamps (E).
  - c. Remove turbine housing. Use a soft hammer if force is needed to remove turbine housing. Be careful not to damage the turbine wheel.



R 26752N  
 A—Turbine Housing  
 B—Lock Plates  
 C—Center Housing  
 D—Cap Screw  
 E—Clamp

Fig. 6-Removing Turbine Housing

**AIRESEARCH T-04B TURBO-CHARGER—Continued**



- 1—Compressor Cover
- 2—Lock Nut
- 3—Impeller
- 4—Backplate Assembly
- 5—Clamp
- 6—Lock Plate
- 7—Cap Screw
- 8—Piston Ring

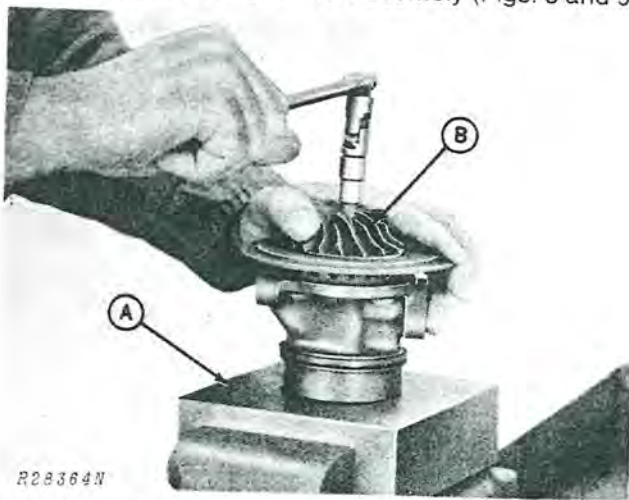
- 9—Thrust Collar
- 10—Thrust Washer
- 11—Retaining Ring (4 used)
- 12—Bearing (2 used)
- 13—O-Ring
- 14—Center Housing
- 15—Lock Plate (2 used)
- 16—Cap Screw (4 used)

- 17—Wheel Shroud
- 18—Piston Ring
- 19—Turbine Wheel with Shaft
- 20—Special Bolt (6 used)
- 21—Lock Plate (3 used)
- 22—Clamp (3 used)
- 23—Turbine Housing

Fig. 7—AiResearch T-04B Turbocharger

**Disassembly—Continued**

2. Remove Shaft and Wheel Assembly (Figs. 8 and 9).



R 28364N  
A—Holding Fixture      B—Compressor Wheel Retaining Nut

Fig. 8—Removing Compressor Wheel Retaining Nut

a. Mount holding fixture (A) or box end wrench in a vise. See Group 5 for dimensions to use when making this tool in your shop.

*NOTE: The wood holding fixture shown above can be fabricated in your shop, according to the specified material and dimensions.*

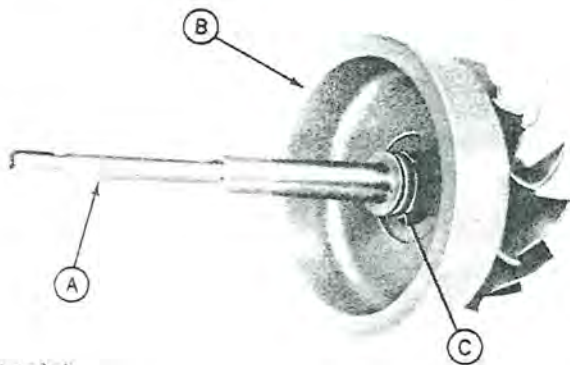
Use of the holding fixture is convenient for servicing the AiResearch T-04B Turbocharger, but not absolutely essential. A box-end wrench may also be used by clamping the handle in a vise and inserting the head end of turbine wheel shaft into the box-end of wrench.

b. Insert turbine wheel into fixture and remove the compressor wheel retaining nut (B). Use a double universal socket to avoid possible bending of the shaft.

c. Remove the compressor wheel from shaft.

d. Withdraw the shaft and wheel assembly (A, Fig. 9) from the center housing. Keep assembly centered with bearings until it is clear of housing.



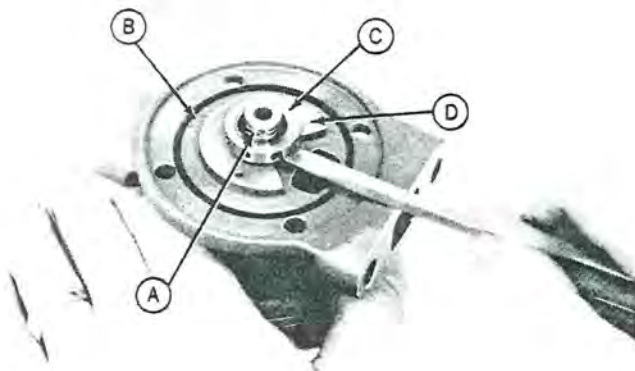


A—Shaft and Wheel Assembly  
B—Wheel Shroud  
C—Piston Ring

Fig. 9-Shaft and Wheel Assembly

- e. Remove wheel shroud (B) and piston ring (C). Discard piston ring.
- 3. Remove Thrust Collar and Thrust Washer (Fig. 12).
  - a. Straighten tabs on backplate-to-center housing lock plates (15, Fig. 7). Remove cap screws (16) and lock plates.
  - b. Remove backplate (4), by tapping with a soft hammer.

**IMPORTANT:** Backplate and spring are sold only as an assembly. The installed depth of the spring is a controlled dimension. Therefore, do not replace or remove the spring by itself.



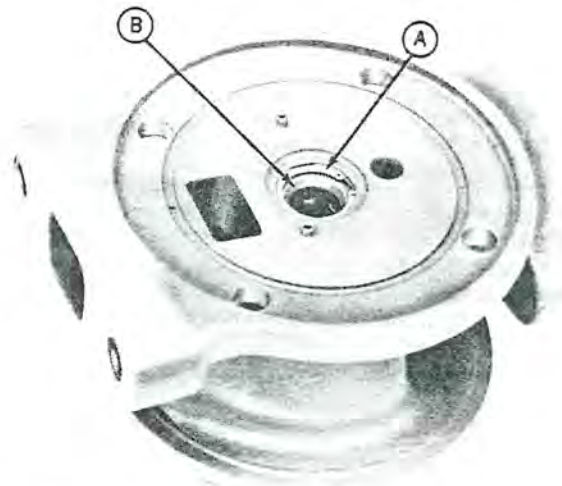
A—Piston Ring  
B—Rubber O-Ring  
C—Thrust Collar  
D—Thrust Washer

Fig. 10-Removing Thrust Collar and Thrust Washer

c. Lift the thrust collar (C) and thrust washer (D) off the center housing retaining pins. Discard the thrust washer.

d. Remove and discard the thrust collar piston ring (A) and rubber O-ring (B).

4. Remove Retaining Rings and Bearings (Fig. 13).



A—Retaining Ring  
B—Bearing

Fig. 11-Removing Retaining Rings and Bearings

- a. Use retaining ring pliers (squeeze-to-close type), and remove outer retaining rings (A). Discard retaining rings.
- b. Remove and discard bearings (B) and inner retaining rings.

**Cleaning**

Before cleaning, inspect parts for signs of burning, rubbing, or other damage which might not be evident after cleaning.

Soak all parts in clean carbon solvent for about 25 minutes. After soaking use a stiff bristle brush to remove all dirt particles. Dry parts thoroughly.

*NOTE:* Normally, a light accumulation of carbon deposits will not affect turbine wheel operation.

## AIRESEARCH T-04B TURBO-CHARGER—Continued

### Inspection

Burnish or polish out minor surface damage. Use silicone carbide abrasive cloth for aluminum parts, and crocus abrasive cloth for the steel parts.

Replace any part which fails to meet the requirements given in the "Inspection Wear-Tolerance Chart" below.

Parts must not show signs of damage, corrosion, or deterioration. Threads must not be nicked, crossed, or stripped.

Replace all damaged cap screws.

### INSPECTION WEAR-TOLERANCE CHART

Item	Maximum Wear Permitted	Inspection Notes
Center Housing		Bore surfaces must be free of scores. Scrape carbonized oil from internal surfaces if present.
Bearing Bore I.D.	0.6228 in. (15.819 mm)	
Seal Bore I.D.	0.703 in. (17.856 mm)	
Shaft and Wheel Assembly		Journal surfaces must not be scored. Polish surfaces with crocus cloth.
Journal O.D.	0.3994 in. (10.150 mm)	
Seal Hub O.D.	0.681 in. (17.297 mm)	
Ring Groove Width	0.0735 in. (1.867 mm)	Ring groove shoulders must be free of step wear.
Turbine Wheel Blades		Slight erosion permissible. Blade tips must not be feather-edged or torn. Minimum tip thickness-0.025 in. (0.635 mm).
Back Plate		Thrust surface must be clean and smooth.
Seal Bore I.D.	0.501 in. (12.725 mm)	
Thrust Collar		Ring groove shoulders must be free of step wear. Thrust faces must be smooth.
Washer Groove Width	0.1752 in. (4.445 mm)	
Ring Groove Width	0.066 in. (1.676 mm)	
Thrust Washer		Replace anytime unit is disassembled.
Journal Bearings		Replace anytime unit is disassembled.
Compressor Wheel		Replace if any evidence of rubbing, erosion or nicks is noted.
Bore I.D.	0.2504 in. (6.360 mm)	
Compressor Housing		Replace if heavily damaged by wheel rub. Clean-up of light rub is permissible.
Turbine Housing		Replace if discharge opening is warped out-of-round, shows erosion, cracked, scaled, or heavy wheel rub.
Turbine Wheel Shroud		Replace if warped, eroded, or heavily rubbed.

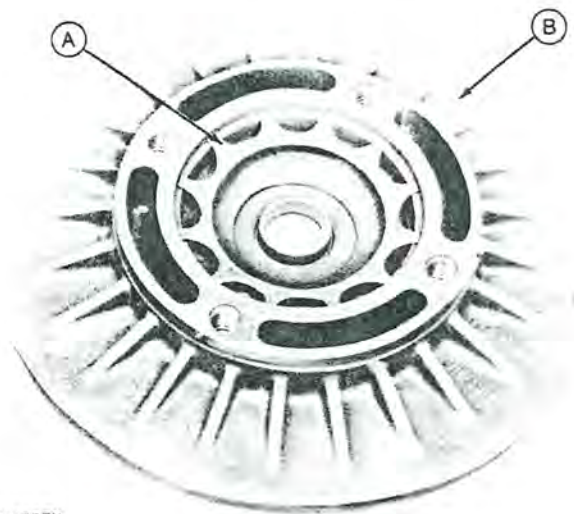


### Assembly

Check each part prior to installation to insure cleanliness. As parts are assembled, cover openings to prevent entry of dirt or other foreign material.

**IMPORTANT:** If any particle falls into the turbocharger during assembly, remove the particle immediately, even though extensive disassembly may be required.

1. Install Retaining Rings and Bearings (Fig. 11).
  - a. Install new inner bearing retaining rings in center housing—rounded shoulder toward the bearing.
  - b. Install new journal bearings (B). Secure with new outer retaining rings (A)—rounded shoulder toward the bearing.
  - c. Lubricate journal bearings with engine motor oil.
2. Install Shaft and Wheel Assembly (Fig. 9).
  - a. Install piston ring (C) in groove of shaft.
  - b. Place wheel shroud (B) in position on shaft, and insert assembly through bearings. A gentle rocking action will allow the piston ring to seat and shaft to bottom. Be careful not to force piston ring since it can easily be broken.
3. Install Thrust Collar and Thrust Washer (Fig. 10).
  - a. Install piston ring (A) in groove on thrust collar (C).
  - b. Place thrust washer (D) on thrust collar and engage unit over pins on center housing. Channeled face of thrust washer must face against the center housing.
  - c. Install rubber O-ring (B) in groove in center housing.
4. Install Backplate (Figs. 6 and 12).
  - a. Check thrust spring (A, Fig. 12) to see that it is positioned in backplate (B).
  - b. Align mounting holes of center housing and backplate and install backplate over shaft and thrust collar. Use care not to break piston ring when engaging seal in backplate bore. Backplate is easily installed if open end of piston ring is engaged in backplate bore first.
  - c. Install backplate-to-center housing cap screws (7, Fig. 6), clamps (5), and lock plates (6). Tighten cap screws to 75-90 in-lbs (8.5-10.2 Nm) (0.85-1.0 kgm) torque. Bend ears of lock plates against head of cap screws.



R 26757N

A—Thrust Spring

B—Backplate

Fig. 12—Thrust Spring Positioned In Backplate

5. Install Compressor Wheel (Fig. 8)
  - a. Mount holding fixture in vise. If desired, a box-end wrench may be clamped in the vise and used in place of the holding fixture.
  - b. Place turbine wheel end of turbocharger in fixture, and install compressor wheel on shaft. Using a double universal socket, tighten locknut to 18-20 in-lbs (2.0-2.3 Nm) (0.2-0.23 kgm) torque. Continue to tighten locknut through an angle of 90°. This is sufficient to stretch the shaft 0.0055-0.0065 in. (0.140-0.165 mm) for proper installation of the locknut.
6. Install Turbine Housing (Fig. 6).
  - a. Orient turbine housing (A) to center housing (C) by aligning punch or scribe marks made just prior to disassembly.
  - b. Coat screw threads with a high-temperature, anti-seizing compound.
  - c. Install clamps (E), lock plates (B), and screws (D). Tighten screws to 100-130 in-lbs (11.3-14.7 Nm) (1.13-1.47 kgm) torque. Bend ears of lock plates against head of screws.



## AIRESEARCH T-04B TURBOCHARGER—Continued

### 7. Recheck Rotating Assembly Clearances (Figs. 4 and 5).

- Check axial end play (Fig. 5). If not within 0.001-0.004 in. (0.025-0.101 mm), recheck parts and installation to determine the cause.
- Check radial movements (Fig. 4). If not within 0.003-0.006 in. (0.077-0.152 mm), recheck parts and installation to determine the cause.
- Check clearance between wheel shroud and turbine wheel. These parts must not contact each other.

### 8. Install Compressor Housing (Fig. 7).

- Position compressor housing (1) on backplate (4).
- Install clamps (5), lock plates (6), and cap screws (7). Leave cap screws slightly loose until turbocharger is mounted on engine. This will permit connection with intake manifold much easier.

After assembly, push the rotating assembly as far as possible from the turbine end and check for binding. Repeat check, pushing from the compressor end.

If binding is evident, try to relieve by lightly tapping both ends of shaft with a soft hammer. Disassembly will be required to determine the cause of binding when the binding cannot be relieved as instructed.

When satisfied that the rotating assembly turns freely and without binding, the turbocharger is ready for installation on the engine.

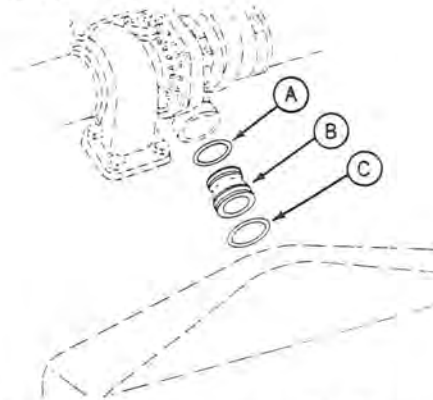
## Installation

**IMPORTANT:** If turbocharger failed because of foreign material entering the air intake system, be sure to examine the system and clean as required to prevent a repeat failure.

Just prior to mounting the turbocharger, prime the turbocharger lubrication system. Fill the center housing with new engine oil through the oil drain hole. Turn the rotating assembly by hand to lubricate the bearings and thrust washer.

Inspect the air cleaner-to-turbocharger hose to see that it is in good condition. Replace hose if it is hard, or shows any signs of deterioration.

To install turbocharger:



R 26788N

A—O-Ring (Turbocharger End)

C—O-Ring (Intake Manifold End)

B—Coupling

Fig. 13-Turbocharger-To-Intake Manifold Coupling

- Coat O-rings (A and C, Fig. 13) with liquid soap, and install on coupling (B). Insert coupling into the intake manifold.

- Place a new gasket on exhaust manifold.

- Mount turbocharger on engine. Position compressor housing to properly align with coupling connection to intake manifold, using alignment marks (placed prior to removal) as a guide.

- Tighten compressor housing-to-backplate cap screws (7, Fig. 7) to 110-130 in-lbs (12.4-14.7 Nm) (1.24-1.47 kgm) torque. Tighten turbocharger-to-exhaust manifold mounting stud nuts.

- Prelubricate turbocharger. Connect the lubricating oil inlet manifold (5, Fig. 2) and return pipe (6) to the turbocharger, using new gaskets.

- Apply a light coating of liquid soap on end of hose which connects to the turbocharger (4). Install hose on turbocharger and tighten hose clamp.

**IMPORTANT:** Since the greatest amount of suction occurs between the air cleaner and turbocharger, it is essential that the hose connections are tight to prevent entry of dirt into the engine.

- Install exhaust adapter and elbow (3). Make certain that the installation does not apply force on the turbine housing. The exhaust adapter must have 1/16 in. (1.59 mm) minimum end play, and must rotate freely. Fasten air stack support to exhaust elbow.



8. Install muffler. Start engine and operate at slow idle speed. Check the turbocharger lubricating oil inlet and outlet connections (5 and 6) for leaks.

**IMPORTANT:** When starting the engine with a new or repaired turbocharger, press stop button and crank the engine with the starter until the engine oil pressure gauge shows 20 psi (1.4 bar) (1.4 kg/cm<sup>2</sup>) pressure.

## SCHWITZER 3LM TURBOCHARGER

### Removal

Schwitzer turbocharger removal procedures are identical to the AiResearch removal procedures. Follow instructions given on Page 30-5-1 and 2.

### Tests

#### Axial End Play Bearing Test

Perform this test to determine the thrust bearing wear.

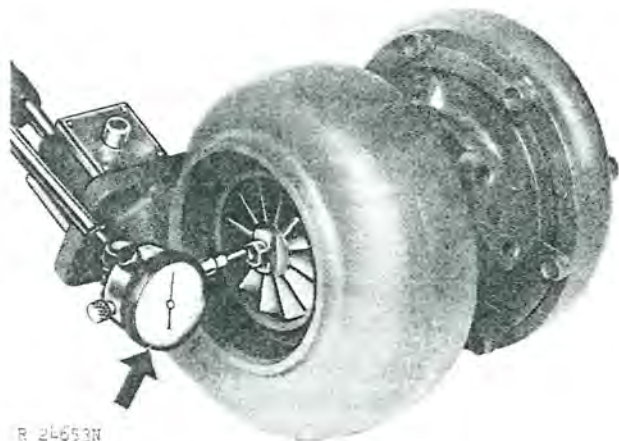


Fig. 14-Dial Indicator Installed To Measure Axial End Play

Mount a dial indicator so the indicator tip rests on a flat surface of the turbine end of the shaft (Fig. 14). Move the shaft axially back and forth by hand. If the total indicator reading is not within 0.002 to 0.005 in. (0.05-0.13 mm), the rotating assembly must be repaired or replaced.

#### Radial Bearing Test

Perform this test to determine condition of bearing, center housing, or rotating assembly.

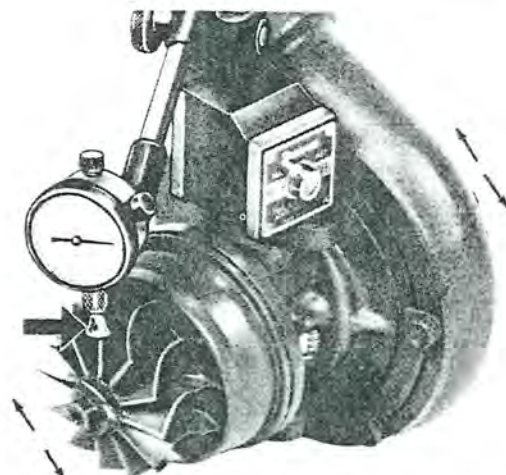


Fig. 15-Dial Indicator Installed To Measure Radial Movement

To check radial bearing clearance, a wire type feeler gauge may be used to measure the distance between the housing and the outboard tip of the compressor and the turbine blade. First with the blade pushed toward the housing, then with the blade pushed away from the housing (move other end of shaft in the opposite direction). Maximum radial movement is 0.021 in. (0.53 mm). If wire gauge is not available, use a dial indicator (Fig. 15).

### Repair

#### General Information

Clean the exterior with a pressure spray of cleaning solvent before disassembly.

Provide a clean, protected location for each part as it is removed. Care must be exercised to prevent damage to turbine and compressor wheels, shaft, and other rotating parts.

Refer to Fig. 16 and the illustrations which follow to assist in repair of turbocharger.

## SCHWITZER 3LM TURBOCHARGER—Continued

## Removal

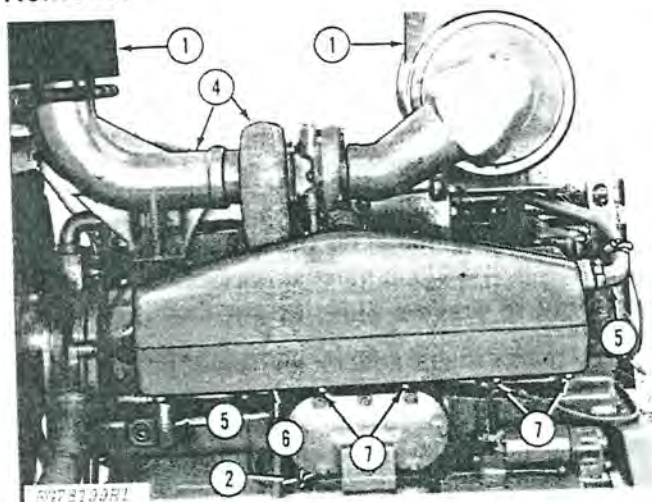


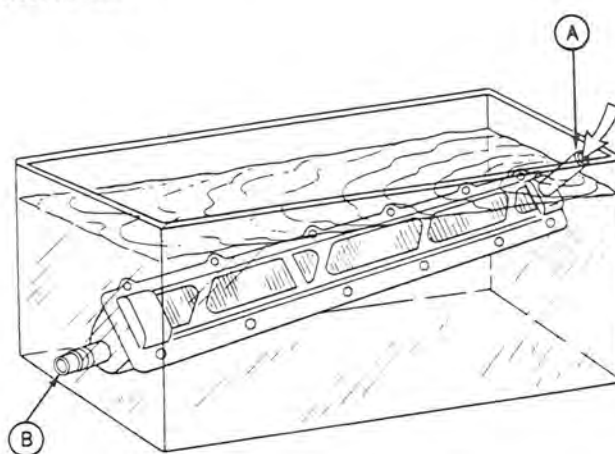
Fig. 24-Intake Manifold and Intercooler Removal Steps

To remove the intake manifold and intercooler, perform the following steps, referring to Fig. 24 as a guide when applicable:

1. Remove air cleaner and muffler.
2. Drain the engine cooling system.
3. Thoroughly clean exterior of turbocharger, intake manifold, and adjacent areas to prevent entry of dirt into the engine when these parts are removed.
4. Remove the exhaust elbow and turbocharger. (See page 05-1 and 2 for removal of the turbocharger.)
5. Disconnect the intercooler inlet and outlet hose connections.
6. Disconnect the intake manifold-to-injection pump aneroid pipe.
7. Remove the intake manifold-to-cover screws and remove cover.
8. Lift intercooler out of manifold. Remove and discard gaskets and O-rings.
9. If necessary to remove the intake manifold, take out the six mounting cap screws, and lift off manifold.

## Inspection and Repair

## Intercooler



R 26794N

A—Inlet

B—Outlet

Fig. 25-Testing Intercooler For Leaks

Inspect the intercooler for general overall condition. The fins should be reasonably straight and the entire unit must be free of leaks.

Inspect the intercooler inlet and outlet hoses (5, Fig. 24) for general condition. Replace either hose if hard, or has a questionable appearance.

To test the intercooler for leaks (Fig. 25), plug or cap one of the openings (B), and apply compressed air to the other opening (A) while unit is submerged under water. Use 20-25 psi (1.4-1.7 bar) (1.4-1.7 kg/cm<sup>2</sup>) air pressure for testing.

A minor leak that is accessible may be repaired. However, if the condition of the core is questionable, replace with a new one.

**IMPORTANT: Coolant leaking from the intercooler may cause severe damage to the engine.**

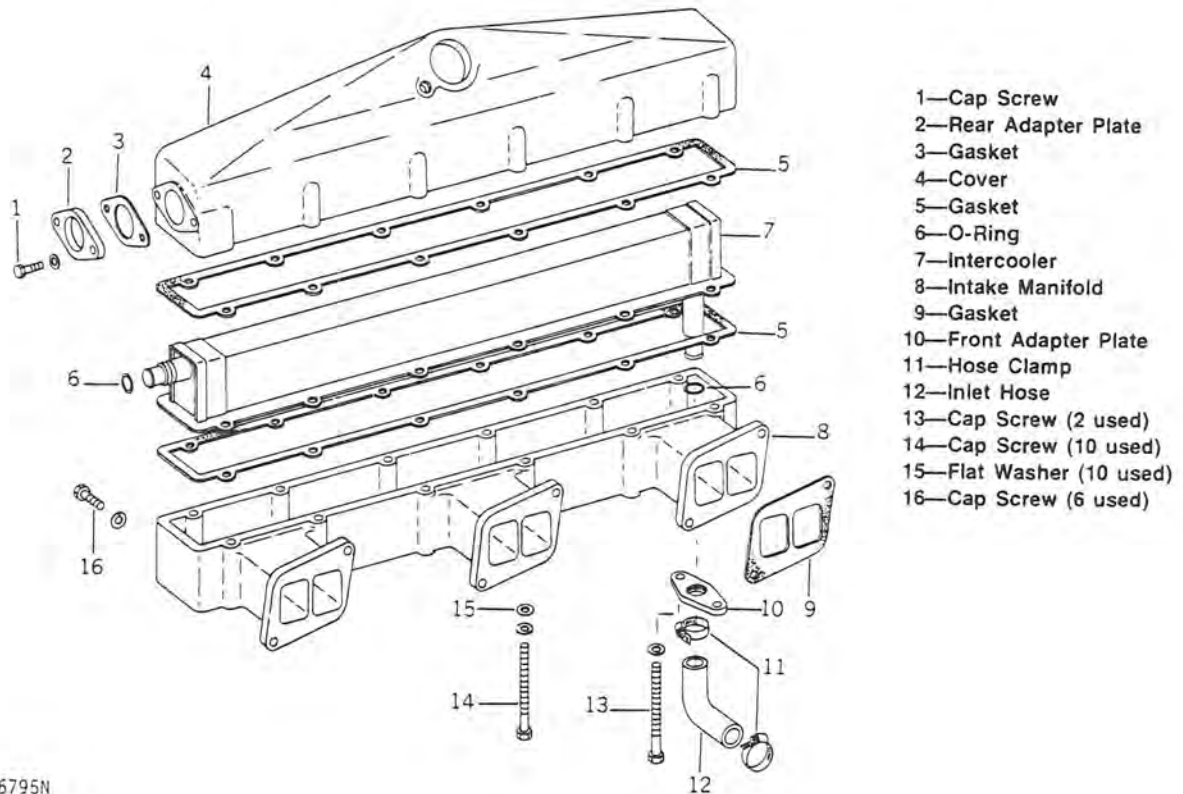
## Intake Manifold

Check the intake manifold for physical damage. Inspect the machined mounting surfaces for burrs or other defects which might prevent gaskets from properly sealing. Repair as required.



## INTERCOOLER AND INTAKE MANIFOLD—Continued

## Installation



R 26795N

Fig. 26—Exploded View of Intercooler and Intake Manifold

Referring to Fig. 26:

**NOTE:** Three inside row cap screws must be inserted into the manifold before the manifold is installed on the engine. Otherwise, interference of the front water hose outlet tube and engine oil cooler will prevent installation of these screws.

Install O-ring (6) in bore of front adapter plate (10). Place adapter plate (with O-ring bore towards manifold) on manifold and insert cap screw with lock washer (13) through adapter plate and into manifold.

Also install cap screws (14) with lock washers and flat washers (15) in third and fourth inside holes (from the front). Secure the three screws temporarily until the manifold is installed on the engine.

1. Install the intake manifold (8) on engine, using new gaskets (9). Tighten cap screws to 35 ft-lbs (47 Nm) (4.7 kgm) torque. Make sure that manifold is clean inside.

2. Place a new upper gasket (5) on top of intercooler. Mount intercooler (7) in manifold cover (4).

3. Place a new lower gasket (5) on manifold (8). Position cover and intercooler on manifold.

4. Align cover and gaskets to permit installation of cap screws (14) with lock washers and flat washers (15). Make sure that front adapter plate (10) and O-ring (6) are correctly positioned, and install outer adapter plate cap screw (13). Tighten all cap screws securely.

5. Install inlet hose (12) and hose clamps (11).

6. Position O-ring (6) in its bore in rear adapter plate (2). Install plate using a new gasket (3) and secure with cap screws and lock washers (1). Connect the intercooler-to-water manifold outlet hose to intercooler. Tighten hose clamp securely.

7. Connect the injection pump aneroid-to-intake manifold pipe to elbow fitting on bottom of manifold, unless the manifold pressure (see Section 230) is to be checked. If so, leave pipe disconnected.

8. Install turbocharger and exhaust elbow. (See page 05-8 for installation instructions on AiResearch turbocharger on page 05-15 for installation instructions on Schwitzer turbochargers.)

9. Fill cooling system and check for leaks.

10. Install muffler. Check the intake manifold pressure to make sure that the air intake system is functioning properly. See "Checking Intake Manifold Pressure" in Section 230.