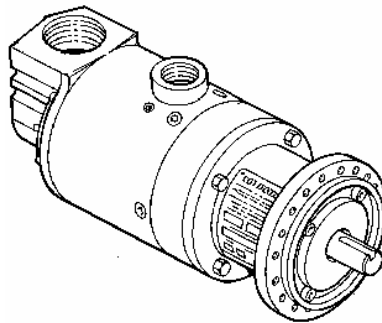


Service Manual



T30-M **TURBO***TWIN* Air Motor



TABLE OF CONTENTS

Section	Subject	Page
1.0	Introduction.....	1
2.0	Description of Basic Groups.....	3
3.0	Disassembly.....	5
4.0	Cleaning and Inspection.....	7
5.0	Assembly.....	10
6.0	Parts.....	12

LIST OF TABLES

Table No.	Title	Page
1	T30 Series Service Tool Kits.....	5
2	Cleaning Materials and Compounds.....	7
3	Parts Inspection Check Requirements.....	8
4	Parts Wear Limits.....	9
5	Torque Values.....	9
6	Materials for Assembly.....	10

LIST OF ILLUSTRATIONS

Figure	Title	Page
1	TDI Turbotwin Nameplate.....	2
2	T30 Series Part Number Coding.....	2
3	Turbine Housing Assembly.....	3
4	Gearbox Housing Assembly.....	4
5	Carrier Shaft Disassembly.....	5
6	Turbine Rotor Removal.....	6
7	Nozzle 2 Removal.....	6
8	Turbine Shaft Removal.....	6
9	Turbine Shaft Installation.....	10
10	T30-M Illustrated Parts Breakdown.....	14

SECTION 1.0 INTRODUCTION

1.1 GENERAL INFORMATION

This manual provides information for servicing, disassembly, and re-assembly of the TDI Turbotwin T30-M air motor. If there are questions not answered by this manual, please contact your local TDI distributor or dealer for assistance. Illustrations and exploded views are provided to aid in disassembly and re-assembly.

The TDI Turbotwin T30-M air motor fits a wide range of engine applications up to 20 horsepower. One basic design can be used on a broad range of pre-lube and post-lube pump motors, plus extended cycle operations.

The Turbotwin T30-M air motor is suited to operate within a wide range of inlet pressures and ambient temperatures. This motor is designed for operation with either compressed air or natural gas.

The robust turbine motor design in the Turbotwin T30-M air motor has no rubbing parts, and is therefore tolerant of hard and liquid contamination in the supply gas with almost no adverse affects. The motor is well adapted to running on "sour" natural gas.

As with all TDI air motor products, there are no rubbing parts so there is no lubrication required. This eliminates failures due to lubricator problems, the expense of installing and maintaining the system, and the messy and hazardous oil film around the motor exhaust. The motor is factory grease packed for the life of the motor so it requires no maintenance.

NOTE

Throughout this manual, the term "air" is used to denote the motor drive medium. Unless otherwise stated, "air" means compressed air or natural gas.

Please review the rest of this manual before attempting to provide service to the TDI Turbotwin T30-M air motor.

1.2 WARNINGS, CAUTIONS, & NOTES

Throughout this manual, certain types of information will be highlighted for your attention:

WARNING - used where injury to personnel or damage to equipment is likely.

CAUTION - used where there is the possibility of damage to equipment.

NOTE - use to point out special interest information.

1.3 DESCRIPTION OF OPERATION

The Turbotwin T30-M air motor is powered by a pair of axial flow turbines coupled to a simple planetary gear reduction set.

The high horsepower of the turbine air motor combined with the planetary gear speed reducer results in a very efficient and compact unit. The Turbotwin T30-M air motor can be used over a wide range of drive pressures from 30 psig (2 BAR) to 120 psig (8 BAR) and is suitable for operation on either air or natural gas.

The T30-M weighs approximately 29 pounds (13KG) and is capable of delivering over 25 HP (18.7 kW) of cranking power at the maximum pressure of 120 psig (8 BAR).

1.4 INSTALLATION AND SERVICE

It is important to properly install and operate the T30-M air motor to receive the full benefits of the turbine drive advantages. It must be installed in accordance with the instructions provided by Tech Development, Inc. (TDI).

WARNING

Failure to properly install the motor or failure to operate it according to instructions provided by TDI may result in damage to the motor or cause personal injury. **DO NOT OPERATE THIS MOTOR UNLESS IT IS PROPERLY INSTALLED.**

Repair technicians or service organizations without turbine motor experience should not attempt to repair this motor until they receive factory approved training from TDI, or its representatives. Proper operation and repair of your TDI Turbotwin will assure continuous reliability and superior performance for many years.

1.5 NAMEPLATE INFORMATION

The nameplate, located on the turbine housing, provides important information regarding the construction of your T30-M air motor, refer to *Figure 1*. The part number coding explanation, refer to *Figure 2*, can help you when talking to your distributor.

NOTE

You should always have the motor's Part Number, Serial Number, Operating Pressure, and Direction of Rotation information before calling your TDI distributor or dealer.


		TURBOTWIN™	
		PNEUMATIC MOTOR TECH DEVELOPMENT INC. 6800 POE AVE., DAYTON OH	
SERIAL NO.	CW (RH) (CCW)LH	MODEL NO.	
<input type="text" value="T30-M"/>	<input type="text" value="9708-105"/>	<input type="text"/>	<input checked="" type="checkbox"/> X
		PART NUMBER	
<input type="text" value="T306-60016-00L-1"/>			
AIR OR NAT. GAS USAGE HOUSING PROOF PRESSURE IS 600 PSIG			
MAX OPERATING INLET PRESS. <input type="text" value="120"/> PSIG			
WARNING DO NOT OPERATE UNLOADED, WITHOUT EXHAUST GUARD OR WITHOUT EXHAUST FITTING			

Figure 1. TDI TURBOTWIN Nameplate

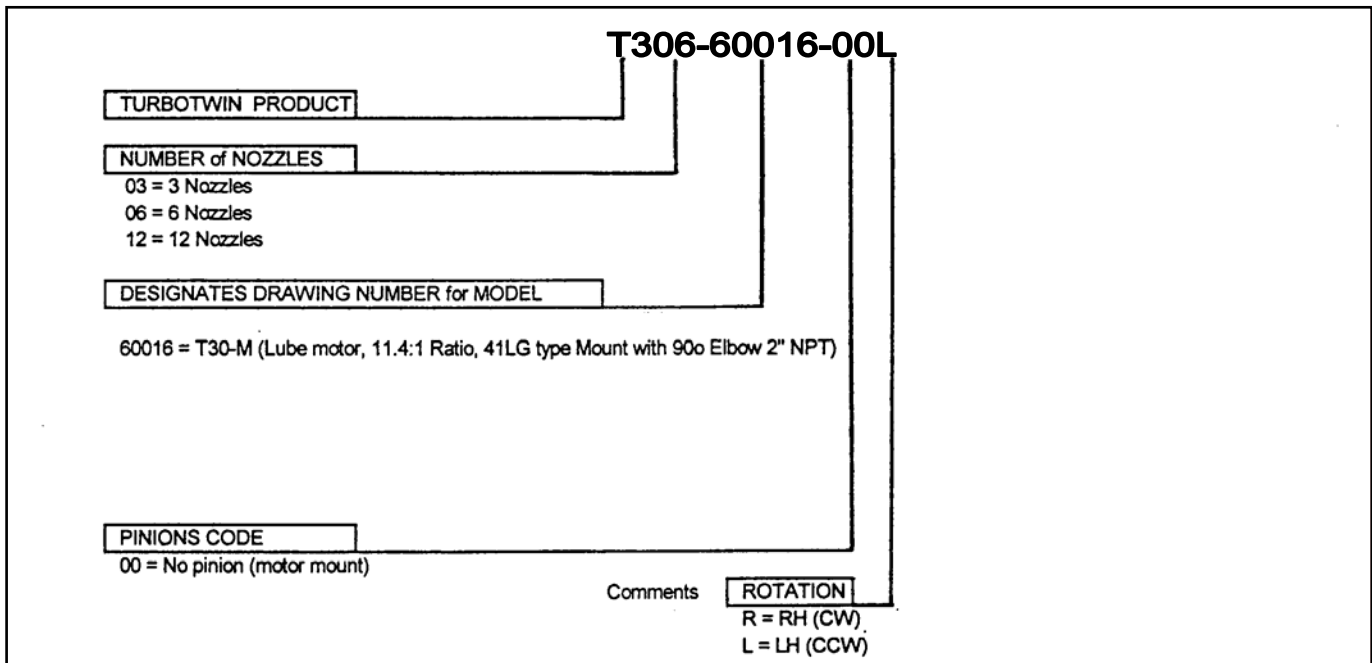


Figure 2. T30 Series Part Number Coding

SECTION 2.0 DESCRIPTION OF BASIC GROUPS

2.1 GENERAL

The TDI Turbotwin T30-M air motor is a lightweight, compact unit driven by a two stage turbine air motor. The motor is composed of two basic assembly groups: Turbine Housing Assembly and Gearbox Housing Assembly.

2.2 TURBINE HOUSING ASSEMBLY

The Turbine housing assembly, refer to figure 3, consists of a stage one (18) and a stage two turbine rotor (9) mounted on sun gear shaft (24). The front bearing (8) is secured by a retainer plate (22) and the aft bearing is pre-load by a spring washer (12).

The ring gear (25) is installed into the front of the turbine housing (21) and secured by four screws.

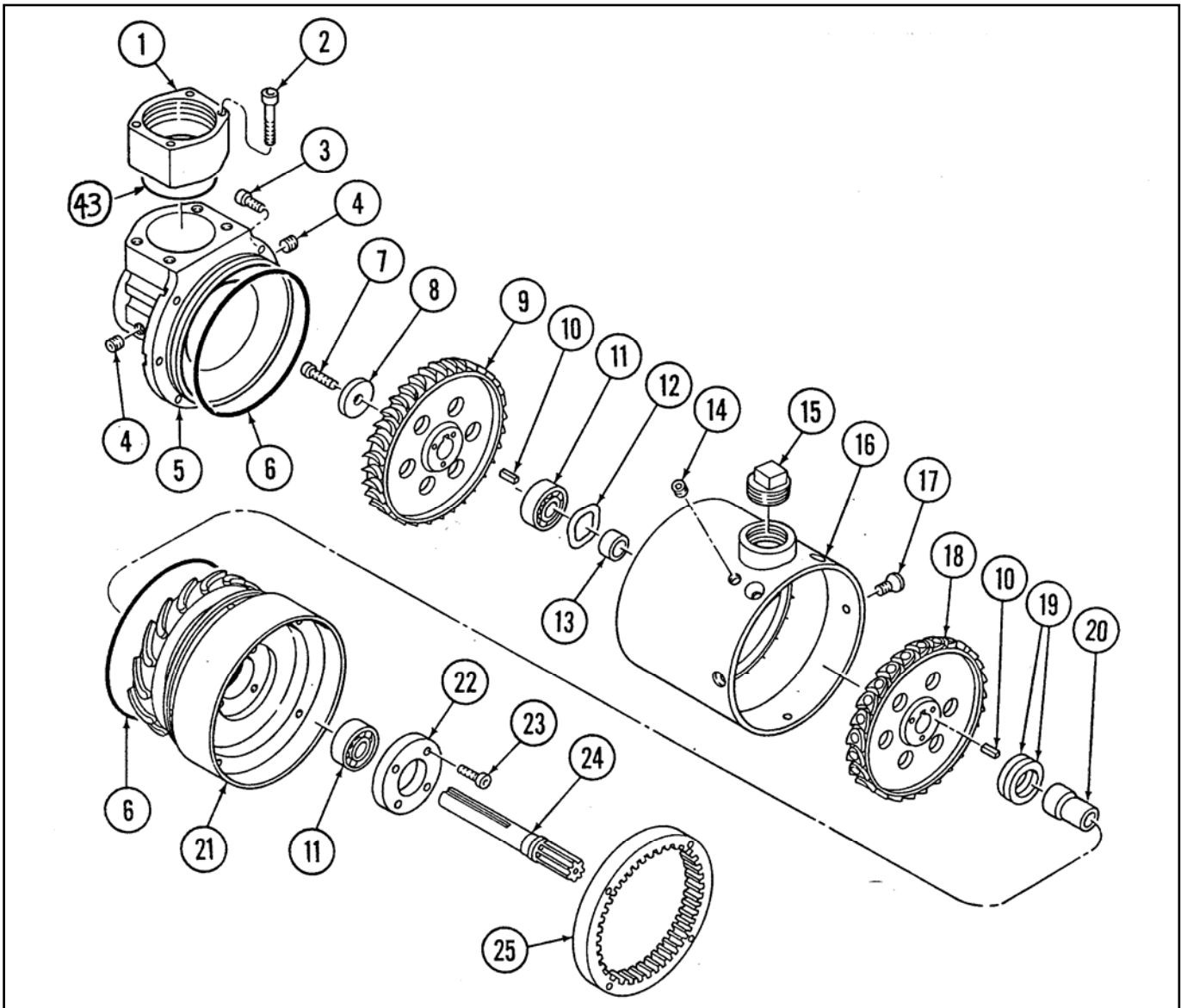


Figure 3. Turbine Housing Assembly

2.3 GEARBOX HOUSING ASSEMBLY

The gearbox housing assembly, refer to figure 4, consist of a planet gear carrier and output shaft (26), three planet gears (29), needle bearings (30), spacers (28), and planet shafts (27).

The carrier shaft (26) is mounted on two ball bearings (31, 37) in the gearbox housing (35). The retainer nut (38) secures the carrier shaft and the front bearing (37) in the gearbox housing. The aft bearing (31) is preloaded by use of a spring washer (32).

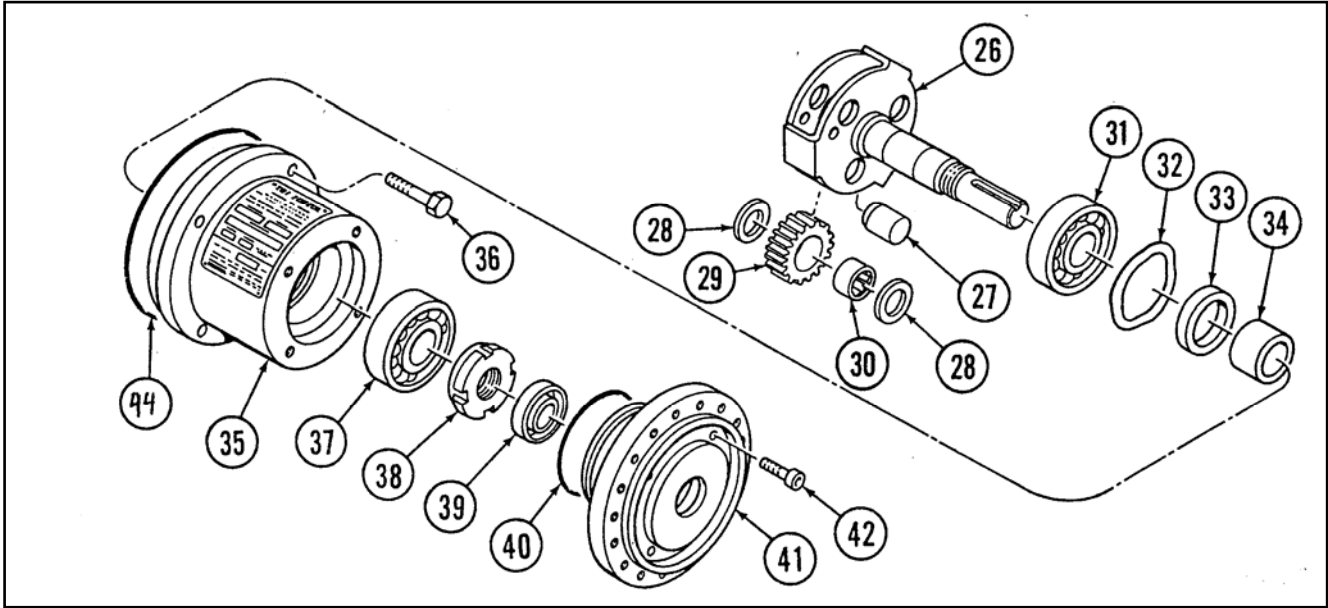


Figure 4. Gearbox Housing Assembly

SECTION 3.0 DISASSEMBLY

3.1 GENERAL

Always mark adjacent parts on the motor housing; Nozzle 2/ Containment Ring (13), Turbine Housing (19), Gearbox Housing (35) so these parts can be located in the same relative position when the motor is re-assembled.

Do not disassemble the motor any further than necessary to replace a worn or damaged part, unless a complete overhaul is being performed.

Always have a complete set of seals and o-rings on hand before starting any overall of a Turbotwin T30-M air motor. Never use old seals or o-rings.

The tools listed in *Table 1* are suggested for use by technicians servicing the Turbotwin T30-M air motor. The best results can be expected when these tools are used, however, the use of other tools are acceptable.

TOOL DESCRIPTION	TDI/PN
Spanner wrench	2-27272
Stage 2 Rotor Puller Tool	52-20076
Tool, Turbine Bearing	45-25294
Tool, Bearing/Seal	2-26943

Table 1. T30 Service Tool Kit (P/N: T30-27639)

3.2 GEARBOX HOUSING

3.3.1 Removal of Gearbox Housing

Remove the four screws (42) and remove the flange (41) from the gearbox assembly (35)

Remove four screws (36) and separate the gearbox assembly from the turbine assembly.

3.3.2 Gearbox Disassembly

Set the gearbox on the gearbox holding tool with the three holes on the gearbox over the dowel pins on the holding tool.

Install spanner wrench on the bearing retaining nut (38) and turn CCW to remove.

Apply pressure to the carrier shaft (26) to remove it from the gearbox housing (35). An arbor press and

brace may be required. Remove spacer (34) and spring washer (32) from carrier shaft.

Press bearing (37) from gearbox housing (35) by tapping inner race.

3.3.3 Carrier Shaft/Planet Gear Disassembly

Place carrier shaft/gear assembly on arbor press with shaft up. With carrier shaft (26) supported, press each planet shaft (27) out opposite the spline shaft. Refer to figure 5.

Remove the planet gears (29) and spacers (28) from the carrier shaft (26).

Needle bearings (30) may be pressed out if replacement is required.

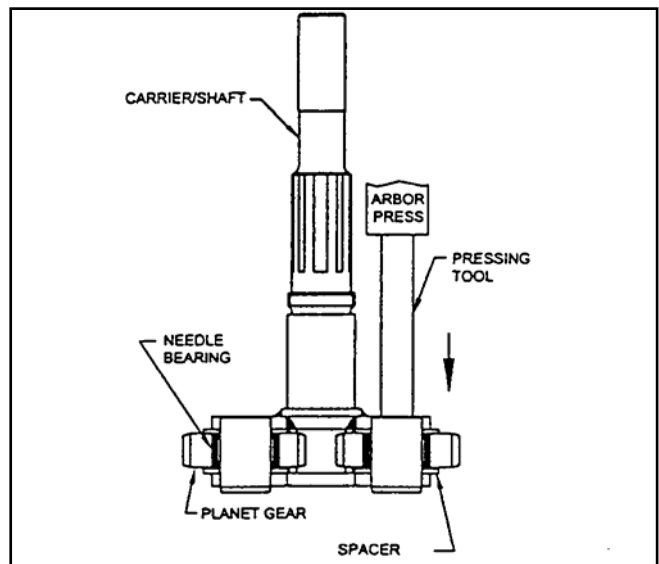


Figure 5. Carrier Shaft Disassembly

3.4 TURBINE HOUSING

3.4.1 Stage 2 Rotor Removal

Remove seven screws (3), and remove the exhaust elbow (5) from the turbine assembly (16)

Hold the stage 2 rotor (9) and remove the turbine screw (7) and washer (8).

Install rotor puller tool P/N 52-20076 and remove the stage 2 rotor per figure 6.

Remove the square key (10) from turbine shaft (24).

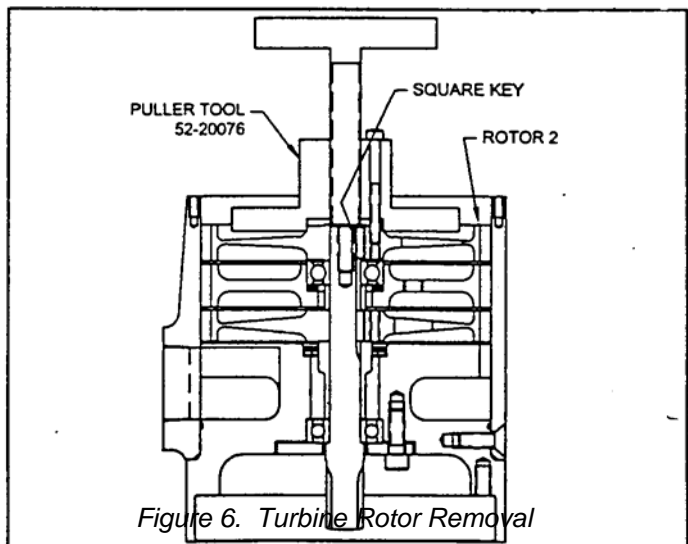


Figure 6. Turbine Rotor Removal

3.4.2 Turbine Housing Disassembly

Remove five screws (17) from the stage 2 nozzle (16) and separate it from turbine housing (21). If turbine housing is too tight, it can be removed by installing two threaded screws into nozzle 2 (exhaust end) and using them as jacks to separate the turbine housing from nozzle 2. The stage 1 rotor may require slight rotation to allow the threaded screws to travel through the holes in the rotor. Refer to *Figure 7*.

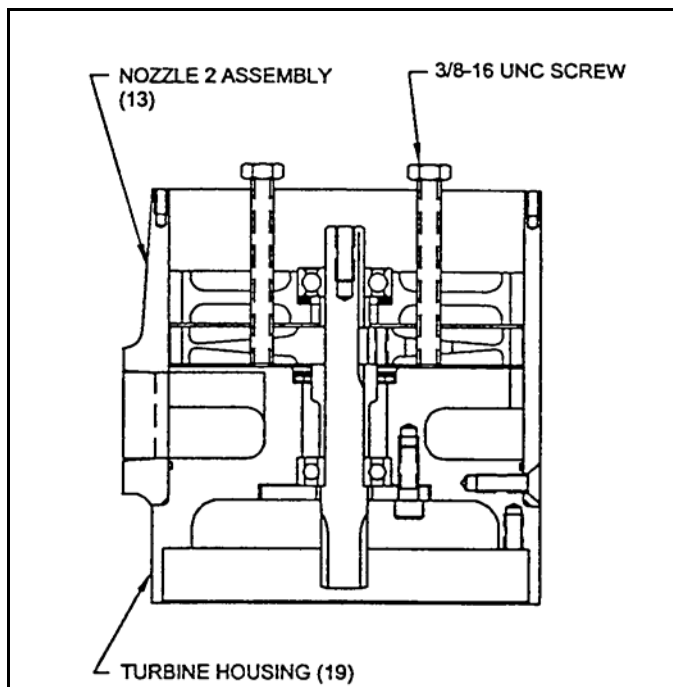


Figure 7. Nozzle 2 Removal

Remove the bearing spacer (13) from the turbine shaft.

Remove turbine bearing (11) and preload spring (12) from nozzle 2 (16).

Remove four screws (23) and bearing retainer plate (22) from turbine housing (21).

Press turbine shaft (24) through turbine housing (21) as shown in figure 8. Remove bearing spacer from turbine shaft.

Remove the stage 1 rotor (18) and square key (10).

Press turbine shaft (24) through bearing (11) to remove bearing from shaft.

Press the lip seal (19) from the turbine housing by applying pressure to the seal through the housing.

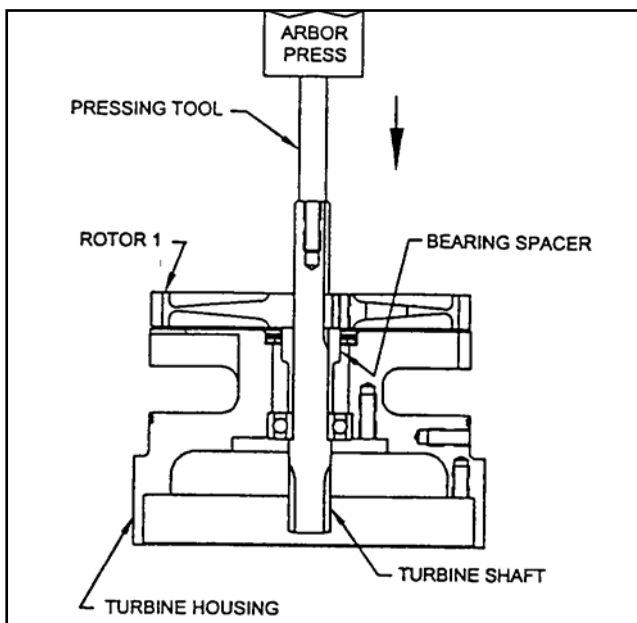


Figure 8. Turbine Shaft Removal

SECTION 4.0 CLEANING and INSPECTION

4.1 CLEANING

Degrease all metal parts, except bearings, using a commercially approved solvent. Refer to *Table 2*.

NOTE

Never wash bendix assembly or bearings in cleaning solvents. It is recommended that the bearings be replaced with new parts.

Clean aluminum parts using the solutions per *Table 2*; soak for 5 minutes. Remove parts, rinse in hot water, and dry thoroughly.

Clean corroded steel parts with a commercially approved stripper.

Clean corroded aluminum parts by cleaning as stated above and then immerse the parts in chromic-nitric-phosphoric acid pickle solution per *Table 2*. Rinse in hot water and dry thoroughly.

MATERIAL or COMPOUND	MANUFACTURER
Degreasing Solvent (Trichloroethylene) (O-T-634)	Commercially Available
Acetone	Commercially Available
Aluminum Cleaning Solution	Diversey Corp., 212 W. Monroe, Chicago, IL 60606 Dissolve 5 oz of Diversey 808 per gallon of water at 155°- 165°F.
Steel Cleaner - Rust & Corrosion	Oakite Products Corp., 50 Valley Rd., Berkeley Heights, NJ 07992 Mix 3-5 lb. of Oakite rust Stripper per gallon of water; use at 160°- 180°F.
Chromic-Nitric-Phosphoric Acid Pickle Solution	Mix 8lb. of chromic acid, 1.9 gal. of phosphoric acid, 1.5 gal. of nitric acid with enough water to make a total of 10 gal. of solution.

WARNING Follow all instructions provided with the MSDS sheets on the materials and compounds listed above.

Table 2. Cleaning Materials and Compounds

4.2 INSPECTION

Use *Table 3* as a guide to check for acceptable condition of the parts listed.

Check all threaded parts for galled, crossed stripped, or broken threads.

Check all parts for cracks, corrosion, distortion, scoring, or general damage.

Check all bearing bores for wear and scoring. Bearing bores shall be free of scoring lines, not to exceed 0.005" width and 0.005" depth.

Check gear teeth and turbine housing ring gear for wear. In general, visually check for spalling, fretting, surface flaking, chipping, splitting, and corrosion. If wear is apparent, check the gear teeth dimensions in accordance with *Table 4*. Nicks and dents that cannot be felt with a .020 inch radius scribe are acceptable.

Part Description	Check For	Requirements (Defective Parts Must Be Replaced)
Planet Gear	Cracked, chipped, or galled teeth. Wear must not exceed limits per Table 4.	Wear must not exceed limits per table 4. There shall be no evidence of excessive wear.
Carrier Shaft	Cracks, scoring or raised metal in planet shaft holes and keyways. Integrity of knurl connection.	Deformation of metal smearing in planet pin holes & keyways not acceptable. Scoring on bearing diameter not to exceed .005" depth. Wear must not exceed limits per Table 4.
Planet Pins	Wear grooves or flat spots	Wear grooves in flat spots not permitted. Wear must not exceed limits per Table 4.
Washers	Wear created grooves	Wear must not exceed limits per Table 4.
Gearbox Housing	Cracks and Breakage	Cracks and breakage not acceptable.
Sungear/Turbine Shaft	Cracks, scoring, wear created grooves, chipped or broken gear- teeth, galling or scoring on bearing surface of shaft. Raised metal on the keyway.	Wear must not exceed limits per Table 4.
Spacers	Parallelism of end surfaces	Ends must be parallel within 0.0005".
Turbine Housing	Cracks and breakage	Cracks and breakage are not acceptable. Minor surface damage is permitted if function is not impaired.
Ring Gear	Cracks, wear, chipped, or broken gear teeth.	Wear must not exceed limits per Table 4.
Seal Assembly	Wear grooves or scratched surfaces on carbon ring.	Wear is not permitted.
Seal Spacer	Wear Grooves	No wear permitted.
Needle Bearings	Freedom of needle rollers	Replace bearings
Ball bearings	Freedom of rotation without excessive play between races	Replace bearings
Containment Ring/ Nozzle	Corrosion, erosion, cracks and broken nozzle edges.	Cracks and breakage are not acceptable. Minor surface damage is permitted if function is not impaired.
Turbine Rotors	Corrosion, erosion, cracks and broken edges. Tip wear; bore and key way wear	Minor tip rub is permitted if function is not impaired. Wear is not permitted.

Table 3. Parts Inspection Check Requirements

PART DESCRIPTION	LIMIT, Inches
Ring gear / Turbine Housing Internal measurement between two .084" diameter pins.	5.0890 max.
Sun Gear / Turbine Shaft Bearing diameter External measurement over two .096 diameter pins. 7.5:1 9:1 11.4:1	0.6690 min 0.952 min 0.808 min 0.670 min
Planet Gear External measurement over two .0864" diameter pins. 7.5:1 9:1 11.4:1	 2.3067 min 2.3699 min 2.4359 min
Carrier Shaft Bearing Diameter Planet Pin Bore	1.1800 min 0.8750 max
Planet Pins Bearing Diameter	0.873 min
Thrust Washer Thickness	.055 min

Table 4. Parts Wear Limits

ITEM NUMBER *	TORQUE	
	In-lbs	Nm
1 (Screw)	50	68
4 (Screw)	180	245
14 (Screw)	75	102
21 (Screw)	113	154
33 (Screw)	113	154
38 (Retainer Nut)	125	170
* Refer to section 6 for part number identification.		

Table 5. Torque Values

SECTION 5.0 ASSEMBLY

5.1 GENERAL INFORMATION

The tools listed in *Table 1* are suggested for use by technicians servicing the Turbotwin T30-M air motor. The best results can be expected when these tools are used, however, the use of other tools is acceptable.

CAUTION

Replace all screws, o-rings, lip seals, and bearings when the T30-M motor is assembled. These parts are included in the overhaul kit shown in the Parts List, Section 6.0.

NOTE

Always press the inner race of a ball bearing when installing a bearing onto a shaft. Always press the outer race of a ball bearing when installing into a housing.

Lubricate all o-rings with petroleum jelly or Parker O-ring Lube before assembly unless otherwise noted. Refer to *Table 6* for a list of materials to be used during assembly.

MATERIALS	SOURCE
Petroleum Jelly	Commercially Available
Parker-O-Ring Lube	Commercially Available
Loctite RC290	Commercially Available
Grease, gearbox	TDI P/N 9-94121-001

Table 6. Materials for Assembly

5.2 TURBINE HOUSING

5.2.1 TURBINE BEARING INSTALLATION

Press the lip seal (19) onto the large end of the bearing spacer (20) with the lips facing up.

Press the lip seal/bearing spacer assembly (19,20) into the stage 1 turbine housing (21).

Press the turbine bearing (11) onto the turbine shaft (24) until seated using press tool 2-26943.

Press the turbine bearing/shaft assembly (11,24) into the turbine housing (21). Use press tool P/N 2-26943 if required per figure 9. Do not press on the end of the shaft because the load could damage the balls of the bearings.

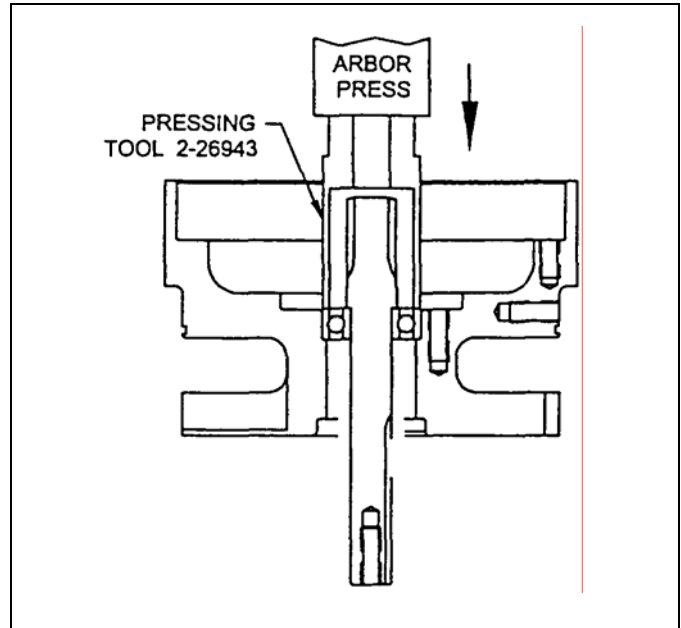


Figure 9. Turbine Shaft Installation

Install the bearing retainer (22) onto the turbine housing (21) and secure with four screws (23). Torque to 113 in-lbs.

5.2.2 ROTOR 1 INSTALLATION

Turn the turbine nozzle over (exhaust end up) and press the square key (10) into the turbine shaft (24) until seated.

Install stage 1 rotor (18) by sliding over turbine shaft (24), while simultaneously aligning the key with the keyway in the rotor.

5.2.3 STAGE 2 NOZLE INSTALLATION

Slip o-ring (6) over stage 1 rotor and into the groove of the turbine housing (21).

Install the stage 2 nozzle (16) over the turbine housing (21) and secure with five (17) hex screws. Torque to 75 in-lb.

NOTE

The air inlet port on nozzle 2 must be aligned with the casting indentation on the turbine housing.

5.2.4 ROTOR 2 INSTALLATION

Slide bearing spacer (13) over turbine shaft (24). Place pre-load spring (12) into bearing bore.

Apply a light coating of oil to the bearing bore in the nozzle 2 containment assembly and press the bearing over the turbine shaft and into the bearing bore.

Insert key (10) into turbine shaft keyway and install stage 2 rotor (9) onto shaft, while simultaneously aligning the key with the keyway in the rotor.

Secure stage 2 rotor with rotor washer (5) and rotor screw (4). Torque to 180 in-lb.

If removed Install plug (14) into nozzle 2 containment assembly.

Hand press ring (25) gear into turbine housing with ring gear holes aligning with holes on gearbox.

5.3 GEAR BOX ASSEMBLY

5.3.1 PLANETARY GEAR CARRIER ASSEMBLY

If disassembled, press needle bearings (30) into planet gear (29) using arbor press.

Place thrust washer (28) on each side of planet gear (29) and install into carrier shaft (26) slot opening.

Press planet shafts (27) into the carrier weldment using arbor press.

5.3.2 CARRIER SHAFT INSTALLATION

Press lip seal (33) into aft side on gearbox housing (35) with lips facing up.

Press aft bearing (31) onto carrier shaft using arbor press.

Place wavy washer (32) and bearing spacer on carrier shaft. The wavy washer should be centered on rear bearing.

Place carrier shaft assembly on a flat surface and hand press the gearbox housing (35) onto carrier shaft.

Press forward bearing (37) over carrier shaft and into gearbox housing using arbor press.

Place carrier shaft assembly on holding tool. Install locknut (38) onto carrier shaft. Tighten locknut using spanner wrench. Torque to 125 in-lb.

5.4 FINAL ASSEMBLY

Temporarily install one screw (36) into ring gear (25) to prevent it from rotating while applying grease. Remove screw after grease is applied to ring gear.

Apply liberal amounts of grease (approximately 100-115 grams) to planet gears (29), turbine shaft sun gear (24), and ring gear (25).

CAUTION

The grease used in the planetary system has a shelf life of 2 years. Therefore, if the starter is **NOT** installed and operated on the engine for 2 years after the starter is manufactured, the grease should be replaced prior to starter operation. The manufactured date is reflected in the starter serial number. (Ex: 0602-0567 has a manufactured date of February 2006).

Align gearbox assembly with turbine assembly and secure with four screws.

Press lip seal (39) into mounting flange (41) with lips facing forward.

Install o-ring (40) on mounting flange (41)

Install flange (41) on gearbox assembly using four screws (42).

Install exhaust elbow (5) using seven screws (3). Torque to 50 in-lb.

SECTION 6.0 PARTS LIST

The components illustrated and/or described in this section are for the Turbotwin T30-M air motor.

When rebuilding the T30-M, it is recommended to purchase and completely install the appropriate service kit(s).

ITEM #	DESCRIPTION	PART NUMBER	QTY	Overhaul Kit T30M-27625-001
1	Inlet Adaptor, 2" NPT; S/N: Before 9608-001	2-27275	1	
2	Screw Used with Item #1 Before 9608-001	14F-31218-028	4	
3	Screw	14F-16432-008	7	√
4	Hollow Hex Plug, Exhaust Check Port	9-93501-002	1	
5	Exhaust Adaptor Elbow (Before S/N: 9608-001)	2-27248	1	
5	Exhaust Elbow, 1 1/2" NPT (After S/N: 9608-001)	2-27555	1	
6	O-Ring	9-90001-047	2	√
7	Screw, Rotor Attachment	14F-25028-012	1	√
8	Rotor Washer	9-93047	1	
9	Stage 2 Rotor	2-27232	1	
10	Square Key (1/8")	9-90220-050	2	
11	Turbine Bearing	9-91224	2	√
12	Bearing Pre-Load Spring	9-90439	1	√
13	Bearing Spacer	9-93091-003	1	
14	Hollow Hex Plug	9-93501-002	1	
15	1" NPT Caplug	9-93502-006	1	
16	Stage 2 Noz/ Containment (RH)	2-27405-00R	1	
16	Stage 2 Noz/ Containment (LH)	2-27405-00L	1	
17	Screw	24F-25020-012	5	√
18	Stage 1 Rotor	2-27225	1	
19	Lip Seal	2-26719	2	√
20	Spacer/SealBearing	9-93114	1	√
21	Turbine Hsg. / Stage 1 (3 Noz. RH)	2-27389-03R	1	
21	Turbine Hsg. / Stage 1 (3 Noz. LH)	2-27389-03L	1	
21	Turbine Hsg. / Stage 1 (6 Noz. RH)	2-27389-06R	1	
21	Turbine Hsg. / Stage 1 (6 Noz. LH)	2-27389-06L	1	
21	Turbine Hsg. / Stage 1 (12 Noz. RH)	2-27389-12R	1	
21	Turbine Hsg. / Stage 1 (12 Noz. LH)	2-27389-12L	1	
22	Bearing Retainer	2-27406	1	
23	Screw	14F-25020-012	4	√
24	Turbine Shaft (11.4:1)	2-27391-002	1	
25	Ring Gear	2-27395	1	
26	Carrier Shaft Weldment (11.4:1)	2-27422-001	1	
27	Planet Shaft	2-22051	3	
28	Planet Gear Spacer	9-93065	6	√
29	Planet Gear (11.4:1)	2-21988	3	

TDI TURBOTWIN™
FROM TECH DEVELOPMENT

				Overhaul Kit
ITEM #	DESCRIPTION	PART NUMBER	QTY	T30M-27625-001
30	Planet Bearing	9-91389	3	√
31	Gearbox Bearing	9-91394	1	√
32	Bearing Pre-Load Spring	9-90402-023	1	√
33	Lip Seal, Gearbox Grease	9-90033	1	√
34	Bearing Spacer (Gearbox)	9-93119	1	√
35	Gearbox Housing	2-27408	1	
36	Hex Bolts (Gearbox Attachment)	14F-25020-024	4	√
37	Gearbox Bearing (Same as #31)	9-91394	1	√
38	Bearing Retainer Nut	9-92105-006	1	
39	Lip Seal	2-23978	1	√
40	O-Ring	9-90001-039	1	√
41	Mounting Flange	2-23976	1	
42	Screw	14F-25020-012	4	√
43	Inlet O-Ring used only before S/N: 9608-001	9-90001-035	1	√
44	O-Ring (Gearbox to Turbine Assy)	9-90001-049	1	

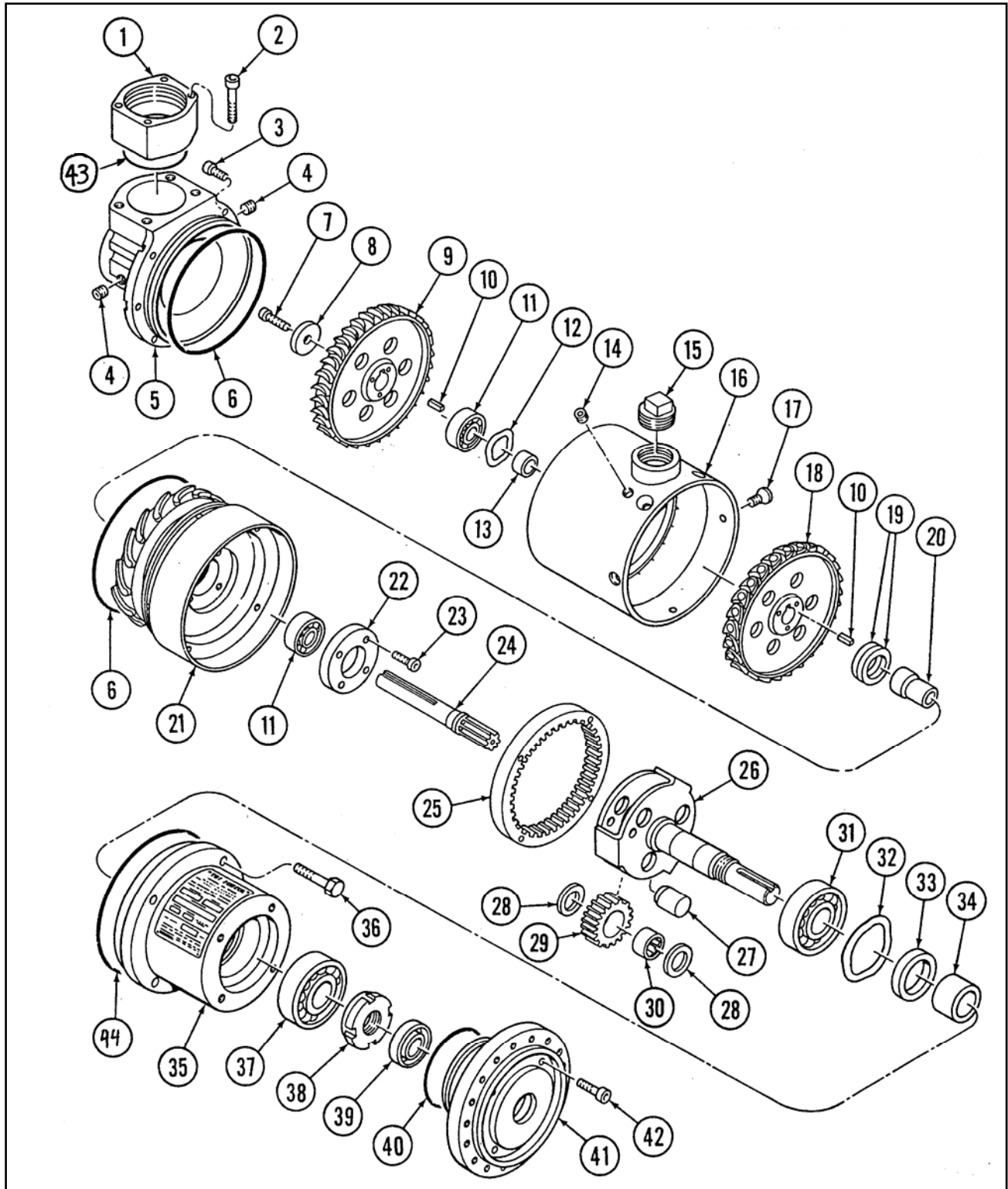


Figure 10. T30-M Illustrated Parts Breakdown