# OPERATION AND MAINTENANCE MANUAL

for

## SERIES 8T AUTOMATIC SHUTOFF TORQUE TRANSDUCER ANGLE WRENCHES

### WITH MAGNETIC ENCODER AND ELECTRIC SHUTOFF

Form P6831
Edition 2
March, 1987

| With 3/8" Square Drive Angle Head | With 1/2" Square Drive Angle Head |
|---|---|
| 8TL32TTMES | 8TN53TTMES |
| 8TM32TTMES | 8TP53TTMES |
| | 8TQ53TTMES |

**Always operate, inspect and maintain this tool in accordance with American National Standards Institute Safety Code for Portable Air Tools (ANSI B186.1) and any other applicable safety codes and regulations.**

The delivered torque of this Angle Wrench can be effectively controlled by regulating the inlet air pressure between 50 psig (3.4 bar/340 kPa) and 90 psig (6.2 bar/ 620 kPa). Operating the Wrench at pressures outside this range will result in inefficient operation, and operating the Wrench on higher pressures will cause premature wear.

Operate this Wrench using 1/2" (13 mm) inside diameter air supply hose.

## LUBRICATION

**Oil:** Ingersoll-Rand Pneu-Lube® Light Oil No. 10 or a good quality high-speed spindle oil

**Grease:** For bevel pinion and bevel gear, use Ingersoll-Rand Lubricant No. 66. For bearings and planet gears, use Ingersoll-Rand Lubricant No. 28.

Before connecting the air supply hose, pour about 2.5 cc of the recommended oil into the Inlet Bushing (1).

A positive displacement injection system provides the best method for lubricating the motor. We recommend the Ingersoll-Rand Single Point Lubricators. Contact your local Ingersoll-Rand representative for details.

**After every 10 000 cycles of operation**, disassemble the gear case and apply 2 cc of the recommended gearing lubricant into the gear case. At the same interval, inject 1 cc of the recommended angle head lubricant through the angle head Grease Fitting (69).

Whenever a Series 8TTMES Angle Wrench is disassembled for overhaul or replacement of parts, lubricate as follows:

1. Apply approximately 30 cc of Ingersoll-Rand Lubricant No. 66 to the Bevel Gear (71) and Bevel Pinion (72).
2. Work 2 to 3 cc of Ingersoll-Rand Lubricant No. 28 into the Spindle Upper Bearing (70), Bevel Pinion Bearing (73), Bevel Pinion Thrust Bearing (77), Spindle Bearing (62), Planet Gear Bearings and Rollers.
3. Pour 2.5 cc of Ingersoll-Rand Pneu-Lube® Light Oil No. 10 into the Inlet Bushing (1) after assembling the Tool.
4. Apply a film of O-ring lubricant to all O-rings.

## DISASSEMBLY

When disassembling the Angle Wrench, take the following precautionary measures:

1. Do not disassemble the Tool any further than necessary to replace or repair parts.
2. Do not remove any part which has a press fit unless the removal of that part is necessary for repair.
3. Always use leather-covered or copper-covered vise jaws when grasping a part. Take extra care with threaded parts and housings.
4. Do not remove a needle bearing unless you have a new needle bearing on hand for replacement. Needle bearings are always damaged during the removal process.

### Disassembly of Angle Attachment

1. Using the No. WFS182-26 Bearing Cap Wrench for the No. 8SA32 Angle Head, or using the No. 8SA32-26 Bearing Cap Wrench for the No. 8SA32 Angle Head, unscrew the Bearing Cap (88). **Note:** This is a left-hand thread. Because an adhesive is used on the threads, it may be necessary to apply moderate heat to release the bond. **CAUTION:** If the application of heat is necessary, apply it only to the area of the Angle Housing (67) directly over the threads. If this procedure is not followed, the Spindle Lower Bearing (85) may be damaged.
2. Withdraw the Socket Adapter Spindle (82) from the Angle Housing. **CAUTION:** If more than one angle head is disassembled at a time, take care not to mix Bevel Gears (72) and Bevel Pinion (71) from different Angle Heads. These gear sets are specially matched and are available only as matched sets.
3. Remove the Bevel Pinion Snap Ring (79) and slip the Bevel Pinion Retainer (80), Thrust Bearing (77) and Thrust Washer (78) from the pinion shaft.
4. Remove the Spacer Retainer (86) and withdraw the Bevel Pinion Bearing Spacer (74).
5. Grasp the Pinion shank in vise jaws and pull on the Angle Housing while rapping the open end with a soft-faced hammer to remove the Bevel Pinion (71) and Bearing (73). **CAUTION:** Do not remove the Pinion and Bearing unless you have a new Bearing available.
6. Press the Spindle Upper Bearing (70) and Angle Housing Cap (68) out using an arbor.

### Disassembly of Gearing and Transducer

1. Hold the Gear Housing (44) in a vise with copper jaws and unscrew Coupling Nut (29).
2. Hold tool horizontally and separate motor housing from gear case.
3. Carefully tip gear housing upright and tap bottom if necessary to remove Transducer (65). **CAUTION:** Do not allow Transducer to fall on a hard surface or damage will result.
4. Withdraw Gear Head (49) and Spindle (55) assemblies.
5. Remove two Screws (117) and pull pick-up assembly off the Transducer. Gently tap the front of the Transducer on a block of wood to remove Bearing (63) and Spacer (48). Remove Retaining Ring (66), Shaft Extension (46), Bushing (307), Encoder Disk Nut (304) and Disk (311).

**Notice:** The use of other than genuine Ingersoll-Rand replacement parts may result in decreased tool performance and increased maintenance, and may invalidate all warranties.

**Refer All Communications to the Nearest Ingersoll-Rand Office or Distributor.**



Printed in U.S.A.

INGERSOLL-RAND®
PROFESSIONAL TOOLS

6. Remove Encoder Bearing Support (301) by gently tapping bearing lip in (301) with brass drift pin inserted from ring gear side. Rotate pin around in different locations to tap out uniformly.
7. Press the Planet Gear Shaft (61 or 52) out from the splined or geared end of the Gear Head or Spindle. **CAUTION**: The Bearing Rollers (58) and Roller Retainers (59) are free to fall when the Planet Gear Shafts are removed from the Spindle on N ratio tools.

### Disassembly of Motor

1. Separate the Motor Housing (18) from the Gear Case (44) as instructed in steps 1 and 2 in Disassembly of Gearing.
2. Grasp the rotor shaft and pull the assembled motor from the Housing.
3. Hold the Cylinder (38) in one hand and tap the splined end of the Rotor (30), with a light plastic-faced hammer to remove the Front Rotor Bearing (40), Front End Plate (39), Cylinder and Vanes (31).
4. Examine all motor parts for wear or damage as follows:
   (a) **Vanes** - Check for evidence of cracking, chipping or spalling. Replace the complete set of Vanes if any of these conditions exists.
   (b) **Rotor Bearings** - Check for looseness or roughness. Replace a Bearing if either condition is detected.
   (c) **Cylinder** - Examine the bore. If it is cracked, wavy or rough, replace the Cylinder.
   (d) **End Plates** - Examine the rotor side for scoring. Polish out shallow score marks using fine (320 grit) emery cloth placed on a hard, flat surface. Replace End Plates having deep score marks.
   (e) **Rotor** - Polish the Rotor with fine emery cloth to remove score marks.

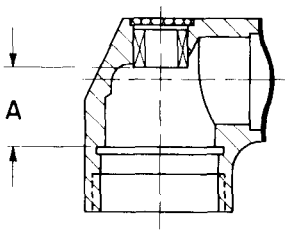
## ASSEMBLY

Take the following precautionary measures when assembling the Angle Wrench:

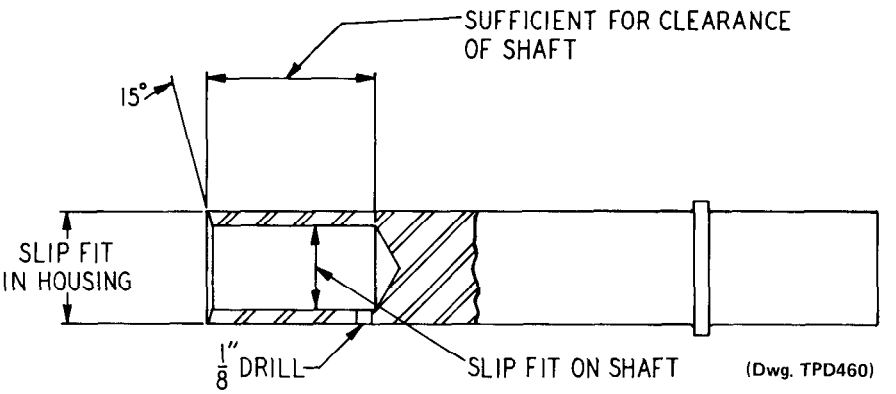
1. Always press on the stamped end of a needle bearing when installing it in a bearing recess.
2. Always press on the inner ring of a ball-type bearing when installing the bearing on a shaft.
3. Always press on the outer ring of a ball-type bearing when pressing the bearing into a bearing recess.
4. Whenever grasping a tool or part in a vise, always use leather-covered or copper-covered vise jaws. Take extra care with threaded parts and housings.
5. Always clean every part and wipe every part with a thin film of oil before installation.
6. Apply O-ring lubricant to each O-ring before assembly.

### Assembly of Angle Attachment

1. Lubricate the Bevel Pinion (71) as instructed on page 1 and insert it, gear end first, into the long bore of the Angle Housing (67).
2. Lubricate the Bevel Pinion Bearing (73) as instructed on page 1 and insert it, **unstamped end first**, into the bore of the Angle Housing, after the Bevel Pinion.
3. Using a bearing inserting tool as illustrated below, press the Bearing so the stamped face is 1-11/32" (34 mm) below the end face of the Angle Housing.
4. Install the Front Seal (75) and the Rear Seal (76) onto the Bevel Pinion Bearing Spacer (74).
5. Insert the Spacer, small diameter first, into the long bore of the Angle Housing and retain it using the Bevel Spacer Retainer (81).
6. Lubricate the Bevel Pinion Thrust Bearing (77) as instructed on page 1. Install, in the order named, the Bevel Pinion Thrust Washer (78), Bevel Pinion Thrust Bearing and the Bevel Pinion Retainer (80), recessed face trailing, over the splined end of the Bevel Pinion. Retain these parts using the Bevel Pinion Snap Ring (79).
7. If the Lower Spindle Bearing (85) has been removed, press the new Bearing onto the Spindle with the red side closest to the square drive end.
8. Slide the Bevel Gear (72), geared side trailing, over the ground end of the Spindle and into contact with the Spindle Lower Bearing.
9. **For No. 8SA32** - Retain the Bevel Gear using the Bevel Gear Retainer (86).
   **For No. 8SA53** - Clean the threads on the Spindle, apply a film of Loctite* No. 242 to the threads, apply the Bevel Gear Lock Nut (87) and tighten it to a minimum of 25 ft-lb (34 N m) torque.
10. If the Spindle Upper Bearing (70) was removed, press a new Bearing into the Angle Housing (67) from the large threaded end to the dimension shown. **CAUTION**: Press on the stamped face of the Bearing. Failure to do so will cause damage to the Bearing.



(Dwg. TPD636)



(Dwg. TPD460)

**Needle Bearing Inserting Tool**

| Angle Attachment | Minimum Dimension "A" | | Maximum Dimension "A" | |
|---|---|---|---|---|
| | in | mm | in | mm |
| 8SA32 | 0.718 | 18.25 | 0.728 | 18.50 |
| 8SA53 | 0.683 | 17.35 | 0.693 | 17.60 |

11. Lubricate the Spindle Upper Bearing as instructed on page 1 and press the Angle Housing Cap (68) into its recess.
12. Insert the assembled Socket Adapter Spindle Assembly (82) into the Angle Housing, clean the threads on the Angle Housing and Spindle Bearing Cap (88), apply a film of Loctite No. 242 to the threads and tighten the Cap to a minimum of 25 ft-lb (34 N m) torque.
13. Slide the Attachment Coupling Nut (89), threaded end trailing, over the splined end of the Angle Housing.
14. Apply the Coupling Nut Retainer (90) to the external groove on the splined end of the Angle Housing.
15. Engage the spline on the Bevel Pinion (71) with the matching spline on the Spindle (55) and tighten the Coupling Nut (89) to a minimum of 35 ft-lb (47 N m) torque.

* Registered trademark of Loctite Corp.

## Assembly of Gearing

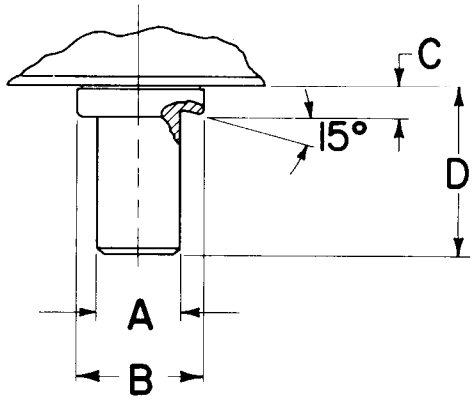
**NOTE**: The letter L, M, N, P or Q is stamped on the web of Gear Heads for identification.

**For L and M ratio gearing**

1. Press a Planet Gear Bearing (57) into each Spindle Planet Gear (56) using the correct inserting tool described below and lubricate the Bearings as instructed on page 1.
2. Insert an assembled Planet Gear into each slot in the Spindle Assembly (55) and press a Planet Gear Shaft (61) into the Spindle through each Planet Gear from the smooth hub end of the Spindle.

**For N, P and Q ratio**

1. **For N ratio gearing** - apply a liberal amount of the recommended grease to the inside diameter of each Spindle Planet Gear (56) and place fifteen Gear Rollers (58) against the inside diameter of each Gear. Apply a Roller Retainer (59) to each end of each Gear.
   **For P and Q ratio gearing,** press a Planet Gear Bearing (57) into each Planet Gear (56) using the correct inserting tool described below.
2. Insert an assembled Gear into each slot in the Spindle and press a Planet Gear Shaft (61) from the smooth bore end of the Spindle into the pin holes to retain the Gears.
3. Press two Planet Gear Bearings (51) into each of the Planet Gears (50).
4. Insert an assembled Planet Gear into each slot in the Gear Head, capturing the appropriate Rotor Pinion (53) in the Gear Head, and retain the Gears by pressing the Planet Gear Shafts (52) from the smooth bore end of the Gear Head.




(Dwg. TPD637-1)

**Planet Gear Bearing Inserting Tool**

| BEARING NUMBER | A | | B | | C | | D | |
|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| WFS182-654 | .152" (3.86 mm) | .153" (3.89 mm) | .265" (6.73 mm) | .266" (6.76 mm) | .051" (1.30 mm) | .059" (1.50 mm) | .296" (7.52 mm) | .312" (7.92 mm) |
| 8SL-500 | .1207" (3.07 mm) | .1217" (3.09 mm) | .234" (5.94 mm) | .235" (5.97 mm) | .005" (0.13 mm) | .010" (0.25 mm) | .125" (3.18 mm) | .140" (3.56 mm) |

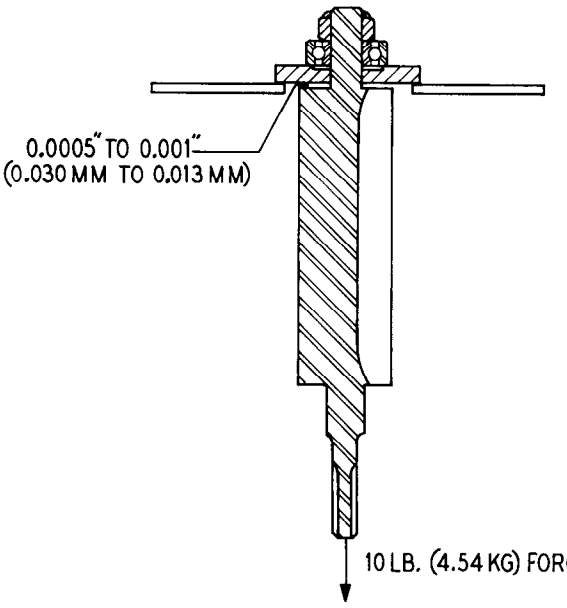
## Assembly of Transducer and Encoder

1. Place a small amount of Loctite* No. 242 to the small bearing bore in the Transducer (65) and install the Front Shaft Extension Bearing (64). Allow to cure before proceeding to step 2.
2. Place the Wave Washer (314), Rear Shaft Extension Bearing (306), and Bushing (307) on the Shaft Extension (46). Place the Shaft Extension with associated parts in the Transducer, through the Front Bearing (64), and retain with the Retaining Ring (66).
3. Assemble Magnet Assemblies (308), Springs (309), and Adjusting Nuts (310) into Bearing Support (301) and insert bearing support into Transducer. Loosely install Setscrews (303), but do not tighten.
4. Install the Encoder Disk (311) using Shims (305) and Nut (304) so that when the Pick-Up Assembly (302) is installed, there is approximately .005" of clearance between the disk and magnetic switches on the Pick-Up Assembly. The magnet assemblies should have approximately .040" clearance from the disk. Retain the Pick-Up Assembly with two Screws (117). See page 5 for Encoder Adjustment.
5. Lubricate gearing per page 1 and place Gear Head and/or Spindle Assemblies (49) and (56) into the Transducer's ring gear.
6. Place assembled motor housing in a vise, and put Transducer with gearing on motor housing using alignment pins and rotating spindle to mesh gears on rotor. Be sure Motor Clamp Washer (47) is in proper location. Align Connector Pins (113) and (114) and push Transducer up against the motor housing.
7. Place gear housing over the Transducer and rotate Spindle (82) to align gearing while tightening the Coupling Nut (29) by hand. Angle Attachment can be repositioned later.
8. Hold tool in a vise by the gear case flats and tighten coupling nut to approximately 40 ft-lb torque.

## Assembly of Motor

1. Slide the Rear End Plate (37) recessed face trailing, followed by the Rear Rotor Bearing (34), shielded side trailing, onto the threaded hub of the Rotor (30). Thread the Rotor Bearing Retaining Nut (35) onto the hub a few turns.
2. Support the Rear End Plate as illustrated below and place one 0.001" (0.03 mm) thick shim between the End Plate and a solid Rotor boss.
3. While applying a 10 lb (4.54 kg) force downward as illustrated, tighten the Retaining Nut until the spacing of the Rotor and End Plate is approximately 0.001". Remove the shim and manually rotate the preloaded Rotor to detect rubbing between the Rotor and End Plate. If rubbing is detected, back the Nut off a turn and repeat this procedure.

* Registered trademark of Loctite Corp.




(Dwg. TPD614)

4. Stand the assembled Rotor on a workbench with the splined end up. Slide the Cylinder (38) over the Rotor so the 1/8" (3 mm) diameter hole in the Cylinder is aligned with the slot in the Rear End Plate and so the recess port in the end of the Cylinder is to the left of the 1/8" hole when viewed from the splined end.
5. Insert a Vane (31) into each slot in the Rotor and slide the Front End Plate (39), recessed face trailing, onto the splined Rotor hub.
6. Press the Front Rotor Bearing (40) onto the splined hub and rotate the Rotor manually to make certain it moves freely without binding.
7. Using an 1/8" (3 mm) diameter rod as a guide through the notches in the Front End Plate and Rear End Plate, through the holes in the bosses on the Cylinder and through the matching hole in the Rear Rotor Bearing Support, guide the motor into the bore of the Housing (18). **NOTE**: The dowel hole in the bore of the Housing is in line with the Throttle Lever.
8. Carefully remove the guide rod and replace it with the Cylinder Dowel (41).
9. Place Front Rotor Bearing Support Assembly (42) on Bearing (39).

### Motor Housing Cable Replacement

1. Hold Motor Housing vertically by flats in copper jaw vise and unscrew Solenoid Assembly (100).
2. Remove Housing from vise and, while holding down Shutoff Valve Assembly (98) with thumb, slide Housing Sleeve (19) and Exhaust Deflector (26) from rear of Housing and over Throttle Lever (12). Be careful not to pinch cable wires.
3. Remove Deflector Seal O-rings (27) and slide back Coupling Nut (29).
4. Remove Retaining Ring (28) and slide Coupling Nut off front of Housing.
5. Remove Screw (21) and slide Handle Sleeve (17) off handle.
6. Unscrew four Screws (117) and four Spacers (114) holding Transducer Cable (109) and Encoder Cable (110).
7. Disconnect cables from External Cable (108) and slide small connectors through hole in Housing; lift Cable (109 and 110) and Diode Ring (99) out. **Caution**: Valve Assembly with Shims and Spring can fall out. Remove or hold in place with tape.
8. Unscrew ground strap of External Cable and lift out of handle.
9. To reassemble reverse procedures 1 to 8 and be sure to take up excess Encoder Cable (110 colored red) slack by creating a "U" shaped loop in the exhaust area prior to assembling Silencer (25) and Deflector (26). Use tape to hold wire in place if necessary.
10. When connecting Cable (109) and the cable from Circuit (201) to the External Cable (108) be sure to insert miniature connector ends in slots provided in handle. (See page 7).

### Assembly of Gear Case and Motor Housing

1. Hold Motor Housing in upright position; use flats to support in vise with copper jaws.
2. Place Motor Clamp Washer (47) on Bearing Support (42), cup side out.
3. Attach Gear Case to Motor Housing making sure Rotor spline fits into Shaft Extension (46) per steps on page 3.

## TRANSDUCER CALIBRATION

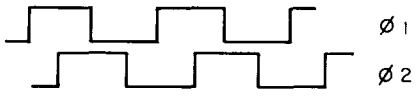
| TOOL MODEL NUMBERS | TRANSDUCER ASSEMBLY PART NUMBER | MAX. TORQUE RATING AND FULL SCALE SETTING |
|---|---|---|
| 8TL, M32TTMES | 400-25-155-1 | 50 ft-lb |
| 8TN, P, Q53TTMES | 400-25-155-2 | 100 ft-lb |

All transducer calibrations based on 2MV/VOLT full scale signal ouput, 10 VOLT D.C. MAXIMUM input, using an 87.15 kilohm ± 1% calibration resistor. Transducer bridge resistance 700 ohms.

1. Connect tool to a strain gauge signal conditioner such as the GSE Model 229 with an 87.15 kilohm external calibration resistor.
2. Set **BALANCE** control to zero.
3. Press the calibration switch and set the **SPAN** control to the appropriate **FULL SCALE SETTING**.
4. Recheck for zero; then reset the **SPAN** if necessary.

## ENCODER ADJUSTMENT

1. Connect the encoder circuit to a 5 VDC ± 5% power supply. Refer to wiring logic below. Connect the output signal to a dual trace oscilloscope. Adjust the oscilloscope time base to 0.2 mS per division and vertical sensitivity to 1.0 volt per division.
2. With Transducer and Encoder Assembly assembled in tool, operate tool at free speed and observe the oscilloscope.




3. The scope trace should appear as shown above. If needed, adjust the magnetic switches in the Pick-Up Assembly (302) and Magnet Assemblies (308) to obtain desired signal.
4. Use Loctite* No. 242 on Screws (313, 303 and 117) and Nut (304); use fast drying lacquer sealer on Screws (310, 312, 117 and 313) after adjustments. Lock the Setscrews (303 and 313); then recheck signal with unit in tool prior to setting up of the Loctite* and drying of the sealer.

### Encoder Pulses per degree of Spindle rotation

| Model | Gear Ratio | Pulses per Degree |
|---|---|---|
| 8TL32TTMES | 11.06 | 1.01 |
| 8TM32TTMES | 14.25 | 1.31 |
| 8TN53TTMES | 22.11 | 1.41 |
| 8TP53TTMES | 26.40 | 1.69 |
| 8TQ53TTMES | 30.80 | 1.97 |

| WIRE COLOR | WIRE GAUGE | CONNECTOR PIN | LOGIC | EQUIPMENT |
|---|---|---|---|---|
| RED | 28 | A | + EXC. | TRANSDUCER |
| BLACK | 28 | B | - EXC. | |
| GREEN | 28 | C | + SIG. | |
| WHITE | 28 | D | - SIG. | |
| SHIELD | 28 | E | SHIELD | |
| BLUE | 28 | F | Ø2 | ENCODER |
| RED/BLACK | 28 | H | Ø1 | |
| WHITE/BLACK | 28 | P | (-) COMMON | |
| ORANGE | 28 | R | + 5VDC | |
| RED | 24 | K | + SOL. | ELECTRIC SHUTOFF |
| BLACK | 24 | L | - SOL. | |

## ELECTRIC SHUTOFF VALVE

Note the Electric Shutoff Valve Assembly (98) and Valve Body (97) are sold as matched sets for proper fit. If damage to either one occurs, Motor Housing Subassembly (18) containing Valve Body (97) should be returned to the factory for repair and replacement of the valve parts.

### DISASSEMBLY

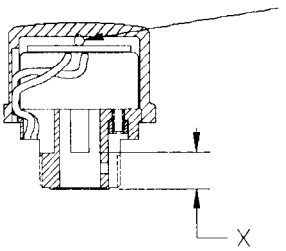
1. Unscrew Solenoid Assembly (100) and, while holding down Shutoff Valve Assembly (98) with thumb, slide Housing Sleeve (19) from Motor Housing and over Throttle Lever.
2. Lift out Diode Ring Assembly (99).
3. Position tool with Valve facing downward and while grasping Shutoff Valve Assembly (98) with finger, pull the Shutoff Valve Assembly out of Valve Body (97) chamber. Be careful not to lose Shims, Spacer or Spring and note their position relative to Valve Assembly. **Caution**: Do not drop, scratch or nick Valve Assembly or valve may not function.
4. Removal of Retaining Ring (101) is usually not necessary.

### ASSEMBLY

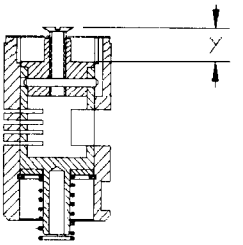
1. Reverse procedure outlined above. Be sure to place shims on Valve Assembly (98) as they were prior to disassembly, that is for normally closed valves the .05" thick Spacer (102) is on spring side; for normally open Valves, Spacer (102) is on the solenoid side.
2. If Solenoid Assembly (100) or Diode Ring (99) is being replaced, check Valve Assembly (98) for proper alignment as follows:
   (a) Disassemble Gear Case from Motor Housing and remove Motor and Rear Rotor Bearing Support.
   (b) Place existing Spacer and Shims with Spring on Valve (98) and insert into Body (97).
   (c) Assemble new Ring (99) and/or Solenoid (100) and tighten to 4 ft-lb of torque.
   (d) Inspect, through motor bore, that Valve (98) is in proper position with Solenoid de-energized, i.e. linear ports completely open for normally open Valve or ports completely closed for normally closed type.
   (e) Repeat if necessary steps (b) to (d), trying different combinations of Shims to achieve proper Valve alignment.

* Registered trademark of Loctite Corp.

(f) After proper shimming is determined, set Valve Assembly Adjustment Screw (104) to proper height using a depth micrometer or caliper depth gauge as follows:




insert 1/16" dia. pin in solenoid air vent and push down on solenoid plunger while taking reading.




take reading with shim in place

Make adjustment with valve in body so that pin can restrain valve while applying torque to screw.

Adjust screw height "Y" so that "Y" - "X" = .040" nominal. **NOTE**: Apply Loctite* to screw threads prior to readjustment of Screw.

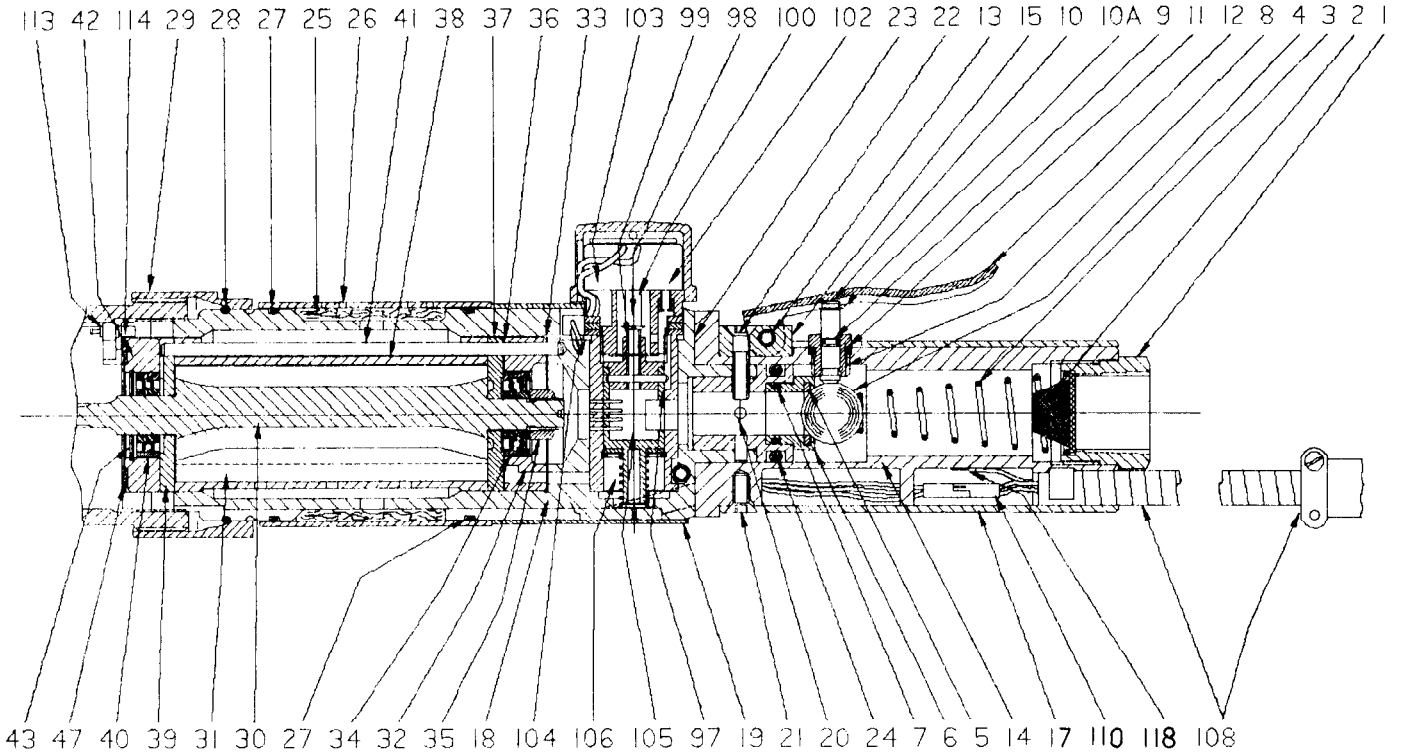
3. Apply a small amount of medium strength Loctite* to Solenoid threads prior to reassembly. Tighten Solenoid to 4 ft-lb of torque. Be careful not to allow Loctite* to run into valve chamber and let sealant set with Solenoid facing downward.

## TORQUE TRANSDUCER ANGLE WRENCH 8T SERIES WITH ENCODER AND ELECTRIC SHUTOFF

| ITEM | PART NUMBER | DESCRIPTION | RATIO L | M | N | P | Q |
|---|---|---|---|---|---|---|---|
| 1 | 400-25-15 | Threaded Adapter | X | X | X | X | X |
| 2 | 834-61 | Air Strainer | X | X | X | X | X |
| 3 | 8SL-262 | Throttle Valve Spring | X | X | X | X | X |
| 4 | K6U-941 | Throttle Valve Ball | X | X | X | X | X |
| 5 | 8SL-159 | Valve Seat Face | X | X | X | X | X |
| 6 | 8SL-A303 | Throttle Valve Seat Assembly | X | X | X | X | X |
| 7 | AF120-290 | Valve Seat Seal | X | X | X | X | X |
| 8 | 8SL-A503 | Throttle Plunger Bushing Assembly | X | X | X | X | X |
| 9 | 8SL-259 | Throttle Plunger Seal | X | X | X | X | X |
| 10 | 8SL-A302 | Throttle Valve Plunger Assembly | X | X | X | X | X |
| 10A | 8SL-305 | Throttle Valve Plunger Stop | X | X | X | X | X |
| 11 | 405-159 | Throttle Plunger Bushing Seal | X | X | X | X | X |
| 12 | 8SL-273 | Throttle Lever | X | X | X | X | X |
| 13 | MR-100 | Throttle Lever Retaining Pin | X | X | X | X | X |
| 14 | 400-25-17 | Valve Body | X | X | X | X | X |
| 15 | 400-25-13 | Mounting Block, Lever | X | X | X | X | X |
| 17 | 400-25-30 | Handle Sleeve | X | X | X | X | X |
| 18 | 400-25-18-3 | Motor Housing Subassembly | X | X | X | X | X |
| 19 | 400-25-31 | Sleeve Housing | X | X | X | X | X |
| 20 | R10V-404 | 8-32 x 3/8" lg. Socket Head Cap Screw (2) | X | X | X | X | X |
| 21 | 400-25-74-5 | 8-32 x 3/8" lg. Flat Head Socket Cap Screw | X | X | X | X | X |
| 22 | 400-25-74-6 | 8-32 x 3/4" lg. Flat Head Socket Cap Screw | X | X | X | X | X |
| 23 | CE110-312 | 8-32 x 5/8" lg. Socket Head Cap Screw (2) | X | X | X | X | X |
| 24 | BU-948 | O-ring, Valve Body | X | X | X | X | X |
| 25 | 8SL-311 | Exhaust Silencer | X | X | X | X | X |
| 26 | 8SL-23 | Exhaust Deflector | X | X | X | X | X |
| 27 | AF160-291Z | Exhaust Deflector Seal (2) | X | X | X | X | X |
| 28 | 8SL-203 | Retaining Ring | X | X | X | X | X |
| 29 | 400-25-20 | Coupling Nut, Housing | X | X | X | X | X |
| 30 | 8SM-53 | Rotor | X | X | X | X | X |
| 31 | 8SL-42-5 | Vane Packet (set of 5 Vanes) | X | X | X | X | X |
| 32 | 8SL-25 | Rear Rotor Bearing Support | X | X | X | X | X |
| 33 | 8SL-283 | Rear Bearing Support Gasket | X | X | X | X | X |
| 34 | R0H-24 | Rear Rotor Bearing | X | X | X | X | X |
| 35 | 8SL-118 | Rear Bearing Retaining Nut | X | X | X | X | X |
| 36 | 8SL-739 | Rear End Plate Gasket | X | X | X | X | X |
| 37 | 8SL-12 | Rear End Plate | X | X | X | X | X |
| 38 | 8SL-3 | Cylinder | X | X | X | X | X |
| 39 | 8SL-11 | Front End Plate | X | X | X | X | X |
| 40 | WFS182-24 | Front Rotor Bearing | X | X | X | X | X |
| 41 | 8SL-98 | Cylinder Dowel | X | X | X | X | X |
| 42 | 400-25-71-1 | Front Rotor Bearing Support Assembly | X | X | X | X | X |
| 43 | AFH120A-362 | Front Rotor Bearing Retainer | X | X | X | X | X |

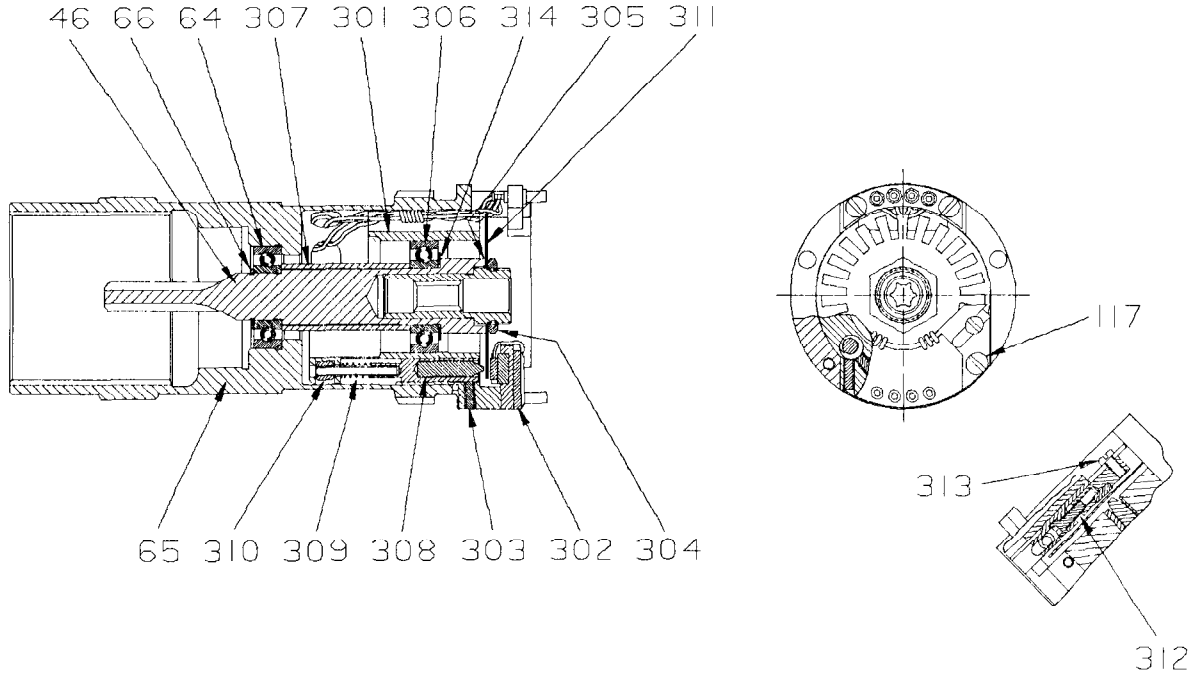
* Registered trademark of Loctite Corp.

## TORQUE TRANSDUCER ANGLE WRENCH 8T SERIES WITH ENCODER AND ELECTRIC SHUTOFF (Continued)




**Series 8T Transducer Motor and Throttle**
**(Normally Closed Type Valve Shown in Energized (Open) Position)**

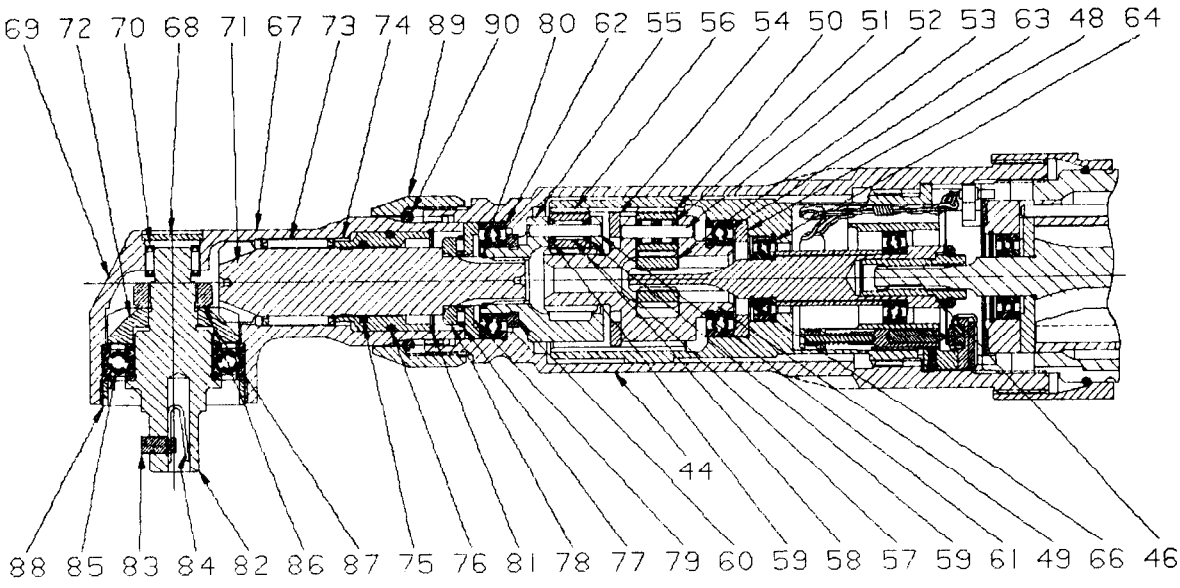
| ITEM | PART NUMBER | DESCRIPTION | RATIO L | M | N | P | Q |
|---|---|---|---|---|---|---|---|
| 44 | 400-25-21-1 | Gear Housing (internal) | | | X | X | X |
| 44 | 400-25-21-2 | Gear Housing (internal) | X | X | | | |
| 46 | 400-25-34-1A | Shaft Extension Assembly | X | | | | |
| 46 | 400-25-34-2A | Shaft Extension Assembly | | X | X | X | X |
| 47 | 8SL-207 | Motor Clamp Washer | X | X | X | X | X |
| 48 | 400-25-06 | Bearing Spacer | X | X | X | X | X |
| 49 | 8SN-A216 | Gear Head Assembly | | | X | | |
| 49 | 8SP-A216 | Gear Head Assembly | | | | X | |
| 49 | 8SQ-A216 | Gear Head Assembly | | | | | X |
| 50 | 8SN-A9 | Gear Head Planet Gear Assembly (3) | | | X | | |
| 50 | 8SP-A9 | Gear Head Planet Gear Assembly (3) | | | | X | |
| 50 | 8SQ-A9 | Gear Head Planet Gear Assembly (3) | | | | | X |
| 51 | 8SL-500 | Planet Gear Bearing (2 per planet gear) (6) | | | X | X | X |
| 52 | 8SN-190 | Planet Gear Shaft (3) | | | X | X | X |
| 53 | 8SN-17 | Rotor Pinion | | | X | | |
| 53 | 8SP-17 | Rotor Pinion | | | | X | |
| 53 | 8SQ-17 | Rotor Pinion | | | | | X |
| 54 | 400-25-201 | Gear Head Spacer | | | X | X | X |
| 55 | 8SL-A108 | Spindle Assembly | X | | | | |
| 55 | 8SM-A108 | Spindle Assembly | | X | | | |
| 55 | 8SN-A108 | Spindle Assembly | | | X | | |
| 55 | 8SP-A108 | Spindle Assembly | | | | X | X |
| 56 | 8SL-A10 | Spindle Planet Gear Assembly (3) | X | | | | |
| 56 | 8SM-A10 | Spindle Planet Gear Assembly (3) | | X | | | |
| 56 | 8SN-A10 | Spindle Planet Gear Assembly (3) | | | X | | |
| 56 | 8SP-A10 | Spindle Planet Gear Assembly (3) | | | | X | X |
| 57 | WFS182-654 | Planet Gear Bearing (3) | X | X | | X | X |
| 58 | 8SN-654 | Bearing Roller (15 for each planet gear) (45) | | | X | | |
| 59 | 8SN-655 | Roller Retainer (2 for each planet gear) (6) | | | X | | |
| 60 | WFS182-111 | Spindle Spacer | X | X | X | X | X |
| 61 | 8SL-191 | Planet Gear Shaft (3) | X | X | | X | X |
| 61 | 8SN190 | Planet Gear Shaft (3) | | | X | | |
| 62 | R1602-510 | Spindle Bearing | X | X | X | X | X |
| 63 | R1602-510 | Gear Head Bearing | X | X | X | X | X |
| 64 | WFS182-24 | Shaft Extension Bearing | X | X | X | X | X |
| 65 | 400-25-155-1 | Transducer/Ring Gear Assembly | X | X | | | |
| 65 | 400-25-155-2 | Transducer/Ring Gear Assembly | | | X | X | X |
| 66 | 400-25-75-1 | Retaining Ring | X | X | X | X | X |
| 67 | 8SA32-A550 | Angle Housing Assembly | X | X | X | | |
| 67 | 8SA53-A600 | Angle Housing Assembly | | | | X | X |
| 68 | 8SA32-110 | Angle Housing Cap | X | X | X | | |
| 68 | 182A53-110 | Angle Housing Cap | | | | X | X |
| 69 | D0F9-879 | Grease Fitting | X | X | X | X | X |
| 70 | 8SA32-603 | Spindle Upper Bearing | X | X | X | | |
| 70 | 182A53-603 | Spindle Upper Bearing | | | | X | X |

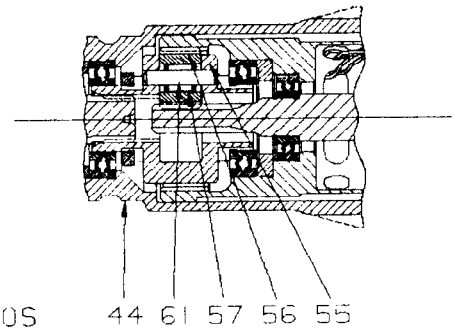



Series 8T Magnetic Encoder

| ITEM | PART NUMBER | DESCRIPTION | RATIO L | M | N | P | Q |
|---|---|---|---|---|---|---|---|
| 71 & 72 | 8SA32-A552 | Matched Gear Set | X | X | X | | |
| 71 & 72 | 182A53-A603 | Matched Gear Set | | | | X | X |
| 71 | | Bevel Pinion (not sold separately) | | | | | |
| 72 | | Bevel Gear (not sold separately) | | | | | |
| 73 | 182A53-606 | Bevel Pinion Bearing | X | X | X | X | X |
| 74 | 182A53-A165 | Bevel Pinion Bearing Spacer | X | X | X | X | X |
| 75 | R18LF-21 | Front Seal | X | X | X | X | X |
| 76 | C321-606 | Rear Seal | X | X | X | X | X |
| 77 | R1610-105 | Bevel Pinion Thrust Bearing | X | X | X | X | X |
| 78 | 182A53-554 | Bevel Pinion Thrust Washer | X | X | X | X | X |
| 79 | 182A53-689 | Bevel Pinion Snap Ring | X | X | X | X | X |
| 80 | 182A53-589 | Bevel Pinion Retainer | X | X | X | X | X |
| 81 | 182A53-685 | Bevel Spacer Retainer | X | X | X | X | X |
| 82 | 8SA32-P507-3/8 | Socket Adapter Spindle Assembly | X | X | X | | |
| 82 | 182A-A507-1/2 | Socket Adapter Spindle Assembly | | | | X | X |
| 83 | 5020-716 | Socket Retainer | X | X | X | | |
| 83 | 804-716 | Socket Retainer | | | | X | X |
| 84 | 401-718 | Socket Retainer Spring | X | X | X | | |
| 84 | 5UHD-718 | Socket Retainer Spring | | | | X | X |
| 85 | 8SA32-593 | Lower Spindle Bearing | X | X | X | | |
| 85 | 182A53-593 | Lower Spindle Bearing | | | | X | X |
| 86 | 8SA32-578 | Bevel Gear Retainer | X | X | X | | |
| 87 | 182A53-578 | Bevel Gear Locknut | | | | X | X |
| 88 | 8SA32-531 | Spindle Bearing Cap | X | X | X | | |
| 88 | 182A53-531 | Spindle Bearing Cap | | | | X | X |
| 89 | 8SA32-27 | Attachment Coupling Nut | X | X | X | X | X |
| 90 | 182A53-29 | Coupling Nut Retainer | X | X | X | X | X |
| * | 8SL-A60 | Reaction Bar Holder Assembly | X | X | X | X | X |
| * | 9SL-50 | Bar Lock Screw | X | X | X | X | X |
| * | 9SL-49 | Adapter Bolt | X | X | X | X | X |
| * | 9SL-48 | Torque Reaction Bar | X | X | X | X | X |
| * | 400-25-77 | Horizontal Hanger | X | X | X | X | X |
| + 97 | 400-25-106 | Valve Body | X | X | X | X | X |
| + 98 | 400-25-109 | Shutoff Valve Assembly | X | X | X | X | X |
| 99 | 400-25-115 | Diode Ring Assembly | X | X | X | X | X |
| 100 | 400-25-135 | Solenoid Assembly | X | X | X | X | X |
| 101 | 400-25-75-2 | Retaining Ring | X | X | X | X | X |
| 102 | 400-25-128 | Spacer | X | X | X | X | X |

+ Items 97 and 98 sold as matched sets only; replacement of item 97 to be done by Ingersoll-Rand.
* Not illustrated.

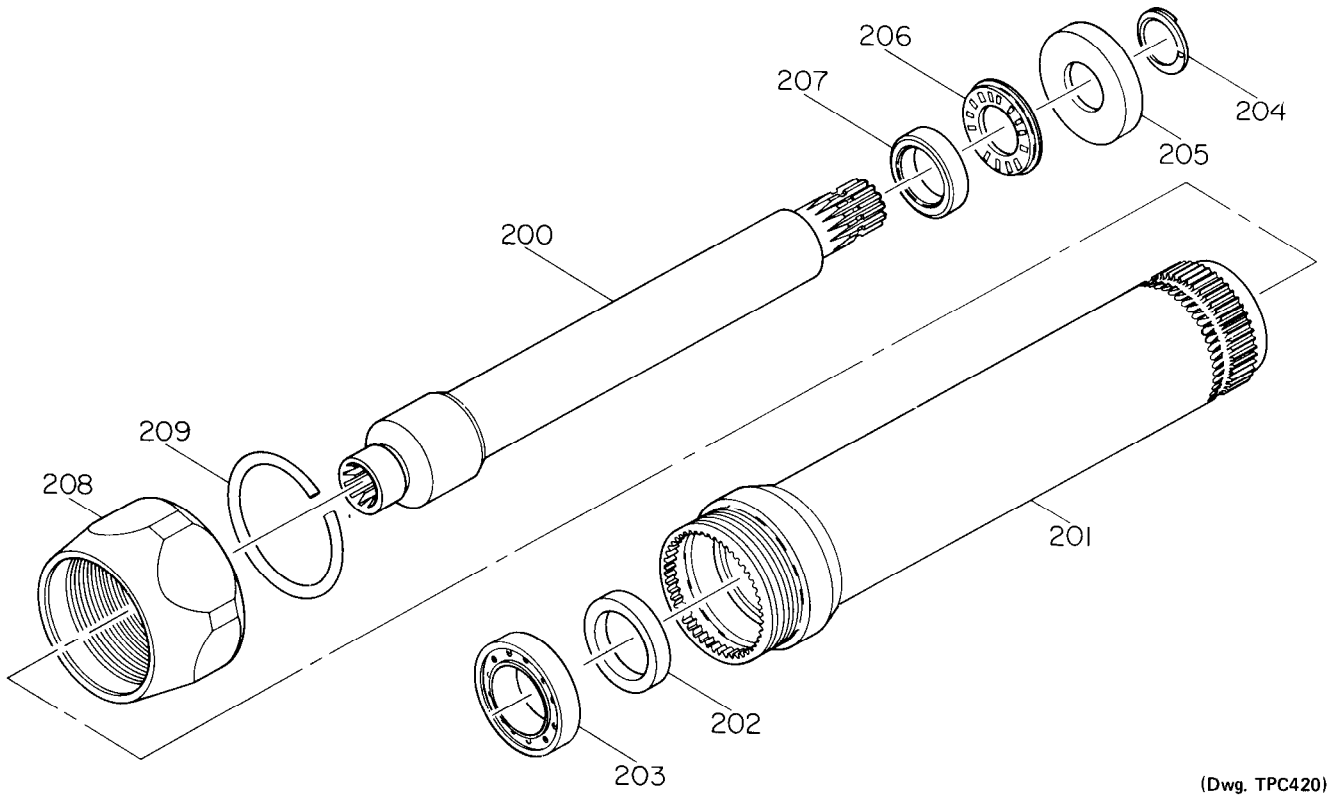



Series 8T Transducer Angle Attachment and Spindle

| ITEM | PART NUMBER | DESCRIPTION | RATIO L | M | N | P | Q |
|---|---|---|---|---|---|---|---|
| 104 | 400-25-119 | Adjustment Screw | X | X | X | X | X |
| 105 | 400-25-129-1 | Shutoff Valve Spring | X | X | X | X | X |
| 108 | 400-25-78-÷ | Cable and Connector Assembly | X | X | X | X | X |
| 109 | 400-25-62-1 | Connector/Cable Assembly (motor housing), Transducer (natural) | X | X | X | X | X |
| 110 | 400-25-62-2 | Connector/Cable Assembly (motor housing), Encoder (red) | X | X | X | X | X |
| 113 | 400-25-52 | Connector Assembly, Transducer | X | X | X | X | X |
| 114 | 400-25-22 | Spacer (4) | X | X | X | X | X |
| 117 | 400-25-74-4 | 3-56 x 3/8" lg. Pan Head Screw (8) | X | X | X | X | X |
| 119 | 8SA32-26 | Spindle Bearing Cap Wrench (not shown) | X | X | X | | |
| 120 | WFS182-26 | Spindle Bearing Cap Wrench (not shown) | | | | X | X |
| 301 | 400-25-172 | Bearing Support, Encoder | X | X | X | X | X |
| 302 | 400-25-188 | Pick-Up Assembly | X | X | X | X | X |
| 303 | 400-25-74-12 | Setscrew (4) | X | X | X | X | X |
| 304 | 400-25-102-2 | Encoder Disk Nut | X | X | X | X | X |
| 305 | 400-25-182-1 | Shim, .001" thick, amber (as required) | X | X | X | X | X |
| 305 | 400-25-182-2 | Shim, .003" thick, green (as required) | X | X | X | X | X |
| 305 | 400-25-182-3 | Shim, .005" thick, blue (as required) | X | X | X | X | X |
| 305 | 400-25-182-4 | Shim, .010" thick, brown (as required) | X | X | X | X | X |
| 306 | 7S60-97 | Rear Shaft Extension Bearing | X | X | X | X | X |
| 307 | 400-25-176 | Shaft Extension Bushing | X | X | X | X | X |
| 308 | 400-25-178 | Magnet Assembly (2) | X | X | X | X | X |
| 309 | 400-25-129-5 | Magnet Spring (2) | X | X | X | X | X |
| 310 | 400-25-179 | Magnet Adjusting Nut (2) | X | X | X | X | X |
| 311 | 400-25-180 | Encoder Disk | X | X | | | |
| 311 | 400-25-181 | Encoder Disk | | | X | X | X |
| 312 | 400-25-74-10 | Pick-Up Adjusting Screw (2) | X | X | X | X | X |
| 313 | 400-25-74-11 | Lock Screw (2) | X | X | X | X | X |
| 314 | 400-25-191 | Wave Washer | X | X | X | X | X |

÷ Dash No. for specific customer.

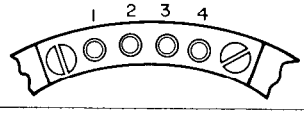



(Dwg. TPC420)

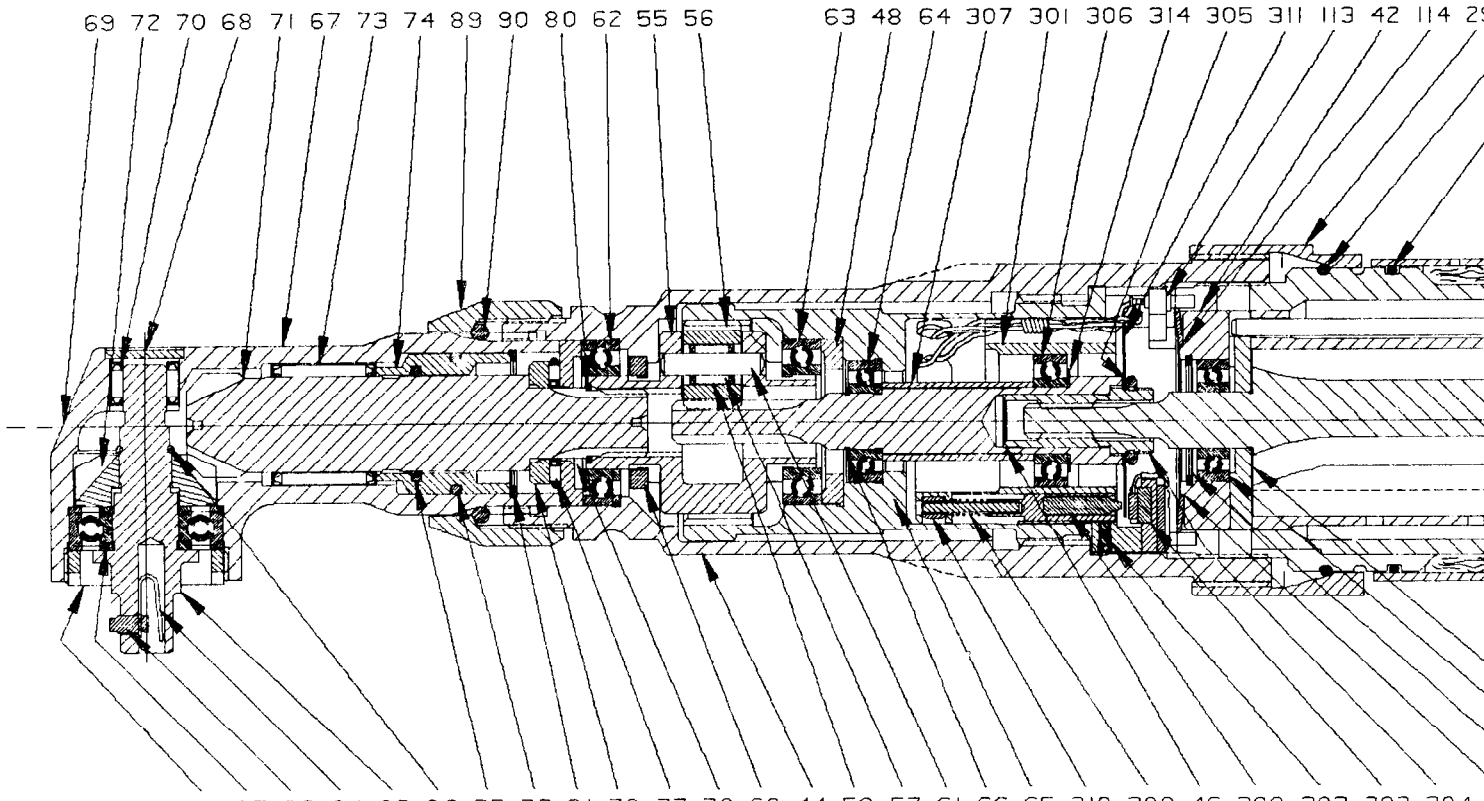
PART NUMBER FOR ORDERING

| | | |
|---|---|---|
| | 6" Angle Housing Extension Assembly | 8SL-A327-6 |
| 200 | Extension Arbor | 8SL-327-6 |
| 201 | Arbor Housing | 8SL-43-6 |
| 202 | Arbor Spacer | WFS182-111 |
| 203 | Arbor Bearing | R1602-510 |
| 204 | Extension Arbor Snap Ring | 182A53-689 |
| 205 | Extension Arbor Retainer | 182A53-589 |
| 206 | Extension Arbor Thrust Bearing | R1610-105 |
| 207 | Extension Arbor Thrust Washer | 182A53-554 |
| 208 | Coupling Nut | 8SA32-27 |
| 209 | Coupling Nut Retainer | 182A53-29 |

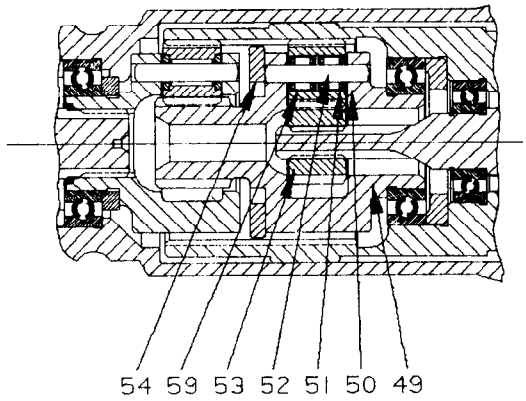
## TROUBLESHOOTING GUIDE

| Trouble | Probable Cause | Test Procedure and Solution |
|---|---|---|
| Low power or low free speed | Low air pressure | Check the air pressure at the inlet. |
| | Worn or broken Vanes | Replace a complete set of Vanes. |
| | Loose Rotor Bearing Retaining Nut | Tighten the Nut as instructed on Pages 3 and 4. |
| | Worn or broken Cylinder | Replace the Cylinder if it is cracked or if the bore appears wavy or scored. |
| | Improper lubrication or dirt buildup | Clean the Motor Unit parts and lubricate them as instructed on Page 1. |
| Gear case gets hot | Excessive grease | Clean and inspect the Gear Case and gearing parts and lubricate as instructed on Page 1. |
| | Worn or damaged parts | Clean and inspect the Gear Case and gearing. Replace worn or broken components. |
| **TRANSDUCER**<br>No torque signal when tightening fastener | Broken wire or connector | **EQUIPMENT**: Volt/Ohm Meter<br>Replace defective component. Trace circuit for continuity; set meter to RX1 scale, start measurements at External Cable and work inwards to transducer. Disassemble tool as required. |
| | Transducer defective<br>  <br> | Return unit to factory for repair. Set meter to RX100 scale. Good unit should read:<br>**PIN NO.** — **APPROX. READING**<br>1 to 2, 3 to 4 — 670 to 770 ohms<br>1 to 3, 1 to 4, 2 to 3, 2 to 4 — 500 to 580 ohms |
| Improper or low torque reading | Calibration off or wrong cal. resistor used | Recheck calibration per Page 4. |
| | Bearing bad in Angle Head causing drag | Replace Angle Head or bearing in Head. |

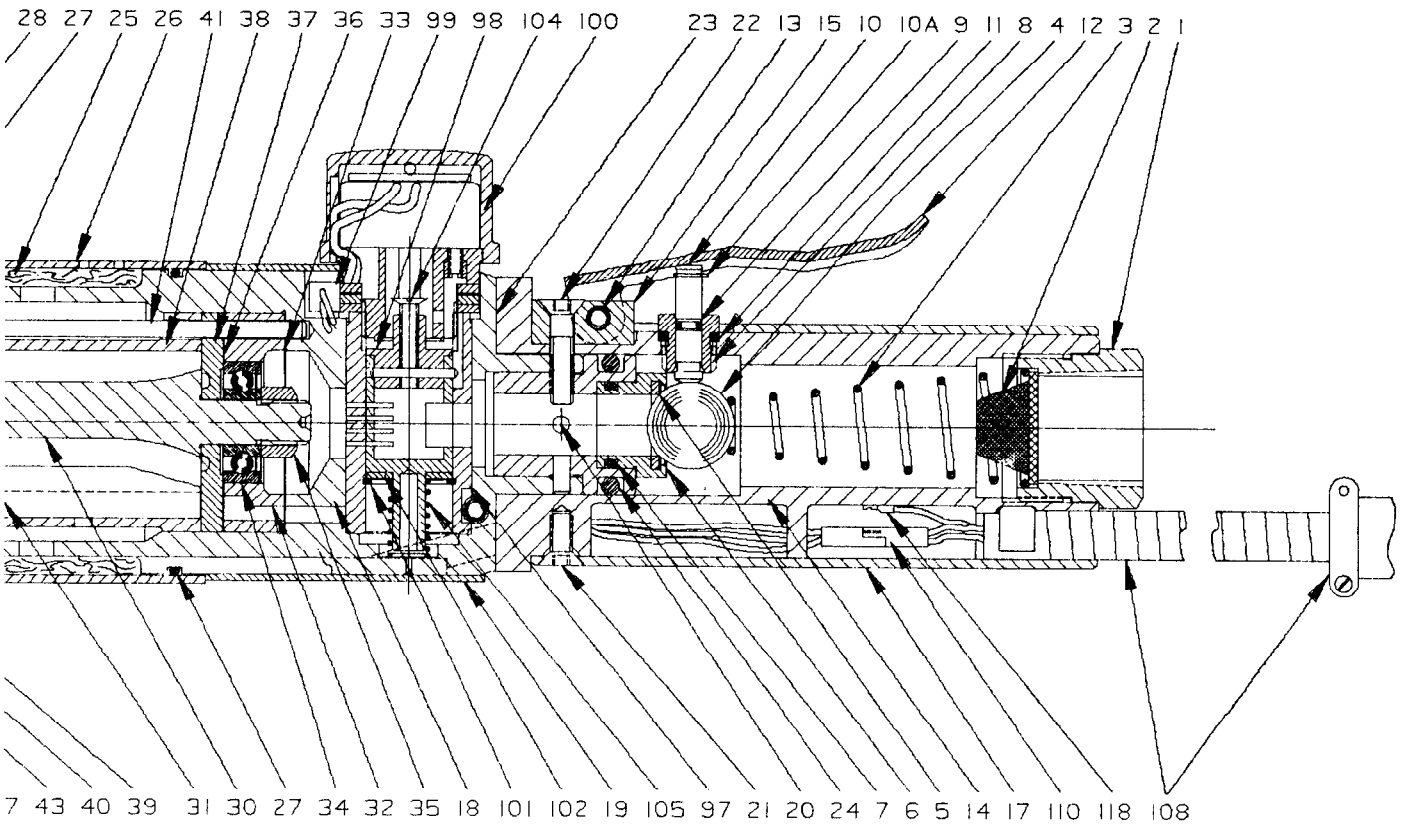
*(Continued on Page 13.)*




"L" AND "M" RATIOS




"N" "P" AND "Q" RATIOS




**Series 8T Automatic Shutoff Torque Transducer Angle Wrench with Magnetic Encoder and Electric Shutoff**

## TROUBLESHOOTING GUIDE

| Trouble | Probable Cause | Test Procedure and Solution |
|---|---|---|
| **ELECTRIC SHUTOFF** (normally closed type) Fails to operate | Broken wire or connector or open Solenoid coil | **EQUIPMENT**: Volt/ohm meter. Replace defective component. Trace circuit for continuity or shorts to casing. Set meter to R x 1 scale, start measurements at External Cable and work inward to Solenoid. Disassemble tool as required; meter (+) on black lead, (-) on red. Reading should be 28 to 32 ohms. |
| | Shorted Diode Ring | Replace components; R x 1 scale<br>**METER POLARITY** (+) Red / Black; Black / Red — **APPROX. READING** 5 to 10 ohms; infinity |
| | Dirt on Valve Assembly or in Valve Body or Damaged Valve | Disassemble per page 5 and clean with trichloroethylene; apply light oil on Valve before reassembly. If damaged, replace valve parts. |
| | Plugged vent hole in Motor Housing (opposite solenoid) | Remove foreign matter with .03" diameter wire. |
| Leaks or fails to shut off | Valve misalignment<br>Weak or broken spring<br>Dirt on Valve Assembly or in Valve Body or damaged Valve<br>Plugged vent holes in Solenoid | Readjust per page 5.<br>Replace spring.<br>Same procedure as described above for contamination.<br>Remove foreign matter with .03" diameter wire. Be careful not to allow dirt to enter and be trapped in upper chamber of Solenoid. |

## CALIBRATION PROCEDURES FOR TRANSDUCER-EQUIPPED ANGLE WRENCHES ON GSE MODELS 228D AND 229D INSTRUMENTS IN FOOT-POUNDS AND NEWTON-METERS

| Tool Models | Transducer Full Scale Rating* ft-lb (N m) | 228D | | 229D |
|---|---|---|---|---|
| | | Span Setting ft-lb (N m) | Display Readout ft-lb (N m) | Span setting with Cal. Switch Set @ 0.8 MV/V 700 ohm ft-lb (N m) |
| 8TL32TTMES<br>8TM32TTMES | 50<br>(68) | 125<br>(170) | 20<br>(27) | 20.0<br>(27.0) |
| 8TN53TTMES<br>8TP53TTMES<br>8TQ53TTMES | 100<br>(136) | 250<br>(339) | 40<br>(54) | 40.0<br>(54.0) |

* All Transducers: 700 ohm bridge resistance with 2.0 MV/Volt sensitivity.

## TEST AND INSPECTION PROCEDURE

Run the performance tests at 90 psig (6.2 bar/620 kPa) air pressure at the inlet of the Tool using 1/2" (13 mm) inside diameter supply hose.

1. Check the free speed of the Angle Wrench using a hand-held tachometer applied to the spindle. The minimum allowable free speeds are listed below.

| Size | Stamped Free Speed rpm (r/min) | Minimum Free Speed rpm (r/min) |
|---|---|---|
| 8TL32TTMES | 1430 | 1290 |
| 8TM32TTMES | 1110 | 1000 |
| 8TN53TTMES | 660 | 600 |
| 8TP53TTMES | 610 | 550 |
| 8TQ53TTMES | 520 | 470 |

2. Using a Model J Skidmore tester, operate the Wrench to determine torque output. The minimum allowable torque levels are as follows:

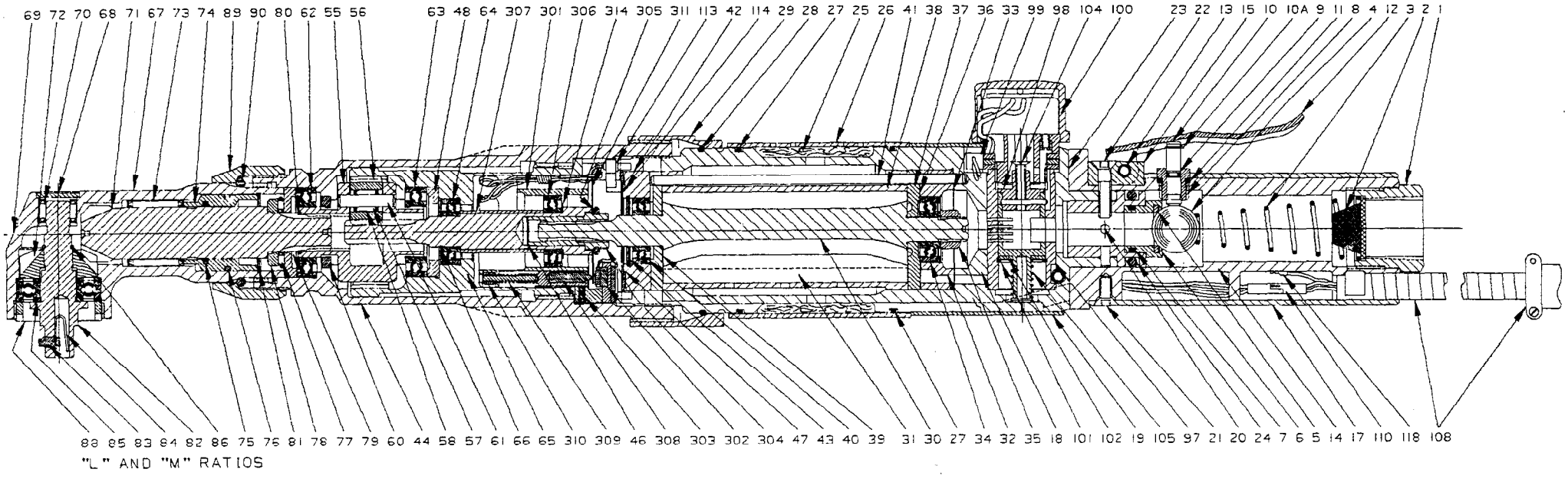
| Size | Minimum Torque ft-lb | N m |
|---|---|---|
| 8TL32TTMES | 18 | 24 |
| 8TM32TTMES | 23 | 31 |
| 8TN53TTMES | 35 | 48 |
| 8TP53TTMES | 40 | 54 |
| 8TQ53TTMES | 50 | 68 |

3. There must be no objectionable leaks in any non-exhaust areas. The exhaust deflector must rotate manually.
4. The throttle must operate freely and must not remain open when the lever is released.
5. The angle attachment, gear case and motor case must not generate excessive heat. Operate the Tool at free speed for 20 seconds.

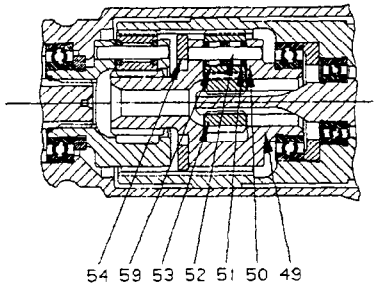
### WARNING

**DISCONNECT THE AIR SUPPLY HOSE OR SHUT OFF THE AIR SUPPLY TO THE TOOL AND DRAIN THE AIR FROM THE HOSE BEFORE PROCEEDING.**

6. Rotate the output spindle using a wrench. The spindle must rotate smoothly with no binding.
7. Examine the Tool to see that the throttle lever is on the opposite side of and in line with the output spindle.




"L" AND "M" RATIOS




"N" "P" AND "Q" RATIOS



**Series 8T Automatic Shutoff Torque Transducer Angle Wrench with Magnetic Encoder and Electric Shutoff**