

OPERATION AND MAINTENANCE MANUAL

for

SERIES 9T AUTOMATIC SHUTOFF TORQUE TRANSDUCER ANGLE WRENCHES

Form P6832
Edition 2
March, 1987

WITH MAGNETIC ENCODER AND ELECTRIC SHUTOFF

With 1/8" Square Drive Angle Head

9TN53TTMES
9TP53TTMES
9TQ83TTMES
9TS83TTMES

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 9TTMES 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. 8SA53 Angle Head, or the No. 9SA83 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.

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.

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INGERSOLL-RAND®
PROFESSIONAL TOOLS

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).
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.

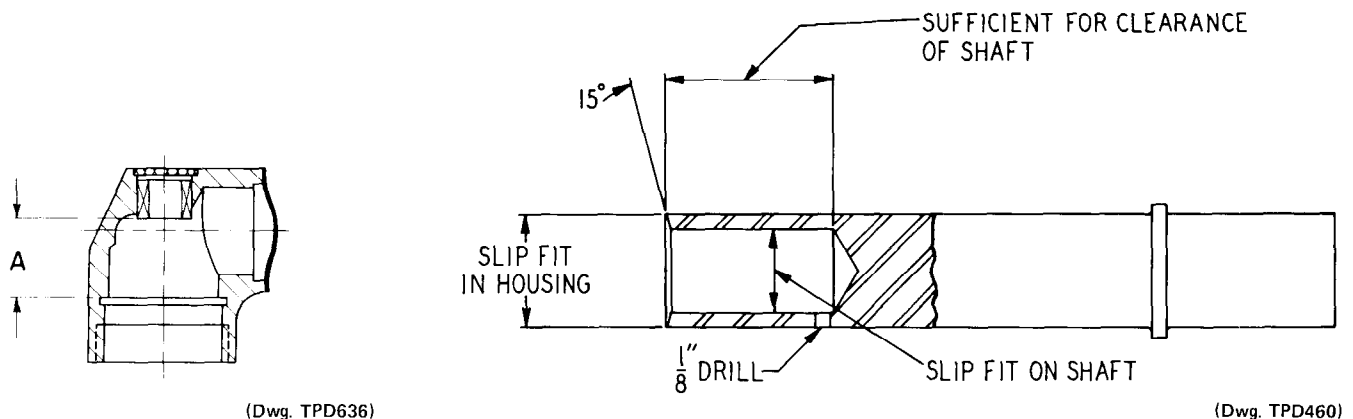
ASSEMBLY

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. 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.



Needle Bearing Inserting Tool

* Registered trademark of Loctite Corp.

Angle Attachment	Minimum Dimension "A"		Maximum Dimension "A"	
	in	mm	in	mm
9SA83	0.720	18.30	0.730	18.55
8SA53	0.683	17.35	0.693	17.60

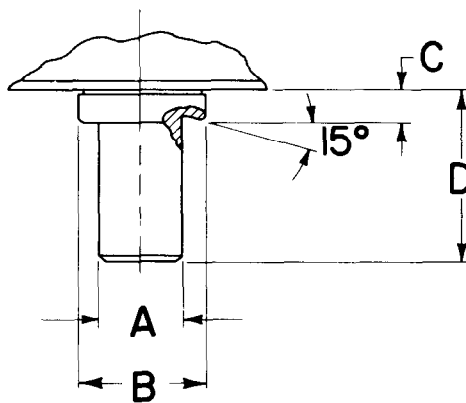
- Lubricate the Spindle Upper Bearing as instructed on page 1 and press the Angle Housing Cap (68) into its recess.
- Insert the assembled Socket Adapter Spindle Assembly (82) into the Angle Housing, clean the threads on the Angle Housing and Spindle Bearing Cap (88), apply a film of Loctite No. 242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

Assembly of Gearing

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

- Press two Planet Gear Bearings (57) into each Spindle Planet Gear (56) using the correct inserting tool described below.
- Insert an assembled Planet 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.
- Press two Planet Gear Bearings (51), into each of the Planet Gears (50) using the correct inserting tool described below.
- 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.

BEARING NUMBER	A		B		C		D	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
WFS182-654	0.152" (3.86 mm)	0.153" (3.89 mm)	0.265" (6.73 mm)	0.266" (6.76 mm)	0.051" (1.30 mm)	0.059" (1.50 mm)	0.296" (7.52 mm)	0.312" (7.92 mm)
8SL-500	0.1207" (3.07 mm)	0.1217" (3.09 mm)	0.234" (5.94 mm)	0.235" (5.97 mm)	0.005" (0.13 mm)	0.010" (0.25 mm)	0.125" (3.18 mm)	0.140" (3.56 mm)
9SN-500	0.1207" (3.07 mm)	0.1217" (3.09 mm)	0.234" (5.94 mm)	0.235" (5.97 mm)	0.000" (0.00 mm)	0.010" (0.25 mm)	0.225" (5.72 mm)	0.240" (6.10 mm)
W22-654	0.152" (3.86 mm)	0.153" (3.89 mm)	0.265" (6.73 mm)	0.266" (6.76 mm)	0.000" (0.00 mm)	0.010" (0.25 mm)	0.225" (5.72 mm)	0.240" (6.10 mm)



(Dwg. TPD637-1)

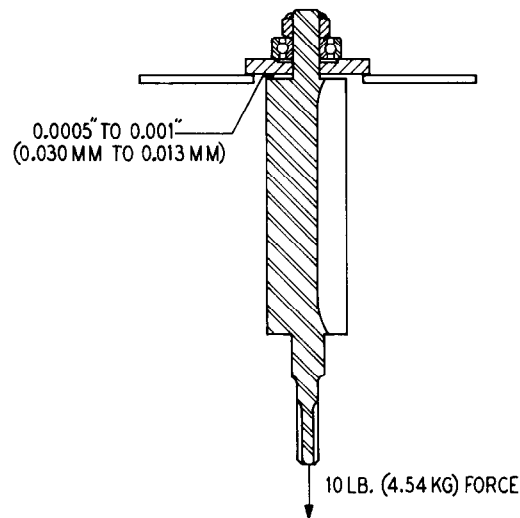
Planet Gear Bearing Inserting Tool

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 (307), and Bushing (176) 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. Intall 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 Encoder Adjustment on page 5.
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.



(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 Plates and Rear End Plates, 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).

* Registered trademark of Loctite Corp.

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 Encoder Circuit (201) 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 illustration on 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 in **Assembly of Transducer and Encoder**.

TRANSDUCER CALIBRATION

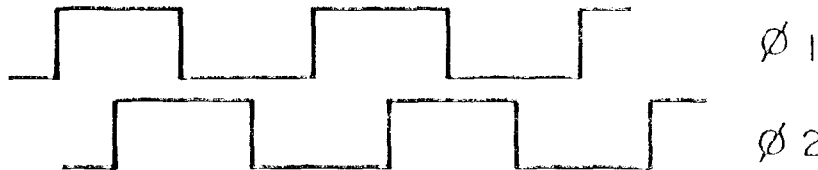
TOOL MODEL NUMBERS	TRANSDUCER ASSEMBLY PART NUMBER	MAX. TORQUE RATING AND FULL SCALE SETTING
9TN, P53, Q83 and S83TTMES	400-25-155-4	200 ft-lb

All transducer calibrations based on 2MV/VOLT full scale signal output, 10 VOLT D.C. MAXIMUM input, using an 87.15 kilohm $\pm 1\%$ 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** control if necessary.

ENCODER ADJUSTMENT

1. Connect the Encoder circuit to 5 VDC $\pm 5\%$ 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 the 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 (312), (310), (117) and (313) after adjustments. Lock the Setscrews (303) and (313); then recheck signal with unit in tool prior to setting up of Loctite* and drying of sealer.

Encoder Pulses per Degree of Spindle Rotation

Model	Gear Ratio	Pulses per Degree
9TN53TTMES	20.57	1.03
9TP53TTMES	25.79	1.29
9TQ83TTMES	36.75	1.84
9TS83TTMES	43.98	2.20

* Registered trademark of Loctite Corp.

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	ENCODER
BLUE	28	F	Ø2	
RED/BLACK	28	H	Ø1	
WHITE/BLACK	28	P	(-) COMMON	
ORANGE	28	R	+ 5VDC	ELECTRIC SHUTOFF
RED	24	K	+ SOL.	
BLACK	24	L	- SOL.	

ELECTRIC SHUTOFF VALVE

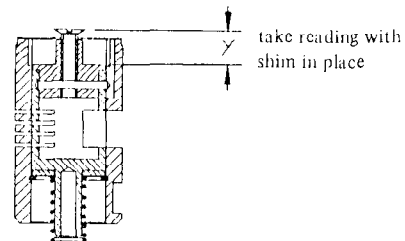
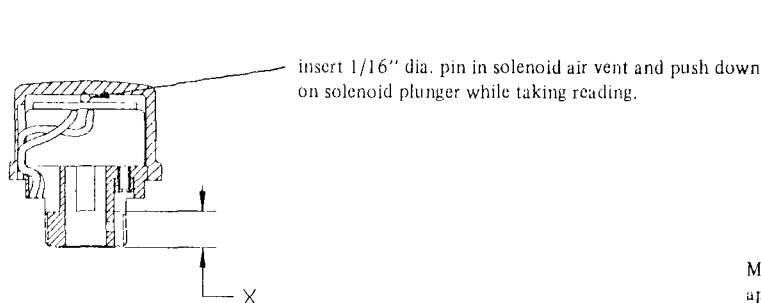
Note the Electric Shutoff Valve Assembly (98) and Valve Body (97) are sold as matched sets for proper fit. If damage to either one occurs, Motor Housing Subassembly (18) containing Valve Body (97) should be returned to the factory for repair and replacement of the valve parts.

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.
 - (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:



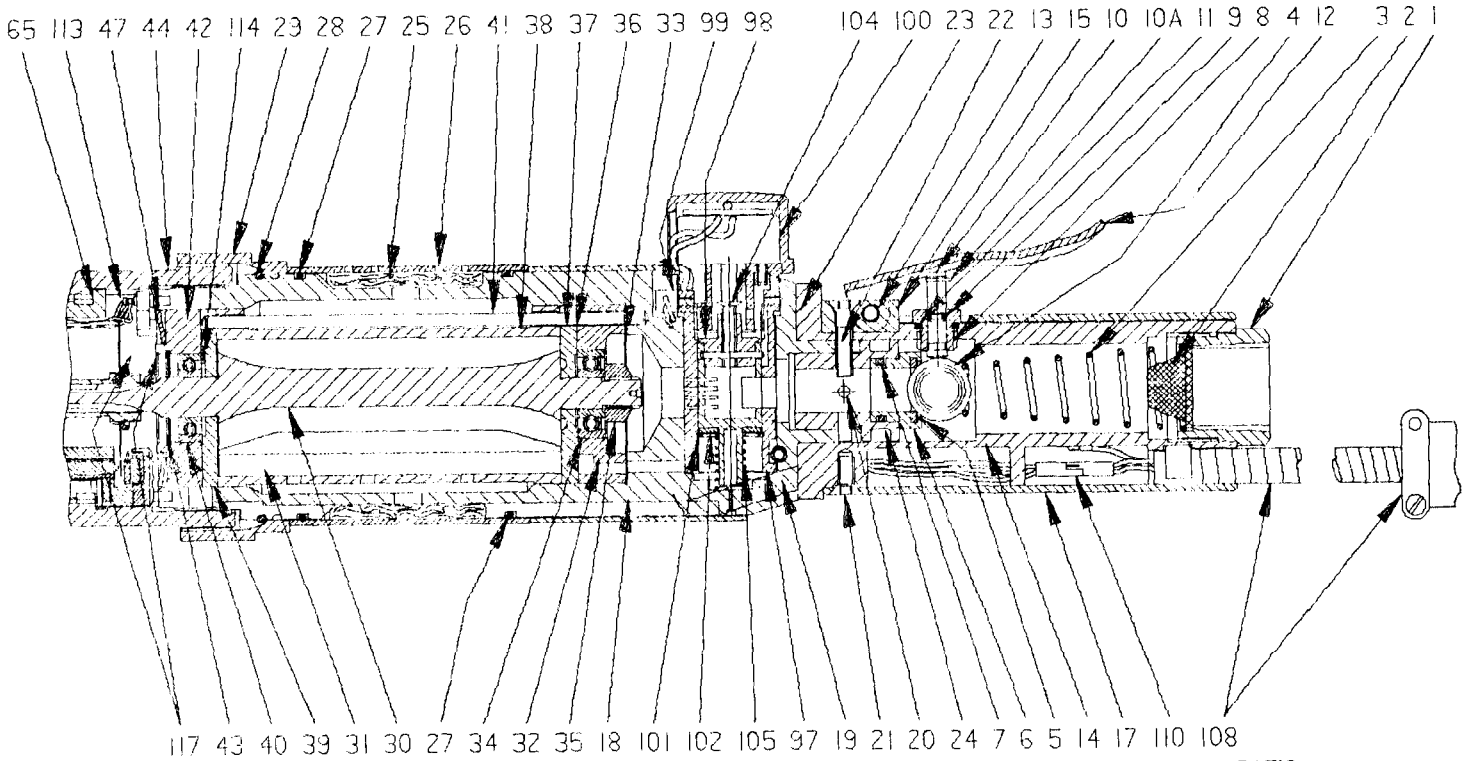
Make adjustment with valve in body so that pin can restrain valve while applying torque to screw.

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.

* Registered trademark of Loctite Corp.

TORQUE TRANSDUCER ANGLE WRENCH 9T SERIES WITH ENCODER AND ELECTRIC SHUTOFF



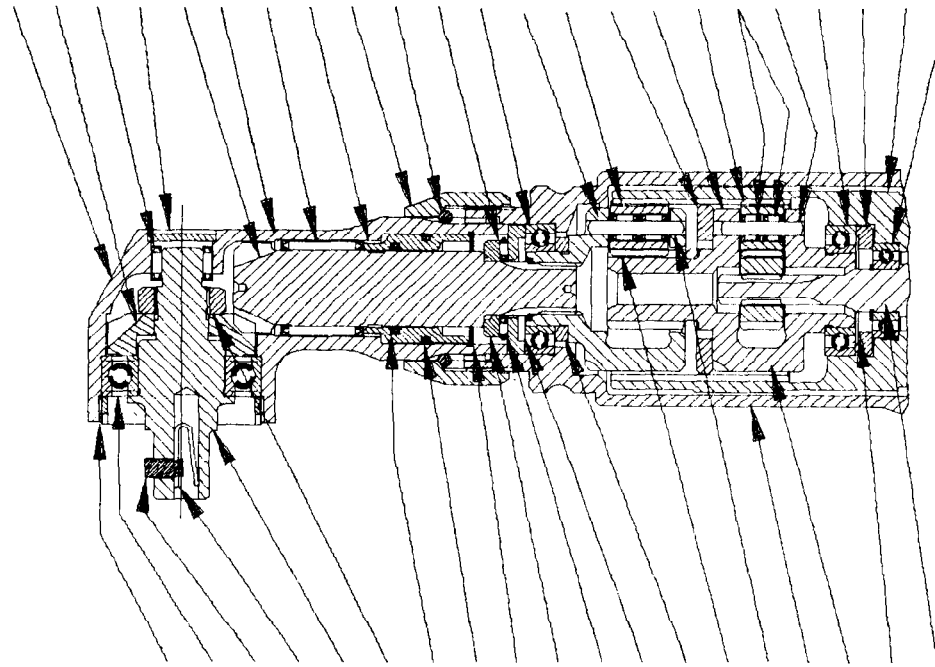
Series 9T Transducer Motor and Throttle

RATIO

ITEM	PART NUMBER	DESCRIPTION	S	N	P	Q
1	400-25-15	Inlet Bushing	X	X	X	X
2	834-61	Air Strainer	X	X	X	X
3	8SL-262	Throttle Valve Spring	X	X	X	X
4	K6U-941	Throttle Valve Ball	X	X	X	X
5	8SL-159	Valve Seat Face	X	X	X	X
6	8SL-A303	Throttle Valve Seat Assembly	X	X	X	X
7	AF120-290	Valve Seat Seal	X	X	X	X
8	8SL-A503	Throttle Plunger Bushing Assembly	X	X	X	X
9	8SL-259	Throttle Plunger Seal	X	X	X	X
10	8SL-A302	Throttle Valve Plunger Assembly	X	X	X	X
10A	8SL-305	Throttle Plunger Stop	X	X	X	X
11	405-159	Throttle Plunger Bushing Seal	X	X	X	X
12	8SL-273	Throttle Lever	X	X	X	X
13	MR-100	Throttle Lever Retaining Pin	X	X	X	X
14	400-25-17	Valve Body	X	X	X	X
15	400-25-13	Mounting Block, Lever	X	X	X	X
17	400-25-30	Handle Sleeve	X	X	X	X
18	400-25-18-4	Motor Housing Subassembly	X	X	X	X
19	400-25-59	Sleeve Housing	X	X	X	X
20	R10V-404	8-32 x 3/8" lg. Socket Head Cap Screw (2)	X	X	X	X
21	400-25-74-5	8-32 x 3/8" lg. Flat Head Socket Cap Screw	X	X	X	X
22	400-25-74-6	8-32 x 3/4" lg. Flat Head Socket Cap Screw	X	X	X	X
23	CE110-312	8-32 x 5/8" lg. Socket Head Cap Screw (2)	X	X	X	X
24	BU-948	O-ring, Valve Body	X	X	X	X
25	9SL-311	Exhaust Silencer	X	X	X	X
26	9SL-23	Exhaust Deflector	X	X	X	X
27	WBT180N-103	Exhaust Deflector Seal (2)	X	X	X	X
28	9SL-203	Retaining Ring	X	X	X	X
29	400-25-43	Coupling Nut, Housing	X	X	X	X
30	9SM-53	Rotor	X	X	X	X
31	9SL-42-5	Vane Packet (set of 5 Vanes)	X	X	X	X
32	9SL-25	Rear Rotor Bearing Support	X	X	X	X
33	9SL-283	Rear Bearing Support Gasket	X	X	X	X
34	ROH-24	Rear Rotor Bearing	X	X	X	X
35	8SL-118	Rear Bearing Retaining Nut	X	X	X	X
36	9SL-739	Rear End Plate Gasket	X	X	X	X
37	9SL-12	Rear End Plate	X	X	X	X
38	9SL-3	Cylinder	X	X	X	X
39	9SL-11	Front End Plate	X	X	X	X
40	WFS182-24	Front Rotor Bearing	X	X	X	X
41	9SI-98	Cylinder Dowel	X	X	X	X
42	400-25-71-2	Front Rotor Bearing Support Assembly	X	X	X	X
43	AFH120A-362	Front Rotor Bearing Retainer	X	X	X	X
44	400-25-37-1	Gear Housing	X	X	X	X
46	400-25-47-2A	Shaft Extension Assembly	X	X	X	X
46	400-25-47-3A	Shaft Extension Assembly	X	X	X	X
47	9SL-207	Motor Clamp Washer	X	X	X	X

TORQUE TRANSDUCER ANGLE WRENCH 9T SERIES WITH ENCODER AND ELECTRIC SHUTOFF (Continued)

69 72 70 68 71 67 73 74 89 90 80 62 55 56 54 53 50 51 52 63 48 45 64



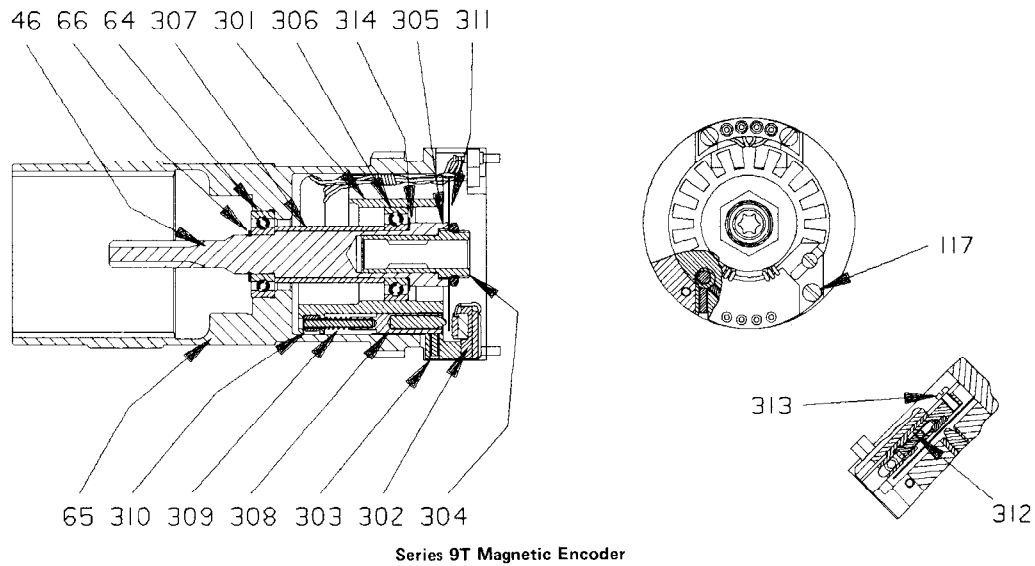
38 85 83 84 82 87 75 76 81 78 77 79 60 57 61 44 49 66 46

Series 9T Transducer Angle Attachment and Spindle

RATIO

ITEM	PART NUMBER	DESCRIPTION	S	N	P	Q
48	400-25-06	Bearing Spacer	X	X	X	X
49	9SN-A216	Gear Head Assembly		X		
49	9SP-A216	Gear Head Assembly			X	
49	9SQ-A216	Gear Head Assembly				X
49	9SS-A216	Gear Head Assembly	X			
50	9SN-A9	Gear Head Planet Gear Assembly (15 teeth) (colored green) (3)		X		
50	9SP-A9	Gear Head Planet Gear Assembly (17 teeth) (colored red) (3)			X	X
50	9SS-A9	Gear Head Planet Gear Assembly (20 teeth) (colored white) (3)	X			
51	WFS182-654	Planet Gear Bearing (3)	X		X	X
51	8SL-500	Planet Gear Bearing (6)		X		
52	8SN-190	Planet Gear Shaft (3)		X		
52	8SN-191	Planet Gear Shaft (3)	X		X	X
53	9SN-17	Rotor Pinion (21 teeth) (colored red)		X		
53	9SP-17	Rotor Pinion (17 teeth) (colored yellow)			X	X
54	400-25-202	Gear Head Spacer	X	X	X	X
55	9SN-A108	Spindle Assembly		X		
55	9SP-A108	Spindle Assembly	X		X	
55	9SQ-A108	Spindle Assembly				X
56	9SN-A10	Spindle Planet Gear Assembly (15 teeth) (colored natural) (3)		X		
56	9SP-A10	Spindle Planet Gear Assembly (16 teeth) (colored green) (3)	X		X	
56	9SQ-A10	Spindle Planet Gear Assembly (19 teeth) (colored red) (3)				X
57	W22-654	Planet Gear Bearing (2 for each Planet Gear) (6)	X		X	X
57	9SN-500	Planet Gear Bearing (2 for each Planet Gear) (6)		X		
60	WFS182-111	Spindle Spacer	X	X	X	X
61	9SN-191	Planet Gear Shaft (3)	X		X	X
61	9SN-190	Planet Gear Shaft (3)		X		
62	R1602-510	Spindle Bearing	X	X	X	X
63	R1602-510	Gear Head Bearing	X	X	X	X
64	WFS182 24	Shaft Extension Bearing	X	X	X	X
65	400-25-155-4	Transducer/Ring Gear Assembly	X	X	X	X
66	400-25-75-1	Retaining Ring	X	X	X	X
67	8SA53-A600	Angle Housing Assembly		X		
67	9SA83-A600	Angle Housing Assembly	X			X
68	182A83-110	Angle Housing Cap.	X			X
68	182A53-110	Angle Housing Cap.		X	X	
69	DOI-9-879	Grease Fitting	X	X	X	X
70	34U-367	Spindle Upper Bearing	X			X
70	182A53-603	Spindle Upper Bearing		X	X	
71 & 72	182A83-A602	Matched Gear Set	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
74	182A53-A165	Bevel Pinion Bearing Spacer	X	X	X	X
75	R18LI-21	Front Seal		X	X	
75	AFH120A-358	Front Seal	X			X

TORQUE TRANSDUCER ANGLE WRENCH 9T SERIES WITH ENCODER AND ELECTRIC SHUTOFF (Continued)



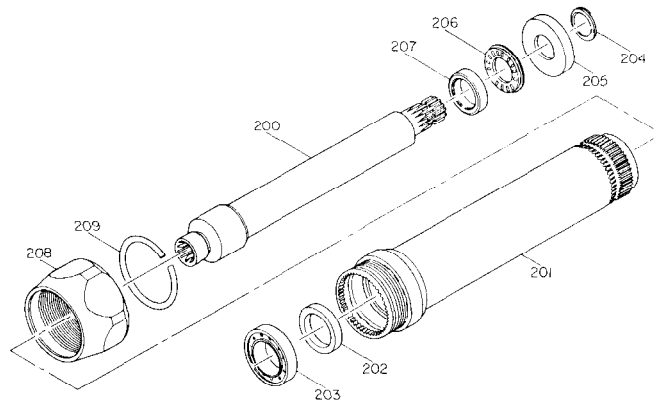
Series 9T Magnetic Encoder

ITEM	PART NUMBER	DESCRIPTION	RATIO			
			S	N	P	Q
76	C321-606	Rear Seal	X	X	X	X
77	R1610-105	Bevel Pinion Thrust Bearing.	X	X	X	X
78	182A53-554	Bevel Pinion Thrust Washer.	X	X	X	X
79	182A53-689	Bevel Pinion Snap Ring	X	X	X	X
80	182A53-589	Bevel Pinion Retainer	X	X	X	X
81	182A53-685	Bevel Spacer Retainer	X	X	X	X
82	8SA53-P507-1/2	Socket Adapter Spindle Assembly		X	X	
82	182A83-A507-1/2	Socket Adapter Spindle Assembly	X			X
83	804-716	Socket Retainer	X	X	X	X
84	5UHD-718	Socket Retainer Spring	X	X	X	X
85	182A83-593	Lower Spindle Bearing.	X			X
85	182A53-593	Lower Spindle Bearing.		X	X	
86	182A53-578	Bevel Gear Lock Nut.		X	X	
87	182A53-578	Bevel Gear Lock Nut.	X	X	X	X
88	182A53-531	Spindle Bearing Cap		X	X	
88	182A83-531	Spindle Bearing Cap	X			X
89	8SA32-27	Attachment Coupling Nut.	X	X	X	X
90	182A53-29	Coupling Nut Retainer.	X	X	X	X
*	9SL-A60	Reaction Bar Holder Assembly.	X	X	X	X
*	9SL-50	Bar Lock Screw.	X	X	X	X
*	9SL-49	Adapter Bolt	X	X	X	X
*	9SL-48	Torque Reaction Bar.	X	X	X	X
*	400-25-90	Horizontal Hanger	X	X	X	X
+ 97	400-25-106	Valve Body	X	X	X	X
+ 98	400-25-109	Shutoff Valve Assembly.	X	X	X	X
99	400-25-115	Diode Ring Assembly	X	X	X	X
100	400-25-135	Solenoid Assembly.	X	X	X	X
101	400-25-75-2	Retaining Ring	X	X	X	X
102	400-25-128	Spacer.	X	X	X	X
104	400-25-119	Adjustment Screw	X	X	X	X
105	400-25-129-1	Shutoff Valve Spring.	X	X	X	X
108	400-25-78†	Cable and Connector Assembly.	X	X	X	X
109	400-25-62-1	Connector/Cable Assembly (Motor Housing, Transducer) (natural)	X	X	X	X
110	400-25-62-2	Connector/Cable Assembly (Motor Housing, Encoder) (red)	X	X	X	X
113	400-25-52	Connector Assembly, Transducer	X	X	X	X
114	400-25-22	Spacer (4)	X	X	X	X
117	400-25-74-4	3-56 x 3/8" lg. Pan Head Screw (8)	X	X	X	X
120	W1S182-26	Spindle Bearing Cap Wrench (not shown)	X	X	X	X
301	400-25-183	Bearing Support, Encoder.	X	X	X	X
302	400-25-188	Pick-Up Assembly	X	X	X	X
303	400-25-74-12	Setscrew (4)	X	X	X	X
304	400-25-102-2	Encoder Disk Nut	X	X	X	X
305	400-25-182-1	Shim, .001" thick (amber) (as required).	X	X	X	X
305	400-25-182-2	Shim, .003" thick (green) (as required)	X	X	X	X
305	400-25-182-3	Shim, .005" thick (blue) (as required).	X	X	X	X
305	400-25-182-4	Shim, .010" thick (brown) (as required)	X	X	X	X
306	7S60-97	Rear Shaft Extension Bearing.	X	X	X	X
307	400-25-176	Shaft Extension Bushing	X	X	X	X
308	400-25-178	Magnet Assembly (2)	X	X	X	X
309	400-25-129-5	Magnet Spring (2)	X	X	X	X
310	400-25-179	Magnet Adjusting Nut (2)	X	X	X	X
311	400-25-184	Encoder Disk	X	X	X	X
312	400-25-74-10	Pick-Up Adjusting Screw (2)	X	X	X	X
313	400-25-74-11	Lock Screw (2)	X	X	X	X

* Not illustrated.

† Dash number for specific customer.

+ Items 97 and 98 sold as matched sets only; replacement of item 97 to be done by Ingersoll-Rand.

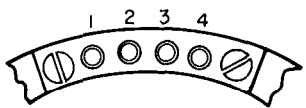


(Dwg. TPC420)

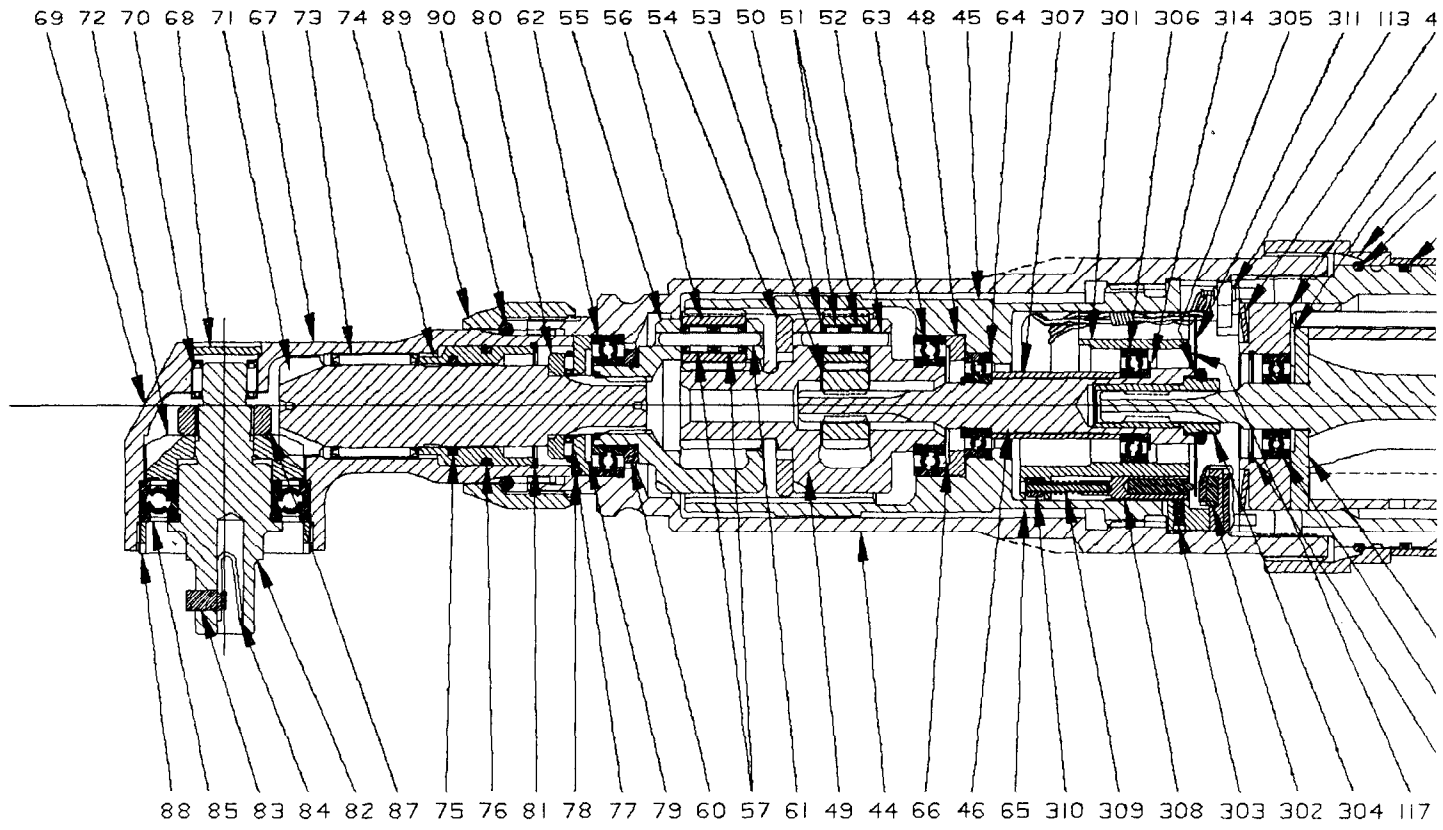
PART NUMBER FOR ORDERING

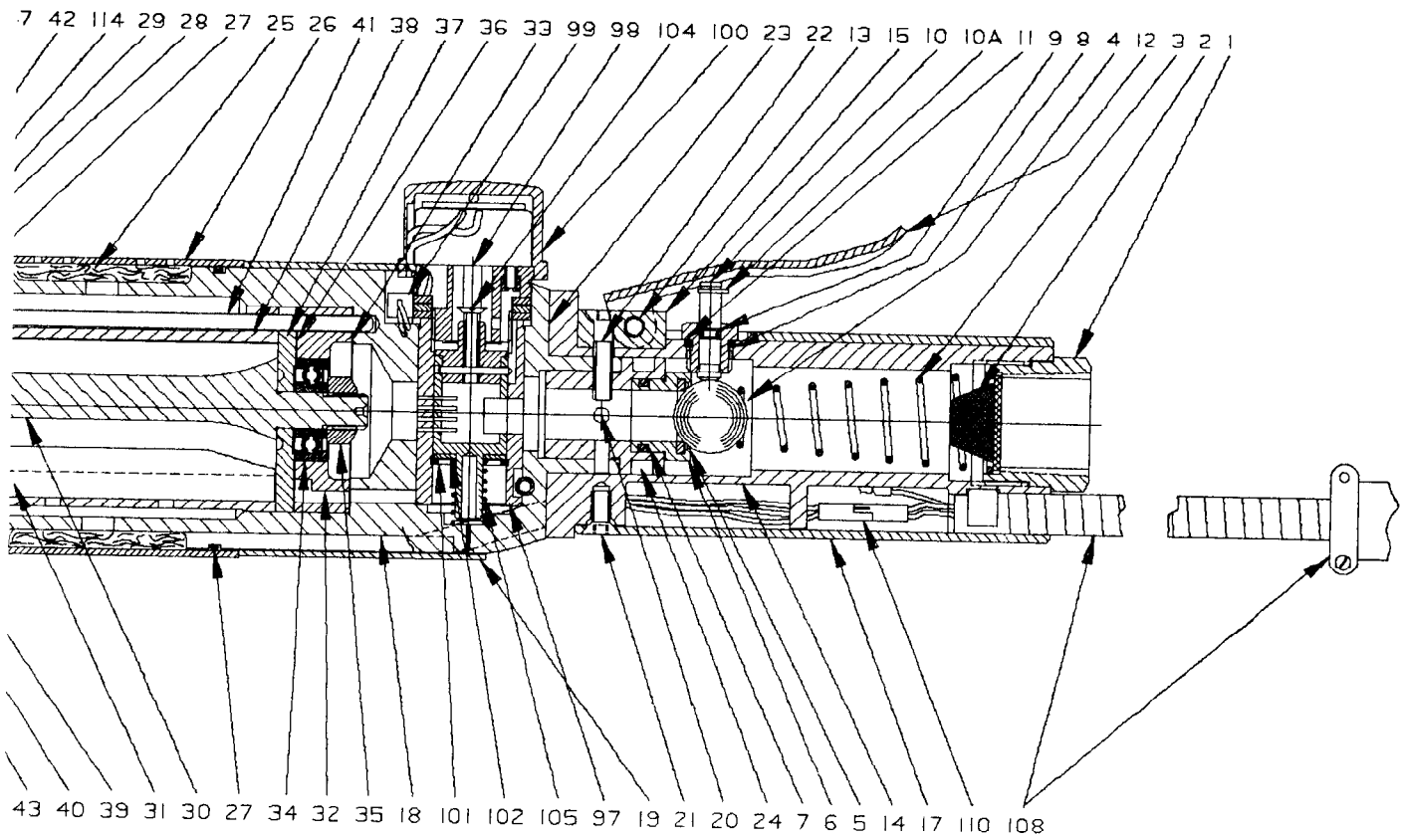
	6" Angle Housing Extension Assembly	8SL-A327-6
200	Extension Arbor	8SL-327-6
201	Arbor Housing	8SL-43-6
202	Arbor Spacer	WFS182-111
203	Arbor Bearing	R1602-510
204	Extension Arbor Snap Ring	182A53-689
205	Extension Arbor Retainer	182A53-589
206	Extension Arbor Thrust Bearing	R1610-105
207	Extension Arbor 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 Worn or broken Vanes Loose Rotor Bearing Retaining Nut Worn or broken Cylinder Improper lubrication or dirt buildup	Check the air pressure at the inlet. Replace a complete set of Vanes. Tighten the Nut as instructed on Page 4. Replace the Cylinder if it is cracked or if the bore appears wavy or scored. Clean the Motor Unit parts and lubricate them as instructed on Page 1.						
Gear case gets hot	Excessive grease Worn or damaged parts	Clean and inspect the Gear Case and gearing parts and lubricate as instructed on Page 1. Clean and inspect the Gear Case and gearing. Replace worn or broken components.						
TRANSDUCER No torque signal when tightening fastener	Broken wire or connector Transducer defective 	EQUIPMENT: Volt/Ohm Meter 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. Return unit to factory for repair. Set meter to RX100 scale. Good unit should read: <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">PIN NO.</td> <td style="text-align: center;">APPROX. READING</td> </tr> <tr> <td style="text-align: center;">1 to 2, 3 to 4</td> <td style="text-align: center;">670 to 770 ohms</td> </tr> <tr> <td style="text-align: center;">1 to 3, 1 to 4, 2 to 3, 2 to 4</td> <td style="text-align: center;">500 to 580 ohms</td> </tr> </table>	PIN NO.	APPROX. READING	1 to 2, 3 to 4	670 to 770 ohms	1 to 3, 1 to 4, 2 to 3, 2 to 4	500 to 580 ohms
PIN NO.	APPROX. READING							
1 to 2, 3 to 4	670 to 770 ohms							
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 Bearing bad in Angle Head causing drag	Recheck calibration per Page 5. Replace Angle Head or bearing in Head.						

(Continued on Page 13.)





Series 9T 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 METER POLARITY APPROX. READING (+) (-) Red Black 5 to 10 ohms Black Red infinity
	Dirt on Valve Assembly or in Valve Body or Damaged Valve	Disassemble per page 6 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 Weak or broken spring Dirt on Valve Assembly or in Valve Body or damaged Valve Plugged vent holes in Solenoid	Readjust per Page 6. Replace spring. Same procedure as described above for contamination. 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 at 0.8 MV/V 700 ohm ft-lb (N m)
9TN53TT 9TP53TT 9TQ83TT 9TS83TT	200 (271)	501 (678)	80 (108)	80 (108)

* 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.

- 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)
9TN53TTMES	630	565
9TP53TTMES	500	450
9TQ83TTMES	355	320
9TS83TTMES	285	250

- 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
9TN53TTMES	50	68
9TP53TTMES	65	88
9TQ83TTMES	85	115
9TS83TTMES	105	142

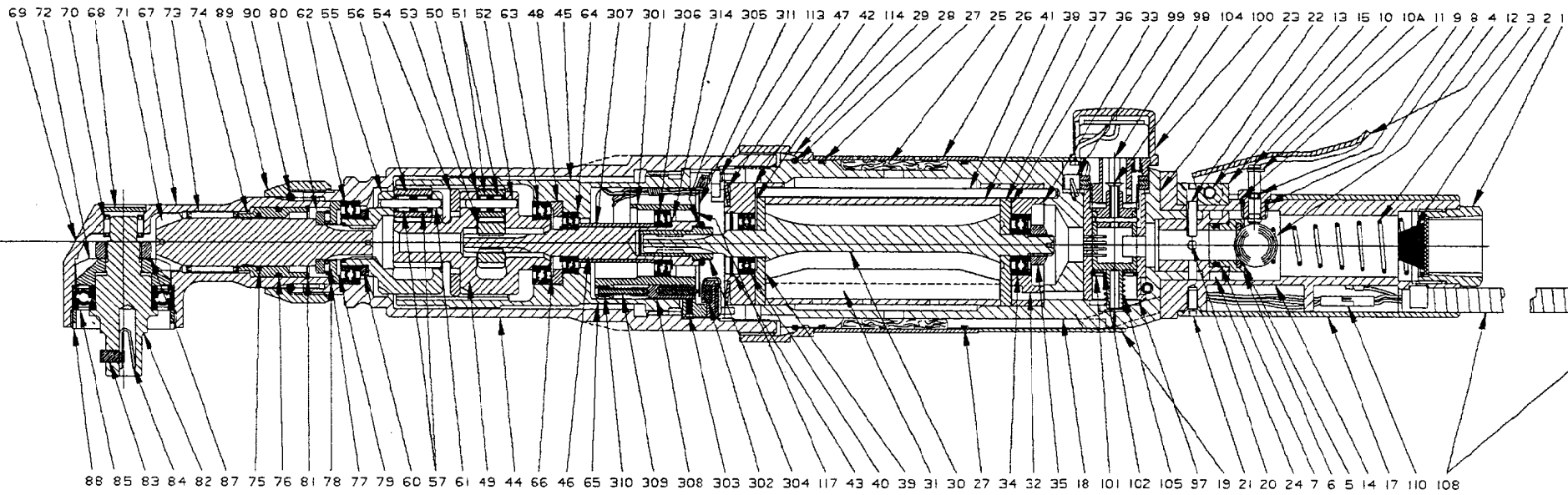
- There must be no objectionable leaks in any non-exhaust areas. The exhaust deflector must rotate manually.
- The throttle must operate freely and must not remain open when the lever is released.
- The angle attachment, gear case and motor case must not generate excessive heat. Operate the Tool at free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

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





Series 9T Automatic Shutoff Torque Transducer Angle Wrench with Magnetic Encoder and Electric Shutoff