OPERATION AND MAINTENANCE MANUAL

for

SERIES 9T AUTOMATIC SHUTOFF TORQUE TRANSDUCER ANGLE WRENCHES

Form P6616
Edition 2
March, 1987

1/2" Square Drive Angle Head

9TN53TT
9TP53TT
9TQ83TT
9TS83TT

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 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 9TT 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 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 (81) 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 in a vise with copper jaws and unscrew Coupling Nut (29) from it using a wrench applied to the flats.
2. Holding tool horizontally separate the Motor Housing from Gear Case.
3. Carefully tip Gear Housing upright and allow Transducer to fall out into hand (if necessary gently tap bottom edge of gear case on a block of wood to assist removal of Transducer from splines). **CAUTION**: Do not allow Transducer to fall out on a hard surface or damage to connector sockets will result.
4. Withdraw Transducer (65), Gear Head Assembly (49) and Spindle Assembly (55).
5. Press the Planet Gear Shaft (61 or 52) out from the splined or geared end of the Gear Head or Spindle.
6. Hold Transducer (65) in hand and gently tap out Bearings (63), and (64) and Spacer (48) with light blows on rear of Shaft Extension (46). **CAUTION**: Use light blows to avoid damage to Bearings and Transducer strain gauges. Remove Bearings and Retaining Ring (66).

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.

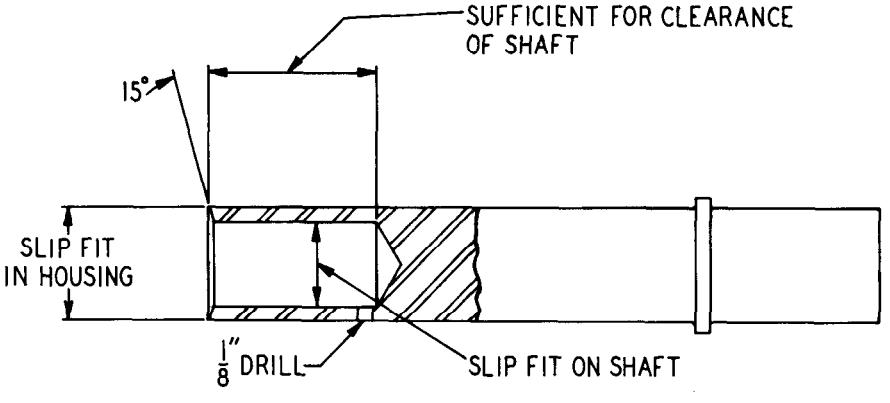
ASSEMBLY

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

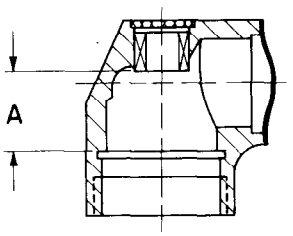
1. Lubricate the Bevel Pinion (71) as instructed on page 1 and insert it, gear end first, into the long bore of the Angle Housing (67).
2. Lubricate the Bevel Pinion Bearing (73) as instructed on page 1 and insert it, **unstamped end first**, into the bore of the Angle Housing, after the Bevel Pinion.
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.



(Dwg. TPD460)

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.

* Registered trademark of Loctite Corp.



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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.

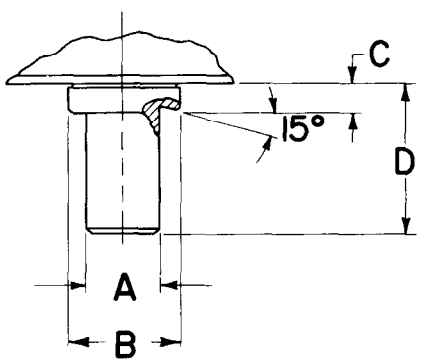
Assembly of Gearing

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

1. Press two Planet Gear Bearing (57) into each Spindle 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) using the correct inserting tool described below.
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.

Assembly of Transducer

1. Place Shaft Extension Bearing (64) into Transducer (65).
2. Put Shaft Extension (46) into Bearing and lock in place with Retaining Ring (66).
3. Put Bearing Spacer, counterbore side out, on Bearing (64), then press Gear Head Bearing (63) into Transducer. **CAUTION**: Support Transducer on large end (rear) when pressing in bearings so as not to damage Transducer strain gauges or connector.
4. Lubricate gearing per page 1 and place Gear Head Assembly (49) and Spindle Assembly (55) into Ring Gear of Transducer.
5. Place assembled Motor Housing in vise, put Transducer and gearing on Motor Housing using alignment pins as guides while rotating Shaft Extension (46) to locate rotor pinion. Be sure Motor Clamp Washer (47) is in place and located on the guide ridge of the Front Rotor Bearing Support (42).
6. Slide Transducer in place while aligning Connectors (113) and (109).
7. Place Gear Housing over Transducer (rotate Housing back and forth to align internal splines) and hand tighten Coupling Nut (29). **NOTE**: Angle Head can be repositioned later.
8. Hold tool by gear case flats in copper jaw vise and tighten Coupling Nut to approximately 40 ft-lb torque. **NOTE**: Rotate square drive while tightening Coupling Nut to assist in alignment of Spindle and Angle Head pinion splines to avoid binding and damage to Gearing and Transducer.



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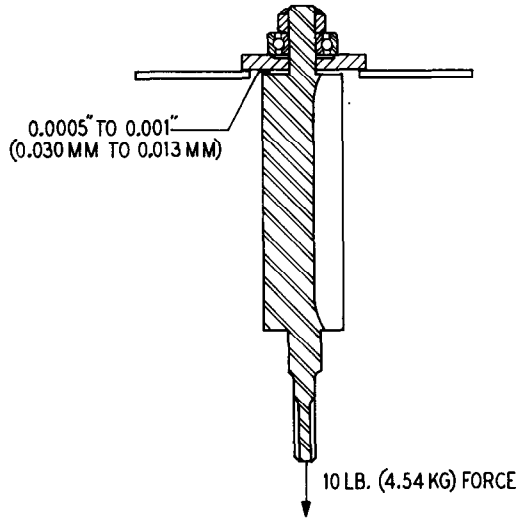
Planet Gear Bearing Inserting Tool

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 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 th Nut off a turn and repeat this procedure.



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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 (40).
10. Screw Connector Assembly (109) using two Screws (117) and two Spacers (114) and feed wire in grooves around recess then into angled hole in Motor Housing.
11. From handle end of tool, slide Coupling Nut (29) up to the Retaining Ring (28), then the Exhaust Deflector Seals (27) into their grooves on the Motor Housing and wrap the Exhaust Silencer (27) over cable and around the Housing in its recess.
12. Slide Exhaust Deflector (26) over the seals and silencer (being careful not to pinch cable wires) and retain them using the Sleeve (19); then screw on Regulator Assembly (97) to hold Sleeve in place.
13. Connect Cable Assembly (109) to Cable (108) and insert miniature connector ends in slots provided in handle; slide Sleeve (17) over handle and secure with Screw (21).

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 5 through 8 in Assembly of Transducer.

TRANSDUCER CALIBRATION

TOOL MODEL NUMBERS	TRANSDUCER ASSEMBLY PART NUMBER	MAX. TORQUE RATING AND FULL SCALE SETTING
9TN, P53TT, 9TQ83TT, 9TS83TT	400-25-155-4	200 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.

TRANSDUCER WIRING

LOGIC	WIRE COLOR	CONNECTOR PIN ASSIGNMENT (TYP.)
(+) Excitation	Red	A
(-) Excitation	Black	B
(+) Signal	Green	C
(-) Signal	White	D

ASSEMBLY OF THROTTLE AND SHUTOFF VALVES

1. Insert Throttle Valve Face (5) into groove in Throttle Valve Seat (6). Apply Valve Seat Seal (7) to the external groove.
2. Insert assembled Valve Seat, small diameter first, into the Motor Housing (18) and seat it firmly.
3. With the Housing held firmly in a vise with the tapped end up, drop in Throttle Valve Ball (12), Throttle Valve Spring (3), smaller diameter first and Air Strainer (2).
4. Thread Inlet Bushing (1) into Housing and tighten it to 100 to 150 ft-lb (135 to 200 N m) torque.
5. Apply Throttle Plunger Bushing Seal (11) to Bushing Assembly (8) and thread it into the Housing.
6. Apply Throttle Plunger Seal (9) to the Plunger (10) and insert Plunger, beveled end first, through the Throttle Plunger Bushing.
7. Install the Throttle Lever (12) with Retaining Pin (13) and operate Lever to check for free movement.
8. Drop the Shutoff Valve Spring (106), then the Shutoff Valve (105) into the Motor Housing. **Note:** Make certain the Spring seats in the Valve recess.
9. Apply Regulator Body Seal (104) to the Regulator Body (97).
10. Drop Regulator Ball (99) followed by Regulator Spring (98), smaller diameter first, into large hole in the top of the Regulator Body. Retain the Ball and Spring using the Regulator Adjusting Screw (100). **CAUTION:** Do not tighten Adjusting Screw. The Spring may be damaged if the Screw is brought down snug.
11. Apply Loctite* Pipe Sealant with Teflon to threads of the Sensor Port Plug (103) and insert it into the tapped hole adjacent to the Regulator Adjusting Screw hole.
12. After assembling the Angle Wrench, adjust the shutoff mechanism as instructed below.

Adjustment of Shutoff Valve

WARNING

The Shutoff Valve system is preset at the factory. Do not adjust any part of the Valve unless the Tool shuts off prematurely or fails to shut off. Only if either of these conditions exists are you to adjust the Valve. Adjust the Valve as follows:

If premature shutoff occurs, proceed as follows:

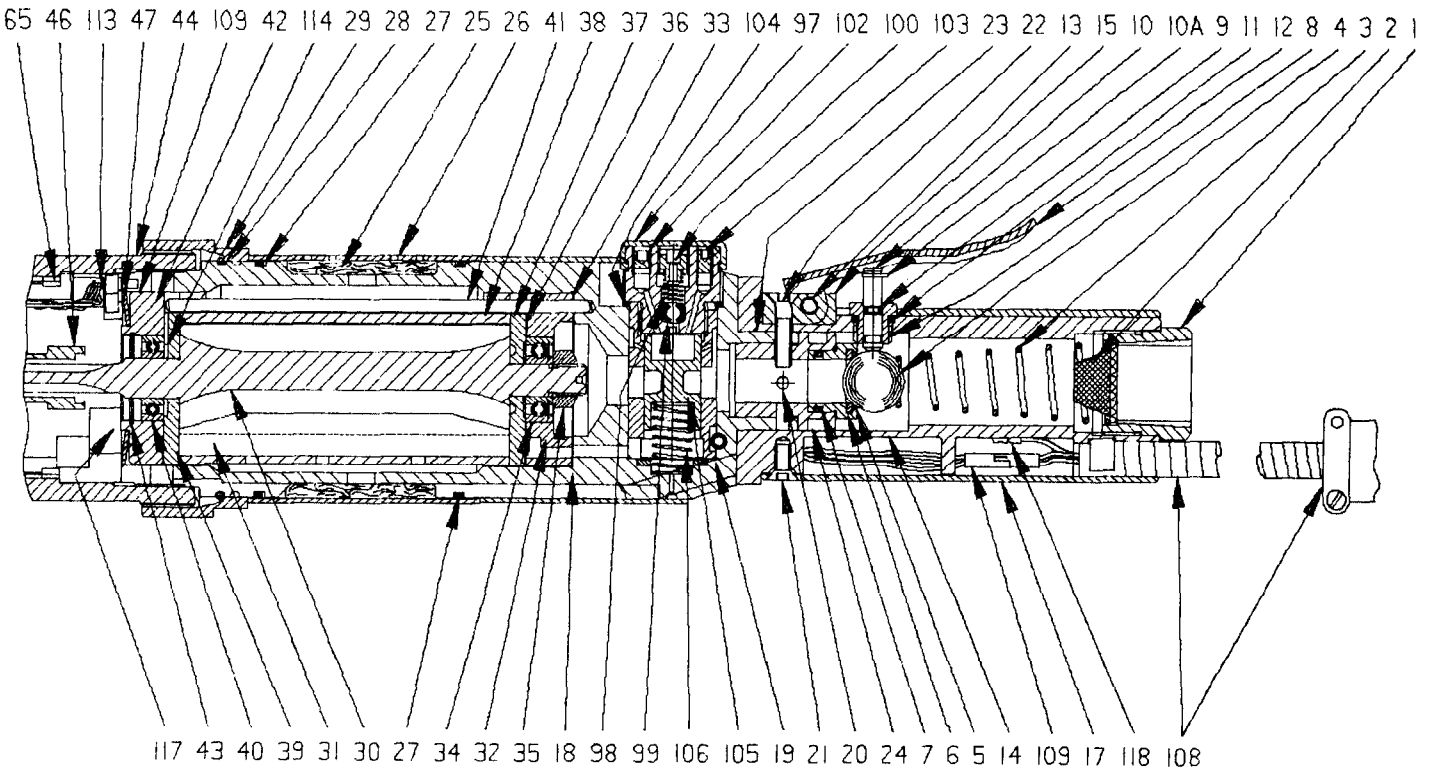
1. Set the inlet air pressure at 90 psig (6.2 bar/620 kPa) with the motor running. Slightly rotate the Bleed Adjusting Screw (102) marked "A", counterclockwise and slowly depress the Throttle Lever to determine continual motor operation. If necessary, repeat this procedure until the motor runs and remains running with the Lever depressed. The port marked "S" is a signal port to be used with monitoring equipment.
2. Securely anchor the Wrench and run it on a Model J Skidmore Test Stand a number of times at 50 psig (3.4 bar/340 kPa) and 90 psig air pressure. The Tool must shut off when tested at each pressure setting. If Tool fails to shut off, refer to the adjustment procedure below.

If the Angle Wrench fails to shut off, adjust as follows:

1. Operate the Tool at 90 psig as instructed in step 2 above. Release the Throttle Lever and rotate the Bleed Adjusting Screw slightly clockwise and retest the Tool. Continue testing and adjusting the Valve a slight amount each time until the Wrench shuts off properly.

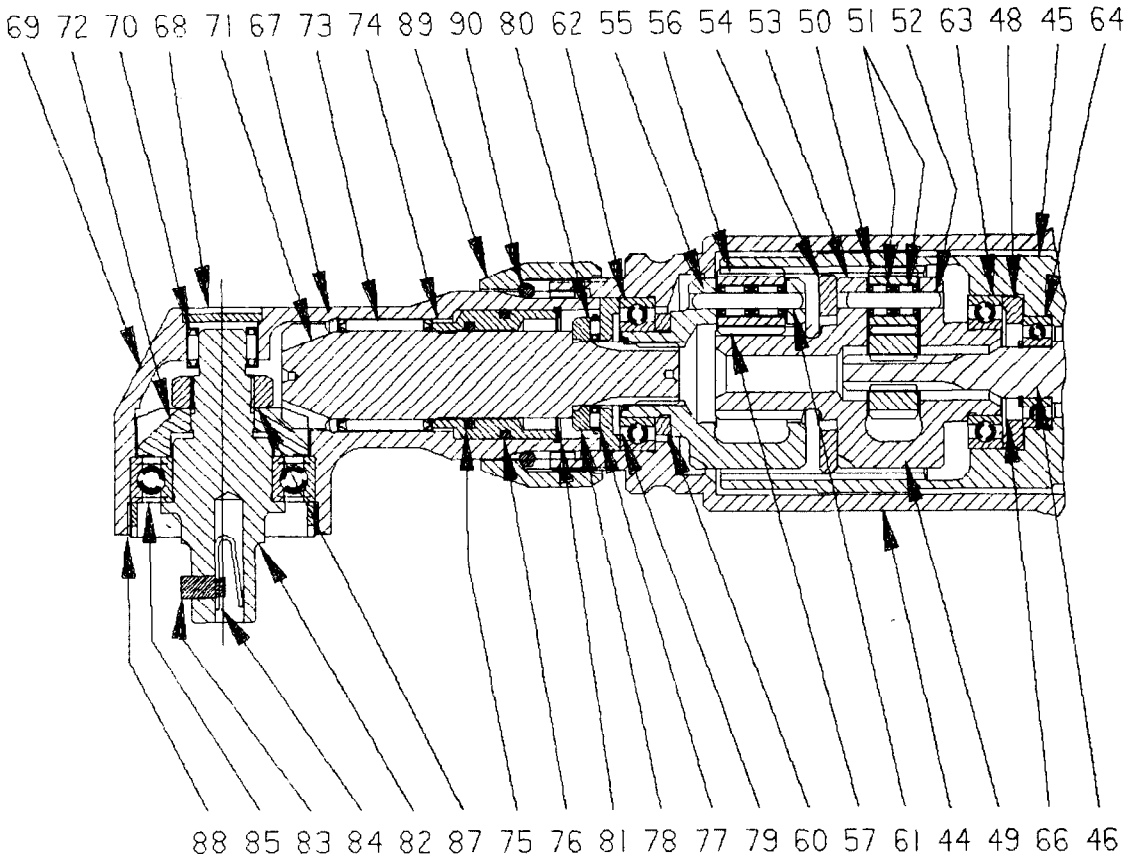
* Registered trademark of Loctite Corporation.

TORQUE TRANSDUCER ANGLE WRENCH 9T SERIES



Series 9T Transducer Motor and Throttle

ITEM	PART NUMBER	DESCRIPTION	RATIO 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 Valve 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	400-25-18-2	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	R0H-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	9SL-98	Cylinder Dowel	X	X	X	X
42	400-25-71-1	Front Rotor Bearing Support Assembly	X	X	X	X
43	AFH120A-362	Front Rotor Bearing Retainer	X	X	X	X
44	400-25-21-1	Gear Housing	X	X	X	X
46	400-25-47-2	Shaft Extension Assembly		X	X	X
46	400-25-47-3	Shaft Extension Assembly	X			
47	9SL-207	Motor Clamp Washer	X	X	X	X
48	400-25-06	Bearing Spacer	X	X	X	X



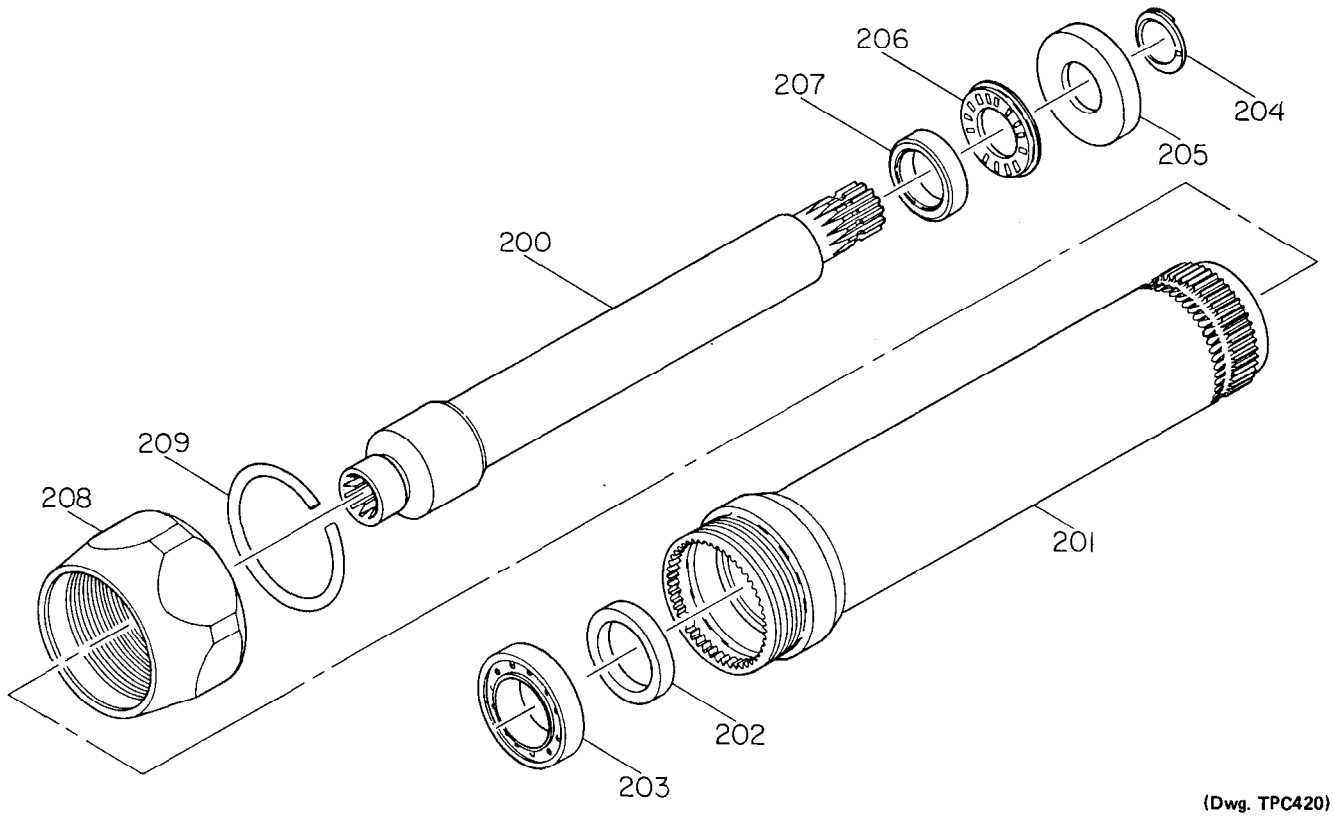
Series 9T Transducer Angle Attachment and Spindle

ITEM	PART NUMBER	DESCRIPTION	RATIO S	N	P	Q
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	9SL-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	8SA32-A550	Angle Housing Assembly		X	X	
67	9SA53-A600	Angle Housing Assembly	X			X
68	182A83-110	Angle Housing Cap	X			X
68	182A53-110	Angle Housing Cap		X	X	
69	D0F9-879	Grease Fitting	X	X	X	X
70	34U-367	Spindle Upper Bearing	X			X
70	182A53-603	Spindle Upper Bearing		X	X	

TORQUE TRANSDUCER ANGLE WRENCH 9T SERIES (Continued)

ITEM	PART NUMBER	DESCRIPTION	RATIO S	RATIO N	RATIO P	RATIO Q
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	R18LF-21	Front Seal		X	X	
75	AFH120A-358	Front Seal	X			X
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	182A53-P507-1/2	Socket Adapter Spindle Assembly		X	X	
82	182A83-P507-1/2	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	
87	182A53-578	Bevel Gear Lock Nut	X	X	X	X
88	182A83-531	Spindle Bearing Cap	X			X
88	182A53-531	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
*		Flush Socket Adapter Spindle				
	182A54-607	1/2" hexagon		X	X	
	182ABMF-807	13 mm hexagon		X	X	
	182A55-807	9/16" hexagon		X	X	
	8SA55-807M	15 mm hexagon		X	X	
	182A56-807	5/8" hexagon		X	X	
	8SA56-807M	17 mm hexagon		X	X	
	182A87-807	11/16" hexagon	X			X
	9SA87-807M	18 mm hexagon	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
97	8TL-A173	Regulator Body Assembly	X	X	X	X
98	8TL-180	Regulator Spring	X	X	X	X
99	2U-722	Regulator Ball	X	X	X	X
100	8TL-174	Regulator Adjusting Screw	X	X	X	X
*	8TL-179	Lock Screw	X	X	X	X
102	8TL-175	Bleed Adjusting Screw	X	X	X	X
103	5081T-266	Sensor Port Plug	X	X	X	X
104	400-25-144	Regulator Body Seal	X	X	X	X
105	8TL-172	Shutoff Valve	X	X	X	X
106	8TL-171	Shutoff Valve Spring	X	X	X	X
108	400-25-89-†	Cable and Connector Assembly	X	X	X	X
109	400-25-62-1	Connector/Cable Assembly (Motor Housing)	X	X	X	X
113	400-25-52	*Connector Assembly, Transducer*	X	X	X	X
114	400-25-22	Spacer (2)	X	X	X	X
*	400-25-90	Horizontal Hanger	X	X	X	X
*	WWA100-77	Hanger Screw	X	X	X	X
117	400-25-74-4	3-56 x 3/8" lg. Pan Head Screw (4)	X	X	X	X
*	WFS182-26	Spindle Bearing Cap Wrench (as required)	X	X	X	X

† Dash No. for specific customer.
* Not illustrated.



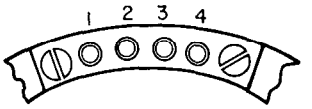
(Dwg. TPC420)

		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 Page 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.
Tool fails to shut off	Dirt or burrs on Shutoff Valve or bushing	Clean the parts and remove the burrs.
	Bleeder parts plugged	Clean the bleeder parts with a fine wire.

TROUBLESHOOTING GUIDE

Trouble	Probable Cause	Test Procedure and Solution
TRANSDUCER No torque signal when tightening fastener	Broken wire or connector	**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.
	Transducer defective 	Return unit to factory for repair. Set meter to RX100 scale. Good unit should read: **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 4. Replace Angle Head or bearing in Head.

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)
9TN53TT 9TP53TT 9TQ83TT 9TS83TT	200 (271)	501 (678)	80 (108)	80.0 (108.0)

* 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)
9TN53TT	630	565
9TP53TT	500	450
9TQ83TT	355	320
9TS83TT	285	250

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

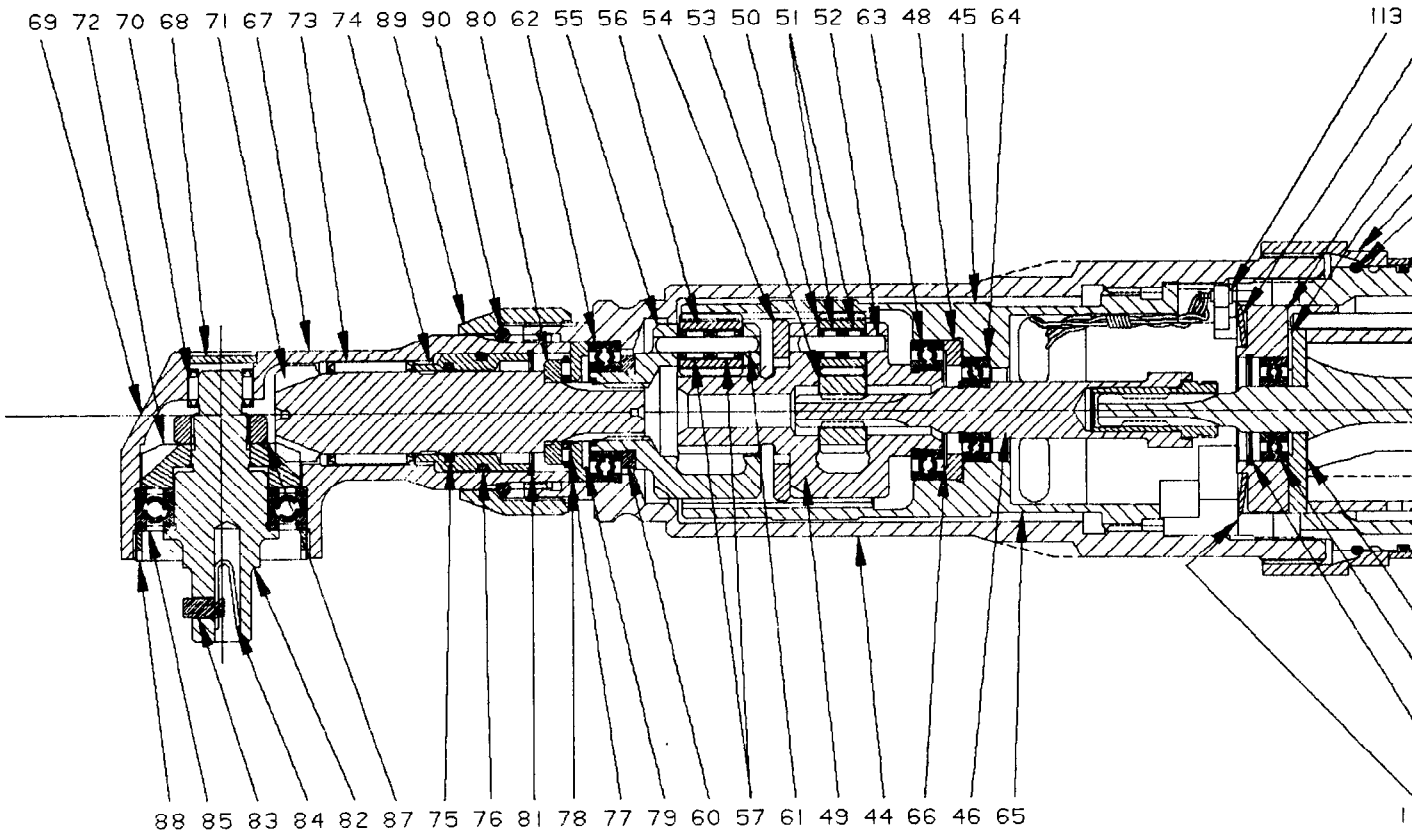
Size	Minimum Torque ft-lb	N m
9TN53TT	50	68
9TP53TT	65	88
9TQ83TT	85	115
9TS83TT	105	142

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.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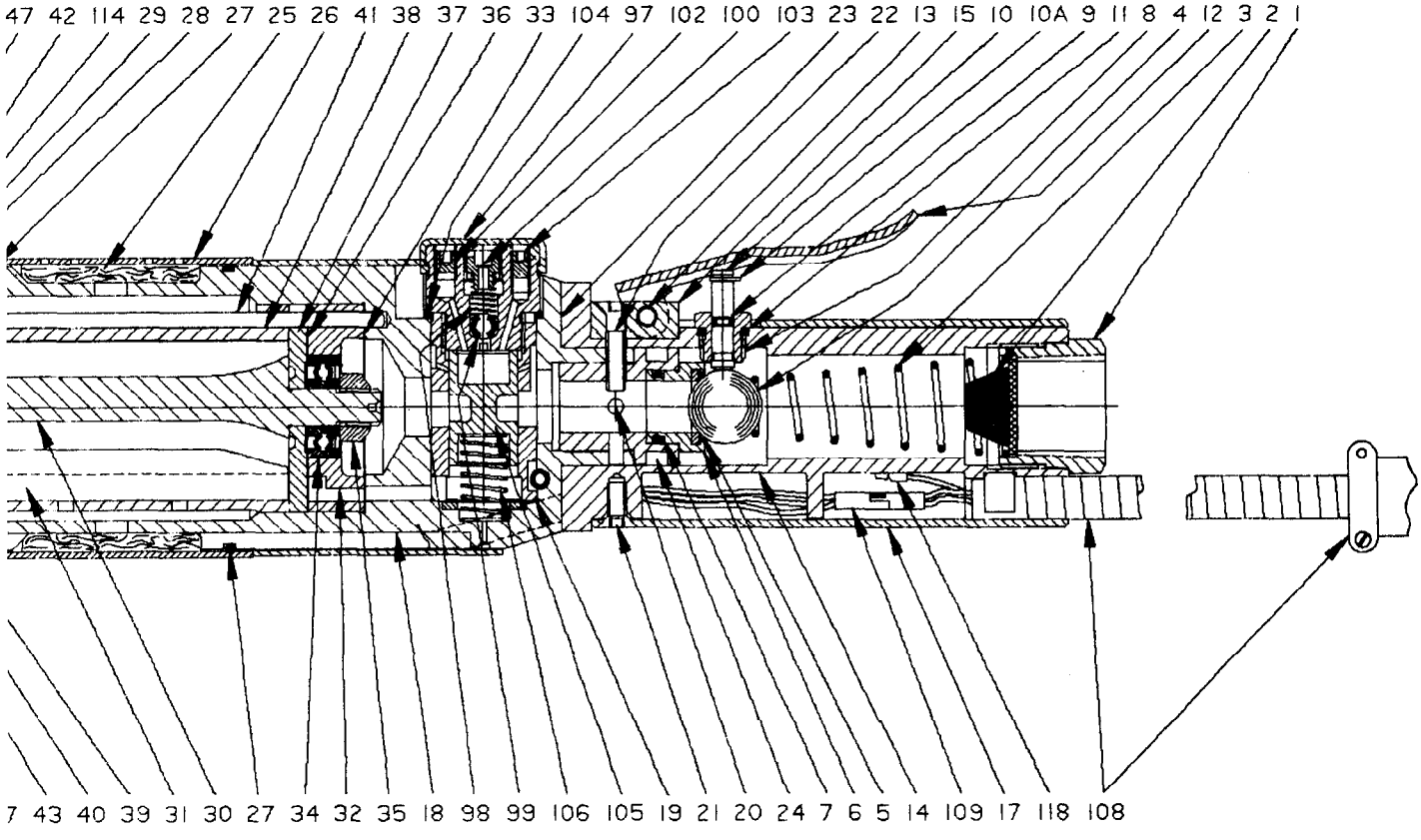
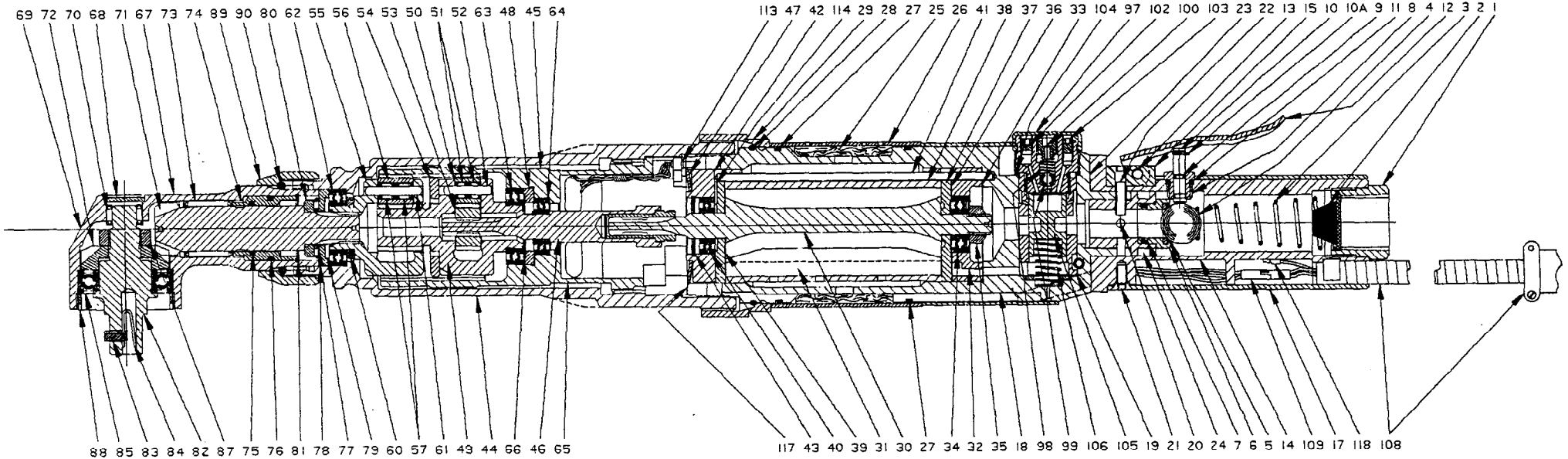
113
88 85 83 84 82 87 75 76 81 78 77 79 60 57 61 49 44 66 46 65
1



Series 9T Automatic Shutoff Torque Transducer Angle Wrench



Series 9T Automatic Shutoff Torque Transducer Angle Wrench