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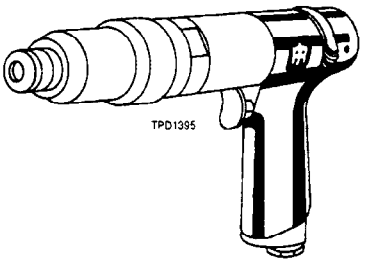
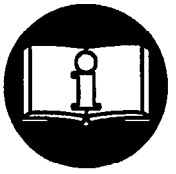
January, 1994

OPERATION AND MAINTENANCE MANUAL
for
MODEL 4RTPSS3G1 SCREWDRIVER





⚠ WARNING

IMPORTANT SAFETY INFORMATION ENCLOSED.
READ THIS MANUAL BEFORE OPERATING TOOL.

FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

- Always operate, inspect and maintain this tool in accordance with American National Standards Institute Safety Code for Portable Air Tools (ANSI B186.1).
- For safety, top performance, and maximum durability of parts, operate this tool at 90 psig (6.2 bar/620 kPa) maximum air pressure at the inlet with 1/4" (6 mm) inside diameter air supply hose.
- Air powered tools can vibrate in use. Vibration, repetitive motions or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.
- Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool.
- Keep hands, loose clothing and long hair away from impacting end of tool.
- Anticipate and be alert for sudden changes in motion during start up and operation of any power tool.
- Tool accessory may continue to impact briefly after throttle is released.
- Do not lubricate tools with flammable or volatile liquids such as kerosene, diesel or jet fuel.
- Do not remove any labels. Replace any damaged label.
- Use accessories recommended by Ingersoll-Rand.

NOTICE

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

Ingersoll-Rand is not responsible for customer modification of tools for applications on which Ingersoll-Rand was not consulted.

Repairs should be made only be authorized, trained personnel. Consult your nearest Ingersoll-Rand Authorized Servicenter.

It is the responsibility of the employer to place the information in this manual into the hands of the operator.

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

Printed in U.S.A.

INGERSOLL-RAND®
PROFESSIONAL TOOLS

WARNING LABEL IDENTIFICATION

⚠ WARNING

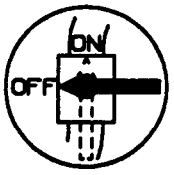
FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

⚠ WARNING

Always wear eye protection when operating or performing maintenance on this tool.

⚠ WARNING

Always wear hearing protection when operating this tool.



⚠ WARNING

Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool.

⚠ WARNING

Air powered tools can vibrate in use. Vibration, repetitive motions or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.

⚠ WARNING

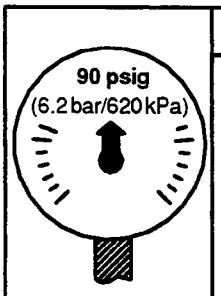
Do not carry the tool by the hose.

⚠ WARNING

Do not use damaged, frayed or deteriorated air hoses and fittings.

⚠ WARNING

Keep body stance balanced and firm. Do not overreach when operating this tool.



⚠ WARNING

Operate at 90 psig (6.2 bar/620 kPa) Maximum air pressure.

PLACING TOOL IN SERVICE

LUBRICATION

Ingersoll–Rand No. 10 **Ingersoll–Rand No. 28**

Always use an air line lubricator with these tools.

We recommend the following Filter–Lubricator Regulator Unit:

For USA – No. C05–02–G00
For International – No. C01–C2–T29

Before starting the tool and after each two hours of operation, unless an air line lubricator is used, inject a few drops of Ingersoll–Rand No. 10 Oil into the air inlet.

Anytime the motor is disassembled for maintenance or repairs, fill the Rotor Bearings (30 and 36) to fifty percent of their capacity with Ingersoll–Rand No. 28 Grease. Fill the cavity for the rear rotor hub between fifty and seventy–five percent of its capacity with the same grease.

Gearing

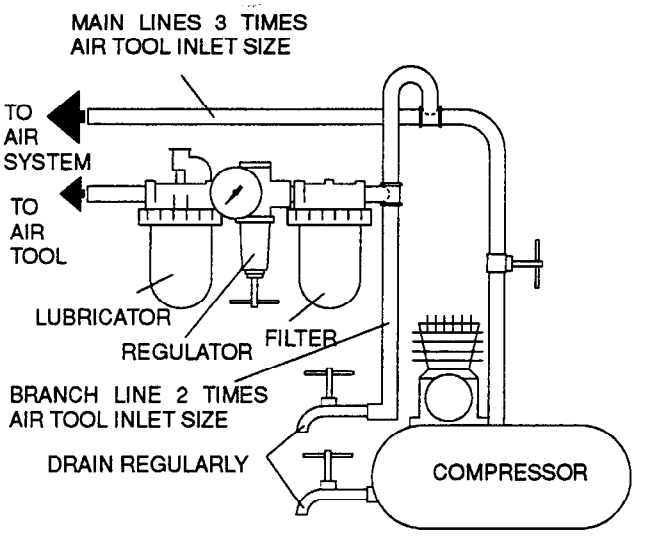
After each 50,000 cycles or 100 hours of operation, whichever occurs first. inject approximately 10 to 12 cc of Ingersoll–Rand No. 28 Grease into the Grease Fitting (39)

Anytime the gear train is disassembled for maintenance or repair, fill the Spindle Bearing (47) to fifty precent of its capacity with Ingersoll–Rand No. 28 Grease.

INSTALLATION

Air Supply and Connections

Always use clean dry air. Dust, corrosive fumes and/or excessive moisture can ruin the motor of an air tool. An air line filter can greatly increase the life of an air tool. The filter removes dust and moisture. Low pressure (under 90 psig; 6.2 bar/620 kPa) reduces the speed of all air tools. Low air pressure not only wastes time, but also costs money. High air pressure (over 90 psig; 6.2 bar/620 kPa) raises performance beyond the rated capacity of the tool and could cause injury. Be sure all hoses and fittings are the correct size and are tightly secured.
See Dwg. TPD905–1 for a typical piping arrangement.



(Dwg. TPD905–1)

Clutch

Lubricate the clutch with 6 to 8 cc of Ingersoll–Rand No. 67 Grease after each 50 000 cycles or 60 days, whichever occurs first. Lubricate the clutch as follows:

⚠ WARNING

Turn off the air supply and disconnect the air supply hose at the tool before doing any maintenance.

1. Being careful not to damage or distort the housing, grasp the handle of the tool in leather–covered or copper–covered vise jaws.
2. Using a wrench on the flats on the Clutch Housing (57), unscrew and remove the assembled clutch unit.

NOTICE

This is a left–hand thread; turn clockwise to remove the Housing.

3. Holding the assembled clutch over a cardboard box to avoid losing the Adjustment Collar Seat Balls (66) and the Adjuster Sleeve Detent Balls (58), unscrew the Clutch Adjuster Sleeve (71) from the Clutch Housing. Remove the Seat Balls and the Detent Balls.
4. Grasping the splined end of the Clutch Driver (63), pull the assembled clutch out of the Clutch Housing. Using snap ring pliers, remove the Spring Seat Stop (64) adjacent to the Clutch Adjustment Collar (65).
5. Slide the Clutch Adjustment Collar, Clutch Bearing Seat (67), the Spring Seat Thrust Bearing (68), Clutch Spring Seat (69) and Clutch Spring (70) off the Clutch Driver.

5. Slide the Clutch Adjustment Collar, Clutch Bearing Seat (67), the Spring Seat Thrust Bearing (68), Clutch Spring Seat (69) and Clutch Spring (70) off the Clutch Driver.
6. Lubricate the Spring Seat Thrust Bearing, Bit Holder Thrust Bearing (84), and all Balls and bearing surfaces with approximately 6 to 8 cc of Ingersoll–Rand No. 67 Grease.
7. After lubricating the components, slide the Clutch Spring, Clutch Spring Seat (hub end leading), Spring Seat Thrust Bearing, Clutch Bearing Seat and Clutch Adjustment Collar (concave end leading) onto the splined end of the Clutch Driver. Using snap ring pliers, install the Spring Seat Stop onto the hub of the Clutch driver.
8. Insert the assembled clutch, square drive leading, into the Clutch Housing.
9. Apply some of the grease to the two Adjuster Sleeve Detent Balls and install them in Clutch Housing against the Sleeve Detent Ball Seats (59).
10. Apply some of the grease to the four Adjustment Collar Seat Balls and insert one Ball into each of the four slots in the Clutch Housing. The Balls will stop against the surface of the Clutch Adjustment Collar.
11. Capture the Detent Balls and Seat Balls in the Clutch Housing by threading the Clutch Adjuster Sleeve onto the Clutch Housing.
12. Align the spline of the Clutch Driver with the gearing and thread the assembled clutch onto the Gear Case.

NOTICE

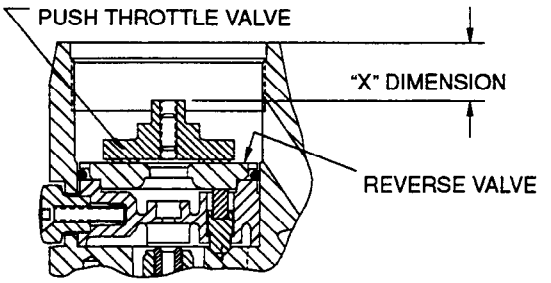
This is a left–hand thread; turn counterclockwise to install the Housing.

13. Using a wrench on the flats of the Clutch Housing, tighten the Housing to between 5 to 10 ft–lb (7 to 14 Nm) torque.
14. Calibrate the clutch after it has been disassembled by following the instructions in the section, **Clutch Calibration.**

Clutch Calibration

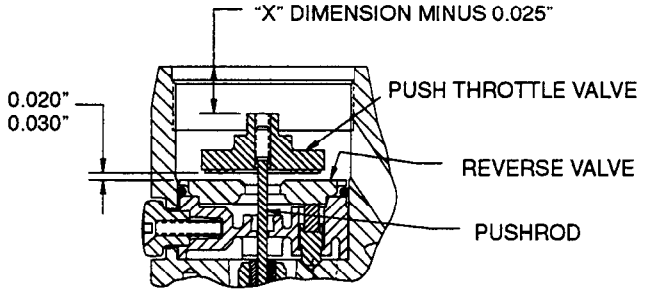
1. Make certain the Clutch Adjusting Bushing (60) is flush with the face of the Clutch Housing (57). If it is not flush, thread the Bushing inward or outward until it is flush.
2. Using a wrench on the flats of the Housing Back Cap (24), unscrew and remove the Back Cap as well as the Pushrod Throttle Valve Spring (22).
3. Using a hex wrench, unscrew and remove the Back Cap Plug (26).
4. If the Back Cap Adjuster (23) is not threaded flush against the inner face of the Back Cap, insert a screwdriver into the slot in the Adjuster through the back cap plug opening and turn the Adjuster counterclockwise until it is flush with the inner face of the Back Cap.
5. Using a hex wrench, adjust the Valve Adjustment Screw (21) until the end of the Screw with the wrench is three full turns below the surface of the Push Throttle Valve (20).
6. Carefully grasp the tool in copper–covered vise jaws with the square drive downward and the Pushrod removed.
7. Place the Push Throttle Valve into the back of the Housing (1) with the face of the large end of the Valve against the face of the Reverse Valve (18).
8. Using depth micrometers, measure the distance between the back end of the Housing to the face of the small hub on the Throttle Valve. Record that dimension.
9. Remove the Throttle Valve and install the Pushrod in the tool. Position the Throttle Valve in the Housing with the Pushrod entering the central opening of the Throttle Valve and stopping against the Valve Adjustment Screw.
10. Using finger pressure against the Throttle Valve to remove the spring load caused by the Plunger Return Spring (78), again measure the distance between the back end of the Housing and the face of the small hub on the Throttle Valve with the depth micrometers. This measurement must be between 0.20" and 0.30" (0.51 and 0.76 mm) less than the first measurement. If the measurement does not provide the required variation, turn the Valve Adjustment Screw inward or outward until the correct measurement is achieved.
11. Once the correct measurement is obtained, install the Pushrod Throttle Valve Spring (22), small end leading, onto the hub of the Push Throttle Valve. Install the Back Cap with the Back Cap Seal (25) on the rear of the Housing and tighten the Back Cap between 5 to 10 ft–lb (7 to 14 Nm) torque. Make certain the large end of the Pushrod Throttle Valve Spring enters the bore in the Back Cap Adjuster.
12. Remove the tool room the vise and approximately set the torque by turning the Clutch Adjuster Sleeve four complete revolutions from the loose or "no load" position.

PLACING TOOL IN SERVICE



PUSH THROTTLE VALVE MEASUREMENT
WITHOUT THE PUSHROD

(Dwg. TPD1179)



PUSH THROTTLE VALVE MEASUREMENT
WITH THE PUSHROD

(Dwg. TPD1180)

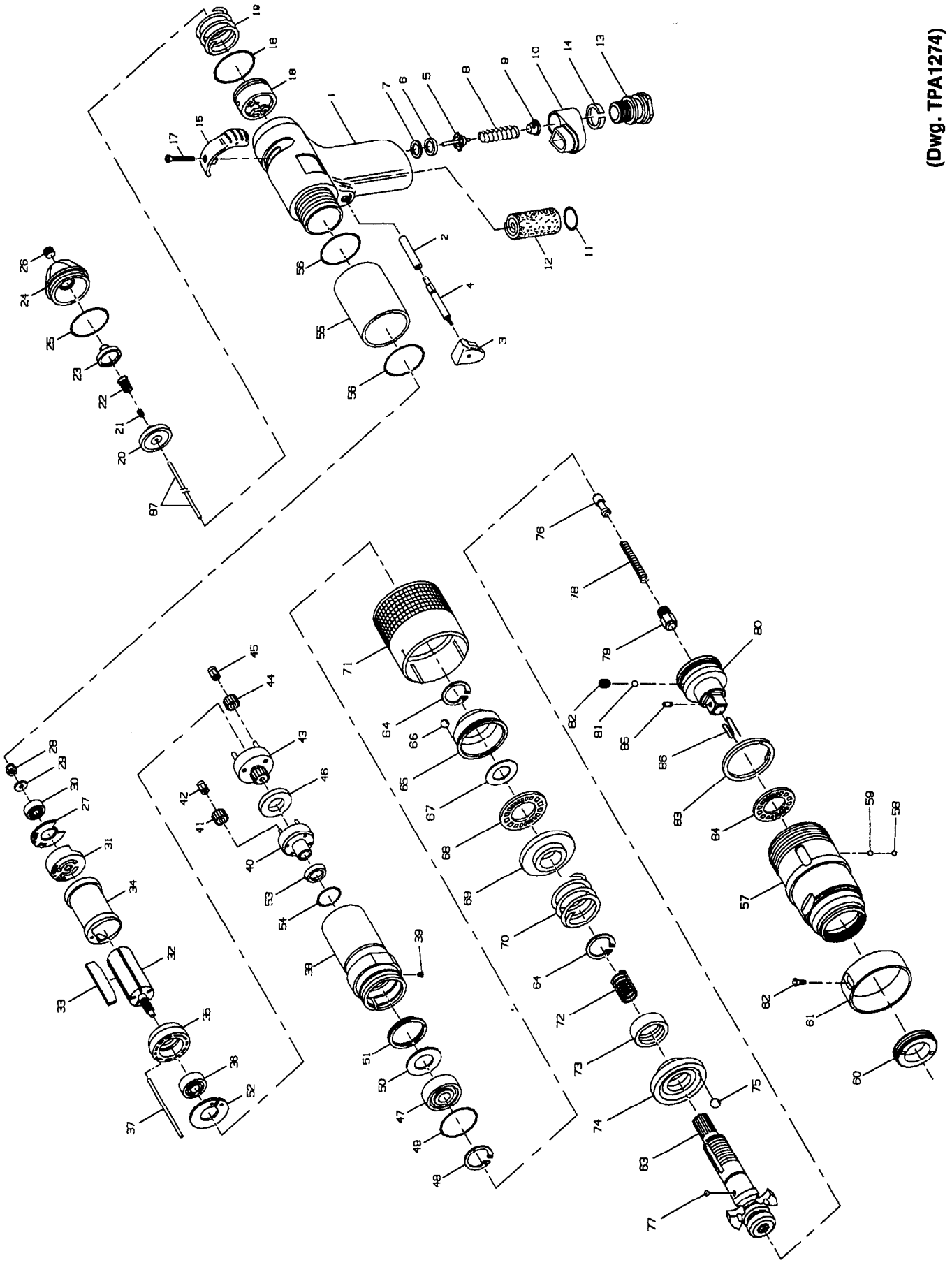
13. Using an Ingersoll–Rand Model ST100 Torque Tester and the air pressure set at 90 psig (6.2bar/620kPa) at the tool inlet, test the tool. The tool should ratchet prior to shutting off. This is a normal occurrence. Rotate the Clutch Adjuster Sleeve until the tester indicates that 60 in–lb (6.8 Nm) of torque has been reached.
14. Using a screwdriver through the Back Cap, turn the Back Cap Adjuster clockwise, a little at a time, until the tool shuts off properly. Proper shutoff is achieved when the clutch cams over once each cycle. The Push Throttle Valve must reset itself without hesitation when the Trigger (3) is released.
15. After adjusting the clutch to function properly, reduce the air line pressure at the tool inlet to 70 psig (4.8 bar/482 kPa) and set the tool to deliver 100 in–lb (11.3 Nm) of torque on the Tester by rotating the Clutch Adjuster Sleeve.
16. If the tool shuts off properly, install the Back Cap Plug (26) in the Back Cap. Tighten the Plug between 10 to 20 in–lb (1.2 to 2.5 Nm) torque. If the tool does not shut off properly, make additional adjustments with the Back Cap Adjuster until the tool does shut off properly and then install the Plug.
17. Reset the air line pressure to 90 psig (6.2 bar/620 kPa) and using the Clutch Adjuster Sleeve in conjunction with the Torque Tester, reset the clutch to provide 60 in–lb (6.8 Nm) torque.
18. To calibrate the Clutch Scale Sleeve (61), proceed as follows:
    a. After using the Tester to set the tool to deliver 60 in–lb (6.8 Nm) of torque, examine the position of the Clutch Scale Sleeve (61).
        1. If the "O" on the Clutch Adjuster Sleeve aligns with the axial line on the Scale Sleeve and the torque output is between 60 to 62 in–lb (6.8 to 7.0 N m), no additional adjustments are required.
        2. If the "5" on the Clutch Adjuster Sleeve aligns with the axial line on the Scale Sleeve and the torque output is between 60 to 62 in–lb (6.8 to 7.0 Nm), rotate the Clutch Adjuster Sleeve counterclockwise to "O" and using the Adjusting Bushing Spanner Wrench, Rotate the Bushing one quarter turn clockwise.
        3. If the "10" on the Clutch Adjuster Sleeve aligns with the axial line on the Scale Sleeve and the torque output is between 60 to 62 in–lb (6.8 to 7.0 Nm), rotate the Clutch Adjuster Sleeve counterclockwise to "O" and using the Adjusting Bushing Spanner Wrench, rotate the Bushing one half turn clockwise.
        4. If the "15" on the Clutch Adjuster Sleeve aligns with the axial line on the Scale Sleeve and the torque output is between 60 to 62 in–lb (6.8 to 7.0 Nm), rotate the Clutch Adjuster Sleeve counterclockwise to "0" and using the Adjusting Bushing Spanner Wrench, rotate the Bushing three quarters of a turn clockwise.

NOTICE

Always rotate the Clutch Adjusting Bushing clockwise. This adjustment changes the previously set gap of the Push Throttle Valve (20). Counterclockwise rotation can cause premature shutoff while excessive clockwise rotation can cause the Valve to become too sensitive. Excessive Clockwise rotation may also make it necessary to readjust the gap needed for the Push Throttle Valve to operate properly.

    b. Using the Adjuster Sleeve Spanner Wrench, loosen the Clutch Scale Sleeve Screw (62) and align the "60" in–lb line on the Sleeve with the leading edge of the Clutch Adjuster Sleeve. When aligned, tighten the Screw between 10 to 20 in lb (1.2 to 2.5 Nm) torque.
19. Final test the tool for torque settings on the Torque Tester.

MAINTENANCE SECTION



(Dwg. TPA1274)

		PART NUMBER FOR ORDERING			PART NUMBER FOR ORDERING
1	Motor Housing	4RA–B40	24	Housing Back Cap	4RTPSS–202
*	Warning Label	WARNING–7–99	♦• 25	Back Cap Seal	AF120–294
2	Trigger Bushing	4RA–91	26	Back Cap Plug	4S3–669
*	Nameplate	4RA–301	♦• 27	Rear End Plate Gasket	4RL–739
*	Nameplate Rivet (2)	BN403–302	♦• 28	Rotor Bearing Retaining Nut	6WT–118
3	Trigger	5RA–93	• 29	Bearing Thrust Washer	6WT–117
4	Trigger Pin	7AH–94	♦ 30	Rear Rotor Bearing	DG20–22
♦ 5	Throttle Valve	7RAK–302	31	Rear End Plate	4RL–12
♦ 6	Throttle Valve Seat	7RAK–303	32	Rotor	4RPL–53
♦ 7	Throttle Valve Seat Support	7RAK–304	♦• 33	Vane Packet (set of 5 Vanes)	4RL–42–5
♦ 8	Throttle Valve Spring	3RA–51	34	Cylinder	4RL–3
♦• 9	Air Strainer Screen	R0A2–61	35	Front End Plate	4RL–11
10	Muffler Assembly	3RA–A123	♦• 36	Front Rotor Bearing	WWA100–97
♦• 11	Muffler O–ring	85H–167	37	Cylinder Dowel	88V60–98
♦• 12	Muffler Element	3RA–310	38	Gear Case Assembly	4RLM–B37
13	Inlet Bushing	7AH–565	39	Grease Fitting	D0F9–879
♦ 14	Inlet Bushing Spacer	7AH–65	40	Spindle	4RLM–8
15	Reverse Valve Switch	4RA–658	41	Spindle Planet Gear (4) (14 teeth)	4RLM–10A
♦• 16	Reverse Valve Seal	R000A2–103	42	Spindle Planet Gear Bearing (4)	6WTM–500
17	Reverse Valve Screw	4RA–665	43	Gear Head	4RLP–216
18	Reverse Valve	4RT–A329	44	Gear Head Planet Gear (3) (20 teeth)	4RLL–10A
♦ 19	Reverse Valve Spring	4RA–515	45	Gear Head Planet Gear Bearing (3)	6WTM–500
20	Push Throttle Valve	4RTPSS–302	46	Gear Head Spacer	6LM–80
21	Valve Adjustment Screw	400–35–74			
♦ 22	Pushrod Throttle Valve Spring	7L–51			
23	Back Cap Adjuster	4RTPSS–201			

* Not illustrated.

• To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

♦ Indicates Tune–up Kit part.

		PART NUMBER FOR ORDERING
47	Spindle Bearing	R1L–24
48	Spindle Bearing Retainer	7L–28
♦ 49	Spindle Bearing Seal	6AH–103
50	Grease Shield	5R–701
51	Grease Shield Retainer	6LL–343
52	Gear Retainer	6LL–81
53	Seal Support	5RAK–5
♦ 54	Seal	182A53–610
55	Housing Sleeve	4RAM–747
♦• 56	Sleeve Support (2)	R00A2–103
57	Clutch Housing	4RTPSS–580
58	Adjuster Sleeve Detent Ball (2)	RX1–629
• 59	Sleeve Detent Ball Seat (2)	7LIB–40Y
60	Clutch Adjusting Bushing	4RTPSS–781
61	Clutch Scale Sleeve	4RTPSS–580X
62	Clutch Scale Sleeve Screw	4RTPSS–667
63	Clutch Driver	4S3–581
64	Spring Seat Stop (2)	5C1–853X
65	Clutch Adjustment Collar	4RTPSS–100
66	Adjustment Collar Seat Ball (4)	2U–722
67	Clutch Bearing Seat	4RTPSS–767
68	Spring Seat Thrust Bearing	55S1–105
69	Clutch Spring Seat	4RTPSS–626
• 70	Clutch Spring	4RTPSS–583
71	Clutch Adjuster Sleeve	4RTPSS–200

		PART NUMBER FOR ORDERING
• 72	Shutoff Collar Return Spring	55S1–405
73	Shutoff Collar	4S3–402
74	Clutch Ball Seat	4S3–627
75	Clutch Cam Ball (4)	G601–65
76	Shutoff Plunger	4RTPSS–408
77	Shutoff Plunger Ball (4)	R000B–263
78	Plunger Return Spring	55S1–420
79	Return Spring Retainer	4S3–95
80	Bit Holder	4RTPSS–586
• 81	Bit Holder Ball Bearing (12)	2U–696
82	Ball Bearing Retainer	4S3–669
83	Ball Retaining Spring	4S3–625
• 84	Bit Holder Thrust Bearing	R02W–696
85	Bit Retaining Plunger	401–715
86	Retaining Plunger Spring	401–718
87	Pushrod	4RTPSS–435
*	Adjusting Bushing Spanner Wrench	4RTPSS–29
*	Adjuster Sleeve Spanner Wrench	4RTPSS–69
*	Horizontal Hanger	R00H–365
*	Grease Gun	R000A2–228
*	Tune–up Kit (includes illustrated items 5, 6, 7, 8, 9, 11, 12, 14, 16, 19, 22, 25, 27, 28, 30, 33, 36, 49, 54 and 56)	4RA–TK1

* Not illustrated.

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♦ Indicates Tune–up Kit part.

MAINTENANCE SECTION

⚠ WARNING

Always wear protective eyewear when operating or performing maintenance on this tool.

Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any Accessory on this tool, or before performing any maintenance on this tool.

DISASSEMBLY

General Instructions

1. Do not disassemble the tool any further than necessary to repair or replace damaged parts.
2. Whenever grasping a tool or part in a vise, always use leather–covered or copper–covered vise jaws to protect the surface of the part to help prevent distortion. This is particularly true of threaded members and housings.
3. Do not press any needle bearing from a part unless you have a new needle bearing on hand for installation. Needle bearings are always damaged during the removal process.
4. Do not remove any part which is a press fit in or on a subassembly unless the removal of that part is necessary for repair or replacement.

Disassembly of the Tool

1. Each Screwdriver is comprised of three modules or units–a motor housing and motor unit, a gear unit and an adjustable clutch unit. Each module or unit can be removed, disassembled for repairs and reassembled independently of the other units.
2. Using a wrench on the flats of the Clutch Housing (57), unscrew and remove the assembled clutch from the Gear Case Assembly (38).

NOTICE

This is a left–hand thread; turn clockwise to remove.

3. Using a wrench on the flats of the Gear Case, unscrew and remove the assembled Gear Case from the Motor Housing (1). When the Gear Case and Motor Housing are separated, the Housing Sleeve (55) and one Sleeve Support (56) will remain with the Gear Case while the other Sleeve Support will remain with the Motor Housing.
4. Remove the Pushrod (87).

Disassembly of the Clutch

1. Holding the assembled clutch over a container to avoid loosing the Adjustment Collar Seat Balls (66) and the Adjuster Sleeve Detent Balls (58), unscrew the Clutch Adjuster Sleeve (71) from the Clutch Housing. Remove the Seat Balls and Detent Balls.
2. Grasping the splined end of the Clutch Driver (63), pull the assembled clutch out of the Clutch Housing. Remove the Bit Holder Thrust Bearing (84).
3. Using snap ring pliers, remove the Spring Seat Stop (64) adjacent to the Clutch Adjustment Collar (65).
4. Slide the Clutch Adjustment Collar, Clutch Bearing Seat (67), the Spring Seat Thrust Bearing (68), Clutch Spring Seat (69) and Clutch Spring (70) off the Clutch Driver.
5. Holding the assembly over a container and using snap ring pliers, remove the remaining Spring Seat Stop. Remove the Shutoff Collar Return Spring (72), the Shutoff Collar (73), the Clutch Ball Seat (74), four Clutch Balls (75) and four Shutoff Plunger Balls (77).
6. Use a thin blade screwdriver to spiral the Ball Retaining Spring (83) out of the groove in the Bit Holder (80).
7. Use a 1/8" hex wrench to remove the Ball Bearing Retainer (82). With the retainer opening downward over a container, rotate the Clutch Driver allowing the twelve Bit Holder Ball Bearings (81) to fall out of the opening one at a time.

NOTICE

If the Bearings are stuck in grease, tap the Driver lightly after aligning each Bearing with the opening.

8. Pull the Clutch Driver from the from the Bit Holder and using a wrench, unscrew the Return Spring Retainer (79) and remove the Plunger Return Spring (78) and Shutoff Plunger (76).
9. If the Clutch Adjusting Bushing (60) must be replaced, use the Adjusting Bushing Spanner Wrench to unscrew and remove the Bushing from the Clutch Housing.
10. To remove the Clutch Scale Sleeve (61), use the Adjuster Sleeve Spanner Wrench to remove the Clutch Scale Sleeve Screw (62) and slide the Sleeve off the Clutch Housing.

Disassembly of the Gear Case

1. Using snap ring pliers, remove the Gear Retainer (52).
2. Remove the Gear Head Planet Gears (44), Gear Head Planet Gear Bearings (45), Gear Head (43), Gear Head Spacer (46), Spindle Planet Gears (41) and Spindle Planet Gear Bearings (42).

3. Position the Gear Case on the table of an arbor press, with the motor end down. Using a 7/16" (11 mm) diameter brass rod against the outer rim of the Spindle (40), press the Spindle from the Gear Case.
4. Using snap ring pliers, remove the Spindle Bearing Retainer (48).
5. Tap the externally threaded end of the Gear Case on a workbench to remove the Grease Shield (50), Spindle Bearing (47) and Spindle Bearing Seal (49).
6. Remove the Seal (54) and Seal Support (53) from the Spindle.
7. If the Grease Shield Retainer (51) must be removed, insert a thin blade screwdriver under the tab and using a rotary motion, spiral the Retainer out of the groove in the Gear Case.

Disassembly of the Motor

1. Grasp the splined end of the Rotor (32) in copper–covered vise jaws and pull the assembled motor from the Motor Housing (1).
2. Remove the Rear End Plate Gasket (27) from the Motor Housing.
3. Using a wrench, unscrew and remove the Rear Rotor Bearing Retaining Nut (28).
4. Remove the Rotor from the vise and remove the Bearing Thrust Washer (29), Rear End Plate (31), Cylinder (34), Cylinder Dowel (37) and Vanes (33).
5. Check the Front Rotor Bearing (36) for damage or roughness. If replacement is necessary, support the Front End Plate (35) between two blocks of wood on the table of an arbor press. Press the Rotor from the Front Rotor Bearing. Using a flat face punch on the inner ring, tap the Bearing out of the End Plate.
6. Check the Rear Rotor Bearing (30) for damage or roughness. If replacement is necessary, use a flat face punch on the inner ring and tap the Bearing out of the End Plate.

Disassembly of the Motor Housing

1. Using a 1/16" hex wrench, unscrew and remove the Reverse Valve Screw (17). Remove the Reverse Valve Switch (15).
2. Lightly grasp the handle of the Motor Housing (1) in copper–covered vise jaws so that the Inlet Bushing (13) is upward.Using a wrench, unscrew and remove the Inlet Bushing.
3. Remove the Muffler Assembly (10), Muffler Element (12), Air Strainer Screen (9), Throttle Valve Spring (8), Throttle Valve (5), Trigger (3) and Trigger Pin (4).
4. To remove the Throttle Valve Seal (6), insert a wire hook through the central hole in the Seat and hooking the underside of the Throttle Valve Seat Support (7), pull the Seat and Support out of the handle. Only remove the Throttle Valve Seat when replacing it or when the Trigger Bushing (2) must be replaced.
5. Using a wrench on the flats of the Housing Back Cap (24), unscrew and remove the Back Cap from the Housing.
6. Remove the Pushrod Throttle Valve Spring (22), the Push Throttle Valve (20), the Reverse Valve Spring (19) and the Reverse Valve (18).
7. If the Back Cap Adjuster (23) must be replaced, use a hex wrench to remove the Back Cap Plug (26) and using a screwdriver through the plug opening, screw the Adjuster out the motor end of the Back Cap.
8. If the Trigger Bushing (2) must be replaced, proceed as follows:
   a. Remove all Seals and components from the Motor Housing.
   b. Carefully grasp the Motor Housing in copper–covered vise jaws with the Trigger Bushing upward.
   c. Using a torch, apply heat to the Motor Housing.

⚠ CAUTION

Apply enough heat to warm the housing, but not enough heat to distort it.

   d. Thread a 12–28 tap into the Bushing and pull the Bushing out of the Housing with the tap.

ASSEMBLY

General Instructions

1. Always press on the **inner** ring of a ball–type bearing when installing the bearing on a shaft.
2. Always press on the **outer** ring of a ball–type bearing when installing the bearing in a bearing recess.
3. Whenever grasping a tool or part in a vise, always use leather–covered or copper–covered vise jaws to protect the surface of the part and help prevent distortion. Take extra care with threaded parts and housings.
4. Always clean every part and wipe every part with a thin film of oil before installation.
5. Apply O–ring lubricant to each O–ring before final assembly.
6. Check every bearing for roughness. If an open bearing must be cleaned, wash it thoroughly in a clean, suitable, cleaning solution and dry with a clean cloth. **Sealed or shielded bearings should never be cleaned.** Work grease thoroughly into every open bearing before installation.

Assembly of the Motor Housing

1. If the Trigger Bushing (2) was removed, proceed as follows:
   a. Put a few drops of Loctite®* No. 601 sealant on the end of a thin stick and insert the stick into the trigger bushing hole of the Motor Housing (1). Work the stick so that the sealant flows against the shoulder inside the housing.
   b. Insert the Trigger Bushing into the Motor Housing to a depth approximately one–half the length of the Bushing.
   c. Put a few drops of Loctite No. 601 sealant in the counterbore surrounding the outside diameter of the Bushing.
   d. Rotate the Bushing approximately 180 degrees to make certain the sealant makes complete contact around the outside of the Bushing.
   e. Push the Bushing into the Housing until it bottoms against the shoulder inside the Housing.
   f. Allow the sealant to cure for eight hours at room temperature.
2. Carefully grasp the tool in copper–covered vise jaws, inlet end facing upward.
3. If the Throttle Valve Seat (6) and Throttle Valve Seat Support (7) were removed, use a flat–faced rod 1/2" (12.7 mm) in diameter by 3" (76 mm) long to push the Seat Support into the Motor Housing until it seats. Use the same rod to push the Seat into the Housing until it seats against the Seat Support.
4. Roll the Muffler Element (12) and work it into the exhaust cavity in the handle of the Motor Housing.
5. Press the Trigger (3) onto the grooved end of the Trigger Pin (4) so that it is at right angles to the hole in the opposite end of the Pin.
6. Insert the assembled Trigger into the Trigger Bushing so that the hole in the Trigger Pin aligns dead center with the hole in the Throttle Valve Seat.
7. Using needle nose pliers to hold the short stem end of the Throttle Valve (5), install the Valve inserting the long stem end through the hole in the Throttle Valve Seat and Trigger Pin.
8. Place the Air Strainer Screen (9), closed end first, inside the large end coil of the Throttle Valve Spring (8).
9. Insert the Throttle Valve Spring and Screen, small coil end first, into the Housing so that the Spring encircles the end of the Throttle Valve.
10. Apply a thin coat of O–ring lubricant to the Muffler O–ring (11) and install the O–ring on the hub of the Muffler (10).
11. Install the Inlet Bushing Spacer (14) in the large hole in the Muffler.
12. Place the Muffler Assembly on the face of the handle so that the hub with the Muffler O–ring extends into the handle.
13. Thread the Inlet Bushing (13) into the large hole in the Muffler Assembly. Tighten the Bushing to a minimum of 26 ft–lb (35 Nm) torque.
14. Install the Reverse Valve Seal (16) in the external groove on the Reverse Valve (18).
15. Being careful not to damage the Seal, insert the Reverse Valve, with the seal end trailing, into the rear of the Motor Housing. Make certain the threaded hole on the side of the Valve aligns with the switch opening.
16. Position the Reverse Valve Switch (15) in the housing opening and fasten the Switch to the Valve with the Reverse Valve Screw (17). Tighten the Screw between 9 to 11 in–lb (1 to 2 Nm) torque.
19. Thread the Back Cap Adjuster (23) into the large bore of the Housing Back Cap (24) until the Adjuster stops against the face of the Back Cap.
20. Install the Back Cap Seal (25) over the threads of the Back Cap.
21. Thread the Back Cap into the Housing and using a wrench on the flats of the Cap, tighten the Back Cap between 5 to 10 ft–lb (7 to 14 Nm) torque.
22. After assembling the complete tool, calibrate the clutch mechanism as instructed in the section **Clutch Calibration**.

Assembly of the Motor

1. Using a sleeve that contacts the outer ring of the Rear Rotor Bearing (30), press the Rear Rotor Bearing into the Rear End Plate (31) if the Bearing was removed.
2. Place the Rear End Plate, bearing end trailing, on the threaded hub of the Rotor (32). Insert a 0.001" feeler gauge or shim between the face of the Rotor and End Plate. Place the Bearing Thrust Washer (29) on the threaded hub of the Rotor. Thread the Rotor Bearing Retaining Nut (28) onto the hub of the Rotor and tighten it until the feeler gauge has a slight drag during removal. **The Rotor must spin freely while holding the End Plate.**
3. Lightly grasp the threaded hub of the Rotor in copper–covered vise jaws with the splined hub upward.
4. Wipe each Vane (33) with a film of light oil and place a Vane in each slot in the Rotor.

* Registered trademark of Loctite Corporation.

5. The Cylinder (34) has a lengthwise string of three drilled holes perpendicular to the central axis. At one end of the string, a punch mark is in line with the holes. With the end of the Cylinder near the punch mark leading, slide the Cylinder down over the Rotor and Vanes and against the Rear End Plate.
6. Push the Front Rotor Bearing (36) into the recess in the Front End Plate (35).
7. Remove the assembled Rotor from the vise and using a sleeve that contacts the inner ring of the Front Rotor Bearing, press the Bearing, flat side of the Front End Plate first, onto the rotor shaft. **Align the cylinder dowel hole in the Rear End Plate, Cylinder and Front End Plate before pressing the Bearing onto the shaft.** After pressing the Bearing onto the shaft, lightly tap the end of the splined hub with a plastic hammer to relax the load on the Bearing. **The Rotor must rotate in the Bearing without drag.**
8. Position the Rear End Plate Gasket (27) in the bottom of the motor housing bore so that the dowel hole and air inlet port in the Gasket align with the dowel hole and air inlet in the housing bore face.
9. Using an assembly dowel 3/32" in diameter by 10" long (2.3 mm x 254 mm), align the dowel holes in the Front End Plate, Cylinder and Rear End Plate. Insert the assembly rod through the aligned holes so that about 3" (76 mm) of the rod extends beyond the Rear End Plate. Insert the extension into the dowel hole at the bottom of the housing bore, and slide the motor into the Motor Housing until it seats.
10. Withdraw the assembly dowel and insert the Cylinder Dowel (37) until the Cylinder Dowel is slightly below the surface of the Front End Plate.

Assembly of the Gearing

1. If the Grease Shield Retainer (51) was removed, install it in the third groove below the front face of the Gear Case (38).
2. Support the face of the Spindle (40), pin end downward, on the table of an arbor press.
3. Install the Seal Support (53), large end first, Spindle Seal (54) and Grease Shield (50) over the hub of the Spindle.
4. Using a sleeve that contacts the inner race of the Bearing, press the Spindle Bearing (47) onto the hub of the Spindle until the Bearing seats against the Seal Support.
5. Install the Spindle Bearing Seal (49) in the second groove below the front face of the Gear Case.
6. Insert the assembled Spindle, pin end first, into the front end of the Gear Case until the Grease Shield is flush against the Grease Shield Retainer.
7. Using snap ring pliers, install the Spindle Bearing Retainer (48) in the groove ahead of the Spindle Bearing.
8. Push the Spindle Planet Gear Bearings (42) into the Spindle Planet Gears (41).
9. Grease the assembled Spindle Planet Gears and Bearings with Ingersoll–Rand No. 28 Grease and install them on the pins of the Spindle from the rear of the Gear Case.
10. Install the Gear Head Spacer (46) in the Gear Case against the Spindle Planet Gears.
11. Grease the splined hub of the Gear Head (43) with Ingersoll–Rand No. 28 Grease and insert it into the Gear Case. The splined hub must pass through the Gear Head Spacer and mesh with the teeth of the Spindle Planet Gears.
12. Push the Gear Head Planet Gear Bearings (45) into the Gear Head Planet Gears (44).
13. Grease the assembled Gear Head Planet Gears and Bearings with Ingersoll–Rand No. 28 Grease and install them on the pins of the Gear Head.
14. Using snap ring pliers, install the Gear Retainer (52) in the shallow internal groove in the Gear Case behind the Gear Head Planet Gears.

Assembly of the Clutch

1. If the Clutch Adjusting Bushing (60) was removed, use the Adjusting Bushing Spanner Wrench to install the Bushing flush with the front face of the Clutch Housing (57).
2. Insert the Shutoff Plunger (76), face with the hole first, into the end of the Clutch Driver (63).
3. Push the Plunger Return Spring (78) into the Clutch Driver and contain the Spring and Plunger by installing the Return Spring Retainer (79). Tighten the Retainer between 60 to 70 in–lb (7 to 8 Nm) torque.
4. Lay a bead of Ingersoll–Rand No. 67 Grease into the annular groove on the Clutch Driver between the Spring Retainer and largest shoulder. Insert the Driver, retainer end first, into the large end of the Bit Holder (80).
5. Insert the twelve Bit Holder Ball Bearings (81) into the threaded opening in the large hub of the Bit Holder. Rotate the Clutch Driver after inserting two or three Bearings to position them around the groove in the Driver.

6. Secure the Bearings by screwing the Ball Bearing Retainer (82) into the Bit Holder until the Retainer contacts the Bearings and then screw the Retainer out of the Bit Holder one and one half turns. Make certain the Bit Holder rotates freely.
7. Using a thin blade screwdriver, spiral the Ball Retaining Spring (83) into the groove in the Bit Holder so that it covers the Ball Bearing Retainer.
8. Inject some Ingersoll–Rand No. 67 Grease into the semicircular openings in the large flange of the Clutch Driver and install a Clutch Cam Ball (75) into each opening.
9. Slide the Clutch Ball Seat (74), hub end trailing, onto the shaft of the Clutch Driver and against the Cam Balls.
10. Insert two Shutoff Plunger Balls (77) in one of the crossholes in the Clutch Driver. While holding these two Balls in position, rotate the Driver 180 degrees and install the remaining two Balls in the other crosshole.
11. Slide the Shutoff Collar (73), counterbored end first, and the Shutoff Collar Return Spring (72) onto the shaft of the Clutch Driver.
12. Using snap ring pliers and while compressing the Shutoff Collar Return Spring, install one of the Spring Seat Stops (64) in the Clutch Driver annular groove nearest to the Bit Holder.
13. Install the Clutch Spring (70) on the shaft of the Clutch Driver against the Clutch Ball Seat and the Clutch Spring Seat (69), hub end first, on the Driver against the Spring.
11. Lubricate the Spring Seat Thrust Bearing (68) with Ingersoll–Rand No. 67 Grease and install it on the shaft of the Clutch Driver against the Spring Seat.
15. Slide the Clutch Bearing Seat (67) and Clutch Adjustment Collar (65), concave end first, onto the shaft of the Clutch Driver and using snap ring pliers, install the remaining Spring Seat Stop in the annular groove of the Clutch Driver.
16. Lubricate the Bit Holder Thrust Bearing (84) with Ingersoll–Rand No. 67 Grease and insert the Bearing into the large end of the Clutch Housing against the Clutch Adjusting Bushing.
17. Insert the assembled clutch, square drive leading, into the Clutch Housing.
18. Apply a light coat of Ingersoll–Rand No. 67 Grease to the two Adjuster Sleeve Detent Balls (58) and install them in the Clutch Housing against the Sleeve Detent Ball Seats (59).
19. Apply a light coat of Ingersoll–Rand No. 67 Grease to the four Adjustment Collar Seat Balls (66) and insert one Ball into each of the four slots in the Clutch Housing. The Balls will stop against the surface of the Clutch Adjustment Collar.
20. Capture the Detent Balls and Seat Balls in the Clutch Housing by threading the Clutch Adjuster Sleeve (71) onto the Clutch Housing.
21. If the Clutch Scale Sleeve (61) was removed, slide the Sleeve onto the front end of the Clutch Housing. Using the Adjuster Sleeve Spanner Wrench, tighten the Clutch Scale Sleeve Screw (62) between 10 to 20 in–lb (1.2 to 2.5 Nm) torque.

Assembly of the Tool

1. Install one Sleeve Support (56) on the threaded hub of the Motor Housing (1) and the other Sleeve Support in the annular groove on the Gear Case (38). Slide the Housing Sleeve (55) onto the rear of the Gear Case over the Sleeve Support.
2. Clean the threads on the Motor Housing and Gear Case to remove all oil and grease. Screw the assembled Gear Case onto the Motor Housing and tighten the Gear Case between 25 to 30 ft–lb (34 to 41 N m) torque.
3. Insert the Pushrod (87) through the gearing and into the central hole in the Rotor (32) and push it toward the rear of the Tool until resistance from the Pushrod Throttle Valve Spring (22) is encountered.
4. Align the spline of the Clutch Driver (63) with the gearing and thread the assembled clutch onto the Gear Case.

NOTICE

This is a left–hand thread; turn counterclockwise to install the Housing.

5. Using a wrench on the flats of the Clutch Housing, tighten the Housing to between 5 to 10 ft–lb (7 to 14 Nm) torque.
6. After the Tool has been assembled, calibrate the clutch as instructed in the section, **Clutch Calibration.**

TROUBLESHOOTING GUIDE

Trouble	Probable Cause	Solution
Low power or low free speed	Pressure at the inlet	Check air supply. For top performance, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet.
	Plugged Air Strainer Screen	Clean the Air Strainer Screen in a clean, suitable, cleaning solution. If it cannot be cleaned, replace it.
	Clogged Muffler	Clean the Muffler Element in a clean, suitable, cleaning solution. If it cannot be cleaned, replace it.
	Worn or broken Vanes	Replace a **complete** set of Vanes.
	Damaged Rear End Plate Gasket	Install a new Rear End Plate Gasket.
	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 3.
Leaky Throttle Valve	Worn Thorttle Valve and/or Throttle Valve Seat	Install a new Throttle Valve and/or Throttle Valve Seat.
	Dirt accumulation on Throttle Valve and/or Throttle Valve Seat	Pour about 3 cc of a clean, suitable, cleaing solution in the air inlet and operate tool for about 30 seconds. **Immediately**, pour 3 cc of the recommended oil in the air inlet and operate the tool for 30 seconds to lubricate all parts cleaned by the cleaning solution.
Gear Case gets hot	Excessive grease	Clean and inspect the Gear Case and gearing parts and lubricate as instructed on page 3.
	Worn or damaged parts	Clean and inspect the Gear Case and gearing. Replace worn or broken components.
Inconsistent disengagement of Clutch	Improper lubrication	Remove Clutch assembly and check. Lubricate per instructions.
	Worn or damaged parts	Remove Clutch mechanism and examine all parts. Replace worn or broken components.
	Clutch improperly calibrated	Calibrate the Clutch as instructed in the **Clutch Calibration** section on page 4.
Motor stalls before Clutch	Low air pressure at the inlet	Check the air supply. For top performance, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet
	Insufficient grease	Lubricate the Clutch as instructed on page 3.
	Clutch improperly calibrated	Calibrate the Clutch as instructed in the section **Clutch Calibration** on page 4.

NOTICE

SAVE THESE INSTRUCTIONS. DO NOT DESTROY.

NOTES