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Edition 3
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Air Screwdrivers

QP1P, QP1S and QP1T Series

Maintenance Information



Save These Instructions

 **Ingersoll Rand**

WARNING

Always wear eye protection 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.

Note: When reading the instructions, refer to exploded diagrams in Parts Information Manuals when applicable (see under Related Documentation for form numbers).

Clutch Spring Selection Chart				
Tool	Free Speed (rpm)	Torque Range (Soft Draw)		
		Light Clutch Spring (Orange)	Medium Clutch Spring (Red)	Heavy Clutch Spring (Green)
"All Series QP Pistol Grip Screwdrivers"	2800	1.7 to 9.7 in-lbs.	----	----
		(0.19 to 1.1 Nm)	----	----
	2000	1.7 to 9.7 in-lbs.	7.9 to 22.1 in-lbs.	----
		(0.19 to 1.1 Nm)	(0.89 to 2.50 Nm)	----
	1500	1.7 to 9.7 in-lbs.	7.9 to 27.3 in-lbs.	----
		(0.19 to 1.1 Nm)	(0.89 to 3.08 Nm)	----
	1000	1.7 to 9.7 in-lbs.	7.9 to 27.3 in-lbs.	13.3 to 40.0 in-lbs.
		(0.19 to 1.1 Nm)	(0.89 to 3.08 Nm)	(1.50 to 4.52 Nm)
	500	1.7 to 9.7 in-lbs.	7.9 to 28.3 in-lbs.	13.3 to 47.8 in-lbs.
		(0.19 to 1.1 Nm)	(0.89 to 3.20 Nm)	(1.50 to 5.40 Nm)
	250	1.7 to 9.7 in-lbs.	7.9 to 28.3 in-lbs.	13.3 to 47.8 in-lbs.
		(0.19 to 1.1 Nm)	(0.89 to 3.20 Nm)	(1.50 to 5.40 Nm)

Lubrication

Each time a Series QP Screwdriver is disassembled for maintenance and repair or replacement of parts, lubricate the tool as follows:

1. Coat all exposed gears with **Ingersoll Rand No. 67 Grease** and work some of the Grease into the gearing of the Spindle Assembly (51).
2. Work approximately 6 to 8 cc of **Ingersoll Rand No. 28 Grease**

into the ball pockets, jaws, adjusting nut lock and shaft threads of the clutch mechanism.

3. Use **Ingersoll Rand No. 10 Oil** to lubricate the motor. Inject approximately 1 to 2 cc of oil into the air inlet before attaching the air hose to the tool.

Changing Inlet Location

Series QP1P, QP1S and QP1T Screwdrivers with the Top Inlet feature are shipped from the factory with the air connection attached to the bottom of the handle. To use the Top Inlet connection on these tools, proceed as follows:

1. Shut off the air supply and disconnect the air supply hose, if the tool is in use.
2. Using a 3/16" hex. wrench, unscrew and remove the Inlet Plug Assembly (15) from the top of the Housing (1).
3. Using a 3/4" wrench on the flats of the Inlet Bushing Assembly (27), unscrew and remove the Assembly.
4. Transfer the Wave Washer (25) and Inlet Bushing Bezel (26) from the threads of the Inlet Bushing to the threads of the Inlet Plug.

Make certain the Washer is against the Grip End Cap (23) and the smaller end of the Bezel is against the Inlet Plug Seal (16).

5. Thread the assembled Inlet Plug into the bottom of the Handle and tighten it between 15 and 20 ft-lbs. (20 and 27 Nm) torque.
6. Thread the Inlet Bushing with Inlet Bushing Seal (28) into the top of the Handle and tighten it between 15 and 20 ft-lbs. (20 and 27 Nm) torque.
7. Connect the air supply hose to the Inlet Bushing and turn on the air supply.

Disassembly

General Instructions

1. Do not disassemble the tool any further than necessary to replace or repair damaged parts.
2. Whenever grasping a tool or part in a vise, always use leather-covered or copper-covered vice jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded members and housings.
3. Do not remove any part which is a press fit in or on a subassembly unless the removal of that part is necessary for repairs or replacement.
4. Do not disassemble the tool unless you have a complete set of gaskets and O-Rings for replacement.

The tool can be disassembled for repairs to each individual unit without disturbing the other units. To separate the modules, proceed as follows:

NOTICE

The thread in the following step is a left-hand thread. Rotate the Bit Finder clockwise to remove it.

1. **For models with Bit Finder Bit Holders**, unscrew and remove the Non-Rotating Bit Finder (110). **For models with Quick Release Bit Holders**, use a thin blade screwdriver to spiral the Retaining Ring (109) out of the groove in the end of the Bit Holder (102). Being careful not to loose the Bit Retaining Ball (103), slide the Spring Seat (108), Retaining Sleeve Spring (107) and the Bit Retaining Sleeve (106) off the Bit Holder.
2. Lightly grasp the flats of the Gear Case (52) in copper-covered or leather-covered vise jaws with the Clutch Housing (100) upward.

Disassembly of the Tool

Each Series QP Screwdriver is made using four modules or units including a motor housing unit, a motor unit, a clutch with bit holder unit and a combined gearing and spindle unit.

NOTICE

The thread in the following step is a left-hand thread. Rotate the Clutch Housing clockwise to remove it.

- Using a strap wrench, loosen the Clutch Housing from the Gear Case and remove the assembled tool from the vise jaws. While holding the assembly over a non-damaging container or surface, finish unscrewing the Clutch Housing from the Gear Case. Remove the Clutch Return Spring (60 or 79), the Clutch Input Driver (61 or 80), the Push Rod (44), and the Clutch Assembly or Clutch Shaft (95), from the Housing.
- Push on the output end of the Bit Holder (102) to remove it from the Clutch Housing.
- For Models with Trigger Start**, slide the Shutoff Spacer (105) and Wave Washer (105A) off the Bit Holder.
- If the Clutch Housing Bearing (101) must be replaced, press it from the Clutch Housing.
- Lightly grasp the flats of the Gear Case in copper-covered or leather-covered vise jaws with the handle upward and rotate the assembled handle to loosen the assembly from the Gear Case. Remove the assembly from the vise jaws and separate the components.
- Remove the Motor Clamp Washer (43) and Motor Seal (42) from the Motor Housing (1).
- Tap the motor end of the Housing on a wooden block to remove the assembled motor from the Housing.

Disassembly of the Adjustable Shutoff Clutch

- Using a thin blade screwdriver, pry the Clutch Adjusting Nut Stop (78) off the end of the Clutch Shaft (66).
- Insert the tip of a #1 Phillips Head Screwdriver into the adjustment opening between the Clutch Adjusting Nut (77) and the Clutch Adjusting Nut Washer (76). Rotate the screwdriver clockwise to thread the Adjustment Nut off the Clutch Shaft.

NOTICE

In the following step, the Clutch Cam Balls will be free to fall from the assembly when the Cam Ball Seat is moved. Make certain the Balls fall into a non-damaging container.

- Holding the assembly over a small pasteboard box, slide the Adjusting Nut Washer, the Thrust Bearing (75), the Spring Seat (74), the Clutch Spring (73) and the Cam Ball Seat (72) off the Clutch Shaft. Allow the three Clutch Cam Balls (70) to fall into the pasteboard box.
- The Clutch Cam Ball Driver (69) has a cross hole that is larger on one side than the other. Insert a 1/16" drill shank or piece of wire into the smaller hole and gently push the Clutch Driver Retaining Pin (71) out of the larger hole and out of the Driver and the Clutch Shaft.

NOTICE

In the following step, the Clutch Balls will be free to fall from the assembly when the Cam Jaw is moved along the Clutch Shaft. Make certain the Balls fall into a non-damaging container.

- Holding the assembly over a small pasteboard box, and using care to drop the twelve Clutch Balls (67) into the box, slide the Clutch Cam Ball Driver and Cam Jaw (68) off the Clutch Shaft. If grease held some of the Balls inside the jaw cavity, remove them.
- With the large end of the Clutch Shaft downward, depress the Automatic Shutoff Pin (64) with varying amounts of finger pressure while tapping the large end edge of the Clutch Shaft on a piece of wood until the Automatic Shutoff Plunger (62) protrudes slightly from the end of the Shaft. Grasp the Plunger and carefully pull it out of the Clutch Shaft.
- Remove the Automatic Shutoff Pin and Automatic Shutoff Pin Spring (65) from the Clutch Shaft. The Pin Spring should remain in the pin recess when the Pin is removed. To separate the Spring from the Pin, gently rotate the Spring while pulling it from the recess to avoid elongating the Spring.

- Using a hooked tool, reach into the opening in the end of the Clutch Shaft and carefully pull the Automatic Shutoff Plunger Return Spring (63) out of the Shaft without elongating the Spring.

Disassembly of the Adjustable Cushion Clutch

- Using a thin blade screwdriver, pry the Clutch Adjusting Nut Stop (94) off the end of the Clutch Shaft (82).
- Insert the tip of a #1 Phillips Head Screwdriver into the adjustment opening between the Clutch Adjusting Nut (93) and the Clutch Adjusting Nut Washer (92). Rotate the screwdriver clockwise to thread the Adjustment Nut off the Clutch Shaft.

NOTICE

In the following step, the Clutch Cam Balls will be free to fall from the assembly when the Cam Ball Seat is moved. Make certain the Balls fall into a non-damaging container.

- Holding the assembly over a small pasteboard box, slide the Adjusting Nut Washer, the Thrust Bearing (91), the Spring Seat (90), the Clutch Spring (89) and the Cam Ball Seat (88) off the Clutch Shaft. Allow the eleven Clutch Cam Balls (86) to fall into the pasteboard box.
- The Clutch Cam Ball Driver (85) has a cross hole that is larger on one side than the other. Insert a 1/16" drill shank or piece of wire into the smaller hole and gently push the Clutch Driver Retaining Pin (87) out of the larger hole and out of the Driver and the Clutch Shaft.

NOTICE

In the following step, the Clutch Balls will be free to fall from the assembly when the Cam Jaw is moved along the Clutch Shaft. Make certain the Balls fall into a non-damaging container.

- Holding the assembly over a small pasteboard box, and using care to drop the twelve Clutch Balls (83) into the box, slide the Clutch Cam Ball Driver and Cam Jaw (84) off the Clutch Shaft. If grease held some of the Balls inside the jaw cavity, remove them.

Disassembly of the Gearing

- For Models having a Clutch**, use snap ring pliers to remove the Gear Retainer (45) from the motor end of the Gear Case (52) and remove the Gear Head Spacer (46) as well.
- For 250, 500 and 1000 rpm Models**, lightly rap the motor end of the Gear Case on a wooden workbench top to remove the three Planet Gears (48), the Planet Gear Head Assembly (47) and the Planet Gear Head Spacer (50).
- For 1500 and 2000 rpm Models**, lightly rap the motor end of the Gear Case on a wooden workbench top to remove the three Planet Gears (48), the Gear Head Pinion (49), the Planet Gear Head Assembly (47) and the Planet Gear Head Spacer (50).
- Using snap ring pliers, remove the Spindle Bearing Retaining Ring (55).
- Stand the Gear Case on the table of an arbor press with the output spindle upward. Using a rod that neatly fits inside the internal hex. of the Spindle (51), press the Spindle Assembly out of the Spindle Bearing (53).

CAUTION

Do not remove the Bearing in the following step unless you have a new replacement available for installation. The Bearing will be damaged by the removal process.

- Invert the Gear Case on the table of an arbor press so that the end face having four notches makes contact with the table. Using a rod against the inner race of the Spindle Bearing, press the Bearing from the Gear Case.
- If the Spindle Bearing Seat (54) must be replaced, use a small, thin blade screwdriver to spiral it out of the groove in the Gear Case.

Disassembly of the Motor

1. Using snap ring pliers, remove the Rear End Plate Assembly Retainer (33) from the shaft of the Rotor (37).
2. Pull the Rear End Plate Face Plate (32) and Rear End Plate Assembly (31) off the hub of the Rotor.
3. Lift the Cylinder (34) from the Rotor.
4. Remove the Vanes (38) from the Rotor.
5. Support the Front End Plate Assembly (39), as near the rotor body as possible, on the table of an arbor press and press the Rotor from the Front Rotor Bearing (41). Remove the Bearing from the Front End Plate.

Disassembly of the Housing

1. Use a wrench to unscrew and remove the Inlet Bushing Assembly (27) from the Motor Housing Assembly (1). Remove the Inlet Bushing Bezel (26) and the Wave Washer (25).
2. Pull the Housing Grip (21) off the Motor Housing.
3. Pull or carefully pry the Grip End Cap (23) off the inlet end of the Grip and remove the two End Cap Muffler Elements (24).
4. Pull the Grip Muffler Element (22) out of the inlet end of the Grip and the two Housing Muffler Elements (20) out of the trigger end of the Grip.
5. **For Top Inlet Models**, use a 3/16" hex. wrench to unscrew and remove the Inlet Plug Assembly (15).
6. Using a 1/4" hex. wrench, unscrew and remove the Rear Housing Cap Assembly (9).

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 pressing the bearing into 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. This is particularly true of threaded members and housings.
4. Except for bearings, always clean every part and wipe every part with a thin film of oil before installation.
5. Apply O-Ring lubricant to all O-Rings 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 into every open bearing before installation.

Assembly of the Housing

1. **For Models having a memory chip**, if the Memory Chip Holder Assembly (14) is being replaced, insert the memory chip into the Holder with the contact ends leading. Position the Assembly at the slot in the exterior wall of the Motor Housing (1) above the trigger hole with the exposed contacts away from the Housing and pointing toward the spindle end of the tool. Press the Assembly into the slot.
2. Lubricate a new Trigger Shaft O-Ring (12) and install it in the groove on the shaft of the Trigger Assembly (11).
3. **For Push-to-Start Models**, insert the shaft of the Trigger Assembly into the hole in the Motor Housing (1) until the flat on the shaft is aligned with the two holes in the Housing for the Trigger Retaining Pins (13). Tap the two pins into the Housing to capture the Trigger Assembly.
For all other Models, insert the shaft of the Trigger Assembly into the hole in the Motor Housing (1) until the flat on the shaft is aligned with the hole in the Housing for the Trigger Retaining Pin (13). Tap the pin into the Housing to capture the Trigger Assembly.
4. Lubricate the Housing O-Ring (4) with O-Ring lubricant and install it at the bottom of the cylinder bore in the Motor Housing.

7. **For Models with Trigger Start or Trigger Permit**, remove the Throttle Valve Spring (19) and the Throttle Valve (18) from the rear of the Housing.
For Models with Automatic Shutoff, remove the Automatic Shutoff Valve (30) from the rear of the Housing.
8. **For Models with Trigger Start or Trigger Permit**, if the Throttle Valve Seat (17) must be replaced, insert a hooked tool through the central opening of the Seat and pull it from the Motor Housing.
9. Use a #2 Phillips Head Screwdriver, to unscrew and remove the Reverse Lever Screw (8) and lift the Reverse Lever (7) out of the Motor Housing.
10. Insert a 5/16" wooden dowel between 6 and 8 inches long, into the Rear Housing Cap opening and push the Reverse Valve Front O-Ring (6B), Reverse Valve Assembly (5) and Wave Washer (6A) out the motor end of the Housing.
11. Use a hooked tool to pull the Housing O-Ring (4) out of the Motor Housing.
12. **For Push-to-Start Models**, use a 1/16" pin punch to drift the two Trigger Retaining Pins (13) out of the Motor Housing and pull the Trigger Assembly (11) out of the Housing.
For all other Models, use a 1/16" pin punch to drift the Trigger Retaining Pin (13) out of the Motor Housing and pull the Trigger Assembly (11) out of the Housing.
13. **For Models having a memory chip**, if the chip must be replaced, pry the Memory Chip Holder Assembly (14) out of the Motor Housing in the area above the trigger location.

5. Inspect the face on the hub of the Reverse Valve Assembly (5) for nicks or damage. Replace the Assembly if damage is evident. Examine the Reverse Valve Seals (6 & 6B) for nicks or cuts and replace the Seals if damaged.
6. Lubricate the Reverse Valve Seals (6) & (6B) with O-Ring lubricant. Insert O-Ring (6B) over front end of Reverse Valve Assembly (5). Insert Reverse Valve Assembly (5), small seal end and Wave Washer (6A), and load into the cylinder bore of the Motor Housing. Push the Assembly toward the bottom of the cylinder and seat in its proper location making sure all Seals are correctly positioned.
7. Rotate the Valve inside the Housing until the threaded hole in the side of the Valve for the Reverse Lever Screw (8) is centered radially in the slot in the top of the Housing for the Reverse Lever (7).
8. Install the Reverse Lever in the slot and use a #2 Phillips Head Screwdriver to secure the Lever to the Valve with the Reverse Lever Screw.
9. Install the Throttle Valve Seat (17) in the bottom of the housing cap opening. Use a rod with a flat end and no sharp edges to push the Seat flat at the bottom face of the opening.
10. **For Models with Automatic Shutoff**, install the Automatic Shutoff Valve (30), large end trailing, through the center of the Valve Seat.
11. Install the Throttle Valve (18), flat face leading, in the opening against the Valve Seat. Place the Throttle Valve Spring (19), small end leading, into the Housing against the Valve. Encircle the hub on the Valve with the Spring opening.
12. Examine the Rear Housing Cap Seal (10) for nicks or cuts. If damaged, carefully install a new Seal over the threads of the Rear Housing Cap Assembly (9).
13. Using a 1/4" hex. wrench, thread the Assembly into the rear of the Motor Housing. Tighten the Assembly between 15 and 20 ft.-lbs. (20 and 27 Nm) torque.
14. **For Top Inlet Models**, examine the Inlet Plug Seal (16) for nicks or cuts. If damaged, carefully install a new Seal over the threads of the Inlet Plug Assembly (15).
15. **For Top Inlet Models**, use a 3/16" hex. wrench to thread the Assembly into the top of the Motor Housing. Tighten the Assembly between 15 and 20 ft.-lbs. (20 and 27 Nm) torque.
16. Lay a Housing Muffler Element (20) on each side of the handle rib and use a non-pointed probe to fully push the end of each Element into the recess near the body of the Housing.

17. Install the Housing Grip (21) over the Elements and onto the inlet end of the Motor Housing. Make certain the Grip is fully seated against the Housing and the Trigger Assembly works freely.
18. Fold the Grip Muffler Element (22) in half and then fold each half equally again and insert it into the bottom of the Grip.
19. Stack the two End Cap Muffler Elements (24) inside the Grip and push the Grip End Cap (23) onto the inlet end of the Grip.
20. If the Inlet Screen (29) required replacement, use a wooden dowel to carefully push a new one into the Inlet Bushing (27).
21. If the Inlet Bushing Seal (28) is nicked or damaged, carefully install a new one over the threads of the Inlet Bushing.
22. Install the Inlet Bushing Bezel (26), small end leading, followed by the Wave Washer (25) onto the threads of the Inlet Bushing against the Seal.
23. Thread the assembled Inlet Bushing through the Grip End Cap into the handle of the Motor Housing and tighten the Bushing between 15 and 20 ft.-lbs. (20 and 27 Nm) torque.

Assembly of the Motor

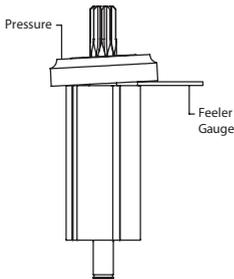
1. Place the Front End Plate (39) on the splined shaft of the Rotor (37) with the bearing recess away from the rotor body.
2. Place the Front Rotor Bearing (41) onto the shaft and using a sleeve or piece of tubing that contacts the inner race of the Bearing, press the Bearing onto the shaft until the Front End Plate nearly contacts the rotor body.

NOTICE

In the following step, the measurement must be made at the end corner of the large rotor body.

3. The clearance between the Front End Plate and Rotor is critical. While pressing down with your finger on the outer edge of the Front End Plate on the bearing side, insert a 0.004" (0.1 mm) feeler gauge between the face of the rotor body and the face of the End Plate at a point that is 180 degrees from where the pressure is applied. Refer to Dwg. TPA1740. To increase the gap, support the End Plate and lightly tap the rotor shaft with a plastic hammer; to decrease the gap, press the Bearing farther onto the rotor shaft.

Measurement of Front End Plate Clearance



(Dwg. TPA1740)

4. Wipe each Vane (38) with a light film of **Ingersoll Rand** No.10 Oil and place a Vane in each slot in the Rotor.
5. One end of the Cylinder Assembly (34) has a notch that breaks the outer wall and end face of the Cylinder. With that end trailing, install the Cylinder Assembly over the Rotor and Vanes against the Front End Plate. Make certain the Cylinder Front Alignment Pin (36) enters the hole in the Front End Plate.
6. Install the Rear End Plate Assembly (31), flat face leading, on the rear hub of the Rotor. Make certain the Cylinder Rear Alignment Pin (35) enters the hole in the Rear End Plate.
7. Examine the Rear End Plate Face Plate (32) for scratches. If it is scratched, replace it. If it is not, slide it onto the rear hub of the Rotor and onto the Cylinder Rear Alignment Pin against the Rear End Plate. Some pressure may be required to fit the hole in the Plate onto the Alignment Pin.

8. Using snap ring pliers, install the Rear End Plate Assembly Retainer (33) in the annular groove on the rear rotor hub to secure the assembly in position.
9. Set the assembled motor aside.

Assembly of the Gearing

1. Using a small screwdriver, work the Spindle Bearing Seat (54) into the internal groove nearest the notched end of the Gear Case (52).
2. Stand the Gear Case, notched end upward, on the table of an arbor press. Using a piece of tubing that contacts the outer race of the Spindle Bearing (53), press a new Bearing into the Gear Case against the Seat.
3. Lubricate the gears in the Spindle Assembly (51) with **Ingersoll Rand** No. 67 Grease.
4. Invert the Gear Case and using another piece of tubing that supports the inner race of the Bearing and clears the output end of the Spindle Assembly, press the Spindle Assembly into the Bearing from the motor end of the Gear Case.
5. Using snap ring pliers, install the Spindle Bearing Retainer (55) in the external groove near the rear end of the spindle.
6. **For all Clutch Models**, lightly lubricate the Planet Gear Head Spacer (50) with **Ingersoll Rand** No. 67 Grease and install it in the Gear Case against the Spindle Assembly.
7. **For all Clutch Models**, lubricate the shafts of the Planet Gear Head Assembly (47) with **Ingersoll Rand** No. 67 Grease and install the Gear Head in the Gear Case meshing the spline on the shaft with the gear teeth in the Spindle Assembly.
8. **For 250, 500 and 1000 rpm Models**, lubricate the Planet Gears (48) with **Ingersoll Rand** No. 67 Grease and install them on the shafts of the Planet Gear Frame Assembly. **For 1500 and 2000 rpm Models**, lubricate the Planet Gears (48) and Gear Head Pinion (49) with **Ingersoll Rand** No. 67 Grease and install the Planet Gears on the shafts of the Planet Gear Frame Assembly. Insert the Gear Head Pinion in the center of the Planet Gears making certain the teeth mesh.
9. **For all Clutch Models**, install the Gear Head Spacer (46) against the Gears and secure the assembly by using snap ring pliers to install the Gear Retainer (45) in the internal groove at the motor end of the Gear Case.

Assembly of the Adjustable Cushion Clutch

1. Insert the small end of the Clutch Shaft (82) into the end of the Cam Jaw (84) having the large opening and slide the Shaft about half way into the Jaw.
2. Drop the twelve Clutch Balls (83) into the Cam Jaw forming a ring around the Clutch Shaft.
3. Lay a bead of **Ingersoll Rand** No. 28 Grease, approximately 2 to 3 cc, on top of the Clutch Balls and then bring the Clutch Shaft and Cam Jaw together capturing the Balls between them.
4. While holding the Shaft and Jaw together, slide the Clutch Cam Ball Driver (85), large end leading, onto the Clutch Shaft until it is against the Cam Jaw.
5. Rotate the Driver to align the large hole through one wall of the Driver with the comparable size opening of the cross hole through the Clutch Shaft. Push the Clutch Cam Ball Driver Retaining Pin (87) into the hole to lock the Driver in position on the Clutch Shaft.
6. Apply a coating of **Ingersoll Rand** No. 28 Grease to each of the eleven Clutch Cam Balls (86).
7. Holding the assembled Clutch Shaft with the Clutch Cam Ball Driver upward, insert a lubricated Ball into each of the eleven ball pockets in the Driver.
8. Slide the Cam Ball Seat (88), large end leading, onto the Shaft against the Balls. Follow with the Clutch Spring (89), Spring Seat (90), Thrust Bearing (91) and the Clutch Adjusting Nut Washer (92) with the smooth face leading.
9. Thread the Clutch Adjusting Nut (93), smooth face trailing, onto the Clutch Shaft.

10. Insert the tip of a #1 Phillips Head Screwdriver into the adjustment opening between the Clutch Adjusting Nut and the Clutch Adjusting Nut Washer. Rotate the screwdriver counterclockwise and thread the Adjustment Nut onto the Clutch Shaft until the external groove for the Clutch Adjusting Nut Stop (94) is visible.
11. Install the Nut Stop in the groove.

Assembly of the Adjustable Shutoff Clutch

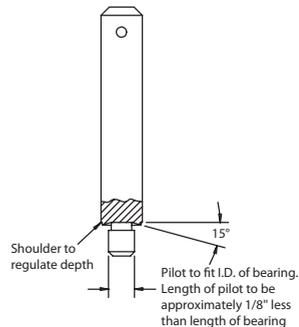
1. Hold the Clutch Shaft (66) in your hand with the large end upward.
2. Insert the Automatic Shutoff Plunger Return Spring (63) into the central opening in the large end of the Clutch Shaft. Use a 1/8" dowel to push the Spring below the cross hole for the Automatic Shutoff Pin (64).
3. Insert the Automatic Shutoff Pin Spring (65) in the end hole of the Automatic Shutoff Pin opposite the pointed end. Rotate the Spring a little to keep it in the hole.
4. Drip one or two drops of **Ingersoll Rand** No. 10 Oil into the central hole with the Plunger Return Spring.
5. Position the Shutoff Pin, Spring leading, in the cross hole on the large end of the Clutch Shaft with the hole in the Shutoff Pin aligned with the central hole containing the Return Spring.
6. Push on the pointed end of the Shutoff Pin to depress the Spring while inserting the Automatic Shutoff Plunger (62) into the central opening with the Return Spring. The smaller center portion of the Shutoff Plunger will allow the Shutoff Pin to spring outward and capture the components within the Clutch Shaft when properly positioned.
7. Insert the small end of the Clutch Shaft into the end of the Cam Jaw (68) having the large opening and slide the Shaft about half way into the Jaw.
8. Drop the twelve Clutch Balls (67) into the Cam Jaw forming a ring around the Clutch Shaft.
9. Lay a bead of **Ingersoll Rand** No. 28 Grease, approximately 2 to 3 cc, on top of the Clutch Balls and then bring the Clutch Shaft and Cam Jaw together capturing the Balls between them.
10. While holding the Shaft and Jaw together, slide the Clutch Cam Ball Driver (69), large end leading, onto the Clutch Shaft until it is against the Cam Jaw.
11. Rotate the Driver to align the large hole through one wall of the Driver with the comparable size opening of the cross hole through the Clutch Shaft. Push the Clutch Cam Ball Driver Retaining Pin (71) into the hole to lock the Driver in position on the Clutch Shaft.
12. Apply a coating of **Ingersoll Rand** No. 28 Grease to each of the three Clutch Cam Balls (70).
13. Holding the assembled Clutch Shaft with the Clutch Cam Ball Driver upward, insert a lubricated Ball into each of the three ball slots in the Driver.
14. Slide the Cam Ball Seat (72), large end leading, onto the Shaft against the Balls. Follow with the Clutch Spring (73), Spring Seat (74), Thrust Bearing (75) and the Clutch Adjusting Nut Washer (76) with the smooth face leading.
15. Thread the Clutch Adjusting Nut (77), smooth face trailing, onto the Clutch Shaft.
16. Insert the tip of a #1 Phillips Head Screwdriver into the adjustment opening between the Clutch Adjusting Nut and the Clutch Adjusting Nut Washer. Rotate the screwdriver counterclockwise and thread the Adjustment Nut onto the Clutch Shaft until the external groove for the Clutch Adjusting Nut Stop (78) is visible.
17. Install the Nut Stop in the groove.

Assembly of the Tool

1. Grasp the spline of the Rotor (37) in the assembled motor and after aligning the End Plate Alignment Pin (40) with the internal notch in the motor end of the housing bore, insert the assembled motor into the Motor Housing (1). Make certain the motor is far enough into the Housing to have the undercut below the internal housing thread visible.

2. Lubricate the Motor Seal (42) with O-Ring lubricant and install it around the Front End Plate (39) and into the undercut in the Housing.
3. Align the tab of the Motor Clamp Washer (43) with the internal notch in the Housing and install it over the rotor hub and End Plate Alignment Pin against the Motor Seal. Make certain the Pin enters the hole in the Washer and the Washer is flat against the Seal.
4. Apply some **Ingersoll Rand** No. 67 Grease to the spline on the rotor shaft.
5. Thread the assembled Gear Case (52), output spindle trailing, into the Motor Housing and using a 1-1/16" wrench, tighten the joint between 15 and 20 ft.-lbs. (20 and 27 Nm) torque.
6. Grasp the flats on the Gear Case lightly in leather-covered or copper-covered vise jaws with the Spindle Assembly (51) upward.
7. **For Automatic Shutoff Models**, insert the Push Rod (44) into the center of the Spindle Assembly. Only a small portion of the Rod should be visible when it has correctly entered the assembled gearing and motor.
8. **For all Clutch Models**, place the narrow end of the Clutch Return Spring (60 or 79) in the Gear Case against the inner race of the Spindle Bearing (53).
9. **For all Direct Drive Models**, insert the Clutch Shaft (95) into the hex. recess of the Spindle Assembly until the Shaft Stop Pin (95A) contacts the Spindle. If the Shaft Stop Pin does not protrude equally from both sides of the Clutch Shaft, adjust it or replace it. **For all Clutch Models**, place the hex. drive end of the Clutch Input Driver (61 or 80) on the Spring and compress the Spring until the hex. on the Driver enters the hex. recess in the Spindle Assembly. While holding the Driver in position, engage the raised bar on the face of the Driver with the jaw of the Cam Jaw (68 or 84).
10. If the Clutch Housing Bearing (101) was removed, stand the Clutch Housing (100) on the table of an arbor press with the gear case end upward.
11. Using a Needle Bearing Inserting Tool as shown in Dwg. TPD786 with a 0.030" (0.76 mm) thick washer that clears the inner bore and outer edge of the Bearing inserted between the Bearing and stop surface on the tool, press the Bearing into the Clutch Housing. The trailing end of the Bearing must be between 0.025" and 0.035" (0.63 and 0.89 mm) below the face of the bore into which the Bearing is being pressed.

Needle Bearing Inserting Tool



(Dwg. TPD786)

12. **For Trigger Start Models**, slide the Wave Washer (105A) followed by the Shutoff Spacer (105) onto the hub of the Bit Holder (102) and insert the Bit Holder into the large end of the Clutch Housing and push the output end through the Clutch Housing Bearing. **For Trigger Permit Models**, insert the Bit Holder (102) into the large end of the Clutch Housing and push the output end through the Clutch Housing Bearing.

NOTICE

The following step has threads with a left-hand thread. Rotate the components counterclockwise to tighten them.

13. Install the assembled Clutch Housing over the clutch components and thread it into the Gear Case. Using a strap wrench, tighten the joint between 15 and 20 ft-lbs. (20 and 27 Nm) torque.
14. **For Quick Release Bit Holder Models**, place the Bit Retaining Ball (103) in the hole through the wall of the Bit Holder and slide the Bit Retaining Sleeve (106) large end trailing, onto the Bit Holder. Slide the Retaining Sleeve Spring (107) and Spring Seat (108) onto the Bit Holder and secure the components by installing the Retaining Ring (109) in the external groove at the output end of the Bit Holder.
For Bit Finder Models, place the Bit Retaining Ball (103) in the hole through the wall of the Bit Holder and spread the Bit Retaining Spring (104) enough to slide it onto the Bit Holder and secure the Ball in position.

NOTICE

The following step has threads with a left-hand thread. Rotate the components counterclockwise to tighten them.

15. **For Bit Finder Models**, thread the Non-Rotating Bit Finder (110) onto the Clutch Housing and hand-tighten it between 2 and 6 ft-lbs. (3 and 8 Nm) torque.
16. Remove the tool from the vise jaws.

Testing the Tool

Before placing the tool back in service, test the tool in a run down application to determine if adjustments are necessary to satisfactorily perform the operation. Since four interrelated adjustments can affect tool performance, only experience, along with trial and error, can dictate which adjustment or combination of adjustments will provide the desired results.

The Clutch Spring (73 or 89), the clutch adjustment procedure, the length of the Push Rod (44) and the length of the Shutoff Valve (30) can individually or collectively have an effect on torque and/or speed. Always try to make adjustments before replacing or attempting to modify components.

If adjustments are unable to provide the desired torque, it may be necessary to install a lighter or heavier Clutch Spring.

If the tool ratchets when operated but fails to shutoff, it may be necessary to shorten the Push Rod. Only shorten the Push Rod in small increments. Increments between 0.005" and 0.010" (0.13 and 0.25 mm) are recommended.

If the tool stalls and does not shutoff, runs slower than normal or has low power, the Shutoff Valve may require lengthening. To lengthen the Shutoff Valve, grasp the stem between two pieces of rubber or other non-slip, non-marring material and rotate the molded nut counterclockwise. Rotating the nut one half revolution will lengthen the Valve approximately 0.009" (0.23 mm). **Should the stem of the Valve become bent, marred, nicked or damaged in any way during the adjustment process, replace it.**

Troubleshooting Guide

Trouble	Probable Cause	Solution
Loss of Power	Low air pressure	Check air supply. For top performance, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet.
	Plugged Inlet Bushing Screen	Clean the Inlet Bushing Screen using a clean, suitable cleaning solution. If the Screen cannot be cleaned, replace it.
	Worn or broken Vanes	Replace a complete set of Vanes.
	Worn or broken Cylinder	Replace the Cylinder if it is cracked or if the bore appears wavy or scored.
	Shutoff Valve too short	Lengthen the Shutoff Valve. Refer to Testing the Tool on page 7.
Motor won't run	Motor Clamp Washer binding	Remove the Gear Case make certain the Washer is flat and the Motor Seal is properly positioned.
	Gears binding	Clean and inspect all gearing. Replace any worn or damaged gearing.
	Push Rod worn	Install a new Push Rod.
Gear Case gets hot	Excessive grease	Clean and inspect Gear Case and gearing parts and lubricate as instructed.
	Worn or damaged parts	Clean and inspect the gear Case and Gearing. Replace worn or broken components.
Inconsistent disengagement of the Adjustable Clutch	Improper lubrication	Remove the Adjustable Clutch mechanism and examine the parts. Lubricate as instructed.
	Wrong Clutch Spring (using Heavy Clutch Spring on light torque application)	Change to Medium or Light Clutch Spring.
Motor stalls before Adjustable Clutch ratchets	Improper Clutch adjustment or improper tool ratio for application	Check Clutch Adjustment and review tool performance vs. requirements.
	Low 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.
Tool ratchets before shutoff	Push Rod too long	Shorten the push Rod. Refer to Testing the Tool on page 7.
Tool stalls without shutting off	Shutoff Valve too short	Lengthen the Shutoff Valve. Refer to Testing the Tool on page 7.
Tool runs slower than normal	Shutoff Valve too short	Lengthen the Shutoff Valve. Refer to Testing the Tool on page 7.

Related Documentation

For additional information refer to:
Product Safety Information Manual Form 04585006.
Product Information Manual Form 80165939.
Parts List Manual Form 16574527.
Manuals can be downloaded from www.irtools.com

www.irttools.com

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