



**16575193**  
Edition 4  
October 2013

## **Air Srewdrivers**

**QS1L and QS1T Inline Series**

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# **Maintenance Information**



**Save These Instructions**

**IR** *Ingersoll Rand*<sup>®</sup>

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## Product Safety Information

### WARNING

- Failure to observe the following warnings, and to avoid these potentially hazardous situations, could result in death or serious injury.
- Read and understand this and all other supplied manuals before installing, operating, repairing, maintaining, changing accessories on, or working near this product.
- Always wear eye protection when operating or performing maintenance on this tool. The grade of protection required should be assessed for each use and may include impact-resistant glasses with side shields, goggles, or a full face shield over those glasses.
- Always turn off the air supply, bleed the air pressure and disconnect the air supply hose when not in use, before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool or any accessory.

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

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## Lubrication

Each time a Series QS 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 (42).
  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.
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## Speed Adjustment

In addition to adjustable clutches for controlling torque, Series QS Lever Inline Screwdrivers are furnished with the ability to precisely control speed, within certain ranges. Setting the speed requires a tachometer. Therefore, the adjustment, although simple, should only be attempted by a competent technician using the proper equipment.

The Back Cap (6) has a small, molded stud on the end face of the Cap nearest the Exhaust Diffuser (15). That stud controls the radial location of the Diffuser which controls the opening size of the exhaust ports. Take an initial reading of the tool speed by applying a tachometer with a convex tip to the inside of the Bit Holder (84). Using the procedure required to activate the motor of your particular model tool, bring the motor to maximum free speed.

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After determining the actual velocity, shut off the air supply and disconnect the air line. Use a 3/4" wrench to loosen the Inlet Bushing. The longest slot in the Exhaust Diffuser will contain the molded stud on the Back Cap. Rotate the Diffuser to open the exhaust ports to increase speed or rotate it to restrict the exhaust to reduce speed. Being careful not to allow the Diffuser to damage the molded stud, tighten the Inlet Bushing to 15 ft.-lbs. (20 Nm) torque. Connect the air line and restore the air supply and check the velocity again. Determine which direction you need to rotate the Diffuser to obtain the desired speed and then rotate it accordingly. Best results are achieved by using gradual increments and frequent tachometer readings. Be sure to turn off the air supply and disconnect the line when making adjustments.

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## 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.

### Disassembly of the Tool

Each Series QS Lever Inline Screwdriver is made using four modules or units which include a motor housing unit, a motor unit, a clutch with bit holder unit and a combined gearing with spindle unit. 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 or Housing Cap clockwise to remove it.**

1. **For models with Bit Finder Bit Holders**, unscrew and remove the Non-Rotating Bit Finder (92).  
**For models with Quick Release Bit Holders**, unscrew and remove the Clutch Housing Cap (98). Use a thin blade screwdriver to spiral the Retaining Ring (91) out of the groove in the end of

the Bit Holder (84). Being careful not to loose the Bit Retaining Ball (85), slide the Spring Seat (90), Retaining Sleeve Spring (89) and the Bit Retaining Sleeve (88) off the Bit Holder.

#### **NOTICE**

**The thread in the following step is a left hand thread. Rotate the Cover clockwise to remove it.**

2. Unscrew and remove the Clutch Adjusting Hole Cover (97). There are two sets of threads with a non-threaded section between them on the Clutch Housing (82).
3. Using external retaining ring pliers or a thin blade screwdriver, remove the Grip Retaining Ring (96) from the groove in the Clutch Housing.
4. Pull the Housing Grip (93) of the front end of the tool.

#### **NOTICE**

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

5. Clamp the Inlet Bushing (16) in leather-covered or copper-covered vise jaws and using a 1-1/16" wrench on the flats of the Gear Case (43) and the Clutch Housing Spanner Wrench (Part No. TRH-478) in the clutch housing slot, unscrew and remove the Clutch Housing.
6. Push on the output end of the Bit Holder (85) to remove it from the Clutch Housing (82).
7. For Models with Lever Start, slide the Shutoff Spacer (87) and Wave Washer (87A) off the Bit Holder.
8. If the Clutch Housing Bearing (83) is worn and must be replaced, press it from the Clutch Housing.

9. Carefully remove the Clutch Assembly or Clutch Shaft (81), the Clutch Input Driver (47 or 66), the Clutch Return Spring (46 or 65), and the Push Rod (67).
10. Lightly grasp the flats of the Gear Case in leather-covered or copper-covered vise jaws with the Inlet Bushing upward.
11. Place a 1-3/16" open end wrench on the flats of the Back Cap (6) to prevent it from rotating, and use a 3/4" wrench to unscrew and remove the Inlet Bushing.
12. Lift the Exhaust Diffuser (15) off the Back Cap.
13. If the Throttle Valve Spring (14) did not come out of the tool with the Inlet Bushing, use needle nose pliers to remove it and the Throttle Valve (13) from the Motor Housing (1).
14. To remove the Throttle Valve Seat, insert a hooked tool through the central opening of the Seat and pull it from the Motor Housing.
15. Using a 1/16" pilot punch, tap the Throttle Lever Pin (11) out of the Back Cap and remove the Throttle Lever (10).
16. Pull the Throttle Plunger (5) out of the Motor Housing and remove the assembly from the vise.
17. Holding the assembly horizontally, remove the Back Cap, the Memory Chip (9) (if included with the tool), the Back Cap Gasket (7) and the Shutoff Valve (20) (if included with the tool).
18. If the Muffler Elements (8) need to be cleaned or replaced, pull them out of the Back Cap.
19. Grasp the flats at the inlet end of the Motor Housing in leather-covered or copper-covered vise jaws, and using a 1-1/16" wrench on the flats of the Motor Housing, unscrew and separate the Gear Case from the Motor Housing.
20. Set the assembled Gear Case on the workbench.
21. Remove the Motor Clamp Washer (33) and the Motor Seal (32) from the assembled motor in the Housing.
22. Tap the Motor Housing on a wood block to remove the Motor Assembly from the Housing.

### Disassembly of the Adjustable Shutoff Clutch

1. Using a thin blade screwdriver, pry the Clutch Adjusting Nut Stop (64) off the end of the Clutch Shaft (52).
2. Insert the tip of a #1 Phillips Head Screwdriver into the adjustment opening between the Clutch Adjusting Nut (63) and the Clutch Adjusting Nut Washer (62). 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.**

3. Holding the assembly over a small pasteboard box, slide the Adjusting Nut Washer, the Thrust Bearing (61), the Spring Seat (60), the Clutch Spring (59) and the Cam Ball Seat (58) off the Clutch Shaft. Allow the three Clutch Cam Balls (56) to fall into the pasteboard box.
4. The Clutch Cam Ball Driver (55) 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 (57) 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.**

5. Holding the assembly over a small pasteboard box, and using care to drop the twelve Clutch Balls (53) into the box, slide the Clutch Cam Ball Driver and Cam Jaw (54) off the Clutch Shaft. If grease held some of the Balls inside the jaw cavity, remove them.
6. With the large end of the Clutch Shaft downward, depress the Automatic Shutoff Pin (50) 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 (48) protrudes slightly from the end of the Shaft. Grasp the Plunger and carefully pull it out of the Clutch Shaft.

7. Remove the Automatic Shutoff Pin and Automatic Shutoff Pin Spring (51) 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.
8. Using a hooked tool, reach into the opening in the end of the Clutch Shaft and carefully pull the Automatic Shutoff Plunger Return Spring (49) out of the Shaft without elongating the Spring.

### Disassembly of the Adjustable Cushion Clutch

1. Using a thin blade screwdriver, pry the Clutch Adjusting Nut Stop (80) off the end of the Clutch Shaft (68).
2. Insert the tip of a #1 Phillips Head Screwdriver into the adjustment opening between the Clutch Adjusting Nut (79) and the Clutch Adjusting Nut Washer (78). 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.**

3. Holding the assembly over a small pasteboard box, slide the Adjusting Nut Washer, the Thrust Bearing (77), the Spring Seat (76), the Clutch Spring (75) and the Cam Ball Seat (74) off the Clutch Shaft. Allow the eleven Clutch Cam Balls (72) to fall into the pasteboard box.
4. The Clutch Cam Ball Driver (71) 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 (73) 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.**

5. Holding the assembly over a small pasteboard box, and using care to drop the twelve Clutch Balls (69) into the box, slide the Clutch Cam Ball Driver and Cam Jaw (70) off the Clutch Shaft. If grease held some of the Balls inside the jaw cavity, remove them.

### Disassembly of the Gearing

1. Using snap ring pliers, remove the Gear Retainer (35) from the motor end of the Gear Case (43) and remove the Gear Head Spacer (36) as well.
2. **For Series QS1L02, QS1T02, QS1L05, QS1T05, QS1L10 and QS1T10**, lightly rap the motor end of the Gear Case on a wooden work bench top to remove the three Planet Gears (39), the Planet Gear Head Assembly (38) and the Planet Gear Head Spacer (41). **For Series QS1L15, QS1T15, QS1L20 and QS1T20**, lightly rap the motor end of the Gear Case on a wooden work bench top to remove the three Planet Gears (39), The Gear Head Pinion (40), the Planet Gear Head Assembly (38) and the Planet Gear Head Spacer (41). **For Series QS1L28 and QS1T28**, lightly rap the motor end of the Gear Case on a wooden work bench top to remove the Planet Gear Head Drive Plate (37), the Planet Gear Head Assembly (38) and the Planet Gear Head Spacer (41).
3. Using snap ring pliers, remove the Spindle Bearing Retaining Ring (45).
4. 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 (42), press the Spindle Assembly out of the Spindle Bearing (44).

## 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.**

5. 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.
6. If the Spindle Bearing Seat (46) 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 (23) from the shaft of the Rotor (27).
2. Pull the Rear End Plate Face Plate (22) and Rear End Plate Assembly (21) off the hub of the Rotor.

## 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. Lubricate the Housing O-Ring (2) with O-Ring lubricant and install it at the bottom of the cylinder bore in the Motor Housing (1).
2. Inspect the face and O-Ring on the hub of the Reverse Valve Assembly (4) for nicks or damage. Replace the Reverse Valve Assembly if any damage is evident.
3. Lubricate the O-Ring on the hub of the Reverse Valve Assembly with O-Ring lubricant and insert the Assembly, O-Ring end leading, into the cylinder bore of the Motor Housing. Push the Assembly toward the bottom of the cylinder bore until it "snaps" into its proper location.
4. Rotate the Valve inside the Housing until the threaded hole into the side of the Valve for the Motor Housing Screw (3) aligns with the hole in the Motor Housing.
5. Using a #2 Phillips Head Screwdriver, thread the Motor Housing Screw into the Reverse Valve Assembly through the Housing until the underside of the screw head stops against the Housing. Back the Screw out of the Valve between 1/4 and 1/2 turn.
6. Align the open end of the slot inside the Reverse Lever (19) with the head of the Housing Screw. From the inlet end of the Housing, slide the Lever onto the Housing, making certain the screw head enters the slot, and move it along the Housing until it stops against the housing shoulder.
7. Rotate the Lever to make certain the Valve only has slight resistance.

### Assembly of the Motor

1. Place the Front End Plate (29) on the splined shaft of the Rotor (27) with the bearing recess away from the rotor body.
2. Place the Front Rotor Bearing (31) 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.

3. Lift the Cylinder (24) from the Rotor.
4. Remove the Vanes (28) from the Rotor.
5. Support the Front End Plate Assembly (29), as near the rotor body as possible, on the table of an arbor press and press the Rotor from the Front Rotor Bearing (31). Remove the Bearing from the Front End Plate.

### Disassembly of the Housing

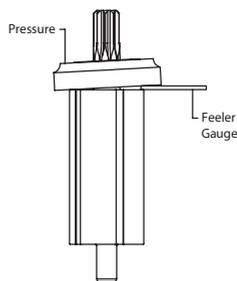
1. Pull the Reverse Lever (19) off the inlet end of the Motor Housing (1).
2. Using a #2 Phillips Head Screwdriver, unscrew and remove the Housing Screw (3).
3. Insert a 5/16" wooden dowel between 6 and 8 inches long, into the inlet end of the Motor Housing and push the Reverse Valve Assembly (4) out the motor end of the Housing.
4. Use a hooked tool to pull the Housing O-Ring (2) out of the Motor Housing.

## 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 (28) 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 (24) 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 (26) enters the hole in the Front End Plate.
6. Install the Rear End Plate Assembly (21), flat face leading, on the rear hub of the Rotor. Make certain the Cylinder Rear Alignment Pin (25) enters the hole in the Rear End Plate.
7. Examine the Rear End Plate Face Plate (22) 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.

- Using snap ring pliers, install the Rear End Plate Assembly Retainer (23) in the annular groove on the rear rotor hub to secure the assembly in position.
- Set the assembled motor aside.

### Assembly of the Gearing

- Using a small screwdriver, work the Spindle Bearing Seat (46) into the internal groove nearest the notched end of the Gear Case (43).
- 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 (44), press a new Bearing into the Gear Case against the Seat.
- Lubricate the gears in the Spindle Assembly (42) with **Ingersoll Rand** No. 67 Grease.
- 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.
- Using snap ring pliers, install the Spindle Bearing Retaining Ring (45) in the external groove near the driver end of the spindle.
- Lightly lubricate the Planet Gear Head Spacer (41) with **Ingersoll Rand** No. 67 Grease and install it in the Gear Case against the Spindle Assembly.
- Lubricate the shafts of the Planet Gear Head Assembly (38) 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.
- For Series QS1L02, QS1T02, QS1L05, QS1T05, QS1L10 and QS1T10**, lubricate the Planet Gears (39) with **Ingersoll Rand** No. 67 Grease and install them on the shafts of the Planet Gear Frame Assembly.  
**For Series QS1L15, QS1T15, QS1L20 and QS1T20**, lubricate the Planet Gears (39) and Gear Head Pinion (40) 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.  
**For Series QS1L28 and QS1T28**, lubricate the Planet Gear Head Drive Plate (37) with **Ingersoll Rand** No. 67 Grease and install it on the shafts of the Planet Gear Frame Assembly.
- Install the Gear Head Spacer (36) against the Gears or Drive Plate and secure the assembly by using snap ring pliers to install the Gear Retainer (35) in the internal groove at the motor end of the Gear Case.

### Assembly of the Adjustable Cushion Clutch

- Insert the small end of the Clutch Shaft (68) into the end of the Cam Jaw (70) having the large opening and slide the Shaft about half way into the Jaw.
- Drop the twelve Clutch Balls (69) into the Cam Jaw forming a ring around the Clutch Shaft.
- 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.
- While holding the Shaft and Jaw together, slide the Clutch Cam Ball Driver (71), large end leading, onto the Clutch Shaft until it is against the Cam Jaw.
- 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 (73) into the hole to lock the Driver in position on the Clutch Shaft.
- Apply a coating of **Ingersoll Rand** No. 28 Grease to each of the eleven Clutch Cam Balls (72).
- 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.
- Slide the Cam Ball Seat (74), large end leading, onto the Shaft against the Balls. Follow with the Clutch Spring (75), Spring Seat (76), Thrust Bearing (77) and the Clutch Adjusting Nut Washer (78) with the smooth face leading.
- Thread the Clutch Adjusting Nut (79), smooth face trailing, onto the Clutch Shaft.

- 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 (80) is visible.
- Install the Nut Stop in the groove.

### Assembly of the Adjustable Shutoff Clutch

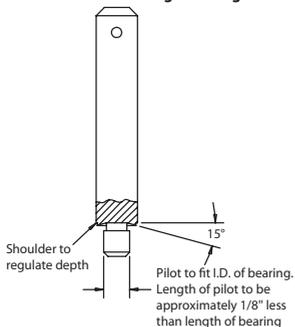
- Hold the Clutch Shaft (52) in your hand with the large end upward.
- Insert the Automatic Shutoff Plunger Return Spring (49) into the central opening in the large end of the Clutch Shaft. Use a 1/8" dowel to push the Spring below the cross hole for the Automatic Shutoff Pin (50).
- Insert the Automatic Shutoff Pin Spring (51) in the end hole of the Automatic Shutoff Pin opposite the pointed end. Rotate the Spring a little to keep it in the hole.
- Drip one or two drops of **Ingersoll Rand** No. 10 Oil into the central hole with the Plunger Return Spring.
- 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.
- Push on the pointed end of the Shutoff Pin to depress the Spring while inserting the Automatic Shutoff Plunger (48) 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.
- Insert the small end of the Clutch Shaft into the end of the Cam Jaw (54) having the large opening and slide the Shaft about half way into the Jaw.
- Drop the twelve Clutch Balls (53) into the Cam Jaw forming a ring around the Clutch Shaft.
- 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.
- While holding the Shaft and Jaw together, slide the Clutch Cam Ball Driver (55), large end leading, onto the Clutch Shaft until it is against the Cam Jaw.
- 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 (57) into the hole to lock the Driver in position on the Clutch Shaft.
- Apply a coating of **Ingersoll Rand** No. 28 Grease to each of the three Clutch Cam Balls (56).
- 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.
- Slide the Cam Ball Seat (58), large end leading, onto the Shaft against the Balls. Follow with the Clutch Spring (59), Spring Seat (60), Thrust Bearing (61) and the Clutch Adjusting Nut Washer (62) with the smooth face leading.
- Thread the Clutch Adjusting Nut (63), smooth face trailing, onto the Clutch Shaft.
- 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 (64) is visible.
- Install the Nut Stop in the groove.

### Assembly of the Tool

- Lightly grasp the flats at the inlet end of the Motor Housing (1) in leather-covered or copper-covered vise jaws with the motor bore upward.
- Grasp the spline of the Rotor (27) in the assembled motor and after aligning the End Plate Alignment Pin (30) with the internal notch in the motor end of the housing bore, insert the assembled motor into the Motor Housing. Make certain the motor is far enough into the Housing to have the undercut below the internal housing thread visible.

3. Lubricate the Motor Seal (32) with O-Ring lubricant and install it around the Front End Plate (29) and into the undercut in the Housing.
4. Align the tab of the Motor Clamp Washer (33) 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.
5. Apply some **Ingersoll Rand** No. 67 Grease to the spline on the rotor shaft.
6. Thread the assembled Gear Case (43), 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.
7. **For Models with a Clutch**, place the narrow end of the Clutch Return Spring (46 or 65) in the Gear Case against the inner race of the Spindle Bearing (44).
8. **For Models with Direct Drive**, insert the hex end of the Clutch Shaft (81) that does not have the step, into the hex. recess of the Spindle Assembly (42).  
**For Models with a Clutch**, place the hex drive end of the Clutch Input Driver (47 or 66) on the Spring and compress the Spring until the hex on the Driver enters the hex recess in the Spindle Assembly (42). While holding the Driver in position, engage the raised bar on the face of the Driver with the jaw of the Cam Jaw (54 or 70).
9. If the Clutch Housing Bearing (83) was removed, stand the Clutch Housing (82) on the table of an arbor press with the smaller, externally threaded end downward.
10. 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 pressed.

#### Needle Bearing Inserting Tool



(Dwg. TPD786)

11. **For Models with Lever Start**, slide the Wave Washer (87A) followed by the Shutoff Spacer (87) onto the hub of the Bit Holder (84) and insert the Bit Holder into the large end of the Clutch Housing (82) and push the output end through the Clutch Housing Bearing.  
**For Models with Lever Permit**, insert the Bit Holder (84) into the large end of the Clutch Housing (82) and push the output end through the Clutch Housing Bearing.

#### NOTICE

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

12. Install the assembled Clutch Housing over the clutch components and thread it onto the Gear Case. Using a 1-1/16" wrench on the flats of the Gear Case and the Clutch Housing Spanner Washer (Part No. TRH-478) in the clutch housing slot, tighten the joint between 15 and 20 ft.-lbs. (20 and 27 Nm) torque.
13. Invert the assembled tool in the vise jaws and lightly grasp the flats on the Gear Case with the inlet end of the tool upward.
14. Insert a 5/8" dowel through the opening in the Back Cap (6), and using the dowel as an alignment device, install the three Muffler Elements (8) in the cavity of the Back Cap. Make certain the notches in the outer edge of the Elements fit over the memory chip pocket in the bottom of the Cap.
15. If the tool is equipped with a Memory Chip (9), install it (with the leads entering first) in the pocket at the bottom of the Back Cap.
16. Make certain the tab on the inside edge of the Back Cap Gasket (7) is aligned with the pocket for the Memory Chip and install the Gasket, metal face leading, in the recess of the Back Cap against the face with the cavity containing the Muffler Elements.
17. Position the gasket end of the alignment dowel against the inlet hub on the Motor Housing. Align the flats on the Cap with the flats on the Housing. Orient the Back Cap to clear the Reverse Lever (19) and slide the Back Cap Assembly off the alignment dowel and onto the Motor Housing.
18. **For all Models with a Shutoff Clutch and Lever Permit Models with a Cushion Clutch**, install the Push Rod (34) into the central hole in the inlet hub. The Rod will enter the assembled motor and disappear from view when released. Install the Shutoff Valve (20), small end first, in the same opening.
19. Being careful not to damage it, insert the Throttle Valve Seat (12) into the central opening at the inlet end of the Motor Housing at an angle until it clears the threads in the Housing. Using a rod with a flat end and no sharp edges, push the Seat to the bottom of the opening until it seats flush.
20. Using needle nose pliers, insert the Throttle Valve (13), long stem leading, into the opening against the Seat. Center the Valve in the Seat.
21. Install the Throttle Valve Spring (14) in the opening so that it encircles the Valve.
22. The Exhaust Diffuser (15) has one slot that is longer than the other five slots. The Back Cap has a short, molded stud projecting from the inlet end. Place the Exhaust Diffuser against the Back Cap with the long slot encircling the molded stud. Rotate the Diffuser counterclockwise until the wall of the slot stops against the stud. The exhaust ports are now in the full open position which will provide maximum free speed.
23. If the Inlet Screen (18) required replacement, use a wooden dowel to carefully push a new one into the Inlet Bushing (16).
24. If the Inlet Bushing Seal (17) is nicked or damaged, carefully install a new one over the threads of the Inlet Bushing.
25. Thread the Inlet Bushing Assembly through the Diffuser and Back Cap into the Motor Housing. Using a 1-3/16" wrench on the flats of the Back Cap to keep it from turning, tighten the Inlet Bushing between 15 and 20 ft.-lbs. (20 and 27 Nm) torque.
26. The Throttle Plunger (5) has a lengthwise flat on the outer edge at one end of the Plunger. Insert the Plunger, flat end first, into the cross hole in the Housing. Push on the end of the Plunger to make certain it springs back from contact with the stem of the Throttle Valve.
27. Position the Throttle Lever (10) in the slot in the Back Cap and Motor Housing and using a 1/16" diameter rod, align the holes through the Back Cap, Motor Housing and Throttle Lever. While maintaining alignment, install the Throttle Lever Pin (11) in place of the rod by tapping it through all three pieces.
28. Remove the tool from the vise jaws and install the Housing Grip (93) over the Clutch Housing.
29. Install the Grip Retaining Ring (96) in the external groove on the Clutch Housing ahead of the Grip to retain the Grip on the Housing.
30. **For Models with Quick Release Bit Holders**, place the Bit Retaining Ball (85) in the hole through the wall of the Bit Holder and slide the Bit Retaining Sleeve (88), large end trailing, onto the Bit Holder. Slide the Retaining Sleeve Spring (89) and Spring Seat (90) onto the Bit Holder and secure the components by installing the Retaining Ring (91) in the external groove at the output end of the Bit Holder.

### NOTICE

The thread in the following step is a left-hand thread. Rotate the component counterclockwise to tighten it.

31. Thread the Clutch Adjusting Hole Cover (97) onto the Clutch Housing against the Housing Grip and hand tighten it between 2 and 6 ft-lbs. (3 and 8 Nm) torque.

### NOTICE

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

32. Thread the Non-Rotating Bit Finder (92) or Clutch Housing Cap (98) onto the Clutch Housing and hand tighten it between 2 and 6 ft-lbs. (3 and 8 Nm) torque.

### Testing the Tool

Before placing the tool back in , test the tool in a run down application to determine if adjustments are necessary to satisfactorily perform the operation. Since five 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 (59 or 75), the clutch adjustment procedure, the exhaust flow, the length of the Push Rod (34) and the length of the Shutoff Valve (20) 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 <b>complete</b> set of Vanes.
	Worn or broken Cylinder	Replace the Cylinder if it is cracked or if the bore appears wavy or scored.
	Exhaust control restricted	Make certain the Exhaust Diffuser against the Back Cap is in the fully open position.
	Shutoff Valve too short	Lengthen the Shutoff Valve. Refer to <b>"Testing the Tool" on page 7</b>
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.
	Improper exhaust control adjustment	Adjust the exhaust flow to obtain the desired speed.
Tool ratchets before shutoff	Push Rod too long	Shorten the push Rod. Refer to <b>"Testing the Tool" on page 7</b>
Tool stalls without shutting off	Shutoff Valve too short	Lengthen the Shutoff Valve. Refer to <b>"Testing the Tool" on page 7</b>
Tool runs slower than normal	Shutoff Valve too short	Lengthen the Shutoff Valve. Refer to <b>"Testing the Tool" on page 7</b>

### Related Documentation

For additional information refer to:  
Product Safety Information Manual Form 04585006.  
Product Information Manual Form 80165921.  
Parts List Manual Form 16574501.

Manuals can be downloaded from [ingersollrandproducts.com](http://ingersollrandproducts.com)

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