



**16575243**  
Edition 2  
October 2013

# Air Screwdrivers

**1R Series**

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## Maintenance Information



Save These Instructions

**IR** Ingersoll Rand®

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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 1R Screwdriver is disassembled for maintenance and repair or replacement of parts, lubricate the tool as follows:

1. Gearing
  - a. **For L ratio**, coat gears with 2 to 4 cc of **Ingersoll Rand** No. 28 Grease.
  - b. **For M, N or Q ratios**, coat gears with 4 to 6 cc of **Ingersoll Rand** No. 28 Grease.
2. Use **Ingersoll Rand** No. 10 Oil for lubricating the motor. Inject approximately 1 to 2 cc of oil into the air inlet before attaching the air hose.
3. **For Cushion Clutch Models**, unscrew and remove the clutch attachment.
  - a. **For L gear ratio**, inject 4 to 6 cc of **Ingersoll Rand** No. 28 Grease through the center hole of the spindle to lubricate the gearing.
  - b. **For M or N gear ratio**, inject 6 to 8 cc of **Ingersoll Rand** No. 28 Grease through the center hole of the spindle to lubricate the gearing.
  - c. Work approximately 6 to 8 cc of **Ingersoll Rand** No. 67 Grease into the ball pockets, jaws, adjusting nut lock and shaft threads of the clutch mechanism.

4. **For Automatic Shutoff Clutch Models**, unscrew and remove the clutch attachment. Remove the Push Rod.
  - a. **For L gear ratio**, inject 4 to 6 cc of **Ingersoll Rand** No. 28 Grease through the center hole of the spindle to lubricate the gearing.
  - b. **For M, N, or Q gear ratio**, inject 6 to 8 cc of **Ingersoll Rand** No. 28 Grease through the center hole of the spindle to lubricate the gearing.
  - c. Work approximately 6 to 8 cc of **Ingersoll Rand** No. 67 Grease into the ball pockets, jaws, adjusting nut lock and shaft threads of the clutch mechanism.
  - d. Insert the Push Rod into the spindle.
5. Thread the clutch attachment onto the Gear Case and hand tighten.

### NOTICE

**This is a left-hand thread; turn counterclockwise to tighten.**

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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 vise 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 new gaskets and O-rings for replacement.

#### Disassembly of the Tool

1. Each Series 1R Air 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. Unscrew and remove the Clutch Housing Assembly (100) from the Gear Case Assembly (39).

### NOTICE

**This is a left-hand thread and should only be handtight. Turn clockwise to remove.**

3. Unscrew the Gear Case Assembly from the Motor Housing, and lift off the entire gear unit.

### NOTICE

**This is a right-hand thread; turn counterclockwise to remove.**

#### Disassembly of the Adjustable Cushion Clutch and Adjustable Shutoff Clutch

1. Withdraw the Clutch Driver Assembly and Bit Holder (125 or 128) from the Clutch Housing.
2. **For Models 1RP and 1RT ending in C1, C3, S1, S3, C9D or S9D**, grasp the Clutch Return Spring (104) near the Spring Seat Stop (114) to avoid elongating the Spring and pull the Spring from the Clutch Driver (106).  
**For Models 1RL ending in S1 or S3**, grasp the Clutch Return Spring (104) near the Spring Seat Stop (114) to avoid elongating the Spring and pull the Spring from the Clutch Driver (106).  
**For Models 1RA and 1RL ending in C1, C3 or C9D**, use a hooked tool to reach into the end of the Clutch Driver and pull the Disengaging Spring (133) from the Driver.  
**For Models 1RL, 1RP and 1RT ending in S1, S3 or S9D**, remove the Shutoff Plunger (120). Using a hooked tool to reach into the end of the Clutch Driver, hook the Plunger Return Spring (122) and pull it from the Driver.
3. Using a thin blade screwdriver, pry the Spring Seat Stop (114) adjacent to the Adjusting Nut (116) off the Clutch Driver.
4. Carefully clamp the external hex end of the Clutch Driver in copper-covered vise jaws. Using a wrench on the flats of the Adjusting Nut, unscrew the Nut.

### NOTICE

**This is a right-hand thread.**

5. Remove the Clutch Driver from the vise, and remove the Adjusting Nut, Adjusting Nut Lock (115), Thrust Bearing (112), Clutch Spring Seat (113) and Clutch Spring (105) from the Clutch Driver.
6. **For Models 1RA, 1RL and 1RP ending in C1, C3 or C9D**, use a thin blade screwdriver to pry off the remaining two Spring Seat Stops (114) from the Clutch Driver.

## NOTICE

**Place a container under the assembly before removing the retainer nearest the Clutch Ball Seat (111). Removal of this retainer allows the eleven Clutch Balls (108) and ten Jaw Bearing Balls (109) to fall from the Assembly.**

Slide the Clutch Ball Seat, Clutch Ball Spacer (110) and Clutch Jaw (107) off the Clutch Driver.

**For Models 1RL, 1RP and 1RT ending in S1, S3 or S9D,** use a thin blade screwdriver to pry off the remaining Spring Seat Stop (114) from the driver.

## NOTICE

**Place a container under the assembly before removing the Spring Seat Stop. Removal of this retainer allows the four Shutoff Plunger Balls (121) and three Clutch Cam Balls (123) to fall from the Assembly.**

Slide the Collar Return Spring (119), Shutoff Collar (118) and Clutch Ball Seat (111) off the Clutch Driver. Using a thin blade screwdriver, carefully pry off the Ball Retaining Spring (117). Dump the ten Bit Holder Bearing Balls (124) into a container. Remove the Bit Holder Assembly (125) from the Clutch Driver. Remove the Clutch Driver Seal (106A) from the groove at the front end of the Clutch Driver. Remove the Clutch Driver Spacer (106B) from Models **1RP** and **1RT** ending in **S9D**.

7. If the Clutch Housing Bushing (101 or 151) is worn, proceed as follows:

**For Models 1RA, 1RL, 1RP and 1RT ending in 9D**

- a. Unscrew and remove the Clutch Housing Cap (103) from the Clutch Housing (100).
- b. Stand the Clutch Housing on a workbench with the bit end upward.
- c. Using a hammer and a blunt rod smaller in diameter than the bushing opening, drive the rearmost Bushing out of the Housing by tapping random locations on the face of the Bushing.
- d. Using a press and supporting the front face of the Housing, press the forward Bushing out the bit end of the Housing.

**For all other Models,** press the single Clutch Housing Bushing from the Clutch Housing (100).

### Disassembly of the Direct Drive Attachment

1. Unscrew and remove the Screwdriver Housing Assembly (150).

## NOTICE

**This is a left-hand thread and should only be hand tight. Turn clockwise to remove.**

2. Using a pair of snap ring pliers, reach into the Screwdriver Housing and remove the Bit Holder Retaining Ring (153) at the Gear Case end of the Bit Holder (154). Slide the Bit Holder out of the Screwdriver Housing.
3. If the Housing Bushing (151) requires replacement, press the Bushing from the Housing toward the Gear Case end of the Housing.
4. Using a pair of snap ring pliers, remove the Bit Holder Retaining Ring near the Bit Retaining Sleeve (155).
5. Remove the Bit Retaining Sleeve from the Bit Holder.
6. Using a pointed rod, spiral the Retaining Sleeve Spring (156) from the bit end of the Bit Holder.
7. Remove the Bit Retaining Ball (152) from the Bit Holder.

### Disassembly of the Gearing

1. Using a thin blade screwdriver, work the Clamp Washer Retaining Ring (50) from the groove in the Gear Case Assembly (39) and withdraw the Motor Clamp Washer (49).
2. **For Models 1RLM and 1RLN,** tap the motor end of the Gear Case Assembly against the top of the workbench to remove the Gear Head (47), Gear Head Planet Gears (48), Rotor Pinion (45) and Gear Head Spacer (46).
3. Using a pair of snap ring pliers, remove the Spindle Retaining Ring (44) from the groove in the front of the Spindle (43).
4. Lightly tap or press the Spindle and Spindle Planet Gears (42) from the Gear Case Assembly.
5. Using a pair of snap ring pliers, remove the Spindle Bearing Retainer (41) from the groove in the front of the Gear Case.
6. Using a sleeve that contacts the outer ring of the bearing, press the Spindle Bearing (40) from the front of the Gear Case.

### Disassembly of the Motor

1. Grasp the splined end of the Rotor (29) and pull the motor from the Motor Housing (1).
2. Withdraw the Rear End Plate Gasket (38) from the bottom of the housing bore.
3. While grasping the Cylinder (36) in one hand, lightly tap on the splined end of the Rotor to drive the Rotor from the bore of the Front Rotor Bearing (32), thus freeing the Front End Plate (30) and Bearing.
4. Using snap ring pliers remove the Front Rotor Bearing Retainer (34) and remove the Front Rotor Bearing from the Front End Plate.
5. Slide the Cylinder off the Rotor, and withdraw the Vanes (35) from the vane slots.
6. Remove the Rear Rotor Bearing Retainer (33) from the groove in the hub of the Rotor.
7. Support the Rear End Plate (31) as close to the rotor body as possible on the table of an arbor press, and press the Rotor from the Rear Rotor Bearing.

### Disassembly of the Reverse Valve and Throttle Mechanism

1. Using a 1/16" Allen Wrench, remove the Retainer Set Screw (5) from the Reverse Valve (2).
2. With the Reverse Valve facing downward, lightly tap the Motor Housing on the workbench until the Lock Pin Retainer (6) falls out of the Reverse Valve.
3. Hold the Motor Housing horizontally with the Reverse Valve on your left as you face the rear of the tool. With slight inward pressure on the Reverse Valve tap the Motor Housing on a workbench until the Valve Lock Pin (4) drops into the opening vacated by the Lock Pin Retainer.
4. Remove the Reverse Valve along with the Reverse Valve Seal (2A), Reverse Valve Spring (3) and Valve Lock Pin from the Motor Housing.
5. **For 1RA and 1RT Models,** lightly grasp the handle of the Motor Housing (1) in copper-covered vise jaws so that the Inlet Bushing (26) is upward. Unscrew the Inlet Bushing and remove the Inlet Bushing Spacer (27), Muffler Assembly (18), Muffler Element (17), Inlet Screen (25), Throttle Valve Spring (7), Throttle Valve (8) and Trigger Assembly (23). Remove the Trigger Pin Seal (23A) from the Trigger Assembly. If the Valve Seat (9) needs to be replaced, use a stiff wire hook and insert it through the Valve Seat and Valve Seat Support (10) to grasp the underside of the Valve Seat Support. Withdraw the Valve Seat and Valve Seat Support from the handle.  
**For 1RT Models,** use an adjustable wrench on the flats of the Back Cap Assembly (24) to unscrew and remove the Back Cap Assembly from the Motor Housing.

 **CAUTION**

**Place a container under the Assembly to catch the Throttle Ball Spring (14) and Throttle Ball (15) when removing the Back Cap Assembly.**

Remove the Push Rod (135) from the Motor Housing. If removal of the Throttle Ball Seat (16) is necessary, use a stiff wire hook inserted through the Seat and withdraw it from the Motor Housing.

**For 1RL Models ending in C1, C3, 9D or D1,** remove the Throttle Valve Cap (12), Throttle Valve Spring (7), Throttle Valve Ball (13) and Throttle Valve Plunger (11) from the Motor Housing.

 **WARNING**

**The Throttle Valve Cap is under pressure from the Throttle Valve Spring and care must be exercised when removing the Throttle Valve Cap.**

Using an adjustable wrench, unscrew the Inlet Bushing Assembly (28). Remove the Exhaust Deflector (20) from the Motor Housing. Insert the eraser end of a wooden pencil into the small end of the Inlet Bushing Assembly and push the Inlet Screen (28A) out through the large end of the Inlet Bushing. Work the four Muffler Elements (17) out of the Exhaust Deflector and remove the Exhaust Deflector Seal (18B).

The Throttle Lever is attached to the Exhaust Deflector with two Throttle Lever Pins (25) which are two-piece rivets. Lightly grasp the Exhaust Deflector in copper-covered vise jaws taking care not to distort the Deflector. Using a pin punch and hammer carefully drive the pin in the center of the rivet inward until it clears the rivet. Repeat this procedure to remove the other pin. Working inside the Exhaust Deflector and using needle nose pliers, squeeze the ends of rivets and push the rivets through the opposite side of the Exhaust Deflector. Remove the Throttle Lever (22).

**For 1RL Models ending in S1 or S3,** remove the Push Rod (135). Remove the Throttle Valve Cap (12) Throttle Valve Spring (7), Throttle Valve Ball (13) and Throttle Valve Plunger (11) from the Throttle Valve Housing (6A).

 **WARNING**

**The Throttle Valve Cap is under pressure from the Throttle Valve Spring and care must be exercised when removing the Throttle Valve Cap.**

## 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. 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 a film of 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 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.

Using an adjustable wrench, unscrew the Inlet Bushing Assembly (28). Remove the Exhaust Deflector (20) from the Throttle Valve Housing. Insert the eraser end of a wooden pencil into the small end of the Inlet Bushing Assembly and push the Inlet Screen (28A) out through the large end of the Inlet Bushing. Work the four Muffler Elements (17) out of the Exhaust Deflector and remove the Exhaust Deflector Seal (18B).

The Throttle Lever is attached to the Exhaust Deflector with two Throttle Lever Pins (25) which are two-piece rivets. Lightly grasp the Exhaust Deflector in copper-covered vise jaws taking care not to distort the Deflector. Using a pin punch and hammer, carefully drive the pin in the center of the rivet inward until it clears the rivet. Repeat this procedure to remove the other pin. Working inside the Exhaust Deflector and using needle nose pliers, squeeze the ends of rivets and push the rivets through the opposite side of the Exhaust Deflector. Remove the Throttle Lever (22). Using a 5/64" hex wrench, loosen and remove the Throttle Valve Housing Cap Screws (13E) and Lock Washers (13F). Remove the Throttle Valve Housing and the Throttle Valve Housing Seal (13D) from the Motor Housing (1). Remove the Throttle Valve Housing Adapter Seal (13B) from the Throttle Valve Housing Adapter (13A). Unscrew and remove the Throttle Valve Housing Adapter, Throttle Ball Spring (13H), Throttle Ball (13G) and the Muffler Element (17).

**For 1RP Models,** use an adjustable wrench to unscrew and remove the Inlet Bushing Assembly (28).

 **CAUTION**

**Place a container under the Exhaust Deflector (19) to catch the Throttle Ball Spring (14) and Throttle Ball (15) when removing the Inlet Bushing Assembly (28).**

Remove the Push Rod (135). If removal of the Throttle Ball Seat (16) is necessary, use a stiff wire hook inserted through the Throttle Ball Seat and withdraw it from the Motor Housing. Insert the eraser end of a wooden pencil into the small end of the Inlet Bushing Assembly and push the Inlet Screen (28A) out through the large end of the Inlet Bushing. Work the four Muffler Elements (17) out of the Exhaust Deflector.

### Assembly of the Reverse Valve and Throttle Mechanism

1. Coat the Reverse Valve Seal (2A) with O-ring lubricant and install it in the groove between the head and lock pin hole on the body of the Reverse Valve (2).
2. Insert the Reverse Valve Spring (3) into the plain end of the Reverse Valve.
3. Insert the Valve Lock Pin (4) into the small hole in the side of the Reverse Valve.
4. Start the Reverse Valve into the bushing, aligning the Valve Lock Pin with the timing notch on the bushing.
5. Holding the tool with the lock pin hole in the Reverse Valve facing downward, push the Reverse Valve into the bushing against the compression of the Reverse Valve Spring.
6. Using a small diameter rod inserted into the end of the Reverse Valve and while maintaining valve pressure on the Spring, use the rod to force the Valve Lock Pin into the slot in the wall of the bushing.
7. After the Valve Lock Pin has engaged the slot in the bushing, slowly release the Reverse Valve and it will stay in position.
8. Insert the Lock Pin Retainer (6) in the tapped end of the Reverse Valve and install the Retainer Set Screw (5).

### For 1RA and 1RT Models

- a. Lightly grasp the handle of the Motor Housing (1) in copper-covered vise jaws so that the inlet end of the Housing is upward.
- b. Install the Throttle Valve Seat Support (10) by pushing it into place with a 1/2" (13 mm) diameter dowel.
- c. Follow this with the Throttle Valve Seat (9).
- d. Apply O-ring lubricant to the Trigger Pin Seal (23A) and install it in the groove on the trigger stem. Insert the Trigger Assembly (23) into the trigger bushing.
- e. Installation of the Throttle Valve (8) is sometimes a bit tricky due to the smallness of the Valve and the depth of the bore in which it is located. The difficult part is in holding the Valve while inserting the long end of the valve stem through the hole in the trigger stem. Although the Valve can be held with a push-button mechanical drafting pencil or a wooden dowel, one of the easiest ways to hold it is by using a common wooden pencil with rubber eraser. Insert the short end of the valve stem into the rubber eraser full depth, then back it out far enough so that the Valve is just nicely supported. Insert the Valve into the bore of the handle so that the long end of the stem enters the hole in the trigger stem. Pull outward on the Trigger to hold the Valve while removing the pencil.
- f. Place the Inlet Screen (25), closed end first, inside the large end coil of the Throttle Valve Spring (7).
- g. Insert the Throttle Valve Spring and Screen, small coil first, into the handle so that the Spring encircles the end of the Throttle Valve.
- h. Work the Muffler Element (17) into the exhaust cavity in the handle of the Motor Housing until the trailing end of the Muffler Element is approximately 1/4" (6 mm) into the Housing.
- i. Lubricate the Muffler O-ring (18A) with O-ring lubricant and place it over the exhaust port of the Muffler.
- j. Place the Muffler Assembly (18) on the face of the handle so that the exhaust port extends into the handle.
- k. Slide the Inlet Bushing Spacer (27) over the threaded end of the Inlet Bushing (26), and install the Inlet Bushing in the handle. Tighten it to a minimum of 26 ft-lb (35 N m) of torque.

### NOTICE

#### The Inlet Bushing must securely clamp the Exhaust Deflector.

##### For 1RT Models only

- a. Lubricate the Back Cap O-ring (24A) with O-ring lubricant and place it into the recess of the back cap.
- b. If the Throttle Ball Seat (16) was removed, install a new Seat using a 5/16" (8 mm) diameter dowel to push it into place.
- c. Insert the Push Rod (135) through the Throttle Ball Seat and into the Motor Housing (1) followed by the Throttle Ball (15) and Throttle Ball Spring (14). If a new Push Rod is being installed, proceed as follows:
9. Assemble the complete Clutch Assembly, Gear Case Assembly and the Motor Housing Assembly without the Back Cap Assembly (24), Throttle Ball (15) and Throttle Ball Spring (14).
10. While pushing the Clutch Assembly against the Spindle (43), insert the new Push Rod through the Throttle Ball Seat (16) in the rear of the Motor Housing until it contacts the Shutoff Plunger (120).

### NOTICE

#### Exert a slight pressure on the Push Rod to make certain the Shutoff Plunger contacts the Shutoff Plunger Balls (121).

11. The length of the Push Rod must be trimmed so that 0.04" to 0.09" (1.0 mm to 2.3 mm) protrudes above the Throttle Ball Seat. There are numerous ways to determine how much material must be trimmed from the Push Rod and experience will dictate the best method to use. Following is one method requiring only a narrow -depth scale. If the Push Rod extends beyond the Housing, measure the distance from the end of the Push Rod to the face of the Throttle Ball Seat. Subtract 5/64" (2 mm) from that distance and cut the remaining difference from the end of the Push Rod. If the Push Rod does not extend beyond the Housing, measure the distance from the end of the Housing to the face of the Throttle Ball Seat. Record that distance. Measure the distance from the end of the Push Rod to the end of the Housing and add 5/64" (2 mm) to that distance. Subtract the added distance from the first measurement and trim the remaining difference from the end of the Push Rod.
12. Insert the Push Rod through the Throttle Ball Seat and into the Motor Housing followed by the Throttle Ball and Throttle Ball Spring. Install the Spring with the small end against the Throttle Ball.
13. Retain these parts with the Back Cap Assembly (24) and tighten the Cap between 7 and 10 ft-lb (9 and 13 Nm) torque.

### CAUTION

#### Do not over tighten the Cap but do not allow a gap to exist between the Back Cap and Motor Housing.

#### For 1RL Models ending in C1, C3, 9D or D1

- a. Position the Throttle Lever (22) on the Exhaust Deflector with the Lever covering the timing notch at the front end of the Deflector.
- b. Insert the two Throttle Lever Pins (21) through the Lever and into the Exhaust Deflector. Using copper-covered vise jaws as a press, press the pins in the center of the Throttle Lever Pins flush with the head of the rivets.

### CAUTION

#### Do not apply a force strong enough to distort the Exhaust Deflector.

- c. Work four new Muffler Elements (17) into the Exhaust Deflector (20).
- d. Center the Inlet Screen (28A) over the air line end of the Inlet Bushing Assembly (28) and, using the eraser end of a wooden pencil, push the Screen into the Bushing until it bottoms on the internal shoulder.
- e. Slide the Exhaust Deflector Seal (18B) onto the rear of the Motor Housing (1). Place the Exhaust Deflector on the rear of the Motor Housing, aligning the Notch in the Deflector with the timing pin in the Housing. Tighten the Inlet Bushing Assembly to a minimum of 15 ft-lb (20 Nm) torque.

### NOTICE

#### The Inlet Bushing must securely clamp the Exhaust Deflector.

- f. With the Throttle Lever downward, insert the Throttle Valve Plunger (11), Throttle Valve Ball (13) and Throttle Valve Spring (7) into the Motor Housing.
- g. Position the Throttle Valve Cap (12) on the Throttle Valve Spring. Screw the Valve Cap into the Housing until the Cap is within approximately two threads of being flush with the Housing. Apply a light, uniform coat of a thread locking compound to the remaining two threads. Tighten the Valve Cap securely and place the Housing on a workbench with the Valve Cap facing downward. Allow the Loctite to cure approximately five minutes.

#### For 1RL Models ending in S1 or S3

- a. Place the Throttle Valve Housing Seal (13D) on the smaller shoulder of the Motor Housing (1). To hold the Seal in position, lightly coat both the Seal and the shoulder with **Ingersoll Rand** No. 28 Grease. Install the Throttle Ball (13G) and the Throttle Ball Spring (13H).
- b. Place one new Muffler Element (17) on the threaded side of the Throttle Valve Housing Adapter (13A) and thread the Adapter into the Motor Housing until the adapter flange contacts the Housing. Center the notch or depression on the Adapter with the housing alignment pin by backing out the Adapter 1/4 turn maximum, if necessary.
- c. Place the Throttle Valve Housing Adapter Seal (13B) on the Adapter.
- d. Place the Throttle Valve Housing over the Adapter and onto the rear of the Motor Housing, making sure that the notch in the Throttle Valve Housing is aligned with the alignment pin on the Motor Housing.
- e. Secure the Throttle Valve Housing with the two Throttle Valve Housing Cap Screws (13E) and Lock Washers (13F). Tighten the Screws between 8 and 10 in-lb (0.90 and 1.13 Nm) torque. If the Cap Screws cannot be started into the Adapter, then the Adapter is not in proper alignment with the Housing. Refer to Step "b".
- f. Work three new Muffler Elements into the Exhaust Deflector (20) to a point beyond the two throttle lever pin holes.
- g. Position the Throttle Lever (22) on the Exhaust Deflector with the Lever covering the timing notch at the front of the Deflector. Insert the Two Throttle Lever Pins (21) through the Lever and into the Exhaust Deflector. Using pliers, press the pins in the center of the Throttle Lever Pins flush with the head of the rivet.

#### CAUTION

#### Do not apply a force strong enough to distort the Exhaust Deflector.

- h. Center a new Inlet Screen (28A) over the air line end of the Inlet Bushing Assembly (28) and, using the eraser end of a wooden pencil, push the Screen into the Bushing until it bottoms on the internal shoulder.
- i. Slide the Exhaust Deflector Seal (18B) onto the rear of the Throttle Valve Housing. Place the Exhaust Deflector on the rear of the Throttle Valve Housing, aligning the notch in the Deflector with the alignment pin in the Housing. Tighten the Inlet Bushing Assembly to a minimum of 15 ft-lb (20 Nm) torque.

#### NOTICE

#### The Inlet Bushing must securely clamp the Exhaust Deflector.

- j. With the Throttle Lever downward, insert the Throttle Valve Plunger (11), Throttle Valve Ball (13) and Throttle Valve Spring (7) into the Throttle Valve Housing.
- k. Position the Throttle Valve Cap (12) on the Throttle Valve Spring. Screw the Valve Cap into the Housing until the Cap is within approximately two threads of being flush with the Housing. Apply a light, uniform coat of thread locking compound to the remaining two threads. Tighten the Valve Cap securely and place the Housing on a workbench with the Valve Cap facing downward. Allow the Loctite to cure approximately five minutes.

#### For 1RP Models only

- a. Work four new Muffler Elements (17) as far as possible into the Exhaust Deflector (20).
- b. Center the Inlet Screen (28A) over the air line end of the Inlet Bushing Assembly (28) and, using the eraser end of a wooden pencil, push the Screen into the Bushing until it bottoms on the Internal shoulder.

- c. If the Throttle Ball Seat (16) was removed, install a new Seat using a 5/16" (8 mm) diameter dowel to push it into place.
- d. Slide the Exhaust Deflector Seal (18B) onto the rear of the Motor Housing (1). Place the Exhaust Deflector (20) on the rear of the Motor Housing.
- e. Insert the Push Rod (135) through the Throttle Ball Seat and into the Motor Housing followed by the Throttle Ball (15) and Throttle Ball Spring (14). Install the Spring with the small end against the Throttle Ball.

#### NOTICE

#### If a new Push Rod is being installed, refer to the section above for 1RT Models for the proper installation procedure. For 1RP Models, the Inlet Bushing Assembly replaces the Back Cap Assembly of the 1RT Models.

- f. Secure the throttle parts and the Exhaust Deflector with the Inlet Bushing Assembly. Tighten the Bushing to a minimum of 15 ft-lb (20 Nm) of torque.

#### NOTICE

#### The Inlet Bushing must securely clamp the Exhaust Deflector.

#### Assembly of the Motor

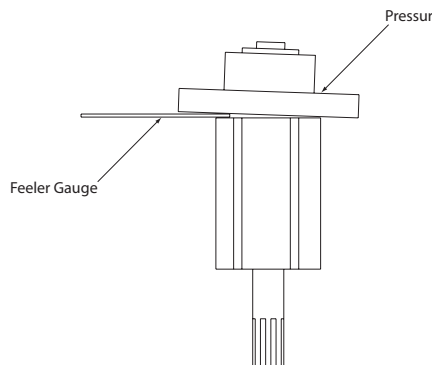
1. Place the Rear End Plate (31) on the short, unsplined shaft of the Rotor (29) with the counterbore away from the body of the Rotor.
2. Using a sleeve that contacts the inner ring of the Rotor Bearing (32), press the Bearing onto the shaft until the Rear End Plate just contacts the rotor body.
3. The clearance between the Rear End Plate and Rotor is critical. **While pressing down** with your finger the outer edge of the End Plate on the Bearing side, insert a .002" (.05 mm) feeler gauge between the face of the Rotor and End Plate directly opposite the point where pressure is applied.

#### NOTICE

#### This measurement must be made at the outside diameter of the rotor body.

Supporting the End Plate, lightly tap the shaft with a plastic hammer to increase the space. Press the Bearing farther onto the shaft if the space is too wide. When the proper clearance is obtained, install the Rear Rotor Bearing Retainer (33) on the shaft.

#### Measurement of Rear End Clearance



(Dwg. TPD789)

4. Place the Rotor, with the splined end up, in a block which has clearance for the Rotor Bearing and supports the End Plate.
5. Wipe each Vane (35) with a light film of **Ingersoll Rand** No. 10 Oil and place a Vane in each slot in the Rotor.

6. Note that the Cylinder (36) has a notch in one end. Place the Cylinder, notched end up, over the Rotor and against the Rear End Plate, aligning the dowel hole in the Cylinder with the U-shaped notch in the rim of the End Plate. The notch in the end of the Cylinder should be against the Front End Plate.
7. Install the Front Rotor Bearing in the Front End Plate (30) and retain it with the Front Rotor Bearing Retainer (34).
8. Using a sleeve that contacts the inner ring of the bearing, press the assembled Front End Plate, flat side first, onto the splined end of the Rotor until the End Plate just contacts the Cylinder.
9. Install the Rear End Plate Gasket (38) in the Motor Housing, aligning the small notch in the Gasket with the dowel pin hole in the Housing.
10. Insert a thin, rigid wire into the dowel pin hole at the bottom of the motor recess in the Motor Housing. Grasping the assembled motor by the spline on the Rotor and with the dowel pin holes of the Front End Plate and Cylinder aligned with the U-shaped notch in the Rear End Plate, install the assembled motor in the Motor Housing. Maintain alignment between the motor and Motor Housing by passing the aligned dowel holes in the assembled motor over the wire positioned in the Motor Housing. Withdraw the wire and install the Cylinder Dowel (37), making certain the Cylinder Dowel is flush with or below the Front End Plate.
11. **For 1RL Models ending in S1 or S3**, insert the Pushrod (135) through the center of the Rotor. If a new Pushrod is being installed in these models. Proceed as follows:
  - a. Assemble the complete Clutch Assembly, Gear Case Assembly and the Motor Housing Assembly without the assembled Throttle Valve Housing (6A), Exhaust Deflector Assembly, Throttle Valve Housing Adapter (13A), Throttle Ball Spring (13H), Muffler Element (17) and Throttle Ball (13G).
  - b. Insert the new Push Rod through the central opening where the Throttle Ball seats at the rear of the Motor Housing until it contacts the Shutoff Plunger (120).

#### NOTICE

**Exert a slight pressure on the Push Rod to make certain the Shutoff Plunger contacts the Shutoff Plunger Balls (121).**

- c. The length of the Push Rod must be trimmed so that 0.04 to 0.09" (1.0 mm to 2.3 mm) protrudes above the seating surface for the Throttle Ball. There are numerous ways to determine how much material must be trimmed from the Push Rod and experience will dictate the best method to use. Following is one method requiring only a narrow-depth scale. If the Push Rod extends beyond the Housing, measure the distance from the end of the Push Rod to the face of the surface where the Throttle Ball seats. Subtract 5/64" (2 mm) from that distance and cut the remaining difference from the end of the Push Rod. If the Push Rod does not extend beyond the Housing, measure the distance from the end of the Housing to the surface where the Throttle Ball seats. Record that distance. Measure the distance from the end of the Push Rod to the end of the Housing and add 5/64" (2mm) to that distance. Subtract the added distance from the first measurement and trim the remaining difference from the end of the Push Rod.

#### Assembly of the Gearing

1. Set the Gear Case (39) on the table of an arbor press with the notched end upward.
2. Using a sleeve that will contact the outer ring of the bearing, press the Spindle Bearing (40), open side first, into the bearing recess until it seats.
3. Install the Spindle Bearing Retainer (41) in the groove adjacent to the Bearing.
4. Work some **Ingersoll Rand** No. 28 Grease into the teeth of the Spindle Planet Gears (42) and onto the planet gear shafts on the Spindle (43).
5. Slide the Spindle into the Gear Case so that the spindle shaft passes through the bore of the Spindle Bearing.
6. Install the Spindle Retaining Ring (44) in the groove on the spindle shaft.
7. Slide the Spindle Planet Gears onto the planet gear shafts, making certain the teeth of the Gears mesh with the teeth of the Gear Case.
8. **For M or N Gear Ratio**, coat the Gear Head Spacer (46) with grease and place it in the Gear Case against the Spindle Planet Gears. Work some grease into the teeth of the Gear Head Planet Gears (48) and onto the planet gear shafts on the Gear Head (47). Slide the Gear Head into the Gear case so that the teeth on the gear head shaft mesh with the Spindle Planet Gears. Slide the Gear Head Planet Gears onto the planet gear shafts making certain the teeth of the Gears mesh with the teeth of the Gear Case. Work some grease into the teeth of the Rotor Pinion (45) and place the Rotor Pinion in the Gear Head so that it meshes with the Gear Head Planet Gears.
9. Place the Motor Clamp Washer (49) in the Gear Case against the internal gear. Install the Clamp Washer Retaining Ring (50). Thread the Gear Case with its assembled gearing into the Motor Housing, and tighten it between 15 and 18 ft-lb (20 and 25 Nm) torque.

#### NOTICE

**This is a right-hand thread; turn clockwise to tighten.**

#### Assembly of the Adjustable Cushion Clutch and Adjustable Shutoff Clutch

1. If the Clutch Housing Bushing was removed, proceed as follows:
  - For Models 1RA and 1RL ending in D1**, standing the Clutch Housing Assembly (150) on an arbor press table with the internal thread upward, press the Clutch Housing Bushing into the Clutch Housing until the shoulder of the Bushing seats.
  - For Models 1RA, 1RL, 1RP and 1RT ending in C1, C3, S1 or S3**, stand the Clutch Housing Assembly (100) on an arbor press table with the internal thread upward. Using a step arbor that pilots the inside of the Bushing with the large bore of the Clutch Housing. Press the Clutch Housing Bushing (101) into the Clutch Housing to a depth between 2.564" and 2.569" (65.12 and 65.25 mm) below the top face. The bore of the Bushing must be parallel with the large bore of the Housing within .0012" (0.03 mm).

#### For Models 1RA, 1RL, 1RP and 1RT ending in S9D or C9D

- a. With the Clutch Housing Cap (103) removed, stand the Clutch Housing Assembly (100) on an arbor press table with the internal thread upward. Press one of the clutch housing bushings into the Clutch Housing until the shoulder of the bushing seats.
- b. Invert the Housing and press the remaining bushing into the front end of the Housing until the shoulder of the bushing seats.
- c. Thread the Clutch Housing Cap (103) onto the Housing.

#### For Models 1RA, 1RL and 1RP ending in C1, C3 or C9D

- a. Apply a coat of the recommended grease to the ten Jaw Bearing Balls (109), eleven Clutch Balls (108), the internal hex of the Clutch Driver (106) and the Thrust Bearing (112).
- b. Holding the Clutch Driver (106) in one hand with the external hex end down, slide the Clutch Jaw onto the external hex end of the Driver. Move the Jaw along the Driver to a point near the front shoulder of the Driver where the ten Jaw Bearing Balls can be installed in the Jaw.
- c. Install the Balls and pull the Jaw toward the shoulder of the Driver to capture the Balls.
- d. While maintaining pressure against the Clutch Jaw, invert the Clutch Driver and install the Clutch Ball Spacer (110) on the Driver.
- e. Place the eleven Clutch Balls in the openings of the Clutch Ball Spacer and install the Clutch Ball Seat (111) with the recess on the face of the Seat toward the Clutch Balls.

- f. Lock all the components in place by installing two of the Spring Seat Stops (114) in the grooves on the Driver nearest the Clutch Jaw.

**For Models 1RL, 1RP and 1RT ending in S1, S3 or S9D**

- a. Apply some of the recommended grease to the groove at the front end of the Clutch Driver (106) and install the Clutch Driver Seal (106A) in the groove.
  - b. Install the Clutch Driver Spacer (106B) into the Bit Holder Assembly (125) or Bit Holder (106).
  - c. Put some of the recommended grease into the opening in the front end of the Clutch Driver (106) and slide the Bit Holder Assembly or Bit Holder onto the flanged end of the Clutch Driver.
  - d. Apply a coat of the recommended grease to each of the ten Bit Holder Bearing Balls (124) and insert the Balls into the bit holder bearing hole.
  - e. Install the Ball Retaining Ring (117) into the groove of the Bit Holder Assembly or Bit Holder to retain the Bit Holder Bearing Balls.
  - f. Apply a coat of the recommended grease to the cam surface, clutch ball pockets, and shaft of the Clutch Driver.
  - g. Holding the Bit Holder, Clutch Driver upward, insert each of the three Clutch Cam Balls (123) into the three sections of the Bit Holder Assembly.
  - h. Install the Clutch Ball Seat (111) over the end of the driver with the large circular groove toward the Clutch Cam Balls.
  - i. Insert the four Shutoff Plunger Balls (121) into the hole on the side of the Clutch Driver.
  - j. Install the Shutoff Collar (118), relieved end first, over the end of the Clutch Driver until it contacts the face of the Clutch Spring Seat (113).
  - k. Slide the Collar Return Spring (119), large end first, over the Clutch Driver until it contacts the Shutoff Collar and retain all components with the Spring Seat Stop (114).
  - l. Apply a light coat of the recommended grease to the Shutoff Plunger (120) and insert the Plunger Return Spring (122) and Shutoff Plunger into the hex of the Clutch Driver.
2. Position the Clutch Spring (105) on the hub of the Clutch Ball Seat and install the Clutch Spring Seat (113) on the Clutch Driver with the hub inside the Clutch Spring.
  3. Lubricate and install the Thrust Bearing (112) and the Adjusting Nut Lock (115), with the flat side of the Lock toward the Bearing, on the Clutch Driver. Lubricate the side of the Adjusting Nut Lock that is not flat.
  4. Thread the Adjusting Nut (116) onto the Clutch Driver, with the smooth face away from the Nut Lock, until the Nut passes the remaining Spring Seat Stop groove in the Clutch Driver.
  5. Install the Spring Seat Stop (114) into the groove adjacent to the Adjusting Nut.

**For Models 1RA and 1RL ending in C1, C3 or C9D**, insert the Disengaging Spring (133) into the front end of the Clutch Driver. Inject a small quantity of the recommended grease into the opening in the bit end of the Clutch Driver and slide the pilot end of the Bit Holder Assembly (128) into the Clutch Driver.

**For Models 1RL, 1RP and 1RT ending in C1, C3, S1, S3, C9D or S9D**, insert the Clutch Return (104), small end first, over the hex end of the Clutch Driver until it stops against the Spring Seat Stop (114).

**For Models 1RP ending in C1, C3 or C9D**, inject a small quantity of the recommended grease into the opening in the bit end of the Clutch Driver and slide the pilot end of the Bit Holder Assembly (128) or (125) into the Clutch Driver.

6. Apply a light coat of the recommended grease to the hex end of the Clutch Driver and to the bearing surface of the Bit Holder.
7. Slide the assembled Clutch into the Clutch Housing (100).
8. Screw the Clutch Housing Assembly onto the Gear Case securely.

**NOTICE**

**The clutch should only be hand tight. It has a left-hand thread. Turn counterclockwise to tighten.**

**Assembly of the Direct Drive Attachment**

1. If the Housing Bushing (151) was removed, press the new Bushing into the Screwdriver Housing (150) until the shoulder of the Bushing is against the face inside the Housing.
2. Install one of the Bit Holder Retaining Rings (153) in the groove at the Gear Case end of the Bit Holder (154).
3. Apply a light coat of the recommended grease to the surface of the Bit Holder that fits into the Bushing and slide the Bit Holder into the Bushing until the Bit Holder Retaining Ring stops against the shoulder of the Bushing.
4. Install the remaining Bit Holder Retaining Ring in the groove nearest the bit end of the Bit Holder.
5. Apply some of the recommended grease to the Bit Retaining Ball (152) and install the Ball in the hole in the Bit Holder.
6. Slide the Bit Retaining Sleeve (155) onto the Bit Holder until it stops against the Bit Holder Retaining Ring at the bit end of the Bit Holder.
7. Install the Retaining Sleeve Spring (156), large end first, onto the Bit Holder and into the Bit Retaining Sleeve. Continue pushing until the small end of the Spring is captured by the groove at the bit end of the Bit Holder.
8. Thread the Screwdriver Housing Attachment onto the Gear Case Assembly until it is hand tight.

**NOTICE**

**This is a left-hand thread. Turn counterclockwise to tighten.**



## 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 Air Strainer Screen or Inlet Screen	Clean the Air Strainer or screen in a clean, suitable, cleaning solution. If the Screen cannot be cleaned, replace it.
	Clogged Muffler or Exhaust Silencer	Clean the Muffler Element in a clean, suitable, cleaning solution. If it cannot be cleaned, replace it.
	Worn or broken Vanes	Replace the <b>complete</b> 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 build-up	Clean the Motor Unit parts and lubricate as instructed.
Leaky Throttle Valve	Worn Throttle Valve and/or Throttle Valve Seat	Install a new Throttle Valve and/or a Throttle Valve Seat.
	Dirt accumulation on Throttle Valve and/or Throttle Valve Seat	Pour about 3 cc of a clean, suitable, cleaning solution in the air inlet and operate the tool Valve for about 30 seconds. <b>Immediately</b> pour 3 cc the recommended oil in the air inlet and operate the tool for 30 seconds to lubricate all the cleaned parts.
Inconsistent disengagement of Adjustable Clutch	Improper lubrication	Remove Adjustable Clutch mechanism and examine 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 ratches	Improper Clutch adjustment or improper tool ratio for application	Check Clutch Adjustment and review tool performance vs. requirements.
	Low air pressure at the inlet	Check the air supply. For top performance, the air pressure must be 90 psig (6.2 psig/620 kPa) at the inlet.
	Insufficient grease	Lubricate the Clutch as instructed.

### Related Documentation

For additional information refer to:

Product Safety Information Manual 04585006.

Product Information Manual 80167265.

Parts Information Manual 16574550.

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

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**Notes:**

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