



16575250
Edition 2
December 2013

Reversible Angle Screwdrivers and Angle Wrenches

Series 1RL

Maintenance Information



Save These Instructions

 **Ingersoll Rand**[®]

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).

Positioning of Throttle Lever on Models with Automatic Shutoff Clutch

WARNING

Disconnect the air supply from the tool before proceeding.

To change the position of the Throttle Lever in relationship to the Reverse Valve, proceed as follows:

1. Secure the tool in leather-covered or copper-covered vise jaws using the flats on the Throttle Valve Housing.
2. Remove the Inlet Bushing Assembly and Exhaust Deflector. Be careful not to lose or damage the Exhaust Deflector Seal or Throttle Valve Plunger.
3. Before proceeding, change position of the tool in the vise so that it is held by the flats on the Motor Housing. Using a 5/64" hex wrench, loosen the Throttle Valve Housing Cap Screws until they can be disengaged from the Throttle Valve Housing Adapter. It is not necessary to remove the Screws from the Throttle Valve Housing.
4. Lift the Throttle Valve Housing enough to clear the Valve Housing Alignment Pin and rotate the Throttle Valve Housing to the desired position, making sure that the notch in the Throttle Valve Housing is aligned with the Valve Housing Alignment Pin.

NOTICE

Before tightening the Throttle Valve Housing Cap Screws, make sure that the Throttle Valve Housing Seal is in the proper position on the smaller shoulder of the Motor Housing and that it has not been damaged.

5. If it is necessary to replace or reposition the Throttle Valve Housing Seal, lightly coat both the Seal and the smaller shoulder of the Motor Housing with **Ingersoll Rand** No. 28 Grease. The grease will hold the Seal in position while installing the Throttle Valve Housing.
6. Tighten the Throttle Valve Housing Cap Screws to 8 to 10 in-lb (0.90 to 1.13 Nm) torque.
7. Before proceeding, change the position of the tool in the vise using the flats on the Throttle Valve Housing.

NOTICE

Before installing the Exhaust Deflector, make sure that the Exhaust Deflector Seal has not been damaged and that it is in the proper position on the smaller shoulder of the Throttle Valve Housing.

8. If it is necessary to replace or reposition the Exhaust Deflector Seal, lightly coat both the Seal and the smaller shoulder of the Throttle Valve Housing with **Ingersoll Rand** No. 28 Grease. The grease will hold the Seal in position while installing the Exhaust Deflector.
 9. Carefully slide the Exhaust Deflector into the proper position making sure that the slot in the Exhaust Deflector is aligned with the Exhaust Deflector Alignment Pin.
 10. Hold the Exhaust Deflector firmly in position while installing the Inlet Bushing Assembly. Tighten to 15 ft-lb (20 Nm) torque. The Inlet Bushing must securely clamp the Exhaust Deflector.
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Lubrication

Each time a Series 1RL-Angle Screwdrivers and Wrenches are disassembled for maintenance, repair or replacement of parts, lubricate the tool as follows:

1. Inject 2 to 4 cc of **Ingersoll Rand** No.67 Grease into Angle Head Grease Fitting.
 2. Use 4 to 6 cc of **Ingersoll Rand** No. 67 Grease in the L Ratio gear trains.
 3. Use 4 to 6 cc of **Ingersoll Rand** No. 67 Grease in the M, N, O and Q Ratio gear trains.
 4. Use **Ingersoll Rand** No. 67 Grease to lightly coat the hex bore of the Bevel Pinion Driver and the portion of the Bevel Pinion Driver that fits into the Clutch Housing Bushing. Inject approximately 2 cc of **Ingersoll Rand** No. 67 Grease into the Thrust Bearings and the Clutch Balls.
 5. Work some **Ingersoll Rand** No. 67 Grease around the Clutch Cam Balls, the cam, Clutch Ball Seat, and the Thrust Bearings. Remove the Ball Retaining Ring. Work some grease into the hole made by removing one of the Bevel Pinion Bearing Balls.
 6. Inject approximately 2 to 3 cc of **Ingersoll Rand** No. 10 Oil into the air inlet before attaching the air hose.
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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 1RL Angle Screwdriver and Series 1RL Angle Wrench with model number ending in C3, S3, C5 or S5 is comprised of four modules - a motor housing and motor module, a gear module, an adjustable clutch module (cushion or shutoff) and an angle attachment. Each Series 1RL Angle Wrench with model number ending in D5 (direct drive) is comprised of three modules - a motor housing and motor module, a gear module and an angle attachment. These tools can be disassembled 16575250_ed1 EN-2 EN for repairs to each module without disturbing the other modules.
2. Clamp the Clutch Housing Assembly (51) in leathercovered or copper-covered vise jaws.

NOTICE

The Coupling Nut (108) has left-hand threads.

3. Unscrew the Coupling Nut from the Clutch Housing Assembly and lift off the entire angle attachment.

NOTICE

The Adjustable Clutch Assembly has left-hand threads.

4. Unscrew and remove the Adjustable Clutch Assembly from the Gear Case (39). For models with Automatic Shutoff, remove the Push Rod (78).

NOTICE

The Gear Case has left-hand threads.

5. Unscrew and remove the Gear Case from the Motor Housing (1).

Disassembly of the Angle Attachment

For 3RL23 and 3RL25 Angle Attachments

NOTICE

The Angle Housing Cap (113) has left-hand threads.

1. Using the 141A12-26 Housing Cap Wrench, unscrew the Angle Housing Cap.
2. Withdraw the Spindle Assembly (114 or 116) from the Angle Housing Assembly (100).

NOTICE

If more than one angle head is disassembled at a time, take care not to mix the Matched Gear Sets (103) from different Angle Attachments. These gear sets are specially matched and are available only as matched sets.

3. Inspect the Lower Spindle Bearing (112) for looseness or roughness. If either of these conditions exists, remove the Bearing as follows:
 - a. Insert a 1/4" Allen Wrench in the Bit Holder Spindle Assembly (116) or grasp the square drive or threaded end of the other Spindle Assembly in leather-covered or copper-covered vise jaws and unscrew the Bevel Gear Retainer Nut (111).
 - b. Lift off the Bevel Gear (103) from the Spindle.
 - c. Press the Spindle from the Lower Spindle Bearing.

NOTICE

Do not remove the Socket Retainer (115) unless you have a new retainer ready to install. The retainer is destroyed during removal.

4. For 3RL25 Angle Attachment, grasp the Spindle in leather-covered or copper-covered vise jaws and using a 1/16" (1.59 mm) punch, drive out the Socket Retainer from the Washer on non-working side of the square on the Spindle.

NOTICE

Do not remove the Upper Spindle Bearing (102) unless you have a new bearing ready to install. This type of bearing is always damaged during removal.

5. If the Upper Spindle Bearing appears rough or loose, press it from the Angle Head.
6. Using snap ring pliers, remove the Thrust Bearing Retainer (104) and slide off the Rear Thrust Bearing Seat (105), and Bevel Pinion Thrust Bearing (106) from the Pinion (103) shaft.

NOTICE

Do not remove the pinion shaft and Bevel Pinion Bearings (110) unless you have two new bearings on hand.

7. Grasp the hex of the pinion shaft in leather-covered or copper-covered vise jaws and tap the rear face of the Angle Housing Assembly with a soft hammer to pull the Bevel Pinion Bearings from the Housing. After the Angle Attachment is disassembled, check all parts for damage or wear. If the gear teeth on either piece of the Matched Gear Set are worn or chipped, replace both parts. They are furnished in a matched set and must be replaced with a matched set.
8. Using a hooked tool, reach inside the Coupling Nut (108) and pull the Coupling Nut Retainer (109) from the Nut. Slide the Coupling Nut and Retainer off the motor end of the Angle Attachment.

For 3RL1A5 Angle Attachment

NOTICE

The Angle Housing Cap (113A) has left-hand threads.

1. Unscrew Angle Housing Cap.

NOTICE

If more than one Angle Head is disassembled at a time, take care not to mix the Matched Bevel Gear Sets (103) from different Angle Attachments. These gear sets are specially matched and are available only as matched sets.

2. Withdraw Spindle (103) and remove Shims (102A) from Angle Housing.
3. Remove Spindle Bearing (119).

NOTICE

Do not remove the Socket Retainer Assembly (103A) unless you have a new Socket Retainer ready to install. The retainer is destroyed during removal.

4. Put the Spindle in leather-covered or copper-covered vise jaws and using a 1/16" (1.59 mm) punch against the Washer, drive out the Socket Retainer Assembly.
5. If the Upper Spindle Bearing (102) appears rough or loose, press it from the Spindle.
6. Using snap ring pliers, remove the Thrust Bearing Retainer (104) and slide off the Rear Thrust Bearing Seat Assembly (105) and Bevel Pinion Thrust Bearing (106).

NOTICE

Do not remove the bevel pinion shaft and Bevel Pinion Bearings unless you have a new Bearing on hand.

7. Grasp the hex of the bevel pinion shaft in leather-covered or copper-covered vise jaws and tap the rear face of the Angle Housing with a soft hammer to pull the Bevel Pinion Bearing (110). After the Angle Attachment is disassembled, check all parts for damage or wear. If the gear teeth on either piece of the Matched Bevel Gear Set are worn or chipped, replace both parts. They are furnished in a matched set and must be replaced with a matched set.
8. Using a hooked tool, reach inside the Coupling Nut (108) and pull the Coupling Nut Retainer (109) from the Nut. Slide the Coupling Nut and Retainer off the motor end of the Angle Attachment.

Disassembly of the Adjustable Cushion Clutch and Adjustable Shutoff Clutch

1. Withdraw the Clutch Driver Assembly and the Bevel Pinion Driver (77) from the Clutch Housing Assembly (51).
2. Grasping the Clutch Return Spring (55) near the Spring Seat Stop (66) to avoid elongating the Spring, pull the Clutch Return Spring from the Clutch Driver (57).
3. **For Models ending in 1S5, 2S3 or 2S5**, remove the Shutoff Plunger (72). Using a hooked tool to reach into the end of the Clutch Driver, hook the Plunger Return Spring (73) and pull it from the Driver.
4. Using a thin blade screwdriver, pry the Spring Seat Stop off the Clutch Driver.
5. Clamping on the hex end of the Clutch Driver, place the Clutch Driver vertically in leather-covered or copper-covered vise jaws and unscrew the Adjusting Nut (68) with an adjustable wrench. A bumping effect, caused by the Adjusting Nut engaging and disengaging the Adjusting Nut Lock (67), may be felt while loosening the Nut.
6. Remove the Clutch Driver from the vise and remove the Adjusting Nut, Adjusting Nut Lock, Thrust Bearing (64), Clutch Spring Seat (65), and Clutch Spring (56) from the Clutch Driver.
7. **For Models ending in 2C3 and 2C5**, using a thin blade screwdriver, pry the remaining two Spring Seat Stops (66) off the Clutch Driver.

NOTICE

Place a container under the assembly before removing the retainer nearest the Clutch Ball Seat (63). Removal of this retainer permits the Clutch Ball Seat, Clutch Ball Spacer (61), and Clutch Jaw (58) to move rearward for removal and allows the eleven Clutch Balls (59) and ten Jaw Bearing Balls (60) to fall from the assembly.

For Models ending in 1S3, 2S3 and 2S5, using a thin blade screwdriver, pry the remaining Spring Seat Stop (66) from the Clutch Driver.

NOTICE

Place a container under the assembly before removing the Spring Seat Stop. Removal of this retainer allows the three Clutch Cam Balls (74) to fall from the assembly.

Slide the Collar Return Spring (71), Shutoff Collar (70) and Clutch Ball Seat (63) off the Clutch Driver. Using a thin blade screwdriver, carefully pry off the Ball Retaining Ring (69). Dump the ten Bevel Pinion Driver Bearing Balls (75) in a container. Remove the Bevel Pinion Driver (77) from the Clutch Driver. Remove the Clutch Driver Seal (62) from the groove at the front end of the Clutch Driver.

8. If the Clutch Housing Bushing (52) is worn, press it from the Clutch Housing Assembly.

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 M, N, O and Q ratios**, 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), Pinion (45) (for M and N ratios) 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 pull 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, and press the Rotor from the Rear Rotor Bearing.

Disassembly of the Motor Housing

1. Using a 1/16" hex wrench, remove the Retainer Set screw (7) from the Reverse Valve (3).
2. With the Reverse Valve facing downward, lightly tap the Motor Housing (1) on the workbench until the Lock Pin Retainer (8) falls out of the Reverse Valve.
3. While holding the Motor Housing horizontally with the Throttle Lever (26) downward, press the Reverse Valve slightly until the Valve Lock Pin (6) drops into the opening vacated by the Lock Pin Retainer. You may have to tap the Motor Housing lightly to jar the Lock Pin free.
4. Remove the Reverse Valve, Reverse Valve Seal (4), Reverse Valve Spring (5) and Valve Lock Pin from the Motor Housing.

WARNING

The Throttle Valve Cap (12) is under pressure from the Throttle Valve Spring (10). Care must be exercised when removing the Throttle Valve Cap.

5. Remove the Throttle Valve Cap, Throttle Valve Spring, Throttle Valve Ball (13) and Throttle Valve Plunger (11) from the Motor Housing and from the Throttle Valve Housing (9) on 1RLS Models.
6. Remove the Inlet Bushing Assembly (27) and pull the Exhaust Deflector (24) from the Motor Housing on Model 1RL and from the Throttle Valve Housing (9) on Model 1RLS.
7. If the Inlet Screen (28) requires replacement, use the eraser end of a wooden pencil to push the Inlet Screen from the Inlet Bushing Assembly.
8. The Throttle Lever is attached to the Exhaust Deflector with two Throttle Lever Pins (25) which are two-piece rivets. Lightly grasping the Deflector in leather-covered or copper-covered vise jaws, drive the pin in the center of the rivet inward with a pin punch until it is free of the rivet. Repeat the procedure on the other rivet. Squeeze the ends of the rivets together and pry them from the Deflector with a screwdriver or pull them with pliers.
9. Work the Muffler Elements (22) out of the Exhaust Deflector.
10. For Model 1RL5, using a 5/64" hex wrench, loosen and remove the Throttle Valve Housing Cap Screws (18) and Lock Washers (19). Remove the Throttle Valve Housing and the Throttle Valve Housing Seal (17) from the Motor Housing.
 - Remove the Throttle Valve Housing Adapter Seal (15) from the Throttle Valve Housing Adapter (14).
 - Unscrew and remove the Throttle Valve Housing Adapter, Throttle Ball Spring (21), Throttle Ball (20), Throttle Ball Seat (20A) and Muffler Element (22).

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. Unless otherwise noted, always press on the stamped end of a needle bearing when installing the needle bearing in a recess.
4. Whenever grasping a tool or part in a vise, always use leather-covered or copper-covered vise jaws. Take extra care with threaded parts and housings.
5. Always clean every part and wipe every part with a thin film of oil before installation.
6. Apply a film of O-ring lubricant to all O-rings before final assembly.

Assembly of the Motor Housing

For Model 3RLS

1. Place the Throttle Valve Housing Seal (17) on the smaller shoulder of the Motor Housing (1). To hold seal in position, lightly coat both the Seal and shoulder with **Ingersoll Rand No. 28 Grease**. Install the Throttle Ball (20), Throttle Ball Seat (20A) and Throttle Ball Spring (21).
2. Place one new Muffler Element (22) on the threaded side of the Throttle Valve Housing Adapter (14) and thread the Adapter into the Motor Housing until adapter flange contacts the Housing. Center notch or depression on Adapter with Housing alignment pin by backing out Adapter 1/4 turn maximum, if necessary.
3. Place Throttle Valve Housing Adapter Seal (15) on Adapter.
4. Place Throttle Valve Housing over Adapter and on rear of Motor Housing, making sure that the notch in the Throttle Valve Housing is aligned with the alignment pin on the Motor Housing.
5. Secure the Throttle Valve Housing with the Throttle Valve Housing Cap Screws (18) and Lock Washers (19). Tighten Cap Screws to 8 to 10 in-lb (0.904 to 1.130 Nm) torque. If the Cap Screws cannot be started into the Adapter, then the Adapter is not in proper alignment. Refer to Step 2.

For All Models

6. Work new Muffler Elements (22) (four for Model 1RL and three for Model 1RLS) into the Exhaust Deflector (24) to a point beyond the two throttle lever pin holes.

NOTICE

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

7. Position the Throttle Lever (26) on the Exhaust Deflector with the Lever covering the timing notch at the front end of the Deflector. Insert the two Throttle Lever Pins (25) 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.
8. Center a new Inlet Screen (28) over the air line end of the Inlet Bushing Assembly (27) and, using the eraser end of a wooden pencil, push the Screen into the Bushing until it bottoms on the internal shoulder.
9. Place the Exhaust Deflector Seal (23) on the smaller shoulder of the Motor Housing for Model 1RL or Throttle Valve Housing for Model 1RLS. To hold the Seal in position, lightly coat the Seal and shoulder with **Ingersoll Rand No. 28 Grease**. Place the Exhaust Deflector on the rear of the Housing, aligning the notch in the Deflector with the alignment pin in the Housing. Secure the Deflector to the Housing with the Inlet Bushing Assembly. Use a torque wrench and tighten the Inlet Bushing Assembly to 15 to 18 ft-lb (20 to 24 Nm) torque.

- With the Throttle Lever downward, insert the Throttle Valve Plunger (11), Throttle Valve Ball (13) and Throttle Valve Spring (10) into the Motor Housing on Model 1RL and into the Throttle Valve Housing on Model 1RLS. 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 compound to cure the specified length of time.
- Install the Reverse Valve Seal (4) on the Reverse Valve (3), insert the Reverse Valve Spring (5) into the end of the Reverse Valve and start the Reverse Valve into the bushing in the Motor Housing. Align the cross hole for the Valve Lock Pin (6) in the Reverse Valve with the timing notch on the bushing. Insert the Valve Lock Pin into the cross hole and push the Reverse Valve into the bushing until the cross hole and pin are inside the bushing. With the timing notch on the bushing downward, insert a small diameter rod into the end of the Reverse Valve and apply pressure to the Lock Pin forcing it outward against the bushing. Continue pushing the Reverse Valve into the bushing until the Lock Pin is forced into the lock pin slot in the bushing. When the Lock Pin moves into the slot, ease back the Reverse Valve until the Lock Pin prevents the Reverse Valve from coming back farther. Remove the rod and insert the Lock Pin Retainer (8) into the Reverse Valve. Using a 1/16" Allen Wrench, lock the pins in position with the Retainer Setscrew (7).

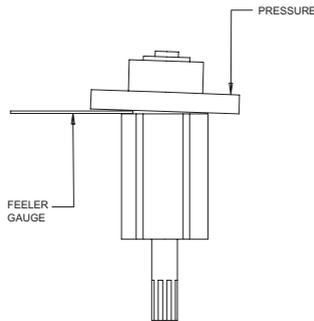
Assembly of the Motor

- 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.
- Using a sleeve that contacts the inner ring of the Rear Rotor Bearing (32), press the Bearing onto the shaft until the Rear End Plate just contacts the rotor body.

NOTICE

The clearance between the Rear End Plate and Rotor is critical. This measurement must be made at the outside diameter of the rotor body.

- While pressing down with your finger on the outer edge of the End Plate on the Bearing side, insert a 0.002" (0.05 mm) feeler gauge between the face of the Rotor and End Plate directly opposite the point where pressure is applied. 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 (33) on the shaft. (Refer to Dwg. TPD789.)



(Dwg. TPD789)

- Place the Rotor, with the splined end up, in a block which has clearance for the Rotor Bearing and supports the Rear End Plate.
- Wipe each Vane (35) with a light film of **Ingersoll Rand** No. 10 Oil and place a Vane in each slot in the Rotor.
- 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 Rear End Plate. The notch in the end of the Cylinder should be against the Front End Plate.
- Install the Front Rotor Bearing (32) in the Front End Plate (30) and retain it with the Front Rotor Bearing Retainer (34).
- Using a sleeve that contacts the inner ring of the bearing, press the assembled Front End Plate, flat side first, on the splined end of the Rotor until the End Plate just contacts the Cylinder.
- 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.
- 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.

Assembly of the Gearing

- Set the Gear Case (39) on the table of an arbor press with the notched end upward.
- 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.
- Install the Spindle Bearing Retainer (41) in the groove adjacent to the Bearing.
- Work some 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 on the Gears mesh with the teeth of the Gear Case.
8. **For M, N, O and Q ratios**, coat the Gear Head Spacer (46) with grease and place it in the Gear Case against the Spindle Planet Gears.
9. **For M, N, O and Q ratios**, work some grease into the teeth of the Gear Head Planet Gears (48) and onto the planet gear shafts on the Gear Head (47)
10. **For M, N, O and Q ratios**, slide the Gear Head into the Gear Case so that the teeth on the gear head shaft mesh with the Spindle Planet Gears.
11. **For M, N, O and Q ratios**, slide the Gear Head Planet Gears onto the planet gear shafts, making certain the teeth on the Planet Gears mesh with the teeth in the Gear Case.
12. **For M and N ratios**, 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.
13. Place the Motor Clamp Washer (49) in the Gear Case against the internal gear. Install the Clamp Washer Retaining Ring (50).

Assembly of the Adjustable Cushion Clutch

For Models ending in 2C3 and 2C5

1. Standing the Clutch Housing Assembly (51) on an arbor press table with the external thread downward, press the Clutch Housing Bushing (52) into the Clutch Housing until the shoulder of the Bushing seats.
2. Apply a coat of grease to the ten Jaw Bearing Balls (60), eleven Clutch Balls (59) and the Thrust Bearing (64).
3. Holding the Clutch Driver (57) in one hand with the external hex end down, slide the Clutch Jaw (58) 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. Install the Balls and pull the Jaw toward the shoulder of the Driver to capture the Balls.
4. While maintaining pressure against the Clutch Jaw, invert the Clutch Driver and install the Clutch Ball Spacer (61) on the Driver.
5. Place the eleven Clutch Balls in the openings of the Clutch Ball Spacer and install the Clutch Ball Seat (63) with the recess on the face of the Seat toward the Clutch Balls.
6. Lock all the components in place by installing two of the Spring Seat Stops (66) in the two grooves on the Driver nearest the Clutch Jaw.
7. Position the Clutch Spring (56) on the hub of the ClutchBall Seat and install the Clutch Spring Seat (65) on the Clutch Driver with the hub inside the Clutch Spring.
8. Install the Thrust Bearing (64) and the Adjusting Nut Lock (67) on the Clutch Driver so that the flat side of the Lock is toward the Bearing.
9. Thread the Adjusting Nut (68) onto the Clutch Driver, with the smooth face away from the Nut Lock, until the Nut passes the remaining Spring Seat Stop groove on the Clutch Driver.
10. Install the Spring Seat Stop in the groove on the Clutch Driver.
11. The Clutch Return Spring (55) has the last coil on one end slightly distorted inward. Place the Spring on the Clutch Driver with the distorted end of the Spring against the Spring Seat Stop.
12. Apply **Ingersoll Rand** No. 67 Grease into the front end of the Bevel Pinion Driver (77), and onto that portion of the Bevel Pinion Driver that fits into the Clutch Housing Bushing. Inject a quantity of grease into the center hole at the front end of the Clutch Driver until the grease is forced out through the cross-hole in the Driver.
13. Insert the Bevel Pinion Driver and the Clutch Driver Assembly into the Clutch Housing.

Assembly of the Adjustable Shutoff Clutch

For Models ending in 1C5, 253, and 255

If it is necessary to replace the Shutoff Clutch Assembly, Clutch Driver (57), Shutoff Plunger (72), Plunger Return Spring (73), Bevel Pinion Driver (77) or Push Rod (78), the tool must be re-gapped. Before assembling the tool, read the section on Gapping Procedure on page 8.

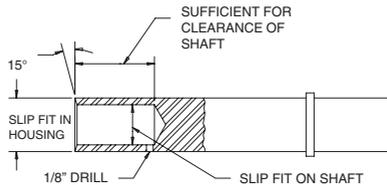
1. Standing the Clutch Housing (51) on an arbor press table with the external thread downward, press the Clutch Housing Bushing (52) into the Clutch Housing until the shoulder of the Bushing seats.
2. Apply **Ingersoll Rand** No. 67 Grease to the groove at the front end of the Clutch Driver (57) and install the Clutch Driver Seal (62) in the groove.
3. Put some grease into the opening in the front end of the Clutch Driver and slide the Bevel Pinion Driver (77) onto the flanged end of the Clutch Driver.
4. Apply a coat of grease to each of the ten Bevel Pinion Driver Bearing Balls (75) and insert the Balls into the hole of the Bevel Pinion Driver.
5. Install the Ball Retaining Ring (69) into the groove of the Bevel Pinion Driver to retain the Bevel Pinion Driver Bearing Balls.
6. Apply a coat of grease to the cam surface, clutch ball pockets, and shaft of the Clutch Driver.
7. Holding the Bevel Pinion Driver and Clutch Driver upward, insert each of the three Clutch Cam Balls (74) into the three sections of the Bit Holder Assembly.
8. Install the Clutch Ball Seat (63) over the end of the driver with the large circular groove toward the Clutch Cam Balls. Insert the four Shutoff Plunger Balls (72A) into the hole on the side of the Clutch Driver.
9. Install the Shutoff Collar (70), relieved end first, over the end of the Clutch Driver until it contacts the face of the Clutch Spring Seat.
10. Slide the Collar Return Spring (71), large end first, over the Clutch Driver until it contacts the Shutoff Collar and retain components with the Spring Seat Stop (66)
11. Apply a light coat of grease to the Shutoff Plunger (72) and insert the Plunger Return Spring (73) and Shutoff Plunger into the hex of the Clutch Driver.
12. Position the Clutch Spring (56) on the hub of the Clutch Ball Seat and install the Clutch Spring Seat (65) on the Clutch Driver with the hub inside the Clutch Spring.

13. Lubricate and install the Thrust Bearing (64) and the Adjusting Nut Lock (67), 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.
14. Thread the Adjusting Nut (68) 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.
15. Install the Spring Seat Stop (66) into the groove adjacent to the Adjusting Nut.
16. Insert the Clutch Return Spring (55), small end first, over the hex end of the Clutch Driver until it stops against the Spring Seat Stop (66).
17. Apply a light coat of grease to the hex end of the Clutch Driver and to the bearing surface of the Bevel Pinion Driver. Slide the assembled Clutch into the Clutch Housing (5).

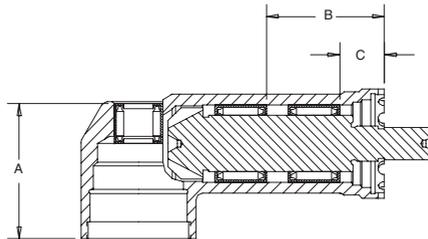
Assembly of the angle Attachment

For 3RL23 and 3RL25

1. Apply 2 to 4 cc of **Ingersoll Rand** No. 67 Grease to the gear and onto the shaft of the Bevel Pinion (103) and insert it, gear end first, into the long bore of the Angle Housing (100).
2. Coat the inside of the two Bevel Pinion Bearings (110) with a small amount of grease and insert one Bearing, unstamped end first, into the bore of the Angle Housing.
3. Using the bearing inserting tool shown in Dwg. TPD460 press the new Bearing to the "B" dimension shown in Dwg. TPD790.



Dwg. TPD460



Dwg. TPD790.

Distance	Minimum Dimension		Maximum Dimension	
	in	mm	in	mm
A	1.181	30.0	1.201	30.5
B	1.102	28.0	1.122	28.5
C	0.334	8.5	0.354	9.0

4. Repeat the process with the second Bevel Pinion Bearing, pressing it to the "C" dimension shown in Dwg. TPD790.
5. Coat the inside of the new Upper Spindle Bearing (102) with a small amount of grease and coat the outside with a small amount of thread locking compound.
6. Install the Front Thrust Bearing Seat (107) on the Bevel Pinion with the beveled side of the seat toward the Pinion Bearings.
7. Grease the Bevel Pinion Thrust Bearing (106) and install it against the Seat.
8. Install the Rear Thrust Bearing Seat (105) with the flatface against the Thrust Bearing and the radial pin captured by an angle housing notch.
9. Install the Thrust Bearing Retainer (104) in the groove on the Pinion to lock the components in position. Make certain the Retainer is completely seated in the groove.
10. The Socket Retainer (115) for the Square Drive Spindle (114) consists of a plunger, spring and washer. The hole through the square on the working end of the Spindle has an internal shoulder and the hole is deeper on one side of the square than it is on the opposite side. Place the spring into the deeper hole and insert the plunger into the spring until the plunger is flush with the face of the square. Holding the plunger side of the square against a steel block, place the washer, chamfered side away from the plunger, onto the plunger. With a rivet tool, rivet the washer to the plunger.

11. Work some grease into the Lower Spindle Bearing (112) and on the Bevel Gear.
12. Using a sleeve that will contact only the inner ring of the Bearing, press the Lower Spindle Bearing, sealed side first, onto the Spindle.
13. Slide the Bevel Gear of the Matched Gear Set (103) onto the Spindle.
14. Apply a thread locking compound to the threads on the Bevel Gear Retainer Nut (111) and Spindle. Allow the compound to cure for the proper length of time and then thread the Bevel Gear Retainer Nut onto the Spindle and tighten it to 10.3 ft-lb (14 Nm) torque.
15. Install the assembled Spindle in the Angle Housing, making certain the teeth of the Matched Gear Set mesh and the Spindle turns freely.
16. Clean the threads of the Angle Housing and the Angle Housing Cap (113). Apply a uniform coat of Vibra-Tite*** VC3 No. 205 to the threads of the Angle Housing Cap and allow the compound to cure between ten and twenty minutes. Install the Angle Housing Cap and tighten the Cap to a minimum of 15 to 18 ft-lb (20 to 24 Nm) torque.
17. Slide the Coupling Nut Retainer (109) and Coupling Nut (108), threaded end trailing, over the notched end of the Angle Housing.
18. Compress the Retainer and work it into the internal groove in the nonthreaded end of the Nut.

For 3RL1A5

1. Work a light coat of **Ingersoll Rand** No. 67 Grease into the gear teeth of the Bevel Pinion (103) and insert it, gear end first, into the long bore of the Angle Housing (100).
2. Work 0.5 to 1 cc of grease into the Bevel Pinion Bearing (110) and insert it, unstamped end first, into the bore of the Angle Housing, after the Bevel Pinion.
3. Support the Angle Housing on an angled support as shown in Dwg. TPD790. Use a bearing inserting tool and press the Bevel Pinion Bearing so the face is a maximum of 1.32" (33.50 mm) but not less than 1.30" (33.00 mm) below the end face of the Angle Head. Refer to Dwg. TPD790.
4. Lubricate the Bevel Pinion Thrust Bearing (106) with 0.5 to 1 cc of grease. Install the Bearing on the rear of the bevel pinion shaft with red-stained end of Bearing toward the rear of the Angle Head. Secure Bearing on shaft with Thrust Bearing Retainer (104).
5. The Socket Retainer (103A) consists of a Plunger, Spring and Washer. The hole through the square on the working end of the Spindle has an internal shoulder and the hole is deeper on one side of the square than it is on the opposite side. Place the Spring into the deeper hole and insert the Plunger into the Spring until the Plunger is flush with the face of the square. Holding the Plunger side of the square against a steel block, place the Washer, chamfered side away from the Plunger, onto the Plunger. With a rivet tool, rivet the Washer to the Plunger.

NOTICE

Do not get any thread locking compound in the bearing; damage to the Bearing could result. Do not get any grease on the inside diameter of the Bearing; grease will prevent the compound from working.

6. Apply a small drop of a thread locking compound to the small outside diameter of the upper spindle bearing shaft on the Spindle (103).
7. Apply 2 to 4 cc of grease to the Upper Spindle Bearing (102) and a light coat of grease to the gear teeth on the Spindle. Press the Upper Spindle Bearing onto the Spindle and allow the compound to dry completely.

NOTICE

Make sure that the Bevel Pinion is pulled outward toward the Bevel Pinion Bearing before inserting the Spindle into the Angle Head.

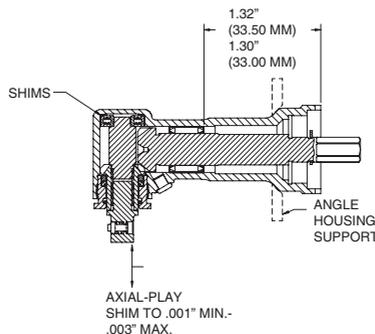
8. Insert the Spindle into the Angle Head until the Upper Spindle Bearing seats into the recess of the Angle Head.
9. Install the Spindle Bearing (119) in the Cap.
10. Install the Angle Housing Cap finger-tight.

NOTICE

Spindle must turn freely.

11. With the Bevel Gear on the Spindle out of mesh with the Bevel Pinion, measure the axial play of the Spindle (use 0.25 lb loads). Subtract 0.002" (0.051 mm) from the reading for required shim thickness. Refer to Dwg. TPB853.

3RL1A5 Angle Attachment



(Dwg. TPB853)

12. Unscrew and remove the Angle Housing Cap. While pulling the Bevel Pinion outward toward the Bevel Pinion Bearing, remove the Spindle from the Angle Head.
13. Insert the required number of shims as determined from Step 11 in the upper bearing recess of the Angle Head.

14. Reassemble and test the Angle Head as indicated in Steps 8, 10 and 11.
15. Once proper shimming has been achieved, remove the Angle Housing Cap, clean the threads on the Angle Head and the Angle Housing Cap, and apply a film of Vibra-Tite® VC3 to the threads.
16. Install the Angle Housing Cap and tighten to 35 in-lb (3.9 Nm) torque.
17. Install the Rear Thrust Bearing Seat (105) on the Bevel Pinion shaft with the flat face against the Thrust Bearing.
18. Slide the Coupling Nut Retainer (109) and the Coupling Nut (108), threaded end trailing, over the notched end of the Angle Housing.
19. Compress the Coupling Nut Retainer, and work it into the internal groove in the nonthreaded end of the Coupling Nut.

Assembly of the Tool

NOTICE

The Gear Case Assembly has left-hand threads.

1. Apply some **Ingersoll Rand** No. 67 Grease to the spline of the rotor shaft and screw the Gear Case Assembly into the Motor Housing Assembly. Tighten the Gear Case to 15 to 18 ft-lb (20 to 25 Nm) torque.
2. **For Model 1RLS**, insert the Push Rod (78) into the gearing and motor through the hole in the center of the Spindle.

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NOTICE

The Clutch Housing (51) has left-hand threads.

3. Screw the Clutch Housing into the Gear Case, making certain that the hex on the Clutch Driver is properly inserted in the Spindle. Tighten the Housing to 18.4 to 22.1 ft-lb (25 to 30 Nm) torque.

NOTICE

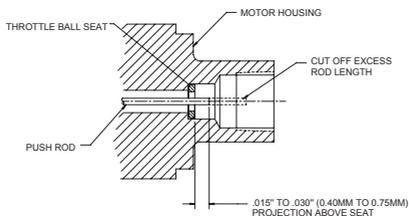
The Coupling Nut (108) has left-hand threads.

4. Aligning the pin in the Rear Thrust Bearing Seat (105) with the notch in the Clutch Housing, screw the Coupling Nut (108) onto the Clutch Housing. Tighten the Nut to 18.4 to 22.1 ft-lb (25 to 30 Nm) torque.
5. If the Clutch Assembly has been disassembled, adjust the clutch according to **CLUTCH ADJUSTMENT** section in Product Information Manual, Form 80167380.

Gapping Procedure for Installation of New Push Rod

1. Remove the Inlet Bushing Assembly (27) and pull the Exhaust Deflector (24) from the Motor Housing (1) on Model 1RL and from the Throttle Valve Housing (9) on Model 1RLS.
2. Follow the steps for Disassembly of the Motor Housing - For Model 1RLS.
3. Remove the Plunger Return Spring (73) and tighten the Clutch Housing Assembly (51) to 18.4 to 22.1 ft-lb (25 to 30 Nm) torque. Adjust the clutch to ten clicks from maximum output.
4. Insert the Push Rod (78). Apply pressure to secure Push Rod against the Shutoff Plunger Balls (72A).
5. Trim the Push Rod so that it projects 0.015" to 0.030" (0.40 to 0.75 mm) above the Throttle Ball seat. Refer to Dwg. TPD1100-1.
6. Remove Clutch Housing and install Plunger Return Spring. Tighten Clutch Housing Assembly to 18.4 to 22.1 ft-lb (25 to 30 Nm) torque.
7. After gap has been set, follow procedure for **Assembly of Motor Housing**.

Gapping Procedure for Installation of New Push Rod



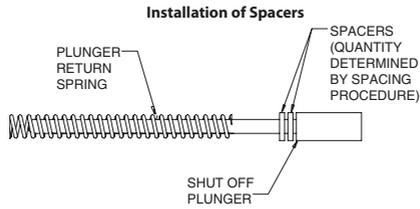
(TPD1100-1)

Spacing Procedure

NOTICE

Before proceeding with SPACING PROCEDURE, the tool must have gap set according to GAPPING PROCEDURE. The clutch should be adjusted ten clicks down from maximum and the tool should be completely assembled without Spacers (72B).

1. Connect tool to a regulated 90 psig (6.2 bar/620 kPa) air supply. Run tool on a soft joint 8 to 16 in-lb (0.90 to 1.81 Nm) torque.
 - a. If the tool runs down the joint, shuts off and reverses off the joint, it is functioning properly. Proceed to Step 2.
 - b. If the tool runs down the joint, shuts off but won't run in either forward or reverse, then the tool did not reset. Loosen Clutch Housing Assembly (51), remove the Plunger (72) and add one Spacer (72B). See Dwg. TPD1101. Insert the Plunger into the Clutch Driver (57) and tighten the Clutch Housing Assembly to 18.4 to 22.1 ft-lb (25 to 30 Nm) torque. Repeat testing. Add Spacers as necessary until tool functions as described.



(Dwg. TPD1101)

- c. If tool does not shut off or if it ratchets, repeat assembly procedure from beginning.
2. After the tool has been properly spaced, adjust clutch. Refer to **CLUTCH ADJUSTMENT** section in Product Information Manual, Form 80167380.

Troubleshooting Guide

Trouble	Probable Cause	Solution
Low power or low free speed	Low air pressure	Check the air line pressure at the Inlet of the tool. It must not exceed 90 psig (6.2 bar/620 kPa).
	Plugged Inlet Bushing Screen or Air Strainer Screen	Clean the Screen in a clean, suitable, cleaning solution. If it 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 worn or broken or if the bore is scored or wavy.
	Scoring of End Plates	Replace End Plates if they are scored.
	Improper lubrication or dirt buildup in the motor	Lubricate the Wrench as instructed in LUBRICATION . If lubrication does not result in satisfactory operation, disassemble the motor inspect and clean all parts.
	Clogged muffler	Clean the Muffler Elements in a clean, suitable, cleaning solution. If they cannot be cleaned, replace them.
	Air leakage to exhaust caused by missing or damaged Housing Adapter Seal	Replace Housing Adapter Seal.
Air leakage to atmosphere caused by missing or damaged Throttle Valve Housing Seal or Exhaust Deflector Seal	Replace Housing Adapter Seal.	
Gear Case gets hot	Excessive grease	Clean and inspect the Gear Case gearing parts and lubricate as instructed in LUBRICATION .
	Worn or damaged parts	Clean and inspect the Gear Case and gearing. Replace worn or broken components.
Inconsistent disengagement of Adjustable Clutch	Improper lubrication.	Remove Adjustable Clutch mechanism and check. Lubricate per instructions.
	Worn or damaged parts	Remove Adjustable Clutch mechanism and examine parts.
	Worn Clutch Spring (using Heavy Clutch Spring on light torque application.)	Change to Medium or Light Clutch Spring.

Trouble	Probable Cause	Solution
Clutch ratchets	Excessive Gap	Reset gap. See GAPPING PROCEDURE .
	Low air pressure at the inlet	Check air supply. For top performance, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet.
	Weak Throttle Ball Spring	Replace Throttle Ball Spring.
	Excessive load on Plunger Return Spring	Remove Spacers as necessary. Refer to SPACING PROCEDURE .
	Worn or defective Clutch Assembly	Repair or replace Clutch Assembly.
Motor stalls before Adjustable Clutch ratchets	Improper Clutch Adjustment or improper tool ratio for application	Check Clutch Adjustment and review tool performance vs. requirements.
Tool stalls before shutoff	Low pressure at the inlet	Check air supply. For top performance, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet.
	Inadequate air motor performance	See LOSS OF POWER section.
	Improper clutch adjustment	Check Clutch Adjustment .
	Improper gear ratio for application.	Review tool performance requirements in relationship to the application.
Tool shuts off while free speeding	Marginal reset	See NO RESET section..
No reset	Inadequate load on Plunger Return Spring	Add Spacers (72B) as necessary. Refer to SPACING PROCEDURE .
	Clutch Driver hole full of grease	Clean grease from Clutch Driver hole.
	Plugged bleed hole in Throttle Valve Housing Adapter	Clean 0.025" (0.635 mm) hole or replace Throttle Valve Housing Adapter.
Angle Head gets hot	Excessive grease	Clean and inspect the Angle Attachment and gearing parts. Lubricate as instructed.
	Inadequate grease	Inject 2 to 4 cc of grease into the Grease Fitting.
	Worn or damaged parts	Clean and inspect the Angle Head and Gearing. If the Bevel Gear and /or the Bevel Pinion is worn or broken, replace both parts as they should be replaced only as a matched set.

Related Documentation

For additional information refer to:

Product Safety Information Manual 04585006.

Product Information Manual 80167380.

Parts List Manual 16574568.

Manuals can be downloaded from ingersollrandproducts.com

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