



**16572620**  
Edition 1  
August 2008

# **Air Drill, Screwdriver and Angle Wrench**

**5L and 5RL**

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## **Maintenance Information**



**Save These Instructions**

 **Ingersoll Rand**

**WARNING**

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

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

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

**Lubrication**

Each time a Series 5L or 5RL Angle Drill, Angle Wrench or Angle Screwdriver is disassembled for maintenance and repair or replacement of parts, lubricate the tool as follows:

1. Moisten all O-rings with O-ring lubricant.
2. Work approximately 1.5 cc of **Ingersoll Rand** No. 28 Grease into the Rear Rotor Bearing (2), Front Rotor Bearing (25) and the Spindle Bearing (29).
3. Work approximately 3 cc to 6 cc of **Ingersoll Rand** No. 28 Grease into the gear train. Grease the Planet Gear Bearings, the teeth on the Planet Gears (34 or 39), the gear teeth inside the Gear Case (36) and the planet gear shafts on the Spindle (27) and Gear Head (38).

4. Work approximately 0.5 cc to 1 cc of **Ingersoll Rand** No. 67 Grease into the Lower Spindle Bearing (119 or 213).
5. Work approximately 0.5 cc to 1 cc of **Ingersoll Rand** No. 67 Grease into the Upper Spindle Bearing (104, 105 or 203), Bevel Pinion Bearing (109 or 205) and Bevel Pinion Thrust Bearing (112 or 211).
6. For **5L2C3, 5L2C5, 5L2C6, 5L2D5, 6L2D6 and 7L2A4 Angle Heads**, apply a light coat of **Ingersoll Rand** No. 67 Grease to the Bevel Gear Set (108 or 204).
7. For **7L1A1, 7L1A3, 7L1A4, 7L1B1 and 7L1B4 Angle Heads**, apply a light coat of **Ingersoll Rand** No. 67 Grease to the Bevel Pinion (107) and Spindle (122).

**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 Angle Attachment**

1. Remove the Drill Chuck, Screwdriver Bit or Socket from the Spindle.
2. Carefully grasp the flats of the Coupling Nut (124 or 216) in leather-covered or copper-covered vise jaws so that the Angle Head (101 or 201) is facing downward.

**NOTICE**

This is a left-hand thread.

3. Using a wrench on the flats of the Gear Case (36), loosen the Gear Case from the Coupling Nut. Remove the tool from the vise. Unscrew and remove the Coupling Nut from the Gear Case.
4. Carefully grasp the Angle Head in leather-covered or copper-covered vise jaws so that the Spindle (107, 108A, 217 or 218) is facing upward.

**NOTICE**

This is a left-hand thread.

5. For **7L1A1, 7L1A3 or 7L1A4 Angle Head**, using a wrench, remove the Spindle Bearing Cap (121).

**NOTICE**

**Do not remove the Spindle from the Angle Head until the Bevel Pinion (107) is pulled out against the Bevel Pinion Bearing (109). Failure to do so could damage the Spindle Upper Bearing (105), the Bearing will not be removable from the Spindle, or the Bevel Pinion will be damaged. If tightness or binding occurs, check to make sure the Bevel Pinion has been pulled outward. For 7L2A4 Angle Head, use a wrench to remove the Spindle Bearing Cap (121).**

**NOTICE**

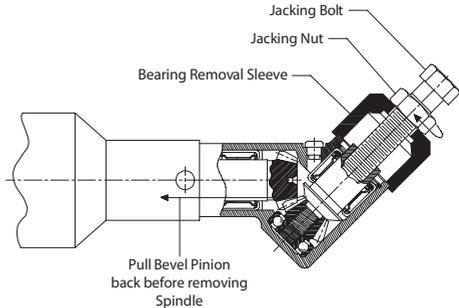
This is a left-hand thread.

Withdraw the Spindle (108A) from the Angle Head. For 7L1B1 or 7L1B4 Angle Head, use a thin blade screwdriver to pry out and under the tab of the Lower Spindle Bearing Retainer (119A). Rotate the screwdriver around the Spindle to spiral the retainer out of its groove.

**NOTICE**

**Do not remove the Spindle from the Angle Head until the Bevel Pinion (107) is pulled outward against the Bevel Pinion Bearing (109). Do not remove the Spindle unless a new Lower Spindle Bearing (119) is available for installation. This type of bearing is always damaged during removal and the bearing must be removed with the Spindle.**

**Each 7L1B1-955 Bearing Inserting Tool includes tooling to remove the Spindle and Lower Spindle Bearing from the 7L1B1 or 7L1B4 Angle Head. See Dwg. TPD792.**



(Dwg. TPD792)

Install the Jacking Nut on the Jacking Bolt near the head of the Bolt. Position the Bearing Removal Sleeve on the face of the Angle Head with the large open end toward the Spindle. With the Angle Head nested in the shallow counterbore of the Sleeve, screw the Jacking Bolt into the Spindle through the sleeve. While keeping the Jacking Bolt stationary with a wrench on the head of the Bolt, use another wrench to rotate the Jacking Nut clockwise pulling the Spindle, Lower Spindle Bearing and Spindle Upper Bearing (105) from the Angle Head.

#### NOTICE

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

**For 5L2C3, 5L2C5, 5L2C6, 5L2D5 or 6L2D6 Angle Head**, use No. 141A12-26 Housing Cap Wrench to remove the Angle Housing Cap (221). Withdraw the Spindle (217 or 218) from the Angle Head.

- Inspect the Lower Spindle Bearing (119 or 213) for looseness or roughness. If either of these conditions exists, replace the bearing as follows:
  - For 7L1A1, 7L1A3 or 7L1A4 Angle Head**, slip the Lower Spindle Bearing from the Spindle.
  - For 7L2A4 Angle Head**, grasp the large threaded end of the Spindle in copper-covered vise jaws.
  - Unscrew the Bevel Gear Retainer (120) and lift off the Bevel Gear (108).
  - Press the Spindle from the Lower Spindle Bearing.
  - For 5L2C3, 5L2C5, 5L2C6, 5L2D5 or 6L2D6 Angle Head**, grasp the output end of the Spindle in leather-covered or copper-covered vise jaws.
  - Unscrew the Bevel Gear Retainer (214) and lift off the Bevel Gear (204).
  - Press the Spindle from the Lower Spindle Bearing.

#### NOTICE

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

- For 7L1A1, 7L1A3, 7L1A4, 7L1B1 or 7L1B4 Angle Head**, if the Spindle Upper Bearing (105) appears rough or loose, press it off the Spindle. **For 7L2A4, 5L2C3, 5L2C5, 5L2C6, 5L2D5 or 6L2D6 Angle Head**, if the Spindle Upper Bearing (203) appears rough or loose, press it from the Angle Head.
- Remove the Bearing Seat Retainer (110, 207 or 212) and slide off the Rear Thrust Bearing Seat (111 or 206), Bevel Pinion Thrust Bearing (112 or 211) and Front Thrust Bearing Seat (113 or 208) from the pinion shaft.
- For 7L2A4, 5L2C3, 5L2C5, 5L2C6, 5L2D5 or 6L2D6 Angle Head**, use snap ring pliers to remove the Pinion Bearing Spacer Retainer (114 or 210). Remove the Pinion Bearing Spacer (116 or 209).

#### NOTICE

**Do not remove the pinion shaft and bearing unless you have a new bearing on hand.**

- Grasp the spline of the pinion shaft in copper-covered vise jaws. While pulling on the Angle Head, tap the rear face of the Angle Housing with a soft hammer to pull the Bevel Pinion and Bearing (109 or 205) from the Angle Housing. After the Angle Head is disassembled, check all parts for damage or wear.
- If the gear teeth on either the Spindle or Bevel Pinion are worn or chipped, replace both parts.

#### Disassembly of Cushion Clutch

- Carefully grasp the flats of the Coupling Nut (69) in leather-covered or copper-covered vise jaws, Clutch Housing facing downward.

#### NOTICE

**This is left-hand thread.**

- Using a wrench on the flats of the Gear Case (36), loosen the Gear Case from the Coupling Nut. Remove the tool from the vise.
- Unscrew the Coupling Nut and remove the Clutch Housing from the Gear Case.
- Pull the Clutch Shaft Assembly out of the Clutch Housing.

#### NOTICE

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

#### CAUTION

**When the Clutch Adjusting Nut (61) is loosened enough to relieve the spring pressure, hold the assembly over a container to catch the twenty-four Clutch Balls (57) that will be free to drop out and might otherwise be lost.**

- Working over a workbench, unscrew and remove the Clutch Adjusting Nut (61).
- Remove the Adjusting Nut Lock (62), Clutch Spring Seat (59), Spring Seat Bearing (60) and another Clutch Spring Seat (59).
- Slide the Clutch Spring (64), the third Clutch Spring Seat (59) and Clutch Ball Spacer (58) off the Clutch Shaft (55).
- Remove the Front Clutch Jaw (56).
- Remove the Clutch Driver Retainer (68) and slide the Clutch Driver (66) from the Clutch Shaft Support (67).

#### NOTICE

**This is a slip fit.**

- Using needle nose pliers or a wire hook, remove the Clutch Engaging Spring (63).

#### Disassembly of Gearing

- Using a pin punch and hammer, drive out the Throttle Lever Pin (4) to release the Throttle Lever (3).
- Grasp the flats of the Motor Housing in leather-covered or copper-covered vise jaws, Gear Case facing upward, being careful not to distort the Motor Housing.

#### NOTICE

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

- Using a wrench on the flats of the Gear Case, loosen, but do not remove the Gear Case.

#### NOTICE

**Be certain to hold the tool over a workbench so that you will not lose any parts.**

- Remove the tool from the vise and, while holding the tool horizontally, carefully unscrew the Gear Case by hand and pull it away from the Motor Housing.
- For H or N ratio**, the Rotor Pinion (32 or 40) and Rotor Pinion Spacer (33 or 41) may come out with the Spindle, or they may have remained with the Rotor (20) when the Gear Case was removed. Remove the Rotor Pinion and Rotor Pinion Spacer.
- For H, K or L ratio**, remove the Spindle Planet Gears (34). Position the Gear Case vertically in arbor press, planet gear end down. Using a 7/16" (11 mm) diameter brass rod against the outer rim of the Spindle, press the Spindle from the Gear Case. **For N ratio**, remove the Gear Head Planet Gears (39), Gear Head (38), Gear Head Spacer (42) and Spindle Planet Gears (34). Position the Gear Case vertically in an arbor press, planet gear end down. Using a 7/16" (11 mm) diameter brass rod against the outer rim of the Spindle, press the Spindle from the Gear Case.
- Using snap ring pliers, remove the Spindle Bearing Retainer (35).

- Tap the externally threaded end of the Gear Case on a workbench to remove the Grease Shield (28) and Spindle Bearing (29).
- Remove the Seal (31) and Seal Support (30) from the Spindle.

### Disassembly of Motor and Throttle

- Remove the Front Rotor Bearing Support (26) along with the Front Rotor Bearing (25) from the Motor Housing (1).
- Slide the Front Rotor Bearing from the Front Rotor Bearing Support. Check it for damage or roughness.
- Grasp the splined end of the Rotor (20) and pull the assembled motor from the Motor Housing.
- Remove the Rear End Plate Gasket (17) from the Motor Housing.

#### **CAUTION**

**Make certain the End Plate Retainer (19) does not fly when it is slipped off the hub of the Rotor.**

- Using a pair of external snap ring pliers with just the tips of the pliers inserted between the ends of the End Plate Retainer, spread the retainer enough to remove it from the groove in the hub of the Rotor.
- Remove the Rear End Plate (18), Cylinder (22) and Vanes (21).

#### **NOTICE**

**Do not remove the Rear Rotor Bearing (2) unless you have a new bearing on hand for replacement. The old bearing will be damaged during the removal process.**

- Grasp the flats in the Motor Housing in leather-covered or copper-covered jaws so that the inlet is upward.
- Using a wrench on the flats, unscrew and remove the Inlet Bushing (15).
- Remove the Throttle Valve Spring (8) and Air Strainer Screen (16).

## Assembly

### General Instructions

- Always press on the **inner** ring of a ball-type bearing when installing the bearing on a shaft.
- Always press on the **outer** ring of a ball-type bearing when pressing the bearing into a bearing recess.
- 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.
- Always clean every part and wipe every part with a thin film of oil before installation.
- Check every bearing for roughness. If an open bearing must be cleaned, wash it thoroughly in clean solvent and dry with a clean cloth. **Sealed or shielded bearings should not be cleaned.** Work grease thoroughly in every open bearing before installation.
- Apply a film of O-ring lubricant to all O-rings before final assembly.
- Unless otherwise noted, always press on the **stamped end** of a needle bearing when installing the needle bearing in a recess. Use a bearing inserting tool similar to the one in Dwg. TPD786.

- Remove the Exhaust Deflector (12), Inlet Bushing Spacer (14), Exhaust Silencer (11), Muffler Element (13), Exhaust Deflector Seal (10) and Silencer Seal Ring (9).
- Remove the Throttle Valve (7) and the Throttle Plunger (5).
- For Angle Drills**, thread a 3/8"-24 thread cap screw about 3" or 4" long into the Throttle Valve Seat (6). Grasp the head of the cap screw in a vise and pull the Seat from the Housing.
- For Angle Wrenches/Angle Screwdrivers**, use a wire hook to pull the Throttle Valve Seat and Throttle Valve Seat Support (6A) from the Motor Housing.
- If removal of the Rear Rotor Bearing is necessary, proceed as follows:

#### **For Nonreversible Models:**

- Insert a 3/8" (9.5 mm) diameter by 6" (152 mm) long, flat-faced steel rod into the air inlet until it contacts the Rear Rotor Bearing.
- Press the end of the steel rod to remove the Rear Rotor Bearing from the front end of the Motor Housing.

### Disassembly of Reverse Valve

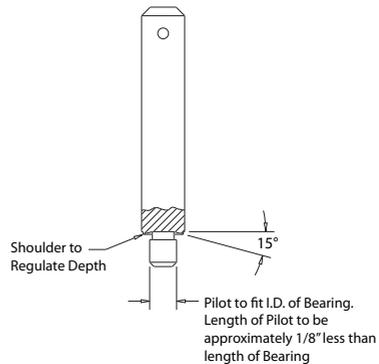
- Using a 3/32" Allen Wrench, remove the Retainer Setscrew (16D).
- Remove the Lock Pin Retainer (16C).

#### **NOTICE**

**Be careful not to lose the Reverse Valve Spring (16E) when removing the Reverse Valve.**

- While holding the Motor Housing horizontally with the throttle plunger hole downward, tap the top side of the Housing with a plastic hammer to dislodge the Reverse Lock Pin (16B), allowing the Reverse Valve (16A) to be withdrawn from the Housing. Remove the Reverse Valve Bushing Seal (16F).

**Needle Bearing inserting Tool**



(Dwg. TPD786)

### Assembly of Motor and Throttle

- If the Rear Rotor Bearing (2) was removed, install a new one as follows:

#### **For Nonreversible Models:**

- Using a bearing inserting tool that has a pilot extending into the Bearing, and a shoulder that contacts the outer radius on the bearing shell, press a new Rotor Bearing, closed end first, into the bearing recess of the Motor Housing (1) until it is about .050" (1.27 mm) below flush. Inject 0.5 cc of **Ingersoll Rand** No. 28 Grease into the Bearing.

#### For Reversible Models:

- a. Using a bearing inserting tool as shown in Dwg. TPD786, press a **new** Rear Rotor Bearing (2) into the Motor Housing until it is about .015" (0.38 mm) below flush. Inject 0.5 cc of **Ingersoll Rand** No. 28 Grease into the bearing.
2. Carefully grasp the flats of the Motor Housing in leather-covered or copper-covered vise jaws, inlet end facing upward.
3. If the Throttle Valve Seat (6) and/or Throttle Valve Seat Support (6A) were removed, use a flat faced rod 1/2" (13 mm) in diameter by 3" (75 mm) long to press the Throttle Valve Seat and/or Support into Motor Housing until it seats.
4. Install the Throttle Plunger (5) until the hole in the Plunger aligns dead center with the hole in the Throttle Valve Seat.
5. Using needle nose pliers to hold the short-stem end of the Throttle Valve (7), install the Valve, long-stem end through the hole in the Throttle Valve Seat and the Throttle Plunger.
6. Install the Muffler Element (13) by wrapping it horseshoe fashion around the inside of the Exhaust Deflector (12).
7. Snap the Exhaust Silencer (11) into the large open end of the Exhaust Deflector.
8. Install the Exhaust Deflector Seal (10) into the groove on the front end of the Exhaust Deflector.
9. Install the Silencer Seal Ring (9) over the hub of the Motor Housing and flush with the base of the hub.
10. Install the Exhaust Deflector over the hub of the Motor Housing, aligning the wide tab on the Exhaust Deflector with the throttle plunger hole in the Motor Housing.

#### NOTICE

**Tabs on the Exhaust Deflector match notches in the Motor Housing. Do not force the Exhaust Deflector in place.**

11. Insert the Air Strainer Screen (16), closed end first, inside the external threaded end of the Inlet Bushing (15).
12. Insert the Throttle Valve Spring, (8), large coil end first, into the Inlet Bushing, making sure it contacts the Air Strainer Screen.
13. Install the Inlet Bushing Spacer (14) in the large hole in the Exhaust Deflector.
14. Thread the Inlet Bushing into the Motor Housing, making certain the Throttle Valve Spring encircles the short-stem end of the Throttle Valve. Tighten the Inlet Bushing to a minimum of 25 ft-lb (33.9 Nm) torque.

#### NOTICE

**Note that the throttle lever pin hole in the Exhaust Deflector is larger at one end than the other.**

15. Install the Throttle Lever (3), pressing the Throttle Lever Pin (4) into the large end of the pin hole.
16. Slip the Rear End Plate (18) on the rear hub of the Rotor (20) and install the Rear Rotor Retainer (19) in the groove.
17. Hold the Rotor vertically and clamp the short hub in leather-covered or copper-covered vise jaws.
18. Wipe each Vane (21) with a film of **Ingersoll Rand** No. 10 Oil and place a Vane in each slot in the Rotor.

#### NOTICE

**When assembling the motor, be sure to install the Cylinder correctly. The motor will not give proper performance if the Cylinder is inverted.**

19. For **5LK1A1**, **5LK1B1** or **5LK1B4**, place the Cylinder (22), front end down, over the Rotor and onto the Rear End Plate.  
For all other models, place the Cylinder (22), front end up, over the Rotor and onto the Rear End Plate.

#### NOTICE

**To determine which end of the Cylinder is the front end, hold the Cylinder horizontally, facing one end. Position the external groove for the Dowel (24) at the top. If the two parts through the cylinder wall are in the bottom right quadrant, you are facing the front end of the Cylinder.**

20. Slip the Front End Plate (23) over the rotor shaft. Slide the Front Rotor Bearing (25) into the Bearing Support (26) until it seats.
21. Enter the Rear End Plate Gasket (17) into the Motor Housing (1), positioning the Gasket smoothly on the back of the bore so that the dowel notch in the Gasket aligns with the dowel hole in the Housing.
22. Obtain a stiff steel rod 3/32" (2.3 mm) diameter and approximately 10" (254 mm) long to use as an assembly dowel.
23. Align the dowel groove in the Rear End Plate, Cylinder and Front End Plate.
24. Place the assembly dowel in the aligned grooves so that about 3" (75 mm) of the dowel extends beyond the Rear End Plate. Insert the extension into the dowel hole at the bottom of the housing bore, and slide the motor into the Motor Housing until it seats.
25. Withdraw the assembly dowel and insert the Cylinder Dowel (24) until the Cylinder Dowel is slightly below the surface of the Front End Plate.
26. Slide the Front Rotor Bearing Support (26), bearing side first, into the Motor Housing until it contacts the Front End Plate.

#### Assembly of Reverse Valve

1. Install the Reverse Valve Lock Pin (16B) into the hole in the side of the Reverse Valve (16A).
2. Slip the Reverse Valve Spring (16E) into the end of the Reverse Valve opposite the reverse valve knob.
3. Hold the Motor Housing (1) horizontally with the Throttle Lever on top. Insert the Reverse Valve and Spring in the reverse valve bushing, so that the Reverse Valve Lock Pin is on top. Rotate the Reverse Valve one-half turn (180°) to allow the Lock Pin to drop into the slot in the wall of the Bushing. Release the Reverse Valve and install the Lock Pin Retainer (16C).
4. Operate the Reverse Valve to make sure it functions smoothly.

#### Assembly of Gearing

1. Work the Seal Support (30), large end first, over the spindle shaft and against the gear frame face.
2. For **K**, **L** and **N** ratios, install the Seal (31) over the spindle shaft against the Seal Support.
3. Install the Grease Shield (28) onto the spindle shaft.
4. Install the Spindle Bearing (29) over the spindle shaft. Firmly support the Spindle (27) and **press but do not drive**, the Bearing into position using an arbor that will contact only the inner ring of the Bearing.
5. For **H** ratio, slide the Rotor Pinion Spacer (33) followed by the Rotor Pinion (32) onto the spline shaft on the Rotor (20).  
For **N** ratio, slide the Rotor Pinion Spacer (41) followed by the Rotor Pinion (40) onto the spline shaft on the Rotor.
6. Place a Spindle Planet Gear (34) onto each of the three shafts on the Spindle.

#### NOTICE

**Spindles and Spindle Planet Gears are identifiable as follows:**

Gear Ratio	Letter Stamped on Spindle	Number of teeth on Spindle Planet Gear
H	H	13
K	K	15
L	H	17
N	N	14

7. Work 3 cc to 6 cc of the recommended grease into the gear train.
8. Insert the Spindle Assembly into the front end of the Gear Case (36), making certain the Assembly is seated in the recess in the Gear Case.
9. Using snap ring pliers, install the Spindle Bearing Retainer (35) in the internal groove in the Gear Case in front of the Spindle Bearing.
10. **For N ratio**, slide a Gear Head Planet Gear (39) onto each of the three gear shafts on the Gear Head (38). Slide the Gear Head Spacer (42) over the spline and flush against the face of the Gear Head. Insert the Gear Head Assembly, spline end first, into the rear of the Gear Case making certain the spline of the Gear Head properly engages the teeth of the Spindle Planet Gears.

**NOTICE**

**This is a right hand thread.**

11. Thread the assembled Gear Case onto the Motor Housing and tighten it to 30 to 40 ft-lb (40 to 54 Nm) torque.

**NOTICE**

**Run the motor at free speed on low air pressure while tightening the Gear Case. Listen while tightening to make sure there is no scoring.**

**Assembly of Cushion Clutch**

1. Install the Clutch Driver (66), flat side first, onto the spline end, of the Clutch Shaft Support (67) and retain with the Clutch Driver Retainer (68). Set the Clutch Driver Assembly aside.
2. Slide the Front Clutch Jaw (56), jaw end first, over the end of the Clutch Shaft (55) and along the splines to the groove at the opposite end.
3. Coat the grooved end with grease and insert thirteen Clutch Balls (9/64" dia.) (57) between the Jaw and into the groove of the Clutch Shaft. Pull the Clutch Jaw down to lock the Bearings into the groove of the Shaft.
4. While holding the Clutch Jaw firmly on the Clutch Balls, insert the Clutch Driver Assembly, spline end trailing, into the bore of the Clutch Shaft.

**NOTICE**

**Make certain the Jaws of the Clutch Driver engage the Front Clutch Jaw.**

5. Carefully grasp the spline of the Clutch Shaft Support in leather-covered or copper-covered vise jaws, spline end of the Clutch Shaft facing upward.
6. Lightly coat the face of the Front Clutch Jaw with the recommended grease.
7. Slide the Clutch Ball Spacer (58) over the splined end of the Clutch Shaft, aligning the holes in the Spacer with the holes in the Clutch Jaw.
8. Insert a Clutch Ball (9/64" dia.) (57) into each of the eleven holes in the Spacer, and, in the order named, slide the following over the Clutch Shaft: one Clutch Spring Seat (59), the Clutch Spring (64), the second Clutch Spring Seat (59), the Spring Seat Bearing (60), the third Clutch Spring Seat (59) and the Adjusting Nut Lock (62), indented side trailing. Thoroughly grease the Clutch Balls, Bearing and Adjusting Nut Lock.

**NOTICE**

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

9. Start the Clutch Adjusting Nut (61), detent side first, onto the Clutch Shaft and run it finger tight against the compression of the Spring.
10. Remove the assembled Clutch from the vise.
11. Install the Clutch Shaft Assembly into the Clutch Housing (51), spline of Clutch Shaft Support trailing.

12. Install the Clutch Housing Assembly into the Gear Case Assembly (36), matching the spline of the Clutch Housing with that of the Gear Case.
13. Thread the Coupling Nut (69) onto the Gear Case, hand tight. Grasp the flats of the Gear Case in leather-covered or copper-covered vise jaws and using a wrench on the flats of the Coupling Nut, tighten it to 25 ft-lb (34 Nm) torque.

**Assembly of the Angle Attachment**

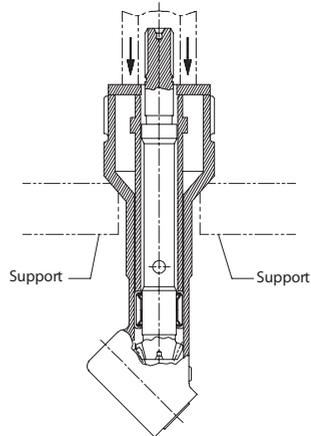
1. Lubricate the Bevel Pinion (107, 108 or 204) as instructed under **LUBRICATION** and insert it, **gear end first**, into the long bore of the Angle Head (101 or 201).
2. Lubricate the Bevel Pinion Bearing (109 or 205) as instructed under **LUBRICATION** and insert it, **unstamped end first**, into the bore of the Angle Head and onto the bevel pinion shaft.
3. **For 7L1A1, 7L1A3 or 7L1A4 Angle Head**, use No. 7L1A-950 Bearing Inserting Tool and press the Bevel Pinion Bearing so the stamped face is a maximum of 2.40" (61 mm), but not less than 2.38" (60.5 mm) below the end face of the Angle Head.  
**For 712A4 Angle Head**, use No. 7L2A-950 Bearing Inserting Tool and press the Bevel Pinion Bearing so the stamped face is a maximum of 1.65" (42.0 mm) but, not less than 1.64" (41.75 mm) below the end face of the Angle Head. Install the Bevel Pinion Bearing Spacer (116). Using snap ring pliers, install the Pinion Bearing Spacer Retainer (114).  
**For 5L2C3, 5L2C5 or 5L2C6 Angle Head**, press the Bevel Pinion Bearing, stamped face facing outward, using the Pinion Bearing Spacer (209).

**NOTICE**

**The outward face of the Spacer must be flush with the internal groove in the Angle Housing. Using snap ring pliers, install the Bearing Spacer Retainer (210).**

**For 5L2D5 or 6L2D6 Angle Head**, use No. 7L2A-950 Bearing Inserting Tool and press the Bevel Pinion Bearing so the stamped face is a maximum of 1.65" (42.0 mm), but not less than 1.64" (41.75 mm) below the end face of the Angle Head. Install the Pinion Bearing Spacer (209). Using snap ring pliers, install the Pinion Bearing Spacer Retainer (210).

**For 7L1B1 or 7L1B4 Angle Head**, use the long Bearing Inserting Sleeve included in the 71B1-955 Bearing Inserting Tool package and press the Bevel Pinion Bearing so the stamped face is a maximum of 2.12" (54 mm) but not less than 2.11" (53.5 mm) below the end face of the Angle Head. See Dwg. TPD793.



(Dwg. TPD793)

4. For **7L1A1, 7L1A3, 7L1A4, 7L1B4, 7L1B4, 7L2A4, 5L2D5 or 6L2D6 Angle Head**, lubricate the Bevel Pinion Thrust Bearing (112 or 211) as instructed under **LUBRICATION**. Install in order named the Front Thrust Bearing Seat (113 or 208), Bevel Pinion Thrust Bearing, and Rear Thrust Bearing Seat (111 or 206) over the splined end of the Bevel Pinion and retain with the Bearing Seat Retainer (110 or 207).  
For **5L2C3, 5L2C5 or 5L2C6 Angle Head**, lubricate the Bevel Pinion Thrust Bearing (211) as instructed under **LUBRICATION**. Install the Bearing over the splined end of the Bevel Pinion and retain with the Bearing Retainer (212).
5. If the Lower Spindle Bearing (119 or 213) has been removed, use a sleeve that will contact only the inner ring of the Bearing and press the Lower Spindle Bearing, sealed side first, onto the Spindle (217 or 219).

**NOTICE**

**The Lower Spindle Bearing is a slip fit on the Angle Drill Spindle (107).**

6. Slide the Bevel Gear (107 or 204) onto the Spindle.
7. Apply Loctite® Primer Grade T to the threads of the Bevel Gear Retainer (120 or 214) and Spindle. Allow to dry for approximately five minutes. Apply Loctite® No. 242 to the threads of the Bevel Gear Retainer and tighten it on the Spindle to 10 ft-lb (13.5 Nm) torque.
8. If the Spindle Upper Bearing (104, 105 or 203) was removed, install a new Bearing as follows:
  - a. For **7L1A1, 7L1A3 or 7L1A4 Angle Head**, apply a small drop of Loctite No. 601 to the small outside diameter of the Upper Spindle Bearing Shaft.

**CAUTION**

**Do not get any Loctite in the bearing; damage to the bearing could result.**

- b. Press the Spindle Upper Bearing (105) onto the Spindle (122) and allow the Loctite to cure for a minimum of 10 minutes.

**NOTICE**

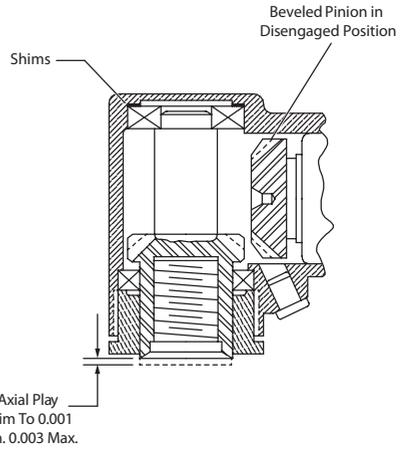
**Make sure the Bevel Pinion (108) is pulled outward toward the Bevel Pinion Bearing before inserting the Spindle into the Angle Head.**

- c. Slip the Lower Spindle Bearing over the end of the Spindle and into the Angle Head recess.
- d. Insert the Spindle into the Angle Head until the Upper Spindle Bearing seats into the recess of the Angle Head.
- e. Install the Spindle Bearing Cap (121) finger tight.
- f. Spindle must turn freely.
- g. While holding the Bevel Pinion out of engagement with the Spindle, measure the amount of end play in the Spindle. Subtract .002" (.051 mm) from the reading to determine the required shim thickness.
- h. Unscrew and remove the Spindle Bearing Cap. While pulling the Bevel Pinion outward toward the Bevel Pinion Bearing (109), remove the Spindle from the Angle Head.

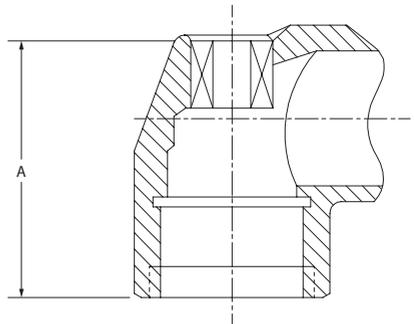
**NOTICE**

**The shim Packet contains three .002" (.05 mm) shims and two .005" (.13 mm) shims.**

- i. Insert the required number of shims, as determined from step (g) into the upper bearing recess of the Angle Head. See Dwg. TPD682-1.



- j. Reassemble and test the Angle Head as indicated in steps (c) through (g).
- k. For **7L2A4, 5L2C3, 5L2C5, 5L2C6, 5L2D5 or 6L2D6 Angle Head**, press on the closed end of a new Upper Spindle Bearing (104 or 203) entering the Bearing into the small bore opposite the threaded end of the Angle Head. See Dwg. TPD680.

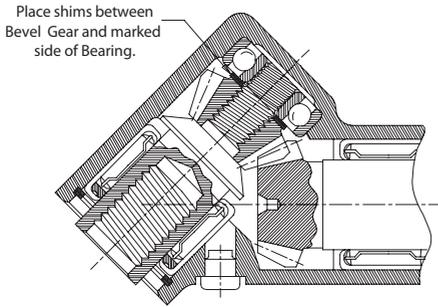


(Dwg. TPD680)

Minimum Dimension "A"		Maximum Dimension "A"	
in	mm	in	mm
1.21	30.75	1.27	31.25

- i. For **7L1B1 Angle Head**, install all the shims provided with each Spindle Upper Bearing on the Spindle against the Bevel Gear. See Dwg. TPD787.

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(Dwg. TPD787)

- m. Apply a small drop of Loctite No. 601 to the small outside diameter at the upper end of the Spindle.



**CAUTION**

**Do not get any Loctite in the Bearing; damage to the Bearing could result.**

- n. Press the Spindle Upper Bearing, stamped side against the shims, onto the Spindle and allow the Loctite to cure for a minimum of 10 minutes.
- o. Lubricate the Spindle as instructed on Page 3 and insert the Spindle into the Angle Head until the Spindle Upper Bearing seats into the recess of the Angle Head.



**NOTICE**

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

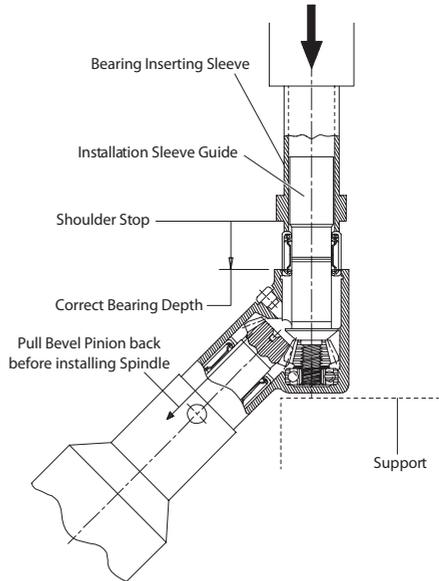
- p. Slip the Lower Spindle Bearing, stamped end out, over the end of the Spindle and against the face of the Angle Head.
- q. Insert the smaller diameter of the Installation Sleeve Guide into the Lower Spindle Bearing until it stops against the face of the Spindle. See Dwg. TPD794-1.



**CAUTION**

**Do not attempt to press the Bearing into the housing with this guide. It is only to be used for alignment.**

- r. Slide the shouldered end of the Bearing Inserting Sleeve onto the Guide until the end of the Sleeve 7 contacts the Lower Spindle Bearing.
- s. With the closed end of the Angle Head resting on a flat surface, press the Lower Spindle Bearing into the housing until the shoulder of the Sleeve stops against the face of the Angle Head or until the stamped face of the Bearing is a maximum of 0.113" (2.88 mm) but not less than 0.108" (2.75 mm) below the face of the Angle Head.



(Dwg. TPD794-1)

- t. Using a thin blade screwdriver, start one end of the Lower Spindle Bearing Retainer (119A) into the groove in the Angle Head. Rotate the screwdriver around the Spindle to spiral the Retainer into the groove.
9. Lubricate the Spindle Upper Bearing, Bevel Gear and Lower Spindle Bearing as instructed under **LUBRICATION** and install the Spindle into the Angle Head.
  10. Clean the threads on the Angle Head and the Spindle Bearing Cap (121 or 218); apply a film of Vibra Tite\*\* VC3 to the threads.
  11. **For 7L1A1, 7L1A3 or 7L1A4 Angle Head**, install the Spindle Bearing Cap and tighten the Cap to a minimum of 35 in-lb (4.0 N m) torque.  
**For 7L2A4, 5L2C3, 5L2C5, 5L2C6, or 5L2D5 Angle Head**, install the Spindle Bearing Cap and tighten the Cap to a minimum of 15 ft-lb (20.0 Nm) torque.  
**For 6L2D6 Angle Head**, install the Spindle Seal (221A) and Spindle Bearing Cap. Tighten the cap to a minimum of 15 ft-lb (20.0 Nm) torque.
  12. Slide the Coupling Nut (124 or 216), threaded end trailing, over the splined end of the Angle Head.
  13. Apply the Coupling Nut Retainer (123 or 215) to the external groove on the splined end of the Angle Head.
  14. **For 5L2C3, 5L2C5 or 5L2C6 Angle Head**, engage the spline on the Bevel Pinion with the matching spline in the Clutch Shaft (55) and thread the Coupling Nut onto the Clutch Attachment. Tighten the Coupling Nut to a minimum of 25 ft-lb (34 Nm) torque. The output end of the Spindle should be on the same side of the tool as the Throttle Lever.  
**For 7L1A1, 7L1A3, 7L1A4, 7L1B1, 7L1B4, 7L2A4, 5L2D5 or 6L2D6 Angle Head**, engage the spline on the Bevel Pinion with the matching spline in the Spindle (27) and thread the Coupling Nut onto the Gear Case (36). Tighten the Coupling Nut to a minimum of 25 ft-lb (34 Nm) torque. The output end of the Spindle should be on the same side of the tool as the Throttle Lever.

\* Registered trademarks of Loctite Corporation.

## Troubleshooting Guide

Trouble	Probable Cause	Solution
Loss of Power	Low air pressure	Check air supply. For top performance, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet.
	Plugged Inlet Bushing Screen or Air Strainer Screen	Clean the screen in a clean, suitable, cleaning solution. If the Screen cannot be cleaned, replace it.
	Worn or broken Vanes	Replace the <b>complete</b> set of Vanes.
	Worn or broken Cylinder	Replace the Cylinder if it is cracked or if the bore appears wavy or scored.
	Scoring of End Plates	Replace End Plates if they are scored.
	Improper lubrication or dirt build-up	Clean the Motor Unit parts and lubricate as instructed.
Leaky Throttle Valve	Clogged Muffler	Clean the Muffler Element in a clean, suitable, cleaning solution. If it cannot be cleaned, replace it.
	Worn Throttle Valve and/or Throttle Valve Seat	Install a new Throttle Valve and/or a Throttle Valve Seat.
Leaky Throttle Valve	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 of the recommended oil in the air inlet and operate the tool for 30 seconds to lubricate all the cleaned parts.
	Scoring	Make certain that all Motor or Cylinder parts are properly aligned prior to clamping the motor assembly.
Gear Case gets hot	Improper assembly	Make certain that all Motor or Cylinder parts are properly aligned prior to clamping the motor assembly.
	Excessive grease	Clean and inspect the Gear Case and gearing parts and lubricate as instructed.
Angle Attachment gets hot	Worn or damaged parts	Clean and inspect the Gear Case and gearing. Replace worn or broken components.
	Excessive grease	Clean and inspect the Angle Head and gearing. Lubricate as instructed.
	Inadequate grease	Inject 0.5 to 1.0 cc of grease into the Grease Fitting.
Inconsistent disengagement of Clutch Attachment	Worn or damaged parts	Clean and inspect the Angle Head and Gearing. If the Bevel Gear and/or Bevel Pinion is worn or broken, replace <b>both</b> parts as they are a matched set.
	Improper lubrication.	Lubricate the Attachment in accordance with the instructions on page 3.
	Worn or damaged part	Replace the worn or damaged parts.
Motor stalls	Worn Clutch Spring (using a Heavy Spring on a light torque application)	Install a Light Clutch Spring in place of the Heavy Spring.
	Improper adjustment of Attachment or incorrect gearing ratio for the application	Check the adjustment of the Attachment and review the tool performance compared to torque requirements.
Motor shuts off before torque peak is reached	Improper adjustment of Attachment or incorrect gearing ratio for the application	Check the adjustment of the Attachment and review the tool performance compared to torque requirements.

### Related Documentation

For additional information refer to:  
 Product Safety Information Manual 04580353 and 04585006.  
 Product Information Manual 16572182, 80167471 and 80167489.  
 Parts Information Manual 16572802.

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

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**Notes:**

**Notes:**

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