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Air Drill

1 Series

Maintenance Information



Save These Instructions

IR *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).

Lubrication

Each time a 1 Series Drill or Angle Drill is disassembled for maintenance and repair or replacement of parts, lubricate the tool as follows:

1. Gearing

For 2100 rpm or more, coat gears with 2 to 4 cc of **Ingersoll Rand** No. 28 Grease.

For models below 2100 rpm, coat gears with 4 to 6 cc of **Ingersoll Rand** No. 28 Grease.

2. Angle Head

Inject 2 to 4 cc of **Ingersoll Rand** No. 67 Grease into the Grease Fitting (101).

3. 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.

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 1 Series Drill is comprised of three modules or units. In-line and Pistol Drills have a motor housing and motor unit, a gear unit and a drill chuck spindle unit. Angle Drills have a motor housing and motor unit, a gear unit and an angle attachment unit. The tool can be disassembled for repairs to each individual unit without disturbing the other units.
2. **For Pistol and In-Line models: to remove Drill Chuck (51)**, lightly grasp the tool in a copper-covered vise using the flats on the Gear Case (38). Insert the Chuck Key into one of the holes in the Chuck and tap lightly with a hammer. Remove the Drill Chuck Spacer (50).
3. **For Models 1LJ1A1 and 1LL1A1**, to remove the Angle Attachment, use two wrenches to unscrew the Coupling Nut (111) from the Gear Case and lift off the entire angle attachment.
4. Using two wrenches, unscrew and remove the Gear Case from the Motor Housing (1).

Disassembly of the Angle Attachment

1. Carefully grasp the Angle Head in copper-covered vise jaws so that the Spindle is facing upward.
2. Using a wrench, remove the Spindle Bearing Cap (110).

NOTICE

This is a left-hand thread.

Do not remove the Spindle (102) from the Angle Head until the Bevel Pinion (102) is pulled outward against the Bevel Pinion Thrust Bearing (106). Failure to do so could damage the Spindle Upper Bearing (103), making it impossible to remove the Bearing

from the Spindle. Also, the Bevel Pinion could be damaged. If tightness or binding occurs, check to make sure the Bevel Pinion has been pulled outward.

3. Pull the Spindle from the Angle Head.
4. Inspect the lower Spindle Bearing (109) for looseness or roughness. If either of these conditions exist, press the Bearing from the Spindle.
5. If the Spindle Upper Bearing (103) appears rough or loose, press off the Spindle.
6. Remove the Thrust Bearing Retainer (107), Rear Thrust Bearing Seat (108) and Bevel Pinion Thrust Bearing (106) from the Bevel Pinion (102) shaft.
7. Grasp the spline of the Bevel Pinion shaft in leather-covered or 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 Bevel Bearing (105) from the Angle Housing.

NOTICE

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

After the Angle Head is disassembled, check all parts for damage or wear.

8. If the gear teeth on either the Spindle or Bevel Pinion are worn or chipped, replace both parts.

NOTICE

These gear sets are furnished in a matched set and must be replaced as a matched set.

Disassembly of Gearing

1. Using a thin blade screwdriver, work the Motor Clamp Washer Retaining Ring (37) from the groove in the Gear Case and withdraw the Motor Clamp Washer (36).
2. **For Models 1P44, 1P21, 1P13, 1P09, 1P06 and 1LJ1A1**, tap the motor end of the Gear Case against the top of the workbench to remove the Gear Head (42), Gear Head Spacer (41), Drive Plate (43) or Gear Head Planet Gears (44).
For 1P76, 1P21 and 1P13, remove the Rotor Pinion (45).
3. **For Models 1LJ1A1 and 1LL1A1**, using pair of snap ring pliers, remove the Spindle Retaining Ring (49A) from the groove in the front of the Spindle.
4. To remove the Spindle (39) and Spindle Planet Gears (40), firmly hold the Gear Case and tap the end of the Spindle on front of the

Gear Case with a soft-faced hammer, driving the Spindle from the Gear Case.

- Use snap ring pliers to remove the Spindle Bearing Retainer (49) from the groove in the front of the Gear Case.
- Using a sleeve that contacts the outer ring of the bearing, press the Rear Spindle Bearing (46) from the front of the Gear Case.

Disassembly of the Motor

- Grasp the splined end of the Rotor (33) and pull the motor from the Motor Housing (1).
- Withdraw the Rear End Plate Gasket (29) from the bottom of the housing bore.
- While grasping the Cylinder (32) in one hand, lightly tap on the splined end of the Rotor to drive the Rotor from the bore of the Front End Plate (30) and Bearing.
- Using snap ring pliers, remove the Front Rotor Bearing Retainer (31) and pull the Front Rotor Bearing from the Front End Plate.
- Slide the Cylinder off the Rotor, and withdraw the Vanes (34) from the vane slots.
- Remove the Rear Rotor Bearing Retainer (26) from the groove in the hub of the Rotor.
- Support the Rear End Plate (28) as close to the rotor body as possible, and press the Rotor from the Rear Rotor Bearing.

Disassembly of the Motor Housing

For Pistol Grip (Models 1A and 1P)

- Lightly grasp the pistol grip handle in copper-covered vise jaws so that the Air Inlet Busing (19) is upward.
- Unscrew the Air Inlet Busing and remove the Inlet Bushing Spacer (21), Muffler Assembly (22), Muffler O-Ring (23), Air Strainer Screen (20), Throttle Valve Spring (11) and Throttle Valve (10).
- Withdraw the Trigger (7) and Trigger Pin Seal (8).

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.
- Apply a film of O-ring lubricant to all O-rings before final assembly.
- 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.

Assembly of the Motor Housing

For Pistol Grip (Models 1A and 1P)

- Grasp the handle in a vise so that the handle is vertical and the entrance to the handle bore is upward.
- Note that the Throttle Seat Valve (9) is symmetrical and can be installed in the handle either side first in order to get full use of each side. Push the Throttle Valve Seat into the tapped bore or the handle with a 1/2" (13 mm) diameter dowel. Push it in until it seats.
- Install the Trigger Pin Seal (8) onto the trigger pin and insert Trigger (7) in the Housing.
- Installation of the Throttle Valve is sometimes a bit difficult 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 pin. Although the Valve can be held with a push-button mechanical 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

- Using a stiff wire hook, pull the Throttle Valve Seat (9) from the handle.
- Using a pair of needle-nose pliers, pull the Muffler Element (24) from the handle.

Disassembly of the Motor Housing

For In-Line and Angle Drills



WARNING

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

- Remove the Throttle Valve Cap (13), Throttle Valve Spring (11), Throttle Valve Ball (14) and Throttle Valve Plunger (12) from the Motor Housing (1).
- Using an adjustable wrench, remove the Inlet Busing Assembly (17).
- If the Inlet Screen (18) requires replacement, use the eraser end of a wooden pencil to push the Inlet Screen from the Inlet Busing Assembly.
- Remove the Exhaust Deflector Assembly (2) from the Motor Housing.
- Remove the Exhaust Deflector Seal (6) from the Housing.
- The Throttle Lever (3) is attached to the Exhaust Deflector Assembly with two Throttle Lever Pins (4) which are two-piece rivets. Lightly grasping the Deflector in 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.
- Work the Muffler Elements out of the Exhaust Deflector.

depth, then backing 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 to hold the Valve while removing the pencil.

- Place the Air Strainer Screen (20), closed end first, inside the large end coil of the Throttle Valve Spring (11).
- Insert the Throttle Valve Spring and Screen, small coil first, into the handle so that the Spring encircles the end of the Throttle Valve.
- If the Muffler Element (24) was removed from the handle, wash it in a clean, suitable, cleaning solution and then fold it and pinch it dry. While keeping it folded, insert it into the exhaust cavity in the handle.
- Place the Muffler O-Ring (23) over the perforated baffle of the Muffler (22).
- Place the Muffler on the face of the handle so that the perforated baffle extends into the handle.
- Slide the Inlet Busing Spacer (21) over the threaded end of the Inlet Busing (19), and install the Inlet Busing in the handle. Tighten it to 26 ft-lb (35 Nm) of torque.

Assembly of the Motor Housing

For In-Line and Angle Drills

- Work new Muffler Elements (25) into the Exhaust Deflector (2) or (5) to a point beyond the two throttle lever pin holes.
- Position the Throttle Lever (3) on the Exhaust Deflector with the Lever covering the timing notch at the front end of the Deflector. Insert the two Throttle Lever Pins (4) 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.

NOTICE

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

- Center a new Inlet Screen (18) over the air line end of the Inlet Busing Assembly (17) and, using the eraser end of a wooden pencil, push the Screen into the Busing until it bottoms on the internal shoulder.

- Place the Exhaust Deflector Seal (6) on the smaller shoulder of the Motor Housing. 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.
- Before installing throttle components, make sure that the Motor Housing is positioned correctly. The Throttle Lever should be facing downward. Shift leftward the Throttle Valve Plunger (12), Throttle Valve Ball (14) and Throttle Valve Spring (11) into the Motor Housing. Position the Throttle Valve Cap (13) on the Throttle Valve Spring. Screw the Valve Cap into the Motor 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 thread locking compound to cure approximately five minutes.

Assembly of the Motor

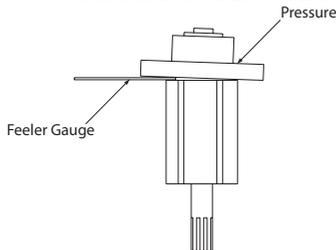
- Place the Rear End Plate (28) on the short, unsplined shaft of the Rotor (33) with the counterbore away from the body of the Rotor.
- Using a sleeve that contacts the inner ring of the Rear Rotor Bearing (27), press the Bearing onto the shaft until the Rear End Plate just contacts the rotor body.
- The clearance between the Rear End Plate and Rotor is critical. While pressing down with your finger on 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 (26) on the shaft.

Measurement of Rear End Clearance



(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 (34) with a light film of **Ingersoll Rand** No. 10 oil and place a Vane in each slot in the Rotor.
- Note that the Cylinder (32) has a notch in one end. Place the Cylinder, notched end up, down 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.
- Install the Front Rotor Bearing (27) in the Front End Plate (30) and retain it with the Front Rotor Bearing Retainer (31).
- 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 (29) 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 (35), making certain the Cylinder Dowel is flush with or below the Front End Plate.

Assembly of the Gearing

For Models 1AL1, 1P06, 1P09, 1P13, 1P21, 1P38, 1P44, 1P76, 1S30, 1S39 and 1S60

- Set the Gear Case (38) on the table of an arbor press with the threaded end down.
- Using a sleeve that will contact the outer ring of the bearing, press the Rear Spindle Bearing (46), open side first, into the bearing recess until it seats.
- Work some grease into the teeth of the Spindle Planet Gears (40) and onto the planet gear shafts on the Spindle (39).
- Slide the Spindle into the Gear Case so that the spindle shaft passes through the bore of the Rear Spindle Bearing.
- For Angle Drills, install the Spindle Retaining Ring (49A) into groove on the Spindle shaft. For Pistol and In-line Drills, install the Spindle Bearing Spacer (47) and Front Spindle Bearing (48), shielded side out, on the shaft of the Spindle.
- Install the Spindle Bearing Retainer (19) in the groove in the Gear Case.
- 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.
- For Models 1P13, 1P21 and 1P76**, work some grease into the teeth of the Rotor Pinion (45). Place the Rotor Pinion in the Spindle so that it meshes with the Spindle Planet Gear.
- For Models 1P06, 1P09, 1P13, 1P21, 1P44 and 1S39**, coat the Gear Head Spacer (41) with grease and place it in the Gear Case against the Spindle Planet Gears.
- For Models 1P06, 1P09, 1P13, 1P21, 1P44 and 1S39**, work some grease onto the planet gear shafts on the Gear Head (42). **For Model 1P06**, work some grease into the teeth of the Gear Head Planet Gears (44).
- For Models 1P06, 1P09, 1P13, 1P21, 1P44 and 1S39**, slide the Gear Head into the Gear Case so that the teeth on the gear head shaft mesh with the Spindle Planet Gears.
- For Models 1P06, 1P09, 1P13 and 1P21**, 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.
- For Models 1P44 and 1S39**, slide the Drive Plate (43) on the planet gear shafts of the Gear Head.
- For Models 1P09, 1P13 and 1P21**, 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.
- Place the Motor Clamp Washer (36) into the Gear Case and install the Clamp Washer Retaining Ring (37).

For Models 1LL1A1 and 1LJ1A1

- Hold the Gear Case (38) with the notched end upward.
- Slide the Spindle Bearing (48), open side first, into the Gear Case until it seats against the bearing recess.
- Install the Spindle Bearing Retainer in the groove in the Gear Case.
- Work some grease into the teeth of the Spindle Planet Gears (40) and into the planet gear shafts of the Spindle (39).
- Slide the Spindle Bearing Spacer (47) over the shaft of the Spindle.
- Slide the Spindle into the Gear Case so that the spindle shaft passes through the bore of the bearing.
- 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.
- For Model 1LJ1A1, put some grease on the planet gear shafts and slide the Gear Head (42) into the Gear Case so that the teeth on the gear head shaft mesh with the Spindle Planet Gears.

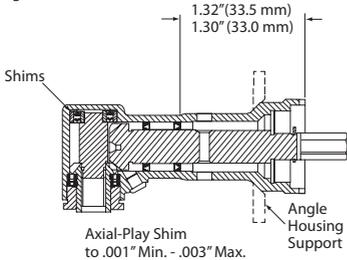
- For Model 1LJIA1, slide the Drive Plate (43) onto the planet gear shafts of the Gear Head.

For all Models

- Place the Motor Clamp Washer (36) in the Gear Case against the internal gear. Install the Clamp Washer Retaining Ring (37).

Assembly of the Angle Attachment

- Work a light coat of grease into the gear teeth of the Bevel Pinion (102) and insert it, gear end first, into the long bore of the Angle Housing (100).
- Work 0.5 to 1 cc of grease into the Bevel Pinion Bearing (105) and insert it, unstamped end first, into the bore of the Angle Housing, after the Bevel Pinion.
- Support the Angle Housing on an angled support as shown. Refer to Dwg. TPB585. 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. TPB585.
- 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. Refer to Dwg. TPB585. Secure Bearing on shaft with Thrust Bearing Retainer (107).



(Dwg. TPB585)

- Apply a small drop of Loctite No. 601 to the small outside diameter of the spindle upper bearing shaft on the Spindle (102).
- Apply 2 to 3 cc of grease to the Spindle Upper Bearing (103) and a light coat of grease to the gear teeth on the Spindle. Press the Spindle Upper Bearing onto the Spindle and allow the Loctite to dry a minimum of ten minutes.

NOTICE

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

- Insert the Spindle into the Angle Head until the Spindle Upper Bearing seats into the recess of the Angle Head.

NOTICE

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

- Slip the Lower Spindle Bearing over the end of the Spindle and into the angle head recess.
- Install the Spindle Bearing Cap (110) finger tight.
- Spindle must turn freely.
- 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.
- Unscrew and remove the Spindle Bearing Cap. While pulling the Bevel Pinion outward toward the Bevel Pinion Bearing, remove the Spindle from the Angle Head.
- Insert the required number of shims, as determined in step (11) into the upper bearing recess of the Angle Head.

NOTICE

Shim Packet contains three .002" (.05 mm) shims and two .005" (.13 mm) shims.

- Reassemble and test the Angle Head as indicated in steps (6) through (12).
- 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.
- Install the Angle Housing Cap and tighten to 35 in-lb (3.9 Nm) torque.
- Install the Rear Thrust Bearing Seat (108) on the bevel pinion shaft with the flat face against the Thrust Bearing.
- Slide the Coupling Nut Retainer (112) and the Coupling Nut (111), threaded end trailing, over the notched end of the Angle Housing.
- Compress the Coupling Nut Retainer, and work it into the internal groove in the unthreaded end of the Coupling Nut.

Assembly of the Tool

- Apply some grease to the spline of the rotor shaft and screw the Gear Case and components into the Motor Housing. Tighten to 15 to 18 ft-lb (20 to 25 Nm) torque.

NOTICE

This is a left-hand thread.

- For Models 1LLIA1 and 1LJIA1, align the pin in the Rear Thrust Bearing Seat with the notch in the Gear Case (38) and screw the Coupling Nut onto the Gear Case. Tighten to 18.4 to 22.1 ft-lb (25 to 30 Nm) of torque.

NOTICE

This is a left-hand thread.

- For all other models, slide the Drill Chuck Spacer (50) over the threaded end of the Drill Chuck Spindle and install the Drill Chuck (51).

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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 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 complete 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 for about 30 seconds. Immediately pour 3 cc of the recommended oil in the air inlet and operate the tool for 30 seconds to lubricate all the cleaned parts.
Gear Case gets hot	Excessive grease	Clean and inspect the Gear Case and gearing parts and lubricate as instructed.
	Worn or damaged parts	Clean and inspect the Gear Case and gearing. Replace worn or broken components.
Angle Head gets hot	Excessive grease	Clean and inspect the Angle Head and gearing parts. Lubricate as instructed.
	Inadequate grease	Inject 0.5 to 1.5 cc of the recommended grease into the Grease Fitting.
	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 both parts as they are a matched set.

Related Documentation

For additional information refer to:

Product Safety Information Manual 04580353.

Product Information Manual 16572059.

Parts Information Manual 16572760.

Manuals can be downloaded from ingersollrandproducts.com

Notes:

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