04576658

Form P7424
Edition 1
August, 1999

MAINTENANCE SECTION COVERING ANGLE HEAD MODULES for 150 SERIES D TORQUE CONTROL WRENCHES

WHEN THIS MODULE IS USED WITH AN ELECTRIC POWERED TOOL

⚠ WARNING

IMPORTANT SAFETY INFORMATION ENCLOSED.
READ ALL THESE INSTRUCTIONS BEFORE PLACING TOOL IN SERVICE OR OPERATING THIS TOOL AND SAVE THESE INSTRUCTIONS.
IT IS THE RESPONSIBILITY OF THE EMPLOYER TO PLACE THE INFORMATION IN THIS MANUAL INTO THE HANDS OF THE OPERATOR.
FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

Disconnect the Power Cord from the receptacle before performing any maintenance on this tool.

This symbol is to alert the user and service personnel to the presence of uninsulated dangerous voltage that will cause a risk of electric shock.

This symbol is to alert the user and service personnel to the presence of important operating instructions that must be read and understood to prevent personal injury, electrical shock or damage to the equipment.

WHEN USING ELECTRIC TOOLS, BASIC SAFETY PRECAUTIONS SHOULD ALWAYS BE FOLLOWED TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK AND PERSONAL INJURY, INCLUDING THE FOLLOWING.

PLACING TOOL IN SERVICE

- **Use only with Ingersoll–Rand Series Controllers.**
- **Always operate, inspect and maintain this tool in accordance with all regulations (local, state, federal and country), that may apply to hand held/hand operated electric tools.**
- **Inspect tool cords periodically and if damaged, have them repaired by an authorized service facility.**
- **Do not remove any labels. Replace any damaged label.**

USING THE TOOL

- **Always wear eye protection when operating or performing maintenance on this tool.**
- **Always wear hearing protection when operating this tool.**
- **Power tools can vibrate in use. Vibration, repetitive motions, or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.**
- **Guard Against Electric Shock.** Prevent body contact with earthed or grounded surfaces. For example; pipes, radiators, ranges, refrigerator enclosures.
- **Don't abuse Cord.** Never carry tool by cord or yank it to disconnect from receptacle. Keep cord from heat, oil, and sharp edges.
- **Keep work area clean.** Cluttered areas and benches invite injuries.

(Continued on page 4–2)

NOTICE

The use of other than genuine Ingersoll–Rand replacement parts may result in personal injury, decreased tool performance and increased maintenance, and may invalidate all warranties.

Have your tool repaired by a qualified person. This electric tool is in accordance with the relevant safety requirements. Repairs should only be carried out by qualified persons using original spare parts, otherwise this may result in considerable danger to the user.

Repairs should be made only by authorized, trained personnel. Consult your nearest Ingersoll–Rand Authorized Servicenter.

Refer All Communications to the Nearest Ingersoll–Rand Office or Distributor.

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INGERSOLL-RAND®
PROFESSIONAL TOOLS

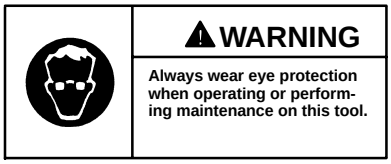
⚠ WARNING

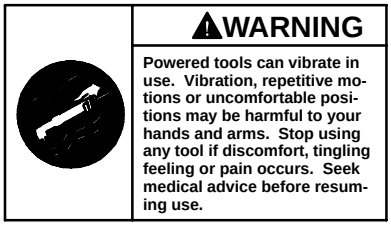
FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

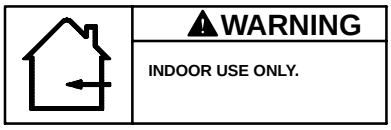
USING THE TOOL *(Continued)*

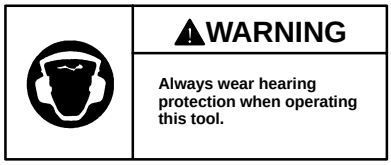
- **Consider work area environment.** Don't expose power tools and chargers to water. Keep work area well lighted. Do not use tool in explosive or flammable atmospheres.
- **Keep bystanders and children away.** Do not permit unauthorized personnel to operate this tool, or touch tool or cord.
- **Store idle tools.** When not in use, tools should be stored in a dry, high or locked up place, out of reach of children.
- **Don't force tool.** It will do the job better and more safely at the rate for which it was intended.
- **Use the right tool.** Do not force a small tool or attachment to do the job of a heavy–duty tool.
- **Do not use a tool for a purpose for which it is not intended.** Example: Do not use a screwdriver as a drill.
- **Dress properly.** Do not wear loose clothing or jewelry. They can be caught in moving parts. Rubber gloves and non–skid footwear are recommended when working outdoors. Wear protective hair covering to contain long hair.
- **Secure work.** Use clamps or a vise to hold work. Operators often need both hands to perform job functions.
- **Don't overreach.** Keep proper footing, balance, and a firm grip on the tool at all times.
- **Maintain tools with care.** Keep tools clean for better and safer performance. Follow instructions for lubricating and changing accessories. Inspect tool cords periodically and if damaged, have them repaired by an authorized service facility. Inspect extension cords periodically and replace if damaged. Keep handles dry, clean, and free from oil and grease.
- **Remove adjusting keys and wrenches.** Form habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.
- **Avoid unintentional starting.** Don't carry tool with finger on switch.
- **Do not drop or abuse the tool.**
- **Anticipate and be alert for sudden changes in motion during start up and operation of any power tool.**
- **Whenever a tool is not being used, position the Power Switch to the "OFF" position and unplug the power cord.**
- **Stay alert.** Watch what you are doing. Use common sense. Do not operate tool when you are tired.
- **Check damaged parts.** Before further use of the tool, a guard or other part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function. Check for alignment of moving parts, binding of moving parts, breakage of parts, mounting, and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced by an authorized service center unless otherwise indicated elsewhere in this operation manual.
- **Have defective switches replaced by an authorized service center.**
- **Do not use the tool if the switch does not turn it on and off.**
- **Whenever the Angle Head is installed or repositioned, the Throttle Lever must be positioned so that reaction torque will not tend to retain the throttle in the "ON" position.**
- **When installing or removing the output device on any tool, ALWAYS grasp a metal component of the tool while tightening or loosening the Coupling Nut or Spindle Cap. Acceptable clamping locations include, but are not limited to, the hex on the Gear Case, the Tool Hanger, the Torque Reaction Arm or any metal Mounting Plate. NEVER grasp the composite tool body or handle in vise jaws to restrain the torque of the Coupling Nut or Spindle Cap. Such practice will result in damage to the tool.**
- **Do not use power units and gear trains that exceed the capability of the output device.**
- **The Tube Nut Attachment has an opening on the front side for construction and application purposes. DO NOT, under any circumstance place your fingers in this opening.**
- **The Torque Reaction Bar must be positioned against a positive stop. Do not use the Bar as a dead handle and take all precautions to make certain the operator's hand cannot be pinched between the Bar and a solid object.**
- **When operated continuously for long periods of time, Series D Nutrunners may become hot at the spindle end of the tool. Take all precautions necessary to avoid skin contact with the hot surfaces. Prolonged contact may result in burns.**
- **All Series D Torque Control Wrenches and Nutrunners with reverse capability have rotational arrows molded into the housing in the area of the reversing mechanism. When the direction switching device is positioned nearest the molded circular arrow with an "F" in the center, spindle rotation will be forward or clockwise direction. When the direction switching device is positioned nearest the molded circular arrow with an "R" in the center, spindle rotation will be reverse or counterclockwise direction.**
- **Use only impact sockets and accessories. Do not use hand (chrome) sockets or accessories.**

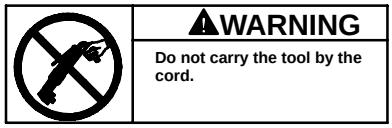
WARNING LABEL IDENTIFICATION

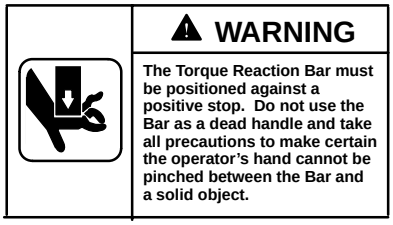


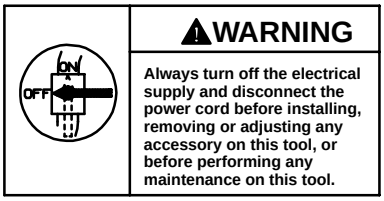


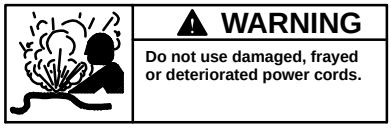


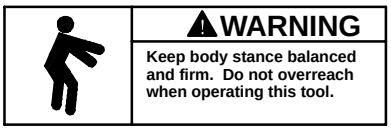












WHEN THIS MODULE IS USED WITH AN AIR POWERED TOOL

⚠ WARNING

IMPORTANT SAFETY INFORMATION ENCLOSED.
READ THIS MANUAL BEFORE OPERATING TOOL.
IT IS THE RESPONSIBILITY OF THE EMPLOYER TO PLACE THE INFORMATION IN THIS MANUAL INTO THE HANDS OF THE OPERATOR.
FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

PLACING TOOL IN SERVICE

- **Always operate, inspect and maintain this tool in accordance with all regulations (local, state, federal and country), that may apply to hand held/hand operated pneumatic tools.**
- **For safety, top performance, and maximum durability of parts, operate this tool at 90 psig (6.2 bar/620 kPa) maximum air pressure at the inlet with 3/8" (10 mm) inside diameter air supply hose.**
- **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.**
- **Do not use damaged, frayed or deteriorated air hoses and fittings.**
- **Be sure all hoses and fittings are the correct size and are tightly secured.**
- **Always use clean, dry air at 90 psig maximum air pressure. Dust, corrosive fumes and/or excessive moisture can ruin the motor of an air tool.**
- **Do not lubricate tools with flammable or volatile liquids such as kerosene, diesel or jet fuel.**
- **Do not remove any labels. Replace any damaged label.**

USING THE TOOL

- **Always wear eye protection when operating or performing maintenance on this tool.**
- **Always wear hearing protection when operating this tool.**
- **Keep hands, loose clothing and long hair away from rotating end of tool.**
- **Note the position of the reversing lever before operating the tool so as to be aware of the direction of rotation when operating the throttle.**
- **Anticipate and be alert for sudden changes in motion during start up and operation of any power tool.**
- **Keep body stance balanced and firm. Do not overreach when operating this tool. High reaction torques can occur at or below the recommended air pressure.**
- **Tool shaft may continue to rotate briefly after throttle is released.**
- **Air powered tools can vibrate in use. Vibration, repetitive motions or uncomfortable positions may be harmful to your hands and arms. Stop using any tool if discomfort, tingling feeling or pain occurs. Seek medical advice before resuming use.**
- **Use accessories recommended by Ingersoll–Rand.**
- **Use only impact sockets and accessories. Do not use hand (chrome) sockets or accessories.**
- **This tool is not designed for working in explosive atmospheres.**
- **This tool is not insulated against electric shock.**

(Continued on page 4–4)

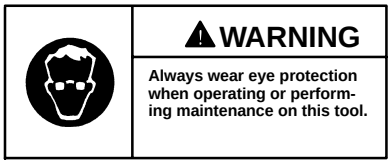
⚠ WARNING

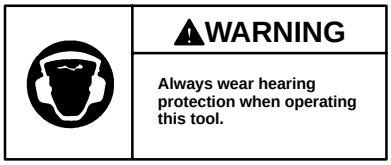
FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

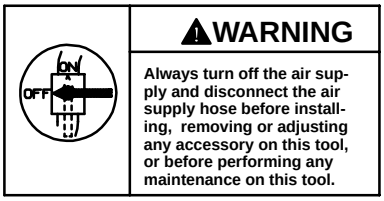
USING THE TOOL *(Continued)*

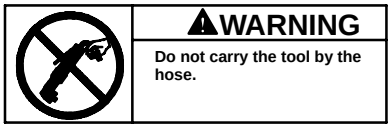
- **Do not remove the Inlet Plug without first disconnecting the live air supply.**
- **Whenever the Angle Head is installed or repositioned, the Throttle Lever must be positioned so that reaction torque will not tend to retain the throttle in the "ON" position.**
- **When installing or removing the output device on any tool, ALWAYS grasp a metal component of the tool while tightening or loosening the Coupling Nut or Spindle Cap. Acceptable clamping locations include, but are not limited to, the hex on the Gear Case, the Tool Hanger, the Torque Reaction Arm or any metal Mounting Plate. NEVER grasp the composite tool body or handle in vise jaws to restrain the torque of the Coupling Nut or Spindle Cap. Such practice will result in damage to the tool.**
- **Do not use power units and gear trains that exceed the capability of the output device.**
- **The Tube Nut Attachment has an opening on the front side for construction and application purposes. DO NOT, under any circumstance place your fingers in this opening.**
- **The Torque Reaction Bar must be positioned against a positive stop. Do not use the Bar as a dead handle and take all precautions to make certain the operator's hand cannot be pinched between the Bar and a solid object.**
- **When operated continuously for long periods of time, Series D Nutrunners may become hot at the spindle end of the tool. Take all precautions necessary to avoid skin contact with the hot surfaces. Prolonged contact may result in burns.**
- **All Series D Torque Control Wrenches and Nutrunners with reverse capability have rotational arrows molded into the housing in the area of the reversing mechanism. When the direction switching device is positioned nearest the molded circular arrow with an "F" in the center, spindle rotation will be forward or clockwise direction. When the direction switching device is positioned nearest the molded circular arrow with an "R" in the center, spindle rotation will be reverse or counterclockwise direction.**

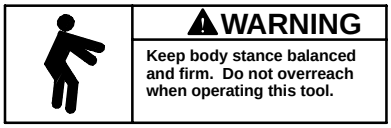
WARNING LABEL IDENTIFICATION

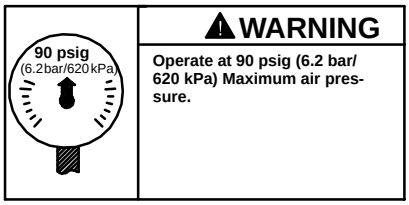


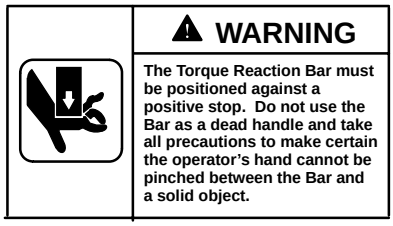






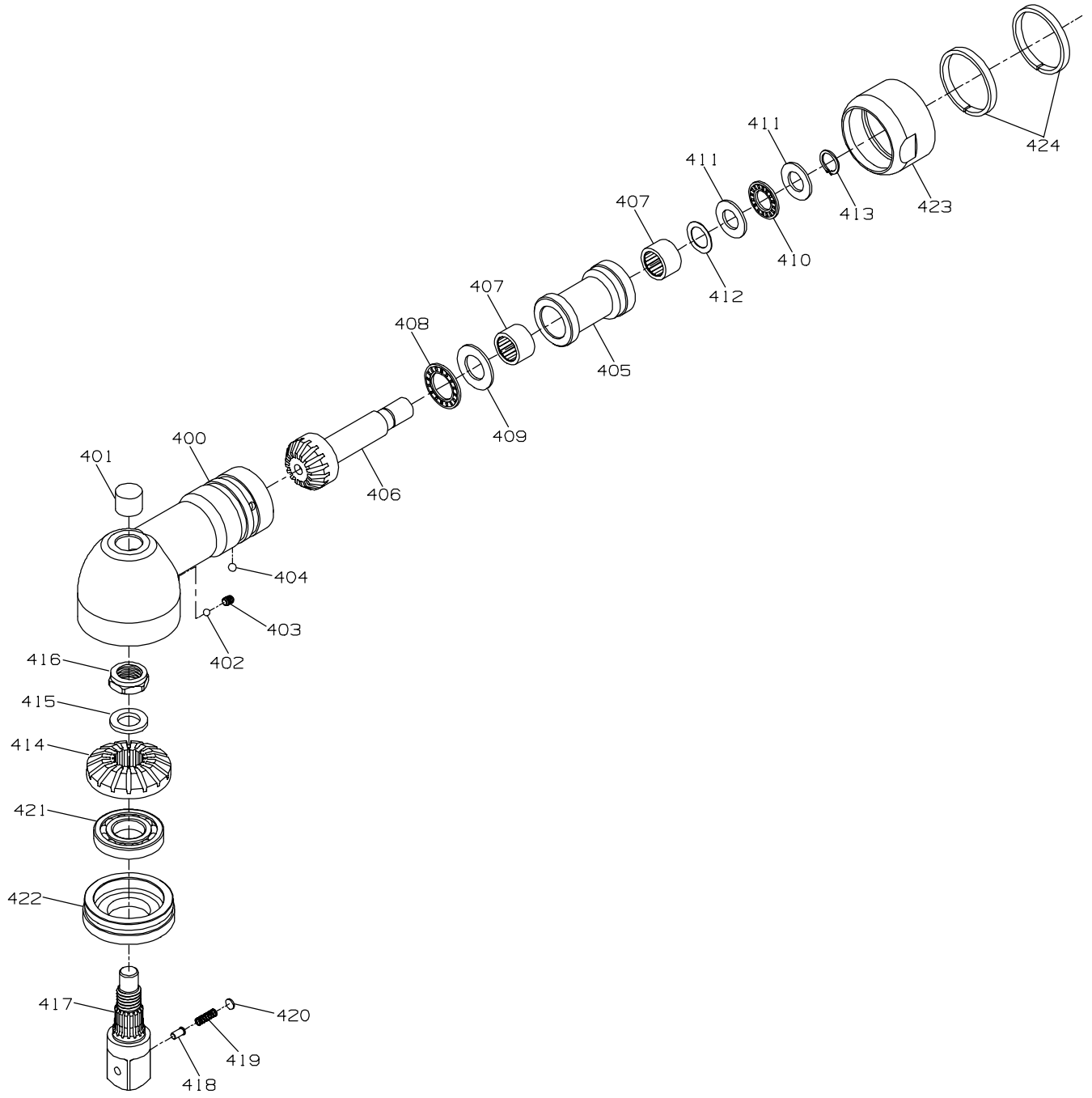






Ingersoll–Rand No. 67

Whenever an Angle Attachment is disassembled for repair or replacement of parts, fill all needle bearings approximately forty percent full with Ingersoll–Rand No. 67 Grease. Apply Ingersoll–Rand No. 67 Grease to both sides of all thrust bearings and pack all ball bearings with Ingersoll–Rand No. 67 Grease.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(Dwg. TPA1724)

	AA15S12 Angle Housing Assembly	5000–90336
400	Angle Housing	5220–99023
401	Spindle Upper Bearing	9411–00781
402	Bearing Cap Retaining Ball (5/32” diameter)	9418–00156
403	Ball Retaining Screw	9051–51006
404	Pinion Housing Alignment Ball (3/16” diameter)	9418–00188
	Bevel Pinion Assembly	5120–90035
405	Bevel Pinion Housing	5224–00026
406	Bevel Pinion	5120–00035
407	Bevel Pinion Bearing (2)	9410–00108
408	Pinion Front Thrust Bearing	9430–01018
409	Front Bearing Thrust Washer	9432–10182
410	Pinion Rear Thrust Bearing	9430–00815
411	Rear Bearing Thrust Washer (2)	9432–08152
412	Pinion Clamp Washer	9110–05017
413	Thrust Washer Retaining Ring	9307–00050

PART NUMBER FOR ORDERING

414	Bevel Gear	5120–00057
415	Bevel Gear Washer	8320–00035
416	Bevel Gear Nut	9027–80056
	Spindle Assembly (3/4” square drive)	5300–90078
417	Spindle	5300–00078
418	Socket Retainer Pin	8500–00250
419	Socket Retainer Pin Spring	9100–70285
420	Socket Retainer Expansion Plug	9322–00055
421	Spindle Lower Bearing	9400–00012
422	Spindle Lower Bearing Cap	5221–00037
423	Coupling Nut	5223–00011
424	Coupling Nut Retaining Ring (2)	8310–00042

Disassembly of the Angle Attachment

1. Using a wrench on the flats of the Coupling Nut (423), unscrew the Coupling Nut and pull the assembled angle head away from the tool.

NOTICE

In the following step, the Ball Retaining Screw has a thread–locking compound applied to the threads. It may be necessary to heat the Screw somewhat to remove it. Do not heat the assembly enough to damage the internal components.

2. Using a hex wrench, unscrew and remove the Ball Retaining Screw (403) from the Angle Housing (400). Remove the Bearing Cap Retaining Ball (402) from the screw hole.
3. Using a spanner wrench, unscrew the Spindle Lower Bearing Cap (422) and pull the assembled Spindle (417) out of the Angle Housing.
4. Grasp the square drive of the Spindle in leather–covered or copper–covered vise jaws and using a 7/8" socket or wrench, unscrew and remove the Bevel Gear Nut (416).
5. Slide the Bevel Gear Washer (415), Bevel Gear (414) and the Spindle Lower Bearing Cap assembled with Spindle Lower Bearing (421) off the Spindle.
6. If the Spindle Lower Bearing needs replacement, press it from the Bearing Cap.
7. If the Socket Retainer Pin Spring (419) is broken or the Socket Retainer Pin (418) is worn and needs replacement, use a pin punch against the end of the Retainer Pin to drive the Socket Retainer Expansion Plug (420) out of the Spindle.
8. Using external retaining ring pliers, remove the two Coupling Nut Retaining Rings (424) from the Angle Housing. Slide the Coupling Nut off and remove the Pinion Housing Alignment Ball (404).
9. Insert a screwdriver or rod into one of the slots in the face of the Bevel Pinion Housing (405) and rotate the assembled Housing counterclockwise to remove it from the Angle Housing.
10. Using snap ring pliers, remove the Thrust Washer Retaining Ring (413) from the shaft of the Bevel Pinion (406). Remove the Pinion Rear Thrust Bearing (410), the two Rear Bearing Thrust Washers (411) and the Pinion Clamp Washer (412) from the shaft of the Bevel Pinion.
11. Push on the small shaft of the Bevel Pinion to remove it from the Bevel Pinion Housing.
12. Slide the Pinion Front Thrust Bearing (408) and Front Bearing Thrust Washer (409) off the shaft of the Bevel Pinion.

NOTICE

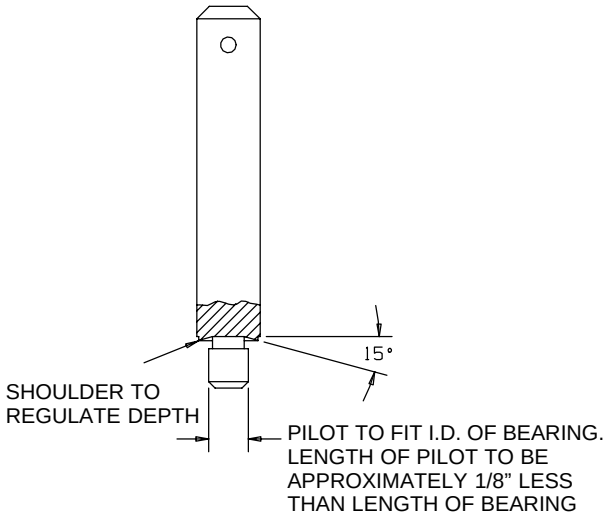
If the bearings in the following steps must be removed, make certain you have replacement bearings on hand. Needle bearings are always damaged during the removal process.

13. If the Bevel Pinion Bearings (407) must be removed, pull them from the Bevel Pinion Housing.
14. If the Spindle Upper Bearing (401) must be removed, press it from the Angle Head.

Assembly of the Angle Attachment

1. If the Spindle Upper Bearing (401) was removed, position the output end of the Angle Housing (400) on the table of an arbor press with the large hub downward. Pressing on the closed end of a new Bearing, press the Bearing into the Housing until the closed, trailing end of the Bearing is flush with the top of the Angle Housing.
2. If the Bevel Pinion Bearings (407) were removed, use a needle bearing inserting tool as shown in Drawing TPD786 to press a new Bearing in each end of the Bevel Pinion Housing (405). Press one Bearing flush with the face of the recess on the one end, and the other Bearing flush with the opposite end face.

Needle Bearing Inserting Tool



(Dwg. TPD786)

3. Inject Ingersoll–Rand No. 67 Grease into the Bearings until they are filled to about forty percent of their capacity.
4. Apply Ingersoll–Rand No. 67 Grease to both sides of the Pinion Front Thrust Bearing (408) and slide it onto the shaft of the Bevel Pinion (406) until it stops against the large gear head.
5. Install the Front Bearing Thrust Washer (409) on the shaft against the Bearing.

6. Insert the assembled Bevel Pinion, gear end trailing, into the unthreaded end of the Bevel Pinion Housing. Move the assembly through the Bearings in the Housing until the Thrust Washer stops against the end face.
7. Install the Pinion Clamp Washer (412), concave end (dish end) trailing, onto the shaft of the Bevel Pinion.
8. Install one of the Rear Bearing Thrust Washers (411) on the shaft against the Clamp Washer.
9. Apply Ingersoll–Rand No. 67 Grease to both sides of the Pinion Rear Thrust Bearing (410) and slide the Bearing followed by the remaining Rear Bearing Thrust Washer onto the shaft of the Bevel Pinion against the installed Washer.
10. While compressing the Bearing and Thrust Washers against the Pinion Clamp Washer, use snap ring pliers to install the Thrust Washer Retaining Ring (413) in the annular groove around the shaft of the Bevel Pinion.
11. If the Socket Retainer Pin (418) was removed from the Spindle (417), insert the smaller shaft of the Pin into the larger opening in the Spindle allowing the Pin to protrude out of the Spindle.
12. Insert the Socket Retainer Pin Spring (419) in the hole against the Pin.
13. Position the Socket Retainer Expansion Plug (420), concave end leading, against the Spring. Use a punch to compress the assembly into the hole until the Plug bottoms on the surface inside the Spindle. When the Plug bottoms out, sharply rap the punch with a hammer to expand the Plug and capture the assembly.
14. Lubricate the Spindle Lower Bearing (421) with Ingersoll–Rand No. 67 Grease and using a piece of tubing that contacts the outer ring of the Bearing, press the Bearing into the large opening of the Spindle Lower Bearing Cap (422).
15. Insert the Spindle, square drive end trailing, through the Bearing Cap and Bearing and install the Bevel Gear (414) on the shaft of the Spindle.
16. Install the Bevel Gear Washer (415), followed by the Bevel Gear Nut (416) against the Gear on the shaft of the Spindle. Using a 7/8" socket, tighten the Nut to 100 ft–lbs. (136 Nm) torque.
17. Apply a thin coat of lubricant to the inner surface of the hole in the Angle Housing where the Bevel Pinion Housing is inserted.
18. Start the assembled Bevel Pinion Assembly, gear end leading, into the Angle Housing until the threads on the Bevel Pinion Housing start to engage the threads in the Angle Housing.
19. To prevent the Angle Housing from rotating, place the Angle Housing, spindle opening upward, in partially open vise jaws.
20. Looking downward into the opening, a slot in the Housing will be visible between the outer surface of the Spindle Upper Bearing and the leading edge of the Bevel Pinion. Position a 0.245" thick gage–block (or equivalent measuring device) in the slot against the cage of the Bearing.
21. Thread the Bevel Pinion Assembly into the Housing until the leading edge of the Bevel Pinion contacts the gage–block.
22. There are holes in the groove for the Coupling Nut Retaining Ring (424) nearest the pinion end of the Housing. There are also slots to the outer edge of the Bevel Pinion Housing. Remove the gage–block and align the closest hole and slot combination. Insert the Pinion Housing Alignment Ball (404) into that hole and slot.
23. Hold the Housing with the Ball at the twelve o'clock position and slide the Coupling Nut (423), threaded end trailing, onto the Angle Housing.
24. Spread one of the Coupling Nut Retaining Rings and install it in the groove to capture the Ball. Install the other Retaining Ring in the remaining groove.
25. Inject Ingersoll–Rand No. 67 Grease into the Spindle Upper Bearing until it is filled to about forty percent of its capacity.
26. Make certain that the leading end of the spindle shaft enters the Spindle Upper Bearing and insert the assembled Spindle into the Angle Housing.
27. Using a spanner wrench, thread the Bearing Cap into the Angle Housing until the Spindle starts to bind. When the Spindle begins to bind, back the Bearing Cap outward 1/8 of a turn (approximately 45 degrees).
28. Look into the opening for the Bearing Cap Retaining Ball (402) to determine that the groove in the Cap aligns with the hole for the Ball. Move the Bearing Cap in or out until they are aligned and the Spindle rotates freely.
29. When they are aligned, insert the Ball into the hole.
30. Apply a quality thread–locking compound to the threads of the Ball Retaining Screw (403) and thread the Screw into the Housing. Make certain the Spindle rotates freely before the compound sets up.
31. Reinstall the Angle Head on the tool.

TROUBLESHOOTING GUIDE

Trouble	Probable Cause	Solution
Angle Head gets hot	Excessive or insufficient grease	Disassemble, clean and inspect the Angle Head and gearing parts. Lubricate as instructed in the **LUBRICATION** Section.
	Worn or damaged parts	Clean and inspect the Angle Head gearing parts. Replace worn or damaged parts.
Noisy Angle Head	Worn or damaged gears	Clean and inspect the Angle Head gearing parts. Replace worn or damaged parts.
	Improper spacing of engagement between the Bevel Gear and Bevel Pinion	Adjust Bevel Pinion/Bevel Gear engagement as described in the **ASSEMBLY OF THE ANGLE ATTACHMENT** Section.

NOTICE

SAVE THESE INSTRUCTIONS. DO NOT DESTROY.