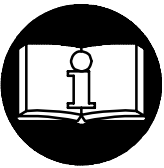


MAINTENANCE SECTION COVERING

ANGLE ATTACHMENT MODULES

for

SERIES DAA40 AND DEA40 TORQUE CONTROL WRENCHES



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 4-2)

NOTICE

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

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.

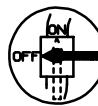
USING THE TOOL (Continued)


- 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


	⚠ WARNING Always wear eye protection when operating or performing maintenance on this tool.
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	⚠ WARNING Always wear hearing protection when operating this tool.
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	⚠ WARNING 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.
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	⚠ WARNING 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.
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	⚠ WARNING Do not carry the tool by the hose.
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	⚠ WARNING Do not use damaged, frayed or deteriorated air hoses and fittings.
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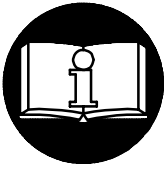
	⚠ WARNING Keep body stance balanced and firm. Do not overreach when operating this tool.
---	--

	⚠ WARNING Operate at 90 psig (6.2 bar/ 620 kPa) Maximum air pressure.
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	⚠ WARNING 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 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.
- 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.

(Continued on page 4-4)




⚠ WARNING

FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

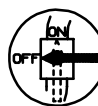


USING THE TOOL (Continued)

- Do not drop or abuse the 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

	⚠ WARNING Always wear eye protection when operating or performing maintenance on this tool.
	⚠ WARNING 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.
	⚠ WARNING INDOOR USE ONLY.

	⚠ WARNING Always wear hearing protection when operating this tool.
	⚠ WARNING Do not carry the tool by the cord.
	⚠ WARNING 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.

	⚠ WARNING Always turn off the electrical supply and disconnect the power cord before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool.
	⚠ WARNING Do not use damaged, frayed or deteriorated power cords.
	⚠ WARNING Keep body stance balanced and firm. Do not overreach when operating this tool.

LUBRICATION



Ingersoll-Rand No. 67

After each eight hours of operation, inject 1 to 2 cc of Ingersoll-Rand No. 67 Grease into the Grease Fitting (401) in the Angle Housing Assembly (400).

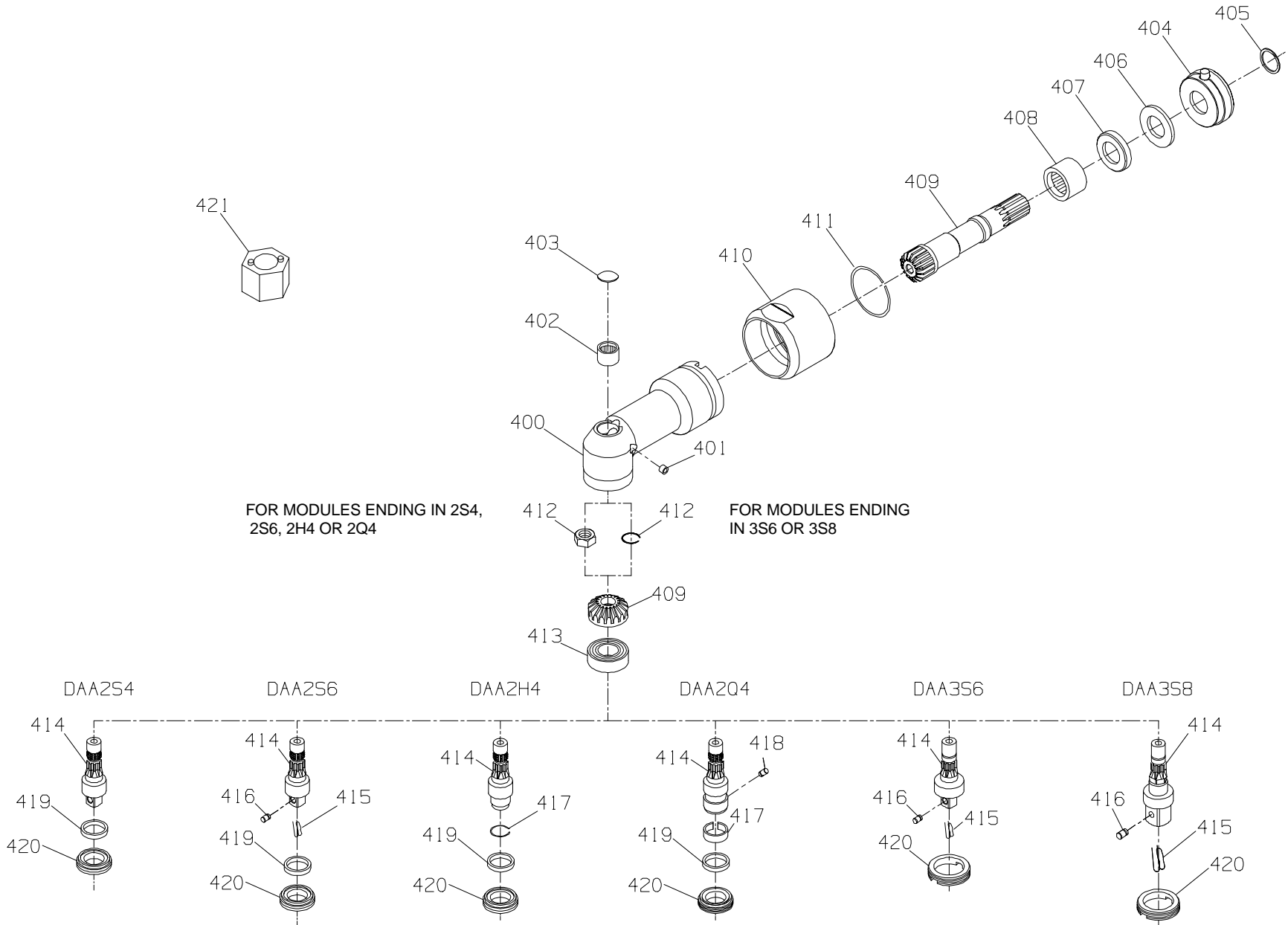
Whenever a Series D Angle Attachment is disassembled for repair or replacement of parts, apply 4 cc to 8 cc of Ingersoll-Rand No. 67 Grease to the Bevel Pinion and Bevel Gear (409) used in DAA2 Angle Attachments, 6 cc to 10 cc of Ingersoll-Rand No. 67 Grease to the Bevel Pinion and Bevel Gear used in DAA3 Angle Attachments and 8 to 12 cc of Ingersoll-Rand No. 67 Grease to the Bevel Pinion and Bevel Gear used in DAA4 Angle Attachments.

INSTALLATION

 **WARNING**

When installing or removing an Angle Attachment on a tool, **ALWAYS** hold the tool by the hex on the Gear Case while tightening the Coupling Nut (403 or 410). **NEVER** grasp the composite tool body or handle in vise jaws to restrain the tightening torque of the

Coupling Nut. Such practice will result in damage to the tool and with electric models will cause wire leads to malfunction creating an electric shock hazard. **Whenever an Angle Head is installed or repositioned,** the Throttle Switch Assembly on electric models and the Throttle Lever on air models must be positioned so that reaction torque will not tend to retain the throttle in the “ON” position.



FOR MODULES ENDING IN 2S4,
2S6, 2H4 OR 2Q4

FOR MODULES ENDING
IN 3S6 OR 3S8

DAA2S4

DAA2S6

DAA2H4

DAA2Q4

DAA3S6

DAA3S8

SERIES D ANGLE HEADS used with ALL 40 Nm AIR TOOLS and 40 Nm ELECTRIC TOOLS that have DEA5, DEA8 or DEA15 GEARING and SERIAL NUMBERS lower than A97G01000 and DEA20, DEA23, DEA31, DEA40 or DEP40 GEARING and SERIAL NUMBERS lower than A97B01000.

(Dwg. TPB999)



PART NUMBER FOR ORDERING

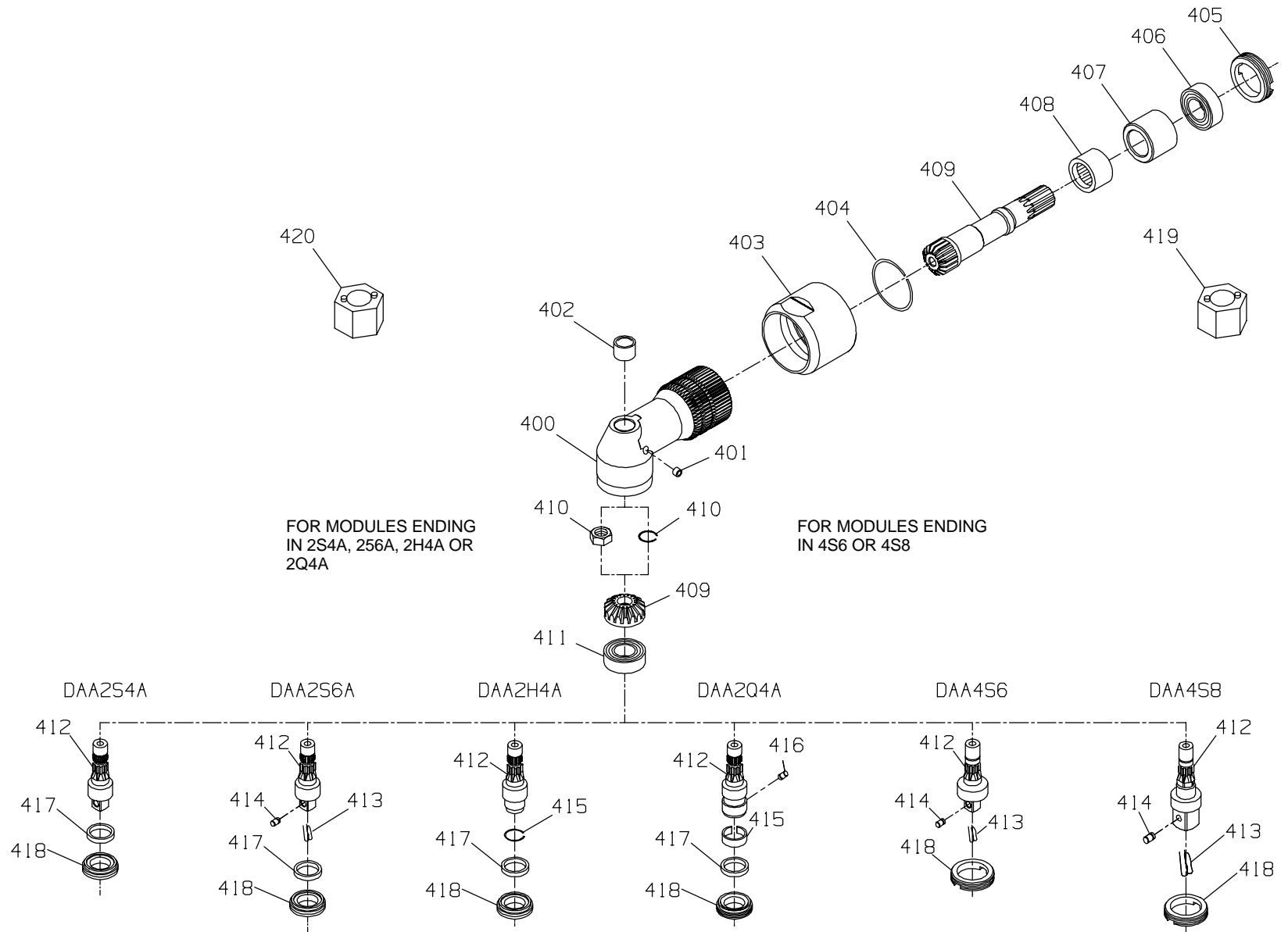


•	+	Angle Housing Module	DAA2S4	DAA2S6	DAA2H4	DAA2Q4	DAA3S6	DAA3S8
	400	Angle Housing Assembly	DAA2-B550	DAA2-B550	DAA2-B550	DAA2-B550	DAA3-B550	DAA3-B550
	401	Grease Fitting	D0F9-879	D0F9-879	D0F9-879	D0F9-879	D0F9-879	D0F9-879
•	402	Upper Spindle Bearing	120A4-603	120A4-603	120A4-603	120A4-603	8SA32-603	8SA32-603
	403	Angle Housing Cap	—	—	—	—	8SA32-110	8SA32-110
	404	Housing Orientation Ring	DAA2-A682	DAA2-A682	DAA2-A682	DAA2-A682	DAA2-A682	DAA2-A682
	405	Orientation Ring Retainer	182A53-689	182A53-689	182A53-689	182A53-689	182A53-689	182A53-689
•	406	Thrust Bearing	R1610-105	R1610-105	R1610-105	R1610-105	R1610-105	R1610-105
	407	Thrust Washer	182A53-554	182A53-554	182A53-554	182A53-554	182A53-554	182A53-554
•	408	Bevel Pinion Bearing	R1410-593	R1410-593	R1410-593	R1410-593	182A53-606	182A53-606
•	409	Bevel Pinion and Bevel Gear (sold only as a matched set) . .	DAA2-A552	DAA2-A552	DAA2-A552	DAA2-A552	DAA3-A552	DAA3-A552
	410	Coupling Nut	DAA2-27	DAA2-27	DAA2-27	DAA2-27	DAA2-27	DAA2-27
	411	Coupling Nut Retainer	DAA2-29	DAA2-29	DAA2-29	DAA2-29	DAA2-29	DAA2-29
	412	Bevel Gear Retainer	120A4-578	120A4-578	120A4-578	120A4-578	8SA32-578	8SA32-578
•	413	Lower Spindle Bearing	6L2D-59	6L2D-59	6L2D-59	6L2D-59	8SA32-593	8SA32-593
	414	Spindle Assembly	DAA2-A607-1/4	6L2D-A607	DAA2-A786-4	DAA2-A586-4	DAA3-P507-3/8	DAA3-P507-1/2
	415	Socket Retaining Spring . .	—	401-718	—	—	401-718	5UHD-718
	416	Socket Retaining Pin	—	5020-716	—	—	5020-716	804-716
	417	Bit Retaining Spring	—	—	5L2C4-425	102A60-241	—	—
	418	Bit Retaining Ball	—	—	—	AV1-255	—	—
•	419	Spindle Seal	6L2D-720	6L2D-720	6L2D-720	6L2D-720	—	—
	420	Spindle Bearing Cap	6L2D-531	6L2D-531	6L2D-531	6L2D-531	8SA32-531	8SA32-531
	421	Spindle Bearing Cap Wrench .	141A12-26	141A12-26	141A12-26	141A12-26	8SA32-26	8SA32-26

4-7

MAINTENANCE SECTION

- To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.
- + These Angle Head Modules are to be used with All 40 Nm Air Tools and 40 Nm Electric Tools having DEA5, DEA8 or DEA15 Gearing and Serial Numbers lower than A97G01000 as well as 40 Nm Electric Tools having DEA20, DEA23, DEA31, DEA40 or DEP40 Gearing and Serial Numbers lower than A97B01000. For 40 Nm Electric Tools with higher Serial Numbers, Refer to Drawing TPB1027 on Page 4-8 and Listing of Part on Page 4-9.



SERIES D ANGLE HEADS used with 40 Nm ELECTRIC TOOLS that have DEA5, DEA8 or DEA15 GEARING and SERIAL NUMBERS higher than A97G01000 and DEA20, DEA23, DEA31, DEA40 or DEP40 GEARING and SERIAL NUMBERS higher than A97B01000.

(Dwg. TPB1027)

PART NUMBER FOR ORDERING



		↓	↓	↓	↓	↓	↓
+	Angle Housing Module	DAA2S4A	DAA2S6A	DAA2H4A	DAA2Q4A	DAA4S6	DAA4S8
400	Angle Housing Assembly	—	—	—	—	DAA4-B550	DAA4-B550
401	Grease Fitting	—	—	—	—	D0F9-879	D0F9-879
402	Upper Spindle Bearing	—	—	—	—	R18L-603	R18L-603
400	Angle Housing	DAA2-550A	DAA2-550A	DAA2-550A	DAA2-550A	—	—
401	Grease Fitting	D0F9-879	D0F9-879	D0F9-879	D0F9-879	—	—
402	Upper Spindle Bearing	120A4-603	120A4-603	120A4-603	120A4-603	—	—
403	Coupling Nut	DAA4-27	DAA4-27	DAA4-27	DAA4-27	DAA4-27	DAA4-27
404	Coupling Nut Retainer	DAA4-29	DAA4-29	DAA4-29	DAA4-29	DAA4-29	DAA4-29
405	Rear Pinion Bearing Cap	8SA32-531	8SA32-531	8SA32-531	8SA32-531	8SA32-531	8SA32-531
406	Rear Pinion Bearing	8SA32-593	8SA32-593	8SA32-593	8SA32-593	8SA32-593	8SA32-593
407	Pinion Spacer	DAA2-165	DAA2-165	DAA2-165	DAA2-165	DAA4-165	DAA4-165
408	Front Pinion Bearing	R1410-593	R1410-593	R1410-593	R1410-593	182A53-606	182A53-606
409	Bevel Pinion and Bevel Gear (sold only as a matched set) . . .	DAA2-A552A	DAA2-A552A	DAA2-A552A	DAA2-A552A	DAA4-A552	DAA4-A552
410	Bevel Gear Retainer	120A4-578	120A4-578	120A4-578	120A4-578	8SA32-578	8SA32-578
411	Lower Spindle Bearing	6L2D-59	6L2D-59	6L2D-59	6L2D-59	8SA32-593	8SA32-593
412	Spindle Assembly	DAA2-A607-1/4	6L2D-A607	DAA2-A786-4	DAA2-A586-4	DAA3-P507-3/8	DAA3-P507-1/2
413	Socket Retaining Spring	—	401-718	—	—	401-718	5UHD-718
414	Socket Retaining Pin	—	5020-716	—	—	5020-716	804-716
415	Bit Retaining Spring	—	—	5L2C4-425	120A60-241	—	—
416	Bit Retaining Ball	—	—	—	AV1-255	—	—
417	Spindle Seal	6L2D-720	6L2D-720	6L2D-720	6L2D-720	—	—
418	Lower Spindle Bearing Cap . . .	6L2D-531	6L2D-531	6L2D-531	6L2D-531	8SA32-531	8SA32-531
419	Spindle Bearing Cap Wrench . .	141A12-26	141A12-26	141A12-26	141A12-26	8SA32-26	8SA32-26
420	Pinion Bearing Cap Wrench . . .	8SA32-26	8SA32-26	8SA32-26	8SA32-26	8SA32-26	8SA32-26

4-9

MAINTENANCE SECTION

+ These Angle Head Modules are to be used with 40 Nm Electric Tools having DEA5, DEA8 or DEA15 Gearing and Serial Numbers higher than A97G01000 as well as 40 Nm Electric Tools having DEA20, DEA23, DEA31, DEA40 or DEP40 Gearing and Serial Numbers higher than A97B01000. For 40 Nm Electric Tools with lower Serial Numbers, Refer to Drawing TPB999 on Page 4-6 and Listing of Parts on Page 4-7.

MAINTENANCE SECTION

Disassembly of the Angle Attachment

1. Carefully grasp the hex of the Gear Case Assembly in copper-covered or leather-covered vise jaws with the Angle Housing Assembly (400) downward.

NOTICE

In the following step, the Coupling Nut (403 or 410) has a left-hand thread.

2. Using a wrench on the flats of the Coupling Nut (403 or 410), loosen the Coupling Nut from the Gear Case. Remove the tool from the vise. Unscrew the Coupling Nut and separate the Angle Housing Assembly from the Gear Case.
3. Carefully grasp the Angle Housing Assembly in copper-covered or leather-covered vise jaws with the Spindle Assembly (412 or 414) facing upward.

NOTICE

The thread in the following step is a left-hand thread.

4. Using the Spindle Bearing Cap Wrench (419 or 421), unscrew and remove the Spindle Bearing Cap (418 or 420).

For models ending in 2S4, 2S6, 2H4 or 2Q4, if the Spindle Seal (419) is damaged, remove it. Withdraw the Spindle from the Angle Housing.

For models ending in 2S4A, 2S6A, 2H4A or 2Q4A, if the Spindle Seal (417) is damaged, remove it. Withdraw the Spindle from the Angle Housing.

5. Inspect the Lower Spindle Bearing (411 or 413) for looseness or roughness. If either of these conditions exists, replace the Bearing as follows:
For models ending in 3S6 or 3S8
 - a. Remove the Bevel Gear Retainer (412).
 - b. Press the Bevel Gear (409) from the Spindle.
 - c. Press the Lower Spindle Bearing from the Spindle.**For models ending in 4S6 or 4S8**
 - a. Remove the Bevel Gear Retainer (410).
 - b. Press the Bevel Gear (409) from the Spindle.
 - c. Press the Lower Spindle Bearing from the Spindle.**For models ending in 2S4, 2S6, 2H4 or 2Q4**
 - a. Grasp the square drive end of the Spindle in copper-covered vise jaws.
 - b. Unscrew the Bevel Gear Retainer (412) and lift the Bevel Gear (409) off the Spindle.
 - c. Press the Lower Spindle Bearing from the Spindle.**For models ending in 2S4A, 2S6A, 2H4A or 2Q4A**
 - a. Grasp the square drive end of the Spindle in copper-covered vise jaws.
 - b. Unscrew the Bevel Gear Retainer (410) and lift the Bevel Gear (409) off the Spindle.

- c. Press the Lower Spindle Bearing from the Spindle.

NOTICE

In the next step, do not remove the Upper Spindle Bearing unless you have a new Bearing ready to install. This type of Bearing is always damaged during the removal process.

NOTICE

The Angle Head used in models ending in 3S6 or 3S8 will require a new Angle Housing Cap (403) when the Upper Spindle Bearing is installed.

6. If the Upper Spindle Bearing (402) appears rough or loose, press it from the Angle Head.
7. **For models ending in 2S4, 2S6, 2H4, 2Q4, 3S6 or 3S8**, remove the Orientation Ring Retainer (405) and slide the Housing Orientation Ring (404), Thrust Bearing (406) and Thrust Washer (407) from the pinion shaft.

NOTICE

The thread in the following step is a left-hand thread.

For models ending in 2S4A, 2S6A, 2H4A or 2Q4A, 4S6 or 4S8, use the Pinion Bearing Cap Wrench (420) to unscrew and remove the Rear Pinion Bearing Cap (405).

NOTICE

In the following step, do not remove the Bevel Pinion and Bearing unless you have a new Bearing on hand. This type of Bearing is always damaged during the removal process. After the Angle Attachment is disassembled, check all parts for damage or wear.

8. **For models ending in 2S4, 2S6, 2H4, 2Q4, 3S6 or 3S8**, grasp the spline of the pinion shaft in copper-covered vise jaws and while gently tapping the rear face of the Angle Attachment with a soft hammer, pull the Bevel Pinion (409) and Bevel Pinion Bearing (408) from the Angle Attachment.
For models ending in 2S4A, 2S6A, 2H4A or 2Q4A, 4S6 or 4S8, grasp the spline of the of the Pinion Shaft in copper-covered vise jaws and while gently tapping the rear face of the Angle Housing with a soft hammer, pull the Bevel Pinion (409), Front Pinion Bearing(408), Spacer (407) and Rear Pinion Bearing (406) from the Angle Housing. The 1/4–20 tapped hole in the rear of the Gear Shaft has been provided to aid in extracting the Bevel Pinion and its bearings from the Angle Housing.

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NOTICE

The Bevel Gear and Bevel Pinion are specially matched sets. Some sets are color coded for manufacturing purposes only. Only the Gear and Pinion set furnished as a replacement part or the same Gear and Pinion set removed from one tool, is a matched set. A Bevel Gear from one tool used with a Bevel Pinion from another tool with the same color code IS NOT A MATCHED SET. Replace these parts only as a matched set. Failure to do so will result in unsatisfactory tool performance and damage to the Bevel Gear and Bevel Pinion.

NOTICE

If the gear teeth on either the Bevel Pinion or Bevel Gear are worn or chipped, replace both parts. These are a matched set and must be replaced with another matched set.

Assembly of the Angle Attachment

NOTICE

The Bevel Gear and Bevel Pinion are specially matched sets. Some sets are color coded for manufacturing purposes only. Only the Gear and Pinion set furnished as a replacement part or the same Gear and Pinion set removed from one tool, is a matched set. A Bevel Gear from one tool used with a Bevel Pinion from another tool with the same color code IS NOT A MATCHED SET. Replace these parts only as a matched set. Failure to do so will result in unsatisfactory tool performance and damage to the Bevel Gear and Bevel Pinion.

1 For DAA2S4, DAA2S6, DAA2H4, or DAA2Q4 Attachments, proceed as follows:

- a. Lubricate the Bevel Pinion (409) with 2 to 4 cc of Ingersoll–Rand No. 67 Grease and insert it, gear end first, into the long bore of the Angle Housing (400).
- b. Insert the Bevel Pinion Bearing (408), unstamped end first, into the bore of the Angle Housing and onto the bevel pinion shaft.
- c. Use a cylinder that has a .573" (14.55 mm) I.D. and a .755" (19.18 mm) O.D. and is 1.411" (35.84 mm) long and press the Bevel Pinion Bearing so the stamped face is a maximum of 1.416" (35.96 mm), but not less than 1.406" (35.71 mm) below the end face of the Angle Housing.
- d. Install, in the order named, the Thrust Washer (407), Thrust Bearing (406) and Housing

* Product of National Starch and Chemical Corporation.

Orientation Ring (404) over the splined end of the Bevel Pinion and retain the components by installing the Orientation Ring Retainer (405) on the pinion shaft.

For DAA3S6 or DAA3S8 Attachments, proceed as follows:

- a. Lubricate the Bevel Pinion (409) with 3 to 5 cc of Ingersoll–Rand No. 67 Grease and insert it, gear end first, into the long bore of the Angle Housing (400).
- b. Insert the Bevel Pinion Bearing (408), unstamped end first, into the bore of the Angle Housing and onto the bevel pinion shaft.
- c. Use a cylinder that has a .699" (17.75 mm) I.D. and a .965" (24.51 mm) O.D. and is 1.255" (31.88 mm) long and press the Bevel Pinion Bearing so the stamped face is a maximum of 1.26" (32.0 mm), but not less than 1.25" (31.75 mm) below the end face of the Angle Housing.
- d. Install, in the order named, the Thrust Washer (407), Thrust Bearing (406) and Housing Orientation Ring (404) over the splined end of the Bevel Pinion and retain the components by installing the Orientation Ring Retainer (405) on the pinion shaft.

For DAA2S4A, DAA2S6A, DAA2H4A or DAA2Q4A Attachments, proceed as follows:

- a. Insert the splined end of the Bevel Pinion (409) into the unstamped end of the Front Pinion Bearing (408), Spacer (407) and Rear Pinion Bearing (406). The marked surface of the Rear Pinion Bearing must face away from the shoulder of the Bevel Pinion. Using a sleeve that will contact the inner race of the Rear Pinion Bearing, press the Bearing onto the Bevel Pinion to seat the parts properly. Apply 2 to 4 cc of Ingersoll–Rand No. 67 Grease to the gear end of the Bevel Pinion.
- b. Insert the assembled Bevel Pinion, gear end first, into the long bore of the Angle Housing (400). Using a sleeve that will contact the outer race of the Rear Pinion Bearing, Press the Bearing into the Angle Housing to seat both the Front Pinion Bearing and the Rear Pinion Bearing.

NOTICE

In the following step, the Rear Pinion Bearing Cap has a left-hand thread.

- c. Clean the threads on the Angle Housing and Rear Pinion Bearing Cap and apply a thin film of Perma–Lok MM–115* to the threads on the Rear Pinion Bearing Cap.

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- d. Using the Pinion Bearing Cap Wrench (420), tighten the Rear Pinion Bearing Cap (405) into the Angle Housing between 20 and 25 ft.-lb. (27 and 34 Nm) torque.

For DAA4S6 or DAA4S8 Attachments, proceed as follows:

- a. Insert the splined end of the Bevel Pinion (409) into the unstamped end of the Front Pinion Bearing (408), Spacer (407) and Rear Pinion Bearing (406). The marked surface of the Rear Pinion Bearing must face away from the shoulder of the Bevel Pinion. Using a sleeve that will contact the inner race of the Rear Pinion Bearing, press the Bearing onto the Bevel Pinion to seat the parts properly. Apply 4 to 6 cc of Ingersoll-Rand No. 67 Grease to the gear end of the Bevel Pinion.
- b. Insert the assembled Bevel Pinion, gear end first, into the long bore of the Angle Housing (400). Using a sleeve that will contact the outer race of the Rear Pinion Bearing, Press the Bearing into the Angle Housing to seat both the Front Pinion Bearing and the Rear Pinion Bearing.

NOTICE

In the following step, the Rear Pinion Bearing Cap has a left-hand thread.

- c. Clean the threads on the Angle Housing and Rear Pinion Bearing Cap and apply a thin film of Perma-Lok MM-115* to the threads on the Rear Pinion Bearing Cap.
 - d. Using the Pinion Bearing Cap Wrench (420), tighten the Rear Pinion Bearing Cap (405) into the Angle Housing between 20 and 25 ft.-lb. (27 and 34 Nm) torque.
2. If the Lower Spindle Bearing (411 or 413) has been removed, proceed as follows:
- a. **For DAA2 Angle Attachments,** using a sleeve that will contact the inner ring of the Bearing, press the Bearing, sealed side first, onto the Spindle (412 or 414).
For DAA3 or DAA4 Angle Attachments, using a sleeve that will contact the inner ring of the Bearing, press the Bearing onto the Spindle (412 or 414). Press on the stamped side of the Bearing with the side marked with red toward the spindle shoulder.
 - b. **For DAA2 Angle Attachments,** slide the Bevel Gear (409) onto the Spindle.
For DAA3 or DAA4 Angle Attachments, align the internal flats of the Bevel Gear (409) with the

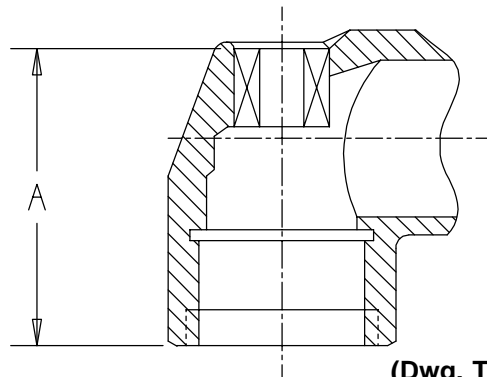
flats on the Spindle and press the Bevel Gear onto the Spindle.

- c. **For DAA2 Angle Attachments,** apply a drop of Permabond Surface Conditioner II * to the threads of the Bevel Gear Retainer (410 or 412) and Spindle and allow it to cure for five minutes. Apply Perma-Lok HF-138 * to the threads of the Bevel Gear Retainer and tighten it on the Spindle between 8 and 12 ft.-lb (11 and 16 Nm) torque.
For DAA3 or DAA4 Angle Attachments, spread the Bevel Gear Retainer (410 or 412) and slip it over the end of the Spindle. Slide the Retainer down the Spindle and into the groove around the Spindle to retain the Bevel Gear.

NOTICE

In the following step, press on the stamped face of the Bearing. Failure to do so will cause damage to the Bearing.

3. If the Upper Spindle Bearing (402) has been removed, proceed as follows:
For DAA2 Angle Attachments, press on the closed end of a new Spindle Bearing entering the Bearing into the small bore opposite the threaded end of the Angle Head to the dimension shown in Drawing TPD680.



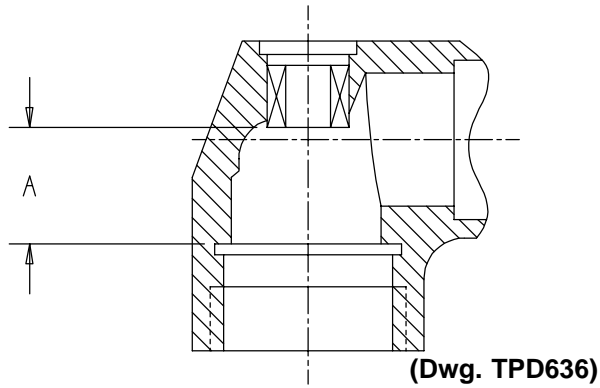
(Dwg. TPD680)

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

For DAA3 Angle Attachments, press a new Spindle Bearing into the Angle Head from the large threaded end to the dimension shown in Drawing TPD636. Install a new Angle Housing Cap (403) into the top of the Angle Head.

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Minimum Dimension "A"	
in	mm
0.718	18.25
Maximum Dimension "A"	
in	mm
0.728	18.50

For DAA4 Angle Attachments, using a sleeve that contacts the outer race of the Upper Spindle Bearing (402), press the new Spindle Bearing into the small bore opposite the threaded end of the Angle Housing to a depth between .010" and .030" below the outer surface of the Angle Housing.

4. **For DAA2 Angle Attachments**, apply 2 to 4 cc of Ingersoll-Rand No. 67 Grease to the Bevel Gear. Lubricate the Upper Spindle Bearing and Lower Spindle Bearing and install the Spindle in the Angle Housing.

For DAA3 Angle Attachments, apply 3 to 5 cc of Ingersoll-Rand No. 67 Grease to the Bevel Gear. Lubricate the Upper Spindle Bearing and Lower Spindle Bearing and install the Spindle in the Angle Housing.

For DAA4 Angle Attachments, apply 4 to 6 cc of Ingersoll-Rand No. 67 Grease to the Bevel Gear. Lubricate the Upper Spindle Bearing and Lower Spindle Bearing and install the Spindle in the Angle Housing.

5. Clean the threads on the Angle Housing and the Spindle Bearing Cap (418 or 420) and apply a film of Perma-Lok MM-115 to the threads.

NOTICE

In the following step, the Spindle Bearing Cap has a left-hand thread.

6. **For DAA2 Angle Attachments**, install Spindle Seal (417 or 419). Using the Spindle Bearing Cap Wrench (419 or 421), install the Spindle Bearing Cap and tighten the Cap between 15 and 20 ft-lb (20 and 27 Nm) torque.
For DAA3 or DAA4 Angle Attachments, using the Spindle Bearing Cap Wrench (419 or 421), install the Spindle Bearing Cap and tighten the Cap between 20 and 25 ft-lb (27 and 34 Nm) torque.
7. If the Coupling Nut (403 or 410) was removed, slide the Coupling Nut, threaded end trailing, over the motor end of the Angle Housing. Apply the Coupling Nut Retainer (404 or 411) to the external groove on the motor end of the Angle Housing.
8. **For models ending in 2S4, 2S6, 2H4, 2Q4, 3S6 or 3S8**, engage the spline on the Bevel Pinion with the matching internal spline of the Spindle Planet Gear Head and thread the Coupling Nut onto the Gear Case. Orient the angle attachment to the desired position and tighten the Coupling Nut between 25 and 30 ft-lb (27 and 40 Nm) torque.
For models ending in 2S4A, 2S6A, 2H4A or 2Q4A, 4S6 or 4S8, engage the spline on the Bevel Pinion with the matching internal spline of the Spindle Planet Gear Head and thread the Coupling Nut onto the Gear Case. Orient the Angle Attachment to the desired position and tighten the Coupling Nut between 50 and 60 ft.-lb. (68 and 81 Nm) torque.

MAINTENANCE SECTION

TROUBLESHOOTING GUIDE

Trouble	Probable Cause	Solution
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 grease into the Grease Fitting.
	Worn or damaged parts	Clean and inspect the Angle Head and gearing parts. If the Bevel Gear and/or Bevel Pinion is worn or broken, replace both parts as they are a matched set.

NOTICE

SAVE THESE INSTRUCTIONS. DO NOT DESTROY.

