

# OPERATION AND MAINTENANCE MANUAL

## for

# SERIES DEA ELECTRIC TORQUE CONTROL ANGLE WRENCHES



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

### ⚠ WARNING

**SAVE THESE INSTRUCTIONS. DO NOT DESTROY.  
READ ALL INSTRUCTIONS BEFORE OPERATING THIS TOOL.**

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

Do not attempt to repair this tool unless you are an authorized trained repairperson.

Consult your Service Center Listing for your nearest Ingersoll-Rand Authorized Service Center.

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:

1. **Always wear ear and eye protection.**
2. **Portable 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.**
3. **Use only impact sockets and accessories. Do not use hand (chrome) sockets or accessories.**
4. **Keep work area clean.**  
Cluttered areas and benches invite injuries.
5. **Consider work area environment.**  
Don't expose the Angle Wrench or components to water. Keep work area well lit.  
Do not use tool in presence of flammable liquids or gases.
6. **Guard against electric shock.**  
Prevent body contact with grounded surfaces, such as pipes, radiators, metal structures or other electrical products.
7. **Keep bystanders away.**  
Do not permit unauthorized personnel to operate this tool.
8. **Store idle tools.**  
When not in use, tools should be stored in a dry, and secured area.
9. **Don't force tool.**  
It will do the job better and safer at the rate for which it was intended.
10. **Use right tool.**  
Don't use a small tool or attachment to do the job of a heavy-duty tool.
11. **Dress properly.**  
Do not wear loose clothing or jewelry. They can be caught in moving parts.  
Wear protective hair covering to contain long hair.
12. **Don't abuse cord.**  
Never carry a tool by its cord or yank the cord to disconnect it from a receptacle.  
Keep cord from heat, oil, solvents and sharp edges.  
Do not use a tool if the cord or plug is broken or damaged.
13. **Secure work.**  
Use a clamp, fixture or a vise to hold work.  
Operators often need both hands to perform job functions.
14. **Don't overreach.**  
Keep proper footing and balance at all times.

### NOTICE

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

Ingersoll-Rand is not responsible for customer modification of tools for applications on which Ingersoll-Rand was not consulted.

It is the responsibility of the employer to place the information in this manual into the hands of the operator.

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

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**INGERSOLL-RAND®**  
**PROFESSIONAL TOOLS**

**15. Maintain tools with care.**

Inspect tool cords periodically and if damaged, have repaired by authorized service facility. Keep handles dry, clean, and free from oil and grease.

**16. Disconnect tools.**

When not in use and when changing accessories.

**17. Remove adjusting keys and wrenches.**

Form habit of checking to see that keys and adjusting wrenches are removed from tool before turning it on.

**18. Avoid unintentional starting.**

Be sure power switch is off before connecting the angle wrench plug.

**19. Stay alert.**

Watch what you are doing. Use common sense. Do not operate tool when you are tired.

**20. 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 instruction manual.



**FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.**

**Have defective switches replaced by authorized service center.**

**Do not use tool if switch does not turn it on and off.**

**Whenever the Angle Head is installed or repositioned, the Throttle Switch Assembly (3) must be positioned so that reaction torque will not tend to retain the throttle in the "ON" position.**

**SAVE THESE INSTRUCTIONS.**

**LUBRICATION**

Adequate lubrication is imperative for maximum performance and durability of the gearing in these Tools.

**Oil:** Ingersoll Rand No. 10 Oil

**Grease:** Ingersoll-Rand No. 67 Grease

**After each 50 000 cycles, or one month of operation,** inject 3 to 4 cc of Ingersoll-Rand No. 67 Grease into the Grease Fitting (36) in the Gear Case Assembly (35).

**After each eight hours of operation,** inject 1 to 2 cc of Ingersoll-Rand No. 67 Grease into the Grease Fitting (101) in the Angle Housing Assembly (100).

**ANGLE HEAD ORIENTATION**



**When making adjustments to the angle head or when removing the gear case, ALWAYS hold the tool by the Housing Coupling Nut (54) while tightening the Coupling Nut (110) or hold the Coupling Nut when tightening the Housing Coupling Nut. NEVER grasp the composite tool body or handle in vise jaws to restrain the tightening torque of the either Coupling Nut or damage to the tool will result which will cause wire leads to malfunction creating an electrical shock hazard.**

The Gear Case (35) has a notch every thirty degrees in the angle head end which enables the Angle Head (100) to be positioned in the optimum radial location to do the job. To reposition the Angle Head, proceed as follows:



**Whenever the Angle Head is installed or repositioned, the Throttle Switch Assembly (3) must be positioned so that reaction torque will not tend to retain the throttle in the "ON" position.**

**NOTICE**

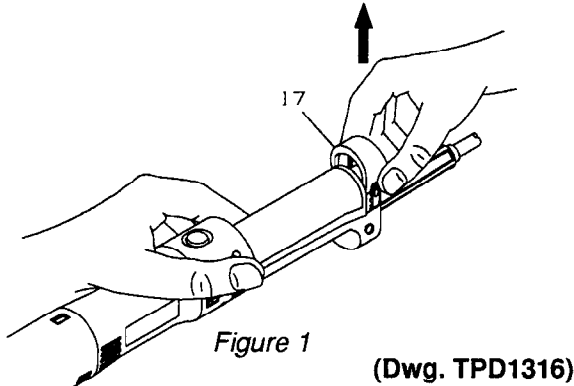
**The Nut in the following step is a left-hand thread. Rotate the Nut clockwise.**

1. Using a wrench on the hex of the Gear Case (35) and a wrench on the Housing Coupling Nut (54), loosen but do not remove the Coupling Nut.
2. Apply some pressure against the Angle Head and continue loosening the Coupling Nut until the pin in the Housing Orientation Ring (104) disengages the notch in the Gear Case.
3. Rotate the Angle Head to the desired location and push the Angle Head against the Gear Case making sure the pin in the Orientation Ring engages a notch.
4. Using the wrenches, tighten the Coupling Nut between 25 and 30 ft-lb (27 and 40 Nm) torque.

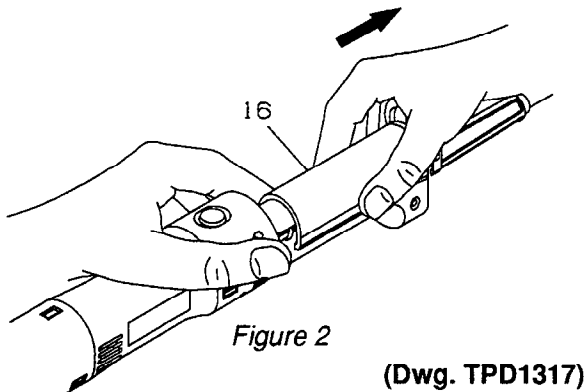
## GRIP ADJUSTMENT

The handle of the Angle Wrench Housings (1 and 2) has an Adjustable Grip (16) which permits individual operators to select one of three handle thickness positions. Operators with large hands can select the bulkiest position and operators with small hands can select the smallest size. To adjust the Grip, proceed as follows:

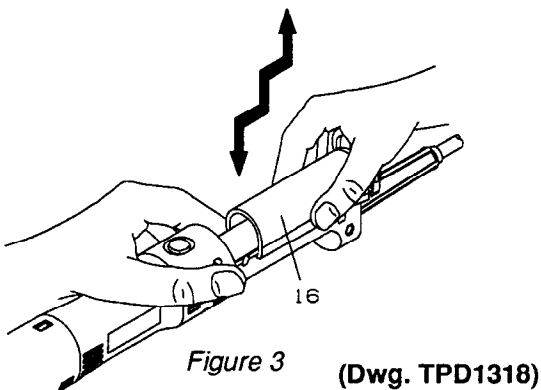
1. Grasp the grooved ends of the Adjustable Grip Latch (17), and spreading the ends slightly, raise the Latch to its uppermost position. (See Figure 1)



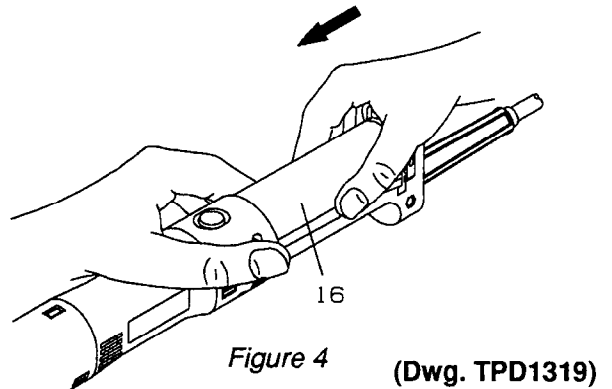
2. Grasp the Adjustable Grip and slide it rearward until it stops. (See Figure 2)



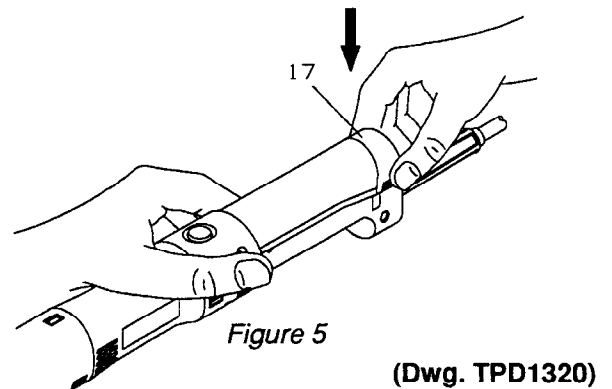
3. Raise or lower the Grip until the desired grooves inside the Grip align with the appropriate lugs on the Handle. (See Figure 3)



4. Slide the Grip forward onto the Handle until it butts against the large portion of the handle. (See Figure 4)



5. Push the Grip Latch downward to its original position to lock the adjustment into position. (See Figure 5)



## MANUAL AND VIDEO AVAILABLE

Ingersoll-Rand has a manual and video available which provides a better understanding of the relationship between these tools and proper torque tension. To obtain a copy, contact your nearest Ingersoll-Rand Distributor and request the following items:

“Torque Tension and Tools” (Manual) Form No. 52074  
“Torque Tension and Tools” (Video) Form No. VCR-101

———— **ERGONOMIC INFORMATION** ————

The Series DEA Torque Control Angle Wrenches incorporate the latest features in ergonomic design. Ingersoll-Rand has a number of informational items available that explain why tools having an ergonomic design are beneficial in the workplace and to the worker. Following is a list of available items:

— **MANUAL AND VIDEO AVAILABLE** —

- “Ergonomics: Design for a Better Workplace”  
(Manual) Form No. 52070
- “Ergonomics: Design for a Better Workplace”  
(Video) Form No. VCR-100

———— **POSTERS AVAILABLE** ————

- Ergonomics Poster – Series #2 Form No. 52109
- Ergonomics Poster – Series #1 Form No. 52108

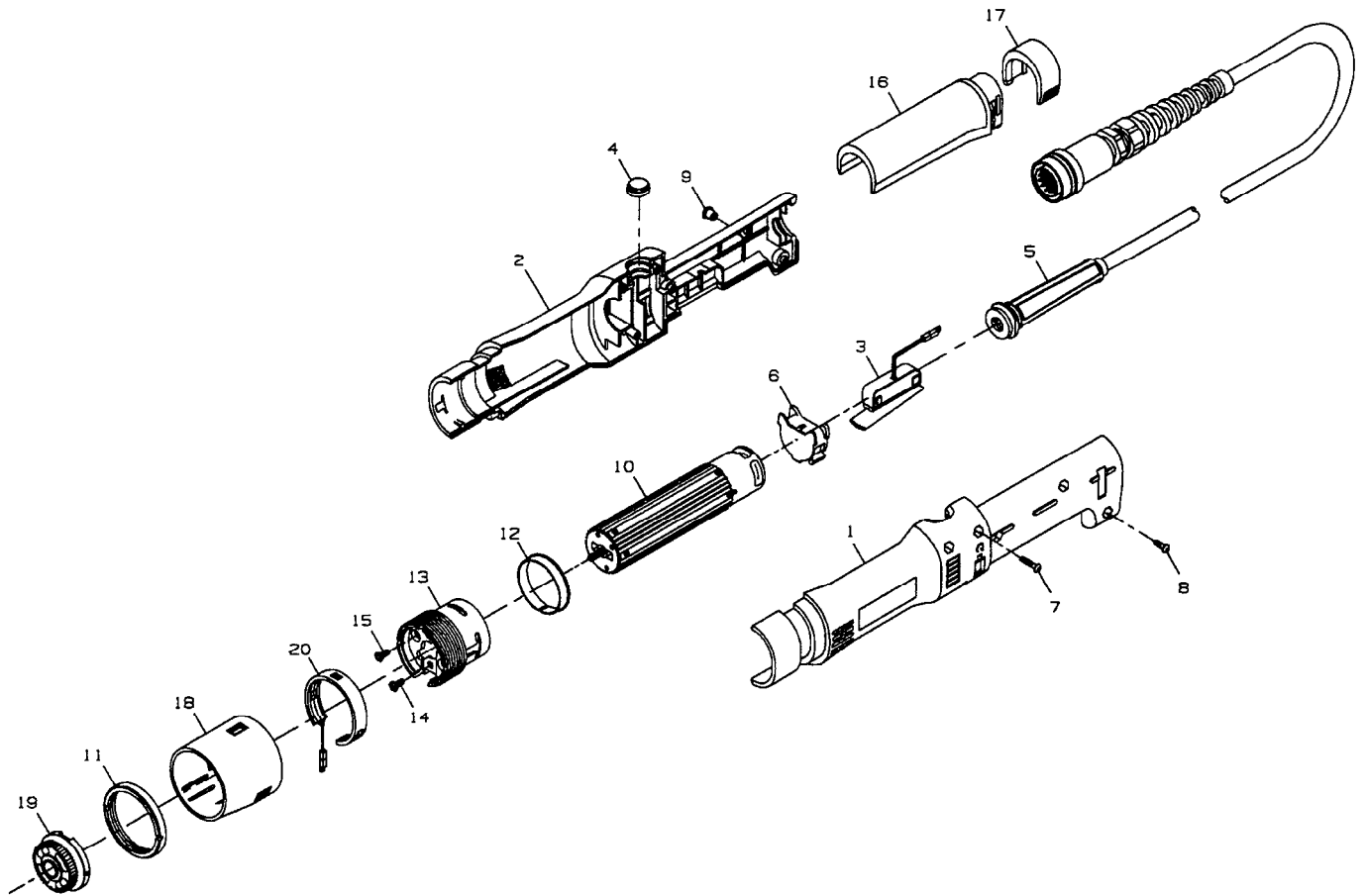
———— **NEWSLETTERS AVAILABLE** ————

- “Ergonomics: Interactive Human Engineering, Edition 1  
Form No. 52094
- “Ergonomics: Interactive Human Engineering, Edition 2  
Form No. 52094A
- “Ergonomics: Interactive Human Engineering, Edition 3  
Form No. 52094B

*To receive any of the above listed ergonomic informational items, contact:*

**ERGONOMICS  
c/o INGERSOLL-RAND COMPANY  
PO BOX 1776  
LIBERTY CORNER, NJ 07938**

## POWER UNIT



(Dwg. TPA1332)

**PART NUMBER FOR ORDERING**

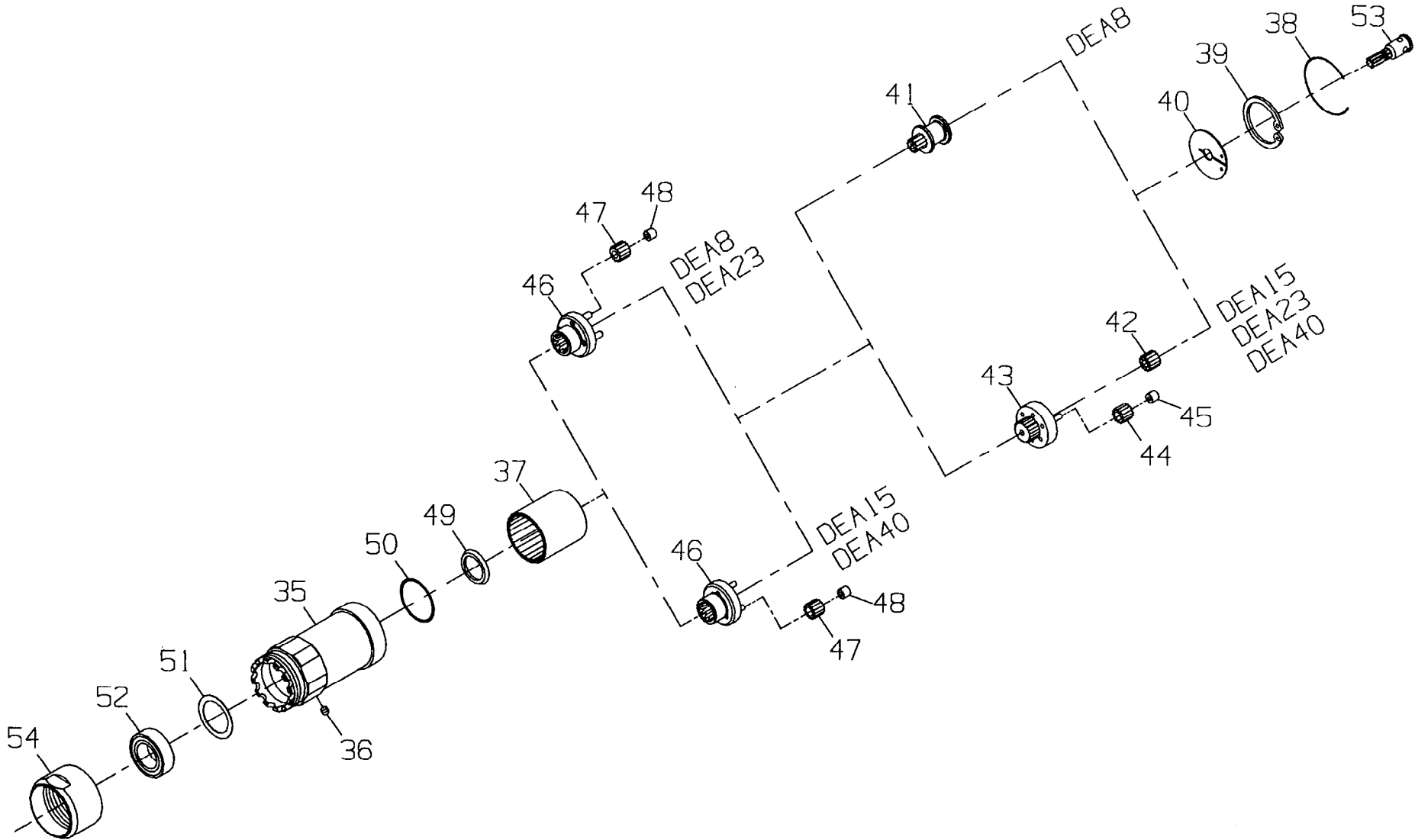
**PART NUMBER FOR ORDERING**

	Motor Housing Assembly for models ending in U, UL, UT or UTL .....	DEA40-A40TC	11	Nose Collar Retaining Ring .....	DEA40-482
	for all other models .....	DEA40-A40RC	12	Motor Clamp Ring .....	DEA40-440
1	Housing (left half) .....	DEA40-40L	13	Motor Coupler .....	DEA40-491
2	Housing (right half) .....	DEA40-40R	14	Ground Screw .....	DEA40-810
3	Throttle Switch Assembly .....	DEA40-A20	15	Mounting Screw (3) .....	400-35-54
4	Cable Port Plug .....	DEA40-701	16	Adjustable Grip .....	DAA40-30
5	Cable Assembly for models ending in U, UL, UT or UTL .....	DEA40-249T	17	Adjustable Grip Latch .....	DAA40-402
	for all other models .....	DEA40-249	*	Warning Label .....	DEA40-878
6	Reversing Switch Assembly .....	DEA40-A19	18	Nose Collar Assembly .....	DEA40-A483
7	Housing Screw (long) (3) .....	DEA40-704	19	Transducer Assembly for models ending in T, TL, UT or UTL .....	DAE40-A755
8	Housing Screw (short) (3) .....	DEA40-703		for all other models .....	DEA40-B755
9	Housing Screw Nut (6) .....	DEA40-23	20	Light Ring (for models ending in L, TL, UL or UTL) .....	DEA40-98
10	Motor Assembly .....	DEA40-A22			

\* Not illustrated.

**GEAR UNITS**

9

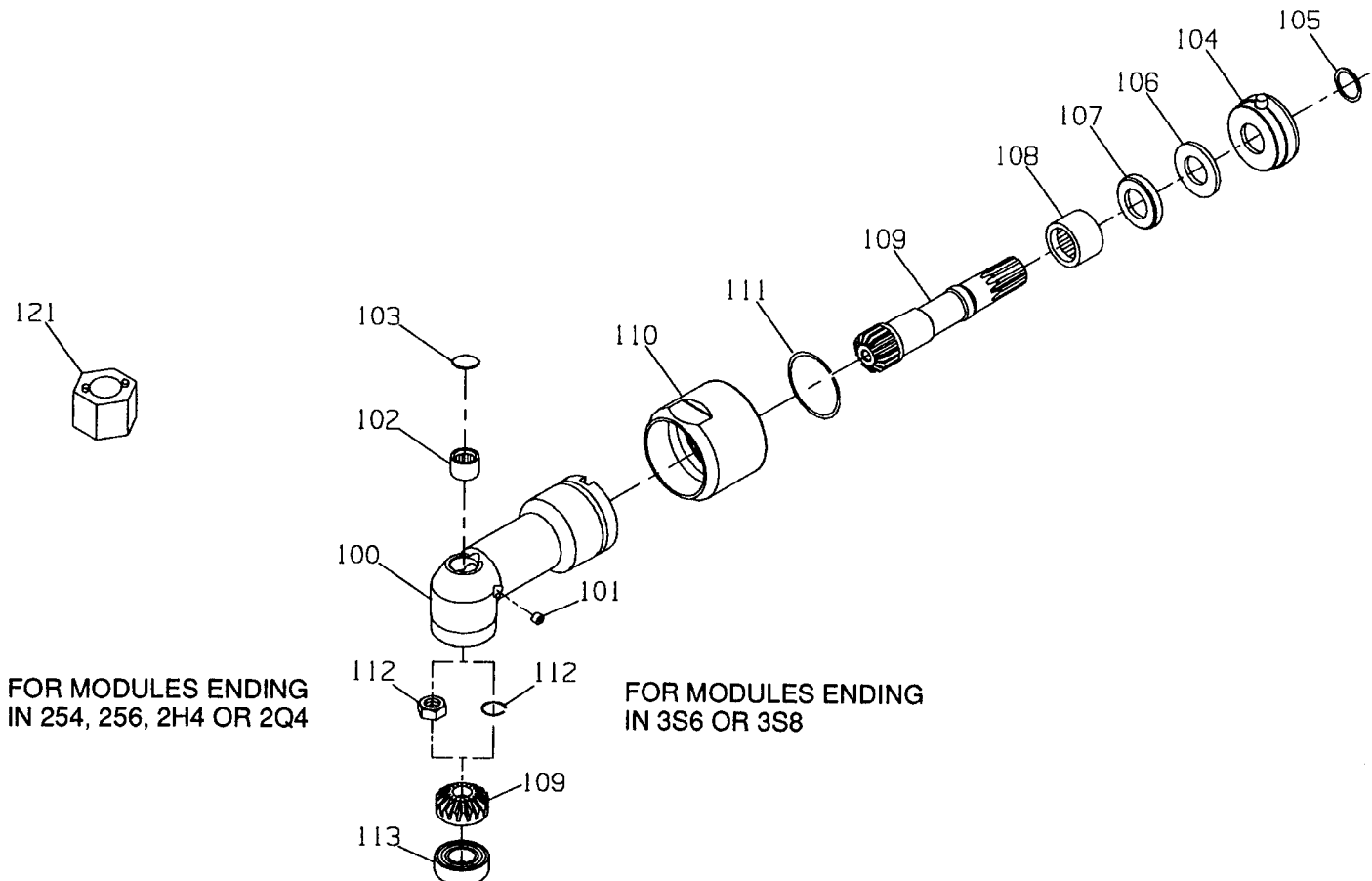


**PART NUMBER FOR ORDERING**



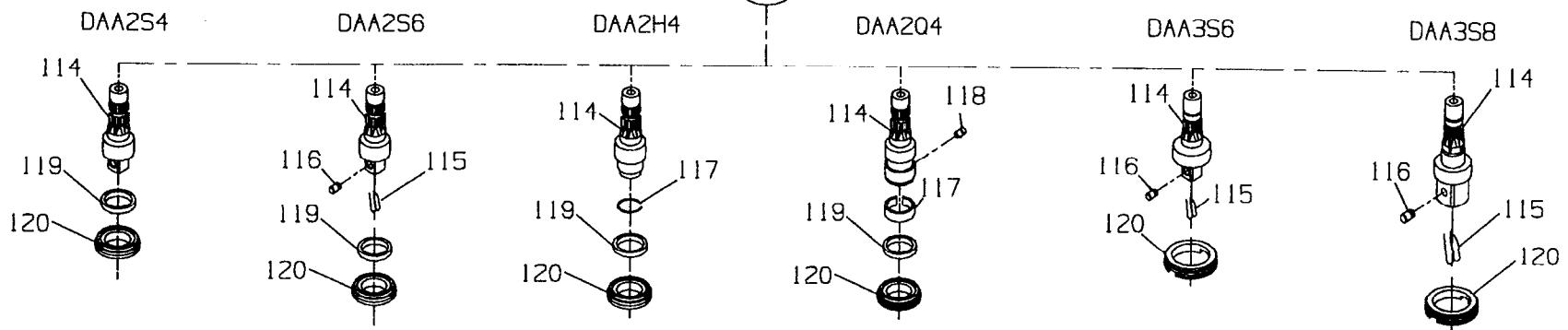
		<b>DEA8</b>	<b>DEA15</b>	<b>DEA23</b>	<b>DEA40</b>
	Gear Case Module .....	DEA8-M37	DEA15-M37	DEA23-M37	DEA40-M37
35	Gear Case Assembly .....	DEA40-B37	DEA40-B37	DEA40-B37	DEA40-B37
36	Grease Fitting .....	D0F9-879	D0F9-879	D0F9-879	D0F9-879
37	Ring Gear .....	DEA40-406	DEA40-406	DEA40-406	DEA40-406
38	Ring Gear Retainer .....	M004-29	M004-29	M004-29	M004-29
39	Retainer Snap Ring .....	4E-118	4E-118	4E-118	4E-118
40	Gear Retainer .....	DEA40-81	DEA40-81	DEA40-81	DEA40-81
41	Drive Coupling .....	DAA14-17	—	—	—
42	Rotor Pinion .....	—	DAA25-17	4RLM-17	—
43	Planet Gear Head .....	—	DAA25-216	DAA40-216	DAP40-216
44	Gear Head Planet Gear (3) .....	—	4RLN-10	4RLM-10	4RLL-10
45	Gear Head Planet Gear Bearing (3) .....	—	6WTM-500	6WTM-500	6WTM-500
46	Planet Gear Spindle .....	DAA14-8	DAA25-8	DAA40-8	DAA9-8
47	Spindle Planet Gear (3 for DEA8-M37 and DEA23-M37; 4 for DEA15-M37 and DEA40-M37) .....	4RLL-10	6WTM-10	DAA40-10	6WTP-10
48	Spindle Planet Gear Bearing (3 for DEA8-M37 and DEA23-M37; 4 for DEA15-M37 and DEA40-M37) .....	6WTM-500	6WTM-500	DAA40-500	WFS182-654
49	Grease Shield Support .....	DAA40-5	DAA40-5	DAA40-5	DAA40-5
50	Shield Support O-ring .....	DAA40-606	DAA40-606	DAA40-606	DAA40-606
51	Grease Shield .....	DAA40-701	DAA40-701	DAA40-701	DAA40-701
52	Gear Case Bearing .....	R1602-510	R1602-510	R1602-510	R1602-510
53	Pinion Coupler .....	DEA40-17	DEA40-17	DEA40-17	DEA40-17
54	Housing Coupling Nut .....	DEA40-43	DEA40-43	DEA40-43	DEA40-43

# ANGLE HEADS



FOR MODULES ENDING  
IN 254, 256, 2H4 OR 2Q4

FOR MODULES ENDING  
IN 3S6 OR 3S8



(Dwg. TPB950)



**PART NUMBER FOR ORDERING**



6

	Angle Housing Module .....	DAA2S4	DAA2S6	DAA2H4	DAA2Q4	DAA3S6	DAA3S8
100	Angle Housing Assembly .....	DAA2-B550	DAA2-B550	DAA2-B550	DAA2-B550	DAA3-B550	DAA3-B550
101	Grease Fitting .....	D0F9-879	D0F9-879	D0F9-879	D0F9-879	D0F9-879	D0F9-879
102	Upper Spindle Bearing .....	120A4-603	120A4-603	120A4-603	120A4-603	8SA32-603	8SA32-603
103	Angle Housing Cap .....	—	—	—	—	8SA32-110	8SA32-110
104	Housing Orientation Ring .....	DAA2-A682	DAA2-A682	DAA2-A682	DAA2-A682	DAA2-A682	DAA2-A682
105	Orientation Ring Retainer .....	182A53-689	182A53-689	182A53-689	182A53-689	182A53-689	182A53-689
106	Thrust Bearing .....	R1610-105	R1610-105	R1610-105	R1610-105	R1610-105	R1610-105
107	Thrust Washer .....	182A53-554	182A53-554	182A53-554	182A53-554	182A53-554	182A53-554
108	Bevel Pinion Bearing .....	R1410-593	R1410-593	R1410-593	R1410-593	182A53-606	182A53-606
109	Bevel Pinion and Bevel Gear (sold only as a matched set) .....	DAA2-A552	DAA2-A552	DAA2-A552	DAA2-A552	DAA3-A552	DAA3-A552
110	Coupling Nut .....	DAA2-27	DAA2-27	DAA2-27	DAA2-27	DAA2-27	DAA2-27
111	Coupling Nut Retainer .....	DAA2-29	DAA2-29	DAA2-29	DAA2-29	DAA2-29	DAA2-29
112	Bevel Gear Retainer .....	120A4-578	120A4-578	120A4-578	120A4-578	8SA32-578	8SA32-578
113	Lower Spindle Bearing .....	6L2D-59	6L2D-59	6L2D-59	6L2D-59	8SA32-593	8SA32-593
114	Spindle Assembly .....	DAA2-A607-1/4	6L2D-A607	DAA2-A786-4	DAA2-A586-4	8SA32-P507-3/8	DAA3-P507-1/2
115	Socket Retaining Spring .....	—	401-718	—	—	401-718	SUHD-718
116	Socket Retaining Pin .....	—	5020-716	—	—	5020-716	804-716
117	Bit Retaining Spring .....	—	—	5L2C4-425	102A60-241	—	—
118	Bit Retaining Ball .....	—	—	—	AV1-255	—	—
119	Spindle Seal .....	6L2D-720	6L2D-720	6L2D-720	6L2D-720	—	—
120	Spindle Bearing Cap .....	6L2D-531	6L2D-531	6L2D-531	6L2D-531	8SA32-531	8SA32-531
121	Spindle Bearing Cap Wrench .....	141A12-26	141A12-26	141A12-26	141A12-26	8SA32-26	8SA32-26

## MAINTENANCE SECTION

### WARNING

Always use protective eyewear when performing maintenance on a tool or operating a tool.

### LUBRICATION

Whenever the Series DEA Angle Wrench is disassembled for repair or replacement of parts, clean the parts and re-lubricate them as follows:

1. Moisten all O-rings with O-ring lubricant.
2. Work approximately 3 cc to 4 cc of Ingersoll-Rand No. 67 Grease into the gear trains. Grease the Planet Gear Bearings (45) and (48), the gear teeth of the Ring Gear (37) and the planet gear shafts on the Planet Gear Head (43) and Planet Gear Spindle (46).
3. Apply 4 cc to 8 cc of Ingersoll-Rand No. 67 Grease to the Bevel Pinion and Bevel Gear (109) used in the DAA2 Angle Attachments and 6 cc to 10 cc of Ingersoll-Rand No. 67 Grease to the Bevel Pinion and Bevel Gear used in the DAA3 Angle Attachments.

### DISASSEMBLY

### WARNING

This procedure is to be done only by an authorized, trained repairman.

#### General Instructions

1. Do not disassemble the tool any further than necessary to replace or repair damaged parts.
2. Whenever grasping a part in a vise, always use leather-covered or copper-covered vise jaws to protect the surface of the part and help prevent distortion.
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 press any needle bearing from a part unless you have a new needle bearing on hand for installation. Needle bearings are always damaged during the removal process.

#### Disassembly of the Angle Attachment

1. Carefully grasp the hex of the Gear Case Assembly (35) in copper-covered vise jaws so that the Angle Housing Assembly (100) is facing downward.

### NOTICE

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

2. Using a wrench on the flats of the Coupling Nut (110), 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 vise jaws with the Spindle Assembly (114) facing upward.

### NOTICE

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

4. Using the Spindle Bearing Cap Wrench (121), unscrew and remove the Spindle Bearing Cap (120).  
**For models ending in 2S4, 2S6, 2H4 or 2Q4, if the Spindle Seal (119) is damaged, remove it. Withdraw the Spindle from the Angle Housing.**
5. Inspect the Lower Spindle Bearing (113) 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 (112).
- b. Press the Bevel Gear (109) 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 (112) and lift the Bevel Gear (109) 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 (103) when the Upper Spindle Bearing is installed.**

6. If the Upper Spindle Bearing (102) appears rough or loose, press it from the Angle Head.
7. Remove the Orientation Ring Retainer (105) and slide the Housing Orientation Ring (104), Thrust Bearing (106) and Thrust Washer (107) from the pinion shaft.

## MAINTENANCE SECTION

### NOTICE

**In the following step, do not remove the Bevel Pinion and Bearing unless you have a new Bearing on hand. After the Angle Attachment is disassembled, check all parts for damage or wear.**

8. 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 (109) and Bevel Pinion Bearing (108) from the Angle Attachment.

### 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.**

### 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.**

### Disassembly of the Gear Case

1. Grasp the Gear Case Assembly (35) in copper-covered vise jaws with the assembled motor upward, and using a wrench on the flats of the Housing Coupling Nut (54), loosen the joint and remove the tool from the vise. Unscrew the Gear Case from the Housing.
2. Using snap ring pliers, remove the Retainer Snap Ring (39) from the motor end of the Gear Case and slide the Gear Retainer (40) out of the Gear Case.
3. **For DEA9 models**, remove the Drive Coupling (41). **For DEA15, DEA23 and DEA40 models**, remove the Rotor Pinion (42), Planet Gear Head (43), Planet Gears (44) and Planet Gear Bearings (45).
4. Slide the Spindle Planet Gears (47) and Spindle Planet Gear Bearings (48) off the shafts of the Planet Gear Spindle (46).
5. Work a pointed probe under the Ring Gear Retainer (38) and spiral it out of the Gear Case.
6. Slide the Ring Gear (37) out of the Gear Case.

7. With the motor end of the Gear Case standing on the table of an arbor press, carefully press the Planet Gear Spindle out of the Gear Case Bearing (52). Remove the Bearing and Grease Shield (51) from the Gear Case and the Grease Shield Support (49) and Shield Support O-ring (50) from the hub of the Planet Gear Spindle.

## ASSEMBLY

### General Instructions

1. Always press on the **inner** ring of a ball-type bearing when installing the bearing on a shaft.
2. Always press on the **outer** ring of a ball-type bearing when installing the bearing in a bearing recess.
3. Whenever grasping a 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.
4. Always clean every part and wipe every part with a thin film of oil before installation.
5. Apply O-ring lubricant to each O-ring before assembly.
6. 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.
7. Unless otherwise noted, always press on the stamped end of a needle bearing when installing the needle bearing in a recess.

### Assembly of the Gear Case.

1. Install the Grease Shield Support (49), small edge trailing, onto the hub of the Planet Gear Spindle (46). Install the Shield Support O-ring (50) on the Support.
2. Support the pin end of the Spindle on a steel rod long enough to keep the Gear Case (35) from contacting the table of an arbor press. Position the Gear Case, external thread upward, on the Spindle. Install the Grease Shield (51) in the Gear Case and press the Gear Case Bearing (52) onto the shaft of the Planet Gear Spindle. Press the Bearing until it enters the Gear Case and bottoms against the Shield Support.
3. Slide the Ring Gear (37) into the motor end of the Gear Case until it stops against the shoulder of the Gear Case.
4. Install the Ring Gear Retainer (38) in the internal groove of the Gear Case to retain the Ring Gear.
5. Install a Spindle Planet Gear (47) and Spindle Planet Gear Bearing (48) on each shaft of the Spindle. Make certain the teeth of the Planet Gears mesh with the teeth of the Ring Gear.

## MAINTENANCE SECTION

6. Work 3 to 4 cc of Ingersoll-Rand No. 67 Grease into the gear train.
  7. **For DEA8 models**, install the Drive Coupling (41), gear teeth first, into the Gear Case. Make certain the gear teeth mesh with the teeth of the Planet Gears.  
**For DEA15, DEA23 and DEA40 models**, install the Planet Gear Head (43) into the Gear Case.
  8. **For DEA15, DEA23 and DEA40 models**, install a Planet Gear (44) and Planet Gear Bearing (45) on each of the pins on the Planet Gear Head. Make certain the teeth on the shaft of the Gear Head mesh with the teeth of the Spindle Planet Gears.
  9. **For DEA15, DEA23 and DEA40 models**, install the Rotor Pinion (42) between the Planet Gears.
  10. Slide the Gear Retainer (40) into the Gear Case and using snap ring pliers, install the Retainer Snap Ring (39) in the internal groove of the Gear Case.
  11. If the Pinion Coupler (53) was removed from the gear train or motor unit, install the Coupler on the shaft of the motor.
  12. Slide the Gear Case onto the motor housing and engage the teeth of the Pinion Coupler with the teeth of the Drive Coupling or Rotor Pinion. It may be necessary to rotate the Spindle to mesh the teeth properly while threading the Housing Coupling Nut onto the motor housing. Tighten the joint between 20 and 25 ft-lb (27 and 34 Nm) torque.
- ### Assembly of the Angle Attachment
1. Lubricate the Bevel Pinion (109) as instructed on Page 10 under **LUBRICATION** and insert it, gear end first, into the long bore of the Angle Housing (100).
  2. Insert the Bevel Pinion Bearing (108), unstamped end first, into the bore of the Angle Housing and onto the bevel pinion shaft.
  3. **For DAA2 Angle Attachments**, 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.  
**For DAA3 Angle Attachments**, 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.
4. Install, in the order named, the Thrust Washer (107), Thrust Bearing (106) and Housing Orientation Ring (104) over the splined end of the Bevel Pinion and retain the components by installing the Orientation Ring Retainer (105) on the pinion shaft.
  5. If the Lower Spindle Bearing (113) 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 (114).  
**For DAA3 Angle Attachments**, using a sleeve that will contact the inner ring of the Bearing, press the Bearing onto the Spindle (114). 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 (109) onto the Spindle.  
**For DAA3 Angle Attachments**, align the internal flats of the Bevel Gear (109) with the flats on the Spindle and press the Bevel Gear onto the Spindle.
    - c. **For DAA2 Angle Attachment**, apply a drop of PermaBond Surface Conditioner II\* to the threads of the Bevel Gear Retainer (112) 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 Angle Attachments**, spread the Bevel Gear Retainer (112) 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.

\* Product of National Starch and Chemical Corporation.

## MAINTENANCE SECTION

6. If the Upper Spindle Bearing (102) 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 Figure 9.

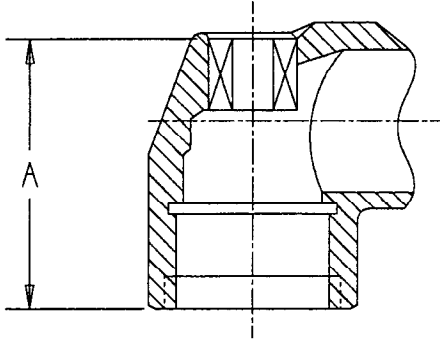


Figure 9 (Dwg. TPD680)

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

### NOTICE

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

**For DAA3 Angle Attachments**, press a new Spindle Bearing into the Angle Head from the large threaded end to the dimension shown in Figure 10. Install a new Angle Housing Cap (103) into the top of the Angle Head.

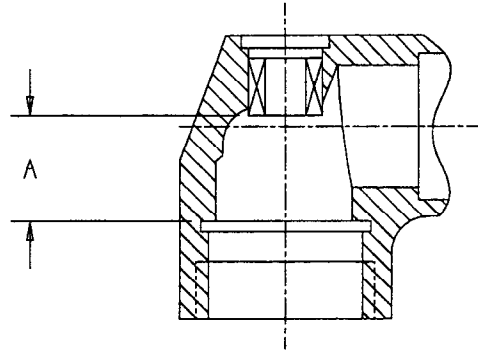


Figure 10 (Dwg. TPD636)

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

7. Lubricate the Upper Spindle Bearing, Bevel Gear and Lower Spindle Bearing and install the Spindle in the Angle Housing.
8. Clean the threads on the Angle Housing and the Spindle Bearing Cap (120) and apply a film of Perma-Lok MM-115\* to the threads.
9. **For DAA2 Angle Attachments**, install Spindle Seal (119). Using the Spindle Bearing Cap Wrench (121), install the Spindle Bearing Cap and tighten the Cap between 15 and 20 ft-lb (20 and 27 Nm) torque. **For DAA3 Angle Attachments**, using the Spindle Bearing Cap Wrench (121), install the Spindle Bearing Cap and tighten the Cap between 20 and 25 ft-lb (27 and 34 Nm) torque.
10. If the Coupling Nut (110) was removed, slide the Coupling Nut, threaded end trailing, over the motor end of the Angle Housing. Apply the Coupling Nut Retainer (111) to the external groove on the motor end of the Angle Housing.
11. Engage the spline on the Bevel Pinion with the matching internal spline of the Spindle Planet Gear Head (46) and thread the Coupling Nut onto the Gear Case (35). Orient the angle attachment to the desired position and tighten the Coupling Nut between 25 and 30 ft-lb (27 and 40 Nm) torque.

\* Product of National Starch and Chemical Corporation.

### WIRING CHART

Connector Pin	Cable Wire Color	Location	Logic
A	Red	Transducer Cable (4 Wire)	(+) Excitation
B	Black		(-) Excitation
C	Green		(+) Signal
D	White		(-) Signal
E	Shield		Shield
F	White	Logic Cable (14 Wire)	Free Speed
G	Green/White		Soft Start
H	Red		(+) 5 Volt
J	Blue/Black		Fwd./Rev.
K	Black/White		(-) LED
L	Red/Black		Red LED
M	Orange/Black		Yellow LED
N	Green/Black		Green LED
P	Green		Ground Sense
R	Blue/White		PTC Return
S	Black	Encoder Common	
T	Blue	Encoder "H1"	
U	Red	Motor	Phase U
V	Black	Power	Phase V
W	White	Leads	Phase W
X	Red/White	Logic Cable	Encoder "H2"
Y	Orange	(14 Wire)	Encoder "H3"
Z	Green	Ground Lead	Ground

### TOOL CALIBRATION SPECIFICATIONS

Tool Configuration	Torque Range		Transducer Full Scale Value		Encoder Angle Scale Factor
	Nm	Ft-Lb	Nm	Ft-Lb	Degrees/Pulse
Angle Head	4 – 8	2.9 – 5.8	75	55.6	2.500
	6 – 15	4.3 – 11	75	55.6	1.333
	11 – 23	8 – 17	75	55.6	0.867
	17 – 40	12.5 – 29.4	75	55.6	0.499
Straight Spindle	2.7 – 5.3	1.9 – 3.9	50	37	3.750
	4 – 10	2.9 – 7.3	50	37	2.000
	7.3 – 15.3	5.3 – 11.3	50	37	1.301
	11.3 – 26.7	8.3 – 19.6	50	37	0.749

## ***NOTES***

