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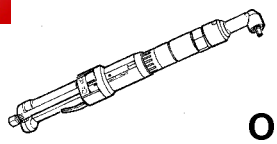
F E P



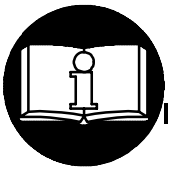
OPERATION AND MAINTENANCE MANUAL FOR SERIES DAA TORQUE CONTROL ANGLE WRENCHES

NOTICE

Series DAA Angle Wrenches are designed for assembly applications requiring precise torque monitoring and control, accuracy, consistency and repeatability.

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

⚠ 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 American National Standards Institute Safety Code for Portable Air Tools (ANSI B186.1).
- 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. See Dwg. TPD905–1 for a typical piping arrangement.
- 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.

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.

Printed in U.S.A.

INGERSOLL-RAND®
PROFESSIONAL TOOLS

WARNING LABEL IDENTIFICATION

⚠ WARNING

FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

⚠ WARNING

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

⚠ WARNING

Always wear hearing protection when operating this tool.

⚠ 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.

⚠ 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.

⚠ WARNING

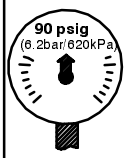
Do not carry the tool by the hose.

⚠ WARNING

Do not use damaged, frayed or deteriorated air hoses and fittings.

⚠ WARNING

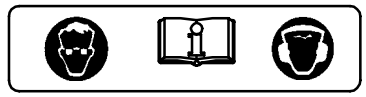
Keep body stance balanced and firm. Do not overreach when operating this tool.



⚠ WARNING

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

International Warning Label:
Order Part No. _____



ADJUSTMENTS

ADJUSTMENTS

Before placing your Ingersoll–Rand Series DAA Torque Control Angle Wrench in service, several optional adjustments can be made to the tool which will enhance the performance of the tool or improve the comfort of the operator. Selection and adjustments should be made prior to placing the tool in service.

TOP/REAR AIR INLET

The air supply hose can be connected conventionally to the rear of the tool or connected to the side of the Handle if an overhead air supply is available. To change the inlet connection, proceed as follows:

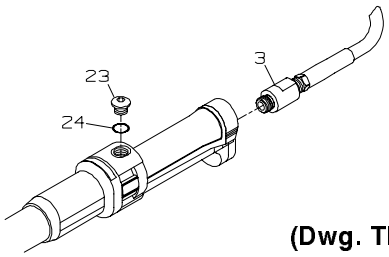
⚠ WARNING

Do not remove the Inlet Plug without first disconnecting the live air supply.

CAUTION

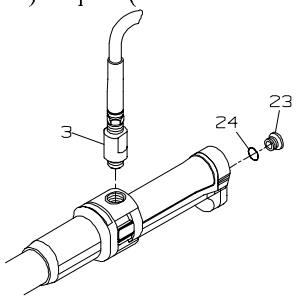
Do not thread pipe thread fittings directly into the Inlet Bushing or Inlet Plug locations in the Handle.

1. Disconnect the air supply hose if it is attached to the tool.
2. Using an adjustable wrench, unscrew and remove the Inlet Bushing and Inlet Bushing Seal.
3. Using a 1/4" hex wrench, unscrew and remove the Inlet Plug and Inlet Plug Seal.
4. Install the Inlet Plug and Seal in the desired location and tighten the Plug between 30 and 40 in–lb (3.4 and 4.5 Nm) torque. (Refer to TPD1254).



(Dwg. TPD1254)

5. Install the Inlet Bushing and Seal in the desired location and tighten the Plug between 20 and 30 ft–lb (27 and 40 Nm) torque. (Refer to TPD1253)



(Dwg. TPD1253)

ANGLE HEAD ORIENTATION

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

⚠ WARNING

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.

ADJUSTMENTS

1. Using a wrench on the hex of the Gear Case and a wrench on the Coupling Nut, loosen but do not remove the Coupling Nut.

NOTICE

This is a left-hand thread. Rotate the Nut clockwise.

2. Apply some pressure against the Angle Head and continue loosening the Coupling Nut until the pin in the Housing Orientation Ring 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.

CLUTCH ADJUSTMENT

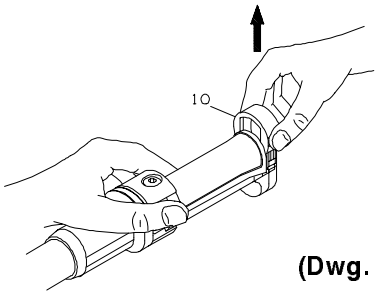
To adjust the clutch on these Angle Wrenches, proceed as follows:

1. Rotate the Clutch Adjusting Hole Cover until the slot in the Cover aligns with a corresponding slot in the Motor Housing Assembly.
2. Using a wrench on the square drive spindle or hex bit insert, rotate the output spindle until the half circle notch on the motor end of the Clutch Adjusting Nut Lock is visible in the slot.
3. Insert a #1 Phillips head screwdriver into the notch of the Nut Lock and one of the notches in the Clutch Adjusting Nut. Insert the screwdriver far enough to create a gap between the Nut Lock and Adjusting Nut.
4. Turn the screwdriver clockwise (as you would to tighten a screw) to increase the clutch torque or counter-clockwise to decrease the clutch torque.
5. Final clutch adjustment should be set on the job.

GRIP ADJUSTMENT

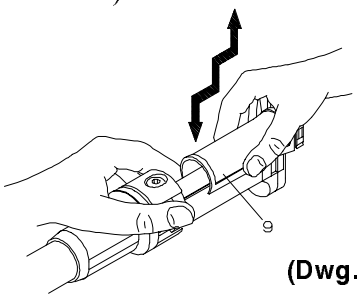
The Handle of the Angle Wrench has an Adjustable Grip which permits individual operators to select one of three handle thickness positions. Operators with large hands can select the bulkiest position and operators with small hands can select the smallest size. To adjust the Grip, proceed as follows:

1. Grasp the grooved ends of the Adjustable Grip Latch, and spreading the ends slightly, raise the Latch to its uppermost position. (Refer to TPD1255).



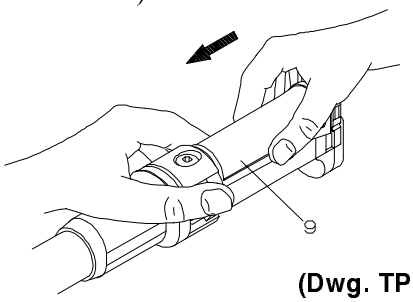
(Dwg. TPD1255)

2. Grasp the Adjustable Grip and slide it rearward until it stops. (Refer to TPD1256).
3. Raise or lower the Grip until the desired grooves inside the Grip align with the appropriate lugs on the Handle. (Refer to TPD1257).



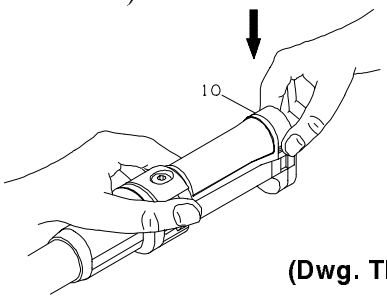
(Dwg. TPD1257)

4. Slide the Grip forward onto the Handle until it butts against the Collar or Collar Assembly. (Refer to TPD1258).



(Dwg. TPD1258)

5. Push the Grip Latch downward to its original position to lock the adjustment into position. (Refer to TPD1259).



(Dwg. TPD1259)

PLACING TOOL IN SERVICE

LUBRICATION

Ingersoll–Rand No. 50

Ingersoll–Rand No. 100

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

We recommend the following Filter–Lubricator–Regulator Unit:

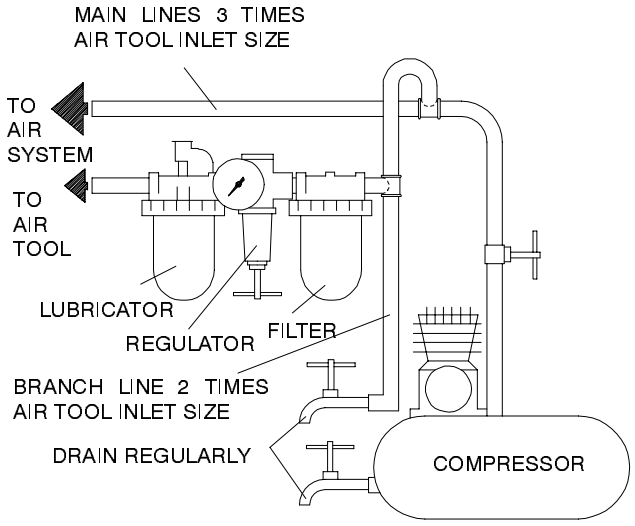
For USA – No. C11–03–G00
For International – No. C16–C3–A29

After each eight hours of operation, unless an air line lubricator is used, inject 2 cc of Ingersoll–Rand No. 10 Oil into the Inlet Bushing.

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 in the Gear Case Assembly.

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

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



(Dwg. TPD905–1)

MANUAL AND VIDEO AVAILABLE

"Egonomics: Design for a Better Workplace" (Manual)
Form No. 52070

"Egonomics: Design for a Better Workplace" (Video)
Form No. VCR–100

POSTERS AVAILABLE

Ergonomics Poster – Series #1
Form No. 52108

Ergonomics Poster – Series #2
Form No. 52109

NEWSLETTERS AVAILABLE

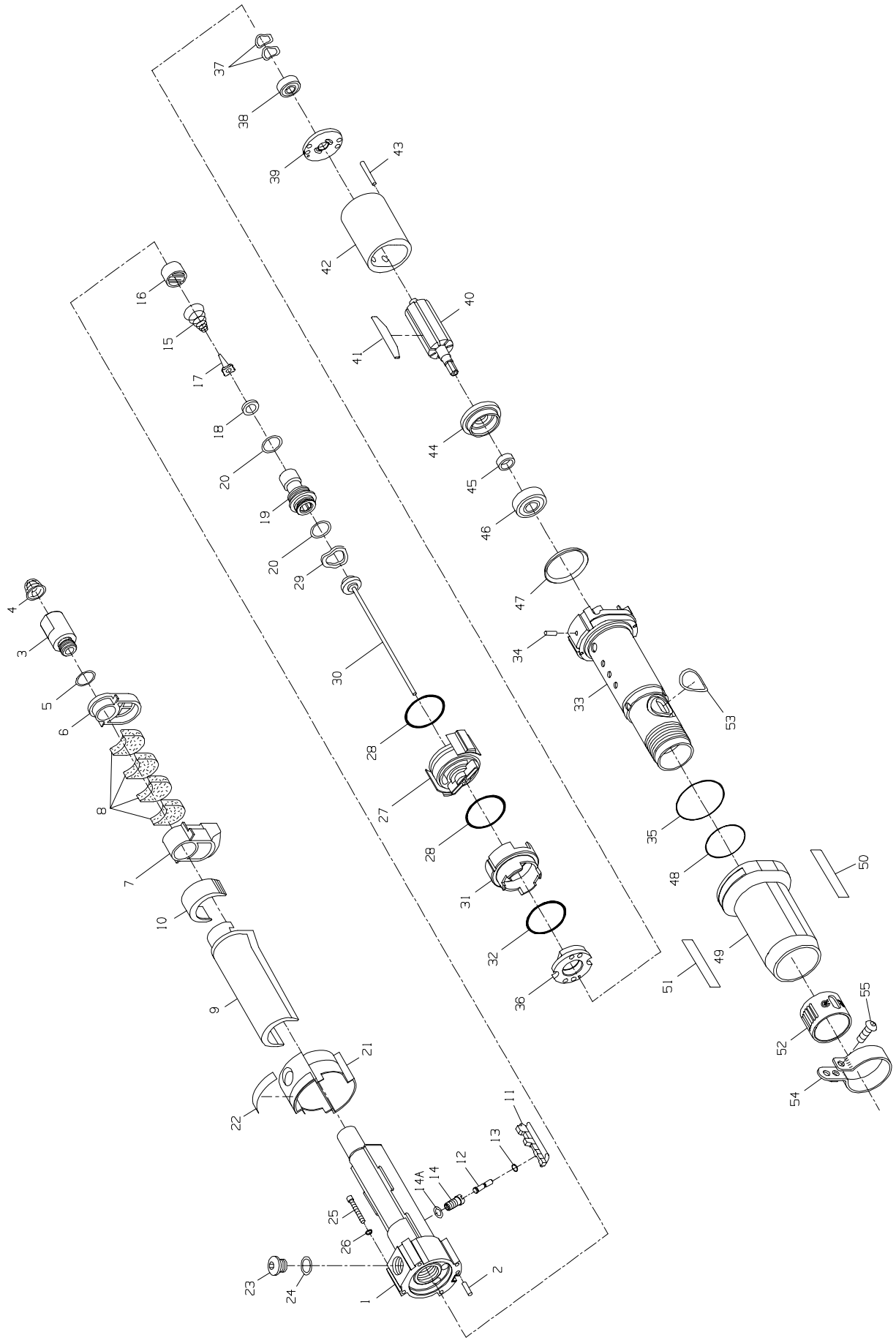
"Ergonomics: Interactive Human Engineering" – Edition 3
Form No. 52094B

"Ergonomics: Interactive Human Engineering" – Edition 1
Form No. 52094

"Ergonomics: Interactive Human Engineering" – Edition 2
Form No. 52094A

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

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



(Dwg. TPA1314–1)

		PART NUMBER FOR ORDERING	
		Handle Assembly	DAA40-A25
	1	Handle	DAA40-B25
	2	Handle Alignment Pin	7RL-56
	3	Inlet Bushing	DAA40-565
♦•	4	Inlet Bushing Screen	5RA-61
♦•	5	Inlet Bushing Seal	DAA40-103
	6	Exhaust Deflector	DAA40-23
	7	Muffler Body	DAA40-123
♦•	8	Muffler Element (3)	DAA40-311
	9	Adjustable Grip	DAA40-30
	10	Adjustable Grip Latch	DAA40-402
	11	Throttle Lever	DAA40-273
	12	Throttle Valve Plunger	DAA40-94
♦•	13	Valve Plunger Seal	WWA100-405
	14	Valve Plunger Bushing	DAA40-503
	14A	Bushing Seal	8SL-259
♦•	15	Throttle Valve Spring	R4-262
	16	Throttle Valve Guide	DAA40-91
♦•	17	Throttle Valve	DAA40-302
♦•	18	Throttle Valve Seat	DAA40-303
	19	Throttle Body	DAA40-300
♦•	20	Throttle Body Seal (2)	410-283
	21	Collar (for models ending in -EU)	DAA40-703
	21	Collar Assembly (for all other models)	DAA40-A703
•	22	Warning Label	DAA40-98
	23	Inlet Plug	DAA40-29
♦•	24	Inlet Plug Seal	DAA40-103
•	25	Handle Mounting Screw (4)	DAA40-68
•	26	Mounting Screw Lock Washer (4)	DAA40-58
	27	Reverse Valve	DAA40-329
♦•	28	Reverse Valve Seal (2)	R00A2-103
	29	Reverse Valve Washer (2)	DAA40-191
♦•	30	Shutoff Valve Assembly	DAA40-A435
	31	Motor Clamp Spacer	DAA40-13
♦•	32	Motor Clamp Seal	WFS182-211
	33	Motor Housing Assembly	DAA40-A40
	34	Housing Alignment Pin	DAA40-669
♦•	35	Rear Motor Housing Seal	DAA40-610
	36	Rear Rotor Bearing Housing	DAA40-203
	37	Rotor Bearing Spring (2)	DG20-278

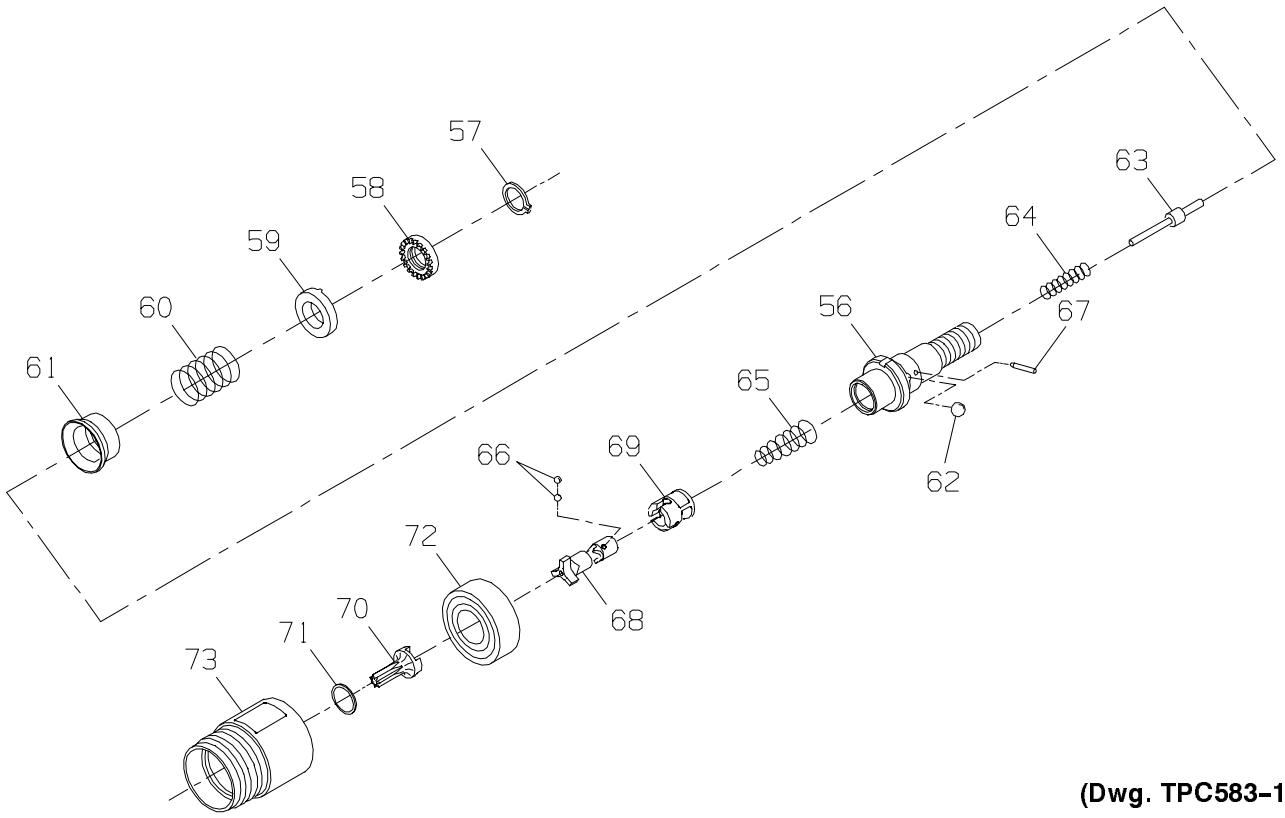
		PART NUMBER FOR ORDERING	
♦	38	Rear Rotor Bearing	DG20-22
	39	Rear End Plate	DAA40-12
	40	Rotor	DAA40-53
♦	41	Vane Packet (set of 7 Vanes)	DAA40-42-7
	42	Cylinder Assembly	DAA40-A3
	43	Cylinder Dowel	9DF5846-667
	44	Front End Plate	DAA40-11
	45	Rotor Spacer	DG10-65-5
♦	46	Front Rotor Bearing	LG1-24
	47	Motor Clamp Washer	401A9-554
♦	48	Front Motor Housing Seal	WFS182-211
+	49	Housing Sleeve Assembly	
		for models ending in -EU	DAA40-EU-A39
		for all other models	DAA40-A39
	50	Warning Label	
		for models ending in -EU	EU-99
		for all other models	DAA40-99
	51	Nameplate	
		for DAA9 models ending in -EU	DAA9-EU-301
		for all other DAA9 models	DAA9-301
		for DAA15 models ending in -EU	DAA14-EU-301
		for DAA14 and all other DAA15 models	DAA14-301
		for DAA25 models ending in -EU	DAA25-EU-301
		for all other DAA25 models	DAA25-301
		for DAA35 models ending in -EU	DAA35-EU-301
		for all other DAA35 models	DAA35-301
		for DAA40 models ending in -EU	DAA40-EU-301
		for all other DAA40 models	DAA40-301
		for DAA60 models ending in -EU	DAA60-EU-301
		for all other DAA60 models	DAA60-301
	52	Clutch Adjusting Hole Cover	DAA40-415
♦	53	Adjusting Hole Cover O-ring	R4-210
	54	Hanger	DAA40-A366
	55	Hanger Screw	DAA40-638
	*	Screwdriver	DAA40-26
	*	Tune-up Kit (includes illustrated items 4, 5, 13, 15, 17, 18, 20[2], 24, 28[2], 30, 32, 35, 38, 46, 48, 53, 62[3], 63, 64, 65, 66[6], 67[3], 71, 111 and 112)	DAA40-TK1

* Not illustrated.

♦ Indicates Tune-up Kit part.

• 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.

\+ When ordering a Housing Sleeve Assembly, order a new Nameplate (51) for the model tool on which the new Sleeve Assembly will be installed.



(Dwg. TPC583–1)

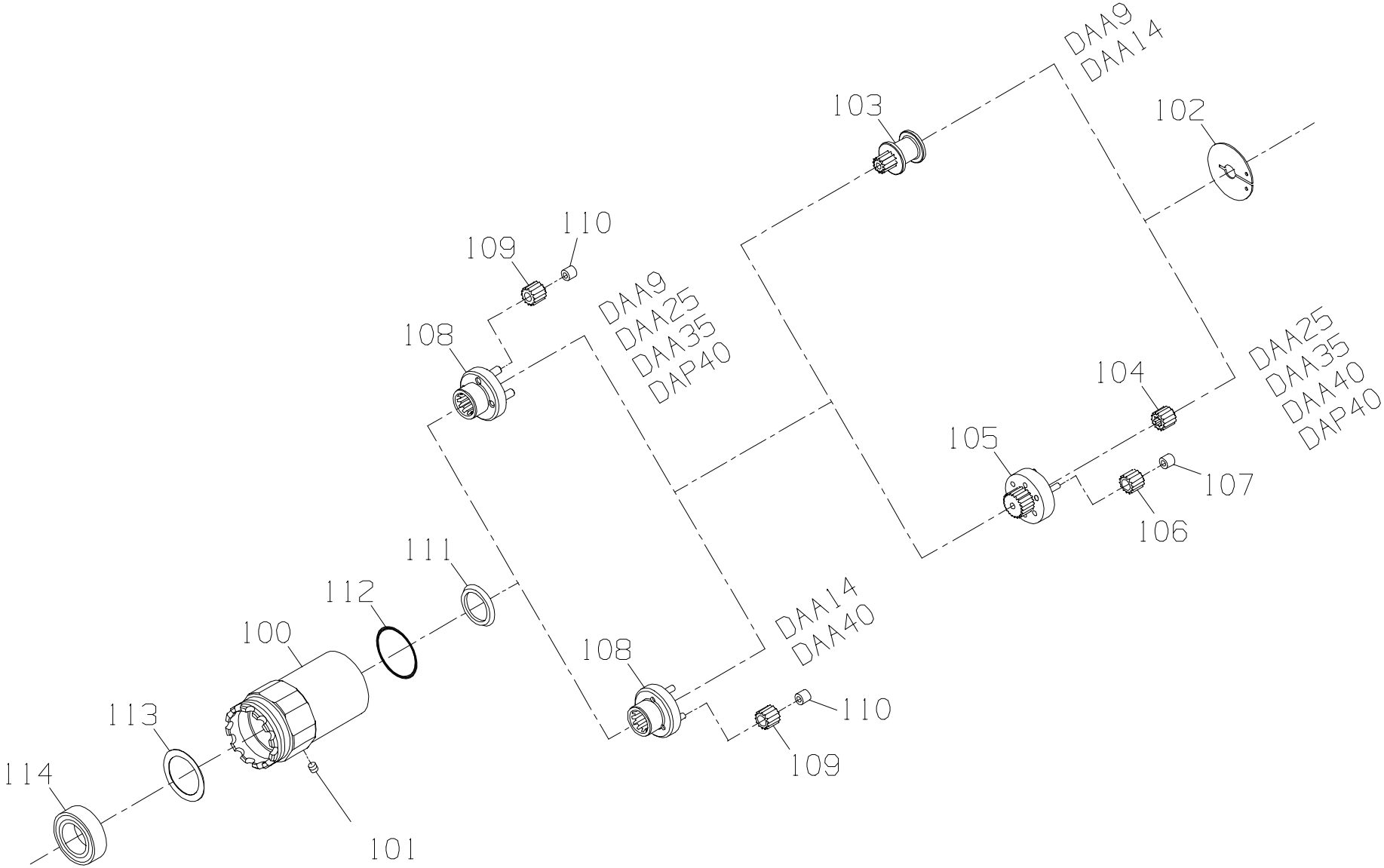
PART NUMBER FOR ORDERING

		Clutch Assembly	DAA40–A581
	56	Clutch Shaft	DAA40–581
•	57	Clutch Adjusting Nut Stop	12E–6
	58	Clutch Adjusting Nut	DAA40–582
	59	Clutch Adjusting Nut Lock	DAA40–588
	60	Clutch Spring	DAA40–583
	61	Cam Follower	DAA40–406
♦•	62	Clutch Ball (3)	2U–722
♦•	63	Shutoff Spool	DAA40–900
♦•	64	Valve Return Spring	DAA40–842
♦•	65	Reset Spring	DAA40–627
♦•	66	Shutoff Ball (6)	DAA40–629
♦•	67	Cam Pin (3)	DAA40–704
	68	Cam Shaft	DAA40–502
	69	Cam Block	DAA40–721
	70	Clutch Spindle	DAA40–584
♦•	71	Spindle Retainer	7L1B–28
	72	Clutch Bearing	R1602–510
	73	Clutch Housing	DAA40–580

♦ Indicates Tune–up Kit part.

• 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.

GEAR UNIT MODULES



(Dwg. TPC582–1)

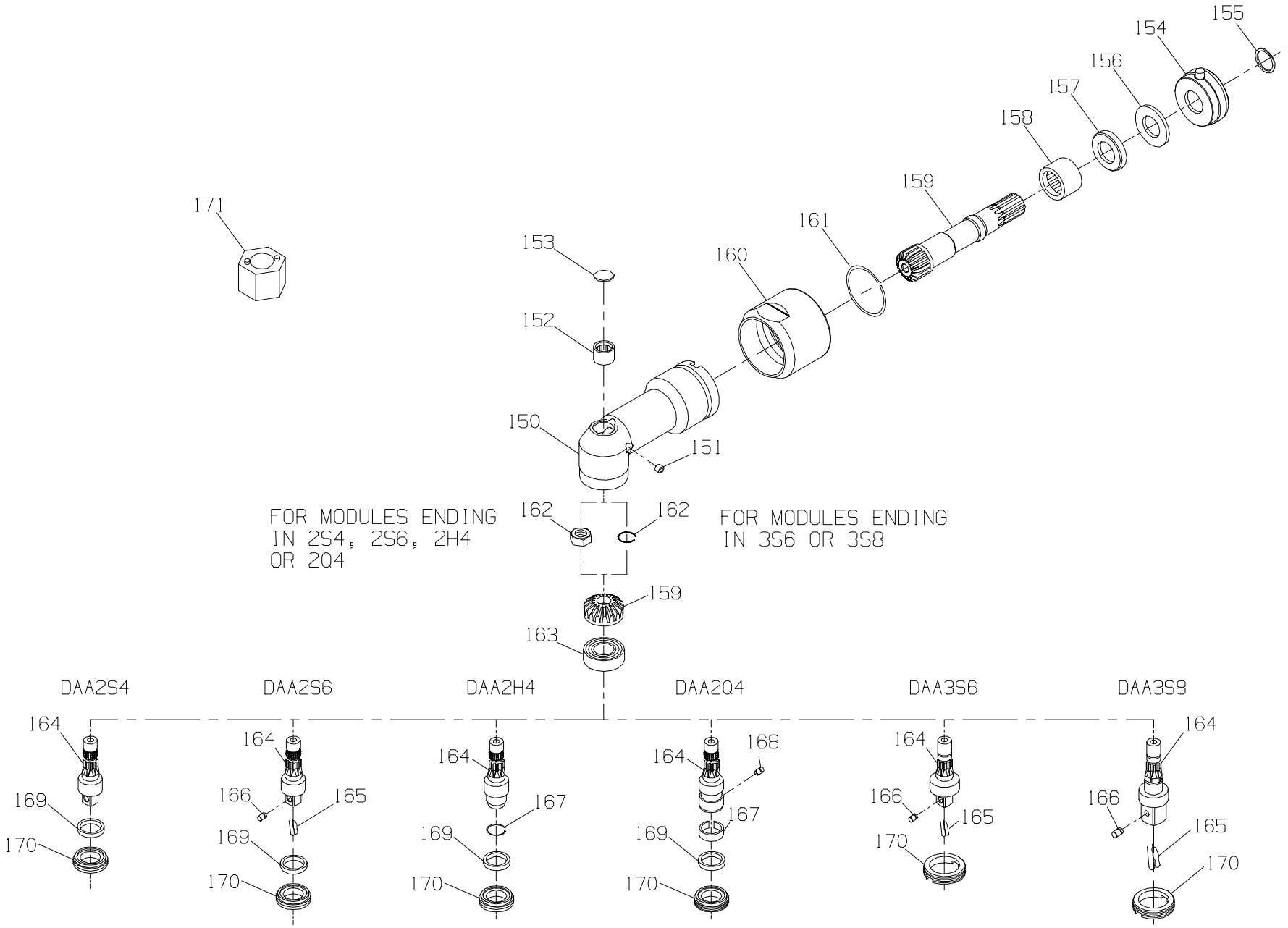
			PART NUMBER FOR ORDERING					
	• +	Gear Case Module	DAA9–M37	DAA14–M37	DAA25–M37	DAA35–M37	DAA40–M37	DAP40–M37
	100	Gear Case Assembly	DAA40–B37	DAA40–B37	DAA40–B37	DAA40–B37	DAA40–B37	DAA40–B37
	101	Grease Fitting	D0F9–879	D0F9–879	D0F9–879	D0F9–879	D0F9–879	D0F9–879
	102	Gear Retainer	DAA40–81	DAA40–81	DAA40–81	DAA40–81	DAA40–81	DAA40–81
	• 103	Drive Coupling	DAA9–17	DAA14–17	------	------	------	------
	104	Rotor Pinion	------	------	DAA25–17	DAA35–17	4RLM–17	------
	• 105	Planet Gear Head	------	------	DAA25–216	DAA35–216	DAA40–216	DAP40–216
	106	Planet Gear (3)	------	------	4RLN–10	6WTN–10	4RLM–10	4RLL–10
	• 107	Planet Gear Bearing (3)	------	------	6WTM–500	7AH–500	6WTM–500	6WTM–500
	108	Planet Gear Spindle	DAA9–8	DAA14–8	DAA25–8	DAA9–8	DAA40–8	DAA9–8
	109	Spindle Planet Gear Assembly (4)	6WTP–A10	------	------	------	------	------
	110	Spindle Planet Gear Bearing	WFS182–654	------	------	------	------	------
	109	Spindle Planet Gear (4 for DAA25–M37, DAA35–M37 and DAP40–M37; 3 for all others)	------	4RLL–10	6WTM–10	6WTP–10	DAA40–10	6WTP–10
	110	Spindle Planet Gear Bearing (4 for DAA25–M37, DAA35–M37 and DAP40–M37; 3 for all others)	------	6WTM–500	6WTM–500	WFS182–654	DAA40–500	WFS182–654
♦	111	Grease Shield Support	DAA40–5	DAA40–5	DAA40–5	DAA40–5	DAA40–5	DAA40–5
♦	• 112	Shield Support O–ring	DAA40–606	DAA40–606	DAA40–606	DAA40–606	DAA40–606	DAA40–606
	• 113	Grease Shield	DAA40–701	DAA40–701	DAA40–701	DAA40–701	DAA40–701	DAA40–701
	• 114	Gear Case Bearing	R1602–510	R1602–510	R1602–510	R1602–510	R1602–510	R1602–510

♦ Indicates Tune–up Kit part.

• 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.

\+ To assure proper gear placement, refer to **Gear Identification Chart** on page 14.

ANGLE HEAD MODULES



(Dwg. TPB939)

		PART NUMBER FOR ORDERING					
•	Angle Housing Module	DAA2S4	DAA2S6	DAA2H4	DAA2Q4	DAA3S6	DAA3S8
150	Angle Housing Assembly	DAA2–B550	DAA2–B550	DAA2–B550	DAA2–B550	DAA3–B550	DAA3–B550
151	Grease Fitting	D0F9–879	D0F9–879	D0F9–879	D0F9–879	D0F9–879	D0F9–879
• 152	Upper Spindle Bearing	120A4–603	120A4–603	120A4–603	120A4–603	8SA32–603	8SA32–603
153	Angle Housing Cap	–––––	–––––	–––––	–––––	8SA32–110	8SA32–110
154	Housing Orientation Ring	DAA2–A682	DAA2–A682	DAA2–A682	DAA2–A682	DAA2–A682	DAA2–A682
155	Orientation Ring Retainer	182A53–689	182A53–689	182A53–689	182A53–689	182A53–689	182A53–689
• 156	Thrust Bearing	R1610–105	R1610–105	R1610–105	R1610–105	R1610–105	R1610–105
157	Thrust Washer	182A53–554	182A53–554	182A53–554	182A53–554	182A53–554	182A53–554
• 158	Bevel Pinion Bearing	R1410–593	R1410–593	R1410–593	R1410–593	182A53–606	182A53–606
• 159	Bevel Pinion and Bevel Gear (sold only as a matched set)	DAA2–A552	DAA2–A552	DAA2–A552	DAA2–A552	DAA3–A552	DAA3–A552
160	Coupling Nut	DAA2–27	DAA2–27	DAA2–27	DAA2–27	DAA2–27	DAA2–27
161	Coupling Nut Retainer	DAA2–29	DAA2–29	DAA2–29	DAA2–29	DAA2–29	DAA2–29
162	Bevel Gear Retainer	120A4–578	120A4–578	120A4–578	120A4–578	8SA32–578	8SA32–578
• 163	Lower Spindle Bearing	6L2D–59	6L2D–59	6L2D–59	6L2D–59	8SA32–593	8SA32–593
164	Spindle Assembly	DAA2–A607–1/4	6L2D–A607	DAA2–A786–4	DAA2–A586–4	8SA32–P507–3/8	DAA3–P507–1/2
165	Socket Retaining Spring	–––––	401–718	–––––	–––––	401–718	5UHD–718
166	Socket Retaining Pin	–––––	5020–716	–––––	–––––	5020–716	804–716
167	Bit Retaining Spring	–––––	–––––	5L2C4–425	102A60–241	–––––	–––––
168	Bit Retaining Ball	–––––	–––––	–––––	AV1–255	–––––	–––––
• 169	Spindle Seal	6L2D–720	6L2D–720	6L2D–720	6L2D–720	–––––	–––––
170	Spindle Bearing Cap	6L2D–531	6L2D–531	6L2D–531	6L2D–531	8SA32–531	8SA32–531
171	Spindle Bearing Cap Wrench	141A12–26	141A12–26	141A12–26	141A12–26	8SA32–26	8SA32–26

• 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.

GEAR IDENTIFICATION CHART

PART NUMBER	PART NAME	ILLUS. NO.	NUMBER OF TEETH EXTERNAL	INTERNAL
DAA9–17	Drive Coupling	103	12	7
DAA14–17	Drive Coupling	103	7	7
4RLM–17	Rotor Pinion	104	19	7
DAA35–17	Rotor Pinion	104	17	7
DAA25–17	Rotor Pinion	104	14	7
DAA25–216	Planet Gear Head	105	21	---
DAA35–216	Planet Gear Head	105	12 •	---
DAP40–216	Planet Gear Head	105	12 •	---
DAA40–216	Planet Gear Head	105	9	---
4RLL–10	Planet Gear	106 & 109	20 +	---
DAA40–10	Planet Gear	109	20 +	---
4RLM–10	Planet Gear	106	19	7
6WTP–10	Planet Gear	109	18	---
4RLN–10	Planet Gear	106	17	---
6WTN–10	Planet Gear	106	16	---
6WTM–10	Planet Gear	109	14	---

• Gear Head DAP40–216 can be distinguished from Gear Head DAA35–216 by the additional three holes in the face of the Gear Head.

+ Gear DAA40–10 can be distinguished from Gear 4RLL–10 by the annular groove across the center of the gear teeth.

MAINTENANCE SECTION

⚠ 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. Failure to do so could result in injury.

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

LUBRICATION

Ingersoll-Rand No. 10 Ingersoll-Rand No. 67

Whenever the Series DAA 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 grease into the gear trains. Grease the Planet Gear Bearings (107 and 110), the gear teeth inside the Gear Case (100) and the planet gear shafts on the Planet Gear Head (105) and Spindle Planet Gear Head (108).
3. Apply 4 cc to 8 cc of grease to the Bevel Pinion and Bevel Gear (159) used in the DAA2 Angle Attachments and 6 cc to 10 cc of grease to the Bevel Pinion and Bevel Gear used in the DAA3 Angle Attachments.
4. The use of an air line lubricator is recommended. For permanent installations, we recommend using an Ingersoll-Rand C11-03-G00 Filter-Lubricator-Regulator Unit.

DISASSEMBLY

General Instructions

1. Do not disassemble the tool any further than necessary to replace or repair damaged parts.
2. 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.
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.
4. 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.

Disassembly of the Angle Attachment

1. Carefully grasp the hex of the Gear Case Assembly (100) in copper-covered vise jaws so that the Angle Housing Assembly (150) is facing downward.
2. Using a wrench on the flats of the Coupling Nut (160), loosen the Coupling Nut from the Gear Case.

NOTICE

This is a left-hand thread.
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 (164) facing upward.
4. Using the Spindle Bearing Cap Wrench (171), unscrew and remove the Spindle Bearing Cap (170).

NOTICE

This is a left-hand thread.
For models ending in 2S4, 2S6, 2H4 or 2Q4, if the Spindle Seal (169) is damaged, remove it. Withdraw the Spindle from the Angle Housing.

5. Inspect the Lower Spindle Bearing (163) 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 (162).
   b. Press the Bevel Gear (159) 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 (162) and lift the Bevel Gear (159) off the Spindle.
   c. Press the Lower Spindle Bearing from the Spindle.
6. If the Upper Spindle Bearing (152) appears rough or loose, press it from the Angle Head.

NOTICE

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 (153) when the Upper Spindle Bearing is installed.

7. Remove the Orientation Ring Retainer (155) and slide the Housing Orientation Ring (154), Thrust Bearing (156) and Thrust Washer (157) from the pinion shaft.

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 (159) and Bevel Pinion Bearing (158) from the Angle Attachment.

NOTICE

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.

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 (100) in copper-covered vise jaws with the assembled motor upward, and using a wrench on the flats of the Clutch Housing (73), loosen the joint and remove the tool from the vise. Unscrew the Gear Case from the Clutch Housing.
2. Using snap ring pliers, remove the Gear Retainer (102) from the clutch end of the Gear Case.
3. **For DAA9, DAA9-EU, DAA14, DAA15 and DAA15-EU models,** remove the Drive Coupling (103).
   For DAA25, DAA25-EU, DAA35, DAA35-EU, DAA40, DAA40-EU, DAA60 and DAA60-EU models, remove the Rotor Pinion (104), Planet Gear Head (105), Planet Gears (106) and Planet Gear Bearings (107).
4. Slide the Spindle Planet Gears (109) and Spindle Planet Gear Bearings (110) off the shafts of the Planet Gear Spindle (108).
5. With the clutch 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 (114). Remove the Bearing and Grease Shield (113) from the Gear Case and the Grease Shield Support (111) and Shield Support O-ring (112) from the hub of the Planet Gear Spindle.

Disassembly of the Clutch

1. Carefully grasp the assembled tool at the Housing Sleeve Assembly (49) with the clutch end upward, and using a wrench on the flats of the Clutch Housing (73), unscrew and remove the Clutch Housing.
2. Grasp the Clutch Spindle (70) and pull the assembled clutch off the Rotor (40).
3. Remove the Shutoff Spool (63) and Valve Return Spring (64) from either the shaft of the Rotor or the inside of the Clutch Shaft (56).
4. Insert the jaws of snap ring pliers into the holes of the Clutch Adjusting Nut Stop (57) and expand the Stop only enough to release the pressure against the Clutch Shaft. While keeping the pressure relieved, unscrew the assembled clutch from the Stop as you would unscrew a nut from a bolt. Expanding the Stop sufficiently to clear the Shaft in a normal manner will distort the snap ring beyond acceptable limits.
5. Insert the tip of a #1 Phillips head screwdriver into the notch in the motor end of the Clutch Adjusting Nut Lock (59) and one of the notches in the Clutch Adjusting Nut (58) and turn the screwdriver counter-clockwise (as you would to remove a screw) to back the Nut off the Clutch Shaft. Insert the screwdriver far enough to create a gap between the Nut Lock and Adjusting Nut.
6. Remove the Nut Lock, Clutch Spring (60), Cam Follower (61) and three Clutch Balls (62) from the Clutch Shaft.
7. Pull the Clutch Bearing (72) off the spindle end of the Clutch Shaft.
8. To remove the three Cam Pins (67), position one pin downward and sharply rap the motor end of the Clutch Shaft on a workbench mat or a piece of corrugated card board box. Repeat the process for each of the remaining two Pins.
9. Using a thin blade screwdriver, spiral the Spindle Retainer (71) out of the groove in the Clutch Shaft and pull the Clutch Spindle from the Shaft.
10. Pull the Cam Shaft (68), Cam Block (69) and Reset Spring (65) from the Clutch Shaft.
11. To remove the six Shutoff Balls (66), insert the shaft of the Shutoff Spool into the end of the Cam Shaft to prevent the Balls from becoming lodged in the central opening. Position one of the shutoff ball openings downward and sharply rap the Cam Shaft on a work bench mat or a piece of corrugated cardboard box. Two Shutoff Balls are installed in each hole. Repeat the process at the other two locations for the remaining four Balls.

Disassembly of the Motor

1. Move the Adjustable Grip (9) to the lowest position on the Handle (1).
2. Using a 2–1/2 mm hex wrench, unscrew and remove the four Handle Mounting Screws (25) with the Mounting Screw Lock Washers (26).
3. Pull the assembled motor away from the Handle.
4. Pull the Clutch Adjusting Hole Cover (52) and the Housing Sleeve Assembly off of the Motor Housing (33). Remove the Adjusting Hole Cover O–ring (53), the Front Motor Housing Seal (48) and Rear Motor Housing Seal (35) from the Motor Housing Assembly.
5. Remove the Reverse Valve (27), two Reverse Valve Seals (28) and the Shutoff Valve Assembly (30) from the Motor Housing Assembly (33).
6. Lightly rap the handle end of the Motor Housing on a padded surface to dislodge the assembled motor from the Housing.
7. Remove the Motor Clamp Washer (47) from the Housing or front of the assembled motor.
8. Grasping the Front End Plate (44) in one hand, tap the hex shaft end of the Rotor (40) with a plastic hammer to remove the Front Rotor Bearing (46), Front End Plate and Rotor Spacer (45) from the Rotor.
9. Slide the Cylinder Assembly (42) off the Rotor and remove the seven Vanes (41).
10. Remove the Rear Rotor Bearing Housing (36) and two Rotor Bearing Springs (37) from the handle end of the Rotor.
11. Press the Rear Rotor Bearing (38) along with the Rear End Plate (39) from the shaft of the Rotor.

Disassembly of the Handle

1. Remove the Reverse Valve Washer (29) from the hub of the Throttle Body (19).
2. Insert a 5/16" hex wrench into the end of the Throttle Body and unscrew it from the Handle (1).
3. Remove the two Throttle Body Seals (20), Throttle Valve Seat (18), Throttle Valve (17) and Throttle Valve Spring (15).
4. Using a 1/4" hex wrench or an adjustable wrench, unscrew and remove either the Inlet Plug (23) or Inlet Bushing (3) and Seal (24 or 5) from the side of the Handle.
5. Depress the Throttle Lever (11) and slide the Collar Assembly (21) rearward until it clears the Lever.
6. Remove the Throttle Lever from the Handle.
7. Using a screwdriver, unscrew and remove the Valve Plunger Bushing (14) and Bushing Seal (14A) along with the Throttle Valve Plunger (12) and Valve Plunger Seal (13).
8. Pull the Throttle Valve Guide (16) from the motor end of the Handle.
9. Using an adjustable wrench or a 1/4" hex wrench, unscrew and remove either the Inlet Bushing or Inlet Plug and Seal from the end of the Handle.
10. Pull the Exhaust Deflector (6), Muffler Body (7) and two Muffler Elements (8) off the end of the Handle.
11. Raise the Adjustable Grip Latch (10) to the highest position, spread the open end slightly and slide the Latch off the rear of the Handle.
12. Slide the Adjustable Grip (9) and Collar Assembly off the rear of the Handle.

ASSEMBLY

General Instructions

1. Unless otherwise noted, always press on the stamped end of a needle bearing when installing the needle bearing in a recess.
2. Always press on the **inner ring** of a ball–type bearing when installing the bearing on a shaft.
3. Always press on the **outer ring** of a ball–type bearing when installing the bearing in a bearing recess.
4. 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.
5. Except for bearings, always clean every part and wipe every part with a thin film of oil before installation.
6. Apply O–ring lubricant to each O–ring before assembly.
7. Check every bearing for roughness. If an open bearing must be cleaned, wash it thoroughly in clean solvent and dry with a clean cloth. Sealed or shielded bearings should never be cleaned. Work grease thoroughly into every open bearing before installation.

Assembly of the Handle

1. Slide the Collar Assembly (21) onto the Handle (1).
2. Install the Muffler Body (7), large opening trailing, onto the inlet end of the Handle.
3. Position the two Muffler Elements (8) into the Muffler Body and then capture them by installing the Exhaust Deflector (6) against the Muffler Body.
4. **If the tool is to be used with the air supply entering the end of the Handle,** install the Inlet Bushing Seal (5) over the threads of the Inlet Bushing (3) and install it in the end of the Handle. Tighten the Bushing between 20 and 30 ft–lb (27 and 40 Nm) torque.
   If the tool is to be used with the air supply entering the side of the Handle, install the Inlet Plug Seal (24) over the threads of the Inlet Plug (23) and install it in the end of the Handle. Tighten the Plug between 30 and 40 in–lb (3.4 and 4.5 Nm) torque.

5. Push the Throttle Valve Guide (16), open end leading, into the recess at the motor end of the Handle. Rotate the Guide until the hole in the side of the Guide aligns with the opening for the Throttle Valve Plunger (12).
6. With the Valve Plunger Seal (13) installed in the annular groove in the Throttle Valve Plunger, slide the Plunger, large end trailing, into the non-slotted end of the Valve Plunger Bushing (14).
7. Install the Bushing Seal (14A) over the threads of the Bushing against the large head.
8. Apply Perma-Lok LH050* Pipe Sealant to the first two threads of the slotted end of the Bushing.
9. Using a screwdriver in the slot of the Bushing, thread the assembled Plunger and Bushing into the Handle until the trailing end of the Bushing is flush with the handle surface. Make certain the Plunger enters the hole in the Throttle Valve Guide. Make certain the Plunger is retracted against the Bushing before installing the Throttle Valve Spring (15).
10. Install the Throttle Valve Spring, large end leading, in the handle against the Throttle Valve Guide.
11. Install the Reverse Valve Washer (29) on the hub with the internal hex of the Throttle Body (19) and secure it by installing one of the Throttle Body Seals (20) in the annular groove ahead of it. Install the other Seal in the annular groove on the other side of the large hub.
12. Position the Throttle Valve Seat (18) and Throttle Valve (17) in the central opening of the Throttle Body opposite the internal hex and carefully slide the assembly into the motor end of the Handle.
13. Using a 5/16" hex wrench, tighten the Throttle Body between 30 and 40 in-lb (3.4 and 4.5 Nm) torque.
14. With the Collar Assembly toward the muffler end of the Handle, position the Throttle Lever (11) in the Handle with the rounded projection at one end of the Lever entering the corresponding rounded notch in the Handle. Depress the Lever and slide the Collar Assembly forward toward the motor end of the Handle to capture and retain the Lever.
15. **If the tool is to be used with the air supply entering the side of the Handle,** install the Inlet Bushing Seal over the threads of the Inlet Bushing and install it through the Collar and into the side of the Handle. Tighten the Bushing between 20 and 30 ft-lb (27 and 40 Nm) torque.
    If the tool is to be used with the air supply entering the end of the Handle, install the Inlet Plug Seal over the threads of the Inlet Plug and install it through the Collar and into the side of the Handle. Tighten the Plug between 30 and 40 in-lb (3.4 and 4.5 Nm) torque.

Assembly of the Motor

1. Place the Rear End Plate (39), face with the kidney shaped slots leading, onto the unsplined hub of the Rotor (40). Position the Rear Rotor Bearing (38) on the same hub and press the Bearing onto the shaft against the Rear End Plate.
2. Install the Cylinder (42) over the Rotor so that the Cylinder Dowel (43) enters the hole in the Rear End Plate.
3. Apply a thin film of oil to each Vane (41) and insert a Vane into each of the rotor vane slots.
4. Place the Rotor Spacer (45) on the splined hub of the Rotor and install the Front End Plate (44) over the Spacer, counterbored end trailing, against the rotor face.
5. Press the flush ground Front Rotor Bearing (46), identifying marks toward the hex end of the Rotor, onto the hub and into the Front End Plate.

NOTICE

The Clutch Assembly must be assembled with the motor before attaching them to the Handle. If the Clutch is not assembled, set the motor aside and assemble the clutch as instructed in the section, ASSEMBLY OF THE CLUTCH.

Assembly of the Clutch

1. Install two Shutoff Balls (66) into each of the three holes located radially in the Cam Shaft (68) and then slide the assembly into the Cam Block (69). Fill the Cam Shaft with grease to retain the Balls.
2. Press the Clutch Bearing (72) onto the spindle end of the Clutch Shaft.
3. Install the Reset Spring (65), tapered end leading, onto the small hub of the Cam Shaft and insert the assembled parts, Spring first, into the central opening at the non-threaded end of the Clutch Shaft (56).
4. Apply pressure to the assembly to keep it in the Shaft and install the three Cam Pins (67) into the radial holes in the Clutch Shaft and into the slots of the Cam Shaft to capture the assembly.
5. Position the Clutch Spindle (70) in the bearing end of the Clutch Shaft and secure it by using a thin blade screwdriver to spiral the Spindle Retainer (71) into the groove inside the Clutch Shaft.
6. Apply grease to the three Clutch Balls (62) and install them in the holes in the Clutch Shaft near the large flange. Slide the Cam Follower (61), large end first, onto the threaded end of the Clutch Shaft and pull it forward to capture the Balls between the flange and the Follower.

7. Slide the Clutch Spring (60) and the Clutch Adjusting Nut Lock (59), notched face trailing, onto the threaded end of the Clutch Shaft.
8. Secure the components by threading the Clutch Adjusting Nut (58), notched face leading, onto the Clutch Shaft. Insert a #1 Phillips head screwdriver into the notch of the Nut Lock and one of the notches in the Nut. Insert the screwdriver far enough to create a gap between the Nut Lock and Adjusting Nut. Turn the screwdriver clockwise as you would to tighten a screw to move the Nut along the Shaft until it clears the groove for the Clutch Adjusting Nut Stop (57).
9. Insert the jaws of snap ring pliers into the holes of the Clutch Adjusting Nut Stop and expand the Stop only enough to release any pressure against the Clutch Shaft. While keeping the pressure relieved, screw the assembled clutch onto the Stop, as you would screw a nut onto a bolt, until the Stop enters the groove. Expanding the Stop sufficiently to clear the Shaft in a normal manner will distort the snap ring beyond acceptable limits.
10. Install the Rear Motor Housing Seal (35), Front Motor Housing Seal (48) and Hole Cover O-ring (53) in the grooves in the Motor Housing (33).
11. Slide the Housing Sleeve Assembly (49), large end first, onto the Motor Housing. Slide the the Clutch Adjusting Hole Cover (52) onto the Motor Housing against the Sleeve Assembly.
12. Insert the assembled clutch, Spindle first, into the Clutch Housing (73).
13. Thread the assembled clutch and Housing onto the Motor Housing and tighten the joint between 20 and 25 ft-lb (27 and 35 Nm) torque.

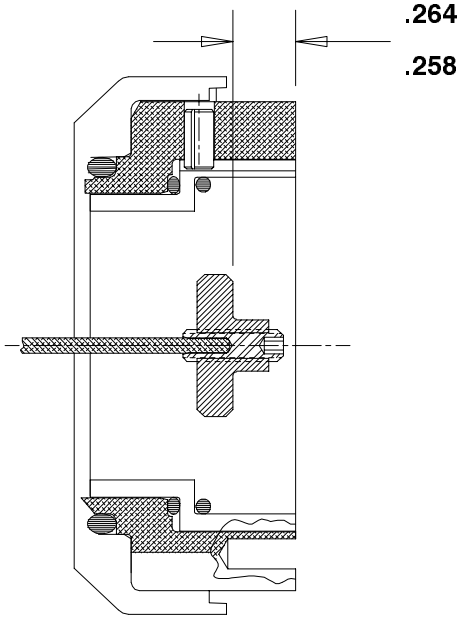
Assembling the Motor to the Handle

1. Drop the Motor Clamp Washer (47), concave side first, into the motor bore of the Motor Housing (33).
2. Apply some grease to the Shutoff Spool (63) and Valve Return Spring (64). Install the Spring on the long stem of the Spool and insert the short stem of the assembly into the hole in the splined end of the Rotor (40).
3. Hold the Motor Housing horizontally and slide the assembled motor into the Housing. Make certain the rotor spline engages the internal spline of the Clutch Shaft (56).
4. Install the two Rotor Bearing Springs (37) in the recess of the Rear Rotor Bearing Housing (36) and place both in position against the Bearing. Make sure that the Cylinder Dowel (43) enters the dowel hole in the Bearing Housing.
5. Install the Motor Clamp Seal (32) on the small hub of the Motor Clamp Spacer (31).
6. Position the Spacer in the Housing, small hub leading, so that the slots of the Spacer engage the flat on the Bearing Housing. While pushing the Spacer toward the motor, rotate the assembly until the alignment notch in the Spacer aligns with the pin in the Housing and the entire assembly moves forward.

NOTICE

It may be necessary to insert a wooden or metal block into the exposed notches of the Motor Clamp Spacer to rotate the assembly, if the assembled motor is a tight fit in the Motor Housing.

7. The distance between the large end of the Motor Housing and the top surface of the large flange of the Shutoff Valve Assembly is critical for efficient operation. The gap must be between .258" and .264" (6.55 mm and 6.70 mm) wide. (See Dwg. TPD1251). To determine if the gap is correct, insert the Shutoff Valve Assembly (30), shaft first, into the central opening of the motor assembly and measure the distance with a depth micrometer.



(Dwg. TPD1251)

If the gap is incorrect, proceed as follows:

a. Remove the Valve Assembly from the motor.
b. Place a wrench on the square of the valve.
c. Insert a hex wrench into the end of the shaft and turn it clockwise to shorten the gap or counterclockwise to increase the gap.
d. Install the Valve Assembly and again, measure the gap. Repeat the process until the distance is correct.

8. When the gap is correct, remove the Valve Assembly from the motor.
9. Install a Reverse Valve Seal (28) into the groove on the rear end of the Reverse Valve (27).

10. Insert the shaft of the Shutoff Valve Assembly through the central opening of the Reverse Valve from the large open end.
11. Insert the Reverse Valve, large open end leading, with the Shutoff Valve Assembly into the Handle. The Seal will hold the parts in position against the Handle.
12. Install the remaining Reverse Valve Seal in the large opening of the Motor Clamp Spacer.
13. Insert the shaft of the Shutoff Valve Assembly into the central hole through the motor and position the assembled handle against the assembled motor.
14. Install the four Handle Mounting Screws (25) and Lock Washers (26) and tighten the Screws between 12 and 18 in-lb (1.4 and 2.0 Nm) torque.
15. Slide the Adjustable Grip (9) onto the Handle.
16. Spread the open end of the Adjustable Grip Latch (10) slightly and install it on the Handle to capture the Grip.

Assembly of the Gear Case

1. Install the Grease Shield Support (111), small edge trailing, onto the hub of the Gear Head Spindle (108). Use O-ring lubricant to hold it in place, install the Shield Support O-ring (112) on the Support.
2. Support the pin end of the Spindle on a steel rod long enough to keep the Gear Case (100) from contacting the table of an arbor press. Position the Gear Case, external thread upward, on the Spindle. Install the Grease Shield (113) in the Gear Case and press the Gear Case Bearing (114) onto the shaft of the Planet Gear Spindle. Press the Bearing until it enters the Gear Case and bottoms against the Shield Support.
3. Install a Spindle Planet Gear (109) and Spindle Planet Gear Bearing (110) on each shaft of the Spindle.
4. Work 3 to 4 cc of Ingersoll-Rand No. 67 Grease into the gear train.
5. **For DAA9, DAA9-EU, DAA14, DAA15 and DAA15-EU models,** install the Drive Coupling (103), gear teeth first, into the Gear Case. Make certain the gear teeth mesh with the teeth of the Planet Gears.
   For DAA25, DAA25-EU, DAA35, DAA35-EU, DAA40, DAA40-EU, DAA60 and DAA60-EU models, install the Planet Gear Head (105) into the Gear Case.
6. **For DAA25, DAA25-EU, DAA35, DAA35-EU, DAA40, DAA40-EU, DAA60 and DAA60-EU models,** install a Planet Gear (106) and Planet Gear Bearing (107) 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.
7. **For DAA25, DAA25-EU, DAA35, DAA35-EU, DAA40 and DAA40-EU models,** install the Rotor Pinion (104) between the Planet Gears.
8. Using snap ring pliers, install the Gear Retainer (102) in the internal groove of the Gear Case.
9. Thread the Gear Case onto the Clutch Housing (73) and engage the teeth of the Clutch Spindle (70) 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 Gear Case onto the Clutch 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 (159) as instructed on Page 15 under **LUBRICATION** and insert it, gear end first, into the long bore of the Angle Housing (150).

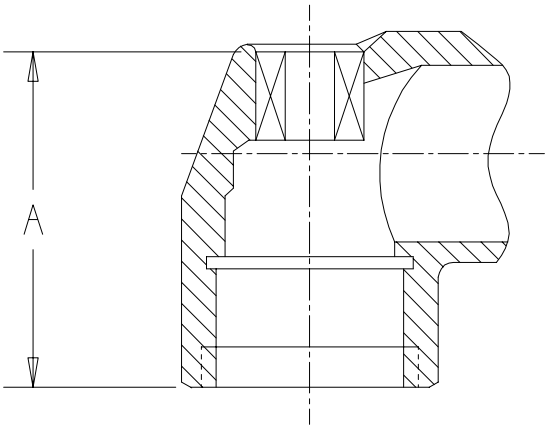
NOTICE

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.

2. Lubricate the Bevel Pinion Bearing (158) as instructed on Page 15 under **LUBRICATION** and insert it, 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 (157), Thrust Bearing (156) and Housing Orientation Ring (154) over the splined end of the Bevel Pinion and retain the components by installing the Orientation Ring Retainer (155) on the pinion shaft.

5. If the Lower Spindle Bearing (163) has been removed, roceed 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 (164). For DAA3 Angle Attachments, using a sleeve that will contact the inner ring of the Bearing, press the Bearing onto the Spindle (164). 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 (159) onto the Spindle.
   For DAA3 Angle Attachments, align the internal flats of the Bevel Gear (159) with the flats on the Spindle and press the Bevel Gear onto the Spindle.
   c. **For DAA2 Angle Attachment,** apply a drop of Perma–bond Surface Conditioner II * to the threads of the Bevel Gear Retainer (162) 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 (162) 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.
6. If the Upper Spindle Bearing (152) 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 Dwg TPD680.



(Dwg. TPD680)

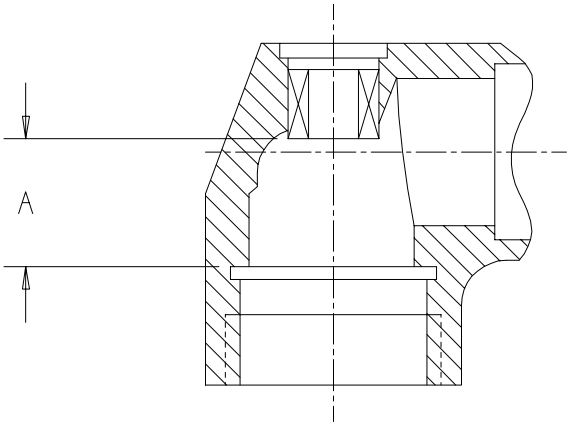
Minimum Dimension "A"		Maximum Dimension "A"	
in	mm	in	mm
1.21	30.75	1.27	31.25

   For DAA3 Angle Attachments, press a new Spindle Bearing into the Angle Head from the large threaded end to the dimension shown in Dwg. TPD635.

NOTICE

Press on the stamped face of the Bearing. Failure to doso will cause damage to the Bearing.

Install a new Angle Housing Cap (153) into the top of the Angle Head.



(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 (170) and apply a film of Perma–Lok MM–115* to the threads.
9. **For DAA2 Angle Attachments,** install Spindle Seal (169). Using the Spindle Bearing Cap Wrench (171), 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 (171), 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 (160) was removed, slide the Coupling Nut, threaded end trailing, over the motor end of the Angle Housing. Apply the Coupling Nut Retainer (161) 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 (108) and thread the Coupling Nut onto the Gear Case (100). Orient the angle attachment to the desired position and tighten the Coupling Nut between 25 and 30 ft–lb (27 and 40 Nm) torque.

TROUBLESHOOTING GUIDE

Trouble	Probable Cause	Solution
Low power or low free speed	Low air pressure at the inlet	Check air supply. for top performance, the air pressure must be 90 psig (6.2 bar/620 kPa at the inlet.
	Plugged Inlet Bushing Screen	Clean the Inlet Bushing Screen in a clean, suitable, cleaning solution. If the Screen cannot be cleaned, replaced it.
	Clogged Muffler	Clean the Muffler Elements in a clean, suitable, cleaning solution If they cannot be cleaned, replace them.
	Worn or broken Vanes	Install a **complete** set of Vanes.
	Worn or broken Cylinder	Replace the Cylinder if it is cracked or if the bore appears wavy or scored.
	Improper lubrication or dirt buildup	Clean the Motor Unit parts and lubricate them as instructed on Page 25.
	Incorrect gap in Shutoff Valve Assembly	Adjust the gap as explained in the section **ASSEMBLING THE MOTOR TO THE HANDLE.**
Leaky Throttle Valve	Worn Throttle Valve and/or Throttle Valve Seat	Install a new Throttle Valve and/or Throttle Valve Seat.
	Dirt accumulation on Throttle Valve and/or Throttle Valve Seat	Pour about 3 cc of a clean, suitable, cleaning solution into the air inlet and operate the tool for about 30 seconds. **Immediately,**pour 3 cc of light oil in the the tool for 30 seconds to lubricate all the parts.
Tool fails to shut off	Dirty Shutoff Valve Assembly	Clean any dirt from the Shutoff Valve.
	Bent stem on Shutoff Valve	Straighten the stem of the Valve or replace the Valve.
	Valve out of adjustment	Adjust the Valve to get the required gap specified on Page 29.
Gear Case gets hot	Excessive grease	Clean and inspect the Gear Case and gearing parts. Lubricate as instructed on Page 25.
	Worn or damaged parts	Clean and inspect the Gear Case and gearing. Replace worn or broken components.
Angle Head gets hot	Excessive grease	Clean and inspect the Angle Head and gearing parts. Lubricate as instructed on Page 25.
	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.