ARO
Tool Products

OPERATOR'S MANUAL

INCLUDING: OPERATION, INSTALLATION & MAINTENANCE

0/2200 SERIES REVERSIBLE POWER MOTORS

SECTION M40
MANUAL 37
Released: 5–1–84
Revised: 12–22–95
Form: 2645–2

Models: 8228–( )B and 8231–( )B.

⚠ WARNING

READ THIS MANUAL CAREFULLY BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT.

FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

Pneumatic tools should always be installed and used in accordance with A.N.S.I. B186.1 "Safety Code For Portable Air Tools."

⚠WARNING

- Operate this tool at 90 p.s.i.g. (6.2 bar) maximum air pressure at the air inlet of the tool.
- Disconnect air supply from tool before performing maintenance procedures.
- Keep hands, clothing and long hair away from rotating end of tool.
- Anticipate and be alert for sudden changes in motion during start up and operation of any power tool.
- Never exceed rated r.p.m. of tool.
- Wear suitable eye and hearing protection while operating 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.
- Use only accessories recommended by ARO.

NOTICE

- The use of other than genuine ARO replacement parts may result in safety hazards, decreased tool performance and increased maintenance and may invalidate all warranties.
- ARO is not responsible for customer modification of tools for applications on which ARO was not consulted.
- Tool maintenance and repair should be performed by authorized, trained, competent personnel. Consult your nearest ARO authorized servicenter.
- It is the responsibility of the employer to place the information in this manual into the hands of the operator.

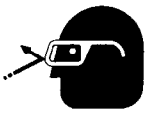
For parts and service information, contact your local ARO distributor, or the Customer Service Dept. of the Ingersoll–Rand Distribution Center, White House, TN at PH: (615) 672–0321, FAX: (615) 672–0801.

ARO Tool Products
Ingersoll–Rand Company
1725 U.S. No. 1 North • P.O. Box 8000 • Southern Pines, NC 28388–8000

ARO®
Part of worldwide Ingersoll-Rand

FAILURE TO OBSERVE THE FOLLOWING WARNINGS COULD RESULT IN INJURY.

⚠ WARNING

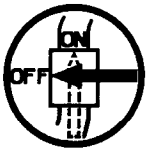


Wear eye protection when operating or performing maintenance on this tool.

⚠ WARNING

Wear hearing protection when operating this tool.

⚠ WARNING



Turn off air supply and disconnect air supply hose before installing, removing or adjusting any accessory on this tool, or before performing any maintenance on this tool.

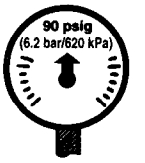
⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING



Operate at 90 p.s.i.g. (6.2 bar/620 kPa) maximum air pressure.

WARNING = Hazards or unsafe practices which could result in severe personal injury, death or substantial property damage.

CAUTION = Hazards or unsafe practices which could result in minor personal injury or product or property damage.

NOTICE = Important installation, operation or maintenance information.

ROUTINE LUBRICATION REQUIREMENTS

Lack of or an excessive amount of lubrication will affect the performance and life of this tool. Use only recommended lubricants at below time intervals:

EVERY 8 HOURS OF TOOL OPERATION – Fill lubricator reservoir of recommended F.R.L. with spindle oil (29665). If an in line or air line lubricator is not used, apply several drops of spindle oil (29665) in air inlet.

EVERY 160 HOURS OF TOOL OPERATION – Flush tool with a solution of three (3) parts cleaning solvent to one (1) part spindle oil (or use kerosene).

EVERY 160 HOURS OF TOOL OPERATION – Lubricate gearing. Pack bearings, coat shafts and lubricate gears with NLGI #1 "EP" grease (33153).

AIR SUPPLY REQUIREMENTS

For maximum operating efficiency, the following air supply specifications should be maintained to this air tool:

- AIR PRESSURE – 90 p.s.i.g. (6.2 bar)
- AIR FILTRATION – 50 micron
- LUBRICATED AIR SUPPLY
- HOSE SIZE – 5/16" (8 mm) I.D.

An ARO® model C28231–810 air line FILTER/REGULATOR/LUBRICATOR (F.R.L.) is recommended to maintain the above air supply specifications.

RECOMMENDED LUBRICANTS

After disassembly is complete, all parts, except sealed or shielded bearings, should be washed with solvent. To relubricate parts, or for routine lubrication, use the following recommended lubricants:

Where Used	ARO Part #	Description
Air Motor	29665	1 qt Spindle Oil
"O" Rings & Lip Seals	36460	4 oz. Stringy Lubricant
Gears and Bearings	33153	5 lb. "EP" – NLGI #1 Grease

INSPECTION, MAINTENANCE AND INSTALLATION

Disconnect air supply from the tool or shut off air supply and exhaust (drain) line of compressed air before performing maintenance or service to the tool.

It is important that the tools be serviced and inspected at regular intervals for maintaining safe, trouble–free operation of the tool.

Be sure the tool is receiving adequate lubrication, as failure to lubricate can create hazardous operating conditions resulting from excessive wear.

Be sure that the air supply lines and connectors are of proper size to provide a sufficient quantity of air to the tool.

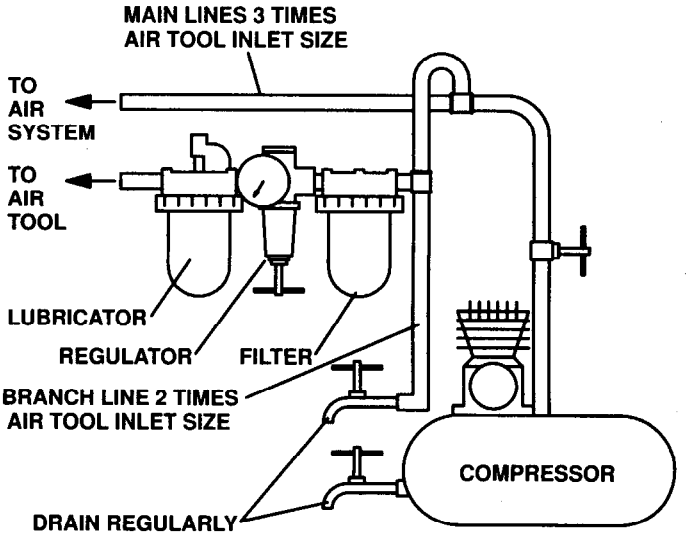
Tool maintenance and repair shall be performed by authorized, trained, competent personnel. Tools, hose and fittings shall be replaced if unsuitable for safe operation and responsibility should be assigned to be sure that all tools requiring guards or other safety devices shall be kept in legible condition. Maintenance and repair records should be maintained on all tools. Frequency of repair and the nature of the repairs can reveal unsafe application. Scheduled maintenance by competent authorized personnel should detect any mistreatment or abuse of the tool and worn parts. Corrective action should be taken before returning the tool for use.

Disassembly should be done on a clean work bench with a clean cloth spread to prevent the loss of small parts. After disassembly is completed, all parts should be thoroughly washed in a clean solvent, blown dry with air and inspected for wear levels, abuse and contamination. Double sealed or shielded bearings should never be placed in solvent unless a good method of re–lubricating the bearing is available. Open bearings may be washed but should not be allowed to spin while being blown dry.

Upon reassembling, lubricate parts where required. Use 33153 grease, or equivalent, in bearings. Use 36460 lubricant for "O" ring assembly. When assembling "O" rings or parts adjacent "O" rings, care must be exercised to prevent damage to the rubber sealing surfaces. A small amount of grease will usually hold steel balls and other small parts in place while assembling.

When replacement parts are necessary, consult drawing containing the part for identification.

Always use clean, dry air. Dust, corrosive fumes and/or excessive moisture can damage the motor of an air tool. An air line filter can greatly increase the life of an air tool. The filter removes rust, scale, moisture and other debris from the air lines. Low air pressure (less than 90 p.s.i.g.) reduces the speed of the air tool. High air pressure (more than 90 p.s.i.g.) raises performance beyond the rated capacity of the tool and could cause injury. Shown below is a typical piping arrangement.



MODEL IDENTIFICATION

MODEL NUMBER	TOTAL RED.	RATED R.P.M.	ROTOR (ITEM 13)	MOTOR ASSEMBLY	ADAPTER GEARING	GEARING AUX.	GEARING DRIVE
8228–1B	3.4:1	5300	46550	46883	42499		40832
8228–2B	5.56:1	3200	46550	46883	42500		40832
8228–3B	6.86:1	2600	46216	46217	42501		40832
8228–4B	13.6:1	1300	46550	46883	42499		40830
8228–5B	22.2:1	800	46550	46883	42500		40830
8228–6B	27.4:1	650	46216	46217	42501		40830
8228–7B	41.3:1	425	46550	46883	42500		40831
8228–8B	50.9:1	350	46216	46217	42501		40831
8228–9B	88.9:1	200	46550	46883	42500	40833	40830
8228–10B	109.7:1	160	46216	46217	42501	40833	40830
8228–11B	165.1:1	100	46550	46883	42500	40834	40830
8228–12B	203.8:1	85	46216	46217	42501	40834	40830
8228–13B	306.7:1	50	46550	46883	42500	40834	40831
8228–14B	378.5:1	40	46216	46217	42501	40834	40831
8231–1B	1:1	18,000	46550	46883			43637
8231–2B	3.4:1	5300	46550	46883			34076
8231–3B	5.56:1	3200	46550	46883			33361
8231–4B	6.86:1	2600	46216	46217			39851
8231–5B	11.6:1	1500	46550	46883		33853	34076
8231–6B	18.9:1	950	46550	46883		33837	34076
8231–7B	23.4:1	750	46216	46217		39852	34076
8231–8B	30.9:1	575	46550	46883		33837	33361
8231–9B	38.1:1	475	46216	46217		39852	33361

☐ SHADED MODELS ARE CANCELLED

		PART NUMBER FOR ORDERING			PART NUMBER FOR ORDERING
1	Head	43632	30	Adapter	32326
2	Pipe Plug (2 req'd)	Y227–2	31	Gearing Assembly (3.4:1 ratio)	33853
3	Muffler	43551–3	32	Shaft (2 req'd)	33436
4	Manifold (includes item 5)	43556	33	Gear (2 req'd)(16 teeth)	33440
5	Set Screw	Y23–102	34	Spindle	33425
6	"O" Ring (2 req'd)	Y325–127	35	Spacer	32312
7	Motor Housing (bolt–on, includes item 8)	42486	36	Gearing Assembly (5.56:1 ratio)	33837
8	Grease Fitting (not shown)	35967	37	Gear (2 req'd)(17 teeth)	33438
9	Cap Screw (4 req'd)	Y154–53	38	Spindle	39849
10	Motor Housing (thread–on, includes item 8)	43634	39	Spacer	39850
11	Ball Bearing	Y65–7	40	Gearing Assembly (6.86:1 ratio)	39852
12	Rear End Plate	31601	41	Ball Bearing	32325
13	Rotor	See chart	42	Shaft (2 req'd)	30765
14	Blade (4 req'd)	30741	43	Splined Driver	32833
15	Roll Pin	Y178–24	44	Spindle	37671
16	Cylinder (includes items 15 and 17)	37684	45	Key	Y62–2
17	Roll Pin	Y178–20	46	Spacer	32315
18	Front End Plate	31602	47	Ball Bearing	Y65–13
19	Ball Bearing	Y65–15	48	Washer	32544
	Motor Assembly (includes items 11 thru 19)	See chart	49	Ring Gear	32935
20	Spacer	32310	50	Gearing Assembly (direct drive)	43637
21	Spacer	32305	51	Thread Guard	32070
22	Ball Bearing	32325	52	Gearing Assembly (3.4:1 ratio)	34076
23	Spacer	37676	53	Spindle	33963
24	Shaft (2 req'd)(includes 15 needle bearings per shaft)	33686	54	Spacer	32313
25	Gear (2 req'd)(12 teeth)	30899	55	Gearing Assembly (5.56:1 ratio)	33361
26	Spindle	37667	56	Spindle	39848
27	Drive Gear (9 interior – 17 exterior teeth)	30901	57	Spacer	32311
28	Spacer	32314	58	Gearing Assembly (6.86:1 ratio)	39851
29	Retaining Ring	Y147–7	59	Spindle	42496
			60	Spacer	33691
			61	Ring Gear	40499

		PART NUMBER FOR ORDERING			PART NUMBER FOR ORDERING
62	Gearing Assembly (3.4:1 ratio)	42499	82	Gearing Assembly (4:1 ratio)	40833
63	Spindle	42497	83	Cap Screw (4 req'd)	Y154–52–C
64	Spacer	33693	84	Lock Washer (4 req'd)	Y14–10
65	Gearing Assembly (5.56:1 ratio)	42500	85	Gear (2 req'd)(18 teeth)	46416
66	Spindle	42498	86	Spindle	40840
67	Gearing Assembly (6.86:1 ratio)	42501	87	Snap Ring	40843
68	Adapter (includes item 69)	42502	88	Gearing Assembly (7.43:1 ratio)	40834
69	Grease Fitting	35323	89	Spindle	40837
70	Cap Screw (4 req'd)	Y154–52–C	90	Key (2 req'd)	41277
71	Lock Washer (4 req'd)	Y14–10	91	Ball Bearing	33706
72	Ball Bearing	33704	92	Wave Washer	47589
73	Shaft (2 req'd)	40841	93	Washer	47590
74	Needle Bearing (2 req'd per shaft)	42271	94	Seal	37389
75	Gear (2 req'd)(14 teeth)	46417	95	Nose Housing	37878
76	Spindle	40839	96	Spacer	33697
77	Gear (7 interior – 17 exterior teeth)	34574	97	Gearing Assembly (4:1 ratio)	40830
78	Snap Ring	40842	98	Spindle	40838
79	Retaining Ring	33708	99	Gearing Assembly (7.43:1 ratio)	40831
80	Housing (includes item 81)	37968	100	Splined Driver	34488
81	Grease Fitting	35323	101	Gearing Assembly (direct drive)	40832

DISASSEMBLY/ASSEMBLY INSTRUCTIONS

NOTICE

- Never apply excessive pressure by a holding device which may cause distortion of a part.
- Apply pressure evenly to parts which have a press fit.
- Apply even pressure to the bearing race that will be press fitted to the mating part.
- Use correct tools and fixtures when servicing this tool.
- Don't damage "O" rings when servicing this tool.
- Use only genuine ARO replacement parts for this tool. When ordering, specify part number, description, tool model number and serial number.

DRIVE GEARING DISASSEMBLY

MODELS 8228–( )B

_ Remove keys (90) from spindle.
_ Remove screws (83) and washers (84), releasing drive gearing from tool.
_ Grasp nose housing (95) in one hand and tap drive end of spindle with a soft face hammer; spindle and components will loosen from nose housing.
_ Gearing should not be disassembled further unless damage is evident, as Brinelling of the bearing races may occur, making replacement necessary.
_ To disassemble further, remove bearing (91).
_ Rotate snap ring (78 or 87) so the open portion will allow the removal of one shaft (73).
_ Remove shaft (73), releasing gear.
_ Repeat for removal of opposite shaft and gear.
_ To remove bearing (72), remove snap ring (78 or 87), insert shafts into spindle and alternately tap ends, loosening bearing.

MODELS 8231–( )B

_ Remove key (45) from spindle.
_ Remove thread guard (51).
_ Using wrenches on flats of ring gear (49) and adapter (30), unthread and remove drive gearing.
_ Grasp ring gear in one hand and tap drive end of spindle with a soft face hammer; spindle and components will loosen from ring gear.
_ Gearing should not be disassembled further unless damage is evident, as Brinelling of the bearing races may occur, making replacement necessary.
_ To disassemble further, remove washer (48), bearing (47) and spacer.
_ Remove shafts, releasing gears.
_ To remove bearing (41), insert shafts into spindle and alternately tap ends, loosening bearing.

DRIVE GEARING ASSEMBLY

MODELS 8228–( )B

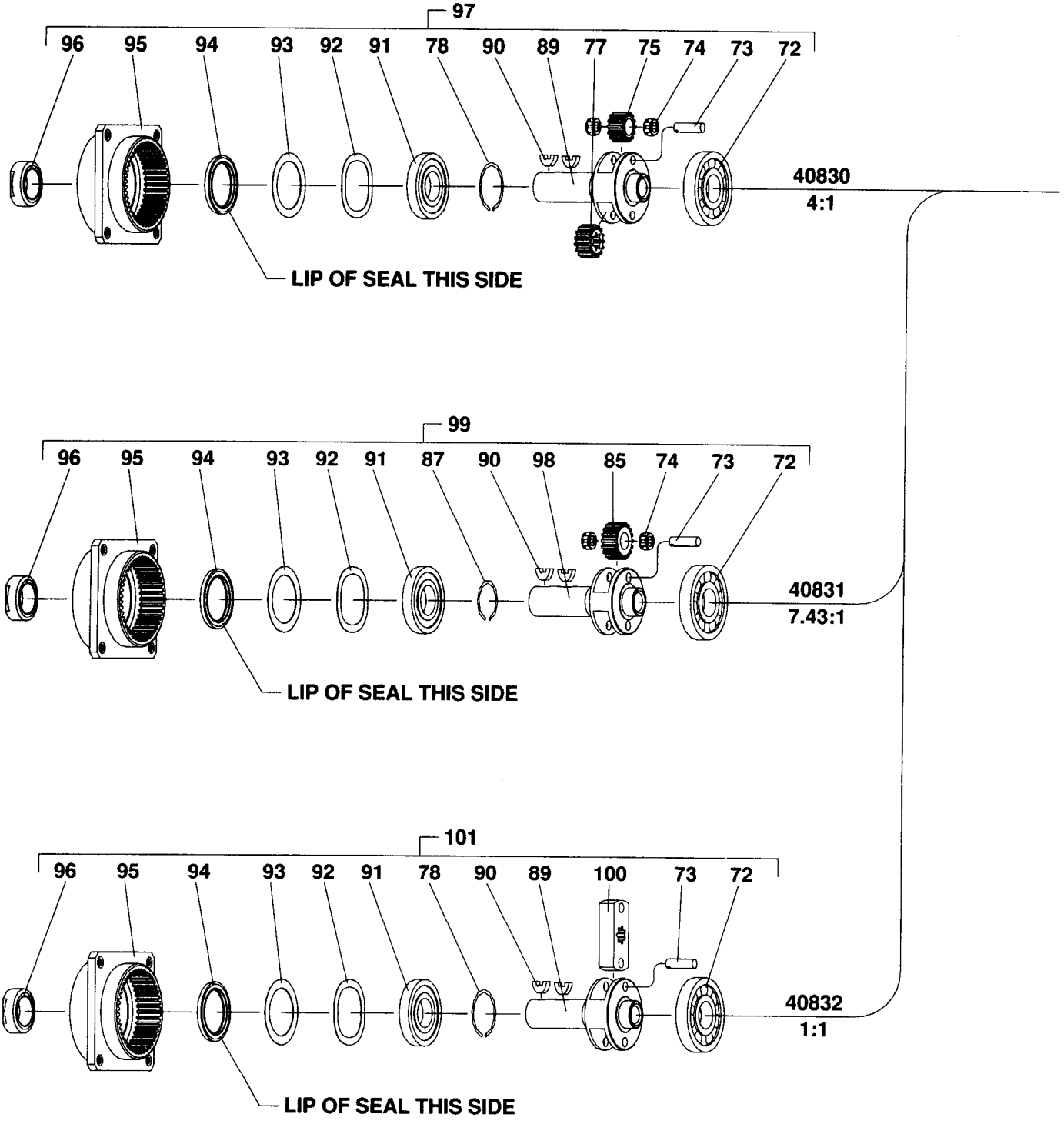
_ Assemble snap ring (78 or 87) to spindle.
_ Pack bearing (72) with ARO 33153 grease and assemble to spindle, pressing on inner race of bearing.
_ Lubricate gears and needle bearings (74) liberally with ARO 33153 grease and assemble one gear to spindle, securing with shaft.
_ Repeat for assembly of opposite shaft and gear. Gearing should contain approximately 1/4 oz. (7 g) of grease.
_ Rotate opening of snap ring 90° from either shaft.
_ Assemble bearing (91) to spindle, pressing on inner race of bearing.
_ Lubricate seal (94) with ARO 36460 lube and assemble into nose housing (95). NOTE: Assemble seal with lips toward gearing.
_ Assemble washer (93), wave washer (92) and spindle and components into nose housing.
_ Assemble nose housing to housing (80) and secure with screws (83) and washers (84). NOTE: Assemble gearing to motor housing (7) before assembling motor assembly or head (1) to tool (see "MOTOR ASSEMBLY").
_ Assemble spacer (96) and keys (90) to spindle.

MODELS 8231–( )B

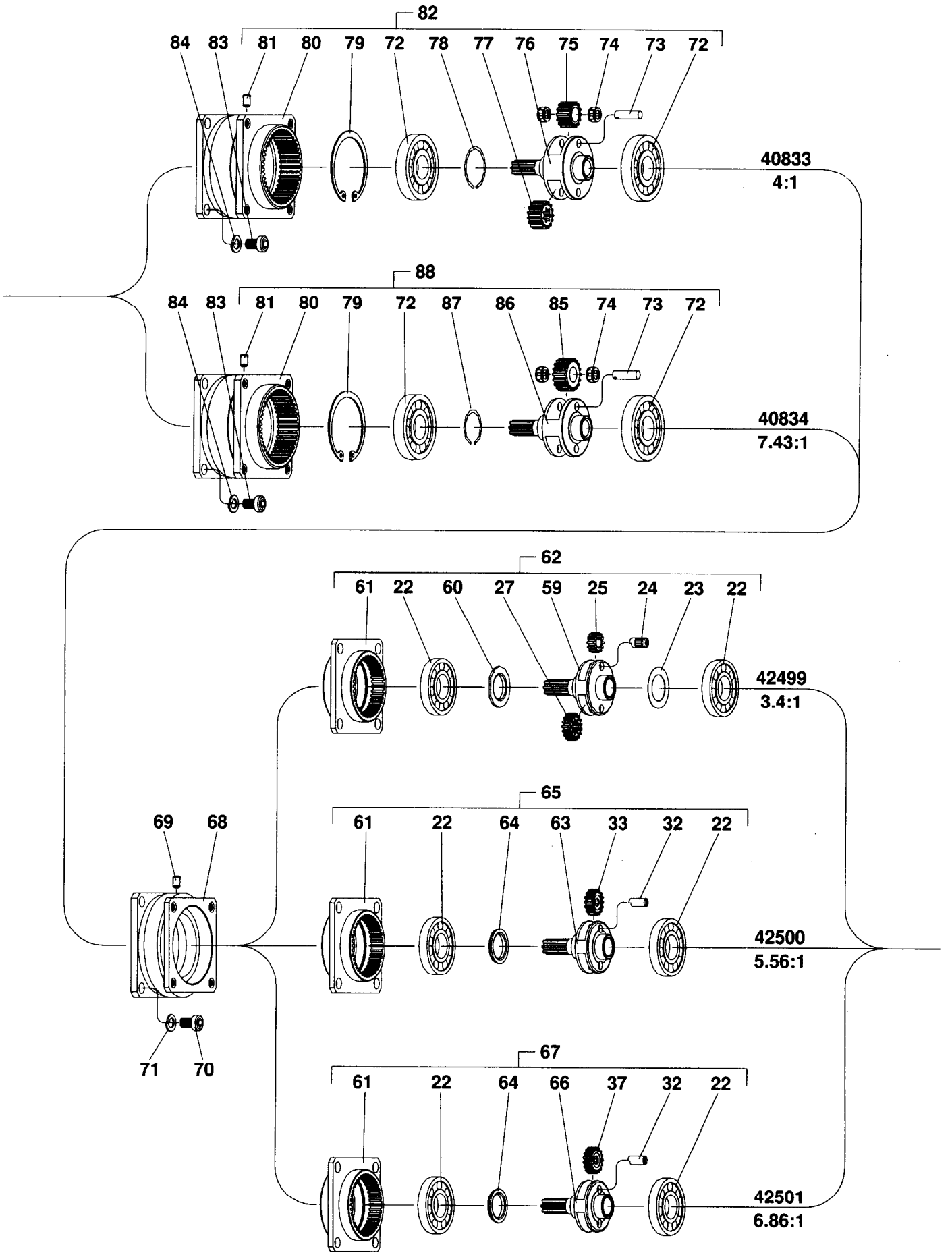
_ Assemble spacer and bearing (47) to spindle, pressing on inner race of bearing.
_ Lubricate gears liberally with ARO 33153 grease and assemble to spindle, securing with shafts. NOTE: Be sure each shaft (24) contains 15 needle bearings. Gearing should contain approximately 1/8 oz. (3.5 g) of grease.
_ Pack bearing (41) with ARO 33153 grease and assemble spacer (23)(where applicable) and bearing (41) to spindle, pressing on inner race of bearing.
_ Assemble washer (48)(large diameter toward bearing) and gearing into ring gear (49).

(CONTINUED ON PAGE 11)

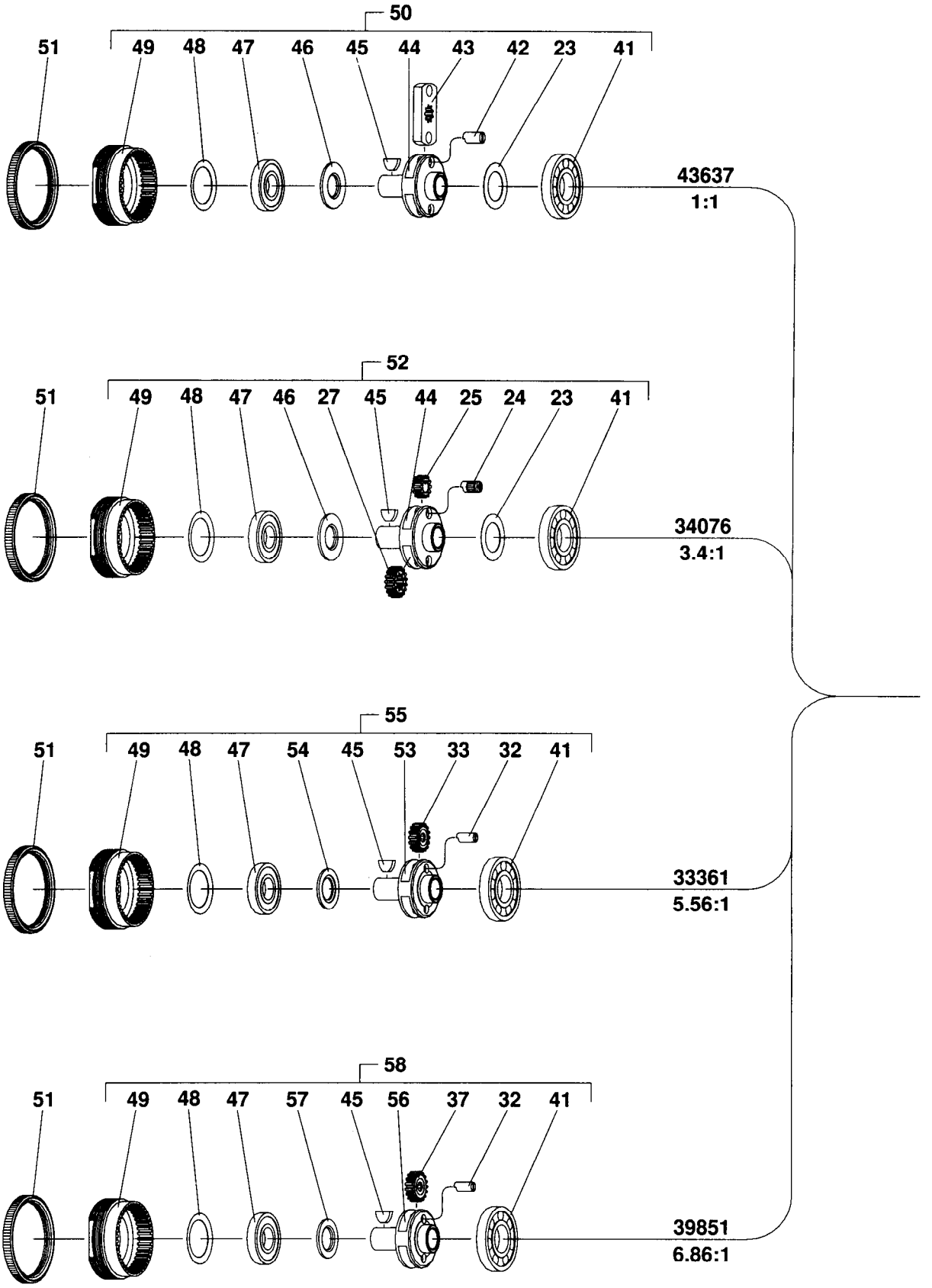
8228–( )B DRIVE GEARING



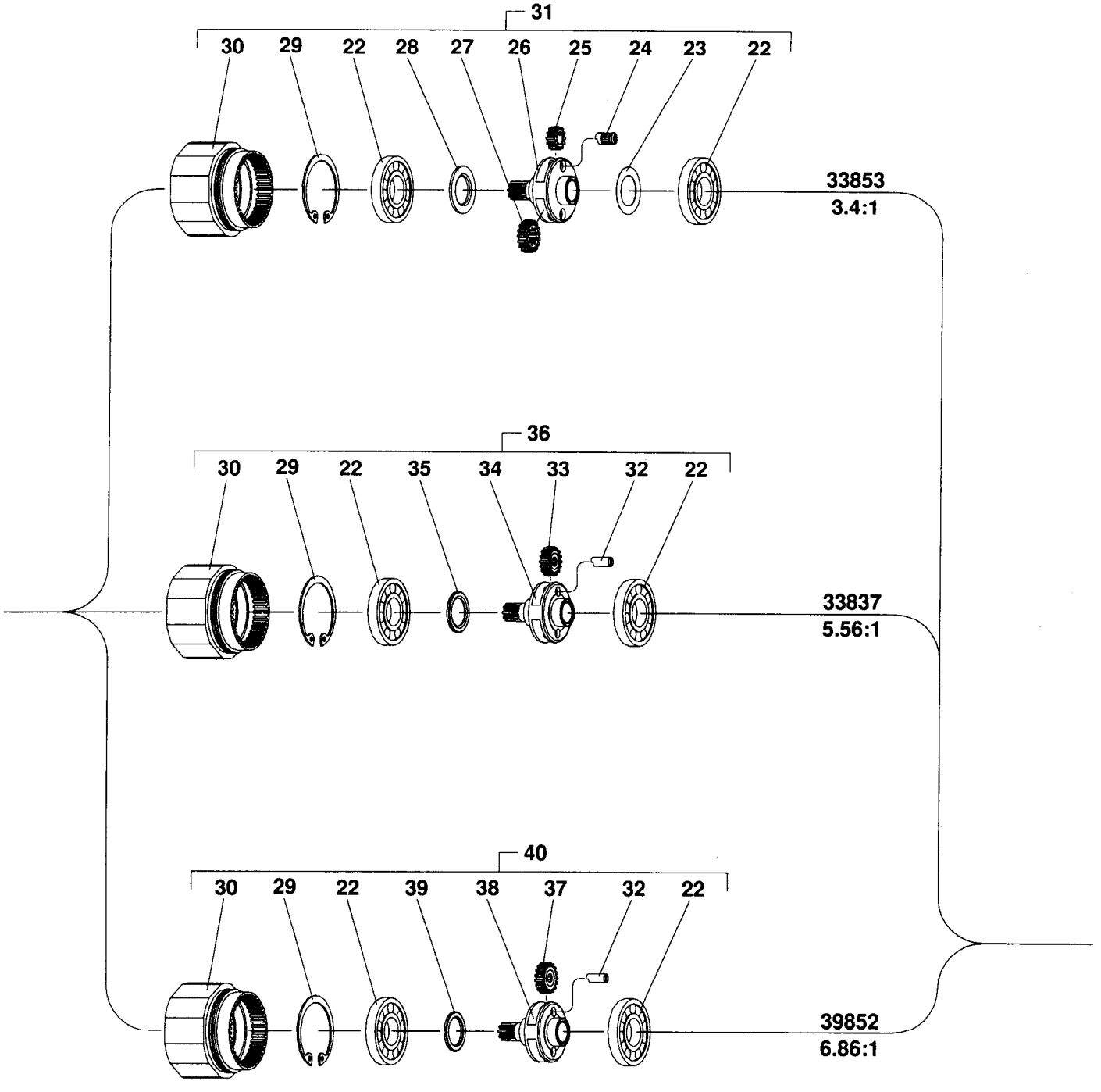
8228-( )B AUXILIARY GEARING



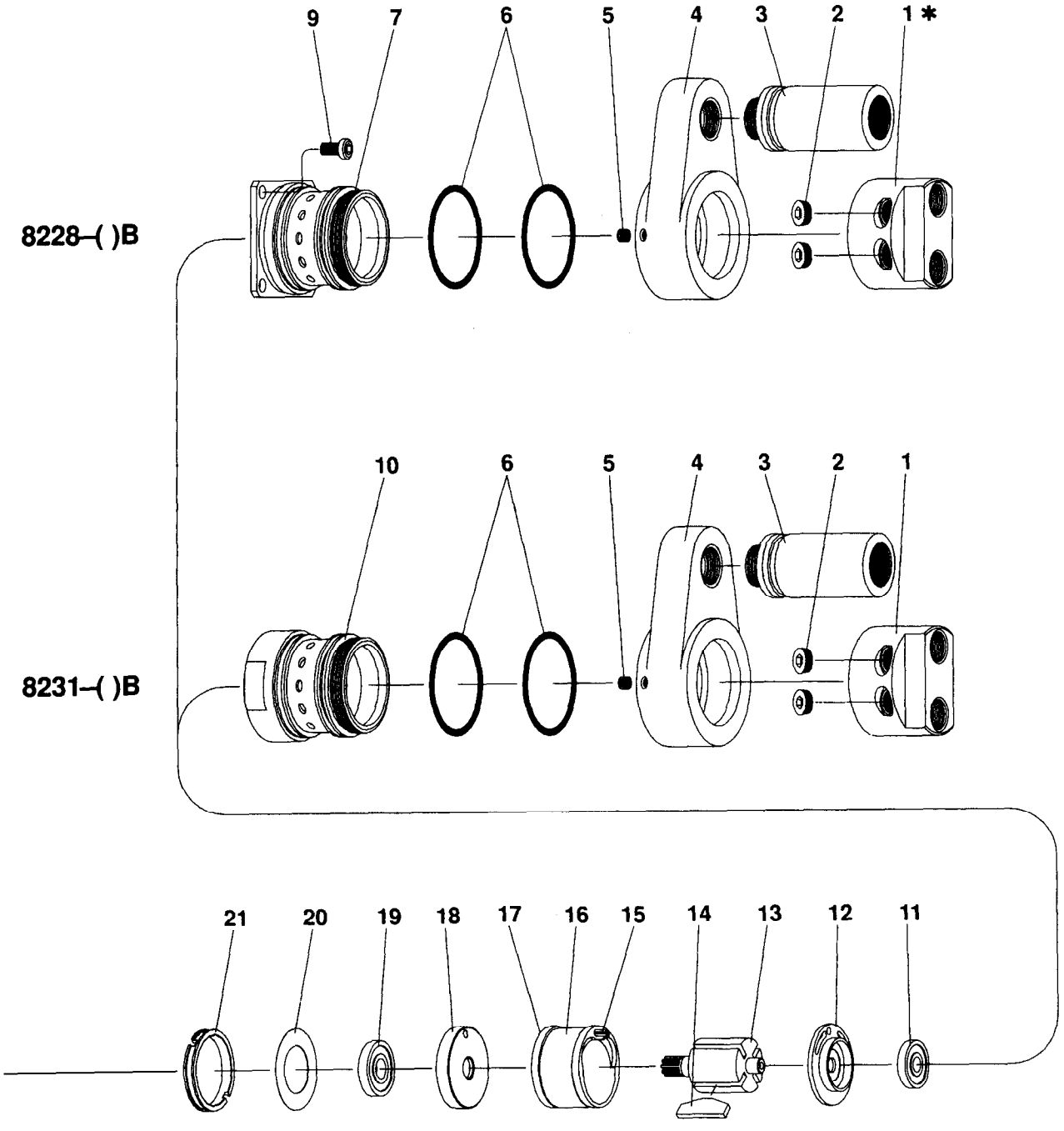
8231–( )B DRIVE GEARING



8231–( )B AUXILIARY GEARING



* TIGHTEN TO 35 – 40 FT LBS.



_ Assemble ring gear and components to tool and tighten, using wrenches on flats of ring gear (49) and adapter (30).
_ Assemble thread guard (51) to ring gear.
_ Assemble key (45) to spindle.

AUXILIARY GEARING DISASSEMBLY

MODELS 8228–( )B

_ Remove drive gearing from tool.
_ Remove screws (70) and washers (71), releasing auxiliary gearing (82 or 88).
_ Grasp housing (80) in one hand and tap drive end end of spindle with a soft face hammer; spindle and components will loosen from housing.
_ Gearing should not be disassembled further unless damage is evident, as Brinelling of the bearing races may occur, making replacement necessary.
_ To disassemble further, remove bearing (72) from splined end of spindle.
_ Rotate snap ring (78 or 87) so the open portion will allow the removal of one shaft (73).
_ Remove shaft (73), releasing gear.
_ Repeat for removal of opposite shaft and gear.
_ To remove bearing (72), remove snap ring, insert shafts into spindle and alternately tap ends, loosening bearing.

MODELS 8231–( )B

_ Remove drive gearing from tool.
_ Using wrenches on flats of adapter (30) and motor housing (10), unthread and remove gearing.
_ Grasp adapter (30) in one hand and tap splined end of spindle with a soft face hammer; spindle and components will loosen from adapter.
_ Gearing should not be disassembled further unless damage is evident, as Brinelling of the bearing races may occur, making replacement necessary.
_ To disassemble further, remove bearing (22) and spacer from splined end of spindle.
_ Remove shafts (24 or 32), releasing gears.
_ To remove bearing (22), insert shafts into spindle and alternately tap ends, loosening bearing.

AUXILIARY GEARING ASSEMBLY

MODELS 8228–( )B

_ Assemble snap ring (79) to housing (80).
_ Assemble snap ring (78 or 87) to spindle.
_ Pack bearings (72) with ARO 33153 grease and assemble one bearing to rear end of spindle, pressing on inner race of bearing.
_ Lubricate gears and needle bearings (74) liberally with ARO 33153 grease and assemble one gear to spindle, securing with shaft.
_ Repeat for assembly of opposite shaft and gear. Gearing should contain approximately 1/4 oz. (7 g) of grease.
_ Rotate opening of snap ring 90° from either shaft.
_ Assemble bearing (72) to spindle, pressing on inner race of bearing.
_ Assemble spindle and components into housing (80).
_ Assemble housing (80) and components to adapter (68) and secure with screws (70) and washers (71). NOTE: Assemble gearing to motor housing (7) before assembling motor assembly or head (1) to tool (see "MOTOR ASSEMBLY"). Align grease fitting (81) with grease fitting (69).
_ Assemble drive gearing to tool.

MODELS 8231–( )B

_ Assemble retaining ring (29) to adapter (30).
_ Pack bearings (22) with ARO 33153 grease and assemble spacer and one bearing to splined end of spindle, pressing on inner race of bearing.
_ Lubricate gears liberally with ARO 33153 grease and assemble to spindle, securing with shafts. NOTE: Be sure each shaft (24) contains 15 needle bearings. Gearing should contain approximately 1/8 oz. (3.5 g) of grease.
_ Assemble spacer (23)(where applicable) and bearing (22) to spindle, pressing on inner race of bearing.
_ Assemble spindle and components into adapter (30).
_ Assemble adapter (30) and components to tool and tighten, using wrenches on flats of adapter (30) and motor housing (10).
_ Assemble drive gearing to tool.

ADAPTER GEARING DISASSEMBLY

_ Remove drive and auxiliary gearing from tool.
_ Remove screws (9), releasing adapter gearing from tool.
_ Grasp ring gear (61) in one hand and tap splined end of spindle with a soft face hammer; spindle and components will loosen from ring gear.
_ Gearing should not be disassembled further unless damage is evident, as Brinelling of the bearing races may occur, making replacement necessary.
_ To disassemble further, remove bearing (22) and spacer from splined end of spindle.
_ Remove shafts (24 or 32), releasing gears.
_ To remove bearing (22), insert shafts into spindle and alternately tap ends, loosening bearing.

ADAPTER GEARING ASSEMBLY

_ Pack bearings (22) with ARO 33153 grease and assemble spacer (60 or 64) and one bearing (22) to splined end of spindle, pressing on inner race of bearing.
_ Lubricate gears liberally with ARO 33153 grease and assemble to spindle, securing with shafts. NOTE: Be sure each shaft (24) contains 15 needle bearings. Gearing should contain approximately 1/8 oz. (3.5 g) of grease.
_ Assemble spacer (23)(where applicable) and bearing (22) to spindle, pressing on inner race of bearing.
_ Assemble spindle and components into ring gear (61).
_ Assemble ring gear (61) and components to motor housing (7) and secure with screws (9). NOTE: Assemble gearing to motor housing (7) before assembling motor assembly or head (1) to tool (see "MOTOR ASSEMBLY").

MOTOR DISASSEMBLY

_ The motor assembly can be removed from either end of motor housing (7 or 10).
_ To remove from "gearing" end of motor housing, remove gearing from tool.
_ Remove spacers (21 and 20) and motor assembly from motor housing.
_ Grasp cylinder in one hand and tap splined end of rotor with a soft face hammer; motor will come apart.
_ Remove bearing (11) and end plate (12) from rotor.

MOTOR ASSEMBLY

_ Assemble bearing (11) to end plate (12), pressing on outer race of bearing.
_ Assemble end plate (12) to rotor, pressing on inner race of bearing.
_ Coat four rotor blades (14) with ARO 29665 spindle oil and assemble to rotor slots – straight side out.
_ Coat i.d. of cylinder (16) with ARO 29665 spindle oil and assemble over rotor, aligning roll pin (15) and air inlet slots in end of cylinder with holes in end plate.

DISASSEMBLY/ASSEMBLY INSTRUCTIONS

_ Assemble bearing (19) to end plate (18), pressing on outer race of bearing.
_ Assemble end plate (18) to rotor, pressing on inner race of bearing. NOTE: Align hole in end plate with roll pin (17) in cylinder. Be sure rotor turns without binding.
- Models 8231–( )B – Assemble motor assembly into motor housing (10), aligning roll pin (15) with .1065" diameter blind hole in head (largest hole). Assemble spacers (20 and 21) and gearing to motor housing (10).
- Models 8228–( )B – Assemble gearing to motor housing (7). Place head (1) in a vise, with the motor end upright. Place motor assembly on head (1), aligning roll pin (15) with .1065" diameter blind hole (largest hole). Assemble spacers (20 and 21) to motor. Assemble motor housing (7), with gearing and manifold attached, over motor and thread to head. NOTE: Tighten to 35 – 40 ft lbs.

MANIFOLD DISASSEMBLY

_ Remove muffler (3) from manifold (4).
_ Place head (1) in a vise, clamping on flats.
_ Unthread and remove motor housing (7 or 10).
_ Unthread set screw (5) and slide manifold off housing.

MANIFOLD ASSEMBLY

_ Grease "O" rings (6) with ARO 36460 lube and assemble to grooves in motor housing (7 or 10).
_ Assemble manifold (4) to motor housing.
_ Assemble motor assembly and gearing to tool (see "MOTOR ASSEMBLY").
_ Assemble head (1) to motor housing. NOTE: For models 8228–( )B, tighten to 35 – 40 ft lbs.
_ Rotate manifold so muffler will be located approximately 180° from cylinder exhaust slots and tighten set screw (5).
_ Assemble muffler (3) to manifold.