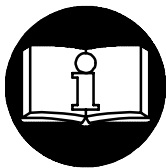


# OPERATION AND MAINTENANCE MANUAL

## for

### SERIES 8R, 17R AND 34R

## REVERSIBLE MULTI-VANE GEARED MOTORS



### ▲ WARNING

**IMPORTANT SAFETY INFORMATION ENCLOSED.  
READ THIS MANUAL BEFORE OPERATING TOOL.**

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

- Always operate, inspect and maintain this motor 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 motor at 90 pig (6.2 bar/620 kPa) air pressure at the inlet with 1-1/4" air supply hose.
- Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any accessory on this motor.
- Keep hands, loose clothing and long hair away from rotating end of motor.
- Anticipate and be alert for sudden changes in motion during start up and operation of any motor.
- Motor shaft may continue to rotate briefly after the throttle is released.
- Do not lubricate motor with flammable or volatile liquids such as kerosene, diesel or jet fuel.
- Do not remove any labels. Replace and damaged label.
- Use accessories recommended by Ingersoll-Rand.
- This motor is not designed for working in explosive atmospheres.
- This motor 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.

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

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

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®**  

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**AIR MOTORS**

## WARNING LABEL IDENTIFICATION



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

	<b>⚠ WARNING</b>
	Always wear eye protection when operating or performing maintenance on this tool.

	<b>⚠ WARNING</b>
	Always wear hearing protection when operating this tool.

	<b>⚠ WARNING</b>
	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.

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

	<b>⚠ WARNING</b>
	Do not use damaged, frayed or deteriorated air hoses and fittings.

## PLACING TOOL IN SERVICE

### LUBRICATION



**Ingersoll-Rand No. 50**



**Ingersoll-Rand No. 100  
SAE 90 Gear  
Lubricant**

We recommend using a Filter-Lubricator -Regulator Unit with these Motors. For Series 8R and 17R, use No. C22-04-G00 (1/2" pipe tap inlet). For Series 34R use No. C31-06-G00 (3/4" tap inlet). Install the Unit as close to the Motor as practical. Keep the Lubricator filled with Ingersoll-Rand No. 50 Oil.

### NOTICE

**If a sight feed lubricator is used,** adjust the lubricator to feed 60 drops per minute for continued duty operation. **Whenever the power unit is disassembled,** work some Ingersoll-Rand No. 28 Grease into the Rear Rotor Shaft Bearing (2). Use a good quality SAE 90 Gear Lubricant in the gear box. The amount of lubricant required is dependent upon the size of gear box and the mounting position of the Motor.

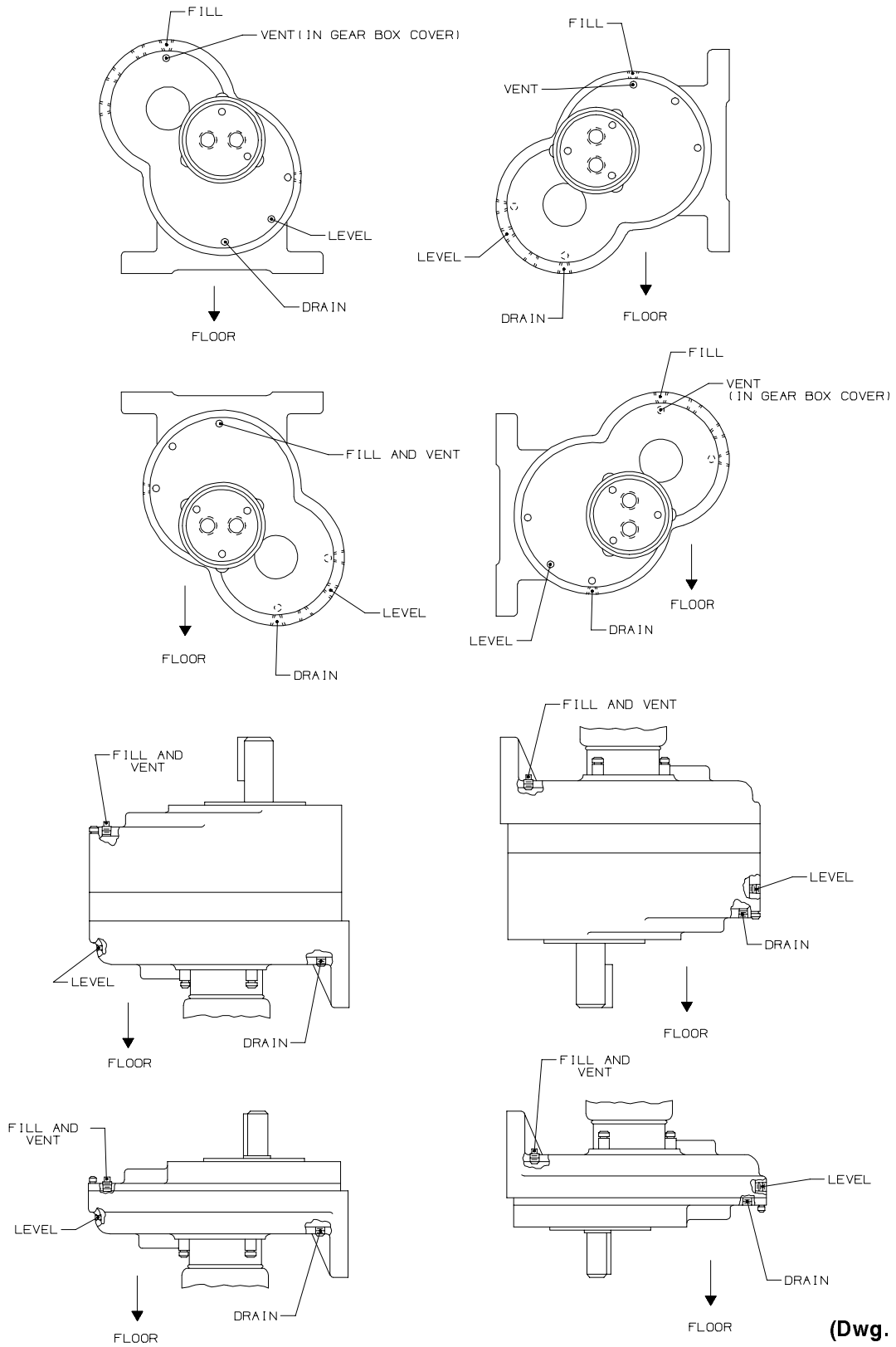
When lubricating the gear box, refer to the illustration showing the various mounting positions and the fill plugs, vent plug and drain plug. In each case, fill the gear chamber up to the "Level" plug. If the Vent Plug (40) is not located at the position indicated for a given mounting, relocate the Vent Plug by interchanging it with the pipe plug at that location.

**Whenever a Series 8R, 17R or 34R Motor is mounted with the Motor Shaft (36) pointing toward the floor or ceiling,** you must install a gravity feed lubrication to make certain the gears in the upper portion of the gear box get adequate lubrication. To do this, remove one of the pipe plugs other than the Vent Plug from the upper side of the motor and connect an oil line from a gravity feed reservoir. Connect an overflow line to the Level Plug opening and run it to a pump to return the lubricant to the gravity feed reservoir.

**If the Motor is mounted in any position other than that illustrated,** contact an Ingersoll-Rand Representative for oil level and venting recommendations.

# PLACING TOOL IN SERVICE

## Lubrication Diagram



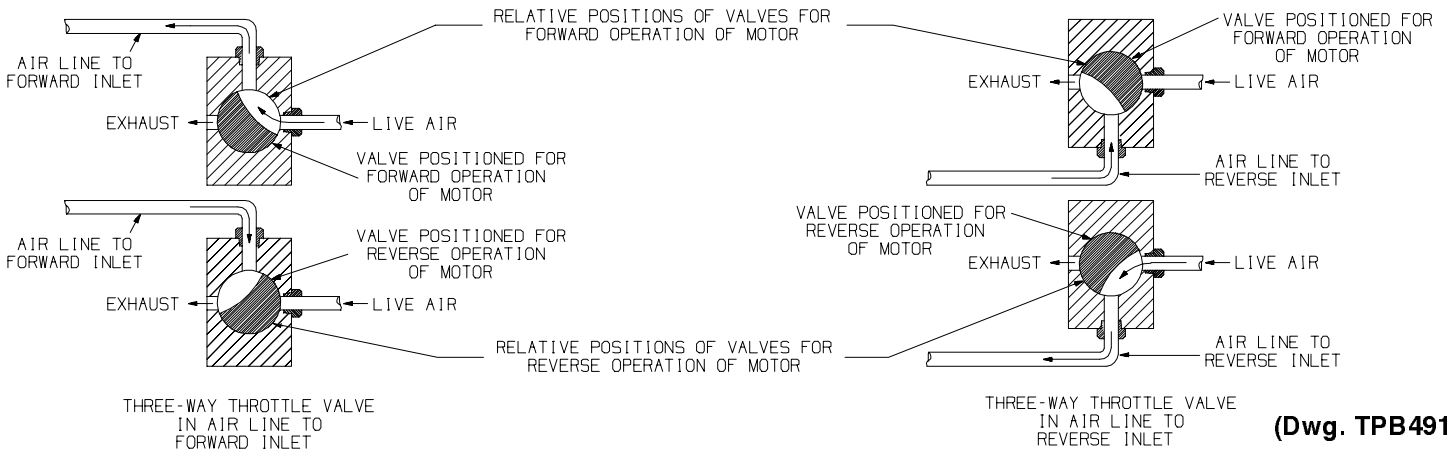
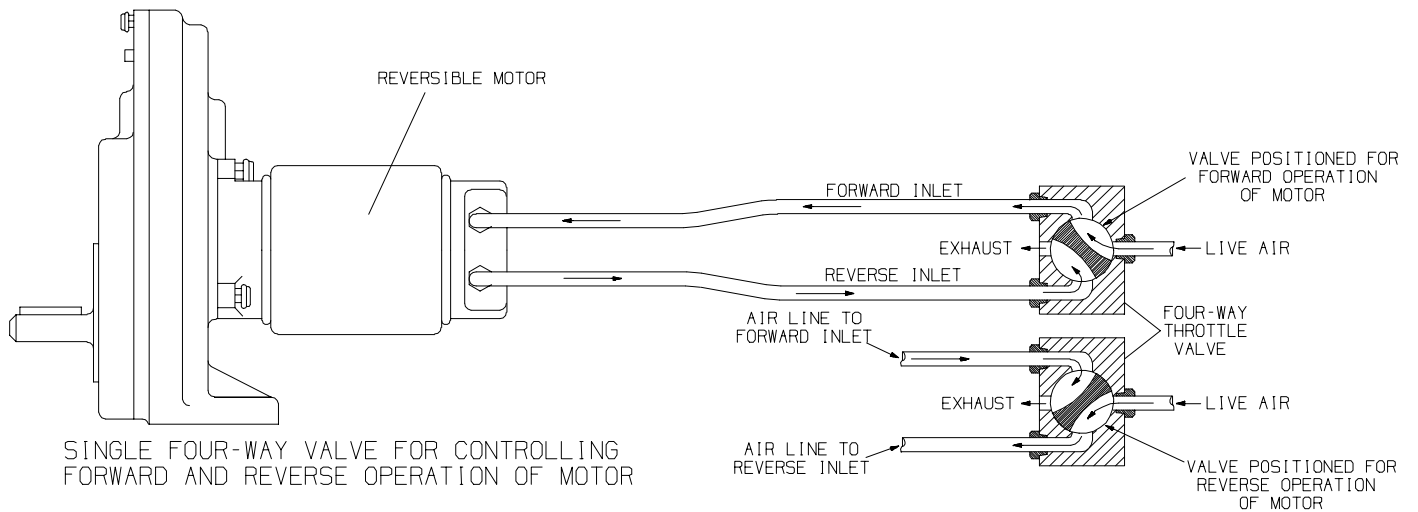
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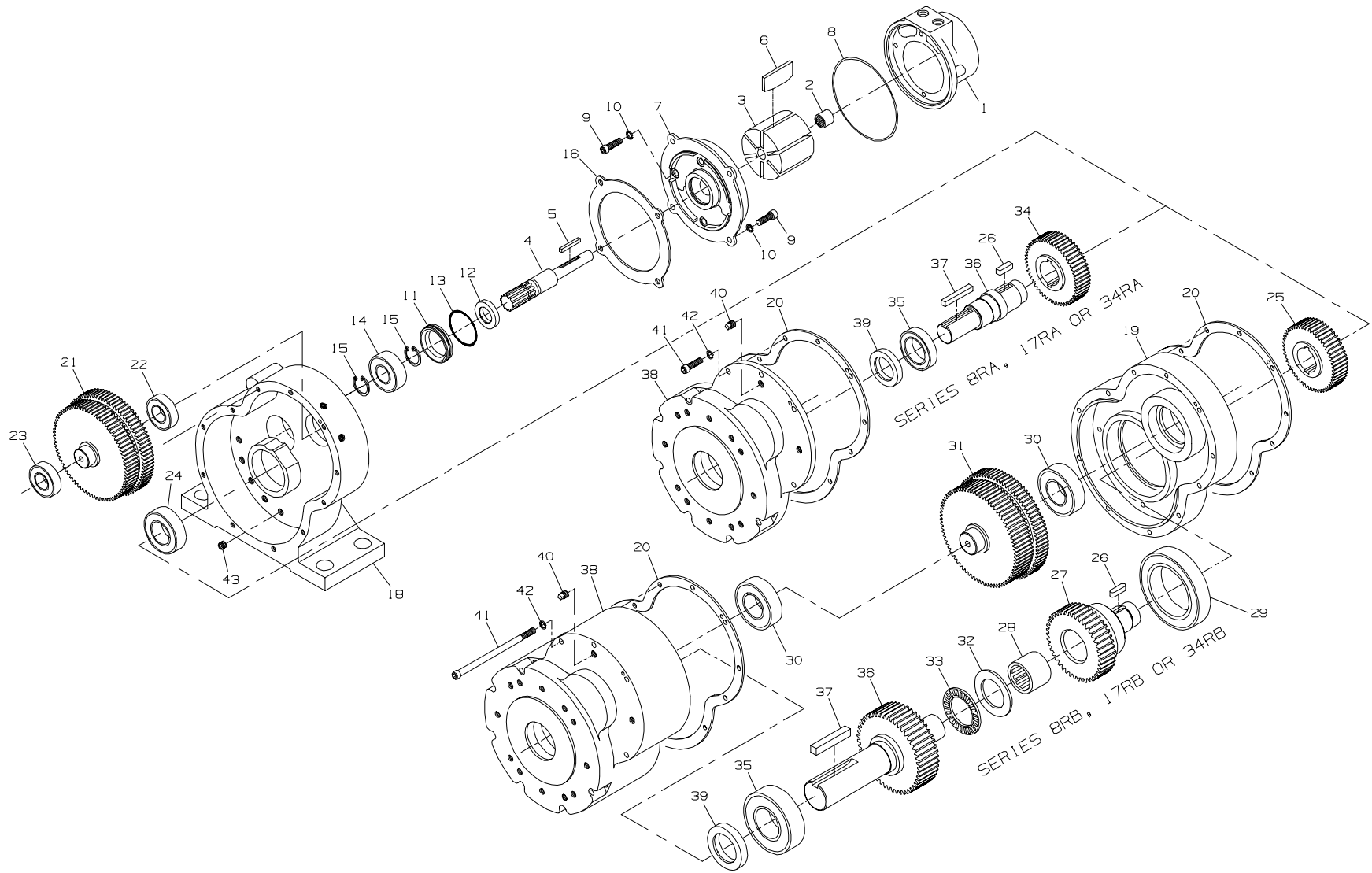
# PLACING TOOL IN SERVICE

## VALVE AND PIPING

### NOTICE

When these motors are used on applications requiring a reversible motor, a 4-way throttle valve or two 3-way throttle valves must be used in the air supply line in accordance with the following schematic diagram. When the application requires a non-reversible motor, a 2-way inline valve can be used in the air supply line. In either case, the inlet and outlet of the valve must be equal in size, and preferably one size larger, than the inlet of the motor.





PART NUMBER FOR ORDERING

PART NUMBER FOR ORDERING

1	Cylinder Assembly for Series 8R . . . . .	MVA008-A3	• 16	Gear Case Gasket . . . . .	8R-284
	for Series 17R . . . . .	MVA017-A3		Gear Box Assembly	
	for Series 34R . . . . .	MVA034-A3		for Model 8RA005, 17RA005 or 34RA005 . . .	92NA-A750-005
• 2	Rear Rotor Shaft Bearing . . . . .	MVA008-22		for Model 8RA008, 17RA008 or 34RA008 . . .	92NA-A750-008
3	Rotor			for Model 8RA011, 17RA011 or 34RA011 . . .	92NA-A750-011
	for Series 8R . . . . .	MVA008-53		for Model 8RA014, 17RA014 or 34RA014 . . .	92NA-A750-014
	for Series 17R . . . . .	MVA017-53		for Model 8RA017, 17RA017 or 34RA017 . . .	92NA-A750-017
	for Series 34R . . . . .	MVA034-53		for Model 8RA022, 17RA022 or 34RA022 . . .	92NA-A750-022
4	Rotor Shaft			for Model 8RB029, 17RB029 or 34RB029 . . .	92NB-A750-029
	for Series 8R . . . . .	8R-52		for Model 8RB036, 17RB036 or 34RB036 . . .	92NB-A750-036
	for Series 17R . . . . .	17R-52		for Model 8RB045, 17RB045 or 34RB045 . . .	92NB-A750-045
	for Series 34R . . . . .	34R-52	18	for Model 8RB078, 17RB078 or 34RB078 . . .	92NB-A750-078
5	Rotor Key		19	Gear Box . . . . .	92NA-750
	for Series 8R . . . . .	TC-410		Gear Box Frame (for Series 8RB, 17RB or 34RB) .	48NB-763
	for Series 17R . . . . .	J5-754	• 20	Gear Box Gasket (2 for Series 8RB, 17RB or 34RB; 1 for others) . . . . .	48NA-752
	for Series 34R . . . . .	MVA034-610	21	First Stage Intermediate Gear	
• 6	Vane Packet (set of 6 Vanes)			for Model 8RA005, 17RA005 or 34RA005 . . .	48NA-755-005
	for Series 8R . . . . .	MVA008-42-6		for Model 8RA008, 17RA008 or 34RA008 . . .	48NA-755-008
	for Series 17R . . . . .	MVA017-42-6		for Model 8RA011, 17RA011 or 34RA011 . . .	48NA-755-011
	for Series 34R . . . . .	MVA034-42-6		for Model 8RA014, 17RA014 or 34RA014 . . .	48NA-755-014
7	Fronthead Assembly . . . . .	8R-A240		for Model 8RA017, 17RA017 or 34RA017 . . .	48NA-755-017
• 8	Fronthead Seal . . . . .	MVA008-103		for Model 8RA022, 17RA022 or 34RA022 . . .	48NA-755-022
9	Fronthead Cap Screw (8) . . . . .	510-638		for Series 8RB, 17RB or 34RB . . . . .	48NB-755-022
10	1/4" Lock Washer (8) . . . . .	8U-58	• 22	First Stage Intermediate Gear Rear Bearing . . . . .	R1AP-97
11	Rotor Bearing Spacer Assembly . . . . .	92N-A65	• 23	First Stage Intermediate Gear Front Bearing . . . . .	R38P-97
• 12	Front Rotor Shaft Seal . . . . .	48N-758	• 24	Motor Shaft Rear Bearing or Intermediate Gear Pinion Rear Bearing . . . . .	48NA-510
• 13	Bearing Spacer Seal . . . . .	AF160-294	25	Second Stage Intermediate Gear (for Series 8RB, 17RB or 34RB) . . . . .	48NA-756-022
• 14	Front Rotor Bearing . . . . .	T02-33			
15	Rotor Shaft Retainer (2) . . . . .	R380Q-6			

MAINTENANCE SECTION

• To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

PART NUMBER FOR ORDERING

PART NUMBER FOR ORDERING

26	Second Stage Intermediate Gear Key or Motor Shaft Gear Key (2) . . . . .	R4H-410	• 35	Motor Shaft Front Bearing for Series 8RA, 17RA or 34RA . . . . .	C6H20A-518
27	Intermediate Gear Pinion for Model 8RB029, 17RB029 or 34RB029 . . . . .	48NB-760-029	36	Motor Shaft for Series 8RA, 17RA or 34RA . . . . .	48NB-766
	for Model 8RB036, 17RB036 or 34RB036 . . . . .	48NB-760-036		for Model 8RB029, 17RB029, 34RB029, 8RB036, 17RB036, 34RB036, 8RB045, 17RB045 or 34RB045 . . . . .	48NA-757-4
	for Model 8RB045, 17RB045 or 34RB045 . . . . .	48NB-760-078		for Model 8RB078, 17RB078 or 34RB078 . .	48NB-762-029
• 28	Intermediate Gear Pinion Roller Bearing (for Series 8RB, 17RB or 34RB) . . . . .	48NB-765	37	Motor Shaft Key for Series 8RA, 17RA or 34RA . . . . .	48NB-762-078
• 29	Intermediate Gear Pinion Front Bearing (for Series 8RB, 17RB or 34RB) . . . . .	48NB-764	38	Gear Box Cover Assembly for Series 8RA, 17RA or 34RA . . . . .	107-54
• 30	Third Stage Intermediate Gear Bearings (2) (for Series 8RB, 17R or 34RB) . . . . .	C6H20A-518		for Series 8RB, 17RB or 34RB . . . . .	R5H51-768
31	Third Stage Intermediate Gear for Model 8RB029, 17RB029 or 34RB029 . . . . .	48NB-761-029	• 39	Motor Shaft Seal for Series 8RA, 17RA or 34RA . . . . .	48NA-A751
	for Model 8RB036, 17RB036 or 34RB036 . . . . .	48NB-761-036		for Series 8RB, 17RB or 34RB . . . . .	48NB-A751
	for Model 8RB045, 17RB045 or 34RB045 . . . . .	48NB-761-045	40	Vent Plug . . . . .	48NA-759
	for Model 8RB078, 17RB078 or 34RB078 . . . . .	48NB-761-078	41	Gear Box Cover Cap Screw (11) for Series 8RA, 17RA or 34RA . . . . .	48NB-759
• 32	Motor Shaft Thrust Bearing Race (for Series 8RB, 17RB or 34RB) . . . . .	48NB-767	42	1/4" Lock Washer (11) . . . . .	48NA-368
• 33	Motor Shaft Thrust Bearing (for Series 8RB, 17RB or 34RB) . . . . .	48NB-769	43	Oil Plug (10 for Series 8RB, 17RB or 34RB; 9 for others) . . . . .	R0H-354
34	Motor Shaft Gear for Model 8RA005, 17RA005 or 34RA005 . . . . .	48NA-756-005			48NB-354
	for Model 8RA008, 17RA008 or 34RA008 . . . . .	48NA-756-008			8U-58
	for Model 8RA011, 17RA011 or 34RA011 . . . . .	48NA-756-011			R2-227
	for Model 8RA014, 17RA014 or 34RA014 . . . . .	48NA-756-014			
	for Model 8RA017, 17RA017 or 34RA017 . . . . .	48NA-756-017			
	for Model 8RA022, 17RA022 or 34RA022 . . . . .	48NA-756-022			

MAINTENANCE SECTION

- To keep downtime to a minimum, it is desirable to have on hand certain repair parts. We recommend that you stock one (pair or set) of each part indicated by a bullet (•) for every four tools in service.

## SPECIAL MOTOR SHAFTS AND MOUNTING FLANGES FOR USE ON SERIES 8RA, 17RA AND 34RA

PART NUMBER FOR ORDERING

PART NUMBER FOR ORDERING

★	<b>Motor Shaft</b>			<b>Mounting Flange</b>	
	5/8" diameter .....	48NA-757-1		9" diameter .....	48NA-580-1
	3/4" diameter .....	48NA-757-2		10" diameter .....	48NA-580-2
	7/8" diameter .....	48NA-757-3		11" diameter .....	48NA-580-3
	1-1/8" diameter .....	48NA-757-5		14" diameter .....	48NA-580-4
	1-3/8" diameter .....	48NA-757-6		Mounting Flange Cap Screw (6) .....	D10-312A
	7/8" diameter .....	48NA-757-7		3/8" Lock Washer .....	D02-321
	<b>Motor Shaft Key</b>				
	for 5/8", 3/4" and 7/8" diameter ..	J5-754			
	for 1-1/8" diameter Shaft .....	MOV050AA-754			
	for 1-3/8" diameter Shaft .....	MOV075AA-754			

★ For identification purposes, these Motor Shafts are stamped on their outboard end with the last digit of the part number.



# MAINTENANCE SECTION

## DISASSEMBLY



**Always disconnect the air supply before performing any maintenance on this motor.**

**Always wear protective eyewear when performing maintenance on a motor or when operating a motor.**

### General Instructions

1. Do not disassemble the motor any further than necessary to replace or repair damaged parts.
2. Do not disassemble the motor unless you have a complete set of new gaskets and o-rings for replacement.
3. Do not remove any part that is a press fit in or on a subassembly unless the removal of that part is necessary for repair or replacement.
4. Whenever a motor or 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 and housings.
5. If it is necessary to remove a needle bearing, make certain you have a new bearing on hand for replacement. These bearings are always damaged during the removal process.

### Disassembly of the Motor

1. Remove the Vent Plug (40) and position the motor so that the oil will drain into a container. Remove the Drain Plug (43) and drain the oil from the Gear Box (18).
2. Unscrew and remove the four Fronthead Cap Screws (9) and Lock Washers (10) that hold the Cylinder Assembly (1) against the Gear Box. Pull the assembled motor away from the Gear Box.
3. Remove the Gear Case gasket (16).
4. Remove the four Fronthead Cap Screws and Lock Washers that secure the Fronthead Assembly (7) to the Cylinder Assembly and pull the Cylinder Assembly away from the Fronthead.
5. Remove the Fronthead Seal (8).
6. If the Rear Rotor Shaft Bearing (2) must be replaced, pull it from the Cylinder.
7. Remove the Vanes (6) from the Rotor (3) and slide the Rotor off the Rotor Shaft (4). Remove the Rotor Key (5) from the Shaft.
8. Grasp the Front Rotor Bearing (14) and the front of the Rotor Shaft and pull the assembled Rotor Shaft out of the Fronthead.
9. Using snap ring pliers, remove the gear end Rotor Shaft Retainer (15) and slide the Front Rotor Bearing off the Rotor Shaft. Use the same snap ring pliers to remove the remaining Retainer.
10. Pull the Rotor Bearing Spacer Assembly (11), and Front Rotor Shaft Seal (12) off the Shaft.

### Disassembly of Series 8RA, 17RA and 34RA

#### Gearing

1. Unscrew and remove the eleven Gear Box Cover Cap Screws (41) and Lock Washers (42).
2. Remove the Motor Shaft Key (37) and lay the assembled gear box on a workbench with the Motor Shaft (36) upward.
3. Carefully separate the Gear Box Cover Assembly (38) from the Gear Box (18) and set it aside. If the Intermediate Gear (21) remains with the Gear Box Cover, make certain it does not drop onto any hard surfaces or other gearing.
4. Remove the Gear Box Gasket (20).
5. Lift the Intermediate Gear out of the Gear Box. Pull the First Stage Intermediate Gear Rear Bearing (22) and First Stage Intermediate Gear Front Bearing (23) off the hubs of the Intermediate Gear. If the Bearings are frozen on the hubs, use a bearing puller to remove them.
6. Push the assembled Motor Shaft out of the Gear Box Cover Assembly.
7. Pull the Motor Shaft Rear Bearing (24) off the rear hub of the Motor Shaft.
8. Pull the Motor Shaft Front Bearing (35) off the front hub of the Motor Shaft.
9. Using a gear puller, pull the Motor Shaft Gear (34) off the rear of the Motor Shaft. Remove the two Shaft Keys (26).
10. Using a hooked tool, pull the Motor Shaft Seal (39) out of the Gear Box Cover.

### Disassembly of Series 8RB, 17RB and 34RB

#### Gearing

1. Unscrew and remove the eleven Gear Box Cover Cap Screws (41) and Lock Washers (42).
2. Remove the Motor Shaft Key (37) and lay the assembled gear box on a workbench with the Motor Shaft (36) upward.
3. Grasp the Gear Box Frame (19) and carefully separate the assembled Frame and Gear Box Cover Assembly (38) from the Gear Box (18) and set it aside. If the First Stage Intermediate Gear (21) remains with the Gear Box Frame, make certain it does not drop onto any hard surfaces or other gearing.
4. Remove the Gear Box Gasket (20).
5. Lift the First Stage Intermediate Gear out of the Gear Box. Pull the First Stage Intermediate Gear Rear Bearing (22) and First Stage Intermediate Gear Front Bearing (23) off the hubs of the Intermediate Gear. If the Bearings are frozen on the hubs, use a bearing puller to remove them.
6. Carefully separate the Gear Box Cover Assembly from the Gear Box Frame and remove the Gear Case Gasket. Be careful not to allow the Motor Shaft Thrust Bearing Race (32) or the Motor Shaft Thrust Bearing (33) to slide off the Motor Shaft and become damaged.

## MAINTENANCE SECTION

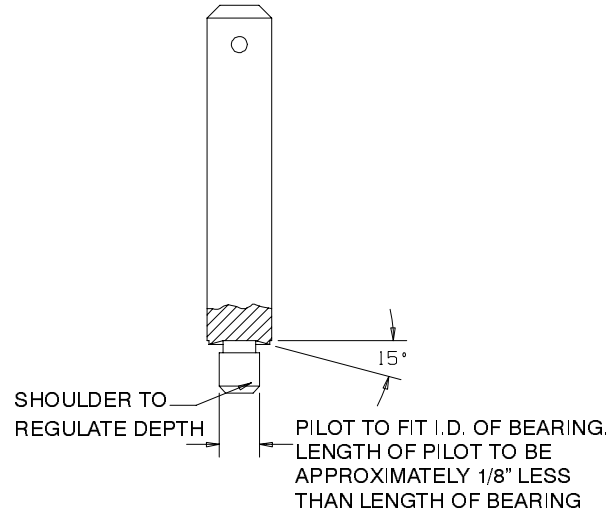
7. Remove the Third Stage Intermediate Gear (31) and the two Third Stage Intermediate Gear Bearings (30) from either the Gear Box Frame or the Gear Box Cover Assembly. Pull the two Bearings from the shafts of the Gear. If the Bearings are frozen on the shafts, use a bearing puller to remove them.
8. Pull the Intermediate Gear Pinion Rear Bearing (24) off the rear hub of the Intermediate Gear Pinion (27).
9. Using a gear puller, pull the Second Stage Intermediate Gear (25) from the rear hub of the Intermediate Gear Pinion. Remove the two Shaft Keys (26).
10. Push the Intermediate Gear Pinion out the motor shaft end of the Gear Box Frame.
11. Pull the Intermediate Gear Pinion Front Bearing (29) off the Pinion and if the Intermediate Gear Pinion Roller Bearing (28) must be replaced, pull it from the Pinion.
12. If the Motor Shaft Thrust Bearing and Bearing Race have not been removed, remove them from the Shaft.
13. Push the assembled Motor Shaft out of the Gear Box Cover Assembly.
14. Pull the Motor Shaft Front Bearing (35) off the front hub of the Motor Shaft.
15. Using a hooked tool, pull the Motor Shaft Seal (39) out of the Gear Box Cover.

### ASSEMBLY

#### General Instructions

1. Always press on the **inner** ring of a ball-type bearing when installing a bearing on a shaft.
2. Always press on the **outer** ring of a ball-type bearing when pressing a bearing into a recess.
3. Whenever grasping a tool or part in a vise, always use leather-covered or copper-covered vise jaws. Take extra care with threaded parts and housings.
4. Always clean every part and wipe every part with a thin film of oil before installation.
5. Check every bearing for roughness. If an open bearing must be cleaned, wash it thoroughly in a clean, suitable, cleaning solution and dry with a clean cloth. **Sealed or shielded bearings should not be cleaned.** Work grease into every open bearing before installation.
6. Apply a film of O-ring lubricant to every O-ring before installation.
7. Unless otherwise noted, always press on the stamped end of a needle bearing when installing a needle bearing into a recess. Use a bearing inserting tool similar to the one shown in Dwg. TPD786.

#### NEEDLE BEARING INSERTING TOOL



(Dwg. TPD786)

#### Assembly of Series 8RB, 17RB and 34RB

##### Gearing

1. Using a bearing inserting tool, press the Intermediate Gear Pinion Roller Bearing (28) into the Intermediate Gear Pinion (27).
2. Using a piece of tubing that contacts the outer ring of the Intermediate Gear Pinion Bearing (29), press the Bearing into the large bearing recess in the spindle side of the Gear Box Frame (19).
3. Insert the shaft of the Intermediate Gear Pinion through the Bearing and Frame, and rest the assembly on the table of an arbor press with the pinion shaft upward and the gear end face of the pinion supported.
4. Insert the two Second Stage Intermediate Gear Keys (26) into the slots in the shaft and press the Second Stage Intermediate Gear (25) onto the pinion shaft capturing the Gear Box Frame within the assembly.
5. Using a piece of tubing that contacts the inner ring of the Third Stage Intermediate Gear Bearing (30), press a Bearing onto each shaft of the Third Stage Intermediate Gear (31).
6. Place the assembled Gear Box Frame on a workbench with the roller bearing end of the Pinion upward.
7. Position the Bearing nearest the large spline on the shaft of Third Stage Intermediate Gear above the bearing recess in the Gear Box Frame. Engage the large spline of the Gear with the spline of the Pinion while pushing the Bearing into the recess.
8. Using a piece of tubing that contacts the inner ring of the Motor Shaft Front Bearing (35), press the Bearing onto the output end of the Motor Shaft (36).

## **MAINTENANCE SECTION**

9. Install the Motor Shaft Thrust Bearing (33) followed by the Motor Shaft Thrust Bearing Race (32) onto the opposite end of the Motor Shaft and insert the assembled Shaft, Bearing Race leading, into the Pinion Roller Bearing.
10. Place one of the Gear Box Gaskets (20) onto the Gear Box Frame making certain the Gasket fits over the alignment pin in the Frame and fits well around the large, raised alignment hub.
11. Using a dowel, push the Motor Shaft Seal (39), small opening leading, into the recess in the Gear Box Cover Assembly (38).
12. Position the Cover over the Box Frame and install the Seal on the Motor Shaft by bringing the Cover down against the Gasket. Make certain the alignment pin and hub on the Frame enter the hole and recess in the Cover.
13. Turn the assembly over so that the output end of the Motor Shaft is downward.
14. Using a piece of tubing that contacts the inner ring of the First Stage Intermediate Gear Front Bearing (23), press the Bearing onto the shaft adjacent to the small spline of the First Stage Intermediate Gear (21).
15. Using a piece of tubing that contacts the inner ring of the First Stage Intermediate Gear Rear Bearing (22), press the Bearing onto the shaft adjacent to the large spline of the First Stage Intermediate Gear (21).
16. Position the Bearing nearest the smaller spline on the shaft of the First Stage Intermediate Gear above the bearing recess in the Gear Box Frame. Engage the smaller spline of the Gear with the spline of the Second Stage Intermediate Gear while pushing the Bearing into the recess.
17. Using a piece of tubing that contacts the inner ring of the Intermediate Gear Pinion Rear Bearing (24), press a Bearing onto the shaft of the Intermediate Gear Pinion.
18. Place the remaining Gear Box Gasket onto the Gear Box Frame making certain the Gasket fits over the alignment pin in the Frame and fits well around the large, raised alignment hub.
19. Position the Gear Box (18) over the assembly and bring the Gear Box down against the Gasket while making sure the Bearings enter the bearing recesses in the Gear Box. Make certain the alignment pin and hub on the Frame enter the hole and recess in the Gear Box.
20. While keeping the assembly together, turn it over and insert the eleven Gear Box Cover Cap Screws (41) with their Lock Washers (42) through the holes of the Cover and Frame and into the Gear Box. Tighten the Screws evenly, a little at a time, using an alternating pattern. Use the Screws to draw the assembly together without distortion and without binding.

### **Assembly of Series 8RA, 17RA and 34RA**

#### **Gearing**

1. Insert the two Motor Shaft Gear Keys (26) into the slots in the Motor Shaft (36) and press the Motor Shaft Gear (34) onto the Motor Shaft.
2. Using a dowel, push the Motor Shaft Seal (39), small opening leading, into the recess in the Gear Box Cover Assembly (38).
3. Using a piece of tubing that contacts the inner ring of the Motor Shaft Front Bearing (35), press the Bearing onto the output end of the Motor Shaft.
4. Using a piece of tubing that contacts the inner ring of the Motor Shaft Rear Bearing (24), press a Bearing onto the motor end of the Motor Shaft.
5. Insert the output end of the Motor Shaft through the Motor Shaft Seal and push it into the gear Box Cover Assembly until the Motor Shaft Front Bearing seats in the bearing recess.
6. Using a piece of tubing that contacts the inner ring of the First Stage Intermediate Gear Front Bearing (23), press the Bearing onto the shaft adjacent to the small spline of the First Stage Intermediate Gear (21).
7. Using a piece of tubing that contacts the inner ring of the First Stage Intermediate Gear Rear Bearing (22), press the Bearing onto the shaft adjacent to the large spline of the First Stage Intermediate Gear (21).
8. Place the Gear Box Cover Assembly on a workbench with the output end of the Motor Shaft downward.
9. Position the Bearing nearest the smaller spline on the shaft of the First Stage Intermediate Gear above the bearing recess in the Gear Box Cover. Engage the smaller spline of the Gear with the spline of the Motor Shaft Gear while pushing the Bearing into the recess.
10. Place the Gear Box Gasket (20) onto the Gear Box Cover making certain the Gasket fits over the alignment pin in the Cover and fits well around the large, raised alignment hub.
11. Position the Gear Box (18) over the assembly and bring the Gear Box down against the Gasket while making sure the Bearings enter the bearing recesses in the Gear Box. Make certain the alignment pin and hub on the Frame enter the hole and recess in the Gear Box.
12. While keeping the assembly together, turn it over and insert the eleven Gear Box Cover Cap Screws (41) with their Lock Washers (42) through the holes of the Cover into the Gear Box. Tighten the Screws evenly, a little at a time, using an alternating pattern. Use the Screws to draw the assembly together without distortion and without binding.

## **MAINTENANCE SECTION**

### **Assembly of the Motor**

1. If the Rear Rotor Shaft Bearing (2) was removed, use a bearing inserting tool to press it into the central opening of the Cylinder Assembly (1).
2. Slide the Front Rotor Shaft Seal, large opening leading, onto the spline end of the Rotor Shaft (4) and move it to a position beyond the two snap ring grooves.
3. Using snap ring pliers, install one of the Rotor Shaft Retainers (15) on the Rotor Shaft. Install it in the groove nearest the small shaft with the key slot.
4. Slide the Front Rotor Bearing (14) onto the spline end of the Rotor Shaft until it contacts the Retainer. Install the remaining Retainer behind it to capture it in position on the Shaft.
5. Slide the installed Front Rotor Shaft Seal toward the Bearing until it contacts the Retainer.
6. Install the Bearing Spacer Seal (13) in the groove around the outside of the Rotor Bearing Spacer Assembly (11).
7. From the small end of the Rotor Shaft and with the large beveled end leading, install the Spacer on the Shaft. Make certain the central opening of the Spacer fits onto the Front Rotor Shaft Seal and the Spacer makes contact with the face of the Rotor Bearing.
8. Insert the small end of the Rotor Shaft through the hole in the Fronthead Assembly (7) from the side having the large central hub.
9. Install the Rotor Shaft Key (5) in the key slot on the Rotor Shaft to keep the assembled Shaft in the Fronthead.
10. Slide the Rotor (3) onto the Rotor Shaft and install a Vane (6) into each of the vane slots in the Rotor.
11. Install the Fronthead Seal (8) on the large hub of the Fronthead.
12. Slide the Cylinder over the Rotor and bring it into contact with the Fronthead. Make certain the Rotor Shaft enter the Rear Rotor Shaft Bearing and the tapped holes in the face of the Cylinder align with the bolt holes in the face of the Fronthead.
13. Thread four of the Fronthead Cap Screws (9) and Lock Washers (10) into the Cylinder through the face of the Fronthead. Tighten the Screws evenly, a little at a time, using an alternating pattern. Use the Screws to draw the assembly together without binding or without damaging the Seals.
14. Position the Gear Case Gasket (16) over the large hub on the face of the Fronthead and insert the remaining four Screws and Lock Washers through the Fronthead and Gasket from the Cylinder end of the assembly.
15. Insert the spline of the Rotor Shaft through the face of the Gear Box (18) making sure the spline engages the gearing in the Gear Box. Bring the face of the Fronthead with the Gasket against the face of the Gear box and thread the Screws into the Gear box. Tighten the Screws evenly, a little at a time, using an alternating pattern.

### **NOTICE**

**SAVE THESE INSTRUCTIONS. DO NOT DESTROY.**