Form P6855
03535812
Edition 5
November 2016

MULTI-VANE® Air Motors

M004 Series

Operation and Maintenance Information

Save These Instructions

Ingersoll Rand

WARNING

General Safety Rules

- **Read and understand this and all other supplied manuals before installing, operating, repairing, maintaining, changing accessories on, or working near this product.**
- **It is your responsibility to make this safety information available to others that will operate this product. Failure to follow standards and regulations can cause personal injury.**
- **Always install, operate, inspect and maintain this product in accordance with all applicable standards and regulations (local, state, country, federal, etc.). Compliance is your responsibility. Failure to follow standards and regulations can cause personal injury.**

WARNING

Product Safety Information - When Placing in Service

- **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 psig (6.2 bar/620 kPa) air pressure at the inlet with 5/16" (8 mm) 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 or before performing any maintenance on this motor.**
- **Do not use damaged, frayed or deteriorated air hoses and fittings.**
- **Keep hands, loose clothing and long hair away from rotating end of motor.**
- **Always wear eye protection when operating or performing maintenance on this motor.**
- **Always wear hearing protection when operating this 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 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 any 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 Motor performance and increased maintenance, and may invalidate all warranties.
- **Ingersoll Rand** is not responsible for customer modification of motors for applications on which **Ingersoll Rand** was not consulted.
- Repairs should be made only by authorized, trained personnel. Consult your nearest **Ingersoll Rand** Authorized Service center.
- Refer to Product Information Manual for model specific Safety information.

Safety Symbol Identification

Wear Eye Protection

Wear Hearing Protection

Read Manuals Before Operating Product

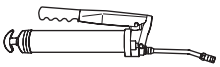
(Dwg. MHP2598)

Safety Information - Explanation of Safety Signal Words

DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.
NOTICE	Indicates information or a company policy that relates directly or indirectly to the safety of personnel or protection of property.

Placing Tool in Service

Lubrication



Ingersoll Rand No. 28

Ingersoll Rand No. 10

It is recommended to use an air line lubricator in the air supply line. Attach the unit as close as practical to the tool where the lubricator cannot be permanently mounted. It is recommended to use **Ingersoll Rand** No. L36221-110 lubricator.

For permanent installations, it is recommended to use an **Ingersoll Rand** No. C38221-810 Filter-Lubricator-Regulator unit. These units have 3/8" pipe tap inlet and outlet and 1.5 oz (44 ml) oil capacity. Larger capacity units may be used, but do not use a unit having less than a 3/8" pipe tap inlet and outlet.

After each forty hours of operation, or as experience indicates, remove the Gear Case Grease Screw (16) and inject 1.5 cc of the recommended grease into the opening. Do not grease excessively. Too much grease in the Gear Case (15) will cause heating. Grease leakage from the spindle end is also an indication that an excessive amount of grease has accumulated within the Gear Case.

Whenever the gear end of the Motor is disassembled, lubricate the gear train as follows:
For gear ratio 000:1, work approximately 19 cc of the recommended grease into and around the Bearings (35) and on the Spindle (27).
For gear ratios 004:1 and 006:1, work approximately 19 cc of the recommended grease into the gearing and around the Bearings (31 and 35) and on the Spindle (27).
For gear ratios 011:1, 015:1, 023:1 and 033:1, work approximately 22 cc of the recommended grease into the gearing and around theBearings (19, 21, 29, 31 and 35) and on the Spindle (27).
For gear ratios 050:1, 083:1 and 167:1, work approximately 26 cc of the recommended grease into the gearing and around the Bearings (21, 25, 29, 31 and 35) and on the Spindle (27).

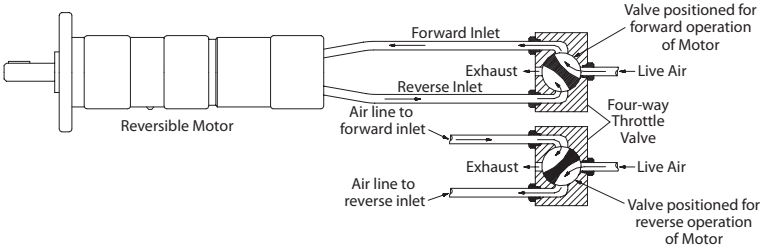
For continuous operation:
Continuous operation of geared motors generates heat which can cause grease to dry out and cake. The addition of fresh grease temporarily rectifies this problem. However, a small amount of oil should be added to the grease to replace the oil which was lost during continuous operation. The oil creates a slurry which makes the grease less likely to dry out and cake. **After each eight hours of continuous operation or as experience indicates,** add ten drops of the recommended oil to the opening of each grease screw or grease fitting.

Operation

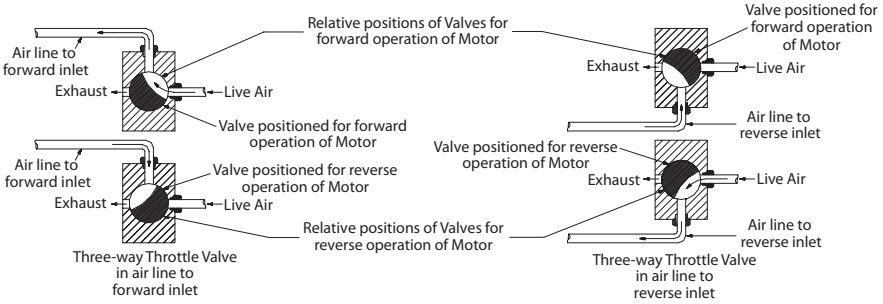
For optimum performance, the air source and supply lines must be capable of maintaining 90 psig (6.2 bar/620 kPa) air pressure at the motor. Hoses that are 5/16" (8 mm) diameter or larger are necessary for ample air flow to each motor.

Reversible motors require the use of a 4-way valve, or two 3-way valves in the supply line because the reverse air inlet port becomes an auxiliary port when the motor operates in forward rotation. In reverse, the forward inlet becomes the auxiliary exhaust port. An example of each method is illustrated in Dwg. TPB854.

Single Four Way Valve for controlling Forward and Reverse operation of Motor

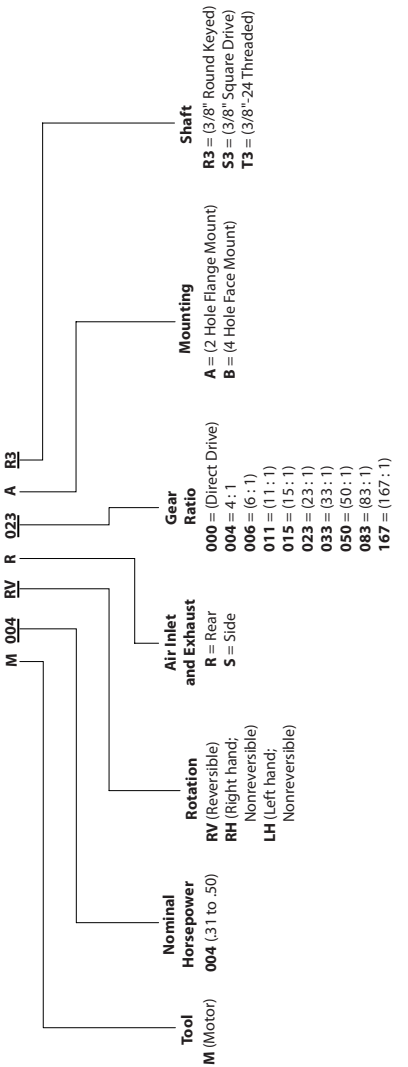


Two Three Way Valve for controlling Forward and Reverse operation of Motor



(Dwg. TPB854)

Model Identification



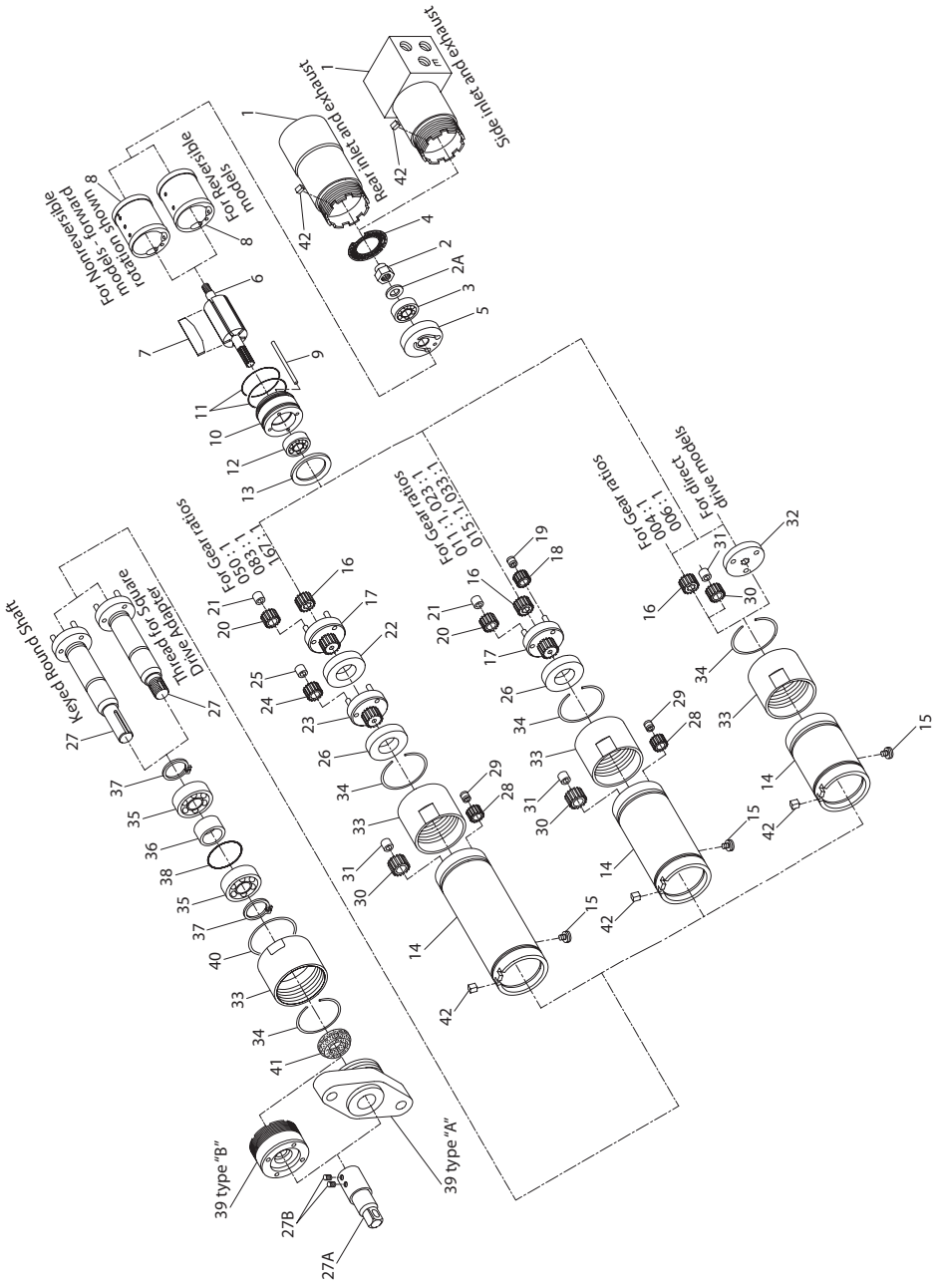
Parts and Maintenance

When the life of the motor has expired, it is recommended that the motor be disassembled, degreased and parts be separated by material so that they can be recycled.

Manuals can be downloaded from ingersollrandproducts.com.

Refer all communications to the nearest **Ingersoll Rand** Office or Distributor.

M004 Series Air Motor Exploded Diagram



(Dwg. TPA1184-1)

M004 Series Air Motor Parts List

Item	Part Description	Part Number
1	Motor Housing	
	for nonreversible models with rear inlet and exhaust	M004-N40
	for reversible models with rear inlet and exhaust	M004-R40
	for reversible models with side inlet and exhaust	M004-R140
2	Rear Rotor Bearing Retaining Nut	6WT-118
2A	Retaining Nut Washer	6WT-117
3	Rear Rotor Bearing	DG20-22
4	Rear End Plate Gasket	M004-739
5	Rear End Plate	M004-12
6	Rotor	M004-53
7	Vane Packet (Set of 5 Vanes)	4RL-42-5
8	Cylinder	
	for nonreversible models	M004-N3
	for reversible models	M004R3
9	Cylinder Dowel	88V60-98
	Front End Plate Assembly	M004-A11
10	Front End Plate	M004-11
11	Front End Plate Seal (2)	M004-210
12	Front Rotor Bearing	WWA100-97
13	Motor Clamp Washer	M004-207
14	Gear Case	
	for 000, 004, and 006 ratios	M004-37
	for 011, 015, 023 and 033 ratios	M004-137
	for 050, 083 and 167 ratios	M004-237
15	Gear Case Grease Screw	M002-95
16	Rotor Pinion	
	for 004, 015 and 050 ratios	6WTN-17
	for 011 ratios	6WTN-17
17	Gear Head	
	for 011 ratios	M004-216-011
	for 015 and 050 ratios	6LN-216
	for 023 ratios	M004-216-023
	for 033 and 167 ratios	6LR-216A
	for 083 ratios	M004-216-083
18	Gear Head Planet Gear (for 011 ratios) (3)	6WTM-10
19	Planet Gear Bearing (for 011 ratios) (3)	6WTM-500
20	Gear Head Planet Gear Assembly (3)	
	for 015 and 050 ratios	6WTN-A10
	for 023, 033, 083 and 167 ratios	6WTK-A10
21	Planet Gear Bearing	
	used with 6WTN-A10	7AH-500
	used with 6WTK-A10	7AJ-500
22	Gear Head Spacer (for 011, 015, 023, 033, 050, 083 and 167 ratios)	6LM-80
23	Intermediate Gear Head	
	for 050 and 083 ratios	M004-316-083
	for 167 ratios	6LQ-216A
24	Intermediate Gear Head Planet Gear Assembly (3)	
	for 050 and 083 ratios	6WTN-A10
	for 167 ratios	6WTP-A10
25	Planet Gear Bearing	
	used with 6WTN-A10	7AH-500
	used with 6WTP-A10	WFS182-654
26	Gear Head Spacer (for 050, 083 and 167 ratios)	6LM-80
27	Spindle	
	Threaded Spindles for use with Square Drive Adapters	
	for 000 and 004 ratios	M004-8-000
	for 006 ratios	M004-8-006
	for 011, 050 and 083 ratios	M004-8-011
	for 015 ratios	M004-8-015
	for 023 ratios	M004-8-023
	for 033 and 167 ratios	M004-8-033
	Rounded Shaft Keyed Spindles	
	for 000 and 004 ratios	M004-108-000
	for 006 ratios	M004-108-006
	for 011, 050 and 083 ratios	M004-108-011
	for 015 ratios	M004-108-015
	for 023 ratios	M004-108-023
	for 033 and 167 ratios	M004-108-033
27A	Spindle Square Drive Adapter	R1440-212-1
27B	Adapter Screw (2)	4UA9-561
28	Spindle Planet Gear	
	for 011, 050 and 083 ratios (3)	6WTM-10
	for 023 ratios (4)	4RLM-10
29	Spindle Planet Gear Bearing (3 for 011, 050 and 083 ratios; 4 for 023 ratios)	6WTM-500
30	Spindle Planet Gear Assembly (3)	
	for 004 and 015 ratios	6WTN-A10
	for 006 ratios	6WTK-A10
	for 033 and 167 ratios	6WTP-A10
31	Planet Gear Bearing	
	used with 6WTN-A10	7AH-500
	used with 6WTK-A10	7AJ-500
	used with 6WTP-A10	WFS182-654
32	Spindle Drive Plate (used with 000 ratios)	6AD-171
33	Coupling Nut (2)	M004-27
34	Coupling Nut Retainer (2)	M004-29
35	Spindle Bearing (2)	M004-510
36	Spindle Bearing Spacer	M004-111
37	Spindle Retaining Ring (2)	RX3-729
38	Gear Case Seal	M004-210
	Flange Assembly	
	for models with type "A" flange	M004-A580
	for models with type "B" flange	M004-A680
39	Flange	
	used with M004-A580	M004-580
	used with M004-A680	M004-680
40	Flange Seal	M004-210
41	Spindle Seal	M004-271
42	Flange Key (2)	M002-561
*	Shaft Key (for models with keyed Shafts)	501-410

* Indicates Not illustrated.

Maintenance Section

WARNING

Always use protective eyewear when performing maintenance on a motor or operating a motor. Always turn off the air supply and disconnect the air supply line before installing, removing or adjusting any accessory on this motor, or before performing maintenance on this motor. Failure to do so could result in injury.

Disassembly

General Instructions

1. Do not disassemble the motor any further than necessary to replace or repair damaged parts.
2. 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.
3. Whenever grasping a motor or part in a vise, always use leather-covered or copper-covered vise jaws to protect the surface of the part or motor and help prevent distortion. This is particularly true of threaded members and housings.
4. Do not disassemble the motor unless you have a complete set of new gaskets and O-rings for replacement.

Disassembly of the Motor

1. Clamp a large adjustable wrench in vise jaws with the adjustable opening upward.
2. Adjust the jaw of the wrench to clear the body of the Gear Case (14).
3. Roll the motor in the wrench jaw until it stops against the Gear Case Grease Screw (15) and, using a wrench on the flats of the Coupling Nut (33) at the flange end of the Gear Case, loosen the Coupling Nut.
4. Roll the motor in the opposite direction until it stops against the Gear Case Grease Screw and, using a wrench on the flats of the Coupling Nut at the flange end of the Gear Case, loosen the Coupling Nut.
5. Holding the motor horizontally over a workbench, unscrew the Coupling Nut at the motor end of the Gear Case and pull the motor from the Gear Case. Do not lose the Flange Key (42).
6. **For Models with Square Drive Adapter (27A),** using a hex wrench, unscrew and remove the two Adapter Screws (27B).
7. Unscrew the Coupling Nut and pull the Flange Assembly and the Spindle (27) out the of Gear Case. Once the Spindle is removed from the Gear Case, the entire gear train must be disassembled to install the Spindle Planet Gears (28) or the Spindle Planet Gear Assemblies (30) on the opposite end of the Spindle. Do not lose the Flange Key.
8. **For Models with Square Drive Adapters,** carefully grasp the Spindle in copper-covered vise jaws and using a wrench on the square drive, unscrew and remove the Adapter.
9. Push the Spindle out the gear end of the Flange Assembly.
10. Remove the Spindle Seal (41) and Flange Seal (40) from the inside of the Flange (39).
11. Using snap ring pliers, remove the Spindle Retaining Ring (37) and pull the two Spindle Bearings (35) and the Spindle Bearing Spacer (36) from the shaft of the Spindle. Remove the second Spindle Retaining Ring.
12. Remove the Motor Clamp Washer (13) from the Gear Case.
13. **For Models with 000 ratios,** pull the Spindle Drive Plate (32) from the Gear Case.
    For Models with 006 ratios, pull the three Spindle Planet Gear Assemblies (30) from the Gear Case.
    For Models with 004 ratios, pull the Rotor Pinion (16) and the three Spindle Planet Gear Assemblies (30) from the Gear Case.
    For Models with 011 ratios, pull the Rotor Pinion (16), three Gear Head Planet Gears (18), three Planet Gear Bearings (19), Gear Head (17), Gear Head Spacer (26), three Spindle Planet Gears (28) and three Spindle Planet Gear Bearings (29) from the Gear Case.
    For Models with 015 ratios, pull the Rotor Pinion (16), three Gear Head Planet Gear Assemblies (20), Gear Head (17), Gear Head Spacer (26) and three Spindle Planet Gear Assemblies (30) from the Gear Head.
    For Models with 023 ratios, pull the three Gear Head Planet Gear Assemblies (20), Gear Head (17), Gear Head Spacer (26), four Spindle Planet Gears (28) and four Spindle Planet Gear Bearings (29) from the Gear Case.
    For Models with 033 ratios, pull the three Gear Head Planet Gear Assemblies (20), Gear Head (17), Gear Head Spacer (26) and three Spindle Planet Gear Assemblies (30) from the Gear Case.
    For Models with 050 ratios, pull the Rotor Pinion (16), three Gear Head Planet Gear Assemblies (20), Gear Head (17), Gear Head Spacer (22), three Intermediate Gear Head Planet Gear Assemblies (24), Intermediate Gear Head (23), Gear Head Spacer (26), three Spindle Planet Gears (28) and three Spindle Planet Gear Bearings (29) from the Gear Case.
    For Models with 083 ratios, pull the three Gear Head Planet Gear Assemblies (20), Gear Head (17), Gear Head Spacer (22), three Intermediate Gear Head Planet Gear Assemblies (24), Intermediate Gear Head (23), Gear Head Spacer (26), three Spindle Planet Gears (28) and three Spindle Planet Gear Bearings (29) from the Gear Case.
    For Models with 167 ratios, pull the three Gear Head Planet Gear Assemblies (20), Gear Head (17), Gear Head Spacer (26), three Intermediate Gear Head Planet Gear Assemblies (24), the Intermediate Gear Head (23), Gear Head Spacer (26) and three Spindle Planet Gear Assemblies (30) from the Gear Case.
14. Using a thin blade screwdriver, pry one of the Coupling Nut Retainers (34) out of the Groove in the Gear Case and slide the two Coupling Nuts off the Gear Case.
15. Grasp the shaft of the Rotor (6) in copper-covered vise jaws and pull the Motor Housing (1) off the assembled motor unit.
16. Pull the Front End Plate Assembly off the Rotor.
17. Remove the two Front End Plate Seals (11) from the Front End Plate (10).
18. Push the Front Rotor Bearing (12) out of the Front End Plate.
19. Separate the Cylinder (8), Vanes (7) and Cylinder Dowel (9) from the Rotor.
20. Remove the Rear End Plate Gasket (4) from inside the Motor Housing.
21. If the Rear Rotor Bearing (3) or Rear End Plate (5) must be replaced, use a wrench to remove the Rear Rotor Bearing Retaining Nut (2).
22. Supporting the End Plate near the rotor body on the table of an arbor press, press the Rotor from the End Plate and Bearing.

Assembly

General Instructions

1. Keep work area and tools neat and clean. Do not remove protective covering from parts, especially bearings, until the time of installation.
2. Unless otherwise noted, always press on the stamped end of a needle bearing when installing needle bearing in a recess.
3. Always press on the **inner** ring of a ball-type bearing when installing the bearing on a shaft.
4. Always press on the **outer** ring of a ball-type bearing when installing the bearing in a bearing recess.
5. Check every bearing for roughness. If an open bearing must be cleaned, wash it thoroughly in clean solvent and dry it with a clean cloth. Work grease thoroughly into every open bearing before installation. Sealed or shielded bearings should ever be cleaned.
6. Except for bearings, always clean every part and wipe every part with a thin film of oil before installation.
7. When grasping a Motor or one of its parts in a vise, always use leather or copper vise jaws covers to protect the surface of the part and reduce the likelihood of damage. This is particularly important when clamping threaded members, shafts with splines, etc.
8. Apply O-ring lubricant to each O-ring before assembly and use only new gaskets when reassembling the Motor.

Assembly of the Motor

1. Place the Rear End Plate (5), porting slots leading, onto the threaded hub of the Rotor (6). Position the Rear Bearing (3) on the hub and using a sleeve that contracts the inner ring of the Bearing, press the Bearing onto the hub to within 1/32″ (1 mm) of the Rear End Plate.
2. Place the Retaining Nut Washer (2A) over the hub against the Bearing. Insert a 0.001″ feeler gauge or shim between the face of the Rotor and End Plate. Thread the Rear Rotor Bearing Retaining Nut (2) onto the hub of the Rotor and tighten until the feeler gauge has a slight drag during removal. The Rotor must spin freely while holding the End Plate.
3. Lightly grasp the threaded hub of the Rotor in copper-covered vise jaws with the splined hub upward.
4. Wipe each vane (7) with a film of light oil and place a Vane in each slot in the Rotor.
5. **For reversible models,** align the cylinder dowel hole in the Cylinder (8) with the hole in the Rear End Plate and install the Cylinder over the Rotor and Vanes against the End Plate.

NOTICE

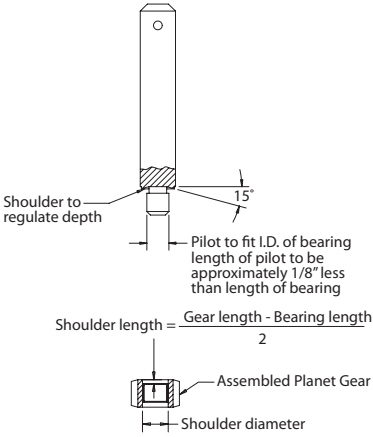
Nonreversible Cylinders have a drill point mark at one end of the three hole string portion of the five hole pattern. When the mark is near the Rear End Plate, rotation will be forward; when near the Front End Plate, rotation will be reverse.
For nonreversible models, the installation of the Cylinder (8) determines the rotational direction of the motor. Looking past the rotor body and vanes, align the cylinder dowel hole in the Rear End Plate at twelve o'clock. There are five holes drilled crosswise into the Cylinder. Align the cylinder dowel hole in the Cylinder with the hole in the Rear End Plate and install the Cylinder over the Rotor and Vanes against the Rear End Plate. If the five holes are at the three o'clock side of the assembly, the rotational direction will be forward (right hand). Rotational direction will be reverse (left hand), if the holes are at the nine o'clock side of the assembly. To change rotational direction, remove the Cylinder, turn it end for end and reposition it in the assembly.

6. Install the two Front End Plate Seals (11) in the annular grooves in the Front End Plate (10).

NOTICE

The Bearing in the following step is a light press and may require the use of an arbor press.

7. Push the Front Rotor Bearing (12) into the recess in the Front End Plate.
8. Remove the assembled motor from the vise and, standing the Rotor on the unsplined end, push the Front End Plate Assembly, bearing end trailing, onto the splined shaft of the Rotor until the Front End Plate just contacts the Cylinder.
9. Align the cylinder dowel holes in the Front End Plate, Cylinder and Rear End Plate and insert an assembly dowel (3/32″ [2.5 mm] diameter by 9″ [230 mm] long) into the aligned dowel holes in the assembly.
10. Inject 2 cc of the recommended grease into the central recess at the bottom of the bore in the Motor Housing (1).
11. Place the Rear End Plate Gasket (4) at the bottom of the bore in the Motor Housing. Make certain all holes and porting align.
12. **For nonreversible models,** insert the end of the assembly dowel nearest the Rear End Plate into the dowel hole at the bottom of the motor bore in the Housing. Slide the assembled motor along the assembly dowel until the motor stops against the bottom of the motor bore. Carefully withdraw the assembly dowel and install the Cylinder Dowel (9) in its place. Make certain the Dowel is below the face of the Front End Plate.
For reversible models, insert the end of the assembly dowel nearest the Rear End Plate into one of the dowel holes at the bottom of the motor bore in the Housing. With the inlet hole at twelve o'clock and the two cylinder dowel holes at eleven and one o'clock respectively, inserting the assembly dowel in the one o'clock hole will orient the motor for forward (right hand) rotation while inserting the assembly dowel in the eleven o'clock hole will orient the motor for reverse (left hand) rotation.
Slide the assembled motor along the assembly dowel until the motor stops against the bottom of the motor bore. Carefully withdraw the assembly dowel an install the Cylinder Dowel (9) in its place. Make certain the Dowel is below the face of the Front End Plate.
13. Install a Coupling Nut Retainer (34) in one of the grooves encircling the Gear Case (14).
14. Position the nonthreaded ends of the two Coupling Nuts (33) against each other and slide them onto the Gear Case from the end without the Retainer.
15. Install the second Retainer in the remaining groove encircling the Gear Case.
16. Using snap ring pliers, install one of the Spindle Retaining Rings (37) in the annular groove on the Spindle (27) adjacent to the large hub.
17. In the order named, install a Spindle Bearing (35), Spindle Bearing Spacer (36) and the remaining Spindle Bearing on the splined shaft against the Spindle Retaining Ring. Secure the three parts by installing the remaining Ring in the groove on the shaft.
18. Lubricate the Spindle Seal (41) with a thin coat of **Ingersoll Rand** No. 28 Grease and insert it, lip end trailing, into threaded end of the Flange (39).
19. Insert the Flange Seal (40) into the groove inside the threaded end of the Flange.
20. Being careful not to damage the Spindle seal, install the Flange Assembly, threaded end first, over the Spindle.
21. **For Models with Square Drive Adapter,** carefully grasp the pin end of the Spindle in copper-covered vise jaws and thread the Adapter (27A) onto the Spindle. Install the two Adapter Screws (27B).
22. Align a notch in the Flange with a notch in the Gear Case and maintain the alignment by installing a Flange Key in the two notches.
23. Thread the Coupling Nut onto the Flange until it is hand tight.
24. Insert the pin end of the Spindle into the unsplined end of the Gear Case and push the large spindle hub against the spline.
25. If the Planet Gear Bearings (21, 25 or 31) are being replaced in the Planet Gear Assemblies (20, 24 or 30), use a bearing inserting tool as shown in Dwg. TPC488 to press the Bearings into the Gears.



(Dwg. TPC844)

26. **For Models with 000 ratios,** insert the Drive Plate (32) into the splined end of the Gear Case. Make certain the spindle pins enter the holes in the Drive Plate.
For Models with 011, 023, 050, and 083 ratios, push a Spindle Planet Gear Bearing (29) into each Spindle Planet Gear (28) and using long tweezers, install a Bearing and Gear on each spindle gear shaft.
For all other models, using long tweezers, install a Spindle Planet Gear Assembly (30) on each spindle gear shaft.

27. **For Models with 004 ratios,** install the Rotor Pinion (16) in the center of the three Spindle Planet Gear Assemblies.
    For Models with 011 ratios, install the Gear Head Spacer (26) against the Spindle Planet Gears. Push a Planet Gear Bearing (19) into each Gear Head Planet Gear (18). Install the Gear Head (17), assembled Gear Head Planet Gears with Planet Gear Bearings and the Rotor Pinion (16) in the Gear Case (14).
    For Models with 015 ratios, install the Gear Head Spacer (26) against the Spindle Planet Gear Assemblies. Install the Gear Head (17), three Gear Head Planet Gear Assemblies (20) and Rotor Pinion (16) in the Gear Case (14).
    For Models with 023 and 033 ratios, install the Gear Head Spacer (26) against the Spindle Planet Gears or Spindle Planet Gear Assemblies. Install the Gear Head (17) and three Gear Head Planet Gear Assemblies (20) in Gear Case (14).
    For Models with 050 ratios, install the Gear Head Spacer (26) against the Spindle Planet Gears. Install the Intermediate Gear Head (23), three Intermediate Gear Head Planet Gear Assemblies (24), Gear Head Spacer (22), Gear Head (17), three Gear Head Planet Gears (20) and Rotor Pinion (16) in the Gear Case (14).
    For Models with 083 and 167 ratios, install the Gear Head Spacer (26) against the Spindle Planet Gears or Spindle Planet Gear Assemblies. Install the Intermediate Gear Head (23), three Intermediate Gear Head Planet Gear Assemblies (24), Gear Head Spacer (22), Gear Head (17) and three Gear Head Planet Gears (20) in the Gear Case (14).
28. Place the Motor Clamp Washer (13), concave end leading, against the Planet Gears or Drive Plate.
29. Being careful that the Spindle does not move out of position, engage the Gear Case gearing with the splined shaft of the Rotor.
30. Align the Gear Case with the Motor Housing by installing a Flange Key (42) to enter the notches in both the Housing and Gear Case. Hand tighten the Coupling Nut onto the Motor Housing.
31. Thread the Gear Case Screw (15) into the Gear Case, if it was removed, and hand tighten it with a hex wrench.
32. Clamp a large adjustable wrench in vise jaws with the adjustable opening upward.
33. Adjust the jaw of the wrench to clear the body of the Gear Case.
34. Roll the Motor in the wrench jaw until it stops against the Gear Case Grease Screw and, using a torque wrench on the flats of one Coupling Nut, tighten the Nut between 45 to 50 ft-lb (61 to 68 Nm) torque.
35. Roll the Motor in the opposite direction untill it stops against the Gear Case Grease Screw and, using a torque wrench on the flats of the second Coupling Nut, tighten the Nut between 45 to 50 ft-lb (61 to 68 Nm) torque.

Troubleshooting Guide

Trouble	Probable Cause	Solution
Motor will not operate.	Gears binding due to improper installation.	Using a hand torque wrench, turn the output shaft. The output shaft should turn freely. The 167:1 gear ratio will require the most force to turn but should not exceed 3-7 ft-lbs (4.0-9.5 N m). If an excessive amount of force is required the gearing may have been improperly installed. Disassemble and reassemble the gearing as instructed in the **Maintenance** section.
Loss of power.	Low air pressure at Motor.	Check air supply. For top performance, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet.
	Worn Vanes	Install a new set of Vanes.
	Damaged Rear End Plate Gasket.	Install a new Rear End Plate Gasket.
	Inadequate Motor lubrication.	Check air line lubricator. Refer to **Lubrication** section for lubrication specifications.
	Worn or damaged parts.	Disassemble the Motor and examine parts. Replace any worn or damaged parts.
Motor heats up.	Inadequate lubrication.	Refer to **Lubrication** section.
Gear Case Heats up.	Improper lubrication.	Refer to **Lubrication** section.
Grease leakage.	Too much grease in the Gear Case.	Refer to **Lubrication** section.

Notes:

Notes:

ingersollrandproducts.com