SM 021 A
JAN. 1999

OPERATION AND MAINTENANCE MANUAL

2202 MA SERIES AIR MOTORS
(REVERSIBLE , FLANGE MOUNTED)

MODEL	COM. NO.	FREE SPEED (rpm)	MAX. POWER (HP)	TORQUE AT MAX.POWER (ft. lbs.)	STALL TORQUE (ft. lbs.)
2202MA-320	04664744	350	0.36	10.8	20.0
2202MA-480	04664751	550	0.37	7.1	13.0
2202MA-750	04664769	850	0.37	4.6	8.3
2202MA-2000	04664777	2300	0.37	1.7	3.0
2202MA-3200	04664785	3600	0.38	1.1	2.0

⚠ WARNING

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

IMPORTANT INSTRUCTIONS

- *Always operate, inspect and maintain this tool in accordance with American National Standards Institute Safety Code for Portable Air Tools (ANSI B186.1) and any other applicable safety codes and regulations.*
- *For safety, top performance and maximum durability of parts ,operate this tool at 6.3 Kg/cm² (90 psig) maximum air pressure.*
- *Use 1/4" bore hose pipe*

⚠ WARNING

- *Always turn off the air supply and disconnect the air supply hose before installing, removing or adjusting any accessory on this tool.*
- *The use of other than genuine IR-Wadco parts may result in safety hazards, decreased tool performance and increased maintenance costs and may invalidate all warranty claims.*

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 - 0801, Fax : (615) 672 - 0801

INGERSOLL-RAND WADCO TOOLS LTD.

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

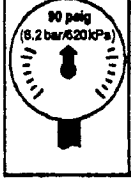
Do not carry the tool by the hose.

⚠ 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

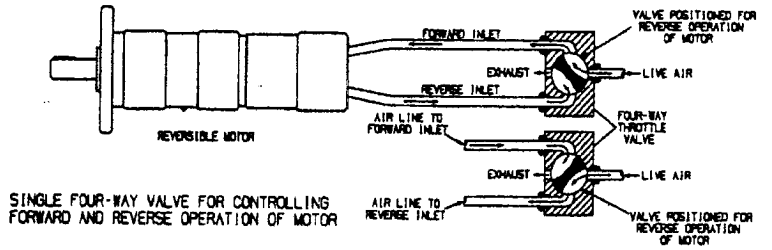
Operate at 90 psig (6.2 bar/620 kPa) Maximum air pressure.

OPERATION

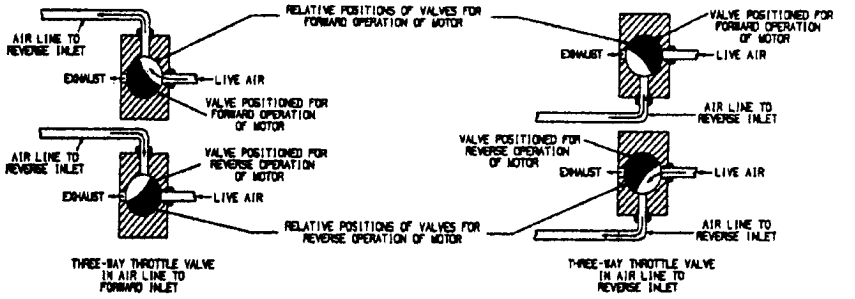
For optimum performance, the air source and supply lines must be capable of maintaining 90 psig (6.2 bar/620 kPa) air pressure at the Motor. *1/4" (6mm)* diameter or larger hose is necessary for ample air flow to each Motor.

Reversible Motors require the use of a 4–way valve, or two 3–way valves in the supply 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 diagrammed in the following illustration.



Single Four–Way Valve for Controlling Forward and Reverse Operation of Motor



Two Three–Way Valves for Controlling Forward and Reverse Operation of Motor

PLACING TOOL IN SERVICE

LUBRICATION

Oil : Ingersoll - Rand No. 10 Lubricant

Grease : Ingersoll - Rand No. 28 Lubricant

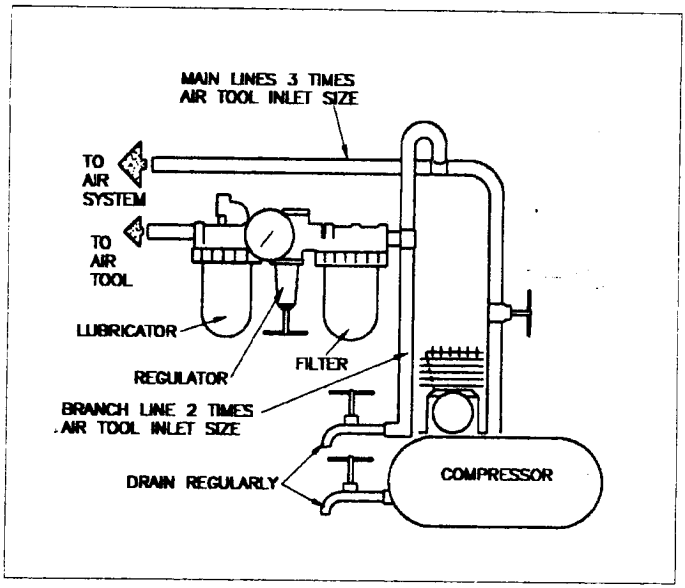
We recommend the use of an air line lubricator in the air supply line. Attach the unit as close to the tool as practical. After each forty hours of operation, or as experience indicates, introduce 1.5cc of the recommended grease. Do not grease excessively. Too much grease in the Gear Case will cause heating.

Grease leakage from the Spindle end is also an indication that an excessive amount of grease has accumulated within the Gear Box.

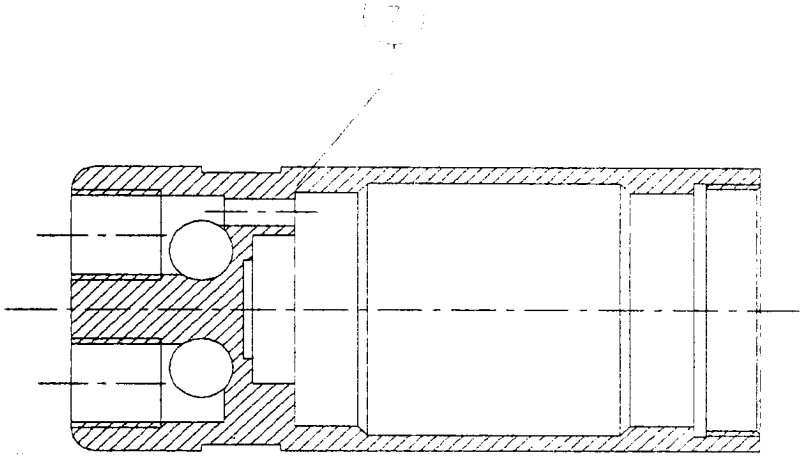
Whenever the Gear end of the Motor is disassembled, lubricate the gear train as follows :

For Single Reduction Motors (2250 & 3600 rpm), work approximately 20cc of the recommended grease into the gearing and around the Bearings and on the Spindle.

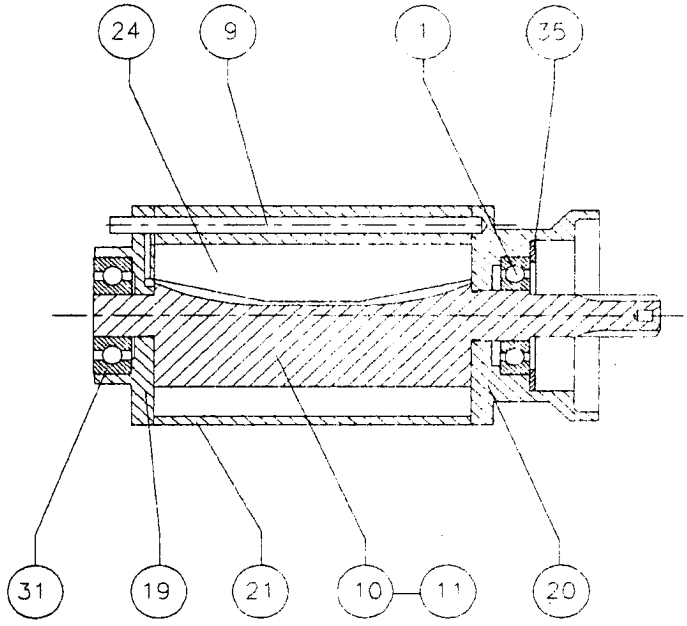
For Double Reduction Motors (360, 540 & 900 rpm), work approximately 25cc of the recommended grease into the gear train and around the Bearings and on the Spindle.



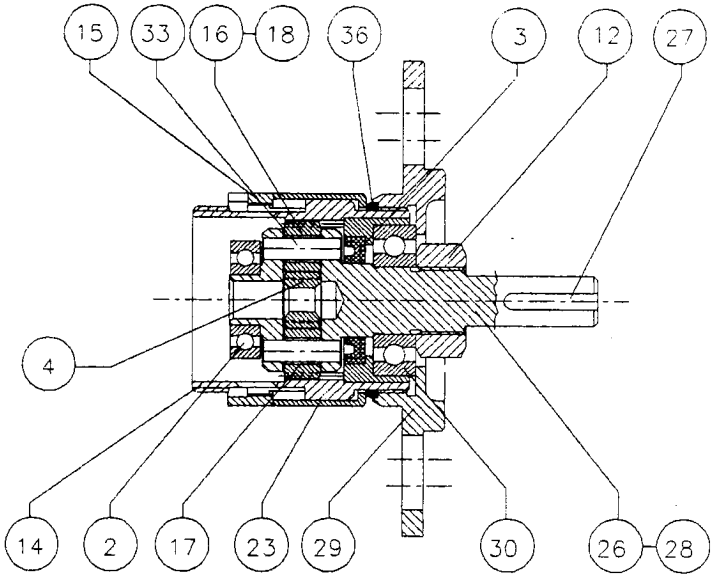
Always use an air line lubricator with this tool. A filter regulator and lubricator (FRL) unit is recommended.



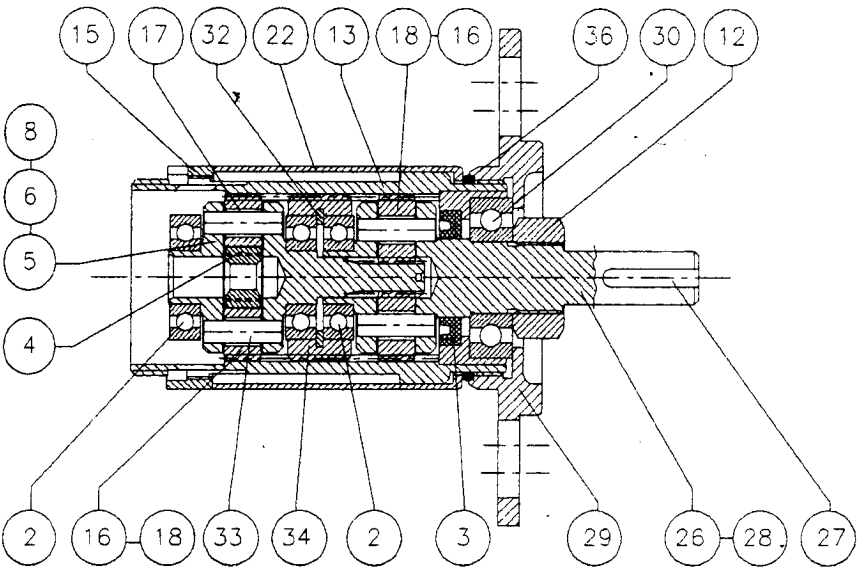
ROTOR HOUSING ASSY.



MOTOR ASSY.



GEAR BOX ASSY. (2202 MA - 2000, 3200)



GEAR BOX ASSY. (2202 MA - 320, 480, 750)

BILL OF MATERIAL

2202 MA - *

Sr.No.	DESCRIPTION	*320	*480	*760	*2000	*3200
1	BEARING	1	1	1	1	1
2	BEARING	3	3	3	1	1
3	OIL SEAL	1	1	1	1	1
4	SUN WHEEL	0	1	2	0	1
5	DRIVE SHAFT	0	1	0	0	0
6	DRIVE SHAFT	0	0	1	0	0
7	ROTOR HOUSING	1	1	1	1	1
8	DRIVE SHAFT	1	0	0	0	0
9	CYLINDER PIN	1	1	1	1	1
10	ROTOR	0	1	1	0	1
11	ROTOR	1	0	0	1	0
12	NUT	1	1	1	1	1
13	GEAR CASE	1	1	1	0	0
14	GEAR CASE	0	0	0	1	1
15	LOCK RING	1	1	1	1	1
16	IDLER GEAR (18 T)	4	2	0	2	0
17	NEEDLE ROLLER	60	60	60	30	30
18	IDLER GEAR (15 T)	0	2	4	0	2
19	UPPER CENTRE PLATE	1	1	1	1	1
20	LOWER CENTRE PLATE	1	1	1	1	1
21	CYLINDER BUSHING	1	1	1	1	1
22	MUFFLER	1	1	1	0	0
23	MUFFLER	0	0	0	1	1
24	ROTOR BLADE	5	5	5	5	5
25	NAME PLATE	1	1	1	1	1
26	SPINDLE	0	0	1	0	1
27	KEY	1	1	1	1	1
28	SPINDLE	1	1	0	1	0
29	FLANGE	1	1	1	1	1
30	BEARING	1	1	1	1	1
31	BEARING	1	1	1	1	1
32	INTERNAL CIRCLIP	1	1	1	0	0
33	IDLER GEAR PIN	4	4	4	2	2
34	BEARING CARRIER	1	1	1	0	0
35	SPACER	1	1	1	1	1
36	'O' RING	1	1	1	1	1

BILL OF MATERIAL

2202 MA - *

Sr.No.	DESCRIPTION	*320	*480	*760	*2000	*3200
1	BEARING	1	1	1	1	1
2	BEARING	3	3	3	1	1
3	OIL SEAL	1	1	1	1	1
4	SUN WHEEL	0	1	2	0	1
5	DRIVE SHAFT	0	1	0	0	0
6	DRIVE SHAFT	0	0	1	0	0
7	ROTOR HOUSING	1	1	1	1	1
8	DRIVE SHAFT	1	0	0	0	0
9	CYLINDER PIN	1	1	1	1	1
10	ROTOR	0	1	1	0	1
11	ROTOR	1	0	0	1	0
12	NUT	1	1	1	1	1
13	GEAR CASE	1	1	1	0	0
14	GEAR CASE	0	0	0	1	1
15	LOCK RING	1	1	1	1	1
16	IDLER GEAR (18 T)	4	2	0	2	0
17	NEEDLE ROLLER	60	60	60	30	30
18	IDLER GEAR (15 T)	0	2	4	0	2
19	UPPER CENTRE PLATE	1	1	1	1	1
20	LOWER CENTRE PLATE	1	1	1	1	1
21	CYLINDER BUSHING	1	1	1	1	1
22	MUFFLER	1	1	1	0	0
23	MUFFLER	0	0	0	1	1
24	ROTOR BLADE	5	5	5	5	5
25	NAME PLATE	1	1	1	1	1
26	SPINDLE	0	0	1	0	1
27	KEY	1	1	1	1	1
28	SPINDLE	1	1	0	1	0
29	FLANGE	1	1	1	1	1
30	BEARING	1	1	1	1	1
31	BEARING	1	1	1	1	1
32	INTERNAL CIRCLIP	1	1	1	0	0
33	IDLER GEAR PIN	4	4	4	2	2
34	BEARING CARRIER	1	1	1	0	0
35	SPACER	1	1	1	1	1
36	'O' RING	1	1	1	1	1

MINOR TUNE - UP KIT
FOR 2202 MA SERIES
AIR MOTORS
P/NO. TK 1011

Sr. NO.	Part Name	Qty
3	Oil Seal	1
24	Rotor Blade	5
27	Key	1
36	'O' Ring	1

MAJOR TUNE - UP KIT
FOR 2202 MA SERIES
AIR MOTORS

Sr. NO.	Part Name	Quantity reqd. for each Models of 2202 MA Series				
		320	480	750	2000	3200
1	Bearing	1	1	1	1	1
2	Bearing	3	3	3	1	1
3	Oil Seal	2	2	2	2	2
4	Sun Wheel	–	1	2	--	1
16	Idler gear (18 T)	4	2	--	2	–
17	Needle Roller	60	60	60	30	30
18	Idler Gear (15T)	–	2	4	--	2
24	Rotor Blade	10	10	10	10	10
27	Key	2	2	2	2	2
30	Bearing	1	1	1	1	1
31	Bearing	1	1	1	1	1
32	Internal Circlip	1	1	1	--	–
33	Idler Gear Pin	4	4	4	2	2
35	Spacer	1	1	1	1	1
36	'O' Ring	2	2	2	2	2
Major Tune - Up Kit P/N		TK5052	TK5053	TK5054	TK5055	TK5056

DISASSEMBLY

General Instructions

⚠ WARNING

1. Always disconnect the air supply before doing any maintenance.
2. Always use protective eye wear when performing maintenance on a tool or when operating a tool.
3. Do not disassemble the tool any further than necessary to replace or repair damaged parts.
4. Do not disassemble the Motor unless you have a complete set of new gaskets and ' O ' rings for replacement.
5. Do not remove any part which is a press fit in or on a subassembly unless the removal of that part is necessary for repair or replacement.
6. Whenever grasping a tool or part in a vice, always use leather - covered or copper - covered vice jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded members and housings.
7. The modular construction of 22 series motors permits selective disassembly whereby gearing can be separated from the power unit and disassembled without removing the motor from the Rotor Housing, or the motor can be removed and disassembled without removing the gear train from the gear chambers. This is especially true for the high torque ratios ie, double and triple reduction motors. Because of the modular construction, the steps in the following disassembly procedures can be sequentially changed to meet the particular situation.

Disassembly of Gear Box

A. For Single Reduction Models (2000 & 3200 rpm models).

1. Unthread Flange (29) (Left hand thread)
2. Take out ' O ' Ring (36) and Muffler (23).
3. Holding the Spindle (26 / 28) stationary using a Spanner over the Key (27), remove the Nut (12) with a Spanner 19 mm A/F.
4. Slide the Lock Ring (15) on to the Gear Case (14) so that it gets disengaged from the Rotor Housing (7).
5. Use a Spanner 36 mm A/F to loosen the Gear Case (14) from the Rotor Housing . The Motor assembly will also come out along with the Gear Case Assembly.
6. Hold the Gear Case (14) in a vice.
7. Tap end of Spindle (26 / 28) using a soft hammer. The Spindle Assembly along with the Motor Assembly will come out.
8. Lightly grasp the shaft portion of the Spindle in Copper - covered vice jaws.
9. Pull the Motor Assembly, so that Spindle Assembly gets separated from it.
10. Hammer out the Idler Gear Pins (33) from the Spindle so that Idler Gear (16 /18), Sun Wheel (4) and Needle Rollers (17) can be taken out.

B. For Double Reduction Models (320, 480 & 750 rpm models).

1. Hold the tool in a vice clamping it on the Rotor Housing (7).
2. Loosen the Flange (29) (Left hand thread).

3. Take out 'O' Ring (36) and Muffler (22).
4. Holding the Spindle (26 / 28) stationary using a Spanner over the Key (27), remove the Nut (12) with a Spanner 19 mm A/F.
5. Slide the Lock Ring (15) onto the Gear Case (13) so that it gets disengaged from the Rotor Housing (7)
6. Use a Spanner 36 mm A/F to loosen the Gear Case (13) from the Rotor Housing. The Motor assembly will also come out along with the Gear Case Assembly.
7. Tap end of Spindle (26 / 28) using a soft hammer. The Spindle Assembly, Bearing Carrier Assy., Drive Shaft Assy. and Motor Assy. will come out.
8. Using a wedge shaped tool and hammer, seperate the above assemblies.
9. Hammer out the Idler Gear Pin (33) from the Spindle (26 / 28) and Drive Shafts (5 / 6 / 8), so that Idler Gears (16 / 18) and Needle Rollers (17) can be taken out.
10. If any of the Bearing needs to be replaced, take it out from the assembly.

Disassembly of the Motor

1. Tap drive end of Rotor (10 / 11) with a soft hammer, motor will come apart.
2. If the Upper Centre Plate bearing (31) needs to be replaced, press it out from the Upper Centre Plate (19).
3. Remove the Cylinder Pin (9).
4. Lift off the Cylinder Bushing (21).
5. Remove the Rotor Blades (24).
6. If the Lower Centre Plate Bearing (1) needs to be replaced, press it out from Lower Centre Plate (20).

ASSEMBLY

General Instructions

⚠ WARNING

1. Always use protective eye wear when performing maintenance on a tool or operating a tool.
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. Check every bearing for roughness. If an open bearing must be cleaned, wash it thoroughly in clean solvent and dry with a clean cloth. Work grease thoroughly into every open bearing before installation. Sealed or shielded bearings should never be cleaned.
5. Except for bearings, always clean every part and wipe every part with a thin film of oil before installation.

6. When grasping a Motor or one of its parts in a vice, always use leather or copper vice jaw covers to protect the surface of the part and reduce the likelyhood of damage. This is particularly important when clamping threaded members, shafts with splines etc.
7. Apply ' O ' Ring lubricant to each ' O ' Ring before assembly.

Assembly of Motor & Housing

1. Press the Upper Centre Plate (19) and the Bearing (31) onto the Rotor Shaft.
2. Replace the Cylinder Pin (9) into the Cylinder Bushing (21).
3. Place the Cylinder Bushing (21) over the Rotor (10 / 11), aligning the Cylinder Pin (9) in the Cylinder Bushing (21) with the dowel hole in the Upper Centre Plate (19).
4. Apply a film of light oil to each Rotor Blade (24) and insert a Rotor Blade, straight edge out, into each vane slot in the Rotor (10 / 11). If new Rotor Blades are required, replace the entire set.
5. Grasp shoulder of Upper Centre Plate (19) in a vice having leather covered jaw.
6. Check the Lower Centre Plate (20) for wear. If there is excessive wear replace with a new one.
7. Press the Lower Centre Plate (20) and Bearing (1) onto the Rotor Shaft aligning the Cylinder Pin (9) in the Cylinder Bushing (21) with the dowel hole in the Lower Centre Plate (20).
8. Replace Spacer (35) next to Lower Centre Plate Bearing (1).
9. Hold Rotor Housing (7) in a vice so that the open side is at the top.
10. Insert the Motor Assembly into the Rotor Housing aligning the Cylinder Pin in the Upper Centre Plate (19) and the blind hole in the Rotor Housing.

Assembly of Gear Box

1. Stick 15 nos. of Needle Rollers (17) into the inner diameter of the Idler Gear (16 / 18) using grease.
2. Place the shoulder of the Drive Shaft (5 / 6 / 8) / Spindle (26 / 28) on the vice jaws.
3. Place the Idler Gear (16 / 18) with Needle Rollers (17) inside the slot of the Drive Shaft (5 / 6 / 8) / Spindle (26 / 28).

IMP :- In models where Sun Wheels (4) are to be used introduce it before assembly of Idler Gears.

4. Press the Idler Gear Pin (33) inside.

A. For Single Reduction Models (2000 & 3200 rpm models).

1. Assemble Oil Seal (3) inside the Gear Case (14) so that the concave face faces the splined portion of Gear Case.
2. Insert the Spindle Assembly from inside the Gear Case (14) keyed end first.

3. Support the keyed end of the Spindle (26 / 28). Lubricate Bearing (30) with the recommended grease. Install it in the recess in the Gear Case pressing the outer race of bearing.
4. Holding the Spindle (26 / 28) from rotating tighten the nut with Spanner 19 mm A/F.
5. Lubricate Bearing (2) with recommended grease. Install it on the Spindle (26 / 28) pressing the inner race of the bearing.
6. Hold the Rotor Housing Assembly on the A/F in a vice.
7. Replace the Lock Ring (15) over the Gear Case (14).
8. Tighten the Gear Case Assembly using a Spanner 36mm A/F on to the Rotor Housing Assembly. When it is almost fully tight slide the Lock Ring (15) so that it's teeth gets engaged with the slots of the Rotor Housing (7).
9. Assemble the Muffler (23) with the large diameter end going first.
10. Coat ' O ' Ring lubricant over the ' O ' Ring (36) and install it in the groove on the Gear Case (14).
11. Tighten the Flange (29) on to the Gear Case (14) (Left hand thread).

B. For Double Reduction Models (320, 480 & 750 rpm models).

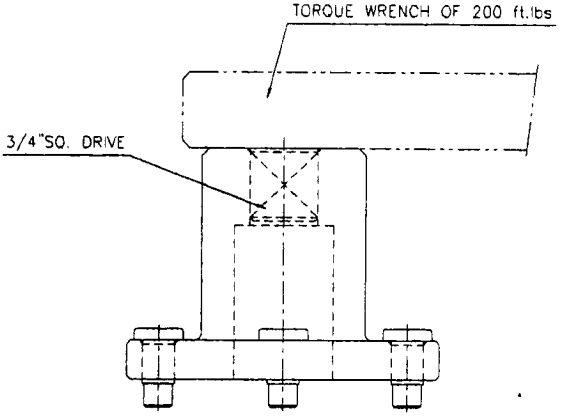
1. Install Internal Circlip (32) inside the Bearing Carrier (34) using Circlip pliers.
2. Lubricate Bearings (2) with the recommended grease and install in the Bearing Carrier (34).
3. Assemble Oil Seal (3) inside the Gear Case (13) so that the concave face is facing the wide mouthed end of insert.
4. Insert the unkeyed end of Spindle (26 / 28) into the Bearing Carrier Assembly.
5. Press the Drive Shaft Assembly into the Bearing (2) of the Bearing Carrier Assembly from it's other side.
6. Coat inside of Gear Case (13) with the recommended grease.
7. Insert the whole Assembly from inside the Gear Case (13) keyed end of Spindle first.
8. Lubricate Bearing (30) with the recommended grease. Support other end of Spindle (26 / 28) from inside the Gear Case. Install Bearing (30) in the recess in the Gear Case (13) pressing it on the outer race.
9. Holding the Spindle (26 / 28) from rotating tighten the nut with Spanner 19 mm A/F.
10. Lubricate Bearing (2) with recommended grease. Install it on the Drive Shaft (5 / 6 / 8) pressing the inner race of the bearing.
11. Hold the Rotor Housing Assembly on the A/ F in a vice.
12. Replace the Lock Ring (15) over the Gear Case (13).
13. Tighten the Gear Case Assembly using a Spanner 36 mm A/F on to the Rotor Housing Assembly. When it is almost fully tight slide the Lock Ring (15) so that it's teeth gets engaged with the slots of the Rotor Housing (7).
14. Assemble the Muffler (22) with the large diameter end going first.
15. Coat 'O' Ring lubricant over the 'O' Ring (36) and install it in the groove on the Gear Case (13).
16. Tighten the Flange (29) on to the Gear Case (13) (Left hand thread). For torque value and other details refer page no. 14.

TROUBLE SHOOTING GUIDE

Trouble	Probable Cause	Solution
Motor will not operate	Rotor shaft and idler gears binding due to improper installation	Using an allen key, turn the output shaft. If the force to be applied is very great considering the gear ratio, the gearing is improperly installed and must be reassembled. See Paragraphs .for assembly of the gearing
	Spline in shaft of drive shaft and idler gears binding due to improper installation	Solution same as above
Loss of power	Low air pressure at motor	Check air supply. For top performance, the air pressure, must be 90 psig (6.3 Kg/cm^2)at the inlet
	Worn Vanes	Install a new Set of Vanes
	Inadequate motor lubrication	Check air line lubricator. Refer page 3 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 on Page 3
Gear Box heat up beyond normal increase	Improper lubrication	Refer to Lubrication Section on Page 3
Grease leakage	Too much grease in the gear box	Refer to Lubrication Section on Page 3

Special Note :

Flanges (29) of all reversible models are to be tightened to about double the stall torque value of the respective air motors. This can be done using a torque wrench of 3/4" SQ DRIVE - 200 ft. lbs capacity and a Coupling (M2360). This arrangement is shown diagramatically in the following sketch.



M 2360