

SLEW motor

# **SERVICE MANUAL**

## **M 31**

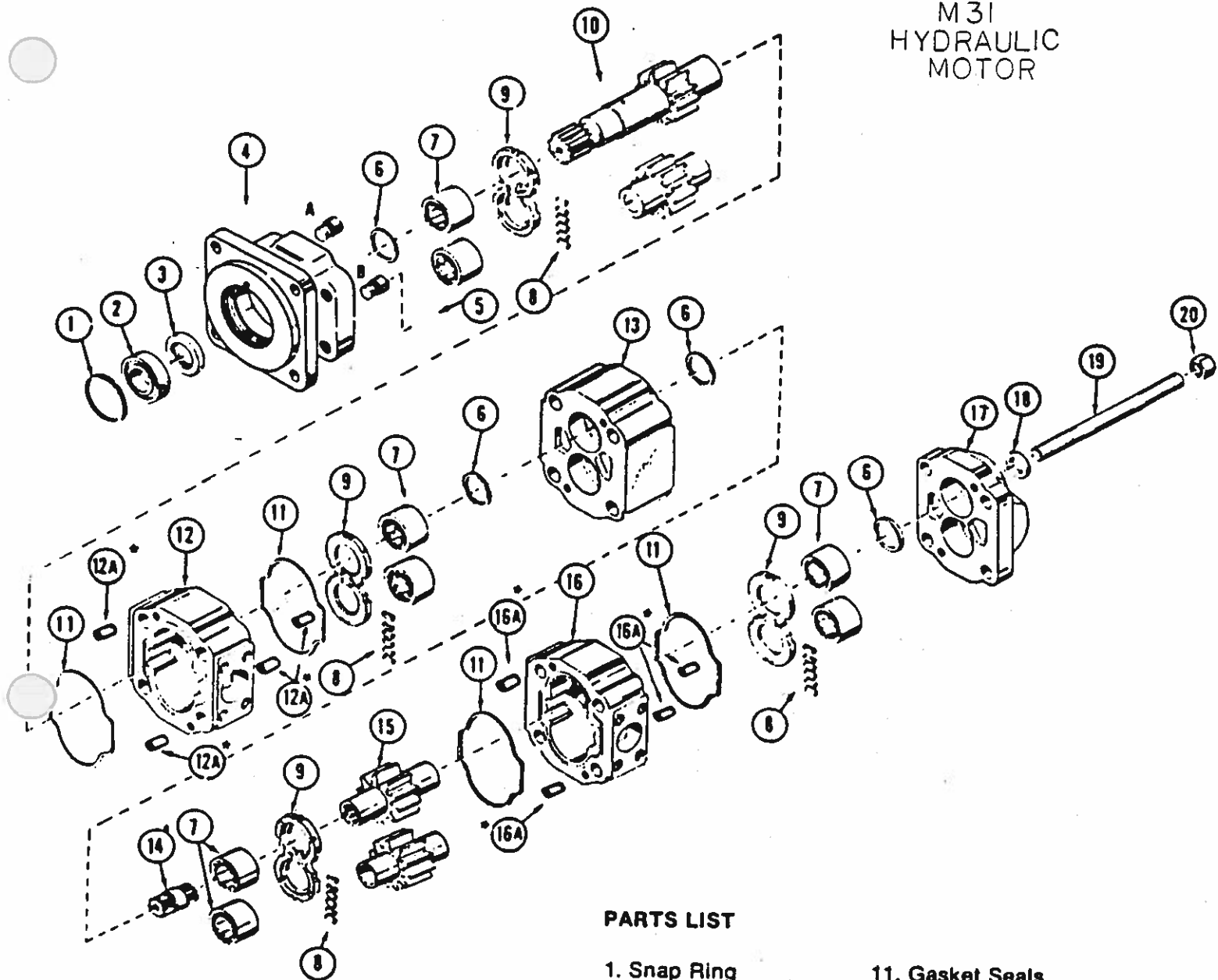
single motor

12856



***COMMERCIAL SHEARING, INC.***  
**Use Genuine Commercial Replacement Parts**

# M31 HYDRAULIC MOTOR



SEAL KIT ARVA 13011

## PARTS LIST

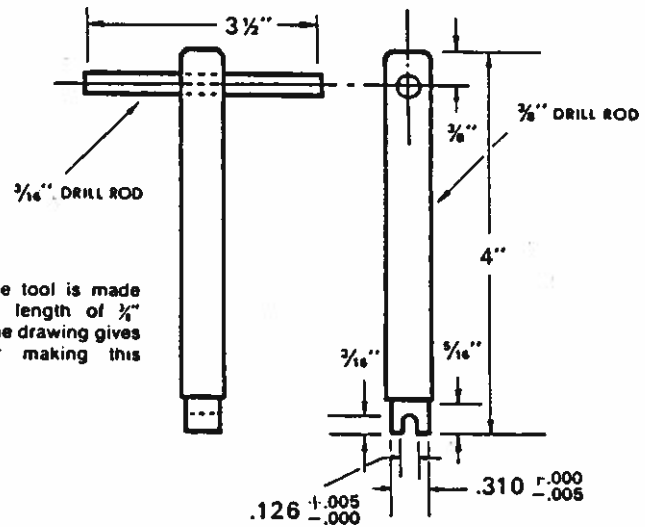
- |                                       |                                  |
|---------------------------------------|----------------------------------|
| 1. Snap Ring                          | 11. Gasket Seals                 |
| 2. Outboard Bearing                   | 12. Gear Housing                 |
| 3. Seal                               | * 12A. Dowel Pins (P31/P51 only) |
| 4. Shaft End Cover                    | 13. Bearing Carrier              |
| 5. Check Assemblies or Plug           | 14. Connecting Shaft             |
| 6. Ring Seals                         | 15. Matched Gear Set             |
| 7. Roller Bearings                    | 16. Gear Housing                 |
| 8. Pocket Seals                       | * 16A. Dowel Pins (P31/P51 only) |
| 9. Thrust Plates                      | 17. Port End Cover               |
| 10. Integral Drive Shaft and Gear Set | 18. Washers                      |
|                                       | 19. Studs or Cap Screws          |
|                                       | 20. Nuts                         |

PART NO. REQUIRED - M31A - 942 - BE - OF15 - 25

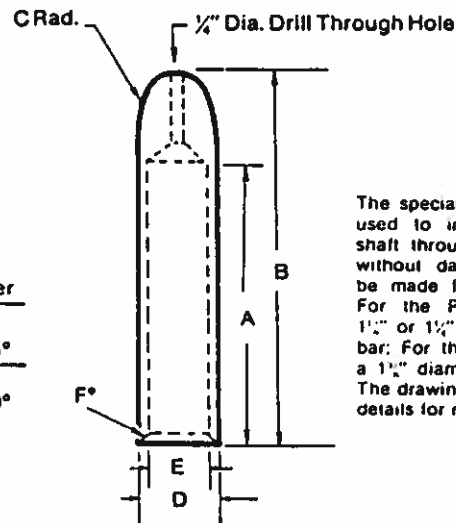
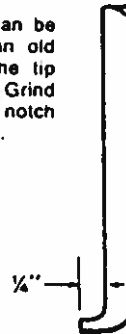
ARVA CRANE # 12856

# tool list

- Arbor Press
- Awl
- 1½" Dia. Steel Ball
- Bearing Puller (Owatonna Tool Co. MD-956 or equivalent)
- Clean Lintless Cloths
- Deburring Tool (an old file with the cutting teeth ground off)
- Machinist's Hammer
- Soft Hammer
- Permatex Aviation Form-A-Gasket No. 3 Non-hardening Sealant or Equivalent
- Medium Grit Carborundum Stone
- Oil and Grease
- Snap Ring Pliers
- Prick Punch
- Sharp Razor Blade
- Scale (½" or ¼" graduations)
- Small Screwdriver
- Torque Wrench
- Vise with 6" Minimum Open Spread
- Bar for Lip Seal Installation  
Note: For P30/P31, use 1½" dia. by 2" bar.  
For P50/P51, use 2½" dia. by 2" bar.
- Special Steel Sleeve



Seal removal tool can be easily made from an old screwdriver. Heat the tip and bend as shown. Grind off the tip to fit the notch behind the shaft seal.



The special steel sleeve is used to insert the drive shaft through the lip seal without damage and can be made from bar stock: For the P30/P31, use a 1½" or 1¼" diameter x 4½" bar; For the P50/P51, use a 1½" diameter x 5½" bar. The drawing and chart give details for making this tool.

|         | A   | B   | C  | D Dia.                                  | E Dia.                                  | F° chamfer  |
|---------|-----|-----|----|---|---|-------------|
| P30/P31 | 3½" | 4½" | ¾" | 1.065 <sup>+.000</sup> <sub>-.002</sub> | 1.002 <sup>+.002</sup> <sub>-.000</sub> | .015" x 45° |
| P50/P51 | 4¼" | 5½" | ¾" | 1.290 <sup>+.000</sup> <sub>-.002</sub> | 1.250 <sup>+.002</sup> <sub>-.000</sub> | .015" x 60° |

All external surfaces must be free of scratches and burrs.

# disassembly

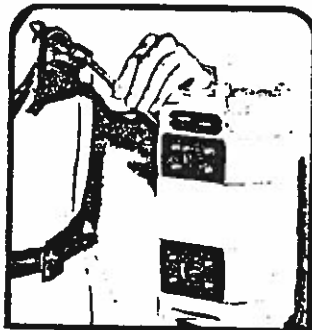
## CAUTION:

1. If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in misalignment and seriously damage parts.

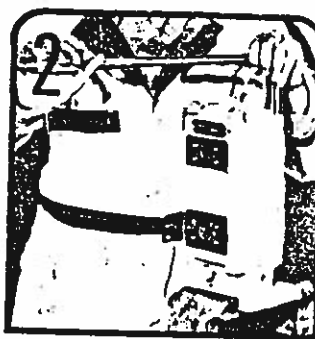
2. If parts are stubborn during assembly, do not force them and never employ an iron hammer.

3. Gears are closely matched, therefore they must be kept together as sets when removed from a unit. Handle with care to avoid damage to the journals or teeth.

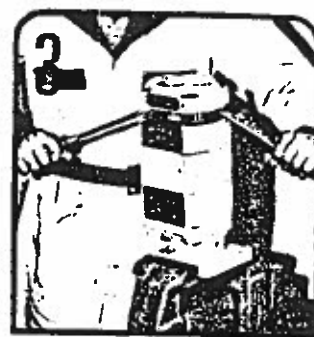
4. Never hammer roller bearings into bores. Use only an arbor press or other suitable tool.



Mount the pump in a vise with the shaft pointing down. Index mark all sections with a punch. Be sure to align these marks when reassembling.

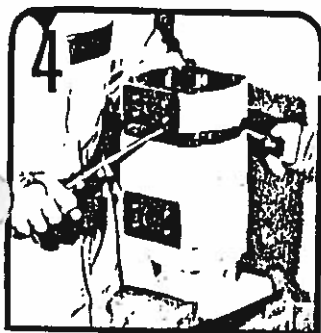


Remove the 4 cap screws on single units or the 4 hex nuts, studs, and washers on multiple units with a socket wrench.



Lift off the port end cover. If necessary to pry loose, refer to caution note.

If the thrust plate remains in the gear housing, it can be tapped out later with a wooden hammer handle. Be careful not to distort the thrust plate.



Lift the gear housing from the gears. Take care not to damage machined surfaces.

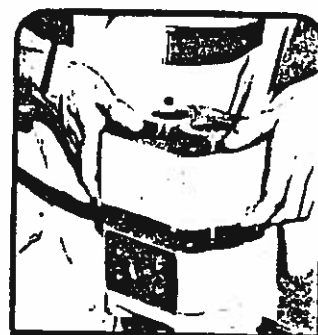
For P31/P51 — Pry the gear housing from the gears and off the dowels from opposite sides taking care not to damage machined surfaces.



Carefully remove the drive and driven gears, not letting the teeth come into rough handling contact. Keep these gears together because they are a matched set. Examine and replace if necessary. See below.\*



Remove the drive gear connecting shaft.



Lift or pry off the bearing carrier carefully to prevent damage to contact face and edges.

For P31/P51, pry the bearing carrier off the dowels from opposite sides. Take care not to damage the machined surfaces. Lift off the bearing carrier.



Lift or pry off the first section gear housing. Be careful not to damage machined surfaces. If the thrust plate remains in the gear housing, remove as described in Step 3.

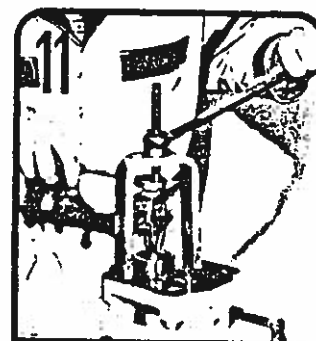
For P31/P51, pry loose the first gear housing section. Be careful not to damage machined surfaces.



Remove the driven gear and the integral gear and drive shaft. Keep these together as they are a matched set. Examine and replace if necessary. See below.\* Be careful not to damage the machined surfaces of the gears.



Pry the thrust plates from the shaft end cover, port end cover, or bearing carrier with a screwdriver or similar tool. Avoid distorting the thrust plates. Visually inspect thrust plates for wear or damage. Replace if necessary. See below.\* Remove and discard all rubber pocket seals and gasket seals.



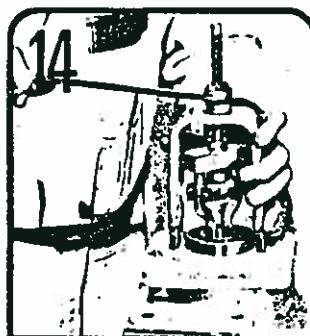
Examine all roller bearings for scoring, spalling, or pitting. If replacement is necessary, remove the bearings with a bearing puller.



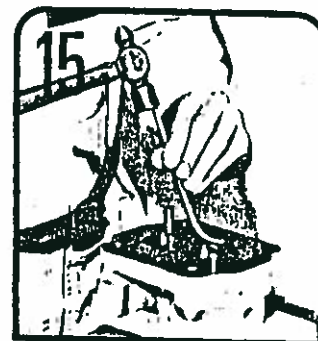
It is generally advisable to replace ring seals when rebuilding unit. To replace, remove the drive gear bearing with a bearing puller and remove ring seal from the bottom of bearing bore.



If the pump is equipped with an outboard bearing, place the shaft and cover in a vise with the mounting face up. Remove the bearing snap ring with a small screwdriver or awl.



Use a bearing puller to remove the outboard bearing.



Grip the shaft and cover in a vise with the mounting face down. Remove double lip seal by inserting the special seal removal tool (see Tool List) into the notch between the double lip seal and the shaft end cover. Tap the seal out and discard.

## assembly



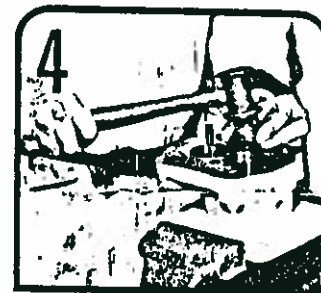
Stone off all machined surfaces with a medium grit carborundum stone.



If bearings have been removed, deburr bearing bores. Rinse parts in a solvent. Air blast all parts and wipe with a clean lintless cloth before starting assembly.



Grip shaft and cover in vise with mounting face down. Examine plug or 2 check valves to be sure they're tightly in place. Replacement is necessary only if parts are damaged. Remove with screwdriver or special check valve tool (see Tool List).



If plug or check valves are being replaced, screw in new parts tightly. Stake plug with prick punch at both ends of screwdriver slot and around edges. Screw check valves in tightly with tool. Peen edge of hole  $\frac{1}{16}$ " to  $\frac{1}{8}$ " with  $\frac{1}{16}$ " diameter steel ball.



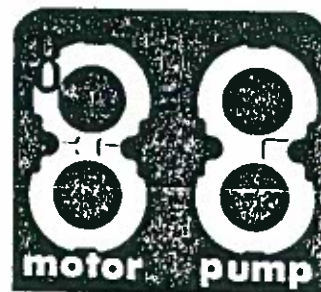
**ASSEMBLY STEPS 5, 6, 7, 9 AND 11 APPLY TO SHAFT END COVER, BEARING CARRIERS, AND PORT END COVER.**  
If ring seals are being replaced, insert into bottom of drive gear bearing bore. The notch in the ring seal **MUST BE VISIBLE**. This is a check to be certain the notched side is next to the bearing.



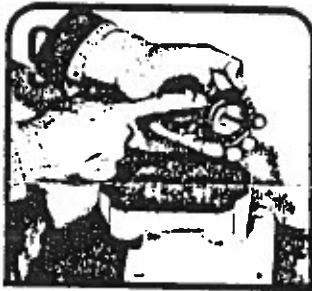
If any bearings have been removed from the shaft end cover, port end cover, or bearing carrier, replace the bearings by pressing them into the bearing bore with an arbor press.



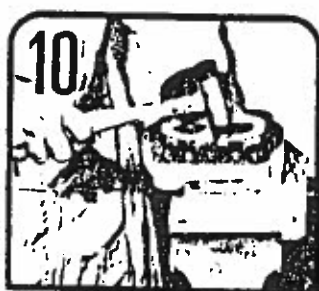
Before inserting a new lip seal in the shaft end cover, coat the outer edge of the lip seal and its recess with Permatex Aviation Form-A-Gasket No. 3 Non-Hardening Sealant or equivalent. With the metal side of the lip seal up, press it into the mounting flange side of the shaft end cover with an arbor press and bar (see Tool List). On the P30/P31 series, make certain lip seal is fully seated in the recess. On the P50/P51 series, do not attempt to bottom-out seal, press in only until it is flush with the face of the recess. Wipe off surplus sealant.



**31/51 SERIES ONLY**  
Check all thrust plates for wear. Replace if necessary (see below). Note that the thrust plates for pumps and motors are different. Pump thrust plates have a single relief pocket and must be installed with this groove on the high pressure side. Motor thrust plates are grooved on both sides.  
For P31/P51, the relief groove on all the unidirectional thrust plates must be towards the high pressure (outlet) side of the pump.  
30/50 series pump and motor plates resemble the motor plate illustration.



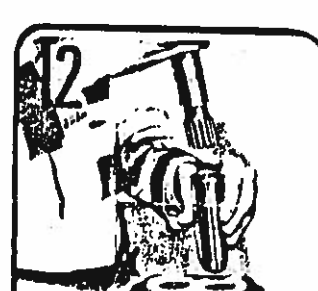
Grip the shaft end cover in a vise with the mounting face down. Cut 2 pocket seals  $\frac{1}{2}$ " long from the pocket seal strip. Grease these pocket seals well and insert them into the middle slots on the reverse side of the thrust plate.



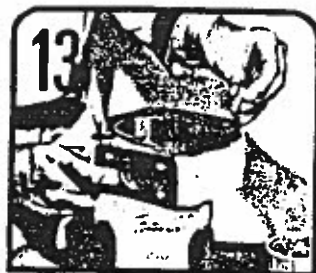
With the pocket seals facing down, place the thrust plate over the bearings in the shaft end cover. Tap thrust plate with a soft hammer to about  $\frac{1}{2}$ " from the machined surface.



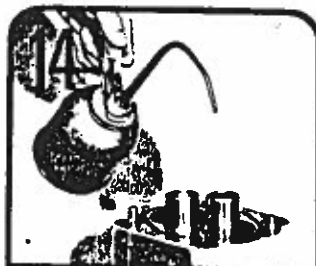
Cut 4 pocket seals approximately  $\frac{1}{2}$ " long from the pocket seal strip. Insert one pocket seal into each of the slots in the thrust plate. Push each pocket seal all the way in so that it touches the roller bearings. Tap the thrust plate down firmly against the machined surface with a soft hammer. Use a sharp razor blade to trim exposed end of the pocket seal square and flush with the thrust plate.



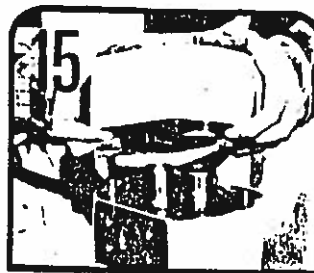
Insert the splined end of the drive shaft into the special steel sleeve (see Tool List). Lightly grease the drive shaft and sleeve. Insert the integral gear and drive shaft with sleeve into the shaft and cover with a twisting motion. Be careful not to damage the double lip seal. Push down carefully until the gear rests against the thrust plate. Remove the steel sleeve. Insert the driven gear.



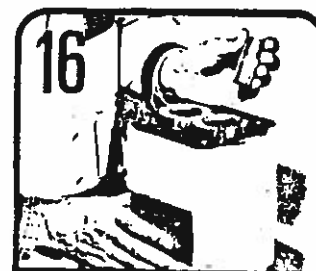
Grease the new gasket seals and insert them into the grooves in both sides of all gear housings.  
For P31/P51—Examine all dowel pins. See below. Before inserting a pin, make certain the hole is clean and free from burrs. Start pin into hole gently and straight, tapping lightly with a soft hammer.



Slide the first section gear housing over the gears and tap it with a soft hammer until it rests tightly against the shaft end cover.  
Be careful not to pinch the gasket seal. Squirt oil over the gears to provide initial lubrication when pump is started.  
For P31/P51—Line up the dowels with the matching holes. When parts are parallel, squeeze them together or gently tap alternately over dowels with a plastic hammer until the parts become parallel and move smoothly together. Do not force.



With the thrust plates mounted on the bearing carrier (as in steps 9, 10, 11), position it on the gear housing so that the roller bearings receive the journals of the drive and driven gears. Make sure that the drain port in the bearing carrier is on the suction or inlet side if the unit is being built as a pump. (Motors do not have drain ports in the bearing carrier.) Make sure that the index marks are properly aligned.  
Insert dowel pins (P31/P51 only).



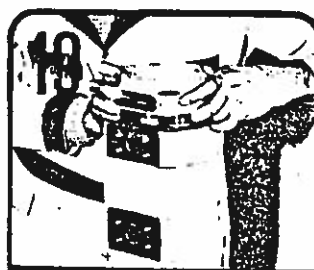
Insert the connecting shaft in the spline of the drive gear.



Insert the drive and driven gears of the second section in their respective bearings. Make certain gears are in contact with thrust plate face.



Slide the second section gear housing over the gears and tap it light against the bearing carrier with a soft hammer. Be careful not to pinch the gasket seal. Squirt oil over the gears to provide initial lubrication when pump is started.  
For P31/P51 line up the dowels and the holes in the 2 castings. When parts are parallel, squeeze them together or gently tap alternately over the dowels with a plastic hammer until parts move smoothly together. Do not force.  
Insert dowel pins (P31/P51 only).



Place the port end cover over the gear journals and tap lightly against the gear housing. Be careful not to pinch the gasket seal.

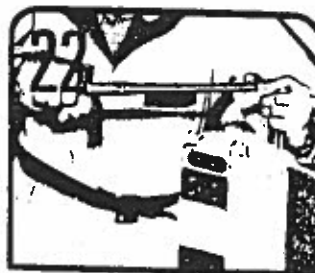
For P31/P51—Align the dowels with the holes in the mating casting. Be careful not to pinch the gasket seal. Tap the port end cover lightly in the center between bearing bores to engage the dowels and to move parts together in final seating.



Thread the 4 fasteners (cap screws and washers, or studs, washers, and nuts) into the shaft end cover and tighten alternately or cross-corner. Rotate the drive shaft with a 6" wrench to make certain there is no binding in the pump.



If the unit is equipped with an outboard bearing, guide the bearing into its recess in the shaft and cover. This is not a press fit. Insert the snap ring into its groove to retain the outboard bearing.



After the fasteners are tight and you are sure there is no internal binding, torque the diagonally opposite fasteners to 200 ft. lbs. (2400 in. lbs.).

## Lubrication and oil recommendations

All parts, with the exception of the outboard bearing, are lubricated by the hydraulic oil in the circuit. Particular attention must be paid to keep the oil in the circuit system clean. Whenever there is a pump or motor failure, and there is reason to feel that metal particles may be in the system, the oil must be drained, the entire system flushed clean, and any filter screens thoroughly cleaned or replaced. New oil should be supplied for the entire system. Oil suitable and recommended for use in circuits involving Commercial's pumps and motors should meet the following specifications:

- Viscosity:**
- 50 SSU minimum @ operating temperature
  - 7500 SSU maximum @ starting temperature
  - 150 to 225 SSU @ 100°F. (37.8°C.) (generally)
  - 44 to 48 SSU @ 210°F. (98.9°C.) (generally)

| Oil Grade | Approximate SSU at . . |                     |
|-----------|------------------------|---------------------|
|           | 100°F.<br>(37.8°C.)    | 210°F.<br>(98.9°C.) |
| SAE 10    | 150                    | 43                  |
| SAE 20    | 330                    | 51                  |

**Viscosity Index:** .90 minimum

**Aniline Point:** +175°F (80°C) minimum.

**Recommended Additives:** Foam Depressant  
Rust and Oxidation Inhibitors

### Other Desirable Characteristics:

- Stability of physical and chemical characteristics.
- High demulsibility (low emulsibility) for separation of water, air, and contaminants.
- Resistant to the formation of gums, sludges, acids, tars, and varnishes.
- High lubricity and film strength.

### General Recommendations:

A good quality hydraulic oil conforming to the characteristics listed above is essential to satisfactory performance and long life of any hydraulic system.

Oil should be changed on regular schedules in accordance with the manufacturer's recommendations, and the system periodically flushed.

Oil temperature in reservoir must not exceed 200°F. (93.3°C) with a maximum temperature of 180°F. (82.2°C.) recommended. Higher temperatures will result in rapid oil deterioration.

Reservoir capacity should equal in gallons the pump output in gpm or the total gpm of all pumps where there is more than one in the system.

Oil poured into the reservoir should pass through a 100 mesh screen. Pour only clean oil from clean containers into the reservoir. A 100 mesh screen may be used in the suction line leading to the pump. A suction filter should be of sufficient size to handle twice the pump capacity. It must be cleaned and checked regularly to avoid damage due to contamination and cavitation.

### **Normal Temperatures:**

0°F. (−18°C.) to 100°F. (37.8°C.) Ambient  
100°F. (37.8°C.) to 180°F. (82.2°C.) System

Be sure your oil is recommended for the temperatures you expect to encounter.

### **Cold Weather Operation**

Oils for use in cold weather should have a viscosity not exceeding 7500 SSU at the minimum start-up temperature. A pour point of at least 20°F. below start-up temperature is recommended. Start-up procedures should allow for a gradual warm-up until the oil reaches a reasonably fluid state.

### **The Use of Other Oils**

• Automatic Transmission Fluid (ATF): General experience here has been satisfactory; however, ATF oils are sometimes too expensive for normal use in hydraulic systems.

• Diesel Fuel or Kerosene (Coal Oil): Sometimes used as dilutants for cold weather operations but are not recommended as they are not sufficiently refined products.

• Fire Resistant Fluids: Of the several different types, only the inverted emulsion types may be used without changing to special seal, packing, gasket, hose, etc., compositions. Their use may materially reduce pump life. Experience indicates that the use of FR fluids can be disastrous unless certain precautions are followed. **DO NOT USE ANY FIRE RESISTANT FLUIDS OR NON-PETROLEUM OILS WITHOUT CONSULTING OUR TECHNICAL SERVICE DEPARTMENT.**

• These suggestions are intended as a guide only. **OBTAIN YOUR FINAL OIL RECOMMENDATIONS FROM YOUR OIL SUPPLIER.**

## **recommended start-up procedure for new or rebuilt pump or motor**

Before installing a new or rebuilt pump or motor, back off the main relief valve until the spring tension on the adjusting screw is relieved. This will avoid the possibility of immediate damage to the replacement unit in the event that the relief valve setting had been increased beyond the recommended operating pressure prior to removing the old unit.

Before connecting any lines to the pump or motor, fill all ports with clean oil to provide initial lubrication. This is particularly important where the unit is located above the oil reservoir.

After connecting the lines and mounting the replacement unit, operate the pump or motor at least two minutes at zero pressure at lowest possible rpm. During this break-in period, the unit should run free and not develop an excessive amount of heat. If the unit operates properly, speed and pressure can then be increased to normal operating settings.

Reset the main relief valve to its proper setting while the pump is running at maximum operating engine (motor) speed for the vehicle.

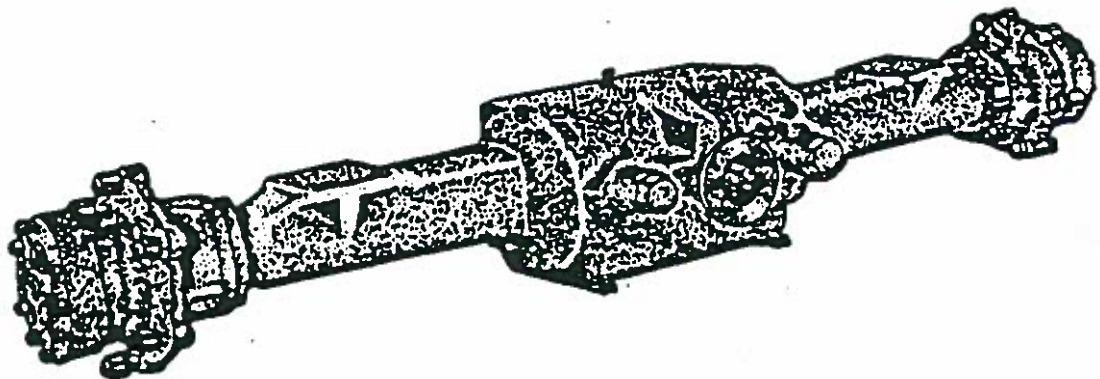
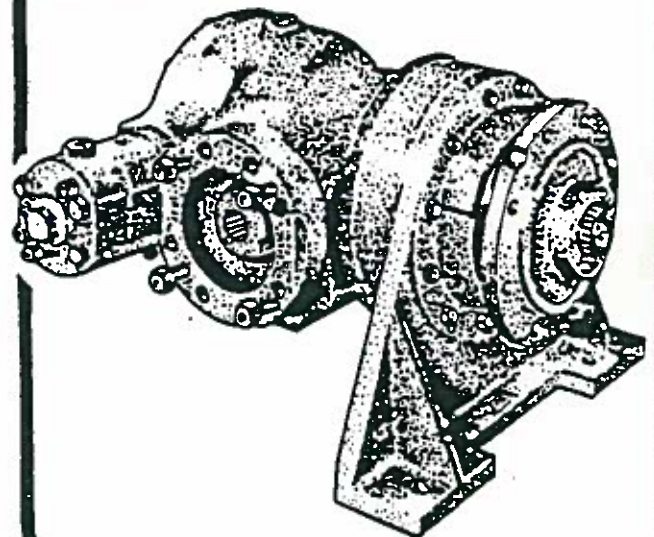
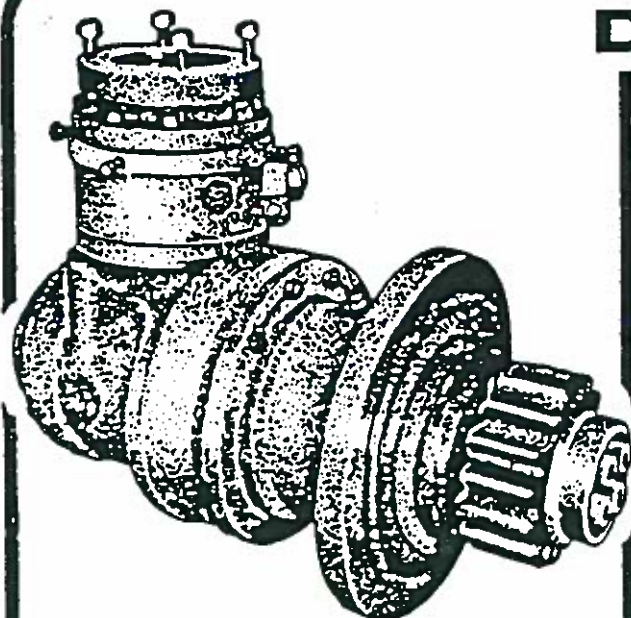
**ALWAYS USE AN ACCURATE GAGE WHEN ADJUSTING  
THE RELIEF VALVE PRESSURE SETTING.**



10874

S235

## TRANSMISSIONS DIVISION



**SPARES MANUAL**

**UNIT: SLEW GEARBOX**

**TYPE: HTLS 235**

**SPECIFICATIONS COVERED:**

**690107665 690207663 690307661**

**HAMWORTHY ENGINEERING LIMITED, TRANSMISSIONS DIVISION, POOLE, DORSET.**

**TELEPHONE: Poole 675123**

**STD: 0202 675123**

**TELEX: 41207 G**

**TDH. 9631**

**October 1984.**

In the List of Parts, Item Numbers with no prefix are common parts.

Any item with a prefix indicates that item is only applicable to certain specifications.

Key

| <u>Key</u> | <u>Specification Number's</u> | <u>Brake Plate Configuration</u> |
|------------|-------------------------------|----------------------------------|
| A          | 690107665                     | 4 working plates                 |
| B          | 690207663                     | 2 working plates                 |
| C          | 690307661                     | 2 working plates                 |

When ordering Spare Parts, or in any correspondence relating to the gearbox, the number stamped on the gearbox nameplate must be quoted. Also give the Item Number, Part Number and full Description, as specified in the LIST OF PARTS.

# LIST OF PARTS

| <u>Key</u> | <u>Item<br/>Number</u> | <u>Description</u>                | <u>Qty</u> | <u>Part<br/>Number</u> |
|------------|------------------------|-----------------------------------|------------|------------------------|
|            | 1                      | Motor Mounting Plate              | 1          | 631185275              |
|            | 2                      | Capscrew: 1/108 108/7             | 16         | 748011076              |
|            | 3                      | Spring Washer: 2                  | 16         | 740773053              |
|            | 4                      | Washer: 9                         | 1          | 740151078              |
|            | 5                      | Washer: 55                        | 2          | 740157091              |
|            | 6                      | Torque Pin                        | 1          | 630096127              |
| A          | 7                      | Motor Adaptor Plate               | 1          | 631172628              |
| A          | 8                      | Brake Shaft                       | 1          | 630171409              |
| BC         | 8                      | Brake Shaft                       | 1          | 630171411              |
|            | 9                      | Bolt                              | 1          | 748230718              |
|            | 10                     | Nut: 9                            | 1          | 748415053              |
| A          | 11                     | Brake Housing                     | 1          | 630068373              |
| BC         | 11                     | Brake Housing                     | 1          | 630068472              |
| A          | 12                     | Capscrew: 46/40 (M12 x 30)        | 12         | 748011324              |
| BC         | 12                     | Capscrew (M12 x 35)               | 8          | 748011322              |
| BC         | 12                     | Capscrew (M12 x 40)               | 6          | 748011340              |
| BC         | 12                     | Capscrew (M12 x 130)              | 2          | 748011480              |
|            | 13                     | Spring Washer: 12                 | 12         | 740773061              |
|            | 14                     | Retaining Plate Setscrew: 19      | 6          | 631180052              |
|            | 15                     | Retaining Plate: 16               | 3          | 630095228              |
|            | 16                     | Planet Wheel: 41                  | 3          | 630027502              |
| AB         | 17                     | Planet Wheel Bush: 16             | 3          | 630044481              |
| C          | 17                     | Needle Roller                     | 66         | 660200144              |
|            | 18                     | Link Plate Bush: 49               | 1          | 630044291              |
|            | 19                     | Planet Pin: 41                    | 3          | 630030423              |
| AB         | 20                     | Planet Wheel Bush                 | 3          | 630044481              |
|            | 21                     | Planet Pin: 30                    | 3          | 630030449              |
|            | 22                     | Link Plate Bush: 35               | 1          | 630044283              |
|            | 23                     | Capscrew: 24/40                   | 12         | 748011332              |
|            | 24                     | Output Shaft Bearing Housing      | 1          | 631017783              |
|            | 25                     | Washer: 9                         | 2          | 740157109              |
|            | 26                     | Oil Seal: 24                      | 1          | 660300472              |
|            | 27                     | Oil Seal Distance Piece: 26       | 1          | 631076292              |
|            | 28                     | Slew Pinion                       | 1          | 630188924              |
| AB         | 30                     | Planet Carrier                    | 1          | 631029184              |
| C          | 30                     | Planet Carrier                    | 1          | 631029630              |
|            | 31                     | Inner Bearing Cone: 32            | 1          | 660101714              |
|            | 32                     | Inner Bearing Cup: 31             | 1          | 660101688              |
|            | 33                     | Bearing Spacer Shim: 31/34        | As Req'd   | 630042659              |
|            | 33                     | Bearing Spacer Shim: 31/34        | As Req'd   | 630042667              |
|            | 33                     | Bearing Spacer Shim: 31/34        | As Req'd   | 630042675              |
|            | 34                     | Bearing Spacer                    | 1          | 631076300              |
|            | 35                     | Pull Rod                          | 1          | 630066021              |
|            | 36                     | Brake Cylinder Distance Piece: 56 | 1          | 630063143              |
|            | 37                     | Planet Wheel: 30                  | 3          | 630027437              |
|            | 38                     | Sun Pinion: 41                    | 1          |                        |
|            | 39                     | Piston                            | 1          | 630064166              |
|            | 40                     | Annulus                           | 1          | 630026827              |
|            | 41                     | Planet Carrier                    | 1          |                        |
|            | 42                     | 1st Stage Sun Gear (5.6)          | 1          | 631028012              |

| <u>Key</u> | <u>Item<br/>Number</u> | <u>Description</u>           | <u>Qty</u> | <u>Part<br/>Number</u> |
|------------|------------------------|------------------------------|------------|------------------------|
|            | 43                     | Brake Cylinder 'O' Ring: 36  | 1          | 742121111              |
|            | 44                     | Disc Spring                  | 15         | 660010048              |
|            | 45                     | Nut: 55                      | 1          | 748415061              |
| A          | 46                     | Brake Housing Adaptor Plate  | 1          | 631172646              |
| BC         | 46                     | Brake Housing Adaptor Plate  | 1          | 631172778              |
|            | 47                     | Middle Plate                 | 3          | 660020468              |
| A          | 48                     | Actuator                     | 1          | 660020120              |
| BC         | 48                     | Actuator                     | 1          | 660021672              |
|            | 49                     | Intermediate Plate           | 1          | 660020138              |
|            | 50                     | Back Up Washer: 39           | 1          | 660320082              |
|            | 51                     | Piston 'O' Ring: 39          | 1          | 742121103              |
|            | 52                     | Spring Washer: 54            | 2          | 660240124              |
|            | 53                     | Oil Plug: 11                 | 1          | 742223040              |
|            | 54                     | Capscrew: 36                 | 2          | 748011423              |
|            | 55                     | Bolt: 48                     | 1          | 748230536              |
|            | 56                     | Brake Cylinder/End Cap       | 1          | 630062517              |
|            | 57                     | Washer: 58                   | 1          | 742171181              |
|            | 58                     | Plug                         | 1          | 630184113              |
|            | 59                     | Spring Washer: 60            | 4          | 660240124              |
|            | 60                     | Brake Cylinder Ssetscrew: 11 | 4          | 748231062              |
|            | 61                     | Damper Cylinder              | 1          | 630062277              |
|            | 62                     | Piston 'O' Ring: 74          | 1          | 742121103              |
|            | 63                     | Bolt: 64                     | 1          | 630193031              |
|            | 64                     | Banjo - Valve                | 1          | 630195010              |
|            | 65                     | Plug: 64                     | 1          | 742223016              |
|            | 65a                    | Plug - Needle Adjustment     | 1          | 660190774              |
|            | 65b                    | Washer                       | 1          | 742171041              |
|            | 66                     | Adaptor: 64                  | 2          | 741610478              |
|            | 67                     | Seal - dowty                 | 2          | 742171066              |
|            | 68                     | Ball 9.5mm (.375") dia: 66   | 1          | 743821115              |
|            | 69                     | Spring Pin: 64               | 1          | 740721151              |
|            | 70                     | Spring: 72                   | 1          | 630069017              |
|            | 71                     | Seal - dowty: 63             | 2          | 742171140              |
|            | 72                     | Ball 6.35mm (.25") dia: 63   | 1          | 743821073              |
|            | 73                     | Screw - valve: 63            | 1          | 630194013              |
|            | 74                     | Damper Piston                | 1          | 630064331              |
|            | 75                     | Spring: 74                   | 1          | 660010238              |
|            | 76                     | End Cap: 61                  | 1          | 630186571              |
|            | 77                     | Seal - dowty: 61             | 1          | 742171140              |
|            | 78                     | Dowel: 24/40                 | 3          | 630048128              |
|            | 79                     | Red Cap: 76                  | 1          | 742254094              |
|            | 80                     | Spring Washer: 23            | 12         | 740773061              |
|            | 81                     | Backup Washer: 74            | 1          | 660320082              |
|            | 82                     | Spirolox Rs 92: 38           | 1          |                        |
|            | 85                     | Link Plate                   | 2          | 630067078              |
| A          | 90                     | Stud Nut: 91                 | 12         | 748415061              |
| A          | 91                     | Stud: 7/11                   | 12         | 630173447              |
|            | 95                     | Thrust Sleeve: 30            | 1          | 630034565              |
|            | 96                     | Outer Bearing Cup: 97        | 1          | 660101706              |
|            | 97                     | Outer Bearing Cone: 96       | 1          | 660101698              |
|            | 98                     | Snap Ring: 30                | 1          | 660070190              |
|            | 99                     | Lockwasher: 28               | 1          | 630023550              |
|            | 100                    | Locknut: 28                  | 1          | 630033542              |
|            | 101                    | Thrust Washer: 30            | 1          | 630031553              |
|            | 102                    | Oil Drain Plug: 24           | 1          | 660190097              |
|            | 103                    | Relief Valve: 1              | 1          | 660500022              |
| A          | 105                    | Nut: 104                     | 12         | 748415079              |

| <u>Key</u> | <u>Item<br/>Number</u> | <u>Description</u>       | <u>Qty</u> | <u>Part<br/>Number</u> |
|------------|------------------------|--------------------------|------------|------------------------|
|            | 108                    | Supplementary Annulus    | 1          | 630026884              |
|            | 109                    | Planet Wheel Bush: 111   | 3          | 630044390              |
|            | 110                    | Planet Wheel: 109        | 3          | 630027692              |
|            | 111                    | Planet Pin: 116          | 3          | 630030498              |
| A          | 114                    | Adjusting Bolt: 116      | 1          | 748231005              |
| BC         | 114                    | Adjusting Bolt: 116      | 1          | 748230890              |
|            | 115                    | Adjusting Nut: 114       | 1          | 748440085              |
|            | 116                    | Planet Carrier           | 1          | 631029465              |
|            | 117                    | Thrust Button: 116       | 1          | 660420015              |
|            | 118                    | Retaining Plate          | 1          | 630095277              |
|            | 119                    | Oil Plug: 125            | 1          | 742223032              |
|            | 120                    | Input Shaft              | 1          | 630196836              |
|            | 121                    | Planet Wheel Spacer: 110 | 3          | 631076482              |
|            | 122                    | Circlip: 111             | 3          | 740732133              |
| A          | 123                    | Bolt: 11/46              | 12         | 748210957              |
| A          | 125                    | Stand Pipe: 7            | 1          | 630151252              |
| BC         | 125                    | Stand Pipe               | 1          | 630151286              |
| C          | 126                    | Side Washer              | 9          | 630031637              |
| C          | 127                    | Spacer                   | 3          | 631076856              |

ITEMS NOT SHOWN

|               |   |           |
|---------------|---|-----------|
| Oil Plugs: 11 | 2 | 742223073 |
| Redcap: 66    | 2 | 742254128 |

NOTE:

The following items are supplied as an assembly only:-

|    |    |  |
|----|----|--|
| AB | 1. | Planet Carrier (41), Spirolox Ring (82) and Sun Pinion (38)<br>As Assembly Number 670029855. |
| C  | 1. | Planet Carrier (41), Spirolox Ring (82) and Sun Pinion (38)<br>As Assembly Number 671029110  |

The following may also be supplied as assemblies:-

|   |    |  |
|---|----|--|
|   | 1. | 3rd Stage Planet Carrier Assembly 687300562<br>comprising items 20, 21, 30, 37 and 95.               |
| C | 2. | 3rd Stage Planet Carrier Assembly 687300745<br>comprising items 20, 21, 30, 37, 95, 126 and 127.     |
|   | 3. | Brake Cylinder Assembly 687500617 comprising items 36,<br>39, 43, 44, 50, 51, 52, 54, 56, 57 and 58. |
|   | 4. | Restrictor Valve Assembly 688000088 comprising items<br>63 - 73 inclusive.                           |
|   | 5. | 1st Stage Planet Carrier Assembly comprising items<br>109, 111, 116, 118, 121 and 122.               |

LUBRICATION

1. Only the brands of lubrication listed on the attached sheet should be used.
2. After the first 200 hours running, drain while the gearbox is warm and re-fill with fresh oil. Top up after every 50 hours running, drain and re-fill with fresh oil after every 1000 hours running.
3. Oil Capacity 5.1 litres (9.0 pt).

ROUTINE MAINTENANCE

1. Every 200 Hours

Clean the gearbox in the area of the oil seals and check for leaks. If there is any sign of leakage fit new seals as applicable. Check the gearbox.

2. Every 500 Hours

Check torque tightness of all external nuts and bolts.

3. Recommended Torque Figures

| <u>Item Number</u> | <u>Torque Figure (kg.m.(lb.ft.))</u> |       |
|--------------------|--------------------------------------|-------|
| 2                  | 8.0                                  | ( 58) |
| 10                 | 4.7                                  | (107) |
| 12                 | 14.8                                 | (107) |
| 14                 | 0.95                                 | (7.0) |
| 23                 | 14.8                                 | (107) |
| 45                 | 2.3                                  | ( 17) |
| 54                 | 14.8                                 | (107) |
| 60                 | 8.8                                  | ( 63) |
| 90                 | 5.0                                  | ( 36) |
| 105                | 8.8                                  | ( 63) |
| 115                | 8.8                                  | ( 63) |

RECOMMENDED SETTINGS

1. Output Shaft Bearings

The procedure for setting the bearings is as follows:-

- a. Assemble the output bearing housing assembly with the same thickness of shims (33) that were removed.
- b. Fit and tighten nut (100) to 55 Kg.m. (400 lbf.ft).
- c. Fasten a length of cord around bearing housing (24) on a mounting register.
- d. Attach a spring balance to the end of the cord. An even pull of 4.5 to 8.6 Kgf. (10 to 19 lbf.) should be obtained (ignoring the initial force required to start motion). If the figure is too high add shims (33), too low subtract shims (33).

NOTE:

The pull figure above includes the "drag" of oil seal (26).

2. First Stage Planet Carrier Assembly

See attached illustration showing setting procedure.

3. Brake Cylinder Setting Dimension

As the brake plates wear the piston (39) moves towards plug (58). To keep the correct tension on disc springs (44) the piston setting dimensions should be checked and adjusted every 1000 hours. Refer to attach illustration. The correct setting dimension is 41 mm.

SPECIAL NOTES

a. Sealing

All mating faces to have jointing compound such as Red Hermetite applied before re-assembly except for bore of spacer (27) which should be sealed with Loctite 275.

b. Brake Assembly

If the brake unit has been dismantled for any reason it is necessary before fitting the hydraulic motor to "pressurise" the brake to allow the input shaft (8) to centralise.

When dismantling the brake plates take note how they have been assembled. It is important that they are re-assembled in the same order to ensure the same braking performance is retained.



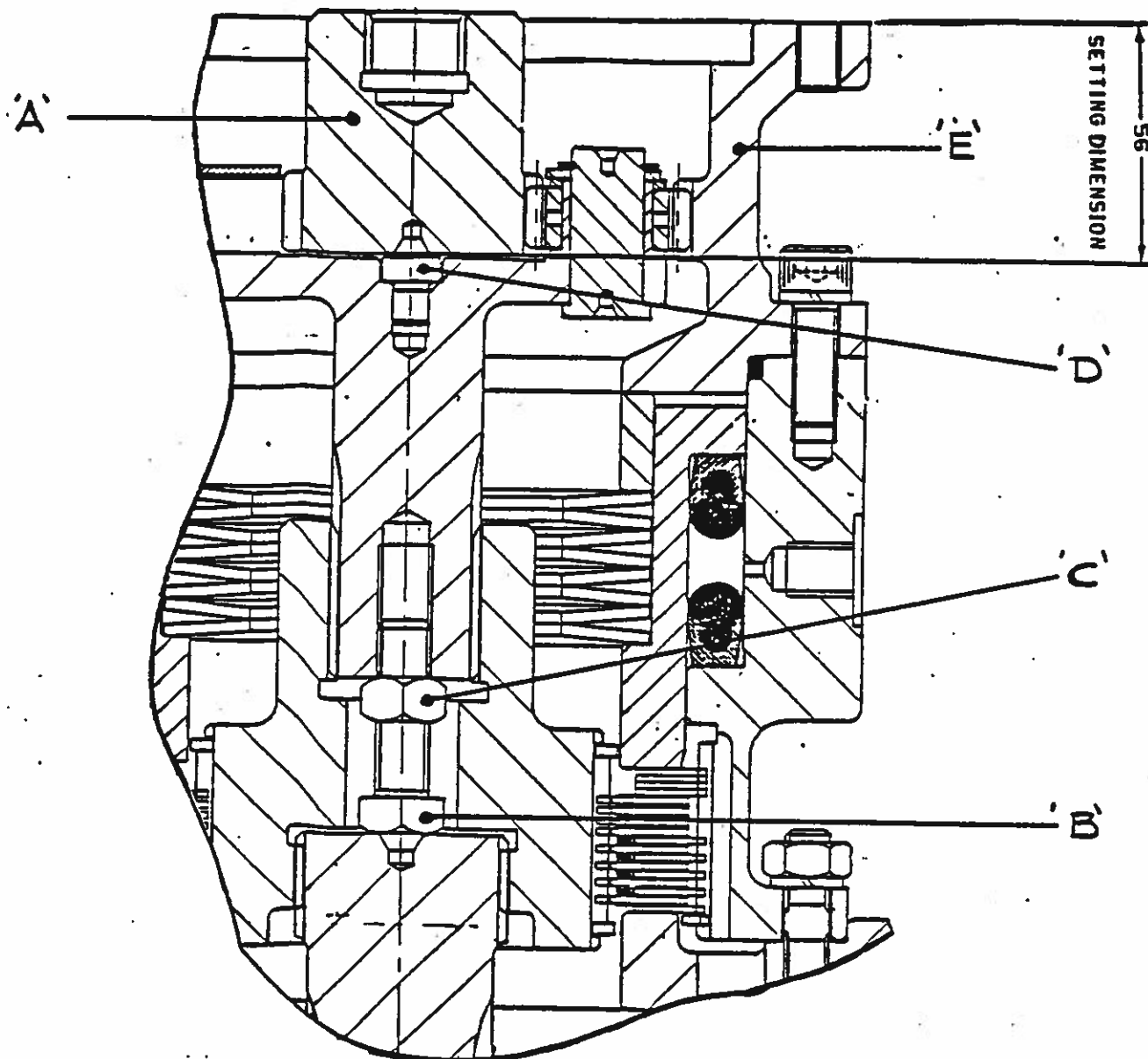
RECOMMENDED LUBRICANTS - AXLES WITH OIL IMMERSED MULTI-PLATE BRAKES

Ambient Temperature Range

| <u>Oil<br/>Company</u> | <u>From - 25°C to - 10°C</u>     | <u>From - 10°C to - 30°C</u>             | <u>Above 30°C</u>                        |
|------------------------|----------------------------------|--|--|
| B.P.                   | B.P. Tractran -<br>(Top Up only) | B.P. Hydraulic TF-8*                     | B.P. Hydraulic TF-8*                     |
| CASTROL                | Agricastrol MD                   | Agricastrol AS                           | Agricastrol AS<br>or<br>Castrol MP       |
| DALTONS                | No suitable grade<br>available   | No suitable grade<br>available           | No suitable grade<br>available           |
| DUCKHAMS               | Hydrolube 303                    | Hydrolube                                | Hydrolube                                |
| ESSO                   | IL 2082                          | IL 2082                                  | No suitable grade                        |
| FINA                   | Agrifina Oil FT*                 | Agrifina Oil FT*                         | Agrifina Oil FT*                         |
| GULF                   | Gulf Universal Tractor<br>Fluid  | Gulf Multi-purpose<br>Tractor Oil 20W/30 | Gulf Multi-purpose<br>Tractor Oil 20W/30 |
| Mobil                  | Mobilfluid 427                   | Mobilfluid 422                           | Mobilfluid 422                           |
| SHELL                  | Donax T.T.                       | Donax T.T.                               | Donax T.T.                               |
| TEXACO                 | No suitable grade<br>available   | *ETL 2039                                | ETL 2039                                 |
| CENTURY OILS           | Centlube E 76 Compound           | Centlube F 76<br>Compound                | Centlube F 76<br>Compound                |

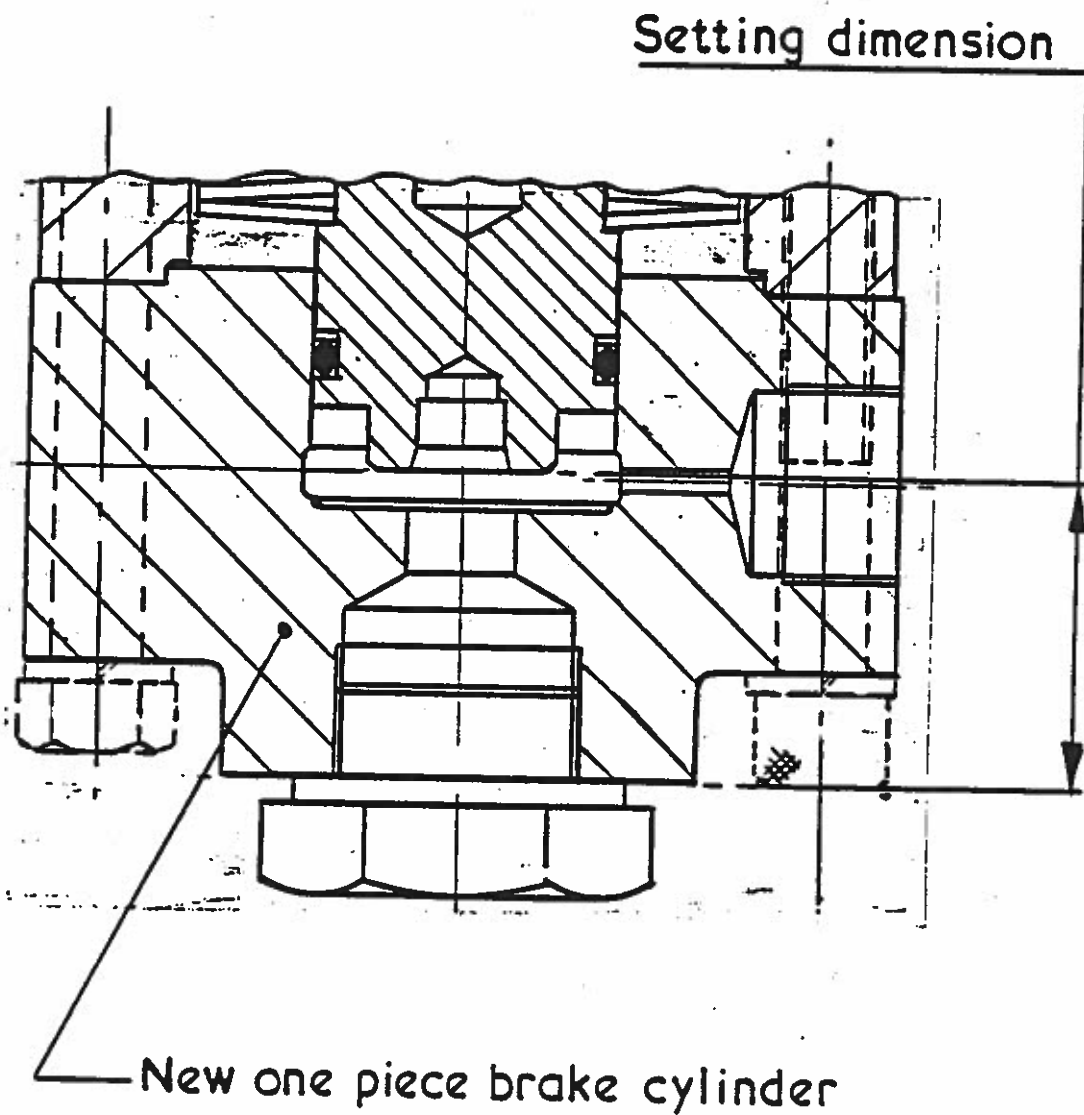
NOTE: 1. All the oils are Extreme Pressure Lubricants containing Limited slip and anti-squawk additives for the brake plates. Oils marked \* meet the specification MIL-L-2105B. API-GL5 CLASS.

2. Should the climatic conditions vary from those listed above, please consult our more detailed Lubrication Book.



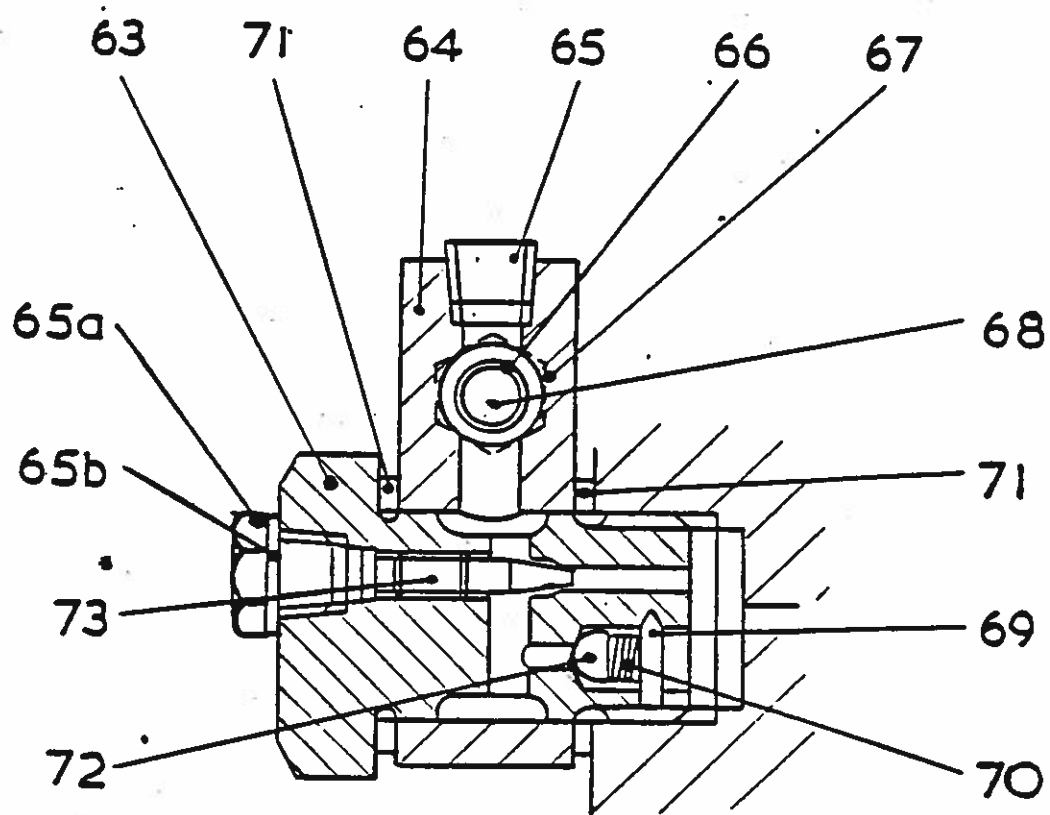
# PLANET CARRIER END FLOAT SETTING

1. Support the gearbox vertically so that input shaft 'A' is in the uppermost position.
2. Adjust setscrew 'B' until a dimension of 56 mm is obtained from the end face of thrust button 'D' to end face of annulus 'E'. When this dimension has been achieved lock nut 'C' to a torque figure of 8.8 Kg.m.

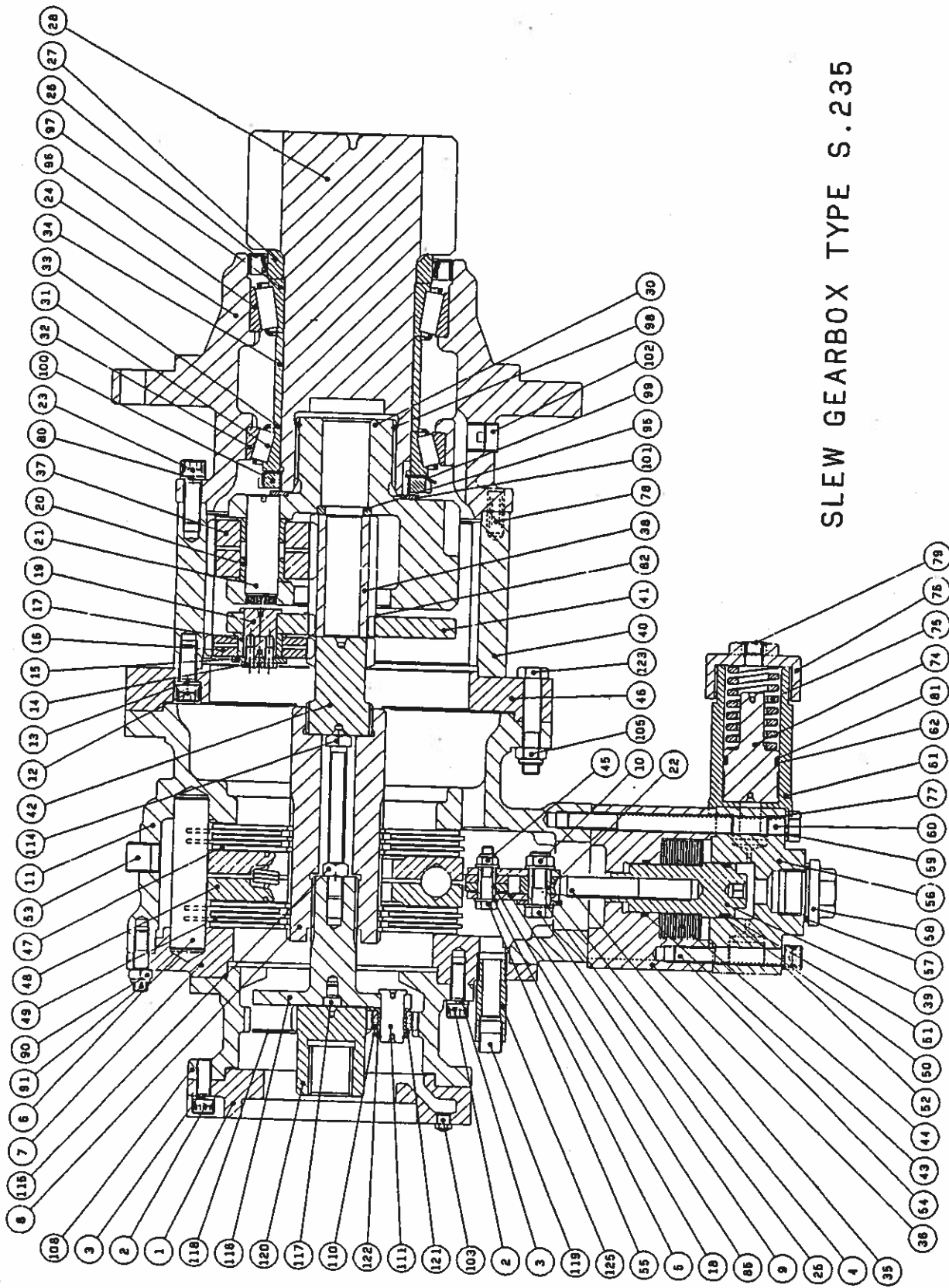


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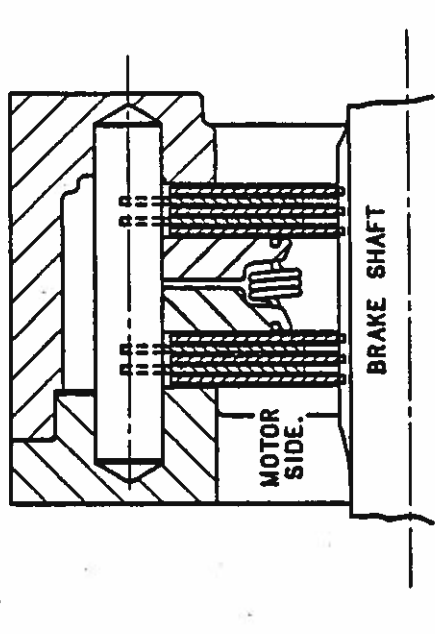
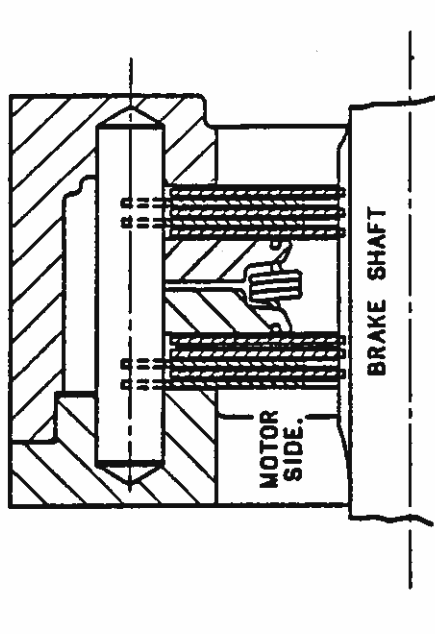
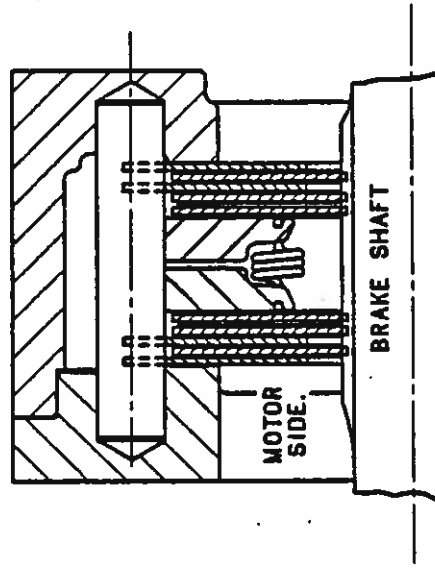
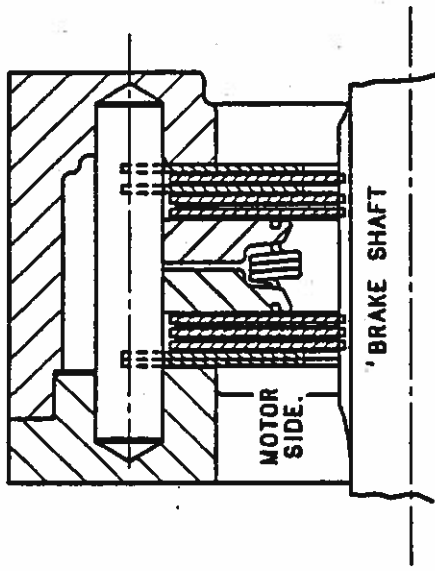
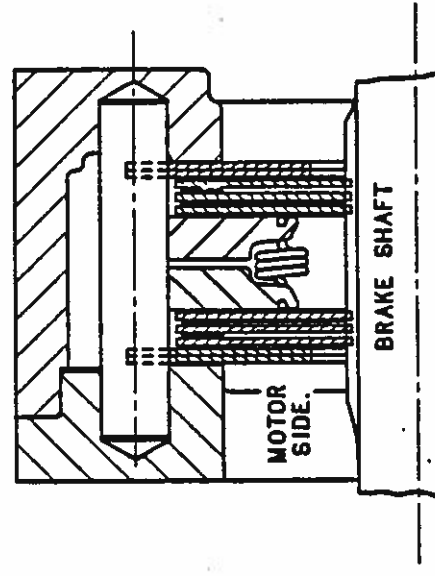
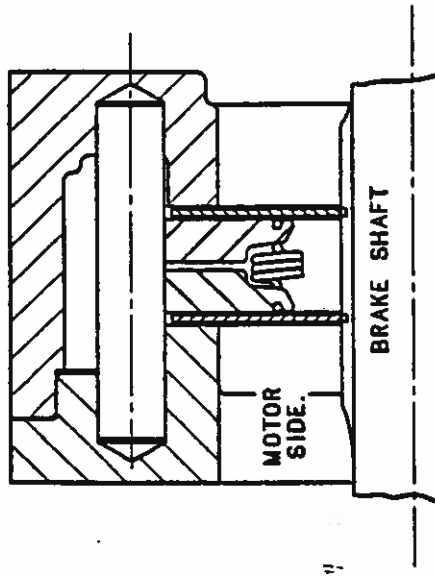
ILLUSTRATION SHOWING NEW "ONE PIECE" BRAKE CYLINDER/END CAP  
(Replacement for Part No. 630062111)



Section Through Restrictor Valve

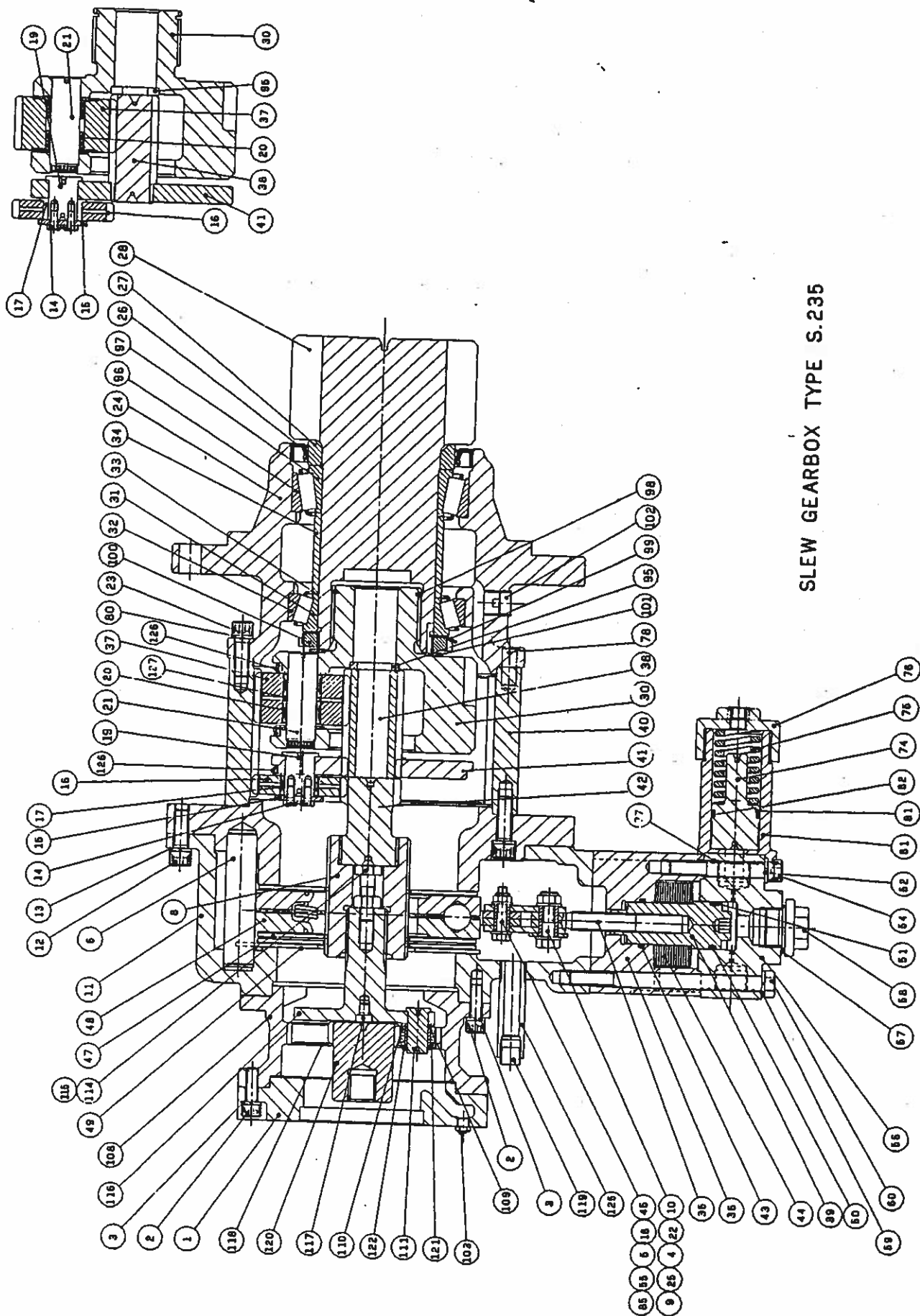


SLEW GEARBOX TYPE S.235



**IMPORTANT CHECK LIST OF PARTS FOR AMOUNT  
OF WORKING BRAKE PLATES REQUIRED.**

[illegible]



SLEW GEARBOX TYPE S.235