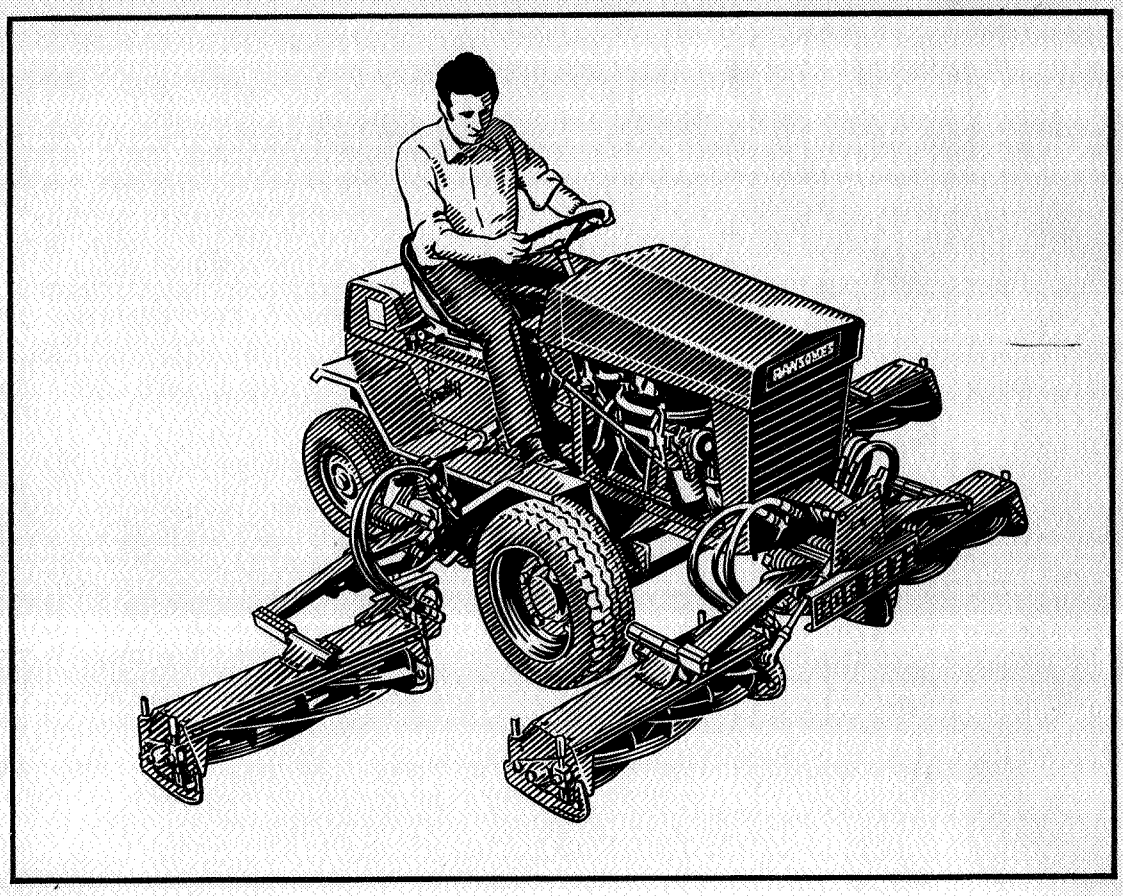
RANSOMES

FAULT FINDING GUIDE

MOTOR 5/3



RANSOMES SIMS & JEFFERIES LTD IPSWICH ENGLAND

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FAULT FINDING CHART

The following initial checks should be carried out before investigations into the hydraulic circuit are commenced :

(a) Check level of oil in hydraulic tank
(b) Check engine speeds
(c) Check for mechanical restrictions
(d) Check for frothing in tank

See page 4

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Section	Symptoms	Action	Page No.
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INITIAL CHECKS

(a) To check the fluid level in the hydraulic tank remove the cover plate behind the seat. Clean around the filler cap before removing it. The correct level should be 13 mm ($\frac{1}{2}$") above the bottom of the filter.

(b) The engine speeds should be :

Starting 2100 r.p.m. Working 3150 r.p.m.

Because it is difficult to measure the speed of the engine crankshaft a reading may be taken off the governor spindle. To give the correct engine speed this should be :

Starting 2320 r.p.m. Working 3480 r.p.m.

(c) Make sure there are no mechanical faults, i.e., cylinders set too tight, brakes binding.

(d) If the oil in hydraulic tank is frothing it could be caused by air in the system. Check the connections between the tank and the boost pump.

NOTE : IF ANY OF THE FOLLOWING TESTS INVOLVE BREAKING INTO THE HYDRAULIC CIRCUITS, THE UTMOST CARE SHOULD BE TAKEN NOT TO ALLOW ANY DIRT TO GET INTO THE CIRCUIT. THE AREA TO BE WORKED ON SHOULD BE CLEANED AND THE PIPES OR COMPONENTS WHICH ARE REMOVED SHOULD BE SEALED WITH PLASTIC PLUGS.

IT IS IMPORTANT AFTER CARRYING OUT ANY WORK WHICH INVOLVES BREAKING INTO THE HYDRAULIC CIRCUITS THAT THE HYDRAULIC OIL FILTER IS REPLACED AFTER 25 WORKING HOURS. (SEE OPERATORS INSTRUCTION BOOK AND SERVICE BULLETIN No. 280).

SECTION 1 — Machine creeps forward or reverse with pedals in neutral

(a) Jack up front of machine. Make sure that the connecting rods between the pedal linkage and pumps are initially set at a length of 187 mm ($7\frac{3}{8}$") between centres of balls (Fig. 2, B and C).

Ensure that there is 3 mm ($\frac{1}{8}$") backward movement on the selector (Fig. 2, A). Position selector in the neutral position, start engine and release handbrake. Put main control in the cutting position. If wheels creep forward tighten the nut on the selector by one turn. If wheels still creep forward lengthen right-hand connecting link (Fig. 2, B) by one turn, if the wheels still creep forward, tighten nut on selector by further $\frac{1}{2}$ turn and if wheels still creep forward lengthen link by one turn.

If when the engine is started wheels creep backwards, then the nut on the selector should be slackened and the connecting link shortened. Put the main control in the transport position, start the engine. If wheels creep forwards then the left-hand connecting link must be lengthened (Fig. 2, C). If wheels creep backwards the link must be shortened. With care this adjustment can be done with the wheels on the ground.

SECTION 2 — Temperature warning light comes on.

(a) Check that the cylinders are free to turn and the grass being cut is not too overloading machine.

(b) If relief valves are continually blowing it will cause the oil to heat up. Remove cutting cylinder valve (Fig. 6, A) and traction valve (Fig. 6, B) and make sure that they are clean. There is a gauze filter on the end of each valve which must be kept clear. If the problem still occurs after cleaning, the valves should be replaced.

(c) To cool the oil quickly put the transmission valve in service position, raise cutting units and run machine at full engine speed with right-hand pedal forward. This circulates the oil and cools it quickly.

(d) When the machine has cooled down :

Check the switch by turning off the engine and switching back on the ignition, the light should not come on unless the switch (Fig. 5, C) is faulty.

SECTION 3 — Boost pressure warning light comes on.

(a) To check the boots pressure, remove the switch in the back of the transmission valve and attach a pressure gauge in its place (Fig. 5, B). Run the machine for about 15 minutes to warm up the oil, and read off the pressure with the engine running at full speed and the pedals in netural. The correct pressure should be 8.4—10.5 kg/cm^2 (120—150 psi).

(b) To check that the ball is seating correctly, the boost valve plug in the top of the transmission valve must be removed (Fig. 5, A). There are some shims between the plug and the spring. As the plug is taken out, a small screwdriver can be used to hold the spring in the plug preventing the shims from falling into the transmission valve. The ball can be removed by using a push type grease gun. Put a little grease on the end of the gun and the ball will fit into the end of the gun and can be lifted out. Alternatively a magnet can be used. It is only the fit of the "O" rings which is now holding the seat in position. A piece of wire with a hook on the end can be used to remove the seat.

All parts should be inspected to make sure they are clean and undamaged.

(c) The pressure can be adjusted by adding or taking out shims. To increase the pressure, shims should be added one at a time.

(d) If the pressure is correct a new switch should be fitted.

(e) If the light still comes on check for internal leakage in the hydraulic circuits. This would normally effect the performance of the machine and the relevant check list should be followed.

(f) If the light still comes on the boost pump flow must be checked and the pump replaced if necessary.

SECTION 4 — Loss or partial loss of cylinder drive in one direction only.

(a) The top four check valves must be inspected (one shown in Fig. 6, C). They are screwed into the transmission valve. The complete transmission valve must be removed and turned on its side so that when the plug is removed the ball stays on its seat. If it is removed while the valve is in place the ball will fall inside.

The check valves should only be removed one at a time. They must not be mixed up with the boost pressure valve because the spring and seats are different. Once removed the parts should be inspected to make sure they are clean and undamaged.

(b) Remove back of cutting pump and inspect the check valve balls (Fig. 3, C) to ensure that they are seated correctly and that the 'O' rings are not damaged. Read paragraph opposite before removing the back of the pump.

SECTION 5 — Loss or partial loss of cylinder drive in both directions.

(a) Make sure the cylinders are free to turn, that there is nothing jammed in them and they are not set too tight.

(b) The selector valves sometimes seize due to lack of lubrication. Normally if the spool is lubricated and the units lifted up and down a few times it will clear.

(c) A quick test for the relief valve is to reverse the positions of the two valves, i.e., fit the 207 kg/cm^2 (3000 psi) valve (Fig. 6, A) in the bottom of the transmission valve and the 276 kg/cm^2 (4000 psi) valve (Fig. 6, B) in the top. If the problem changes to the other circuit the relief valve is faulty.

NOTE : This is only a quick test, and the machine must never be worked with the valves in this positon. If a fault is found by the above test, the valve should be removed and checked to make sure it is clean; both the valve seat and the gauze at the end of the valve should be checked.

(d) To check the oil drain from the cylinder motors disconnect the drain line. Measure the flow of oil with the engine at working speed and the cylinders off cut and running at maximum speed, with the transmission valve control set in the service position.

Should the drain exceed 1 litre (2 pints)/min., the motor must be examined. An excessive drain may be caused by damaged seals in the motor, in which case the motor can be brought back into a serviceable condition by renewing the seals.

Where excessive scoring exists on the end faces of the gears and motor or in the body of the motor, the complete motor must be replaced.

(e) The cutting pump (left hand) (Fig. 1, A) can be checked without breaking into the hydraulic circuits by checking the wheel speeds, providing there is nothing wrong with the wheel motors. The procedure for this is as follows :

Jack up the front of the machine and support securely, chock one wheel, put the transmission valve in the transport position and with the engine running at full speed and the right-hand pedal pushed fully forward measure the speed of the wheel which is turning. This wheel should turn at approximately 400 rpm.

The hand brake should then be applied and this speed should not drop significantly. This test should be carried out on both wheels to make sure the problem is in the pump.

NOTE :

Machine must be adequately supported and secured.

Wheel must be positively chocked.

Do not touch chocked wheel during test, in case this revolves unexpectedly and exercise extreme caution when approaching any moving part.

If a fault is indicated by the above test the pump should be inspected. First the area around the cutting pump should be thoroughly cleaned. The two pipes between the transmission valve and the pump should be removed and plugged. Four bolts should be removed from the back of the pump and the back plate removed taking care that the piston assembly does not come out with it.

Pegged onto this back plate is a brass plate with six slots called a valve plate (Fig. 3, A). The surface of this plate should be perfectly flat. If any scoring can be felt with the finger nail, the pump will not operate efficiently.

The piston assembly (Fig. 3, B) can be removed taking care not to drop any of the pistons out. Each piston is matched into its bore and they must not be mixed up. Inspect the piston retaining plate to make sure it is flat and inspect the piston slippers to make sure there are no scoring marks. On all slippers there are very fine marks but if they can be felt with the finger nail the pump will not work efficiently. The swash plate (Fig. 3, D) should also be inspected. If deep scoring is present, the plate can be reversed.

There is a small lubricating hole in the piston slippers. Ensure these are not blocked, making sure to only inspect one at a time.

NOTE : When re-assembling the pump, attention must be paid to the following points :

(i) Ensure that the piston assembly is pushed fully home and that the slippers are correctly positioned against the swash plate.

(ii) Ensure that the valve plate is correctly located on the pump back plate.

(iii) Ensure that the two "O" rings (Fig. 3, C) are in place.

If a new pump is fitted attention must be paid to the following points :

(i) Ensure that the splined pump input shaft is correctly matched with its gear.

(ii) Do not use excessive force when sliding splined pump shaft into gear. If necessary, dress splines.

(iii) When satisfied that splined shaft fits correctly, remove pump and degrease splined pump shaft and splined bore of gear. Re-assemble using Loctite 270 on splines.

(iv) When handling pump, avoid knocking end of splined shaft and cross shafts.

SECTION 6 — Loss or partial loss of drive to wheels in cutting position only (both directions).

(a) See 5 (c).

(b) The procedure for 5 (e) should be followed except that the transmission valve should be in the cutting position and the corresponding wheel speed should be approximately 200 rpm. This test checks the condition of the right-hand pump (Fig. 1, B).

If a fault is indicated the same internal inspection should be followed as in 5 (e), but the two pipes to be removed are underneath the pump.

SECTION 7 — Loss or partial loss of drive to wheels in cutting position only (one direction).

(a) See 4 (a), but note that the bottom four check valves should be inspected as they are used in the traction circuit.

(b) Remove back of traction pump (Fig. 1, B) and check as in 4 (b).

SECTION 8 — Loss or partial loss of drive to wheels in transport position only (one direction only).

(a) See 4 (a).

(b) See 4 (b).

SECTION 9 — Loss or partial loss of drive to wheels in transport position only (both directions).

(a) See 5 (c).

(b) See 5 (e).

SECTION 10 — Loss or partial loss of drive to wheels in both positions (one direction only).

(a) As for 4 (a) except the bottom four check valves are used in traction circuit, not the top four.

(b) Jack up the front of the machine and support securely. Disconnect the drain hose from the wheel motor (Fig. 7, C). This is the small pipe which is connected underneath the two main pipes.

Plug up the hose and with the engine running at full speed and the pedal pushed forward measure the amount of oil coming from the wheel motor. This should only be a trickle. If there is a fault, oil will pump out and check (c) should then be made.

(c) To check the port adaptor "O" rings the complete wheel should be taken off the machine. Take out the five screws holding the mudguard and slacken the brake cross shaft clamp (Fig. 7, A). Remove the two main pipes and the drain hose making sure to plug them (Fig. 7, B and C). Three bolts now hold the wheel assembly to the chassis (Fig. 7, E). These should be removed carefully remembering the motor is very heavy. Lay the wheel on the floor and take off the port adaptor from the wheel motor by removing the four 'unbrako' screws (Fig. 7, F).

Make sure the "O" rings are not damaged or crushed, if they are, oil could by-pass the motor.

NOTE: Each time the port adaptor is removed it is better to renew these three "O" rings.

When refitting motor to the machine the brake cross shaft clamp bolt (Fig. 7, A) must be tightened to 5.5 kgm (40 lb.ft.).

(d) See 7 (b).

SECTION 11 — Loss or partial loss to drive to wheels in both positions (both directions).

(a) Jack up front of machine and support securely and with transmisson valve in the service position turn wheels by hand. They should revolve easily.

(b) With machine still jacked up and transmission valve in cutting position turn one wheel forward by hand and the other wheel should react instantly by turning in the opposite direction. If the reaction feels spongy check the hose between the hydraulic tank and the boost pump (mounted underneath the two main pumps). There is a jubilee clip each end of this hose, which must be tightened securely to prevent air being drawn into the system.

(c) See 5 (c).

(d) See 6 (b).

(e) See 10 (b).

(f) Follow procedure for 10 (c). If "O" rings are not damaged, then a faulty wheel motor is indicated.

SECTION 12 — Cutting units slow to lift.

(a) Make sure the lift arm pivots are free and well lubricated.

(b) Check the weight of the unit by attaching a spring balance to the centre pivot of the unit.

Lift the unit using the spring balance and take the reading as the unit is being lowered. The correct weight should be 50 kg (110 lb.) max. If the springs are damaged they must be replaced as they cannot be adjusted.

This test should be carried out with the engine running at full speed as oil pressure in the rams relieves some of the weight of the units. On the centre unit the weight is relieved solely by the ram and no spring is attached. The seat must be removed to check this unit.

(c) If the problem occurs on two units which are connected, i.e., numbers 2 and 4, the restrictor should be inspected. This is situated underneath the lift valve. Disconnect the relevant hose (i.e., for number 2 and 4 the middle lever controls these units and so the middle hose (Fig. 4, B) is removed, and remove the hydraulic adaptor.

The restrictor can now be unscrewed from underneath the valve. It is a brass plate with a small hole through. Make sure it is clean and the hole is not blocked.

(d) If all units are affected check the relief valve (Fig. 4, A) on top of the lift valve. This is the larger slotted plug on top of the lift valve. Make sure the poppet valve inside is clean and free to move.

Take care not to drop the shims which are on top of the spring into the valve.

(e) Disconnect hose from ram and from the bottom of lift valve and check there is no restriction in the hose.

SECTION 13 — Cutting units lift too fast.

(a) To check restrictor follow procedure for 11 (c), make sure the brass plate is screwed tightly into the valve, the threads are not damaged and the hole in the centre is the correct size, 0.52 mm (.021") dia.

SECTION 14 — Cutting units do not float correctly.

(a) To check the detents lower the cutting units to the ground and unscrew the plug (Fig. 4, C), being very careful not to drop any of the parts. Inside the plug is a spring, detent plunger and in some cases shims.

Check these parts to make sure they are all clean and in good condition.

SECTION 15 — Hydraulic oil leaking from brakedrum.

(a) Procedure for replacing wheel motor shaft seal is as follows :

(i) Slacken off nuts holding wheel to motor, remove the wheel and motor assembly from the machine as in 10 (c). It is safer to remove it this way because the motor by itself is awkward to lift. The wheel can be taken off the motor when it is on the floor.

(ii) Remove port adaptor by taking out four allen screws (Fig. 7, F). Seal up the three ports in the end of the motor to stop any dirt getting inside.

(iii) Remove the circlip and slacken off the four clamp bolts (Fig. 7, D); the brake assembly can then be lifted off. Take out the key and the other circlip.

(iv) Thoroughly clean the motor and make sure you have a clean area to work before taking off any more parts.

(v) Remove vee-ring seal and remove the five screws holding the brake drum on; replace two of the screws in the tapped holes provided. They can then be used as an extractor to push off the brake drum.

(vi) There are a number of plastic shims between the brake drum and the motor body; these give the correct end clearance to the bearing. Make sure the same ones are re-fitted and the holes are lined-up correctly.

(vii) Remove the seal cover from the brake drum (four allen screws), take out old seal and fit new one.

NOTE : Care must be taken when fitting new seal over the motor crankshaft to make sure the lip of the seal does not get damaged on the keyway or circlip grooves. To overcome this a thin brass or plastic shim should be put around the crankshaft and the seal slid over it.

(viii) Refit in reverse order making sure the vee-ring seal is fitted with the vee section down.

(ix) Torque figures required when re-fitting wheel motor :

Brake drum screws	—	6.2 kgm (45 lb/ft)
Seal cover screws	—	0.05 kgm (4 lb/in)

Torque figures required when re-fitting to the machine :

Brake cross shaft clamp	—	5.5 kgm (40 lb/ft)

SECTION 16 — Hydraulic oil leaking from cutting cylinder gearbox.

(a) This normally only applies to machines fitted with Plessey motor; it is caused by the bush inside the motor moving and contacting the shaft seal.

The procedure for this is explained in Service Bulletin No. 224.

SECTION 17 — Hydraulic oil leaking from end on transmission valve spool.

(a) If transmission valve spool leaks from the detent end, before changing any of the main seals, check the small "O" ring on the spool extension (detent). The extension can be unscrewed and the "O" ring which is fitted over the threaded section can be replaced.

Make sure the detent spool extension (Fig. 5, E) is tightened up correctly.

(b) If main spool seals need replacing, the following procedure should be followed :

(i) Remove transmission valve from the machine making sure all pipes and ports on the valve are plugged.

(ii) Take off the operating lever (Fig. 6, D) and spool extension.

(iii) Unscrew the detent extension (Fig. 5, E) on the other end of the spool.

(iv) Remove the screw (Fig. 5, D) holding detent springs and detent plungers and take them out so that they do not damage the spool when moving it along.

(v) Push spool towards detent end until it clears the seal at the other end. The seal can then be replaced.

(vi) Push the spool in the other direction until the other end seal is accessible. This can then be replaced.

NOTE : When moving the spool make sure there is plenty of oil on it, and it is moved smoothly with a gentle rotary action to prevent damage to the "O" rings.

(vii) Replace detents, spool extension, operating lever etc., and replace valve onto the machine.

SECTION 18 — Hydraulic oil leaking from check valve plug in transmission valve.

(a) To change an "O" ring in one of the check valves, the complete transmission valve must be removed. Place the complete valve unit onto a clean bench with the leaking plug facing up, unscrew the plug and remove the spring and ball. There is an "O" ring and a back-up ring on the plug; normally just the "O" ring needs to be replaced.

Take out the seat as in 3 (b) and make sure that the "O" ring fitted to it is not damaged.

SECTION 19 — Hydraulic oil leak from divertor valve.

(a) Remove the valve from the machine, take off circlip from the end of the spool which is leaking and push the spool into the valve until it clears the "O" ring. The "O" ring can then be taken out with a scriber; there is a back-up ring fitted in the same groove and it is advisable to replace it at the same time.

SECTION 20 — Hydraulic leak from ram.

(a) Disconnect the ram at both ends. If the ram is leaking from the pivot end there is an end plug which can be tapped out. On this end plug there is an "O" ring which should be replaced.

If the ram is leaking from the other end, tap the end cap out, and the piston can then be removed. There is a plastic wiper seal which is pushed into the end of the ram. Once this is removed, the "O" ring can be taken out with the aid of a scriber. The back-up ring should also be replaced.

SECTION 21 — Oil leak from gearbox.

(a) If oil is being lost from the gearbox through the sealed bearing on the centre gear it will normally be seen by oil coming through the two holes on top of the gearbox casing, and being thrown up underneath the instrument panel.

Procedure for changing this bearing and nilos ring is as follows :

(i) With units on the ground, remove seat, pump cover, side covers and foot plates.

(ii) Take off connections between the engine and instrument panel, i.e., handbrake cable, throttle lever, choke cable, and wires connecting the starter motor, alternator or generator, oil pressure switch and temperature switch. Take off the coil. Take off three wires connected to transmission valve.

(iii) Disconnect the steering at rear axle end; this prevents altering the setting of the rack.

(iv) Take out two bolts holding pedals to gearbox and unscrew hand-wheels on cut per metre levers.

(v) Remove the starter motor (three bolts) and take out the four bolts holding instrument panel to chassis. Pull the panel back slightly and the pedal assembly can be lifted clear of the machine. The instrument panel can now also be lifted off.

(vi) Disconnect hydraulic pipes; there are four on each of the main two pumps (the pipe which comes out of the side of each pump is disconnected more easily at the other end), two pipes on the boost pump; the larger feed pipe should be lifted above the tank level when removed.

NOTE : All the pipes and open ports must be plugged to prevent any dirt entering the system.

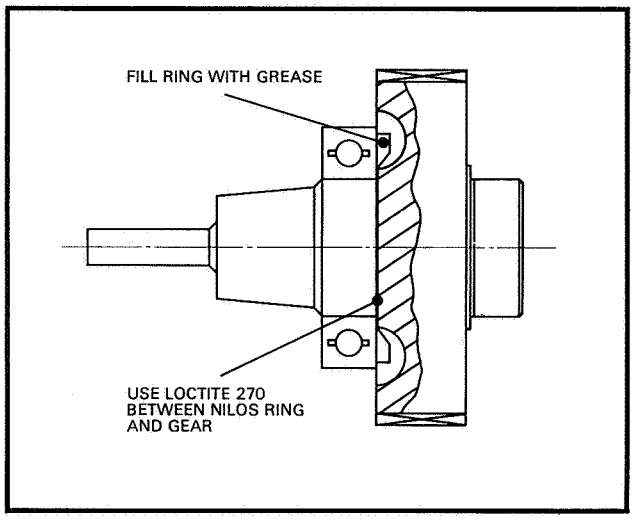
(vii) Take out the six bolts holding the gearbox to the engine and take out the bolts holding the gearbox mounting.

(viii) Take out one bolt holding the left hand side of the hydraulic junction and push it down so that it is clear of the boost pump.

(ix) Drain the gearbox and lift it complete with pumps onto a bench.

(x) Remove the three pumps (two screws in each) and split the gearbox by taking out the eight bolts (note their location as they are different lengths).

(xi) Remove the three planet gears and hold the centre gear in soft jaws to undo the nut holding coupling; take coupling off taper gear.



(xii) Remove the sealed bearing and nilos ring from centre gear. The gear must be thoroughly cleaned, and a new nilos ring fitted with Loctite 270 to the gear as shown. Leave to cure for three hours.

Fill nilos ring with a high melting-point grease and re-fit new sealed bearing.

(xiii) Re-assemble gearbox, torque up the coupling nut to 14 kgm (100 lb/ft) and Hermatite the two halves of the gearbox.

(xiv) Replace the three pumps; make sure the splines fit into the gears correctly; the two main pumps should be re-fitted with Loctite 270.

(xv) Replace gearbox onto machine making sure the rubber coupling is lined up.

(xvi) Replace pedals, instrument panel, starter motor and connections. Fill pump gearbox to required level ($\frac{1}{2}$ litre EP90) top up hydraulic tank. Re-adjust pedal linkage.

SECTION 22 — Hydraulic oil in gearbox

(a) If hydraulic oil is found in main gearbox check the shaft seal on the Sunstrand pumps (Fig. 1, A and B). The pump must be removed to replace this seal. See note on page 5 when re-fitting pump.

HYDRAULIC SPECIFICATION

Traction Pump (Fig. 1, B)	
Type	Sundstrand. Type 15 variable displacement axial piston reversible pump
Control	Swash plate
Displacement	0—15 cc/rev
Max. Flow	37L/m (8 gals/m) at governed engine speed 3000 rpm
Input Speed	2538 rpm at 3000 rpm engine speed
Cutting Pump (Fig. 1, A) ...	As traction pump
Boost and Ancillary Pump	
Type	Cessna fixed displacement gear pump
Displacement	6 cc/rev
Max. Flow	18L/m (4 gal/m) at governed engine speed 3000 rpm
Input Speed	3000 rpm at 3000 rpm engine speed
Transmission Valve (Fig. 1, C)	
Type	Special spool valve Cessna 31408 incorporating cross line check relief valves and filter
Relief Valve Settings	
Cutting (Fig. 6, A) ...	207 kg/cm² (3000 psi)
Traction (Fig. 6, B) ...	276 kg/cm² (4000 psi)
Boost (Fig. 5, A)	8.4—10.5 kg/cm² (120—150 psi)
Filter	10 microns Purolator MF 26.A.4
Spool	3 positions each with detent
Wheel Motors	
Type	Hydrostatic Transmissions Ltd. M1875/b/S radial piston wheel motor
Swept Volume	169 cc/rev.
Torque Rating	15.9 kg/70 kg/cm² (115 lb ft/1000 psi)
Transmission Ratio	At maximum pump delivery
One Pump	Engine to wheels 26.67 : 1 — Pumps to wheels 22.56 : 1
Both Pumps	Engine to wheels 13.33 : 1 — Pumps to wheels 11.28 : 1
Diverter Valve	
Type	Cessna selector valve 300—064—AAA
Cylinder Motors	
Type	H.P.I. M 3BA 2015—L10 Reversible motor with side ports 2500561
Displacement	15L/1000 revs. (3.3 gals/1000 revs.)
Lift Valve	
Type	Cessna control valve assembly 30 923—AAD—P2 3 spools, no detents
Relief Valve Setting ...	130 kg/cm² (1875 psi)
Restrictors	2 way restrictor 0.52 mm (0.021") orifice
Lift Rams	Single acting displacement. Chromium plate pistons
Stroke	
Front and Wing Units ...	176 mm ($6\frac{15}{16}$")
Rear Unit	105 mm ($4\frac{1}{8}$")
Piston Diameter	25.4 mm (1")

ILLUSTRATIONS

Fig. 1 Layout of Components

Fig. 2 Pedal adjustment

Fig. 3 Main pumps

Fig. 4 Lift valve

Fig. 5 Transmission valve

Fig. 6 Transmission valve

Fig. 7 Wheel motor

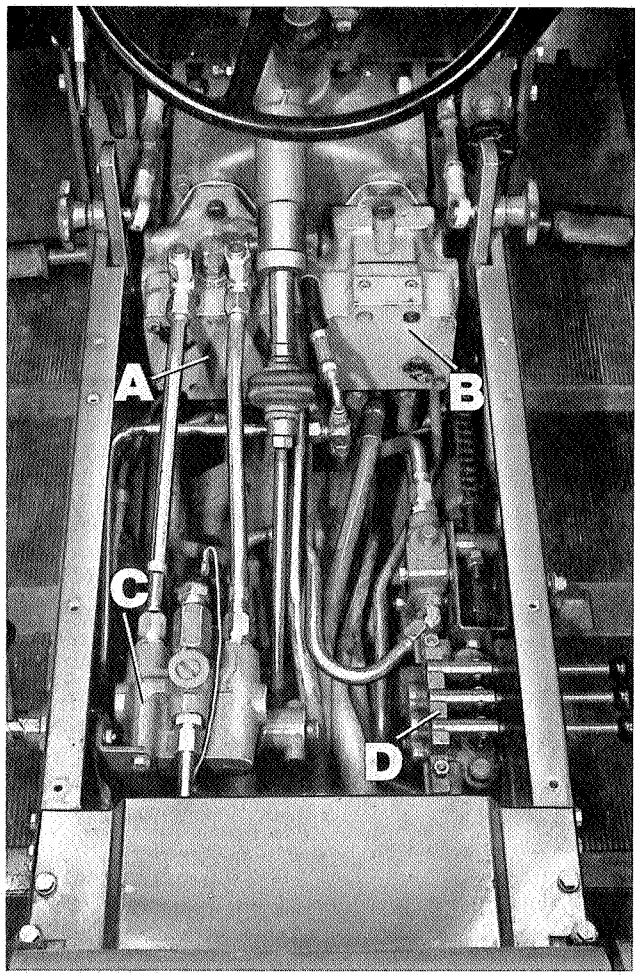


Fig. 1

Fig. 2

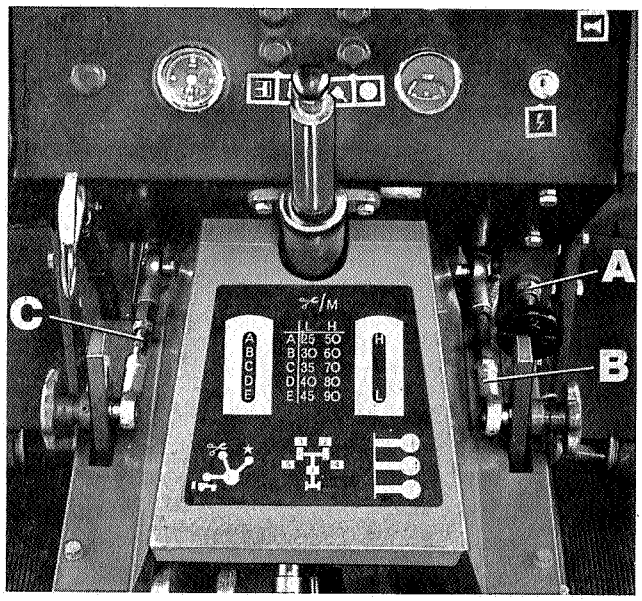
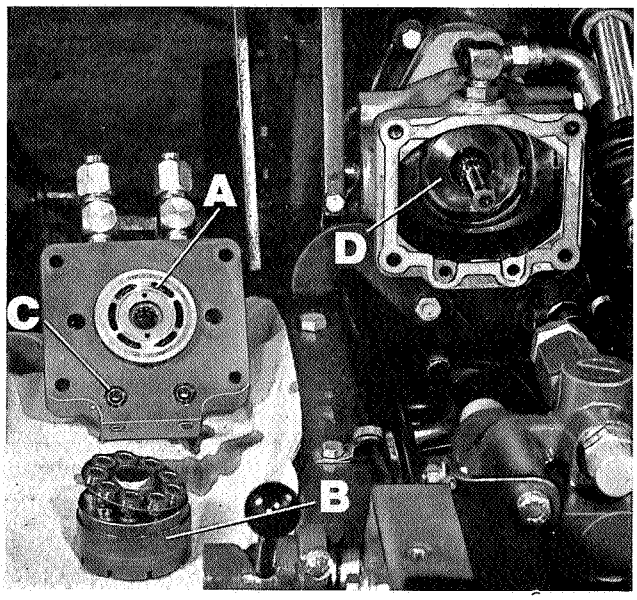


Fig. 3



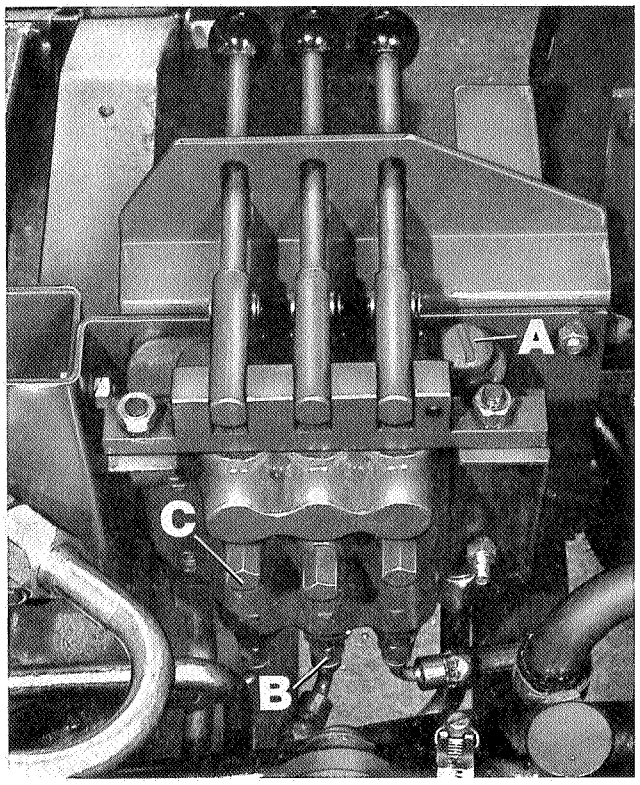


Fig. 4

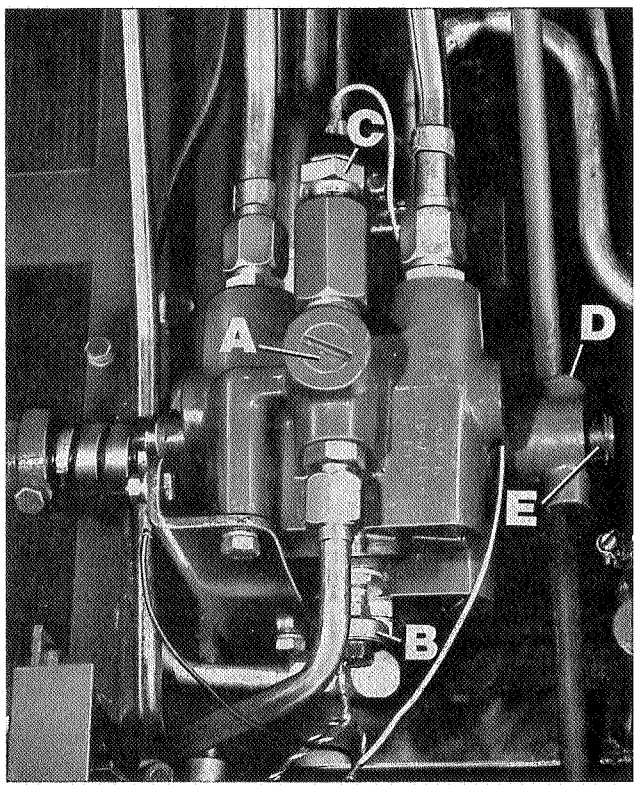


Fig. 5

Fig. 6

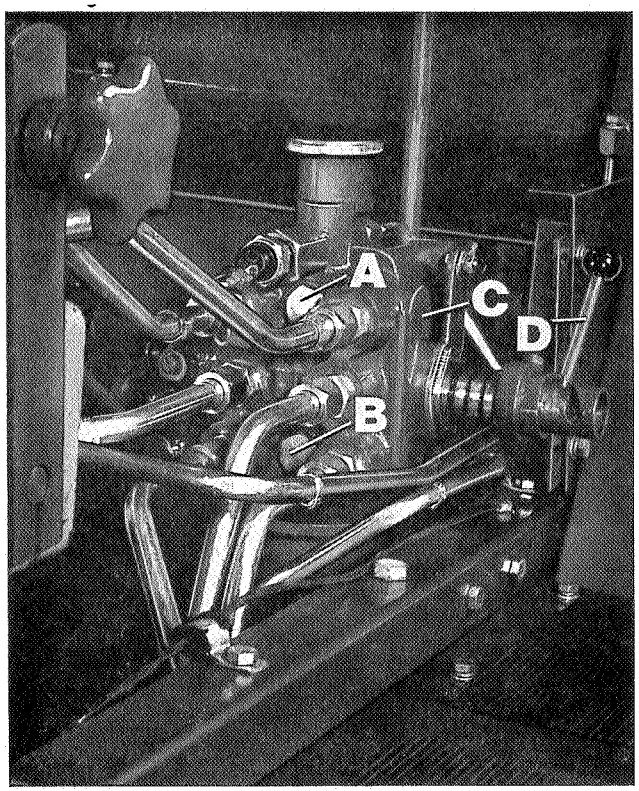
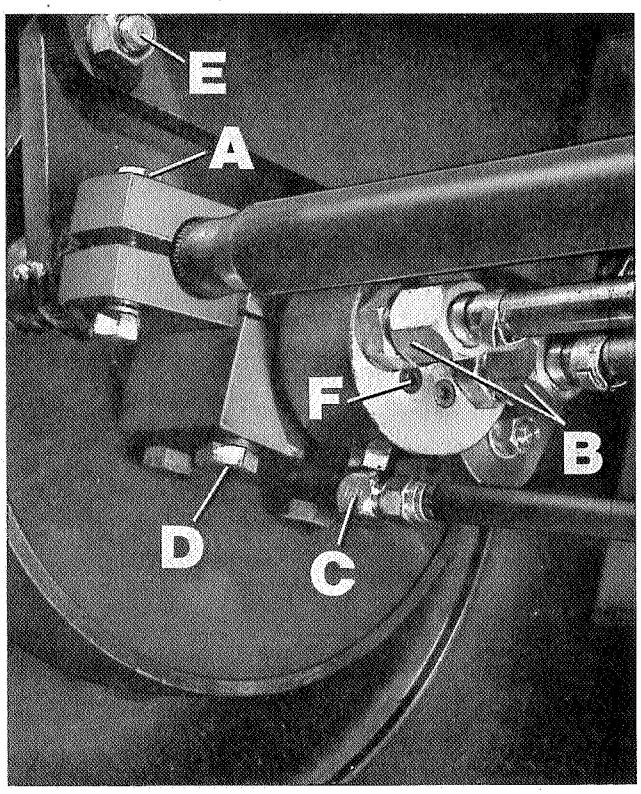
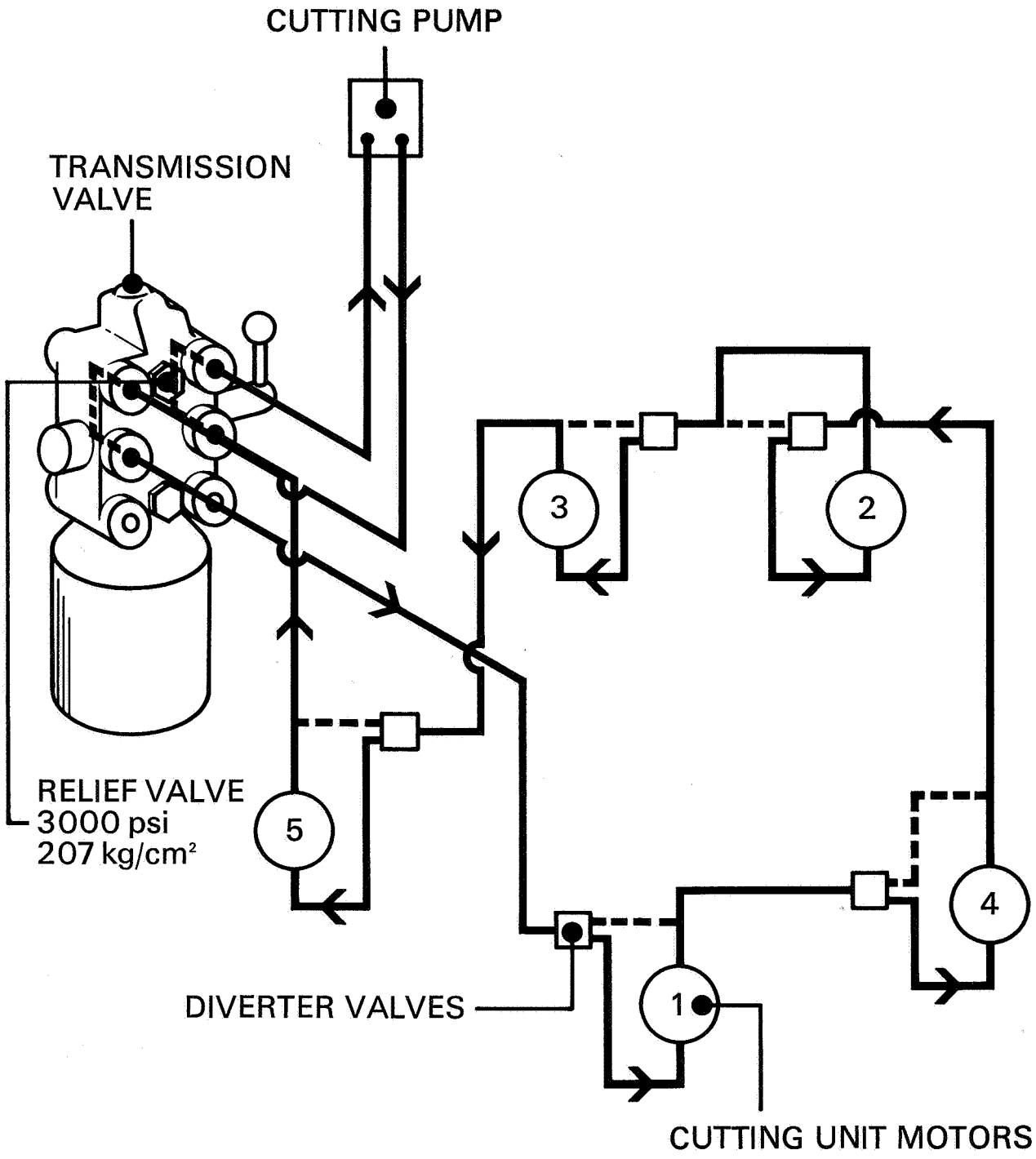


Fig. 7



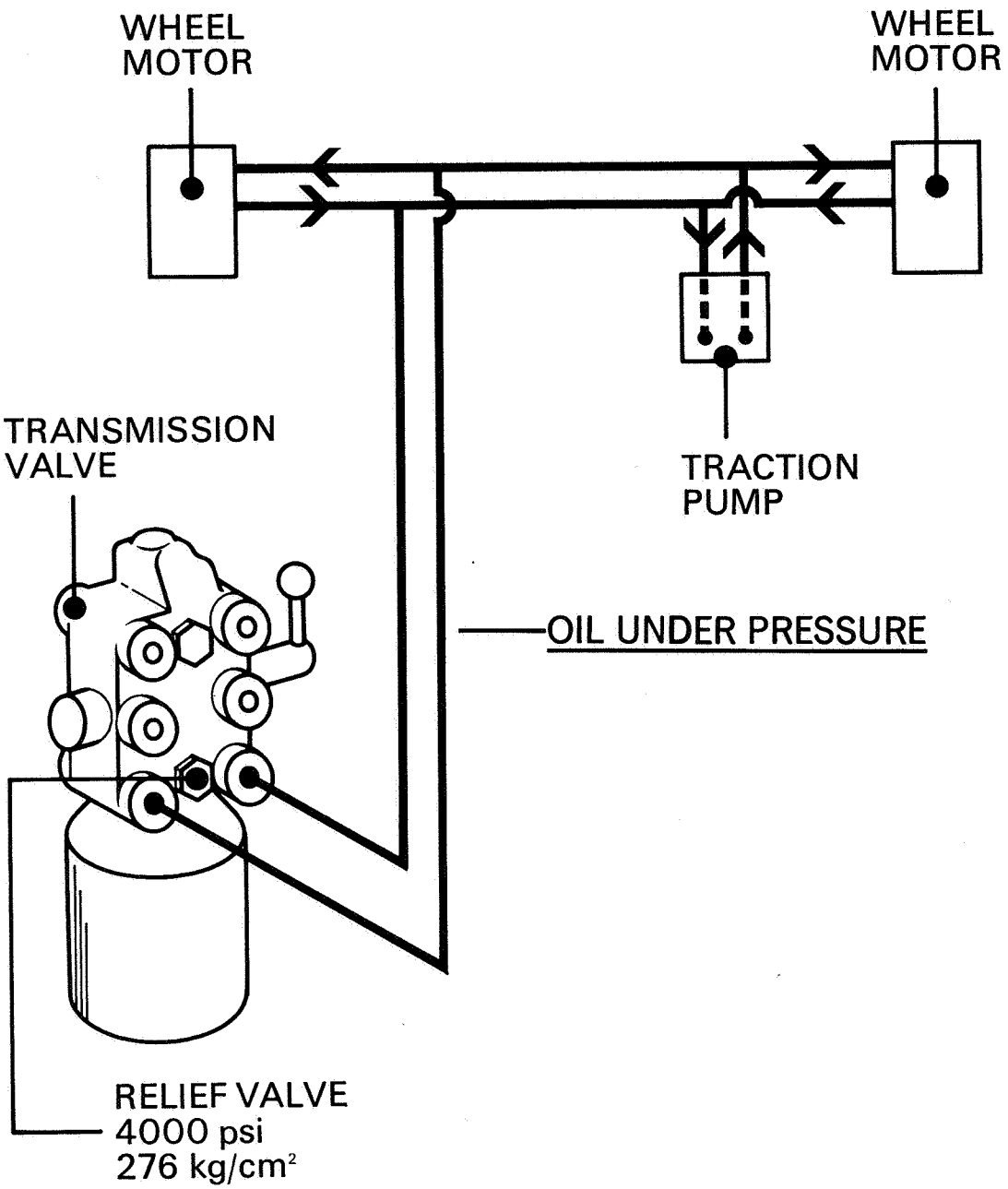
CUTTING CIRCUIT

Arrows denote oil flow for forward motion



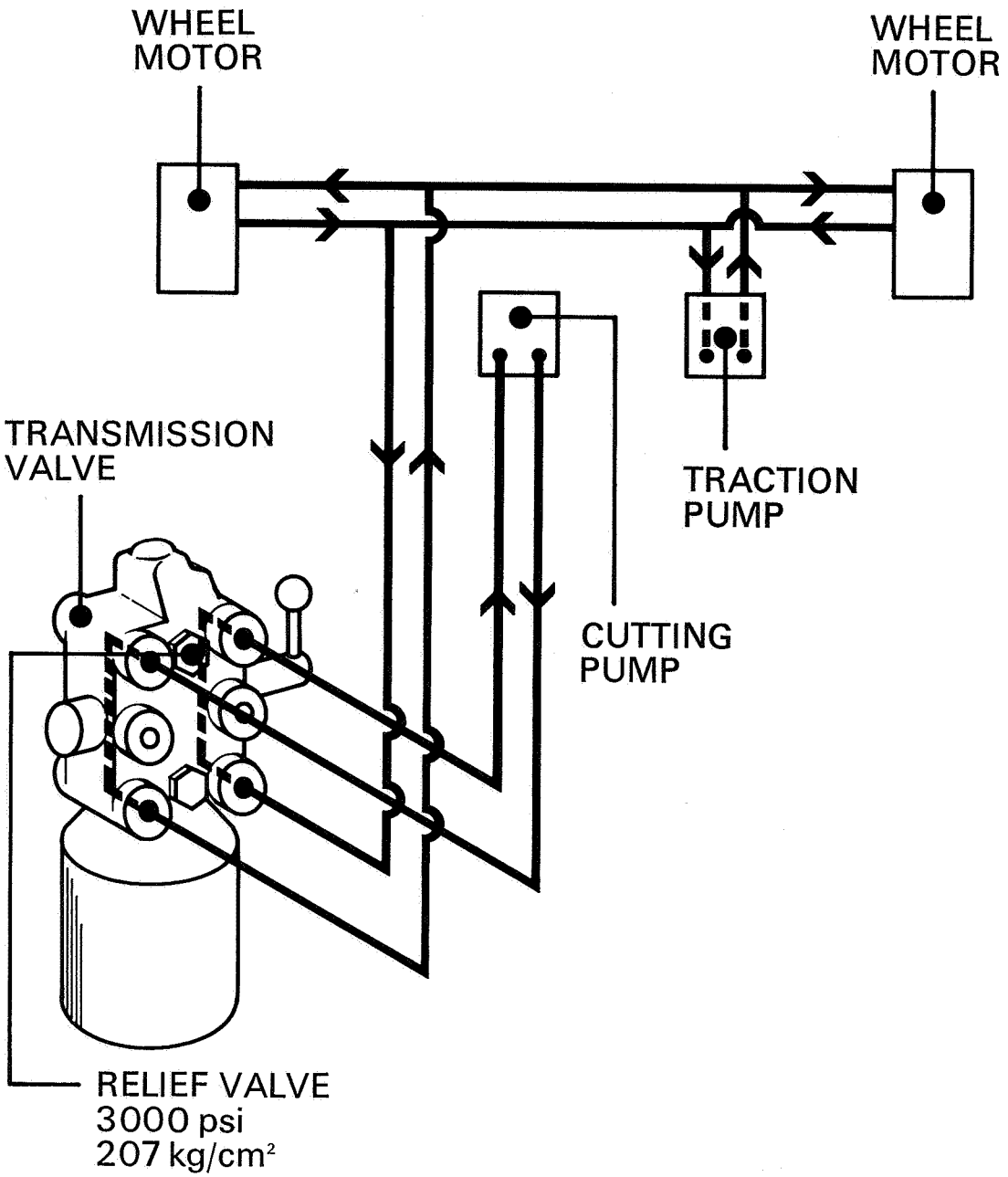
TRACTION CIRCUIT

Arrows denote oil flow for forward motion

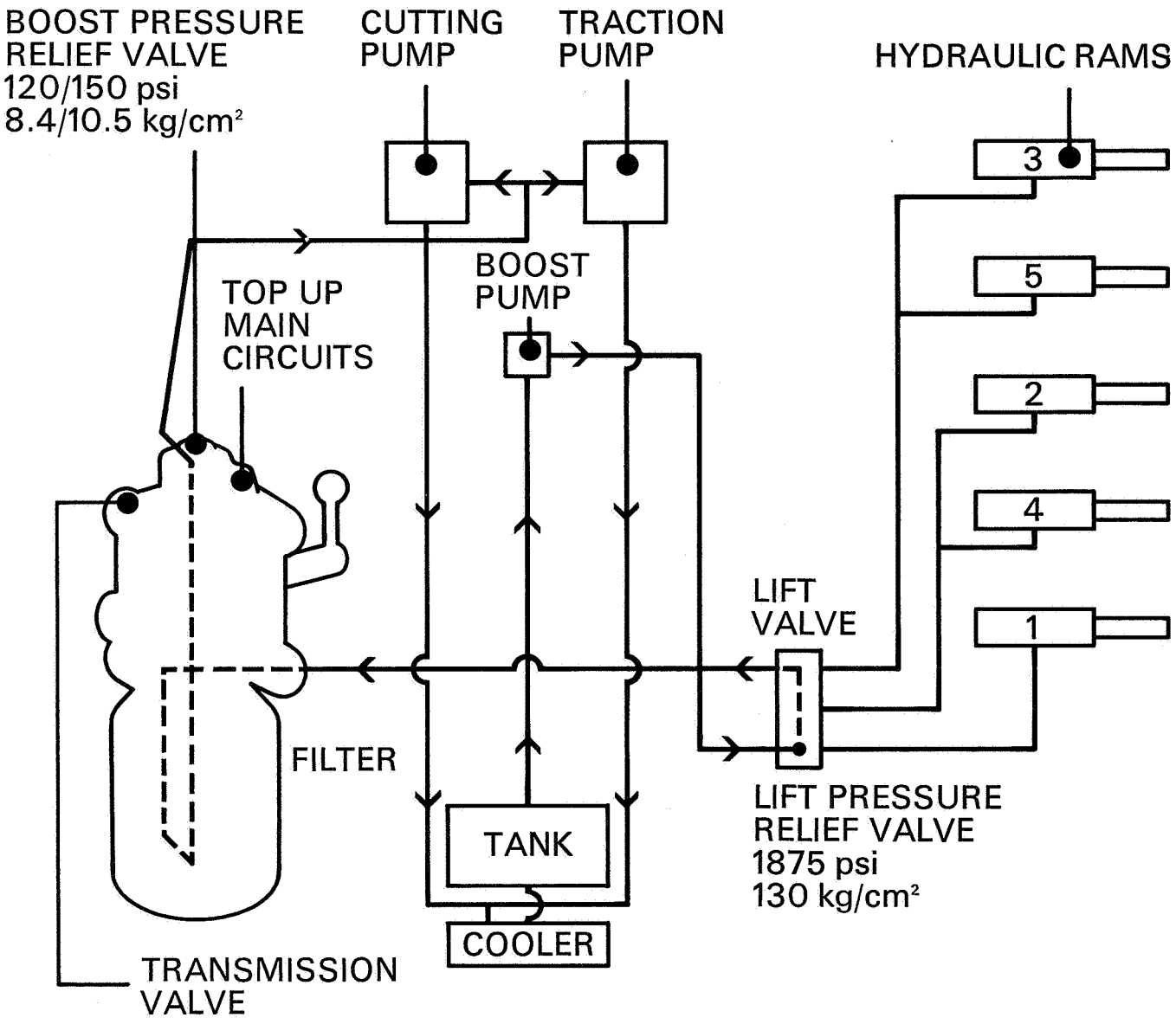


TRANSPORT CIRCUIT

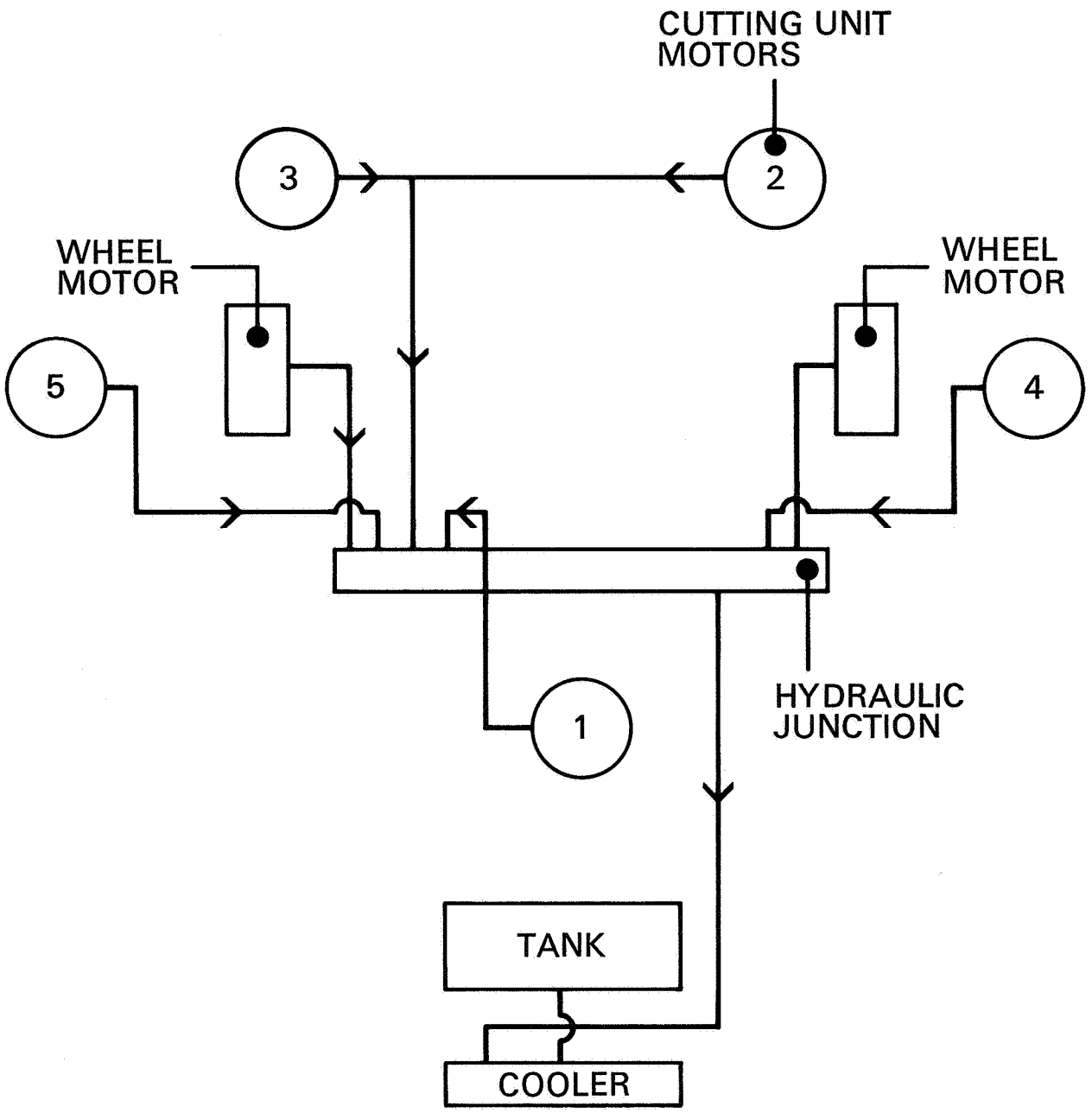
Arrows denote oil flow for forward motion



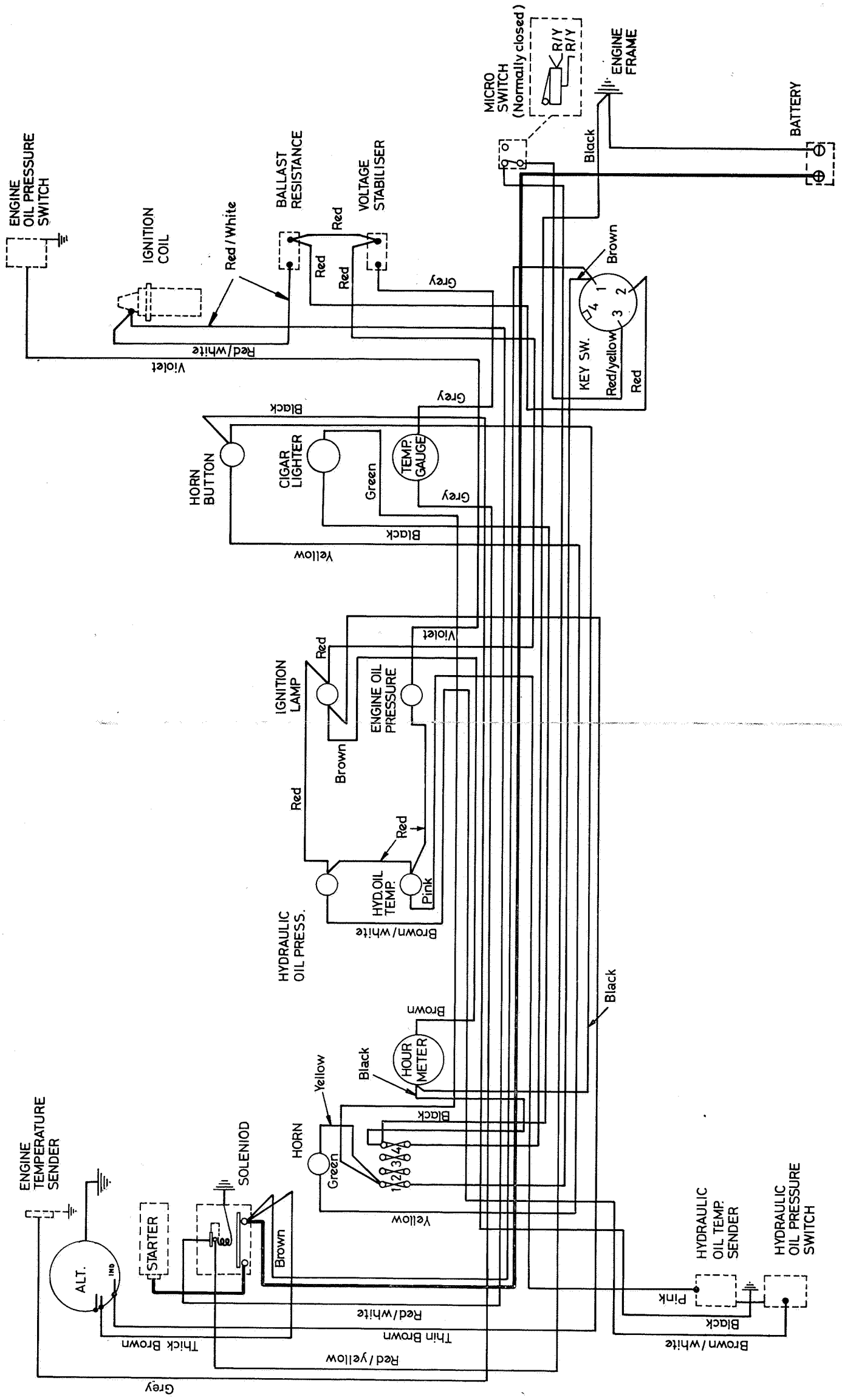
BOOST AND LIFT CIRCUIT



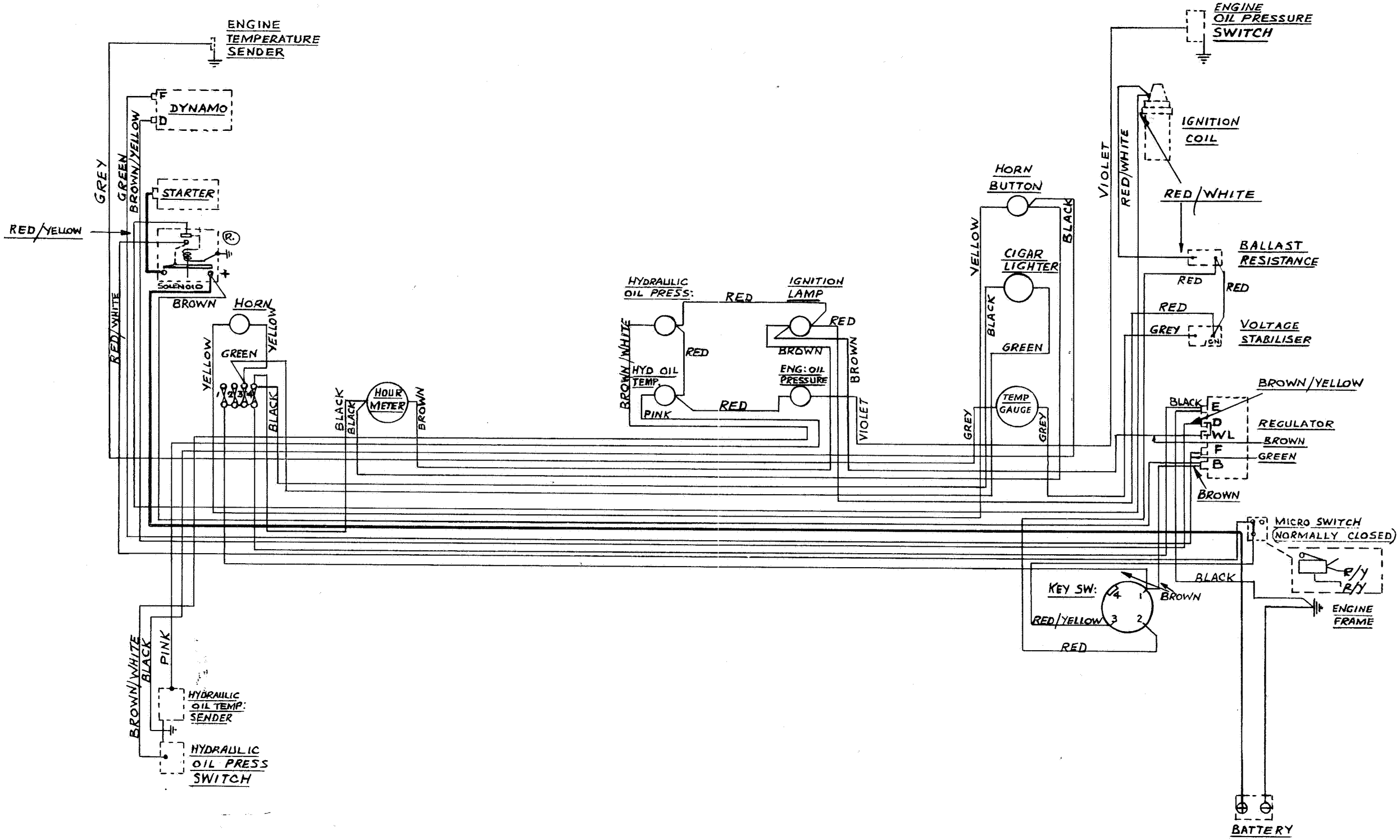
DRAIN CONNECTIONS



WIRING DIAGRAM FOR MACHINES WITH ALTERNATOR



WIRING DIAGRAM FOR MACHINES WITH GENERATOR



NOTES

NOTES