

Electronically-controlled hydraulic lift unit.

REMOVAL



WARNING

Lift and handle all heavy parts with a lifting device of proper capacity.

Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

To remove the lift unit from the tractor proceed as follows:

- Disconnect lift arms from the three point linkage.
- Remove remote control valve coupling bulkhead plate from lift body.
- Disconnect remote control valve oil lines from lift body.
- Remove vent pipe between lift top cover and parking brake quadrant support.
- Remove auxiliary cylinder (if fitted).
- Disconnect electrical wiring at: oil delivery control solenoid, oil return control solenoid and potentiometer.
- Remove lift to rear drive housing screws and lift unit clear from the rear, using adaptor **292575** and sling hook **291359/2**.

Note - To facilitate lift unit removal it may be advisable to first take down the electro-hydraulic control valve complete with its oil delivery and return solenoids.

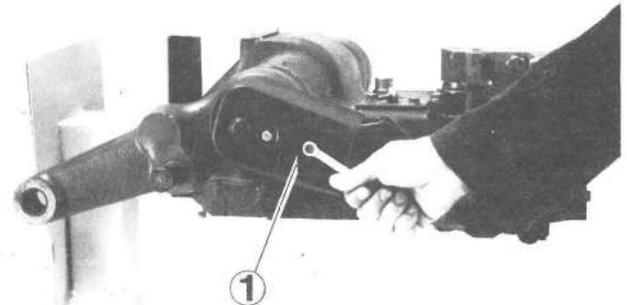
DISASSEMBLY



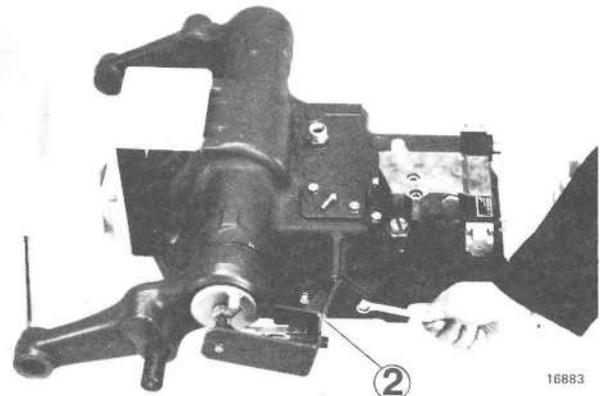
WARNING

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety goggles, heavy gloves, safety shoes.

To facilitate lift disassembly, shop-build bracket **50023** as shown on page 2. Use bracket to secure lift to revolving stand **290086**. Disassemble lift noting the following points:

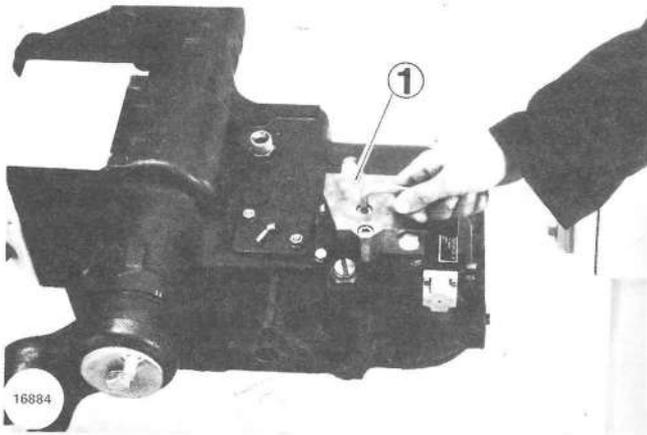


- Remove potentiometer protection cover (1).

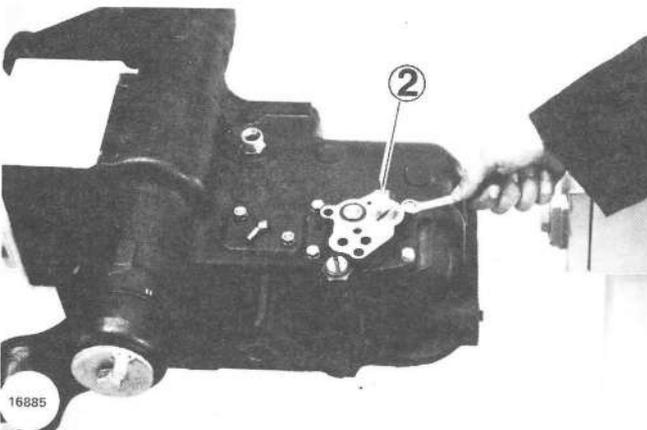


- Remove potentiometer bracket (2).

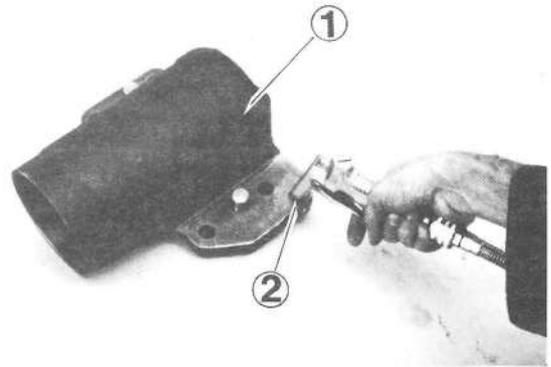
HYDRAULIC LIFT UNIT: Electronically-controlled lift



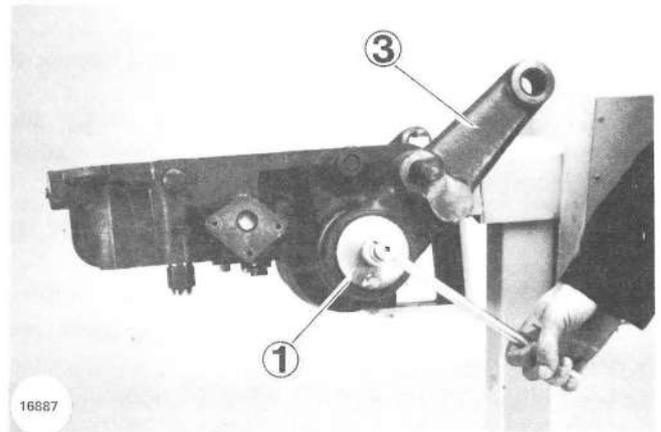
- Back out the two screws retaining the electrohydraulic control valve (1) and take off this valve complete with its oil delivery and return control solenoids (unless this was already done earlier during lift unit removal).



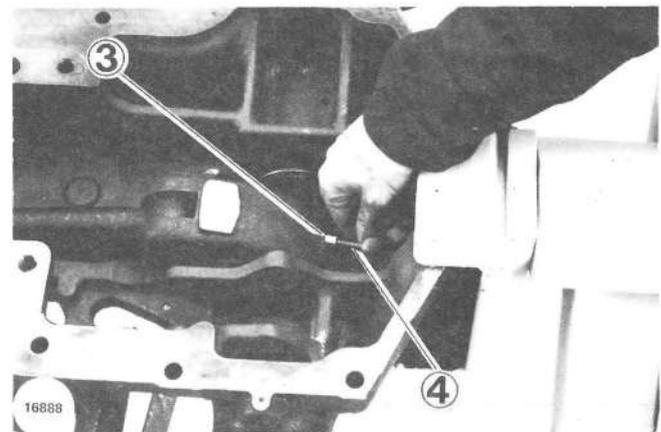
- Remove the hydraulic control valve (2) after taking out its three mounting screws.



- Take off the cylinder, complete with piston, after removing its four screws.
- Expel piston from barrel of cylinder (1) by blowing compressed air through oil delivery port (2).

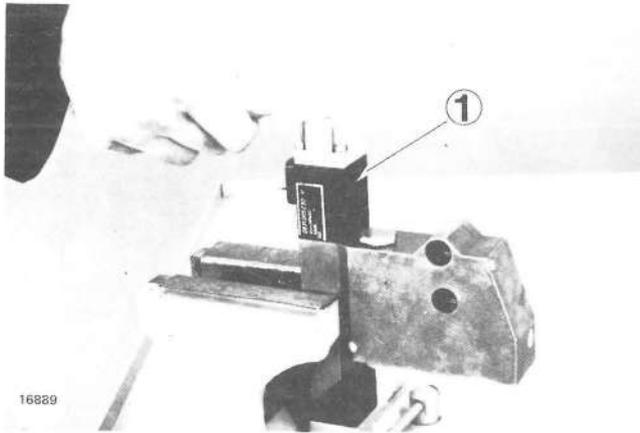


- Take off lift RH arm (3) and plate (1) with potentiometer/max raise control pin by backing out its fixing screw.



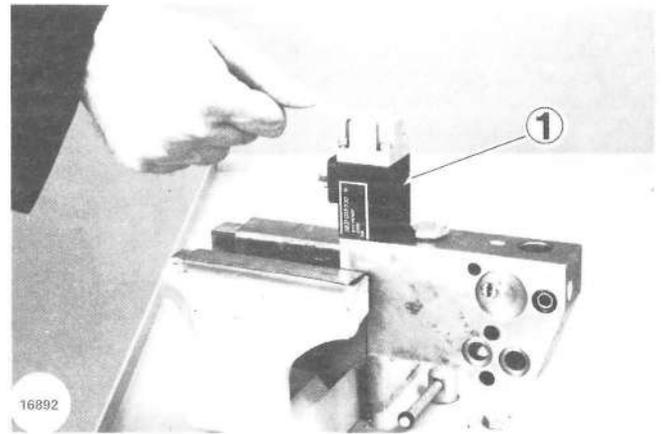
- Straighten the tab of screw lock plate and back out both the screw and locating dowel (3) securing the inner arm to cross shaft.
- Take out the LH arm complete with cross shaft and thrust plate.
- If damaged, remove the cross shaft seals.

Disassemble the **electrohydraulic control valve** into its components, proceeding as follows:



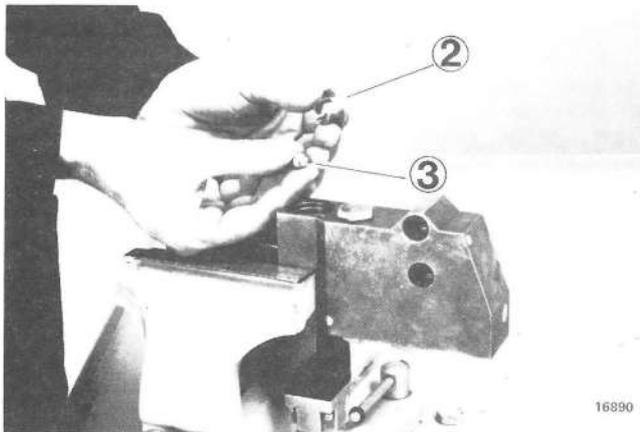
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— Back out the three screws securing the oil return solenoid (1) to electrohydraulic control valve housing.



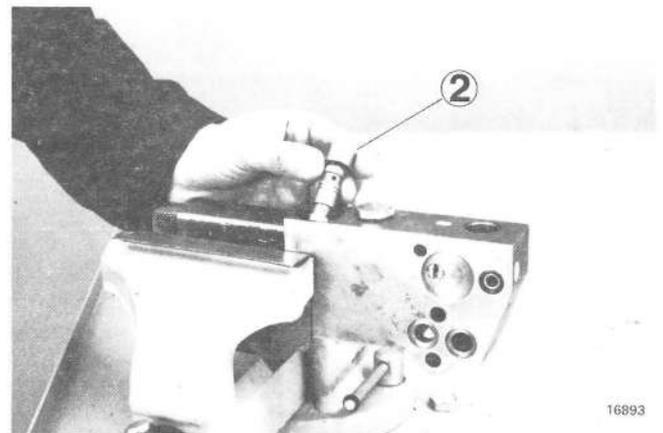
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— Back out the screws securing the oil delivery control solenoid (1) to the electrohydraulic control valve housing.



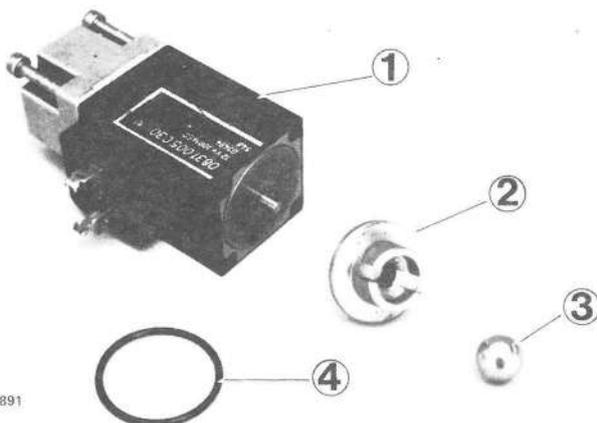
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— From electrohydraulic control valve housing remove the oil return control ball (3) and its housing (2).



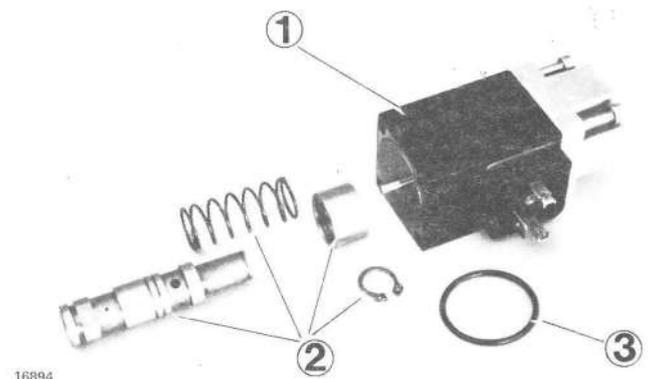
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— From electrohydraulic control valve housing take out the complete spool (2).



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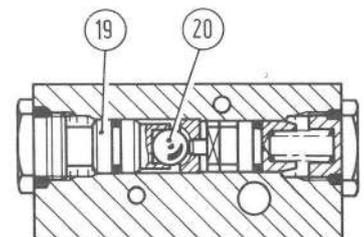
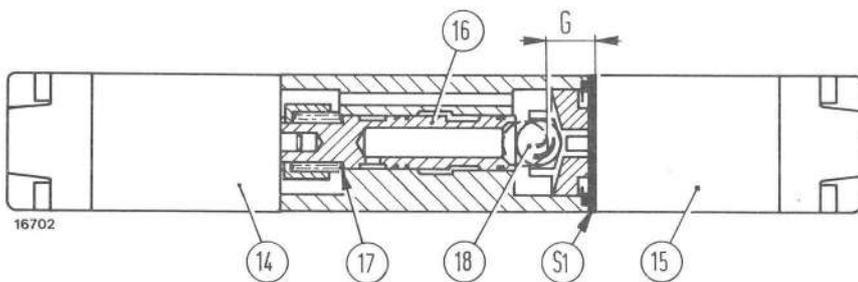
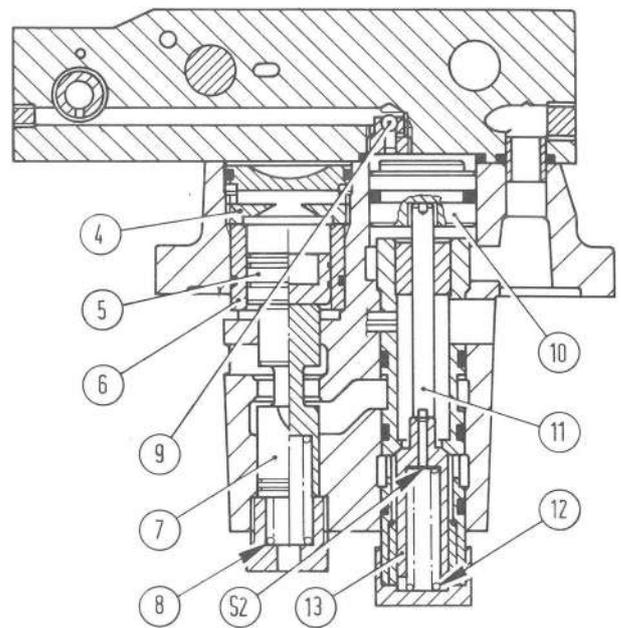
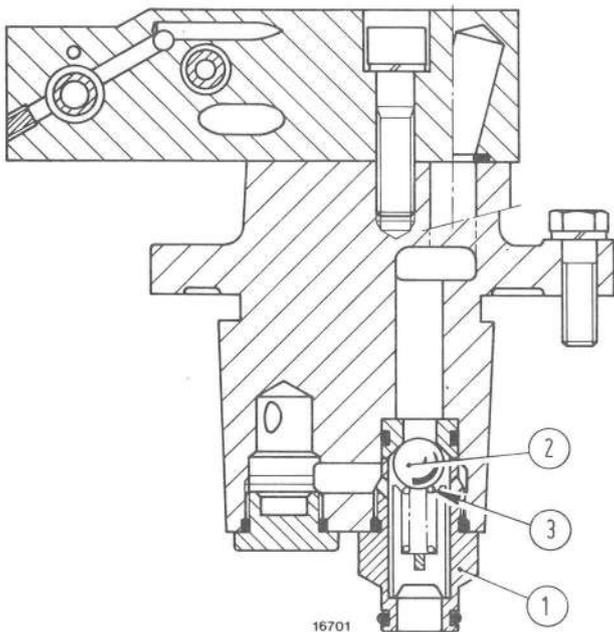
— On bench check ball (3), housing (2) and O-ring (4) for good condition and efficiency.



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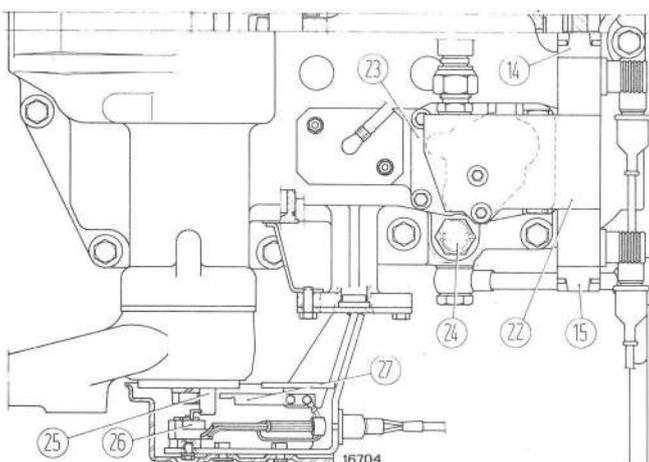
— On bench, check the following items for good condition and efficiency: spool (2) complete with spring, cup and retaining ring, and O-ring (3).

HYDRAULIC LIFT UNIT: Electronically-controlled lift



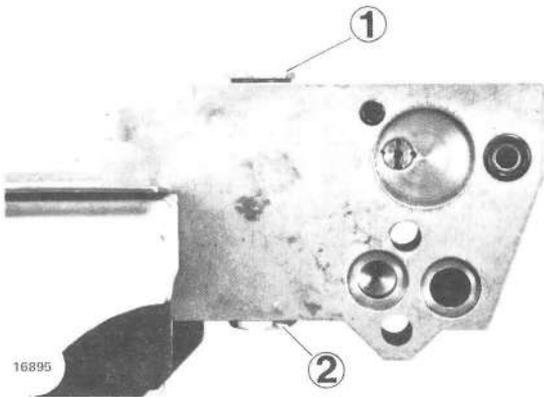
Sections through the electronic lift control valve.

G = 11 to 11.5 mm (.433 to .453 in). Oil return valve ball fit clearance - S₁. Oil return solenoid shim - S₂. Oil return valve spring shim - 1. Oil delivery connection - 2. Check valve - 3. Check valve spring - 4. Pilot valve connection - 5. Pilot valve piston - 6. Pilot valve piston barrel - 7. Pilot valve poppet - 8. Pilot valve spring - 9. Check valve with restrictor - 10. Oil return valve piston - 11. Oil return valve poppet control pin - 12. Oil return valve spring - 13. Oil return valve poppet - 14. Oil delivery control solenoid - 15. Oil return control solenoid - 16. Control valve spool - 17. Spool return spring - 18. Oil return valve ball - 19. Oil delivery pressure regulating valve - 20. Pressure regulating valve ball.

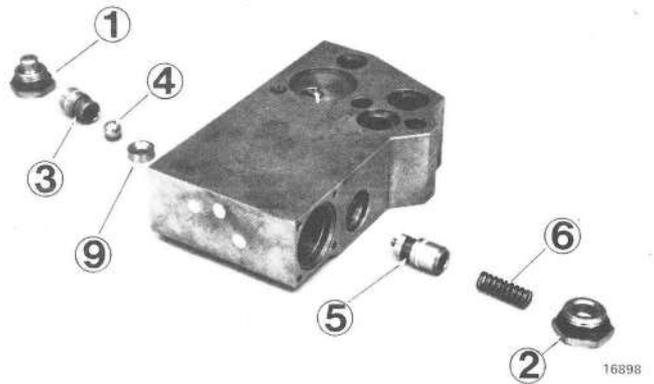


Electronically controlled lift unit top view.

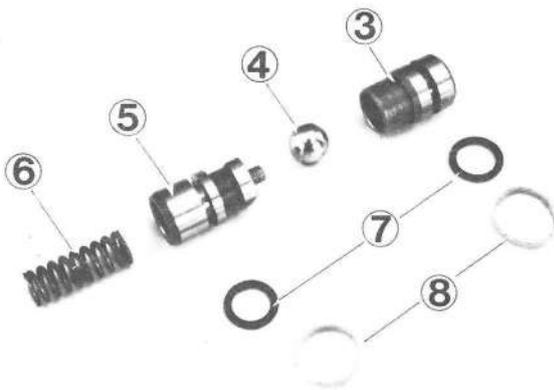
14. Oil delivery control solenoid - 15. Oil return control solenoid - 22. Electrohydraulic control valve - 23. Hydraulic control valve - 24. Cylinder pressure limiting valve - 25. Lift arm RH retaining washer - 26. Position sensor - 27. Stroke end limiter.



— Unscrew plugs (1) and (2) from the oil delivery pressure regulating valve.

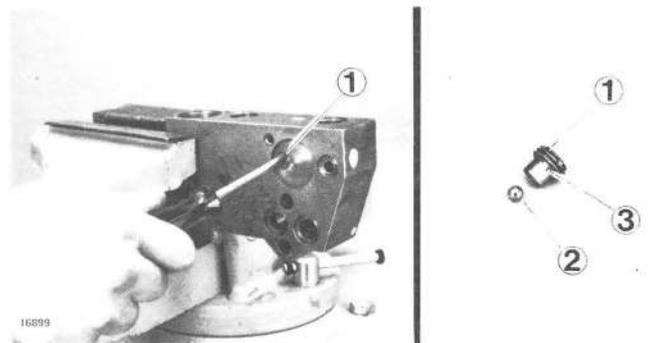


— On bench, check for good condition and efficiency the following items: plugs (1 and 2), pump end valve (3), ball (4), cylinder end valve (5), spring (6) and ball housing (9) with calibrated orifice.

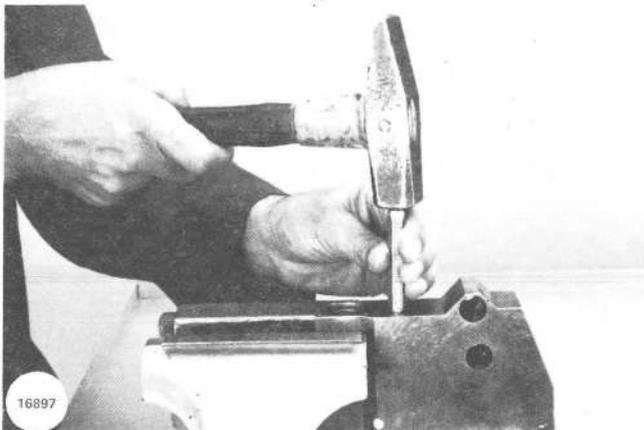


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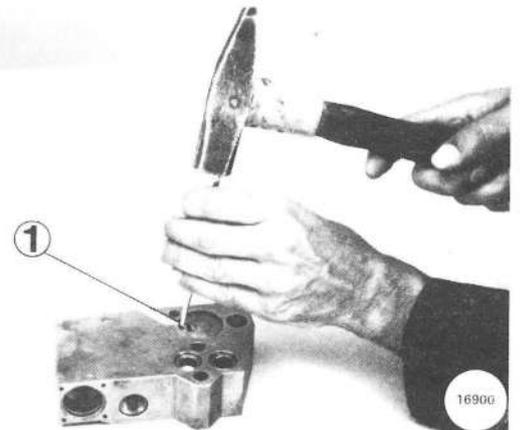
— From electrohydraulic control valve housing, remove the cylinder end valve (5), spring (6), ball (4), pump end valve (3), O-rings (7) and backup rings (8).



— Unscrew plug (1) complete with calibrated orifice (3) and pick up ball (2) of the check valve with restrictor.



— From electrohydraulic control valve housing, take out the ball housing.

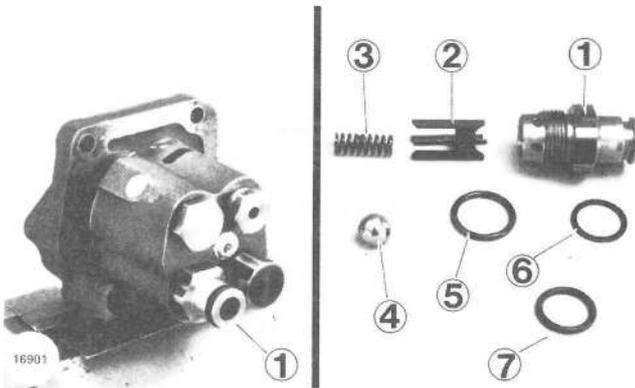


— On bench check all items for good condition and then reassemble.

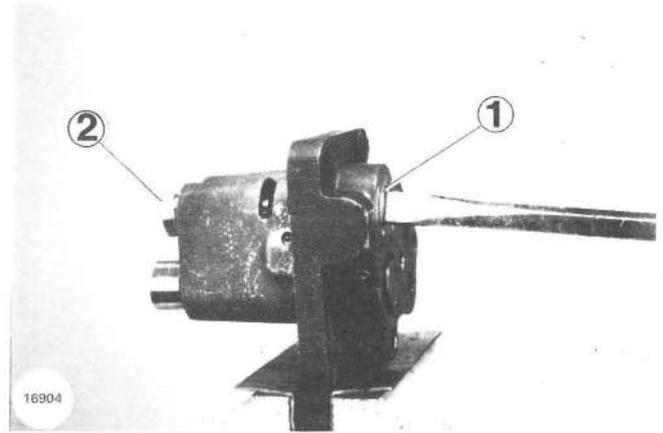
Note - Upon reassembly, screw in the restrictor check valve plug (1) flush with electrohydraulic control valve housing and stake in position.

HYDRAULIC LIFT UNIT: Electronically-controlled lift

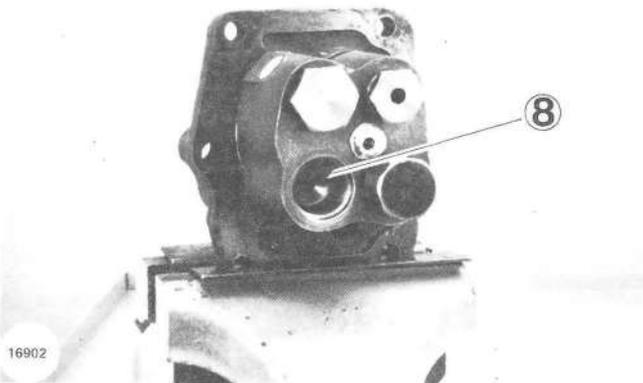
Next, disassemble the hydraulic control valve unit as follows:



— Remove the check valve and inspect on bench the following items for good condition: oil delivery connection (1) spring guide (2), spring (3), ball (4), O-rings (5 and 7) and backup ring (6).



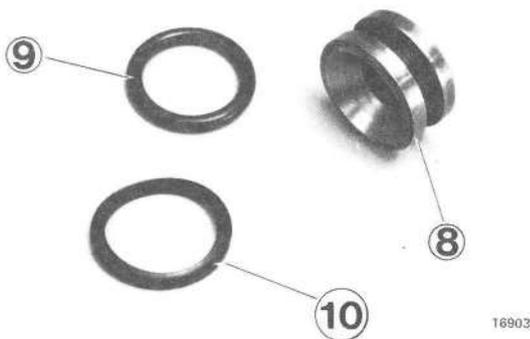
— Unscrew plugs (1 and 2) and pickup the pilot valve from control valve housing.



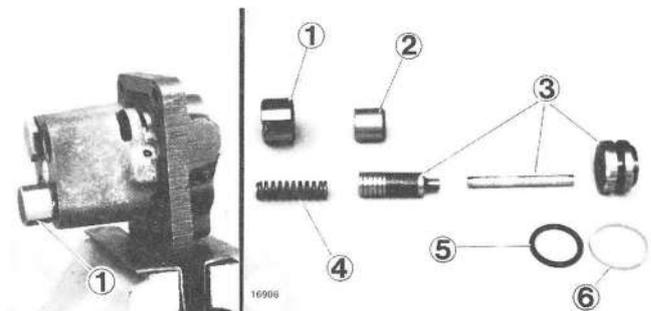
— From hydraulic control valve housing take out the check valve ball housing (8).



— On bench check the following items for good condition: plugs (1 and 2), pilot valve (3), pilot valve piston barrel (4) and spring (5).

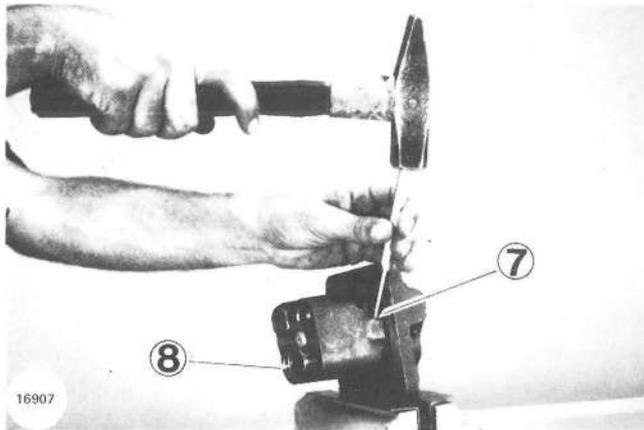


— On bench, check the following items for good condition: check valve ball housing (8), O-ring (9) and backup ring (10).



— Remove plug (1) and from inside the control valve remove the oil return valve. Next, on bench, check the following items for good condition: plug (1), oil return valve housing (2), oil return valve (3), spring (4), O-ring (5) and backup ring (6).

Note - Shims (S₂, page 22) may be fitted inside the oil return valve poppet to adjust the spring load setting.



— Remove roll pin (7) and take out the oil return valve case (8).



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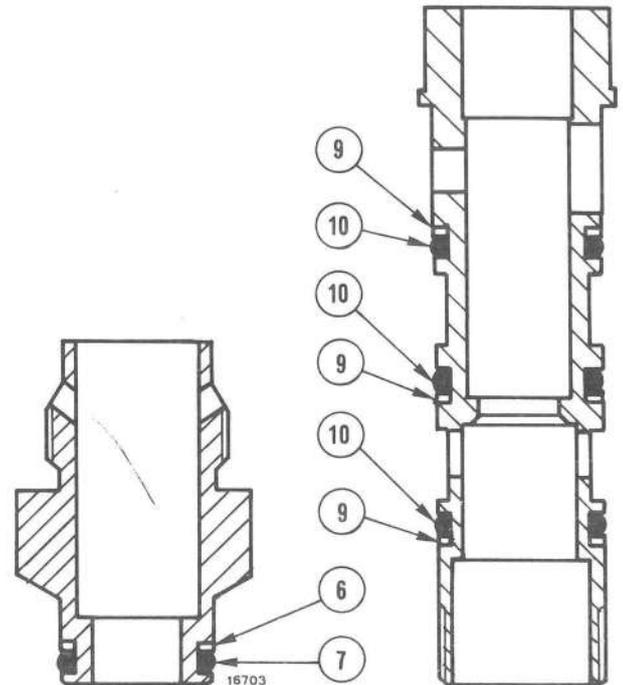
— On bench, check the following items for good condition: roll pin (7), valve case (8), backup ring (9), and O-rings (10).

If O-rings (10) and backup rings (9) are damaged, replace without hesitation and fit back in the return valve case and on delivery connection as shown in illustration alongside (O-ring to be located between pressure side and backup ring).

INSPECTION

Refer to the data given in the table on pages 7 and 8 Sect. 50, and proceed as follows:

- Check the seals for inefficiency and replace as necessary.
- Check valves for wear and appropriate fit clearances.
- Check the pressure setting of relief valve (incorporated in remote control valves) as shown on page 16, Sect. 51 or page 6 Sect. 54 and cylinder safety valve as shown on pages 15 and 16, Sect. 51.



Correct assembly locations of O-rings (7 and 10) and backup rings (6 and 9) on oil delivery connection and in oil return valve case.

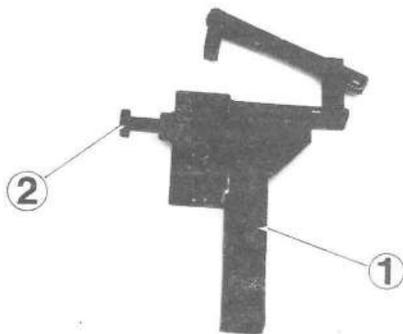
ASSEMBLY

Reverse the disassembling procedure noting the following points:

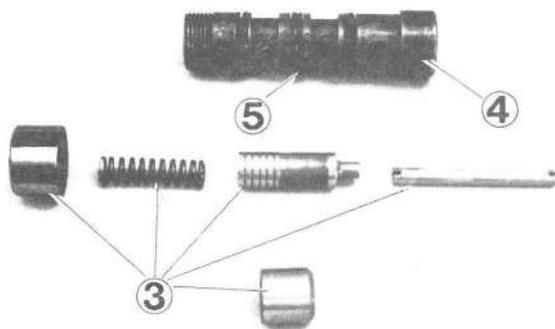
- If cross shaft bushing replacement is necessary, press the replacement bushings into the lift body from outside ensuring that bushings lie flush with face (A, page 4). These bushings do not require reaming after fitting.
- Install cross shaft as shown on page 5.
- If inefficient, replace cross shaft seals as instructed on page 5.
- Insert piston in barrel as instructed on page 5.
- Assemble control valve as shown on page 22. Thoroughly clean and degrease mating surfaces and apply one of the jointing compounds indicated on page 6, section A.

Note - Upon control valve reassembly, check oil return valve poppet for efficiency and check valve opening load setting as follows:

HYDRAULIC LIFT UNIT: Electronically controlled lift

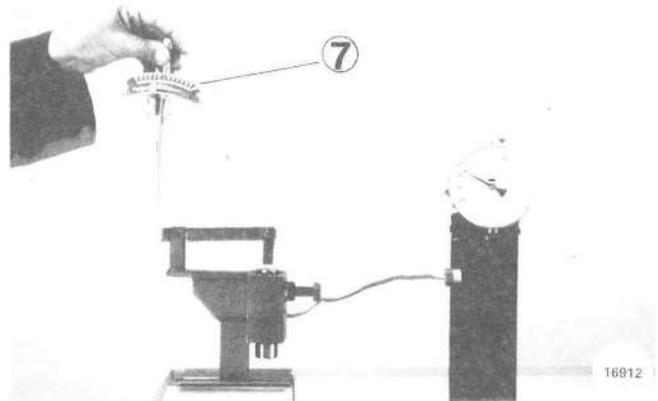


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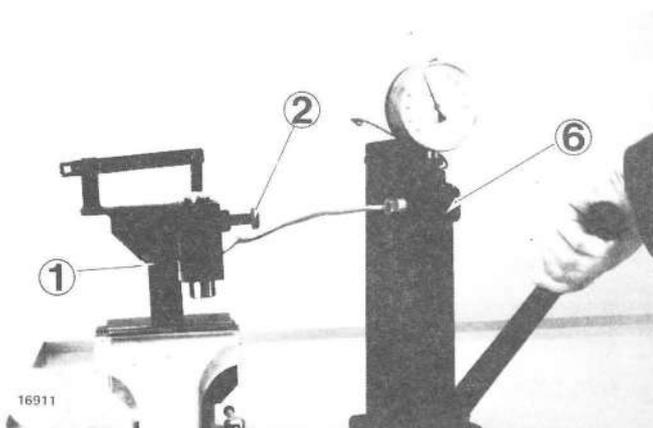
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- Fit oil return valve (3) complete with case (4) already containing O-rings and backup rings (5) in tool **292843** (1) and lock in position by screw (2).



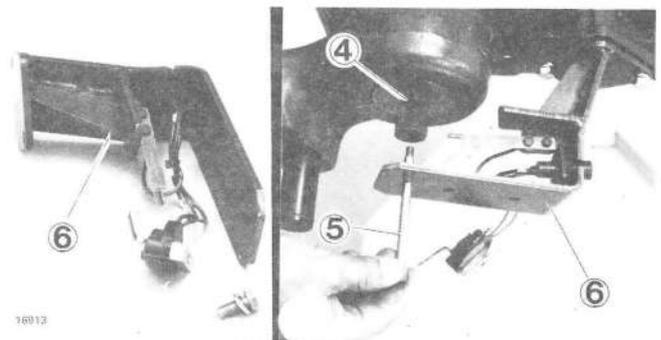
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- Raise oil pressure again to about 100-200 kg/cm² or 1451 to 2901 psi) and then, using a torque wrench **293512** applied **exactly** as shown above, check that oil return valve begins to open when a torque of .65 to .70 daNm (9.2 to 9.9 ft lb) is applied.
- Should this not occur, add or remove shims (S₂, page 22) as required to obtain the correct load of spring (12, page 22).
- Between oil return valve solenoid (15, page 22) and electrohydraulic control valve, insert the associated seal and shims (S₁) totalling the thickness needed to provide a fit clearance (G, page 22) of 11 to 11.5 mm (.433 to .453 in) for the valve ball.
- Fit the RH lift arm on cross shaft, respecting the reference marks provided on either item.



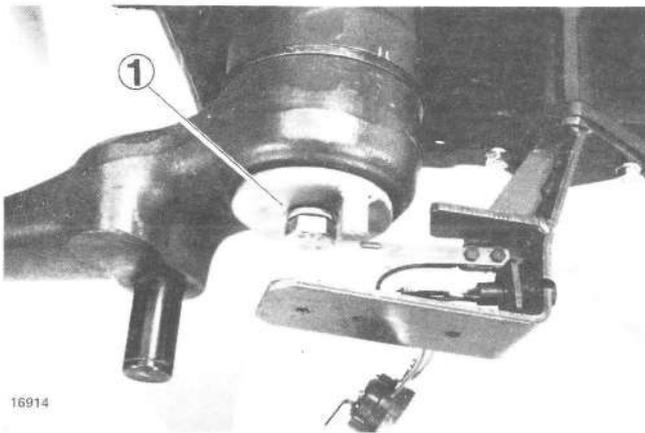
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- Couple tool **292843** (1) to hand pump **290284** supplied with **IDRAULICAR AP 51** oil.
- Operate pump to bring circuit to an initial pressure of 250 kg/cm² or 3626 psi. Then check that pressure takes more than six seconds to drop from 200 kg/cm² (2901 psi) to 100 kg/cm² (1451 psi).



16913

- Install item (4) of tool **292849** on cross shaft.
- Fit potentiometer bracket (6) without fully tightening its screws.
- Insert item (5) of tool **292849** in the hole drilled in bracket (6) for potentiometer mounting screw and tighten onto item (4).
- Lock screws (6) securing the bracket (6) on lift body and take off items (4) and (5) of tool **292849**.



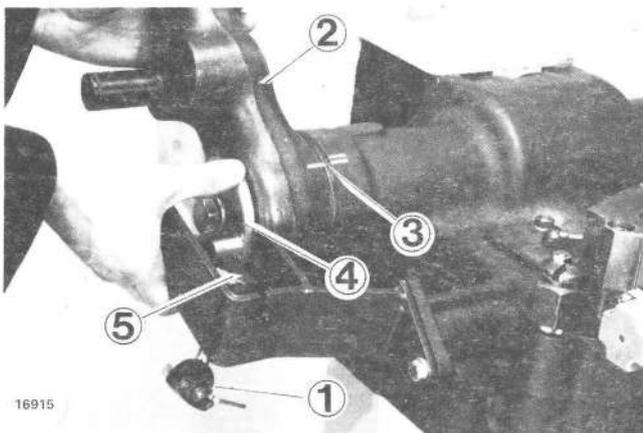
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- Install the LH arm and torque the retaining screw.
- Fit the right washer (1) without tightening the arm retaining screw.
- Proceed with the lift adjustment operations as described below.

LIFT UNIT ADJUSTMENTS

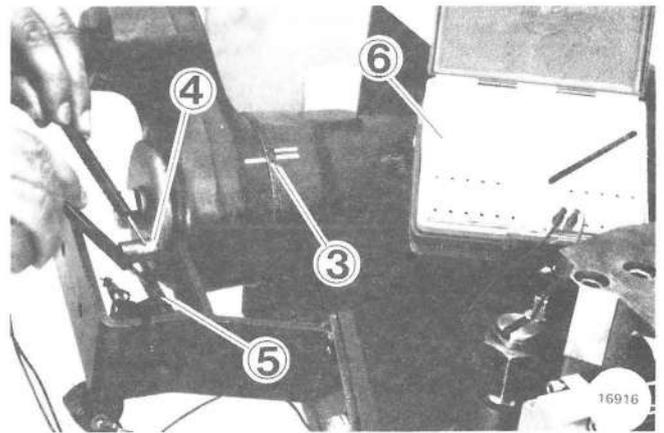
Maximum lift arm travel adjustment.

Proceed as follows:



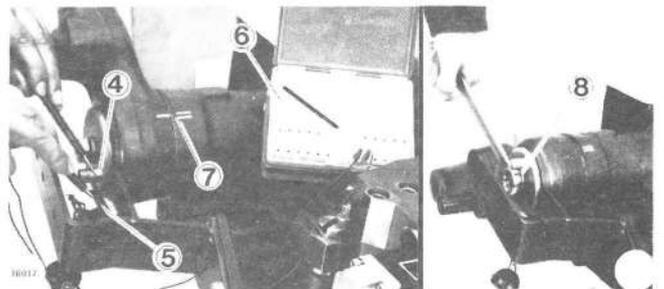
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- With potentiometer (1) disconnected, raise lift arms (2) so that the internal arm comes into contact with the lift body.
- Trace two lined up reference marks (3) on lift body and on RH lift arm.
- Turn right washer (4) until washer pin and max travel limiter (5) come into contact.



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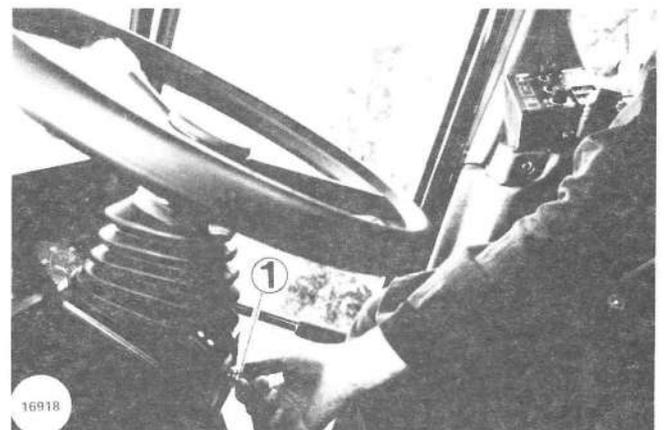
- Using tester (6) check that under these conditions electrical contact between pin (4) and limiter (5) is still effective.



- Lower the arm until the distance (7) between the two reference marks is 2 to 3 mm (.0787 to .1181 in) at the same time checking that electrical contact between pin (4) and limiter (5) is interrupted.
- Tighten the right washer retaining screw (8) to the specified torque: washer must not be allowed to turn.

Position control sensor on-tractor adjustment.

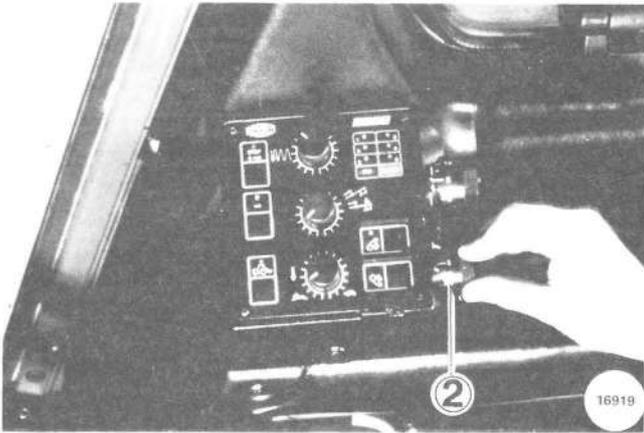
Proceed as follows:



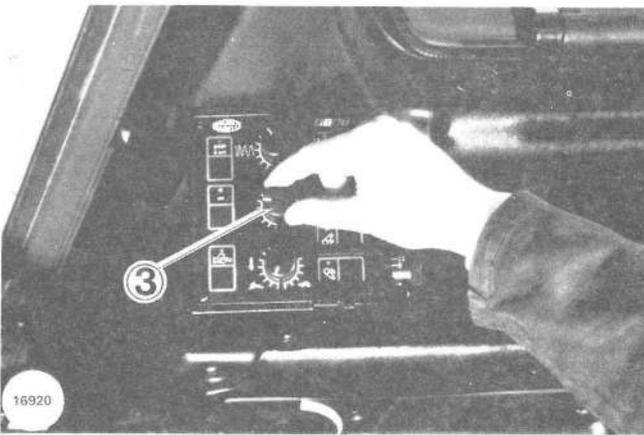
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HYDRAULIC LIFT UNIT: Electronically-controlled lift

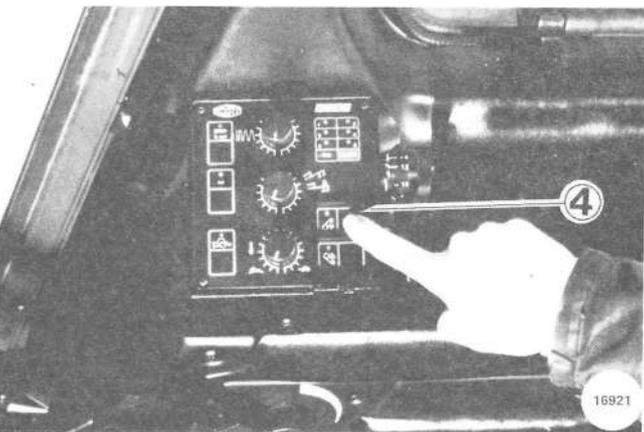
— With engine OFF, activate the electronic control unit by setting the lock switch on START.



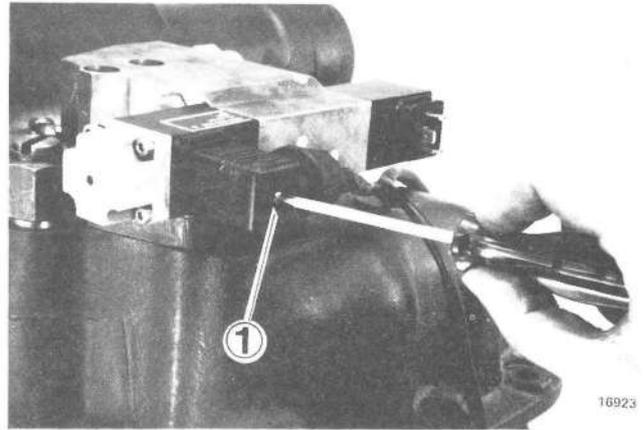
— Set position control knob (2) all down (on ZERO).



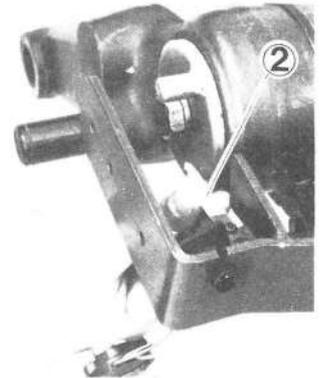
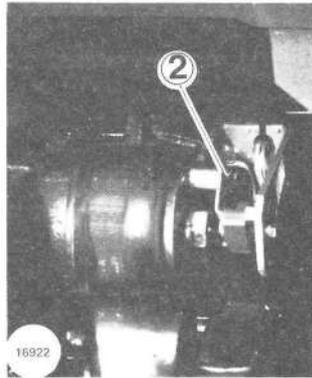
— Set the lift top travel limit control knob (3) all up.



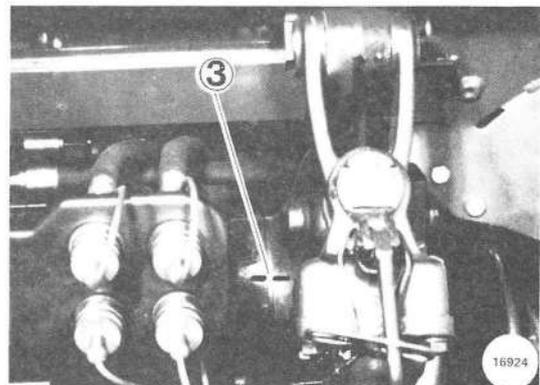
— Press lift arm raise button (4).



— 'Break' the oil delivery solenoid connection (1).

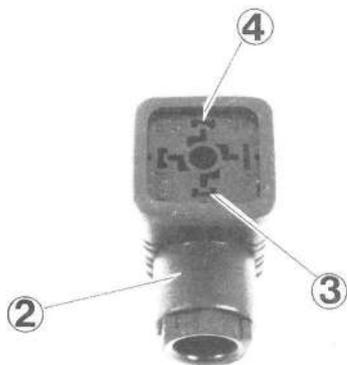
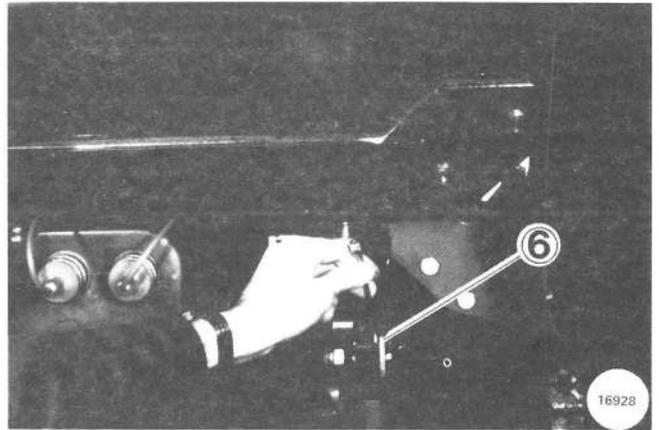
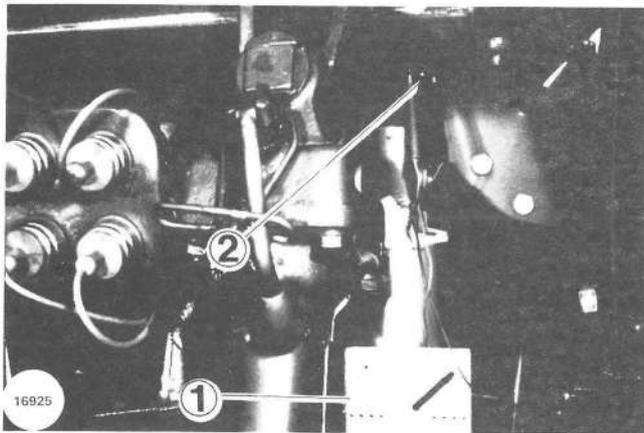


— Isolate the max lift travel limiter (2).



— Manually raise the lift arms so that the inner arm comes into contact with the lift unit body.

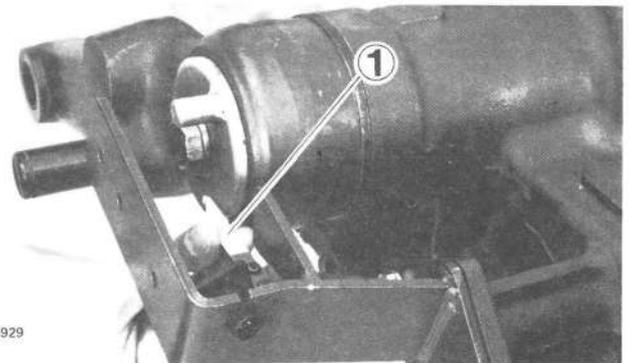
— Trace two lined-up reference marks (3) on lift body and on RH lift arm.



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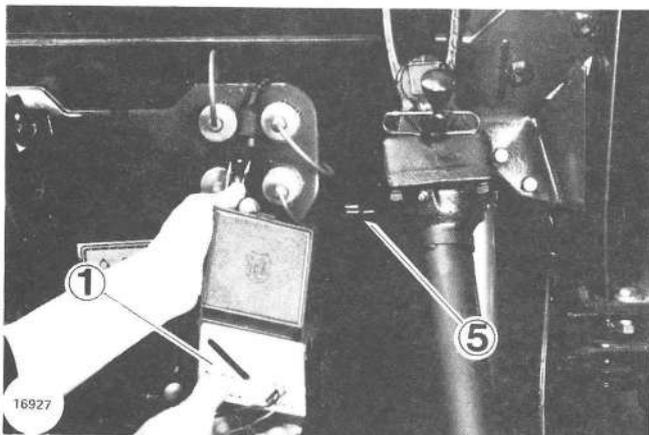
— With arms raised, touch connection (2) contacts (3 and 4) with tester probes (1) and check for electrical continuity.

— Should this not occur (current keeps flowing) turn potentiometer (6) until the conditions specified earlier are obtained.



16929

— Once adjustment is over, eliminate the insulation of max lift travel limiter (1) wire up the connection to the oil delivery solenoid and fit back the protection covers.



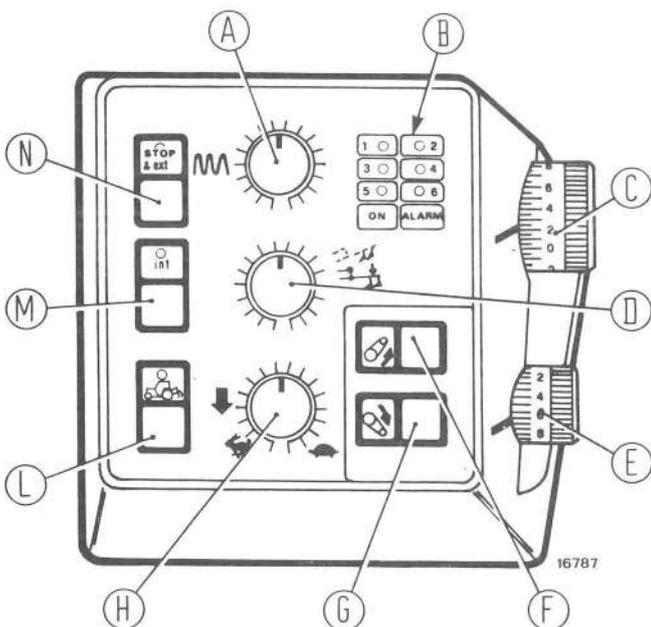
— Lower the arms until the distance between the two reference marks is 2 to 3 mm (.0787 to .1181 in) at the same time checking on tester that current through contacts 'breaks'.

TROUBLE SHOOTING

If with lock switch in ON position the ECU does not turn ON check, and if necessary replace, the associated fuse.

If with lock switch in ON position warning light 1 stays ON (see page 30) check ECU for efficiency and if necessary replace.

HYDRAULIC LIFT UNIT: Electronically-controlled lift

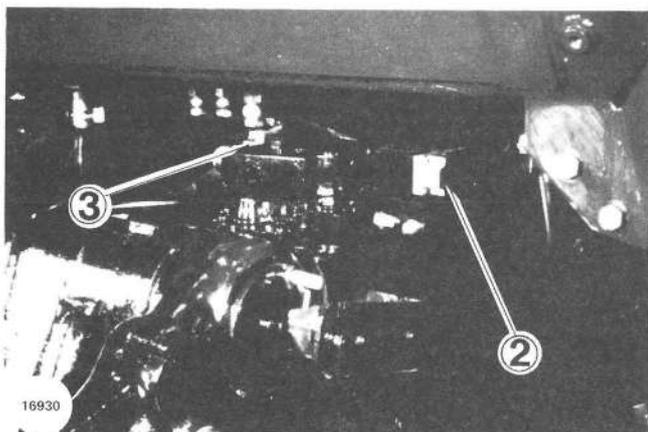


Hydraulic lift electronic control unit (ECU).

A. Response sensitivity adjustment knob - B. System self-diagnosis warning indicator lights.

- 1. Electronic control unit.
- 2. Oil delivery control valve solenoid.
- 3. Oil return control valve solenoid.
- 4. Position control sensor or misadjustment of same.
- 5. RH draft control sensor.
- 6. LH draft control sensor.

C. Draft control knob - D. Raise travel limiter setting knob - E. Position control knob - F. Raise control button - G. Lower control button - H. Lower rate adjustment knob - L. Transport safety button - M. Internal controls activation button - N. External controls activation button.



Note - Should solenoids (2) or (3) develop any faults remember that RAISE and LOWER functions may be obtained just the same by acting with a screwdriver on the core of the solenoid involved.

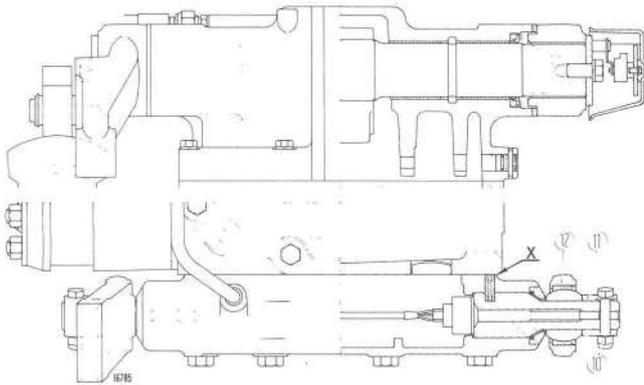
When with lock switch in ON position the warning indicator 4 stays ON check the potentiometer for correct adjustment and, if necessary, replace.

If one of the two draft control sensors is faulty (indicators 5 or 6 ON) the ECU will automatically exclude the malfunctioning pin without stopping the implement control which will continue to be effective by using the operational sensor signal alone. To obtain the same working depth it will however be necessary to change the setting of the draft control knob (C).

Should both draft control sensors fail (warning indicators 5 and 6 ON) the ECU de-activates the draft control function keeping all the other functions unchanged.

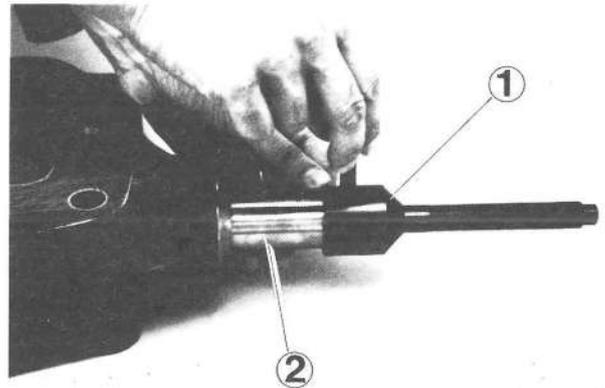
Should the potentiometer and both sensors fail (warning indicators 4, 5 and 6 all ON) the external controls are automatically activated.

When with lock switch in ON position, the warning indicators 2 (oil delivery control solenoid) or 3 (oil return control solenoid) stay ON check and if necessary replace either solenoid (2) or (3) as applicable.



Section through draft control device.

10. Arm retaining screw - 11. Thrust bushing - 12. Lift arms.
Note - On assembly, clean and degrease thoroughly the surfaces marked X and apply one of the sealing compounds listed on page 6, Sect. A.

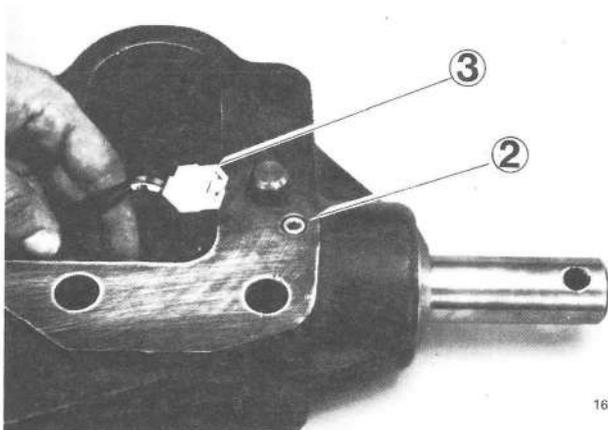


16935

— Apply tool **292847** (1) on draft control sensor (2).

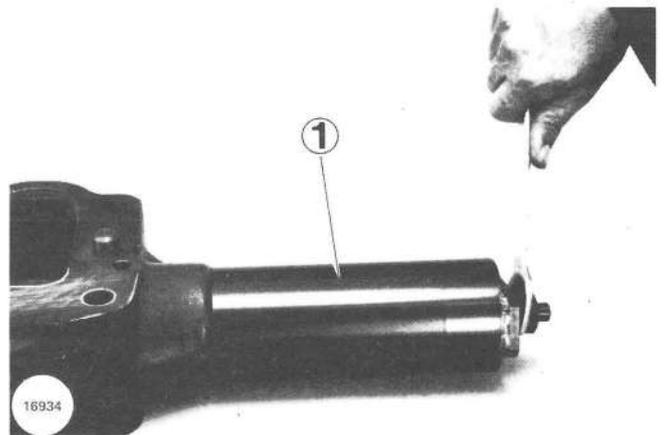
DRAFT CONTROL SENSORS REMOVAL/INSTALLATION

When one of the sensors needs replacement, proceed as follows:

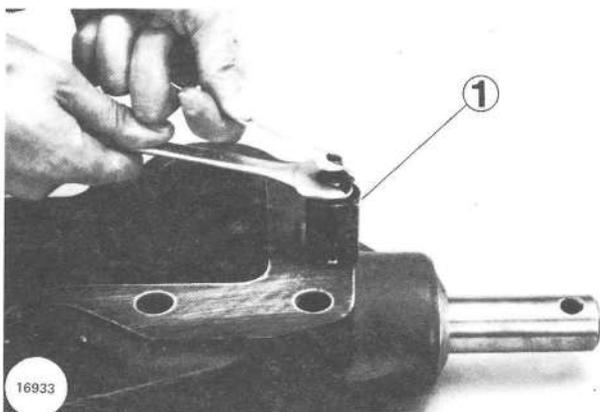


16932

— Unjoin electrical connection (3) and screw tool **292848** on dowel (2).



— Operate on the screw of tool **292847** (1) until the draft control sensor is unseated.



16933

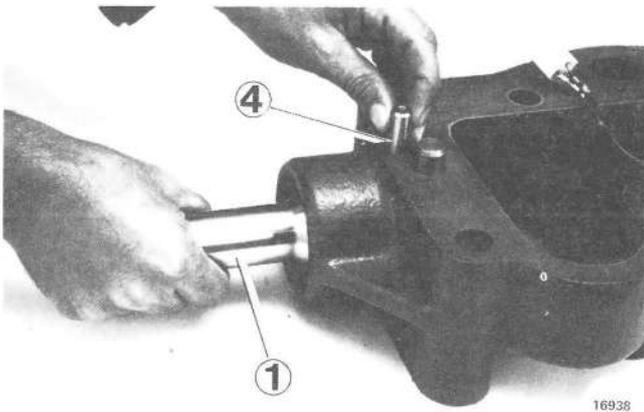
— Operate on tool **292848** as shown in figure until the locating dowel is unseated.



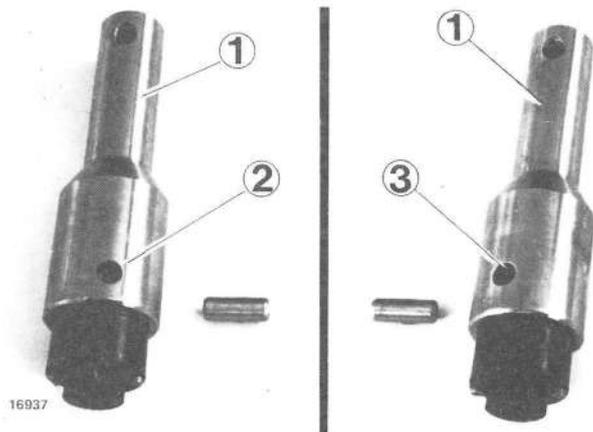
16936

— On bench, check the following items for good condition: sensor (2), bushing (3) and O-ring.

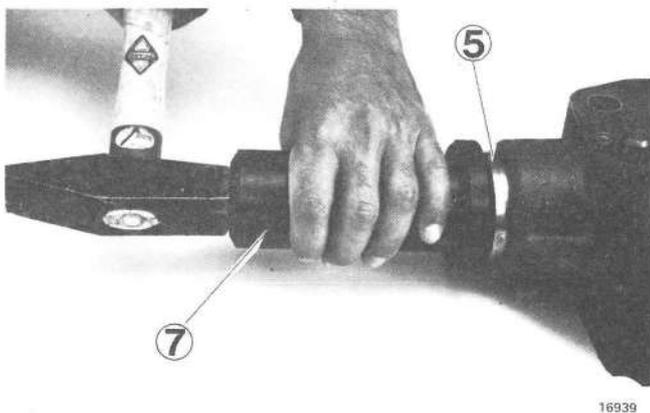
HYDRAULIC LIFT UNIT: Electronically-controlled lift



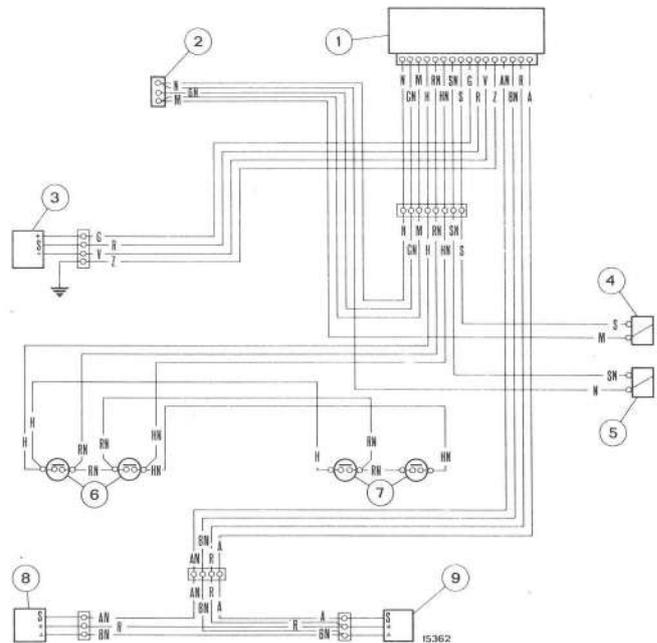
— Fit the draft control sensors (1) and associated positioning dowels (4).



Note - Two differently angled holes are provided in support (one for the RH (2) and one for the LH (3) sensors) depending on sensor positioning hand at assembly which also prevents accidental exchange of sensors.



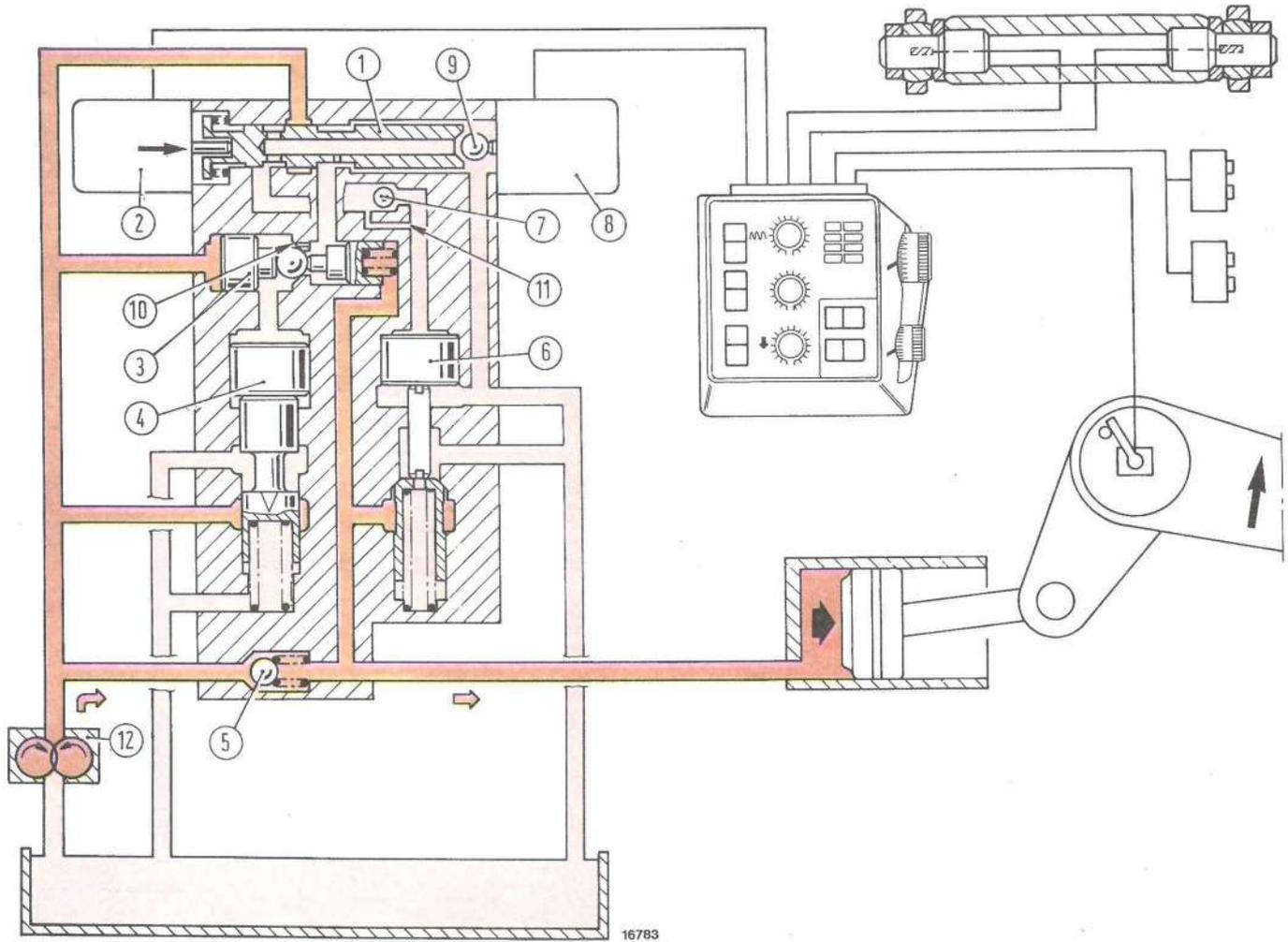
— As last item, and using a suitable drift, fit the sensor retaining bush complete with O-ring.



Wiring diagram detail.

(Differences with respect to the basic diagram shown on page 14, Sect. 60, are listed below).

1. Electronic control unit (ECU) - 2. Connection for wiring to tractor electrical system - 3. Position control sensor - 4. Oil return valve solenoid - 5. Oil delivery valve solenoid - 6. Left external control - 7. Right external control - 8. LH spool sensor - 9. RH spool sensor.



S. Arms RAISE stage.

1. Control valve spool - 2 and 8. Oil delivery and return valve solenoids - 3. Oil delivery regulating valve - 4. Pilot valve - 5. Check valve - 6. Oil return valve - 7. Check valve w/restrictor - 9. Oil return valve ball - 10. Calibrated orifice - 11. Restriction - 12. Hydraulic pump.

Everytime a load is raised by acting on the controls on the ECU or everytime the ECU receives a RAISE signal from the draft control sensors the ECU will send out an electrical impulse to the oil delivery control solenoid (2). The control valve spool thus moves to the right and cuts out oil flow to the valve (4) which, under the action of its spring, will move up to blank the oil return outlet port.

At this point, the oil under pressure will open check valve (5) to act upon the arms raise piston.

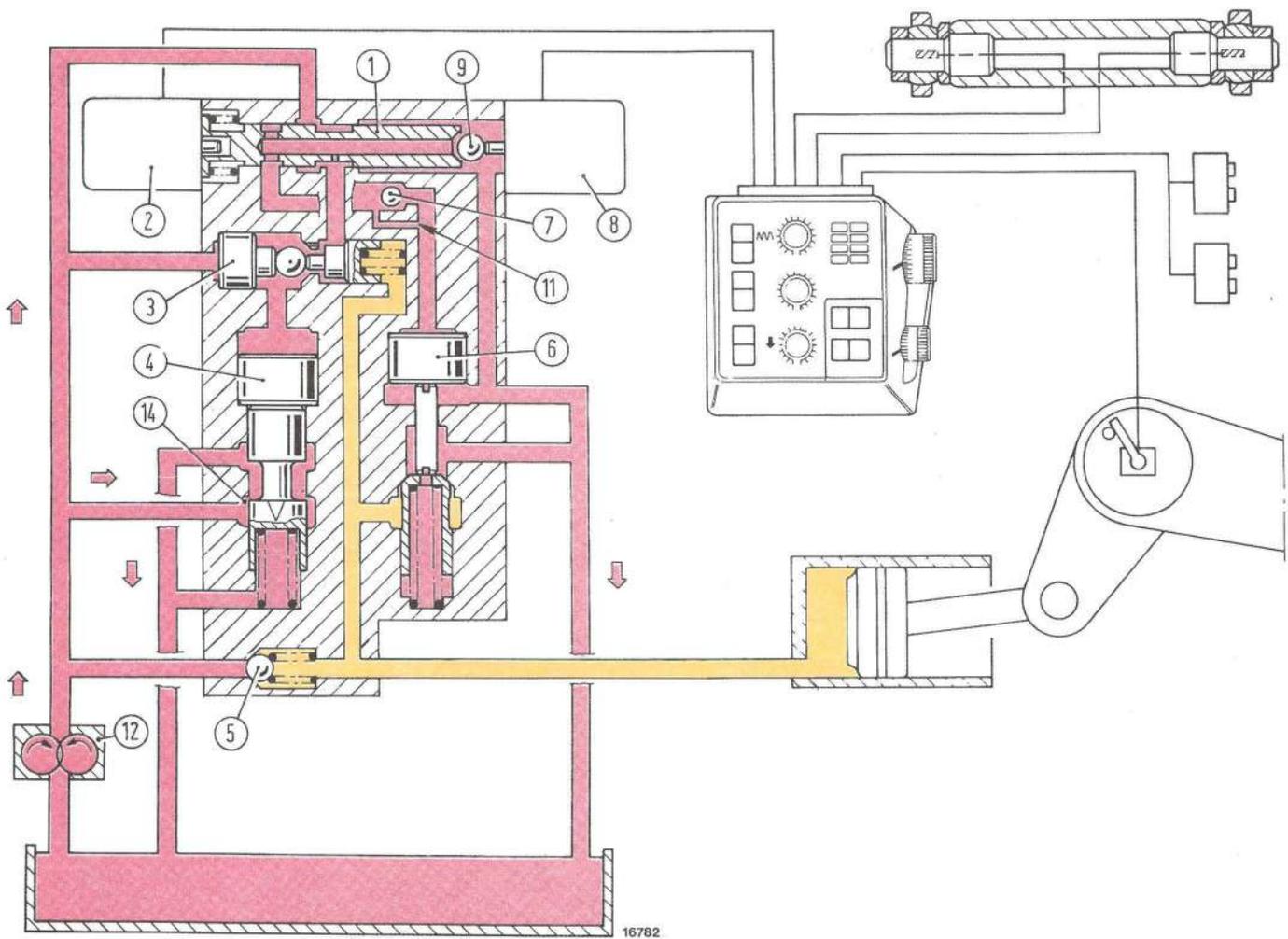
Note - During the return stage of the oil coming from the cavity above pilot valve (4) the oil delivery pressure regulating valve (3) is active in smoothening the initial load raise, avoiding excessive shocks and consequently improving Operator comfort.

This valve, modulated by oil pressure inside the cylinder barrel, stays open until the pressure of oil flowing in from the pump is just below the pressure of oil contained in the cylinder, at which time it closes. During this stage, the oil from the cavity above pilot valve (4) will drain out fast and just as fast will the valve shift be.

With regulating valve (3) closed, the oil above pilot valve (4) is allowed to flow to the oil return circuit only through restriction (10) and as a result the residual shift of valve (4) will take place more slowly (dashpot effect) thus smoothening the initial part of the RAISE stage.

- Oil under pressure
- Oil in the suction, delivery or return stages.

HYDRAULIC LIFT UNIT: Electronically-controlled lift

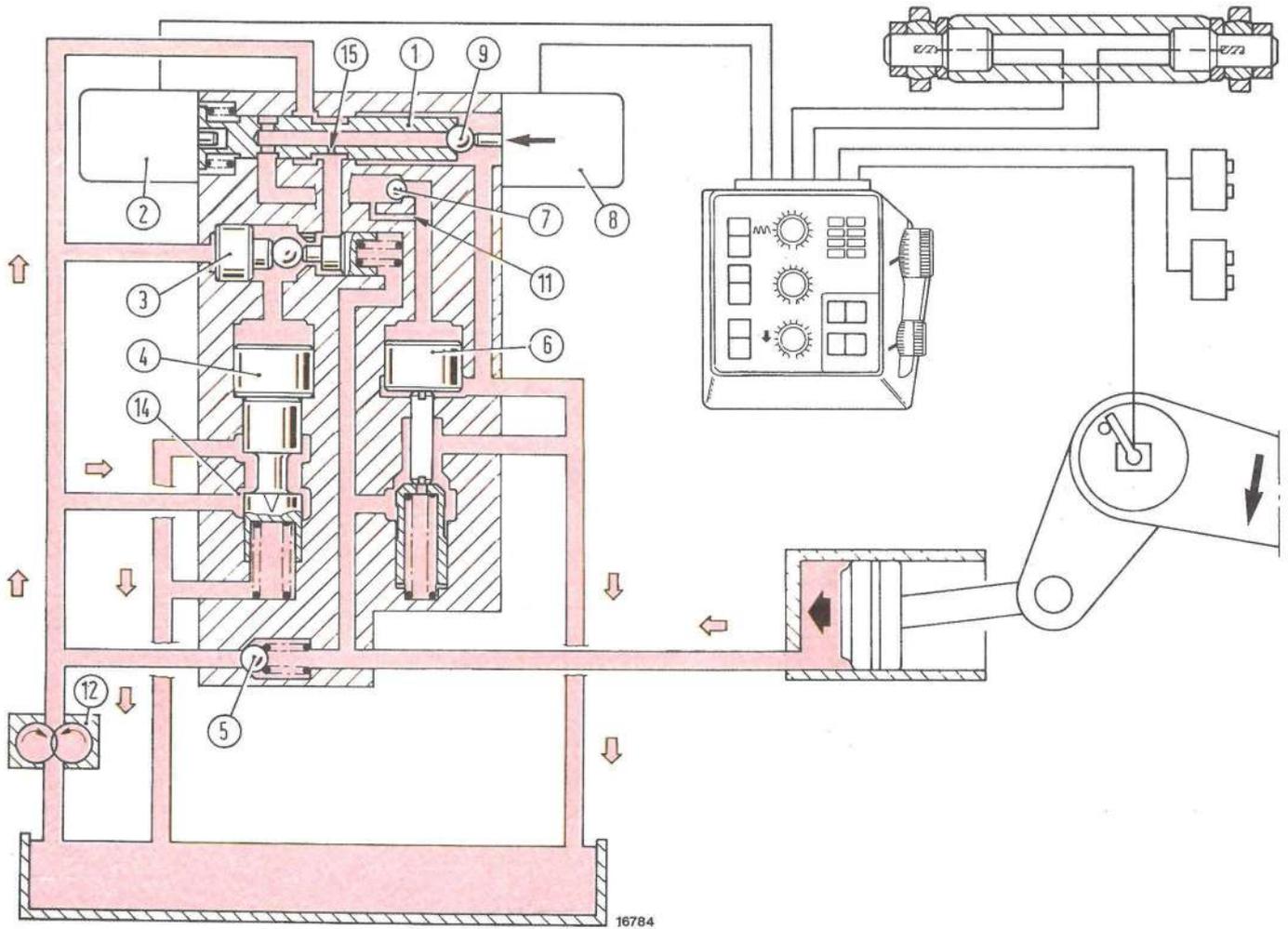


N. Neutral stage.

1. Control valve spool - 2 and 8. Oil delivery and return valve solenoids - 3. Oil delivery pressure regulating valve - 4. Pilot valve - 5. Check valve - 6. Oil return valve - 7. Check valve w/restrictor - 9. Oil return valve ball - 11. Restriction - 12. Hydraulic pump - 14. Oil return duct.

The position taken up by the control valve spool — as determined by the return spring — conveys the oil via the pressure regulating valve (3) to piston (4) which thus can overcome the resistance of the spring, moves down, opens oil outlet port (14) and directs the oil flow to the rear drive housing instead of to the cylinder.

- Oil in the suction, delivery or return stages.
- Static oil.



A. Arm LOWER stage.

1. Control valve spool - 2 and 8. Oil delivery and return valve solenoids - 3. Oil delivery pressure regulating valve - 4. Pilot valve - 5. Check valve - 6. Oil return valve - 7. Check valve w/restrictor - 9. Return valve ball - 11. Restriction - 12. Hydraulic pump - 14. Oil return duct - 15. Calibrated orifice.

Everytime a load is lowered by acting on the controls on the ECU or everytime the ECU receives a LOWER signal from the draft control sensors, the ECU will send out an electrical impulse to the oil return control solenoid (8). The control valve spool, held in neutral by its spring, allows the system oil to act — through the spool and pressure regulating valve (3) — on pilot valve (4) keeping it in the position shown: this will permit the oil delivered by the pump to drain out via duct (14). At the same time, oil return solenoid (8) shifts ball (9) causing it to press, at varying pressures, against the control valve spool. The system oil is thus conveyed to the top of the oil return valve (6) which overcomes the reaction of its spring and opens thus allowing the oil contained in the cylinder to drain out through the return circuit. During this stage, the restrictor check valve (7) is closed and the oil can flow to the cavity above the return valve (6) only through restriction (11) thus modulating its opening.

In the closing stage, instead, the ball of check valve (7) shifts to the open position and allows the oil to drain out rapidly.

■ Oil in the suction, delivery or return stages.