

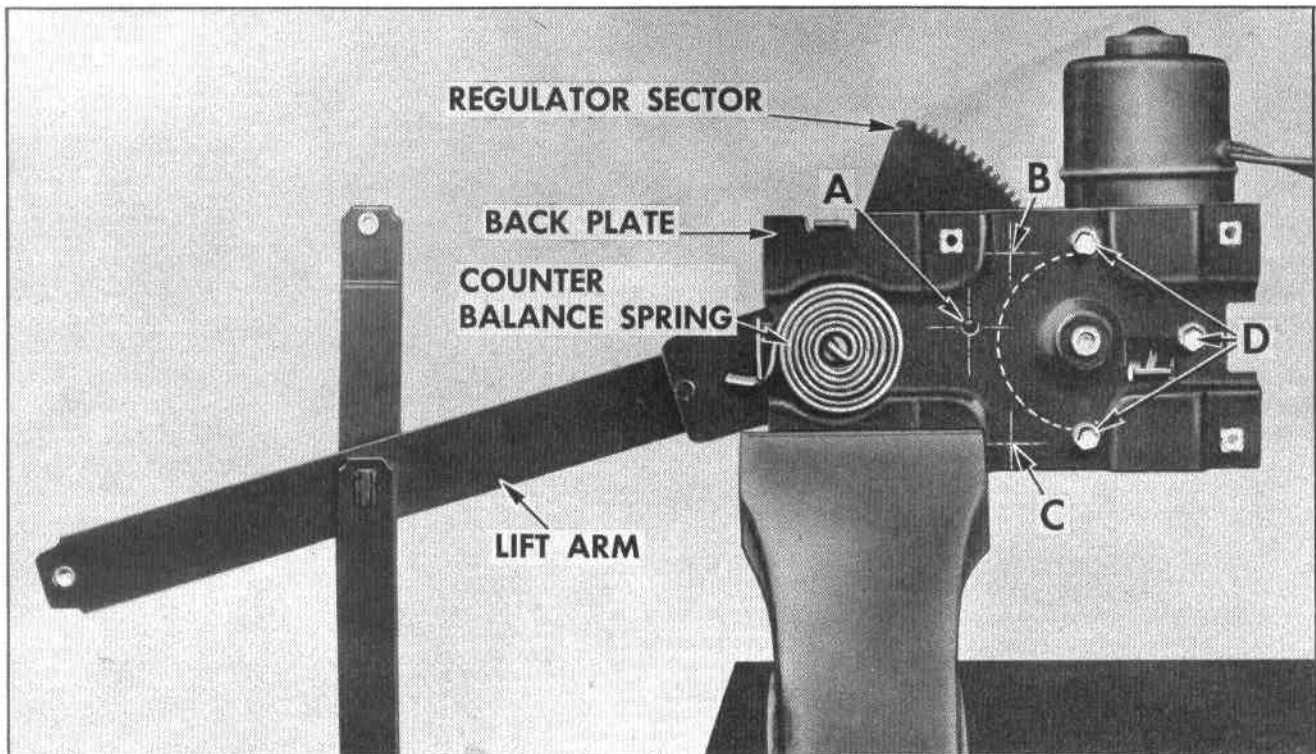
ELECTRIC AND HYDRO-LECTRIC SYSTEMS

WINDOW REGULATOR ELECTRIC MOTOR ASSEMBLY

ALL STYLES EQUIPPED WITH ELECTRIC WINDOW REGULATORS

The electric motor assembly, which powers the window regulator on electrically-operated windows, is a twelve (12) volt reversible direction motor with a built-in circuit breaker and a self-locking gear drive. The motor is secured to the regulator assembly with three (3) screws.

The principle of operation of the electrically-powered window regulator is as follows: When the motor is actuated, the motor pinion gear which is meshed with the rack portion of the regulator sector, rotates, providing the up and down movement of the regulator lift arm.



REMOVAL AND INSTALLATION

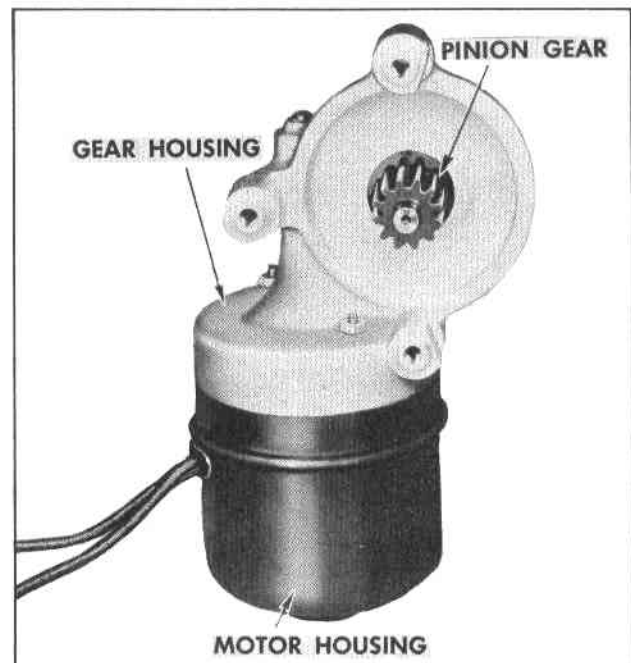
1. Remove electric window regulator assembly from door or rear quarter. See Door Window Regulator on page 18, or Rear Quarter Window Regulator on page 49.
2. Clamp electric window regulator securely in vise, as shown in illustration. Door window regulator illustrated.

NOTE: The position of the regulator assembly clamped in the vise will vary with the type of regulator and position of the lift arm.

CAUTION: BE SURE TO PERFORM STEPS 3 & 4 BEFORE ATTEMPTING TO REMOVE THE MOTOR FROM THE REGULATOR. The regulator lift arm, which is under tension from the counter-balance spring, can cause serious injury if the motor assembly is removed without locking the sector in position with a nut and bolt.

The illustration shows the motor removed from the regulator assembly.

(Continued on next page.)



WINDOW REGULATOR ELECTRIC MOTOR ASSEMBLY

CONTINUED

3. Drill a 1/4" hole through back plate and sector at location indicated at A, or B, or C, depending on position of lift arm.

NOTE: Do not drill into motor housing, part of which is indicated by dotted lines. In addition, locate hole not less than 3/4" away from edge of back plate or sector. See illustration on previous page.

4. Insert 3/16" bolt through holes in back plate and sector, and install nut to bolt. Do not tighten nut.

5. Remove three (3) attaching bolts "D", and remove motor.

6. To install, reverse the removal procedure. If difficulty is encountered when trying to line up the motor attaching holes, the regulator lift arm may be moved up or down manually, so that the motor pinion gear will mesh with the teeth on the regulator sector, and the regulator attaching holes will line up.

NOTE: Be sure to remove temporary nut and bolt from regulator before installing it into the door or rear quarter.

TROUBLE SHOOTING PROCEDURE

ALL STYLES EQUIPPED WITH ELECTRIC WINDOWS

The electric window regulators are operated by 12-volt, individual, reversible direction motors. Each motor has an internal circuit breaker to prevent overloading of the motor when it has completed a cycle of operation. Other components of the circuit are protected by a circuit breaker in the feed wire circuit.

When a switch is operated, the feed wire is connected to one of two motor leads. When a door window switch is pushed upward the motor operates to raise the window. When a door window switch is pushed downward, the motor operates in a reversed direction to lower the window. The switch operation is similar on styles having electrically-powered rear quarter windows.

CHECKING THE CIRCUIT

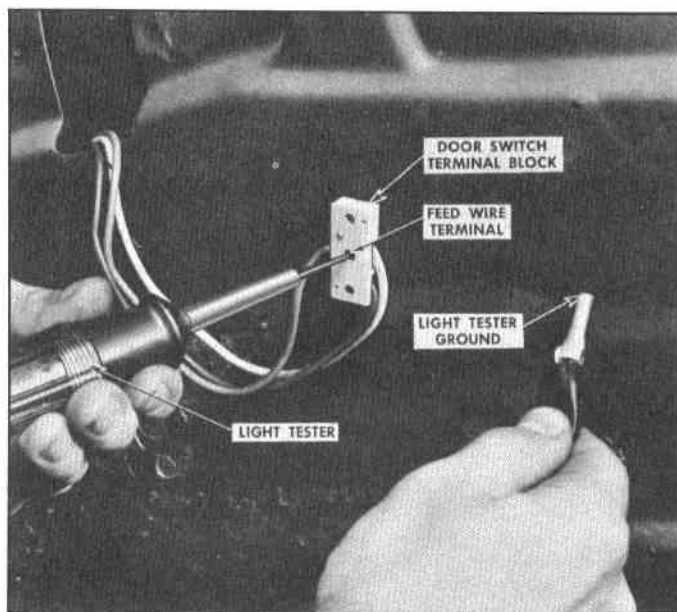
Failures in a circuit are usually caused by short circuits or open circuits. Open circuits are usually caused by breaks in the wiring, faulty connections, or mechanical failure in a component such as a switch or circuit breaker. Short circuits are usually caused by wires from different components of the circuit contacting one another or by a wire or component grounding to the metal of the body.

A light tester can be used for locating open circuits or short circuits. If the light tester indicates current at one terminal of a wire but does not indicate current at the other, there is an open circuit or a short circuit in the wire. To check for an open circuit or a short circuit between two terminals of a component, the component must first be actuated to connect the two terminals electrically. If the light tester indicates current at one of the two terminals but does not indicate current at the other, there is an open circuit or a short circuit in the component.

CHECKING PROCEDURES

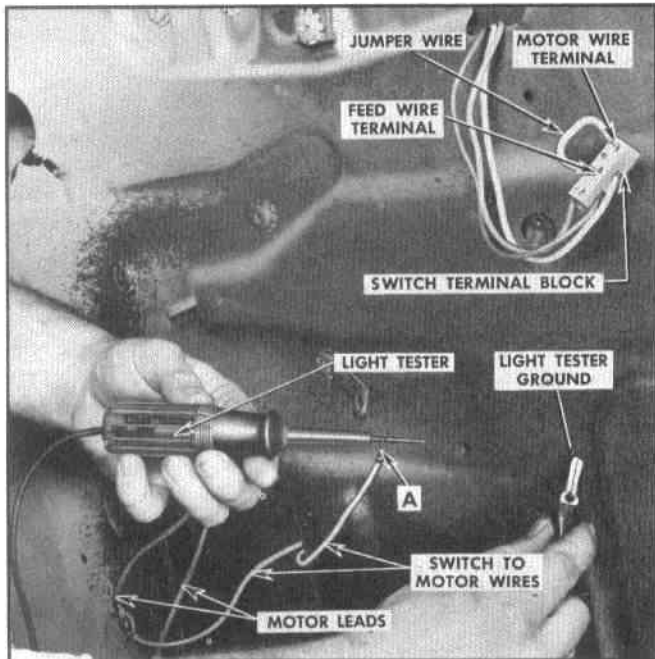
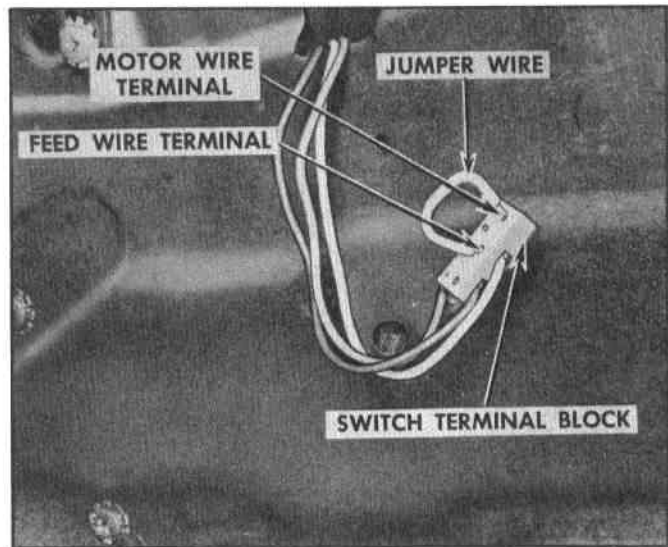
A. Checking for current at a door window switch.

1. Connect the light tester to the center terminal of the switch terminal block.
2. Ground the light tester ground lead to the body metal.
3. If tester does not light, there is no current at the terminal block.



B. Checking a door window switch.

1. Place a #12 jumper wire on the switch terminal block between the center terminal (feed) and one of the two motor wire terminals. If motor operates, the switch is defective.
2. Connect the jumper wire between the center terminal (feed) and the other motor wire terminal on the switch terminal block. If motor operates, the switch is defective. ➔

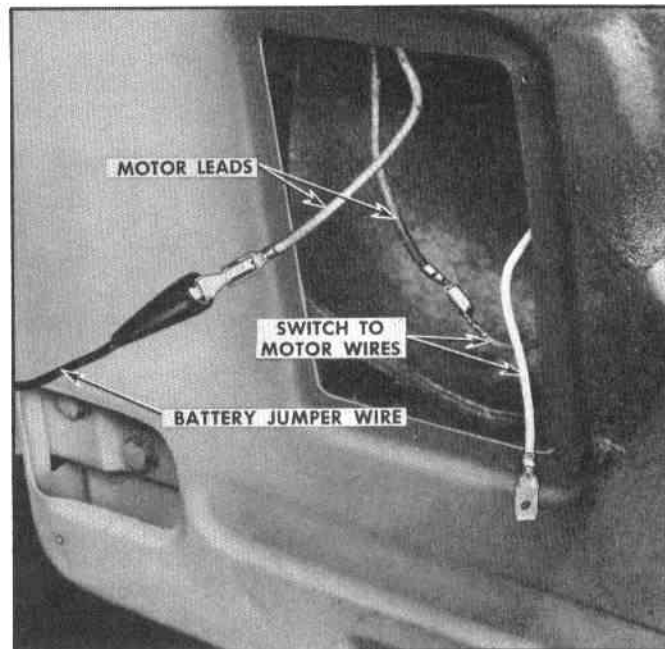


C. Checking the wires between a door window switch and a door window motor.

1. Place a #12 gauge jumper wire on the switch terminal block between the center terminal (feed) and the terminal of the motor wire to be checked.
2. Disconnect the end of the motor wire "A" from the motor lead and connect wire "A" to the light tester.
3. Ground the light tester ground lead to the body metal.
4. If the tester does not light, there is no current at wire "A" terminal contacting light tester. ➔

D. Checking a door window motor.

1. Check the ground of the motor. Motor is grounded to door inner panel through regulator frame attaching screws.
2. Connect one end of #12 gauge jumper wire to battery positive pole and the other end to the lowering cycle motor lead terminal. If motor fails to operate, motor unit is defective or a mechanical stoppage exists in the window system. ➔
3. Disconnect the jumper wire from the lowering cycle motor lead terminal and connect it to the raising cycle motor lead terminal. If motor fails to operate, motor unit is defective or a mechanical stoppage exists in the window system.



TYPICAL CONDITIONS

The following typical conditions and corrections have been listed as an aid for eliminating electrical failures in the electrically-powered windows. On styles with electrically-powered rear quarter or rear door windows, the right and left rear quarters and rear door window circuits are essentially the same as the right door window circuit, therefore all references to the right door window circuit will also apply to the right and left rear quarter or right and left rear door window circuits.

It should be noted that multiple failures in the circuit may lead to a combination of conditions, each of which must be checked separately.

A. Right door window will not operate from right door window switch but will operate from master switch.

The trouble is located in the circuit between the circuit breaker and the right door window motor lead terminals.

1. Check the feed wire from the circuit breaker to the right door window switch.
2. Check the operation of the right door window switch.
3. Check the two motor wires from the right door window switch to the right door window motor leads.

B. Right door window will not operate from master switch, but will operate from right door window switch. The left door window will operate from master switch.

The trouble is located in the circuit between the feed wire terminal of the master switch and the right door window motor lead terminals.

1. Check the operation of the master switch.
2. Check the two motor wires from the master switch to the right door window motor lead terminals.

C. Right door window will not operate from master or right door window switches. The left door window operates from master switch.

The trouble is located between the feed wire terminals of both switches and the right door window motor.

1. Check for mechanical stoppage in right door window.
2. Check operation of master and right door window switches.
3. Check motor wires from master and right door window switches to right door window motor leads.
4. Check operation of right door window motor.

D. Right and left door windows will not operate from master switch, but right door window will operate from right door window switch.

The trouble is located between the circuit breaker and the master switch motor wire terminals.

1. Check feed wire between circuit breaker and master switch.
2. Check the operation of the master switch.

E. Left door window will not operate but right door window will operate from master and right door window switch.

The trouble is located between the feed wire terminal on the master switch and the left door window motor.

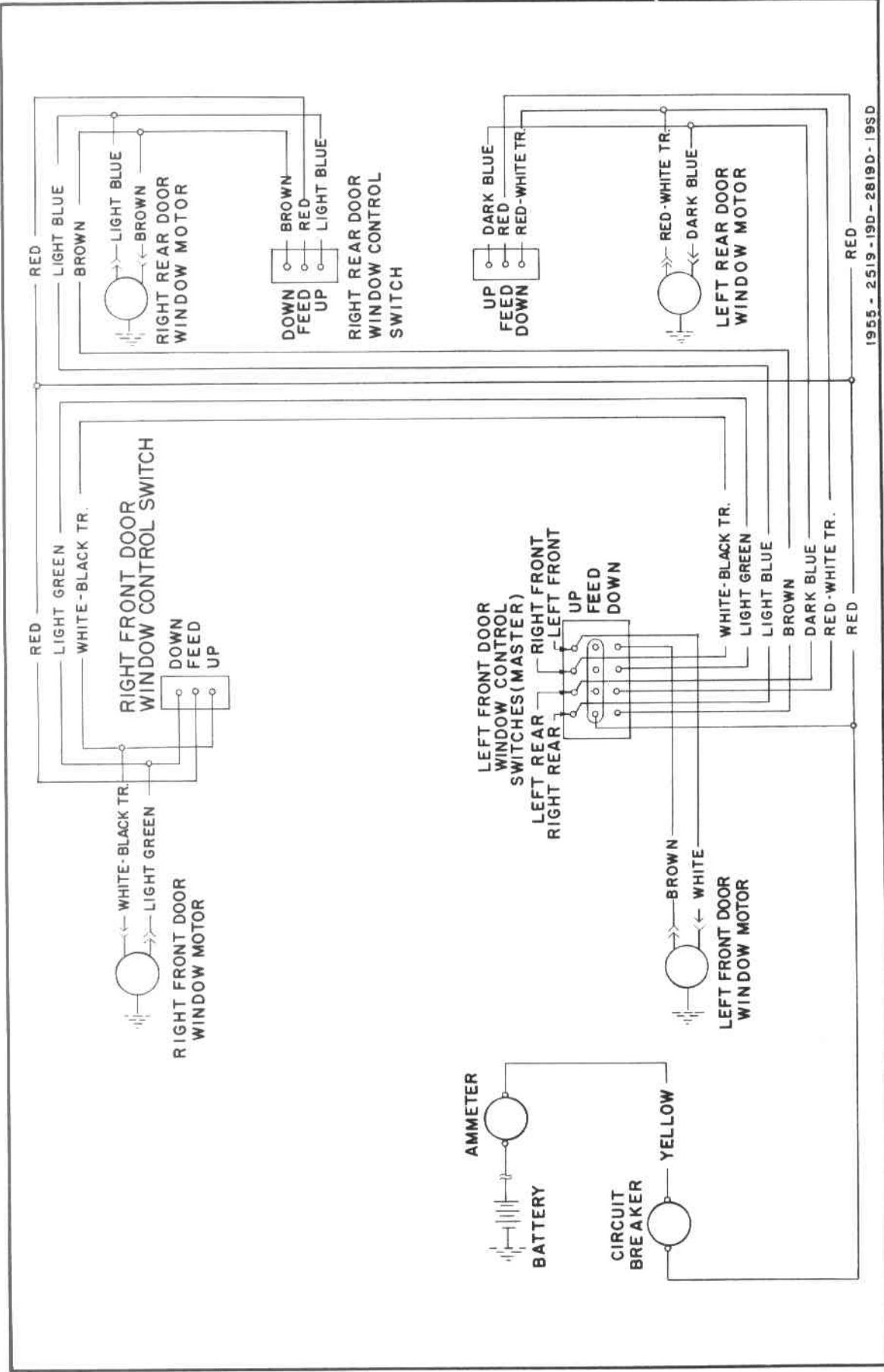
1. Check for mechanical stoppage of left door window.
2. Check the operation of the master switch.
3. Check motor wires from master switch to left door window motor leads.
4. Check the operation of the left door window motor.

F. All electrically-powered windows will not operate.

1. Check battery.
2. Check circuit from battery to ammeter.
3. Check wire from ammeter to circuit breaker.
4. Check circuit breaker.
5. Check wire from circuit breaker to window switches.
6. Check operation of window switches.

NOTE: For reference to above typical conditions, see electric wiring diagram on the following page.

WIRING DIAGRAM

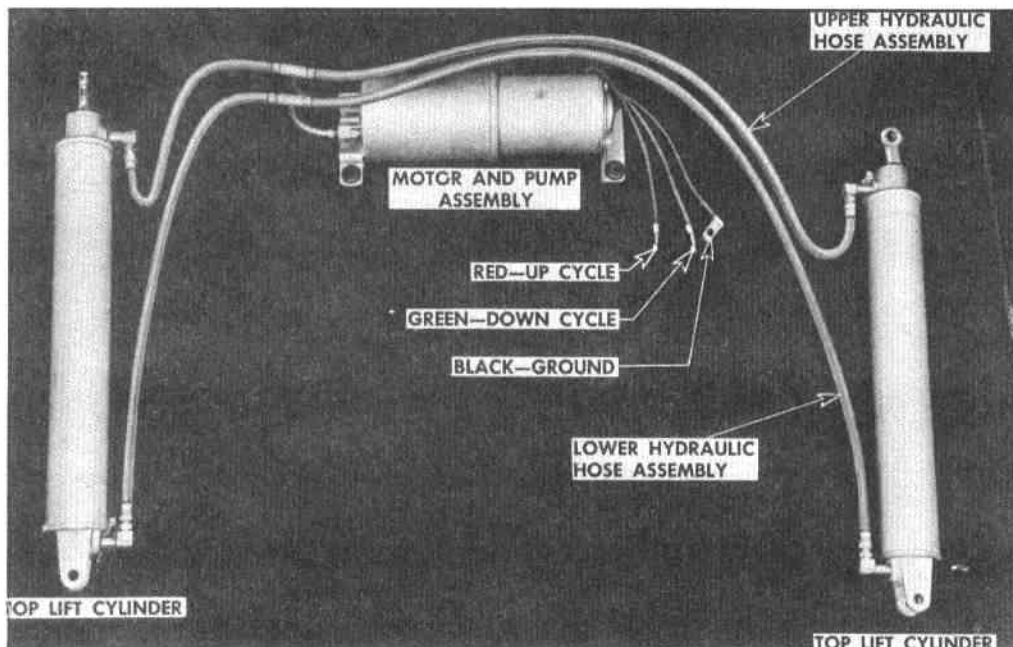


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The above drawing is a schematic wiring diagram of the Special Order Power Window Circuit of a Four-Door Sedan Style. The circuits for other styles, which take the Special Order equipment are similar.

HYDRO-LECTRIC SYSTEM FOR OPERATING CONVERTIBLE TOPS CONVERTIBLE STYLE

The convertible folding top is operated by a hydraulic package unit shown below. The unit is comprised of a motor and pump assembly, an upper and lower hose assembly, and two hydraulic lift cylinders. The fluid pressure for operating the lift cylinders is provided by a 12 volt D. C. reversible direction motor. The motor and pump assembly is installed in a horizontal position, in the rear compartment, behind the rear seat back. The sealed-in motor and pump assembly is equipped with an adjustable pressure relief valve and is designed to deliver a maximum pressure in the range of 240 psi. to 280 psi. The motor and pump assembly is controlled by a self-centering top control switch which is connected directly to the pump motor by two wires.



The Hydro-Lectric system operates as follows:

When the control knob is pushed forward, the feed wire is connected to the red motor lead. The motor and pump assembly operate to force the hydraulic fluid through the hoses to the lower ends of the double acting cylinders. The fluid forces the piston rods out of the cylinder, thus raising the top. The fluid in the top of the cylinder returns to the pump for recirculation to the bottom of the cylinder.

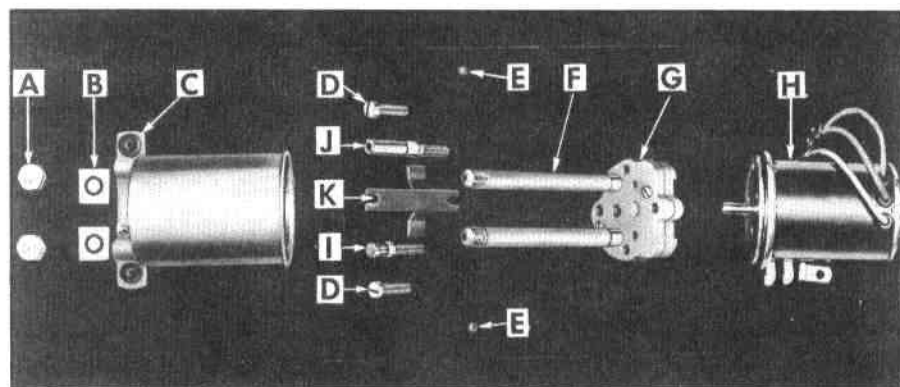
When the control knob is pulled rearward, the feed wire is connected to the dark green motor lead and the motor and pump assembly operate in a reversed direction to force the hydraulic fluid through the hoses to the top of the lift cylinders. The fluid forces the piston rods into the cylinders, thus lowering the top. The fluid in the bottom of the cylinder returns to the pump for recirculation to the top of the cylinder.

MOTOR AND PUMP ASSEMBLY

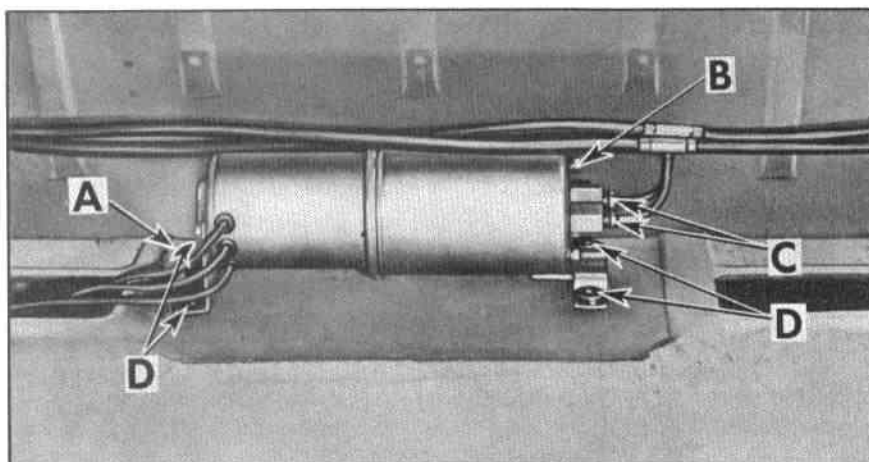
The Hydro-Lectric motor and pump assembly consists of an electric motor, a spur gear pump with an adjustable pressure relief valve and a fluid reservoir. The entire unit is sealed from the atmosphere. An exploded view of the motor and pump assembly is shown in the illustration below.

The component parts of the assembly are identified as follows:

- a. Reservoir retaining nuts
- b. Pump tube sealing rings
- c. Assembly fastener grommets
- d. Valve and pump attaching screws
- e. Ball check valves
- f. Pump tubes
- g. Spur gear pump unit
- h. Motor unit and end plate
- i. Pressure relief valve spring and pump attaching screw
- j. Pressure relief valve adjusting stud
- k. Pressure relief valve spring.



MOTOR AND PUMP ASSEMBLY



REMOVAL AND INSTALLATION

1. Operate the folding top to the full "up" position.
2. Disconnect the positive battery cable.
3. In the rear compartment, remove the pump and motor shield to expose assembly as shown in the illustration.
4. Remove the clip securing the wire harness and motor lead connections, and motor ground wire from location "A". Illustration shows the clip removed and wires disconnected.
5. Disconnect the motor leads from the wire harness.
6. Obtain absorbent rags and place below reservoir and hose connections to prevent hydraulic fluid from damaging body parts.
7. Remove filler cap "B" to vent reservoir, then reinstall cap.

NOTE: Venting of the reservoir is necessary in this sealed-in unit, to equalize the air pressure in

the reservoir to that of the atmosphere. This operation prevents the hydraulic fluid from being forced under pressure from disconnected lines and causing damage to trim or body finish.

8. Disconnect the hydraulic lines "C" and cap open fittings to prevent leakage of fluid. Use a cloth to absorb any leaking fluid.

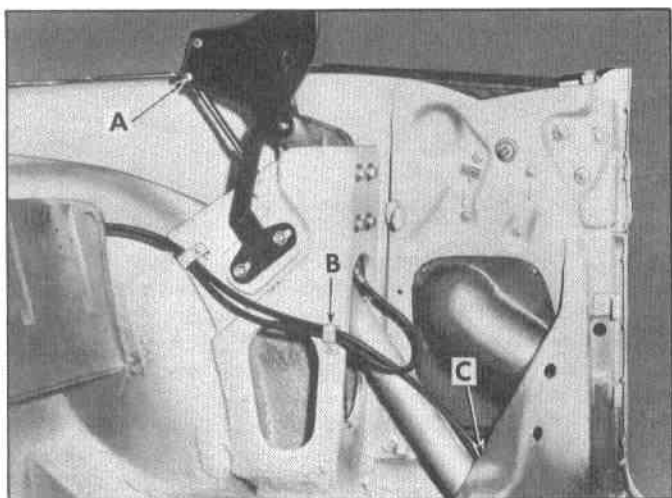
NOTE: Install plug to openings as soon as hose is disconnected, to prevent excessive loss of fluid and damage to body parts.

9. Release four (4) grommets "D" from panel and lift motor and pump assembly from the body.

10. To install, reverse the removal procedure. Check the hydraulic fluid level in the pump reservoir. See Checking the Hydraulic System on page 85.

FOLDING TOP LIFT CYLINDER

REMOVAL AND INSTALLATION



9. Carefully remove cylinder from body, through opening in face of folding top compartment brace.

10. To install, reverse the removal procedure. Seal hydraulic fittings by applying a good high pressure sealing compound to the threads of all male fittings, prior to connecting the lines. Check the hydraulic fluid level in the pump reservoir. See Checking Hydraulic Fluid Level on page 85.

1. Operate the folding top to the full up position.
2. Disconnect the positive battery cable.

3. At rear compartment, remove the pump and motor shield. Place absorbent rags under end of reservoir. Remove filler cap to vent reservoir then reinstall cap.

NOTE: Venting of the reservoir is necessary in this "sealed-in" unit to equalize the air pressure in the reservoir, to that of the atmosphere. This operation prevents the hydraulic fluid from being forced from disconnected lines and causing damage to trim or body finish.

4. Remove rear seat cushion, rear seat back, and folding top compartment side panel assembly.

5. Remove nut and bolt indicated at "A" in the illustration securing lift cylinder piston rod to top linkage.

6. Remove retainer "B" securing hydraulic hose to folding top compartment brace.

7. Remove cotter pin and clevis, indicated at "C", at the lift cylinder support bracket. Note location of washers.

8. Disconnect hoses from cylinder and cap open fittings to prevent leakage of fluid.

NOTE: Have a cloth handy to absorb fluid dripping from the hydraulic hoses.

MECHANICAL CHECKING PROCEDURE

If there is a failure in the Hydro-Lectric system and the cause is not evident, the mechanical operation of the top should first be checked. If the folding top assembly appears to have a binding action, disconnect the top lift cylinder piston rods from the top linkage and then manually raise and lower the top. The top should travel through its up and down cycle without any evidence of a binding action. If a binding action is noted when the top is being locked at the header, check the alignment of the door windows, ventilators, and rear quarter windows with relation to the side roof rail weatherstrips. Make all necessary adjustments for correct top alignment. If a failure continues to exist after a check for mechanical failure has been completed, the Hydro-Lectric system should then be checked for electrical or hydraulic failures.

ELECTRICAL CHECKING PROCEDURE

If a failure in the Hydro-Lectric system continues to exist after the mechanical operation has been checked, the electrical system should then be checked. A failure in the electrical system may be caused by a low battery, breaks in the wiring, faulty connections, mechanical failure of an electric component, or wires or components shorting to one another or to the body metal. Before beginning checking procedure, check battery according to procedure recommended by the Pontiac Motor Division.

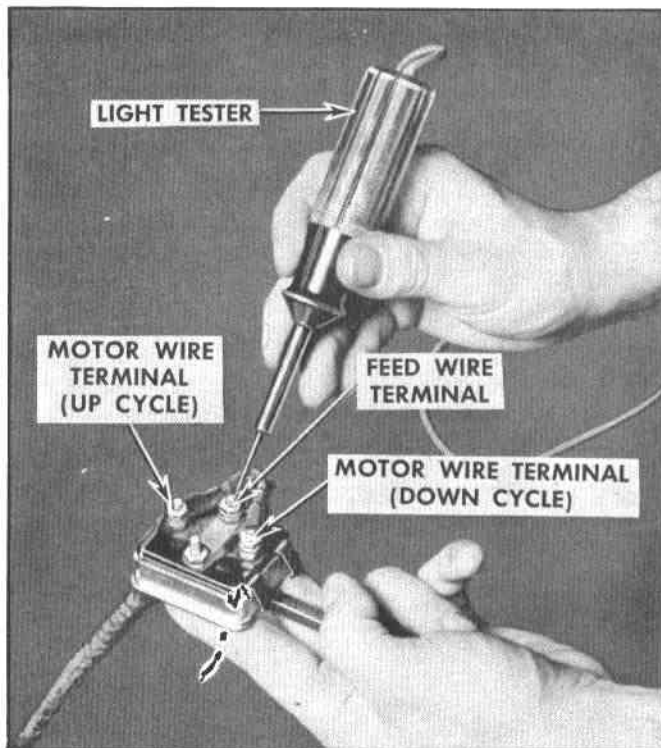
CHECKING FOR CURRENT AT THE FOLDING TOP CONTROL SWITCH

1. Connect a light tester to the feed wire terminal of the control switch.
2. Ground the light tester ground lead to the body metal.
3. If light tester does not light, there is an open or a short circuit between the battery and the switch.

CHECKING THE FOLDING TOP CONTROL SWITCH

If there is current at the feed wire terminal of the switch, the operation of the switch can be checked as follows:

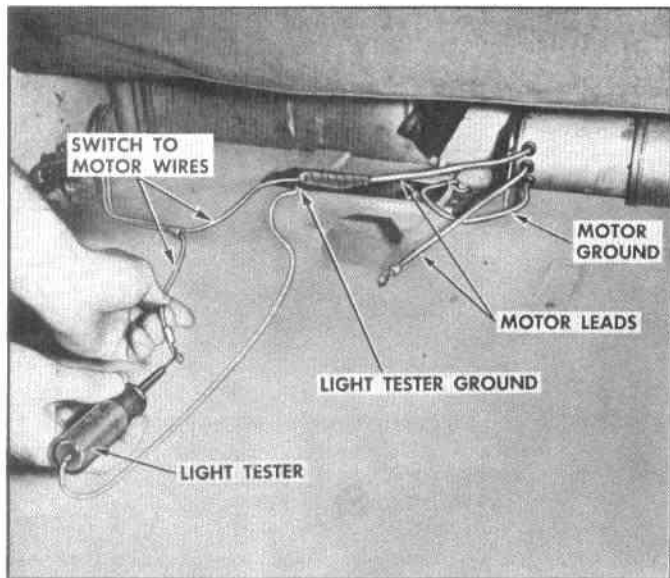
1. Disconnect the switch to pump motor wires from the switch terminals.
2. Connect a light tester to the "up cycle" pump motor terminal of the switch.
3. Ground the light tester ground lead to the body metal.
4. Push the control knob forward. If tester does not light, switch is defective.
5. Connect the light tester to the "down cycle" motor wire terminal of the switch.
6. Pull the control knob rearward. If tester does not light, switch is defective.



CHECKING SWITCH TO MOTOR LEAD WIRES

If switch is found to be operating properly, the switch to motor lead wires can be checked as follows:

1. Disconnect the green switch-to-motor wire from the motor lead.
2. Connect a light tester to the green switch-to-motor wire terminal.
3. Ground the light tester ground lead to the body metal.
4. Pull the switch control knob rearward. If tester does not light, there is an open or a short circuit in the wire.
5. Disconnect the red, switch-to-motor wire from the motor lead.
6. Connect the light tester to the red, switch-to-motor wire terminal.
7. Push the switch control knob forward. If tester does not light, there is an open or short circuit in the wire.



CHECKING THE MOTOR UNIT

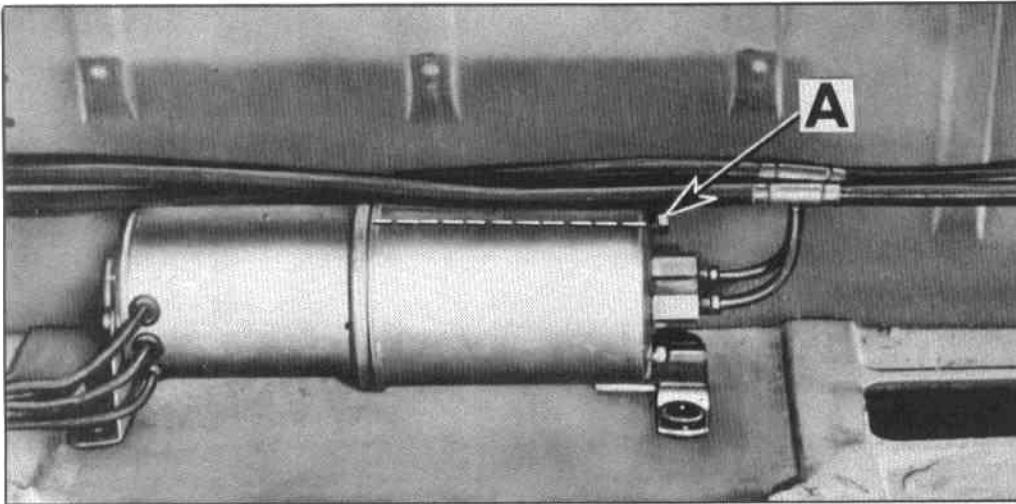
If a light tester indicates current at the motor lead terminals of the switch to motor wires but the motor unit does not operate from the switch, a final check of the motor unit can be made as follows:

1. Check the connection of the motor ground wire to the body metal.
2. Connect a #12 gauge jumper from the battery positive pole to the motor lead terminal that connects to the green switch-to-motor wire. The motor should operate to lower the top.

3. Connect the jumper wire to the motor lead terminal that connects to the red, switch-to-motor wire. The motor should operate to raise the top.
4. If motor fails to operate on either or both of these checks, it should be repaired or replaced.
5. If motor operates with jumper wire but will not operate from switch-to-motor wires, the trouble may be caused by reduced current resulting from damaged wiring or poor connections.

HYDRAULIC CHECKING PROCEDURE

Failures in the hydraulic system can be caused by lack of hydraulic fluid, leaks in hydraulic system, obstructions or kinks in hydraulic tubing, or faulty operation of a cylinder or pump. A pressure gauge can be used to check the pressure in the hydraulic system. Pressure should be between 240 and 280 psi. when pressure relief valve opens.



CHECKING HYDRAULIC FLUID LEVEL IN RESERVOIR

1. Operate top to the raised position.
2. Disconnect positive cable from battery.
3. Remove pump and motor shield.
4. Place absorbent rags below reservoir at hydraulic hose attaching end.
5. Remove filler cap indicated at "A" in illustration. Fluid level should come up to the lower edge of the filler cap hole, indicated by dotted line.
6. If fluid is low add fluid, (Delco Super #11) to bring fluid to specified level.
7. Reinstall filler cap and pump and motor shield. Connect positive cable to battery.

CHECKING THE PRESSURE TO THE CYLINDERS

1. Remove filler cap to vent reservoir, then reinstall cap.
2. Install a standard pressure gauge between the pump port and "T" of the hydraulic lines leading to the bottom of the lift cylinders.
3. With the top in a full "up" position, push control knob in and hold for a few seconds. The pressure should read between 240 and 280 psi. If pressure indicated is below this range, either the pump is not delivering the required pressure or there is fluid leakage past the piston in one or both cylinders.
4. In a similar manner, the pressure to the top of the cylinders is checked by installing the pressure gauge between the pump port and the "T" of the hydraulic lines leading to the top of the cylinders. The pressure reading is taken with the top in the raised and locked position and the control knob pulled "out".

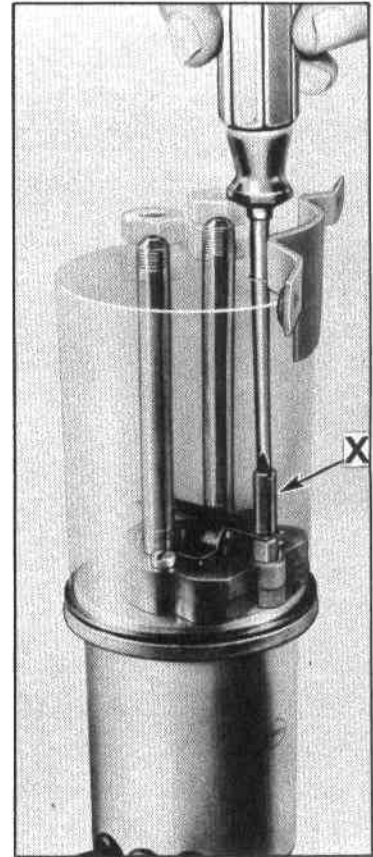
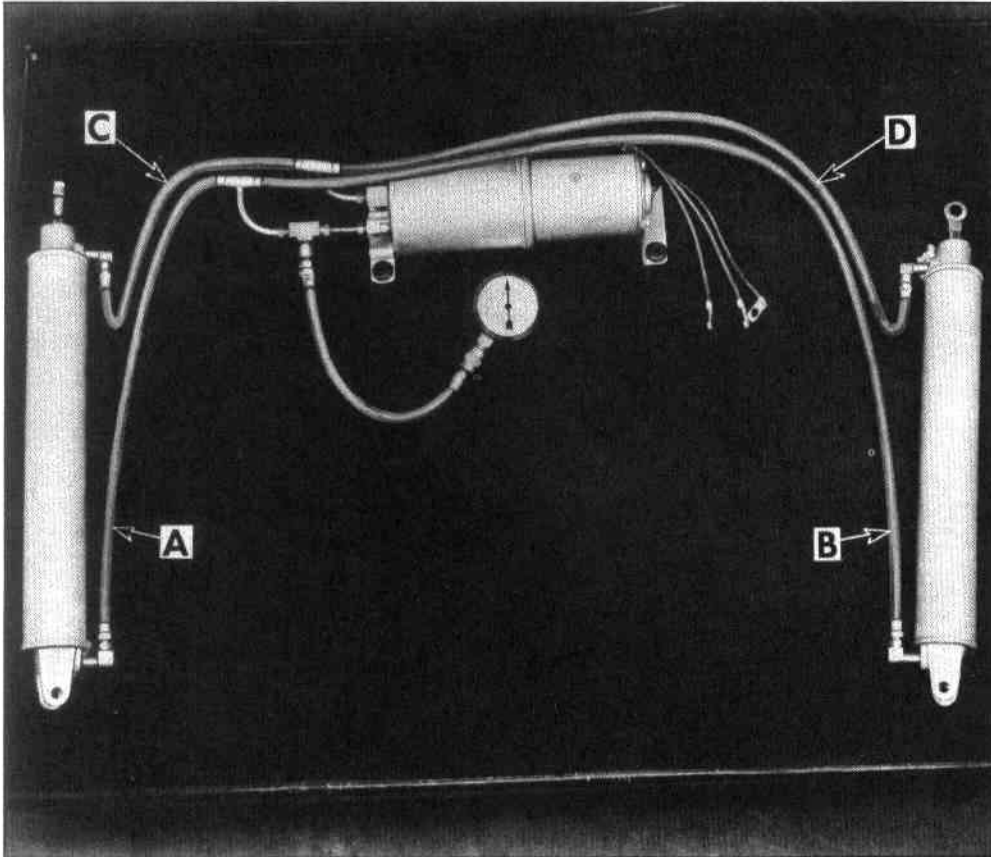
CHECKING OPERATION OF LIFT CYLINDERS

1. Remove the rear seat cushion and rear quarter side trim.
2. Operate the folding top control switch and observe the operation of the lift cylinders during the "up" and "down" cycles.
3. If operation is sluggish or causes binding of the top linkage, one of the cylinders may be inoperative or operating too slowly. This condition may be caused by either a defective cylinder or a clogged or kinked hydraulic line. Inspect the hydraulic tubing from the reservoir to the top and bottom of the lift cylinder to determine if the obstruction lies within the hoses to the cylinder.
4. If lift cylinders do not operate or operate slowly, the pressure at the pump should be checked.

CHECKING THE PRESSURE OF THE PUMP

1. Install pressure gauge in hydraulic lines leading to the bottom of the lift cylinders as shown in the illustration.
2. Kink hoses "A" and "B" to shut off fluid flow to the bottom of each cylinder.
3. Push control knob "in" and hold a few seconds. The pressure should read between 240 and 280 psi.
4. Install pressure gauge in hydraulic line leading to the top of the lift cylinders.
5. Kink hoses "C" and "D" to shut off fluid flow to the top of each cylinder.
6. Pull control knob "out" and hold a few seconds. The pressure should read between 240 and 280 psi.

NOTE: A difference in pressure readings may exist between the pressure port for the top of the cylinders and the pressure port for the bottom of the cylinders. This condition is acceptable if both readings are within the limits of 240 and 280 psi.



ADJUSTING THE PRESSURE OF THE PUMP

1. Remove the motor and pump assembly from the rear compartment as outlined on page 83, and place in a vise.
2. Install plug in one port, and pressure gauge in port to be checked.
3. Remove cap nearest reservoir attaching bracket from top of reservoir.
4. Insert screw driver through hole in reservoir and on screw "X" as shown in illustration.
5. Actuate motor and pump assembly and with motor operating, adjust pressure relief valve by turning adjusting screw "X". Gauge should show a reading of 240 to 280 psi. Turn screw clockwise to increase pressure, and counterwise to decrease pressure.

NOTE: The adjusting stud should not have to be turned more than two (2) turns in either direction to obtain specified pressure.

6. Repeat procedure on other port.

NOTE: A difference in pressure readings may exist between the pressure port for the top of the cylinders and the pressure port for the bottom of the cylinders. This condition is acceptable if both readings are within the limits of 240 and 280 psi.

If pressure cannot be adjusted within the limits, the trouble lies within the pump unit. If pressure reads within the limits, but the top does not operate, or operates slowly, the fluid may be leaking past the piston in one or both of the cylinders.