1964 OLDSMOBILE

Service manual

CONTENTS

no. 4

1964 OLDSMOBILE

SERVICE MANUAL

NUMBER 4

MANUAL NO. | CONTENTS

FOREWORD

This manual is compiled to provide service procedures, adjustments and specifications for the 1964 Oldsmobiles. An understanding of the material contained herein and in monthly issues of the Oldsmobile Service Guild and Dealer Technical Information Bulletins, issued when necessary, will assist service personnel in properly maintaining the quality to which Oldsmobile cars are built.

QUICK REFERENCE INDEX. To use, move either the hand or selection tool directly over the section you desire to reference. Simply click once with the mouse button and the manual will automatically jump to that section.

CONTENTS
MANUAL NUMBER 4

SERVICE DEPARTMENT
OLDSMOBILE DIVISION
GENERAL MOTORS CORPORATION
LANSING, MICHIGAN

Litho in U.S.A.
GMP B-1875

INSTRUMENT PANEL AND ACCESSORIES

(33-34-35-36-38 & 39 SERIES)

CONTENTS OF SECTION 12

INSTRUMENT PANEL

The instrument panel lower section is a removable panel and is retained by bolts and sheet metal screws. All instruments and units can be removed without removing the instrument panel lower section, with the exception of the safety pad.

Remove and Install

1. Remove the windshield side garnish moldings.
2. Disconnect steering column assembly.
3. The following wiring and/or controls must be disconnected:
   a. Heater, ventilation and/or air conditioning control.

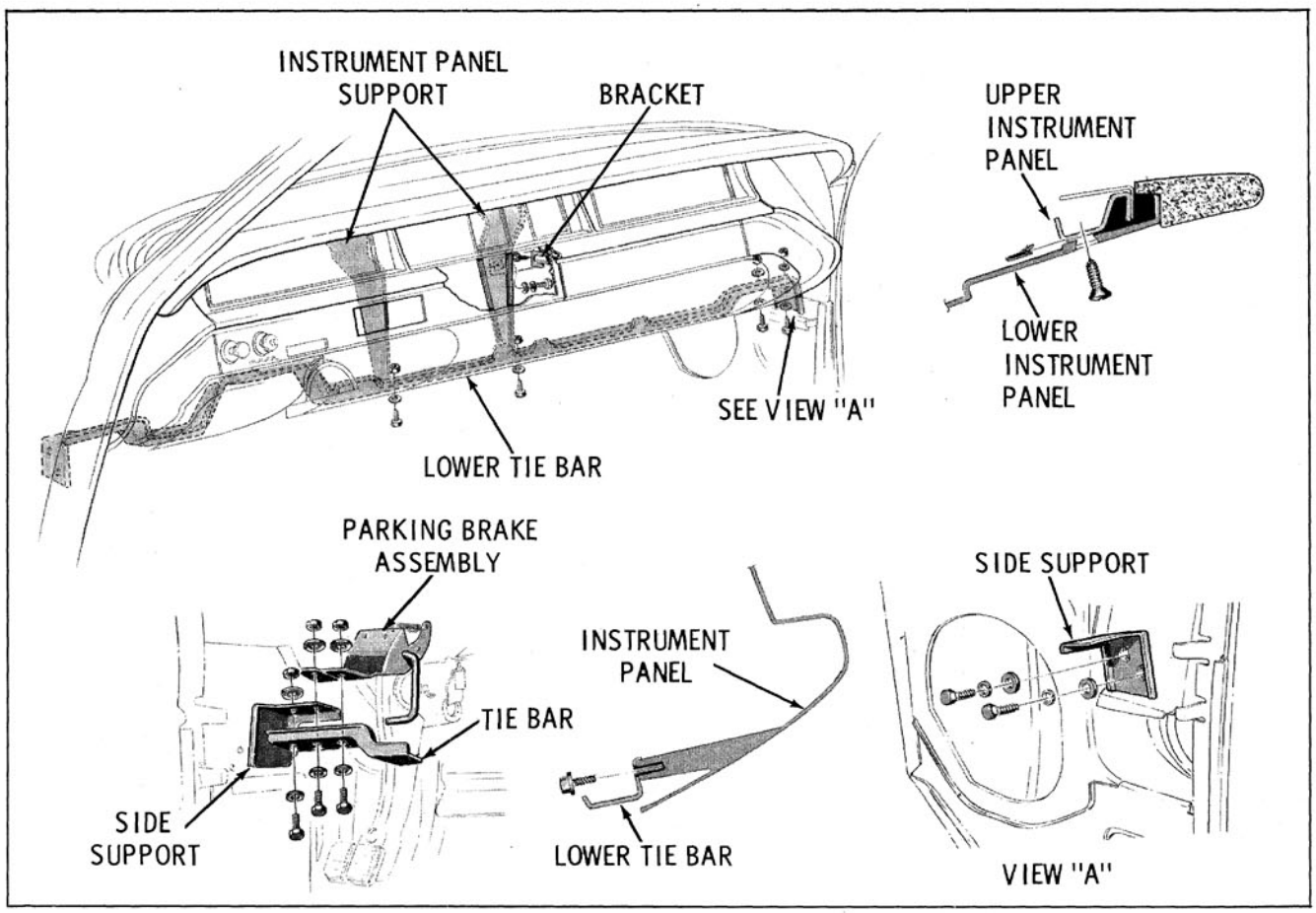


Fig. 12-1 Instrument Panel Components

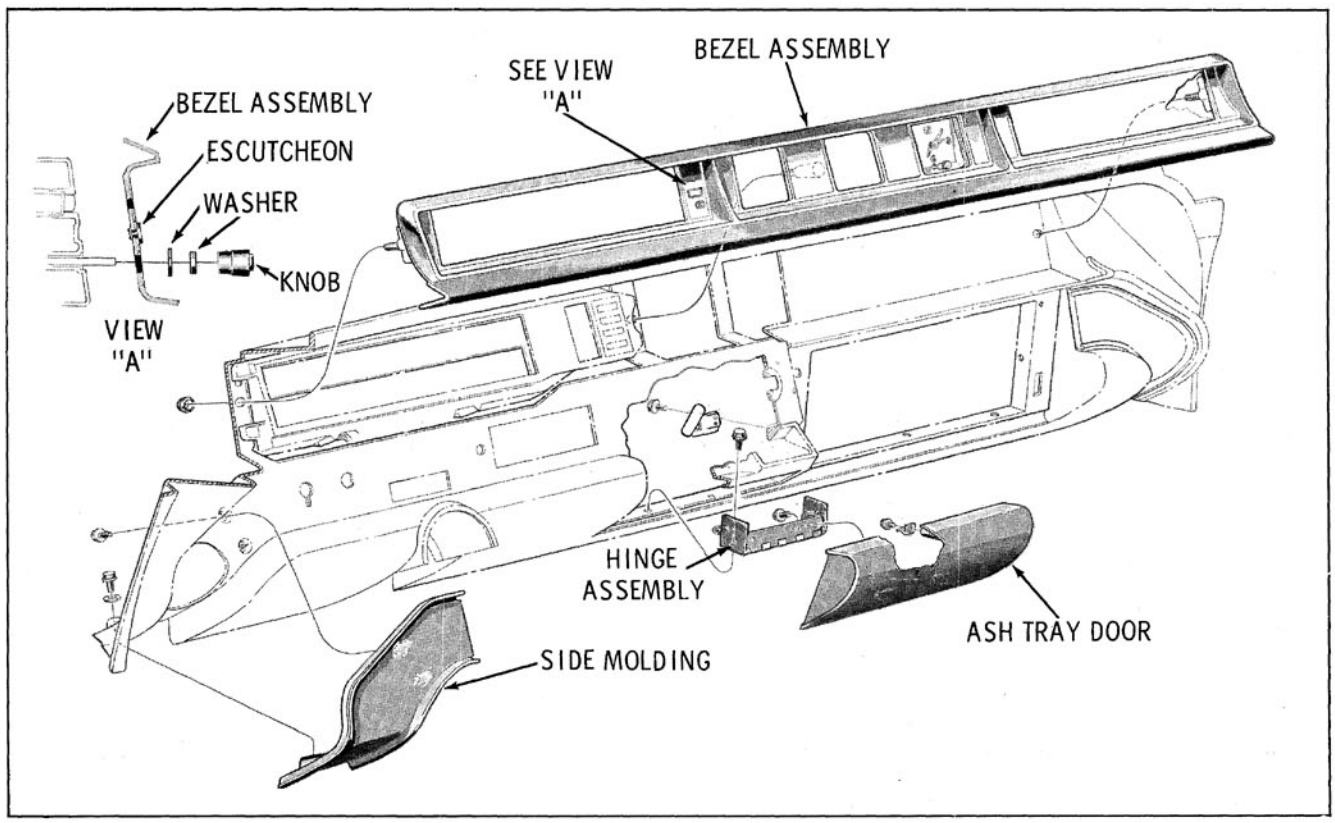


Fig. 12-2 Instrument Panel Components

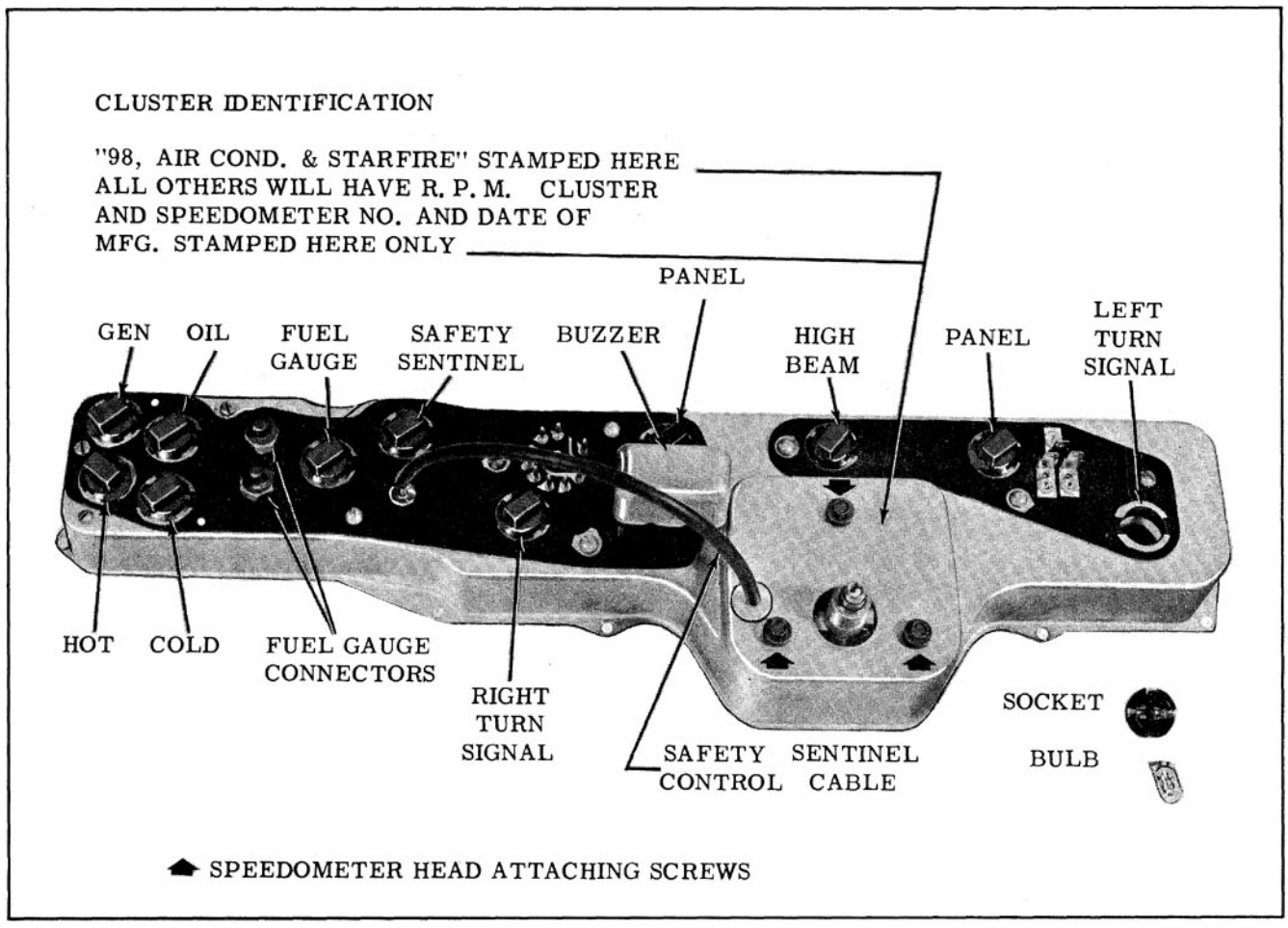


Fig. 12-3 Instrument Cluster

b. Printed circuit connectors.

c. Speedometer cable.

d. Radio, front and rear seat speaker and antenna leads.

e. Ignition and headlight switch connectors.

f. Power top, courtesy light and power antenna switch leads.

g. Instrument panel wiring harness connector.

h. Hoses from deck lid vacuum release control.

i. Courtesy or map lights.

j. Cruise Control selector.

k. Cigar lighter lead.

l. Guide-Matic amplifier.

4. Remove instrument panel attaching screws. (Fig. 12-1)
5. With aid of a helper, lower panel and remove assembly from car.
6. To install the lower panel assembly, reverse the removal procedure.

INSTRUMENTS

All the instruments are electrically operated, except the speedometer and Hydra-Matic indicator which are mechanically operated. A speed warning device (Safety Sentinel) is offered as optional equipment on all models. A knob on the instrument cluster allows the driver to pre-set his desired speed. When this speed is reached, a light goes on and a buzzer sounds. (View A, Fig. 12-2)

The generator, temperature, and oil pressure indicators use colored lights to warn the driver of conditions other than normal when the engine is operating at speeds above idle or is at normal operating temperature.

When removing an instrument cluster light bulb, the bulb must be pulled straight out of the socket. Before installation of the bulb, be sure bulb wires are parallel with the center line of the bulb to prevent a short or open circuit. (Fig. 12-3)

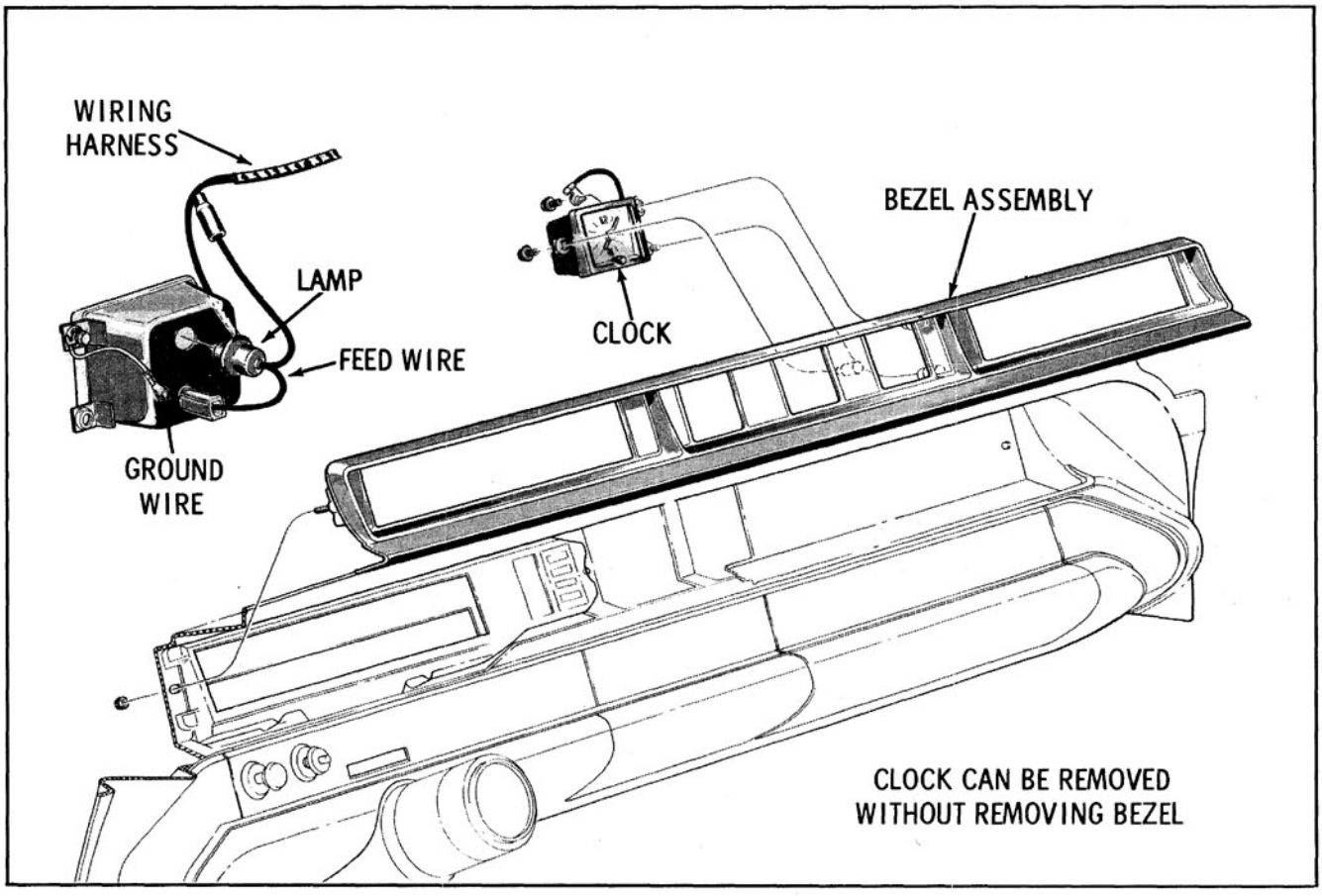


Fig. 12-4 Clock Installation

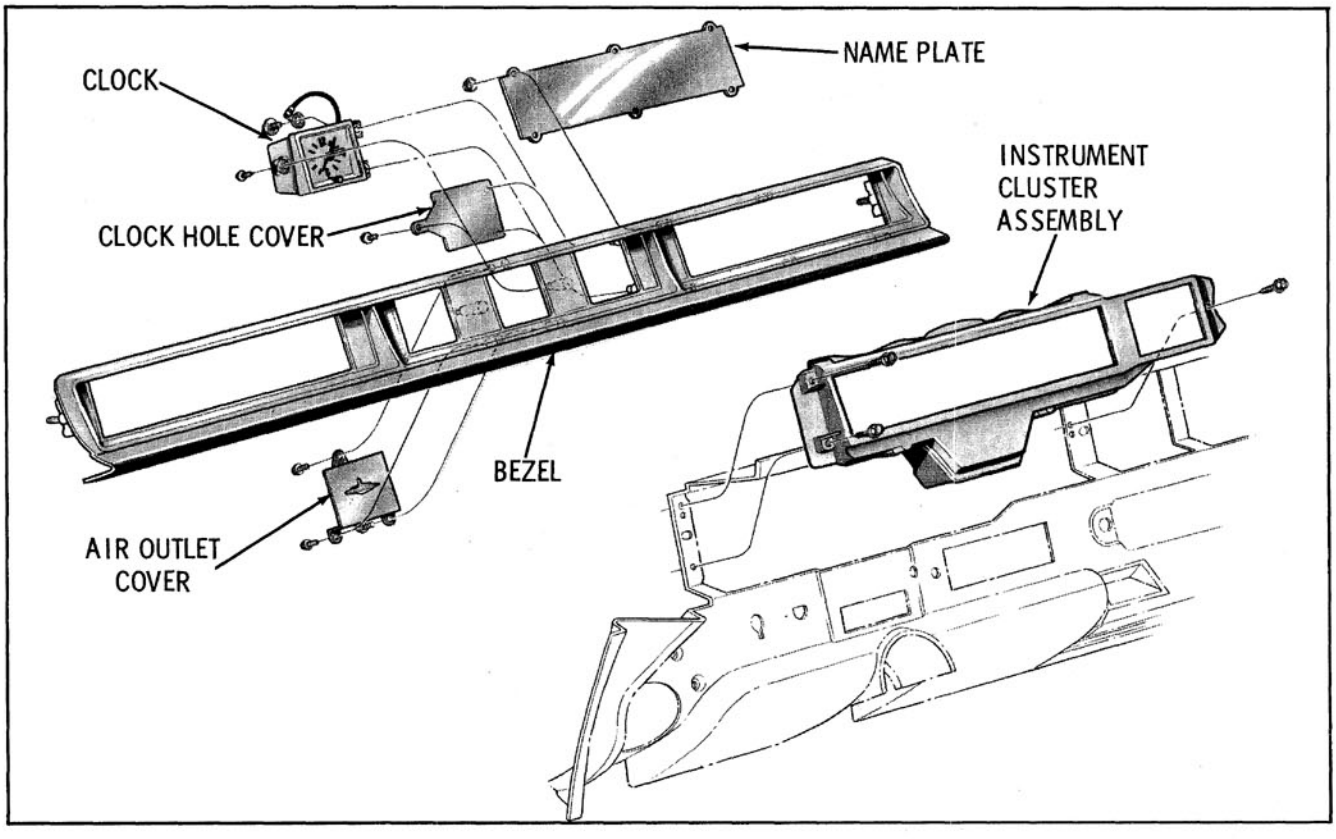


Fig. 12-5 Instrument Cluster Attachment

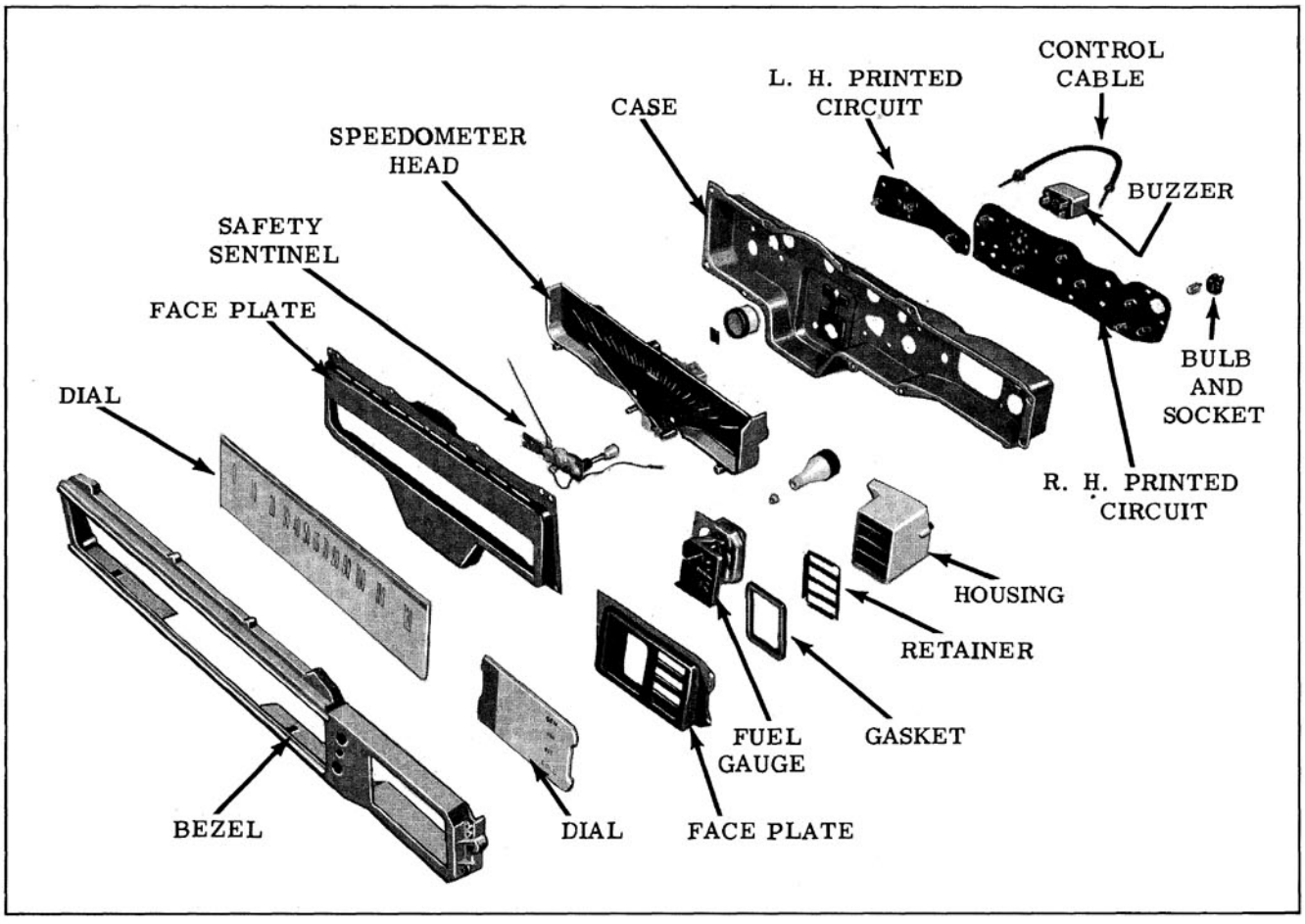


Fig. 12-6 Speedometer Head Exploded

INSTRUMENT CLUSTER

Removal and Installation

1. If car is equipped with air conditioning, the air conditioning manifold must be removed.
2. Disconnect clock feed and lamp. (Fig. 12-4)
3. Remove the instrument panel bezel by removing the three attaching nuts from beneath the instrument panel. (Fig. 12-2)
4. Disconnect the printed circuit connectors.
5. Disconnect the speedometer cable from the speedometer head.
6. Disconnect the printed circuit buzzer.
7. Remove the three cluster-to-instrument panel attaching screws. (Fig. 12-5)
8. Rotate top of cluster downward and remove cluster assembly from instrument panel.
9. If necessary to replace any internal components of the instrument cluster, refer to Fig. 12-6.
10. To install, reverse removal procedure.

PRINTED CIRCUITS OR FUEL GAUGE

Remove and Install (Fig. 12-6)

1. Remove the speedometer cluster assembly.
2. To remove the left hand printed circuit, remove the attaching screws, then remove the printed circuit.
3. To remove the right hand printed circuit or fuel gauge, proceed as follows:
   a. If equipped with safety sentinel, remove the control cable from the printed circuit.
   b. Remove the protective caps from the fuel gauge terminals, then remove the nuts and flat washers.
   c. Remove the printed circuit attaching

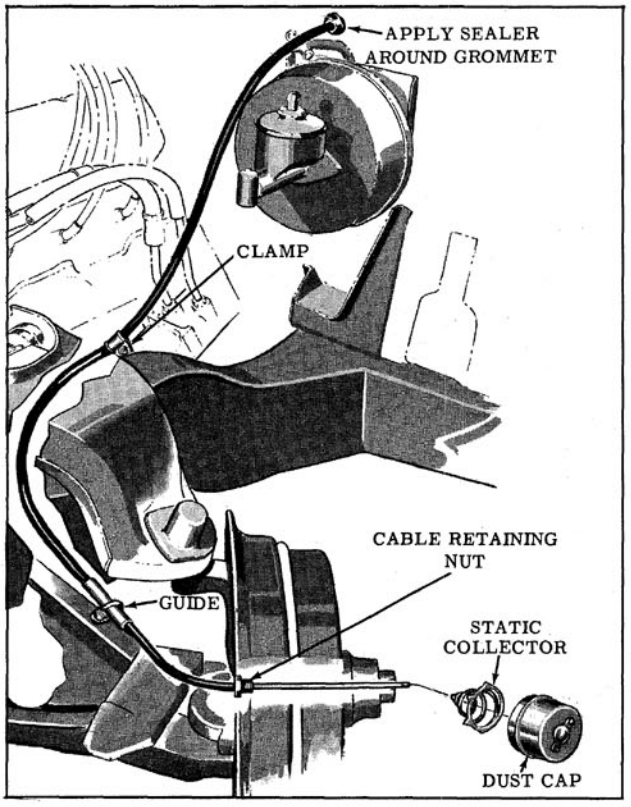


Fig. 12-7 Speedometer Cable

screws, then lift the printed circuit from the cluster.

NOTE: If equipped with safety sentinel, disconnect the wire lead from the printed circuit.

d. To remove the fuel gauge, remove the attaching screw; then lift the fuel gauge out of the cluster.

To install fuel gauge and printed circuits, reverse the removal procedure.

NOTE: If equipped with safety sentinel, connect the wire lead to the printed circuit before installing printed circuit on the cluster.

SPEEDOMETER CABLE—(34-35-36-38-39) (Refer to 30-31 & 32 Series for 33 Series)

Removal and Installation (Fig. 12-7)

1. Disconnect cable from speedometer head.
2. Remove the speedometer cable clamp.

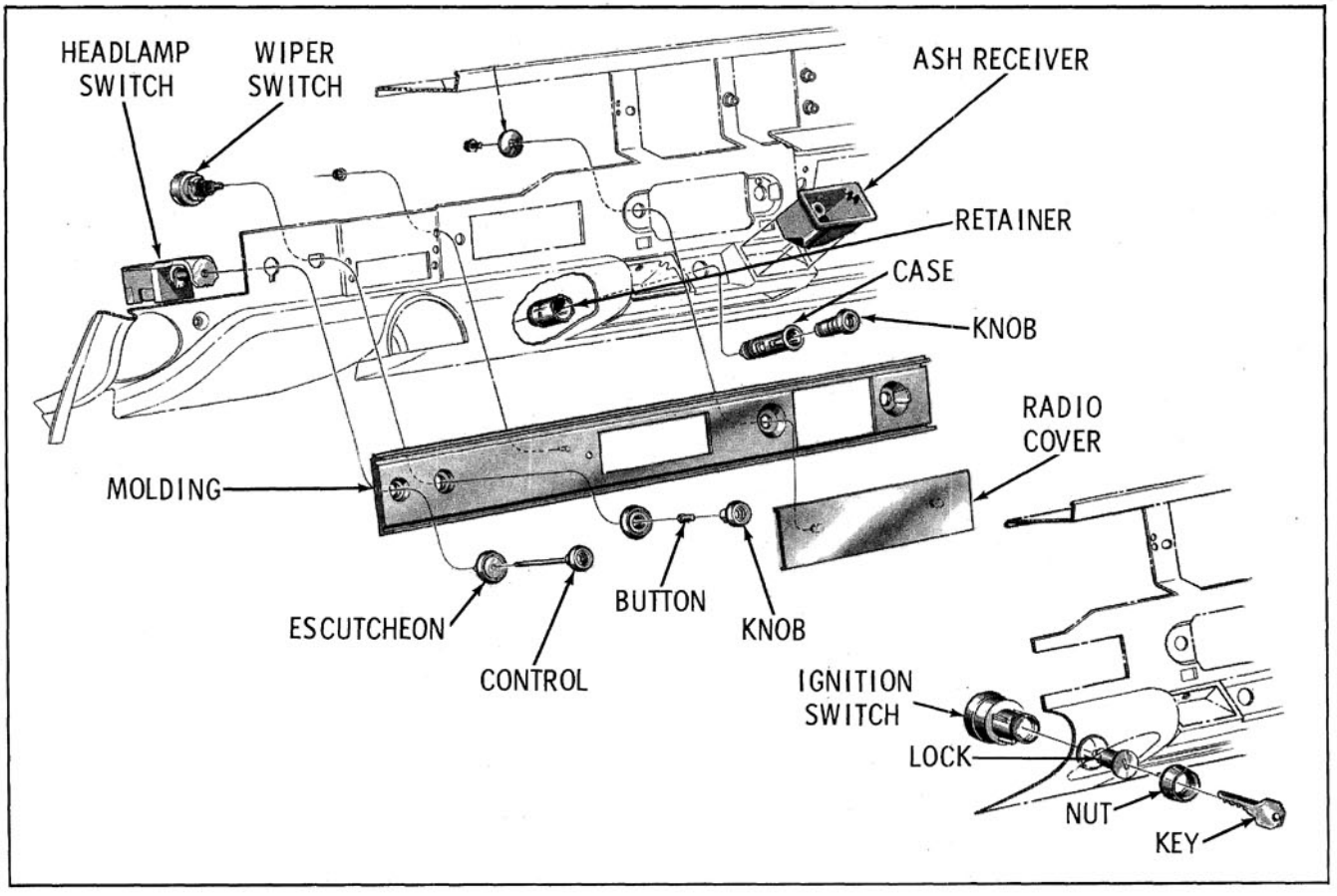


Fig. 12-8 Instrument Panel Components

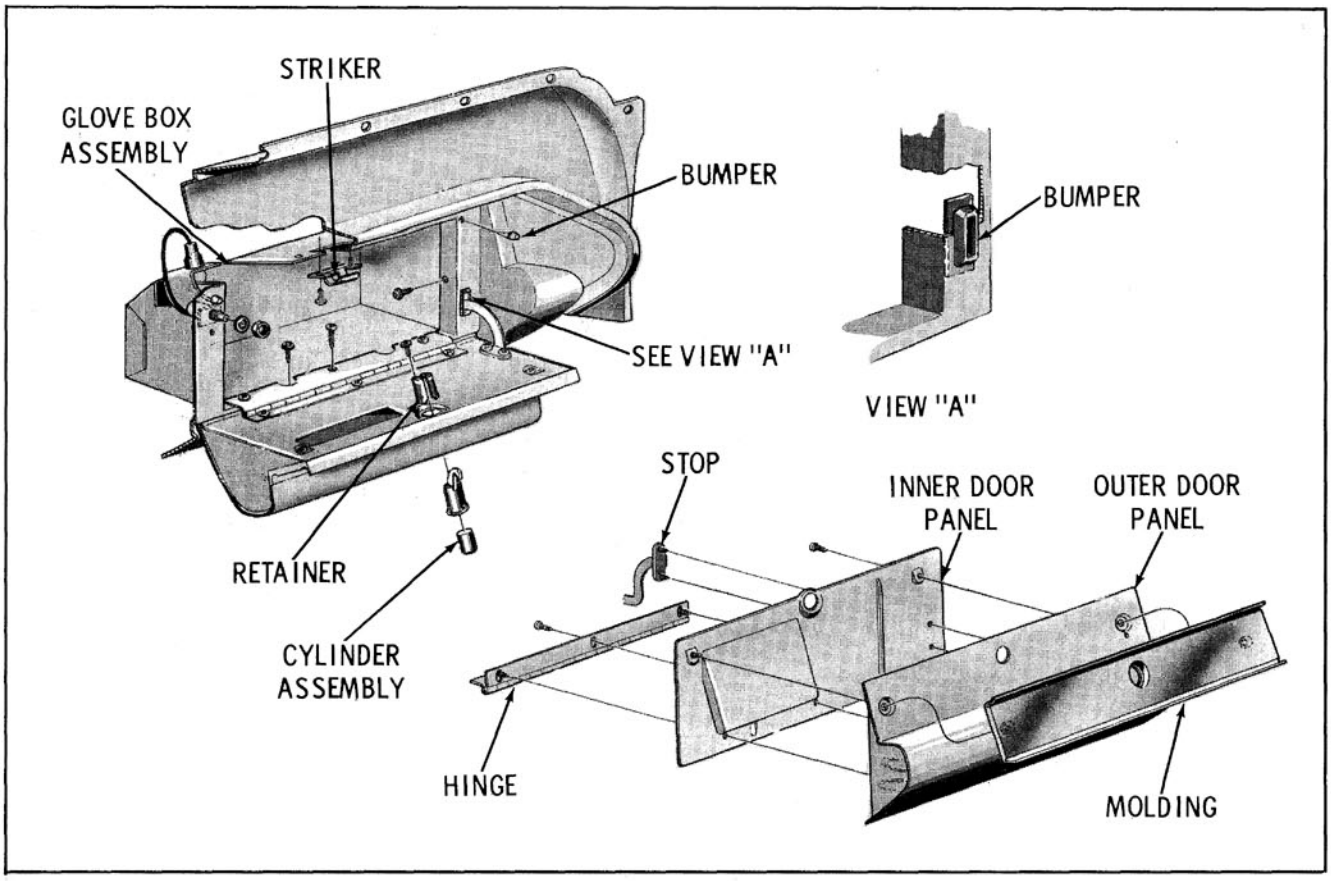


Fig. 12-9 Glove Box Components

3. Remove the grommet from the cowl and withdraw cable.

4. Loosen the cable housing retaining nut at the knuckle, then thread the cable through the guide.

5. To install, reverse removal procedure.

NOTE: If the cable housing retaining nut

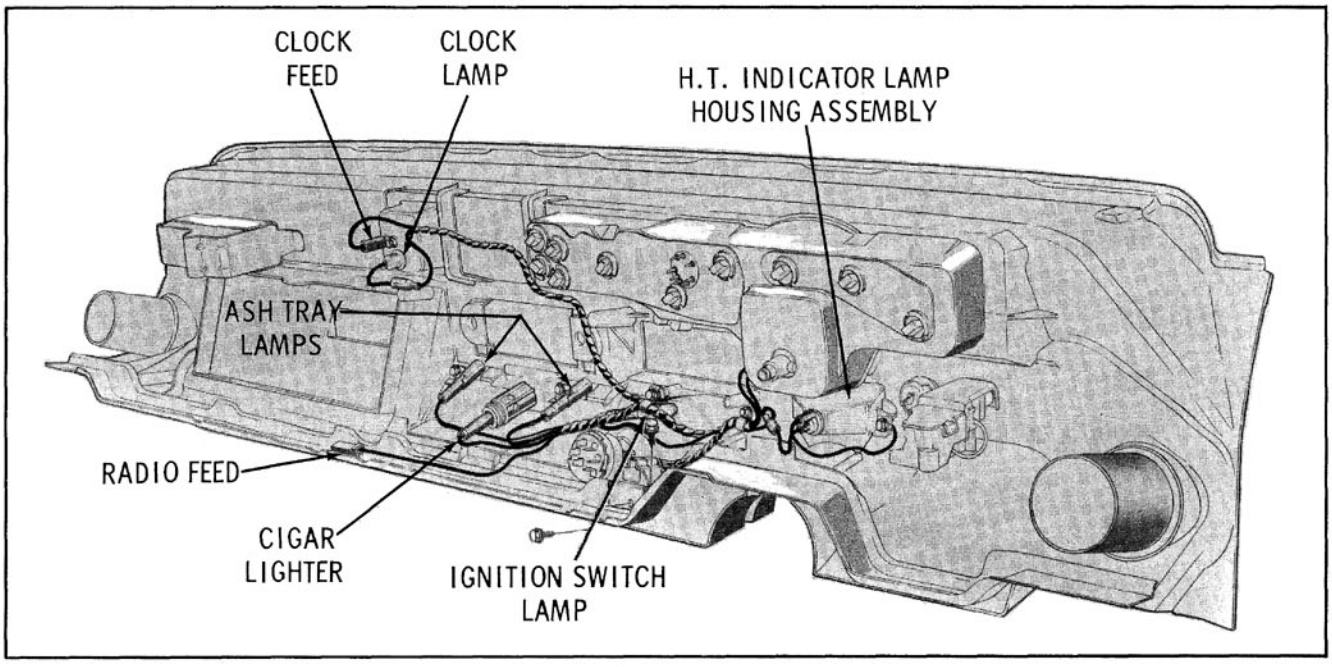


Fig. 12-10 Instrument Panel Harness

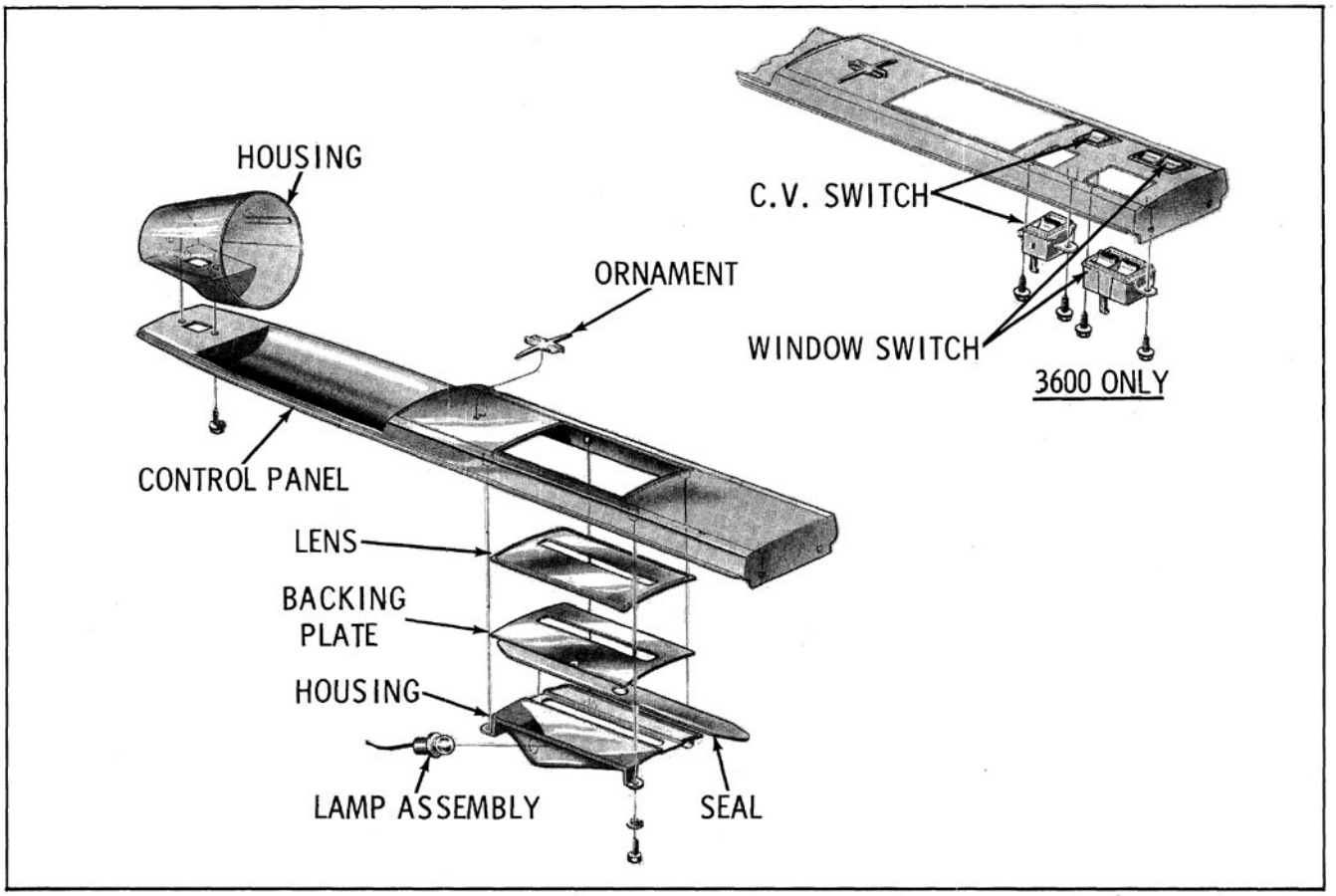


Fig. 12-11 Control Panel Switch Installation

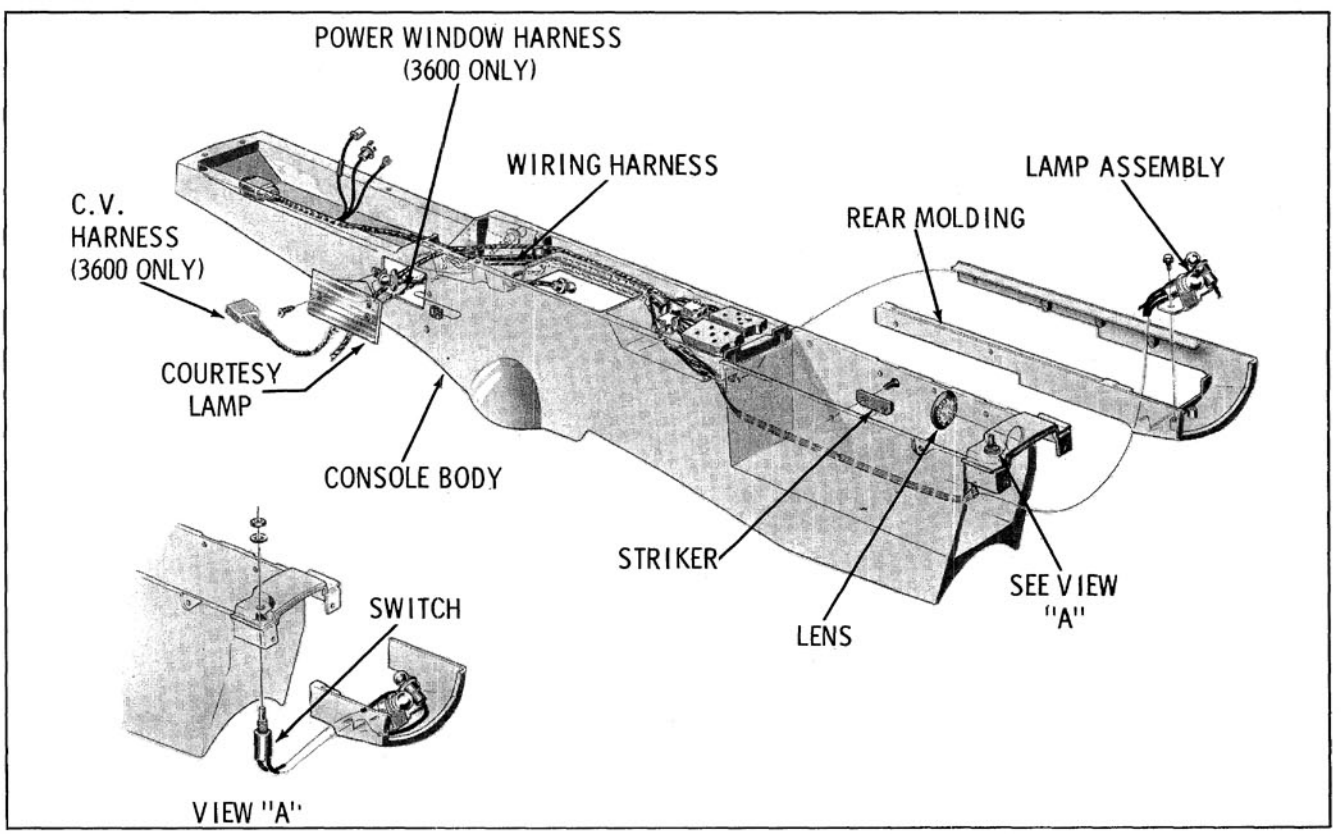


Fig. 12-12 Console Wiring

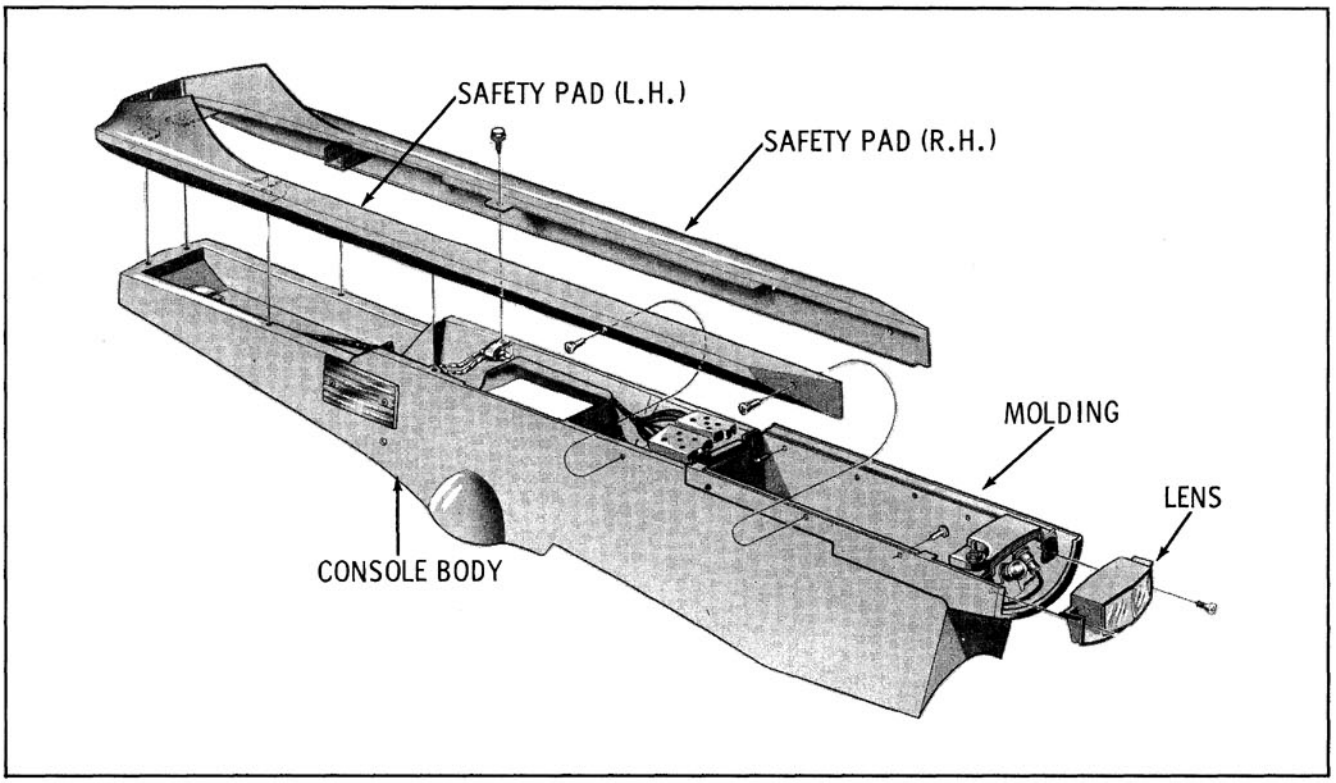


Fig. 12-13 Console Components

cannot be readily started into the knuckle, the cable is not indexed with the dust cap. Rotate wheel or drive cable slightly to index drive cable.

INSTRUMENT PANEL COMPONENTS

The various instrument panel components are attached as shown in Figs. 12-8, 12-9 and 12-10.

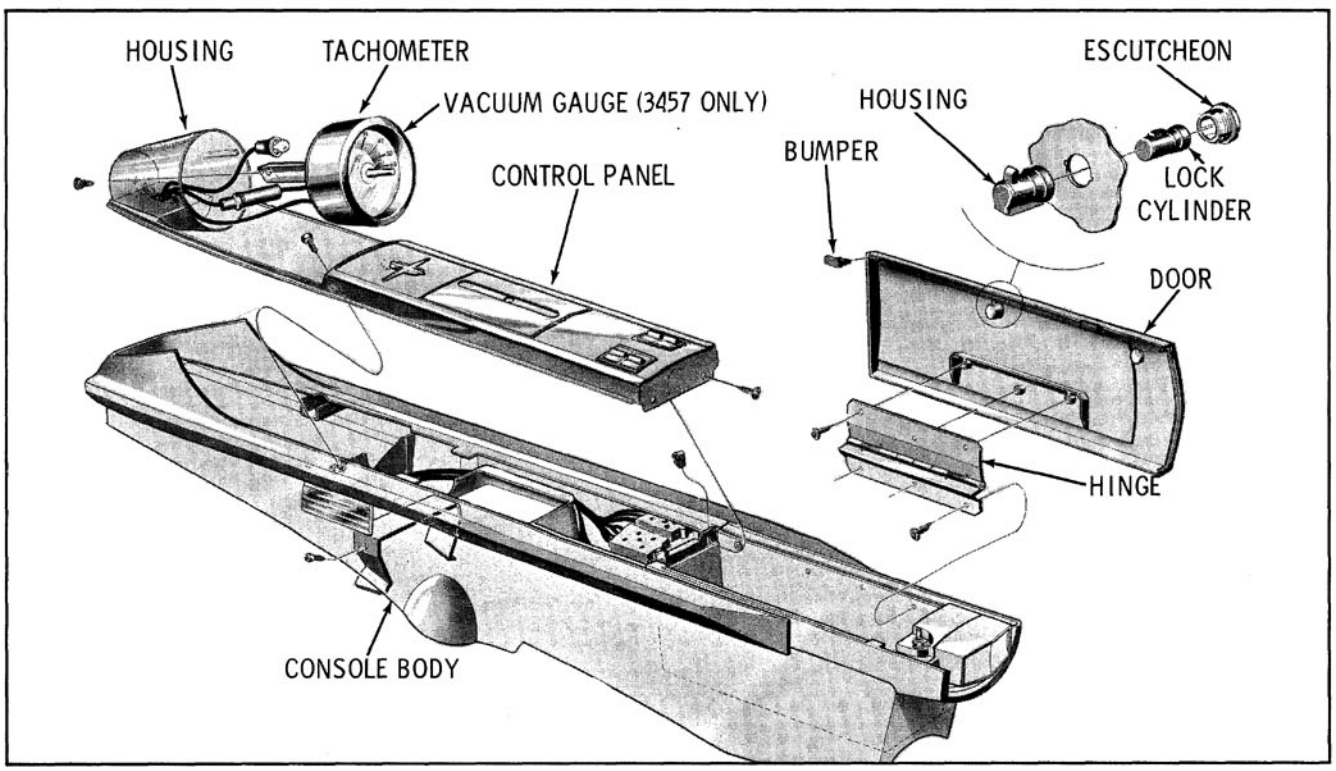


Fig. 12-14 Console Components

CONSOLE

The console is assembled in three sections: console body, safety pad (LH) and safety pad (RH). The tachometer or vacuum gauge (3457 only) can be removed by removing one screw at the rear of tachometer housing. The window switches, Hydra-Matic indicator components, neutral safety and back-up lamp switch can be serviced after removing the selector handle and control panel. For detailed disassembly and assembly, refer to Figs. 12-11, 12-12, 12-13, 12-14, 12-15, 12-16, 12-17 and 12-18.

NOTE: For 3300 series, refer to INSTRUMENT PANEL AND ACCESSORIES, 30, 31 and 3200 Series.

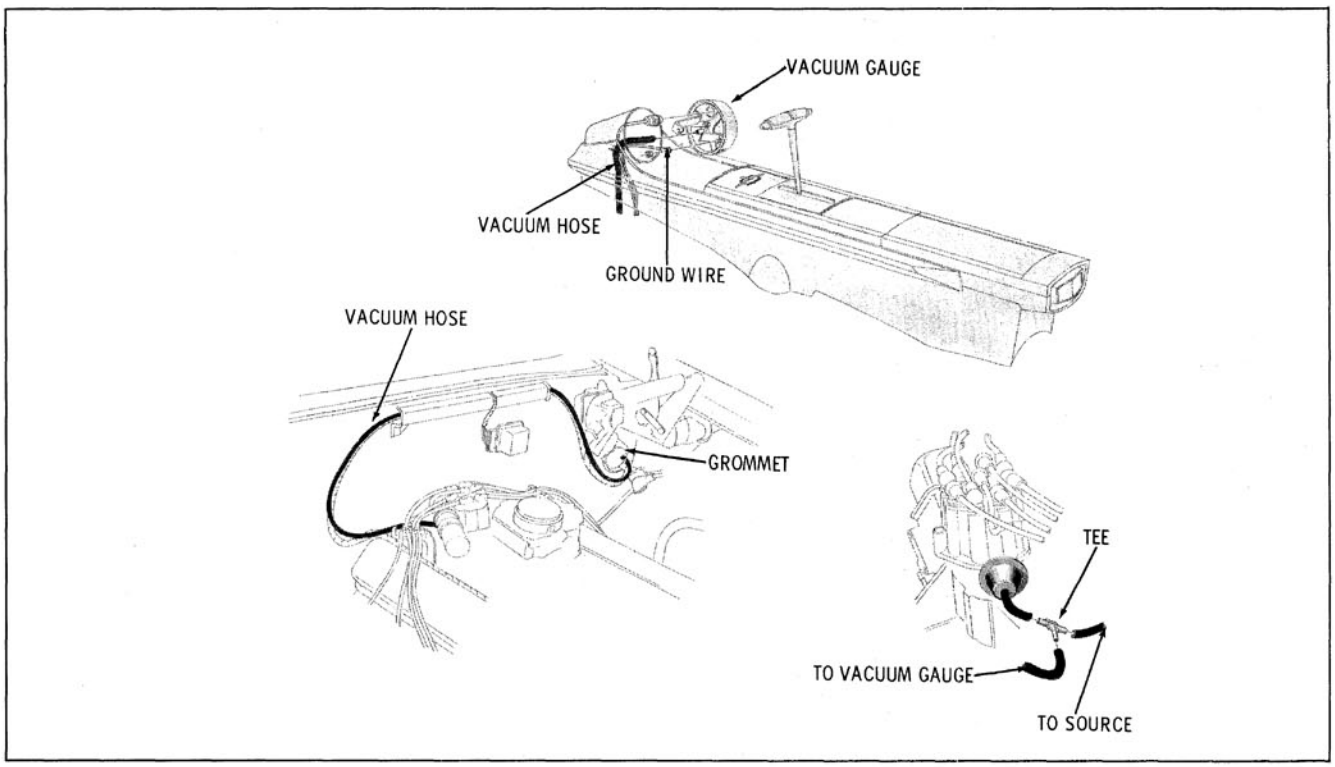


Fig. 12-15 Console Vacuum Gauge Hose Routing

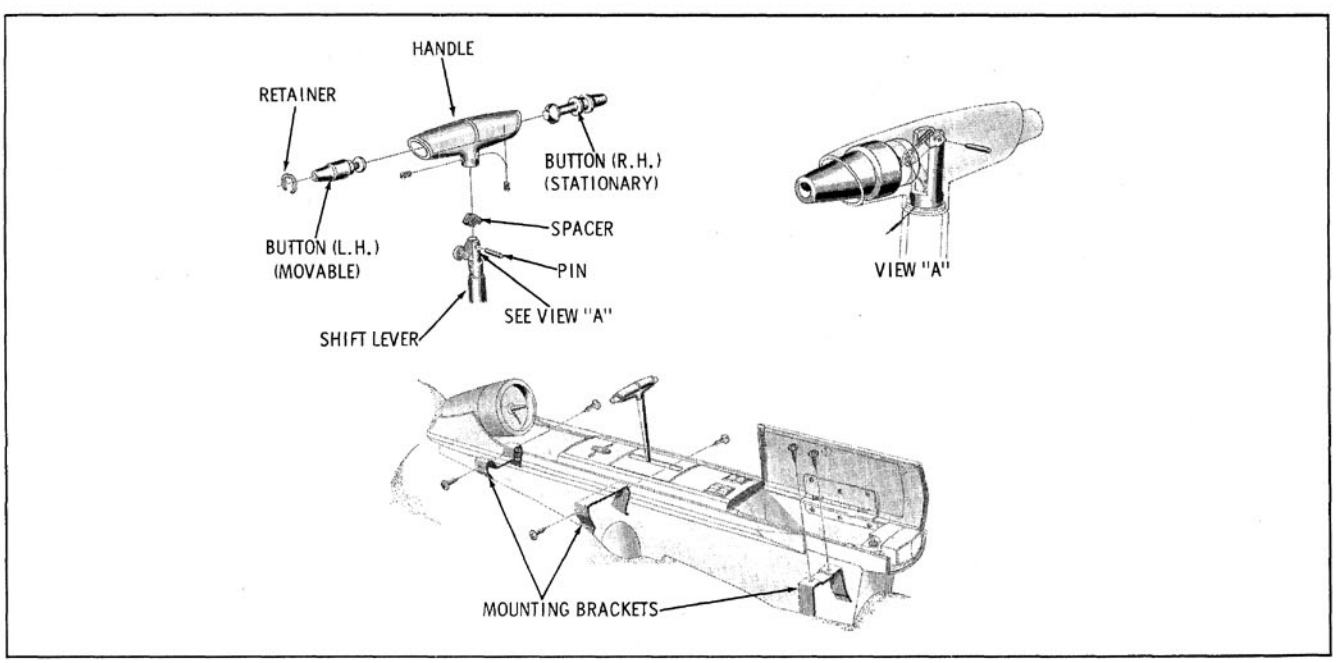


Fig. 12-16 Console Mounting

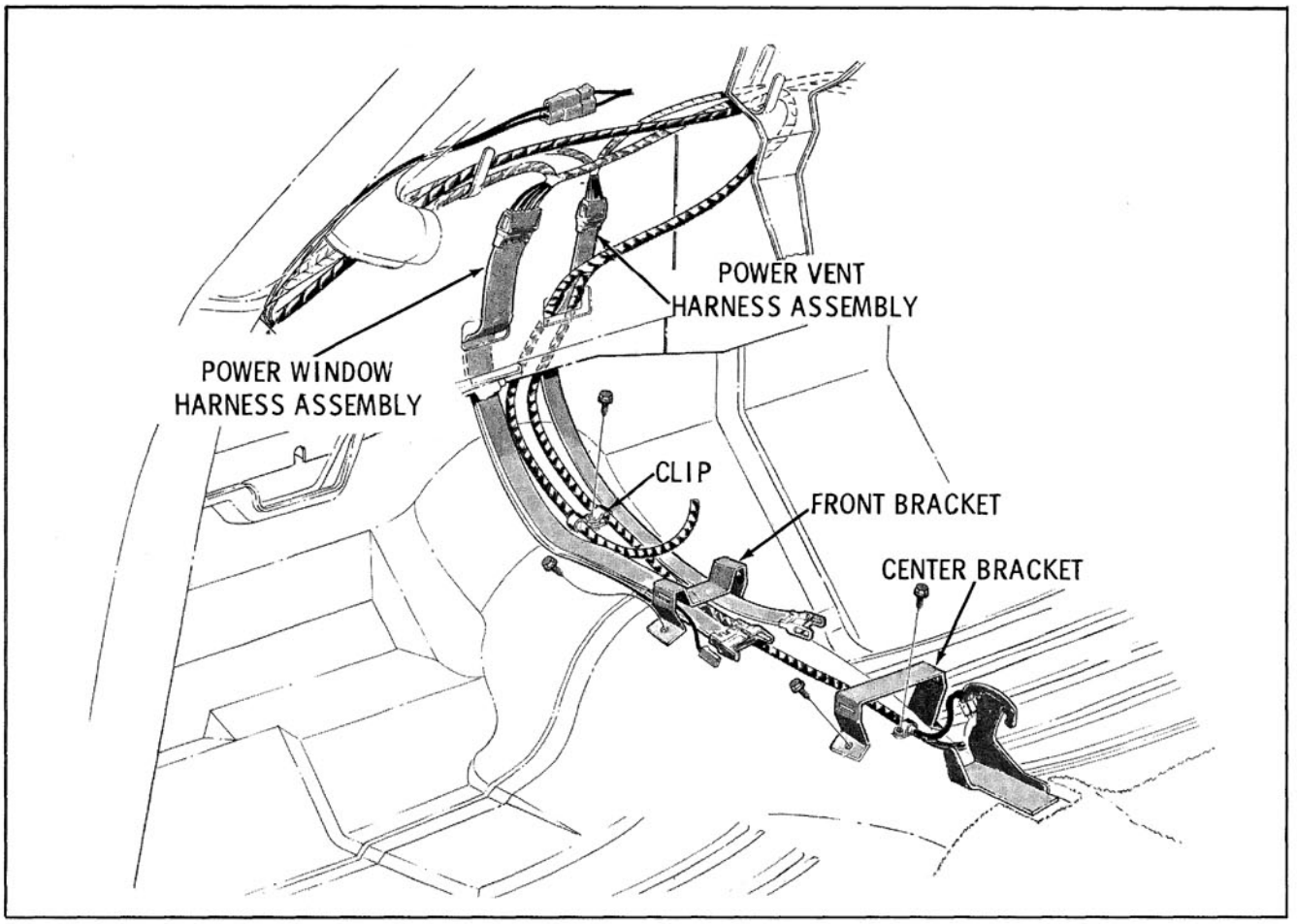


Fig. 12-17 Console Power Harness Installation

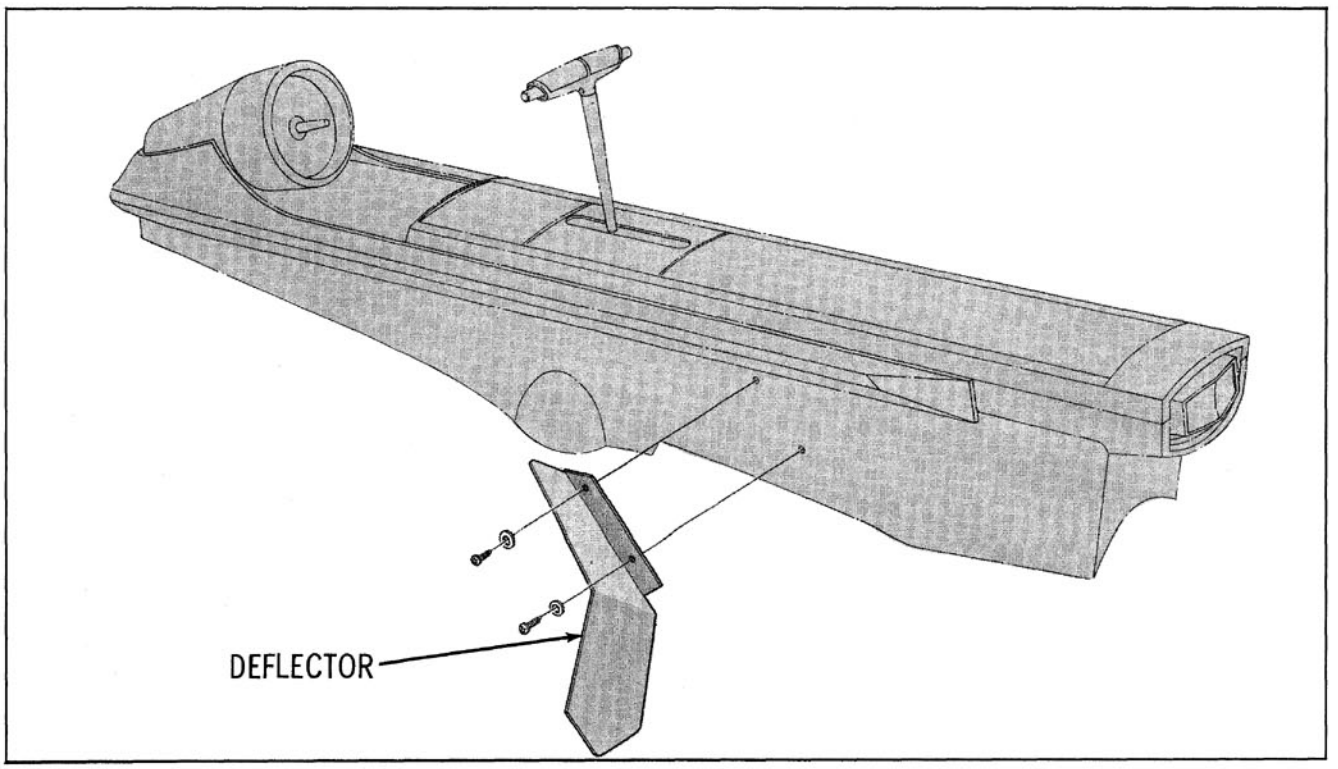


Fig. 12-18 Console Air Deflector

ACCESSORIES

RADIO (Figs. 12-19 and 12-21)

Three types of radios are available: Deluxe, Super Deluxe and AM-FM. The receiver circuit in all radios is transistorized. The outer left knob operates the On-Off switch and volume control, while the inner left knob operates the tone control. The right hand outer knob controls manual tuning of the radio.

On cars equipped with a rear seat speaker, a variable type control located behind the manual tuning knob modulates both the front and rear speakers simultaneously. As the control is turned counterclockwise, the volume of the front speaker increases while the volume of the rear speaker decreases. As the control is turned clockwise, the volume of the front speaker diminishes while the volume of the rear speaker increases. After the desired speaker modulation is obtained, the volume of both speakers can be regulated by the volume control knob.

All radios have five pushbuttons for touch tuning, which mechanically tunes the radio to pre-selected stations, and a control knob for manual selection of stations.

In addition to pushbutton tuning, the Super Deluxe model features automatic tuning. Depressing the foot selector switch (Fig. 12-20) or the center push bar, rejects any station previously selected and automatically selects and tunes the next available station.

The sensitivity of the automatic tuning mechanism can be increased or decreased by the sliding lever located under the bar. The lever has three positions. When the lever is to the left, only the stronger or local stations will be received. The sensitivity can be increased by moving the lever to the middle or extreme right position.

NOTE: The automatic tuning unit uses a vacuum tube. This tube requires a short warm-up period before the automatic tuning can be used, after the radio is first turned on.

Remove and Install (Fig. 12-20)

1. Remove radio knobs, wave washers, escutcheons or rear seat speaker control.
2. Remove the radio attaching nuts and washers.

   NOTE: If equipped with A.C., the A.C. manifold must be removed.
3. Disconnect all radio connectors.
4. Remove the radio to instrument panel bracket attaching screw.
5. Remove radio from the rear of the instrument panel.

   To install, reverse removal procedure.

PUSHBUTTON ADJUSTMENT

Adjustment of the mechanical pushbutton tuning system on the Deluxe, Super Deluxe and AM-FM models is the same.

1. Turn on the receiver.
2. Select a pushbutton for desired station. Pull the button slightly to the left and then out as far as it will go.
3. Tune in the desired station manually.
4. Push the selected button to its maximum in position. This is the locking operation.
5. Proceed in the same manner for the remaining stations.

Fig. 12-19 Super Deluxe Radio

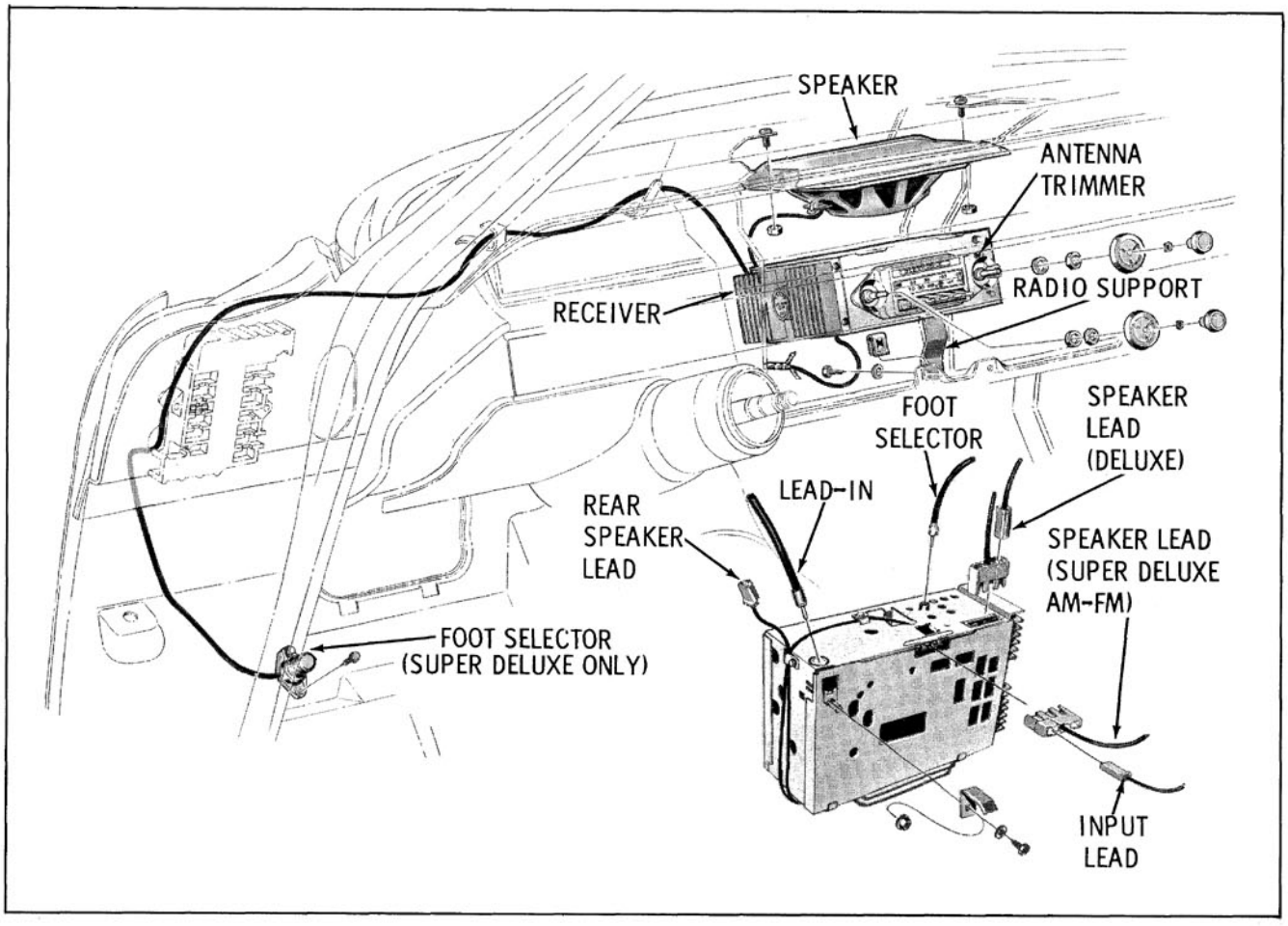


Fig. 12-20 Radio Installation

6. After all the buttons have been adjusted, recheck the settings. Push each button, then see if the station can be tuned in more accurately manually. If so, repeat Step 2 and reset the station manually.

NOTE: Any single pushbutton on the AM-FM radio, may be adjusted for either AM or FM reception. When a pushbutton is adjusted for FM, it cannot be used for selecting a station on AM without first re-adjusting the pushbutton for AM.

AM-FM RADIO (Fig. 12-21)

AM or FM radio broadcasts may be selected by sliding the control switch located above the radio dial, to the right or left. The letters AM or FM will appear in the upper left or right corners of the control panel, indicating the type of broadcast being received.

Normal FM reception will be almost noise-free unless the radio is tuned to a weak station in a fringe area. It may be necessary, while driving,

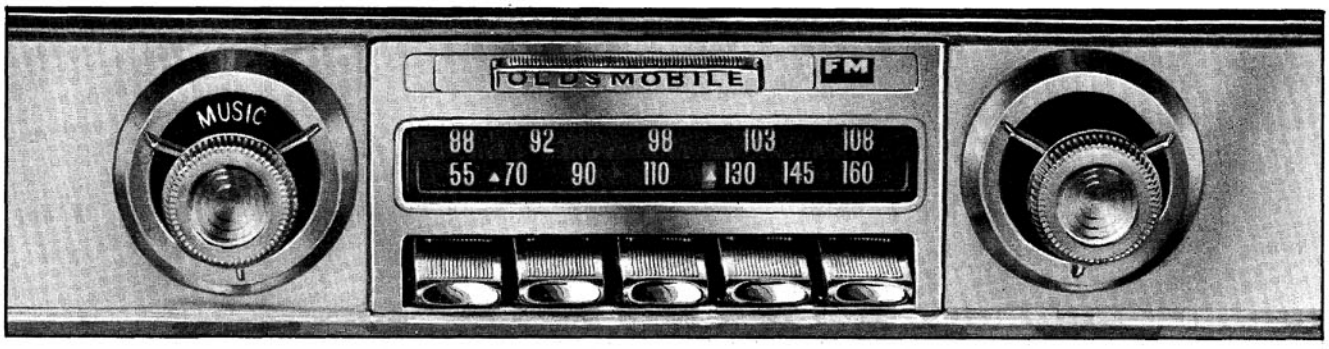


Fig. 12-21 AM-FM Radio

to manually re-tune FM stations slightly to maintain peak reception. The average FM station coverage is approximately 20 to 30 miles.

NOTE: Maximum FM reception is obtained with the antenna extended approximately 30".

TRIMMER ADJUSTMENT (Fig. 12-20)

1. Fully extend antenna.

   NOTE: AM-FM radio must be set on the AM band.

2. Remove the manual tuning knob and escutcheon or rear seat speaker fader control, if so equipped.

3. Turn the volume control full on and tune the receiver to a weak station between 600 and 1000 K.C. on the dial.

   NOTE: Do not turn on radio unless shunt wire is installed.

4. With a small screwdriver, adjust the antenna trimmer until loudest signal is received.

RADIO DIAL LIGHT

The radio dial light on the Deluxe radio is located on top of the receiver and can be removed without removing the radio. If equipped with air conditioning, the center outlet must first be removed before the bulb is accessible.

To remove the dial light on AM-FM or Super Deluxe radios, the radio receiver must first be removed. The bulb is located beneath the radio cover.

FOOT SELECTOR SWITCH—REMOVAL (Fig 12-20) (Super Deluxe Radio)

1. Fold floor mat to expose foot switch and remove attaching screws.

2. Remove foot switch wiring lead from clips along upper side of dash, then remove plug-in connector from the rear of the radio receiver.

   To install switch, reverse the removal procedure.

SPEAKERS

Rear Speaker Removal

The rear seat speaker is mounted under the parcel shelf, and is accessible through the rear compartment. To remove speaker:

1. Disconnect lead from terminal.

2. Remove four mounting locknuts while supporting speaker to prevent it from dropping. (Fig. 12-22)

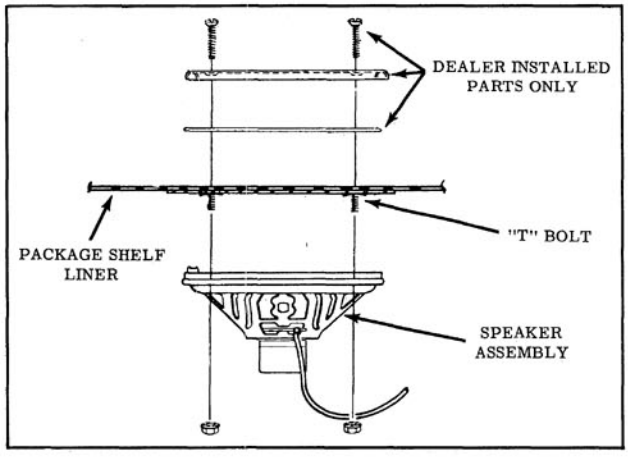


Fig. 12-22 Rear Seat Speaker (Except 35, 45 & 67)

To install, reverse removal procedure, being careful to avoid damaging the speaker cone while aligning the speaker assembly over the mounting screws.

CONVERTIBLES

The rear seat speaker on convertibles is mounted on the rear seat back. To remove speaker, proceed as follows:

1. Remove rear seat cushion.

2. Remove the upper two body to seat back attaching screws, accessible from the rear compartment.

3. Remove the two lower seat back attaching screws and tip seat back forward.

   NOTE: Place protective covering on floor panel to prevent soiling of seat back.

4. Remove four speaker assembly to seat back attaching screws.

5. Disconnect lead wire from speaker. Remove

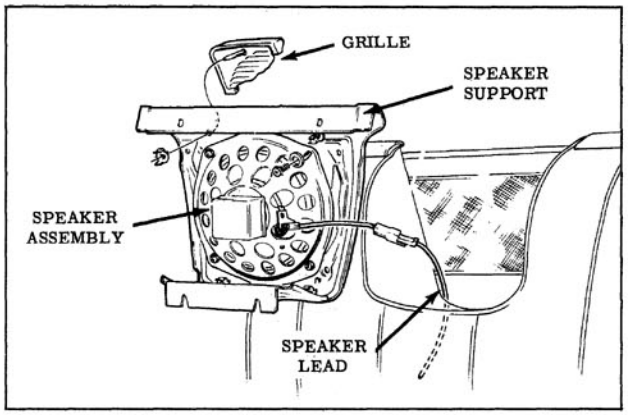


Fig. 12-23 Rear Seat Speaker (67 Styles)

the four speaker attaching screws and remove speaker. (Fig. 12-23)

6. If speaker grille is to be replaced, it can be removed by removing the four self-threading attaching nuts.

7. To install, reverse removal procedure.

FIESTAS

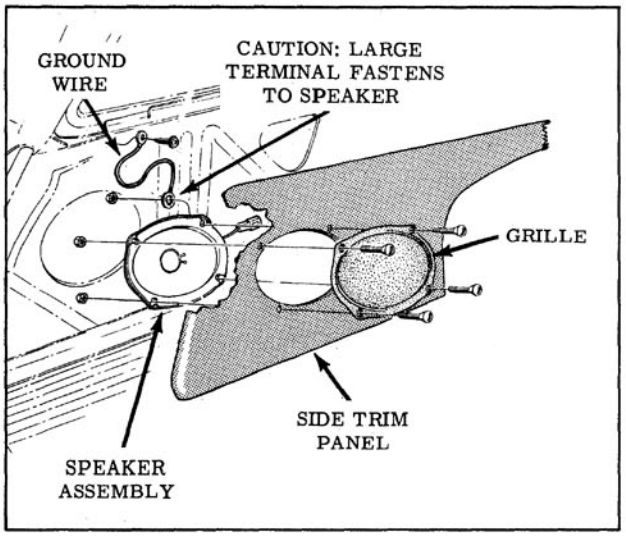


Fig. 12-24 Rear Seat Speaker (Fiestas)

The rear speaker on Fiestas is mounted on the rear quarter trim panel on the left side of the car. To remove the speaker, proceed as follows:

1. Remove rear quarter trim panel.

   CAUTION: Speaker ground wire is attached to inner quarter panel. Do not break the ground wire.

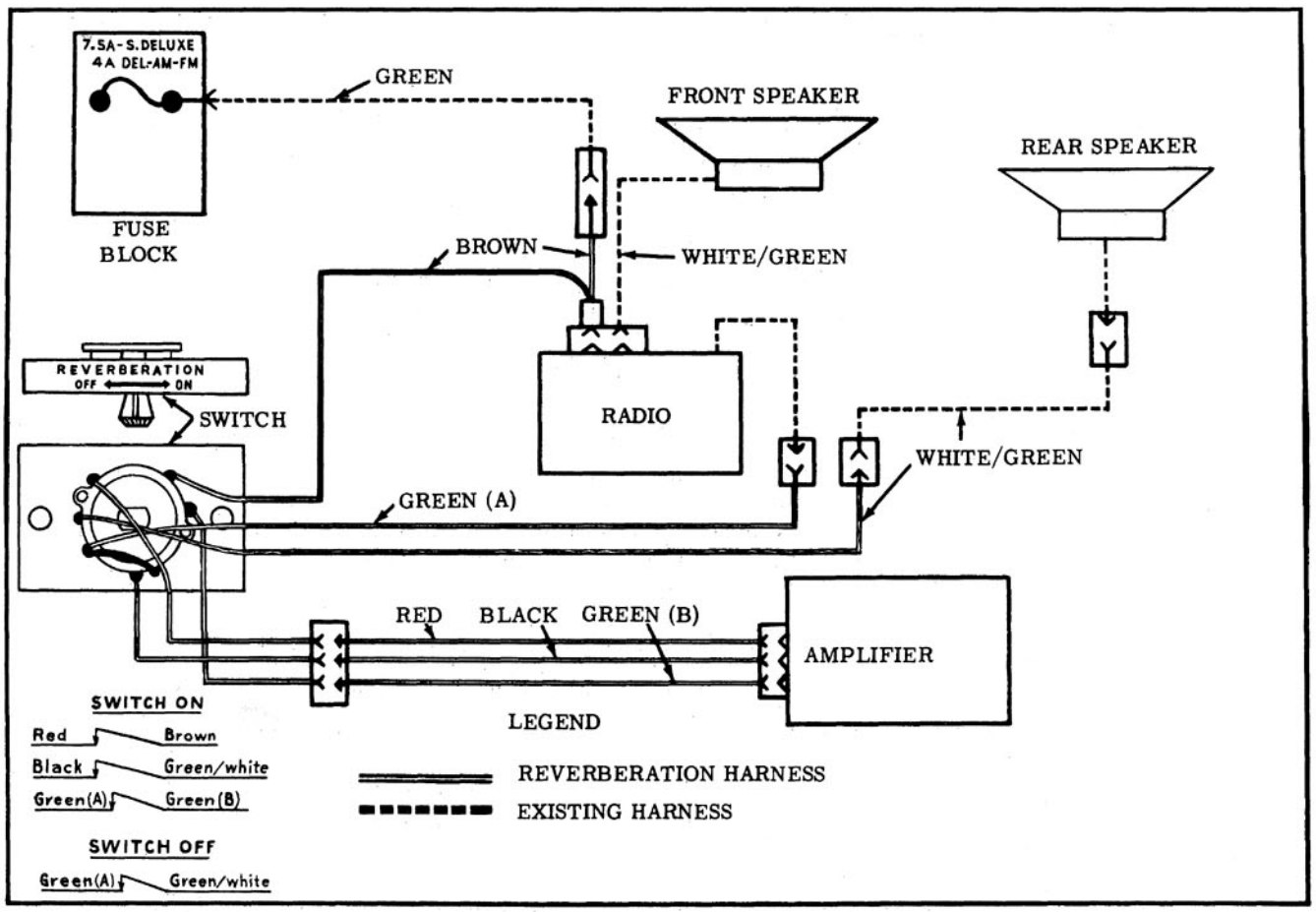


Fig. 12-25 Reverberation Schematic

2. Disconnect speaker ground wire from the inner quarter panel.

3. Remove speaker assembly from the quarter panel. (Fig. 12-24)

4. To install, reverse the removal procedure. The speaker lead is routed in the same manner as the rear antenna lead-in.

REVERBERATOR REAR SEAT SPEAKER

REVERBERATION SCHEMATIC (Fig. 12-25)

Amplifier

The location and installation of the reverberator amplifier is shown in Figs. 12-26, 12-27 and 12-28.

Wiring

The location of the instrument panel wiring is shown in Fig. 12-29.

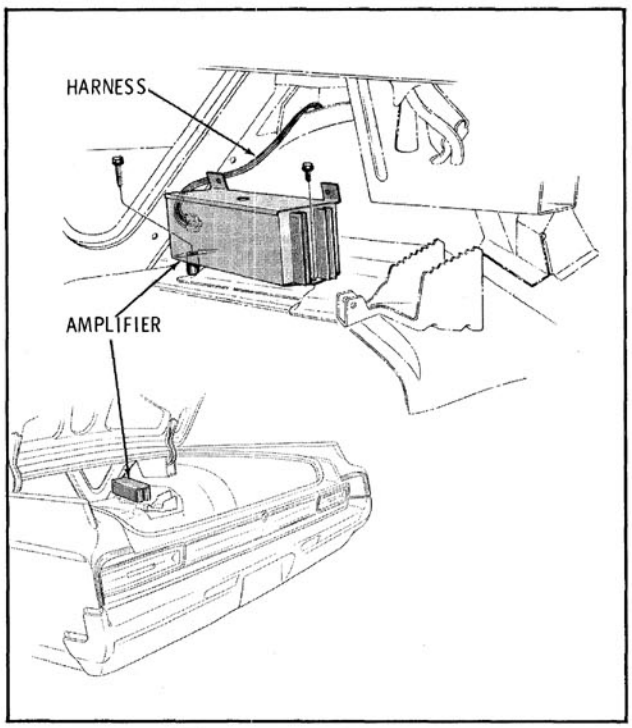


Fig. 12-26 Reverberation Amplifier Location (Sedan Models)

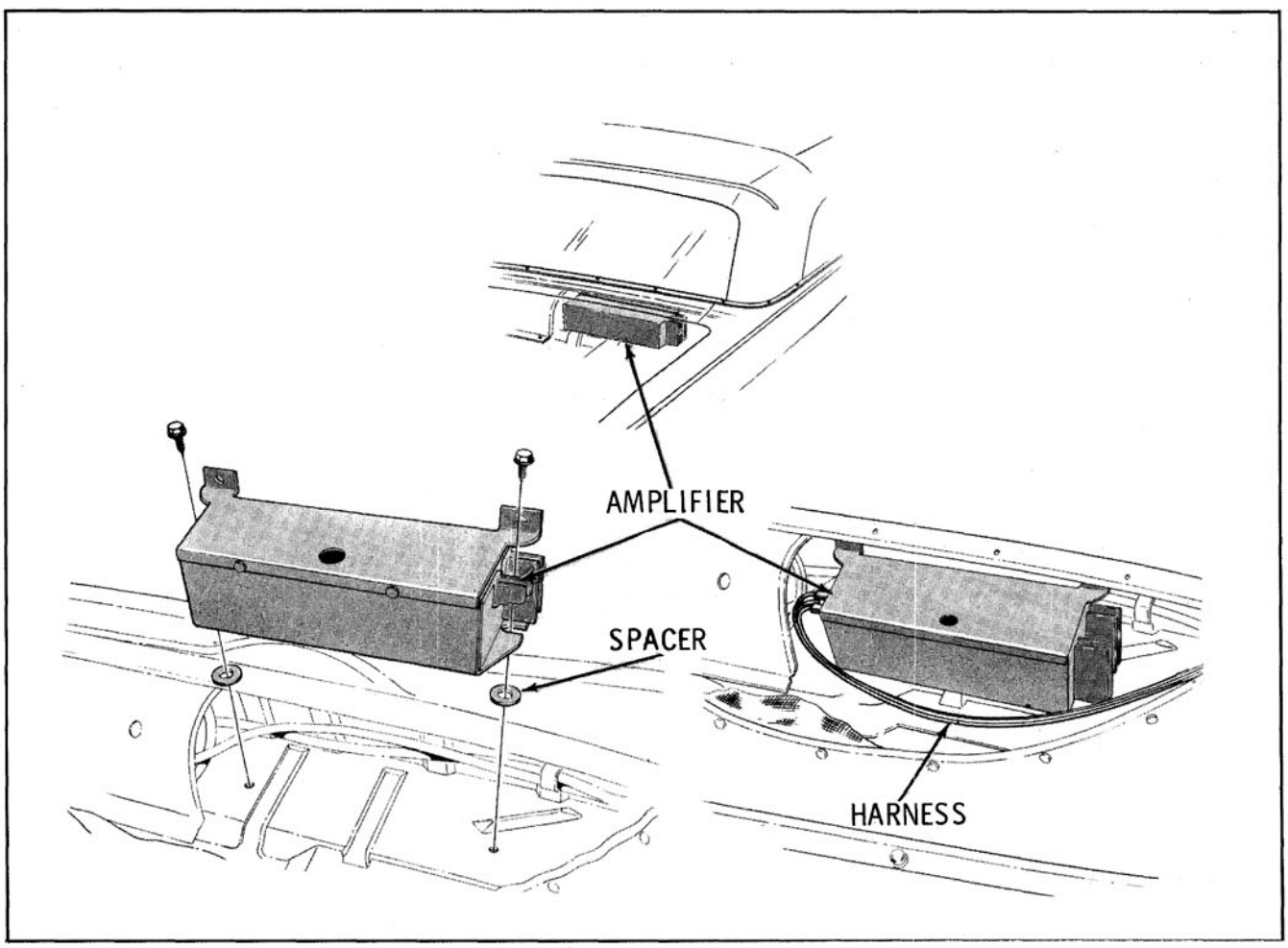


Fig. 12-27 Reverberation Amplifier Location (Convertibles)

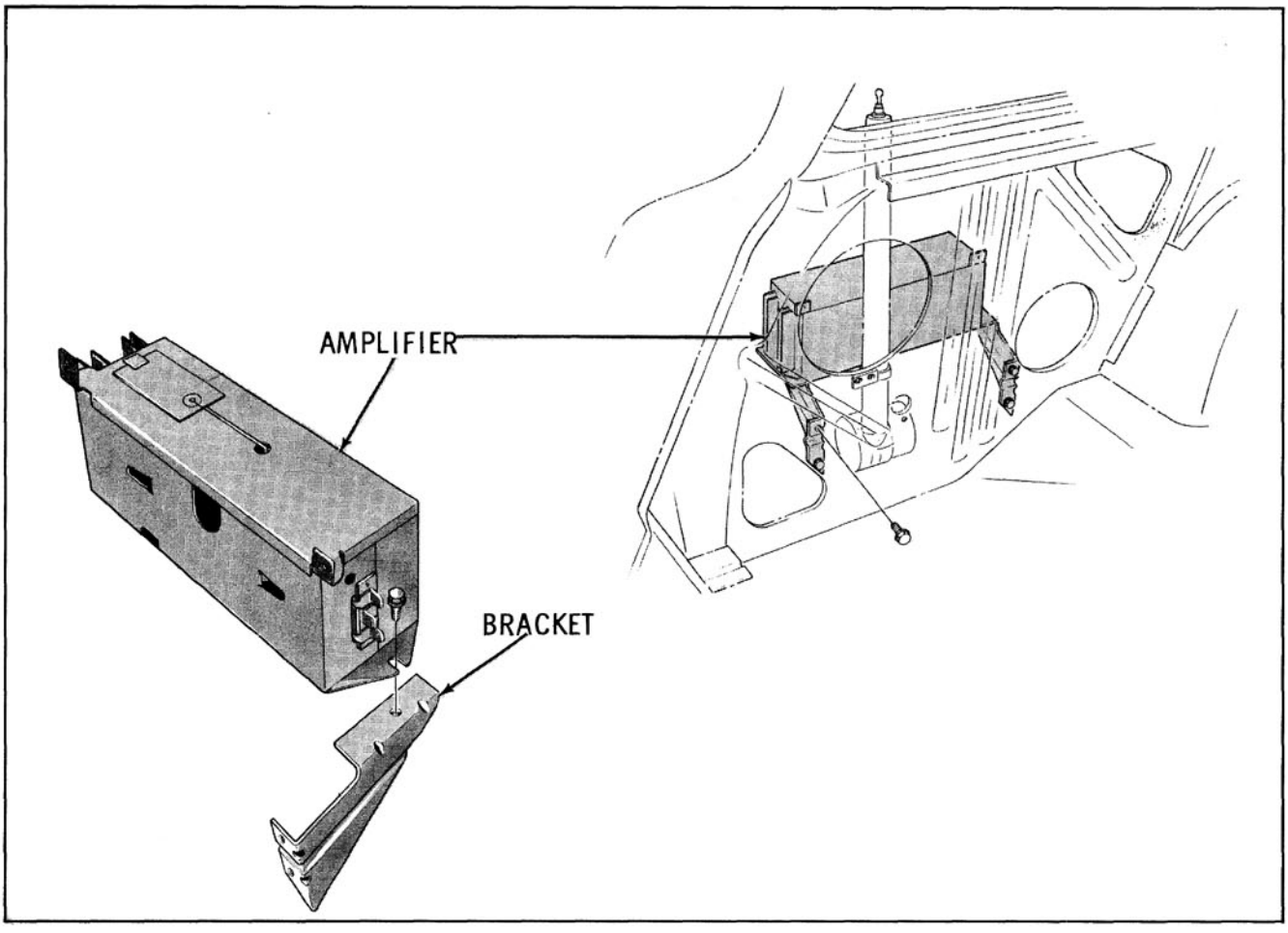


Fig. 12-28 Reverberation Amplifier Location (Station Wagons)

ANTENNA

Manual

The manual antennas are installed as shown in Figs. 12-30 and 12-31. On cars equipped with front manual antenna and dealer installed air conditioning, the evaporator must be removed before the antenna can be removed.

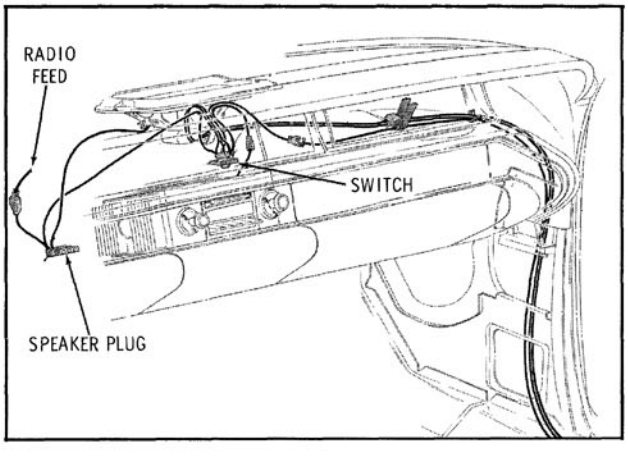


Fig. 12-29 Reverberation Instrument Panel Wiring

Power

Power antennas are installed as shown in Figs. 12-32 and 12-33. When replacing the lead-in or

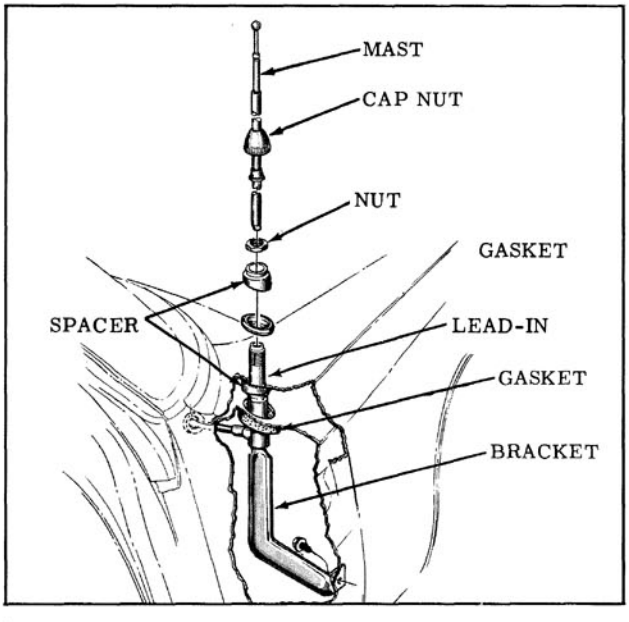


Fig. 12-30 Manual Antenna, Front Installation

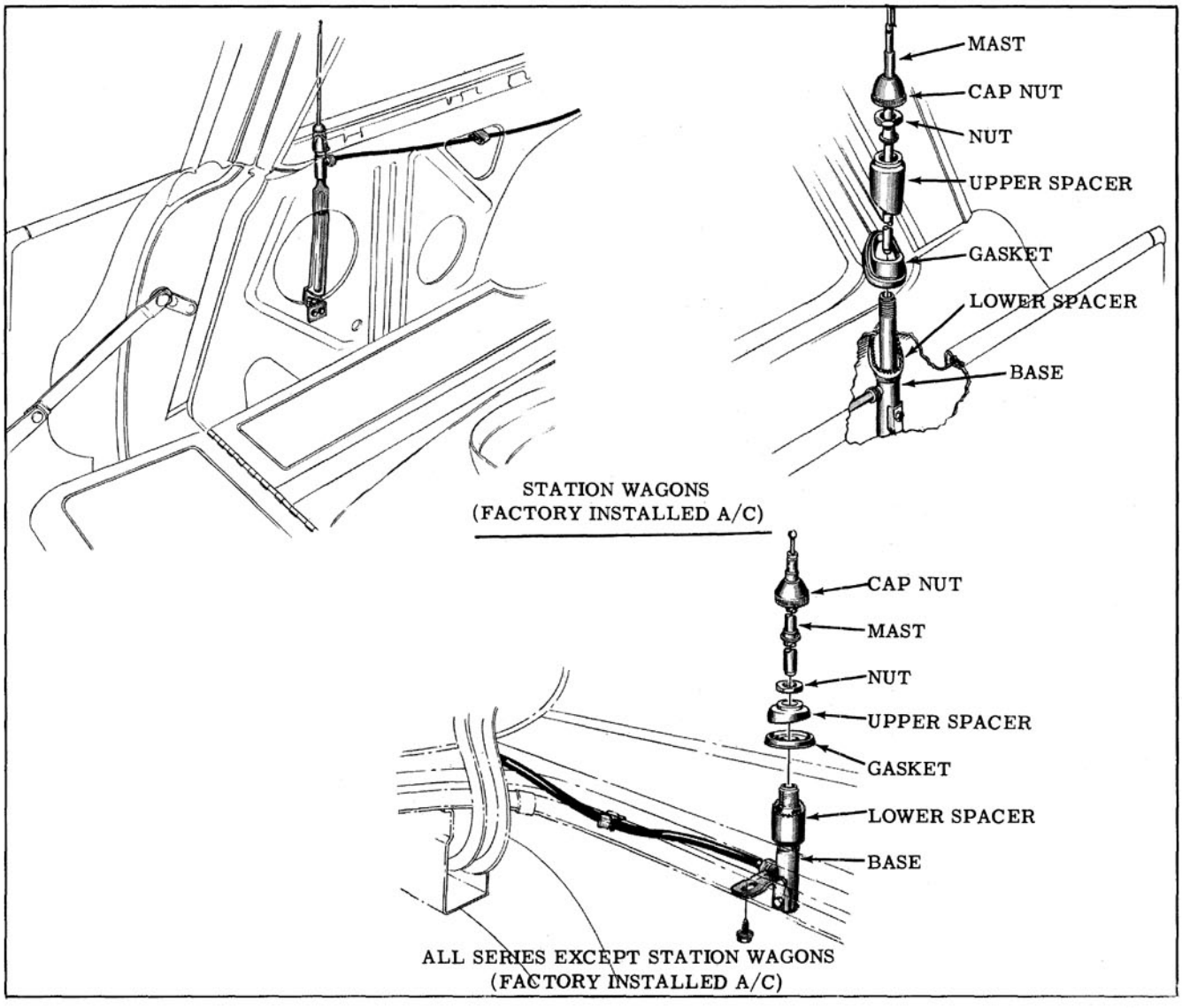


Fig. 12-31 Manual Antenna Rear Quarter Installation

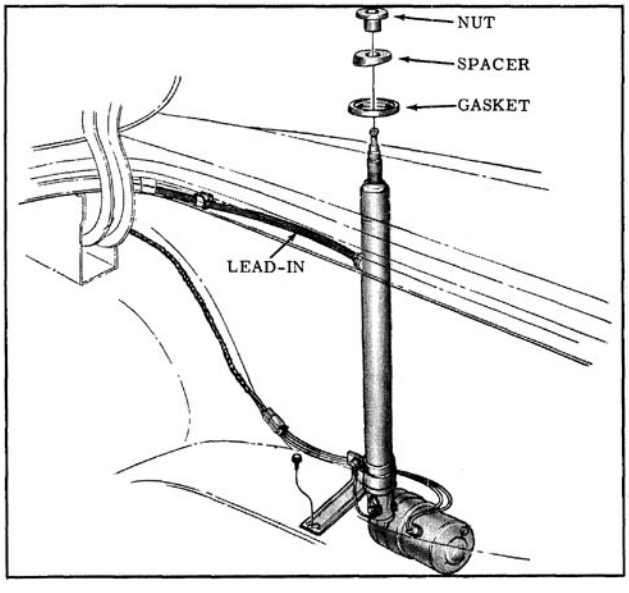


Fig. 12-32 Power Antenna Installation

wiring, use the existing harness to route the new harness through body panels. See Fig. 12-34 for typical cable and wire routing for sedans and convertibles.

Disassembly (Fig. 12-35)

The following parts of the power antenna are serviceable: Drive Assembly, Mast Assembly and Support Tube Assembly. To service any of these parts, proceed as follows:

1. Remove the two connector to support tube screws and remove connector.

2. Unsolder hook-up wire at pin and remove pin and insulator assembly.

   NOTE: Do not overheat pin by slow soldering as the pin insulator will be destroyed.

3. Remove the three support tube to drive assembly screws.

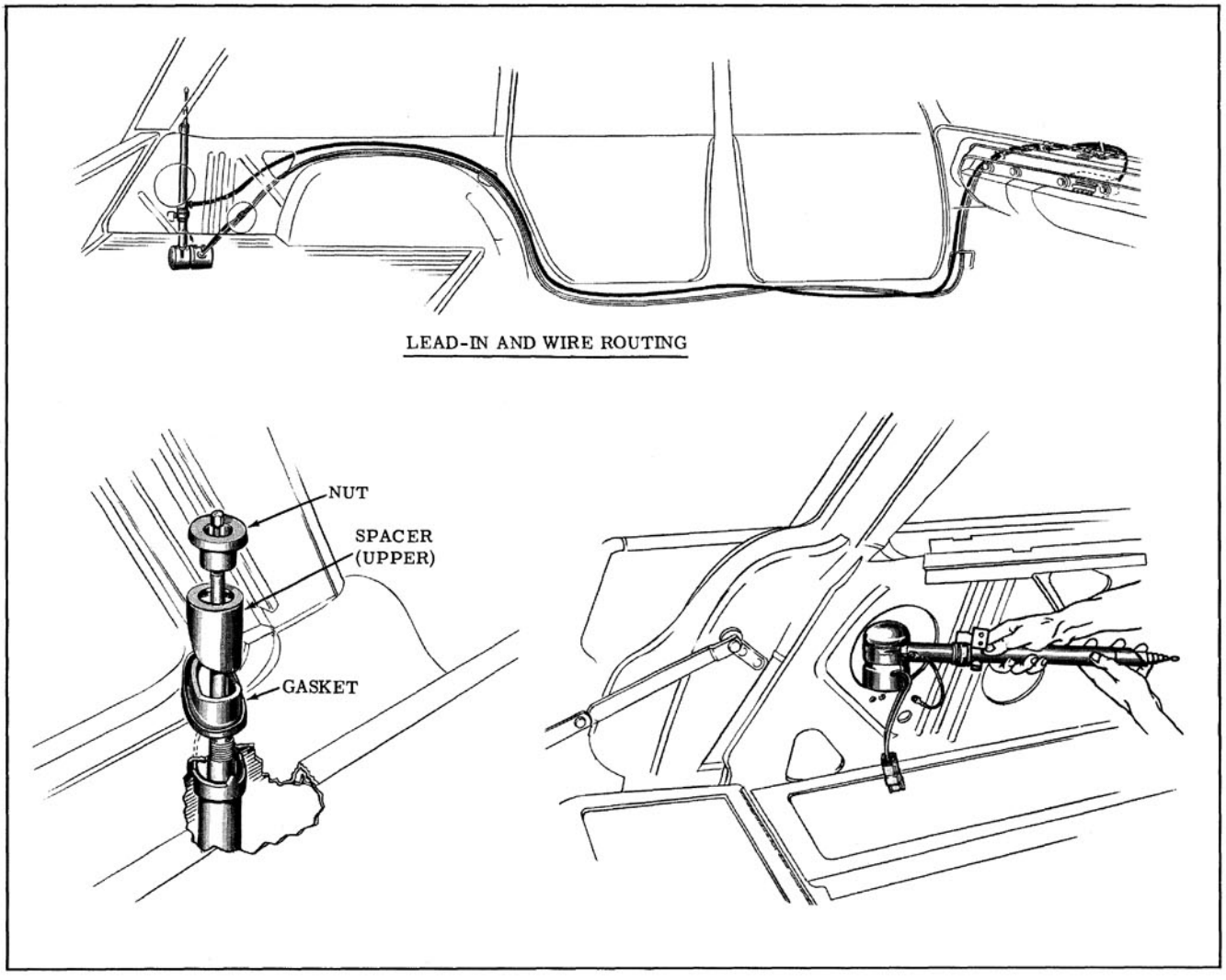


Fig. 12-33 Power Antenna Installation, Fiestas

4. While applying a back and forth rotary motion, pull until support tube is removed from antenna.

5. If the drive assembly or mast assembly is to be replaced, proceed as follows:

   a. While applying a rocking motion, pull on mast until insulator bushing is removed from the drive assembly tubular fitting.

   b. Energize motor until entire length of nylon cord is expelled from drive assembly. To prevent a kink or bend in nylon cord, keep it taut by pulling on mast.

      NOTE: If motor is inoperative, it will be necessary to manually remove the nylon cord from the drive assembly as follows:

   c. Place the assembly in a vise so that the normal plane of the nylon cord is parallel with the floor.

   d. Pull on nylon cord until it is completely expelled from the drive assembly.

CAUTION: No attempt should be made to disassemble antenna further than Step 5-D.

Assembly

1. Thread nylon cord through bottom insulator, (small diameter end down) and water seal washer.

2. Energize motor and feed nylon cord into drive assembly. Do not allow nylon cord to bend or kink.

   NOTE: Push water seal washer and bottom insulator all the way down into tubular fitting (make sure that keyways in bottom insulator are rotated to key position) before nylon cord completely disappears into drive assembly.

3. Push mast assembly into tubular fitting making sure that the upper edge of the insulator bushing is below the center of the three support tube to drive assembly screw holes.

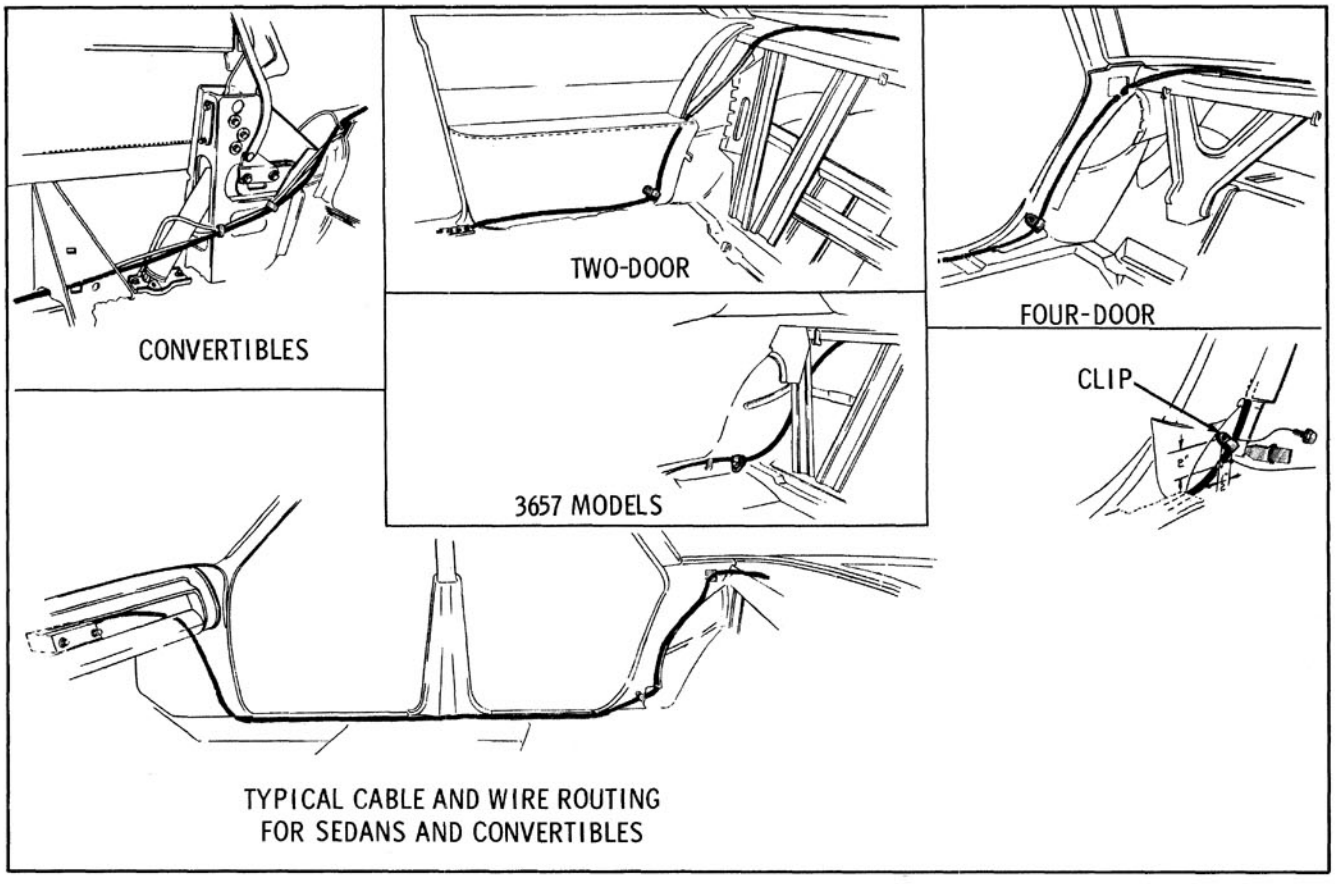


Fig. 12-34 Electric Antenna Cable and Wiring Routing

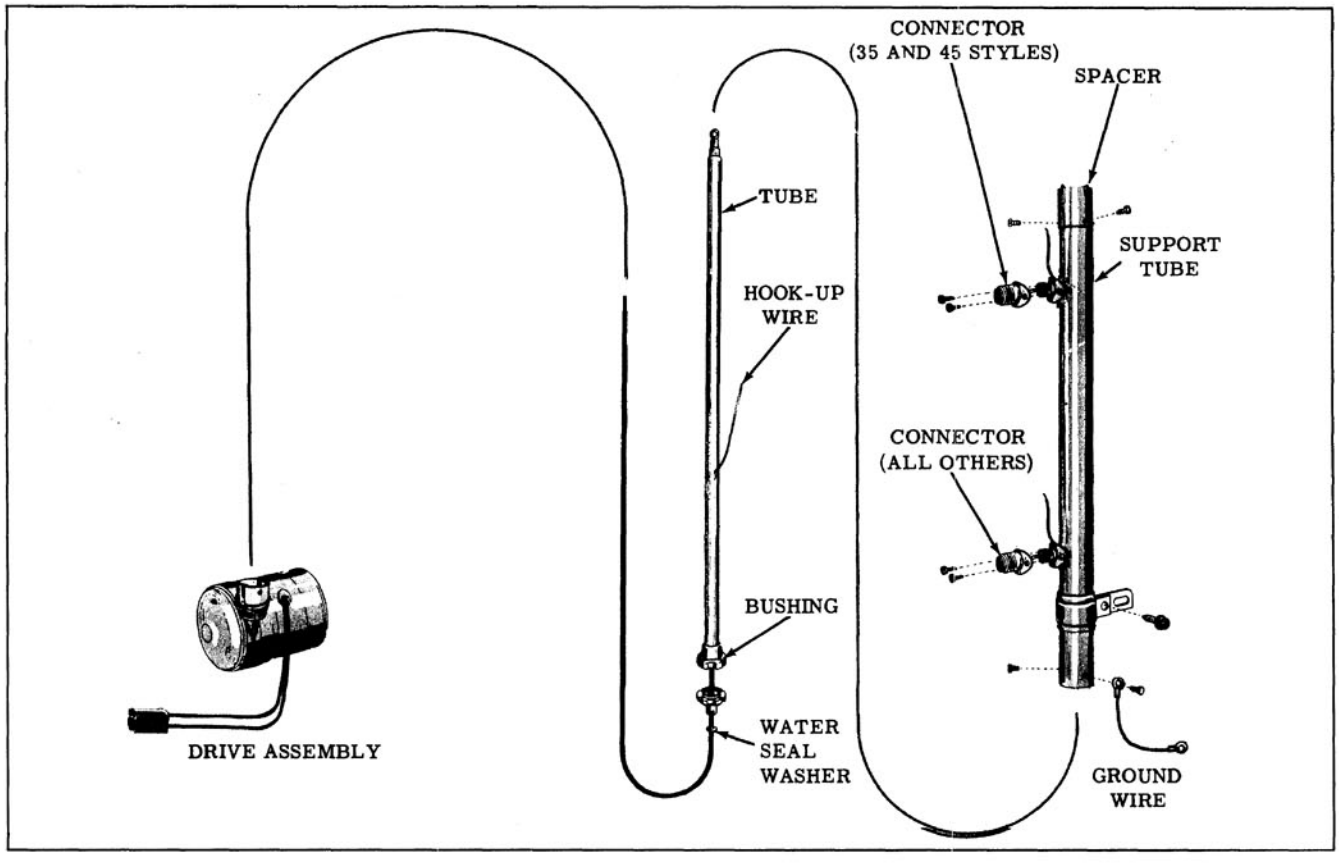


Fig. 12-35 Power Antenna Components

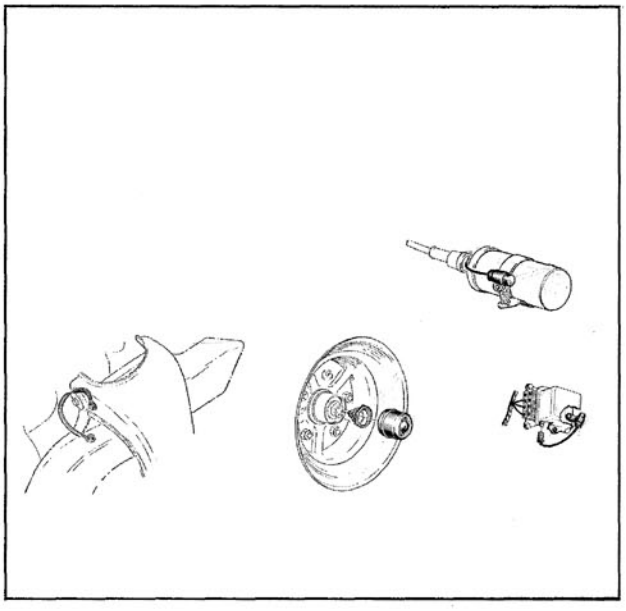


Fig. 12-36 Static Eliminators and Suppressors

4. Install support tube over mast assembly, making sure hook-up wire is extended through proper hole in support tube. Line up three holes in support tube and install the three screws.

5. Solder hook-up wire to pin and insulator assembly being careful not to overheat.

6. Install connector over pin and insulator assembly and install two screws.

Diagnosis

If antenna fails to operate properly, check the following possible sources of trouble.

1. Excessive tightening of cap nut on quarter panel will result in excessive operating noise in the car.

2. A stalled or slowly operating mast may be caused by bent or dirty mast sections. If dirty, wipe with oily cloth.

3. See that fuse is not burned out.

4. See that ground wire is tight.

5. To determine whether fault is in the antenna or the control circuit, disconnect the leads coming from antenna. Connect a jumper wire from a known hot source and touch jumper wire to each of the terminals of the wires coming from the drive assembly. If antenna does not operate, the fault is in the antenna drive assembly. If antenna does operate, the fault is in the control circuit.

6. If trouble is in the control circuit:

   a. Examine electrical connections at switch, making sure they are securely connected.

   b. Check wiring at switch with lamp or motor.

If antenna lead-in is suspected of being bad, check radio operation using an antenna lead-in known to be good.

NOTE: If excessive static is encountered, check suppressors and static eliminators for proper installation. (Fig. 13-36)

CRUISE CONTROL

GENERAL DESCRIPTION

Cruise Control is a driver-operated speed regulating device that may be used either as a speed reminder or as an automatic speed control for any car speed above 25 mph.

The major components of Cruise Control are: The regulator, mounted in the engine compartment, Figs. 12-37, 12-38 and 12-39; and the selector control assembly, located on the instrument panel. (Figs. 12-40 and 12-41)

The regulator is driven by a flexible drive cable from the transmission or the left front wheel. The drive cable also drives the speedometer cable that runs from the regulator to the speedometer. The selector control assembly is connected to the regulator by means of a Bowden cable. Mechanical linkage connects the regulator to the accelerator rod.

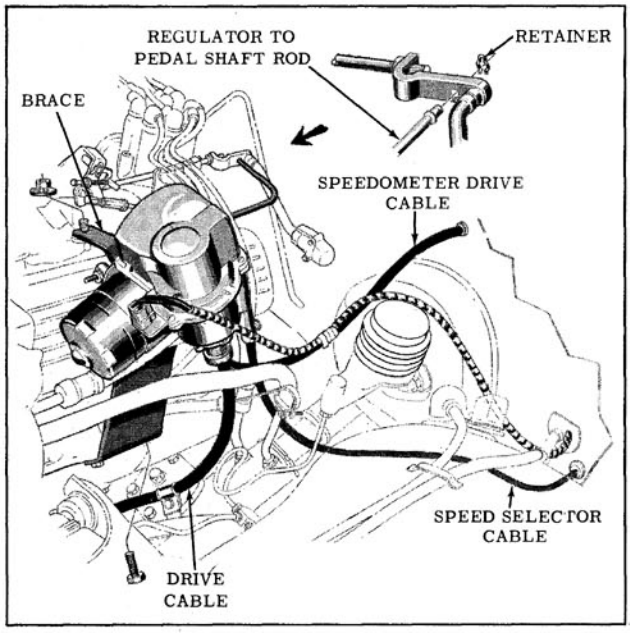


Fig. 12-37 Regulator Installation (34, 35, 36, 38 & 39)

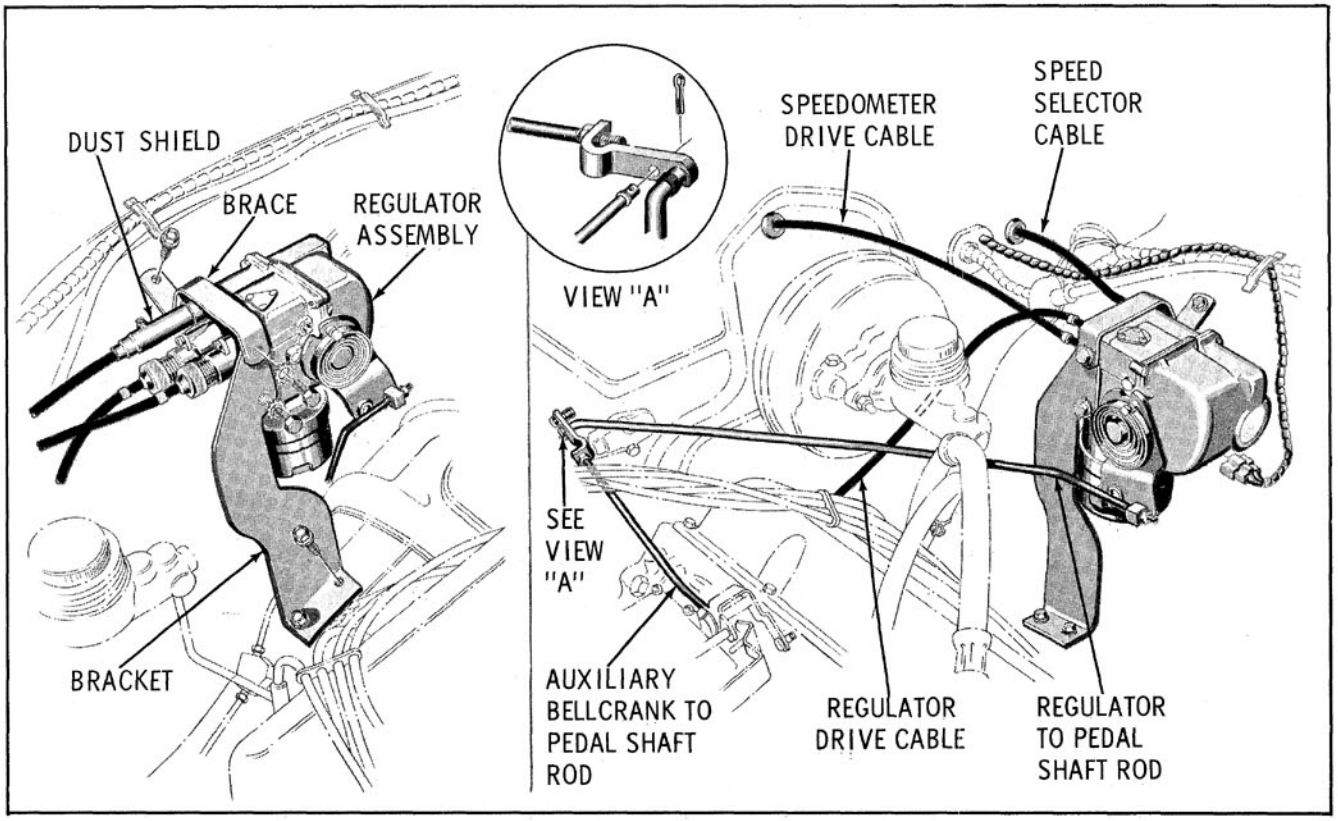


Fig. 12-38 Regulator Installation (3300)

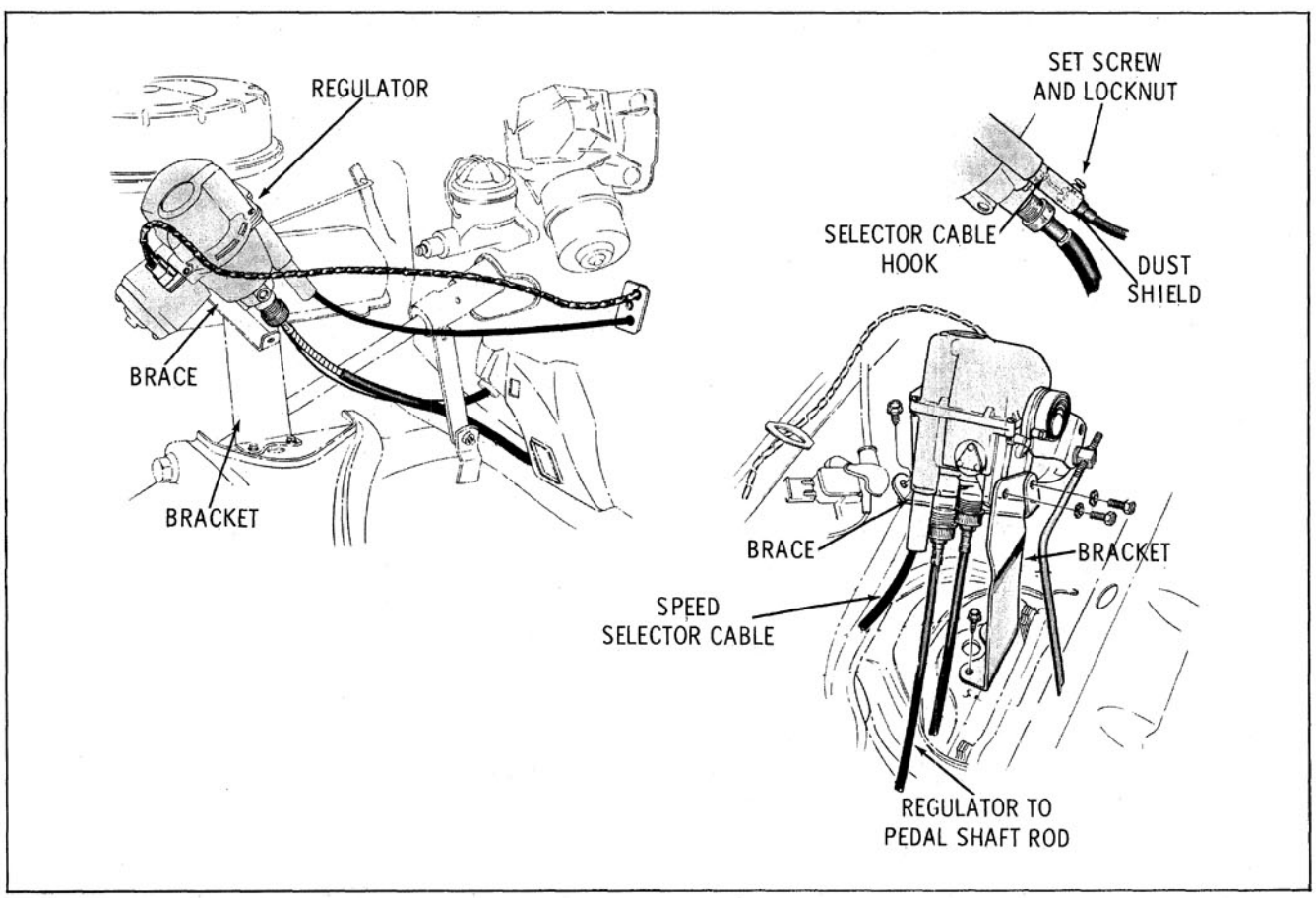


Fig. 12-39 Regulator Installation (30, 31 & 32)

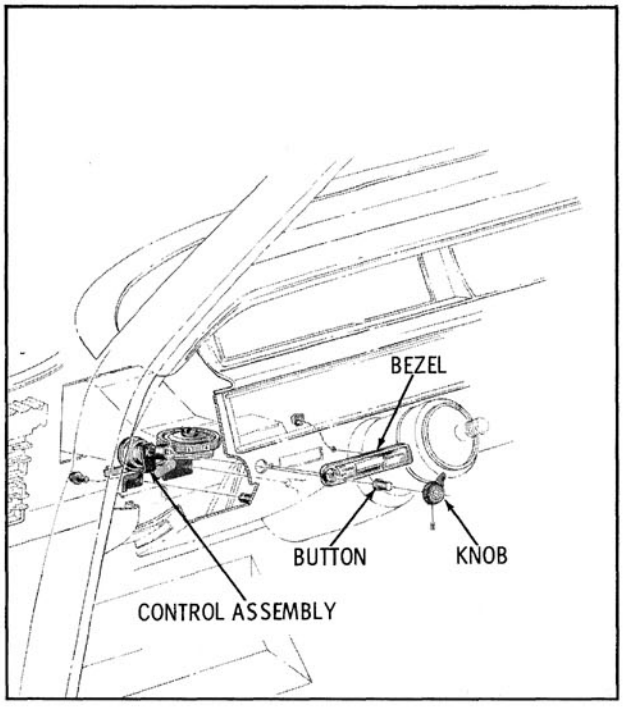


Fig. 12-40 Speed Selector Control
(33, 34, 35, 36, 38 & 39)

Speed settings are obtained by use of a calibrated selector wheel. The selector wheel is numbered with speed markings indicating from 30 mph to 90 mph, in increments of ten mph.

The ON-OFF switch for automatic speed control operation is located to the left of the selector wheel. When the switch in in the OFF position, the unit has no effect at any speed. Once the switch has been moved to the ON position, the unit is on and accelerated back pressure will be felt as a warning at the speed the wheel is set for. To obtain LOCK position, the pushbutton is depressed which closes an electrical circuit, provided foot pressure is maintained on the accelerator pedal. Once the unit is locked in, the foot may be removed from the accelerator pedal, if desired. When the switch is in the OFF position, depressing the pushbutton will automatically turn the Cruise Control switch on.

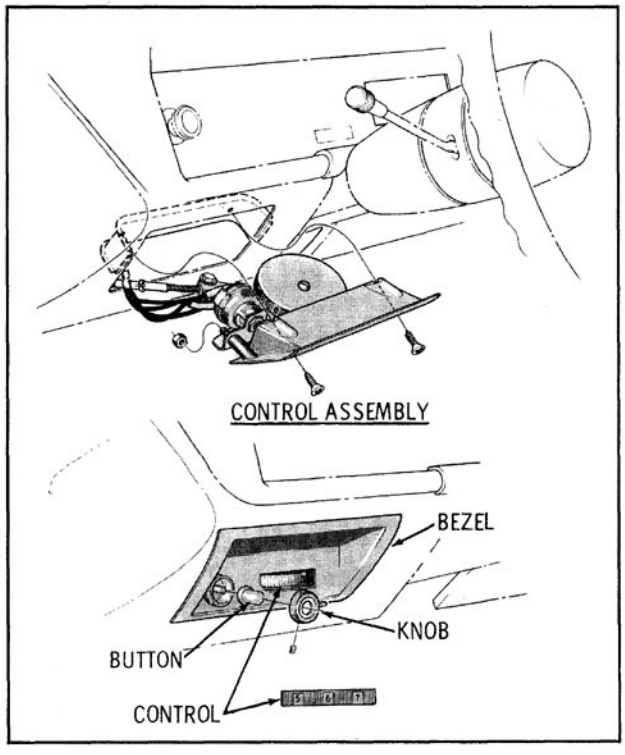


Fig. 12-41 Speed Selector Control (30, 31 & 32)

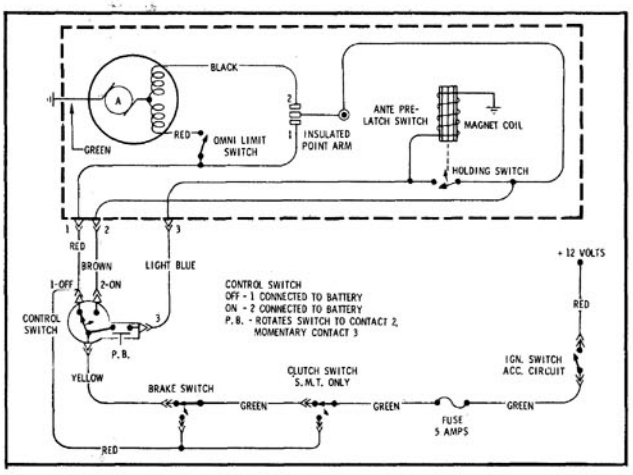


Fig. 12-42 Cruise Control Schematic Wiring Diagram
(All Series)

The electrical circuit for the Cruise Control is shown in Fig. 12-42. A reversible electric motor in the regulator actuates the mechanical linkage between the regulator and the accelerator pedal. Grounding points for forward and reverse energizing of the motor are closed and opened by a governor, under control of a governor spring that is compressed or relaxed to calibrated positions, corresponding to selected speeds, by the Bowden cable leading to the selector control.

SPEED REMINDER OPERATION

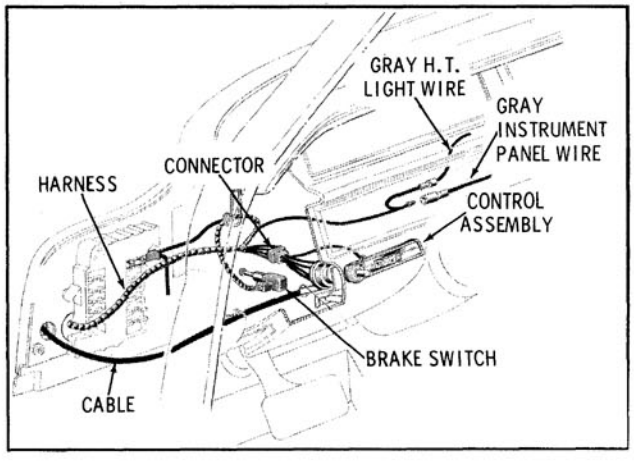


Fig. 12-43 Control Assembly Wiring
(33, 34, 35, 36, 38 & 39)

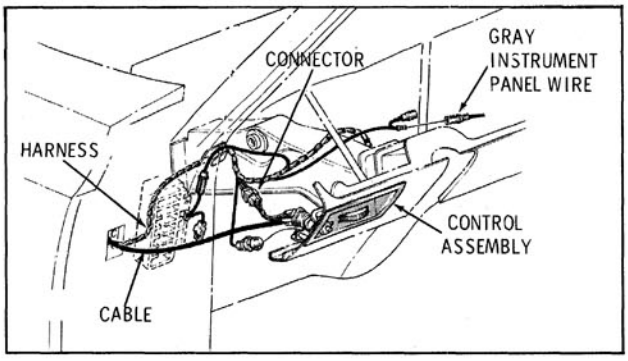


Fig. 12-44 Control Assembly Wiring (30, 31 & 32)

Move the switch to ON position and rotate the selector wheel to the desired speed setting. The Cruise Control will then function as a speed reminder by exerting back pressure on the accelerator pedal whenever the speed setting is reached. The unit will function in the same way whenever the speed setting is changed.

Cruise Control does not interfere with normal acceleration up to the selected speed setting Further acceleration may be obtained above that speed by pressing the accelerator pedal past the warning back pressure position.

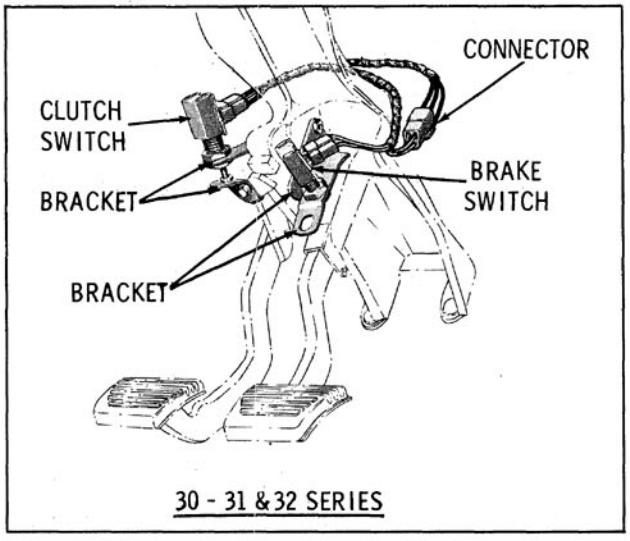


Fig. 12-45 Release Switch Adjustment (30, 31 & 32)

AUTOMATIC SPEED CONTROL OPERATION

For automatic speed control, move the switch to the ON position and rotate selector wheel to desired speed setting. Accelerate until selected speed is reached and back pressure is felt on the

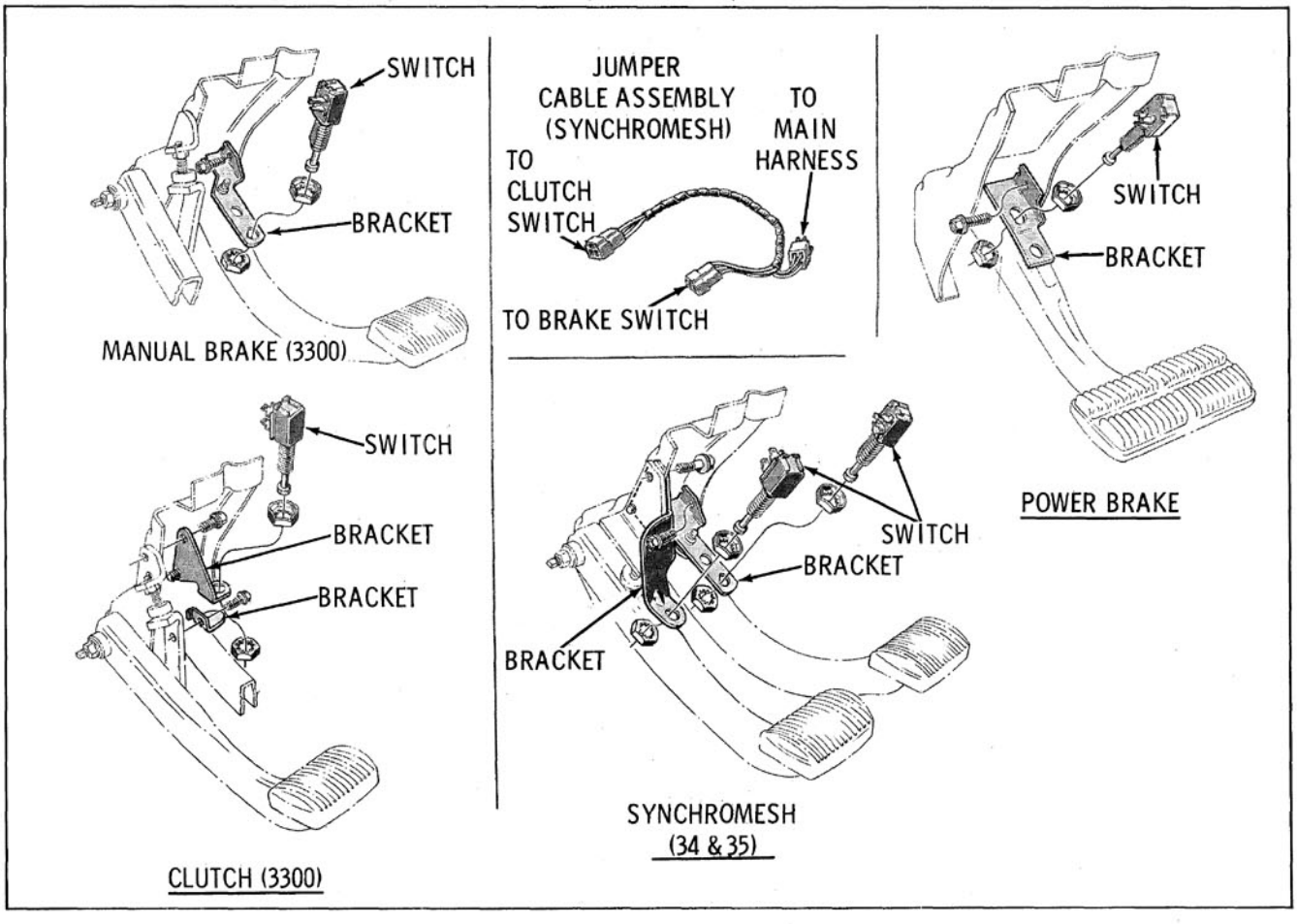


Fig. 12-46 Release Switch Adjustment (33, 34, 35, 36, 38 & 39)

accelerator pedal. Depress pushbutton while holding down against accelerator back pressure, and then release switch. The car will now maintain the selected speed automatically and the driver may remove his foot from the accelerator pedal if desired. Selected speed will be maintained regardless of road terrain, within limits of engine performance.

When the unit is in automatic control, car speed can be changed by slowly rotating the selector wheel to the left to increase speed or to the right to decrease speed.

CAUTION: When changing car speed during automatic control, always rotate wheel slowly to prevent sudden acceleration or deceleration.

Automatic control is disengaged when the brake pedal is depressed. It can be re-engaged by accelerating until back pressure is felt and momentarily depressing the pushbutton. It is not necessary to rotate the selector wheel to re-engage automatic control. The unit can be canceled by turning off the ignition switch, depressing the clutch or brake pedal and disengaged completely by moving the switch to the OFF position, without touching the selector wheel.

CRUISE CONTROL PRELIMINARY EXTERNAL CHECKS

It is not always necessary to remove and disassemble the regulator in cases of an inoperative Cruise Control. The following checks should be performed as part of the diagnosis to determine the cause and correction of Cruise Control trouble and to eliminate unnecessary service work on the regulator.

1. Disconnect multiple connector at regulator.
2. Turn ignition switch to accessory position.
3. Move switch to OFF position.
4. Using a test lamp, ground one test lamp lead and touch other lead to terminal #1. Test lamp should light. If lamp fails to light, check for blown fuse, improperly adjusted brake or clutch release switch, or defective wiring in selector control assembly.
5. Ground one test lamp lead, touch other lead to terminal #2 and move switch to ON position. Test lamp should light. If lamp fails to light, check for defective wiring in selector control assembly.
6. Ground one test lamp lead and touch other lead to terminal #3. Depress pushbutton. Lamp should light when pushbutton is depressed and then should go out when it is released. If test lamp fails to operate as described above, check for defective wiring in selector control assembly.
7. Turn ignition switch and Cruise Control switch off.
8. Check adjustment of selector control cable.
9. Check adjustment of accelerator linkage rod.
10. Check selector control wheel calibration. If the above checks fail to locate and correct the Cruise Control trouble, the regulator should be removed for service.

RELEASE SWITCH ADJUSTMENT

1. Turn ignition switch to accessory position.
2. Move switch to OFF position.
3. Using a test lamp, ground one test lamp lead and touch other lead to terminal #1.
4. Adjust switch so that lamp will light when brake or clutch pedal is released and will not light when brake or clutch pedal is depressed approximately 1/4". (Figs. 12-45 and 12-46)

   NOTE: If switch cannot be adjusted, it is defective and should be replaced.
5. Install new switch and repeat Step 4.
6. Remove test lamp and turn ignition switch off.

CONTROL CABLE ADJUSTMENT (Fig. 12-47)

1. Rotate selector wheel to low speed as far as it will turn without forcing.
2. Loosen screw on dust shield. (This screw retains control cable in bottom of dust shield).
3. Again try to rotate selector wheel to low speed, making certain it is against low speed stop.
4. Push in lightly on control cable at dust shield until it stops.

   CAUTION: Do not force cable beyond this position.
5. Hold cable against stop and tighten screw on dust shield securely.

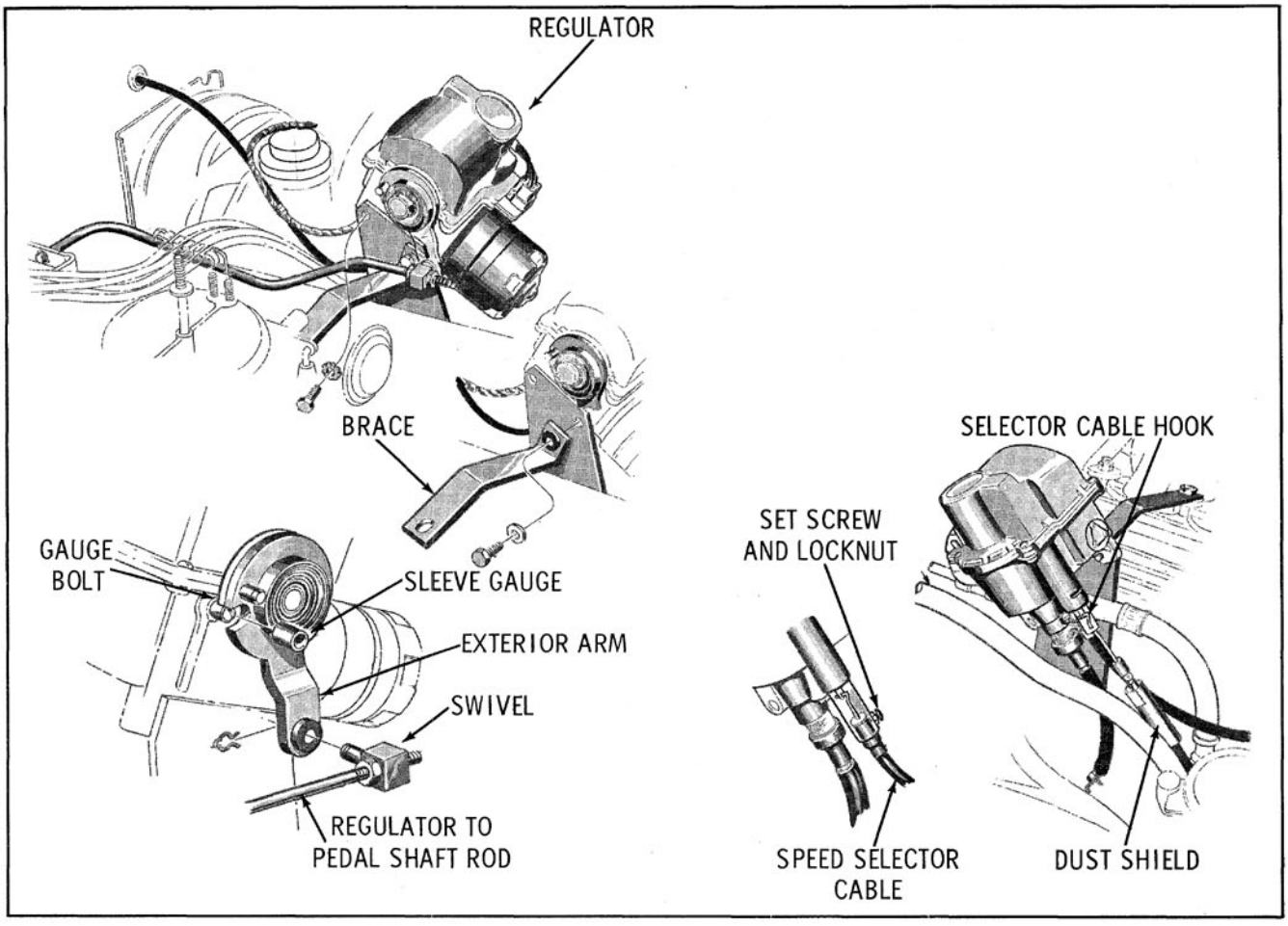


Fig. 12-47 Linkage Adjustment (33, 34, 35, 36, 38 & 39)

LINKAGE ADJUSTMENT

1. Start engine and operate at slow idle with transmission selector lever in PARK.
2. Remove retaining pin securing swivel on exterior arm and separate linkage from exterior arm.
3. Line up locating hole in exterior arm with gauge bolt and install Sleeve Gauge J-7652, over gauge bolt. (Figs. 12-47 or 12-48)
4. Turn swivel until it aligns with and enters hole in exterior arm freely.
5. Secure trunnion to exterior arm with retaining pin.
6. Remove sleeve gauge and shut off engine.

SELECTOR WHEEL ADJUSTMENT

1. Rotate selector dial to high speed position against its stop.
2. Move switch to ON position.
3. Operate car at a steady speed of 50 mph, as indicated on speedometer.
4. Rotate selector wheel to the right until back pressure is felt on accelerator pedal, then depress pushbutton.
5. With car speed at 50 mph, as indicated on speedometer, the numeral 50 on selector wheel should be in line with the pointer on the Cruise Control bezel. Observe reading on wheel, then move switch to OFF position. Do not rotate selector wheel.
6. If reading on selector wheel agrees with reading on speedometer, selector wheel is properly calibrated. If readings do not agree, adjust selector wheel as follows:
   a. With switch in OFF position, rotate wheel either to the left (if reading is on the low side) or to the right (if reading is on the high side) against its stop. Then rotate wheel by hand beyond its stop the necessary amount of travel as observed in Step 5 to correct the selector setting.
   b. Repeat complete adjustment procedure until reading on wheel agrees with reading on speedometer.

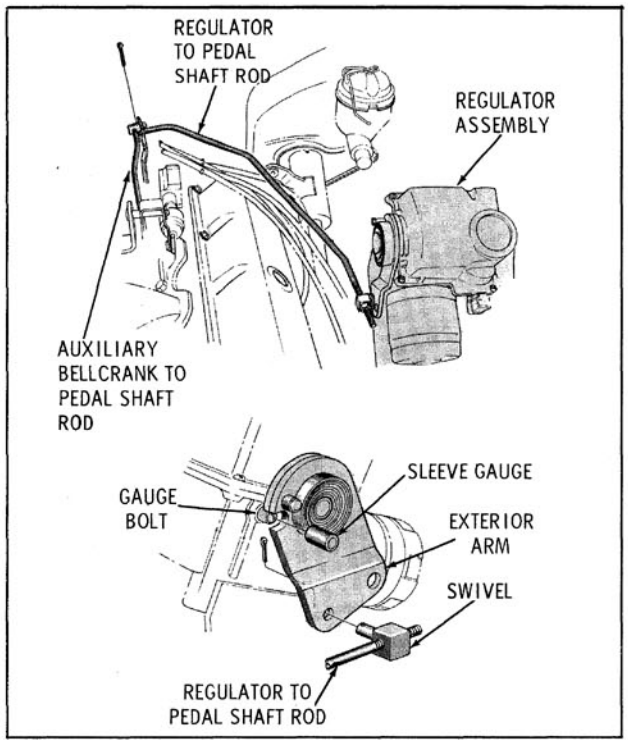


Fig. 12-48 Linkage Adjustment (30, 31 & 32)

GROUNDING POINTS ADJUSTMENT (ON CAR)

There are two sets of electrical grounding points that operate the Cruise Control motor in the forward and reverse direction. One grounding point on the motor side of the magnet controls acceleration, while the other grounding point on the locking arm side of the magnet controls deceleration.

The contact arm is energized, and any grounding resulting from contact with a screwdriver or similar tool, can cause a short or blow a fuse.

The grounding points are still operative when blackened or pitted; however, any build-up on the points should be removed. When filing points, use a cloth to catch filings as they could become wedged between the small ball bearings in the nut on the drive screw and cause the drive screw to stick.

1. Remove four screws securing regulator cover and remove cover.

2. Disconnect drive cable at base of regulator.

3. Move contact arm against either grounding point and use a feeler gauge to measure the full gap between contact arm and other point. (Fig. 12-49) This gap must be .090" ± .010". If gap is not within specifications, carefully bend either grounding point on point adjuster until proper gap is obtained.

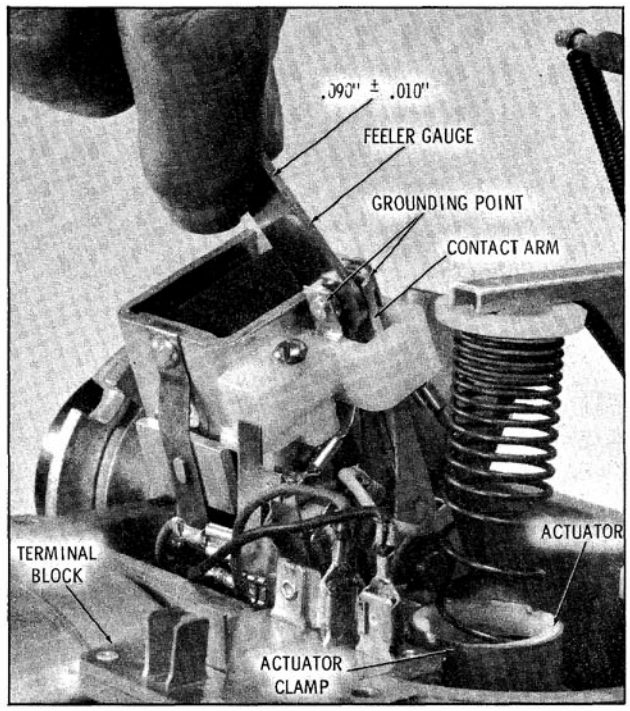


Fig. 12-49 Checking Grounding Points

4. Loosen screw on actuator clamp and rotate actuator until clamp fingers are at right angles (90°) to actuator cam shoulders. Then tighten actuator clamp screw.

   NOTE: Make certain that clamp fingers are pressed down firmly against actuator cams before tightening clamp screw.

5. Insert Sleeve Gauge J-7652 over gauge bolt. Turn ignition switch to accessory position and Cruise Control switch on.

6. Move contact arm against ground point on locking arm side of magnet. When magnet is in low speed position, disconnect plug from terminal block while still holding contact arm against point. Do not use screwdriver to turn drive screw.

7. Turn governor weights until they are parallel with drive screw. Place Governor Weight Wedge J-8547, between governor weights, pressing down lightly on wedge and actuator until weights are held out to their stop position.

8. Use a feeler gauge to measure gap between contact arm and either grounding point on adjuster. (Fig. 12-50) This gap should be approximately one-half of the full gap measurement in Step 2. If gap is not within specifications, contact arm is not centered properly. Loosen screw on point adjuster, (Fig. 12-50) and move adjuster until contact arm is centered between the two grounding points on the points adjuster. Then tighten point adjuster screw and recheck gap.

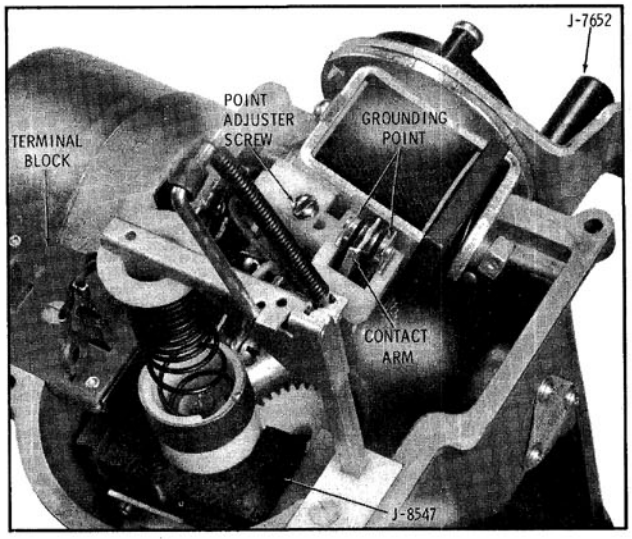


Fig. 12-50 Checking Point Gap

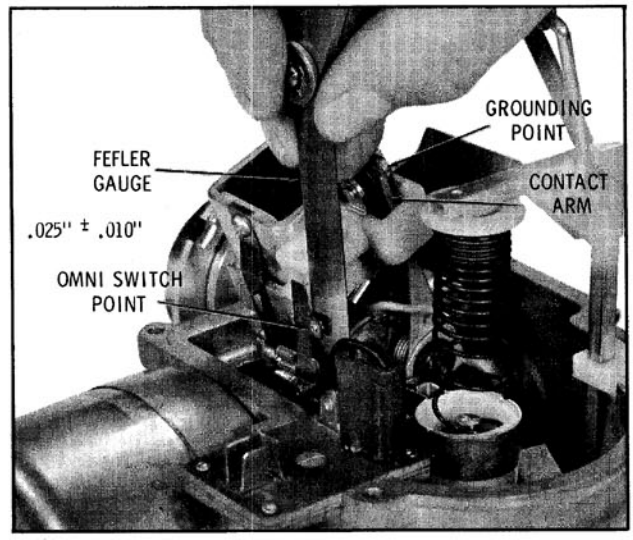


Fig. 12-51 Checking Omni Switch Adjustment

9. Remove sleeve gauge and governor weight wedge.

10. Connect multiple connector at power unit.

11. Turn ignition switch and Cruise Control switch off.

12. Connect drive cable to base of regulator.

13. Install cover, making certain that rubber seal and felt seal are properly seated in grooves of cover and housing. Secure cover with four screws.

OMNI SWITCH ADJUSTMENT (ON CAR)

1. Remove four screws that hold cover to regulator and remove cover.

2. Turn ignition switch to accessory position and Cruise Control switch on.

3. Hold contact arm against grounding point on locking arm side of magnet assembly until magnet assembly reaches low speed position, then release contact arm. Magnet assembly should move to wide open position and open points of omni switch.

4. Using a feeler gauge, measure gap opening between points of omni switch. (Fig. 12-51) This gap must be .025" ± .010". If gap is not within specifications, bend inboard point (inboard from magnet assembly) until proper gap is obtained and points are aligned.

5. Turn ignition switch and Cruise Control switch off.

6. Install cover, making certain that rubber seal and felt seal are properly seated in grooves of cover and housing. Secure cover with four attaching screws.

REGULATOR

Whenever the regulator is removed, the car can be driven with the speedometer operating by removing the regulator cables from the speedometer and transmission or front wheel and installing a standard speedometer cable and housing assembly.

Removal

1. Disconnect multiple electric connector at the regulator.

2. Disconnect drive cable and speedometer cable from regulator.

3. Loosen set screw at lower end of dust shield.

4. Remove dust shield from housing, then slide dust shield down cable and disconnect end of Bowden cable from compressor rod and spring assembly.

5. Disconnect accelerator linkage from exterior arm on regulator.

6. Remove bolts securing regulator to mounting bracket and remove regulator.

Installation

1. Position regulator on mounting bracket and secure to bracket with bolts.

2. Connect accelerator linkage to exterior arm on regulator. Adjust linkage as described under LINKAGE ADJUSTMENT.

3. Connect end of Bowden cable to compressor rod and spring assembly.

4. Install dust shield in housing. Dust shield has bayonet type retention. Push in and turn clockwise. Do not tighten set screw on end of dust shield until control cable is properly adjusted.

5. Adjust control cable.

6. Connect drive cable and speedometer cable to regulator.

7. Connect multiple electric connector at regulator.

REGULATOR

Disassembly (Fig. 12-52)

1. Remove four screws securing cover and remove cover, being careful not to lose rubber seal or felt seal in cover groove.

2. Remove motor mounting stud nut from inside housing and disconnect green motor wire from mounting stud.

3. Remove governor spring and plastic cap.

4. Remove locknut from lower end of compressor rod and spring assembly and remove compressor rod and spring assembly from housing.

5. Remove screw securing compressor rod guide to housing and remove rod guide from housing.

6. Disconnect red and black wires from bottom of grounding points on point adjuster assembly.

7. Disconnect two red wires from omni switch and black wire from bottom of magnet assembly.

   NOTE: The omni switch acts as a limit switch which stops travel of the magnet assembly and prevents motor from running, when unit is shut off.

8. Remove remaining nut securing motor to housing and remove motor.

9. Disconnect red and black wires from terminal block.

10. Remove screw securing terminal block to housing and remove terminal block.

11. Disconnect torsion spring from exterior arm, and remove spring and exterior arm.

12. Remove locking arm stop stud and washer and two pintle retaining screws and washers located under locking arm.

13. Lift magnet and pintle assembly out of housing, being careful not to lose felt seal in groove of housing.

14. Lift contact arm actuator assembly and clamp off drive shaft.

15. Remove locking arm from pintle shaft and remove wave washer.

16. Remove screw securing point adjuster assembly to point bracket on magnet assembly and remove point adjuster assembly.

17. Remove screw securing grey wire terminal and leaf switch to point bracket on magnet assembly and remove leaf switch.

18. Remove snap ring and fabric washer from end of pintle shaft and remove contact arm from shaft. Discard snap ring.

19. Remove pintle shaft from magnet assembly.

    NOTE: Do not remove secondary armature assembly on the magnet assembly, as it is not serviceable.

20. Remove three screws from serial number plate and remove plate and bushing.

21. Remove snap ring, outer bearing race, bearing and inner bearing race. Then remove drive screw and nut assembly from motor end of housing.

    CAUTION: When handling drive screw assembly, keep parts clean, as dirt particles can become wedged between the small ball bearings on end of shaft or in shaft nut, and cause drive screw to stick.

22. Remove snap ring, spacer, wave washer, and governor weight assembly from drive shaft inside housing.

23. Remove two screws securing speedometer adapter to housing and remove adapter.

24. Remove springrip nut securing plastic gear in housing and remove gear.

25. Remove two screws securing drive adapter to housing and remove adapter.

NOTE: The governor assembly and power unit housing are serviced as a single unit.

ASSEMBLY (Fig. 12-52)

1. Install drive adapter on bottom of housing and secure with two screws.

   NOTE: The drive adapter and speedometer adapter are interchangeable.

2. Lubricate plastic gear with cam and bearing lubricant, and install gear in housing.
3. Secure gear in housing with springrip nut.
4. Install speedometer adapter on bottom of housing and secure with two screws.
5. Install governor weight assembly, wave washer, and spacer on drive shaft, secure with new snap ring.
6. Lubricate drive screw assembly sparingly with cam and bearing lubricant and install through motor end of housing.
7. Insert end of drive screw through boss in housing and install inner bearing race, bearing, outer bearing race, and new snap ring on end of drive screw.
8. Insert bushing in opening in housing; install serial number plate on housing, and secure with three screws.
9. Insert pintle in magnet assembly, through side opposite grounding points.
10. Install contact arm on end of pintle shaft with actuator pin facing away from magnet and install fabric washer. Then secure with new snap ring.
11. Install leaf switch on point bracket, positioning end of leaf switch between insulated end of secondary armature spring and terminal on back side of magnet assembly. DO NOT BEND LEAF SWITCH.
12. Install grey wire terminal over leaf switch and secure switch and terminal to point bracket with attaching screw.

    NOTE: When properly installed, end of leaf switch should rest against insulated end of secondary armature spring.

13. Install point adjuster assembly on point bracket, positioning the contact arm between the grounding points, and loosely install attaching screw.
14. Install large wave washer on pintle shaft and install locking arm on pintle.
15. Position drive nut in center of drive screw.
16. Attach actuator and clamp assembly on contact arm and install complete assembly in housing, positioning actuator over governor shaft, and align bracket tangs on bottom of magnet assembly with grooves in drive screw nut. Press down on complete assembly until it seats itself in housing.
17. Install two pintle screws and lockwashers securing pintle assembly in housing.
18. Install locking arm stop stud and lockwasher.
19. Install exterior arm on locking arm shaft with throttle arm end toward serial number plate.
20. Install torsion spring on exterior arm. Using a pair of pliers, tighten spring one complete turn before connecting to stud on arm.
21. Install terminal block on housing with numbered terminals outboard of housing and secure block with attaching screw.
22. Route red wire, attached to grey wire terminal, between magnet assembly and pintle shaft, around pintle shaft and connect to inboard terminal (adjacent to omni switch) on terminal block.

    CAUTION: Be careful when routing wires so they will not come into contact with leaf switch, or any moving parts.

23. Route black wire from lower connection on magnet assembly (connection on secondary armature spring side of magnet) under pintle shaft, around pintle shaft and connect to outboard terminal on terminal block.
24. Route red wire from upper omni switch connection under pintle shaft, around pintle shaft, and connect to grounding point on motor side of magnet.
25. Install motor on housing, threading wires through upper hole in housing. Make certain that end of motor shaft engages in slot of drive screw.
26. Connect green motor wire to inside housing motor mounting stud and install mounting nuts and tighten securely.

    NOTE: Do not tighten nuts on motor end cover as this may result in binding of the motor bearings.

27. Route black motor wire under pintle shaft between legs of magnet assembly, and connect wire to bottom of grounding point on locking arm side of magnet.

28. Connect red motor wire to lower terminal on omni switch.

29. Install compressor rod guide on housing and secure with attaching screw.

30. Lubricate compressor rod with cam and bearing lubricant, install compressor rod through guide into housing, and install locknut on threaded end of compressor rod.

31. Install governor spring with plastic cap in actuator assembly.

32. Move contact arm against either grounding point and use a feeler gauge to measure the gap between contact arm and other point, Fig. 12-49. This gap must be .090" ± .010". If gap is not within specifications, carefully bend either grounding point on point adjuster assembly until proper gap is obtained.

33. Loosen screw on actuator clamp and rotate actuator until clamp fingers are at right angles (90°) to actuator cam shoulders. Then tighten actuator clamp screw.

    NOTE: Make certain that clamp fingers are pressed down firmly against actuator cams, before tightening clamp screw.

34. Insert Sleeve Gauge J-7652, over gauge bolt. Move magnet assembly to low speed position (magnet away from motor). Turn governor weights until they are parallel with drive screw, then place Governor Weight Wedge J-8547, between governor weights, pressing down lightly on wedge and actuator until weights are held out to their stop position.

35. Use a feeler gauge to measure gap between contact arm and either grounding point on point adjuster assembly. (Fig. 12-50) This gap should be approximately one-half of the full gap measurement. To obtain this gap measurement move point adjuster assembly until gap is within specifications. Then tighten screw on point adjuster and recheck gap.

36. Remove sleeve gauge and governor weight wedge.

37. Move magnet assembly to wide open throttle position (magnet away from locking arm). This must be done to prevent pre-loading of the governor spring by the contact arm before adjusting the compressor rod.

38. Hold housing in an upright position, and adjust locknut on end of compressor rod until lower edge of compressor rod arm rests against plastic cap without exerting pressure against governor spring. Then back off locknut two complete turns. This will provide the correct low speed calibration for the power unit.

39. With magnet assembly still in wide open throttle position, measure gap opening between omni switch points. (Fig. 12-51) This gap must be .025" ± .010". If gap is not within specifications, bend arm of inboard point (inboard from magnet) until proper gap is obtained and points are aligned.

40. Install cover, making certain that rubber seal and felt seal are properly seated in grooves of cover and housing. Secure cover with four screws.

DIAGNOSIS

Since Cruise Control is mechanically driven and electrically operated, diagnosis and trouble shooting procedures involve both mechanical and electrical tests. Electrical tests are to made with ignition switch in the accessory position.

Possible malfunctions requiring service on the Cruise Control unit will fall under one of the following categories:

1. No Cruise Control response.
2. Constant pressure on accelerator pedal regardless of selector setting.
3. No automatic control when pushbutton is depressed.
4. Automatic control engages at selected speed without pushing button.
5. Automatic control remains engaged when brake or clutch pedal is depressed.
6. Automatic control remains engaged when switch is moved to the OFF position.
7. Pulsating accelerator pedal.
8. Engine does not return to normal idle.
9. Speedometer does not register or unit does not operate.
10. Noisy speedometer.
11. Blown fuse.
12. Unit does not control at selected speed.

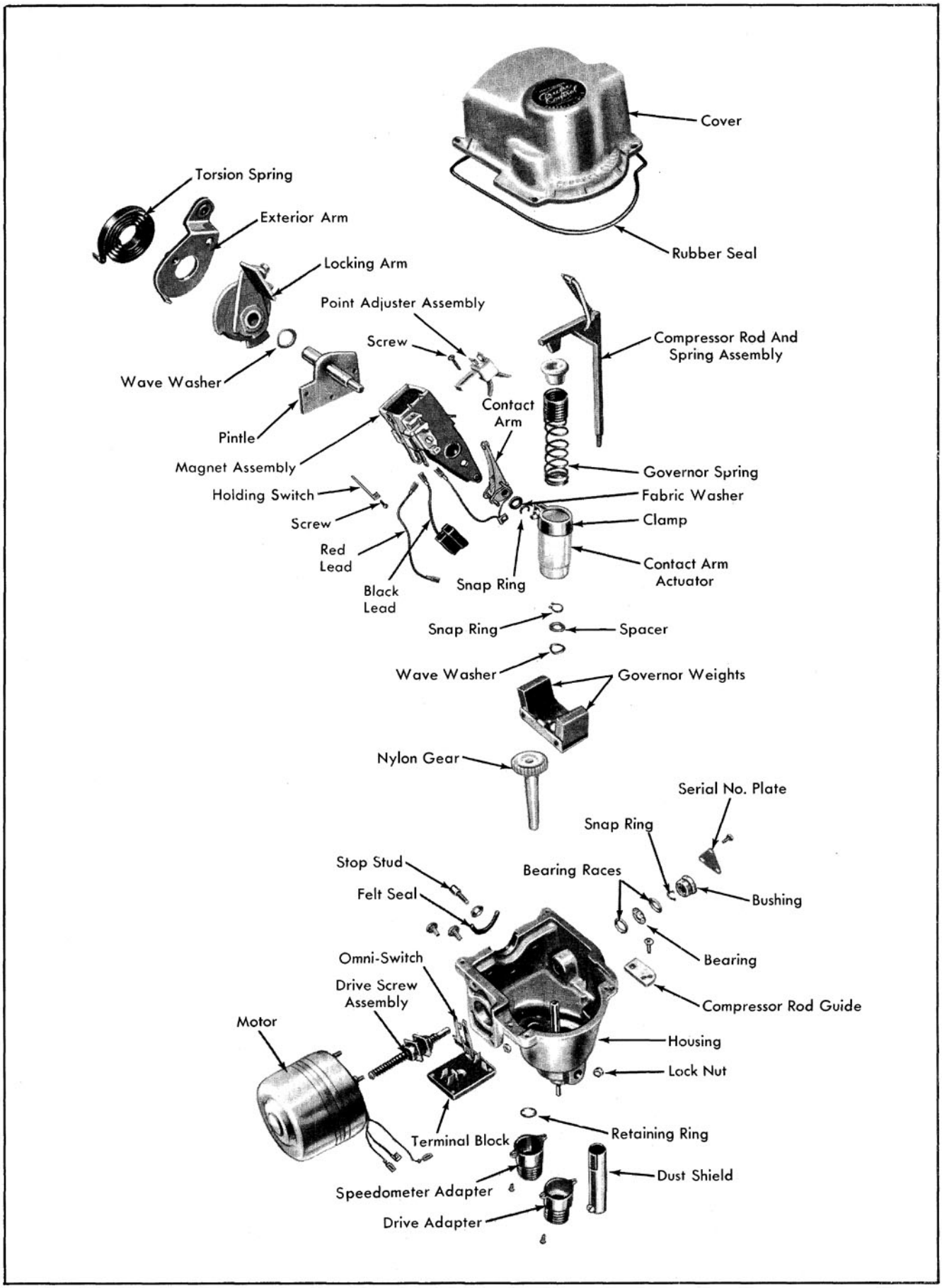


Fig. 12-52 Regulator Assembly

The following mechanical and electrical tests will aid in isolating and correcting the above conditions. Diagnosis and trouble shooting procedures must be followed to make certain that the trouble is in the unit itself and not in some other component of the system.

OPERATIONAL TEST

1. Turn ignition switch to ACCESSORY position.
2. Move Cruise Control selector wheel to lowest speed position.
3. Depress accelerator pedal to wide open position.
4. Depress push-button and release. If accelerator pedal stays in the depressed position, electrical circuit and selector control mechanism is operating properly.
5. Slowly depress brake pedal. If accelerator pedal returns to the idle position, brake pedal switch is operating properly. Repeat Step 5 if car is equipped with clutch pedal.
6. Repeat Steps 3 and 4.
7. Turn off ignition switch. If accelerator pedal returns to the idle position, the ignition switch portion of the electrical circuit and latching mechanism is operating properly.
8. Perform Steps 3 and 4.
9. Move Cruise Control switch to OFF position. If accelerator returns to idle position, and then can be pushed to the floor without encountering resistance, omni switch is operating properly.

ELECTRICAL TESTS

Perform electrical tests as outlined under CRUISE CONTROL PRELIMINARY CHECKS.

CHECKING MOTOR OPERATION

1. Turn ignition switch to ACCESSORY position. Move Cruise Control switch to ON.
2. Remove four screws securing regulator cover and remove cover.
3. Check accelerator linkage adjustment, as outlined under LINKAGE ADJUSTMENT.
4. Move locking arm against magnet and press down on armature plate to latch unit, simulating automatic control.
5. Move contact arm to touch grounding point on locking arm side of magnet. Motor should rotate drive screw and close the throttle through the accelerator linkage. Motor should move magnet to wide open throttle position when contacts are free.
6. Move contact arm to touch grounding point on motor side of magnet. Motor should rotate drive screw and open the throttle through the accelerator linkage.
7. If motor will not open or close throttle through accelerator linkage, motor may be binding. Check alignment of motor with housing. To check motor for binding, loosen motor from housing without disconnecting motor leads and disengage motor shaft from drive screw. Move contact arm against grounding point on motor side of magnet assembly to check reverse operation, and against grounding point on locking arm side of magnet assembly to check forward operation. If motor does not run free, replace motor. If motor does run free, stall test motor as outlined under MOTOR STALL TEST.
8. The drive screw or carburetor linkage may also be binding. To check drive screw for binding, disengage motor shaft from drive screw, insert screwdriver in slotted end of drive screw and check for free rotation. If drive screw does not rotate freely, it is defective and should be replaced. If motor and drive screw operate satisfactorily, then adjust carburetor linkage.
9. Turn ignition switch off and install regulator cover.

MOTOR STALL TEST

1. Disconnect multiple electric connector at front of regulator.
2. Remove four screws securing regulator cover to housing and remove cover.
3. Connect red lead of an ammeter tester to positive battery terminal.
4. Insert Sleeve Gauge J-7652, over gauge bolt to limit travel of locking arm and prevent rotation of drive screw.
5. Connect black lead of tester to #1 terminal on front of power unit.

6. Hold contact arm against grounding point on locking arm side of magnet and observe reading on ammeter. If reading on ammeter indicates more than seven amps, motor is drawing too much current and should be replaced.

7. Disconnect tester leads, remove sleeve gauge, install cover and connect multiple connector.

CHECKING FOR DAMAGED CABLES AND GEARS

1a. Raise rear end of car and place on jack stands. (30-31-32-33 Series)

1b. Raise left front wheel. (34-35-36-38-39 Series)

2a. Start engine and place transmission in gear. (30-31-32-33 Series)

2b. Spin left front wheel using suitable wheel spinner. (34-35-36-38-39 Series)

3. Remove speedometer cable at regulator and check to see if nylon gear is turning. This will determine if cable from the transmission or front wheel to the regulator is turning and if gear is operating.

4. If nylon gear is turning, cable to speedometer is broken or speedometer is inoperative.

5. If nylon gear is not turning, disconnect speedometer cable at regulator.

6. If cable is turning, gears are stripped inside regulator.

7. If cable is not turning, check for a broken cable or stripped speedometer drive mechanism.

8. Shut off engine and lower car.

9. Replace parts as required.

CRUISE CONTROL DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	REMEDY
Speedometer Noise	Cables bent or kinked.	Straighten or replace cables.
	Lack of cable lubrication.	Lubricate.
	Noisy Speedometer head assembly.	Repair.
Blowing Fuses	Short or ground in wiring circuit.	Check for short or ground. Repair or replace if necessary.
	Improper linkage adjustment.	Adjust accelerator linkage.
	Defective motor.	Check operation of motor. If more than 7 amps at 12.5 volts are noted in either direction, replace motor.
	Locked drive screw.	Check drive screw for binding. Replace if necessary.
No Cruise Control Response	Accelerator linkage broken or disconnected.	Connect or replace linkage and adjust.
	Drive cables broken or disconnected.	Connect or replace cables.
	Blown fuse.	Replace and check cause.
	Loose connections or broken wires (internal or external).	Check for current at the unit. Repair wires or tighten wiring connections as required.

CRUISE CONTROL DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
No Automatic Control When Depressing Push Button	Driver riding the brake or clutch pedal or driver does not hold accelerator against back pressure when depressing selector button.	Instruct owner.
	No current at #2 terminal.	Perform Electrical Test. Correct as required.
	Loose or disconnected ground wire between selector control and #3 terminal.	Tighten or connect ground wire.
Constant Pressure on Accelerator Pedal Regardless of Dial Setting	Blown fuse.	Replace fuse and perform Electrical Test.
	No current at #2 terminal.	Perform Electrical Test, and correct as required.
	Control cable improperly adjusted.	Adjust cable.
	Control cable defective.	Replace selector control assembly.
	Inoperative motor or locked drive screw.	Check operation of motor and/or drive screw. Replace or repair as necessary.
Automatic Control Engages at Selected Speed without using Selector Switch	Continuous ground in ground circuit or switch.	Check for ground and repair as required. Perform Electrical Test.
Automatic Control Remains Engaged When Brake or Clutch Pedal is Touched	Inoperative switch on brake or clutch pedal.	Perform Electrical Test. Adjust release switch or replace if necessary.
Unit Does Not Remain Inoperative in the "Off" Position	Omni switch not properly adjusted.	Adjust Omni switch points.
Pulsating Accelerator Pedal	Speedometer cable or drive cable kinked or lack of lubrication.	Lubricate or replace cables if necessary.
	Improper accelerator linkage adjustment.	Adjust accelerator linkage.
	Improper grounding points adjustment.	Adjust grounding points.
Carburetor Does Not Return to Normal Idle.	Improper carburetor or accelerator linkage adjustment.	Adjust throttle control rod T.V. rod, and accelerator linkage. On 30-31-32-33 Series with Jetaway, adjust throttle control switch and dashpot assembly.
	Weak throttle return spring.	Replace spring.

CRUISE CONTROL DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	REMEDY
Unit Does Not Control at Selected Speed.	Improper control cable adjustment.	Adjust control cable
	Selector dial not installed properly.	Reinstall selector dial
Speedometer Does Not Register or Unit Does Not Operate	Speedometer drive defective.	Replace defective parts.
	Broken drive cable.	Replace drive cable.
	Damaged drive gear or nylon gear in regulator.	Replace nylon gear. If metal drive gear is damaged, replace housing assembly.

GUIDE-MATIC POWER HEADLIGHT CONTROL

The Guide-Matic Power Headlight Control consists of: the phototube, amplifier unit, power relay, and a combination override and foot dimmer switch. (Fig. 12-53)

The phototube unit picks up light from an approaching car and operates the amplifier unit.

The amplifier unit supplies voltage to the phototube unit and operates the power relay in response to a signal from the phototube unit. It is mounted under the instrument panel above the glove box.

The power relay is mounted on the cowl, below the fuse block, and switches the headlamps between high and low beam. The power relay also operates when the "Guide-Matic" switch is off.

The phototube unit has a sensitivity control knob which enables the driver to adjust the sensitivity for conditions such as heavy snow or fog. The knob has a "FAR" and "NEAR" at the extreme ends of the adjustment range and a detent position midway in the range for the normal setting. Ad-

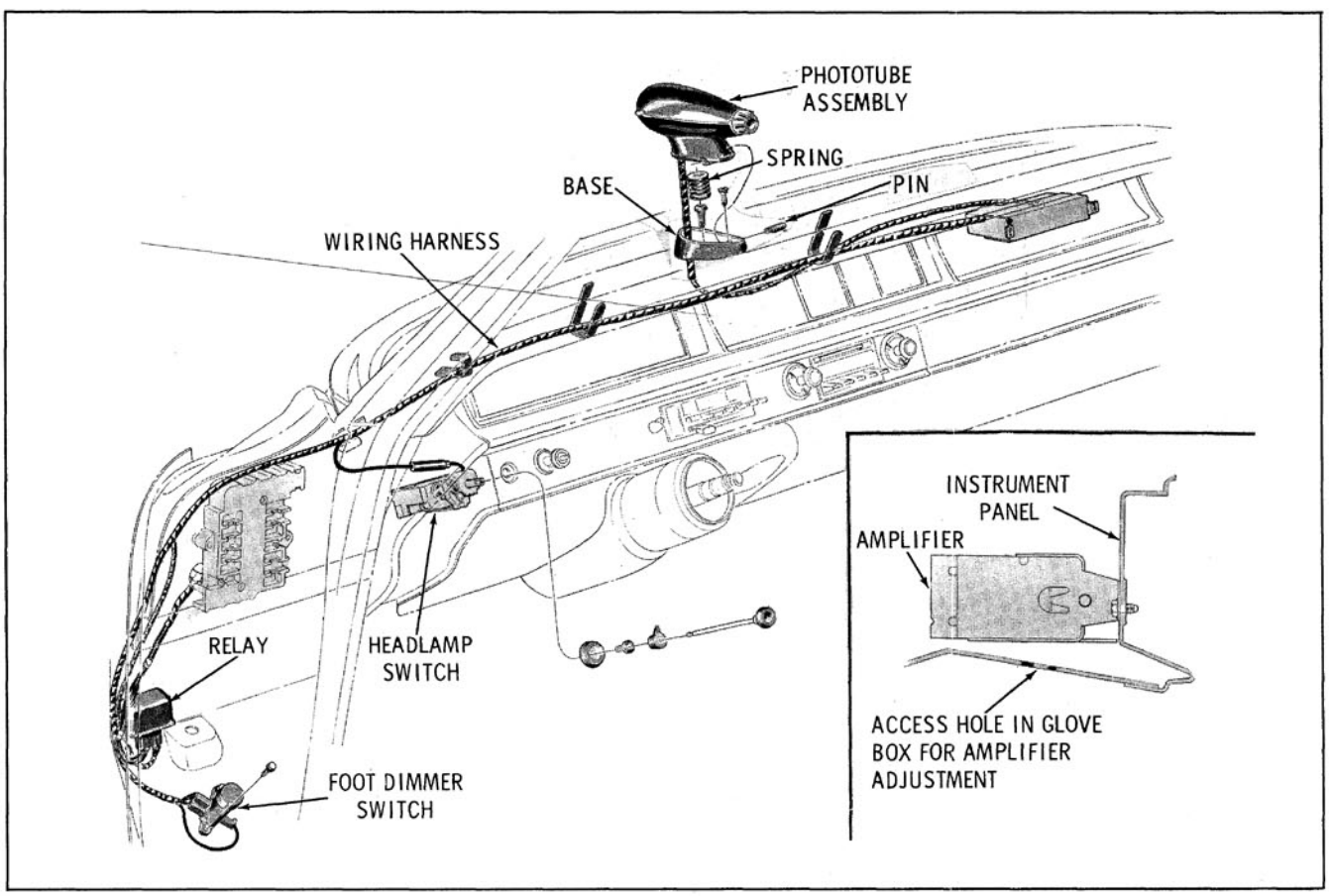


Fig. 12-53 Guide-Matic Installation

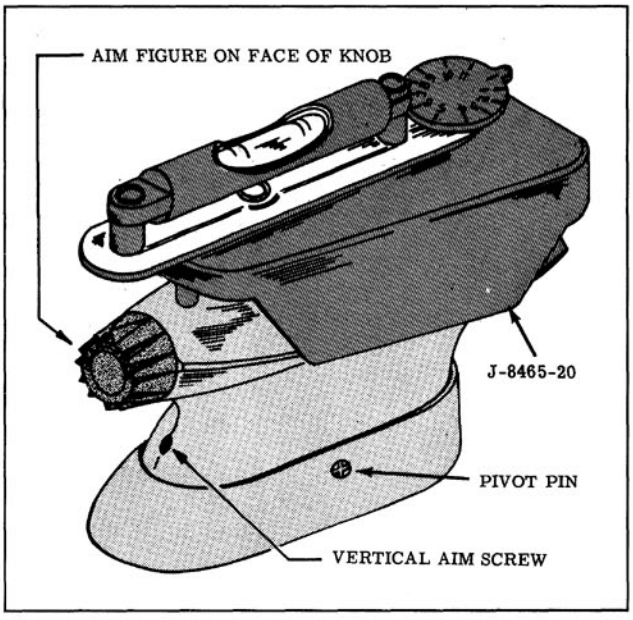


Fig. 12-54 Level Installation

justment toward the "FAR" (clockwise) position increases the sensitivity for driving during foggy weather conditions when light penetration from oncoming cars is poor. Adjustment toward the NEAR position (counterclockwise) decreases the sensitivity for driving during heavy snowstorms or similar conditions when there is abnormal light reflections.

REMOVAL AND INSTALLATION

NOTE: If diagnosis indicates that the phototube unit must be removed for repair by an authorized warranty repair dealer, the amplifier unit should also be removed and sent with the phototube unit. If the amplifier unit must be removed for repair, the phototube unit need not be sent with it if diagnosis indicated it was operating satisfactorily.

Phototube Unit

1. Disconnect the phototube unit harness plug from the amplifier. (Fig. 12-53)
2. Remove the pivot pin from the right side of the phototube unit base, (Fig. 12-54), then lift off the mounting plate and remove the phototube unit and wiring.

To install, reverse the removal procedure, check vertical and horizontal aim, and the Dim and Hold sensitivity adjustment. (See ADJUSTMENTS AND TESTS)

Amplifier Unit

1. Disconnect the fuse connector from the Guide-Matic "off-on" switch terminal on the headlight switch. (Fig. 12-53)
2. Lift floor carpet and remove the two connectors from the foot switch.
3. Remove the dual connector from the power relay.
4. Remove the amplifier attaching screws and remove the amplifier.

To install, reverse the removal procedure. After installing the amplifier unit, check the Dim and Hold sensitivity adjustment. (See ADJUSTMENTS AND TESTS)

ADJUSTMENTS AND TESTS

GUIDE-MATIC TESTING EQUIPMENT

Level J-8465-20 and a test lamp, are required for the aiming and sensitivity adjustments, and must be used in conjunction with the AE-2 Tester. The test lamp and adapter are identified by tool number J-8662.

Vertical Aiming Adjustment

1. Phototube unit aiming should be done with the car unloaded, trunk empty except for spare tire, gas tank at least half full, and with correct tire pressure.
2. Position car on a level floor. Floor must be level within 1/4" fore and aft of car.
3. Rock car gently sideways to equalize springs.
4. Set the Level J-8465-20 on top of phototube unit as shown in Fig. 12-54.

   NOTE: The three points on aiming device must be resting on top of phototube unit and the aiming device must touch front of phototube unit.

5. Observe number stamped on driver control knob. Adjust aiming dial until corresponding number is under pointer.
6. Adjust vertical aim screw until bubble is centered in level.

   NOTE: If the phototube unit is aimed too low, back reflections from the headlights of the car, on which the Guide-Matic is installed, will hold its own headlights on the lower beam. Also, the phototube unit must be aimed as low as possible to provide the maximum tolerance for car loading.

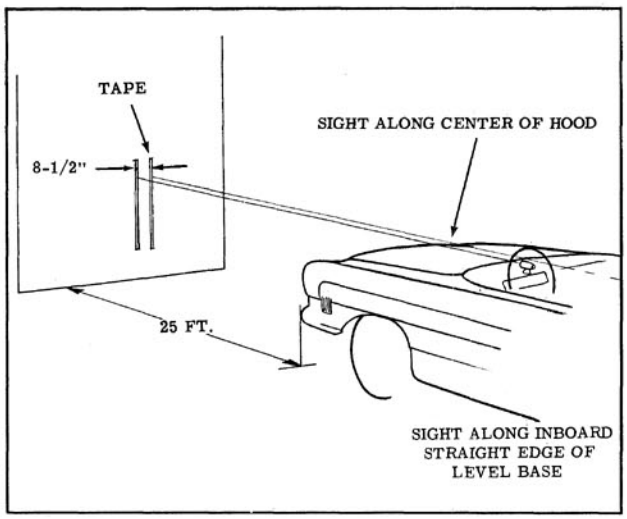


Fig. 12-55 Horizontal Aim

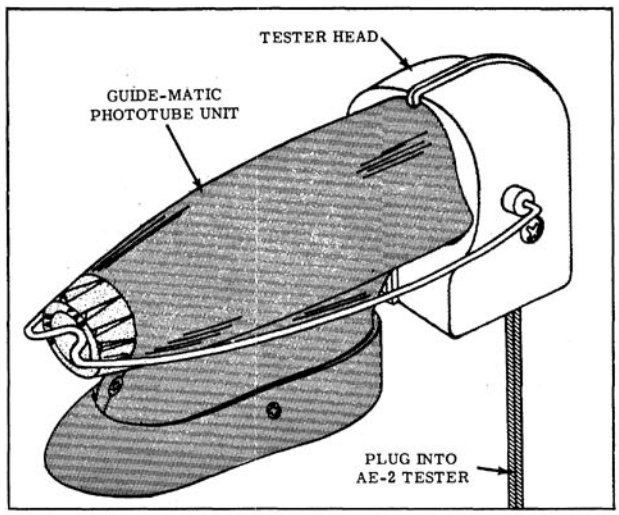


Fig. 12-56 Tester Head Installation

Horizontal Aiming Adjustment (Fig. 12-55)

NOTE: If the phototube unit has been removed for service, it must be aimed parallel to the centerline of the car after the installation is made.

1. Place two pieces of tape or chalk marks 8-1/2" apart on a wall or screen at hood level height.

2. Line up the center of the hood with the right hand tape or chalk mark. The car must be positioned perpendicular to and 25 feet from the wall or screen.

3. With Level J-8465-20 installed on phototube unit, sight along inboard straight edge of level base to the left hand tape or chalk mark.

NOTE: If the unit is aimed more than four inches to the right or left of the left hand tape, horizontal aim must be readjusted by removing phototube base and elongating forward screw hole as necessary to aim phototube.

Hold Sensitivity Test

1. Place tester head against front of phototube unit and position bail into place over sensitivity control knob. Plug tester head into modified AE-2 tester. (Fig. 12-56)

2. Turn on headlights, and with Guide-Matic switch On, WAIT AT LEAST FIVE MINUTES for amplifier to stabilize. Set standard foot dimmer switch to Automatic position. Upper beam will then be on.

IMPORTANT: SENSITIVITY CONTROL ON PHOTOTUBE UNIT MUST BE IN CENTER (DETENT) POSITION WHILE TESTING AND ADJUSTING HOLD SENSITIVITY.

3. Turn Zero Corrector on face of tester until meter pointer is on zero set line. (Fig. 12-57)

4. Turn Intensity Rheostat of tester counterclockwise.

5. Insert tester connector of Model AE-2 tester into cigar lighter receptacle.

6. Operate engine at fast idle while making sensitivity tests and adjustment.

7. Turn Tester Selector Switch to dim position. Be sure to use proper dim position for clear or tinted windshield.

8. Turn Intensity Rheostat all the way clockwise to turn headlights on lower beam.

NOTE: If lights do not switch to lower beam, the dim control in the amplifier must be turned completely clockwise and then readjusted after hold adjustment is correct.

9. Turn Tester Selector to hold position.

10. Slowly turn Intensity Rheostat counterclockwise just to point where headlamps switch to upper beam. The meter pointer should now read in the Hold Sensitivity Adjustment Bar on the meter scale. (Fig. 12-58)

If Hold Sensitivity is not properly adjusted, proceed with HOLD SENSITIVITY ADJUSTMENT.

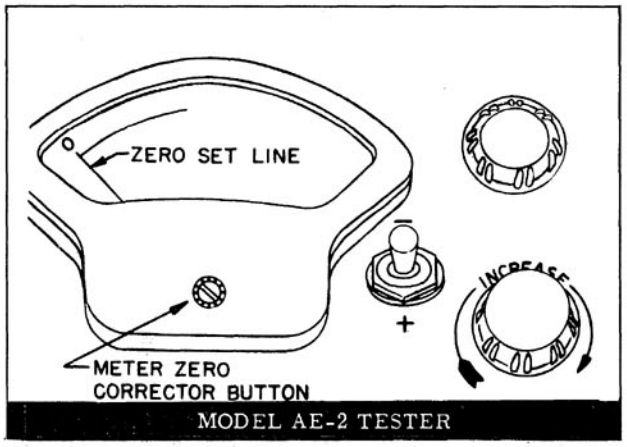


Fig. 12-57 Setting Zero Corrector

Hold Sensitivity Adjustment

The hold and dim adjusting controls are located in the amplifier unit and can be adjusted with a screwdriver through holes in the top of the glove box.

THE SENSITIVITY ADJUSTMENT MUST NOT BE MADE UNTIL AFTER THE HOLD SENSITIVITY IS CORRECTLY ADJUSTED.

1. Turn hold control clockwise to end of adjustment.
2. Rotate Intensity Rheostat all the way clockwise.
3. Turn Selector switch momentarily to dim position to switch lights to lower beam, then switch back to hold position.

   NOTE: If lights do not switch to lower beam, the amplifier dim control must be turned completely clockwise and then readjusted after hold adjustment is correct.

4. Adjust tester Intensity Rheostat until meter pointer is at center of Hold Sensitivity bar. (Fig. 12-58)
5. Turn the hold control counterclockwise SLOWLY just to the point where headlights switch to upper beam.
6. Rotate tester Intensity Rheostat clockwise to end of travel, then turn Selector Switch momentarily to dim position and back to hold. (Headlights should now be on lower beam.)
7. Recheck hold adjustment by turning Intensity Rheostat SLOWLY counterclockwise just to point where headlights switch to upper beam. Meter pointer should now read in the hold adjustment green bar if adjustment is correct. If not, repeat procedure starting with Step 1.

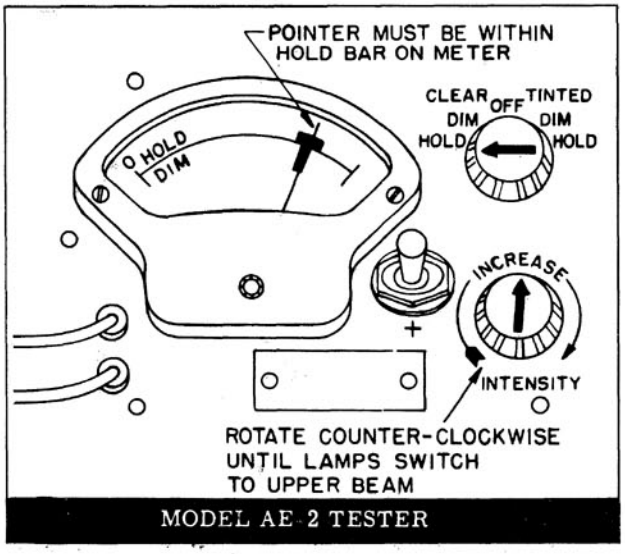


Fig. 12-58 Hold Sensitivity Test

Dim Sensitivity Test

IMPORTANT: SENSITIVITY KNOB ON PHOTOTUBE UNIT MUST BE IN CENTER (DETENT) POSITION WHILE TESTING AND ADJUSTING DIM SENSITIVITY.

1. Rotate tester Intensity Rheostat completely counterclockwise. (Fig. 12-59)
2. Turn Selector Switch momentarily to hold position, then back to dim position. Headlights should now be on upper beam.
3. Turn Intensity Rheostat SLOWLY clockwise stopping at the exact point where the headlights switch to lower beam. Meter pointer should read within the Dim Sensitivity Adjustment Line.

If Dim Sensitivity is not properly adjusted, proceed with DIM SENSITIVITY ADJUSTMENT.

Dim Sensitivity Adjustment

NOTE: DIM SENSITIVITY SHOULD NOT BE ADJUSTED UNTIL AFTER HOLD SENSITIVITY IS PROPERLY ADJUSTED.

1. Rotate dim control completely counterclockwise.
2. Momentarily turn tester off, then back to dim position. Headlights should now be on upper beam.
3. Adjust Intensity Rheostat until meter pointer is at the Dim Sensitivity Adjustment Line.
4. SLOWLY rotate dim control clockwise just to point where headlights switch to lower beam. DO NOT GO BEYOND THIS SETTING.

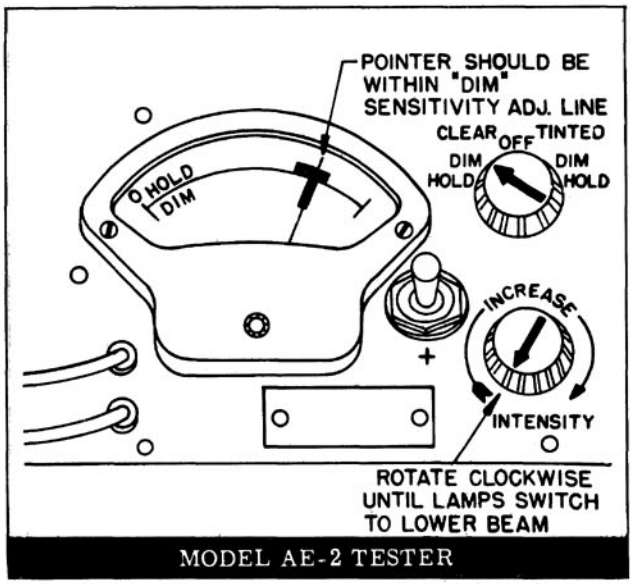


Fig. 12-59 Dim Sensitivity Test

5. Turn tester Intensity Rheostat completely counterclockwise, then momentarily turn tester to hold and back to dim to place headlights on upper beam.

6. Rotate tester Intensity Rheostat SLOWLY clockwise just to point where headlights switch to lower beam. Meter will read within Dim Sensitivity Line if adjustment is correct. If not, repeat Steps 1 thru 6.

7. Turn off headlights and remove tester.

GUIDE-MATIC DIAGNOSIS

IMPORTANT: Check the four-amp fuse in fuse connector near headlight switch if Guide-Matic is inoperative.

Lights Stay On Low Beam

1. With the headlight switch on and the Guide-Matic switch off, operate the dimmer switch to see if lights can be switched from low to upper beam.

   a. If lights change beams when dimmer switch is operated, then the power relay and dimmer switch are functioning. Leave dimmer switch in upper beam (automatic) position, then proceed with Step 2.

   b. If the lights stay on low beam, the dimmer switch, power relay or wiring at these units is at fault.

2. With headlight switch and Guide-Matic switch on, wait at least a minute for the amplifier to warm up, then cover the phototube unit with a dark cloth.

   a. If lights go to upper beam, system is operating but requires adjustment.

   b. If the lights stay on low beam, position the amplifier hold control in approximately the center of its travel to eliminate the possibility of complete misadjustment locking the headlights on low beam. If the headlights still stay on low beam when the phototube unit is again covered, the amplifier or phototube unit is defective. Proceed with Step 1.

   (1) Disconnect the phototube unit from the amplifier.

      (a) If the lights go to upper beam, the phototube unit is at fault. Remove the cover and substitute the phototube and pre-amplifier tube assembly with a known good tube assembly. (Remove attaching screw and unsolder wire from cap of tube.) If the condition still exists remove the phototube unit and amplifier unit for testing and repair by an authorized warranty repair dealer.

      (b) If the lights stay on low beam, the amplifier unit is at fault. Substitute known good tubes. If the condition still exists, remove the amplifier unit only for repair by an authorized warranty repair dealer.

Lights Stay On Upper Beam

1. With the headlight switch on and Guide-Matic switch off, operate the dimmer switch to determine if lights can be switched from upper beam to low beam.

   a. If lights go to low beam, the power relay and dimmer switch are functioning. Leave the dimmer switch in upper beam (automatic) position, then proceed with Step 2.

   b. If lights stay on upper beam, the dimmer switch, the power relay or wiring at these units is at fault.

      (1) Check 4 amp fuse in holder at headlight switch.

      (2) Remove the two-way connector from the power relay and place on the dimmer switch. If headlights change beams, trouble is in the relay. If not, trouble is in dimmer switch harness wires or connectors.

2. With headlight switch and Guide-Matic switch on, wait at least a minute for the amplifier to warm up, then remove the phototube unit control knob, C ring, cover screws and cover.

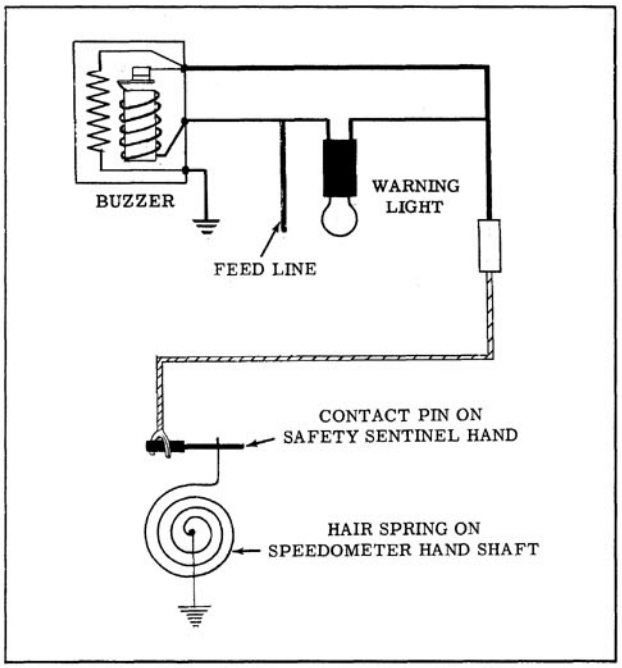


Fig. 12-60 Safety Sentinel Circuit

Ground the white wire terminal in phototube unit.

a. If the lights go to lower beam, trouble is in the phototube unit. Substitute the phototube and pre-amplifier tube assembly with a known good tube assembly. (Remove attaching screw and unsolder wire from switch.) If condition still exists, remove the phototube unit and amplifier for testing and repair by an authorized warranty repair station.

b. If the lights stay on upper beam when the white wire terminal in the phototube unit is grounded, the amplifier unit or dimmer switch is at fault.

(1) Remove red wire from dimmer switch, if headlights go to low beam, the dimmer switch is at fault.

(2) If headlights remain on upper beam, disconnect dimmer switch harness and amplifier harness. Connect car harness to dimmer switch. If headlights change from upper beam to lower beam, trouble is in the amplifier. Substitute known good tubes. If condition still exists, remove amplifier unit for testing and repair by an authorized warranty repair station.

SAFETY SENTINEL (Fig. 12-60)

A speed warning device (Safety Sentinel), is available as factory installed optional equipment. A knob on the instrument panel can be turned by the driver to adjust the sentinel dial in the cluster face to any desired speed setting between 25 and 100 mph. When car speed is equal to, or exceeds the setting on the sentinel dial, a warning light and buzzer warn the driver that he is exceeding his desired speed.

The circuit is complete when a hair spring on the speedometer hand shaft contacts an insulated pin on the safety sentinel hand. The hair spring is grounded and the insulated pin is connected to the buzzer and warning light. If speed is increased further, the hair spring remains in contact with the pin on the safety sentinel hand and is wound up by the speedometer hand.

CHECKING THE SAFETY SENTINEL

1. Check the nine ampere fuse in the fuse block. The parking brake lamp, back-up lamps, temperature, generator, oil pressure warning lamps, and fuel gauge are also on this fuse.
2. Raise the car so that the left front wheel is off the floor.
3. Adjust the Safety Sentinel to 30 mph.
4. Using a wheel spinner on the left front wheel, rotate wheel until speedometer reads approximately 32 mph. The buzzer and light should operate.
5. If the buzzer operates and light does not, remove the bulb from the rear of the speedometer head assembly and install a new one.
6. If the light comes on and the buzzer does not sound, remove the buzzer and replace with one known to be working.
7. If the buzzer and light do not operate, but other panel units in the same circuit operate, check Safety Sentinel circuit connection to the printed circuit. If connection is good, remove the speedometer head for repair by an authorized warranty repair dealer.

CORNERING LAMPS (Fig. 12-61 & 12-62)

The cornering lamps are located in the side of the front fenders. The switch that operates the cornering lamp is integral with the directional signal switch. When either turn signal is operating with the headlamps or parking lamps ON, the corresponding cornering lamp will light continuously. After the turn is completed, the return of the steering wheel to the straight ahead position automatically turns off the cornering lamps.

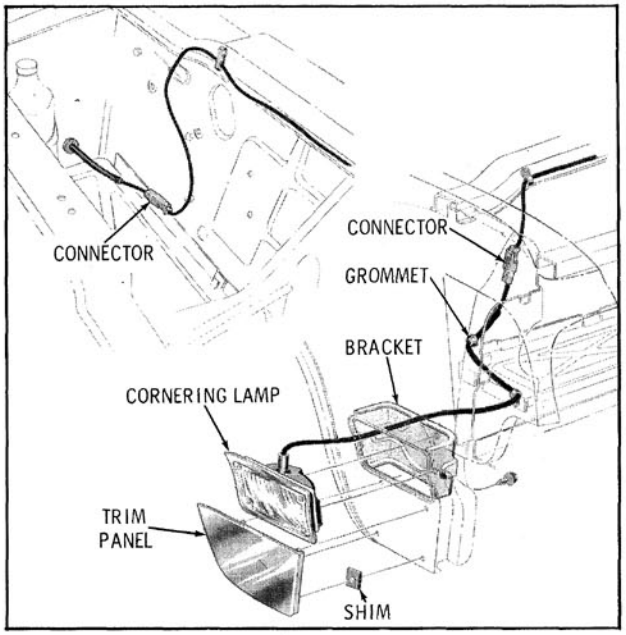


Fig. 12-61 Cornering Lamps

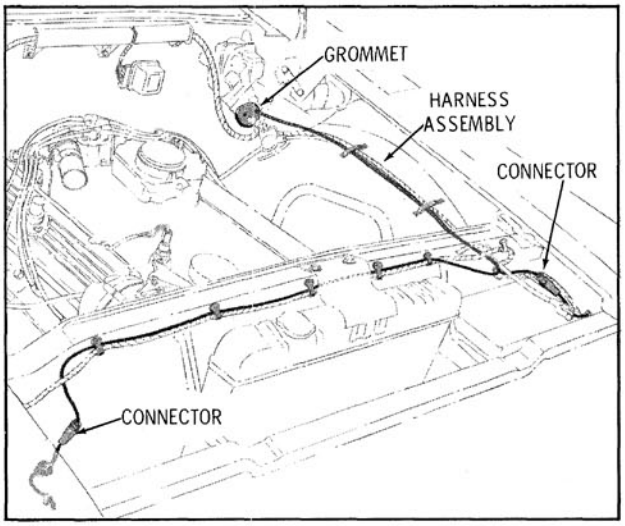


Fig. 12-62 Cornering Lamp Wiring

ACCESSORY LAYOUTS

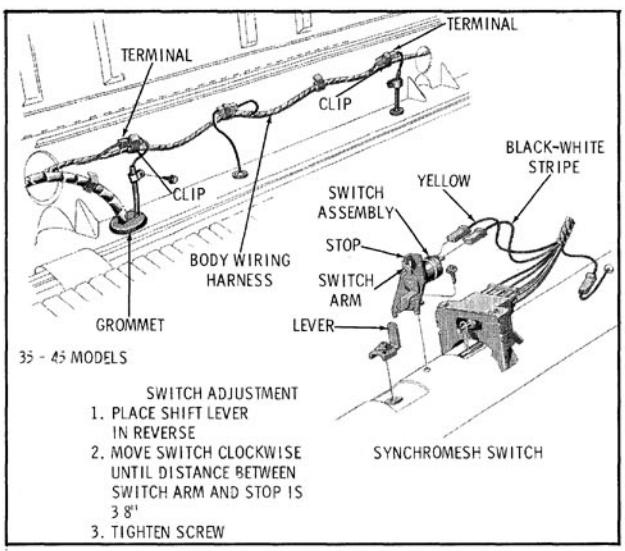


Fig. 12-63 Back-Up Lamps

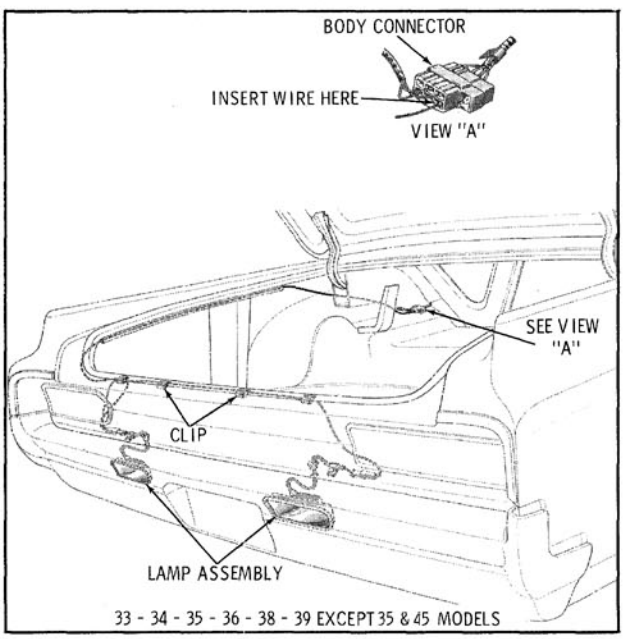


Fig. 12-64 Back-Up Lamps

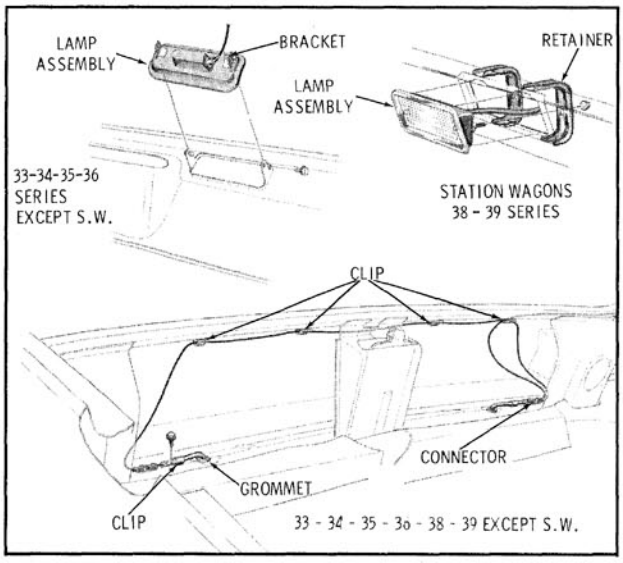


Fig. 12-65 Back-Up Lamps

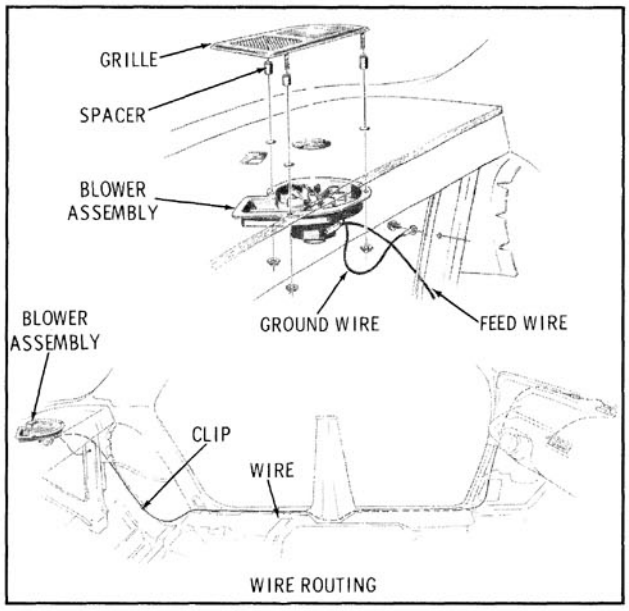


Fig. 12-67 Rear Window Defroster

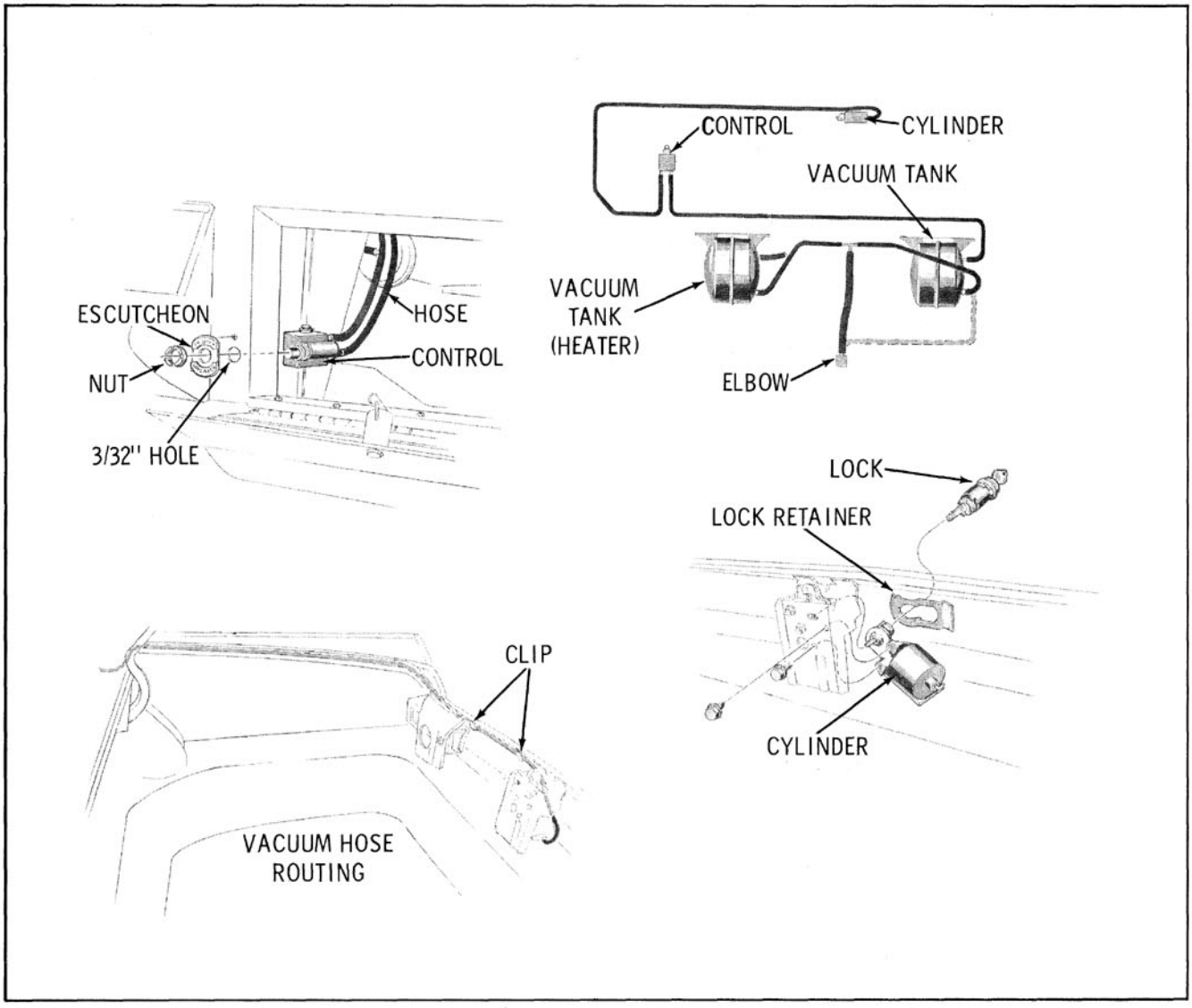


Fig. 12-66 Vacuum Trunk Lock

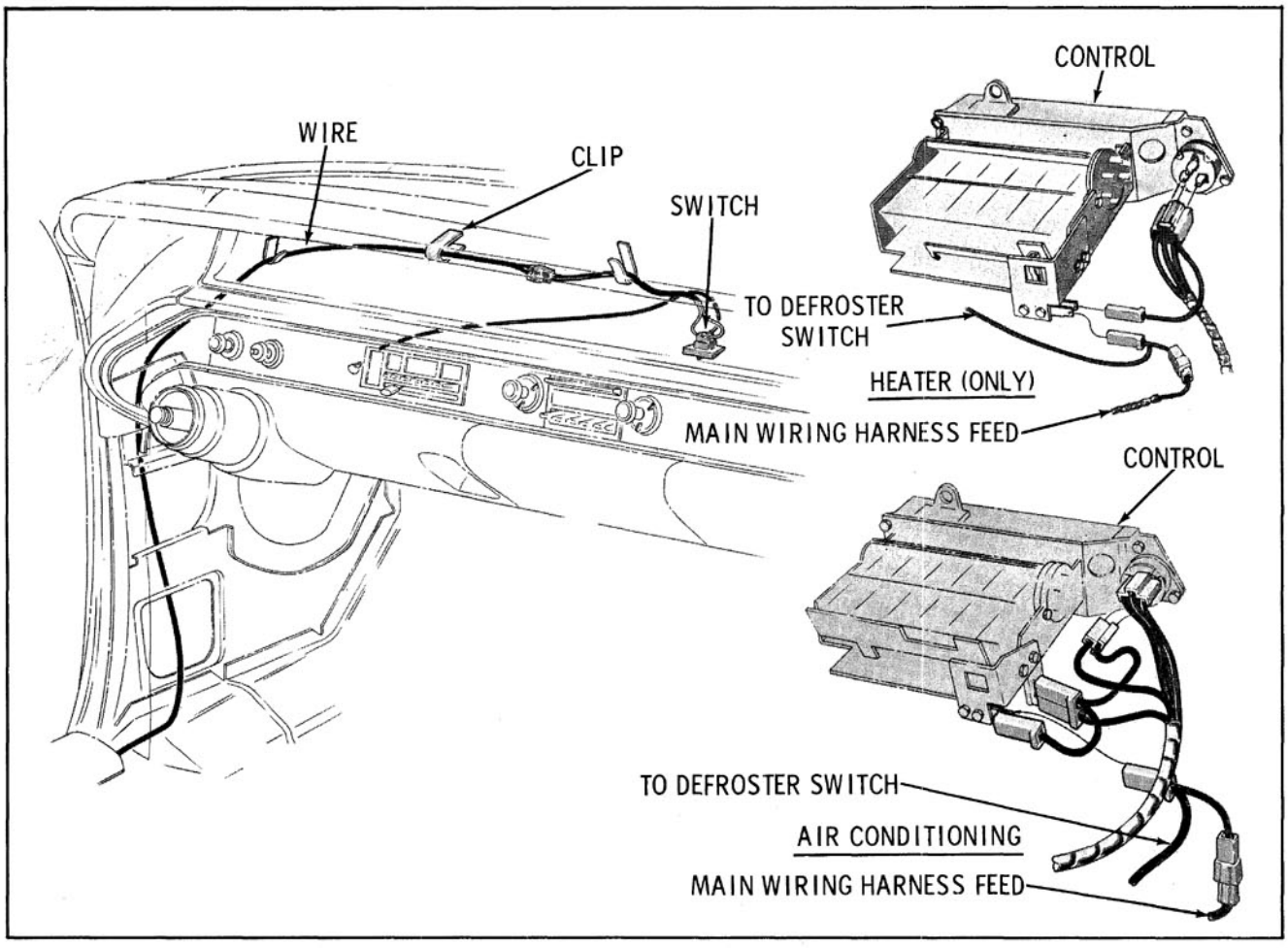


Fig. 12-68 Rear Window Defroster Wiring

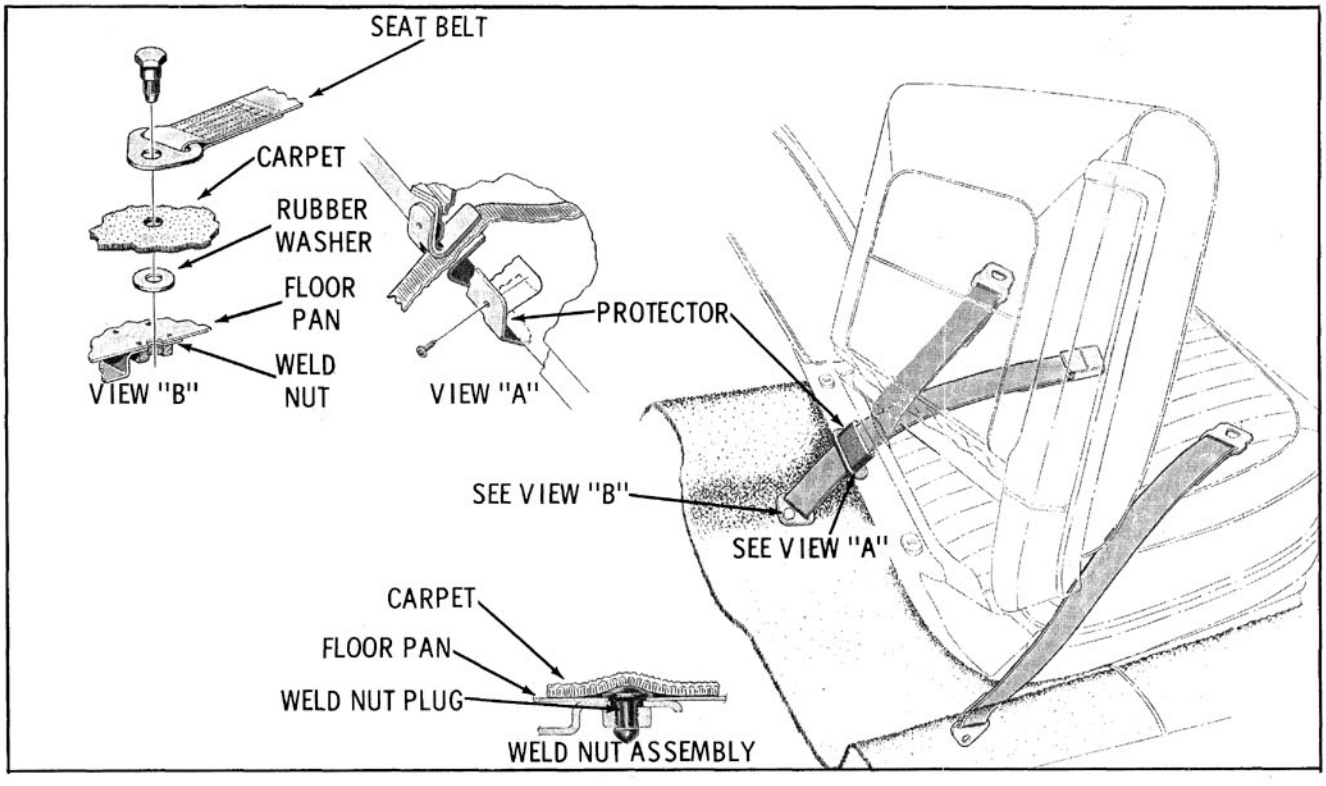


Fig. 12-69 Seat Belt Installation

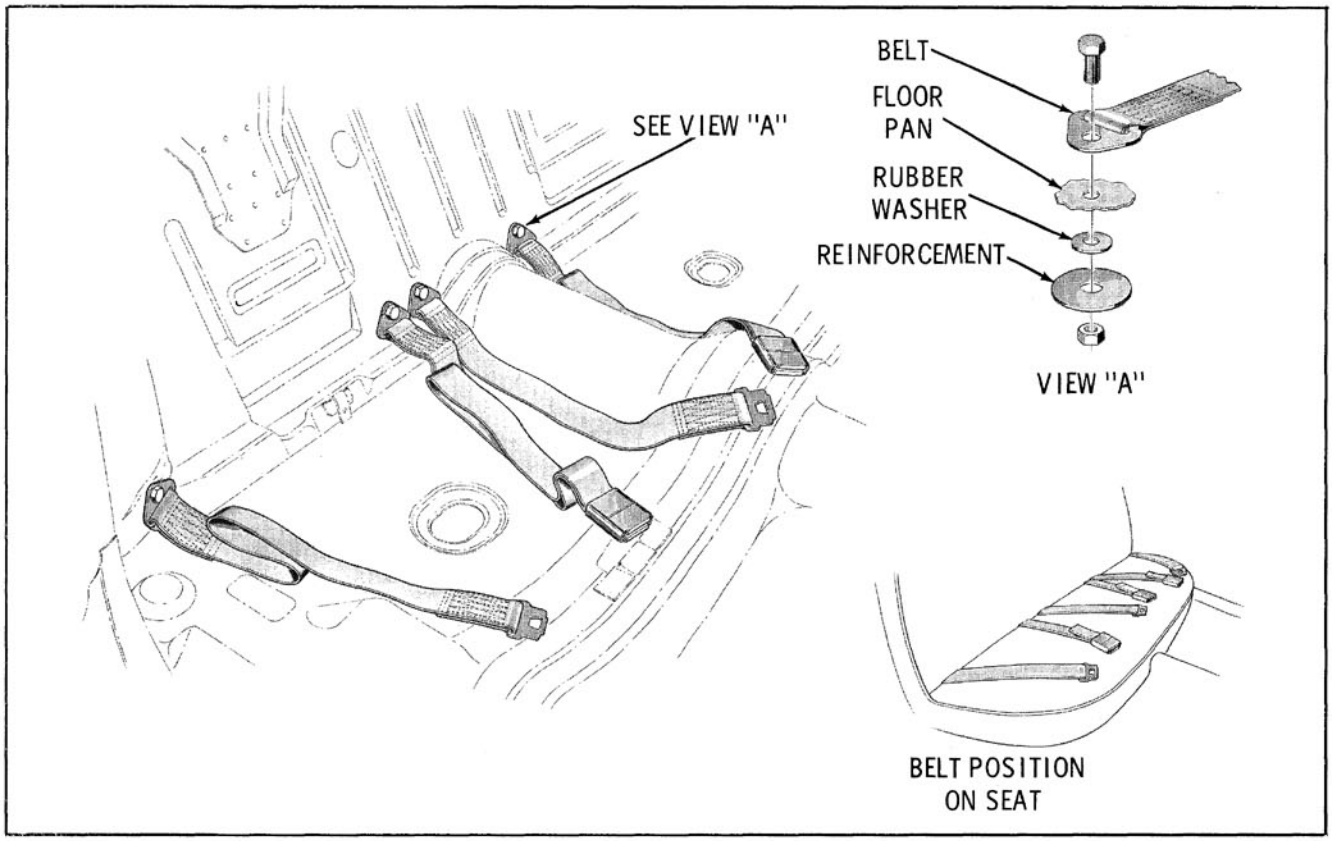


Fig. 12-70 Seat Belt Installation

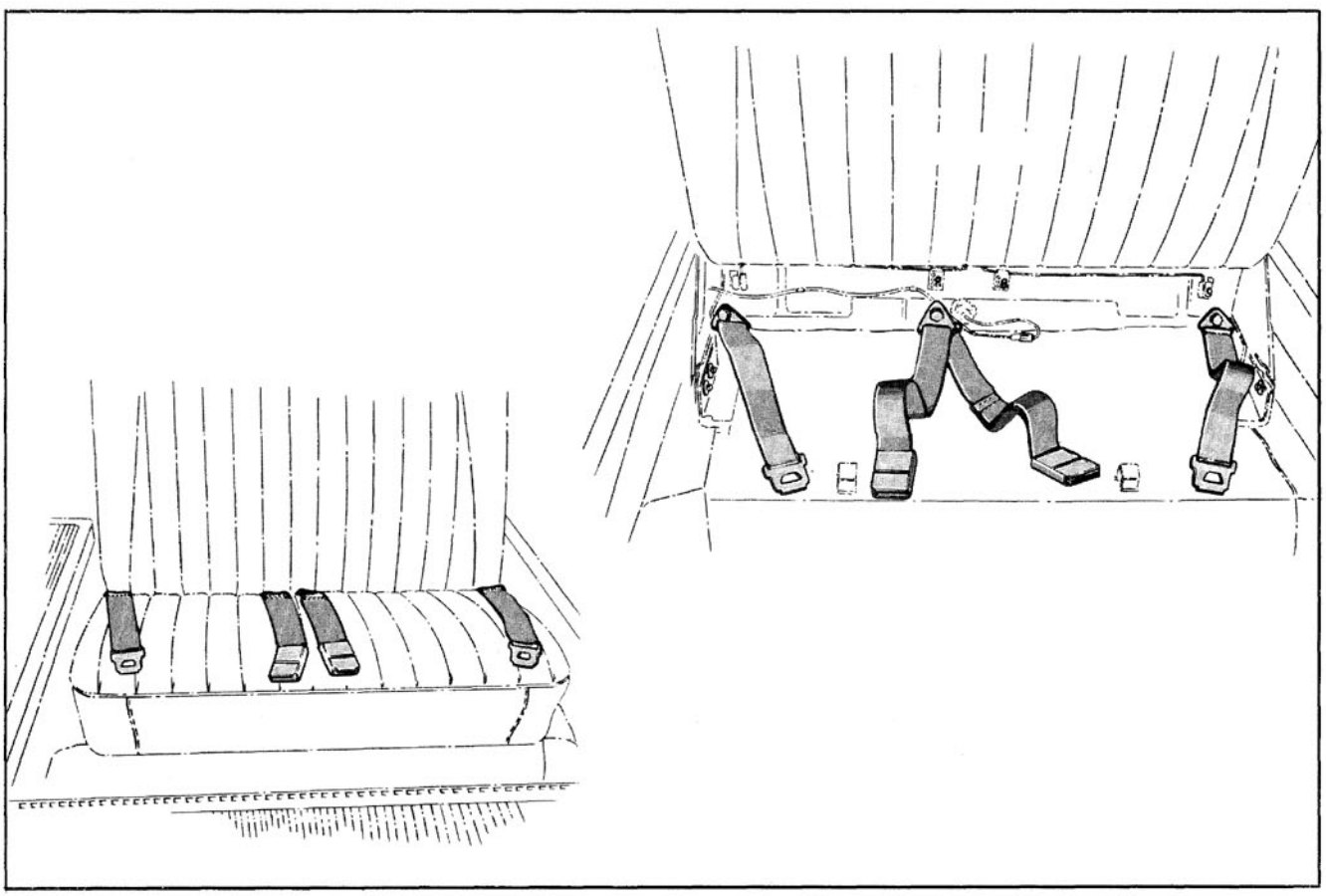
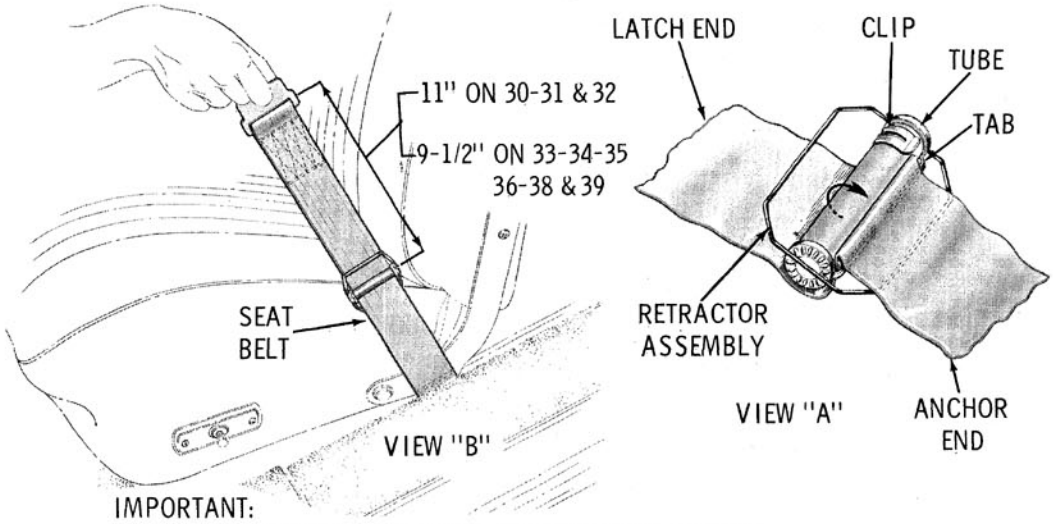


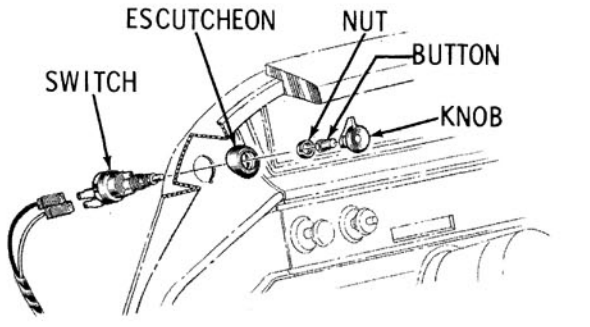
Fig. 12-71 Seat Belt Installation (3445 only)

1. WITH SEAT BELT LATCH FULLY EXTENDED, THREAD BELT THROUGH PRE-WOUND RETRACTOR AND UNDER TABS AS SHOWN IN VIEW "A". BE SURE DIRECTION OF WIND-UP IS AS SHOWN.
2. SLIDE RETRACTOR INTO POSITION ON BELT AS SHOWN BY DIMENSION IN VIEW "B". MAKE SURE RETRACTOR IS SQUARE WITH BELT.
3. CLAMP BELT FIRMLY BETWEEN TABS AND TUBE WITH PLIERS TO PREVENT RETRACTOR FROM MOVING ON WEBBING WITH USE.
4. REMOVE CLIP HOLDING TUBE FROM ROTATING.



IMPORTANT:
RETRACTOR MUST ONLY BE USED ON OUTBOARD SIDE OF FRONT SEAT BELT. NEVER ON BOTH ENDS OF BELT.

Fig. 12-72 Seat Belt Retractor



FOR MOTOR, JAR AND PUMP INSTALLATION REFER TO SECTION 16

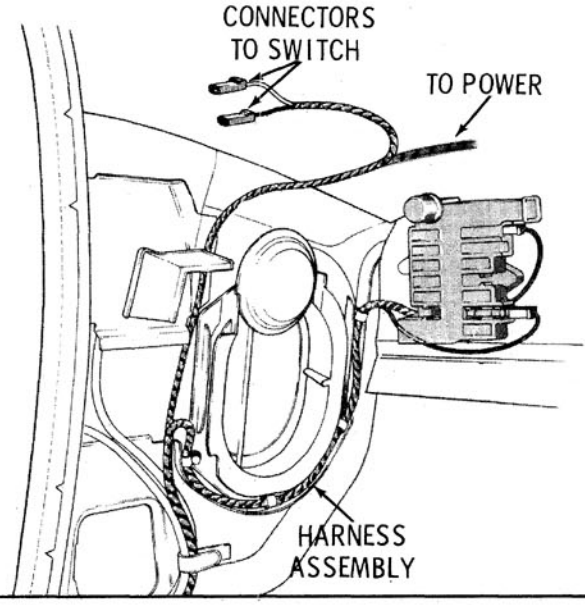


Fig. 12-73 Rear Window Wiper Control

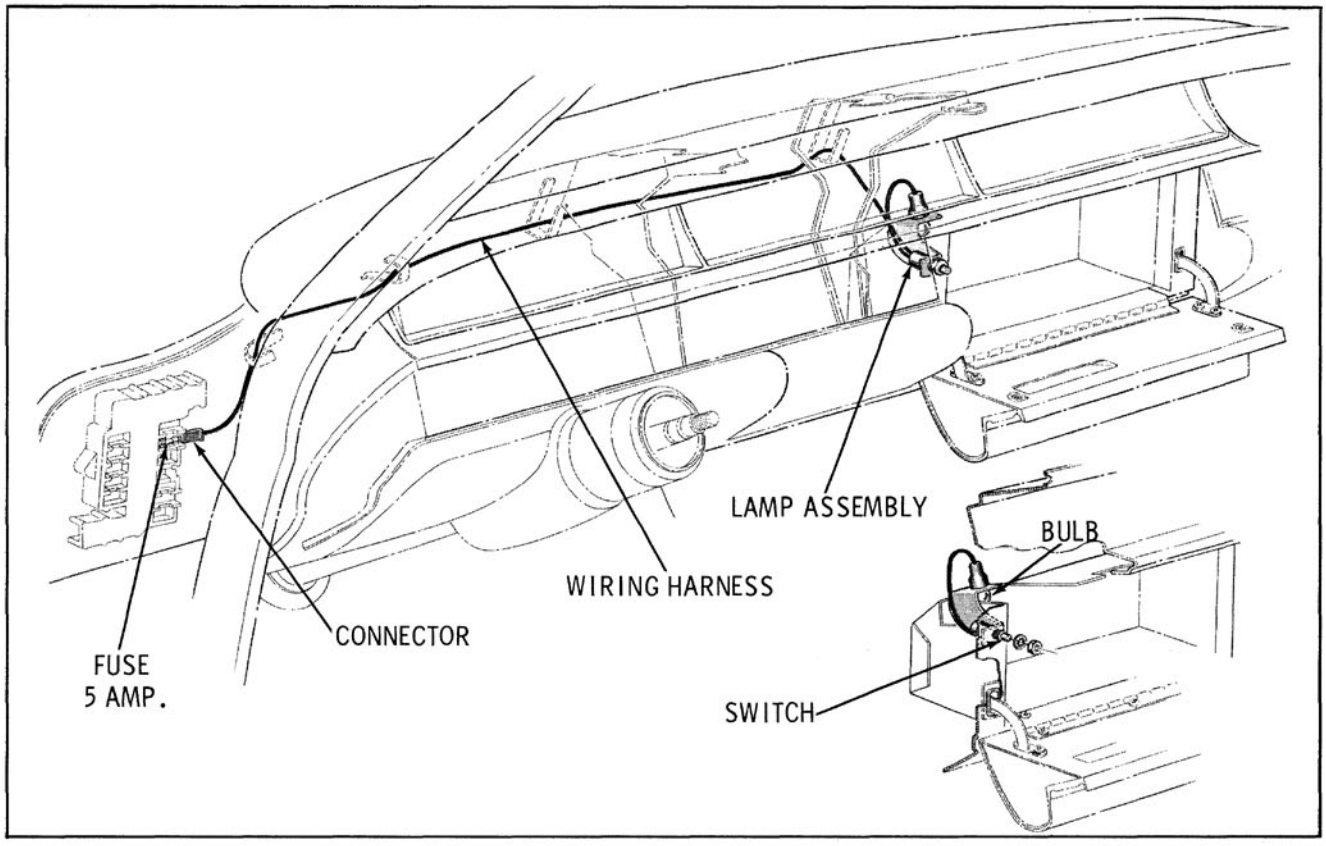


Fig. 12-74 Glove Box Lamp

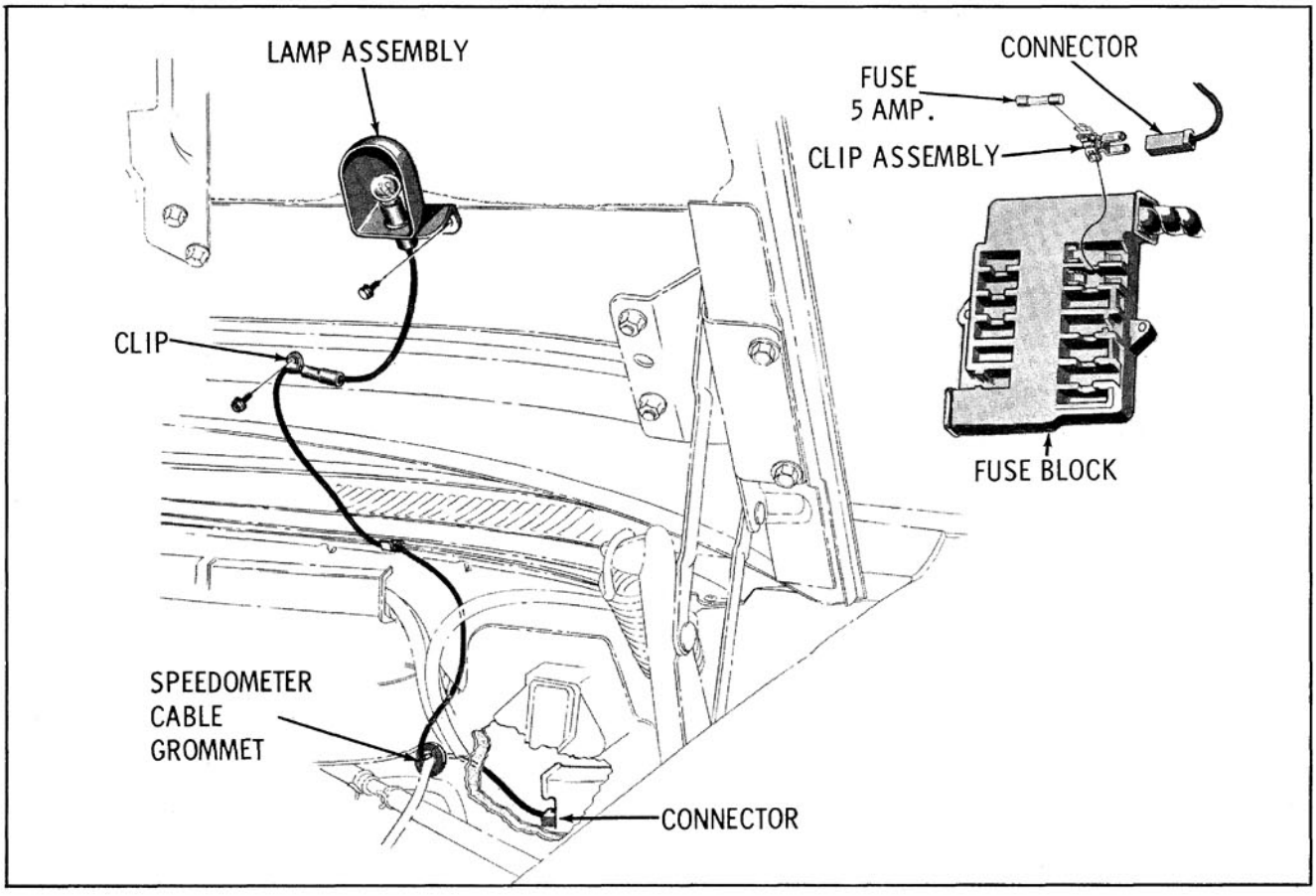


Fig. 12-75 Underhood Lamp

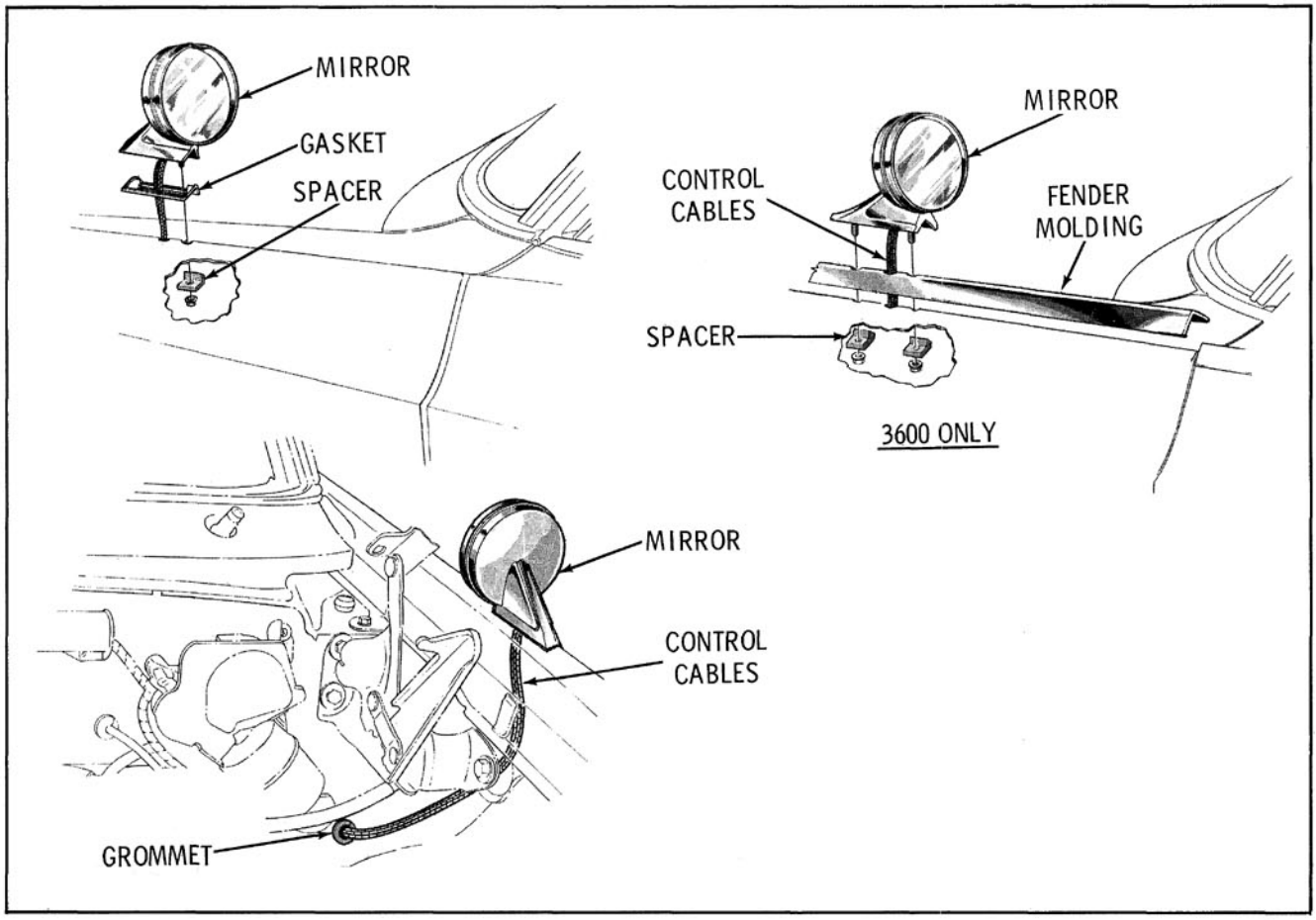


Fig. 12-76 Remote Control Mirror

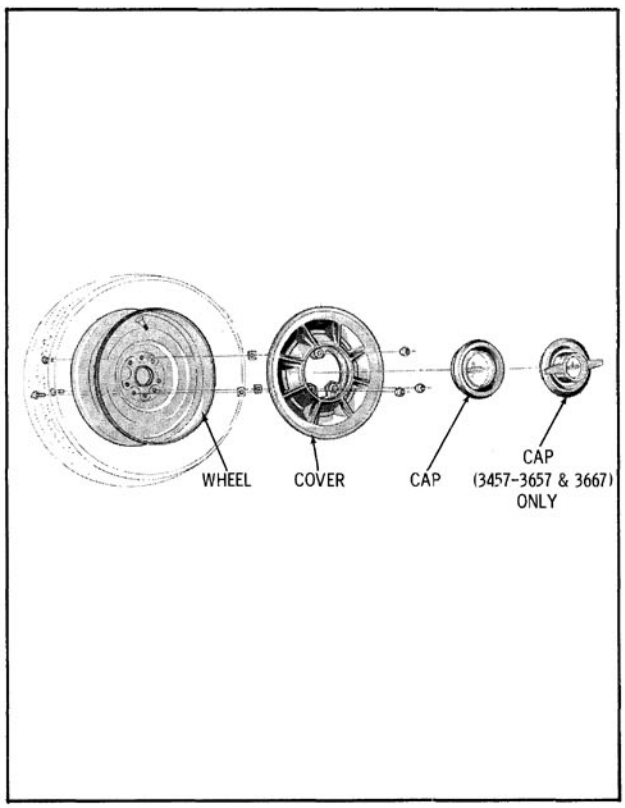


Fig. 12-77 Custom Deluxe Cover

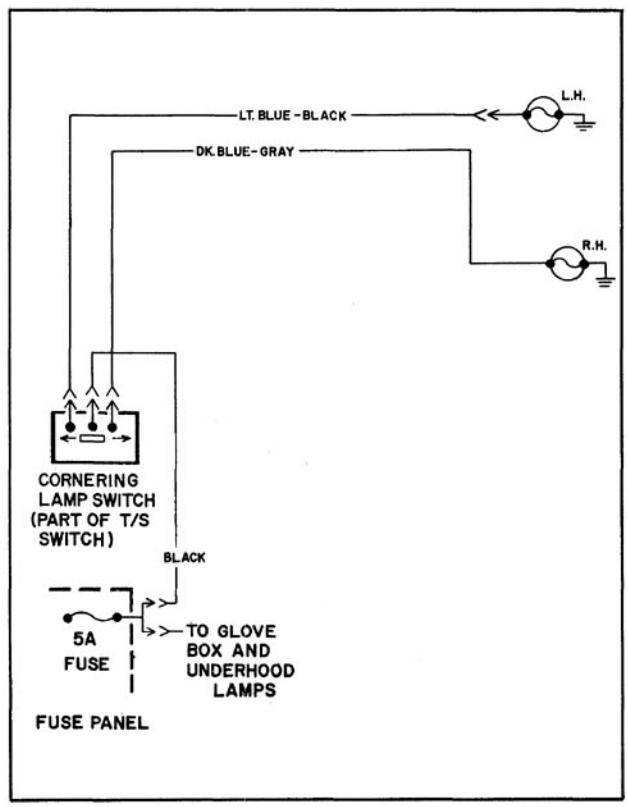


Fig. 12-78 Cornering Lamp Wiring Diagram

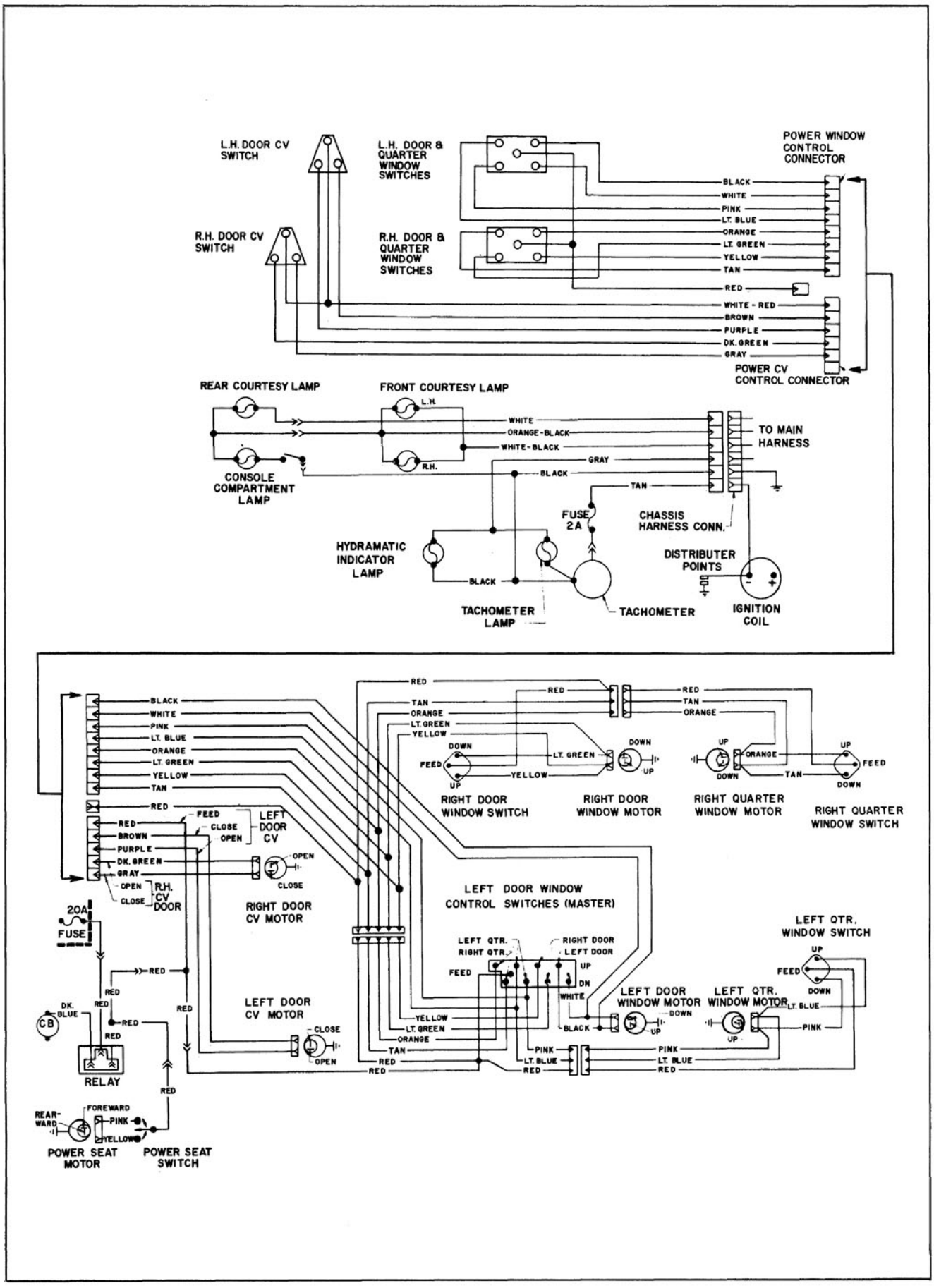


Fig. 12-79 Console Wiring Diagram

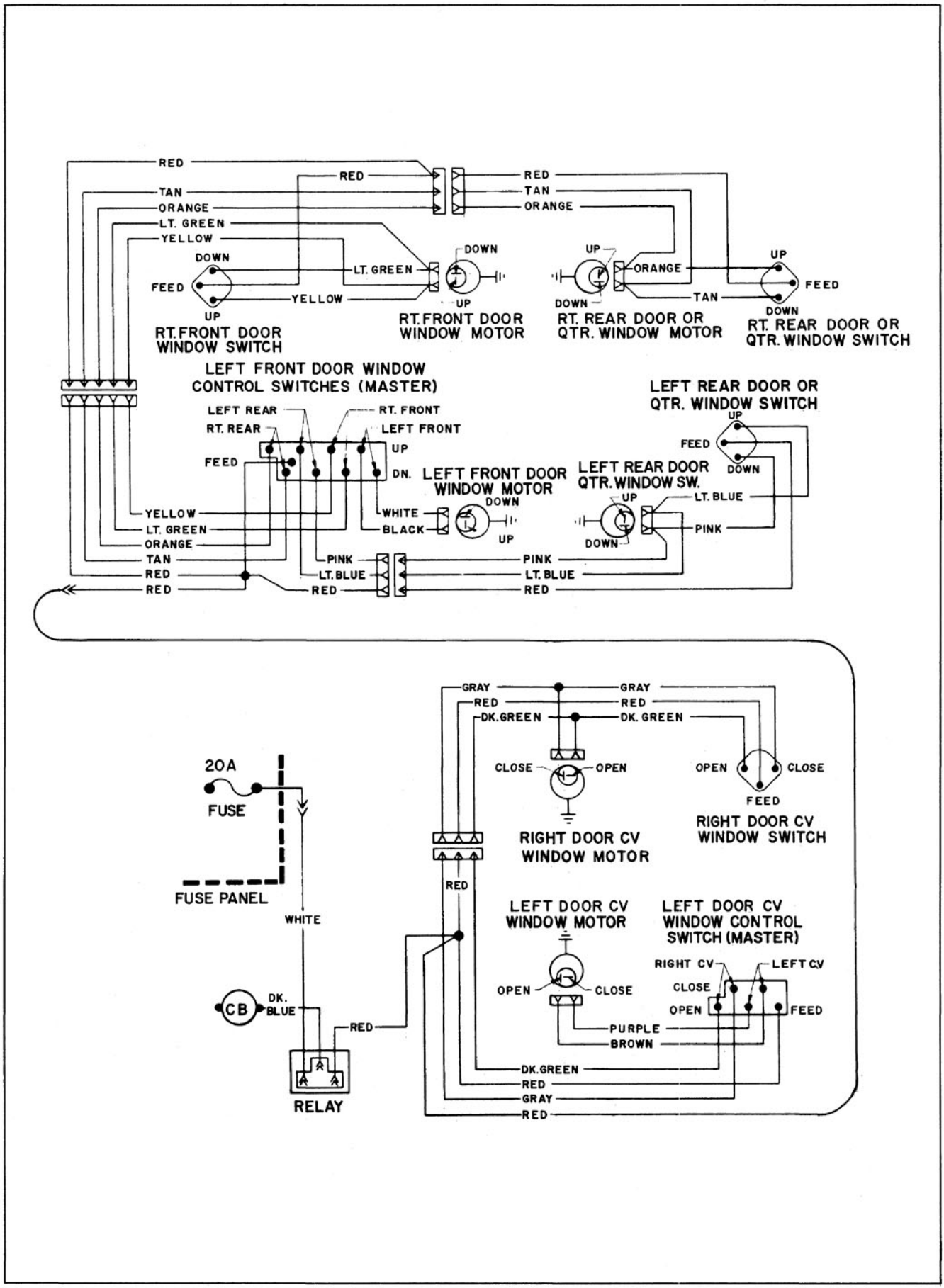


Fig. 12-80 Front Door Power CV Window Wiring (Except 3600)

INSTRUMENT PANEL AND ACCESSORIES

(30-31-32 SERIES)

CONTENTS OF SECTION 12

DESCRIPTION

The instruments and controls are mounted in a control panel assembly which is bolted to the instrument panel. The control panel assembly can be removed from the instrument panel in a single unit with all controls, instruments and accessories attached to the panel, however it is not necessary to remove the complete panel to service individual units. (Fig. 12-101)

All the instruments are electrically operated, except the speedometer and Jetaway indicator, which are mechanically operated. The generator, temperature and oil pressure indicators use colored lights to warn the driver of conditions other than normal when the engine is operating at speeds above idle, or when the engine is operating at normal operating temperature.

The lamp sockets used in the printed circuit board can be removed by turning the socket 1/8 of a turn counterclockwise. The lamp bulb can then be removed from the socket by simply pulling the bulb straight out of the socket.

The instruments and lamps are of the printed circuit type and they are connected to the chassis wiring harness by a multiple connector plug on the printed circuit board.

CONTROL PANEL ASSEMBLY

Removal

1. Disconnect battery cable.
2. Disconnect speedometer cable, remove the wiring harness clip from the lower cluster mounting stud and the rear of the heater

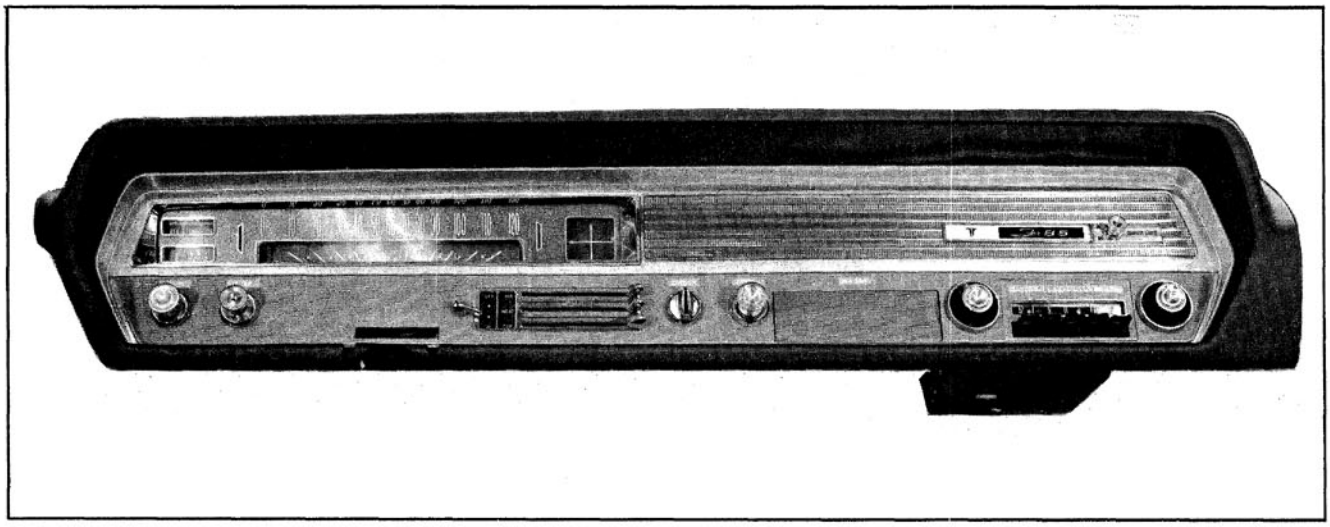


Fig. 12-101 Control Panel Assembly

control, disconnect the printed circuit connector, headlamp connector, heater control, clock, rear seat speaker wire, cigarette lighter, parking brake light and ignition switch.

If equipped with air conditioning, disconnect cables and vacuum hoses, remove center outlet bezel and duct assembly and remove manifold to gain access.

3. Remove the screw securing steering column to support bracket and lower column.
4. Remove the control panel to instrument panel attaching nuts (Fig. 12-102) and remove the control panel with all controls intact.

INSTRUMENT PANEL TRIM

The trim panel is attached to the control panel with either screws or nuts depending upon the

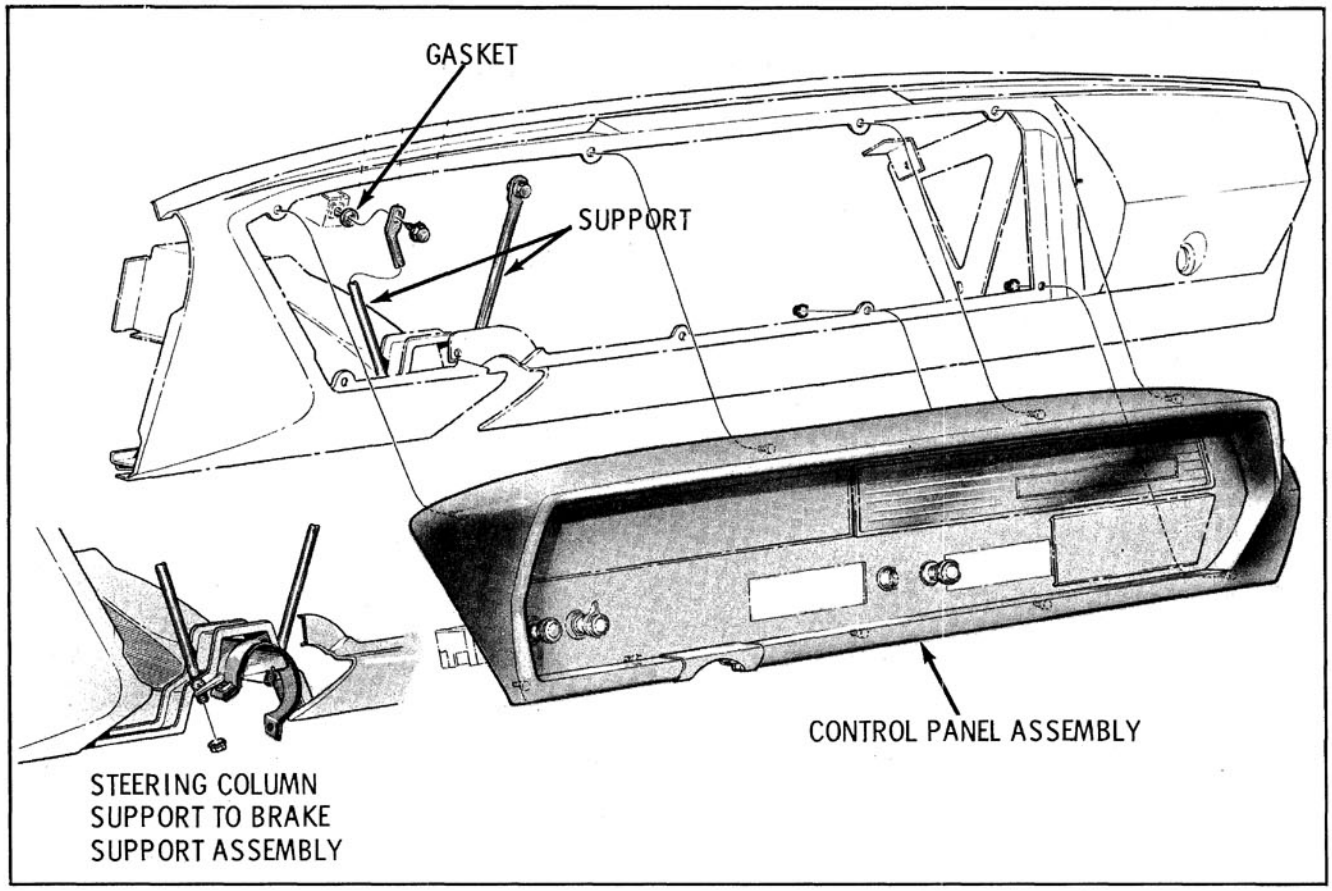


Fig. 12-102 Control Panel Attachment

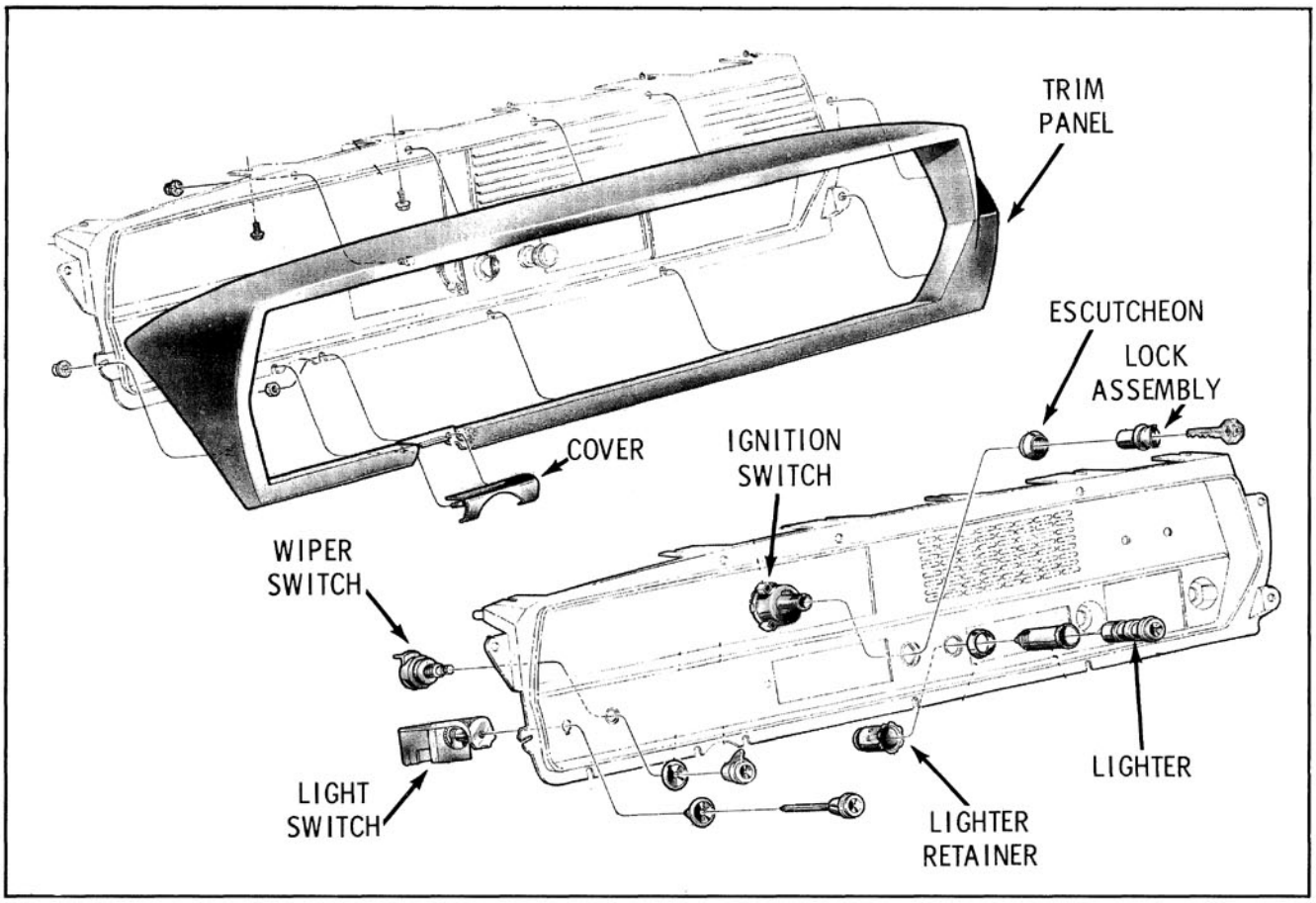


Fig. 12-103 Trim Panel Attachment

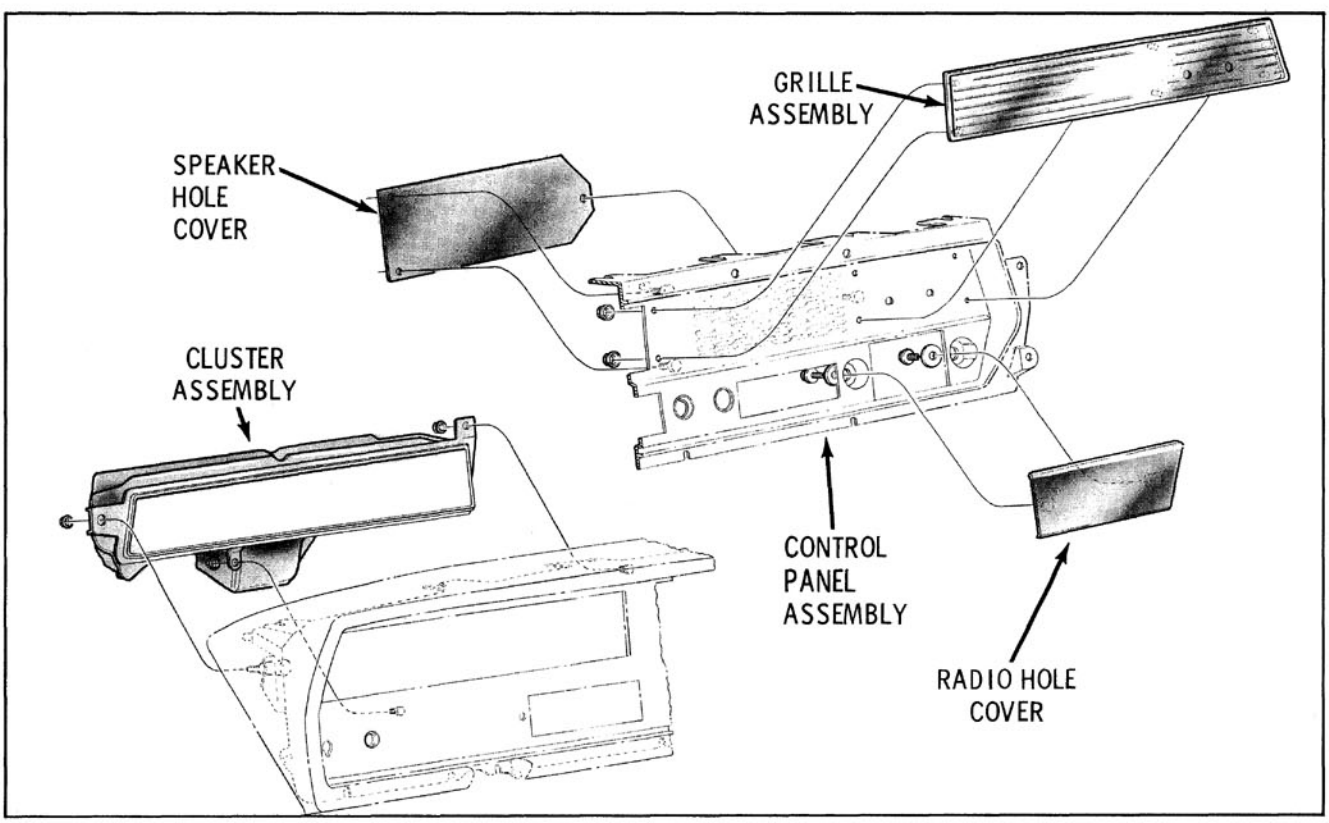


Fig. 12-104 Instrument Panel Hole Covers

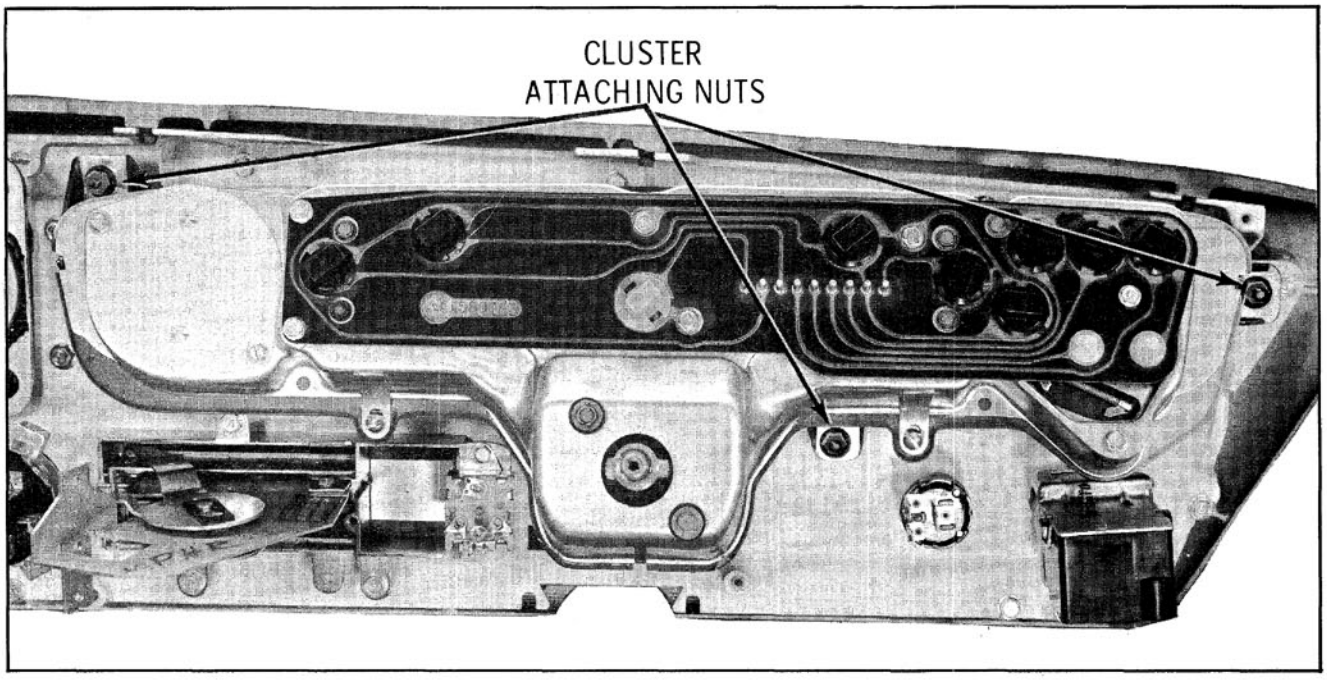


Fig. 12-105 Instrument Cluster

series. To replace the trim panel, it is necessary to remove the complete control panel assembly. (Fig. 12-103)

INSTRUMENT PANEL HOLE COVERS (Refer to Fig. 12-104)

INSTRUMENT CLUSTER

Removal

1. Disconnect speedometer cable.
2. Disconnect printed circuit connector plug.
3. If equipped with clock, disconnect wiring.
4. Remove the three cluster attaching nuts and remove cluster. (Fig. 12-105)

Fig. 12-106 illustrates printed circuit installed. If necessary to disassemble the cluster assembly, refer to Fig. 12-107.

HEADLIGHT SWITCH

All connections in the headlight switch are

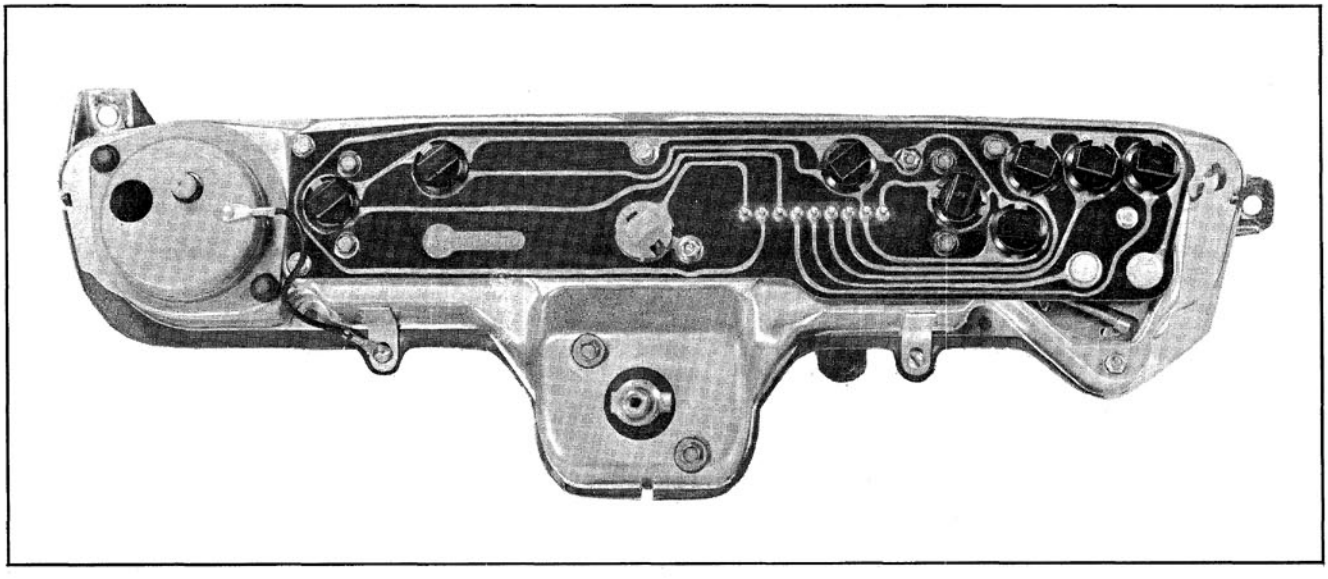


Fig. 12-106 Printed Circuit Installed

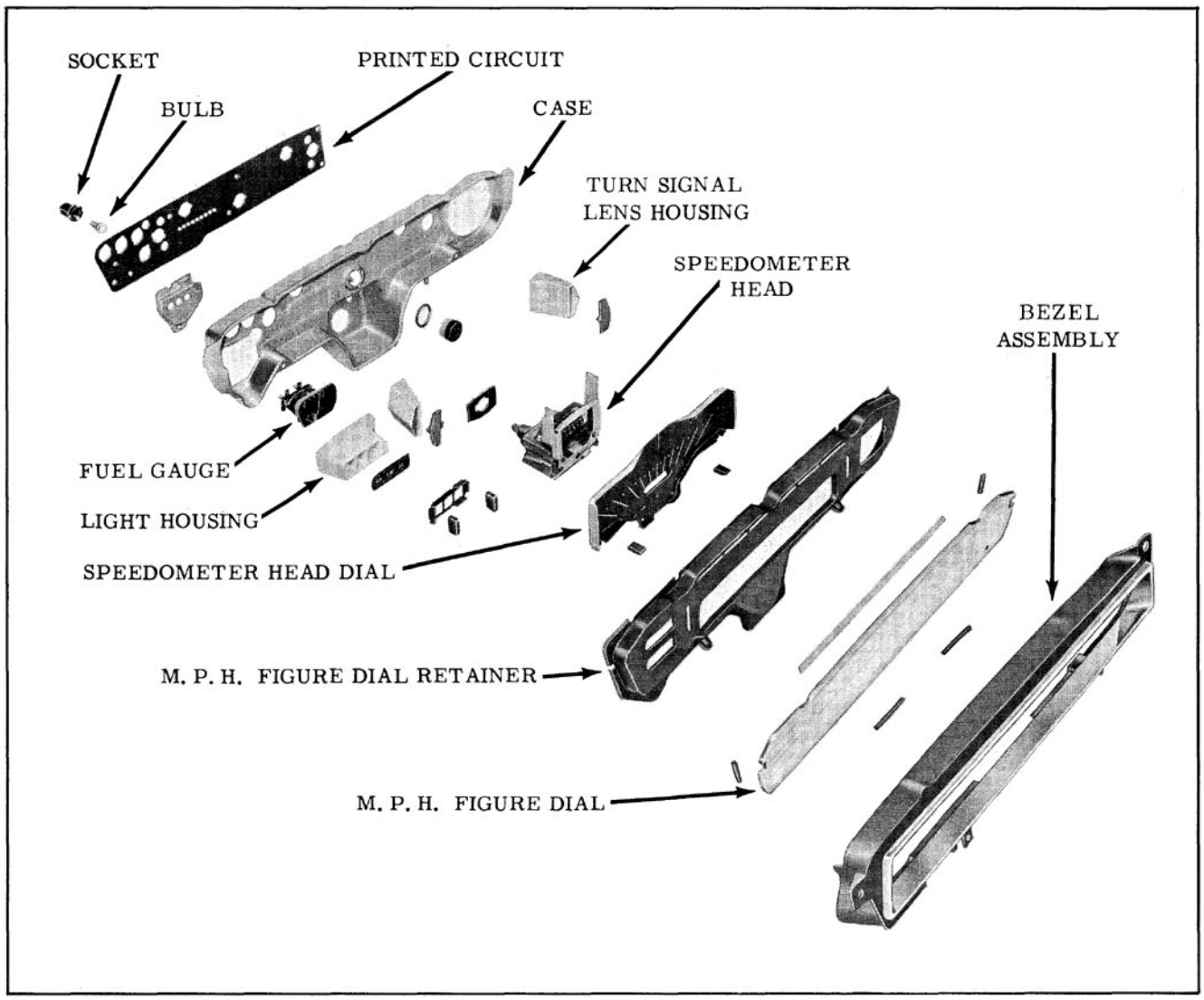


Fig. 12-107 Exploded View of Instrument Cluster

connected as a group by a multiple connector.

The brightness of the instrument panel lights is controlled through a variable resistor unit by turning the light switch knob right or left. Rotating the knob fully counterclockwise will cause the dome lamp to light.

Removal

1. Disconnect wiring from light switch.
2. Remove knob by first pulling knob out to the HEADLIGHT position, then depress the spring loaded button on switch body and pull knob out of switch assembly.
3. Remove escutcheon nut using Tool BT 6411. (Fig. 12-108)
4. Remove headlight switch from rear of instrument panel.

To install, reverse removal procedure and check switch operation.

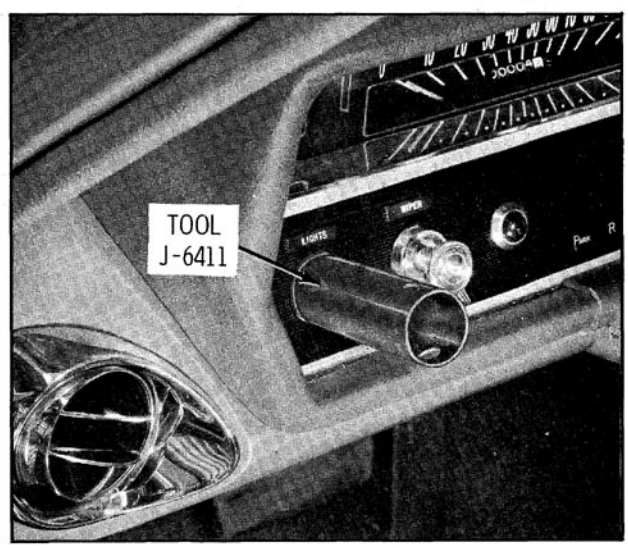


Fig. 12-108 Removing Light Switch

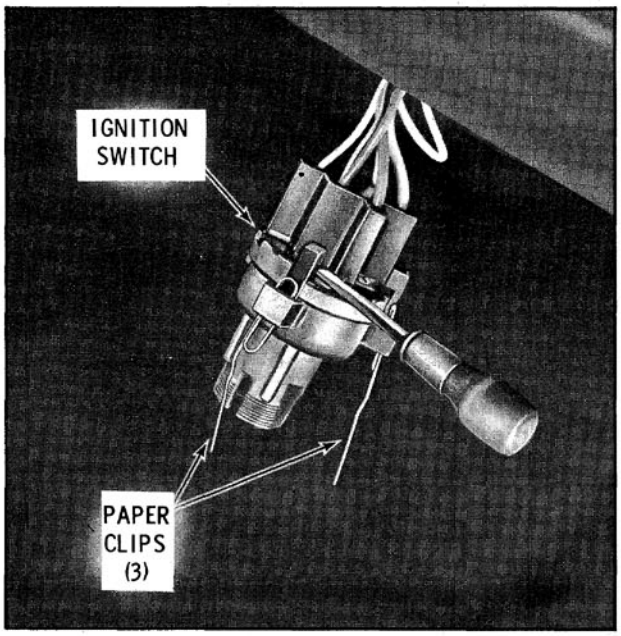


Fig. 12-109 Disconnecting Ignition Switch

WIPER CONTROL

Removal

1. Disconnect switch wiring harness.
2. Remove wiper control knob set screw and remove knob.
3. Remove escutcheon nut and remove switch from rear of the instrument panel.

IGNITION SWITCH

Removal

1. Turn switch to ACCESSORY position.
2. Insert a paper clip into the small hole in the front side of the switch and depress, the lock will then release.
3. Remove the escutcheon using Tool BT 6411.
4. Drop the switch down behind the instrument panel to remove the wiring connector. (Fig. 12-109)

NOTE: If equipped with air conditioning, remove the center outlet and the upper outlet duct, slide the lower outlet duct rearward and pull wiring and switch through center outlet opening to disconnect the wiring connector.

CIGAR LIGHTER (Fig. 12-103)

From beneath the instrument panel, disconnect the wiring connector and unscrew the retainer from the lighter case.

If equipped with air conditioning, remove the center outlet and upper outlet duct to gain access.

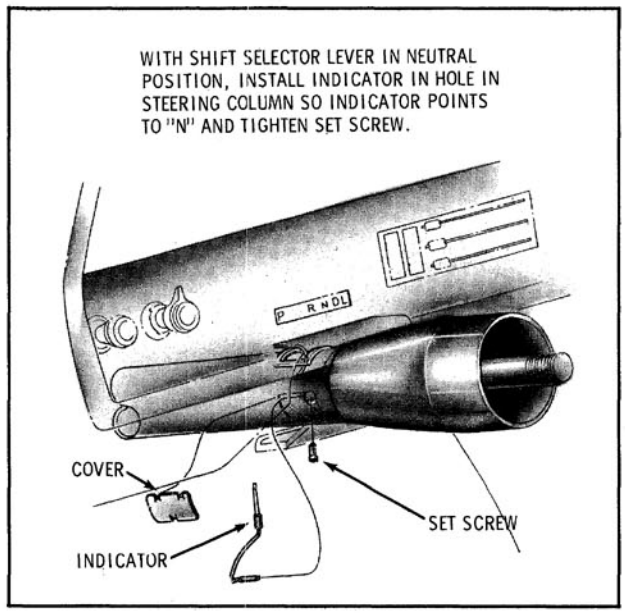


Fig. 12-110 Jetaway Shift Indicator

JETAWAY INDICATOR

For installation and adjustment, refer to Fig. 12-110.

CLOCK

For removal and installation refer to Fig. 12-111.

ASH TRAY (Fig. 12-112)

Removal

1. Disconnect speaker lead from radio.
2. Remove the three nuts securing radio speaker and remove the speaker.
3. Remove the pivot pin retainer.
4. Lift pin upward while observing the spring washers.
5. The ash tray door can now be removed.

The ash tray lamp bulb located above the radio speaker, can be replaced by removing the radio speaker and the lamp attaching screw. The lamp bulb is No. 1445.

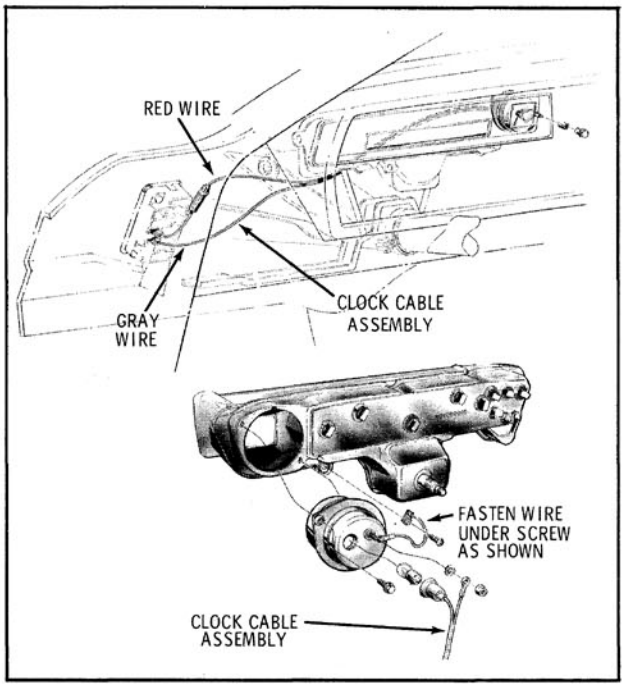


Fig. 12-111 Clock Installation

If equipped with air conditioning, access to the speaker can be made by removing the center outlet bezel and upper duct. The lower duct can be shifted rearward to allow access.

CONSOLE ASSEMBLY (Jetaway—Includes 3300 Series)

Removal

1. Remove two screws from each side securing console to brackets. (Fig. 12-113)
2. Open console door and remove two screws from bottom of map case.
3. Loosen set screw from bottom right side of handle assembly, remove button and spring. (Fig. 12-114)

   NOTE: Piston will usually stay in the handle.
4. Loosen two set screws on the shank of the handle, depress the left button and remove the handle.
5. Lift the rear of the console and shift to the side to disconnect the wiring connector.

REAR COURTESY AND GLOVE BOX LAMP

The lamp assembly is retained to the console

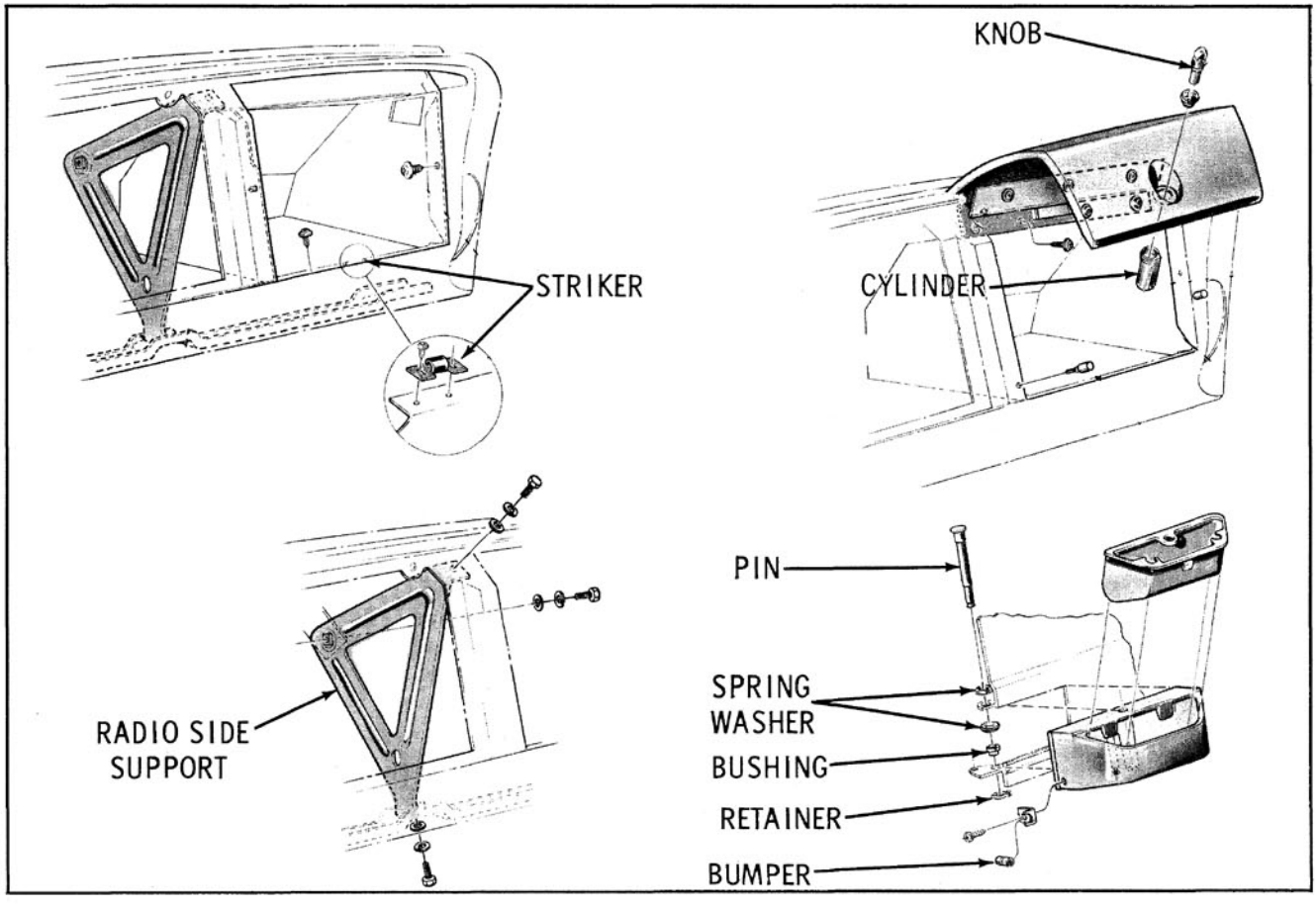


Fig. 12-112 Ash Tray, Glove Box and Support

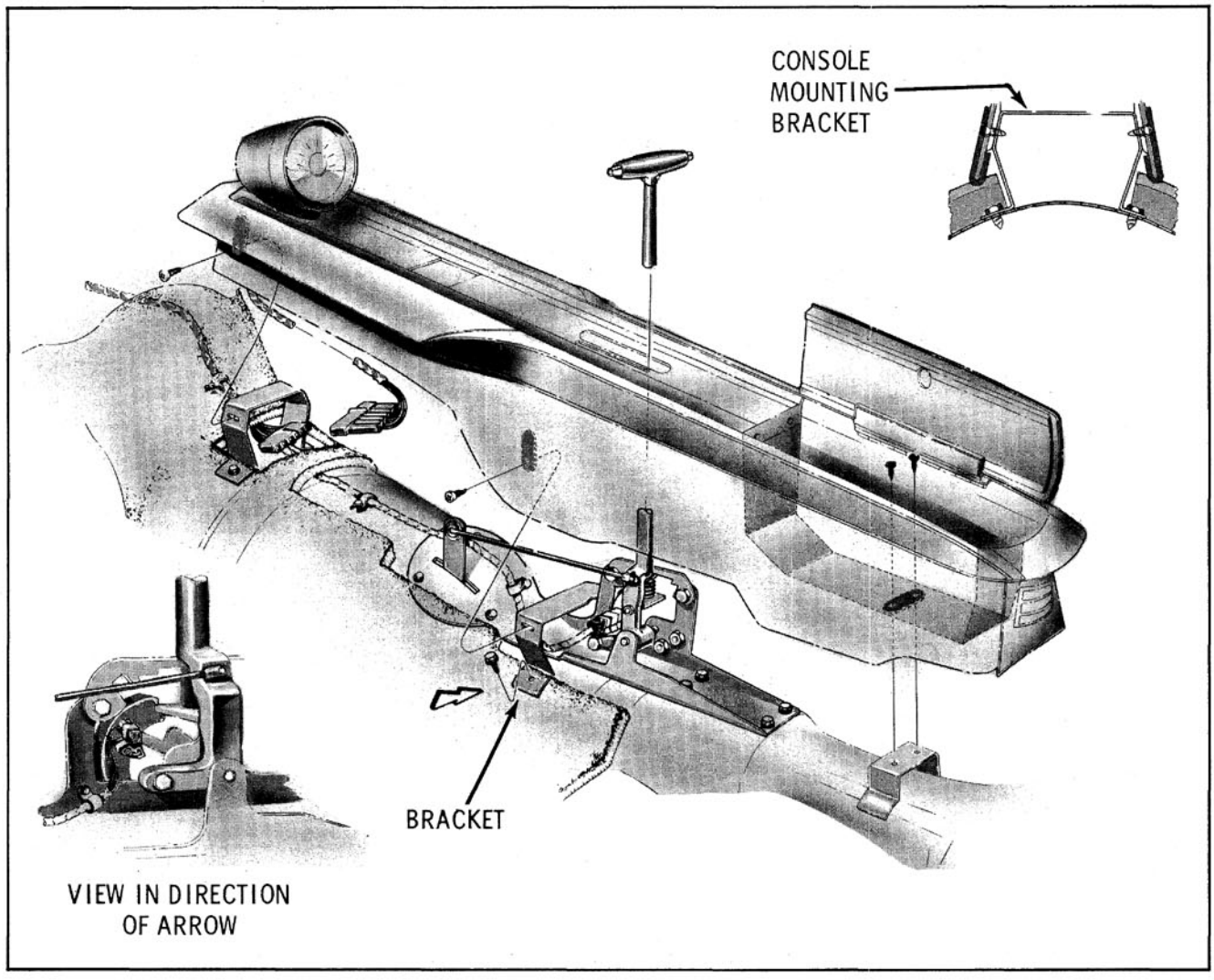


Fig. 12-113 Console Mounting

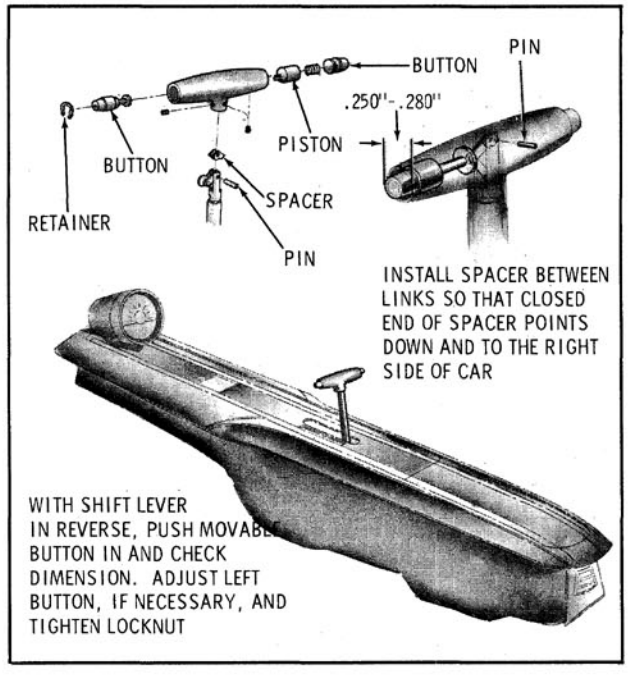


Fig. 12-114 Handle Assembly

body by two screws accessible inside of the glove box. To change either bulb it is necessary to remove the two screws retaining the lamp assembly. (Fig. 12-115) The glove box lamp bulb is the snap-in type and the rear courtesy lamp bulb is the depress and turn type.

To change the rear courtesy lamp lens, it is necessary to remove the two screws retaining the lamp assembly from inside the glove box. Position lamp assembly out of the way to gain access to the lower console rear molding attaching nut and remove the nut. Remove the rear screws retaining side moldings (Fig. 12-116) to rear molding and remove the rear molding. The lens can then be removed by removing the attaching screw.

SHIFT SEAL, INDICATOR, LENS AND INDICATOR HOUSING (Fig. 12-115)

1. Remove handle assembly.
2. From inside the glove box, remove two screws securing console panel to console body.

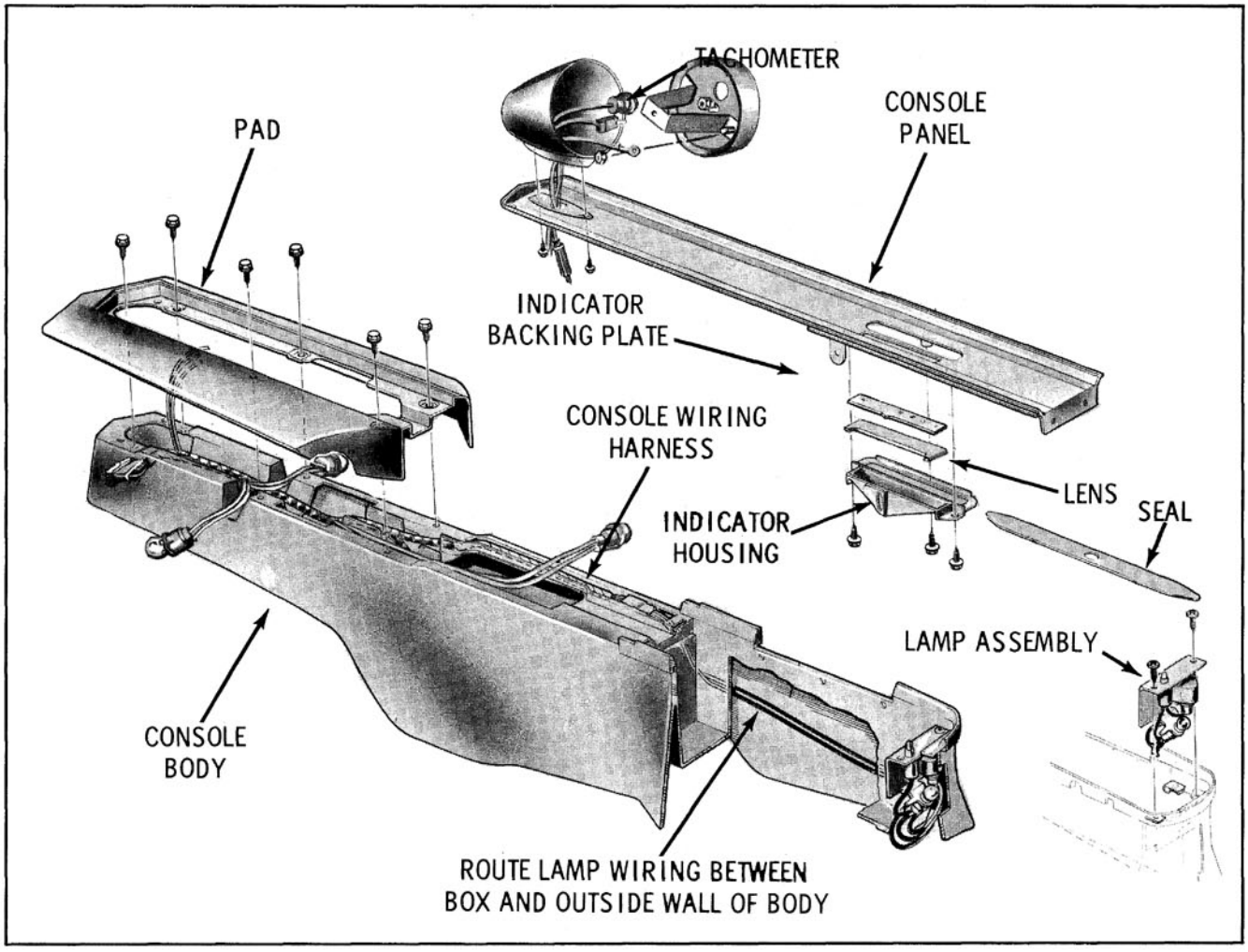


Fig. 12-115 Console Assembly - Jetaway

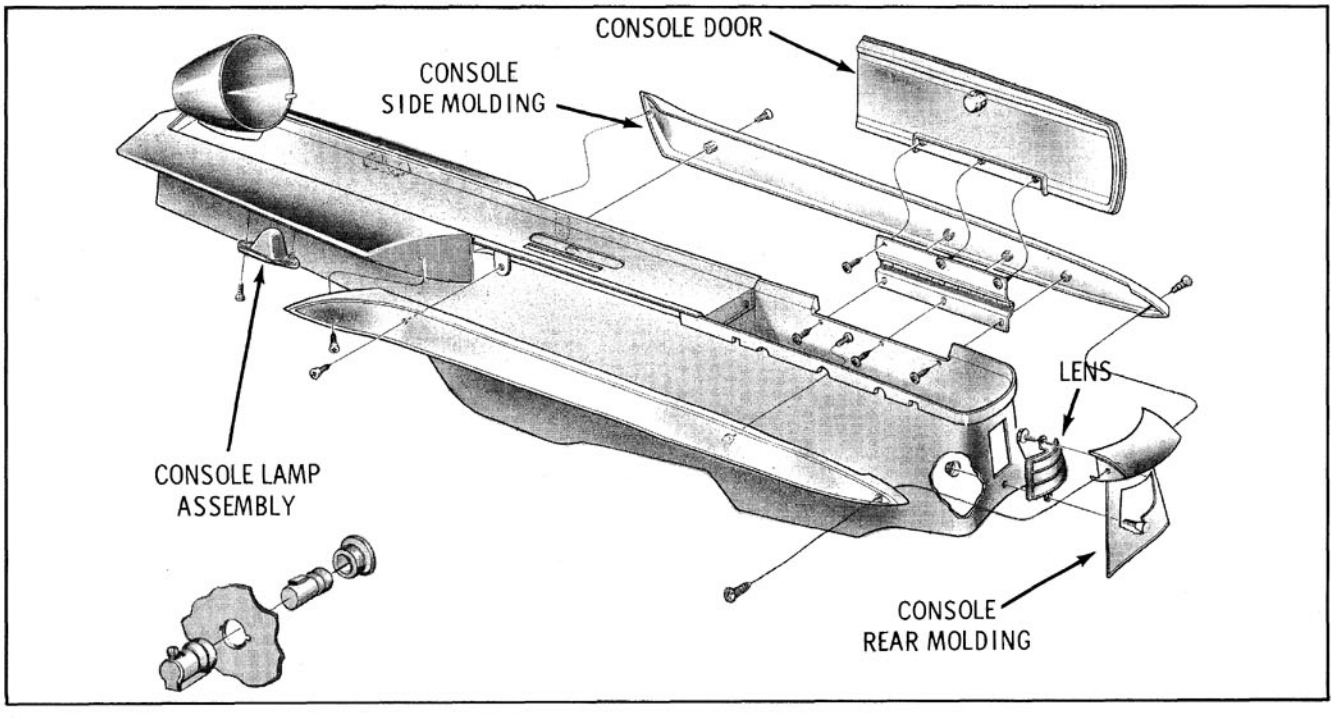


Fig. 12-116 Console Moldings

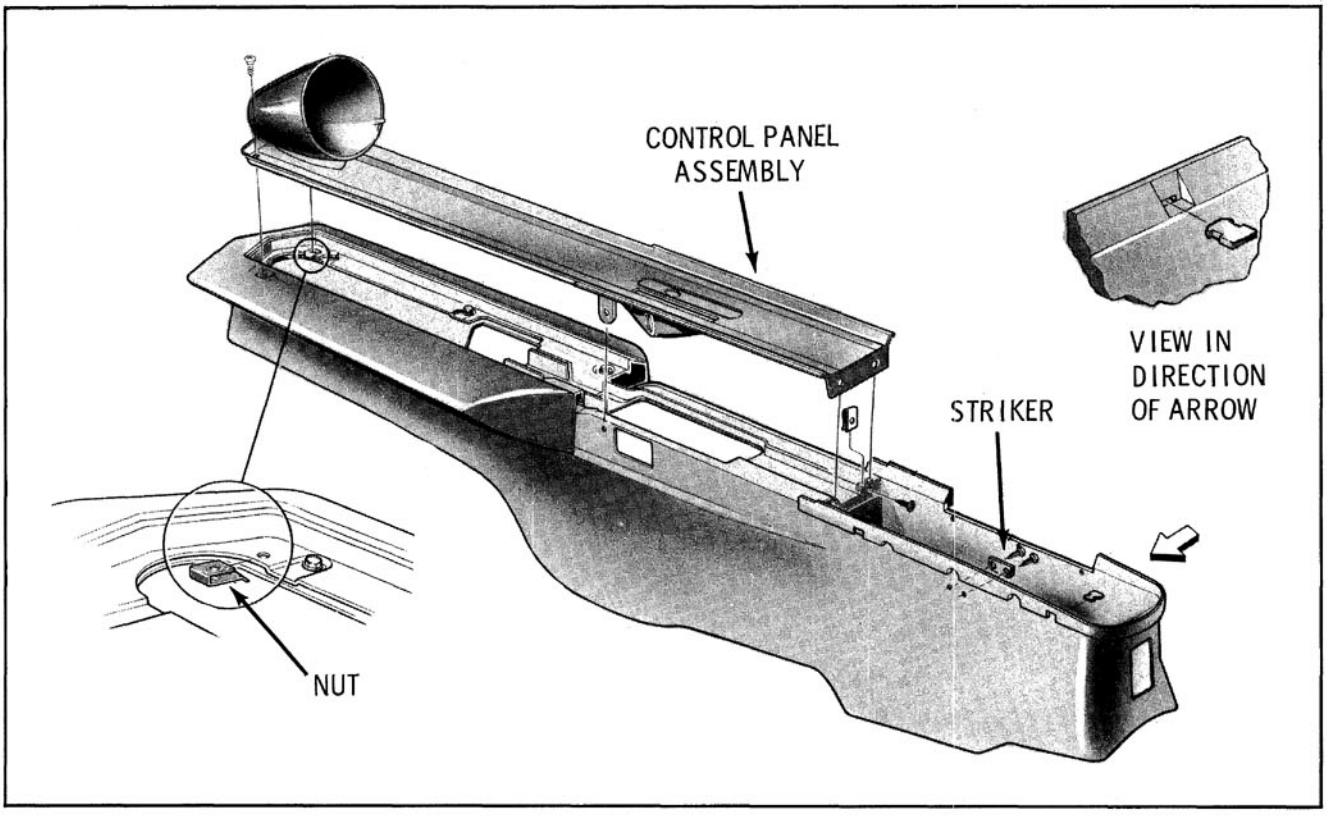


Fig. 12-117 Control Panel to Console Attachment

3. From the top of the console panel, remove the two retaining screws.

4. Remove the two forward side molding attaching screws from each side.

5. Loosen the console door hinge attaching screws.

6. Spread the console side moldings apart and lift off the console control panel. (Fig. 12-117)

   NOTE: It is not necessary to disconnect the tachometer.

7. Remove the three screws securing the shift indicator housing to the console panel and remove the plate and lens. (Fig. 12-115)

   The shift lever seal can be replaced after removing the console panel by sliding the seal forward.

TACHOMETER
(Synchromesh and Jetaway)

The tachometer can be removed for service by removing the bezel retaining screw located at the rear of the tachometer housing. After removing the attaching screw, pull the tachometer outward to disconnect the bulb, feed and ground wire.

Before replacing a tachometer, the following tests should be performed:

INOPERATIVE TACHOMETER

1. Check the tachometer ground connection by connecting a jumper wire to a good ground and holding the other end against the tachometer bezel. If the tachometer will now operate, a defective ground is indicated and must be corrected.

2. Check for loose connections or broken wire from the ignition coil to the console. Repair if necessary.

3. Check the tachometer fuse located inside the console by replacing it with a known good fuse. (AGA-2 amp.)

4. If the tachometer is still inoperative, remove it from the console. After removal, inspect the connector and ground wire at the back of the tachometer for loose connections. Repair if necessary.

5. Connect a jumper wire between the terminal of the tachometer and the negative side of

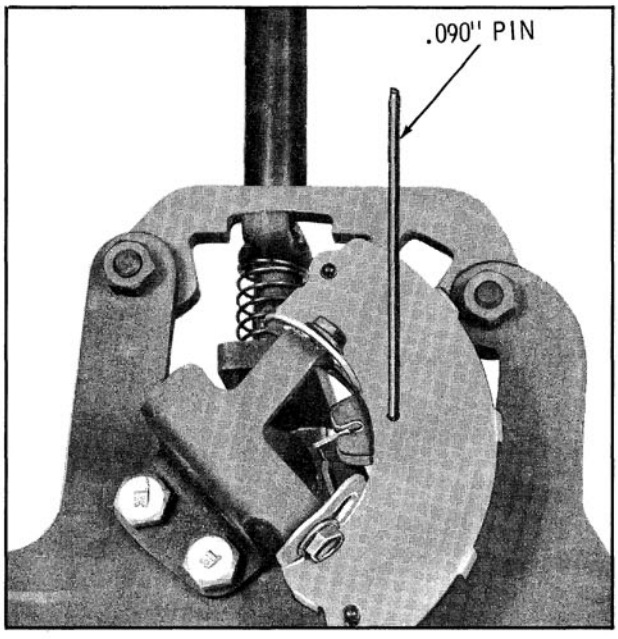


Fig. 12-118 Adjusting Switch

the coil. Connect another jumper between the tachometer ground and a good ground on the car. Start the engine and observe tachometer operation. If the tachometer now operates, the trouble is not in the tachometer assembly and Steps 1 through 3 must be rechecked to locate the trouble.

6. If the tachometer is still inoperative, it must be replaced.

INACCURATE TACHOMETER

If the tachometer is inaccurate, it must be calibrated against a known accurate tachometer, such as one used in engine tune-up work. Calibration is performed as follows:

1. Remove tachometer from console.

2. Remove calibration hole cover (brass plug or tape) from back of tachometer case.

3. Connect jumper wire between the terminal of the tachometer and the negative side of the ignition coil. Connect another jumper between the tachometer ground and a good ground on the car.

4. Start the engine.

5. Accelerate engine to 2000 rpm indication on the tune-up tachometer.

6. Insert a small screwdriver through the hole and into the adjusting slot, turn the screwdriver slowly until the tachometer reading agrees with the tune-up tachometer.

7. Vary engine rpm from idle to 2000 rpm. Electronic tachometer indication should be smooth throughout range of operation and comparable to the test tachometer.

8. Replace the hole cover.

9. Turn off engine, disconnect jumpers and install tachometer. Make sure all connections are tight and electrically secure.

HANDLE ASSEMBLY

Refer to Fig. 12-114 for assembly and adjustments.

NEUTRAL SAFETY AND BACK-UP LAMP SWITCH

The neutral safety switch mounted inside the console and attached to the shift lever bracket prevents the starting of the car with the transmission in gear. The engine may be started in NEUTRAL or PARK position only.

Adjustment

1. Remove console.

2. Loosen the switch attaching screws.

3. Set shift lever in "D" position within .020" of stop.

4. Position the switch so that a .090" gauge pin can be inserted into the hole as indicated in Fig. 12-118.

5. Tighten the switch retaining screws and remove the gauge pin. Recheck adjustment.

MANUAL LEVER ADJUSTMENT

The manual lever adjustment provides for proper clearance between the neutral detent in the transmission and the stop for the selector lever in the console.

1. Place selector lever in "D" position.

2. Remove the retainer from the manual rod and disengage rod from the manual lever. (Fig. 12-119)

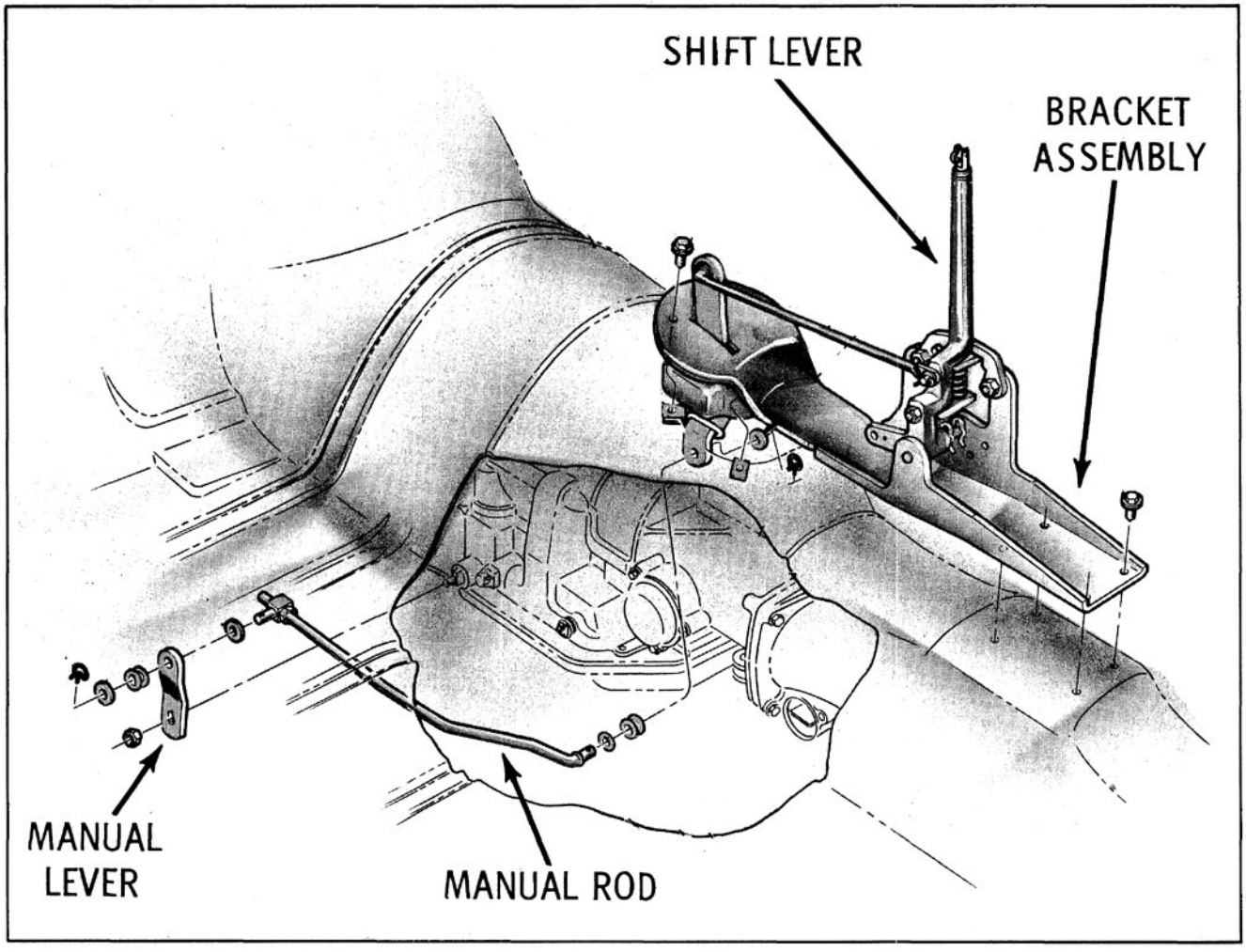


Fig. 12-119 Manual Rod

3. Position manual lever in "D" detent. (Fig. 12-120)

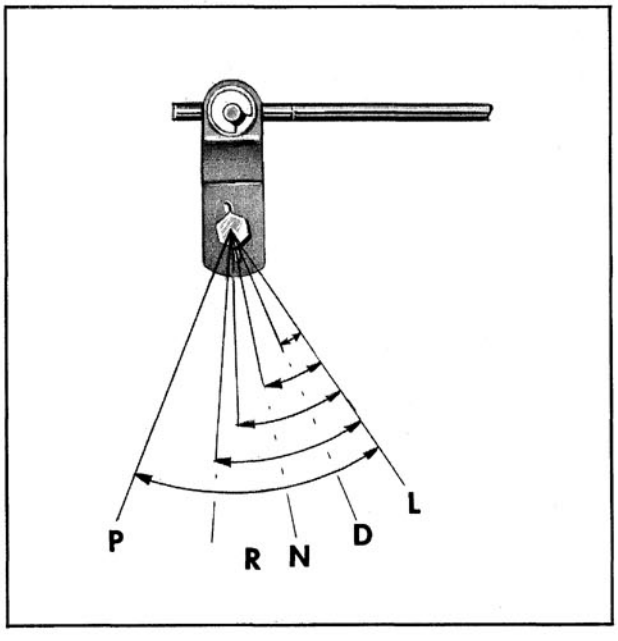


Fig. 12-120 Manual Lever

4. Adjust the swivel on the manual rod to free pin, then shorten rod one-half turn.

5. Tighten swivel locknut.

6. Install washers and retainer.

PAD ASSEMBLY (Fig. 12-115)

To replace the pad assembly it is necessary to remove the side moldings and console panel to gain access to the six pad attaching screws.

CONSOLE ASSEMBLY (Synchromesh—Includes 3300 Series)

The console assembly is attached to three mounting brackets by six screws. Four screws are accessible inside the glove box and two screws are located at the rear of the trim panel on the top surface. (Fig. 12-121) To remove the

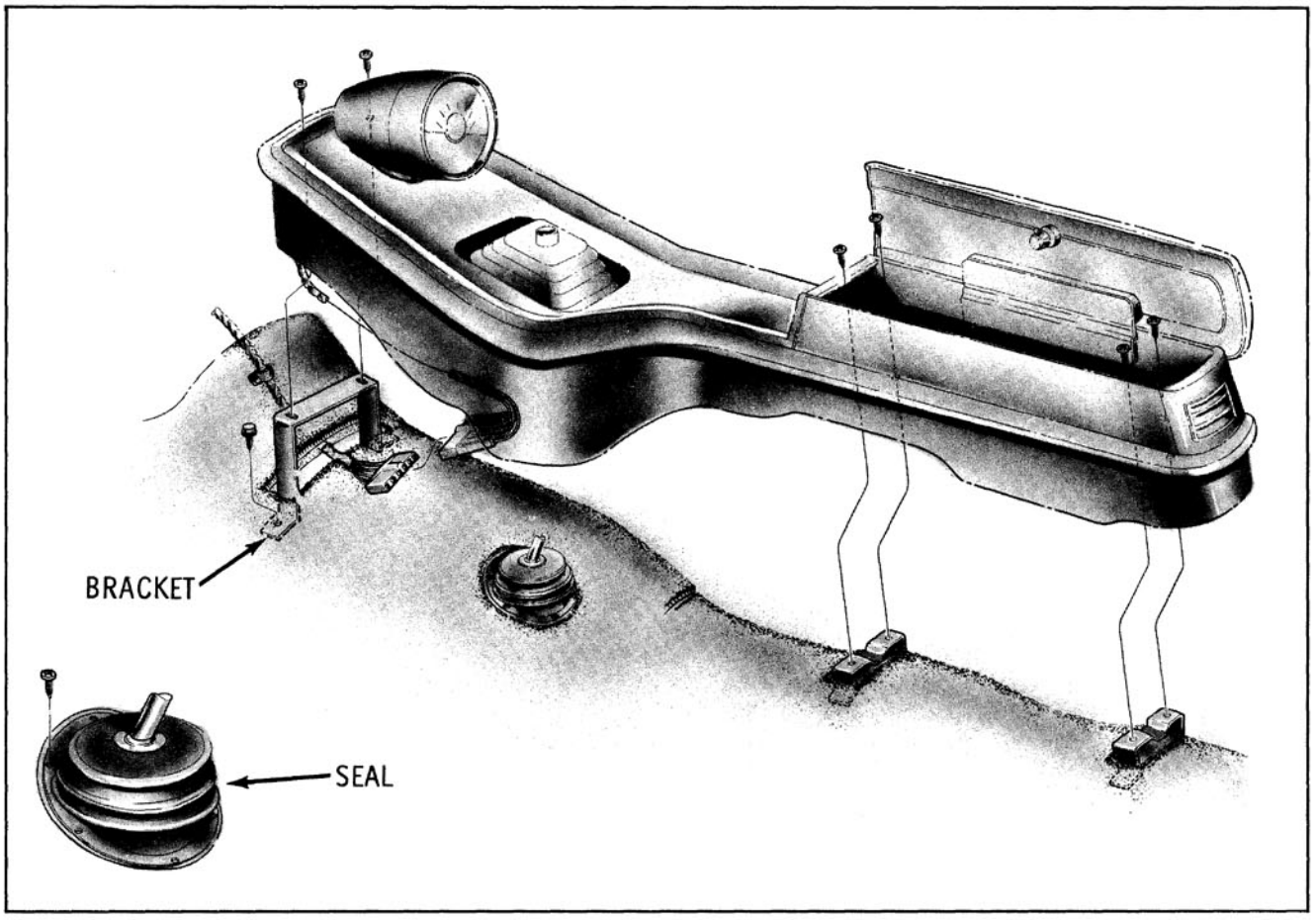


Fig. 12-121 Console Mounting - Synchromesh

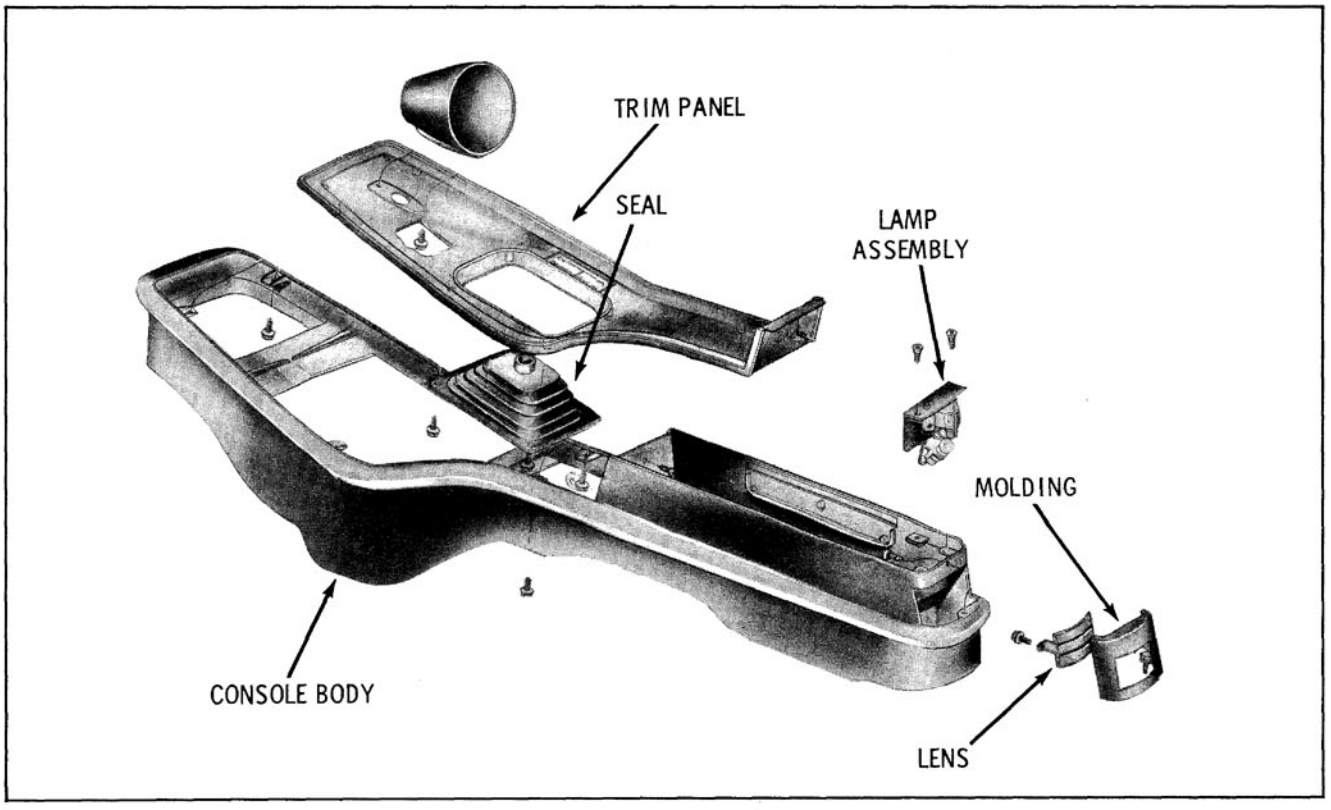


Fig. 12-122 Console Assembly - Synchromesh

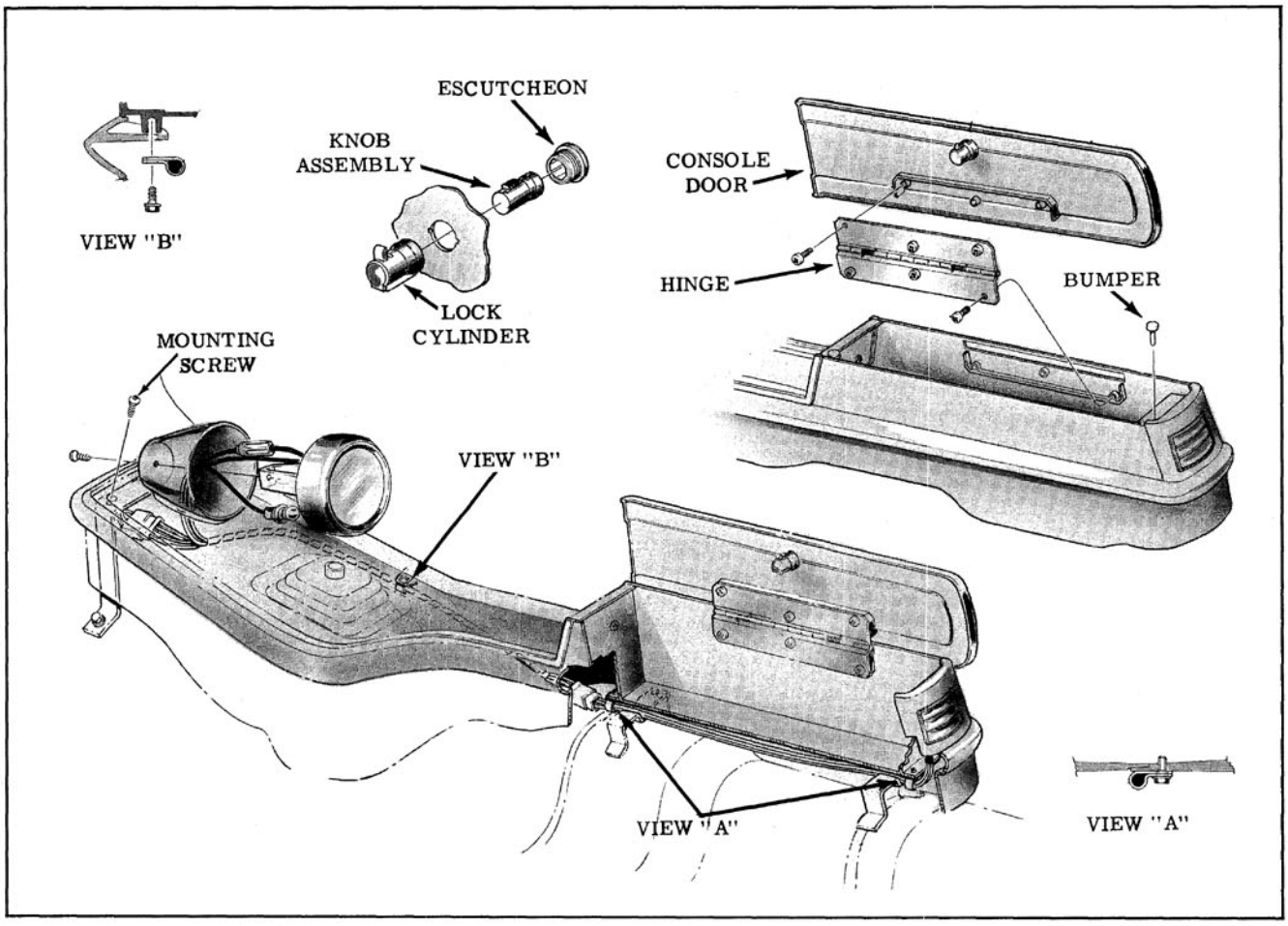


Fig. 12-123 Console Wiring and Mounting

console, remove shift lever knob, remove the six attaching screws and lift the console to disconnect the wiring connector.

TRIM PANEL (Fig. 12-122)

The trim panel is attached to console body by seven screws. Six of the attaching screws are accessible from the button side and can be removed after removing the console. One attaching screw is accessible inside the glove box.

TACHOMETER

Refer to Fig. 12-123 for removal and installation. For checking procedures, refer to TACHOMETER - JETAWAY CONSOLE.

SHIFT LEVER SEALS

Refer to Fig. 12-121 and Fig. 12-122.

COURTESY LAMP

Refer to Fig. 12-122.

CONSOLE WIRING (Jetaway and Synchromesh)

For wiring schematic refer to Fig. 12-124. Console wiring under the instrument panel is illustrated in Fig. 12-125 and tachometer wire routing in the engine compartment is illustrated in Fig. 12-126.

FLOOR SHIFT SEAL

For floor shift lever seal and retainer installation refer to SYNCHROMESH and CLUTCH 30-31-32 Series.

RADIO

The radio consists of the receiver unit and the speaker unit. The serial number plate on the radio is located on the RH side of the receiver chassis and it can be seen by removing the glove box.

The radio receiver has five push buttons for touch tuning. By depressing a push button, the

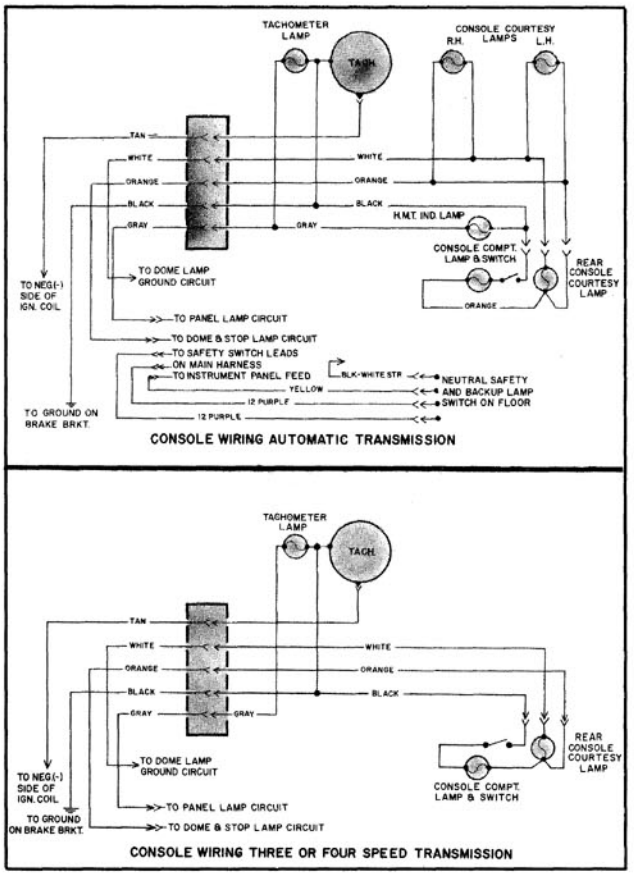


Fig. 12-124 Console Wiring

receiver can be mechanically tuned to a preselected station. The RH control knob can be selected normal manual selection of stations. The LH control knob is the ON-OFF volume control switch. The tone control knob is stacked on the left hand shaft behind the ON-OFF volume control knob.

On cars equipped with a rear seat speaker, a variable resistor control located behind the manual tuning knob (RH knob) modulates both the front and rear speakers simultaneously. As the control is rotated clockwise, the volume of the front speaker increases while the volume of the rear speaker decreases. As the control is rotated counterclockwise, the volume of the front speaker decreases while the volume of the rear speaker increases. After the desired speaker modulation is obtained, the volume of both speakers can be simultaneously regulated by the volume control knob.

Pushbutton Adjustment

1. Allow the receiver to warm up for a few minutes.
2. Select a pushbutton for the desired station. Holding the button to the left, pull the button out to the extreme position.
3. Tune in the desired station manually.
4. Push the selected button to its maximum IN position. The button will then be locked on the selected station.

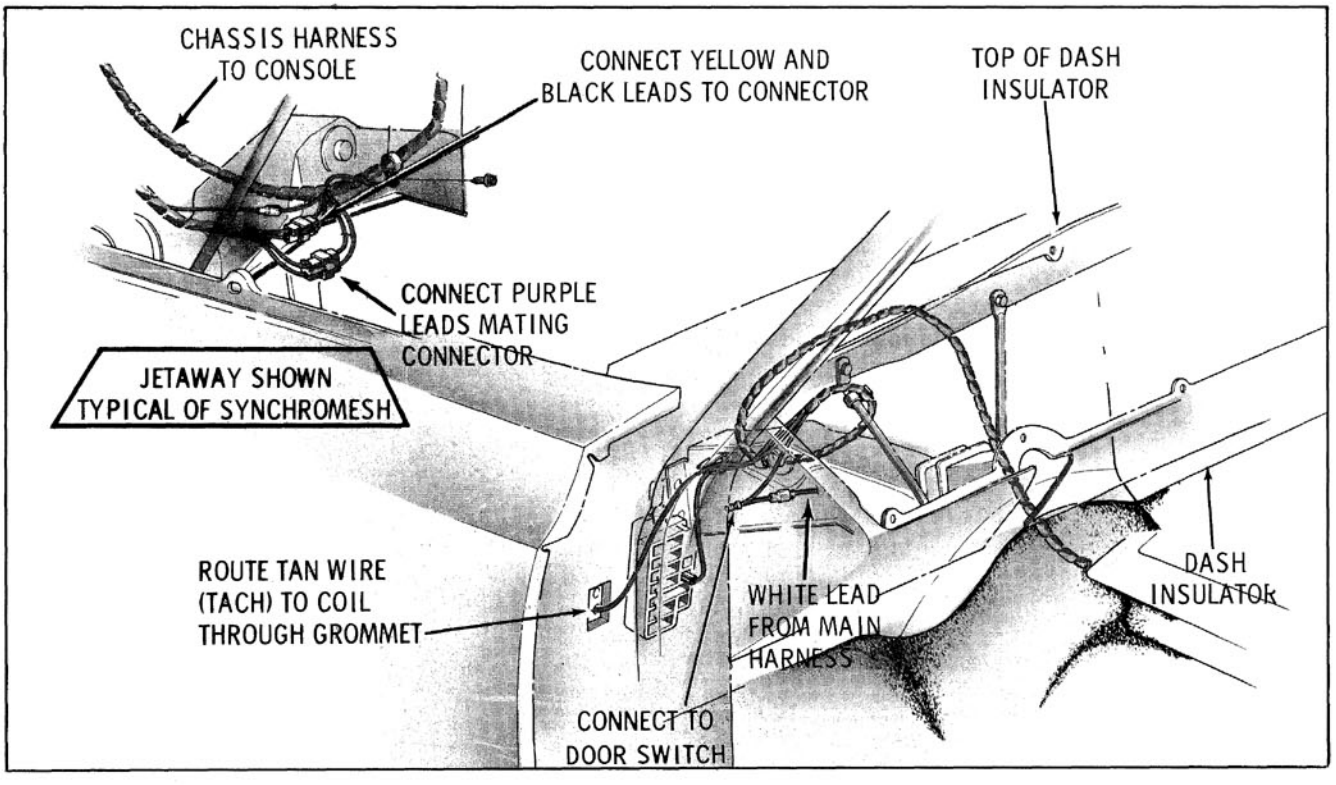


Fig. 12-125 Console Wiring Under Instrument Panel

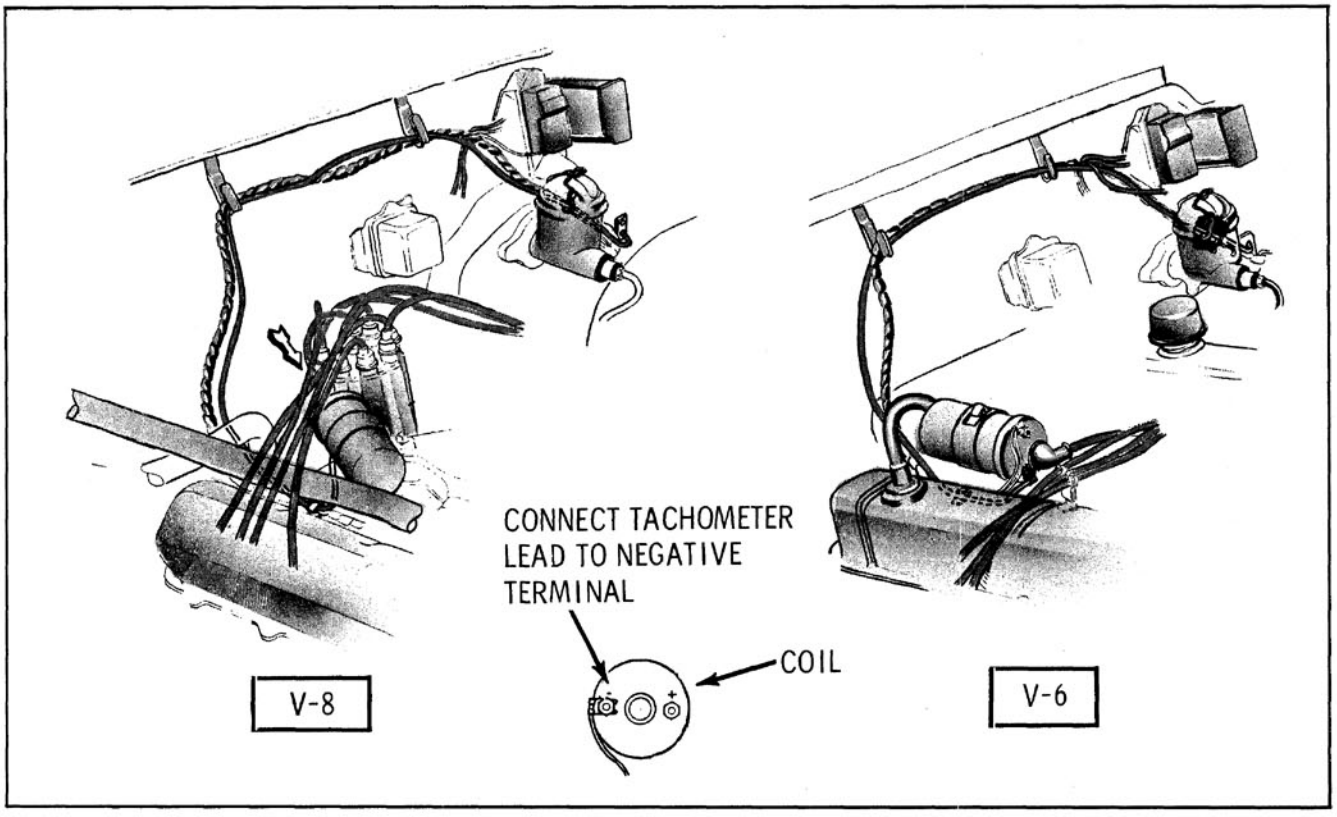


Fig. 12-126 Tachometer Wire Routing

5. Proceed in the same manner to set the remaining pushbuttons.

6. After all the buttons have been adjusted, recheck the settings. Push each button, then see if the station can be tuned in more accurately manually. If so, repeat Steps 2, 3 and 4.

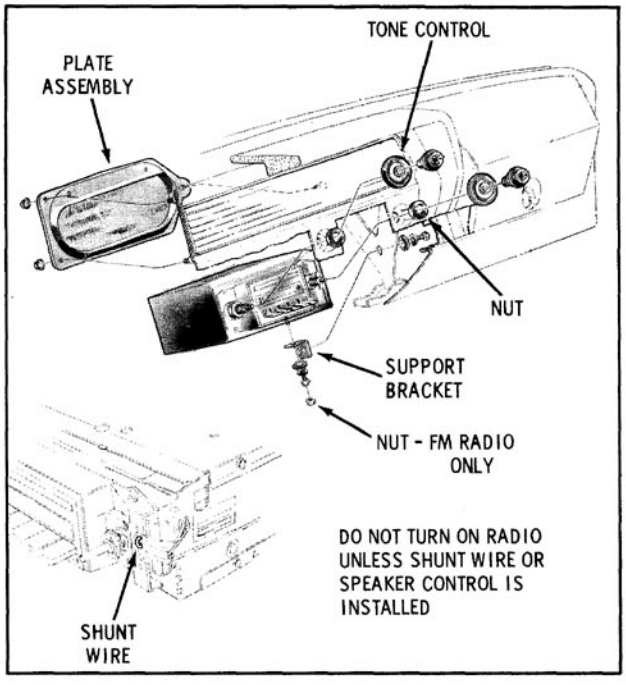


Fig. 12-127 Radio Mounting

RECEIVER

Removal and Installation

1. Disconnect antenna lead.

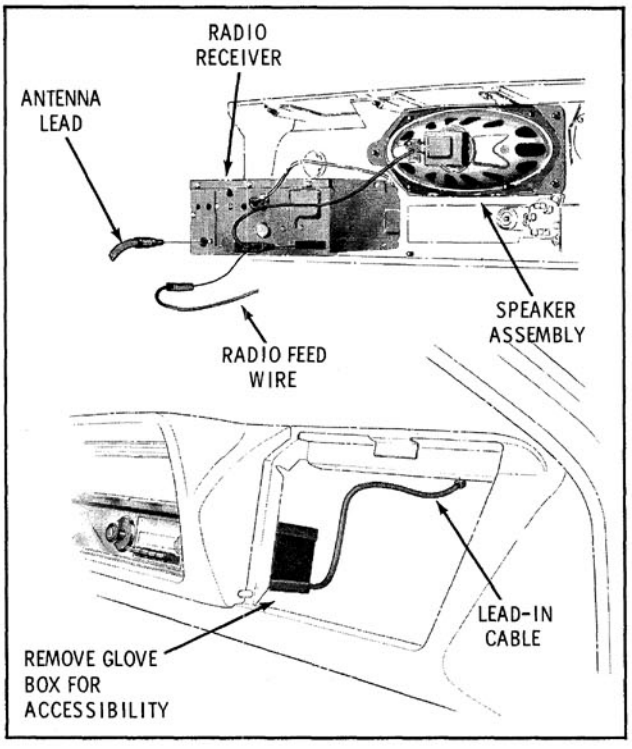


Fig. 12-128 Speaker Attachment

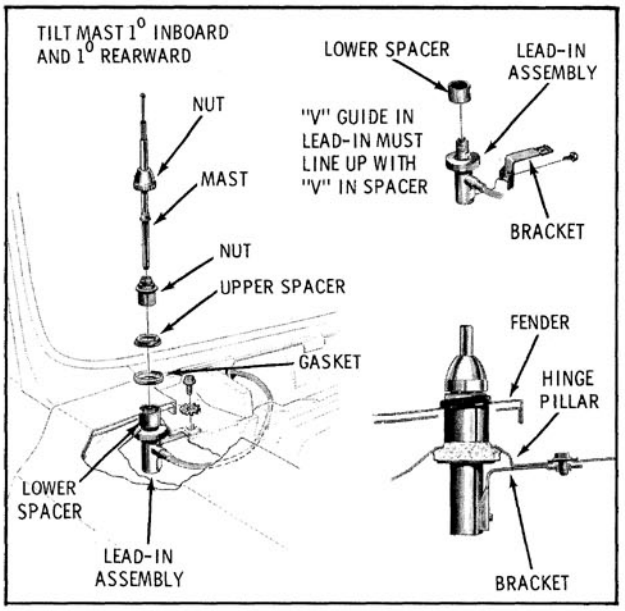


Fig. 12-129 Manual Antenna

2. Disconnect front speaker connection and rear speaker wire if so equipped.

3. Remove bolt securing bracket to RH instrument panel support.

4. Remove both knobs.

5. While supporting radio, remove both nuts securing radio to instrument panel. (Fig. 12-127)

If equipped with air conditioning, it will be necessary to remove the manifold to gain removal clearance.

To install, reverse the removal procedure. Check radio operation.

SPEAKER

The speaker is attached to the instrument panel by three nuts as illustrated in Figs. 12-127 and 12-128. The speaker can be removed for service without removing the receiver.

RADIO DIAL LAMP

The radio dial lamp plugs into the top side of the receiver. It is not necessary to remove the receiver to replace the bulb, however, if car is equipped with air conditioning, it will be necessary to remove the glove box to gain access.

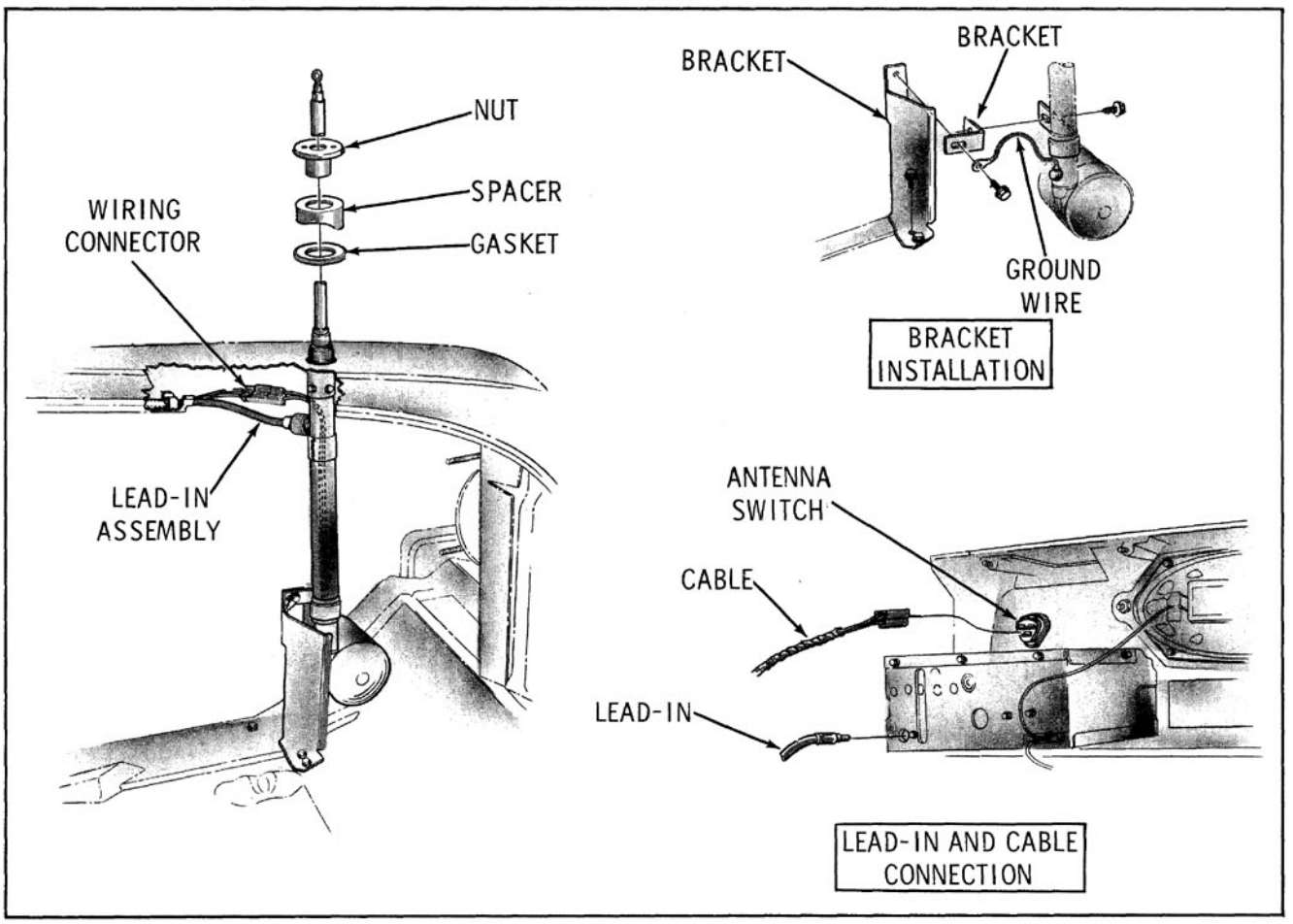


Fig. 12-130 Power Antenna

ANTENNA

TRIMMER ADJUSTMENT (Manual or Power)

1. Remove the right hand knob, trimmer screw is accessible through the hole in the control panel.

   NOTE: If car is equipped with rear seat speaker, install a shunt wire as illustrated in Fig. 12-127. If radio is operated without the shunt wire, damage will result to the output power transistor.

2. With antenna fully extended, turn the radio on.

3. Tune the radio to a weak station between 600 kc and 1000 kc. Adjust trimmer screw until the best reception is obtained for that station.

4. If a shunt wire was used, remove the shunt and replace the knob.

CHECKING ANTENNA (Manual or Power)

To check antenna for partial short, remove lead-in from rear of radio and check resistance from lead-in connector to a good ground using an ohmmeter. Resistance should be three megohmes or more.

Removal—Manual

To remove the antenna mast, loosen the antenna cap nut and lift the mast out of the socket. To remove the lead-in assembly, proceed as follows:

1. Remove windshield wiper arms.
2. Remove vent grille and screen.
3. Disconnect lead-in from radio and pull the cable through the hole in the plenum chamber.
4. Remove lead-in nut, upper spacer and gasket. (Fig. 12-129)
5. Remove the lead-in bracket attaching screw and washer.
6. Remove lead-in assembly and lower spacer by reaching through the plenum chamber.

When installing, be sure to align the lower spacer to the lead-in as illustrated in Fig. 12-129.

Removal—Power

Power antennas are installed as illustrated in Figs. 12-130 and 12-131. The lead-in cable is routed in the body channel and behind the dash insulator.

Disassembly (Fig. 12-132)

The following parts of the power antenna are serviceable: Drive Assembly, Mast Assembly and Support Tube Assembly. To service any of these parts, proceed as follows:

1. Remove the two connector-to-support tube screws and remove connector.
2. Unsolder hook-up wire at pin and remove pin and insulator assembly.

   NOTE: Do not overheat pin by slow soldering as the pin insulator will be destroyed.

3. Remove the three support tube-to-drive assembly screws.
4. While applying a back and forth rotary motion, pull until support tube is removed from antenna.
5. If the drive assembly or mast assembly is to be replaced, proceed as follows:

   a. While applying a rocking motion, pull on mast until insulator bushing is removed from the drive assembly tubular fitting.

   b. Energize motor until entire length of nylon cord is expelled from drive assembly. To prevent a kink or bend in nylon cord, keep it taut by pulling on mast.

      NOTE: If motor is inoperative, it will be necessary to manually remove the nylon cord from the drive assembly as follows:

   c. Place the assembly in a vise so that the normal plane of the nylon cord is parallel with the floor.

   d. Pull on nylon cord until it is completely expelled from the drive assembly.

      CAUTION: No attempt should be made to disassembly antenna further than Step 5-D.

Assembly

1. Thread nylon cord through bottom insulator, (small diameter end down) and water seal washer.
2. Energize motor and feed nylon cord into drive assembly. Do not allow nylon cord to bend or kink.

   NOTE: Push water seal washer and bottom insulator all the way down into tubular fitting (make sure that keyways in bottom insulator are rotated to key position) before nylon cord completely disappears into drive assembly.

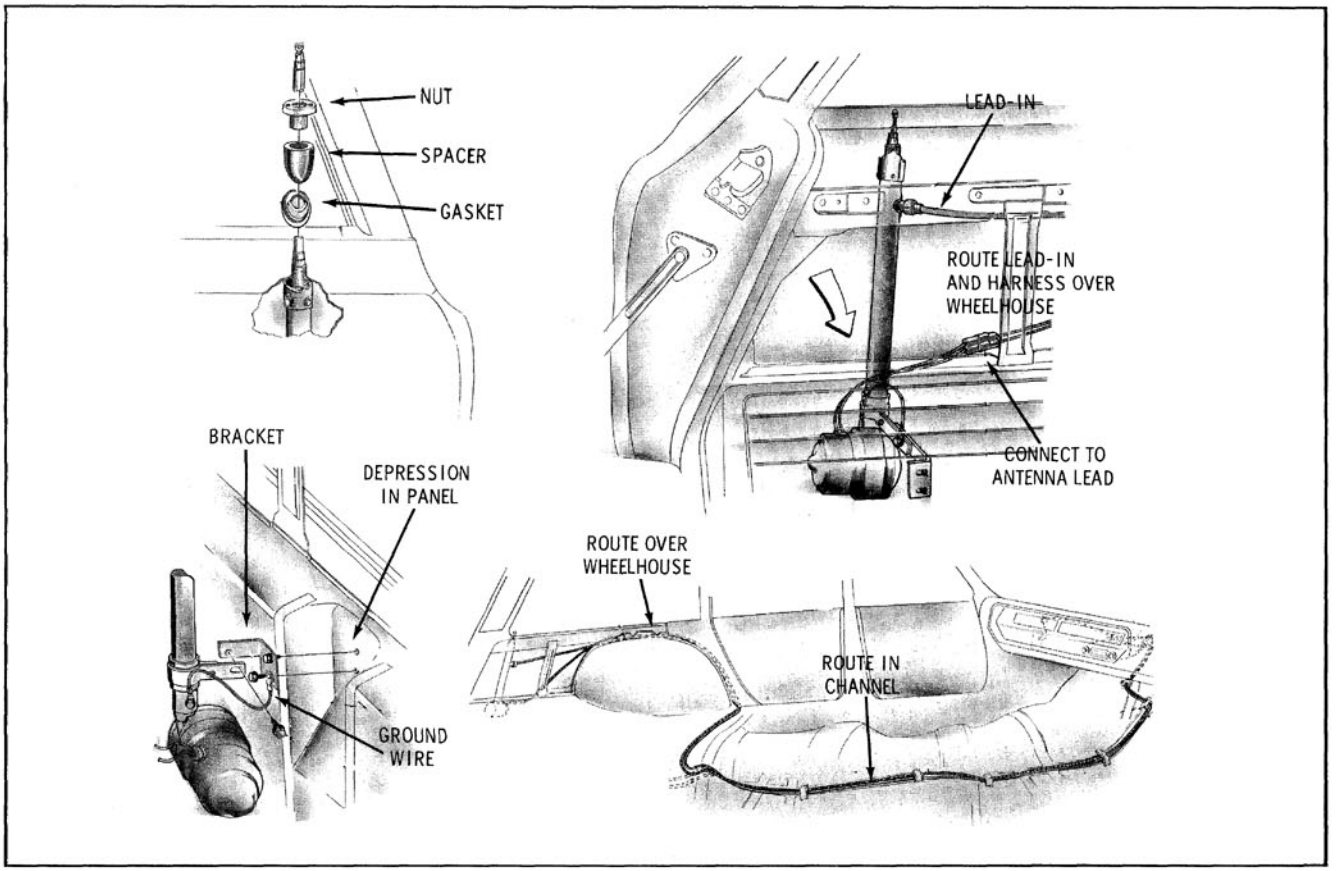


Fig. 12-131 Power Antenna - Station Wagon

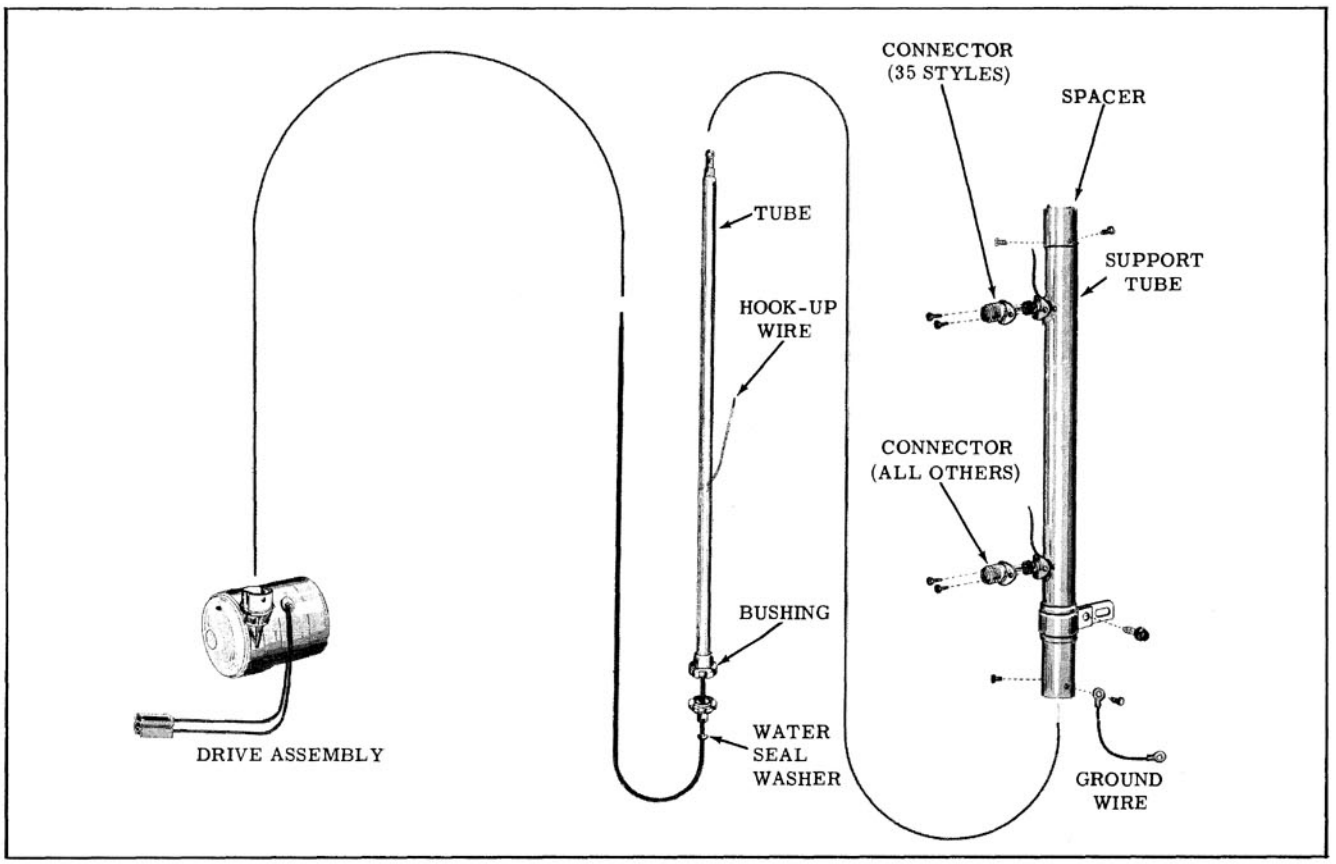


Fig. 12-132 Antenna Assembly

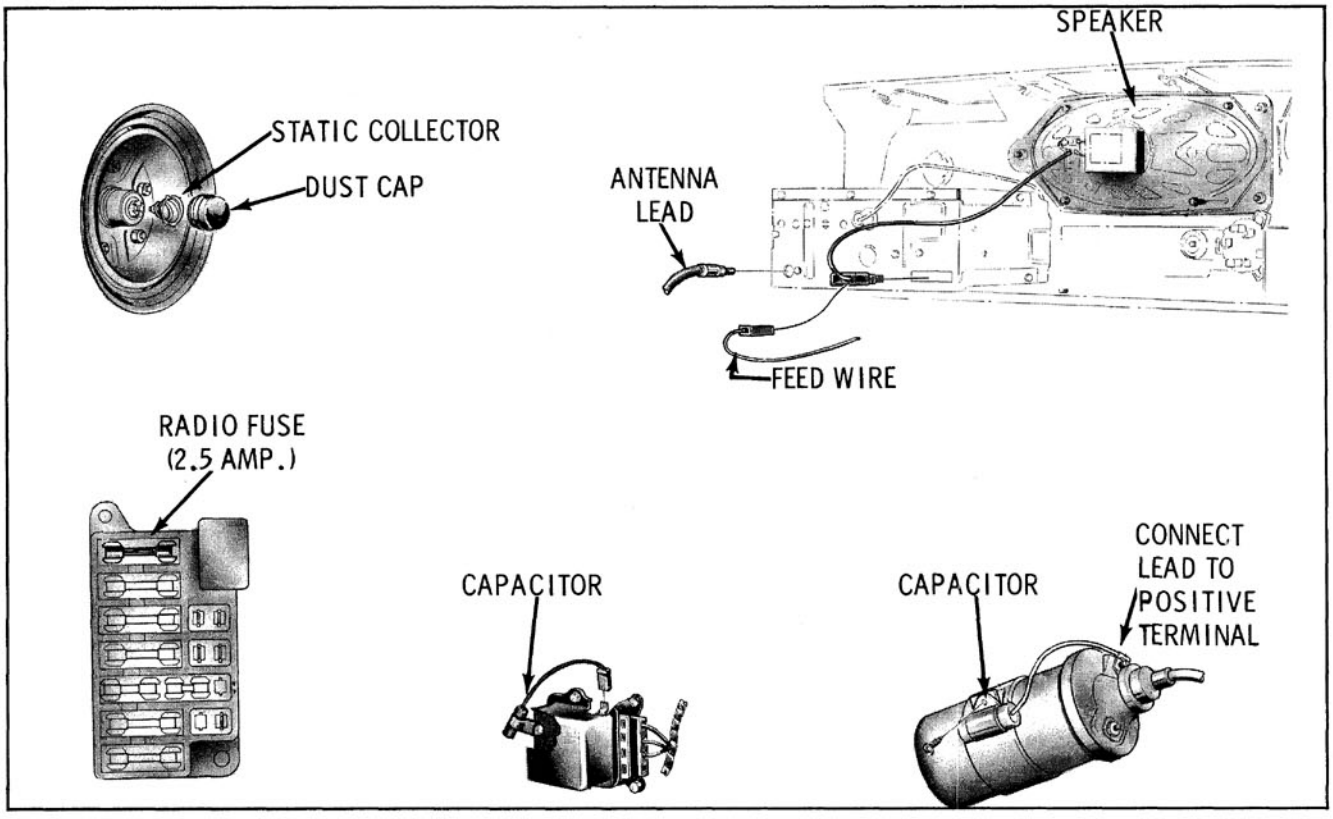


Fig. 12-133 Static Eliminators and Suppressors

3. Push mast assembly into tubular fitting, making sure that the upper edge of the insulator bushing is below the center of the three support tube-to-drive assembly screw holes.

4. Install support tube over mast assembly, making sure hook-up wire is extended through proper hole in support tube. Line up three holes in support tube and install the three screws.

5. Solder hook-up wire to pin and insulator assembly being careful not to overheat.

6. Install connector over pin and insulator assembly and install two screws.

Diagnosis

If antenna fails to operate properly, check the following possible sources of trouble:

1. Excessive tightening of cap nut on quarter panel will result in excessive operating noise in the car.

2. A stalled or slowly operating mast may be caused by bent or dirty mast sections. If dirty, wipe with oily cloth.

3. See that fuse is not burned out.

4. See that ground wire is tight.

5. To determine whether fault is in the antenna or the control circuit, disconnect the leads coming from antenna. Connect a jumper wire from a known hot source and touch jumper wire to each of the terminals of the wires coming from the drive assembly. If antenna does not operate, the fault is in the antenna drive assembly. If antenna does operate, the fault is in the control circuit.

6. If trouble is in the control circuit:

   a. Examine electrical connections at switch, making sure they are securely connected.

   b. Check wiring at switch with lamp or motor.

If antenna lead-in is suspected of being bad, check radio operation using an antenna lead-in known to be good.

NOTE: If excessive static is encountered, check suppressors and static eliminators for proper installation. (Fig. 12-133)

CRUISE CONTROL

For service procedures, refer to INSTRUMENT PANEL AND ACCESSORIES section, 33-34-35-36-38-39 Series.

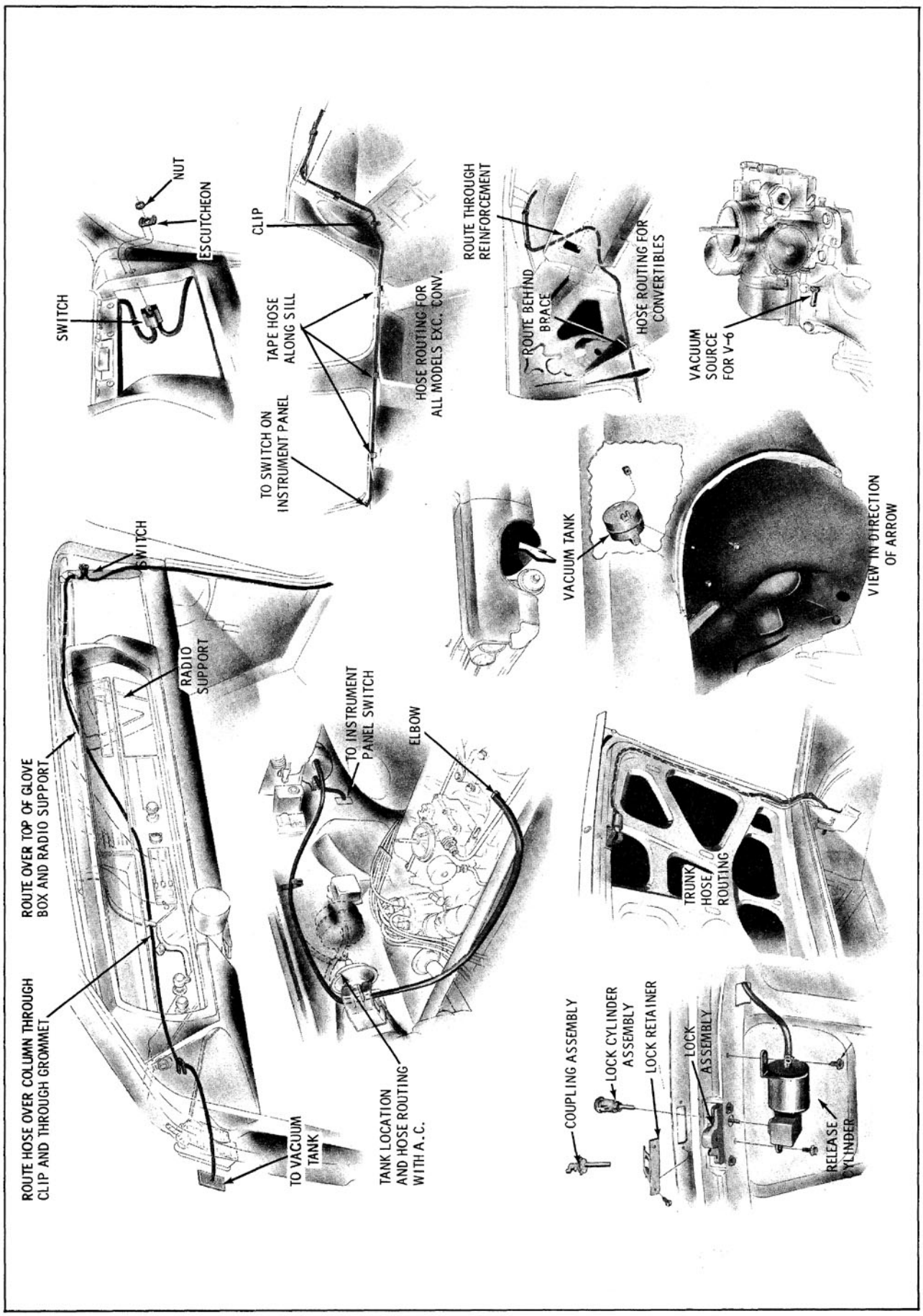


Figure 12-134 Vacuum Lid Latch

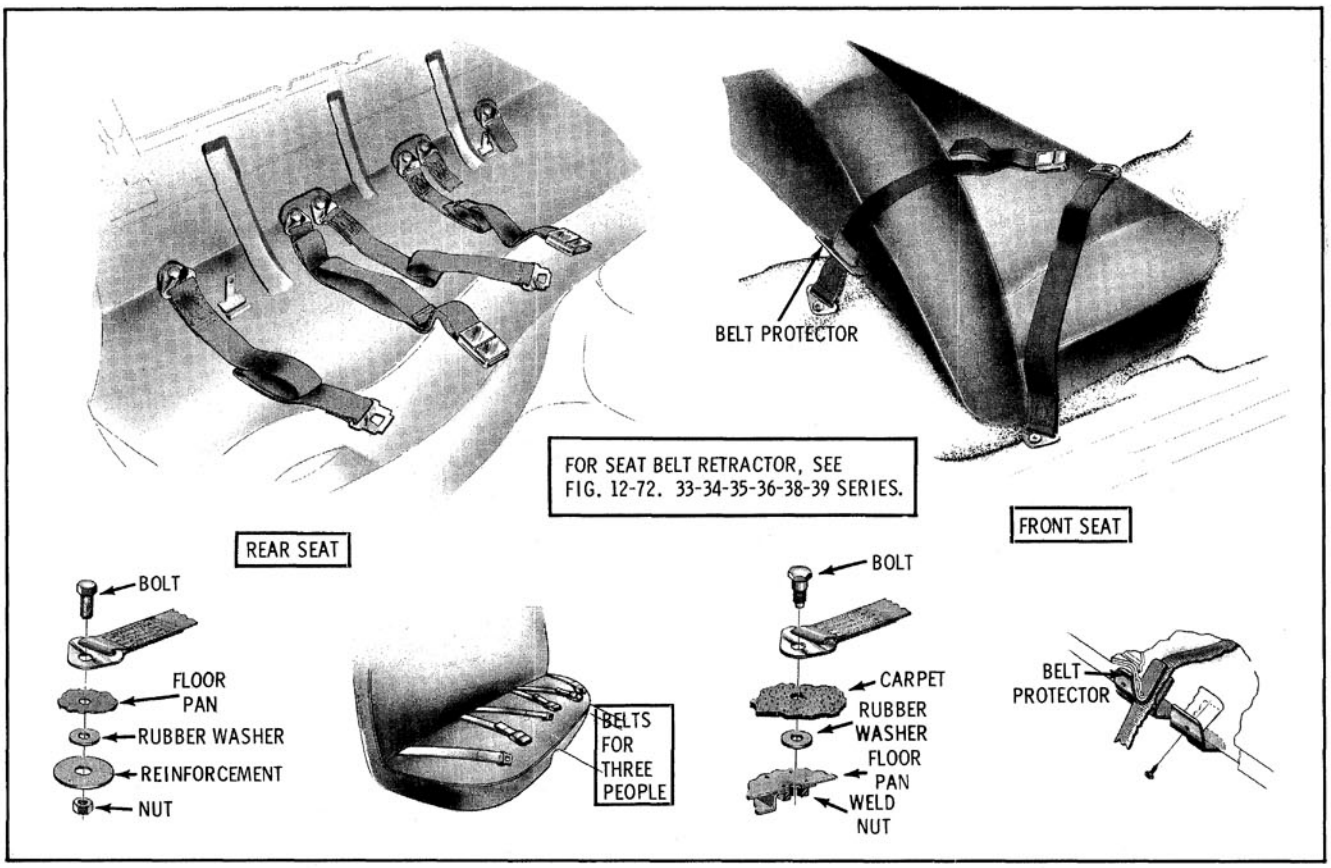


Fig. 12-135 Seat Belt Installation

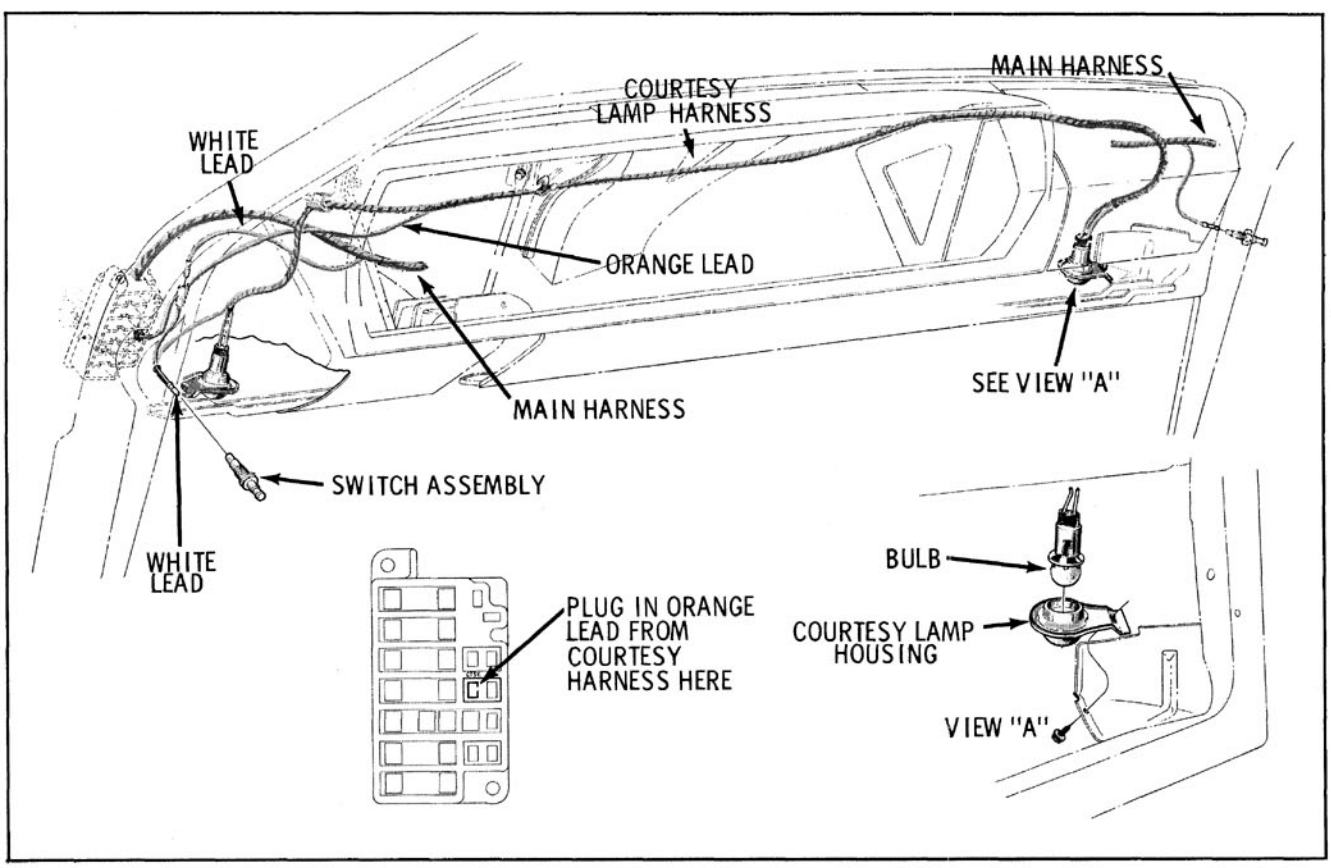


Fig. 12-136 Courtesy Lamp Installation

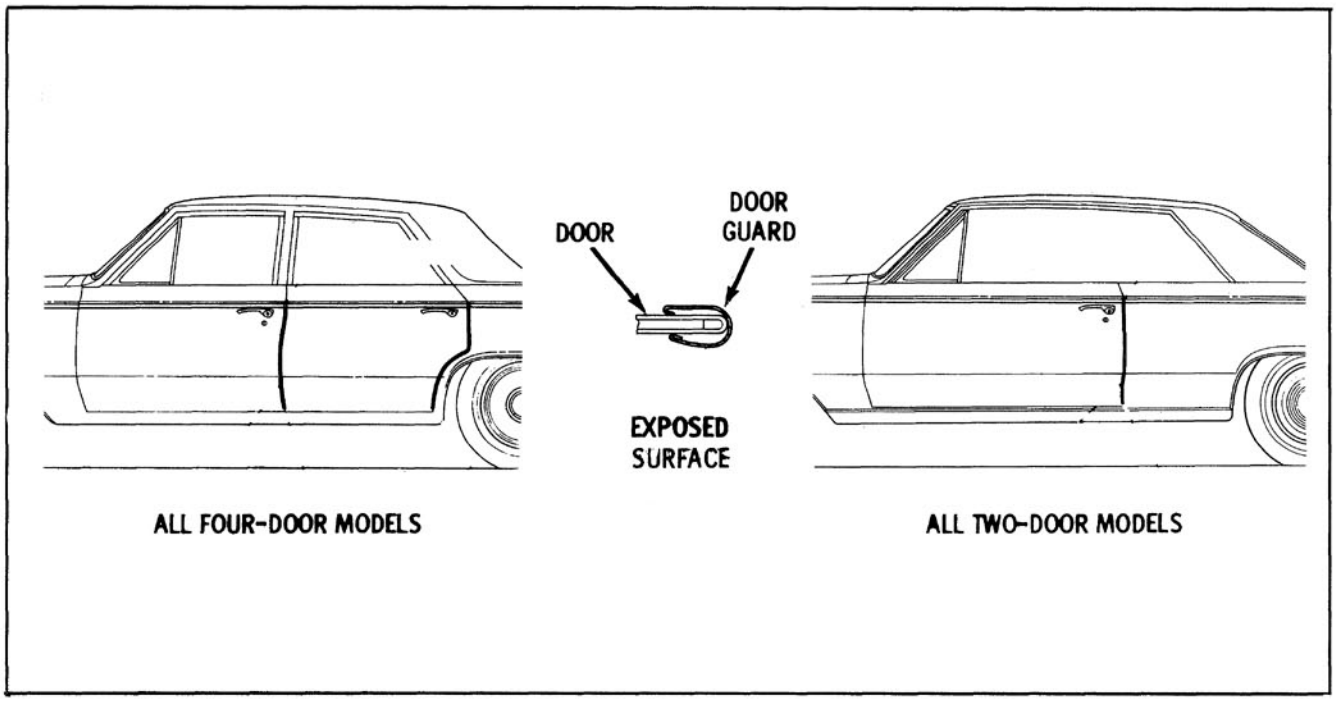


Fig. 12-137 Door Guards

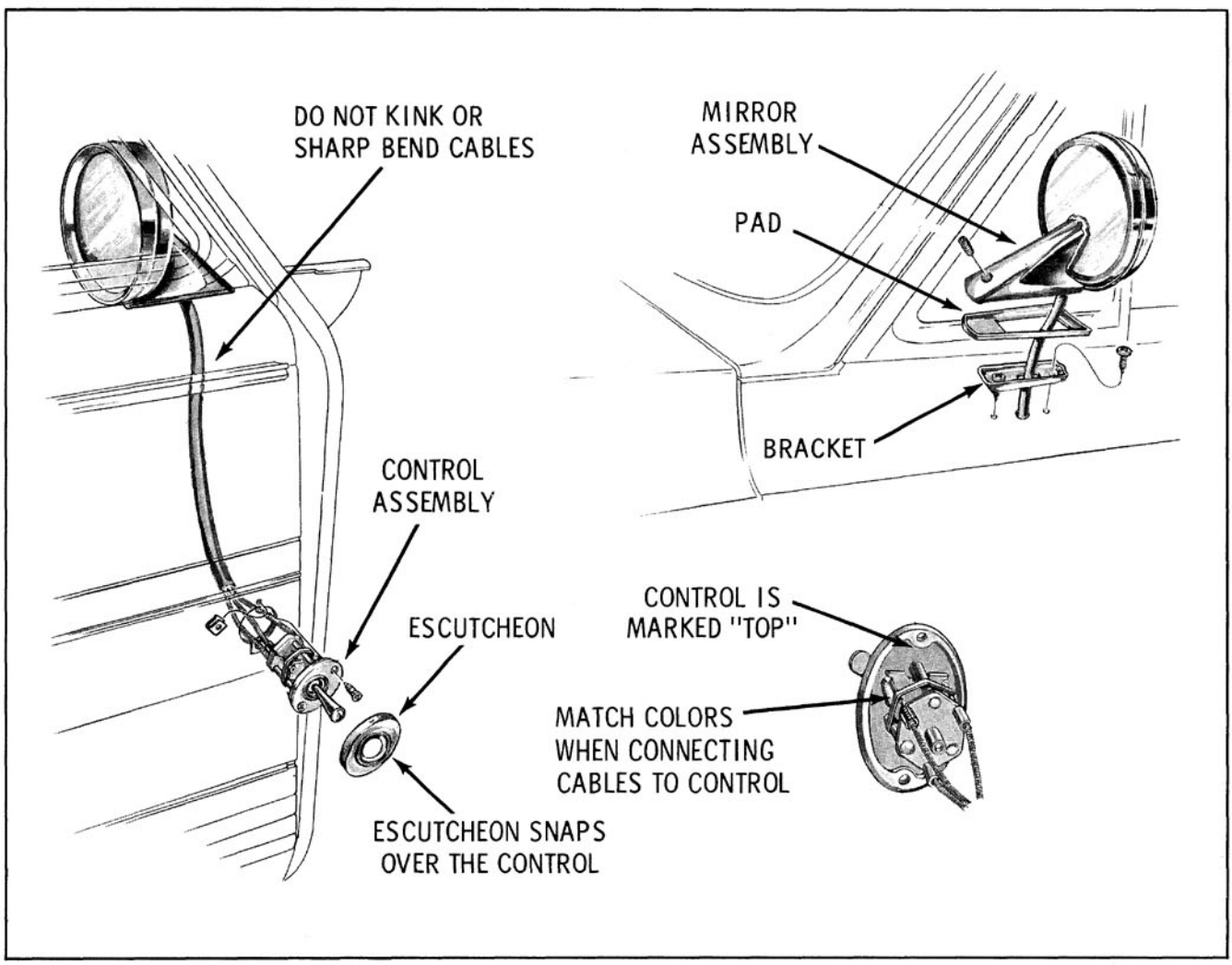


Fig. 12-138 Remote Controlled Mirror

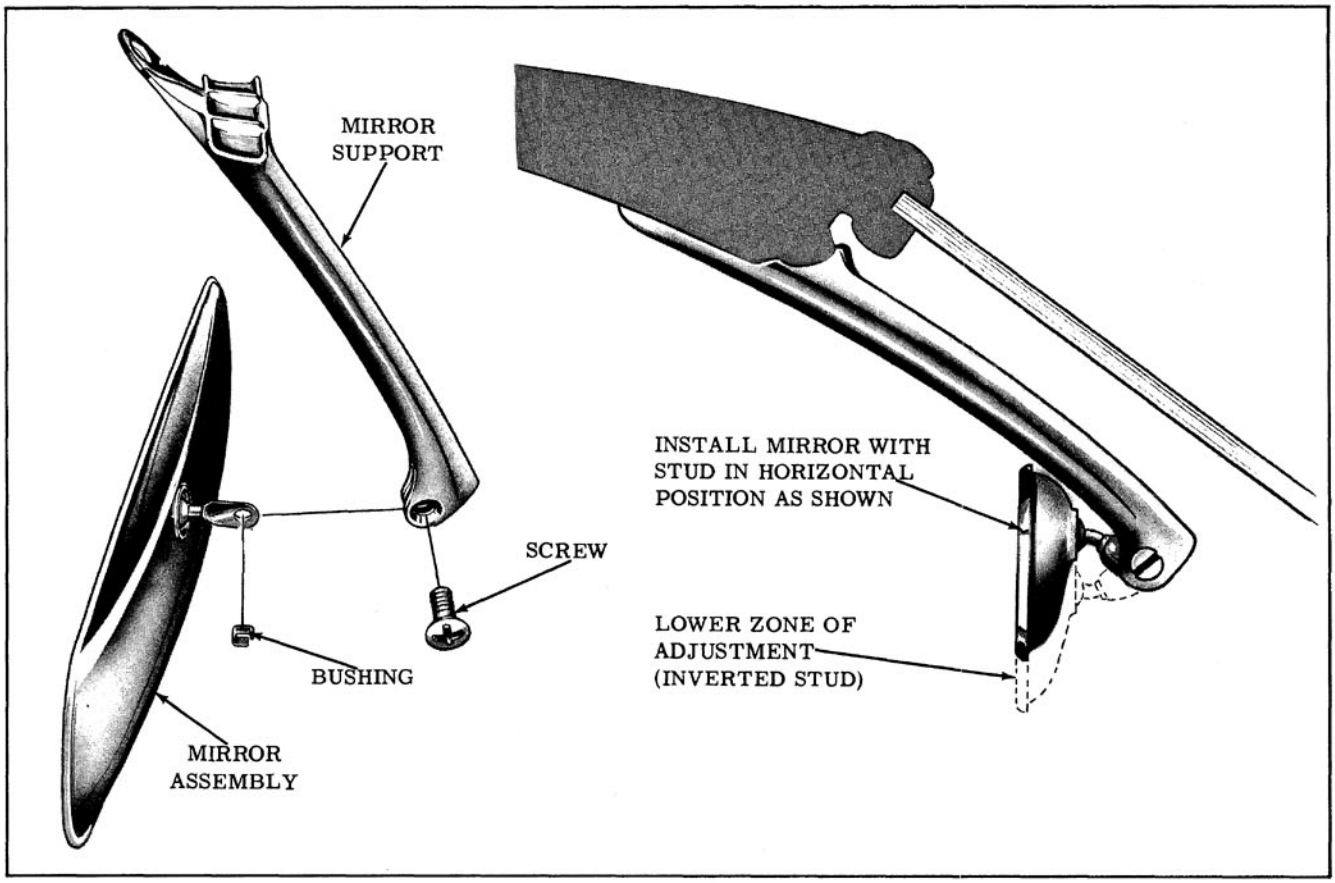


Fig. 12-139 Rear View Mirror

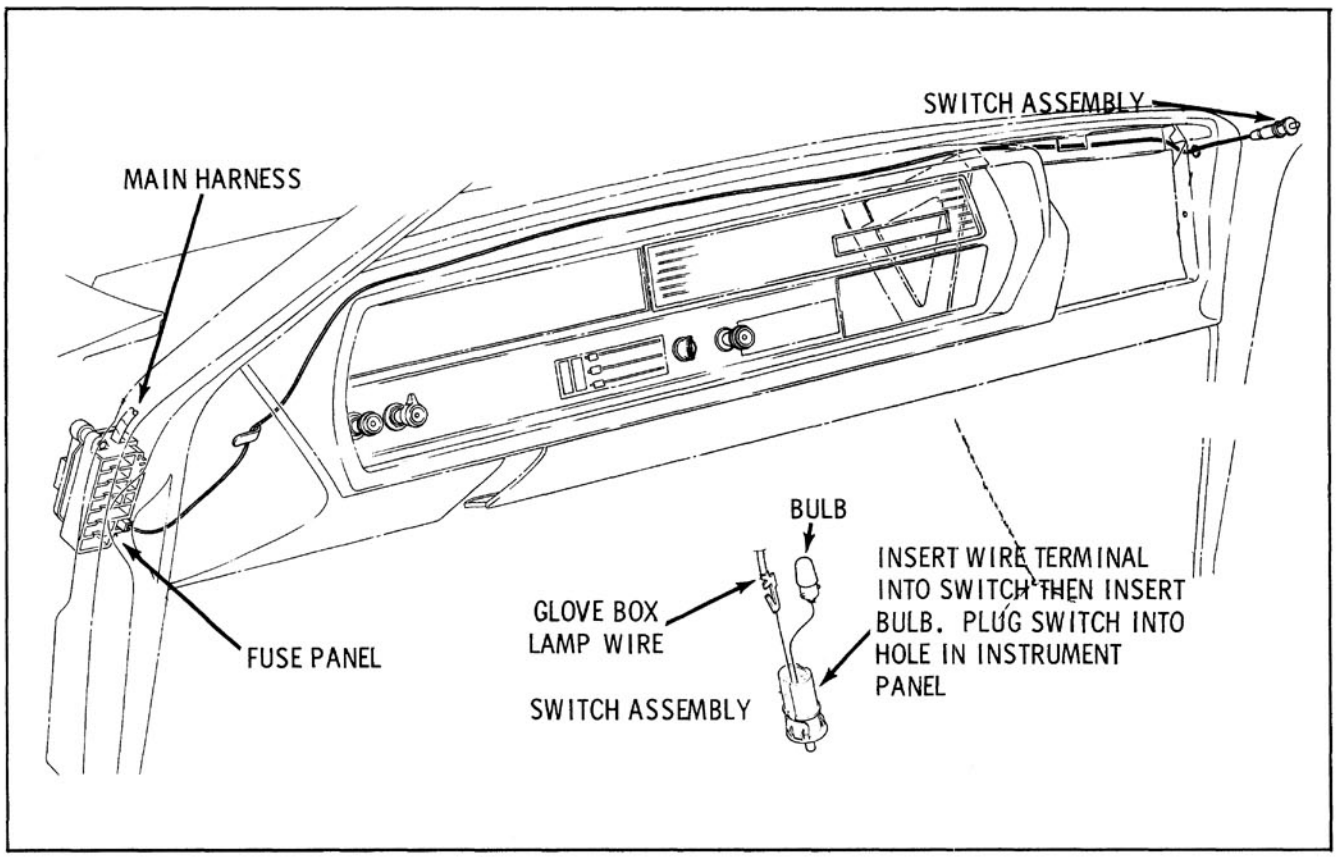


Fig. 12-140 Glove Box Lamp Installation

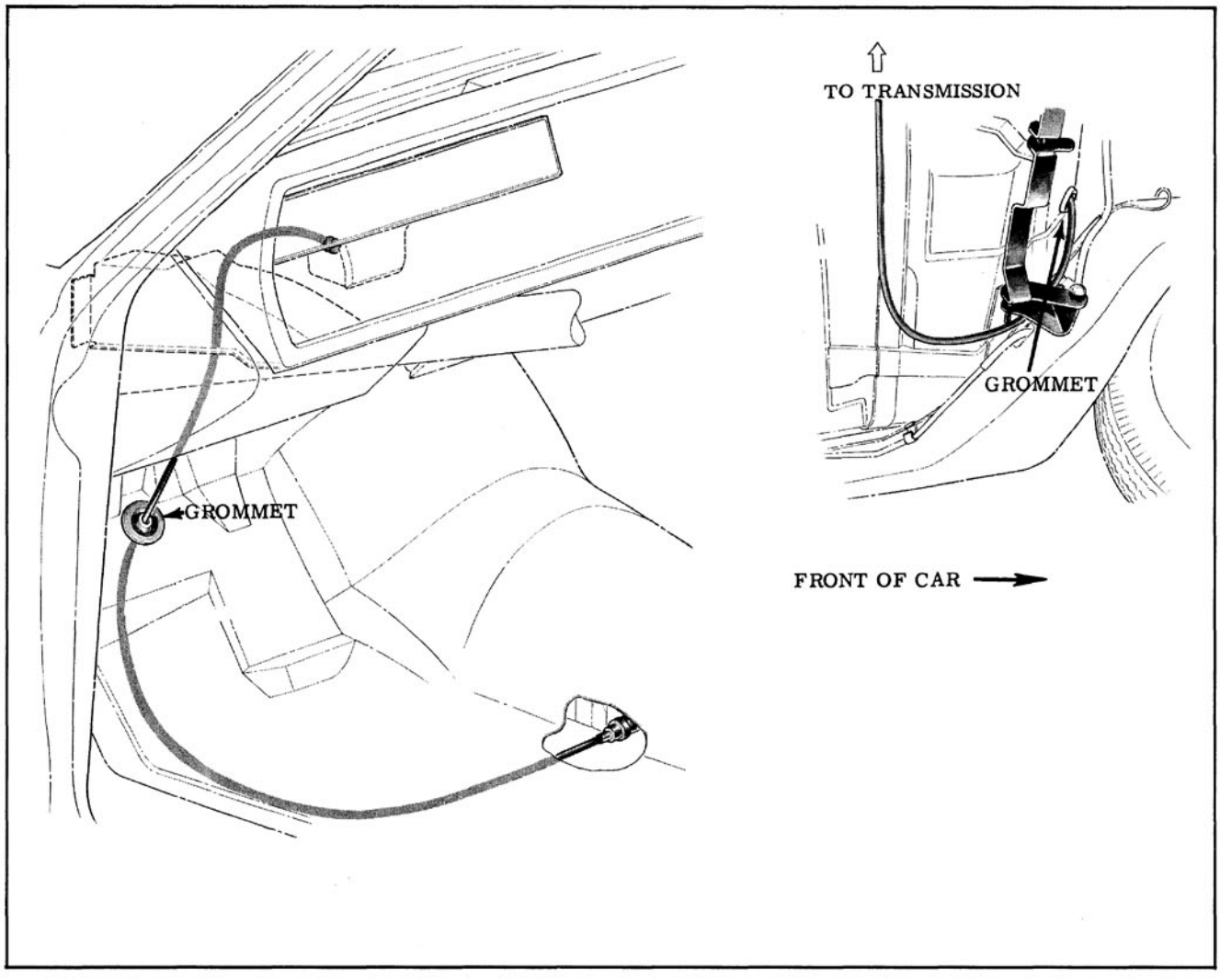


Fig. 12-141 Speedometer Cable Routing

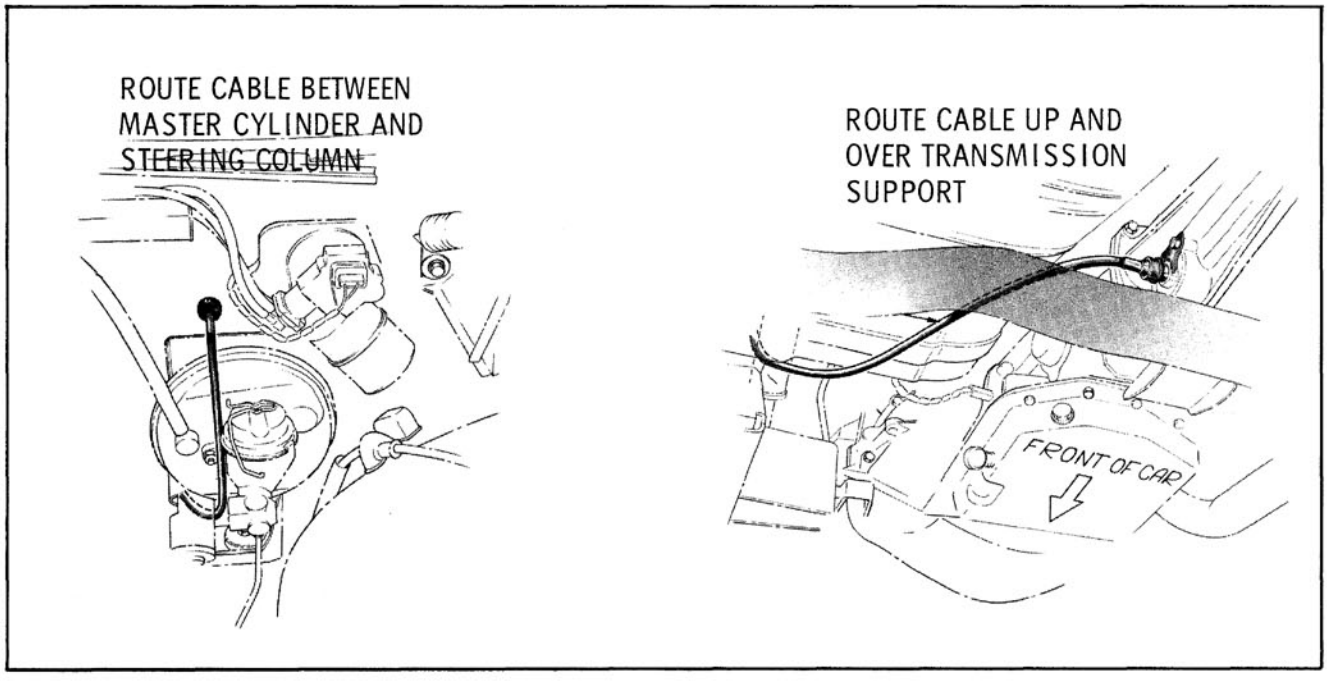
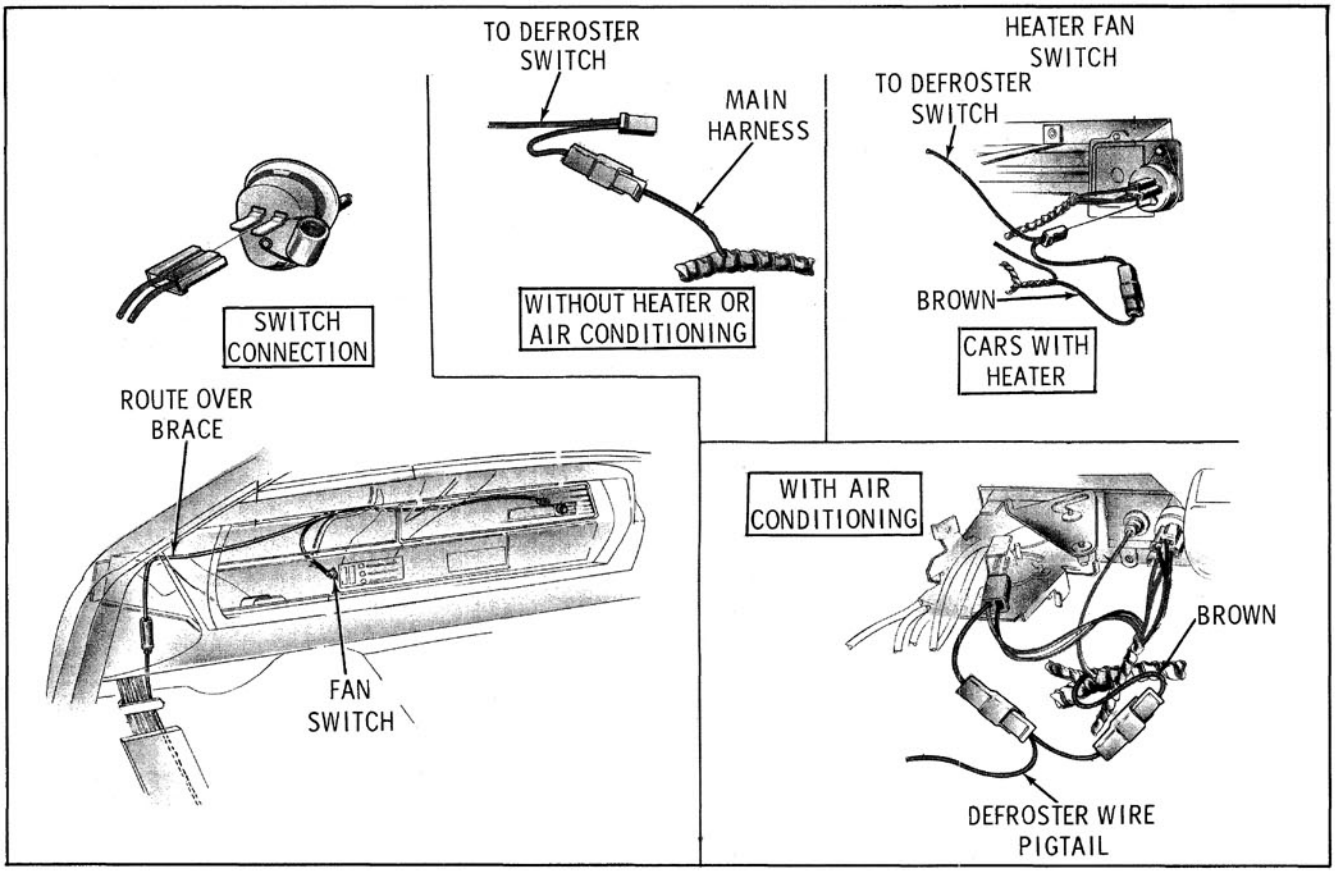


Fig. 12-142 Speedometer Cable Routing (3300 Series)



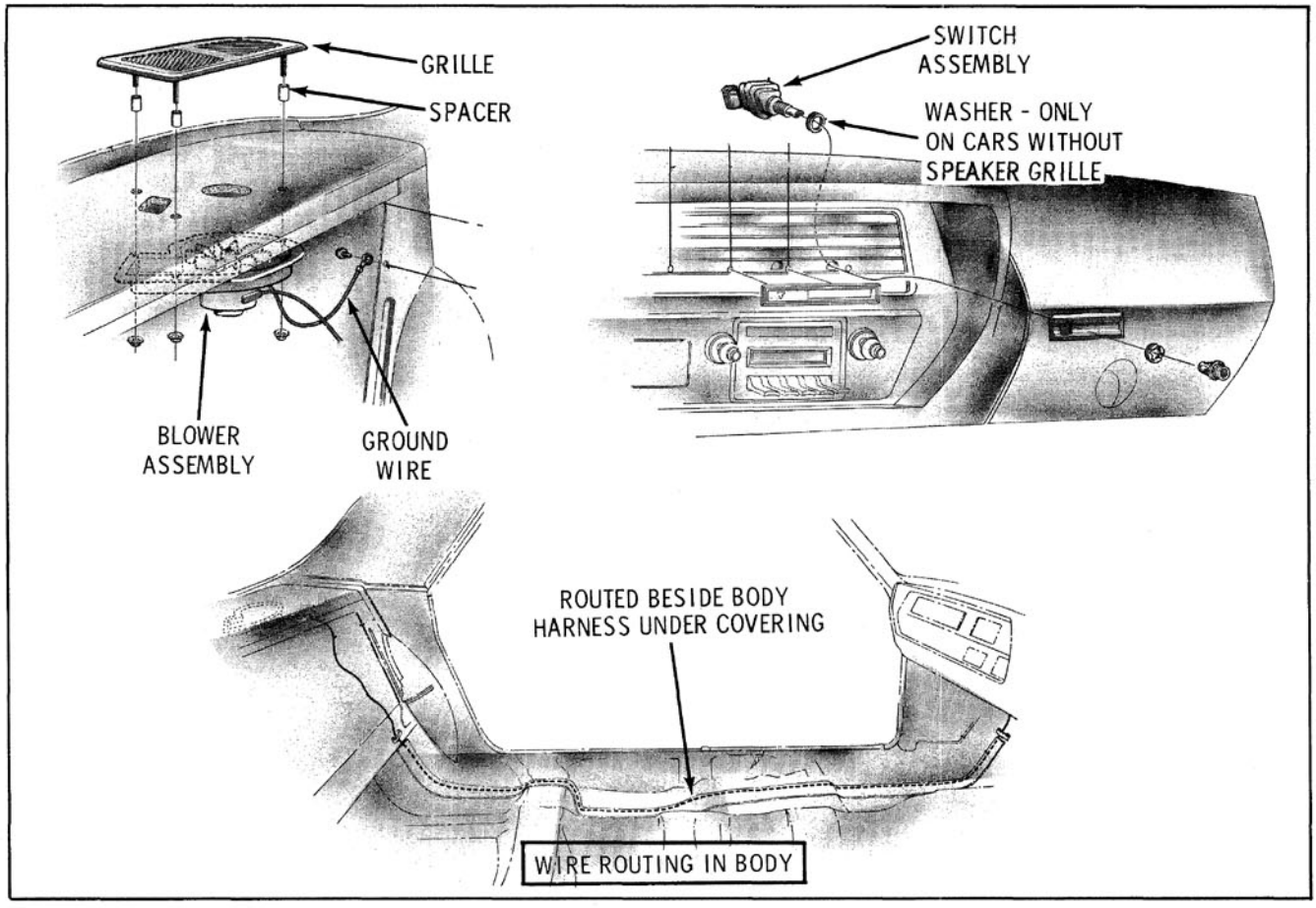


Fig. 12-143 Rear Window Defroster

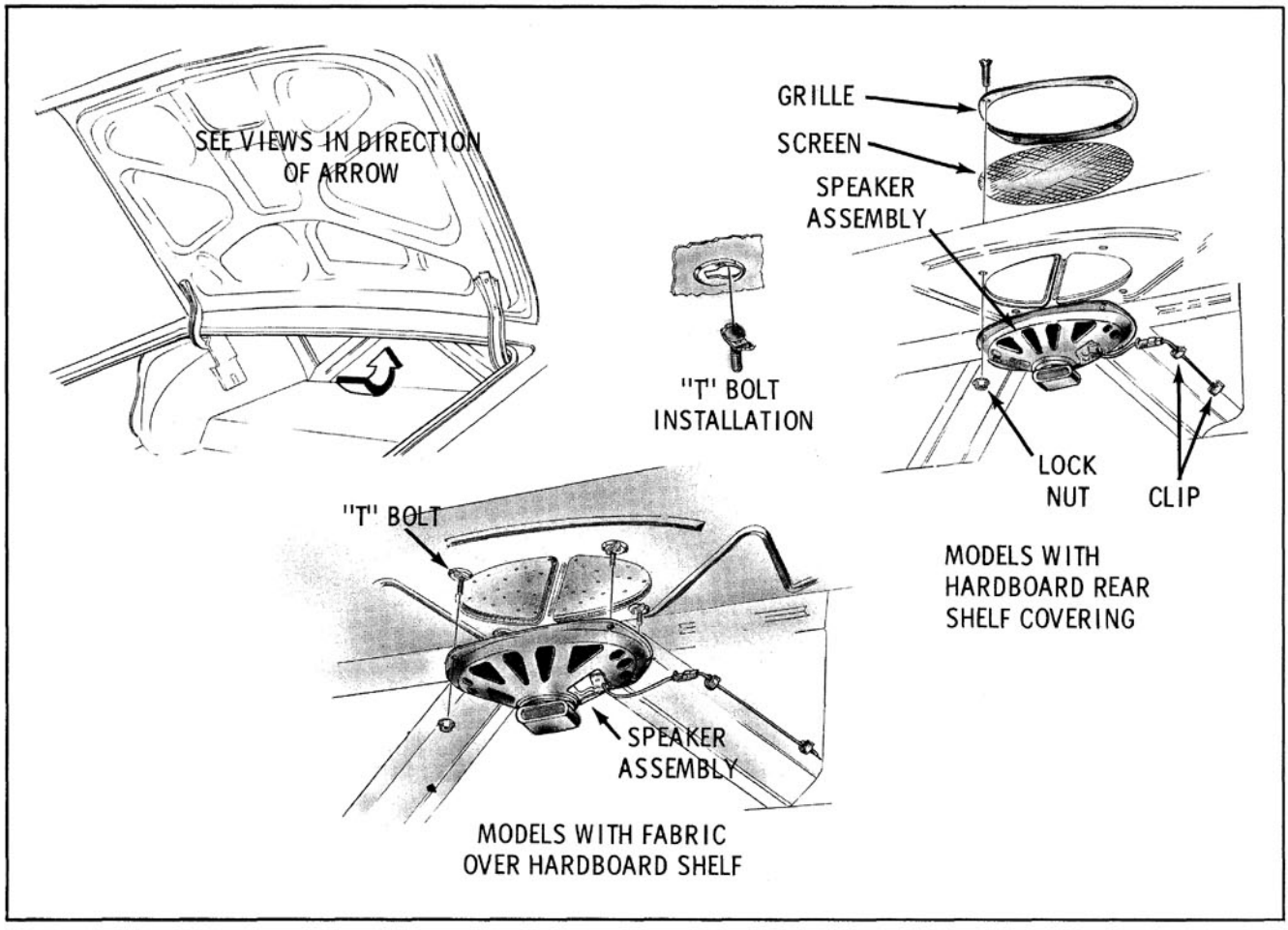


Fig. 12-144 Rear Seat Speaker Installation

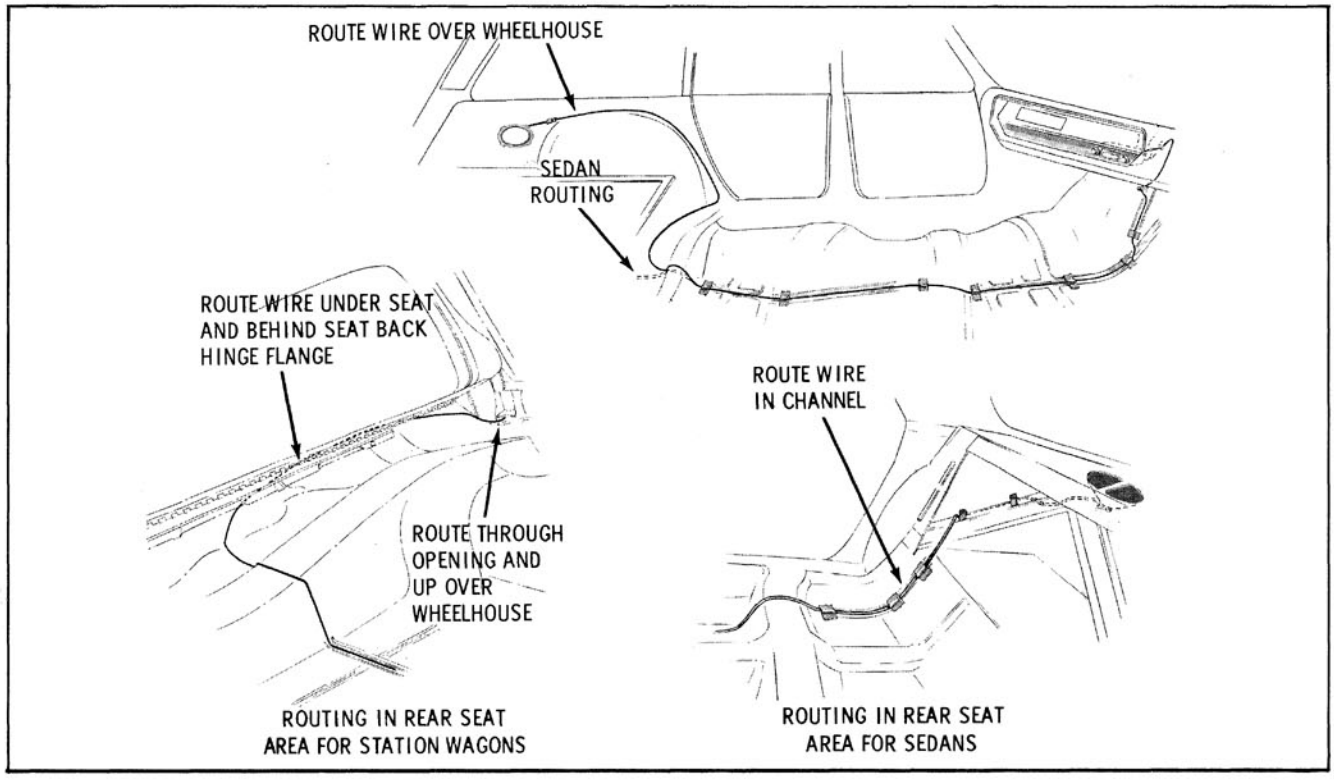


Fig. 12-145 Rear Seat Speaker Lead Routing

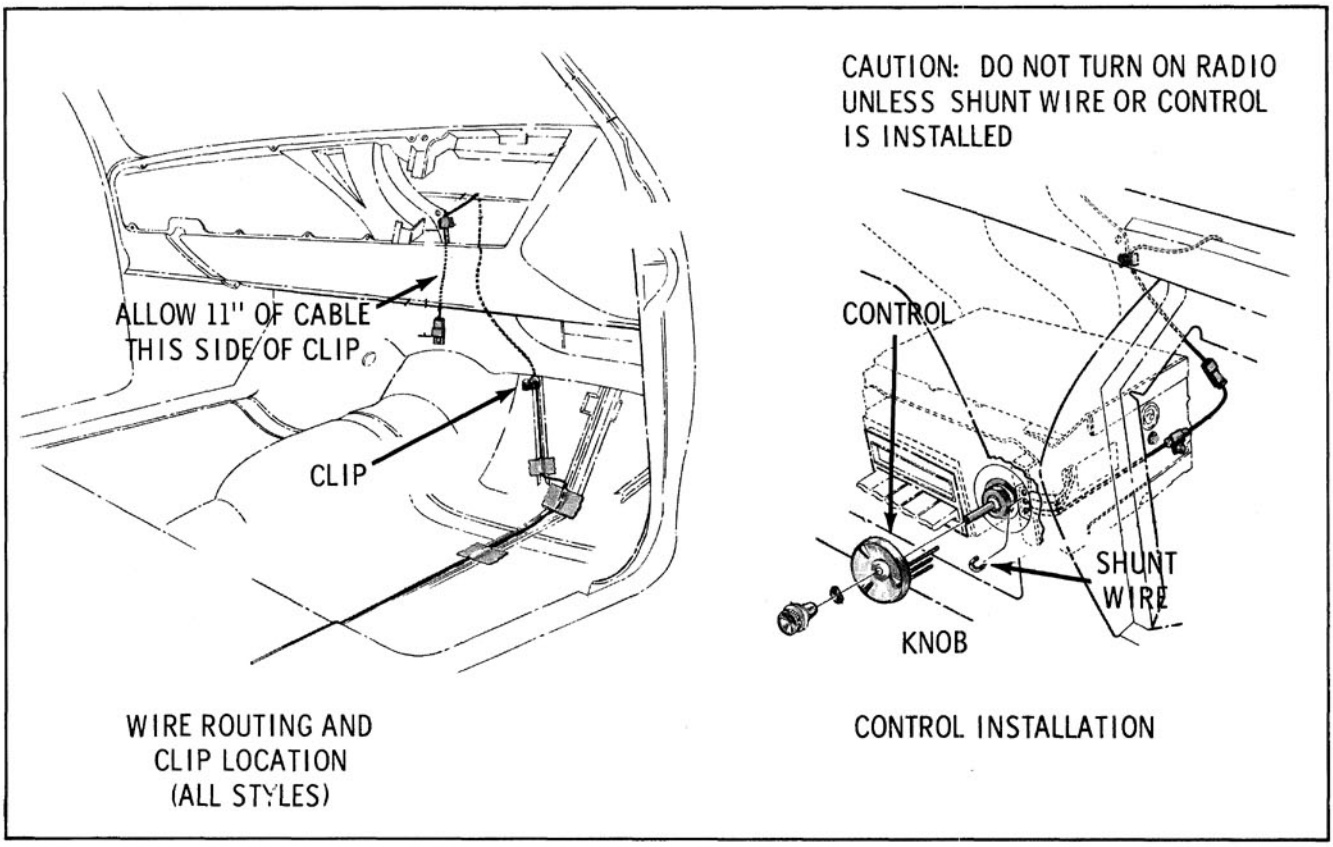


Fig. 12-146 Rear Seat Speaker Control and Wiring

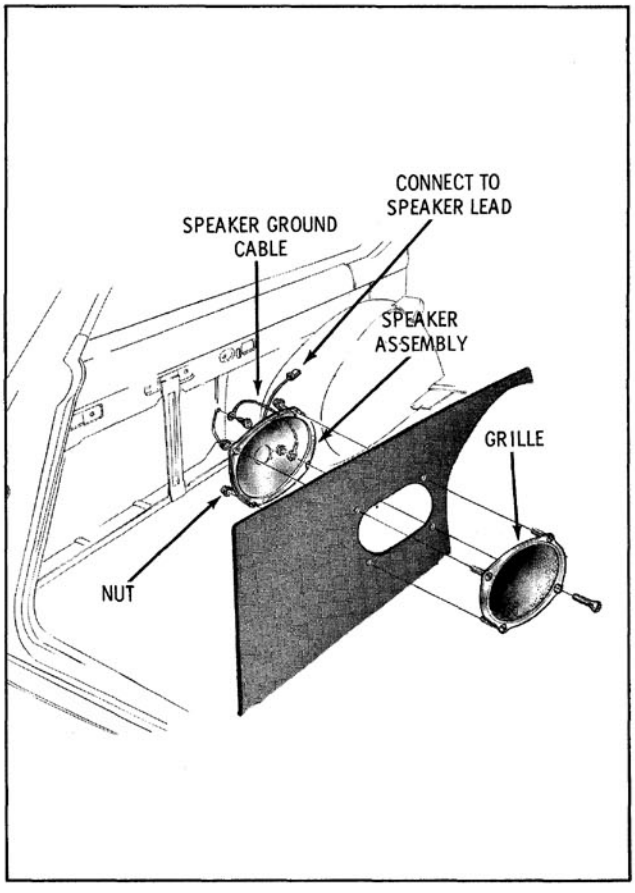


Fig. 12-147 Speaker Installation (S.W.)

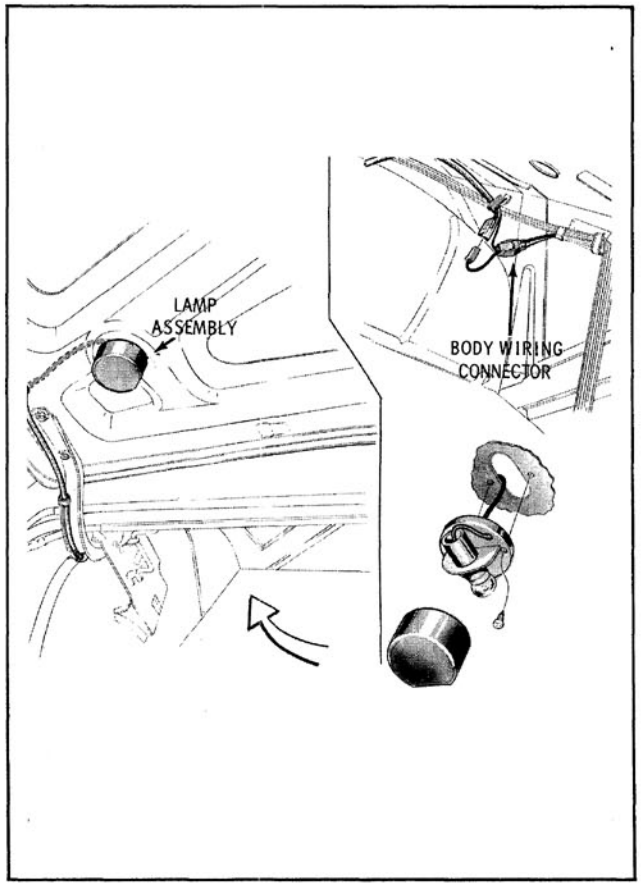


Fig. 12-148 Trunk Lamp Installation

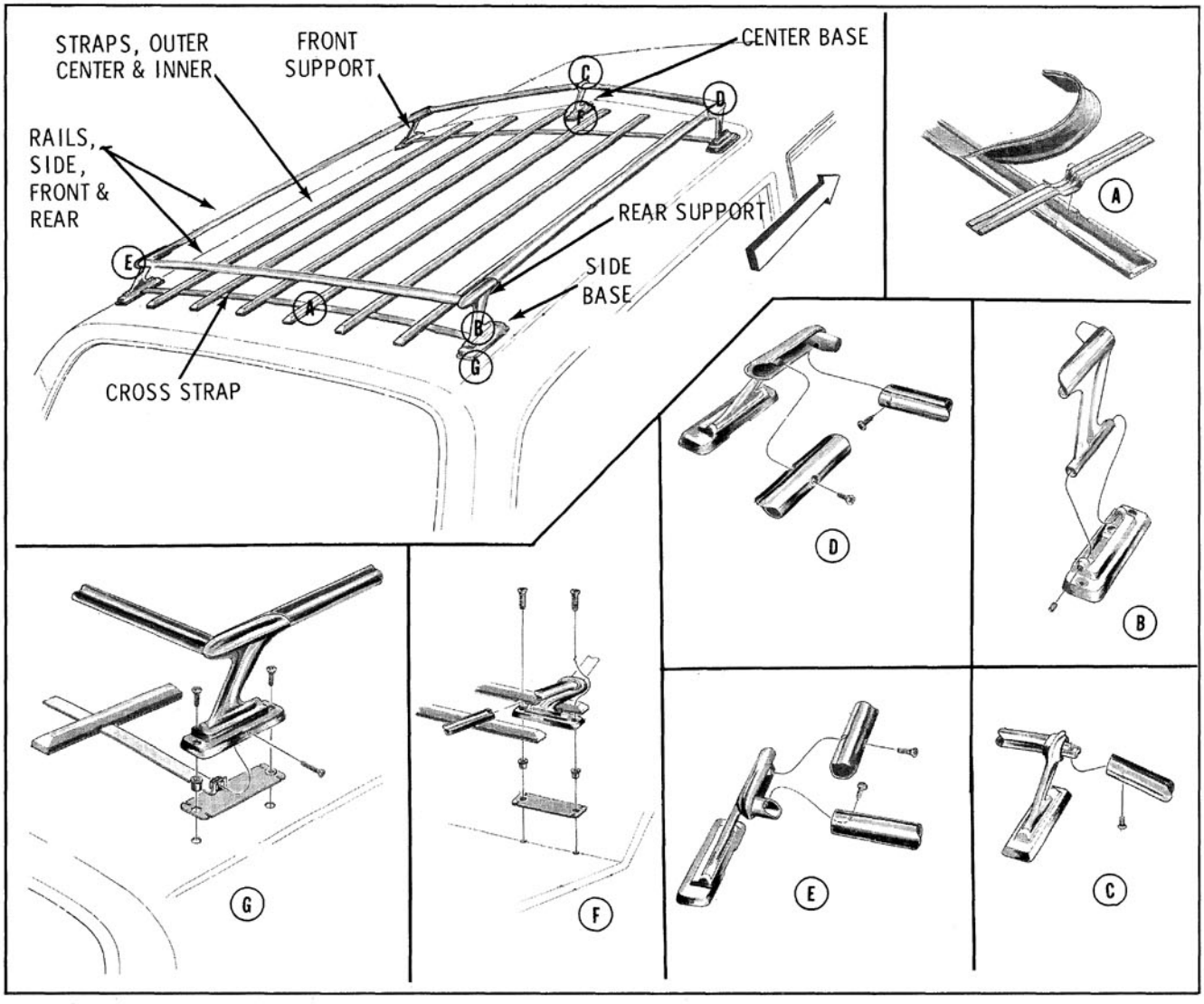


Fig. 12-149 Station Wagon Cargo Carrier

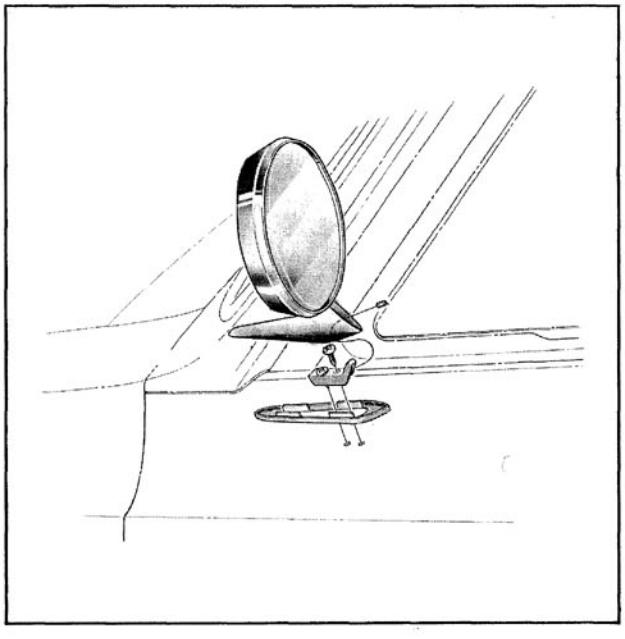


Fig. 12-150 Outside Mirror

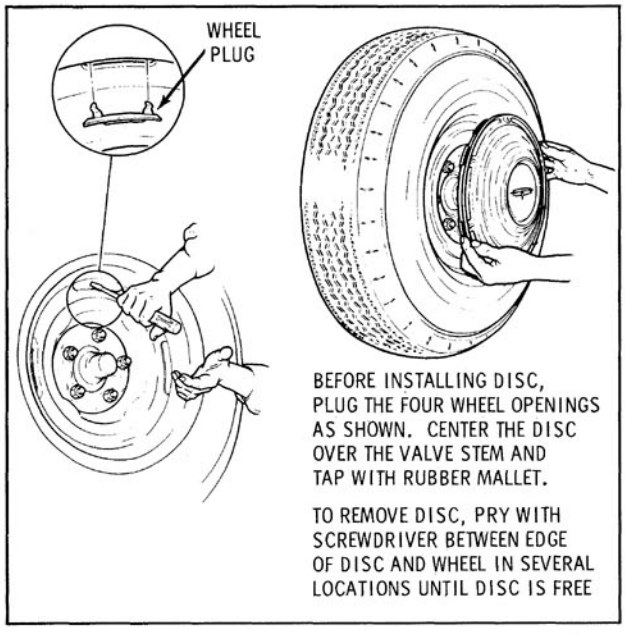


Fig. 12-151 Wheel Disc Installation

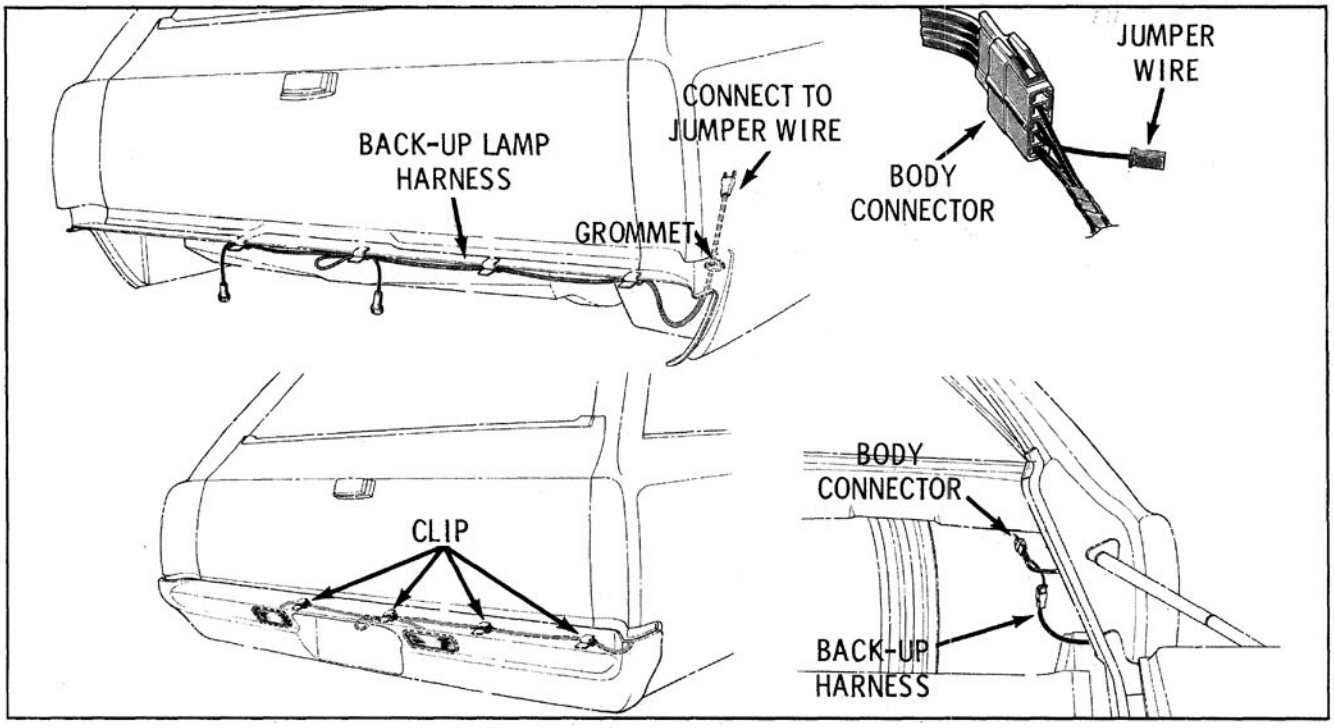


Fig. 12-152 Back-Up Lamp Installation (S.W.)

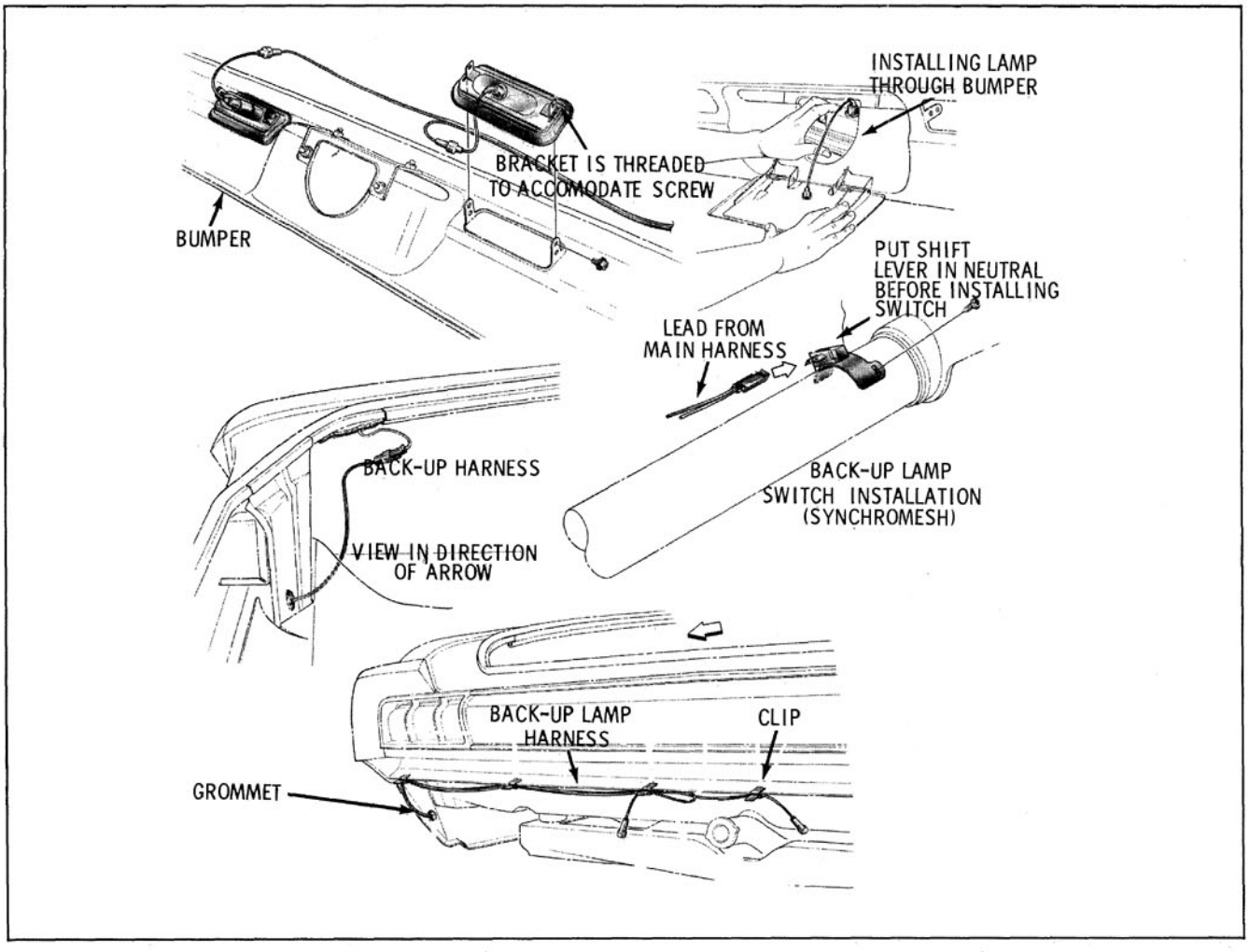


Fig. 12-153 Back-Up Lamp Installation (Exc S.W.)

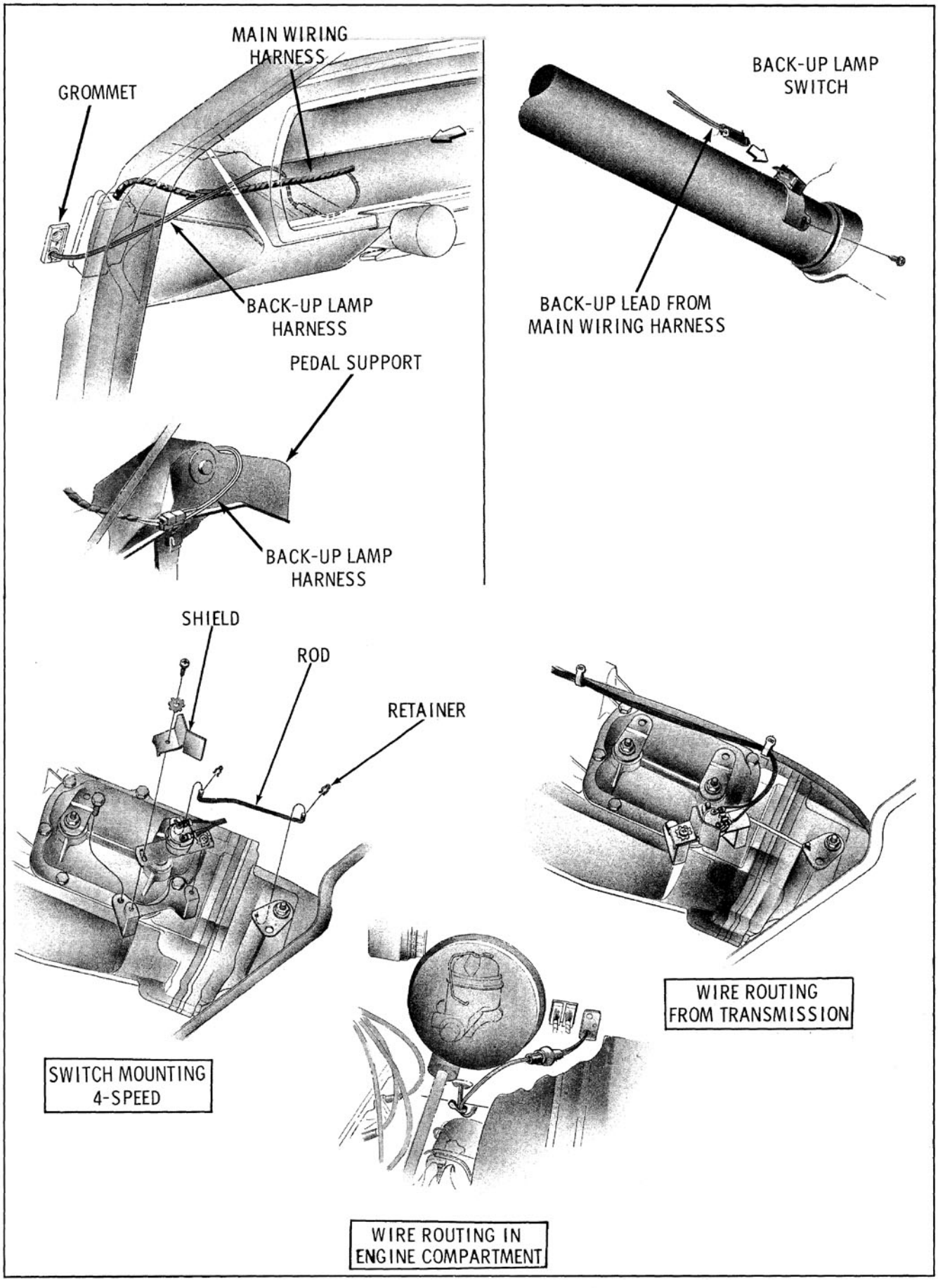


Fig. 12-154 Back-Up Lamp Wiring and Switches (Floor and Column Shift)

ELECTRICAL

(ALL SERIES)

CONTENTS OF SECTION 13

PERIODIC MAINTENANCE

BATTERY

1. Check battery liquid level at each engine oil change, once a month or more often (when refueling) in hot weather. Level should reach the bottom of the vent well. DO NOT OVERFILL.

   CAUTION: HYDROGEN GAS IS PRODUCED BY THE BATTERY. A FLAME OR A SPARK NEAR THE BATTERY MAY CAUSE AN EXPLOSION. BATTERY LIQUID IS HIGHLY ACIDIC. AVOID SPILLING ON FABRICS, PAINTED, PLATED OR BRIGHT SURFACES.

2. Clean top of battery and terminals every 12,000 miles and check tightness of battery hold-down bolt. To properly clean battery:

   a. Make sure vent plugs are installed tight.

   b. Remove battery cables from battery.

   c. Clean battery and battery cable clamps with a diluted ammonia or soda solution and a brush. When the solution stops foaming, rinse with clear water.

   d. Apply a thin coating of petrolatum to terminals and clamps after installing clamps.

DELCOTRON

The Delcotron belt tightness should be checked with Tool 33-70M and adjusted if necessary. No periodic lubrication is required on the Delcotron.

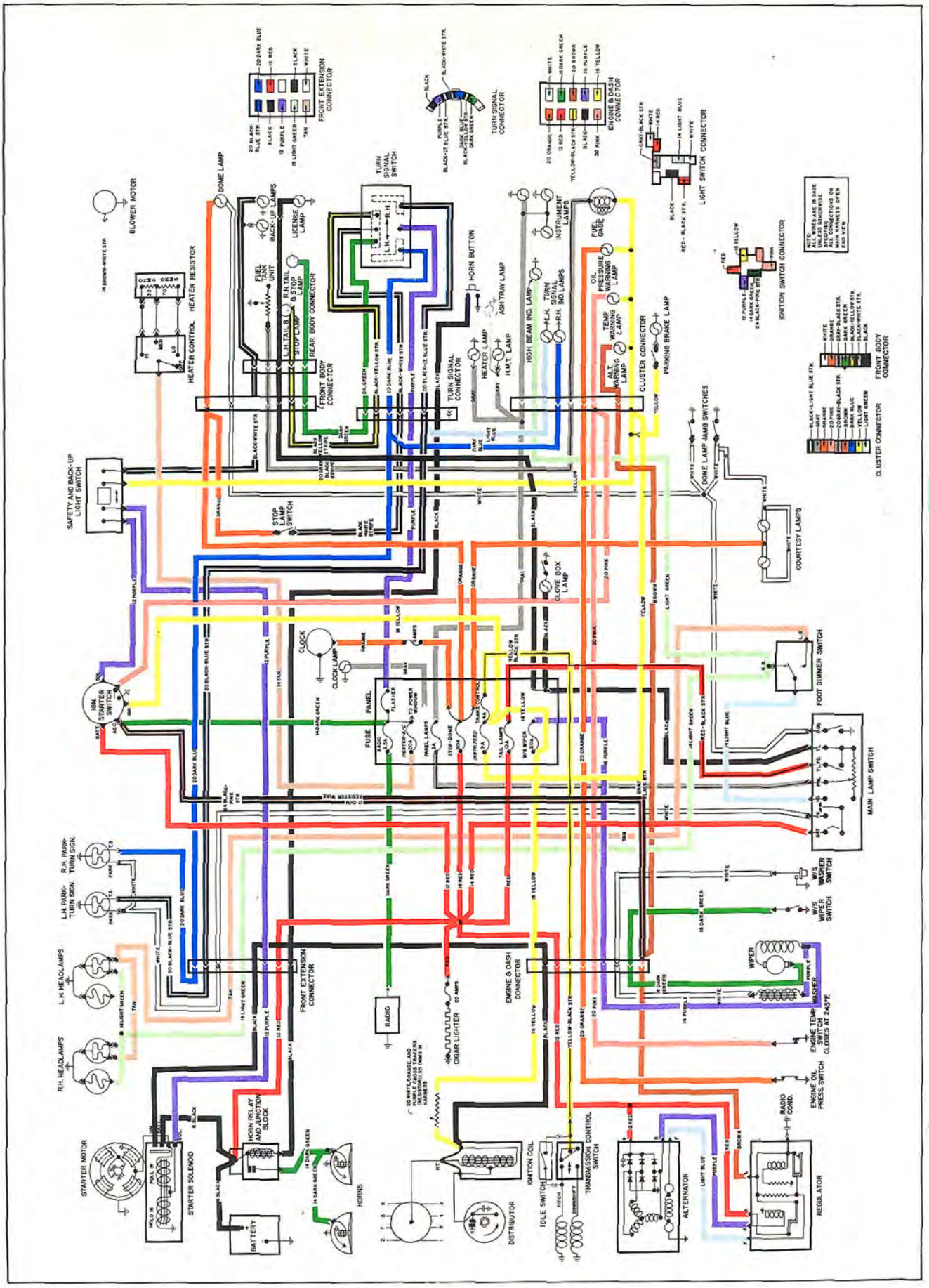


Fig. 13-1 Wiring Diagram (30-31 & 32 Series V-8)

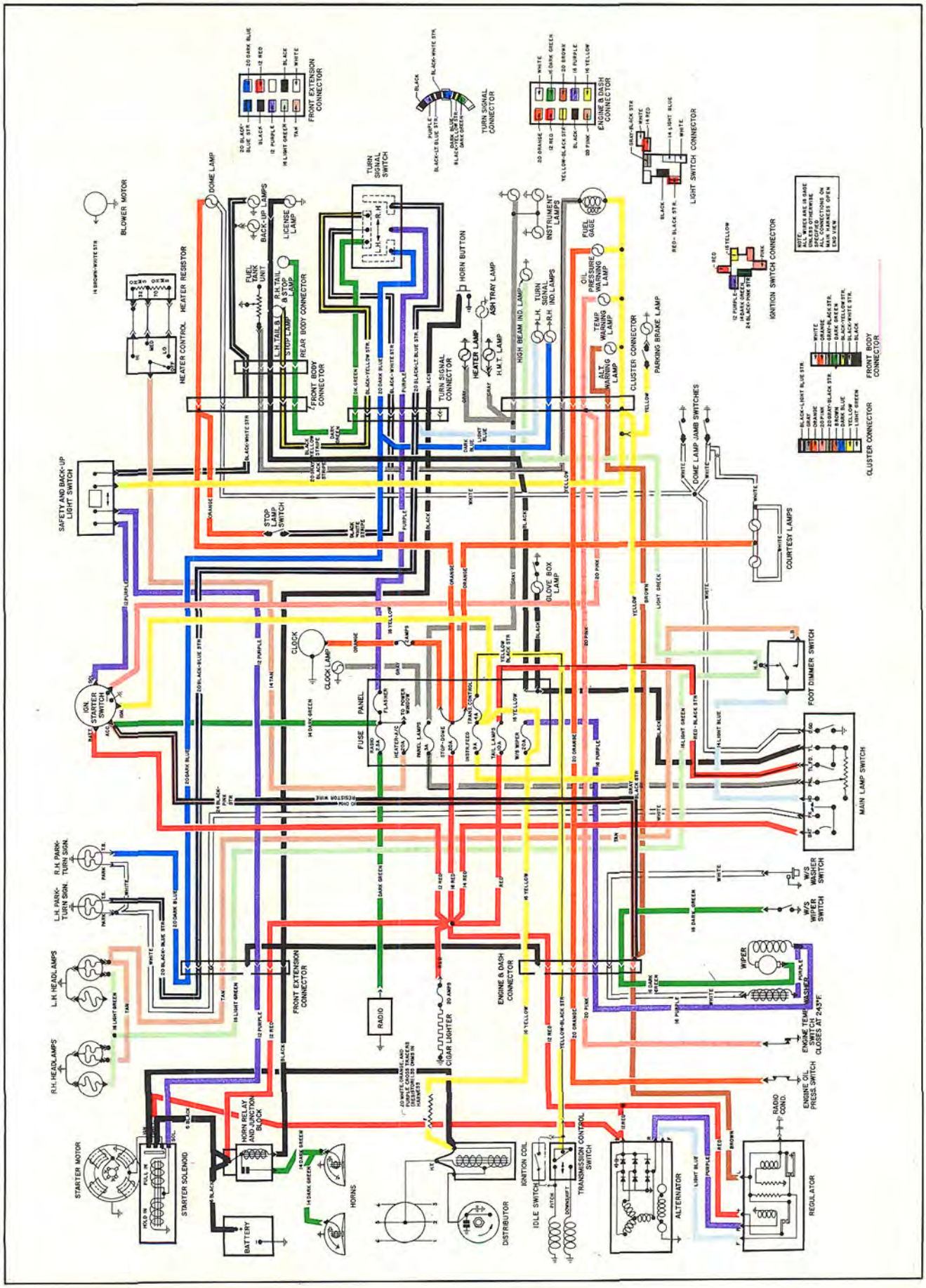


Fig. 13-2 Wiring Diagram (30-31 & 32 Series V-6)

DISTRIBUTOR

The distributor requires periodic inspection of the cap, rotor, wiring, breaker points and timing.

When replacing the contact point assembly, apply a small amount of ball bearing lubricant or equivalent to the breaker cam. No other lubrication is required.

WIRING CIRCUIT

A combination junction and fuse block is mounted on the cowl under the instrument panel. Each wire from the fuse panel is color coded to simplify servicing. (Figs. 13-1, 13-2 and 13-4)

On the 30, 31 and 32 series, the chassis wiring, in the engine compartment, plugs into the rear of the fuse block.

The wiring harness installation under the instrument panel is shown in Figs. 13-3 and 13-5.

The wiring harness installation in the engine compartment is shown in Figs. 13-6, 13-7 and 13-8.

The fuse block, fuse size and location are shown in Figs. 13-9, 13-10 and 13-11.

FUSE HOLDER OR CONNECTOR TERMINAL REPLACEMENT

The fuse holders and connector terminals can be removed by compressing the small tangs on both sides of the holder while applying pressure to the holder. A tool to compress the tangs can be made with a cotter pin, or by using a small screwdriver or awl. (Fig. 13-12)

CHARGING CIRCUIT (Fig. 13-13)

The charging circuit consists of the battery, Delcotron, regulator, and the warning light. Cars without air conditioning are equipped with a 42 ampere Delcotron. Cars with factory installed air conditioning are equipped with a 55 ampere Delcotron.

DESCRIPTION

With the ignition switch on, before the engine has started, the indicator lamp lights to indicate the Delcotron is not charging. Current flows from the battery to the BAT terminal on the switch, through the indicator lamp and resistor, which is in parallel, and then through the voltage regulator contacts. It continues to flow through the Delcotron field winding to ground, completing the circuit. Current through this circuit energizes the field windings sufficiently to insure voltage build-up in the stator windings when the engine starts. The voltages generated in the stator windings are then changed or rectified by the six Delcotron diodes to a DC voltage which appears at the BAT or output terminal on the Delcotron. The resistor, in parallel with indicator lamp, allows more current to flow through the field winding to insure voltage build-up in the stator windings.

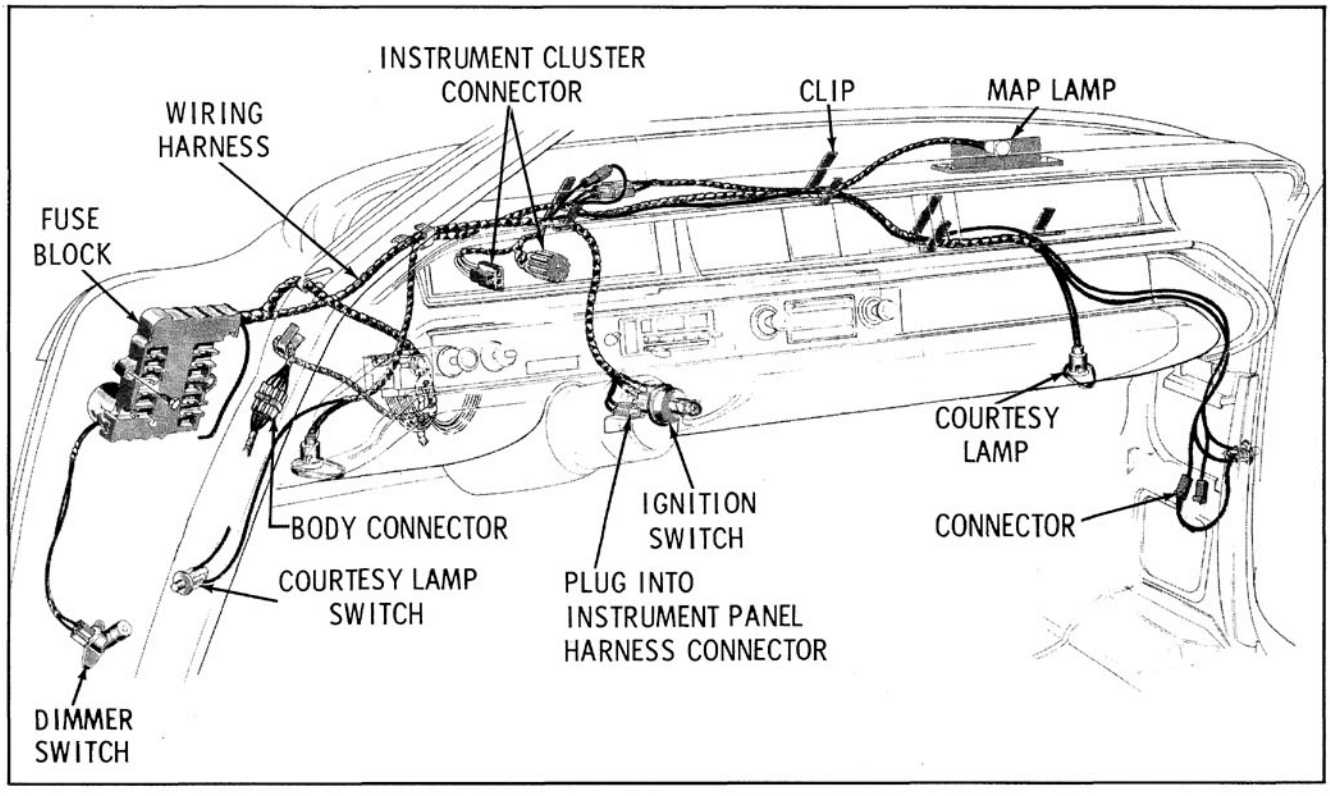


Fig. 13-3 Instrument Panel Wiring (33-34-35-36-38 & 39 Series)

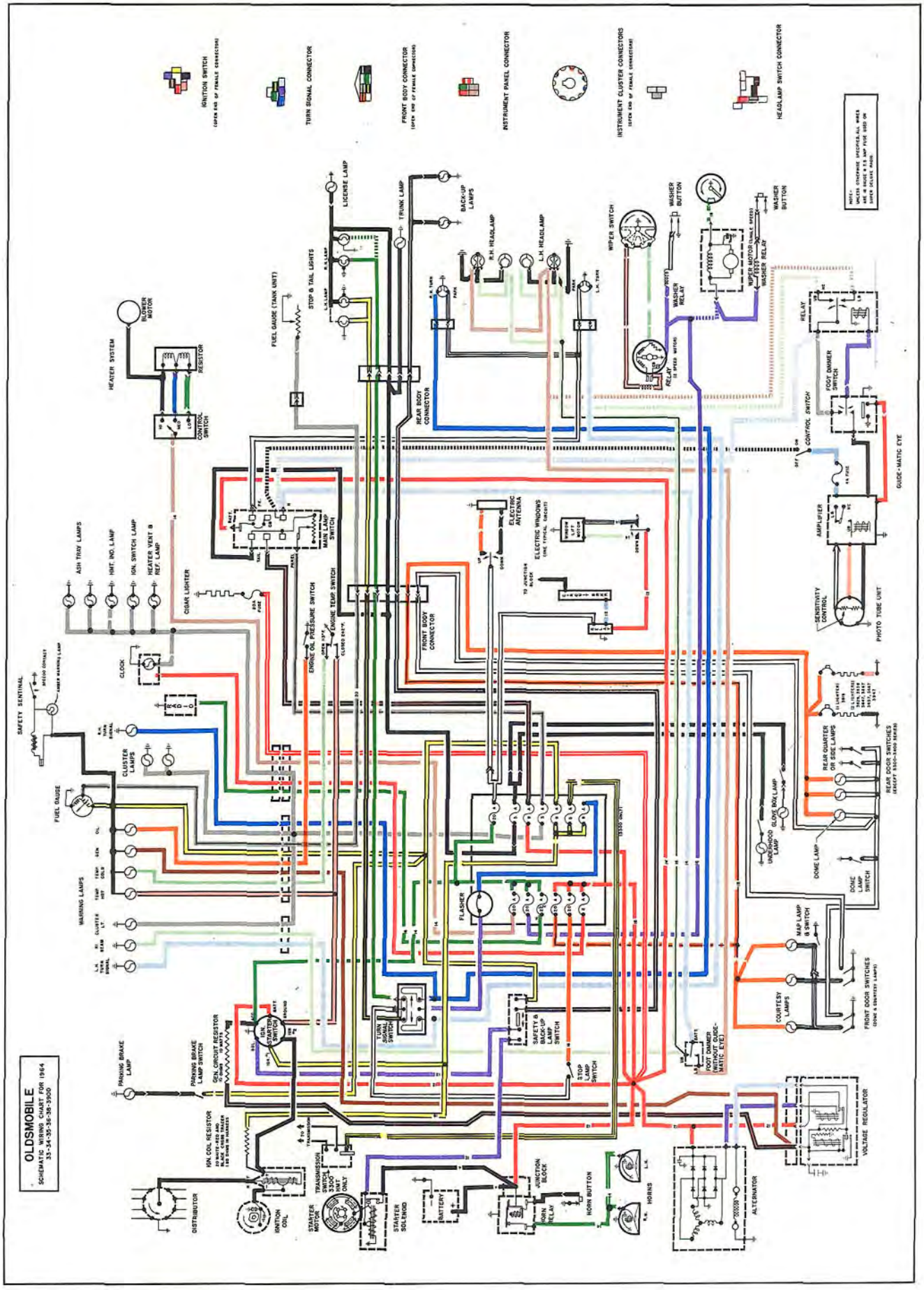


Fig. 13-4 Wiring Diagram (33-34-35-36-38 & 39 Series)

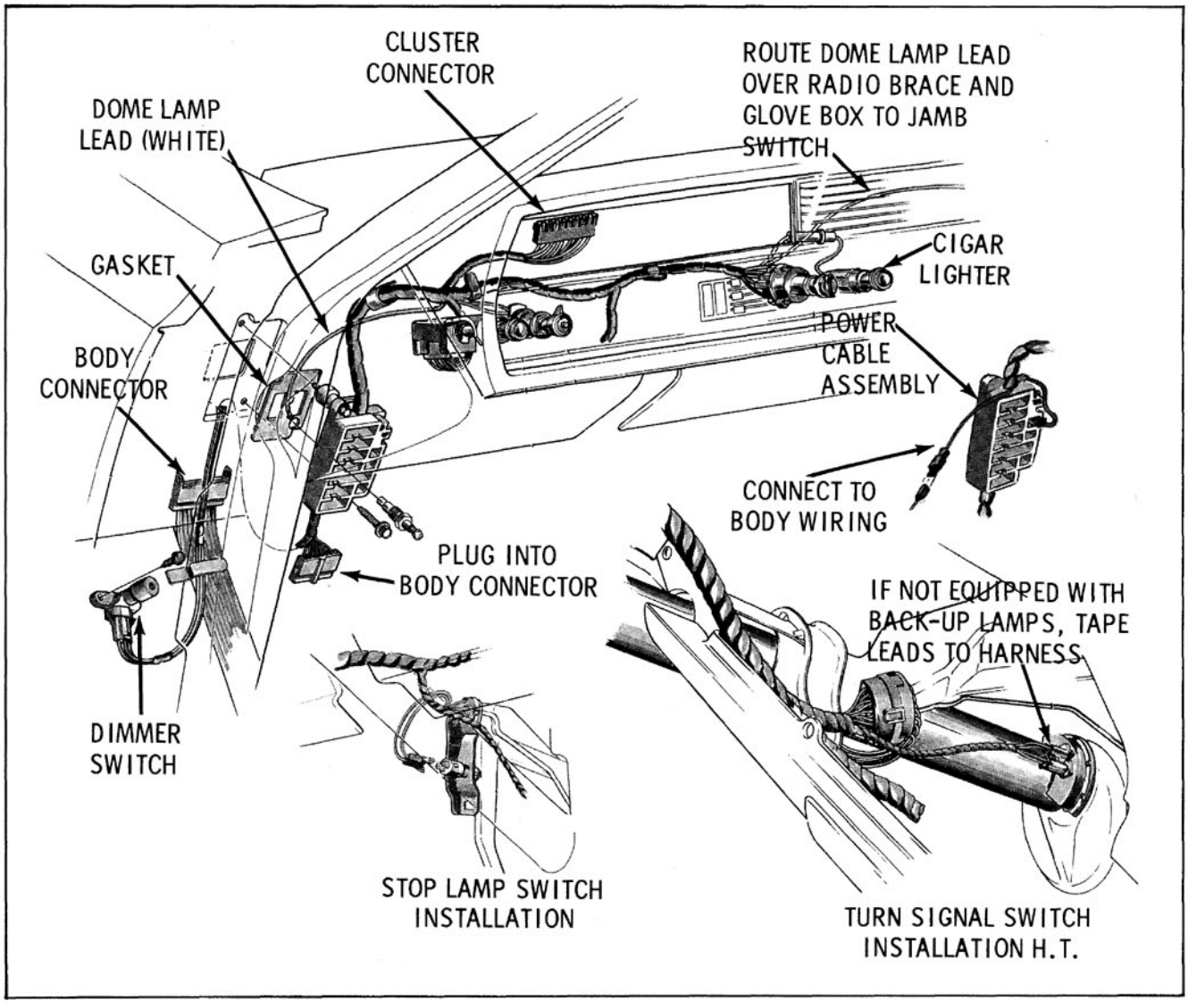


Fig. 13-5 Instrument Panel Wiring (30-31 & 32 Series)

As the Delcotron begins to operate, voltage from the "R" terminal is impressed through the regulator No. 2 terminal across the field relay winding, causing the relay contacts to close. This connects the regulator No. 4 terminal directly to the battery through the field relay contacts, causing the indicator lamp to go out. Delcotron field current then flows from the battery to the regulator No. 3 terminal and then through the field relay contacts and voltage regulator lower or series contacts to the field winding.

As the speed of the Delcotron increases, the voltage at the BAT terminal of the Delcotron also increases. This impresses a higher voltage through the field relay contacts and across the voltage regulator shunt winding. The increased magnetism, created by this higher voltage across the winding, causes the lower or series contacts of the relay to separate. Field current then flows through a resistor which reduces the field current. This reduced field current causes the Delcotron voltage to decrease; thereby decreasing the magnetic pull of the voltage regulator shunt winding. Consequently the spring causes the contacts to reclose. This cycle repeats many times per second to limit the Delcotron voltage to a pre-set value.

As the Delcotron speed increases even further, the resistor, connected across the contacts, is not of sufficiently high value to maintain voltage control on the contacts. Therefore, the voltage increases slightly causing the upper or "shorting" contacts to close. When this happens, the Delcotron field winding is shorted and no current passes through the winding. With no current in the field winding, the Delcotron voltage decreases which also decreases the magnetism in the shunt winding and the upper contact points open. With these points open, field current flows through the resistor and the field winding. As the voltage increases, the contacts reclose. This cycle then repeats many times per second to limit the Delcotron voltage to a pre-set value at high generator speeds. The voltage regulator unit thus

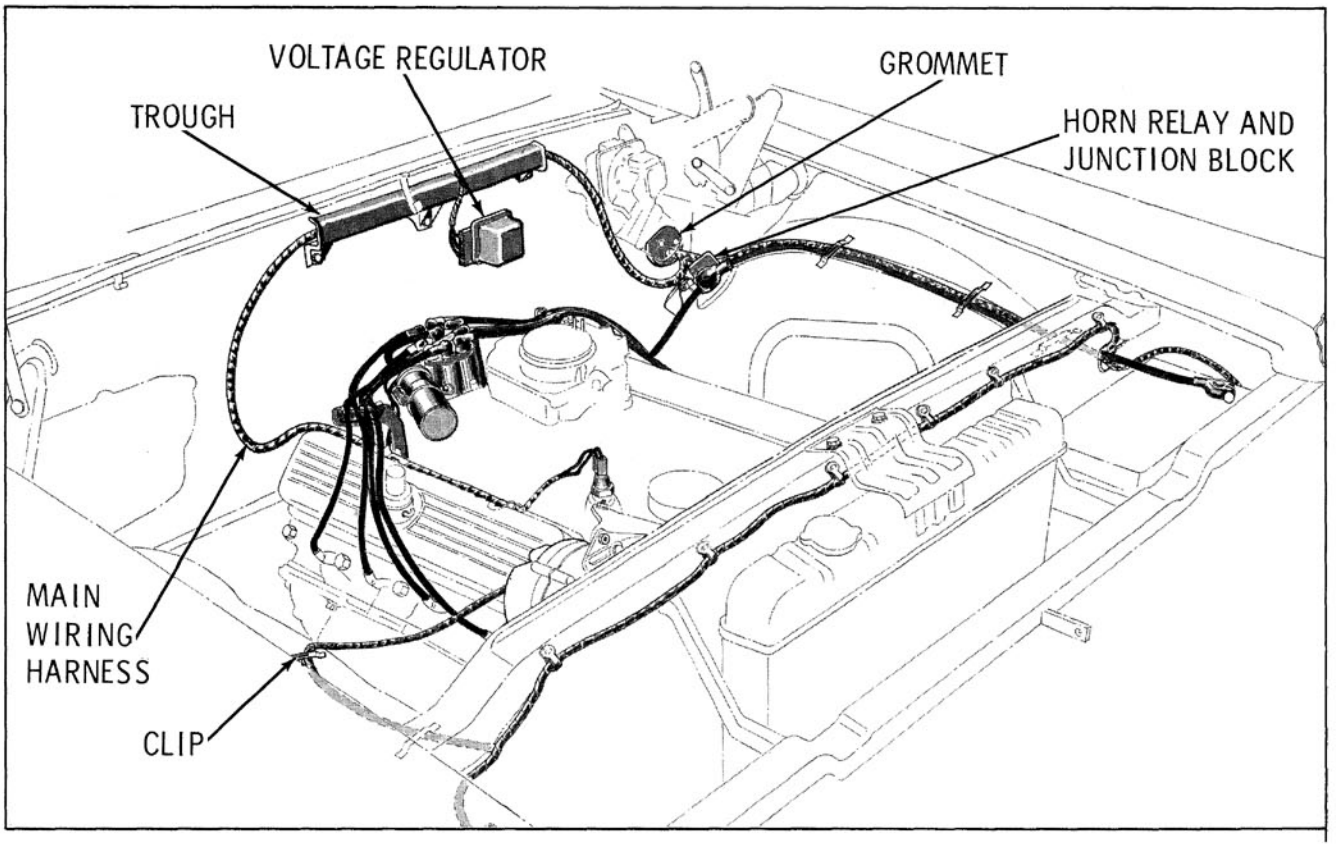


Fig. 13-6 Chassis Wiring Harness (33-34-35-36-38 & 39 Series)

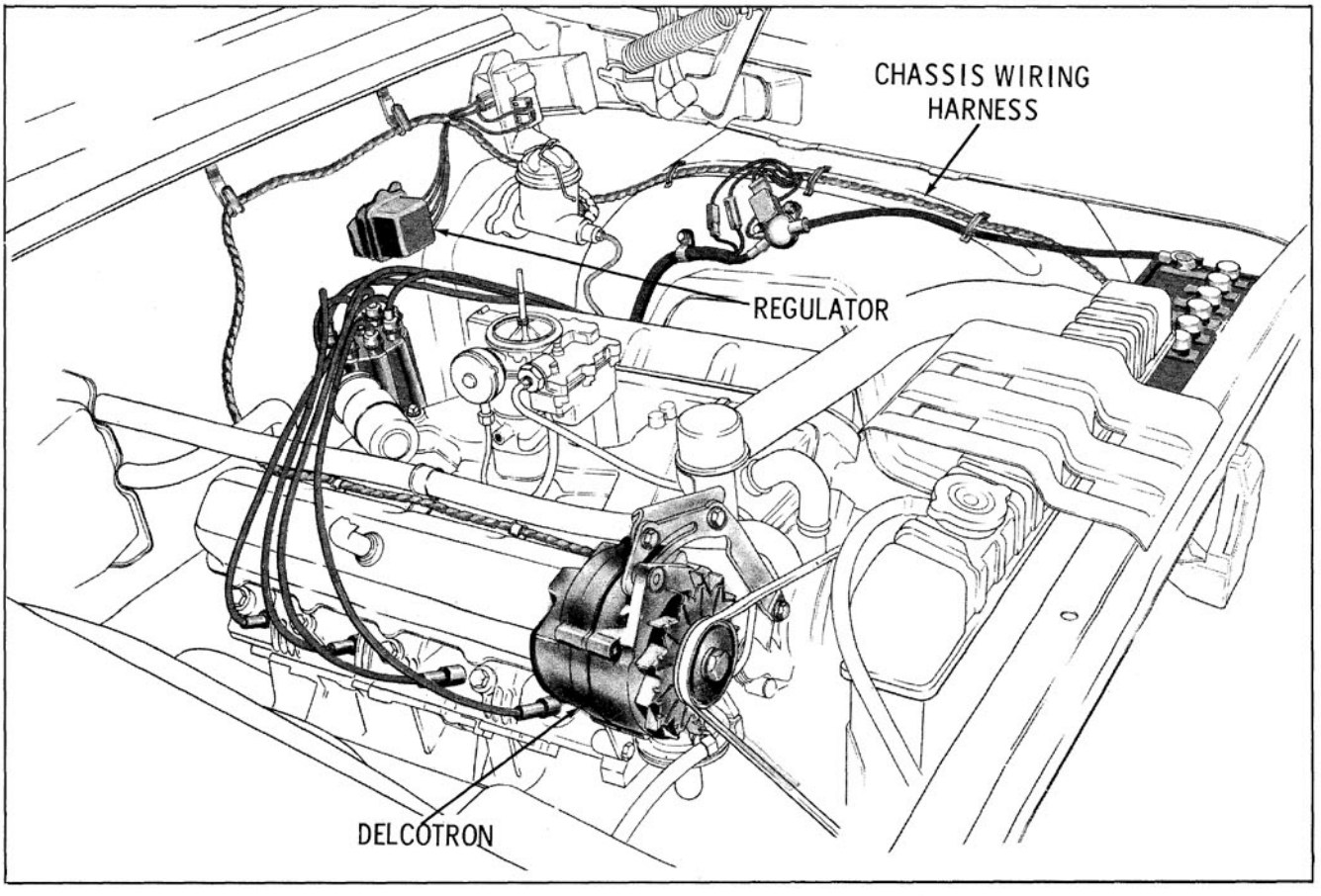


Fig. 13-7 Chassis Wiring Harness (30-31 & 32 Series V-8)

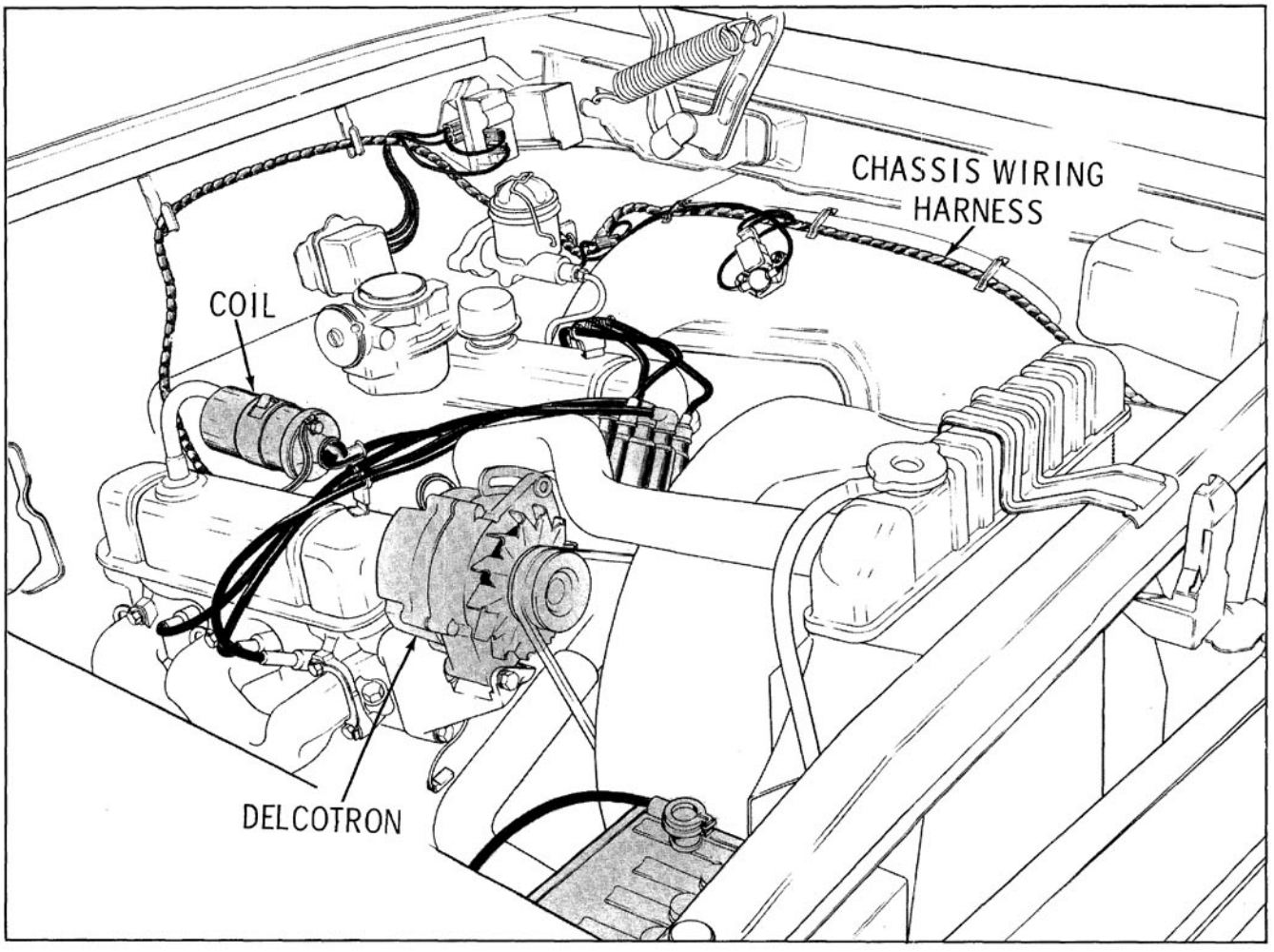


Fig. 13-8 Chassis Wiring Harness (30-31 & 32 Series V-6)

operates to limit the value of Delcotron voltage throughout the Delcotron speed range. Consequently the electrical accessories are protected from excessive voltage which would cause damage.

BATTERY

For battery usage, refer to the BATTERY CHART.

BATTERY CHART			
Series	Engine	Amp. Hr.	Plates
30 & 31	V-6	44	54
30, 31, 32 & 33	V-8	61	66
34, 35, 36, 38 & 39	V-8 H.C.	70	66
34	V-8 L.C.	62	54

DELCOTRON

The Delcotron consists of a rotor, a stator, two brushes and slip rings and six diode rectifiers. (Fig. 13-14)

The brushes and slip rings allow battery current to flow through the rotor creating a magnetic field. The stator consists of three sets of windings, each set containing seven coils, alternately spaced around the stator ring. The magnetic field produced by the rotor induces an AC voltage in the stator windings. This AC voltage is then directed to diode rectifiers.

A diode rectifier is an electrical device which resists current flow in one direction but allows it to flow in the other. Six diode rectifiers are used in the Delcotron. Three of the diode rectifiers are positive and three are negative and are arranged so that the AC voltage produced by the Delcotron is changed to a DC voltage. This DC voltage is used to charge the battery and operate electrical accessories.

REGULATOR

The regulator contains a voltage regulator and a field relay. (Fig. 13-15) A current regulator is

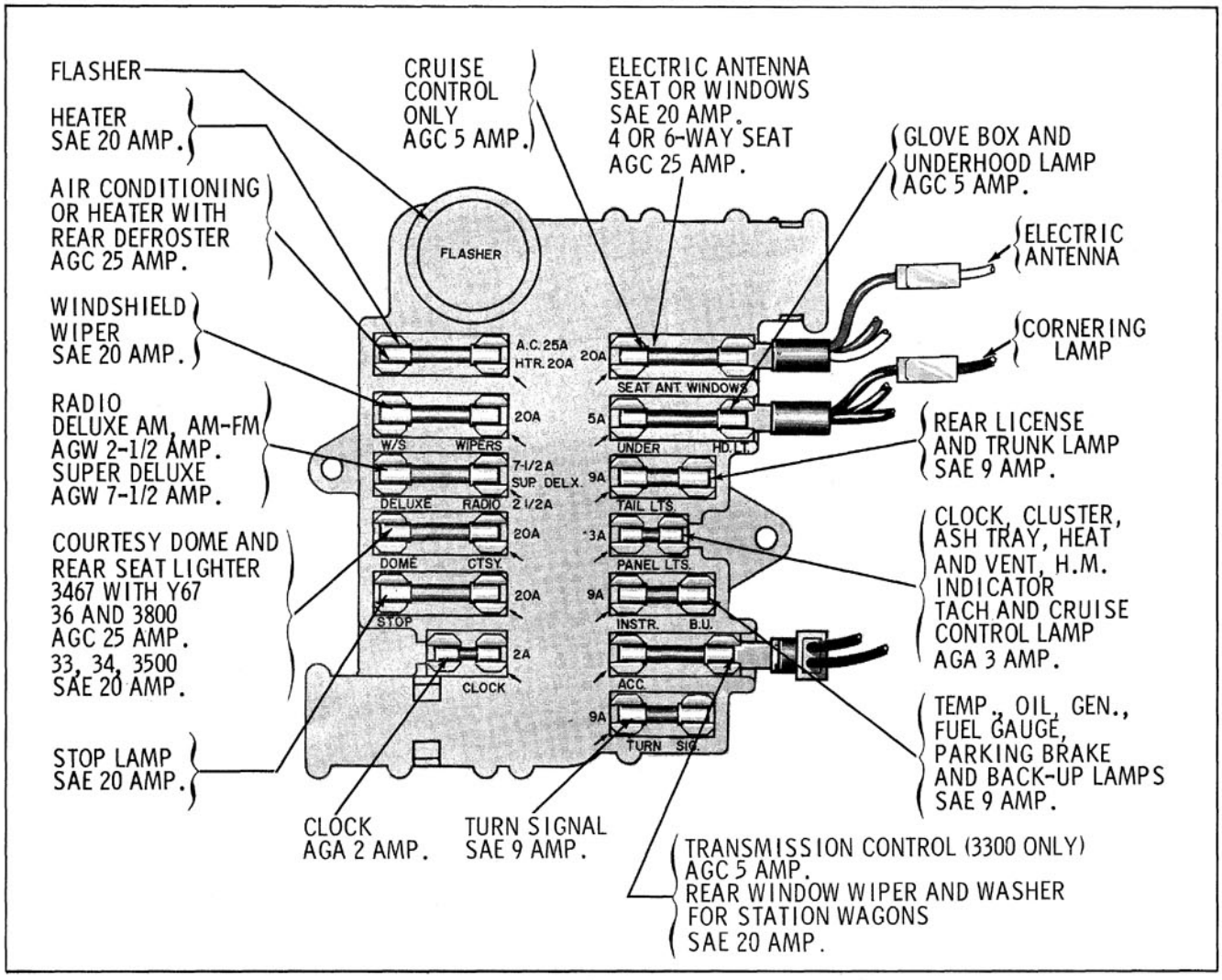


Fig. 13-9 Fuse Block (33-34-35-36-38 & 39 Series)

not required because the Delcotron is capable of self regulating the current at a given speed and voltage. A cut-out relay is not required because the action of the diode rectifiers prevent battery voltage from discharging through the Delcotron.

Voltage Regulator

The voltage regulator limits the voltage of the electrical system to a safe maximum. The contacts of the voltage regulator oscillate at a high speed, opening and closing the points. This action intermittently introduces resistance into the field circuit, thereby reducing voltage.

The voltage regulator has a double set of contacts to regulate voltage. The lower set of contacts limits voltage at low Delcotron rpm. Vibration of the lower contacts intermittently inserts a resistance in the field circuit. This resistance is satisfactory at low rpm; however, when the rpm is increased the lower set of points can no longer control the voltage and the upper contacts close. A vibrating action takes place on the upper set of contacts which intermittently grounds the field to control voltage to a safe value.

Field Relay

The field relay acts as an "on" "off" switch between the field winding and the battery.

When the ignition switch is closed, the field relay winding is connected to the battery. Current from the battery creates magnetism in the relay winding and closes the contact points. Current from the battery can now flow from the battery through the closed relay points, through the closed voltage regulator points, to the field windings in the Delcotron.

WARNING LIGHT

The red warning light located in the instrument panel should light when the ignition key is turned on and the engine is not running. When the engine is started, the light will go out indicating that the Delcotron is operating. If the light remains on with the ignition key in the "off" position, it indicates a shorted positive diode in the Delcotron.

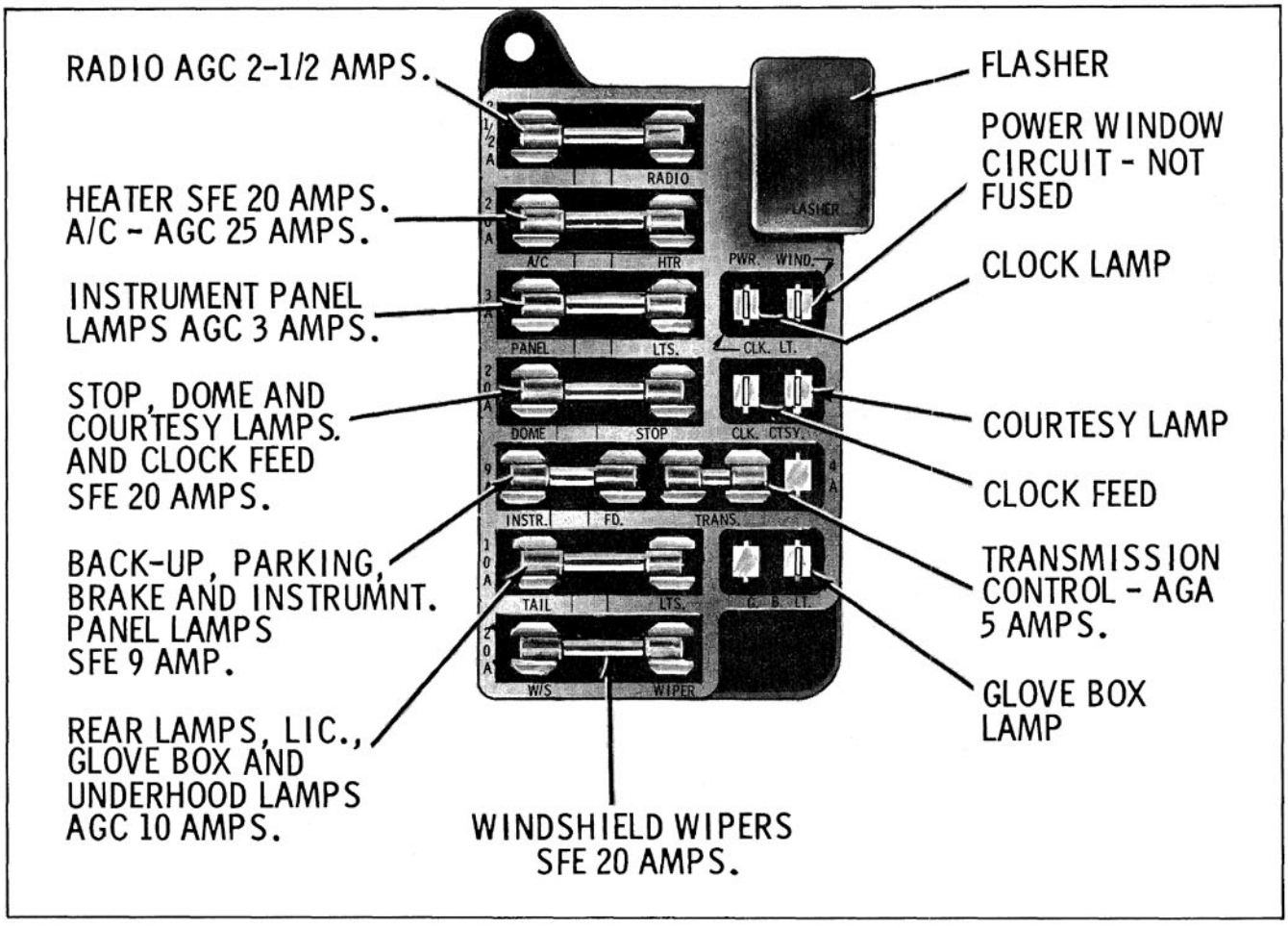


Fig. 13-10 Fuse Block (30-31 & 32 Series)

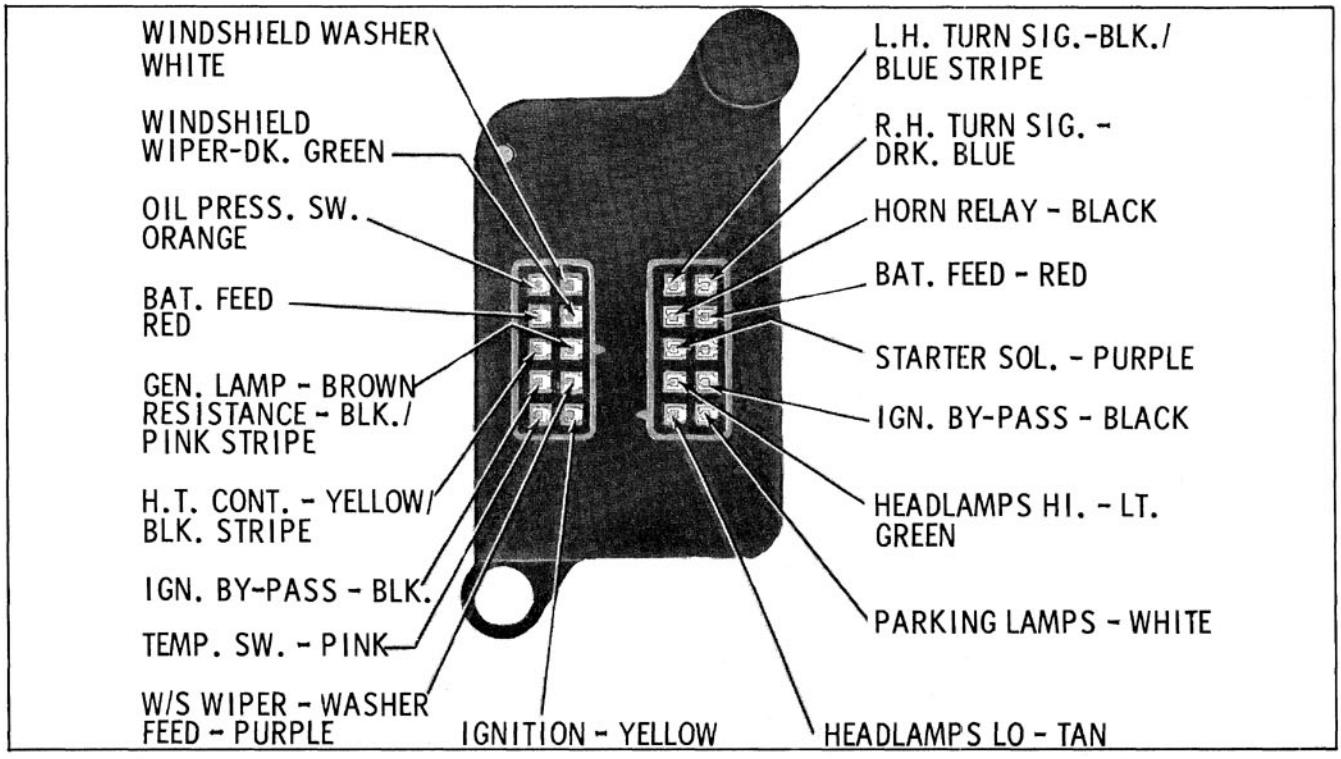


Fig. 13-11 Fuse Block (30-31 & 32 Series)

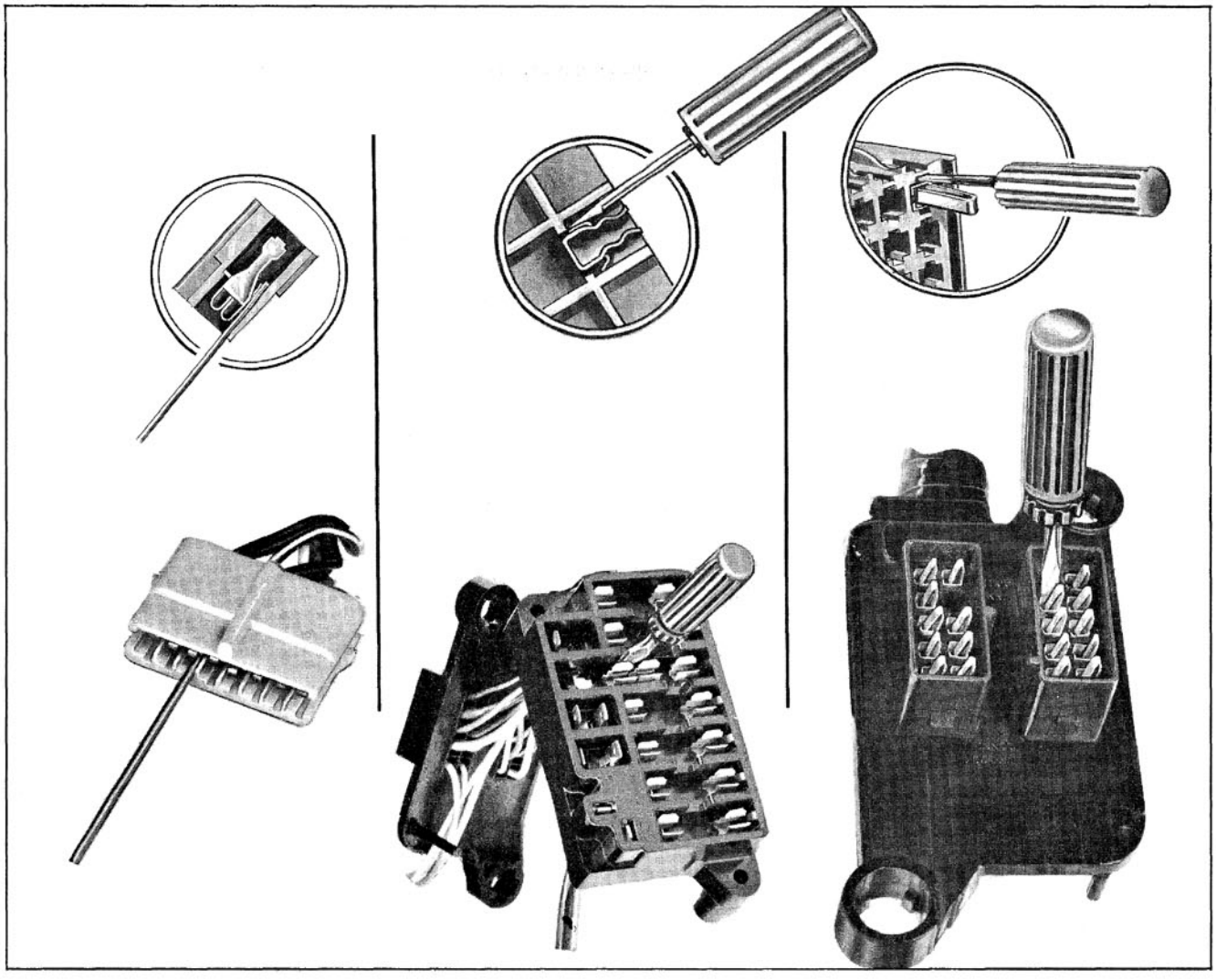


Fig. 13-12 Electrical Terminal Removal

SERVICE PRECAUTIONS

The following precautions must be observed when servicing the charging circuit to prevent serious damage to the electrical equipment:

1. When installing a battery, using jumper cables, a booster battery or connecting a charger, the negative terminals of the battery or charger must be connected to the ground side of the system and the positive terminals of the battery or charger, to the positive side of the system. Failure to observe polarity will result in the battery being directly shorted through the diodes and could result in a burned wiring harness or damaged diodes.
2. Never operate the Delcotron with any of the wires or connectors disconnected or loose. Operating the Delcotron with disconnected or loose connections could result in development of extremely high voltages.
3. Do not short across or ground any of the terminals on the Delcotron or regulator as damage to these units could result.
4. Do not attempt to polarize the Delcotron or regulator as these units could be damaged. Polarization is not required with this type of charging circuit.
5. When removing a Delcotron from the car or working in the engine compartment near the Delcotron, always disconnect the battery negative cable first; as the red wire connected to the BAT terminal on the Delcotron is connected to battery voltage.

CHECKS AND ADJUSTMENTS OF THE CHARGING CIRCUIT

Trouble in the charging circuit will usually show up as faulty warning light operation or by an undercharged or overcharged battery. Before attempting any checks and adjustments, be sure that all wiring connections are clean and tight and that the battery is in satisfactory condition.

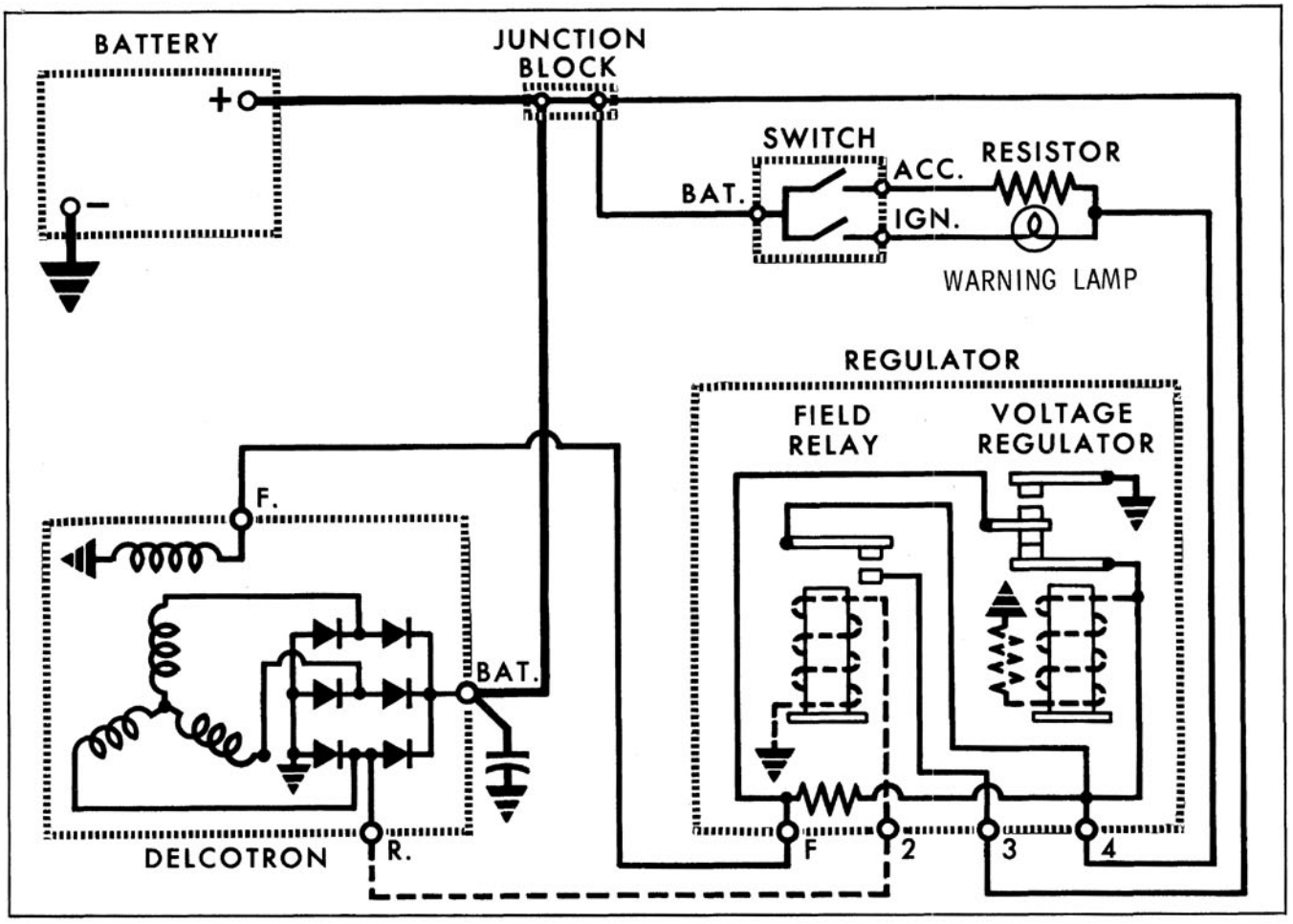


Fig. 13-13 Charging Circuit

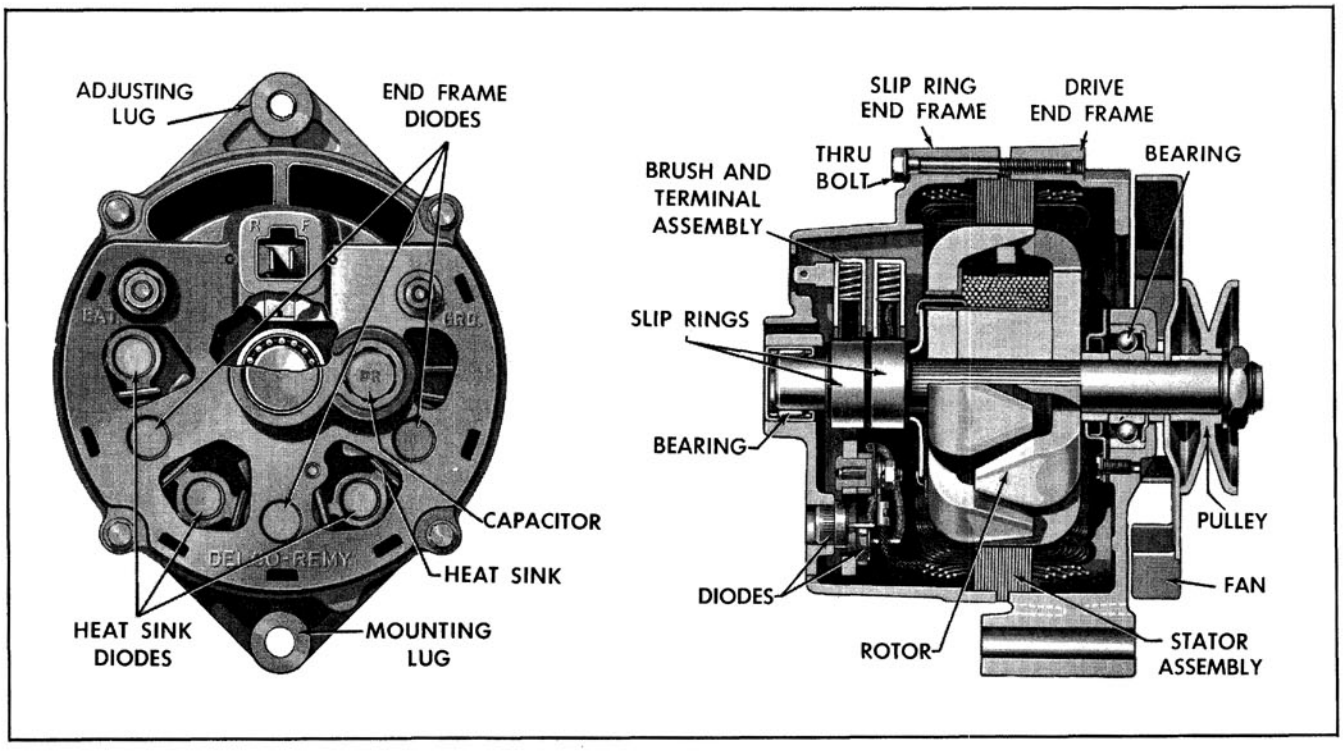


Fig. 13-14 Delcotron

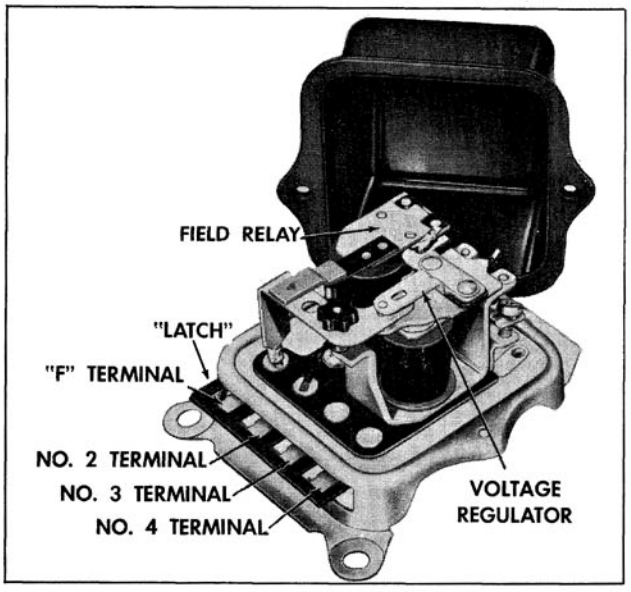


Fig. 13-15 Voltage Regulator

WARNING LIGHT CIRCUIT AND FIELD RELAY CHECK (Fig. 13-16)

If the warning light fails to light when the ignition switch is turned on, engine not running, check for a burned out bulb or fuse, then check the field relay. If the light stays on with the ignition switch "off", check for a shorted positive diode in the Delcotron.

If the warning light fails to go out with the Delcotron in operation, the trouble is in either the field relay or the Delcotron. Check the field relay first, as follows:

1. Insert a cotter key into the R terminal on the Delcotron.
2. Connect the positive lead of a voltmeter to the cotter key and the other lead to ground.
3. Start the engine and run at fast idle. Observe the voltmeter reading.
4. If the voltmeter reading is 5 volts or above, and the warning light fails to go out, either the warning light relay is defective and must be replaced, or the wire from the "R" terminal on the Delcotron to the relay is open. The wire can be checked for continuity with an ohmmeter or test light.
5. If the voltmeter reading is below 5 volts, the trouble is in the Delcotron. Proceed with the Delcotron output check.
6. Shut off engine.

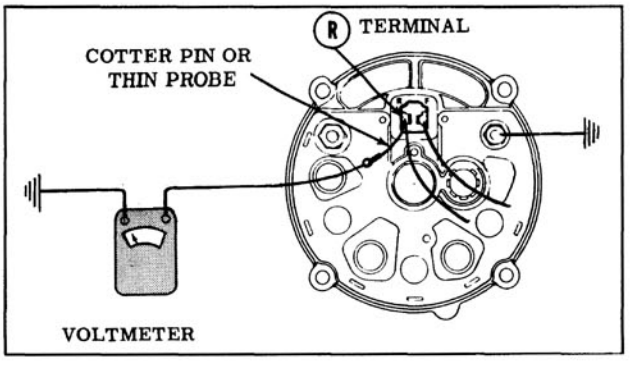


Fig. 13-16 Field Relay Check

DELCOTRON OUTPUT CHECK (Fig. 13-17)

1. Disconnect the battery.
2. Remove the red wire from the BAT terminal on the Delcotron. Connect one lead of an ammeter to the red wire and the other lead to the BAT terminal on the Delcotron.
3. Connect a voltmeter across the battery terminals.
4. Remove the F and R terminal connector from the Delcotron.
5. Install the test adapter connector J-21053 on the F terminal of the Delcotron. Attach the alligator clip to the BAT terminal.
6. Connect the negative battery cable. Load the battery with a carbon pile rheostat or by turning on the lights and accessories to prevent excessive voltage.
7. Start the engine and while observing the ammeter, gradually raise engine rpm until output is reached. Do not run engine faster than the specified rpm, as the regulator is by-passed and excessive voltage could be built up.

NOTE: Variations in engine rpm are necessitated by differences in pulley ratios.

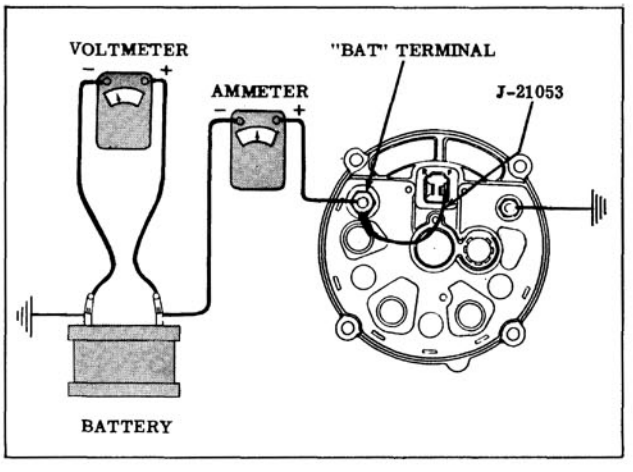


Fig. 13-17 Checking Delcotron Output

CAUTION: Do not allow the output voltage to exceed the regulator setting.

8. If output is not within specifications, it will be necessary to disassemble and test the components within the Delcotron.

9. Stop engine and disconnect battery.

10. Disconnect the test adapter, ammeter and voltmeter.

11. Install the connector on the F and R terminals and the red wire to the BAT terminal of the Delcotron.

12. Install the battery cable.

OUTPUT CHART

Unit Tested	Engine rpm	Amp. Output
(1100616 55 amp.)	775 1950	29 to 36 50 to 57
(1100657 55 amp.)	750 1850	29 to 36 50 to 57
(1100658 55 amp.)	750 1850	29 to 36 50 to 57
(1100664 55 amp.)	800 2000	29 to 36 50 to 57
(1100659 42 amp.)	850 2150	23 to 30 37 to 44
(1100663 37 amp.)	900 2200	20 to 27 32 to 39
(1100656 37 amp.)	850 2150	20 to 27 32 to 39
*(1100629 42 amp.)	900 2200	23 to 30 37 to 44
*(1100629 42 amp.)	850 2150	23 to 30 37 to 44
**(1100659 42 amp.)	750 1850	23 to 30 37 to 44
***(1100663 37 amp.)	800 2000	20 to 27 32 to 39
****(1100656 37 amp.)	850 2150	20 to 27 32 to 39

*Service Replacement for 37 amp. Delcotron.
**34, 35, 36, 38 & 39 Series Dealer Installed A/C.
***30 & 31 Series V-6 Dealer Installed A/C.
****30, 31, 32 & 33 Series V-8 Dealer Installed A/C.

VOLTAGE REGULATOR ASSEMBLY

The voltage regulator contacts should not be cleaned unless the electrical performance indicates it is necessary. A sooty or discolored condition of the contacts is normal after a relatively short period of operation and is not an indication that cleaning is necessary. However, if the voltage fluctuates as evidenced by an unsteady voltmeter reading when checking the voltage setting, the contacts may have excessive resistance or be sticking and should be cleaned.

CAUTION: Before cleaning contacts, make sure the unsteady voltage is not being caused by loose connections or high resistance elsewhere in the system.

The contacts on the voltage regulator unit are of a soft material and must not be cleaned with a file. A strip of No. 400 silicon carbide paper or equivalent folded over and then pulled back and forth between the contacts is recommended as a satisfactory method of cleaning. After cleaning, the contacts should be washed with alcohol to remove any residue. If the voltage control has not improved, repeat the cleaning and washing process.

To clean the field relay contacts, use a thin, fine-cut, flat file. Remove only enough material to clean the points.

Never use emery cloth or sandpaper to clean contact points.

Voltage Regulator

Three checks and adjustments can be performed on the double contact voltage regulator. They are voltage setting, point opening and air gap. The only time the point opening and air gap should be checked is when the correct voltage setting cannot be made.

Voltage Setting

Before making any voltage adjustments, position a mercury type glass thermometer within 1/4" of the regulator cover. This measures the surrounding temperature of the regulator. After the temperature is known, the voltage settings can be made in relation to the temperature.

1. Check battery and charge, if necessary, as the voltage setting must be made with a fully charged battery, to limit the Delcotron output

AMBIENT TEMPERATURE	VOLTAGE SETTING
65	13.9 to 15.0
85	13.8 to 14.8
105	13.7 to 14.6
125	13.5 to 14.4
145	13.4 to 14.2
165	13.2 to 14.0
185	13.1 to 13.9
205	13.0 to 13.8

Fig. 13-18 Temperature - Voltage Chart

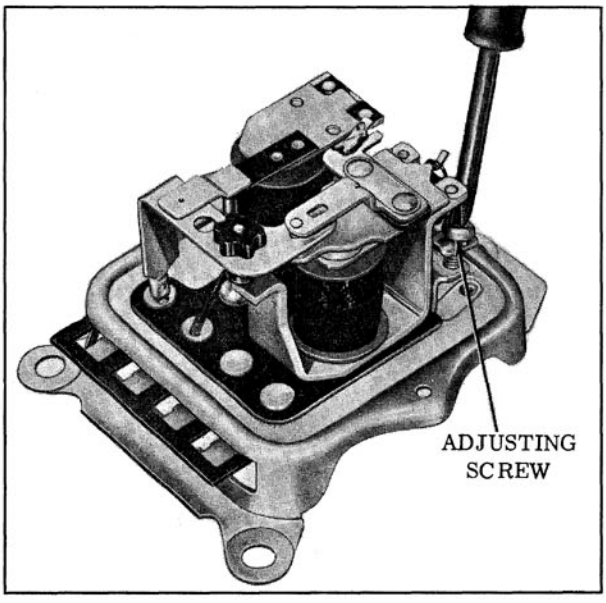


Fig. 13-19 Adjusting Voltage Setting

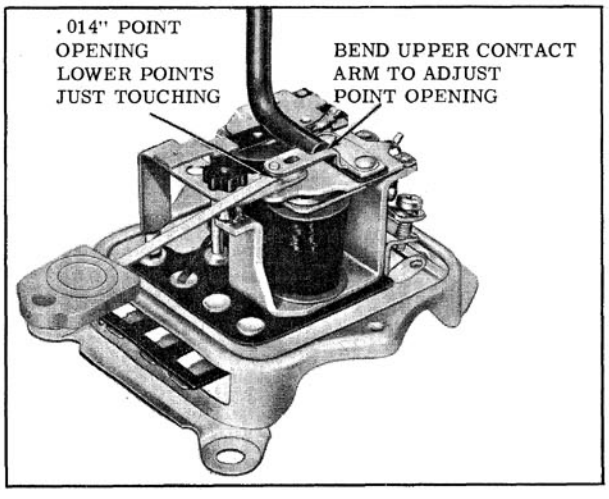


Fig. 13-20 Checking Point Opening

to 10 amperes or less. Correct voltage settings cannot be made if the Delcotron output is greater than 10 amperes.

If the battery is suspected of being defective, a LIGHT LOAD TEST should be performed to determine the condition of the battery.

2. Connect a voltmeter across the battery terminals.

3. Position the bulb of a glass mercury type thermometer, such as J-5421, within 1/4" of the regulator cover.

4. Start the engine and run for 15 minutes at approximately 1200 rpm. Leave the cover on the regulator to establish operating temperature. All accessories and lights must be turned off.

5. After the 15-minute warm-up, cycle the Delcotron by shutting off the engine, removing the regulator cover and restarting.

6. Raise engine speed to 2200 rpm. The regulator should be operating on the upper contacts. This can be visually observed in the regulator. Note the voltage reading on the voltmeter. The voltage reading should be within the voltage specifications as indicated by the temperature voltage chart. (Fig. 13-18)

7. If the voltage does not fall within the normal specification range, the voltage can be adjusted by turning the adjusting screw. (Fig. 13-19)

   CAUTION: Always make final setting by turning the screw clockwise. This insures that the spring holder will be against the head of the screw. If it is necessary to turn the screw head counterclockwise, turn it until the screw head is approximately 1/8" above the adjusting bracket, then pry holder up against screw head, then turn screw clockwise to make setting.

8. Cycle the Delcotron and recheck voltage reading. Readjust if necessary.

9. Turn on the lights and accessories to operate the voltage regulator on the lower set of contact points. Run the engine at 2200 rpm and note the voltage reading. The voltage should be .1 to .3 volts lower than the reading obtained in Step 8.

10. If necessary to adjust, turn the nylon nut counterclockwise to increase the difference and clockwise to decrease the difference between the upper and lower points. After making the adjustments, it is necessary to recheck the voltage setting on both upper and lower contact points.

11. Install the regulator cover and remove the voltmeter. Avoid contact with the regulator

units when installing the regulator cover.

Point Opening (Fig. 13-20)

1. Remove the electrical connector from the regulator.
2. With the lower contacts touching, measure the point opening between the upper contact points. Clearance should be .014".
3. If necessary to adjust, bend the upper contact arm, being careful not to bend the hinge.

Air Gap (Fig. 13-21)

1. With the electrical connector removed, measure the air gap between the armature and core with the lower contact points touching. Clearance should be .060".
2. If necessary to adjust, rotate the nylon nut on the contact support.

NOTE: The .060" air gap adjustment is only an initial setting. Final adjustment must be made with the engine running, so that the voltage reading, when operating on the lower contacts, is .1 to .3 volts less than the voltage reading when operating on the upper contacts.

FIELD RELAY

The two checks required on the field relay are air gap and point opening.

1. Disconnect the electrical connector from the regulator.
2. Remove the regulator cover.
3. Check clearance between the armature and core with the points just touching. Air gap should be .015". (Fig. 13-22)
4. If necessary to adjust, bend the contact support.
5. To check point opening, insert a feeler gauge between the contact points. Clearance should be .030". (Fig. 13-23)
6. If necessary to adjust, bend the armature stop.
7. Install the regulator cover and electrical connector.

TAILORING THE VOLTAGE SETTING

The voltage setting for one type of operating condition may not be satisfactory for a different type of operating condition. Vehicle underhood temperatures, operating speeds, and the amount of night-time driving are factors which determine the proper voltage setting. The proper voltage

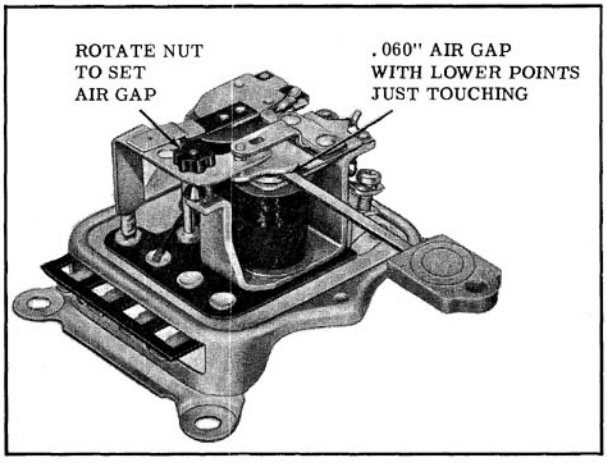


Fig. 13-21 Checking Air Gap

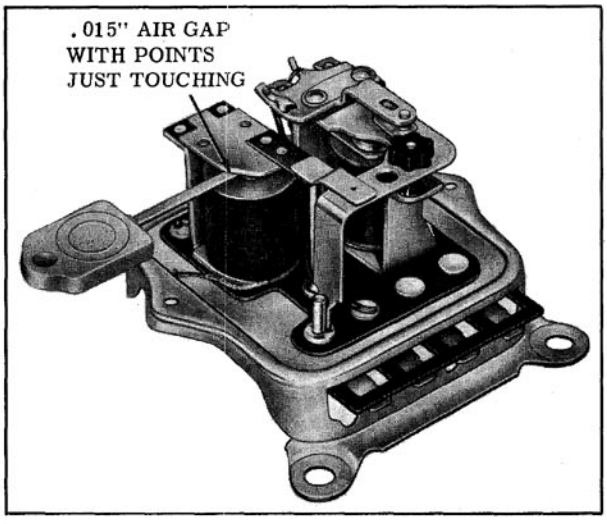


Fig. 13-22 Checking Field Relay Air Gap

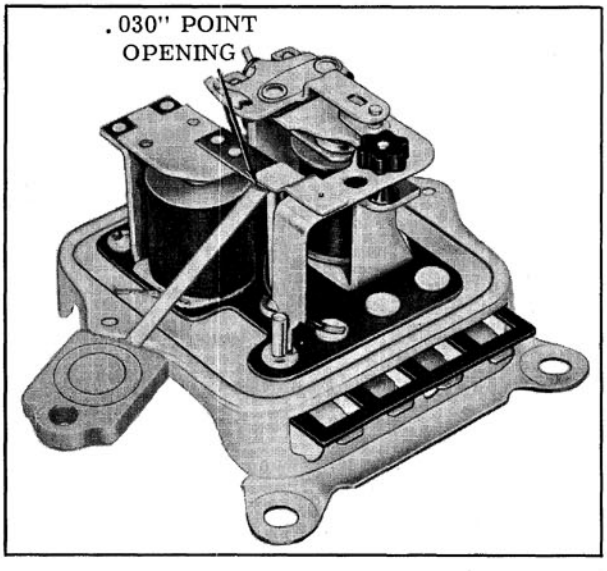


Fig. 13-23 Checking Field Relay Point Opening

setting is attained when the battery remains fully charged with a minimum use of water.

If no circuit defects are found, yet the battery remains undercharged, raise the voltage setting by .3 volt, and then check for an improved battery condition over a service period of reasonable length. If the battery remains overcharged, lower the setting by .3 volt, and then check for an improved battery condition.

BATTERY

A hydrometer test will indicate the state of charge of a battery unless water has recently been added to the battery or the battery has been recently fast charged. A good hydrometer reading does not necessarily indicate that the battery will perform its normal functions. (See LIGHT LOAD TEST IN SERVICING OF UNITS IN THE CHARGING CIRCUIT.)

Specific gravity of the electrolyte varies .004 units for every 10° difference between the temperature of the electrolyte and 80°F. The hydrometer reading must be corrected to 80°F.

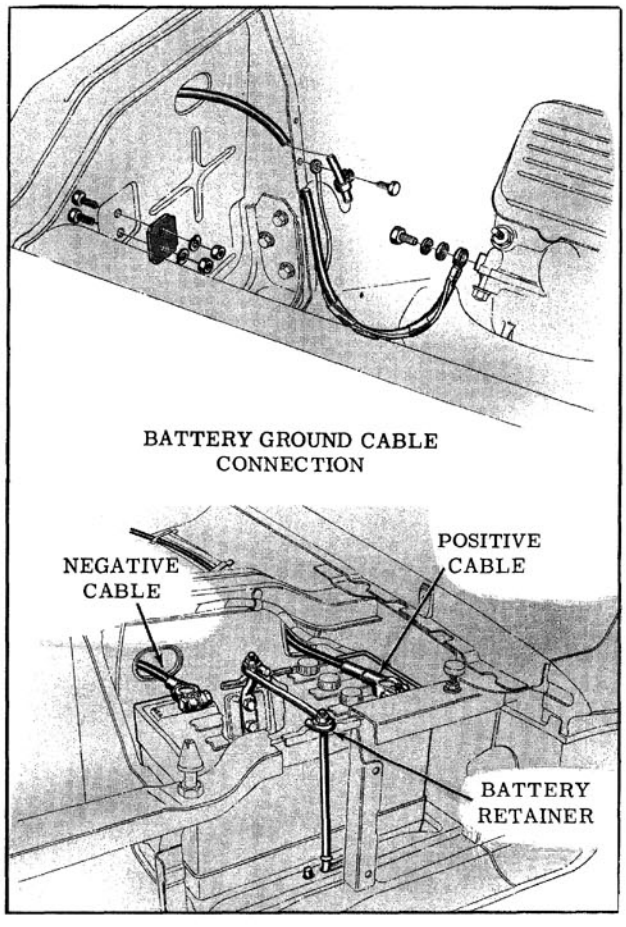


Fig. 13-24 Battery Installation (33, 34, 35, 36, 38 and 39 Series)

Examples:

a. Hydrometer gravity reading	1.235
Electrolyte temperature 110°F Correction (4x3)	+ .012
Corrected gravity reading	1.247
b. Hydrometer gravity reading	1.250
Electrolyte temperature 0°F Correction (4x8)	- .032
Corrected gravity reading	1.218

A battery with a corrected specific gravity reading of 1.215 is half charged. A battery with a specific gravity reading of 1.270 ± .010 at 80°F is fully charged.

If the corrected specific gravity of the electrolyte is less than 1.215 or varies more than .025 between cells, the battery should be removed for a slow charge and a light load test.

SERVICING OF UNITS IN THE CHARGING CIRCUIT

BATTERY

Removal and Installation

The batteries are installed as shown in Figs. 13-24, 13-25 and 13-26. When installing batteries, tighten the battery retainer nuts 1.5 to 2.5 ft. lbs.

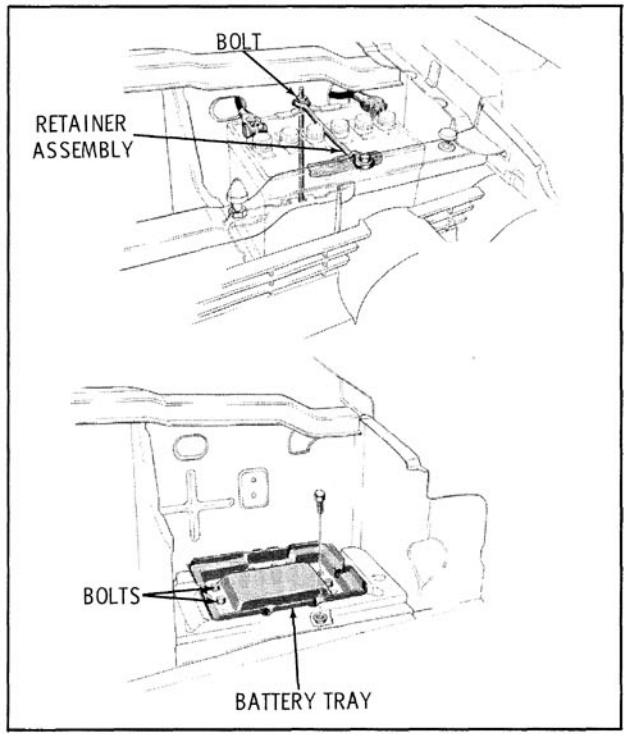


Fig. 13-25 Battery Installation (33 Series)

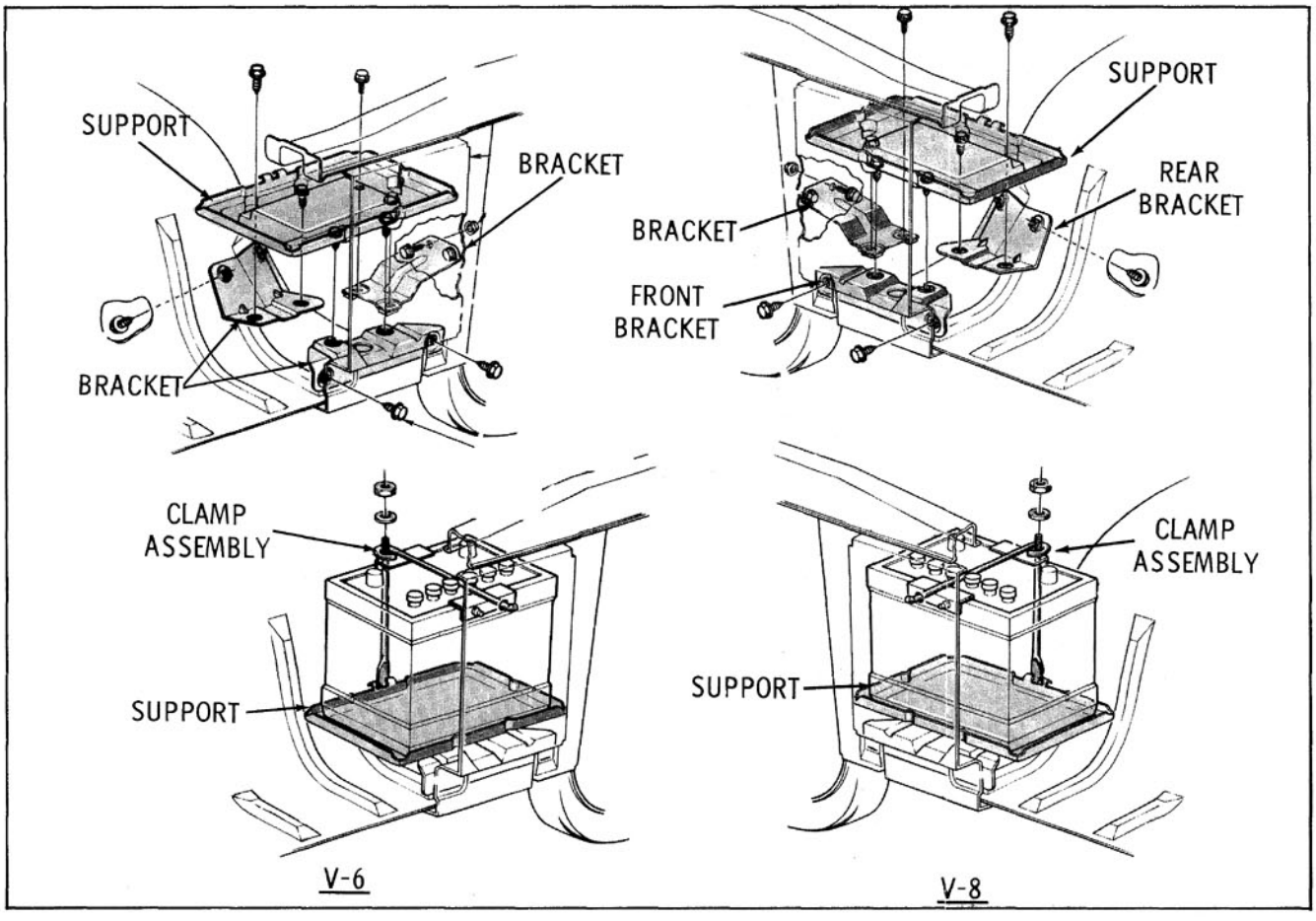


Fig. 13-26 Battery Installation (30-31 & 32 Series)

IN-THE-CAR BATTERY TEST AND CHARGING

INSPECTION

Check outside of battery for damage or signs of serious abuse such as broken case or covers. Check electrolyte level. If electrolyte level is low, bring it up to the split ring by adding odorless, colorless drinking water.

If battery shows signs of serious damage or abuse, it should be replaced. If not, make a light load test.

LIGHT LOAD TEST

1. Place load on battery by holding starter switch "ON" for three seconds. It makes no difference whether starter turns engine or not. However, if engine starts, turn off ignition immediately.

2. Turn on headlamps (low beam) for one minute. With headlamps still "ON", read individual cell voltages of battery with voltmeter (.01 volt division). Compare readings with the following:

A. Uniform Readings

If any cell reads 1.95 volts or more and the difference between the highest and lowest cell is less than .05 volt, battery is good. (Fig. 13-27) If any cell reads less than 1.95 volts, battery should be fully recharged for good performance. (Fig. 13-28) See CHARGING AFTER LIGHT LOAD TEST.

B. Non-Uniform Readings

If any cell reads 1.95 volts or more and there is a difference of .05 volt or more between the highest and lowest cell, the battery should be replaced. (Fig. 13-29)

C. Low Readings

If all cells read less than 1.95 volts, battery is too low to test properly. (Fig. 13-30) FAILURE OF THE METER TO REGISTER ON ALL CELLS DOES NOT INDICATE A DEFECTIVE BATTERY. Boost charge battery and repeat Light Load Test. (See BOOST CHARGING FOR LIGHT LOAD TEST.) If battery is found to be good after boosting, it should be fully recharged for good performance.

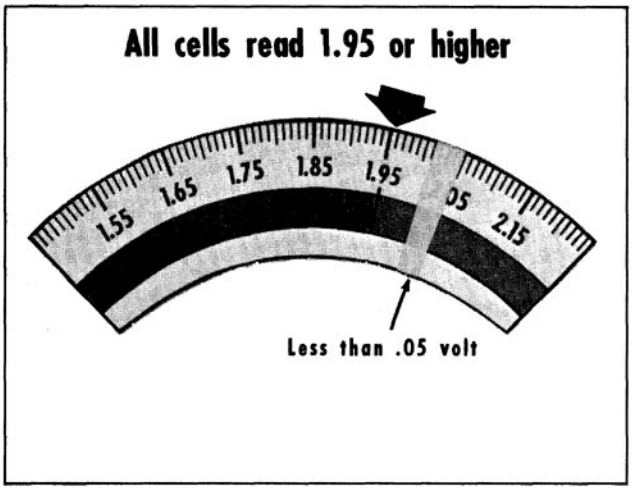


Fig. 13-27 Good Battery (Sufficiently Charged)

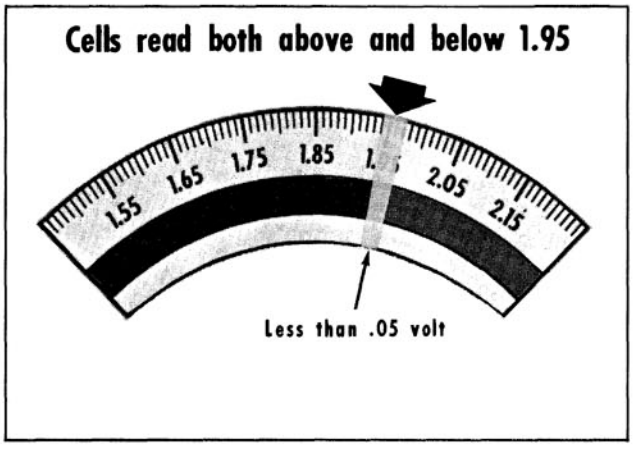


Fig. 13-28 Good Battery (Requires Charging)

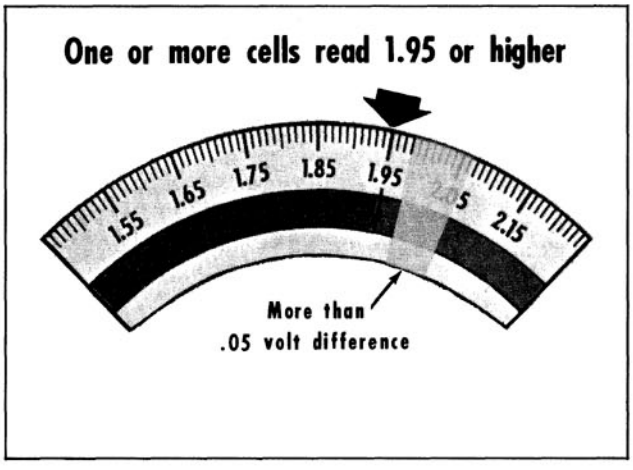


Fig. 13-29 Replace Battery

If none of the cells come up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not come up after the second boost charge should be replaced.

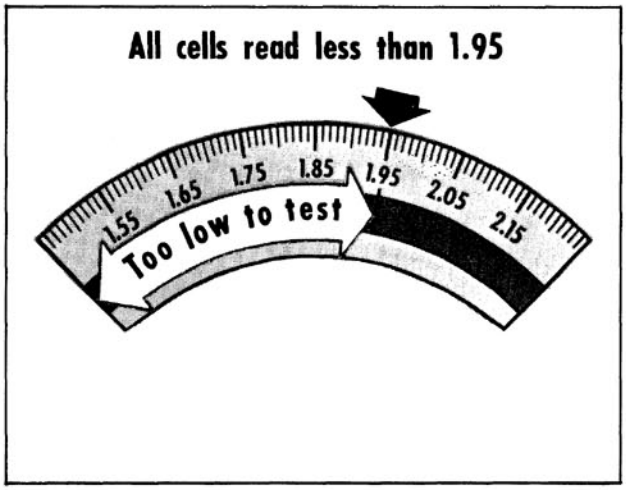


Fig. 13-30 Charge Battery and Retest

BOOST CHARGING FOR LIGHT LOAD TEST

Boost 12-volt batteries at 50 amperes for 20 minutes (50 x 20 = 1000 ampere minutes). If charger will not give this rate, charge for an equal number of ampere minutes at best rate available. For purposes of light load test, do not boost battery more than the amount indicated.

CHARGING AFTER LIGHT LOAD TEST

1. For best performance, a good battery should be fully charged before being returned to service.

2. If batteries are to be fully charged by means of a quick charger, the charge rate must be "tapered" (reduced to a safe limit) when the electrolyte temperature reaches 125°F or when gassing becomes excessive. Failure to do so may harm the battery.

SLOW CHARGING

Batteries removed from the car for charging should be charged continously at a low rate. Batteries may be safely slow-charged at a rate in amperes equal to 7% of the battery's ampere-hour capacity. This is called the "Normal" charge rate.

Although the slow-charge method is recommended for charging all batteries, discharge batteries in otherwise good condition, may be given a "boost" with a fast charger if time does not permit complete slow-charging. When using a fast charger, it must be remembered that the battery is only receiving a partial charge and that the battery electrolyte temperature must not be allowed to exceed 125°F. If the battery heats excessively, quick charging must be discontinued.

Batteries removed from the car for further checking, in order to determine whether or not

the unit should be replaced, should first be brought to a fully-charged condition by slow charging. Badly sulfated batteries may require a continuous slow-charging for 48 hours or more before a rise in gravity reading occurs. If the specific gravity reading of any cell fails to reach 1.215 (corrected to 80°F) or if there is a variation of more than 25 points between cells after thorough slow charging, replace the battery.

REGULATOR (Figs. 13-31 and 13-32)

Removal and Installation

1. Disconnect electrical connector from regulator by lifting the connector retainer.
2. Remove the regulator attaching screws and remove regulator. To install, reverse the removal procedure. DO NOT ATTEMPT TO POLARIZE THE DELCOTRON.

DELCOTRON

Removal and Installation

The Delcotron is attached as shown in Figs. 13-33 and 13-34. Before removing the Delcotron, disconnect the battery negative cable.

After installing the Delcotron, tighten the belts using Tool 33-70 M.

Disassembly (Fig. 13-35)

1. Scribe alignment marks on the end frames, then remove the four through-bolts.
2. Separate the drive end-frame and rotor assembly from the stator assembly by prying at the stator slot.
3. Position the rotor in a vise and tighten only enough to permit loosening of the shaft nut. Avoid excessive tightening to prevent distortion of the rotor. Tool BT-6317 will easily remove the pulley nut without clamping the rotor in a vise.
4. Remove the shaft nut, wave washer, pulley, fan and collar. Separate the drive end-frame and spacer from the rotor shaft.
5. If necessary to remove the bearing from the drive end-frame, proceed as follows:
   A. Remove bearing retainer and gasket.
   B. Back-up the bearing housing with Tool J-7584-1 (Front Cover Seal Installer).
   C. Drive out bearing with Tool J-5158-2 (Valve Guide Installer).

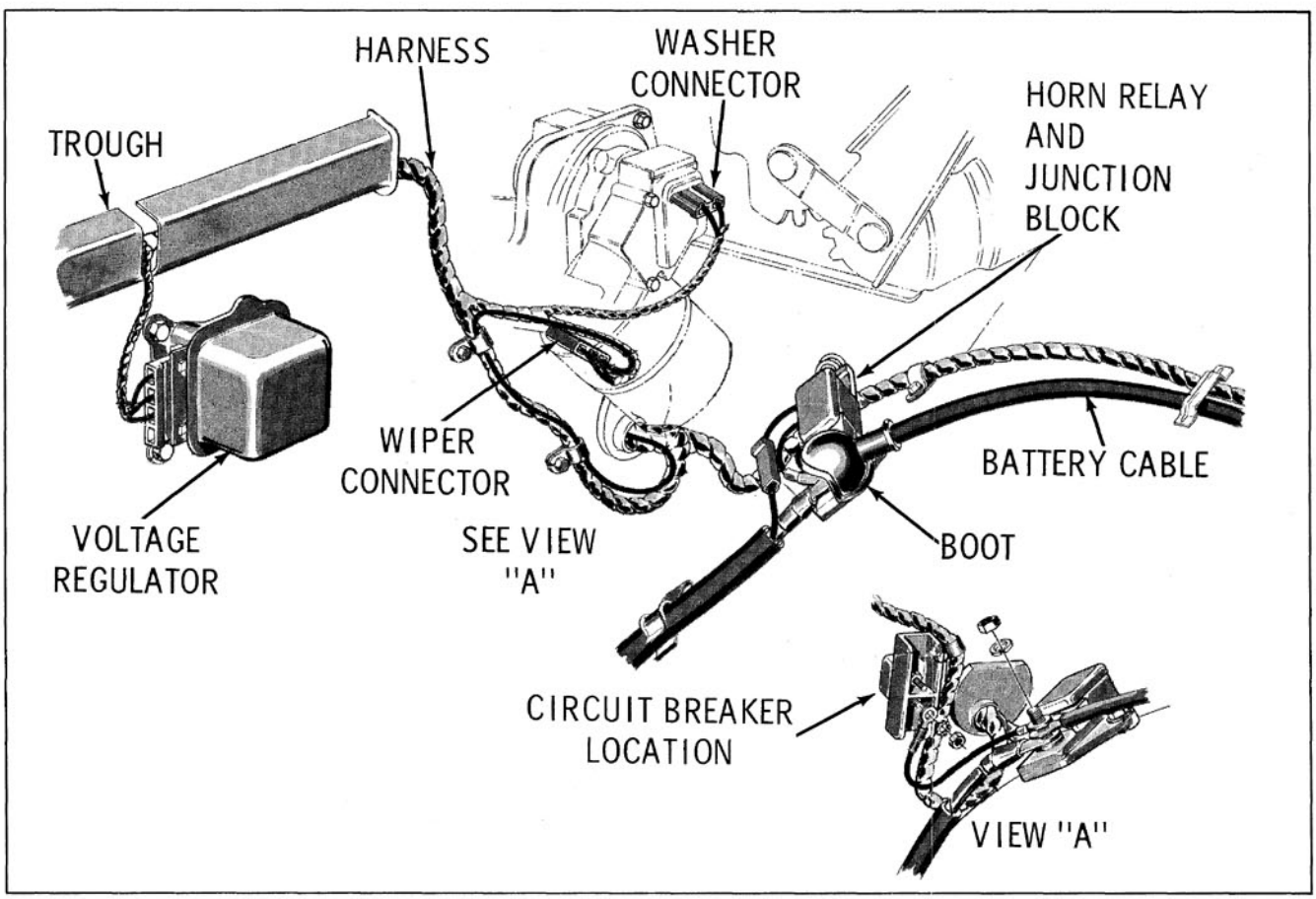


Fig. 13-31 Regulator

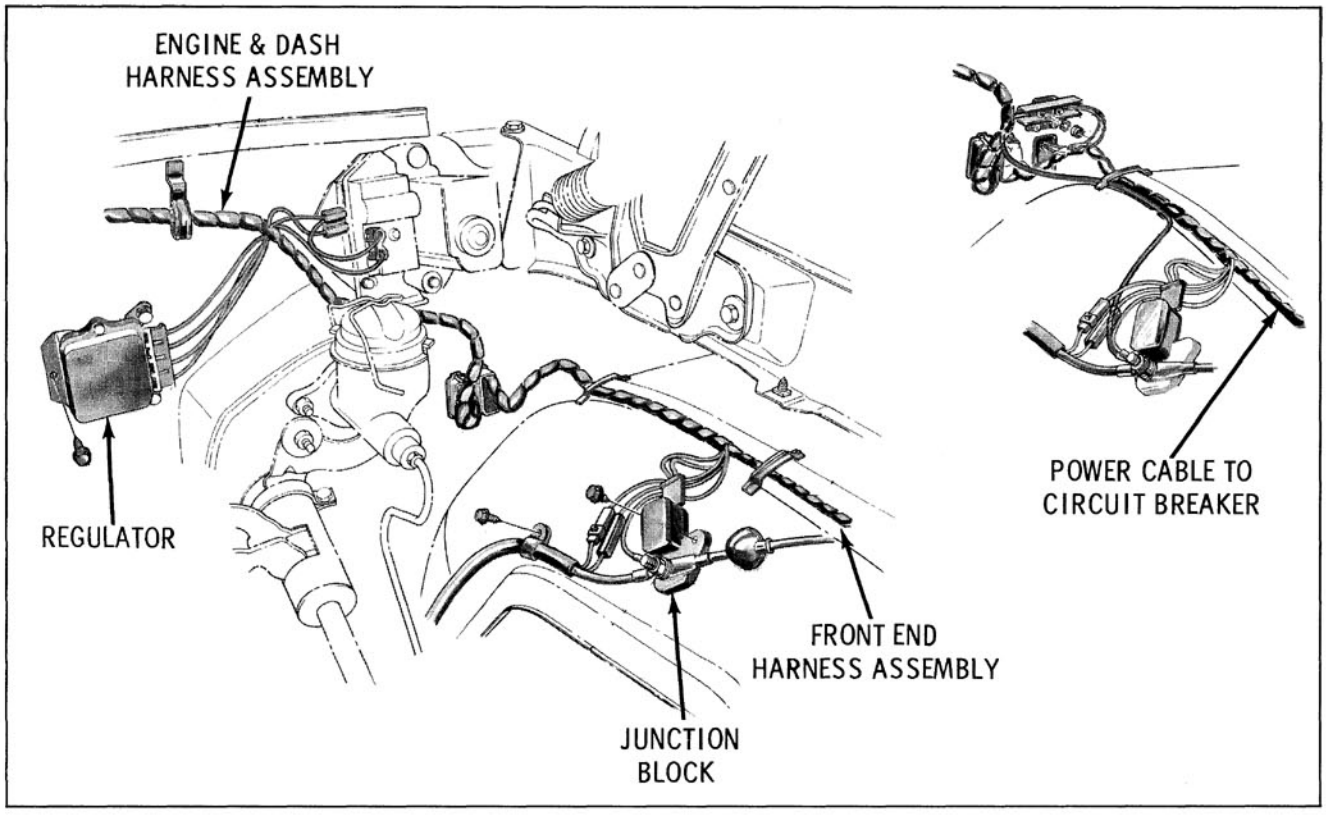


Fig. 13-32 Regulator Installation (30-31 & 32 Series)

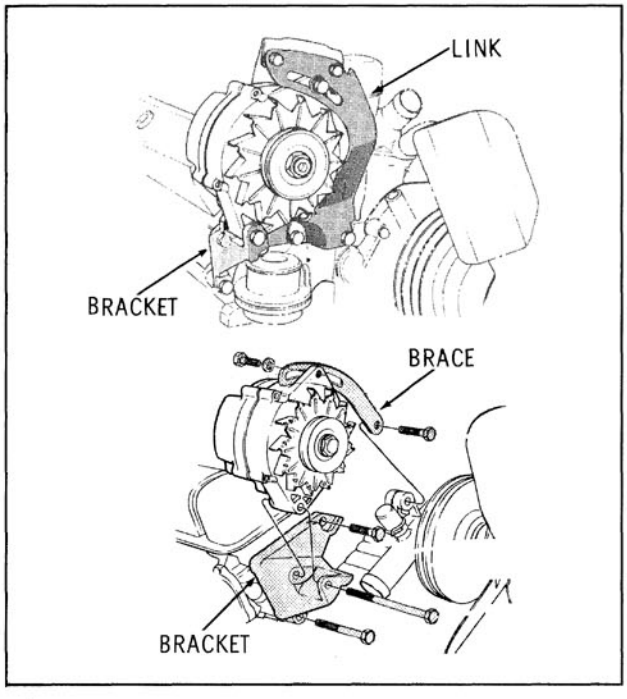


Fig. 13-33 Delcotron Installation (30-31 & 32 Series)

6. Remove the three stator winding to diode attaching nuts and separate the stator from the slip ring end-frame.

7. Remove the two brush holder attaching screws and remove the brush holder from the end-frame.

8. Separate the brushes and relay lead from the brush holder.

9. Remove the condenser to heat sink attaching screw and fiber washer.

10. Remove the BAT and GRD terminal nuts, bolts and washers; then remove the heat sink.

11. If necessary to remove the condenser, it can be removed by pushing it out to the rear of the end-frame.

Cleaning and Inspection

1. Check roller bearing in slip ring end-frame. If bearing has sufficient lubricant and shows no sign of damage, protect the bearing opening with masking tape to prevent entrance of foreign material, and clean end-frame with compressed air. If bearing shows roughness or lack of lubricant, the bearing should be replaced as follows:

   A. Position end-frame on the open jaws of a vise so that the jaws support the area around the bearing.

   B. Using Valve Guide Installer J-5158-2, press bearing rearward out of end-frame Clean end-frame in cleaning solvent.

   C. To install new bearing, back up the inside area of the end-frame surrounding the bearing with Tool J-8810.

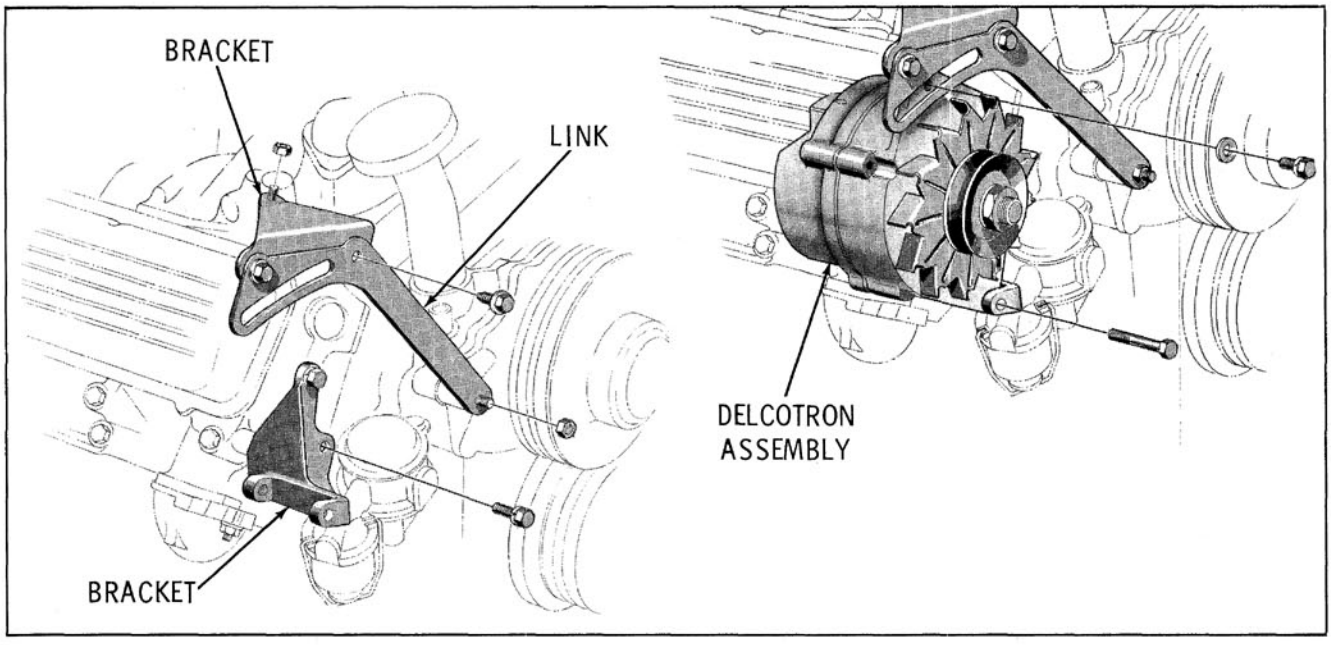


Fig. 13-34 Delcotron Installation (33-34-35-36-38 & 39 Series)

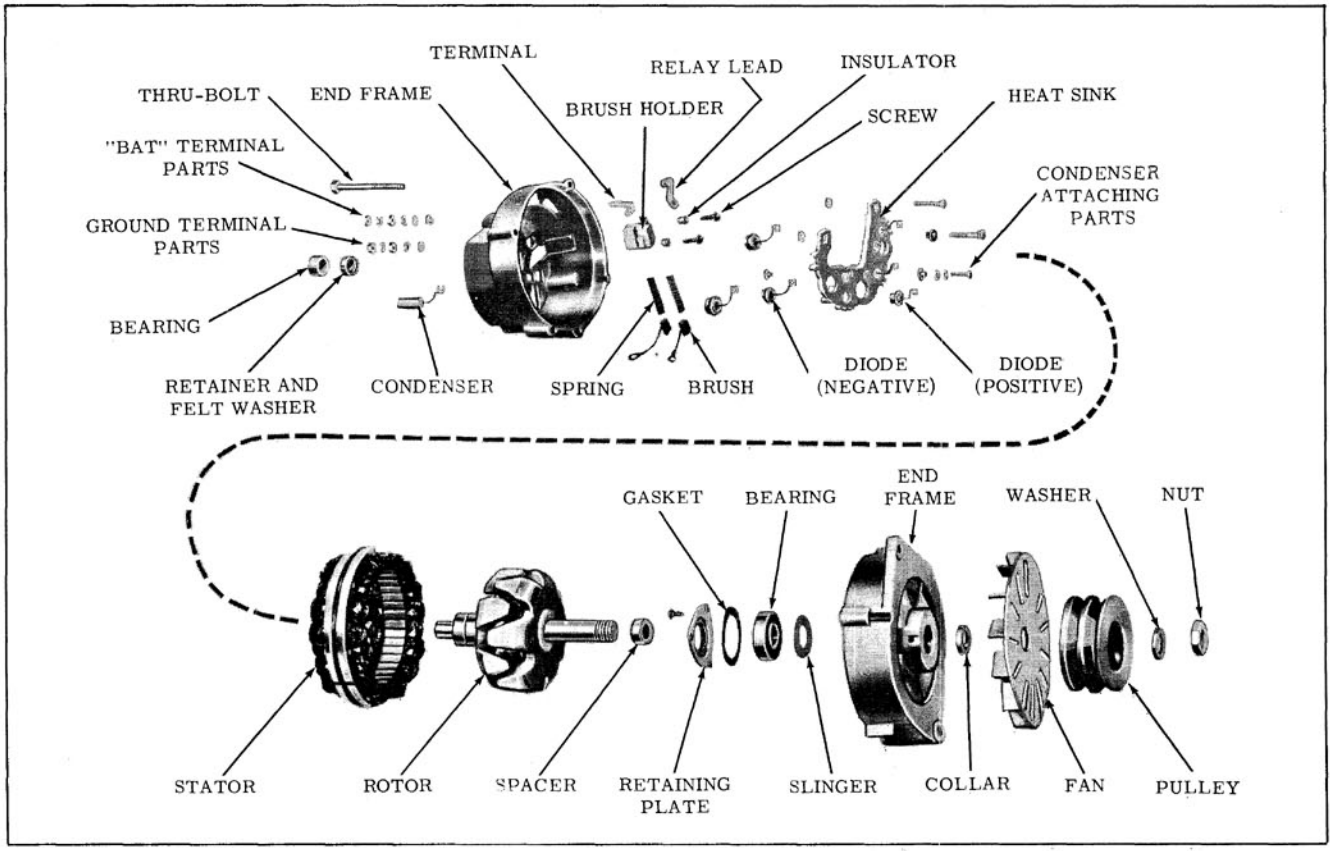


Fig. 13-35 Delcotron Assembly

D. Press on closed end of needle bearing until bearing is flush with the end-frame housing.

E. Install a new retainer and felt washer with J-5158-2 until retainer seats against bearing.

2. Wash metal parts except stator and rotor in cleaning solvent. Degreasing solvent will damage the rotor and stator insulation. The rotor and stator should be cleaned with compressed air.

3. Check the rotor as follows:

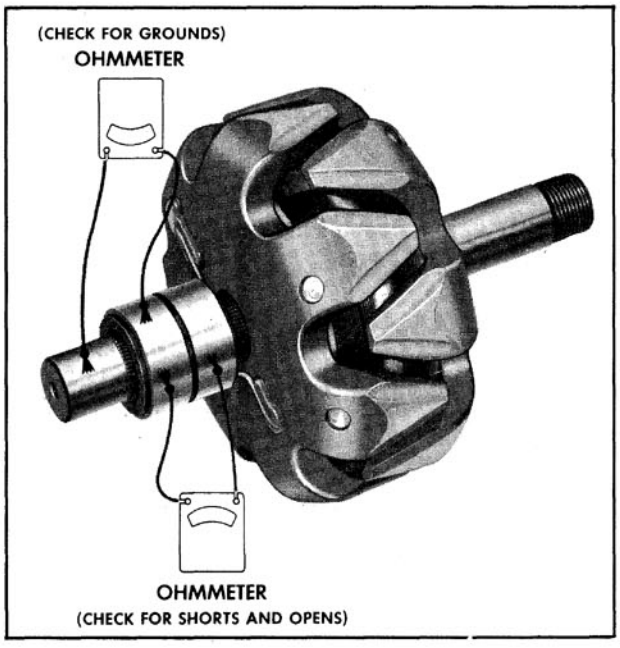


Fig. 13-36 Checking Rotor

A. To check rotor for grounds, connect a 12-volt test lamp or a ohmmeter from either slip ring to the rotor shaft or poles. If the lamp lights or the ohmmeter reading is low, the field winding is grounded and the rotor must be replaced. (Fig. 13-36)

B. To check rotor for opens, connect the test lamp or an ohmmeter lead to each slip ring. If the test lamp does not light or no reading can be obtained on the ohmmeter, the field winding is open and the rotor must be replaced. (Fig. 13-36)

C. To check rotor for short circuits, connect a 12-volt battery and an ammeter is series with the two slip rings. The ammeter should read 1.9 to 2.2 amps. If ammeter reading is higher than specified, the field windings are shorted and the rotor must be replaced.

D. The slip rings on the rotor can be cleaned with 400 grain or finer polishing cloth. When cleaning slip rings, the rotor must be rotating to prevent flat spots on the slip rings which could cause brush noise.

Slip rings which are rough or out-of-round should be trued in a lathe with a .002" maximum indicator reading. After turning slip rings in a lathe, polish with 400 grain or finer polishing cloth. Thoroughly clean away all dust particles.

4. The stator can be checked as follows:

A. Connect a 12-volt test lamp or an ohmmeter from a stator lead to the stator frame. If the lamp lights or the ohmmeter reading is low, the winding is grounded and the stator must be replaced. If lamp does not light or no ohmmeter reading can be obtained, repeat procedure on the other two stator leads. (Fig. 13-37)

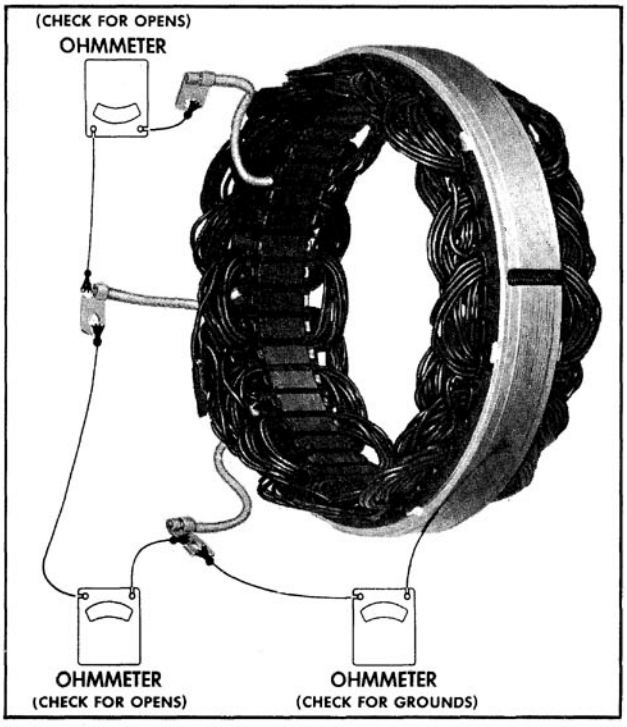


Fig. 13-37 Checking Stator

B. Connect a 12-volt test lamp or an ohmmeter between each pair of stator leads. If the lamp fails to light or the ohmmeter reading is high between any pair of leads, the stator winding is open and the stator must be replaced. (Fig. 13-37)

C. A short circuit in the stator windings is difficult to locate without special test equipment due to the low resistance of the windings. However, if all other electrical checks are normal and the Delcotron fails to supply rated output, it is an indication that the stator windings are shorted.

5. Check each diode for a shorted or open condition. Refer to diode checking.

6. Inspect the drive end frame bearing for roughness.

7. Inspect brushes and brush springs.

8. Inspect drive end-frame bearing retainer plate felt. If felt is hard or worn, the retainer plate should be discarded.

Diode Checking

The positive diodes, located in the heat sink, are checked as follows:

A. Attach the positive test lamp lead to a diode lead.

B. Attach the negative test lamp lead to the heat sink; the lamp should light indicating a good positive diode.

C. Check the other two positive diodes in the same manner.

D. Reverse the test lamp leads and again check the three positive diodes. The lamp should not light, indicating a good positive diode.

The negative diodes, located in the slip ring end-frame are checked as follows:

A. Attach the negative test lamp lead to a diode lead.

B. Attach the positive test lamp lead to the ship ring end frame, the lamp should light, indicating a good negative diode.

C. Check the other two negative diodes in the same manner.

D. Reverse the test lamp leads and again check the three negative diodes. The lamp should not light, indicating a good negative diode.

If the lamp lights in both checks of each diode, or fails to light in both checks, the diode is shorted or open and must be replaced. This procedure can also be used to determine the polarity of a new diode. If necessary to replace a diode, refer to DIODE - Remove and Install.

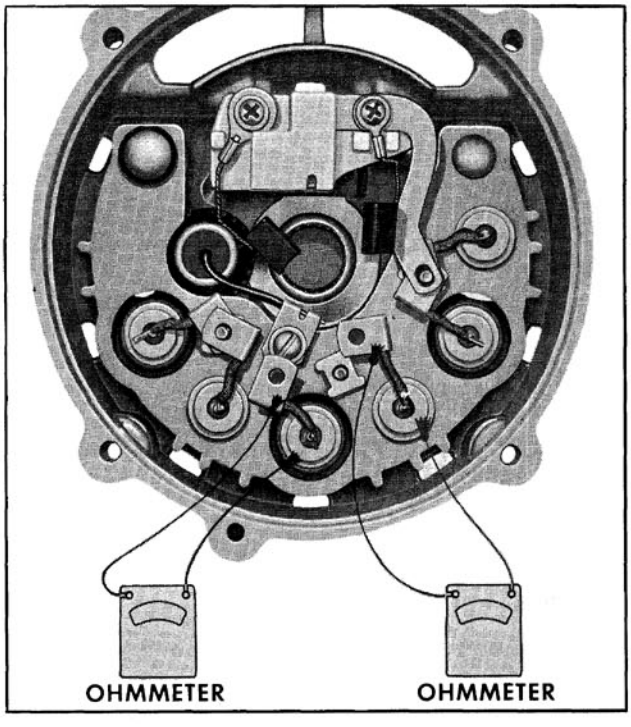


Fig. 13-38 Checking Diodes

Ohmmeter Method (Fig. 13-38)

The lowest range scale on the ohmmeter should be used, and the ohmmeter should have a 1-1/2 volt cell. To determine the cell voltage, turn the selector to the lowest scale, and then connect the ohmmeter leads to a voltmeter. The voltmeter will indicate the cell voltage.

Check the diode in the heat sink by connecting one of the ohmmeter leads to the heat sink, and the other ohmmeter lead to the diode lead and note the reading, then reverse the ohmmeter lead connections and note the reading. If both readings are very low, or if both readings are very high, the diode if defective. A good diode will give one low reading and one high reading. Check the other two diodes in the heat sink in the same manner.

To check a diode mounted in the end-frame, connect one of the ohmmeter leads to the end frame, and the other ohmmeter lead to the diode lead and note the reading, then reverse the ohmmeter lead connections, and note the reading. If both readings are very low, or if both readings are very high, the diode is defective. A good diode will give one low reading and one high reading. Check the other two diodes in the end-frame in the same manner.

Special Tester Method

Special testers are available for checking diodes. To use these testers, follow the tester manufacturer's recommendations.

DIODE

Remove

1. With the Delcotron disassembled and the stator removed, position Tool J-9617-1, J-9617-2 and the slip ring end-frame in a vise as shown in Fig. 13-39.

NOTE: Diodes can be removed from either the end frame or the heat sink without removing the heat sink.

2. Operate vise until the defective diode is removed from the end-frame or heat sink.

3. Remove tools, diode and end-frame from the vise.

Install

1. Insert a diode into Tool J-9600 as shown in Inset, Fig. 13-40.

NOTE: The positive diode rectifiers are located in the heat sink and the negative diode rectifiers are located in the end-frame.

2. Position Tools J-9617-1, J-9600 (with diode) and end-frame as shown in Fig. 13-40.

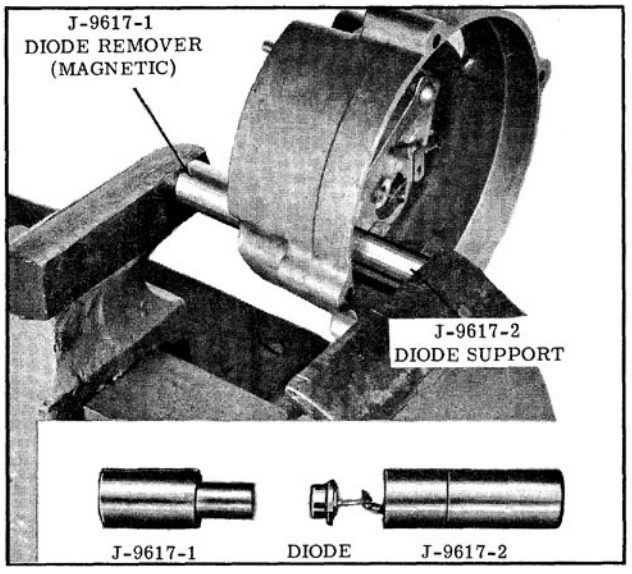


Fig. 13-39 Diode Removal

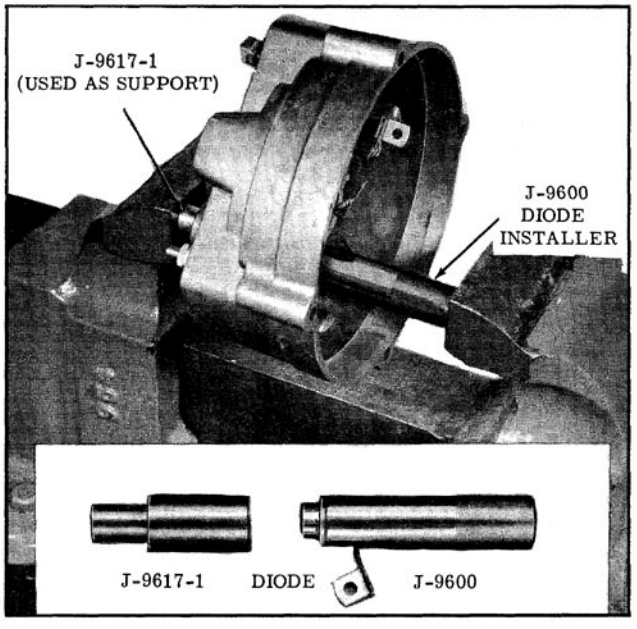


Fig. 13-40 Diode Installation

3. Operate vise until the diode shoulder bottoms against the end-frame or heat sink.

4. Remove tools and end-frame from vise.

Delcotron Assembly

NOTE: If a new slip ring end-frame is to be installed, stamp the last three numbers of the old end-frame on the new end-frame as shown in Fig. 18-41.

1. If the capacitor was removed, install from the inside of the end-frame until the capacitor is flush with capacitor housing.

2. Install the heat sink, making sure insulated washers are installed as shown in Fig. 13-42.

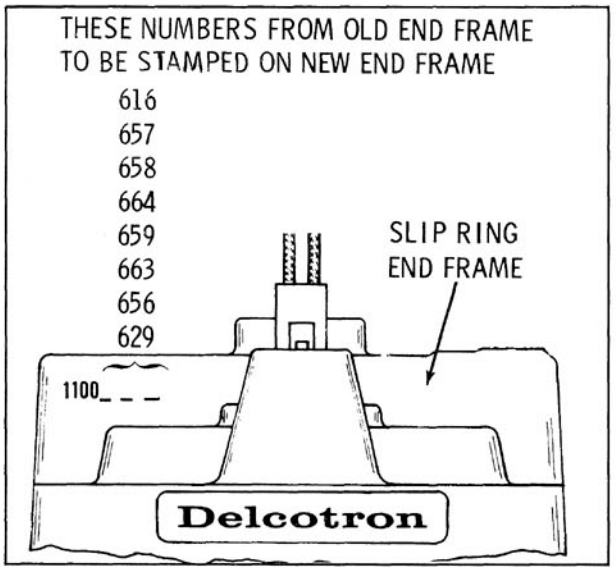


Fig. 13-41 Delcotron Part No. Location

3. Install the capacitor to heat sink lead.

4. Assemble the brush holder as shown in Fig. 13-43. Install the brush springs and brushes into the brush holder and retain with a straight piece of wire inserted through the hole in the brush holder.

5. Install the brush holder assembly into the end frame and retain with the two attaching screws.

6. Position the stator into the slip ring end frame with the stator leads aligned with the stator and diode lead attaching studs. Before installing the attaching nuts, position the relay lead over the diode lead attaching stud. Tighten all nuts. (Fig. 13-41)

7. If the bearing in the drive end-frame is to be re-used, it should be re-packed one-quarter full of lubricant, Part No. 1948791. Install the bearing into the drive end-frame as follows:

   A. Position drive end-frame on a flat surface.

   B. Retain grease slinger to the bearing with grease.

   C. Using Tool J-6133 (Speedometer Gear Installer) press bearing into position.

   D. Install bearing retainer.

8. Position the rotor in a vise. Tighten vise only enough to permit tightening the shaft nut.

9. Install the spacer, drive end-frame, collar, fan, pulley, wave washer and rotor nut. Tighten nut 50 to 60 ft. lbs.

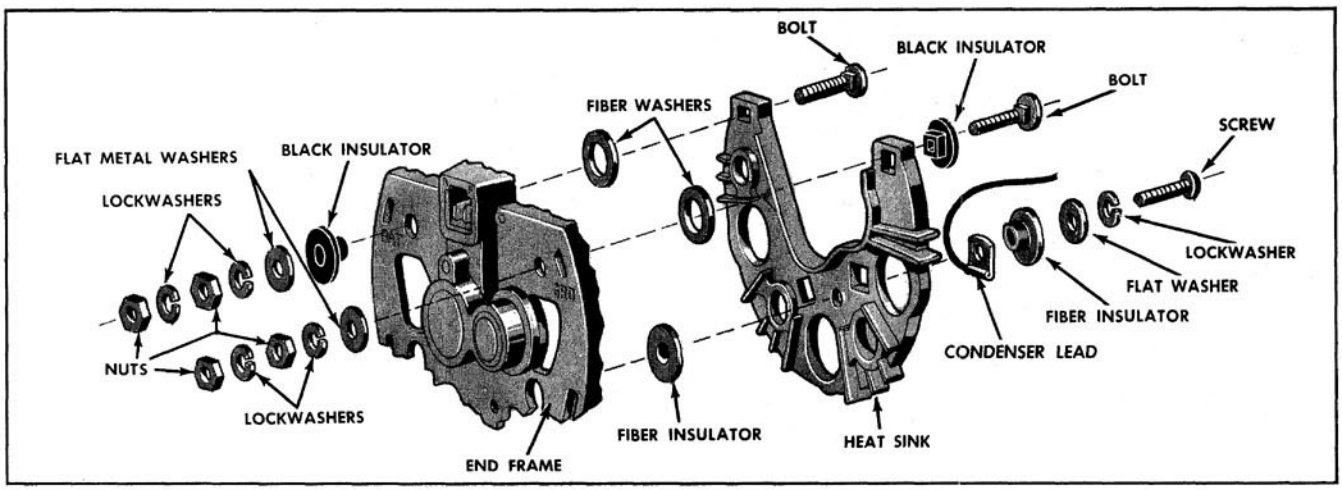


Fig. 13-42 Slip Ring End Frame Assembly

10. Assemble the two end-frames with scribe marks aligned and install the through-bolts.

11. Remove the brush retaining wire. The brushes will seat on the slip rings.

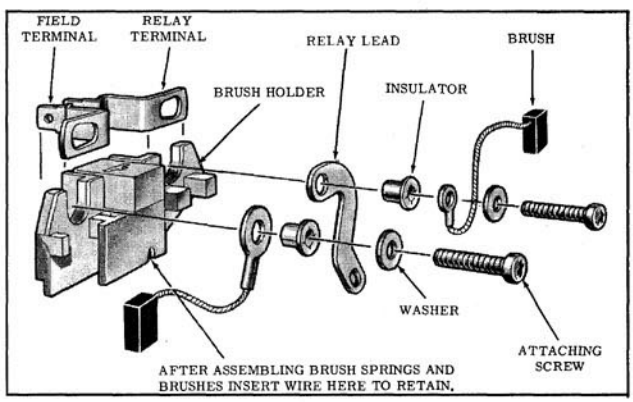


Fig. 13-43 Brush Holder Assembly

STARTING CIRCUIT

STARTING MOTOR ASSEMBLY (Fig. 13-45)

The starting motor is a 12-volt extruded frame type unit, having four poles and a compound field. The starting motor used on the 30, 31, 32 and 33 series and the 34 series with the regular fuel engine (fig. 13-46) has three field coils connected in series from the field terminal to the insulated brushes, and one shunt coil connected from the field terminal to ground.

The starting motor used on 34, 35, 36, 38 and 39 series H.C. engines (Fig. 13-47) has heavier armature and field windings, and has two field coils in series with the armature circuit and in parallel to each other. The other two field coils are in parallel with each other and are connected from the field terminal to ground.

The armature rotates in bushings at both ends. An overrunning clutch drive is used to engage the cranking motor pinion with the flywheel. The overrunning action of the clutch protects the cranking motor armature from excessive speed when the engine starts.

A solenoid switch, integral with the solenoid assembly, operates the overrunning clutch drive by means of a linkage to the shift lever. When the ignition switch is turned to the starting position, the solenoid is energized, moving the cranking motor pinion into mesh with the flywheel. The solenoid switch contacts are then closed so that battery current is delivered to the cranking motor.

To provide full battery voltage to the coil, the ignition resistor is by-passed during cranking. On the 33, 34, 35, 36, 38 and 39 series, this is accomplished within the ignition switch. On the 30, 31 and 32 series, the resistor is by-passed at the R terminal on the starting motor.

The armature shaft and clutch have spiral splines which prevent full cranking power until the clutch pinion is fully engaged in the flywheel ring gear. An assist spring (34 series regular fuel only) between the armature winding and the collar of the clutch drive aids the solenoid in overcoming the return spring force in the initial movement of the clutch. A pinion stop, consisting of a snap ring retainer and thrust collar assembled on the armature shaft, takes all the end thrust.

V-8 STARTER (With Jetaway) (30-31-32 & 3300 Series)

Removal

1. Disconnect battery.

2. Noting position of wires, disconnect starter wiring.

3. Remove four screws securing flywheel housing cover and remove cover.

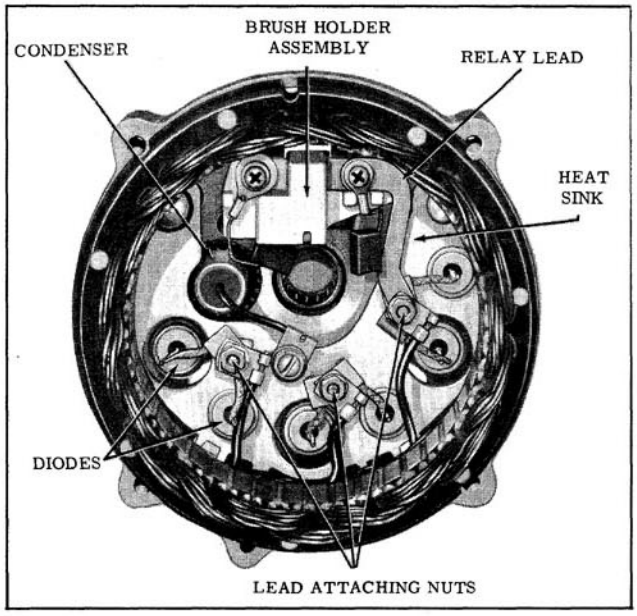


Fig. 13-44 Stator and Diode Leads

4. Remove upper support attaching bolt.
5. Remove two mounting bolts and remove starter.
6. To install, reverse the removal procedure.

SYNCHROMESH

Removal

1. Disconnect battery.

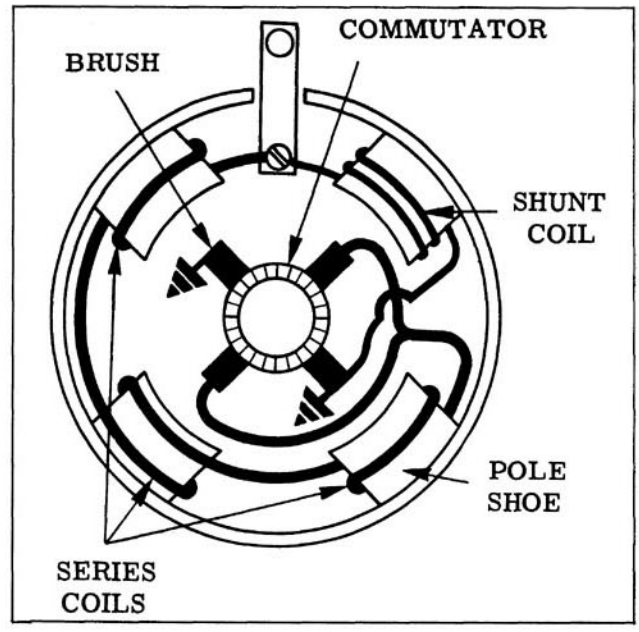


Fig. 13-46 Field Windings (30, 31, 32, 33 and 34 Series with L.C. Engine

2. Remove exhaust crossover pipe (not necessary on 3300 series).
3. Noting position of wires, disconnect starter wiring.
4. Remove upper and lower support attaching bolts and remove support.
5. Remove the two starter mounting bolts.
6. Pull starter approximately 1/4" forward, then

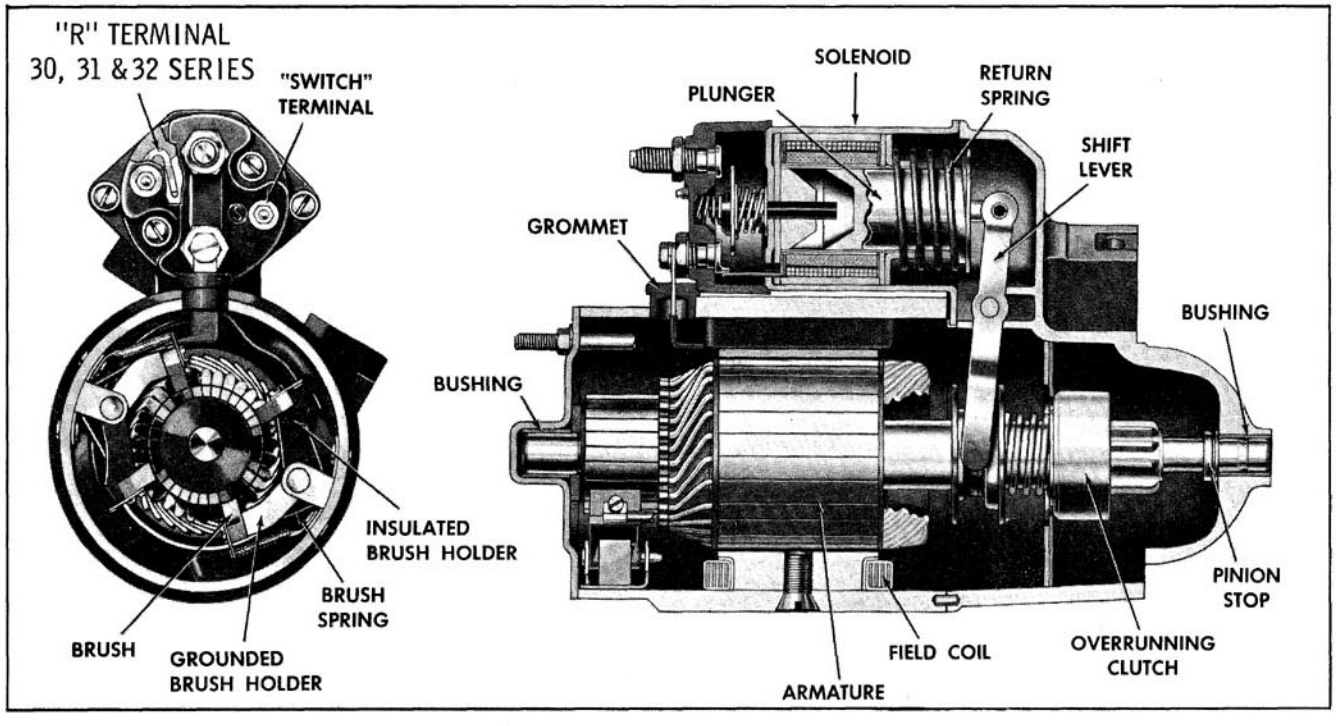


Fig. 13-45 Starter Motor Details (30-31-32 & 33 Series Shown)

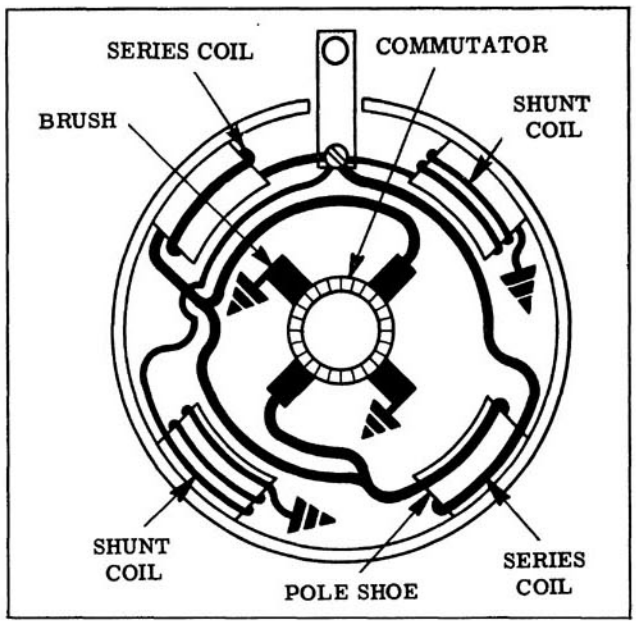


Fig. 13-47 Field Windings (34-35-36-38 & 39 Series with H. C. Engine)

tip solenoid towards the engine.

NOTE: If starter assembly is moved too far forward before tipping it towards the engine, interference will be encountered at the pan flange. It may be necessary to lower front flywheel cover for additional clearance.

7. To install, reverse the removal procedure.

Removal

1. Disconnect battery, then disconnect the positive battery cable at junction block and disconnect the solenoid switch wire (purple) from the chassis wiring harness.
2. Hoist the car.
3. If equipped with dual exhaust, disconnect exhaust pipe at manifold.
4. Disconnect starting motor from lower flywheel housing and remove motor while sliding battery cable loom through sleeve.

Disassembly (Fig. 13-48)

1. Disconnect the field coil connector from the motor solenoid terminal.
2. Remove through-bolts, then remove commutator end frame and leather washer.
3. Remove field frame assembly, armature, and clutch assembly from drive gear housing.
4. If necessary to remove overrunning clutch from armature shaft, proceed as follows:
   a. Remove thrust collar from armature shaft. (Fig. 13-49)
   b. Slide a standard half-inch pipe coupling or

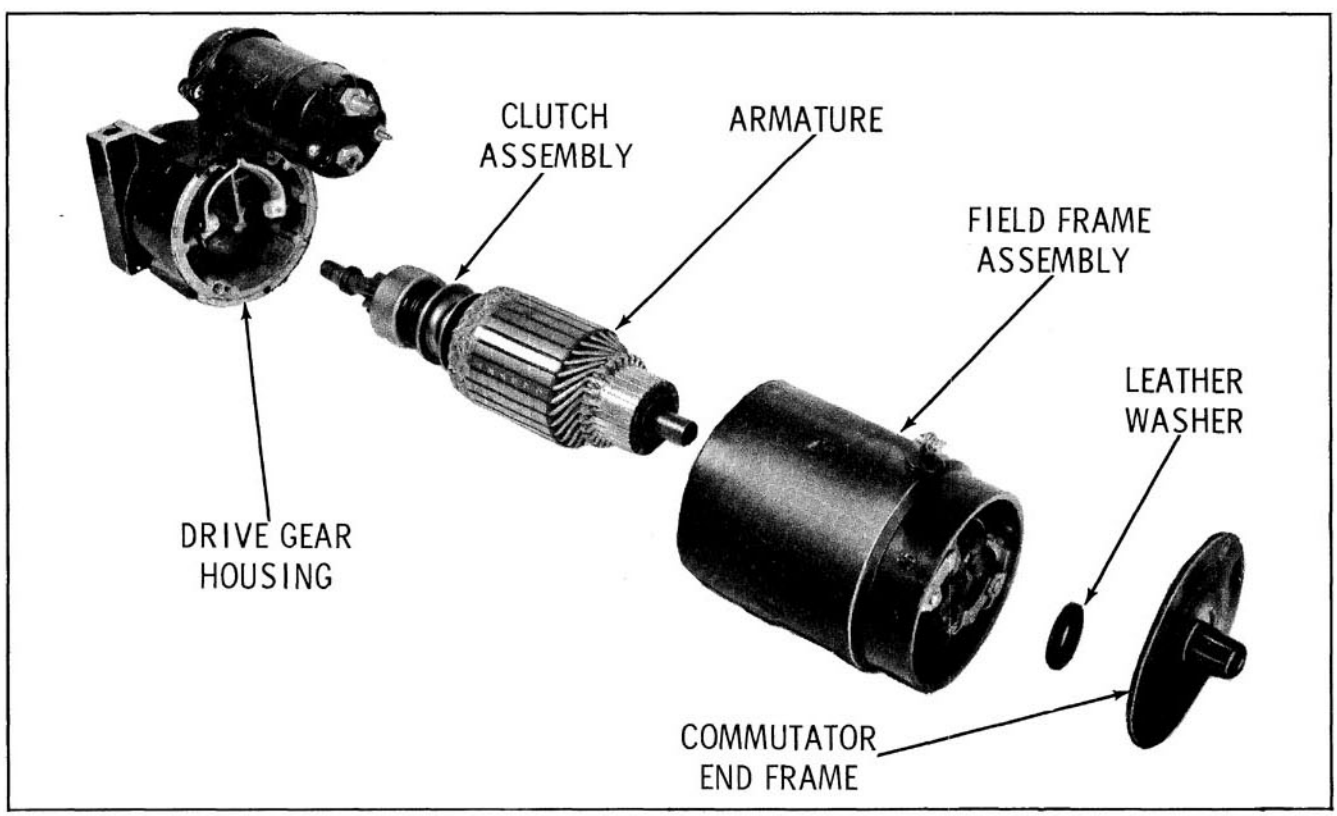


Fig. 13-48 Starter Motor

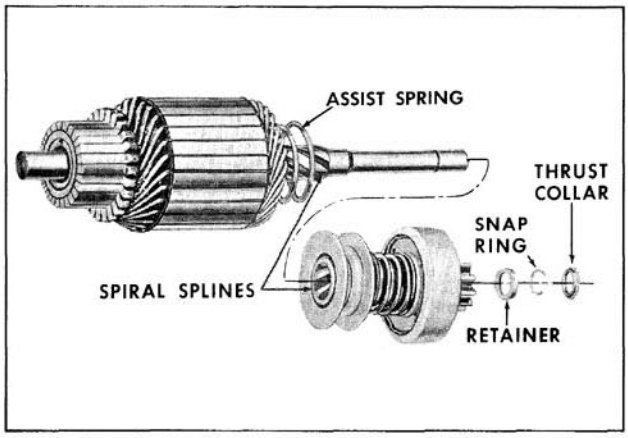


Fig. 13-49 Overrunning Clutch

other metal cylinder of suitable size (an old pinion can be used if available) over shaft against retainer to be used as a driving tool. (Fig. 13-50) With armature shaft supported on wood block, tap end of driving tool until retainer clears snap ring.

c. Remove snap ring from groove in shaft using pliers or other suitable tool. If the snap ring is distorted during removal, it will be necessary to use a new one upon reassembly.

d. Remove retainer, clutch assembly, and assist spring from armature shaft.

5. If necessary to replace brush holding parts, refer to fig. 13-51, then proceed as follows:

a. Remove brush holder pivot pin which positions one insulated and one grounded brush.

b. Remove brush spring.

c. Replace brushes as necessary.

To assemble, reverse removal procedure.

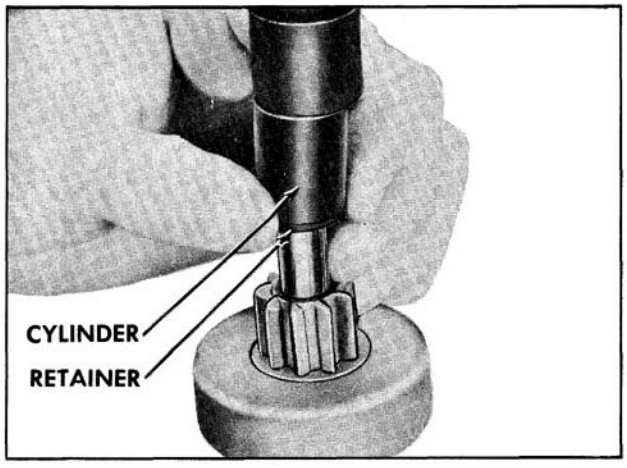


Fig. 13-50 Removing Pinion Retainer

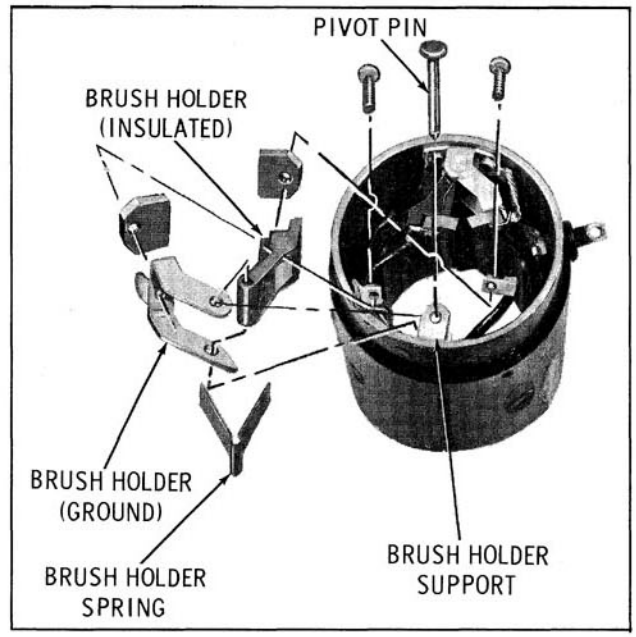


Fig. 13-51 Brush Installation

6. If necessary to remove solenoid assembly or shift lever, proceed as follows:

a. Remove solenoid to drive gear housing attaching screws, then remove solenoid assembly. (Fig. 13-52)

b. To remove shift lever and/or plunger, remove shift lever pivot bolt. (Fig. 13-53)

c. Disassemble shift lever from plunger.

Cleaning, Inspection and Tests

1. Clean all starting motor parts, but DO NOT USE GREASE DISSOLVING SOLVENTS FOR CLEANING THE OVERRUNNING CLUTCH, ARMATURE, AND FIELD COILS, since such

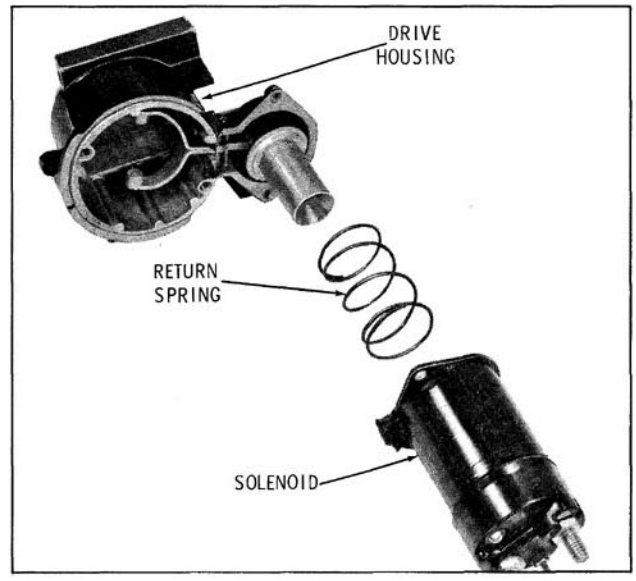


Fig. 13-52 Solenoid Installation

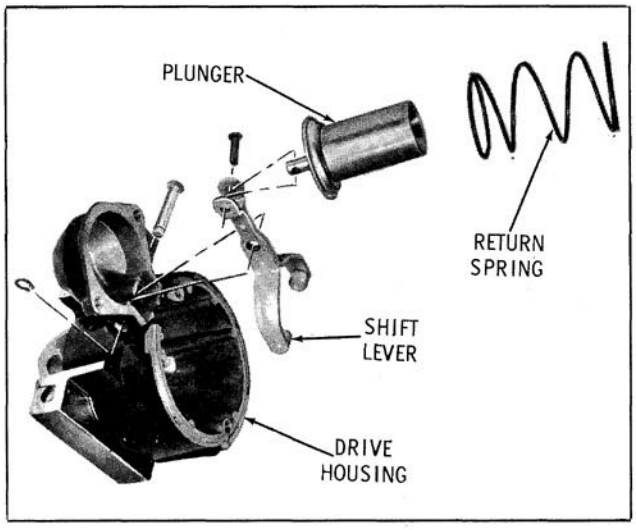


Fig. 13-53 Shift Lever Assembly

a solvent would dissolve the grease packed in the clutch mechanism and would damage armature and field coil insulation.

2. Test overrunning clutch action. The pinion should turn freely in the overrunning direction. Check pinion teeth to see that they have not been chipped, cracked, or excessively worn. Replace assembly if necessary.

3. Check brush holders to see that they are not deformed or bent, but will properly hold brushes against the commutator.

4. Check fit of armature shaft in bushing of drive housing. Shaft should fit snugly in the bushing. If the bushing is worn, it should be replaced.

5. Inspect armature commutator. If commutator is rough or out-of-round, it should be turned down and the mica undercut 1/32". Inspect the points where the armature conductors join the commutator bars to make sure they have a good connection. A burned commutator bar is usually evidence of a poor connection.

6. If test equipment is available:

   a. Check the armature for short circuits by placing on growler and holding hack saw blade over armature core while armature is rotated. If saw blade vibrates, armature is shorted. Recheck after cleaning between the commutator bars. If saw blade still vibrates, replace the armature.

   b. Using a 110-volt test lamp, place one lead on each end of the field coils connected in series. (Fig. 13-54) If the lamp does not light, the field coils are open and will require repair or replacement.

   c. Using a 110-volt test lamp, place one lead on the connector strap and the other on the field frame. (Fig. 13-55) Disconnect the shunt coil or coil ground before this check is made. If the lamp lights, the field coils are grounded and the defective coils will require repair or replacement.

   d. Using a 110-volt test lamp, place one lead on each end of the shunt coil or coils. (Fig. 13-56) Disconnect the shunt coil grounds before this check is made. If the lamp does not light, the shunt coil is open and will require replacement.

   e. Check the current draw of the solenoid winding as follows: (Fig. 13-57)

      If solenoid is not removed from starting motor, the connector strap must be removed from the terminal on the solenoid before making these tests. Complete tests in a minimum of time to prevent overheating of the solenoid.

      To check hold-in winding, connect an

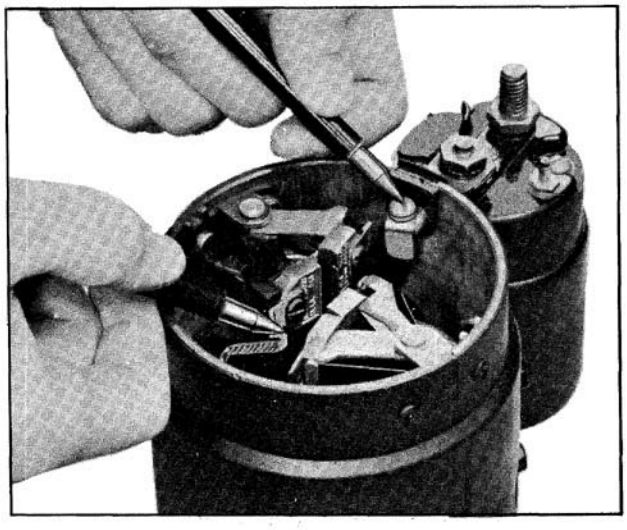


Fig. 13-54 Checking Field Coil for Open

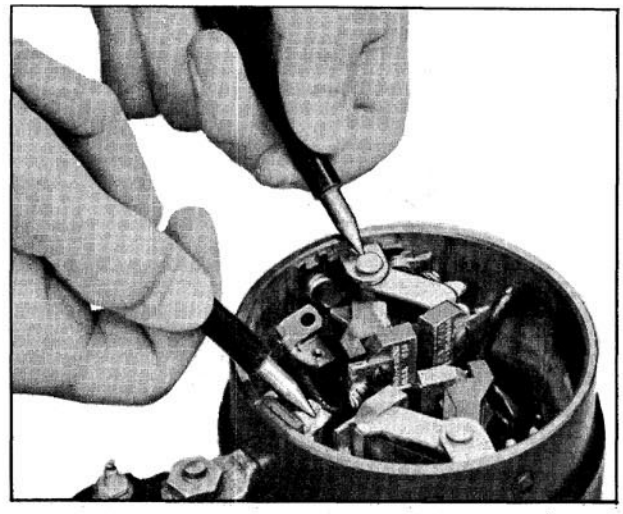


Fig. 13-55 Checking Field Coil for Ground

ammeter and a variable resistance in series with a 12-volt battery and the "switch" terminal on the solenoid. Connect a voltmeter to the "switch" terminal and to ground. Adjust the voltage to 10 volts and note the ammeter reading. It should be 10.5 to 12.5 amperes for starting motors used with the 30, 31, 32 and 33 series engines and 34 series regular fuel engines and 15.5 to 17.5 amperes for starting motors used with premium fuel engines on the 34, 35, 36, 38 and 39 series.

To check both windings, connect the ammeter, variable resistance and voltmeter as for previous test. Ground the solenoid "motor" terminal. Adjust the voltage to 10 volts and note the ammeter reading. It should be 42 to 49 amperes for starting motors used with 30, 31, 32 and 33 series engines, and 34 series regular fuel engines and 47 to 54 amperes for starting motors used with premium fuel engines on the 34, 35, 36, 38 and 39 series.

Current draw readings that are over specifications indicate shorted turns or ground in the windings of the solenoid, and the solenoid should be replaced. Current draw readings that are under specifications indicate excessive resistance. Check connections, then replace solenoid if necessary. (Fig. 13-58)

Assembly

1. If the solenoid assembly or shift lever was removed, proceed as follows:

   a. Assemble shift lever and plunger.

   b. Position shift lever and plunger assembly in drive gear housing and install lever pivot bolt. (Fig. 13-53)

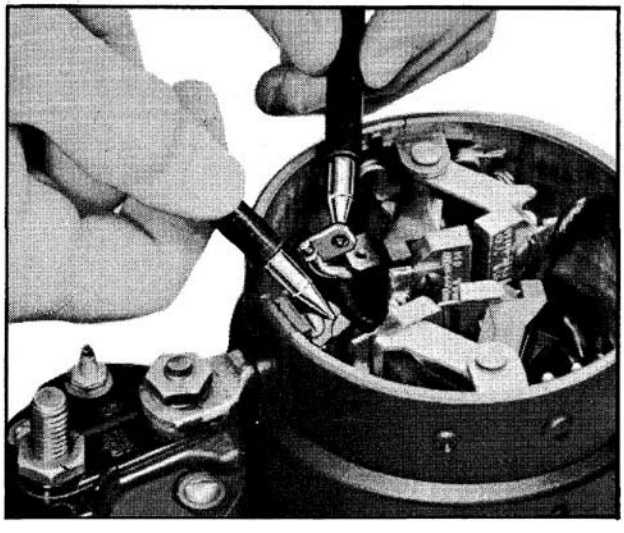


Fig. 13-56 Checking Shunt Coil for Open

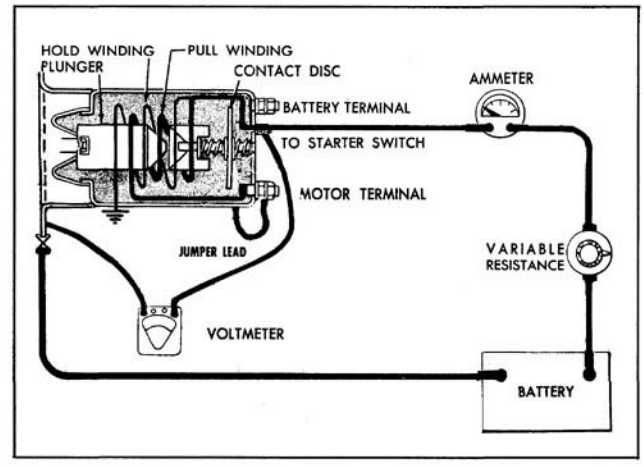


Fig. 13-57 Checking Solenoid Windings

   c. Install solenoid assembly to drive gear housing. (Fig. 13-52)

2. If the overrunning clutch was removed from the armature shaft, assemble as follows:

   a. Lubricate drive end of armature shaft with SAE No. 10 oil, then install assist spring against armature.

   b. Slide clutch assembly onto armature shaft with pinion away from armature. (Fig. 13-49).

   c. Slide retainer onto shaft with cupped surface facing away from clutch assembly.

   d. Install snap ring into groove on armature shaft.

   e. Assemble thrust collar onto shaft with shoulder next to snap ring.

   f. Position retainer and thrust collar next to snap ring. Using two pliers, grip retainer and thrust collar and squeeze until snap

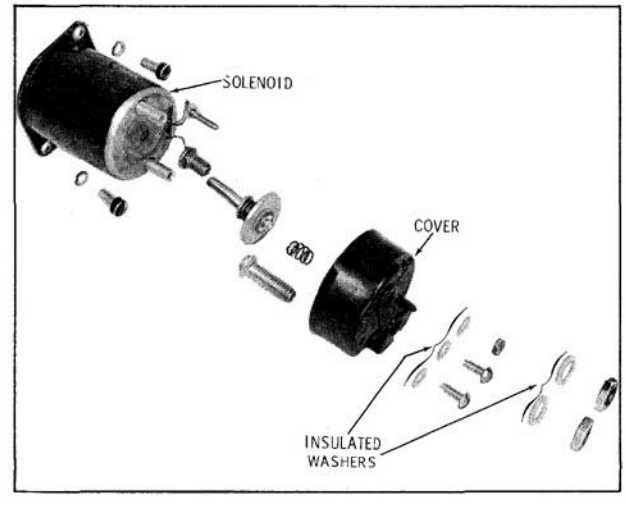


Fig. 13-58 Solenoid Assembly

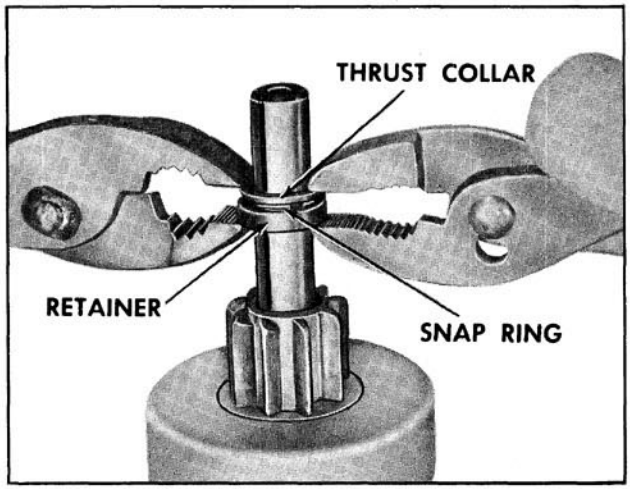


Fig. 13-59 Installing Retainer and Snap Ring

ring is forced into retainer and is held securely in groove in armature shaft. (Fig. 13-59)

3. Lubricate drive gear housing bushing with four or five drops of SAE 10W-30.

4. With thrust collar in place against snap ring and retainer, slide armature and clutch assembly into drive gear housing and engage clutch with shift lever yoke.

5. Apply sealer, Part No. 557622 on solenoid flange as shown in Fig. 13-60.

6. Position field frame against drive gear housing using care to prevent damage to brushes.

7. Lubricate commutator end-frame bushing with four or five drops of SAE 10W-30.

8. Install leather washer on armature shaft and slide end frame onto shaft, then install and tighten through-bolts.

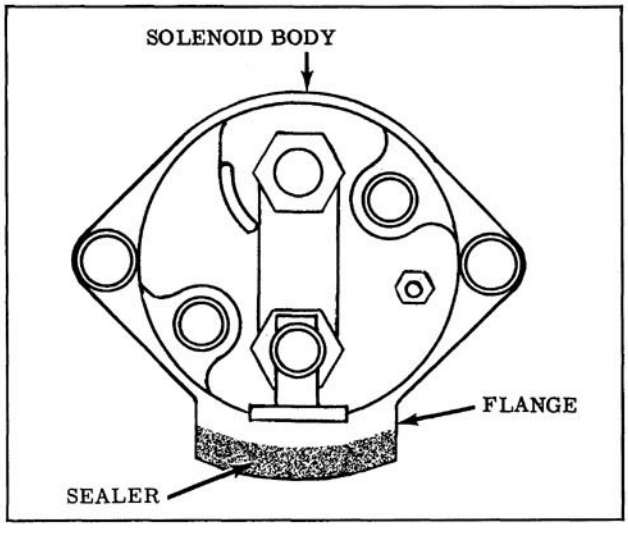


Fig. 13-60 Sealing Solenoid Housing

9. Connect the field coil connector to the motor solenoid terminal.

10. Check pinion clearance as outlined under PINION CLEARANCE.

Pinion Clearance

Whenever the cranking motor has been disassembled or the solenoid has been replaced, it is necessary to check the pinion clearance. Pinion clearance must be correct to prevent the buttons on the shift lever yoke from rubbing on the clutch collar during cranking.

To check, connect a voltage source of approximately 6 volts between the solenoid switch terminal and ground.

CAUTION: If a 6-volt battery is not available, a 12-volt battery may be used PROVIDING ONLY THREE CELLS ARE CONNECTED IN SERIES. TO PREVENT MOTORING, CONNECT A HEAVY JUMPER LEAD FROM THE SOLENOID MOTOR TERMINAL TO GROUND.

Energize the solenoid to shift the clutch, push the pinion back as far as possible to take up any movement, and check the clearance with a feeler gauge. (Fig. 13-61) The clearance should be .010" to .140".

Means for adjusting pinion clearance is not provided on the starter motor. If the clearance does not fall within limits, check for improper installation and replace all worn parts.

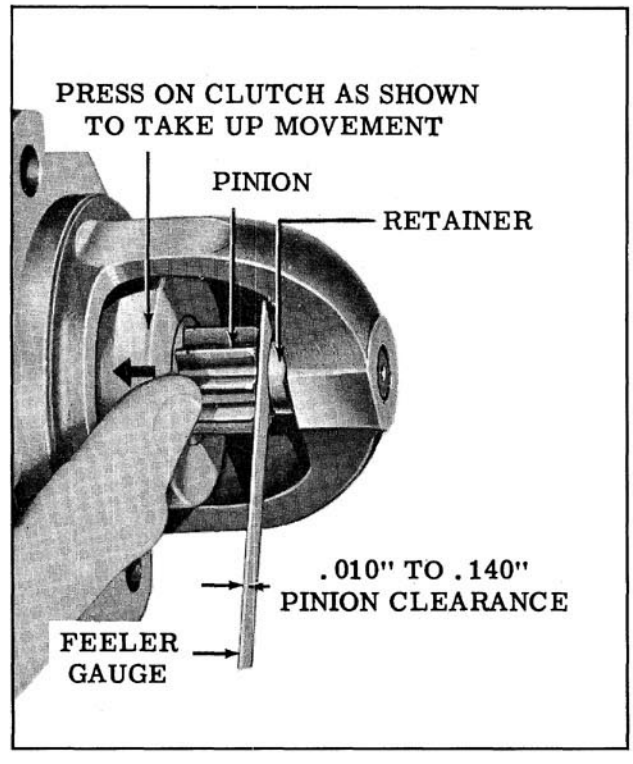


Fig. 13-61 Checking Pinion Clearance

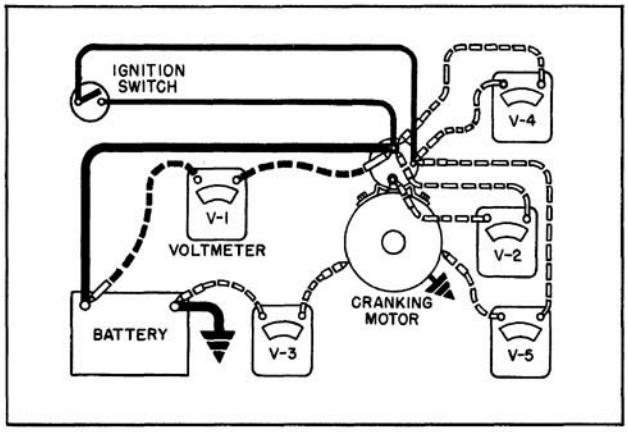


Fig. 13-62 Checking Starter Circuit Resistance

CHECKING STARTING CIRCUIT RESISTANCE

Whenever the starter motor turns over slowly or not at all, or the solenoid fails to engage the starter with the flywheel, excessive resistance of the starter circuit may be the cause.

The following checks for excessive resistance can be performed with the starter motor on the car:

1. Test battery and charge if necessary.

   CAUTION: To prevent the engine from firing during the following checks, ground the distributor primary lead.

2. Measure the voltage drop (VI) during cranking between the positive battery post and the "battery" terminal of the solenoid. (Fig. 13-62)

3. Measure the voltage drop (V2) during cranking between the "battery" terminal of the solenoid and the "motor" terminal of the solenoid.

4. Measure the voltage drop (V3), during cranking between the negative battery post and the starter motor frame.

If the voltage drop for any one of the above three checks exceeds 0.2 volt, excessive resistance is indicated in that portion of the starting circuit being checked. Locate and eliminate the cause for any excessive voltage drop in these circuits in order to obtain maximum efficiency of the starting system.

If the solenoid fails to pull in, the trouble may be due to excessive voltage drop in the solenoid circuit. To check for this condition, measure the voltage drop (V4) during cranking, between the "battery" terminal of the solenoid and the "switch" terminal of the solenoid. If the voltage drop exceeds 2.5 volts, the resistance is excessive in the solenoid circuit.

If the volage drop does not exceed 2.5 volts and the solenoid does not pull in, measure the voltage (V5) available at the "switch" terminal of the solenoid. The solenoid should pull in with 8.0 volts at temperatures up to 200°F. If not, remove the starter motor and test the solenoid.

IGNITION CIRCUIT

The ignition circuit includes the distributor, ignition coil, ignition resistor wire, ignition switch, spark plugs, and battery. For servicing of the battery, see CHARGING CIRCUIT.

DISTRIBUTOR (Fig. 13-63)

Description

The distributor cap has a window for adjusting point opening (dwell angle) while the cap is mounted and the engine is running. The contact

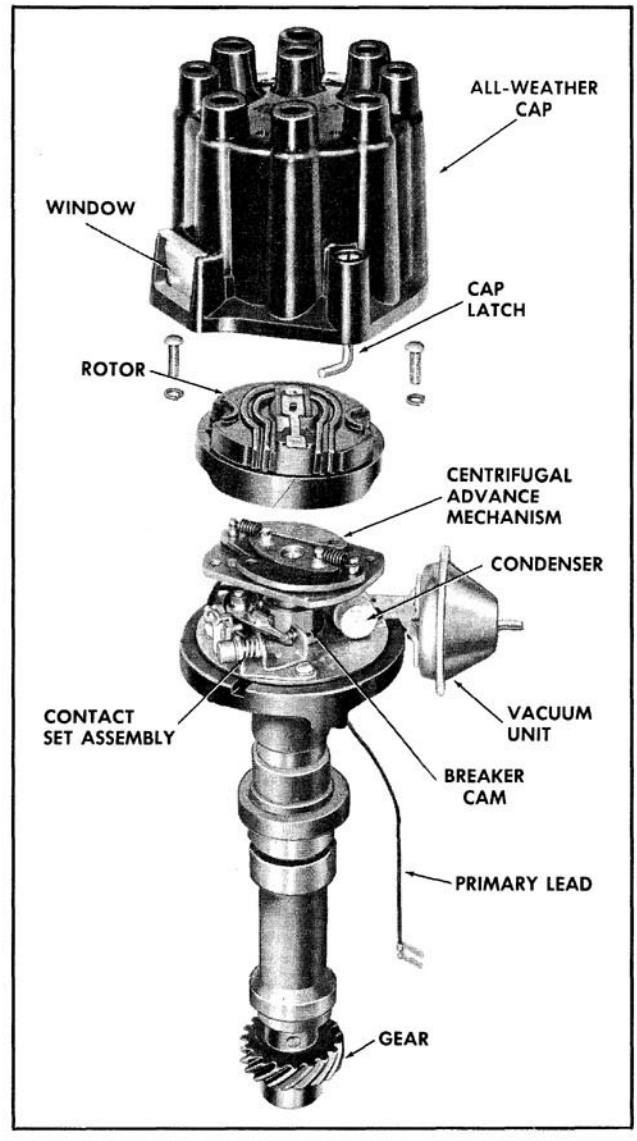


Fig. 13-63 Distributor (V-8 Shown)

point set is replaced as one complete assembly. The service replacement contact set has the BREAKER LEVER SPRING TENSION AND POINT ALIGNMENT pre-adjusted. Only the POINT OPENING requires adjusting after replacement.

Under part throttle operation, the intake manifold vacuum actuates the vacuum control diaphragm, thus advancing the spark and increasing fuel economy. During fast acceleration or when the engine is pulling heavily, the vacuum is not sufficient to actuate the diaphragm; therefore, the movable breaker plate is held so that the ignition timing is retarded.

The centrifugal advance mechanism consists of a cam actuated by two centrifugal weights controlled by springs. As the speed of the distributor shaft increases with engine speed, the centrifugal advance weights move outward which advances the cam, causing the contact points to open earlier, thus advancing the spark.

Adjustment of Distributor Dwell Angle (On Car)

1. Remove the distributor cap and inspect contact points; clean if necessary. Lubricate cam with cam and bearing lubricant. Install cap.
2. Connect a dwell meter to the primary distributor lead terminal on the coil and a suitable ground.
3. Raise window on side of distributor cap.
4. With the engine running at idle speed, insert Dwell Adjusting Tool BT-1501 into the head of the adjusting screw as shown in Fig. 13-64 and adjust dwell angle to 30°

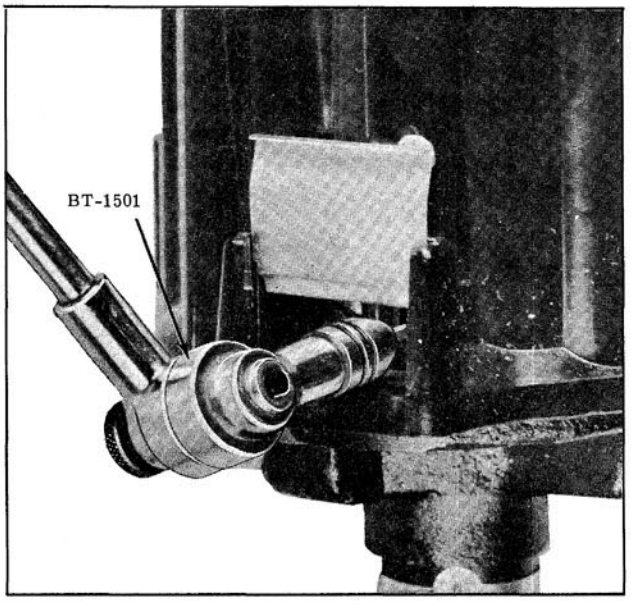


Fig. 13-64 Adjusting Dwell Angle

NOTE: If the dwell angle reading is erratic, check the primary circuit points and condenser.

The dwell angle variation should not exceed 3° at engine speeds between idle and 1750 rpm. Excessive variation indicates distributor wear.

Removal

1. Disconnect the distributor wire from coil.
2. Remove distributor cap as shown in Fig. 13-65.

NOTE: If necessary to remove secondary wires from cap, mark position on cap tower for lead to No. 1 cylinder. This will aid in reinstallation of leads. (Figs. 13-66, 13-67 and 13-68)

3. Remove vacuum hose line from vacuum advance unit.
4. Remove distributor clamp screw and hold-down clamp.
5. Note position of rotor, then pull distributor up until rotor just stops turning counterclockwise and again note position of rotor.

To install, reverse removal procedure.

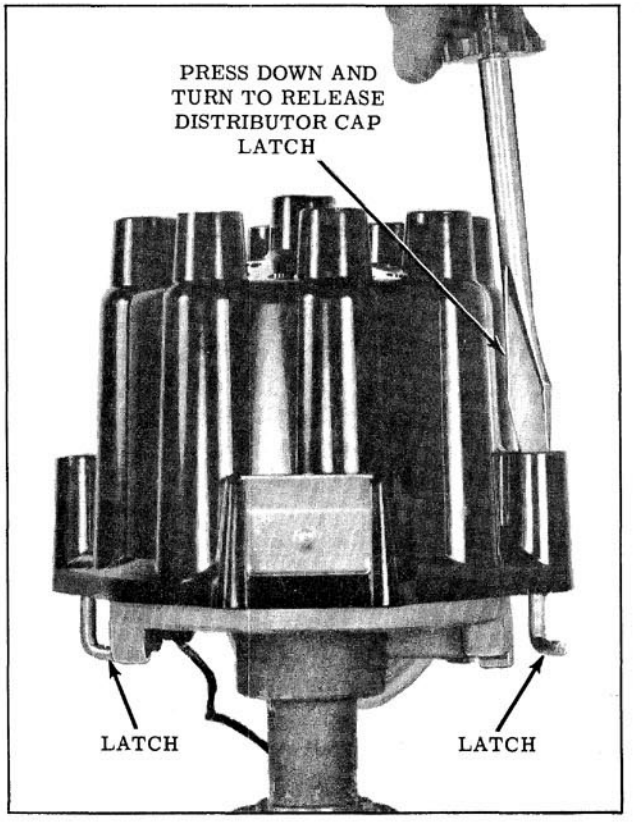


Fig. 13-65 Removing Distributor Cap

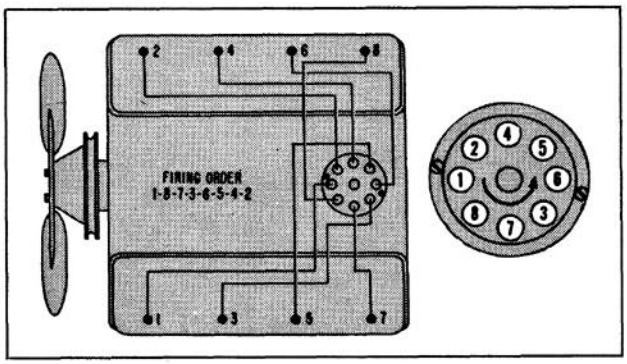


Fig. 13-66 Spark Plug Wiring (34-35-36-38 & 39 Series)

IMPORTANT: To insure correct timing of the distributor, the distributor must BE INSTALLED with the rotor correctly positioned as noted in Step 5.

If the engine has been turned after the distributor was removed, it will be necessary to install a jumper wire and crank engine until the saw slot on the harmonic balancer indexes with the 0° timing mark on the engine front cover. If both valves of the No. 1 cylinder are closed, the piston will be on top dead center of the firing stroke and the distributor can be installed with the rotor pointing to the No. 1 spark plug terminal in the distributor cap. If not, crank engine one complete revolution, then install distributor.

Tests (Distributor Removed from Car)

With the distributor removed from the vehicle, place the distributor in a distributor testing machine. When mounting distributor in tester, first secure the gear in the drive mechanism, then push distributor housing down toward the gear to take up end play between the gear and housing, and finally secure the housing in the tester. Test the distributor for variation of spark,

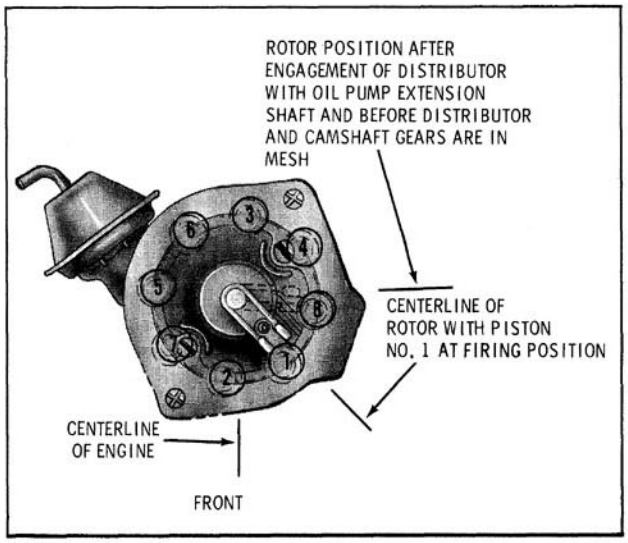


Fig. 13-67 Spark Plug Wiring (30-31-32 & 33 Series V-8)

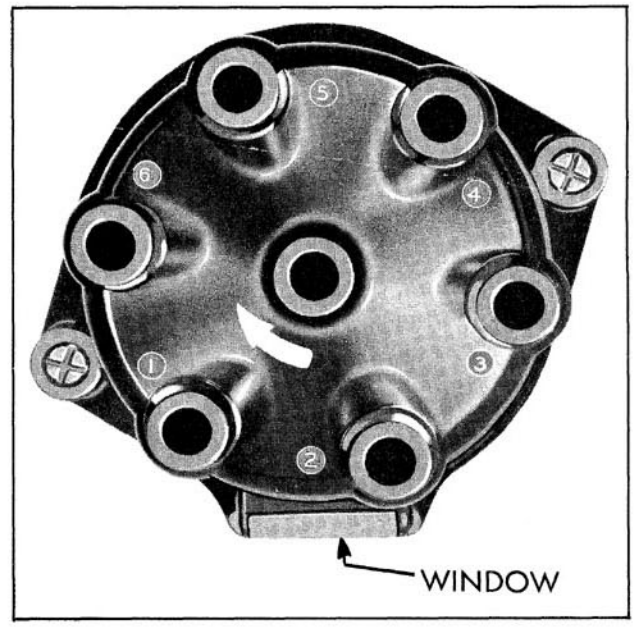


Fig. 13-68 Spark Plug Wiring (30-31 & 32 Series, V-6)

correct centrifugal and vacuum advance (See SPECIFICATIONS), and condition of contact points. This test will give valuable information on the distributor condition and indicates parts replacement which may be necessary.

Replacing Distributor Contact Set

1. Remove distributor cap. Remove condenser lead and primary lead from the contact set terminal by loosening the attaching screw.
2. Loosen the two attaching screws which hold the base of contact set, turn and lift out the assembly. (Fig. 13-69)
3. Upon reassembly, make sure that hole "A"

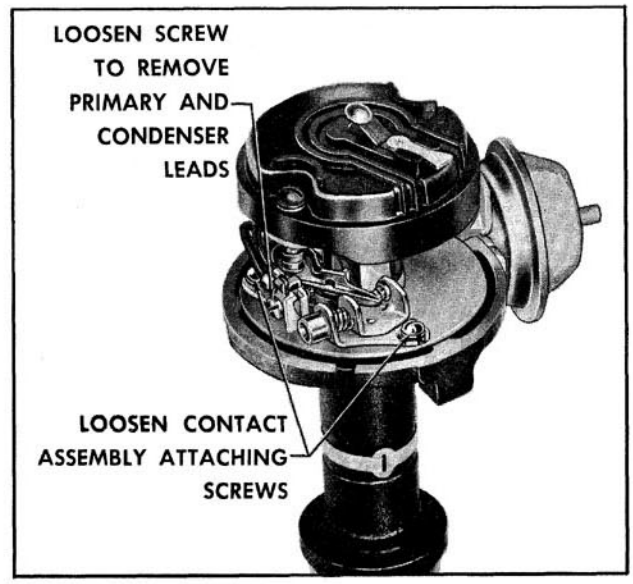


Fig. 13-69 Removing Contact Point Set

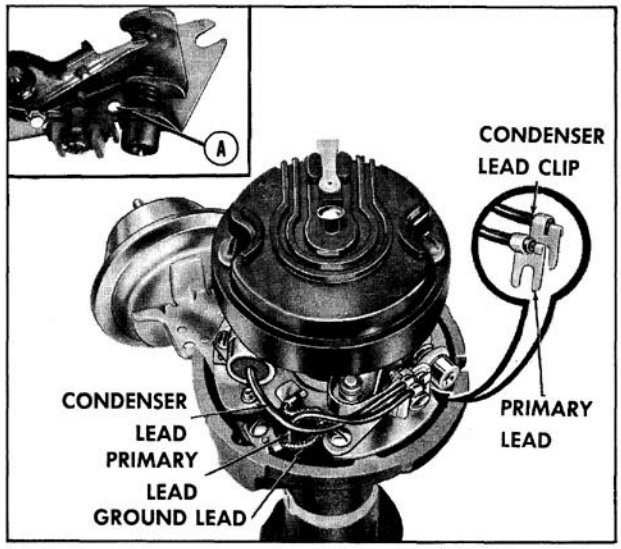


Fig. 13-70 Installing Contact Point Set

in the contact set is centered over the dowel on the distributor plate and install the primary leads as shown in Fig. 13-70. Leads must be properly located to eliminate lead interference between cap, weight base, and breaker advance plate.

4. Apply a film of cam and ball bearing lubricant, or equivalent, to the breaker cam.

Adjusting Distributor Dwell Angle

1. With distributor mounted in distributor testing machine, connect the dwell meter to the distributor primary lead.

2. Turn the adjusting screw to set the dwell angle at 30°.

If a distributor tester is not available, the dwell angle may be adjusted as follows:

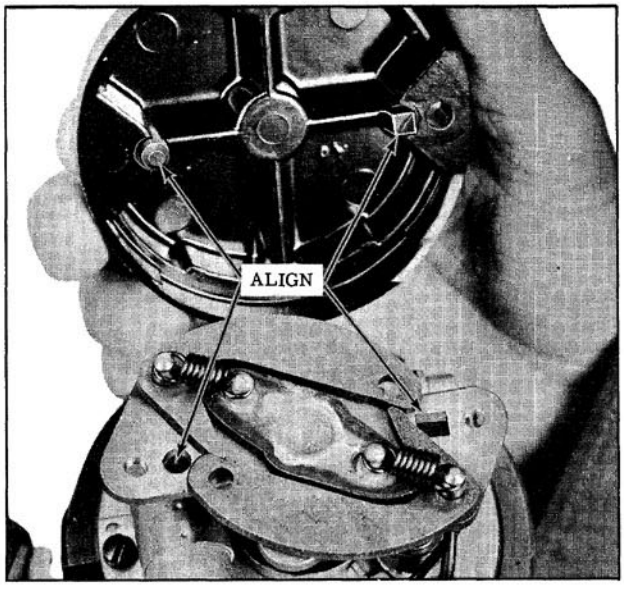


Fig. 13-71 Installing Rotor

1. Mount distributor in a vise.

2. Connect a testing lamp between the primary lead and ground.

3. Rotate the shaft until one of the breaker cam lobes is under the center of the rubbing block on the moveable point.

4. Turn the adjusting screw clockwise until the lamp lights, then give the wrench one-half turn in the opposite direction.

When distributor has been installed in car, point opening must be reset by connecting a dwell meter to the primary distributor lead terminal on the coil and a suitable ground. The dwell angle must be set at 30° with the engine running at idle speed.

Rotor

The rotor is retained by two screws and is provided with round and square lugs which engage with the mechanical advance plate so that the rotor may be installed in only one position. (Fig. 13-71)

Mechanical Advance

The mechanical advance weights and springs are accessible by removing the rotor. The mechanical advance plate is assembled to the breaker cam. In order to remove the breaker cam and advance plate, follow the procedure for DISTRIBUTOR-DISASSEMBLY and ASSEMBLY.

VACUUM ADVANCE UNIT

Removal

1. Remove the two vacuum advance attaching screws. (Fig. 13-72)

2. Turn the breaker plate clockwise and push the rod end of the vacuum advance down so that it will disengage and clear the breaker plate. Remove vacuum advance unit.

Installation

1. Position the rubber sleeve over the rod end of the vacuum advance.

2. Insert the rod end of the unit between the housing and the breaker plate.

3. Turn the breaker plate clockwise so that the rod end can be inserted into the hole in the breaker plate.

4. Install the attaching screws with the ground lead terminal under the inner mounting screw. (Fig. 13-72)

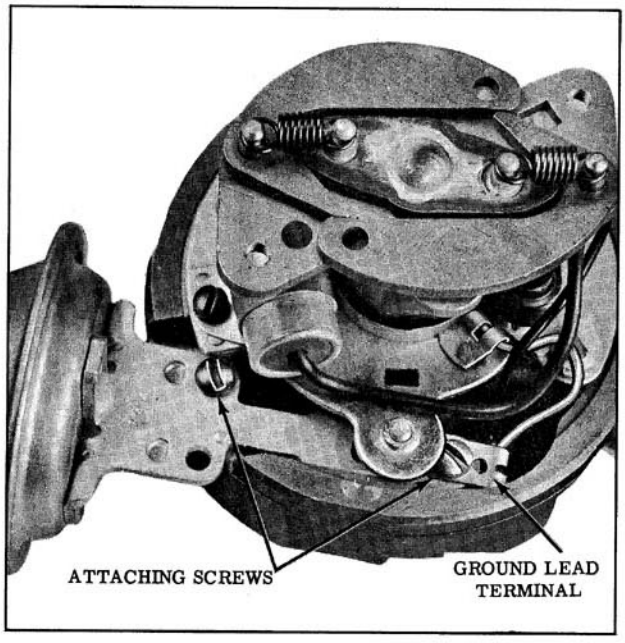


Fig. 13-72 Vacuum Advance Unit

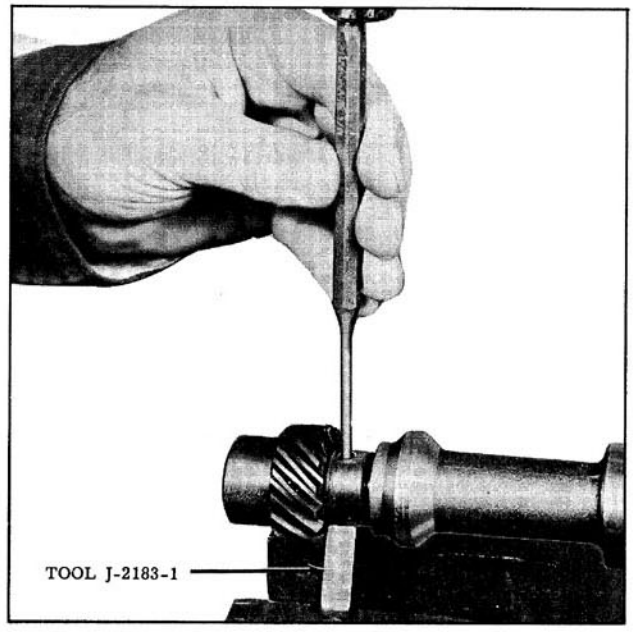


Fig. 13-73 Removing Roll Pin

DISTRIBUTOR

DISASSEMBLY

1. Mark distributor shaft and gear so that they may be reassembled in the same position.
2. Drive out the roll pin. (Fig. 13-73)
3. Pull the distributor assembly from the gear and pull the distributor shaft and breaker cam from the housing.

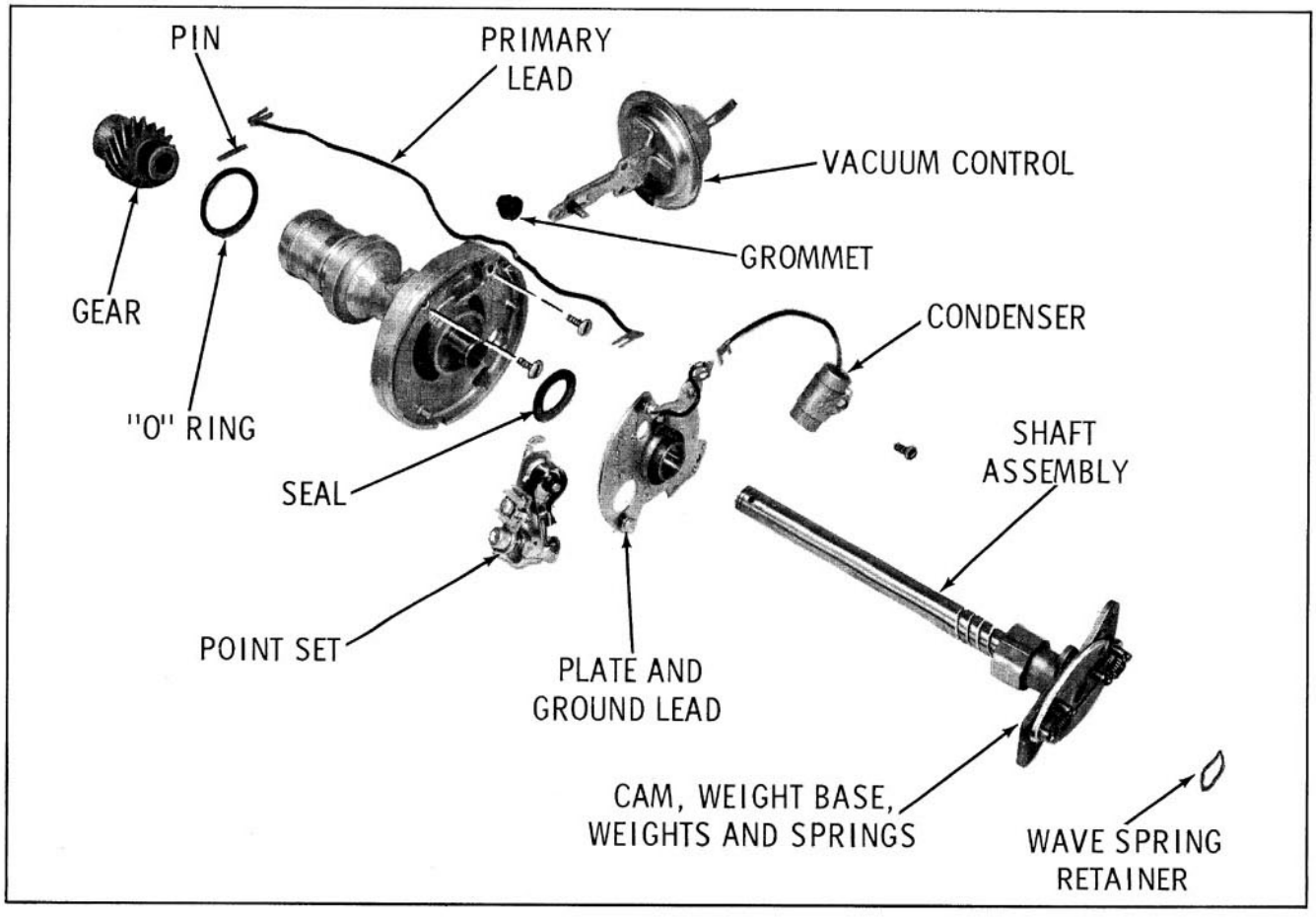


Fig. 13-74 Distributor Disassembled

4. Remove the retaining ring from the upper bushing and lift the breaker plate and felt wick from the bushing. (Fig. 13-74)

5. Remove the two retaining screws and the vacuum advance.

ASSEMBLY

1. Install the vacuum advance with the ground lead terminal under the inner mounting screw. (Fig. 13-72)

2. Place the felt wick on the upper bushing, then place the breaker plate over the upper bushing and vacuum advance link.

3. Install the retaining ring on the upper bushing.

4. Slide the distributor shaft through housing bushings.

5. Push the driven gear onto the distributor shaft with the holes aligned.

6. Install the roll pin.

7. Check and adjust dwell angle, vacuum advance, and mechanical advance. Refer to ELECTRICAL SPECIFICATIONS (Distributor).

IGNITION COIL and IGNITION RESISTOR

The ignition resistor, connected in series with the primary circuit between the battery and coil, limits the primary current at low speeds and allows the coil to operate at maximum efficiency at road speeds. The resistor is by-passed during cranking, thereby connecting the ignition coil directly to the battery. This makes full battery voltage available at the coil and keeps ignition voltage as high as possible during cranking. The by-passing of the resistor during cranking is accomplished within the ignition switch on 33, 34, 35, 36, 38 and 39 series. On the 30, 31 and 32 series by-passing of the resistor is accomplished at the R terminal of the starter solenoid.

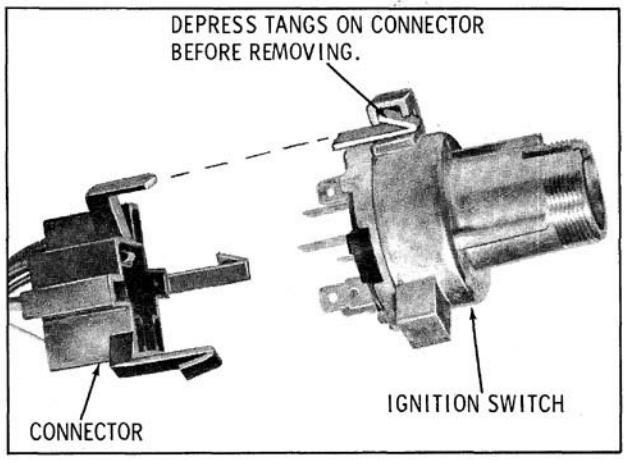


Fig. 13-75 Ignition Switch (30-31 & 32 Series)

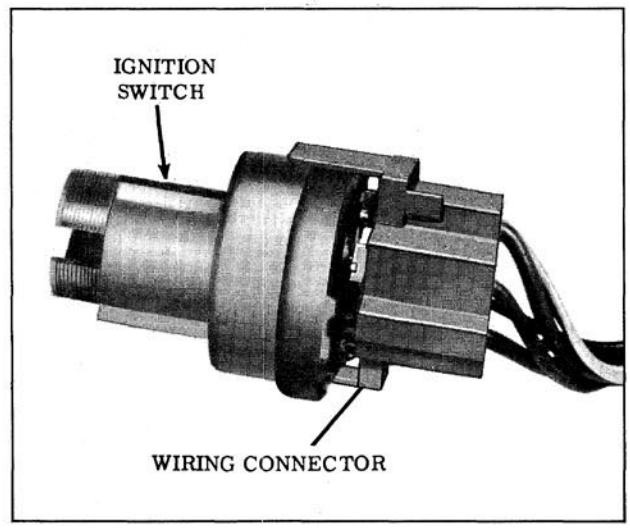


Fig. 13-76 Ignition Switch (33-34-35-36-38 & 39 Series)

IGNITION AND STARTING SWITCH

The ignition and starting switch is key-operated to close the ignition primary circuit and to energize the solenoid for cranking. The ignition key must be turned to the extreme clockwise position to energize the starter solenoid. Spring tension returns the key to the normal ignition position when it is released.

Accessories may be used when the engine is not running if the ignition key is turned counterclockwise. The ignition switch can be removed from the connector as shown in Figs. 13-75 and 13-76.

SPARK PLUGS

Whenever spark plugs are removed from the car and cleaned, the following precautionary steps should be followed:

1. The center electrode should be filed flat before the gap setting is made. (Fig. 13-77) Spark plug gap should be .030".

   NOTE: Do not file electrodes when setting gap on new plugs.

2. Any traces of paint or dirt should be cleaned from the spark plug porcelain.

3. All plugs should be checked for cracks in the porcelain. These cracks are not always visible because they may be hidden by the steel body. Use a spark plug tester to test plugs. If the spark plug procelain is cracked, a new spark plug must be installed.

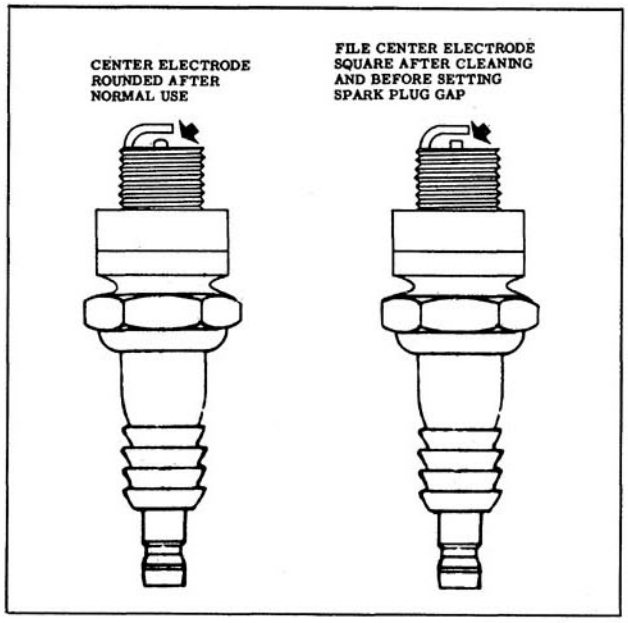


Fig. 13-77 Filing Center Electrode

SPARK PLUG CHART		
Series	Engine	Spark Plug
30 & 31	V-8 L.C.	45S
30, 31, 32 and 33	V-8 H.C.	44S
30 & 31	V-6	44S
34, 35, 36, 38 and 39	V-8	44
34	V-8 L.C.	45
	V-8 Police	43

Starfire engines that are used mainly on the highways, with very little slow or city driving, should be equipped with type 43 spark plugs. These plugs are more susceptible to lead fouling when driven at continuous slow or city driving.

IGNITION SYSTEM DIAGNOSIS

If the engine does not run, the ignition system may be at fault if:

1. There is no spark during cranking when a spark plug wire is held 1/4" from the engine.
2. The engine starts but immediately stops when the ignition switch is released from the "START" position.

If the above checks indicate that the ignition system is at fault, the following checks may be made to help locate the difficulty, or locating trouble in the ignition system if the car runs, but

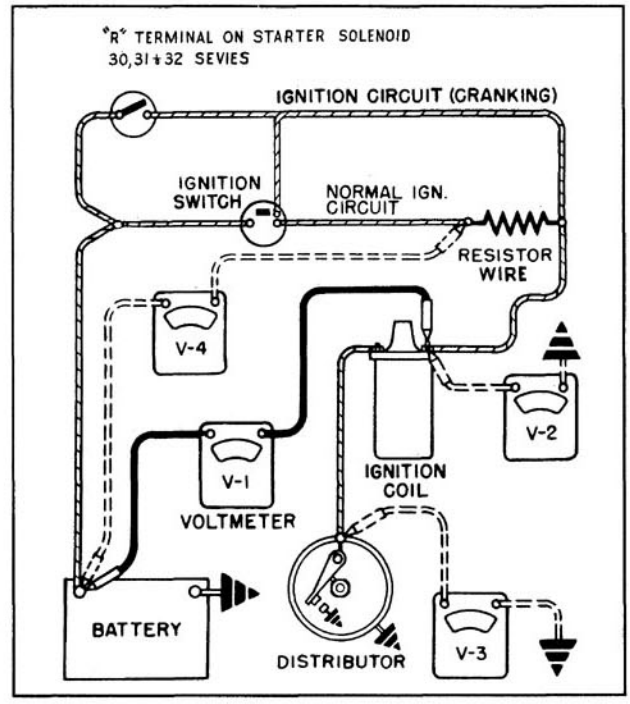


Fig. 13-78 Ignition System Tests

not satisfactorily. (Fig. 13-78 and IGNITION SYSTEM CHECK CHART) All checks are to be made with the lights and accessories off and in the sequence shown.

MILLIAMP TEST

The milliamp test will indicate the presence of faulty ignition cables, cracked distributor cap, or burned rotor.

NOTE: When making a milliamp test, use the indicated reading values as furnished by the testing equipment manufacturers.

1. Connect tachometer, start engine, and set engine speed according to the directions on the test equipment.
2. Set meter knob to secondary efficiency position.
3. Ground positive lead.
4. Check each spark plug lead by connecting the positive lead of the meter directly to the cable. A variation of five graduations between plugs is allowable.
5. A low reading indicates high resistance in the circuit. If a low reading is encountered, disconnect the cable from the spark plug and check the reading again. If the reading increases, the spark plug is partially shorted.
6. A low reading with the cable disconnected from the spark plug indicates:

a. Poor connection on either end of the cable.

b. Burned or corroded connector inside the distributor cap.

c. Damaged or broken cable.

Clean and inspect the distributor cap terminals on both ends. Check cable insulation for cracks, pinholes, or an oil-soaked condition. DO NOT attempt to shorten, rework, or repair cables.

NOTE: If the milliamp reading is still unsatisfactory, carefully check the distributor cap and rotor for leakage or cracks. Test the coil, condenser, and primary circuit, including starter solenoid connections, ignition switch and terminals, as well as the coil and distributor terminals.

7. A low reading on all cables indicates:

a. Burned or broken rotor.

b. Faulty distributor cable.

c. Weak coil.

d. Cables not tight in distributor cap.

e. Excessively burned rotor or distributor cap terminal electrodes.

f. Spring button not contacting carbon brush in distributor cap.

g. Incorrect breaker point tension. (19 to 23 oz.)

HORNS

The horns are mounted as shown in Figs. 13-79 and 13-80. When installing a new horn, the horn

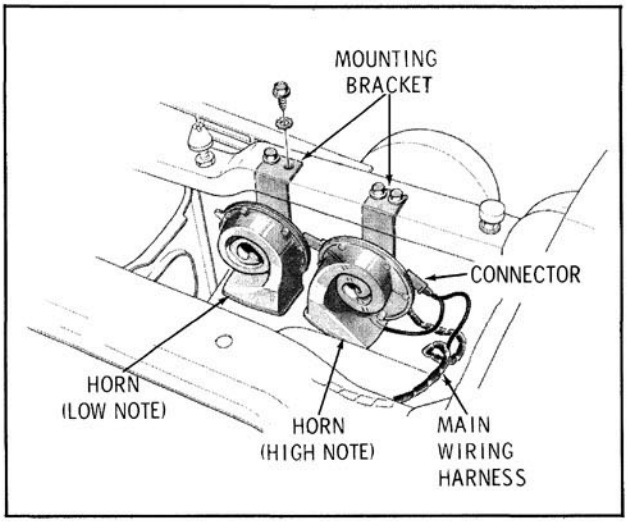


Fig. 13-79 Horn Mounting (33-34-35-36-38 & 39 Series)

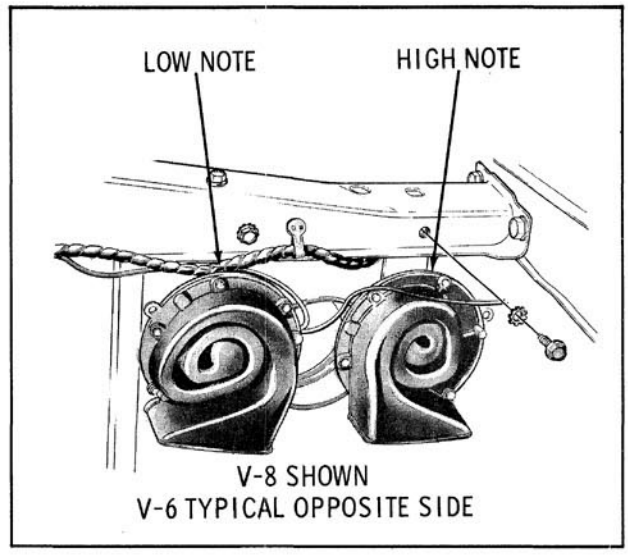


Fig. 13-80 Horn Mounting (30-31 & 32 Series)

service replacement package also contains two mounting brackets. Use the correct bracket which will allow the horn to be mounted in the same position and location as the original.

QUICK CHECKS FOR HORN TROUBLE

When horn trouble is encountered, the difficulty may be in the horn relay, wiring, or the horn itself. Quick checks to determine cause for trouble may be made as follows:

1. Hold the horn button down to energize horn.

2. While energized, tap horn lightly. If horn fails to blow after tapping, see Step 7. If horn should start to blow after tapping, proceed to Step 3.

3. Release horn button so that the horn will stop blowing.

4. Hold horn button down again. If the horn blows normally, a particle of foreign material between the contact points caused the trouble and no adjustment is needed. If the horn still fails to blow until tapped again, proceed with Step 5.

5. To adjust horns which blow only when tapped, turn adjustment screw one full turn counterclockwise.

CAUTION: This adjustment is sensitive. Do not turn screw more than one full turn or in the wrong direction. Misadjustment will require removing the horn for adjustment on the bench.

6. Check horn for normal operation and if still inoperative, remove for a bench check.

7. For horns that will not blow after tapping,

IGNITION SYSTEM CHECK CHART

Step No.	Operation	Specification	Possible Trouble
1	Check all connections in Primary and Secondary circuit		
2	Remove secondary lead from distributor cap. Hold 1/4" from engine while cranking and observe if spark occurs.		IF SPARK OCCURS: Distributor cap Rotor Spark plug wiring
3	Check Voltage V1 while cranking	1 volt Max.	Open circuit from battery side of coil to IGN, on ignition switch. Ignition switch not closing ignition circuit in start position. Ground in circuit from coil terminal to IGN, on ignition switch. Ground in coil.
4	Check Voltage V2 ignition switch "On", points open	Normal Battery	Low battery Points not open Ground in circuit from coil to distributor Ground in distributor Ground in coil Ground in circuit from coil to ignition switch or to resistor
5	Check Voltage V2 ignition switch "On", points closed	5 to 7 Volts	IF UNDER 5 VOLTS: Loose connection from resistor through ignition switch circuit to battery. Loose connection between resistor and coil. Resistor is open or has too much resistance. IF OVER 7 VOLTS: Loose connection between coil and distributor. Resistor out of circuit due to shorted or incorrect wiring. Resistor has too little resistance Coil primary is open
6	Check Voltage V3 ignition switch "On", points closed	0.2 Volt Max.	Contacts not closed Loose connection in distributor Distributor not grounded to engine Faulty contacts
7	Check Voltage V4 ignition switch "On", points closed	0.7 Volt Max.	Loose connection from resistor through ignition switch circuit to battery
8	If these checks fail to find cause of trouble - remove distributor and coil from engine and check to specifications. Also check wiring harness and ignition resistor.		

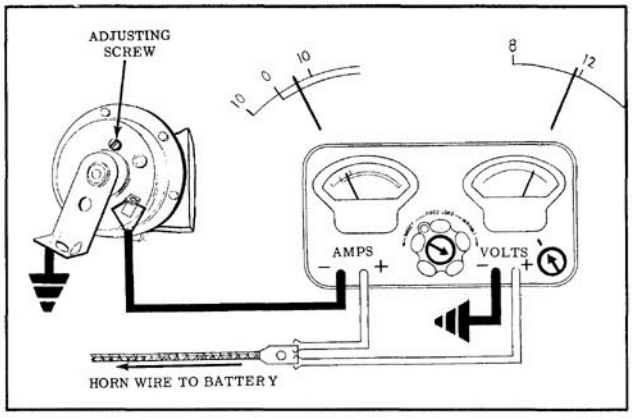


Fig. 13-81 Checking Current Draw

check to make sure that voltage is available at the horn terminal or for a poor ground connection at the horn mounting. If no trouble is located during these checks and horn is inoperative, remove for a bench check.

Bench Checks

1. No current may indicate a broken connection or an open circuit due to a broken lead or overheating. Most horn failures are caused by horns being operated continuously which develops sufficient heat to melt the wires in the winding causing an open circuit. Overheating is accompanied by a burned odor which indicates that the horn should be replaced.

2. No current can also indicate that the contact points are open and a current adjustment is required.

3. High current over 20 amperes indicates an overheated winding or shorted horn which should be replaced.

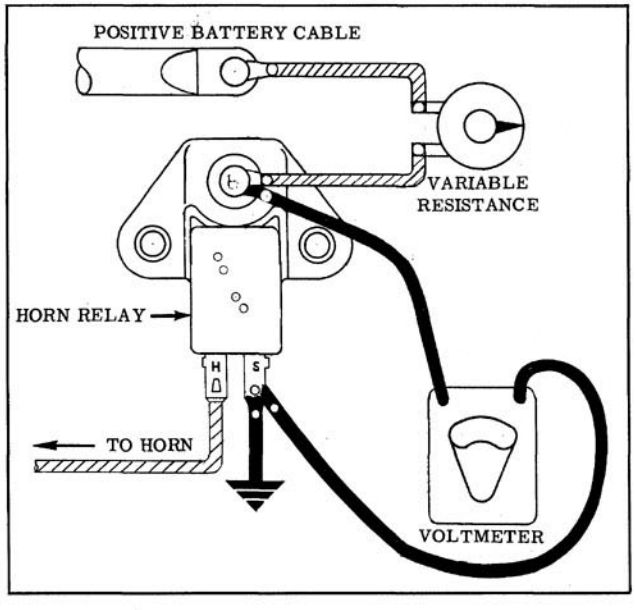


Fig. 13-82 Checking Horn Relay Closing Voltage

4. A reading of approximately 18 amperes for a 12-volt horn indicates a condition in which the contact points are not opening. A current adjustment is required.

HORN CURRENT ADJUSTMENT

Connect an ammeter and a voltmeter as shown in Fig. 13-81. With horn operating, the current draw should be 4.5 to 5.5 amperes at 11.5 volts.

Current adjustment is made by turning the adjusting screw counterclockwise to increase the current or clockwise to decrease the current until the specified current is reached. Care must be taken not to turn the adjusting screw too far. Turn only 1/4 of a turn at one time. If adjustment loosens the screw excessively, it may be staked with punch.

Other Horn Problems

A. Poor Tone

1. Harsh tone - caused by loose bolts in sheet metal mounting area.

2. Low pitch roar - sounds like a "moo-ing" and is caused by too high a current. Horn needs adjusting.

3. Weak tone - caused by too low a current. Horn needs adjusting.

4. Weak strained tone - foreign body in horn trumpet that should be shaken out or removed.

5. Harsh vibration - caused by horn touching sheet metal and bracket should be bent to give horn clearance and freedom from interference.

B. Horn Blows Constantly

1. This can be caused by a sticking horn relay.

2. Horn relay can be energized by grounded or shorted wiring.

3. Horn button can be grounded by sticking closed.

NOTE: Most horns with burned open windings are caused by one of the above malfunctions. Before replacing horns with open windings with new horn, check to make sure that none of the above conditions exist which would again cause the horn winding to burn open.

HORN RELAY CHECKS

Closing Voltage

1. Disconnect positive battery cable from "B" terminal of horn relay.
2. Connect a variable resistance of at least 10 ohms in series between battery cable and "B" terminal. (Fig. 13-82)
3. Connect a voltmeter across the "S" terminal and the "B" terminal of the horn relay. Ground the "S" terminal.
4. Slowly decrease the resistance until horn relay points close. Closing voltage should be 1.50 to 9.5 volts. If voltage is outside this range, the horn relay should be replaced.

TURN SIGNAL

The turn signal circuit consists of the switch, flasher, two pilot lamps in the instrument panel, the stop lamp filaments in the rear lamps, and the turn signal filaments in the parking lamps. (Fig. 13-83)

The turn signal switch is mounted on the steering column mast jacket just above the Hydra-Matic neutral safety switch and actuated by a rod extending down the mast jacket from the turn signal actuator assembly.

See SECTION 8 for servicing of turn signal switch.

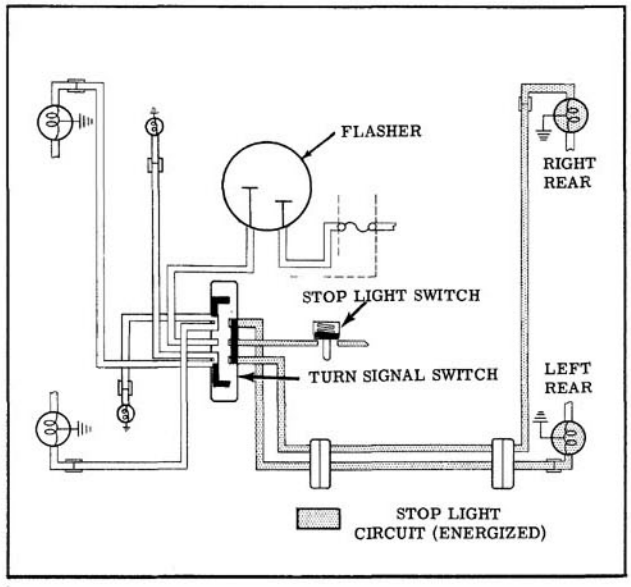


Fig. 13-83 Turn Signal Circuit (Off Position)

TURN SIGNAL DIAGNOSIS (Fig. 13-84 and 13-85)

The turn signal wiring diagrams indicate the stop light circuit and the turn signal circuit energized at the same time in order to show how the stop light circuit is changed to a turn signal circuit when the turn signal switch is actuated.

1. PILOT LIGHT REMAINS ON

A. Right turn - right rear or right front turn signal filaments burned out, light bulb base not grounded or an open in the front or rear turn signal circuit.

B. Left turn-left rear or left front turn signal filaments burned out, light bulb base not grounded or an open in the front or rear turn signal circuit.

C. Flasher inoperative.

2. ONE PILOT LIGHT INOPERATIVE

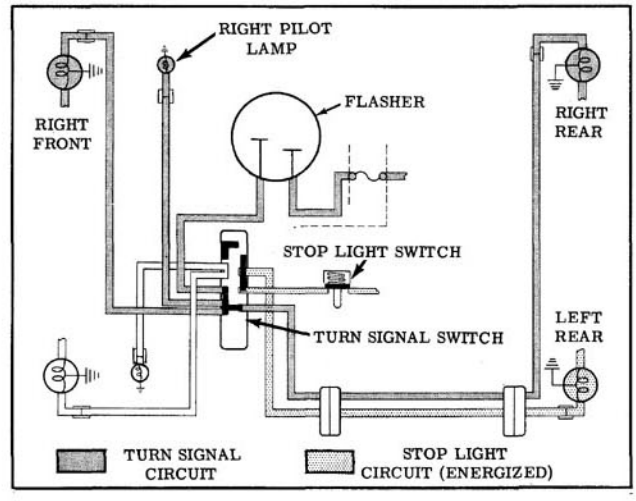


Fig. 13-84 Right Turn Position

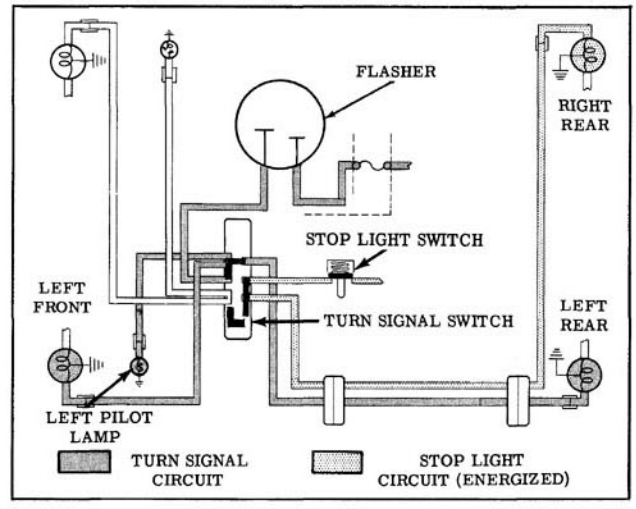


Fig. 13-85 Left Turn Position

A. Pilot light filament burned out.

B. Poor connection or a defective printed circuit.

3. ALL TURN SIGNAL LIGHTS INOPERATIVE

A. Fuse blown (If new fuse burns out, check for short circuit).

B. Flasher inoperative.

C. Defective turn signal switch.

D. Open circuit in the wire from fuse block to flasher or in the wire from flasher to turn signal switch.

TURN SIGNAL SWITCH (30, 31 & 32 Series)

The turn signal switch is an electrically operated self-contained unit having the cancelling mechanism and the electrical switch in one assembly.

No adjustments are required on the turn signal switch. However, if any malfunctions should occur, the switching mechanism should be checked for defective parts. For switch removal, refer to STEERING, Section 8.

SWITCH ADJUSTMENT

Regular (33, 34, 35, 36, 38 & 39 Series)

To adjust the turn signal switch, loosen the switch attaching screws, and with the turn signal lever in the neutral position, shift the switch until the operating pin is in the center detent. (Fig. 13-86) Tighten attaching screws and check operation of turn signals.

Tilt Wheel (All Series)

1. Check to see that the turn signal lever is in the neutral position.

2. Remove switch.

3. Loosen the control cable clamp.

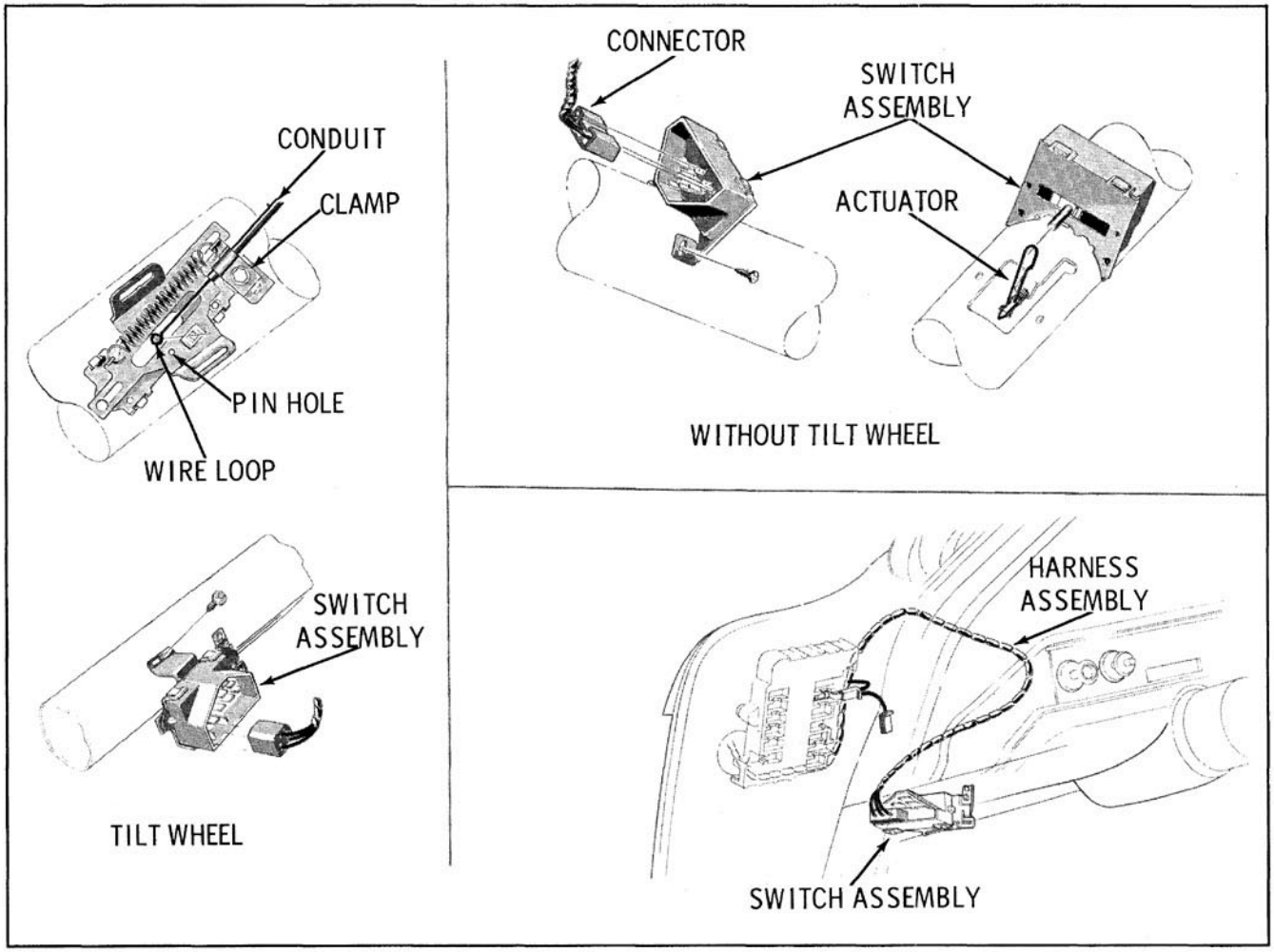


Fig. 13-86 Turn Signal Switch Adjustment

4. Insert a .090" gauge pin in the pin hole then tighten the control cable clamp. Remove the gauge pin. (Fig. 13-86)

5. Move the steering wheel to the full down position.

6. Position the switch on the column and secure with the two screws leaving a minimum amount of slack in the control cable.

7. Check operation of turn signal switch.

TEMPERATURE INDICATOR

The engine temperature indicator lights are controlled by a thermal switch in the right front of the intake manifold.

If the engine cooling system is not functioning properly, the thermal switch will close the circuit to the red light when the engine temperature reaches 243°F. ± 2°F. The thermal switch does not require servicing. If it is defective, it should be replaced. (Figs. 13-87, 13-88 & 13-89)

OIL PRESSURE INDICATOR

The engine oil pressure indicator light is controlled by a pressure operated switch. When the engine is running, the light operates only when the oil pressure is not satisfactory. This light should come on when the ignition is turned on and the engine is not running. If the switch is defective it must be replaced. (Fig. 13-87, 13-88 & 13-89)

FUEL GAUGE

The gasoline fuel gauge circuit consists of an electrical indicator in the instrument panel and a float-controlled rheostat in the tank.

CHECKING GAS GAUGE

Testing Fuel Gauge Circuit

IMPORTANT: Engine must be running when testing the gasoline gauge to insure adequate operating voltage (14.5 volts) at the gauge.

When checking either at the trunk compartment or the instrument cluster, be sure that the correct

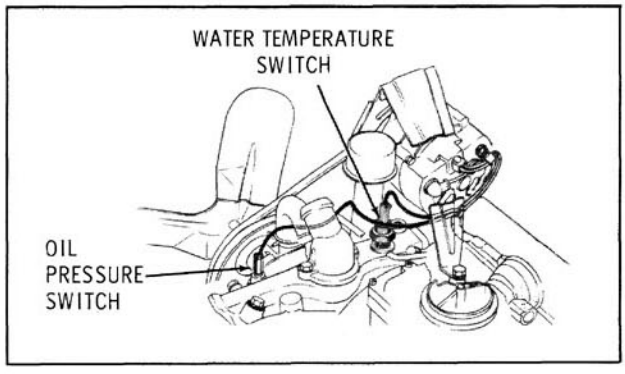


Fig. 13-87 Oil and Temperature Indicator Switches (V-8)

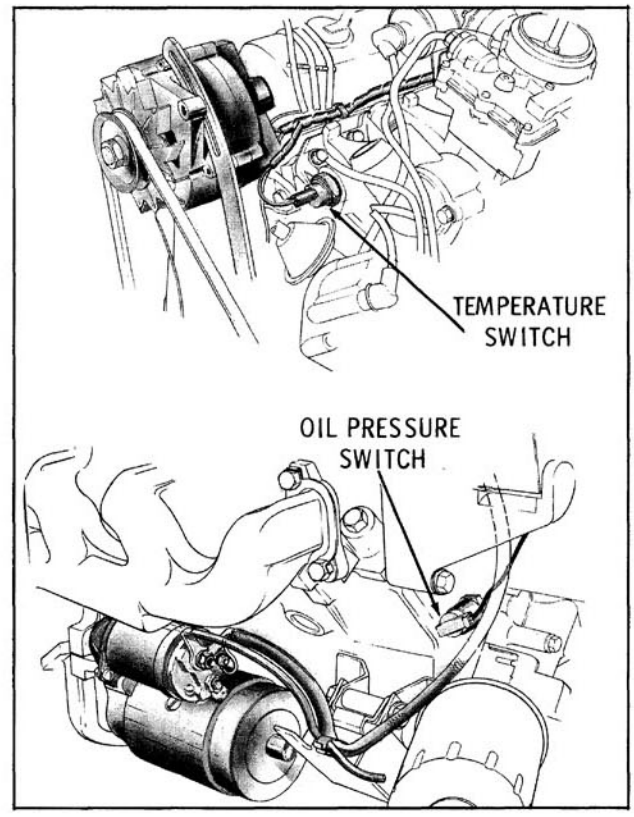


Fig. 13-88 Oil and Temperature Indicator Switch (V-6)

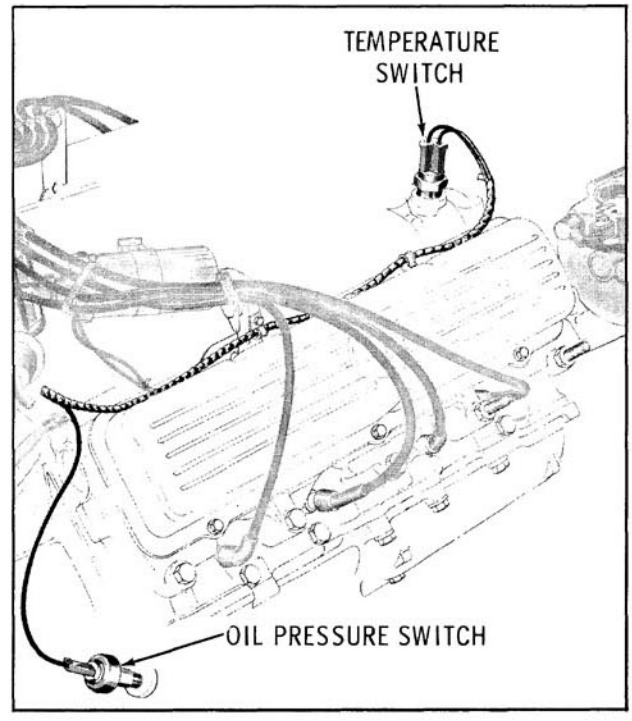


Fig. 13-89 Oil and Temperature Switch (34-35-36-38 & 39 Series)

sequence is followed to insure accurate readings. The checking procedure must be started with Tester BT-11-13 on the "F" position, then moved to the "1/2" and "E" positions in that order. If checks are made in any other sequence, it will be necessary to stop the engine and restart it before taking each fuel gauge reading.

Fuel Gauge Check At Trunk Compartment

1. Set Tester BT-11-13 on "F" position.
2. Disconnect the tank unit connector. Connect one lead of the tester to the gray wire from the instrument panel gauge and the other lead to ground.
3. Start the engine and run at idle. Gauge should read on the "F" graduation or above.

   NOTE: Most gauges will read above the "F" graduation.
4. Set the tester on "1/2" position. Gauge should read on the "1/2" graduation or1/8" above or below the "1/2" graduation.
5. Set tester on "E" position. Gauge should read on "E" graduation or below. If gauge reads above "E" position, replace gauge.

If the gauge registers correctly during this test, the trouble is in the tank unit or the wire from the trunk compartment connector, to the tank unit. If the gauge registers full, regardless of the position of the tester, there is an open circuit in the wire from the instrument panel gauge to the trunk compartment connector.

When removing the tank unit for inspection, if it appears to be defective, check as follows:

1. Remove the fuel tank and the tank unit. Clean all dirt from around the tank unit terminal.
2. Connect an ohmmeter to the tank unit and check the resistance at top, bottom and mid-point of float arm travel.
3. Resistance at empty should be between 0 and .5 ohms. At mid-point, resistance should be 15 ohms plus or minus .1 ohm. At full, the resistance should be between 29.4 and 31.5 ohms. If ohmmeter check indicates that tank unit gauge reads within specifications, check for poor connections between tank gauge and body. Resistance between tank gauge and body should be less than .1 ohm.
4. If the tank unit is replaced, always check the new unit in the same manner before installing it in the tank.

Fuel Gauge Check At Cluster

To determine whether the instrument panel gauge or wiring to the trunk compartment connector is at fault, proceed as follows:

NOTE: With the instrument cluster printed circuit, it is not possible to disconnect the tank unit wire at the dash gauge. Disconnect tank unit in trunk. To check the dash gauge alone, disconnect the tank gauge in the trunk compartment.

1. Unscrew the plastic caps on both terminals of the dash gauge.
2. Connect one lead of tester to the upper terminal of the gauge or left terminal on 30, 31 & 32 series (as viewed from the rear of the instrument cluster) and the other lead to ground.
3. Repeat Steps 3, 4 and 5 of Fuel Gauge Check At Trunk Compartment.

If the dash gauge does not register correctly, make a visual inspection of the printed circuit. Defects will show up in the form of blisters or breaks in the circuit. Shorts or breaks in the wiring can be isolated by making a continuity check of the wiring. If printed circuit is not defective, replace dash gauge.

HEADLAMP

The dual headlight system consists of four headlights paired horizontally. Each pair of lights consists of a sealed beam unit (inner unit with No. 1 embossed on the lens) with one filament which provides an upper beam only, and a sealed beam unit (outer unit, with No. 2 embossed on the lens) with two filaments which provides both an upper and lower beam. The sub-body is also identified.

Since the No. 2 headlight lens is designed to provide maximum illumination on lower beam and the upper beam filament is not at the focal point of the No. 2 light, the major portion of the upper beam illumination is supplied by the No. 1 unit. Thus, the upper beam is supplied by all four headlights.

When the lower beam is desired, the No. 1 lights are turned off, the upper filament of the No. 2 lights are turned off and the lower filaments of the No. 2 lights are turned on.

SEALED BEAM UNIT

Remove and Install (Fig. 13-90 & 13-91)

1. Remove headlight rim.

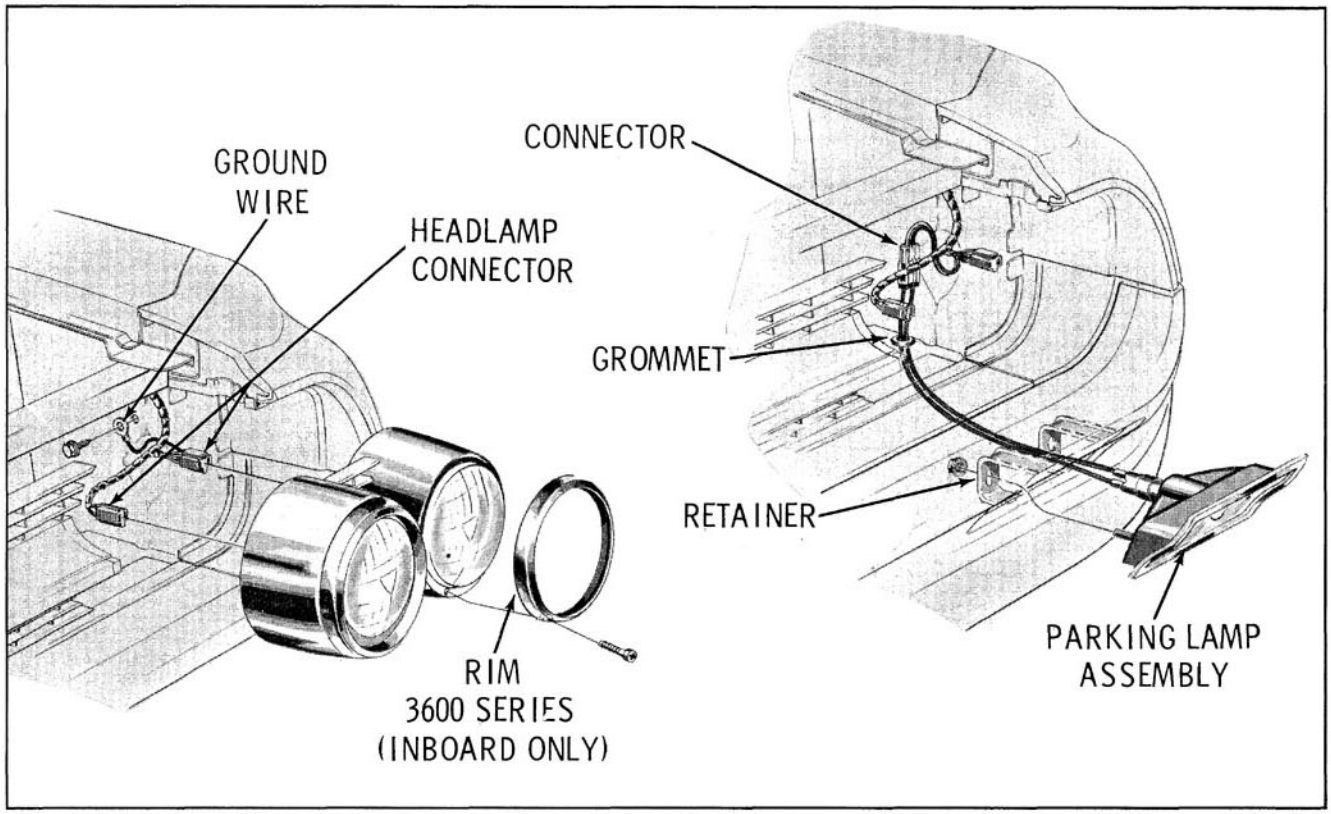


Fig. 13-90 Headlamps and Parking Lamps (33-34-35-36-38 & 39 Series)

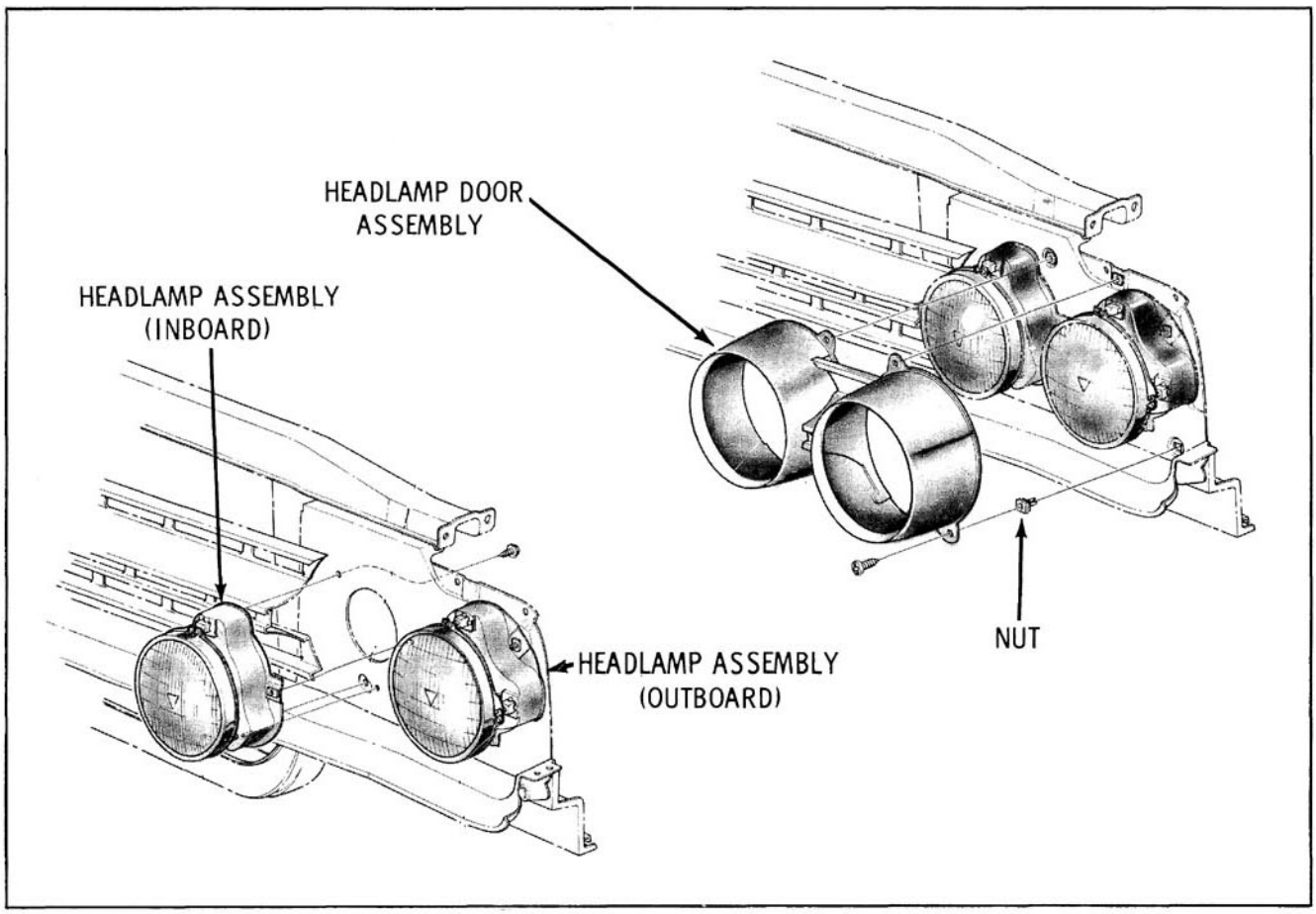


Fig. 13-91 Headlamps (30-31 & 32 Series)

2. Disengage the coil spring from the retaining ring, then pull the assembly out of the body and disconnect plug from rear of sealed beam unit.

3. Remove the two retaining ring attaching screws, then remove retaining ring and sealed beam unit and sub-body.

To install unit, reverse the removal procedure.

NOTE: The locating bosses on the back of the sealed beam units are designed so that the No. 1 and No. 2 units are not interchangeable.

HEADLIGHT AIMING

Aimers J-6663 meet the SAE specifications for mechanical headlight aimers.

1. Before proceeding with headlight aiming, the following items should be performed.

   a. Locate car on a known level surface or recalibrate aimers for a selected unlevel area. (Refer to AIMING AREA)

   b. Check and equalize tires to recommended pressures.

   c. Car should not be loaded with passengers or have excess weight in rear compartment.

   d. Rock car sideways to stabilize springs.

   e. Turn on headlights, replace any units burned out.

2. Remove all the headlight rims.

3. Mount Aimers J-6663 on either the two outer or two inner headlights so that the cross arm of each aimer is horizontal and pointing inward.

   IMPORTANT: Guide points on sealed beam unit must contact inner ring of aimer.

4. Fasten string to RH aimer. Rotate aimers until string just clears "F" and "G". (Fig. 13-92)

5. Horizontal Aim

   a. Loosen horizontal adjusting screw "A" of RH headlight and tighten until string is positioned directly over the center line of the RH aiming dial and point "G".

   b. Repeat adjustment on horizontal screw "A" of LH headlight until string is positioned directly over center line of the LH aiming dial at point "F".

   c. Recheck points "F" and "G" and readjust if necessary.

6. Vertical Aim

   a. Loosen knob "O" on both aimers and move slide until numeral "2" appears in "down" view window. Tighten knobs. (Fig. 13-93)

   b. Loosen vertical adjusting screws "B" and tighten until bubbles are centered in level.

   c. Recheck horizontal string alignment at points "F" and "G" and readjust horizontal aim if necessary.

7. Remove aimers and repeat Steps 3 through 6 on other set of headlight units.

8. After headlight aiming is completed, install the headlight rims.

AIMING AREA

In order to obtain accurate headlight aim, the car must be either located on a known level surface, or the Aimers J-6663 must be calibrated to compensate for an unlevel surface.

Select an area which appears to be level. Drive car into that area and install aimers on either the two outer or the two inner lights so that both cross arms point toward the center of the car. Loosen knob on bottom of aimer and move slider until numeral 2 appears in "down" view window. (Fig. 13-94) Turn headlight vertical aiming screws to center the level bubbles. Mark the wheel positions on the floor, then turn car end for end making sure that all four wheels are positioned within the marks located on the floor. If the bubbles are still centered, (Fig. 13-95) the aiming area is level and the Aimers J-6663 can be used without further adjustments with the car in this area and position.

If the bubbles are not centered after turning car end for end, (Fig 13-96) the aimers must be recalibrated as follows:

1. Loosen knob on bottom of aimer and move slider until bubble is centered. Record numeral that now appears in the view window.

2. Move slider to a position half-way between the recorded number in Step 1 and the numeral 2 in the "down" view window.

3. Without moving the car, recalibrate aimers by turning the adjusting screw until bubble is centered. (Fig. 13-97)

The aimer is now calibrated for this specific area. Tire locations should be permanently marked so that all future headlight adjustments are performed with the car facing in the same direction and tires located in the same position.

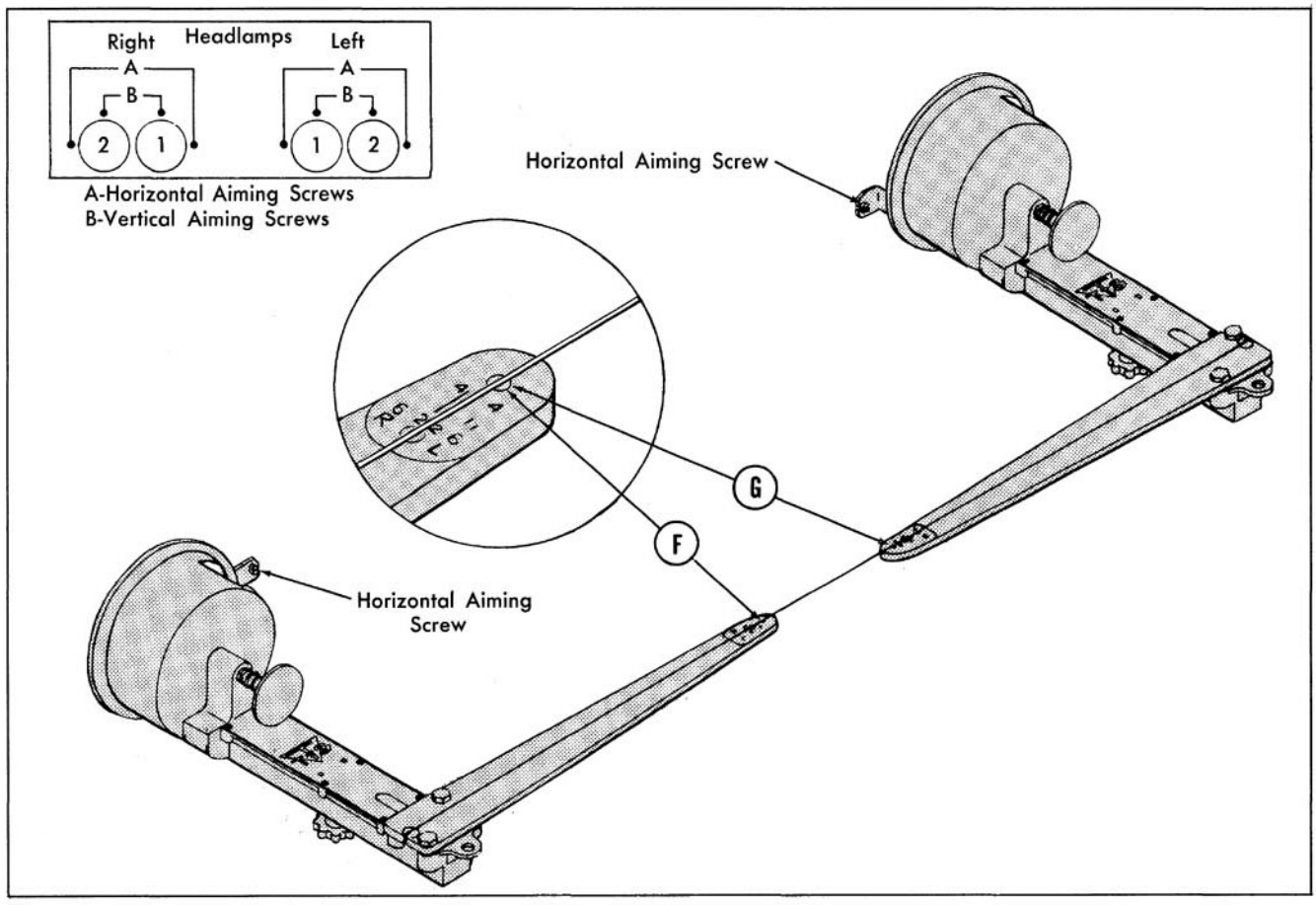


Fig. 13-92 Horizontal Aim

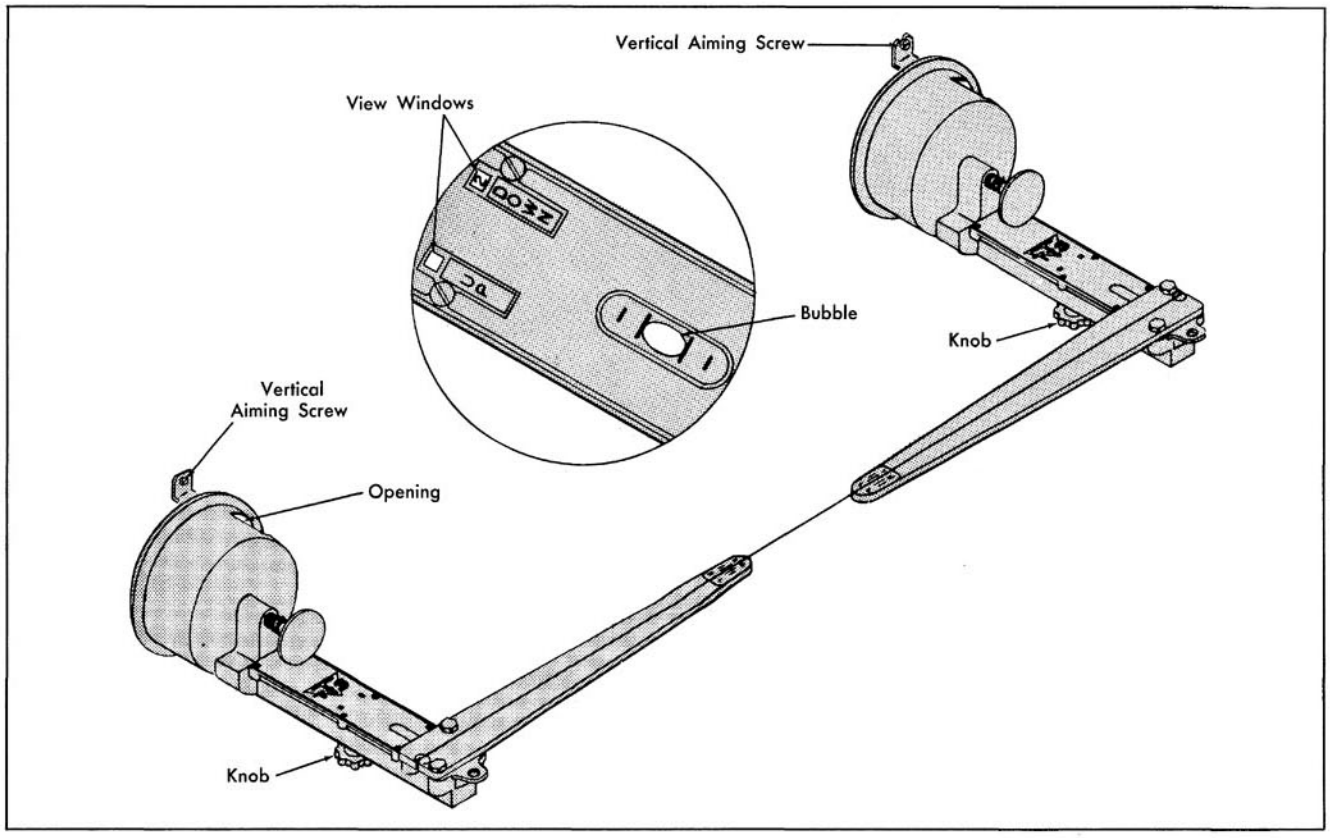


Fig. 13-93 Vertical Aim

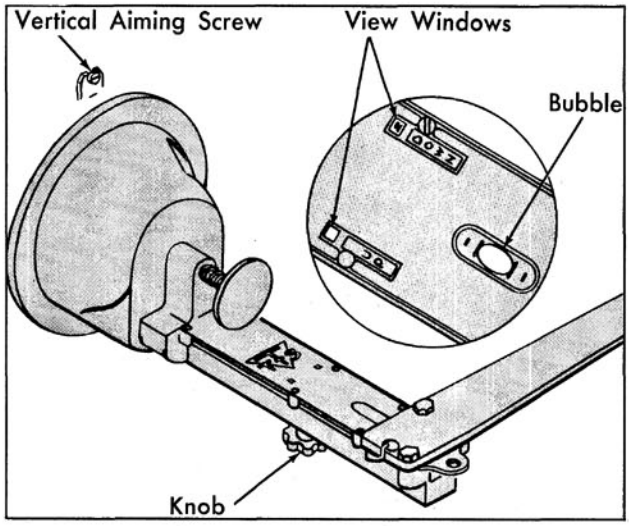


Fig. 13-94 Vertical Alignment

AIMING FIXTURE

An easily constructed checking fixture can be made to correct aimer alignment according to original manufacturers specifications, after the aimers have been dropped or damaged. Since the manufactures calibration is required in making this fixture, care must be taken to use only an aimer that is known to be properly aligned.

1. Mount a 10" x 10" square of 3/4" plywood in a vertical position on a wall.

2. Install three 1/2" No. 6 pan head wood screws on the boards as shown in Fig. 13-98. The screw heads should be approximately 3/4" from board.

3. Place the aimer against the screws with the horizontal arm parallel to the floor and the numeral 2 in the "down" view window. Be certain the screw heads provide adequate clearance between the flange of the aimer and the board.

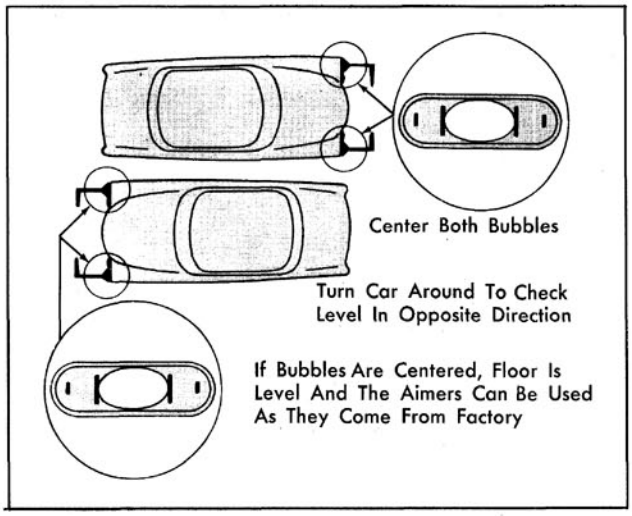


Fig. 13-95 Selection of Aiming Area

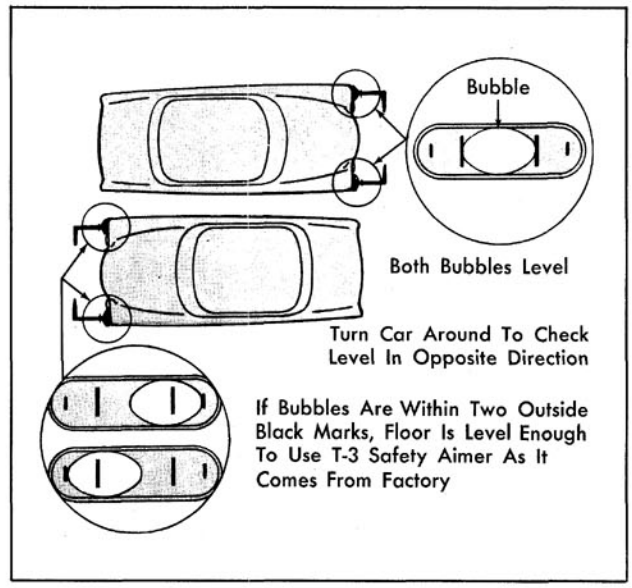


Fig. 13-96 Floor Level Limits

4. Adjust the three screws until the bubble in the aimer is centered. Screws should be left in this position.

5. After the checking fixture has been constructed and adjusted as outlined above, any aimer can be quickly and easily checked periodically and especially if it should be dropped or damaged in any way.

AIMER CALIBRATION

When an aimer has been dropped or damaged, the alignment should be checked as follows:

1. With the numeral 2 in the "down" window of

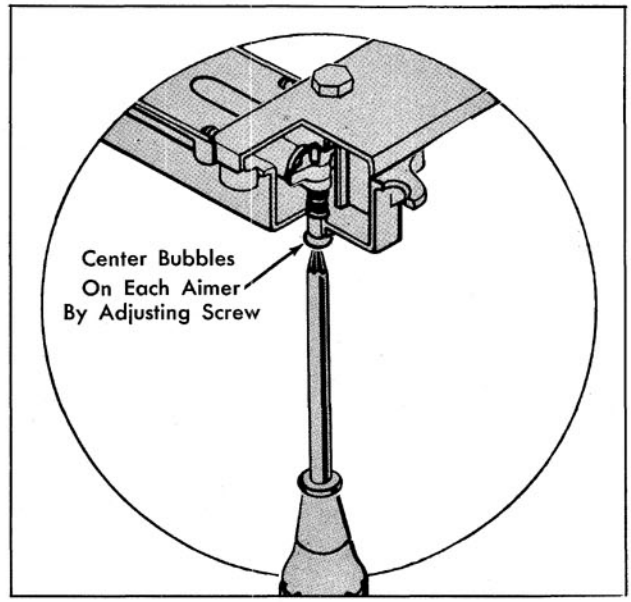


Fig. 13-97 Adjusting Aimer

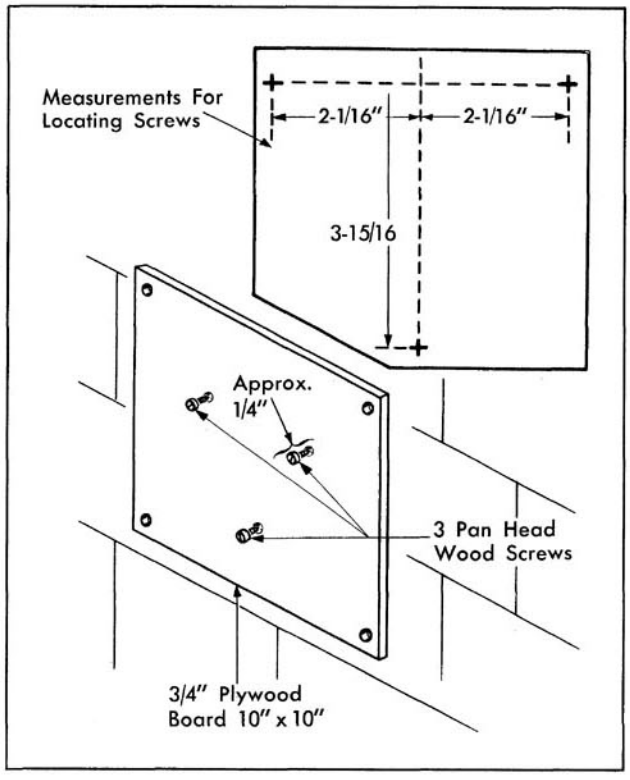


Fig. 13-98 Aiming Fixture

the aimer, hold the aimer retaining ring against the three screws in the checking fixture and with the horizontal arm parallel to the floor as shown in Fig. 13-99. If the bubble is centered, the aimer is vertically calibrated.

2. If the bubble is not centered, adjust the screw on the bottom of the aimer, Fig. 13-97, until the bubble is centered. The aimer is now calibrated vertically.

3. The horizontal check of the aimer is made by

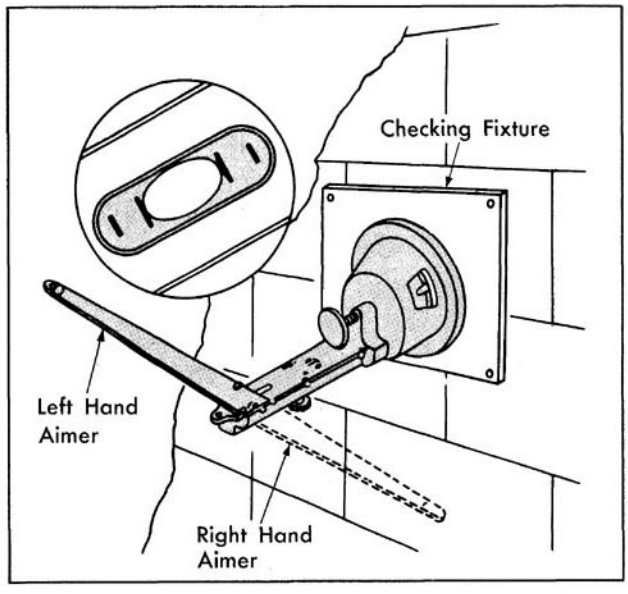


Fig. 13-99 Checking Vertical Calibration

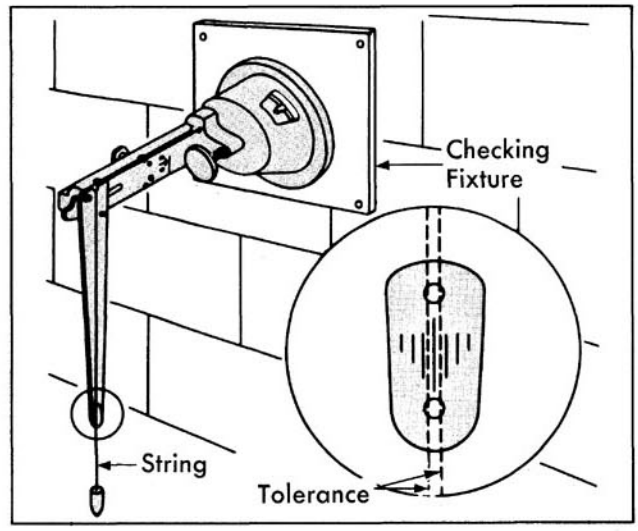


Fig. 13-100 Checking Horizontal Calibration

placing the aimer on the board as in the vertical check, except that the horizontal arm is pointing toward the floor as shown in Fig. 13-100. With a small weight or plumb bob on one end of a three-foot string, connect the opposite end of the string to the slot in the aimer arm. The string should fall as shown, inset, Fig. 13-100. If it falls outside the tolerances shown, the aimer should be replaced.

TAIL LAMPS

The tail light bulb is a double element bulb which acts as a stop light, tail light and turn signal light.

The tail light bulb on all models, except station wagons, can be replaced from within the rear compartment by removing the socket from the tail light housing. When installing the socket, align the tang of the socket with the slot in the housing and push until socket snaps into place.

The tail light bulb on stations wagons can be replaced by removing the tail light lens.

BACK-UP LAMPS SWITCH
(REFER TO INSTRUMENT PANEL AND ACCESSORIES)

HEADLAMP SWITCH

The headlamp switch controls the headlamps, parking lamps, tail lamps, and instrument panel lamps. On 30, 31 & 32 Series the dome lamps are actuated by turning the headlamp switch fully counterclockwise. These circuits are protected by a circuit breaker incorporated in the headlamp switch. In addition, the tail lamps and instrument panel lamps are protected by fuses located in the

fuse block. The brightness of the instrument panel lamps is adjustable by means of a rheostat built into the headlamp switch. Turning the knob of the switch operates the rheostat.

The lamp switch used on cars with Guide-Matic has a separate ON-OFF switch for Guide-Matic actuation, and also incorporates a 4-amp fuse to protect the circuit.

HEADLAMP CIRCUIT BREAKER

The normal lighting load is not sufficient to cause the circuit breaker (located on the headlamp switch) to open. If a short occurs, the circuit breaker will cause the lights to flicker. This flickering will continue until the cause of the short is corrected. The circuit breaker is not adjustable.

DIMMER SWITCH

The foot dimmer switch is used to select high or low beam of the headlights as desired. Cars equipped with Guide-Matic have a combination override and dimmer switch. The override position of the switch is obtained by depressing the switch half-way, and is used to signal oncoming cars by switching momentarily to upper beam. The headlights return to automatic operation when the switch is released. The foot dimmer switch must be in the upper beam position before the Guide-Matic will operate.

NEUTRAL SAFETY SWITCH

A neutral safety switch, mounted on the mast jacket, or inside the console is employed as a safety factor on cars equipped with automatic transmission. The switch prevents starting of the engine with the transmission in gear. The engine may be started with the selector lever in "Neutral" or "Park" position.

CHECKING

1. Apply parking brake firmly.
2. Position selector lever into "D" range and turn ignition switch to "Start".
3. While holding ignition switch on "Start", slowly move selector lever toward "N" position until engine cranks and starts.
4. Without moving the selector lever after engine starts, depress accelerator pedal slightly to determine whether or not transmission is in gear. If neutral safety switch is properly adjusted, transmission will not be in gear.

NOTE: If equipped with back-up lights, the lights should operate with the ignition on and the selector lever in reverse.

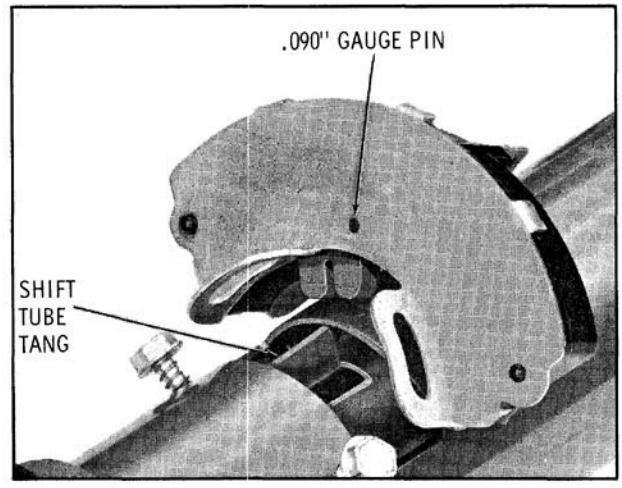


Fig. 13-101 Neutral Safety Switch Adjustment (Column Shift 30-31-32 & 33 Series)

ADJUSTMENT (34, 35, 36, 38 & 39 Series)

1. If equipped with console, remove the console control panel.
2. Loosen switch attaching screws.
3. With selector lever in "Neutral," position the switch so that a .090" gauge pin can be inserted through the hole in the switch arm and into the hole in the face of the switch.
4. Tighten the switch attaching screws and remove the gauge pin.
5. Recheck adjustment.
6. Install console control panel.

ADJUSTMENT (30, 31, 32 & 33 Series)

1. If equipped with console, remove the console.
2. Remove the switch attaching screws.
3. With the ignition OFF, position the selector lever in "D".
4. Align the slot in the contact support with the hole in the bracket and insert a .090" pin. (Fig. 13-101 and 13-102)

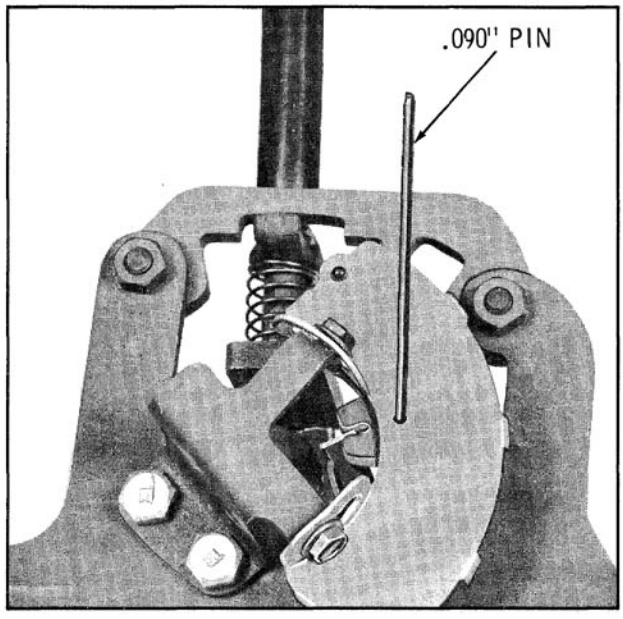


Fig. 13-102 Neutral Safety Switch (Floor Shift 30-31-32 & 33 Series)

5. Position the contact support drive slot over the shifter tube drive tang and install mounting screws.

6. Recheck adjustment.

ELECTRICAL CIRCUIT DIAGNOSIS PROCEDURE

CAUTION: The gasoline tank gauge unit can be partially or completely damaged by a momentary surge of 12 volt current across the resistance coil in the tank guage. To prevent damaging the tank unit resistance coil, it is recommended that the tank wires be disconnected before any electrical tests or repairs are made in the wiring harness. The above precaution should also be exercised whenever the chassis to body wiring connector plug has to be disconnected.

Failures in a circuit are usually caused by short 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 due to a screw driven through the wire, insulation cut through by a sharp metal edge, etc.

If a failure is encountered in one of the body circuits, the circuit diagrams should be thoroughly reviewed to become familiar with the circuit before performing an intensive checking procedure to determine the cause and location of the failure.

The body circuit diagrams are located in the BODY SECTION. The following information may aid in locating and correcting a failure in the body wiring electrical system.

1. If a major portion of the electrical circuit becomes inoperative simultaneously, the failure may be due to improper connections between the front and rear harness, or between the front harness and the chassis wiring connector.

2. If only one of the circuits is inoperative, the failure is due to an open circuit or short in the affected circuit. Short circuits usually result in blown fuses or in the case of power equipment circuits, in the circuit breaker opening the circuit. If the fuse is not blown and the circuit affected is a lamp circuit, check the bulb before proceeding with any checking procedures.

3. The dome lamp and courtesy lamp circuits are designed so that the switches are in the "ground" side of the circuit. If a condition is encountered where the lamps remain "on" even though the jamb of courtesy lamp switches are not actuated, the failure is probably due to defective switches, or to the wire leading to the switches being grounded to the metal body.

TESTING WITH BT 11-20

If the preliminary checks have not located the cause of failure, Tester BT 11-20 can be used to isolate the defective circuit without the unnecessary removal of trim or hardware.

TESTING FOR SHORT CIRCUIT

CAUTION: If the turn signal fuse is blown, remove the flasher and install a jumper wire in its place before connecting test leads. Do not use BT 11-20 in the clock, radio or fuel gauge circuits.

1. Move detector switch to TEST.

2. Remove blown fuse and connect a test lead to each fuse clip. Move detector switch to SHORT.

3. Turn on all switches in the blown fuse circuit.

4. Observe each unit or light in shorted circuit. Units or lights that operate momentarily (when tester light is out) are not shorted.

5. Position meter over the shorted circuit, at the fuse block, with the base of the meter or

arrows directly above the wiring. The meter needle will deflect AWAY from the direction of the short each time the tester completes the circuit. Note the amount of needle deflection.

6. Move meter progressively from the fuse block toward the unit that is not operating. The location of the short will be indicated by a reduction in needle deflection. If the needle ceases to deflect, the short circuit has been passed, the wrong circuit has been followed or the meter is not above the circuit.

7. After the short is located and repaired, remove the test leads and replace the fuse.

WINDSHIELD WIPER SYSTEM

DESCRIPTION

3000, 3100 & 3200 Series - The wiper consists of a rectangular shaped single-speed wiper motor using 15" wiper blades with tandem wiping action. A two-speed wiper motor equipped with a washer pump is available as an option.

3300 & 3400 Series (Except 3457) - A rectangular shaped single-speed wiper motor without a washer pump is standard equipment. A two-speed motor is available as an option and has a round motor housing. Both motors have tandem wiping action.

3457 Series - The wiper system consists of a tandem operating two-speed motor equipped with a washer pump. The unit can be identified by the round motor housing. The motor used on this series is identical to the optional two-speed motor offered on the 3300 & 3400 Series.

3500 Series - A round shaped two-speed motor without the washer system is used as standard equipment. A round shaped two-speed motor with washer system is offered as an option. Both models have overlap wiping action.

3600, 3800 & 3900 Series - A round shaped two-speed motor with washer pump using the overlap wiper system is standard equipment. The two-speed motor is identical to that offered as an option the 3500 Series.

All 3000, 3100 and 3200 models, and 3300 and 3400 models with rectangular shaped motors use 15" blades, models 3300 through 3900 with round motors use 18" blades.

A washer pump accessory package is available for all motors not equipped with washer system.

The single-speed rectangular shaped wiper system consists of a shunt wound motor and a gear

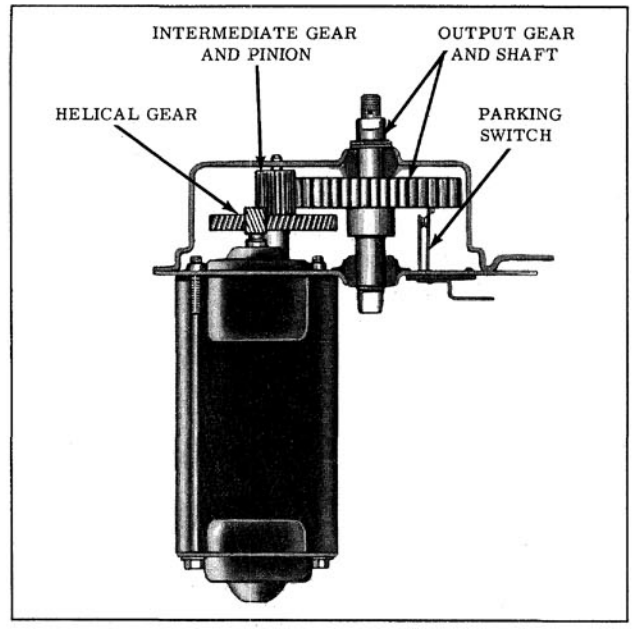


Fig. 13-103 Gear Train - Single Speed

train. The gear train consists of a helical gear which drives an intermediate gear and pinion, the pinion of which drives an output gear and shaft assembly. (Fig. 13-103) The gear train ratio used on the 30, 31 and 3200 series is 40:1. The ratio used on the 33 and 3400 series is 33:1. (Fig. 13-104)

The two-speed rectangular shaped wiper

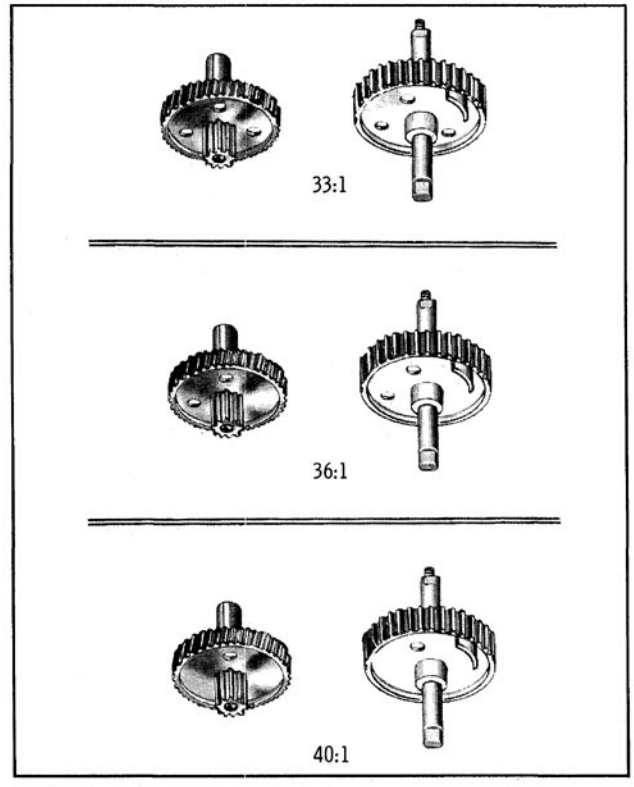


Fig. 13-104 Gear Identification

consists of a rectangular shaped compound wound motor (series and shunt field) adapted to the same type gear train as used with the single-speed motor. The two-speed wiper used on the 30, 31 and 3200 series has a gear train ratio of 36:1.

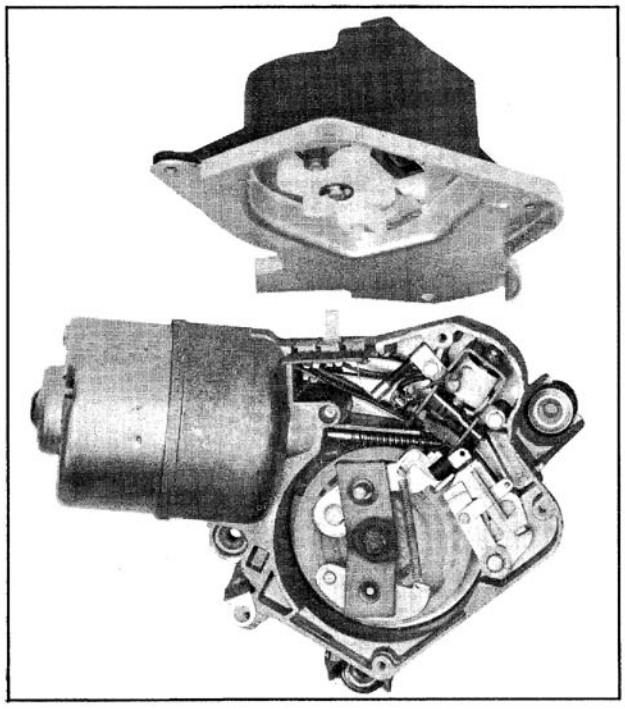


Fig. 13-105 Wiper and Washer Assembly (Two-Speed)

ture has a worm shaft which drives the main gear assembly (red gear - 102 teeth, ratio 51:1) and related parts.

Two relay controls, consisting of a relay coil, relay armature and switch assembly are located in the gear housing and controls the starting and stopping of the wiper through a latching mechanism.

The wiper transmission linkage attaches to the crank arm which is driven by the gear assembly. During normal operation, the crank arm rotates continuously through 360°. Oscillation is accomplished at the wiper transmission.

OPERATION

Single Speed

Two switches, dash and parking, are connected in parallel and control the starting and stopping of the wiper. The park switch contacts, located in the wiper gear box (Fig. 13-103), are normally closed. The purpose of the parking switch is explained in the following paragraph.

When the car owner shuts the wiper "off" at the dash switch, the motor circuit to ground is opened at the dash. However, the parking switch con-

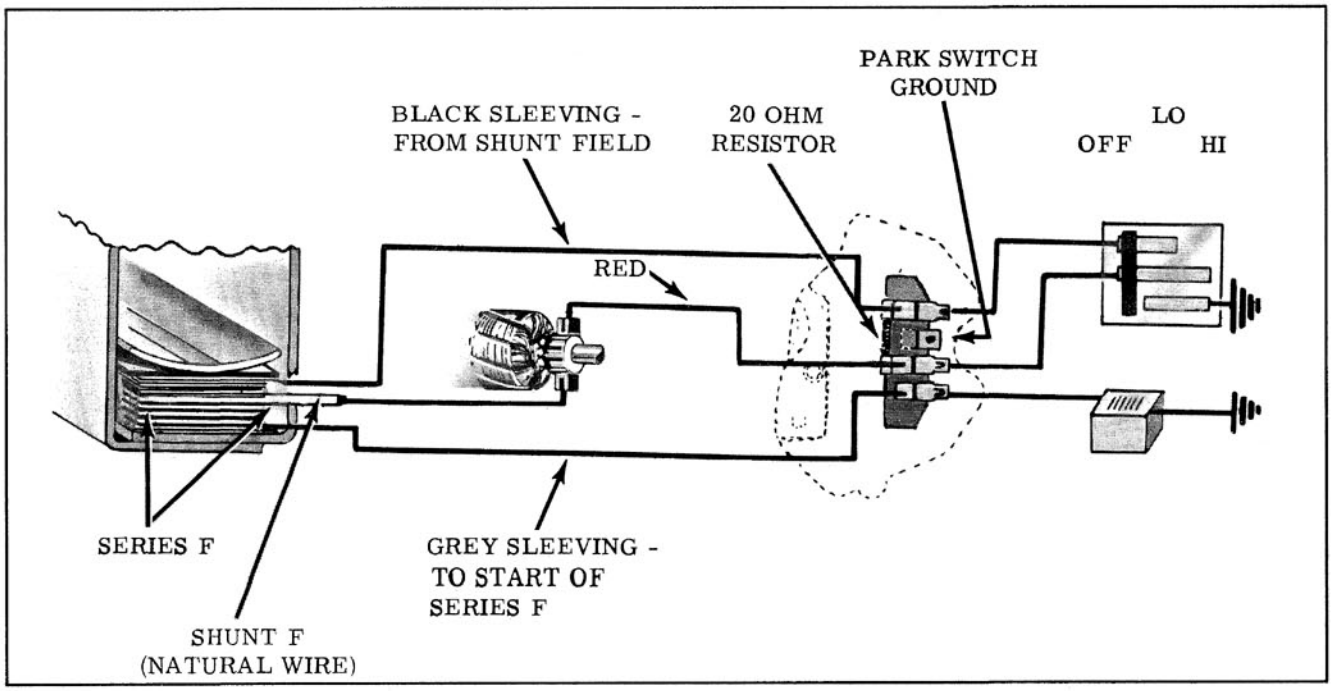


Fig. 13-106 Wiring Circuit

The two-speed round shaped wiper motor consists of a compound wound 12-volt DC motor and a gear box section containing the gear mechanism and relay control. (Fig. 13-105) The motor armatacts, which are normally closed, maintain the motor circuit to ground at the wiper. This allows the wiper to keep operating until the blades or wiper crank arm can reach the park position

(blades approximately 2" above windshield molding). At the same time the blades reach the park position, a cam on the output gear opens the park switch contacts. This opens the motor circuit to ground, stopping the motor. Thus, the parking switch actually controls wiper operation only during that short period of time, between the owner turning the wiper "off" at the dash switch and when the wiper has completely stopped.

Turning the wiper "on" at the dash switch overrides the open park switch contacts and closes the wiper motor circuit to ground starting the wiper.

NOTE: Although the park switch contacts are opened once during each revolution of the output gear, the park switch has no control over the wiper until the dash switch is turned off.

TWO-SPEED (Rectangular Shaped Motor)

The principle of operation is very similar to that of the single-speed wiper. (Fig. 13-106)

LO SPEED (Fig. 13-107)

When the dash switch is moved to the "lo" speed position (ignition switch "on") current from the battery flows through the series field coil and divides; part passing through the shunt field coil to ground at the dash switch, the other part passing through the armature to ground at the dash switch.

HI SPEED (Fig. 13-108)

Moving the dash switch to the "hi" speed position opens the shunt field circuit to ground at the dash switch and keeps the armature circuit closed to ground. The shunt field current must then pass through a 2 ohm resistor located on the back of the wiper terminal board, and then through the same lead that connects the armature circuit to ground through the dash switch.

PARKING CIRCUIT (Fig. 13-109)

Moving the dash switch to the "off" position

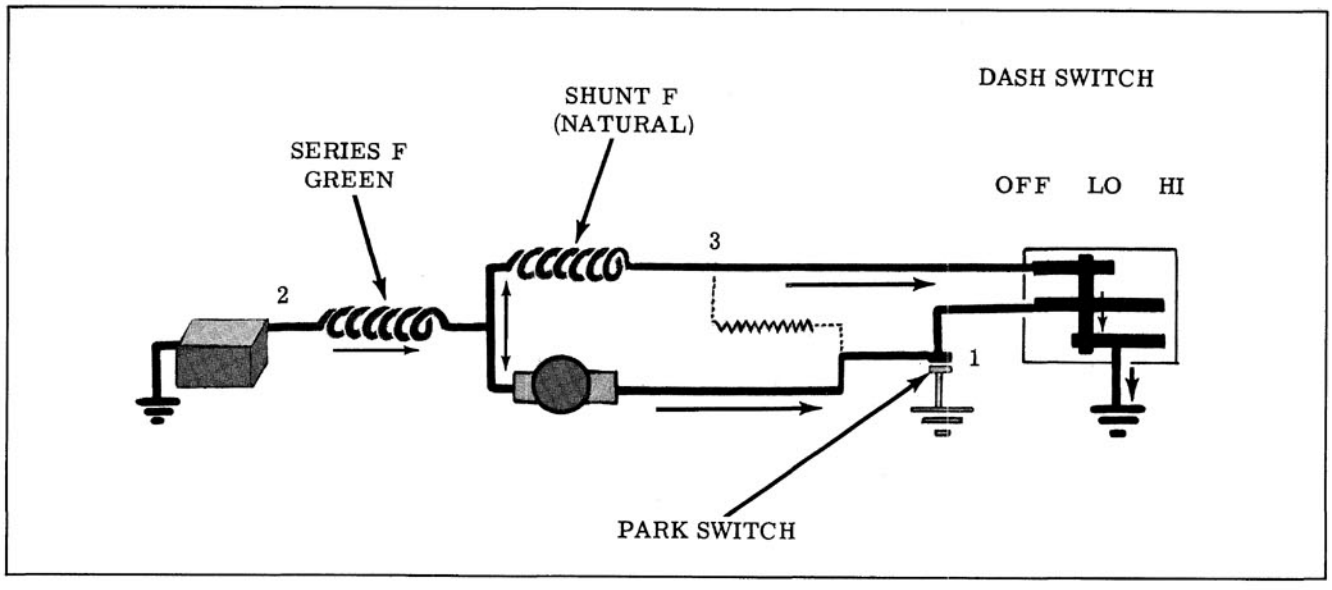


Fig. 13-107 Lo-Speed (Two-Speed Rectangular)

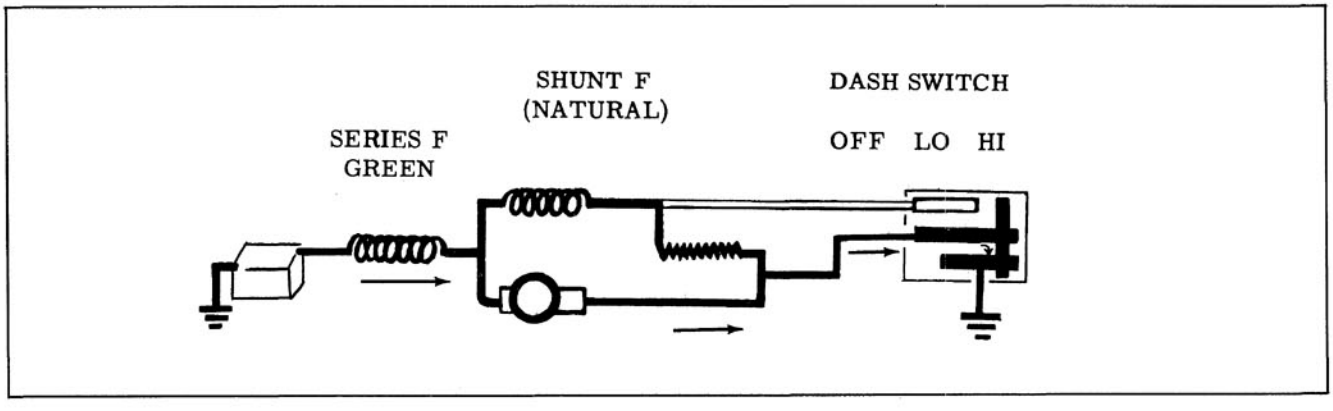


Fig. 13-108 Hi-Speed (Two-Speed Rectangular)

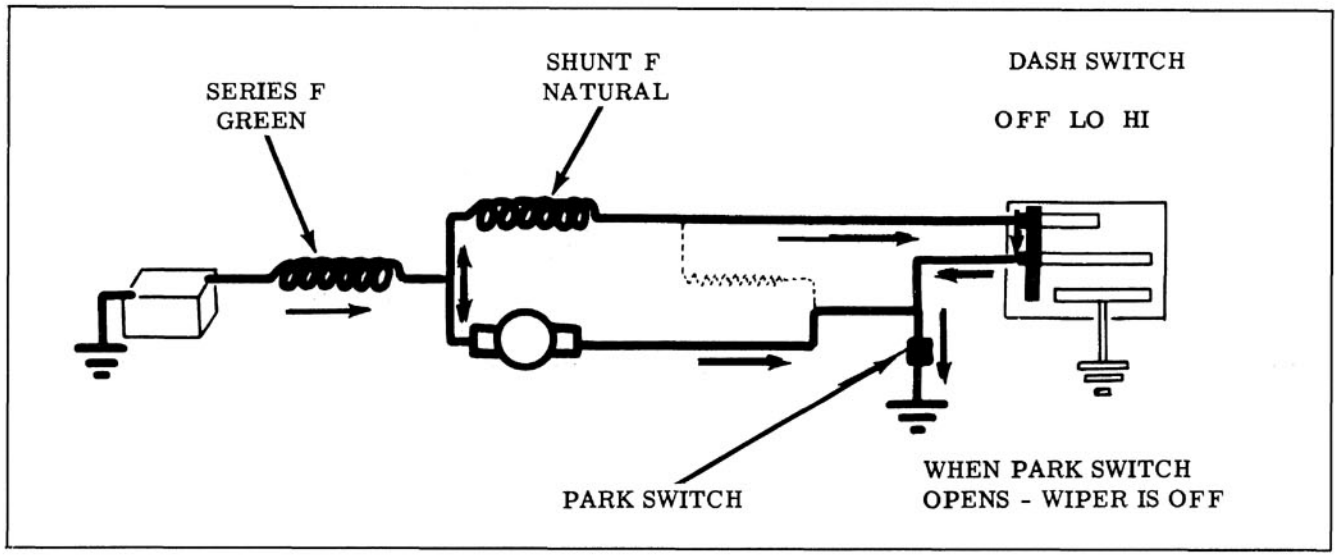


Fig. 13-109 Parking Cycle (Two-Speed Rectangular)

opens both the armature and shunt field circuits to ground at the dash switch. However, both of these circuits are still closed to ground through the parking switch.

NOTE: The shunt field circuit actually flows via the dash switch back to the wiper parking switch direct to ground which means that wiper is actually operating in "lo" speed during parking cycle.

When the cam on the wiper output gear opens the park switch contacts, the wiper is off and the blades and/or wiper crank arm should be in the "park" position.

TWO-SPEED (Round Shaped Motor)

Lo Speed

"Lo" speed position connects the relay coil and the motor shunt field circuit to ground. (Fig. 13-110) When the relay coil circuit is closed to ground, the relay armature (Fig. 13-111) pulls "in" which in turn pulls the latch arm out of the normal path of the gear assembly drive pawl and, the circuit to the wiper motor is completed through the relay control switch. Fig. 13-111 shows position of relay armature and latch arm in "park" position and Fig. 13-112 shows latch arm pulled out of path of drive pawl by the relay armature.

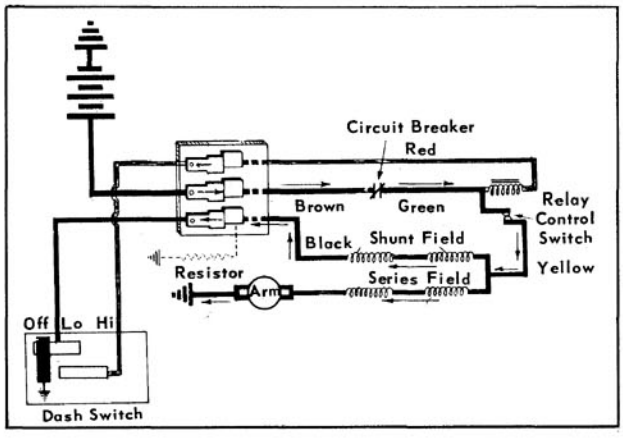


Fig. 13-110 Lo-Speed (Two-Speed Round)

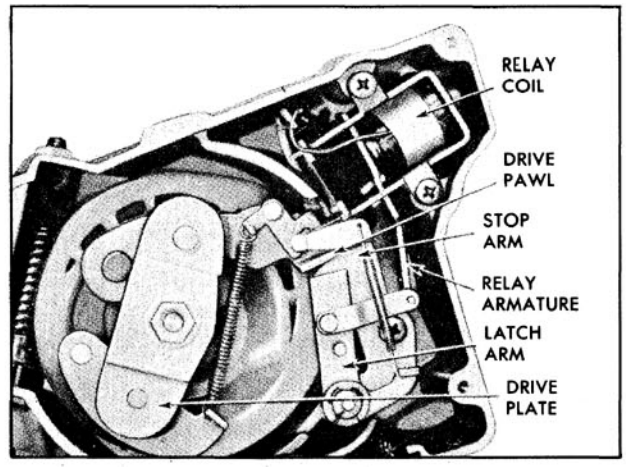


Fig. 13-111 Relay in Park Position

The drive plate and shaft assembly, drive pawl, lock pawl and spring act as a clutch mechanism. At this point, the clutch is disengaged so that the drive gear can rotate independently of the drive plate shaft assembly and crank arm. When the wiper motor starts, only the nylon gear and eccentric shaft start to rotate, the drive plate assembly, crank arm and related clutch parts are held from rotating by the drive pawl pressure against the stop arm. (Fig. 13-111)

After the nylon gear and eccentric shaft assembly have rotated approximately 180°, the guide

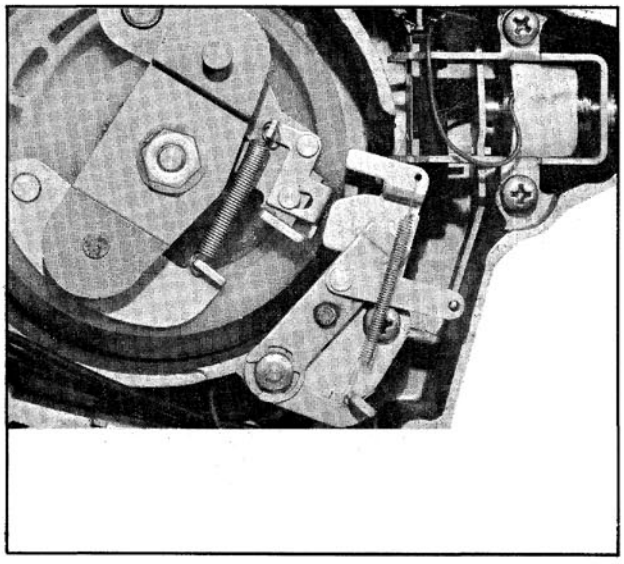


Fig. 13-112 Relay Disengaged

pins of the drive and lock pawl assemblies (Fig. 13-113) snap into their respective gear pockets locking the drive plate and shaft assembly and crank arm to the drive gear. This allows the drive pawl to clear the stop arm and the entire drive gear assembly then rotates as a unit. The wiper unit is now in its normal operating position.

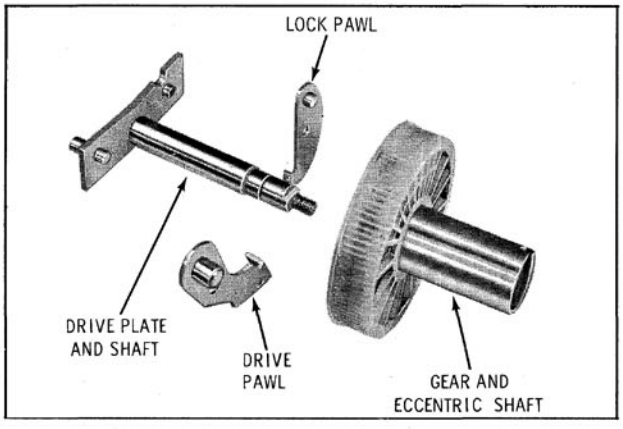


Fig. 13-113 Drive Gear and Pawls

Hi Speed

Moving the switch to the "hi" speed position opens the shunt field circuit to ground at the switch. The shunt field circuit is then completed to ground through the resistor located on the wiper terminal board. (Fig. 13-114)

Parking Circuit

Turning the switch to the "off" position opens the relay control coil circuit, (Fig. 13-115) allowing the spring loaded latch arm to move into the path of the drive pawl. (Fig. 13-116) The circuit to the motor is still closed through the relay

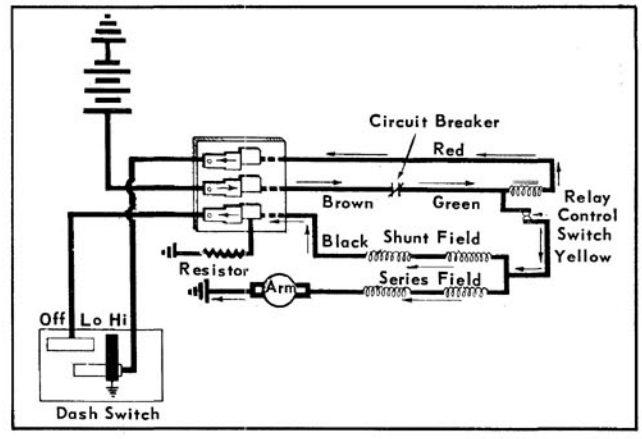


Fig. 13-114 Hi-Speed (Two-Speed Round)

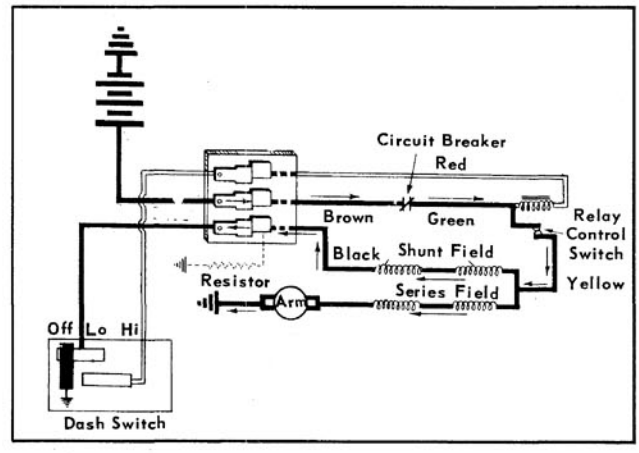


Fig. 13-115 Parking Cycle (Two-Speed Round)

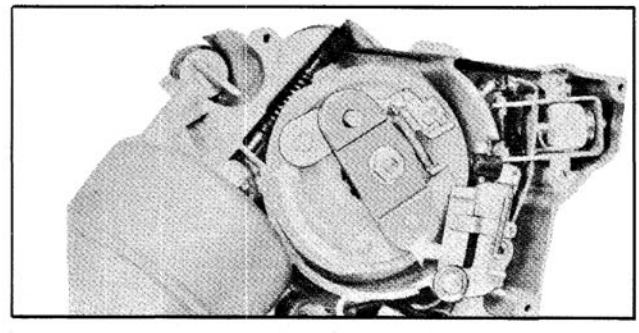


Fig. 13-116 Latch Arm Action

control switch during this period of the parking cycle as shown in Fig. 13-115.

When the drive pawl contacts the latch arm disengaging the clutch (Fig. 13-117) the drive plate and shaft assembly, crank arm, drive pawl and lock pawl stop rotating, whereas the gear and eccentric shaft continue to rotate. The cam type action between the eccentric shaft and the drive plate shaft moves the drive plate shaft and attached parts in a direction toward the relay control switch. This causes the drive pawl switch lever to push against a relay control switch tab which opens the circuit to the motor. Fig. 13-118 shows relative position of gear assembly parts

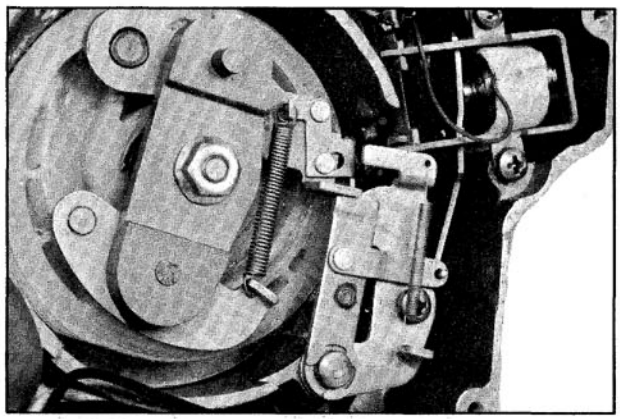


Fig. 13-117 Clutch Mechanism Released

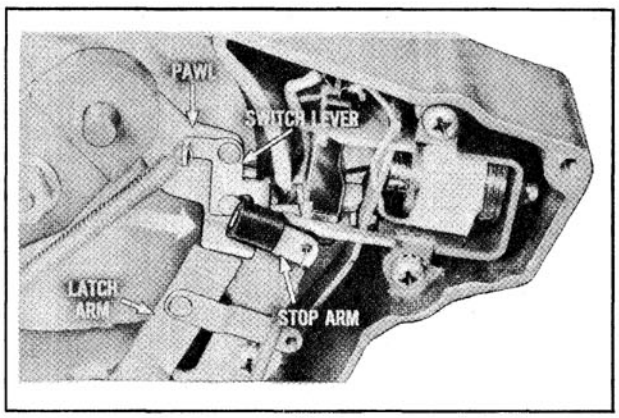


Fig. 13-118 Mechanism in Park Position

at completion of park cycle. Fig. 13-119 for wiring diagram of wiper at completion of park cycle.

CONTROLS (Fig. 13-120)

Two types of wiper controls are used and consist of electrical switches that start and stop the wiper motor. The controls consist of a knob for actuating the wiper motor and a push button for operating the windshield washer pump if the car is so equipped. When the push button is depressed to actuate the washer pump, the wipers are also actuated. Manual operation of the wiper speed knob is required to turn the wipers off.

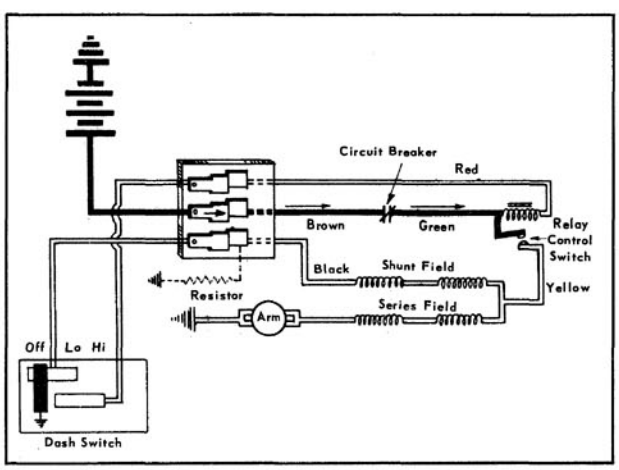


Fig. 13-119 Park Cycle

TRANSMISSION—REPLACEMENT (Figs. 13-121 & 13-122)

1. Remove cowl vent grille attaching screws.
2. Detach transmission drive linkage retainer from wiper motor crank arm. (Fig. 13-123)
3. Remove the transmission attaching screws and remove transmission.
4. Remove transmission and linkage arms from cowl.

To install, reverse removal procedure. Lubricate pivot points with SAE 10W-30.

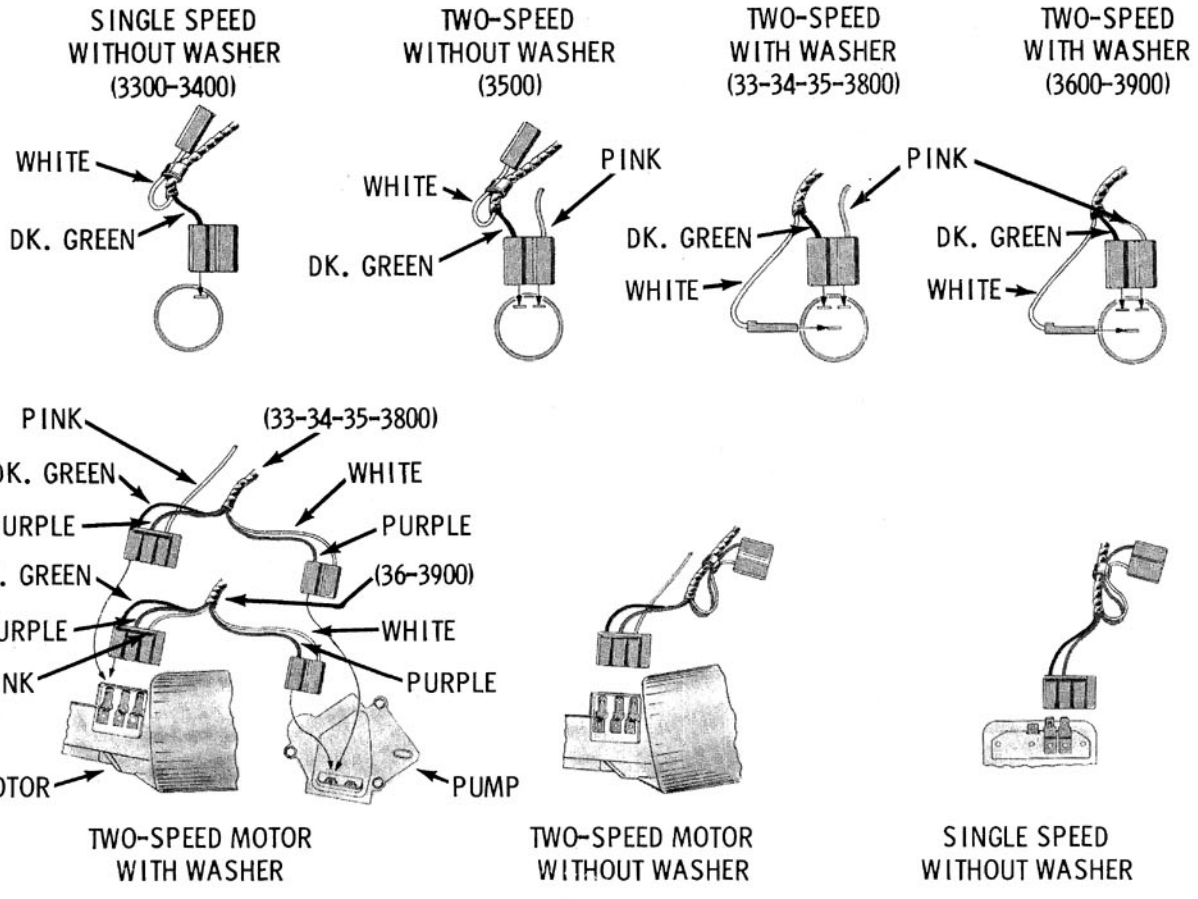
WIPER MOTOR—REPLACEMENT

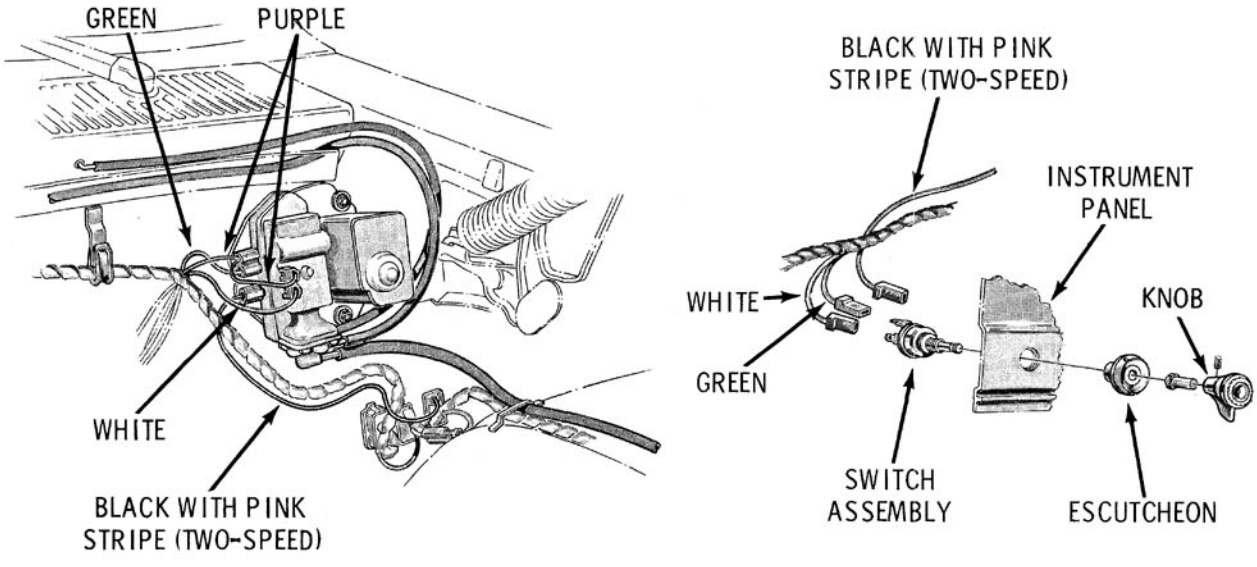
1. Turn wiper switch "on" and operate wipers through several cycles then turn switch to "off" position. Motor will then be in "park" position.
2. Disconnect electrical connector(s) from motor. If equipped with windshield washers, remove washer hoses. Remove three motor mount screws holding motor in position.
3. While slowly moving arms and blades across windshield, feed motor crank and transmission drive link through dash opening.
4. Remove motor crank to transmission drive link retainer.

To install, reverse the removal procedure. Tighten the attaching screws so that the sleeves surrounding the screws bottom to prevent "floating of the motor".

Disassembly (Single & Two-Speed Rectangular)

1. For wipers equipped with a washer pump remove the two washer pump mounting screws (Fig. 13-124) and lift washer pump off wiper.
2. Remove 4 lobe cam as required. (Fig. 13-125) The cam is pressed on the shaft but can be wedged off by using two screwdrivers between cam and plate.
3. Clamp crank arm in a vise and loosen crank arm retaining nut.





TWO-SPEED MOTOR
WITH WASHER
(30, 31 & 3200)

SWITCH INSTALLATION
(TYPICAL ALL SERIES)

Fig. 13-120 Controls and Connections

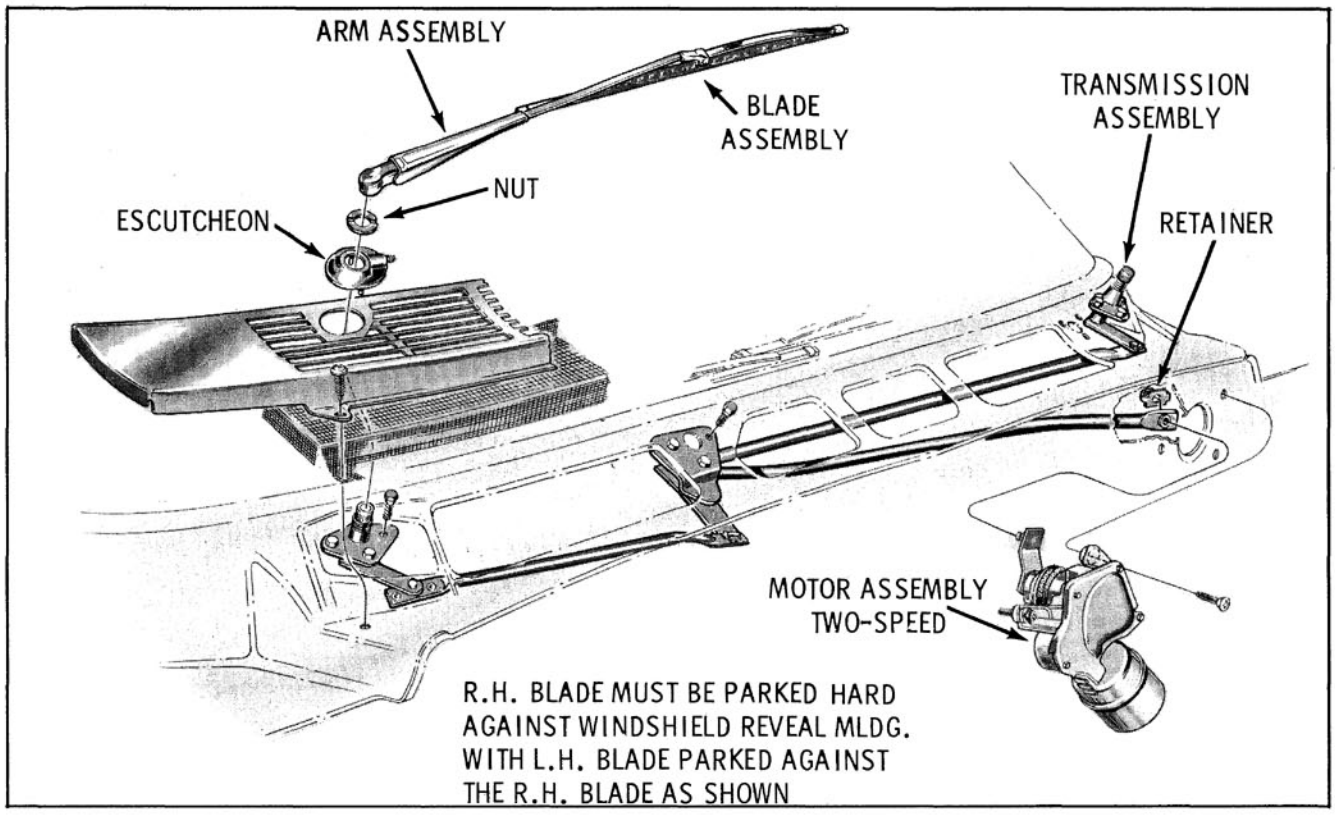


Fig. 13-121 Overlap Wiper System

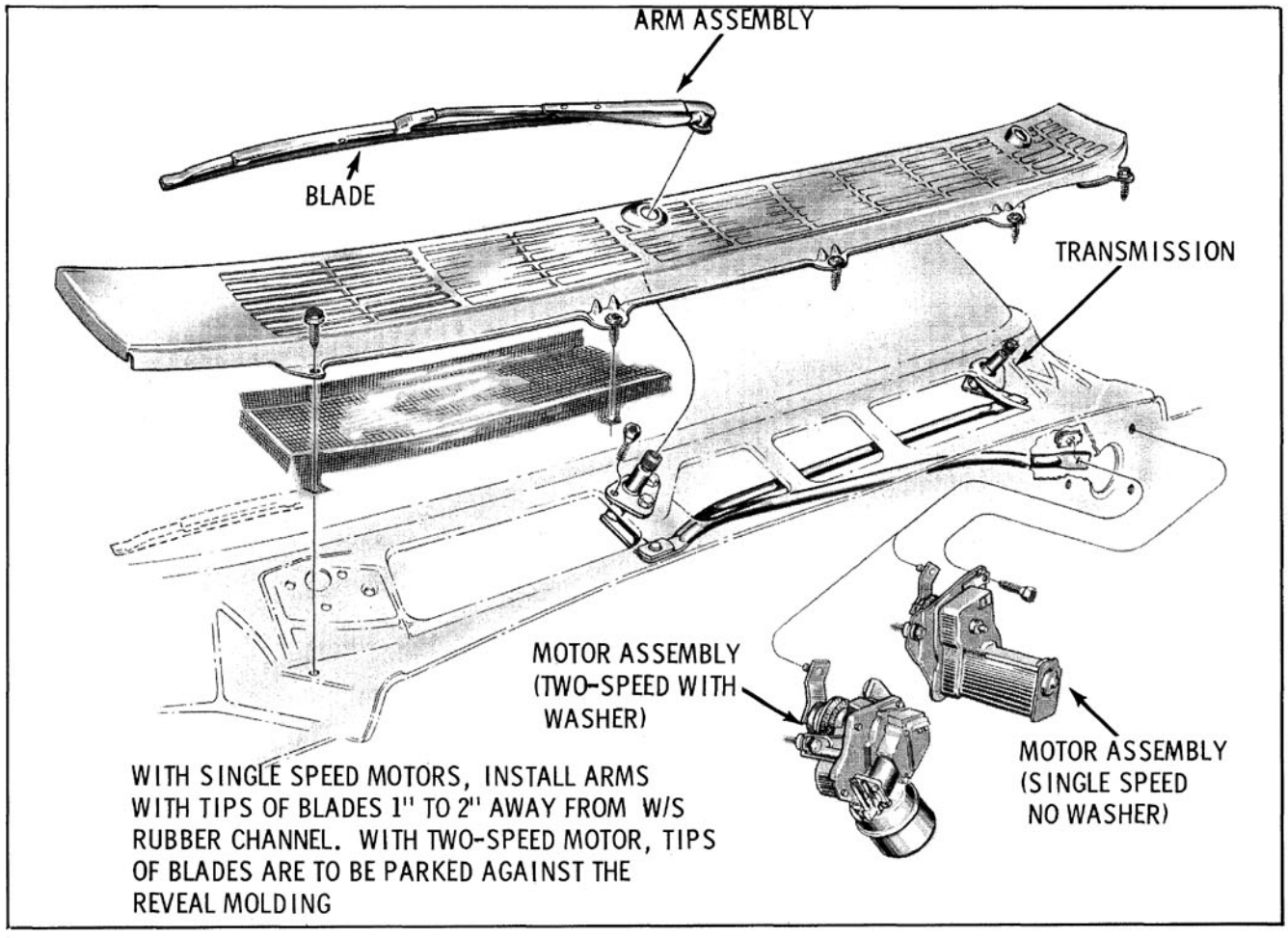


Fig. 13-122 Typical Tandem Wiper System

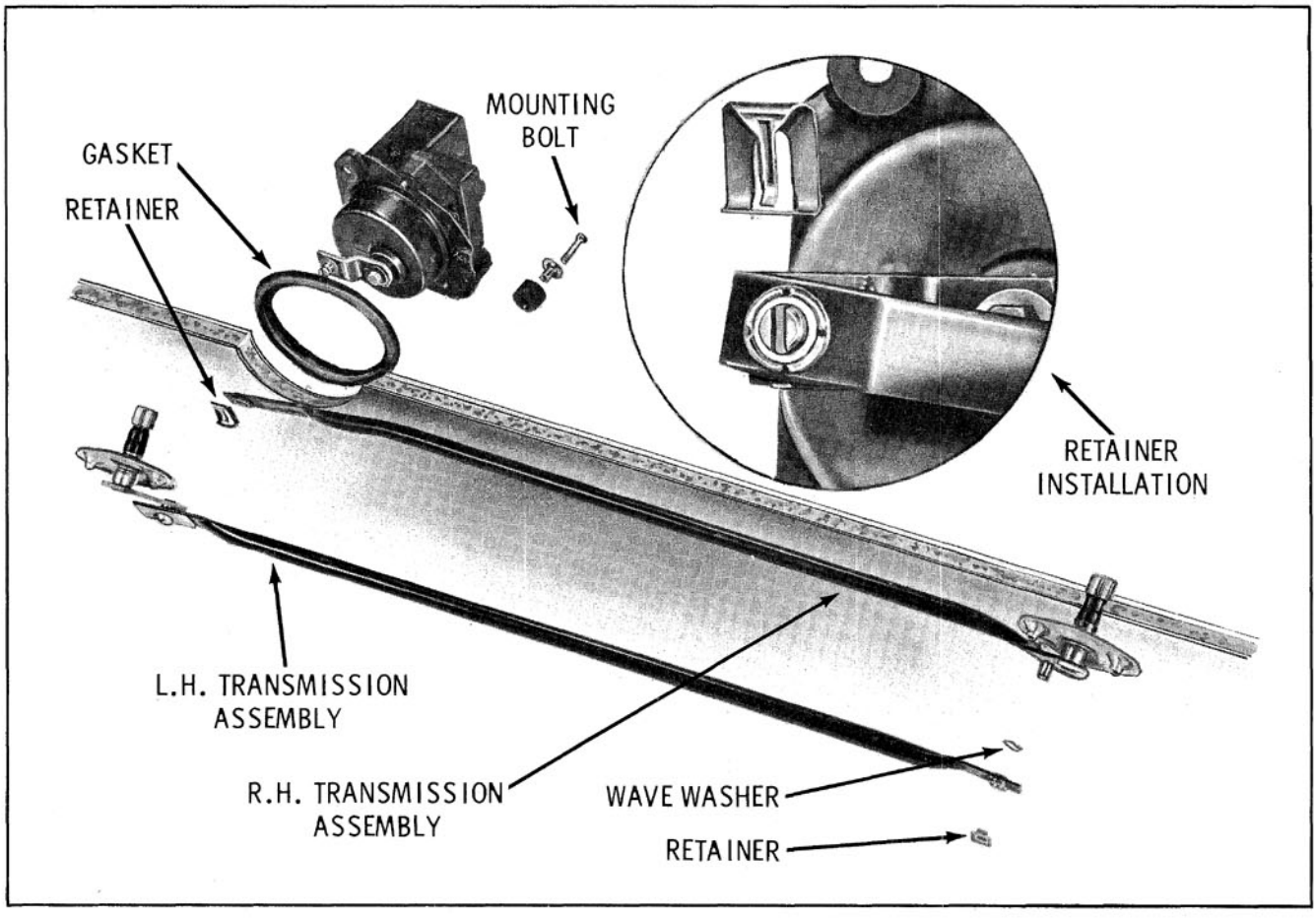


Fig. 13-123 Typical Retainer Installation

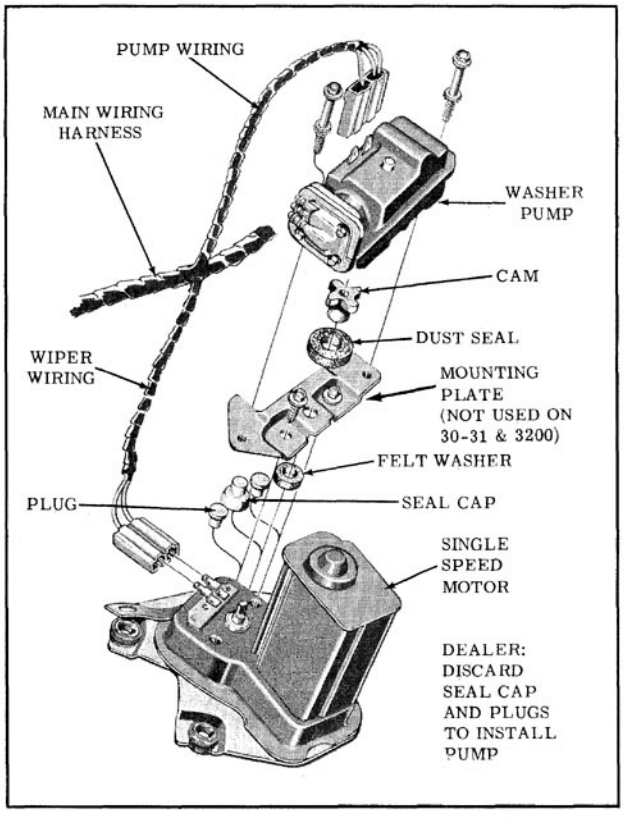


Fig. 13-124 Washer Installation

4. Remove seal cap, retaining ring and end-play washers. NOTE: Seal cap should be cleaned and re-packed with a waterproof type grease before reassembly.

   NOTE: Seal cap used only on wipers without washer pump.

5. Drill out the gear box cover retaining rivets and remove cover from gear train. Mark ground strap location for reassembly purposes.

   NOTE: Screws, nuts and lockwashers for reassembling cover to wiper are contained in a service repair package, Part No. 4910591.

6. Remove output gear and shaft assembly, then slide intermediate gear and pinion assembly off shaft. (Fig. 13-126)

7. Remove terminal board and park switch assembly as follows:

   a. Unsolder motor leads from terminals, coding of these leads on single speed is not necessary.

   b. Drill out rivets that secure terminal board and park switch ground strap to plate.

Fig. 13-125 Four Lobe Cam

NOTE: Screws, nuts and washers for attaching a replacement terminal board park switch are included with the replacement assembly.

Assembly

Reverse Steps 1 thru 7 except as noted:

1. REASSEMBLY OF GEAR BOX COVER - Cover must be located properly over locating dowel pins and intermediate gear shaft and reinstall ground strap.

2. REASSEMBLY OF CRANK ARM - Operate wiper to "park" position and install crank arm on output shaft so that identification marks line up with those in the cover. (Fig. 13-127) Check position of cam before installing gear. (Fig. 13-128) Clamp crank in vise before securing the retaining nut.

NOTE: Use cam and ball bearing lubricant on all gear teeth and light oil on shafts and bearings.

Motor Section

1. Follow Steps 1 thru 7(a) under gear box disassembly.

2. Release brush spring pressure against brushes as shown in Fig. 13-129.

3. Move brushes away from armature and slide armature out of frame and field assembly. Pull end cap assembly off armature. CAUTION: Be careful not to lose the black plastic thrust plug located in end of armature.

4. Remove end play adjusting washers.

To re-assemble motor, reverse Steps 1 thru 4 as required.

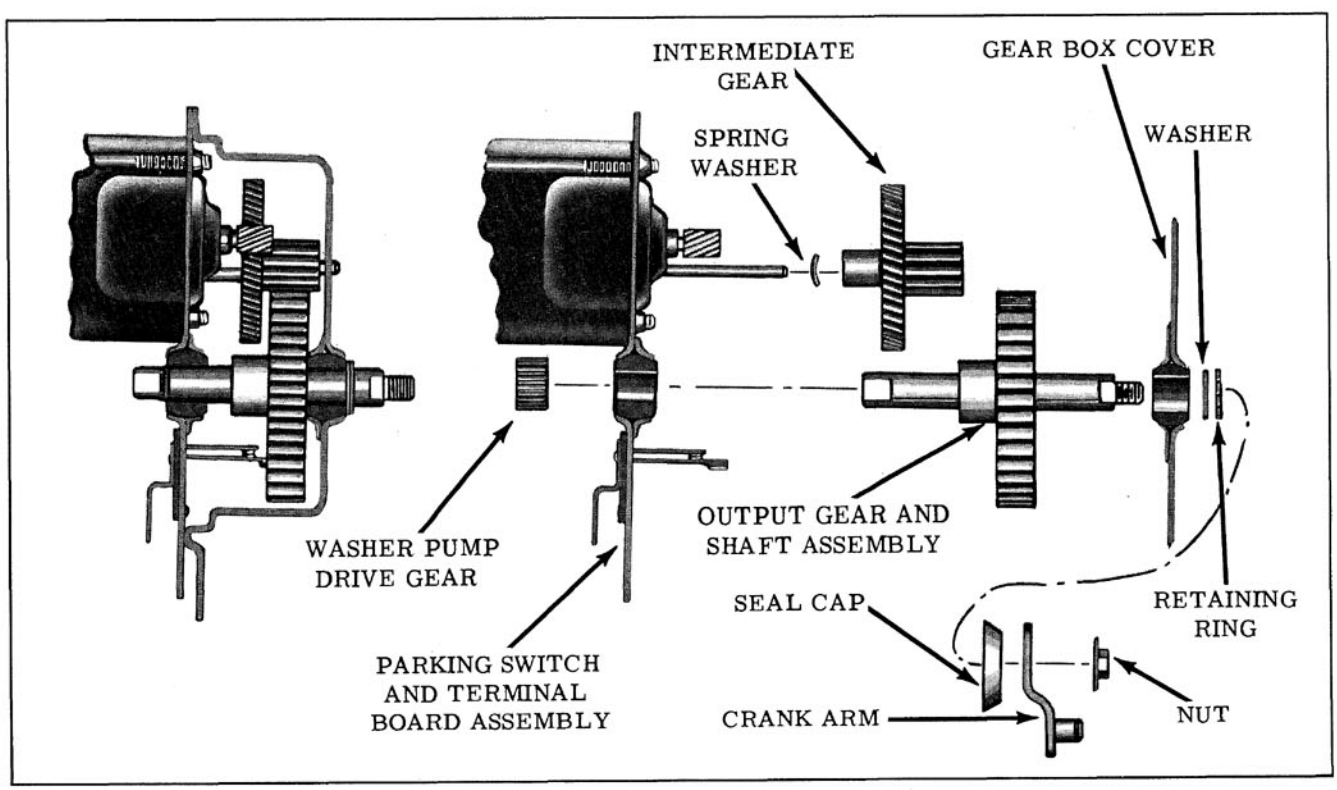
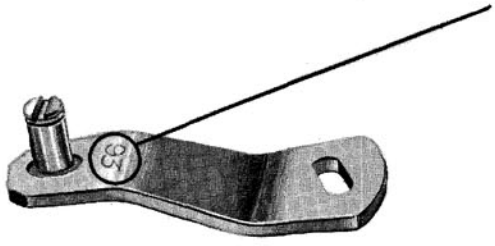
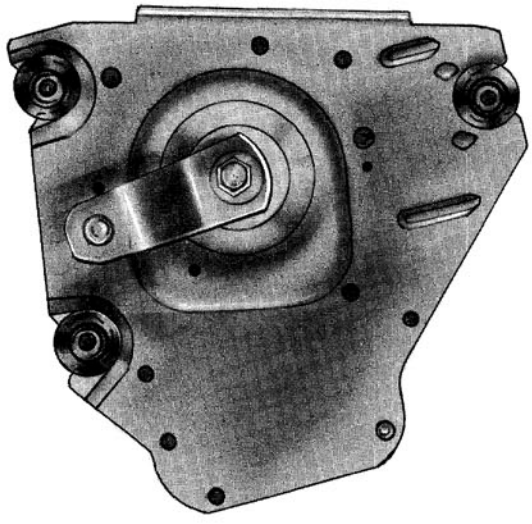


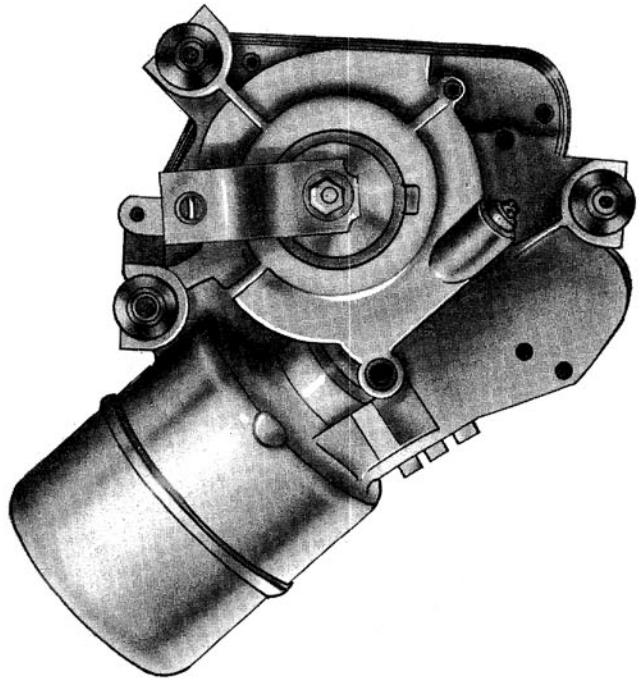
Fig. 13-126 Gear Box (Rectangular)

SERIES	TYPE	NUMBER
30-31 & 3200	One Speed	83
	Two Speed	78
33-34-35-36	One Speed (Tandem)	05
38 & 3900	Two Speed (Tandem)	93
	Two Speed (Overlap)	72

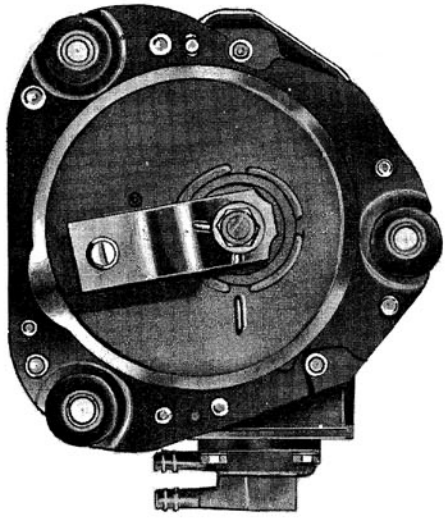




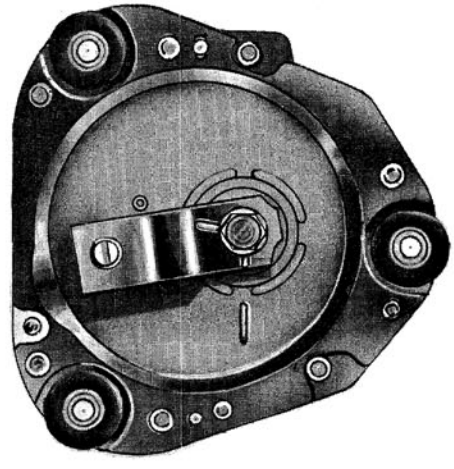
ONE SPEED
(RECTANGULAR)
33 & 3400



TWO SPEED
(ROUND)
35-36-38 & 3900



TWO SPEED
(RECTANGULAR)
30-31 & 3200



ONE SPEED
(RECTANGULAR)
30-31 & 3200

Fig. 13-127 Park Position

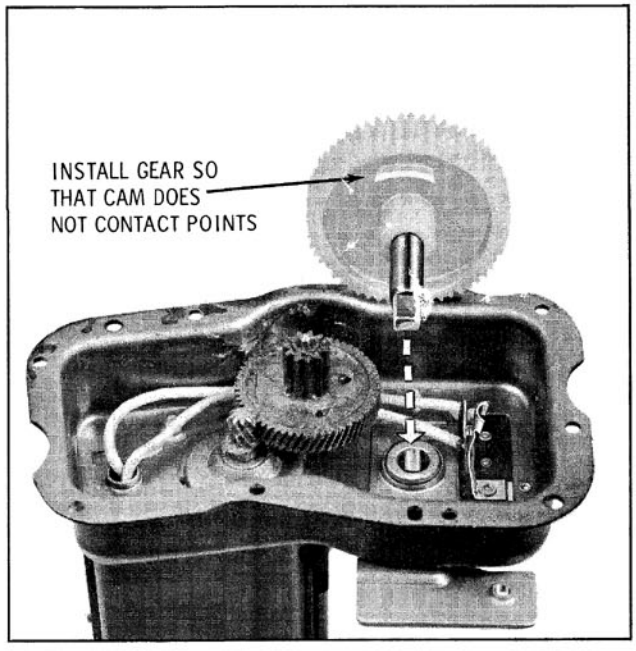


Fig. 13-128 Gear Installation

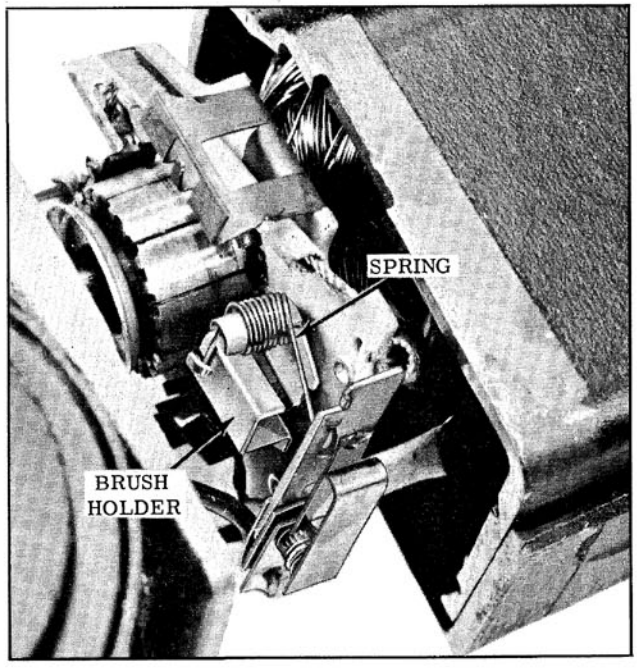


Fig. 13-129 Removing Armature

Adjustments

Armature end play is automatically adjusted by the proper assembly of end play washers. (Fig. 13-130)

DIAGNOSIS—SINGLE SPEED

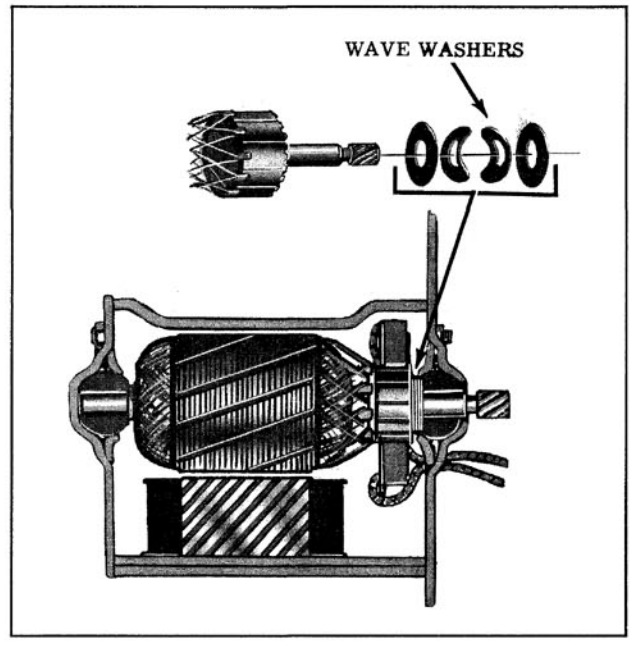


Fig. 13-130 Armature End Play Washers

WIPER INOPERATIVE (ON CAR)

NOTE: Ignition switch must be on to make electrical tests.

1. Check the following:
   a. Car wiring harness is properly attached to wiper terminals and dash switch.
   b. Wiper ground strap properly connected to wiper and car body.
   c. Dash switch is mounted securely in dash.
   d. Check fuse.
2. If everything checks out in Step 1 and wiper fails to operate, disconnect wiring harness from wiper and check for 12 volts at harness terminal that connects to wiper terminal No. 2. (Fig. 13-131) No voltage indicates defective car wiring.

   CAUTION: DO NOT connect hot line to No. 1 Terminal.
3. Connect 12 volt supply to No. 2 wiper terminal and connect a jumper wire from terminal No. 1 to ground. If wiper operates, the dash switch or wiring between dash switch and wiper is defective.
4. If wiper fails to operate in Step 3, disconnect wiper transmission from wiper crank arm. Recheck wiper operation as explained in Step 3. If wiper operates correctly, a defective transmission or binding condition exists. If wiper still fails to operate, remove wiper from car and follow instructions under Trouble-Shooting, Wiper Detached.

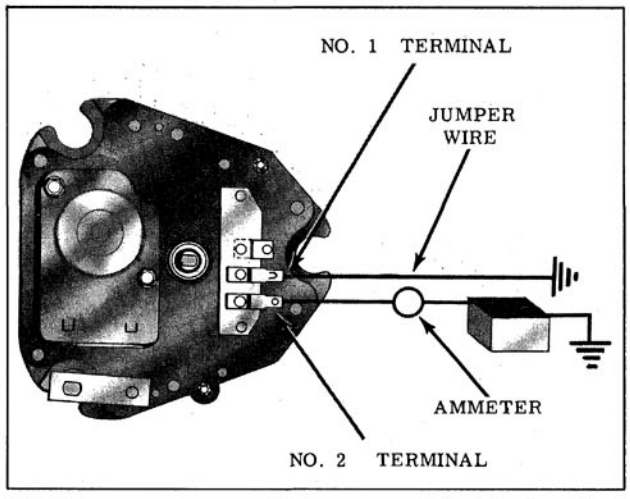


Fig. 13-131 Terminal Board Connections

WIPER WILL NOT SHUT OFF

1. Disconnect wiring from dash switch. If wiper shuts off, a defective dash switch is indicated.

2. If wiper still operates in Step 1, disconnect wiring from wiper and connect 12 volt supply direct to wiper terminal No. 2. (Fig. 13-131) DO NOT connect any jumper wire to terminal No. 1.

   -- Wiper shuts off correctly - check for grounded lead that extends between wiper terminal No. 1 and dash switch.

   -- Wiper fails to shut off - remove wiper from car and follow instructions under "Diagnosis - Off Car".

INTERMITTENT OPERATION

Check the following: Loose ground strap, loose dash switch mounting, or loose connection.

BLADES DO NOT RETURN TO PARK POSITION WHEN WIPER IS TURNED OFF

Remove wiper from car and check for a dirty or broken park switch.

DIAGNOSIS (OFF CAR)

Connect 12 Volt DC power source and ammeter to wiper as shown in Fig. 13-131 and observe current draw and wiper operation. For proper current draw see specification table.

WIPER INOPERATIVE

Current Draw, 0 Amps.

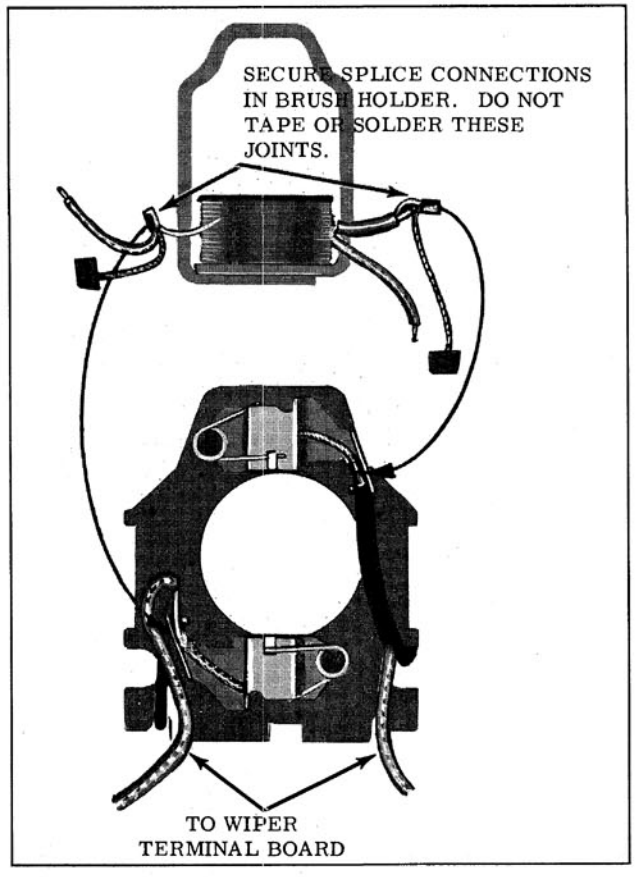


Fig. 13-132 Splice Connections

1. Check solder connection at terminal board.
2. Disassemble motor section and check all splice connections.

CURRENT DRAW, 1-1.5 AMPS.

1. Disassemble motor and check for the following items:

   a. Open armature.

   b. Brushes sticking.

   c. Brush springs improperly positioned. (Fig. 13-129)

   d. Poor solder joints at brush pigtail connections. (Fig. 13-132)

CURRENT DRAW, 10-12 AMPS.

1. Check for open shunt field circuit.

2. Check for broken gear.

WIPER RUNS SLOW, VIBRATES AND CURRENT DRAW APPROXIMATELY 7-9 AMPS

1. Check for binds in gear train.

2. Check for shorted armature. (Armature may by checked on a growler).

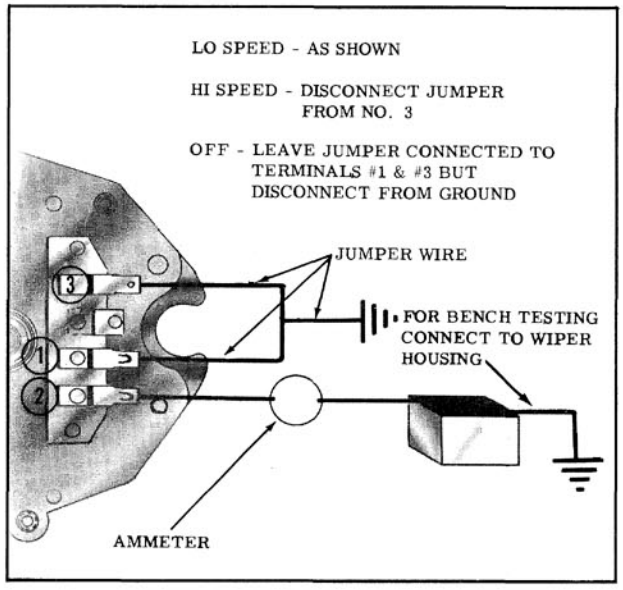


Fig. 13-133 Trouble Shooting Connections

DIAGNOSIS TWO SPEED RECTANGULAR

WIPER INOPERATIVE (ON CAR)

1. Check that wiring harness is properly connected to wiper and dash switch; wiper ground strap is connected securely to car body; and dash switch is securely mounted.

2. With ignition switch on, check for 12 volts at harness terminal that connects to number (2) terminal. (Fig. 13-133)

3. To determine if dash switch or car wiring are at fault, disconnect harness from wiper motor and try operating wiper as shown in Fig. 13-133. If wiper fails to operate, disconnect transmissions from wiper crank arm and recheck wiper operation. If wiper still fails to perform correctly, remove wiper from car and check wiper according to procedure under TROUBLE SHOOTING WIPER DETACHED.

WIPER WILL NOT SHUT OFF

1. Using the dash switch, determine if wiper has both "LO" and "HI" speeds; "LO" speed only; or "HI" speed only. (IMPORTANT: Wiper must operate in "LO" speed during parking cycle.)

2. Disconnect wiring harness from wiper motor and try operating wiper independently of dash switch as shown in Fig. 13-133.

   If wiper operates correctly, independently of the dash switch and shuts off correctly with crank arm in park position, refer to the following:

WIPER WILL NOT SHUT OFF HAS BOTH SPEEDS

1. Lead between wiper terminal No. 1 and dash switch grounded.

2. Defective dash switch.

WIPER WILL NOT SHUT OFF HAS "LO" SPEED ONLY

1. Lead between terminal No. 3 and dash switch grounded.

2. Defective dash switch.

WIPER SHUTS OFF BEFORE CRANK ARM REACHES PARK POSITION

Wiper crank arm stops rotating immediately when jumper wire is disconnected from wiper terminal No. 1. (Fig. 13-131) NOTE: When crank arm has reached park position, the crank arm index grooves will line up approximately with the ridges on the gear box cover. (Fig. 13-127)

Check for dirty, broken or bent park switch contacts.

WIPER WILL NOT SHUT OFF

Wiper crank arm fails to stop in park position when jumper wire is removed from wiper terminal No. 1. (Fig. 13-131)

1. Check that park switch contacts are opening.

2. Check for grounded condition in the internal motor lead that connects to terminal No. 1.

SPECIFICATIONS

Operating Test Voltage	12 Volt DC
Crank Arm Rotation (looking at arm)	CCW
Current Draw (Amps)	
No Load	3 Max.
Dry Windshield	3.5 Max.
Stall	11.0 Max.

WIPER WILL NOT SHUT OFF HAS "HI" SPEED ONLY

1. Lead between wiper terminal No. 3 and dash switch open.

2. Defective dash switch.

If wiper still fails to operate correctly in Step 2, remove it from car and check it per instructions under DIAGNOSIS (OFF CAR).

WIPER HAS ONE SPEED "FAST"

Check for a defective dash switch or open lead between terminal No. 3 and dash switch.

WIPER HAS ONE SPEED SLOW AND SHUTS OFF WITH DASH SWITCH IN "HI" SPEED POSITION

Reverse harness leads that connect to wiper terminals 1 and 3.

BLADES DO NOT RETURN TO PARK POSITION WHEN WIPER IS TURNED OFF

1. Check wiper ground strap connection to car body.

2. Remove wiper from car and check for dirty, bent or broken park switch contacts.

WIPER SPEED NORMAL IN "LO". BUT TOO FAST IN "HI"

Remove wiper from car and check for an open terminal board resistor.

INTERMITTENT OPERATION

Check for loose wiper ground strap connections and/or loose dash switch mounting.

DIAGNOSIS (OFF CAR)

It is assumed that in many cases there is no information available to the repairman about the original wiper complaint. It is necessary, therefore, that wiper operation be checked according to the instructions shown in Fig. 13-133. IMPORTANT: Be sure to use an ammeter capable of reading at least 30 amperes in the feed wire circuit.

WIPER INOPERATIVE

Connect wiper to operate in "LO" speed and observe current draw. Current draw ratings shown below will provide a hint as to the possible source of trouble.

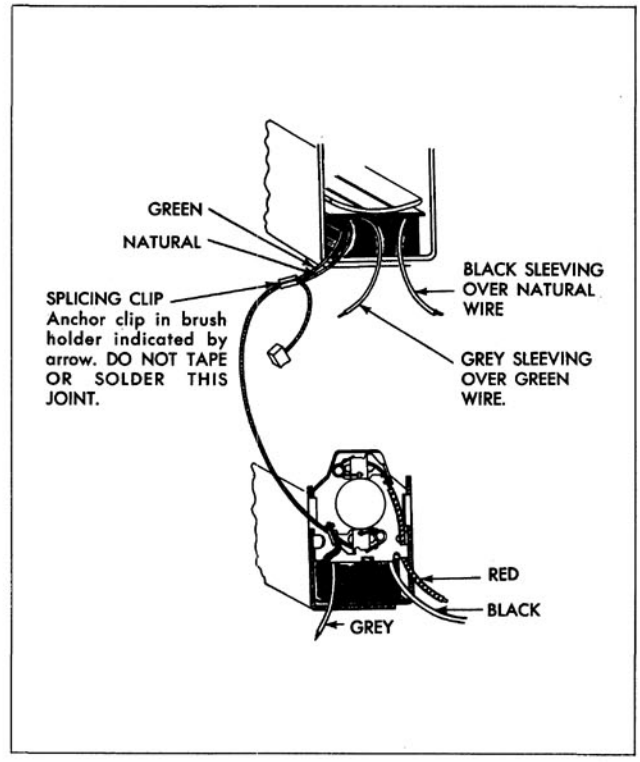


Fig. 13-134 Splice Connections

AMMETER READING (Amps)	POSSIBLE TROUBLE
0	(1) Loose solder connection at wiper terminal No. 2. (Fig. 13-133) (2) Loose splice joints. (Fig. 13-134)
1-1.5	(1) Open armature. (2) Brushes sticking. (3) Loose splice joint at brush leads.
11.0	(1) Broken gear or some other condition that will stall the wiper.

TWO SPEED (ROUND)

MOTOR CASE AND/OR ARMATURE (Fig. 13-135)

Remove

1. Remove the two through-bolts and the arma-

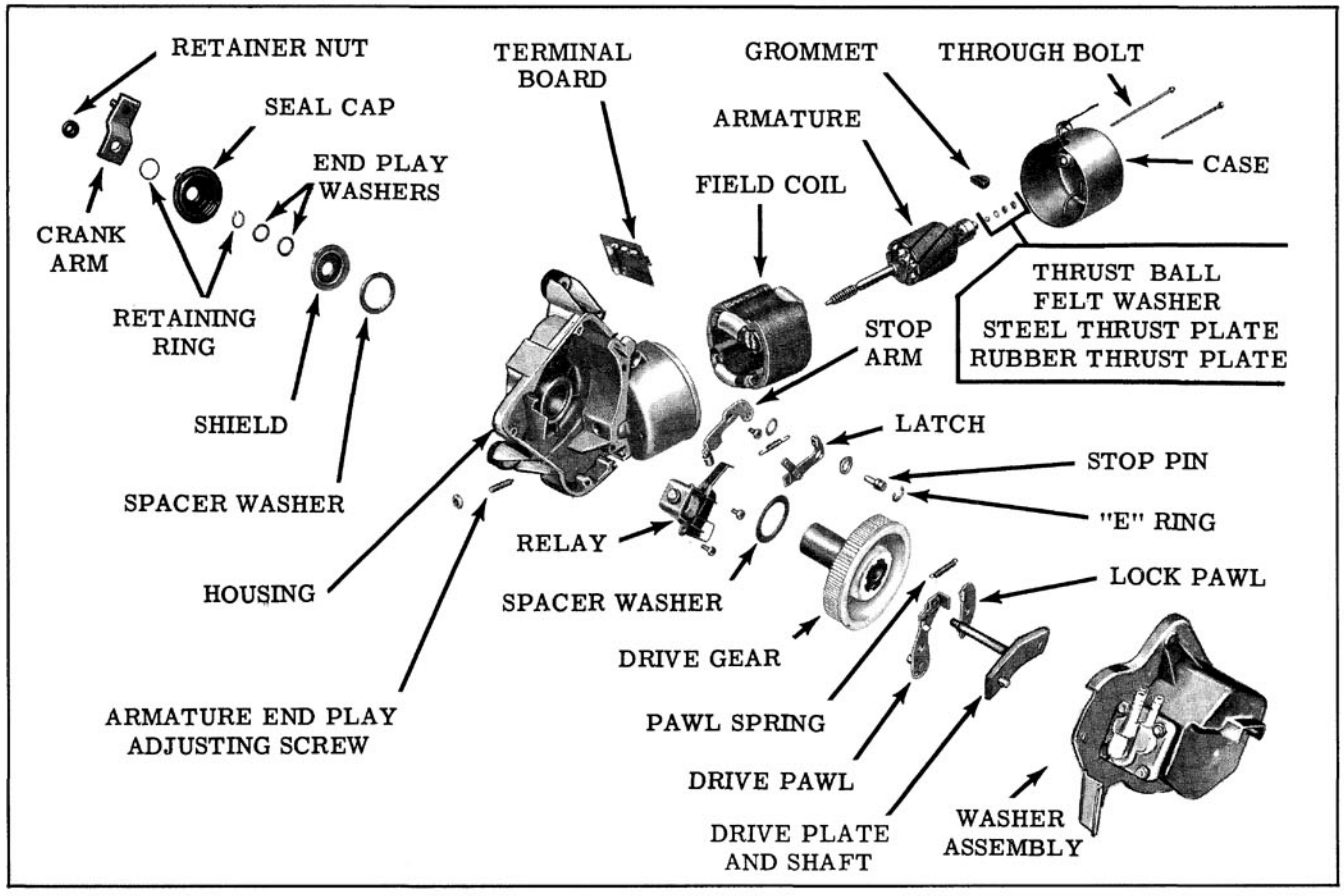


Fig. 13-135 Wiper and Washer Assembly (Two-Speed)

ture end play adjusting screw and locknut.

2. Tap the brush end of the motor case with a mallet to free it from the gear housing, then insert a brass drift into the armature end play adjusting screw opening in the gear housing to push the armature and motor case from the housing.

3. Remove the armature from the motor case.

   NOTE: The steel thrust ball is retained in the commutator end of the armature shaft by grease. The ball can be removed by dissolving the grease with solvent.

4. Remove the felt washer, thrust disc and rubber disc from the bore of the armature bearing in the motor case.

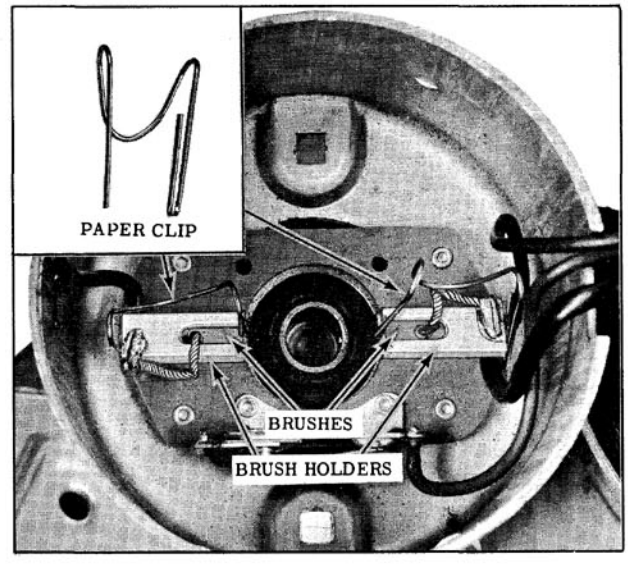


Fig. 13-136 Retaining Brushes

Assembly

1. Install the rubber disc, steel thrust disc, and felt washer into the bore of the armature bearing.

2. Install brush springs and brushes in holder. Retain brushes in holders with a brush retainer as shown in Fig. 13-136.

3. Lubricate the steel thrust ball, the bearing and worm surface of the armature shaft with cam and ball bearing lubricant.

4. Install the armature in the motor case, then remove the brush retainers.

5. While holding the armature in the motor case,

start the armature shaft through the bearing in the gear housing.

6. Rotate motor case until the through-bolt holes in the case are aligned with those in the gear housing, then install the two through-bolts and tighten.

7. Install the armature end play adjusting screw.

8. Adjust the armature end play with either of the following two methods:

   a. Stand motor on end with motor running. Loosen locknut and turn end play adjusting screw out 1/4 turn. Turn screw in until a light pressure is felt between the armature and the screw. Tighten locknut.

   b. With motor running and an ammeter connected, loosen locknut and turn adjusting screw out until a minimum current reading is obtained. Tighten adjusting screw until current reading increases 0.1 ampere. Tighten locknut.

FIELD COIL

Remove (Armature Removed)

1. Scribe an alignment mark on the field coil and housing for reference when installing new field coil. This mark can be transferred to the new coil for proper installation in housing.

2. Remove wiper gear cover or washer.

3. Remove two relay attaching screws, remove relay and unsolder yellow wire at relay connection.

4. Remove terminal board from housing and unsolder black wire from connection.

5. Unsolder black solid wire from brush holder in case as shown in Fig. 13-137.

6. Remove field coil with Tool J-7844 as shown in Fig. 13-138.

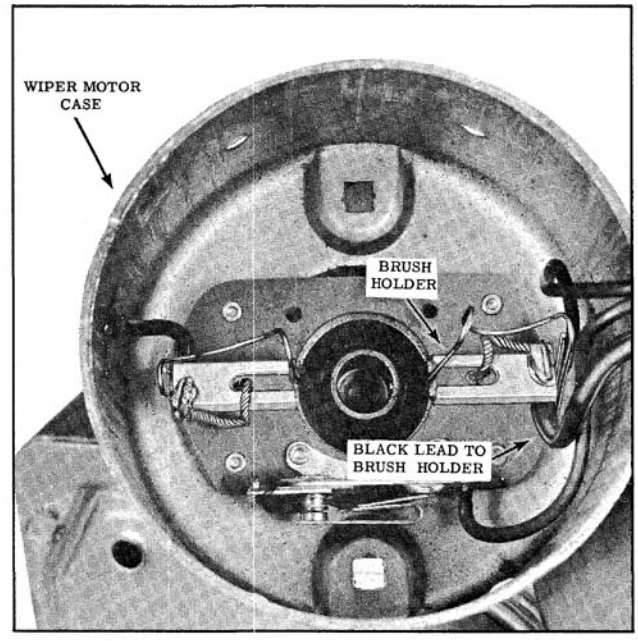


Fig. 13-137 Field Coil Connections in Case

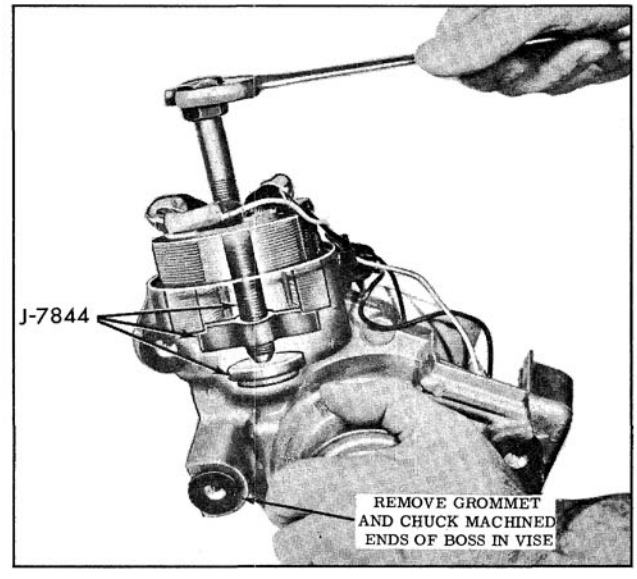


Fig. 13-138 Removing Field Coil

NOTE: If field coil requires excessive force to install, remove and file outer diameter of field laminations at point of interference.

Install

1. Position a new field coil in the housing in proper alignment.

2. Temporarily install the through bolts to act as guides while installing the field coil.

3. Using a small brass drift, tap the field coil lightly and evenly into housing. Use caution not to damage field wiring.

4. Route yellow wire to relay control assembly and solder to relay terminal.

5. Solder black wire to connector block terminal.

6. Thread black solid wire through hole in brush holder. Loop end of black wire over armature brush wire and solder both wires to brush holder.

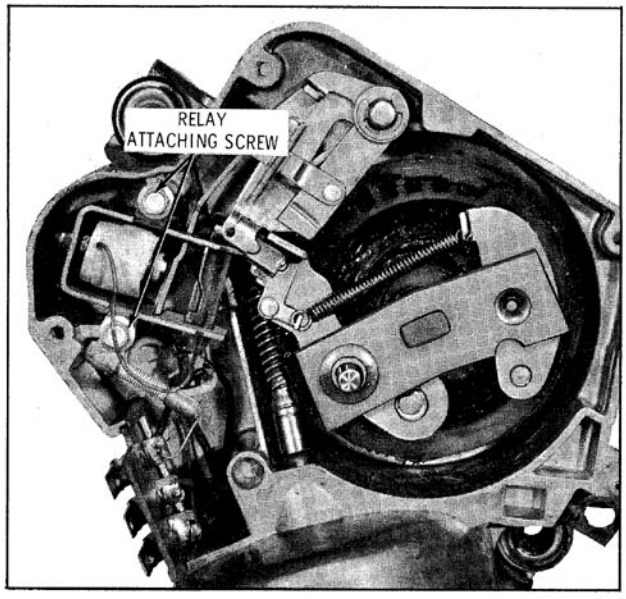


Fig. 13-139 Relay Control and Drive Gear Mechanism

GEAR BOX

The gear box is divided into two areas; the relay control and latching mechanism and the drive gear mechanism. (Fig. 13-139)

RELAY CONTROL

Disassembly

NOTE: Before unsoldering any wires, mark the color code of the wires to their respective terminals.

1. Remove the four screws which secure the gear box cover or washer pump assembly to the gear box.
2. Remove the two screws that secure the relay control assembly. (Fig. 13-139)
3. Lift the relay control assembly out of the gear box and unsolder leads as required.
4. If terminal board is to be replaced, it can be removed at this time.

Assembly

Solder existing green and yellow wiper leads to relay control switch and solder the relay coil lead to the wiper unit terminal board and reverse disassembly procedure.

DRIVE GEAR AND LATCH MECHANISM

Disassembly

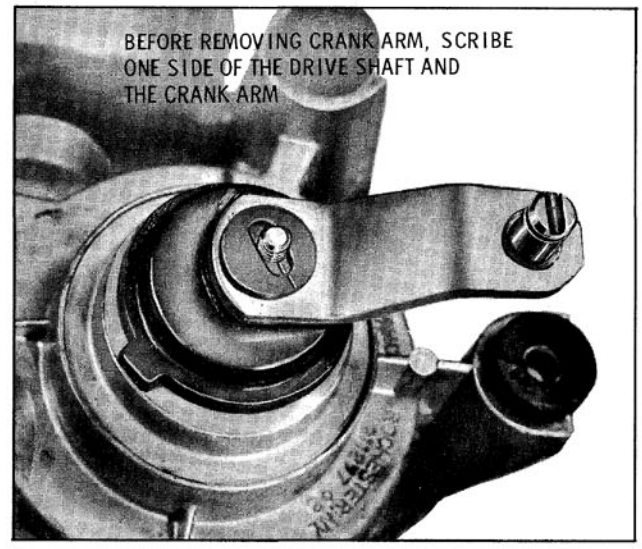


Fig. 13-140 Marking Crank Arm

1. Mark the crank arm, drive shaft and the motor housing, then remove the crank arm retaining nut. (Fig. 13-140)

   NOTE: The alignment marks are necessary in order to assemble the parts in their original location. If the parts are not installed in their original location, the wiper blades will be mispositioned in the "Park" position.

2. Remove crank arm, and rubber seal.
3. Remove the snap ring, end play washers, and shield. (Fig. 13-141)

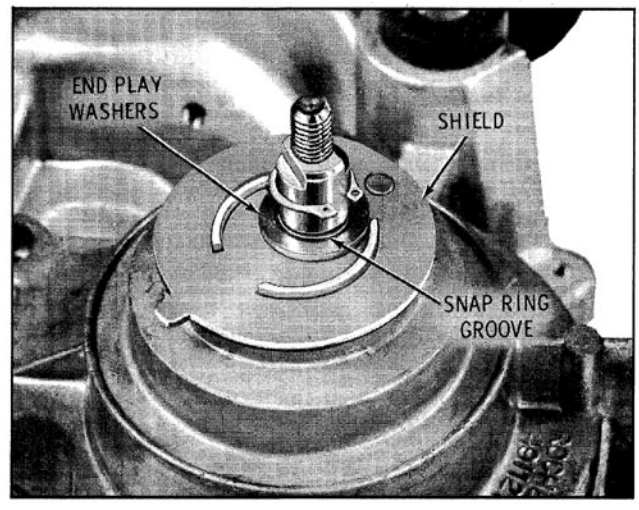


Fig. 13-141 Snap Ring Location

4. Remove stop arm retaining screw and plastic bumper.
5. Remove gear mechanism from the gear box and slide spacer washer off the gear assembly eccentric shaft. (Fig. 13-142)

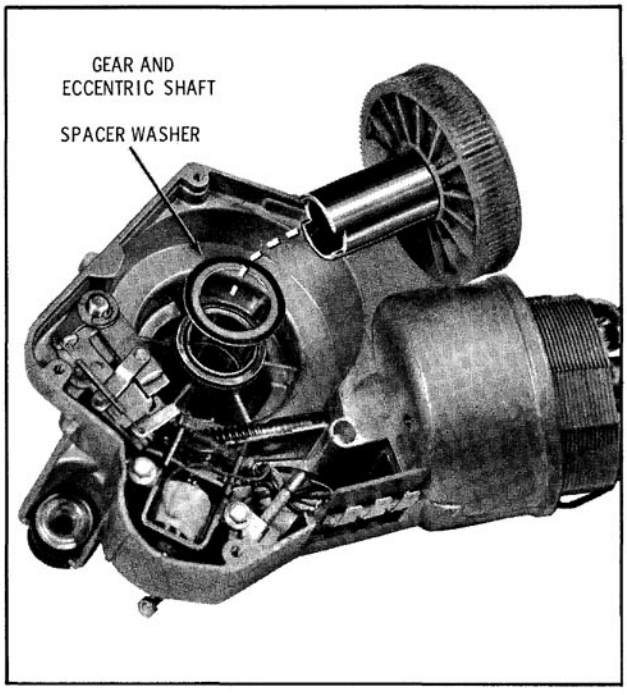


Fig. 13-142 Spacer Washer Location

6. Slide the drive plate and shaft assembly out of the gear assembly, remove the lock and drive pawls, and remove the coil spring.

7. Remove the stop assembly pivot pin and the stop assembly.

   NOTE: It may be necessary to use vise grip pliers to remove the stop assembly pivot pin. A new pivot pin is included in the stop assembly parts package.

8. Clean and inspect all parts, replace as necessary.

Assembly

1. Position stop assembly and pivot pin into the housing. Tap lightly with a brass drift to seat the pivot pin.

2. Assemble lock and drive pawls to the shaft and drive plate assembly. (Fig. 13-143)

3. Install the assembled parts in the gear and eccentric shaft.

4. Hold the gear and drive plate assembly in this relative position until installed in housing since no retainer is used and accidental disassembly can easily occur.

5. Connect the coil tension spring between the lock and drive pawls. (Fig. 13-144)

6. Install spacer washer on the eccentric shaft of the gear.

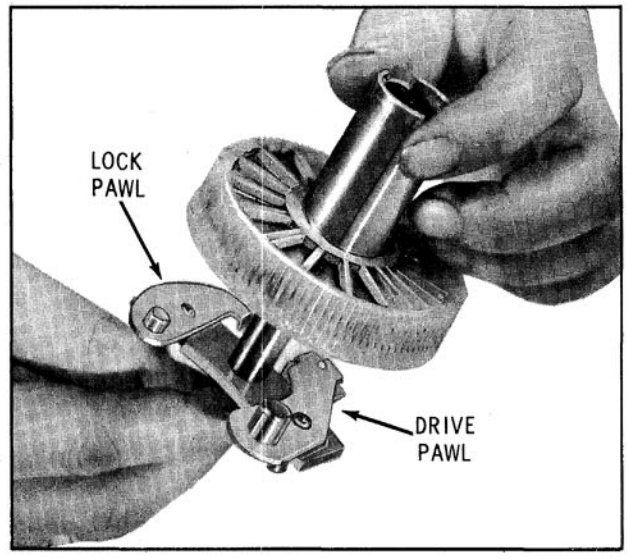


Fig. 13-143 Assembling Pawls to Shaft

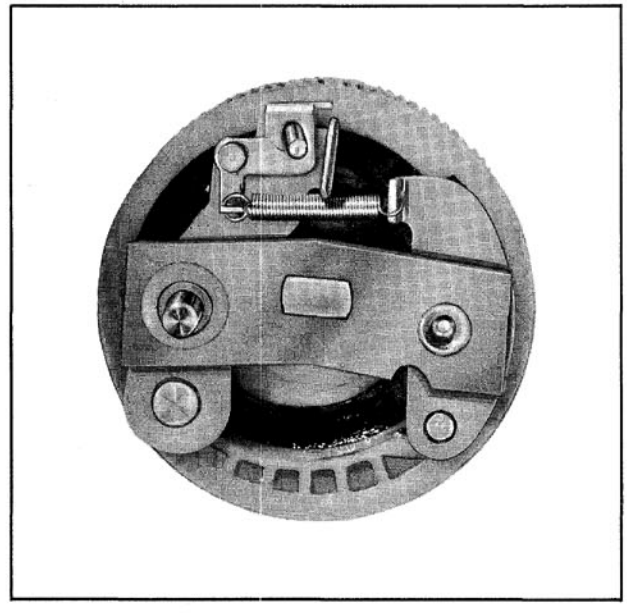


Fig. 13-144 Pawls Assembled

7. Install gear mechanism in the housing.

8. Reassemble parts removed in Steps 1 through 4 under drive gear disassembly. Install a tablespoonful of lubricant around the worm drive gear. Be sure the rubber seal is fully seated on the housing.

   NOTE: When installing washer pump, align cam slot with drive pin. (Fig. 13-145)

DIAGNOSIS
TWO-SPEED WIPER MOTOR

WIPER INOPERATIVE (ON CAR)

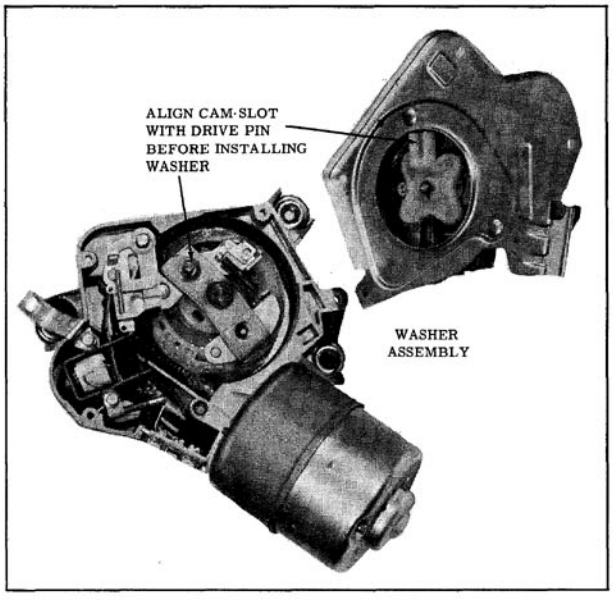


Fig. 13-145 Washer Installation

1. Check for blown fuse. If a new fuse blows, check for mechanical "lock-up" or short in circuit. If equipped with washer, check purple wire from wiper terminal board to washer connection for a short.

2. Connect a jumper wire from the wiper motor to ground. If the wiper motor will operate with ignition switch in "accessory" position and wiper control switch in low or high speed position, a defective wiper ground strap or connection is indicated.

3. With the ignition in the "accessory" or "on" position, check for 12 volts at the center terminal of wiper terminal board (purple wire connected). If there is no voltage at this point, but there is voltage at the fuse clips, the purple wire from the fuse block to the wiper connector is open.

4. To determine if the wiper control switch or wiper is inoperative, disconnect wires at the wiper terminal board and operate the wiper motor independently of the wiper control switch as follows:

   a. Connect a 12 volt supply to the center terminal (purple) of the wiper terminal board and connect a jumper wire from the

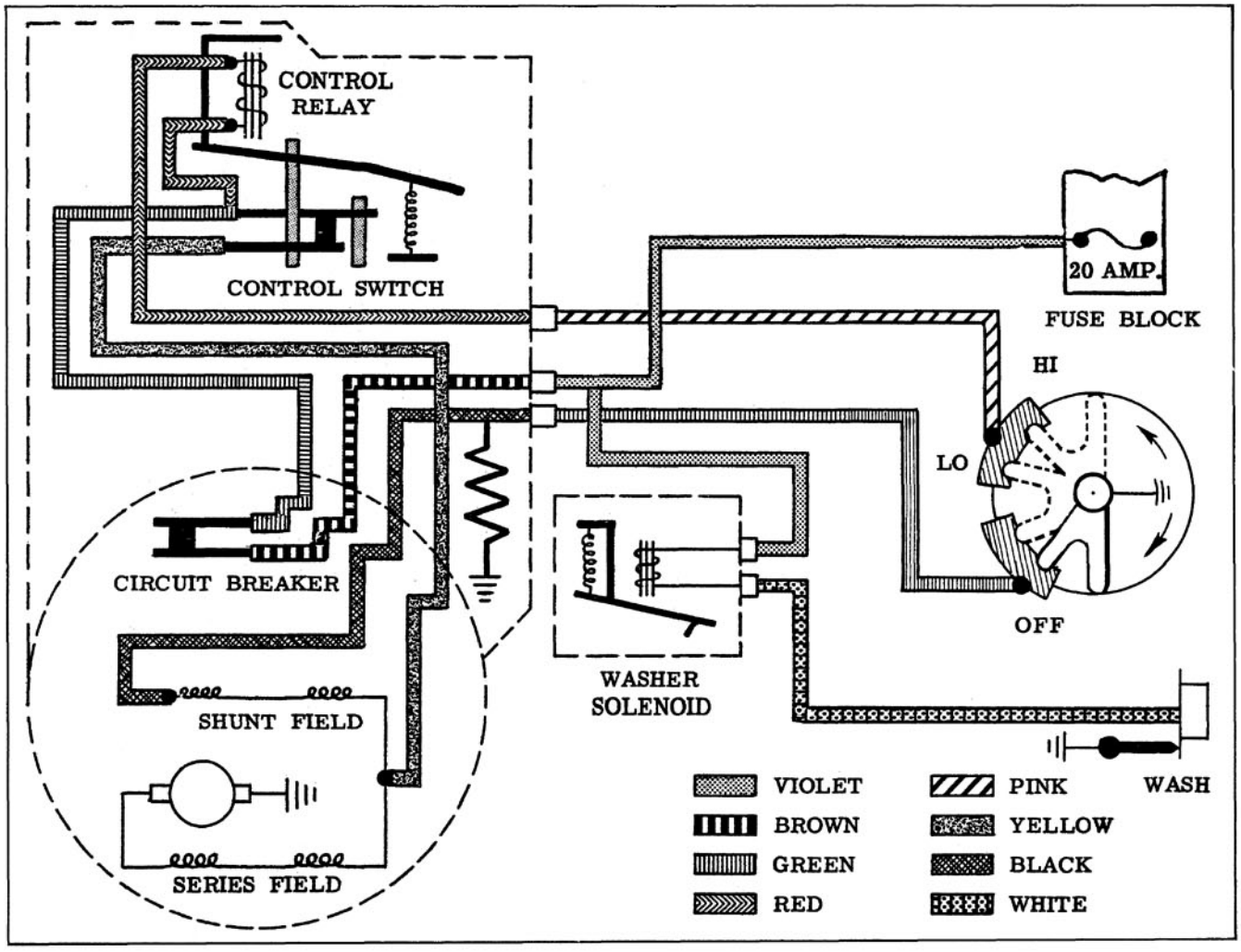


Fig. 13-146 Wiring Diagram

control relay terminal (pink) of the wiper terminal board to ground. The wiper should operate at high speed.

b. With the wires connected as in Step a, check the low speed operation by connecting another jumper wire from the shunt field terminal (light green) of the wiper terminal board to ground. (Fig. 13-146)

c. If the wiper operates when making either test a or b, it indicates that the wires from the motor to the wiper control switch, the wiper control switch, or the connectors are at fault.

5. If the wipers fail to operate after making tests a, b, and c, disconnect the transmission link arm from the motor. If the wiper motor will operate with the transmission disconnected, the trouble is in the transmission(s). If wiper fails to operate, remove the wiper motor for checking off the car.

WIPERS INOPERATIVE (Off Car)

1. Connect wiper to operate in "lo" speed as shown in Fig. 13-147 and observe whether relay armature pulls in. Use the following chart to select the next step.

Current Draw (Amps)	Relay Armature Pulls In	Proceed To Step No.
0	No	2
.5-1.0	Yes	3
2.0	Yes	4
17-20	No	5

2. With wiper connected to operate in "lo" speed, connect 12-volt test lamp to green lead on relay.

a. If test lamp does not light, check for open or dirty circuit breaker contacts, poor solder connection at circuit breaker and/or broken green or brown wire. (Fig. 13-148)

b. If test lamp lights, manually operate relay armature towards the coil. If the relay armature and latching mechanism is not binding and the wiper starts up, an open relay coil is indicated.

3. With wiper connected to operate in "lo", connect 12-volt test lamp to yellow lead on relay.

a. If test lamp does not light, relay control switch is defective. (relay pulls in)

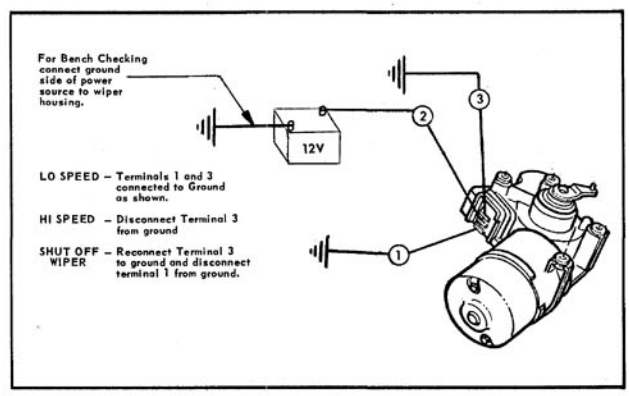


Fig. 13-147 Bench Checking Connections

b. If test lamp lights, disassemble motor and check splice connection of yellow lead to field coils.

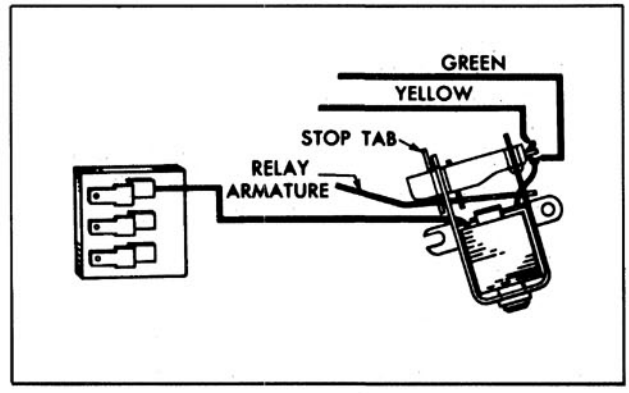


Fig. 13-148 Checking Relay

4. Disassemble motor section and check for the following:

a. Open armature.

b. Brushes binding.

c. Bad solder connections at brush holder.

d. Bad connection between yellow lead and series field coil lead (larger wire).

5. a. Look for drive pawl jammed against latch arm.

b. Force the latch arm away from drive pawl. If wiper starts up and drive pawl comes around and jams against latch arm again, the drive plate shaft is probably seized inside the large eccentric shaft of the gear. Remove gear and related parts from housing and free up or replace parts as required.

If wiper appears to operate normally after moving the latch arm away from the drive pawl and the original trouble cannot be duplicated, this indicates wiper was probably stalling coming out of park.

Check end-play of gear assembly and check for a binding action between the metal shield cap (located under the rubber seal cap) and the drive plate shaft. Open up hole in metal shield so that it easily slides on drive plate shaft.

WIPER WILL NOT SHUT OFF—CRANK ARM ROTATES IN A COMPLETE CIRCLE

Connect power source to wiper as shown in Fig. 13-147. DO NOT connect jumper wires. Observe if relay armature pulls in.

a. If relay armature pulls in, check for a grounded condition in the small red lead between the relay coil and terminal board. If no grounded condition exists in the lead, a grounded relay coil is indicated and the relay switch assembly must be replaced.

b. If relay armature did not pull in, look for a broken drive pawl tab or latch assembly. Check for a binding condition in the latching mechanism.

WIPER WILL NOT SHUT OFF (Recycles)—A LOUD "CLUNK" WITH EACH REVOLUTION OF THE GEAR

1. Check that drive pawl and latch arm springs are properly connected.
2. Check that drive pawl switch lever is not binding.
3. Check that relay control switch tabs are not broken.
4. Connect up wiper as shown in Fig. 13-147 and check that wiper operates in both speeds.

   a. If wiper has both speeds but fails to shut off in the manner described above, a defective relay-switch assembly is indicated.

   b. If wiper has one speed, "fast", look for an open in the shunt field circuit. (Splice joint at yellow lead and shunt field coil, splice joint between terminal board black lead and shunt field coil.)

WIPER HAS ONE SPEED, "FAST"

See Step 4 (b) under "WIPER WILL NOT SHUT OFF."

WIPER HAS ONE SPEED, "SLOW"

Look for a grounded condition in the black lead that connects to terminal #3 (Fig. 13-147) or in the shunt field.

WIPER HAS EXCESSIVE SPEED IN "HI" RANGE BUT "LO" SPEED IS NORMAL

Check for an open resistor on terminal board.

WIPER WILL NOT PARK—CRANK ARM STOPS IN ANY POSITION

Relay switch not maintaining motor circuit during park cycle. Replace relay-switch assembly.

INTERMITTENT OPERATION—WIPER AUTOMATICALLY SHUTS OFF AND STARTS UP AT 2 TO 3 MINUTE INTERVALS

1. With wiper connected to operate in "lo" speed (Fig. 13-147) observe current draw.

   a. Current draw normal (3.5-5 Amps.) indicates a weak circuit breaker. Replace case and brush assembly.

   b. Current draw exceeds 5 Amps. Proceed to Steps 2, 3 and 4.

2. Adjust armature end-play as required and recheck current draw.
3. Adjust gear assembly end-play and recheck current draw. (Add end-play washers as required to obtain .006" maximum end-play.)
4. Disassemble motor section and check for a shorted or grounded armature on a growler. Also check for grounded field coils.

NOTE: Occasionally the field coils are loose on the poles and this enables them to slide into a position where they short on the corners of the poles. Center the coils on the poles and wedge them in a fixed position.

SPECIFICATIONS

Operating Test Voltage	12 Volt DC
Crank Arm Rotation	CCW
Crank Arm Speed (rpm)	
Lo	40 to 50
Hi	70 to 85
Current Draw	
No Load	3-4.5 Amps.
Wet Windshield	3.5-5 Amps.
Stall	20-Amps.

WASHER SYSTEM (Used on Rectangular Motor)

DESCRIPTION

The washer pump is a positive displacement type pump employing a small bellows, bellows spring and valve arrangement. The pump mechanism is actuated by a 4 lobe cam driven by the wiper.

OPERATION

The starting and completion of a wash cycle is accomplished electrically and mechanically by a relay assembly and ratchet wheel arrangement. (Fig. 13-149)

WIPER "ON"—WASHER "OFF"

With the washer pump mounted on the wiper, the 4 lobe cam actuates a spring loaded plate and ratchet pawl assembly. Thus, with the wiper running, the 4 lobe cam rotates continuously actuating the plate and ratchet pawl assembly back and forth in a horizontal plane. A pin, attached to the plate and ratchet pawl assembly, extends through a slot in the bellows plunger arm. This pin moves freely back and forth in the slot while the pumping mechanism is in the "locked-out" position and no pump action develops. (Fig. 13-150)

The pump is in the "lock-out" position when the relay holding contacts are open and a tang on the plunger arm rests against the widest part of an eccentric ramp on the bottom of the ratchet wheel. The tang holds the bellows plunger arm in a retracted position (bellows spring compressed) allowing the plunger arm pin to move back and forth in the plunger arm slot preventing pumping action. (Fig. 13-151)

The ratchet pawl is spring loaded to keep it from engaging the ratchet wheel until the pump relay is energized by the dash switch washer button.

WASHER "ON"

Depressing the dash washer button, closes the

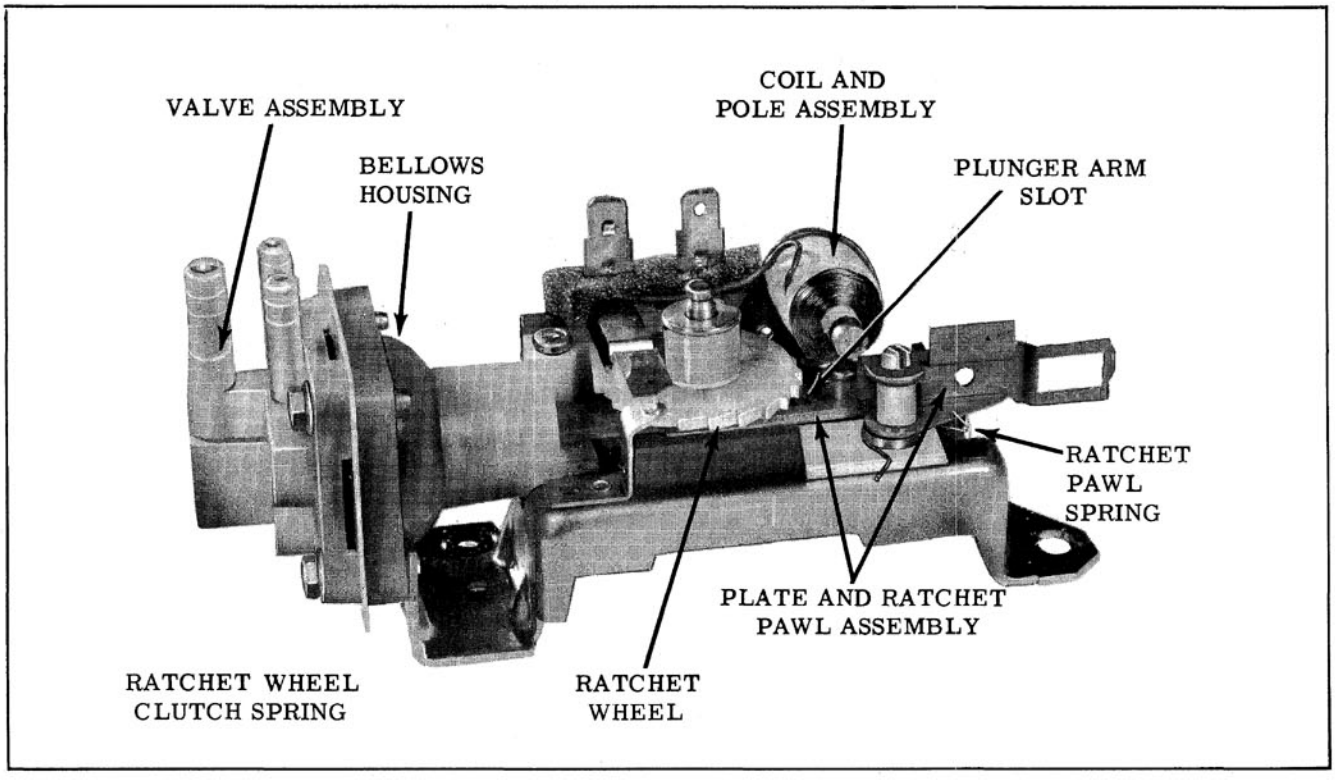


Fig. 13-149 Pump Assembly

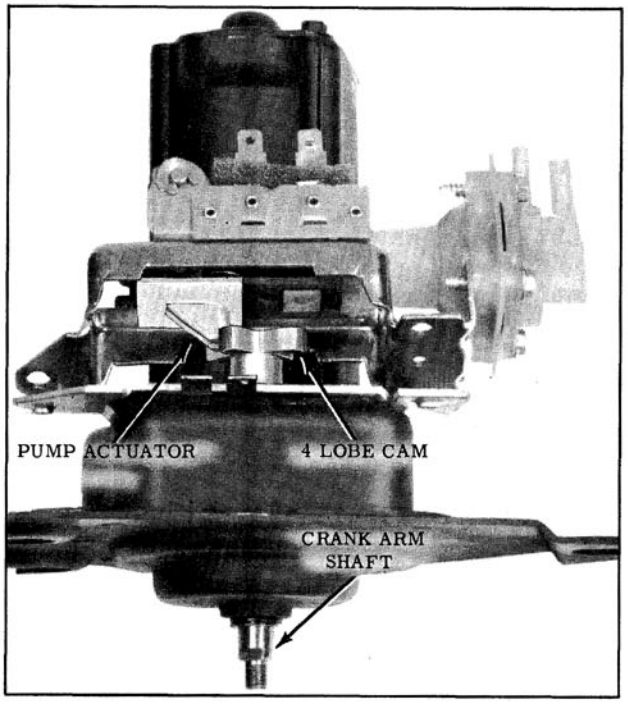


Fig. 13-150 Pump Actuator

washer pump relay circuit to ground (if the wiper was off, the wiper switch is mechanically turned on by the washer button). (Fig. 13-152)

With the washer coil energized, the pawl, normally held away from the ratchet by spring force, is pulled towards the coil pole and engages the ratchet wheel. The ratchet pawl and plate assembly, which moves back and forth any time the wiper is on, now starts to rotate the ratchet wheel. (Fig. 13-153)

When the ratchet wheel has been rotated one tooth, two functions occur:

1. The eccentric ramp on the ratchet wheel is moved away from the plunger arm releasing the pump mechanism from its locked-out position.

2. A set of holding contacts close, maintaining the coil circuit to ground. The contacts remain closed until the ratchet wheel is turned through 360°, at which time the ratchet wheel again opens the contacts.

PUMPING CYCLE

Exhaust Half of Pump Stroke

With the pumping mechanism released from the "lock-out" position, the bellows spring expands collapsing the bellows forcing the water out through two outlet valves. (Fig. 13-154) The plunger arm, attached to the bellows, is pulled forward with the bellows and the back edge of the plunger arm slot moves up tight against the plunger arm actuator pin. The actuator pin, which was previously moving back and forth freely in the plunger arm slot, pulls the plunger arm back and compresses the bellows spring each time a lobe of the cam actuates the plate and ratchet assembly.

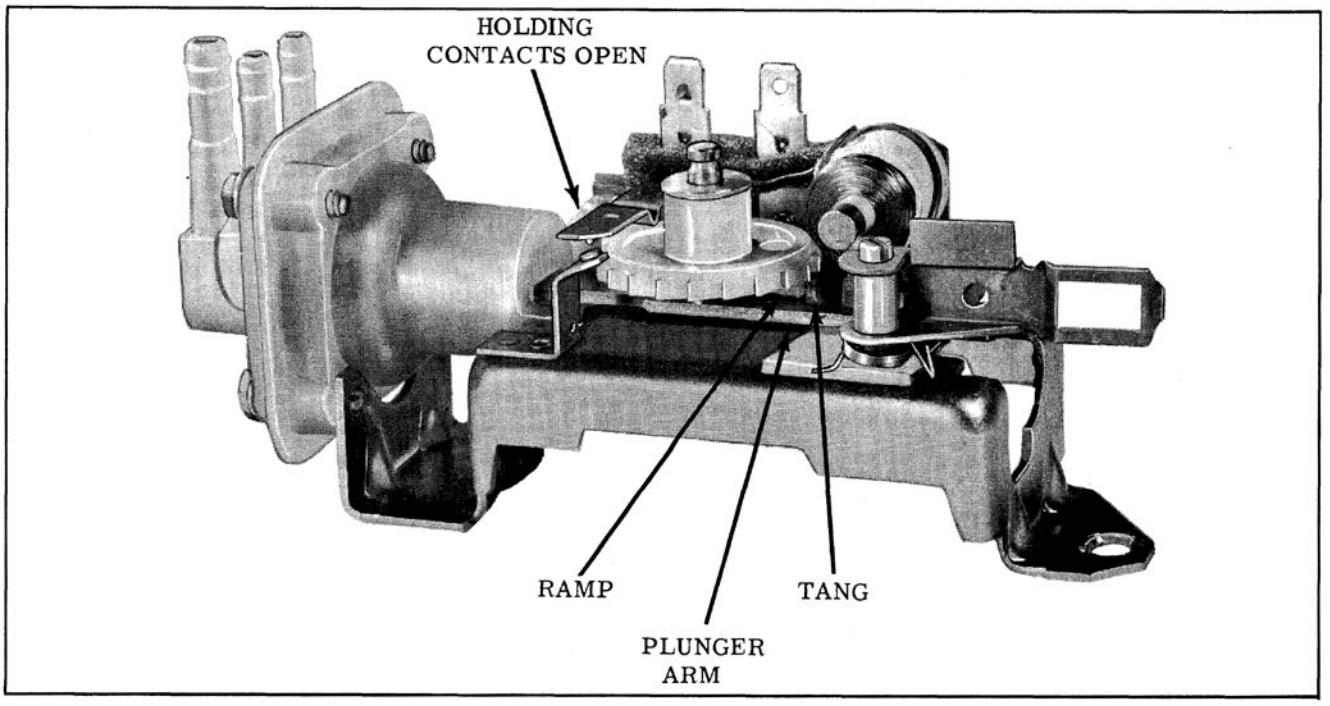


Fig. 13-151 Pump Lockout Position

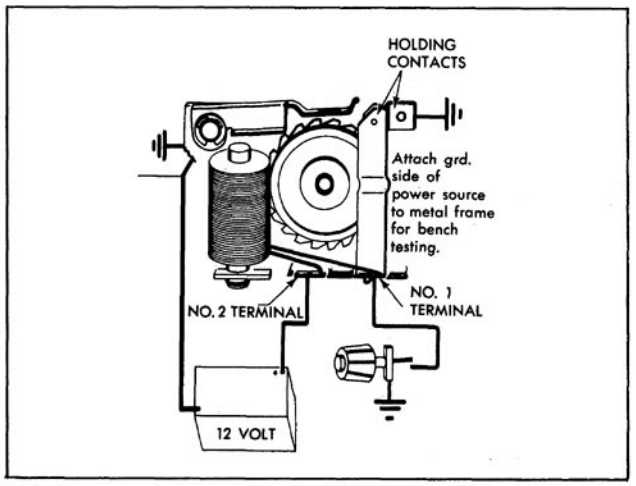


Fig. 13-152 Pump Wiring Circuit

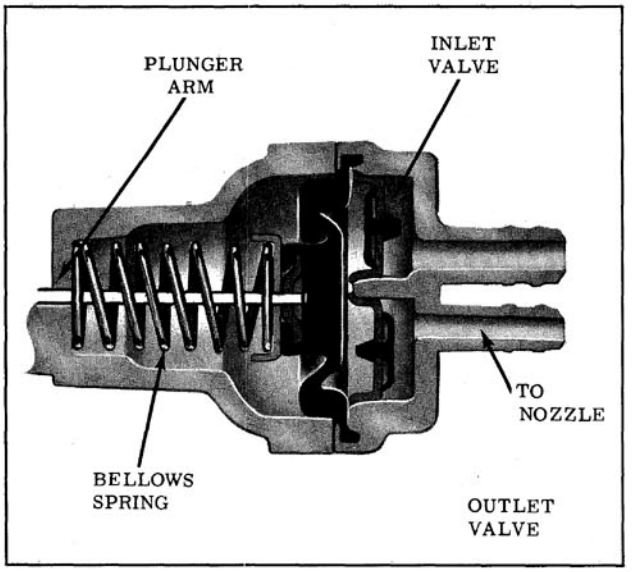


Fig. 13-154 Exhaust Half of Pump Stroke

Intake Half of Pump Stroke

Pulling the plunger arm back compresses the bellows spring and water is drawn into the bellows through the intake valve. (Fig. 13-155) During the intake of water, the exhaust or outlet valves are drawn tight against their seats. During each intake stroke of the pumping mechanism, the ratchet wheel is rotated one tooth.

The wash cycle is completed when the electrical circuit to the relay coil is opened and the pumping mechanism reaches its "lock-out" position. This is accomplished as follows:

When the ratchet wheel has been rotated through 360° or 21 teeth, the relay coil holding contacts are pushed open by a "hump" on the ratchet wheel. This opens the coil circuit and the spring loaded ratchet pawl moves away from the ratchet wheel preventing further rotation of the ratchet wheel.

As the ratchet wheel rotates, the tang on the bellows plunger arm starts to ride up the eccentric ramp on the lower surface of the ratchet wheel. The full "lock-out" position of the pumping mechanism is reached when the tang is up on the widest part of the ramp. (Fig. 13-151) The tang reaches the "lock-out" position at the same time the relay coil holding contacts open.

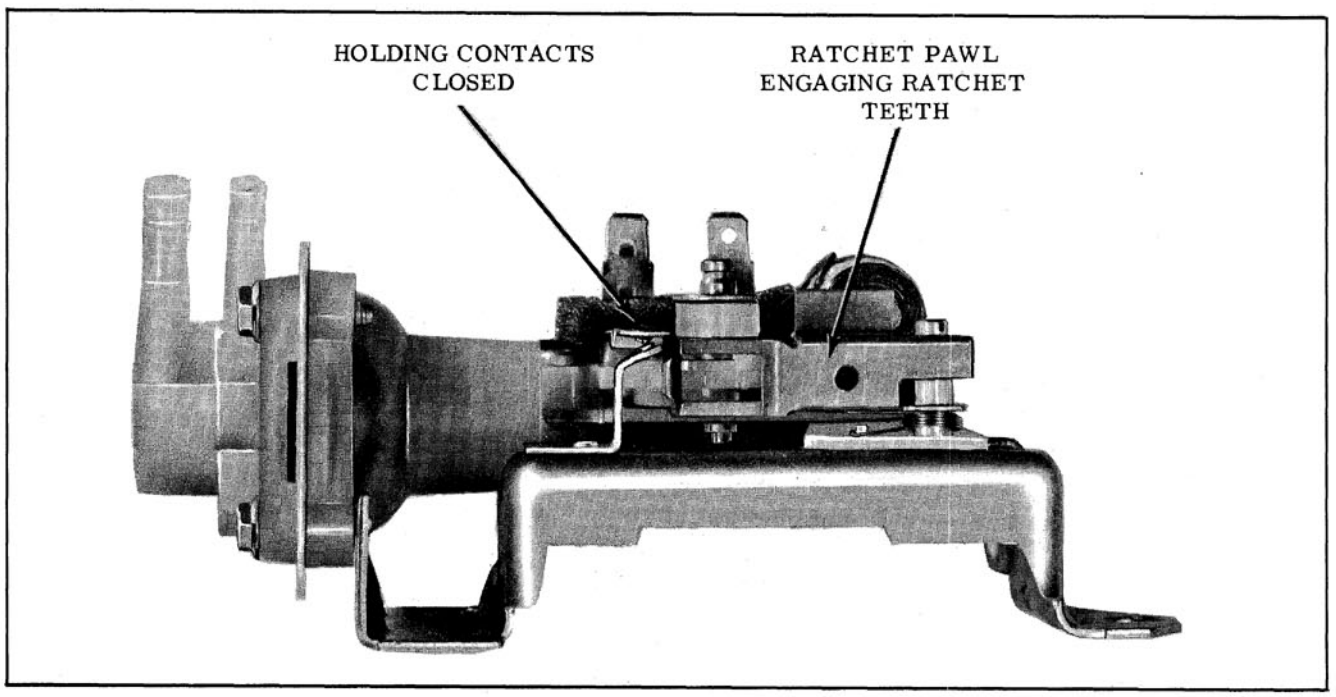


Fig. 13-153 Relay Coil Energized

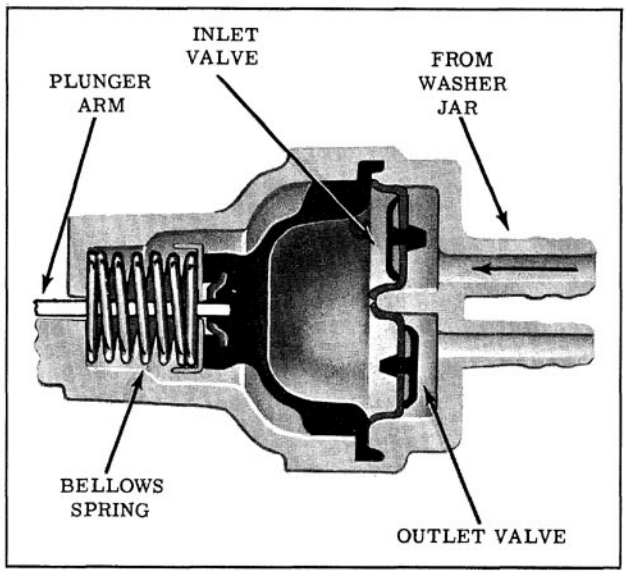


Fig. 13-155 Intake Half of Pump Stroke

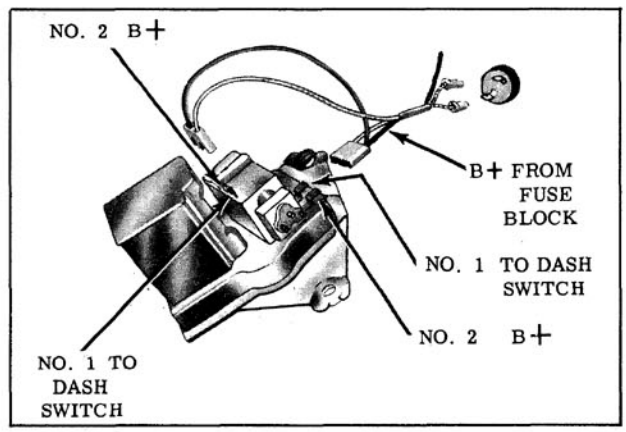


Fig. 13-156 Checking Connections

DIAGNOSIS (ON CAR)

Washer Inoperative

1. Check the following items:

a. Jar had adequate quantity of water solution.

b. Hoses are not damaged and hose connections are tight.

c. Screen at end of jar cover hose is not plugged.

d. Electrical connections to washer pump and dash switch.

e. Nozzles are not plugged.

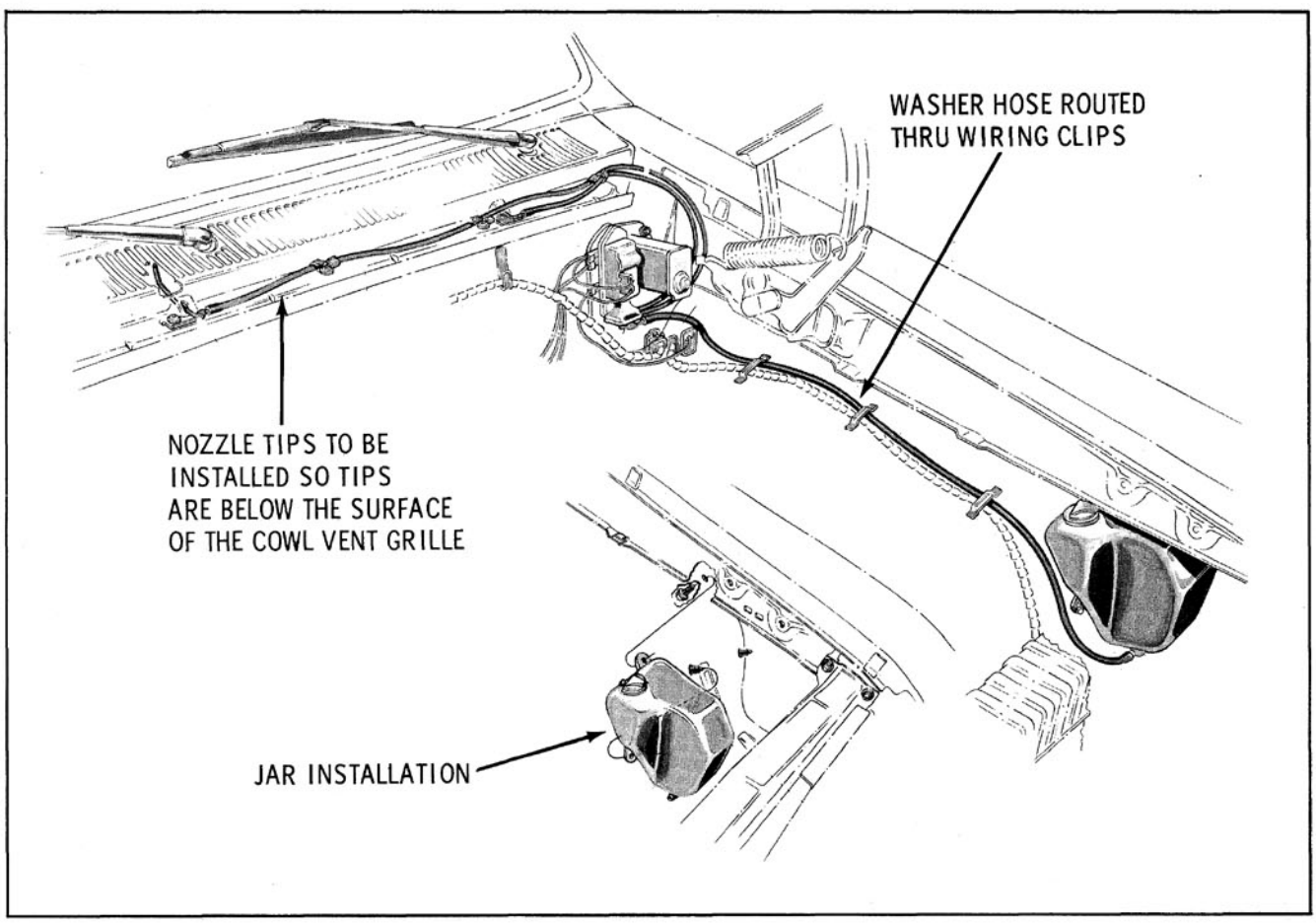


Fig. 13-157 Washer System (30-31 and 3200 Series)

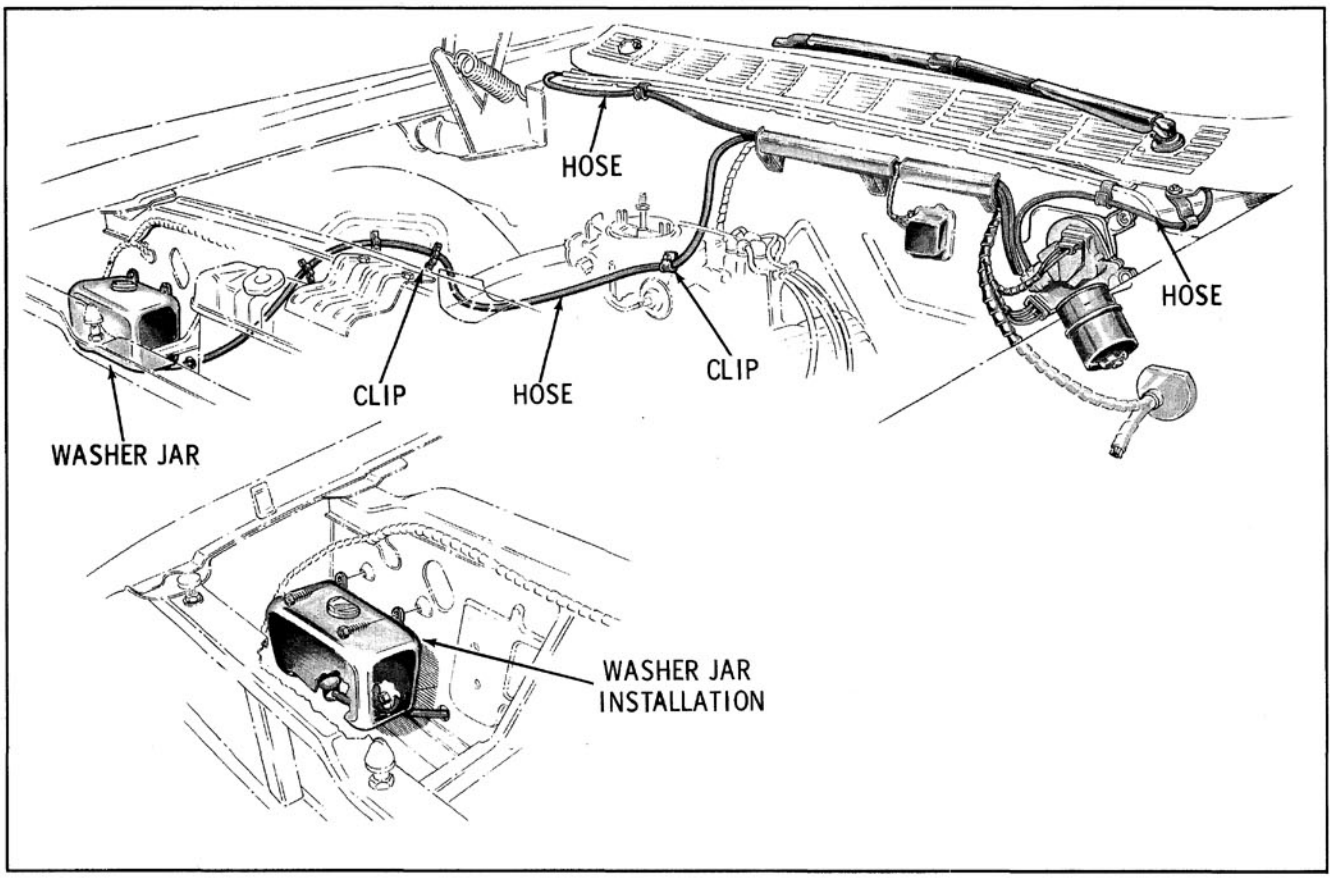


Fig. 13-158 Washer System (33-34-35-36-38 and 3900 Series)

2. If all items in Step 1 check out, start wiper motor only, then push washer button and listen for "click" as washer relay pulls in. If no "click" is heard, check for 12 volts at terminal No. 2. (Fig. 13-156) No voltage indicates defective wiring. If "click" is heard, proceed to Step 4.

3. If correct voltage was found in Step No. 2, connect a jumper wire from terminal No. 1 to ground (Fig. 13-156) and operate wiper. If washer relay "click" is heard and pump functions correctly, a defective dash switch or an open circuit between washer pump and dash switch is indicated - "No Click" indicates an open relay coil.

4. If relay "click" is heard in Step 2, listen for the soft clicking as the pump ratchet wheel is rotated. If "soft clicking" is not heard, the pump mechanism is faulty and should be removed from the wiper motor and checked. If soft clicking is heard but no pumping action occurs, replace the valve assembly and recheck pump.

DIAGNOSIS (OFF CAR)

1. Remove washer pump cover and connect 12 volt power supply to washer pump as shown in Fig. 13-152. Connect jumper wire from terminal No. 1 to ground. Turn ratchet pawl to position shown in Fig. 13-152.

   Ratchet pawl should be pulled toward relay pole and engage ratchet teeth. Failure to do as described indicates an open relay coil.

2. If relay and ratchet pawl perform correctly in Step 1, manually actuate the washer pump to rotate the ratchet wheel one tooth. Observe if relay holding contacts close and the pump plunger arm is released from its lock-out position. Figure 13-151 shows plunger in lock-out position.

3. Disconnect jumper wire from terminal Number 1. Relay coil should remain energized and hold ratchet pawl against ratchet wheel. Failure to do so indicates open or dirty holding contacts.

4. If pump performs correctly in Step 3, continue to manually actuate the slide and ratchet pawl assembly until the ratchet wheel has been turned through 360° or 21 teeth. After the ratchet wheel has been rotated 21 teeth, the holding contacts should be opened by a "hump" on the wheel and the pump plunger arm should be in the "lock-out" position. (Fig. 13-151)

Check Valve Assembly as Follows:

1. Attach a hose to the large or intake pipe. You should be able to blow through it but not draw through it.

2. Attach a hose individually to each of the small or exhaust pipes. You should be able to draw through them but not blow through them.

   If any of the three valves allow air to pass in both directions, the valve assembly is defective.

PUMP DISASSEMBLY—Refer to Fig. 13-149

Relay

1. Remove washer pump cover.

2. Unsolder coil leads from terminals. (Note: No coil polarity is necessary when resoldering coil leads.

3. Remove coil retainer clip and slip coil assembly out of mounting bracket.

Ratchet Pawl

1. Remove washer pump cover.

2. Disengage spring from ratchet pawl. (CAUTION: Be sure spring is properly assembled before replacing washer pump cover.)

3. Slide ratchet pawl off plastic shaft.

Valve Assembly

Remove the four screws that secure the valve assembly to the bellows housing.

CAUTION: It is sometimes necessary to carefully pry the bellows lip out of the valve body groove.

Bellows

1. Remove valve body.

2. Manually operate pump to release pump from "lock-out" position (See "Checking Washer Pump Detached").

3. Hold bellows plunger arm from moving, then push in against bottom of bellows with thumb and twist bellows 90°. This should release bellows and bellows spring.

Assembly

To assemble the relay, ratchet pawl, valve assemble or bellows, reverse the disassembly procedure. For washer hose routing and jar installation See Fig. 13-157 and 13-158.

SPECIFICATIONS

Number of "squirts" at full pressure	12
Pressure (PSI)	11-15
Coil Resistance (ohms)	20

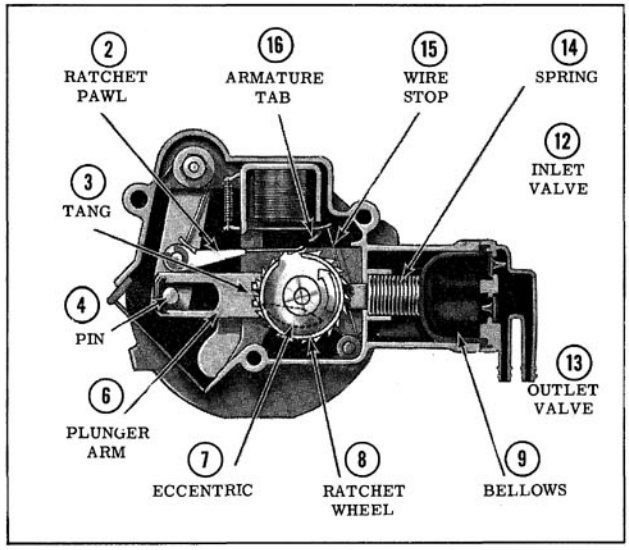


Fig. 13-159 Washer-Off

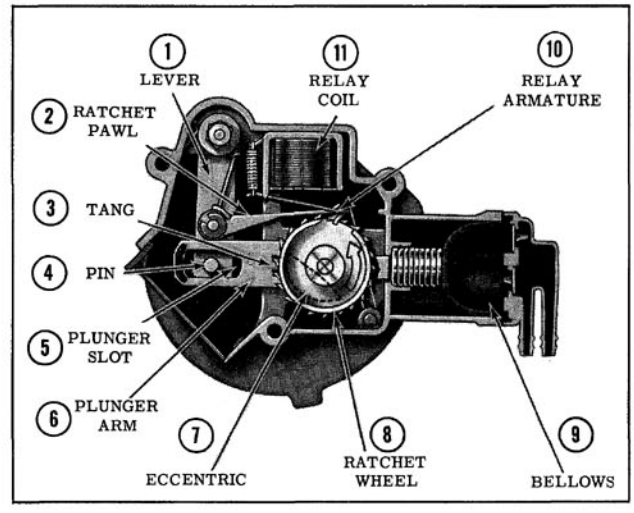


Fig. 13-160 Washer-On Position

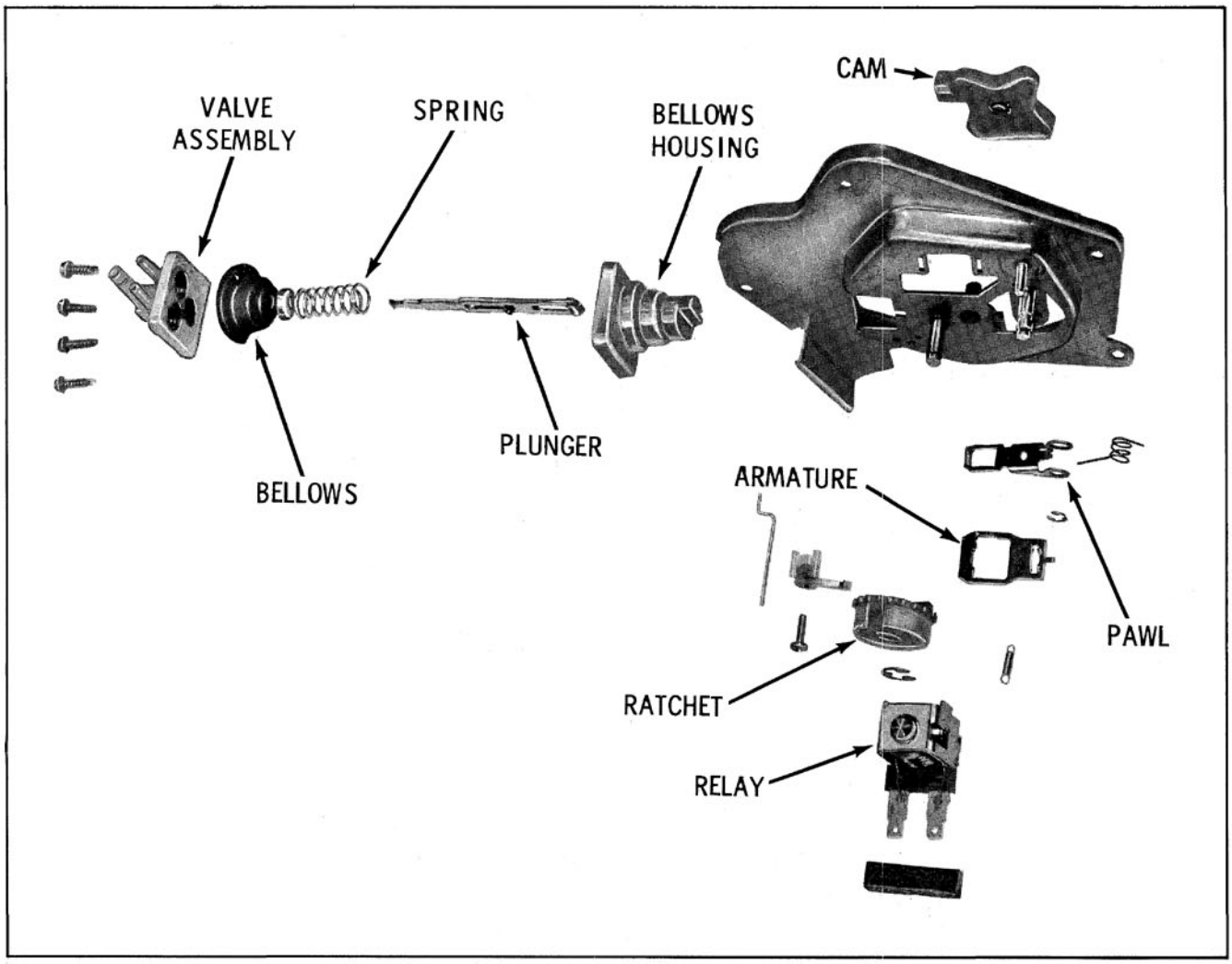


Fig. 13-161 Washer Assembly

WASHER SYSTEM (Used With Round Motor)

The windshield washer pump consists of a relay, pump assembly, valve assembly and related parts assembled in a casting which attaches directly to the wiper gear box.

OPERATION

Washer Off (Fig. 13-159)

When the wiper is operated, the rotor cam is always turning with the wiper gear. As the rotor cam rotates it actuates a spring loaded lever (1) and pin (4) assembly to which a ratchet pawl (2) is attached.

The lever arm pin extends into the slot (5) of a spring loaded plunger arm (6). The spring loaded plunger arm which is attached to the pumping bellows (9), is held in a retracted position (spring compressed) by an eccentric (7) on the ratchet wheel (8) when the pump is idling.

While the pumping mechanism is idling, the lever arm pin can move freely back and forth in the plunger arm slot and no pumping action occurs.

The ratchet pawl, which extends through an opening in the relay armature (10), is prevented from rotating the ratchet wheel by the relay armature.

Washer On (Fig. 13-160)

When the washer button on the instrument panel is depressed, the circuit to the washer pump relay coil (11) is closed to ground. The relay is held in the energized position by a wire stop (15). The ratchet pawl (2), which previously was moving

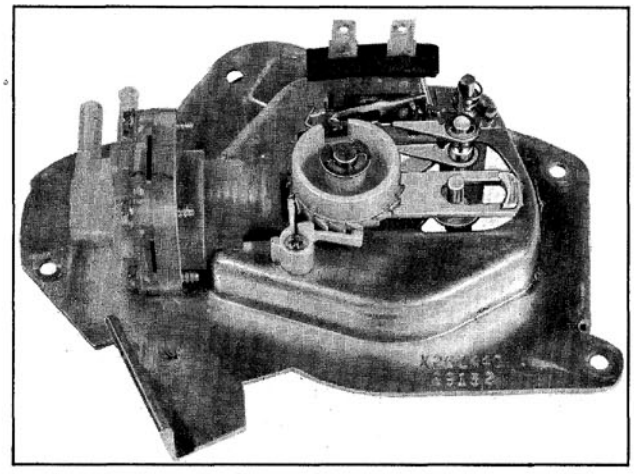


Fig. 13-162 Idling Position

freely back and forth through the armature opening now drops out of the opening and engages the ratchet wheel (8).

As the ratchet wheel is rotated, the eccentric moves away from the plunger arm tang (3) releasing the plunger arm (6) for pumping action.

The plunger arm being spring loaded, now moves toward the bellows (9) and collapses the bellows forcing the water in the bellows out through the outlet valves (13) to the nozzles (exhaust stroke). At the same time the edge of the plunger arm slot moves up tight against the lever arm pin (4). As the rotor cam is turned, each of the four lobes actuate the lever arm which in turn pulls the plunger arm back compressing the spring (14). While the plunger arm is being pulled back (suction stroke) water is drawn in through the inlet valve (12). As the high point of each lobe is passed, the plunger arm spring pulls the plunger arm toward the bellows. This collapses the bellows and forces water out through the outlet valve (exhaust stroke).

For each revolution of the wiper gear and/or rotor cam, there are four pumping strokes. For each pumping stroke, the ratchet wheel is actuated or turned one tooth by the ratchet pawl. As the ratchet wheel turns, the eccentric pushes the wire stop out of the way of the relay armature. This allows the armature to partially drop so that the armature tab (16) rests against the edge of the ratchet wheel. After the ratchet wheel has been rotated about 12 teeth, the ratchet wheel eccentric starts to interfere with the plunger arm tang (3), resulting in shorter pumping strokes.

When the ratchet wheel has been turned through 360° or 21 teeth, two simultaneous functions occur as the wash cycle is completed:

A. The relay armature tab drops into the ratchet wheel slot allowing the ratchet pawl to enter the armature opening preventing further ratchet wheel rotation.

B. The ratchet wheel eccentric moves into a position which holds the plunger arm in a retracted position preventing further pumping action.

Disassembly & Assembly (Fig. 13-161)

1. Remove washer cover.
2. Rotate cam until pump is in idling position. (Fig. 13-162)
3. Remove cam retainer and cam.
4. Move cam lever to the rear and lift up on armature as shown in Fig. 13-163.

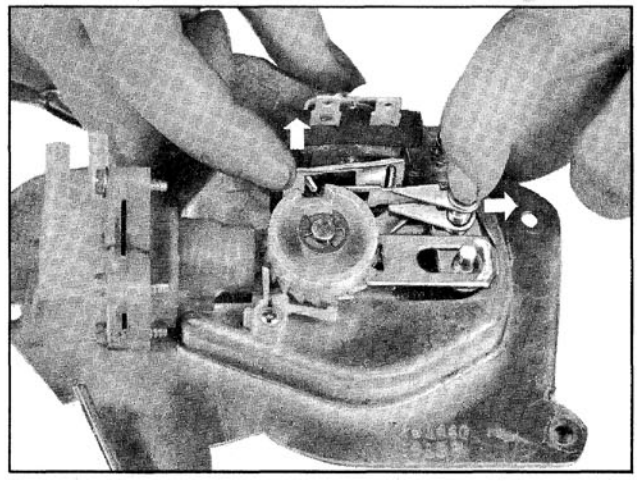


Fig. 13-163 Disengaging Pawl

5. Remove relay as shown in Fig. 13-164.

   NOTE: Armature is attached to the relay by a spring, do not lose spring.

6. Disengage spring from tang and pawl and remove spring.
7. Lift pawl from cam lever.
8. Remove valve assembly.
9. Rotate ratchet with thumb until bellows extends out of housing. (Fig. 13-165)
10. While holding the rear of the plunger, press it on bellows and turn approximately 90°. This will release the bellows from the plunger.
11. Remove bellows, retainer and spring.

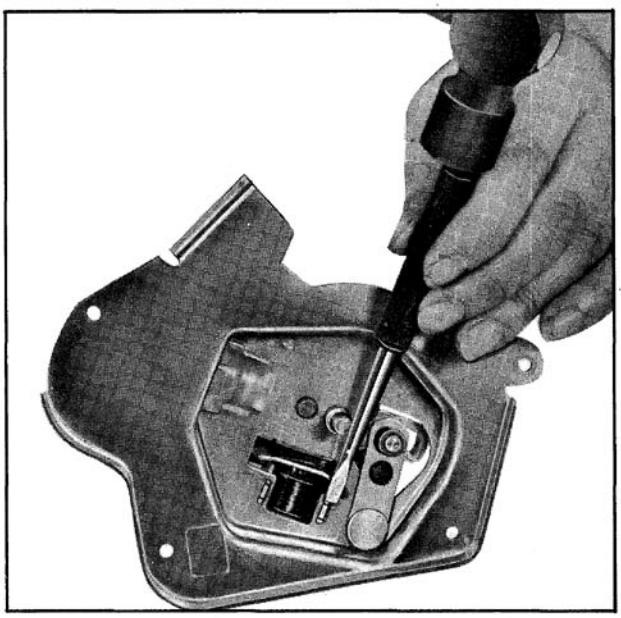


Fig. 13-164 Removing Relay

12. Remove valve housing.

13. Remove ratchet retainer and remove ratchet.

14. Remove plunger with plastic bumper in place.

15. Remove white plastic ratchet stop & spring.

16. To assemble, reverse the disassembly procedure. Apply Lubriplate or similar lubricant to the ratchet shaft and the bottom of the plunger where it contacts the housing. Also lubricate the bottom of the ratchet where it contacts the plunger.

WASHER DIAGNOSIS (ON CAR)

Washer Pump Inoperative

1. Inspect all washer hoses and hose connections. Inspect screen at end of jar cover tube for being plugged and for adequate supply of liquid in jar.

2. Start wiper motor first, then push washer button and listen for "click" as washer relay pulls in. If no "click" is heard, check power supply (12V) at washer pump wiring connector. No voltage indicates defective car wiring.

3. If correct voltage reading was obtained in Step 2, start wiper first, then connect 12 volt supply to one of washer terminals and ground the other. If washer relay "click" is heard, a defective instrument panel switch is indicated.

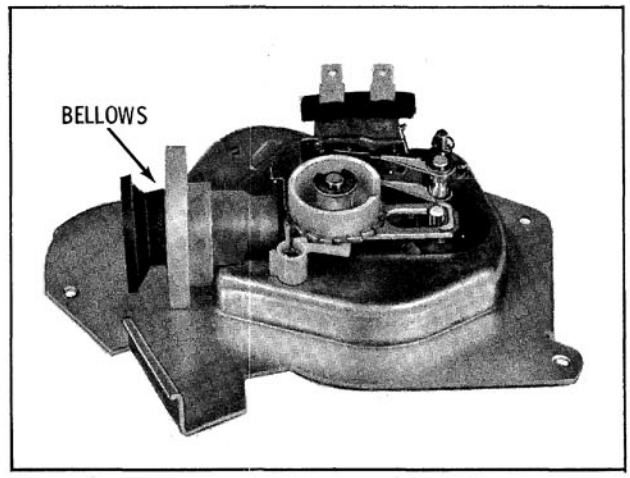


Fig. 13-165 Bellows Extended

4. If washer relay click is not heard in Step 3, a defective washer pump relay coil is indicated.

5. If relay click is heard in Step 3, and pump still does not pump water, a defective valve assembly is indicated. (Note: Listen for soft clicking as washer pump ratchet wheel is rotated through a cycle.)

Washer Pump Will Not Shut Off When Wiper Is "On"

1. Disconnect wiring from washer pump. If pump shuts off, trouble is located in the wiring or switch.

2. If pump fails to shut off in Step 1, remove pump assembly from car for further checking (See WASHER DIAGNOSIS-OFF CAR).

WASHER DIAGNOSIS—OFF CAR

1. Connect 12 volt supply to one of washer terminals and ground the other. Manually rotate the rotor cam and observe if relay armature pulls in. Failure of relay to pull in indicates an open relay coil or poor solder connections.

2. If relay pulled in in Step 1, manually rotate the rotor cam (CCW looking at rotor) through a complete cycle (Ratchet wheel rotated 360° or 21 teeth) carefully observing if performance matches that as explained under washer operation. Binds or any other type of malfunction can usually be located in this manner.

GENERAL SPECIFICATIONS

STARTING MOTOR

a. Make	Delco-Remy
b. Brush Spring Tension	35 oz. Min.
c. Number of Brushes	4
d. Number of Fields	4
e. Rotation, Viewed From Drive End	Clockwise
f. Pinion Clearance	.010" to .140"
g. Free Speed (Model 1107260) 6200 to 9400 rpm at 10.6 volts,	49 to 76 Amps.
h. Free Speed (Model 1107298) 3600 to 5100 rpm at 10.6 volts,	65 to 100 Amps.
i. Free Speed (Model 1107316) 3600 to 5100 rpm at 10.6 volts,	65 to 100 Amps.
j. Free Speed (Model 1107665) 3600 to 5100 rpm at 10.6 volts,	65 to 100 Amps.
k. Free Speed (Model 1107776) 3800 to 6200 rpm at 10.6 volts,	70 to 105 Amps.

DELCOTRON

a. Charging Rate - Refer to output chart, Page 13-14	
b. Field Current Draw at 12 Volts, 80°F.	1.9 to 2.2 Amps.

REGULATOR

Field Relay

a. Air Gap	.015"
b. Point Opening	.030"

Voltage Regulator

c. Air Gap	.060"
d. Point Opening	.014"
e. Voltage Setting	Refer to Fig. 13-18

BATTERY--12 VOLT

Series	Engine	Amp Hr.	Plates
30 & 31	V-6	61	66
30, 31, 32 & 33	V-8	61	66
34, 35, 36, 38 & 39	V-8 H.C.	70	66
34	V-8 L.C.	62	54

Specific Gravity for fully Charged Battery . . . . . 1.270 ± .010 at 80°F.

COIL

a. Primary Resistance	75°F.	1.77 to 2.05 Ohms
b. Secondary Resistance	75°F.	6500 to 9500 Ohms

RESISTOR, IGNITION COIL (IN WIRING HARNESS)

a. Resistance 80°F.	1.35 Ohms

DISTRIBUTOR

a. Cam Angle Range	28° to 32° (Adjust to 30°)
b. Contact Point Opening	.016"
c. Contact Arm Spring Tension	19 to 23 oz.
d. Condenser Capacity	.18 to .23 Mfd.

SPARK PLUGS

a. Make . . . . . AC

b. Type

Series	Engine	Spark Plug
30 & 31	V-8 L.C.	45S
30, 31, 32 and 33	V-8 H.C.	44S
30 and 31	V-6	44S
34, 35, 36, 38 and 39	V-8	44
34	V-8 L.C.	45
	V-8 Police	43

Starfire engines that are used mainly on the highways, with very little slow or city driving, should be equipped with type 43 spark plugs. These plugs are more susceptible to lead fouling when driven at continuous slow or city driving.

c. Thread	Metric 14MM
d. Body	13/16" Hex.
e. Spark Gap	.030"

GENERAL SPECIFICATIONS (Cont'd)

HORNS	
a. Current Draw at 11.5 Volts	4.55 to 5.5 Amps.
HORN RELAY	
a. Closing Voltage	1.5 to 9.5 Volts.

LAMP BULB NUMBERS
33, 34, 35, 36, 38 and 39 Series

Headlamps (inner) (#1) (Upper beam only)	L-4001
Headlamps (outer) (#2) (Lower & Upper Beam)	L-4002
Stop Lamps and Tail Lamps	1157
Parking Lamps and Turn Signal Front	
Dome Lamp	1004
Door Lamp	212
License Lamp	1155
Courtesy Lamp (Including Console Side)	90
Side Roof or Rear Quarter Lamp	
Arm Rest	
Map Lamp	
Ignition Switch	1445
Console Shift Indicator Lamp	
Ash Tray Lamp	
Cruise Control Lamp	
Shift Indicator Lamp (Panel)	1895
Heater, Ventilation and A/C Control Lamp	
Map Case Lamp, Console	
Tachometer or Performance Gauge Lamp	
Parking Brake Warning Lamp	57X
Oil Pressure Warning Lamp	158
Speedometer and Odometer Lamp	
Fuel Gauge	
Generator Warning Lamp	
Safety Sentinel	
Temperature Indicator Lamps	
Turn Signal Indicator Lamps	
High Beam Indicator	
Cornering Lamp	1195
Underhood Lamp	631
Rear Compartment Lamp	

LAMP BULB NUMBERS (Cont'd.)

Back-Up Lamps	1156
Electric Clock	1816
Radio Dial Lamp Deluxe, Super, Deluxe, AM & FM)	1893
Glove Box	1893

FUSE SPECIFICATIONS AND LOCATION
33, 34, 35, 36, 38 and 39 Series

APPLICATION	FUSE TYPE AND AMPERES	FUSE LOCATION
Heater	SAE 20	Located in Fuse Block For exact location Refer to Fig. 13-9
Air Conditioning or Heater with Rear Defroster	AGC 25	
Windshield Wiper	SAE 20	
Radio - Deluxe AM, AM & FM	AGW 2.5	
Radio - Super Deluxe	AGW 7.5	
Transmission Control (33 Series Only)	AGC 5	
Tailgate Wiper and Washer	SAE 20	
Courtesy, Dome and Rear Seat Lighter		
36, 38 & 39 Series	AGC 25	
33, 34, 35 Series	SAE 20	
Stop Lamp	SAE 20	
Clock	AGA 2	
Cruise Control Only	AGC 5	
Electric Seat or Windows, Cruise Control	SAE 20	
4 or 6-Way Seat, Cruise Control	AGC 25	
Cornering Lamp, Glove Compartment Lamp, Underhood Lamp	AGC 5	
Rear License and Trunk Lamp	SAE 9	
Clock, Cluster, Ash Tray, Heat, Vent, A/C Control, HM Indicator, Tach. and Cruise Control Lamps	AGA 3	
Temp, Oil, Gen, Fuel, Parking Brake and Back-Up Lamp	SAE 9	
Turn Signal	SFE 9	
Headlamps	Circuit Breaker	On Headlamp Switch
Electric Seat, Window and/or Convertible Top	Circuit Breaker	L.H. Side of Cowl (in engine compartment)
Guide-Matic Headlamp Control	AGC 4	In line fuseholder near Headlamp Switch
Tachometer	SFE 2	Inside Console
Instrument Panel Cigar Lighter	SAE 20	On Back of Lighter

FUSE SPECIFICATIONS AND LOCATIONS
30, 31 and 32 Series

APPLICATION	FUSE TYPE AND AMPERES	FUSE LOCATION
Electric Clock	AGA 2	Located in Fuse Block For Exact Location, Refer to Fig. 13-10
Dome Lamp	SAE 20	
Courtesy Lamp		
Stop Lamp		
Temperature Indicator Lamp	SAE 9	
Fuel Gauge		
Oil Pressure Warning Lamp		
Parking Brake Indicator Lamp		
Delcotron Warning Lamp		
Back-Up Lamp		
Turn Signal		
License Lamp		
Tail Lamps		
Radio	AGW 2.5	
Transmission	AGA 5	
Heater and/or Air Conditioning	SAE 20	
Electric Windshield Wipers & Washer		
Instrument Cluster Lamp	AGA 3	
Clock Lamp		
Shift Indicator Lamp (Includes Console)		
Heater Ventilation & Air Conditioning Lamps		
Headlamps	Circuit Breaker	On Headlamp Switch
Cigar Lighter (Instrument Panel)	SAE 20	On Back of Lighter
Flasher		Upper L.H. Corner of Fuse Block
Power Seat & Power Windows	Circuit Breaker	On Junction Block
Tachometer	AGA 2	Inside Console
Cruise Control	AGA 4	In Line Fuse

LAMP BULB NUMBERS
30, 31 and 32 Series

Courtesy Lamp (Including Console)	90
Dome	211
Electric Clock	1893
Radio Dial	1893
Glove Box	1893
Heater Control	1895
Parking Brake Warning	1895
Tachometer	1895
Console Compartment	1895
Shift Indicator	1445
Ash Tray	1445
Cruise Control	1445
Speedometer and Odometer	158
Oil Pressure Warning	158
Generator Warning	158
Temperature Indicator	158
Fuel Gauge	158
Turn Signal Indicator	158
High Beam Indicator	158
Park Turn Signal	1157
Tail and Stop	1157
License	1155
Back-Up	1156
Headlamp (Upper Beam Only)	L-4001
Headlamp (Upper and Lower Beam)	L-4002

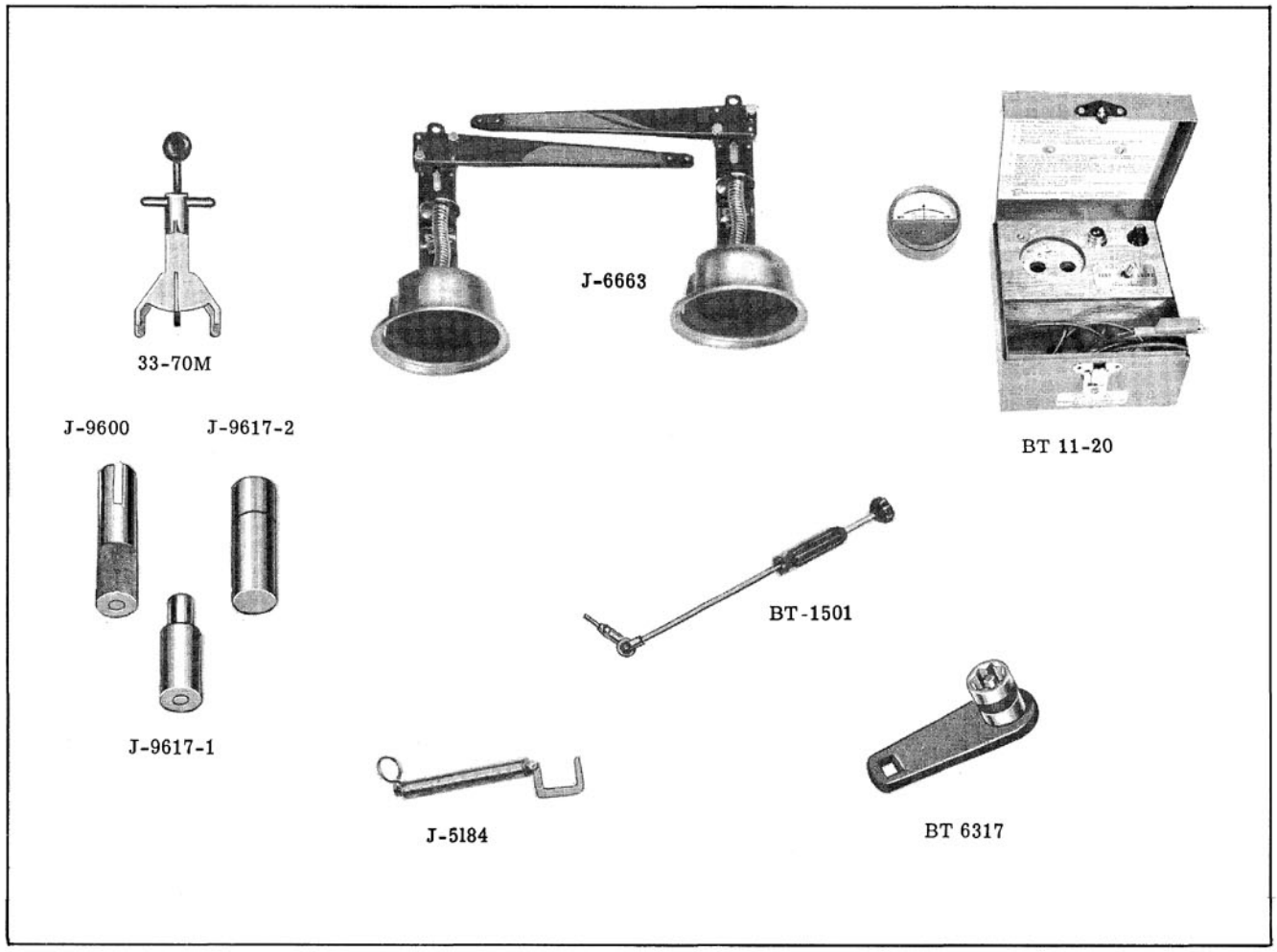
TORQUE SPECIFICATIONS

NOTE: Specified torque is for installation of parts only. Checking of torque during inspection may be 15% below the specifications.

APPLICATION	Ft. Lbs.
Battery Hold Down Nuts	1.5 to 2.5
Connector Strap to Starting Motor Bolt	6 to 8
Distributor Clamp to Cylinder Block Bolt	11 to 14
Delcotron - 34, 35, 36, 38 & 39 Series	
Delcotron to Bracket	22 to 34
Bracket to Cylinder Head	28 to 38
Terminal Nuts	2 to 4
Link to Front Cover	22 to 34
Link Clamp Bolt	14 to 17
Delcotron - 30, 31, 32 & 33 Series	
5/16" Thread Dia.	20 to 25
3/8" Thread Dia.	25 to 35
7/16" Thread Dia.	40 to 50
Spark Plugs	35
Starting Motor - 34, 35, 36, 38 & 39 Series	
Link Support to Intake Manifold	22 to 34
Starting Motor to Flywheel Housing	35 to 50
Starting Motor - 30, 31, 32 & 33 Series	
Starting Motor to Cylinder Block	25 to 35
Brace to Cylinder Block	15 to 25
Brace to Starter	10 to 15
Junction Block Nut	8 to 10
Solenoid Terminal Nuts	1 to 2
Ignition Coil Terminal Nuts	1 to 2

DISTRIBUTOR TEST SPECIFICATIONS

		DISTRIBUTOR		BASED ON DISTRIBUTOR RPM		
Series	Engine Model	Distr. No.	Vacuum Unit No.	Vacuum Advance Per Inch of Vacuum	Mechanical Advance Per Distributor RPM	
34 - 35 36 - 38 & 39	All	1111033	1116220	Start - 9 to 11 in. HG. 12° to 14° at 19 in. HG.	0° to 2° 9° to 11° 12° to 14°	400 RPM 1200 RPM 2000 RPM
30 - 31 32 & 33	Hi Compr. 2 Bbl. 4 Bbl.	1111048	1116232	Start 6 to 8 in. HG. 7 1/2° to 10° at 18 in. HG.	0° to 2° 7 1/2° to 9 1/2° 12° to 14°	400 RPM 1000 RPM 2100 RPM
30 - 31 32 & 33	Low Comp. 2 Bbl.	1111029	1116232	Start 6 to 8 in. HG. 7 1/2° to 10° at 18 in. HG.	0° to 2° 7 1/2° to 9 1/2° 14° to 16°	400 RPM 1000 RPM 2000 RPM
V-6	S.T. and Jetaway	1110322	1116210	Start 6 to 8 in. HG. 7° to 9° at 16 in. HG.	0° to 2° 7° to 9° 12° to 14°	450 RPM 700 RPM 2100 RPM



Tools

BT-11-20	SHORT DETECTOR	J-5184	ELECTRICAL TENSION CHECKING SCALE
BT-33-70-M	BELT TENSIONER GAUGE	J-6663	HEADLIGHT AIMERS
BT-1501	DISTRIBUTOR DWELL ANGLE ADJUSTING TOOL	J-9600	DIODE INSTALLER
BT-6317	DELCOTRON PULLEY NUT TOOL	J-9617-1	DIODE REMOVER
		J-9617-2	DIODE SUPPORT

This page intentionally left blank

HEATER AND AIR CONDITIONER

(ALL SERIES)

CONTENTS OF SECTION 14

HEATER

GENERAL DESCRIPTION (Fig. 14-1)

Air enters the ventilation and heater system at the cowl vent grille, travels through the plenum chamber and into the cowl air chamber. Air can now be directed into the passenger compartment by opening the right and left side cowl doors or by opening the heater inlet door. The doors are opened by vacuum operated diaphragms, actuated by push buttons, and closed by spring force.

The ventilation and heater control push buttons are in a single control unit located on the instrument panel on the right side of the steering column. The control also contains the blower speed switch and the temperature control slide lever.

The blower motor is started whenever the heater inlet air door is opened. Movement of the inlet door actuates a master ON, OFF switch which controls operation of the blower motor.

Cars without heaters are equipped with hand operated cowl outlet doors for right and left side ventilation. (Fig. 14-2)

VENTILATION SYSTEM (Fig. 14-3)

When the left button is depressed, air flows into the passenger compartment through the left vent door.

When the right button is depressed, air flows into the passenger compartment through the right vent door.

When the "MAXIMUM" button is depressed, both the right and left cowl outlet doors are opened.

HEATER SYSTEM (Fig. 14-3)

For heating, the temperature control lever must be moved to the right, depending on the amount of heat desired.

Operation (Fig. 14-4)

Depressing the "HEAT" button opens the heater inlet air door which starts the blower motor.

Outside air is drawn through the cowl air intake grille into the ventilation duct and into the heater blower and air inlet assembly. The heater blower then forces a portion of the outside air through the heater core and into the ducting system. The remaining air is forced directly into the ducting system. To obtain the desired discharge air temperature, the heater air then mixes with the unheated air in the necessary proportions.

The temperature lever operates the temperature door which controls the temperature of the discharged air by regulating the mixing of heated and unheated air. In the COOL position, the air flow from the heater core is completely blocked. As the lever is moved to WARM, the temperature

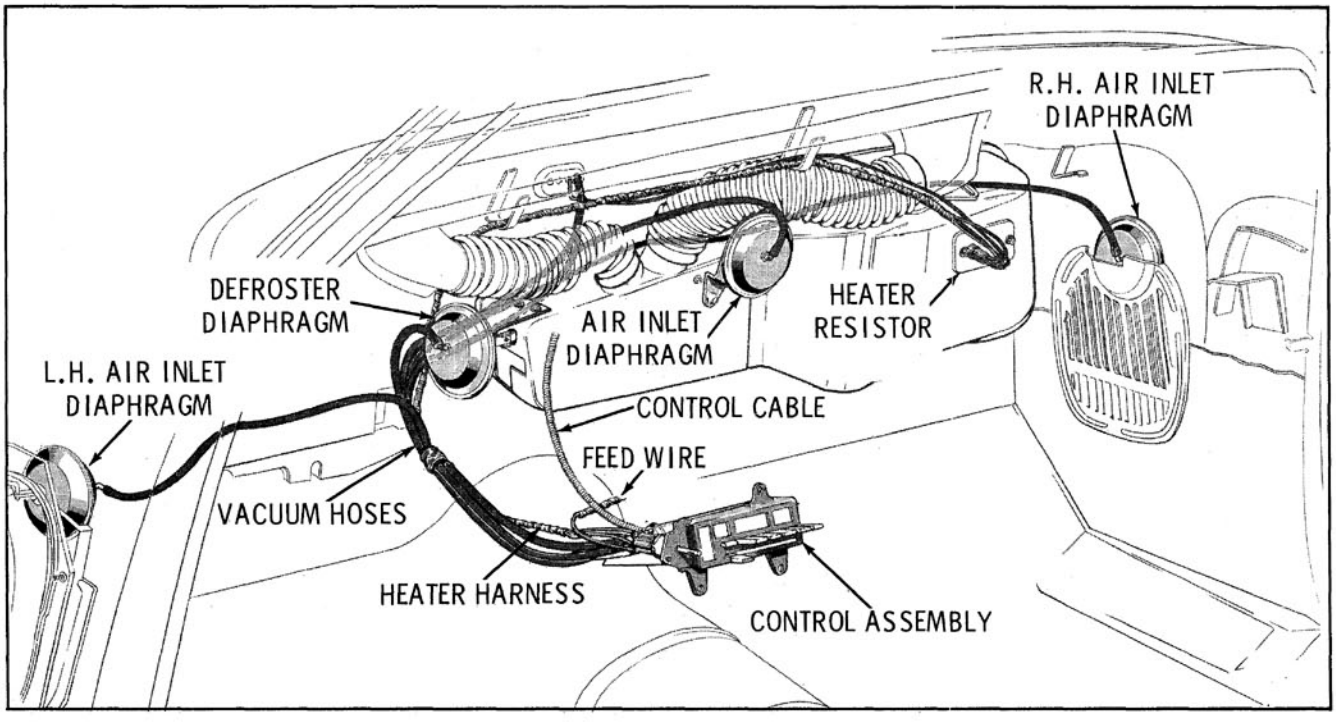


Fig. 14-1 Heater Control Layout

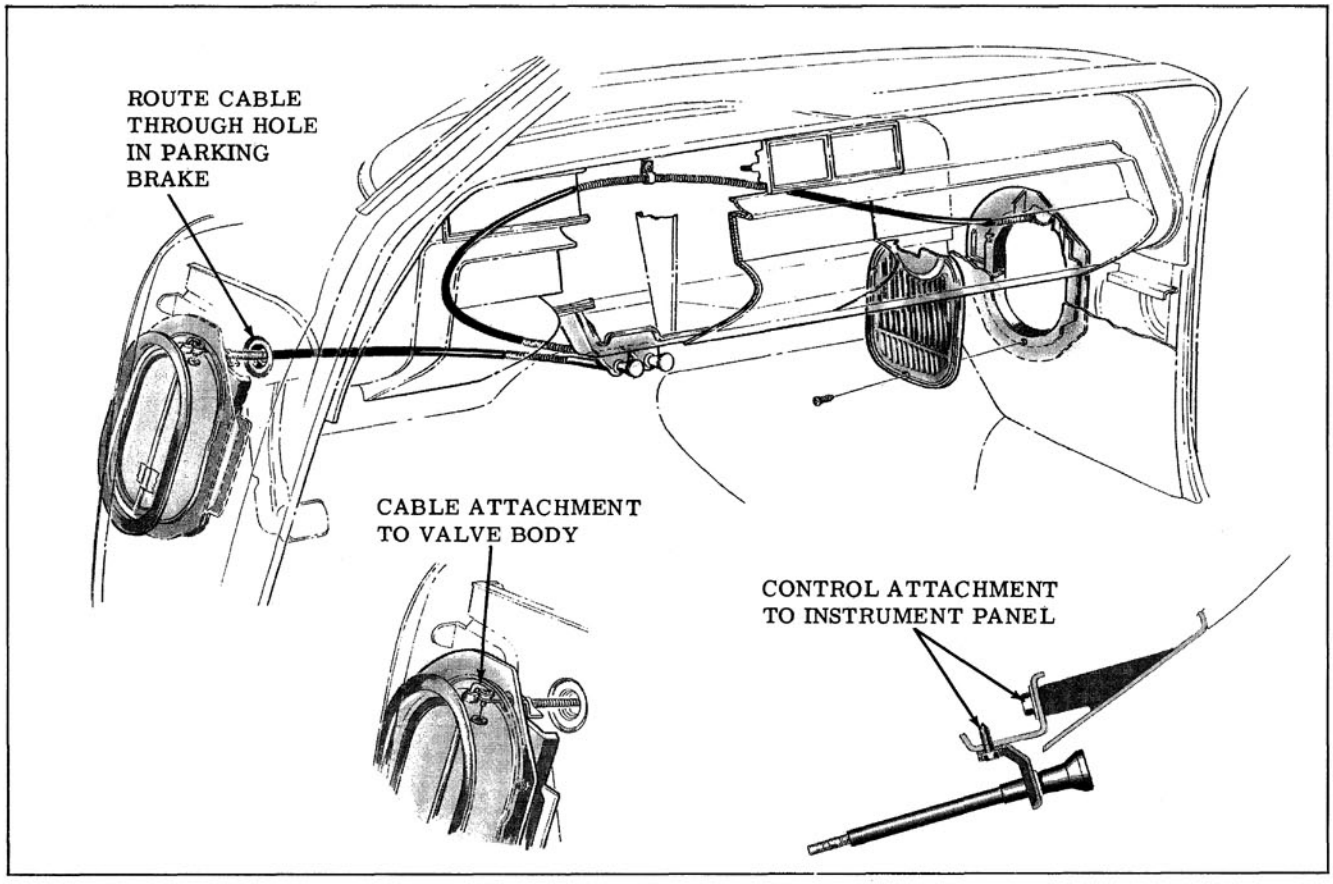


Fig. 14-2 Ventilation Without Heater

door opens, admitting heated air into the ducting and progressively decreases the amount of unheated air. In the MAX. WARM position, the flow of unheated air is completely blocked directing all the air through the heater core, for maximum heating.

Depressing the "DEF" button operates a vacuum operated diaphragm which opens the defroster door and air flows into the right and left defroster nozzles, diverting the air flow onto the windshield. Approximately 80% of the air flow is directed on the windshield. The balance of the air flow enters the passenger compartment through the heat outlets.

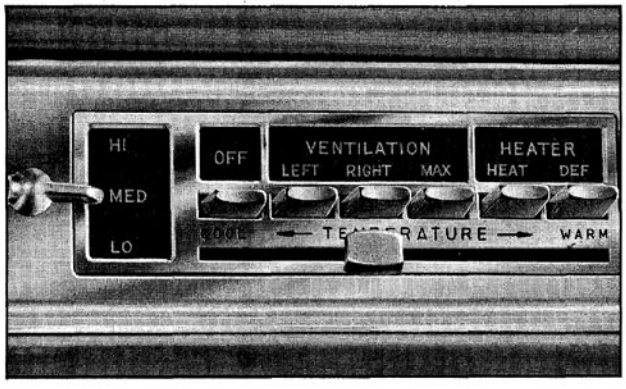


Fig. 14-3 Heater and Ventilation Control

Rate of air flow on "HEAT" and "DEF" can be controlled by the blower speed switch.

ADJUSTMENTS

TEMPERATURE CONTROL CABLE

1. Disconnect cable at cam on heater case.
2. Loosen cam attaching screws.
3. While holding the upper half of the cam to the extreme left position, move the lower half until a 3/16" pin can be inserted into the gauge holes. (Fig. 14-5)
4. Tighten the cam attaching screws.
5. Adjust control cable until the temperature lever is 1/8" from the extreme left position. (Fig. 14-6)

COWL OUTLET DOOR

Adjustment of the cowl outlet door and diaphragm linkage is provided at the diaphragm. (Fig. 14-7)

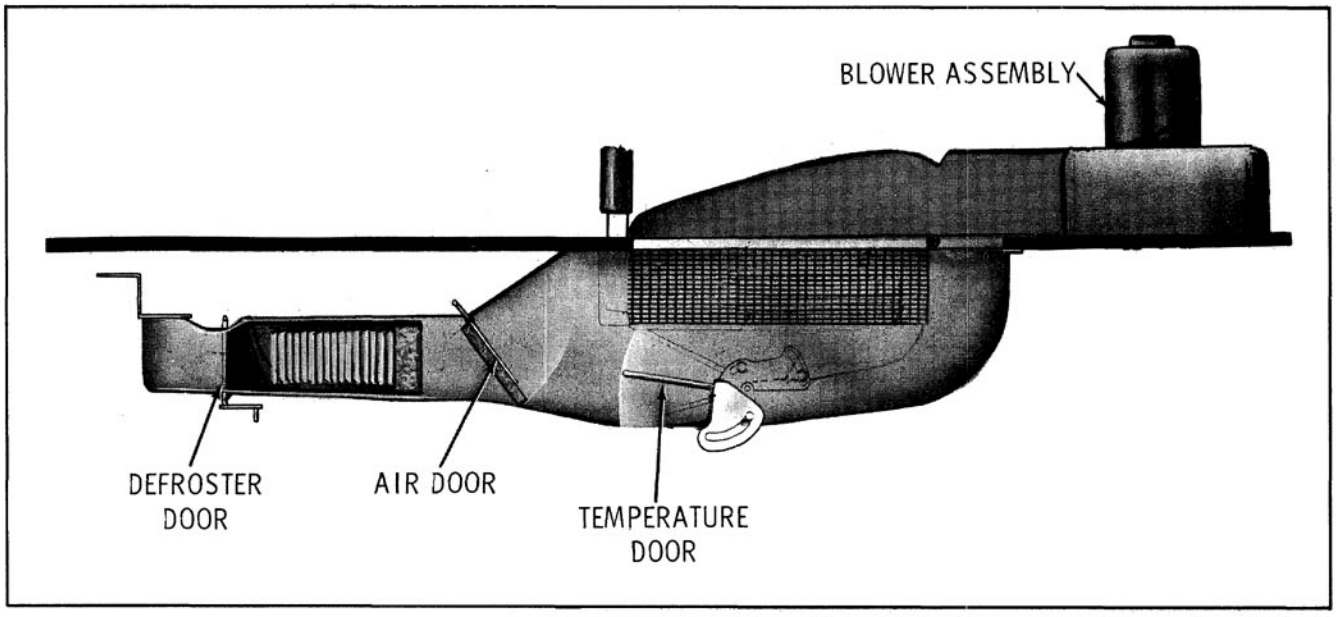


Fig. 14-4 Air Doors

1. With cowl vent body removed, loosen set screw.
2. Pull diaphragm lever to its extreme stop, then push back 1/16".
3. While holding door closed, tighten set screw.

HEATER INLET DIAPHRAGM

1. Remove vacuum hose from diaphragm. (No vacuum must be applied to diaphragm when making adjustment.)
2. Loosen the set screw on the diaphragm arm.
3. With the inlet door held closed by spring force and diaphragm in the fully released position, tighten the set screw.

DEFROSTER DOOR DIAPHRAGM

1. With vacuum applied to the defroster diaphragm, loosen the set screw on the diaphragm arm.
2. Remove heater outlet. Pull defroster door down until it contacts the rubber stop, then tighten set screw.
3. Install heater outlet.

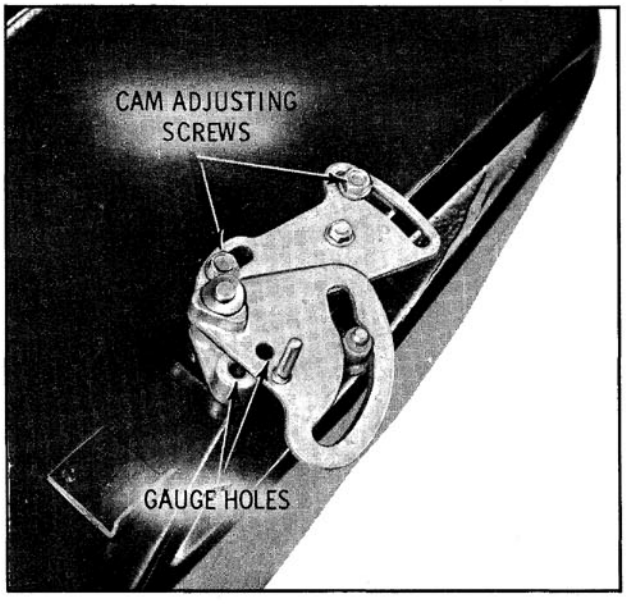


Fig. 14-5 Cam Adjustment

COWL VENT DOOR ASSEMBLY

REMOVE AND INSTALL (Fig. 14-8)

1. Remove cowl vent grille and trim pad.
2. Disconnect vacuum line from diaphragm.

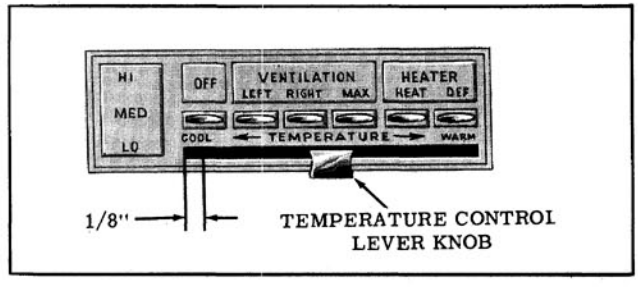


Fig. 14-6 Temperature Control Adjustment

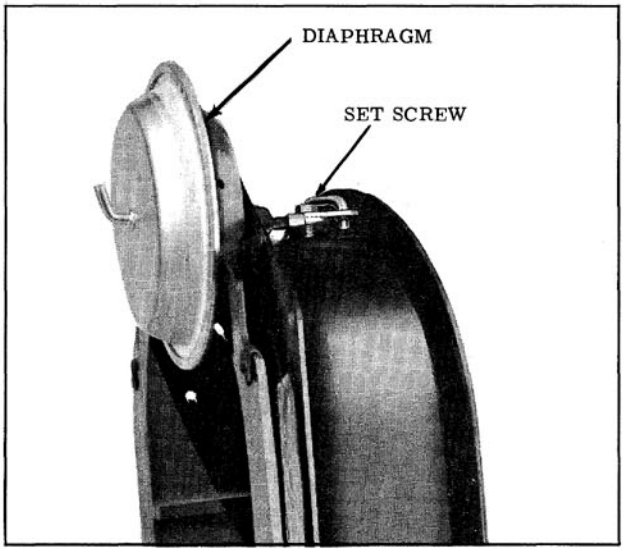


Fig. 14-7 Cowl Outlet Diaphragm Adjustment

3. Remove the door assembly to cowl attaching screws and remove assembly.

4. If necessary to remove the diaphragm, refer to Fig. 14-9 for details.

On installation, apply a 3/8" bead of caulking compound between the assembly and cowl, make sure water seal tape is installed over actuating wire rod hole in door body, then reverse removal procedure.

HEATER INLET ASSEMBLY

REMOVE AND INSTALL (Fig. 14-9)

1. Scribe hood hinge location on right side of hood and cowl.

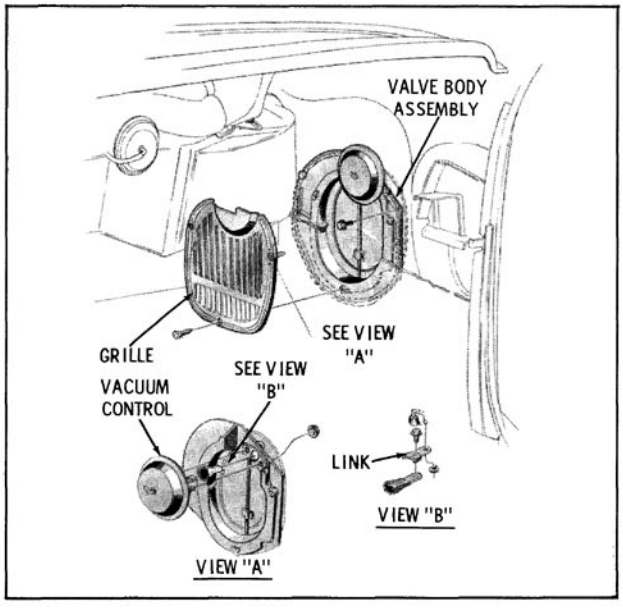


Fig. 14-8 Cowl Vent Door Assembly

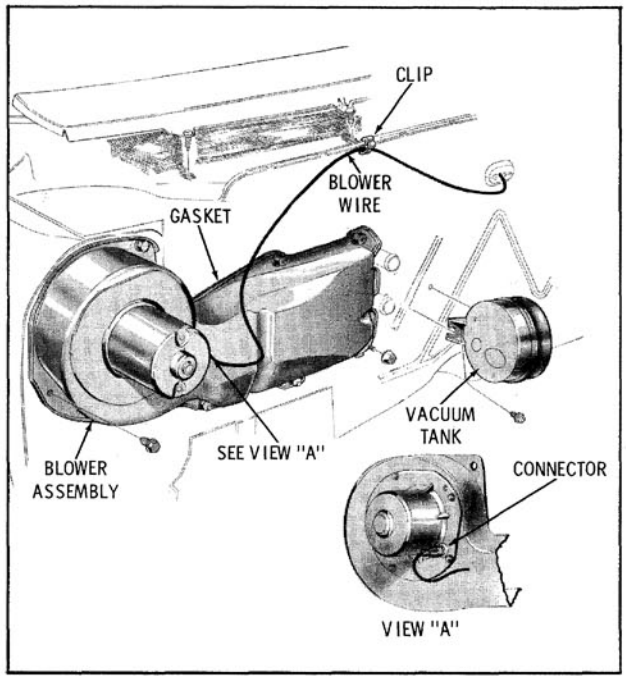


Fig. 14-9 Blower Duct Attachment

2. Remove hood hinge spring.

3. While firmly supporting hood, remove the right hood hinge from cowl and hood.

4. Disconnect heater motor wiring.

5. Remove the heater inlet attaching screws, and remove heater inlet assembly.

6. If necessary, remove the blower motor.

To install, reverse removal procedure and align hood.

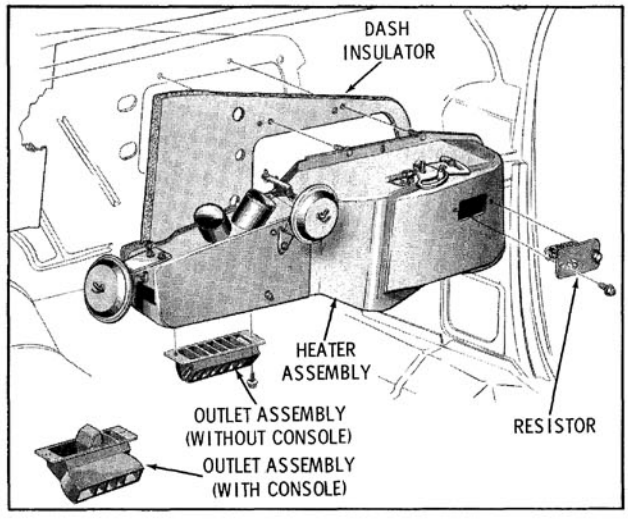


Fig. 14-10 Heater Case Attachment

HEATER CASE AND CORE

REMOVE AND INSTALL (Fig. 14-10)

1. Remove glove box.
2. Disconnect wiring, vacuum lines and defroster hoses from heater case.
3. Drain radiator below heater level, then disconnect heater hoses. (Fig. 14-11)
4. Remove the heater case and heater inlet attaching screws and nuts.
5. From inside the car, remove the heater case.
6. Remove the heater core from the case.

To install, reverse the removal procedure.

VENTILATION AND HEATING CONTROL

REMOVE AND INSTALL (Fig. 14-12)

1. Disconnect all vacuum lines and wiring.
2. Remove blower speed control lever.
3. Remove the attaching nuts and remove control from the rear of instrument panel.

To install, reverse removal procedure. Refer to schematic diagrams (Fig. 14-39 and Fig. 14-40) for proper installation of hoses. Wiring and hoses must be properly routed and retained.

HEATER RESISTOR

REMOVE AND INSTALL (Fig. 14-10)

The heater resistor is mounted on the heater case with two sheet metal screws. To remove, disconnect wiring connector and remove attaching screws.

To install resistor, reverse removal procedure.

VACUUM TANK

A vacuum tank, located next to the heater inlet in the engine compartment, provides a constant supply of vacuum to operate the vacuum diaphragms. (Fig. 14-9) The vacuum tank is retained with two sheet metal screws.

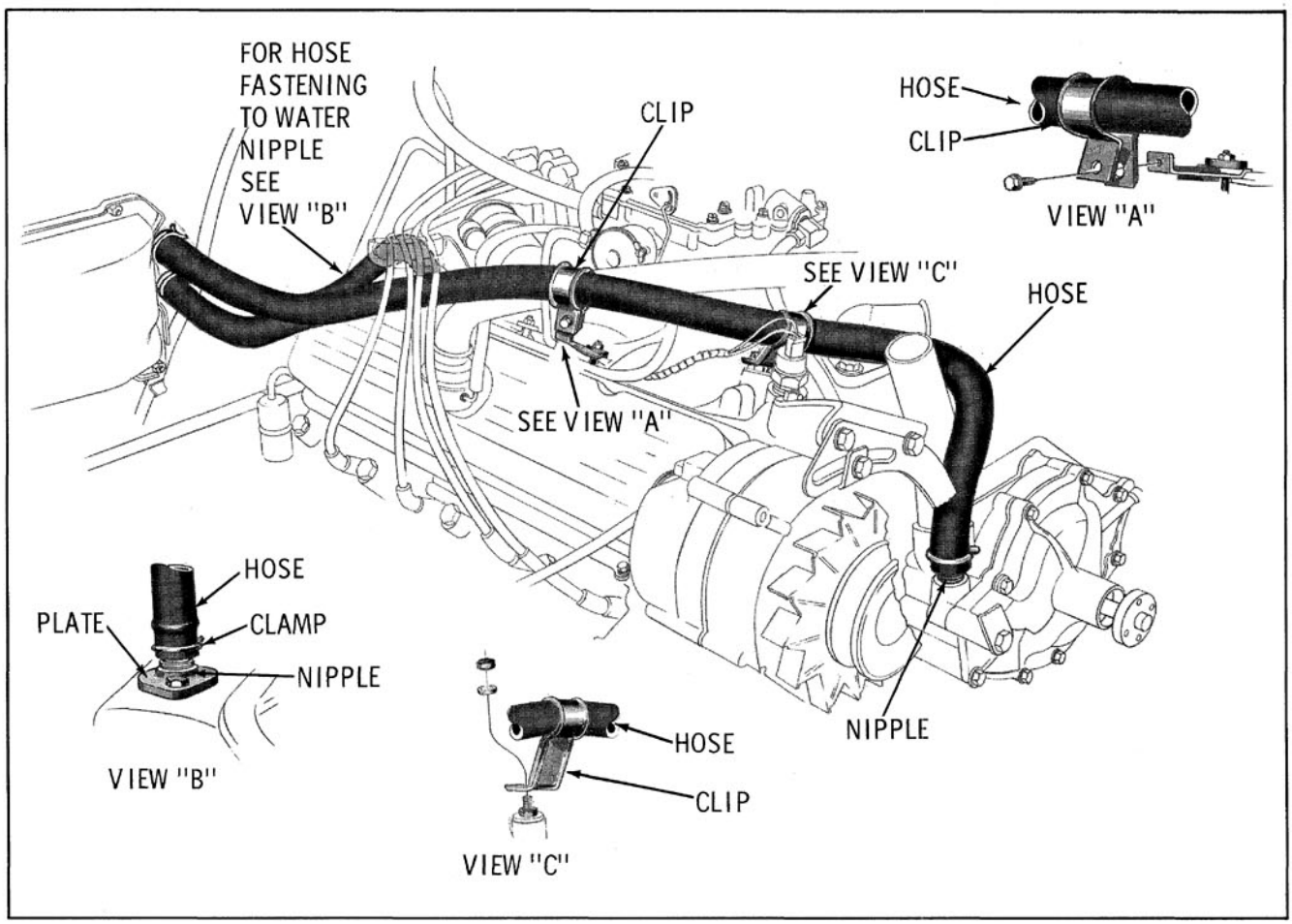


Fig. 14-11 Heater Hose Routing

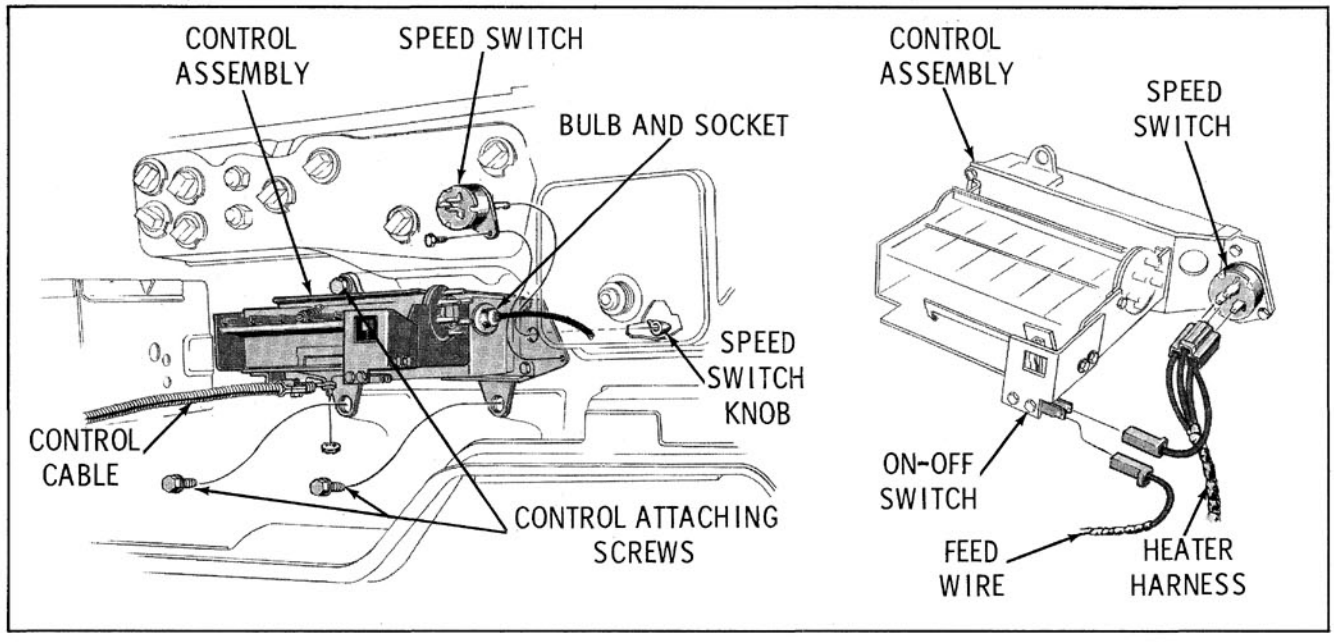


Fig. 14-12 Heater Control Attachment

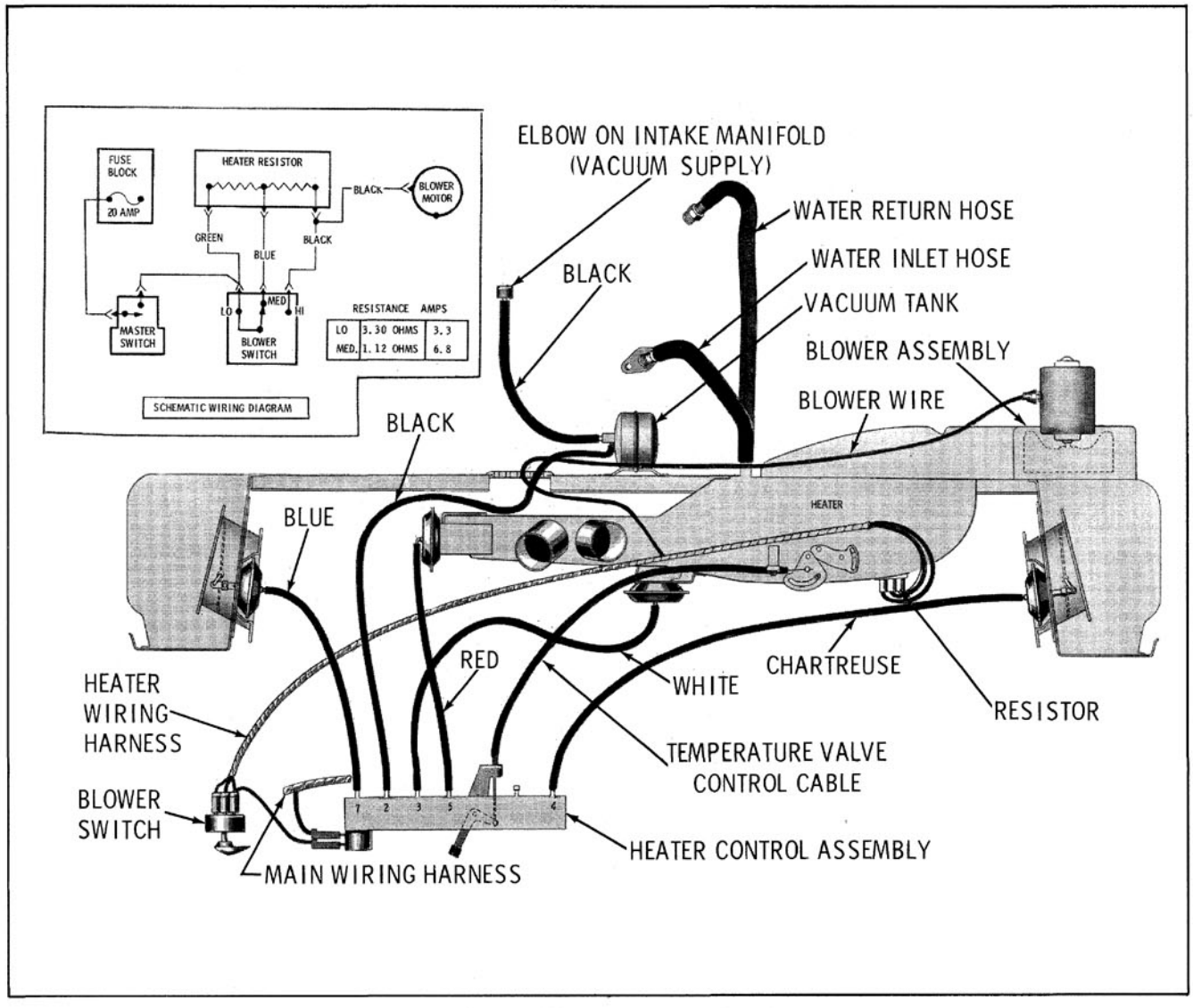


Fig. 14-13 Schematic Diagram of Heater and Ventilation

HEATER (30-31-32 & 33 SERIES)

DESCRIPTION

Air is supplied to the heater through the air intake grille and is blown into the air inlet assembly where its path is controlled by three different doors.

The heater operates on outside air only and does not have a water valve to control water circulation. Air passing through the core receives maximum heat at all times.

Heater output and operation is controlled by three bowden cable operated doors; temperature door, air door and defroster door. The temperature door can be adjusted so that all or any desired amount of air can be directed through the heater core. The heater output temperature is dependent upon the blending of heater air and ambient air controlled by the position of the temperature door. (Fig. 14-25) The air door must be open whenever the heater is in operation. The defroster door diverts the air that has passed through the air door either into the passenger compartment through the heater outlet or into the defroster duct up to the windshield for defrosting. The amount of air being diverted either place is controlled by the position of the door.

CONTROL ASSEMBLY (Fig. 14-26)

Removal

1. Disconnect the wiring connectors and pull out lamp socket.

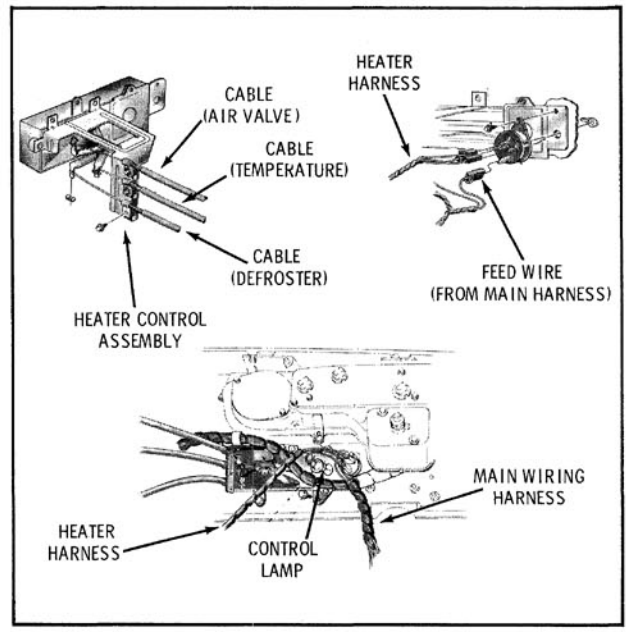


Fig. 14-26 Control Installation

2. Remove the spring nuts retaining the cables to the control levers.
3. Remove the three screws securing the cables to the control.
4. Remove the three nuts securing control to instrument panel and remove control assembly.

Install

1. Position control assembly to instrument panel and retain with the three screws.
2. Position the ends of the cables over the control levers and retain with the spring nuts.

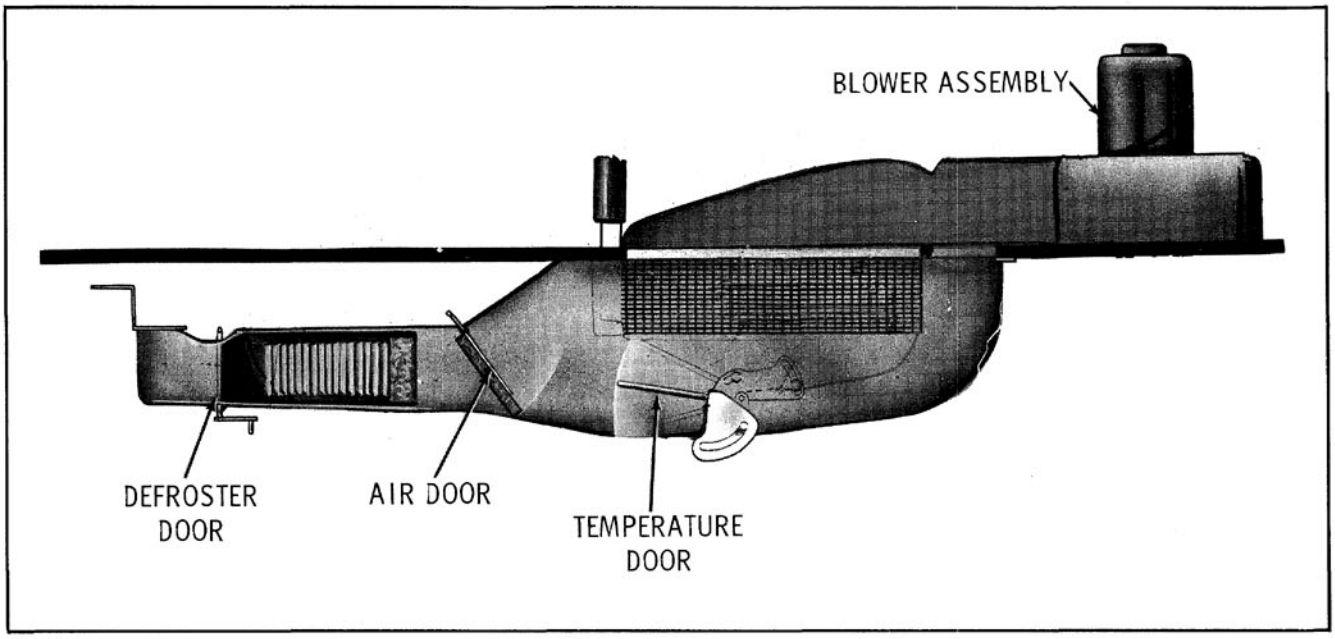


Fig. 14-25 Air Doors

3. Retain the cables to the control.

4. Install lamp socket and connect the two connectors.

NOTE: If the control only is removed, it should not be necessary to adjust the cables. When the cables are properly adjusted, the levers should have 1/8" clearance when moved to the extreme left position. Cable adjustment is provided on the heater case end of the cable.

FAN SWITCH (Fig. 14-26)

Removal

1. Loosen the set screw retaining the switch knob and remove the knob.

2. Disconnect the two wiring connectors.

3. Remove the screw holding the switch to the heater control and remove the switch.

Install

1. Position the switch to the heater control assembly and install the retaining screw.

2. Connect the two wiring connectors.

3. Observe the flat on the switch shaft and install the knob so that the set screw contacts the flat.

RESISTOR

The resistor can be removed by disconnecting the harness and removing the two attaching screws. To install, on 30-31-32 series, position the resistor on the heater as shown in Fig. 14-27. Retain with the two screws and connect wiring. To install, on 33 series, refer to Fig. 14-28.

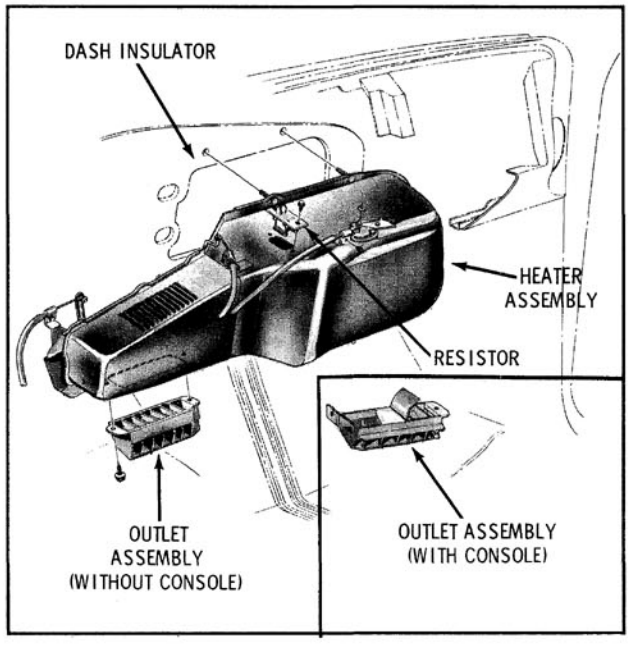


Fig. 14-27 Heater Assembly (30-31 & 32 Series)

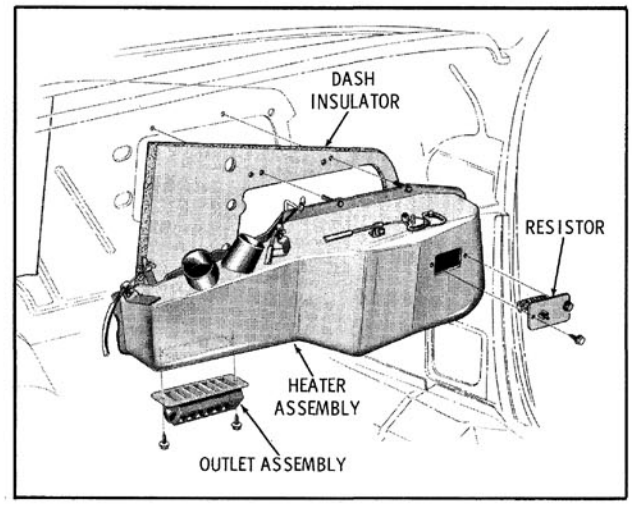


Fig. 14-28 Heater Assembly (33 Series)

	Resistance	Amps
LO	3.30 OHMS	3.3
MED	1.12	6.8

ADJUSTMENTS

Each cable assembly is provided with an elongated mounting bracket on the heater end of the cables. To adjust any of the three cables, it is only necessary to loosen the cable attaching screw and slide the cable in the necessary direction to obtain 1/8" clearance between the levers and the control assembly when the levers are moved to the left side of the control assembly. Fig. 14-29 and 14-30 illustrate cable and wire routing.

DEFROSTER CABLE

The cable must be adjusted so that, when the lever is to the extreme left, the defroster door is in the closed position.

TEMPERATURE CABLE

The cable is connected to a cam lock device that assures positive closing of the temperature door. To adjust, disconnect the cable, loosen the cam attaching screws and, while holding the upper half of the cam to the extreme left position, slide the lower half either left or right until a 3/16"

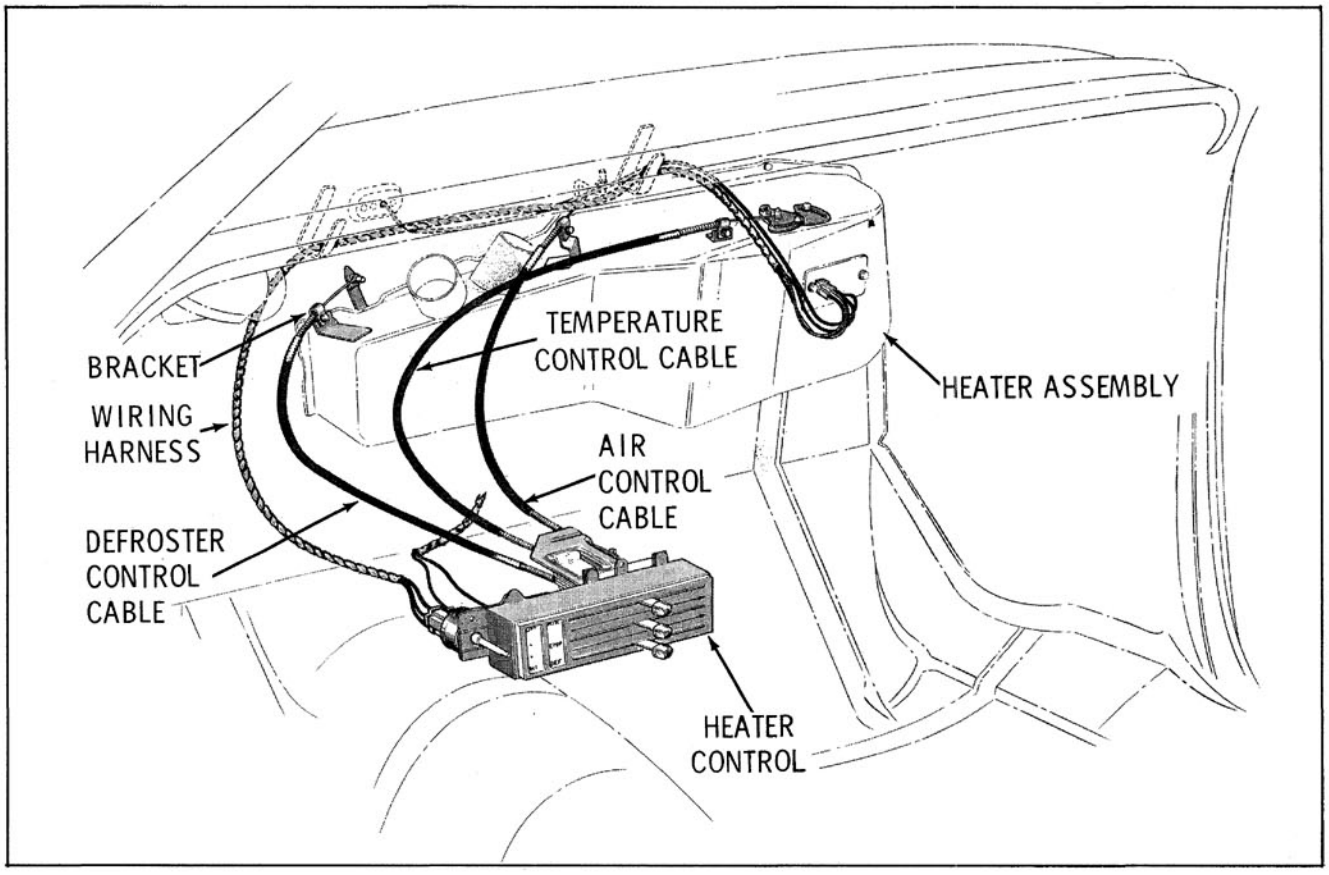


Fig. 14-29 Cable and Wire Routing (33 Series)

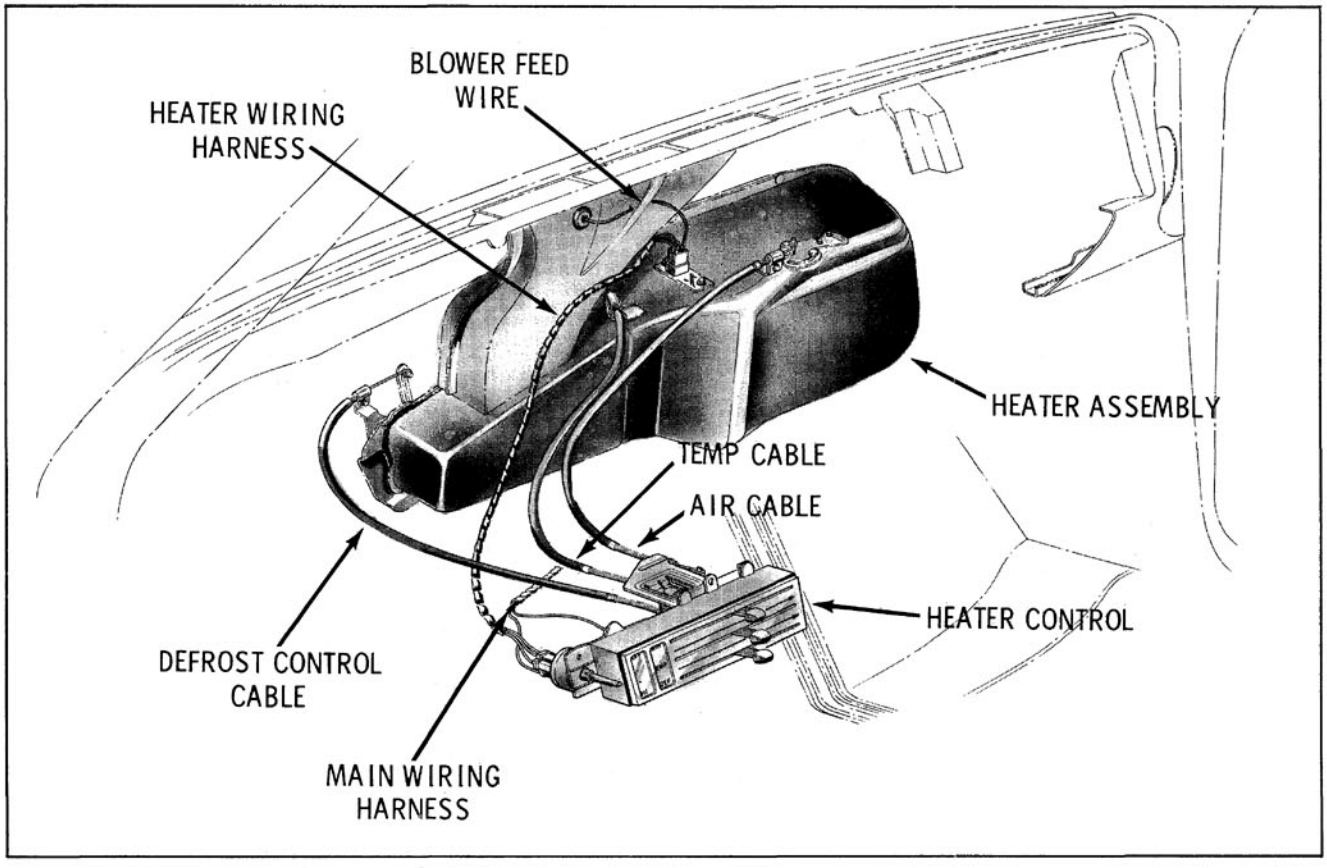


Fig. 14-30 Cable and Wire Routing (30-31 & 32 Series)

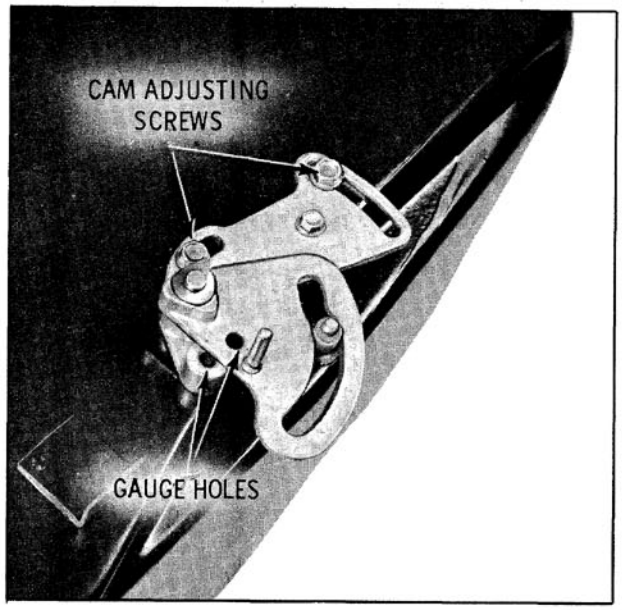


Fig. 14-31 Cam Adjustment

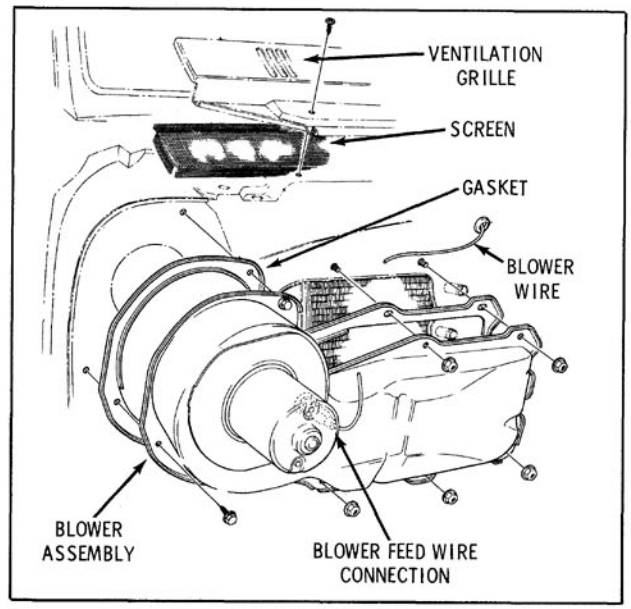


Fig. 14-32 Blower Installation

pin can be inserted into the gauge holes. (Fig. 14-31) While holding firmly, tighten the cam attaching screw. Connect and adjust the cable so that, when the lever is to the left side of the control, a clearance of 1/8" is obtained.

AIR CABLE

Loosen the cable attaching screw and, with the door fully closed, tighten the cable attaching screw.

BLOWER MOTOR AND AIR INLET ASSEMBLY (Fig. 14-32)

1. Remove the right front wheel and fender filler panel.
2. Disconnect blower motor wiring.
3. Remove the five nuts and two screws securing inlet assembly to dash.
4. Disengage the inlet assembly from the studs and remove from the car. The blower motor can be removed from the inlet assembly by removing the attaching screws. The fan is secured to the motor shaft by a nut and lockwasher.

CORE ASSEMBLY

The heater core is located in and attached to the heater case. To remove the core, disconnect heater hoses and remove the five attaching nuts shown in Fig. 14-33. The lower outboard nut can be removed by drilling a 3/4" hole through the fender filler panel at the dimple provided in the fender filler panel.

Disconnect the resistor wiring, the three control cables and remove the case assembly from the dash panel. The core can be removed from the case as illustrated in Fig. 14-34. When replacing the core in the case, use body sealer or caulking compound as indicated in Fig. 14-35.

After installing the core, plug the hole in the fender filler panel using a 3/4" accessory hole grommet and body sealer.

HEATER HOSE

The heater water hoses are routed and retained as shown in Figs. 14-36, 14-37 and 14-38. The core inlet hose is 5/8" ID and the core outlet hose is 3/4" ID.

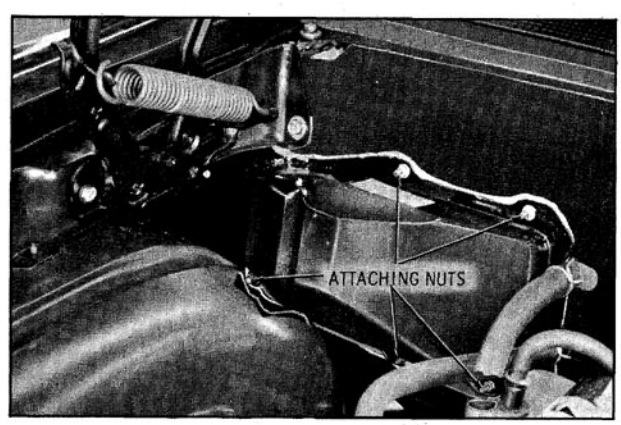


Fig. 14-33 Blower and Air Inlet Attachment

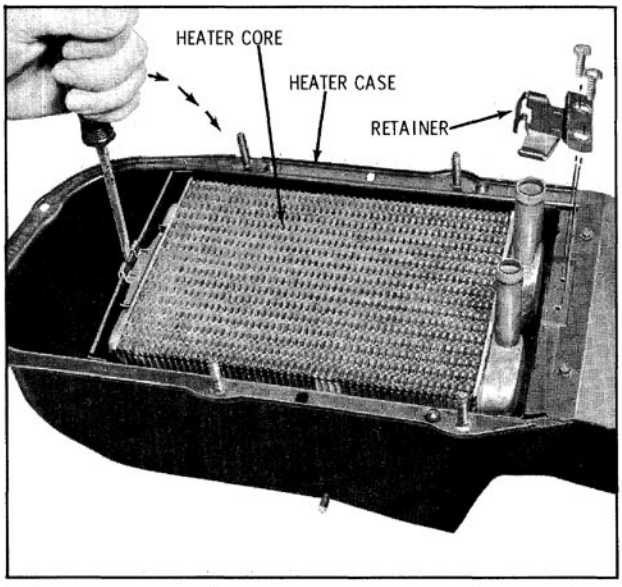


Fig. 14-34 Core to Case Attachment

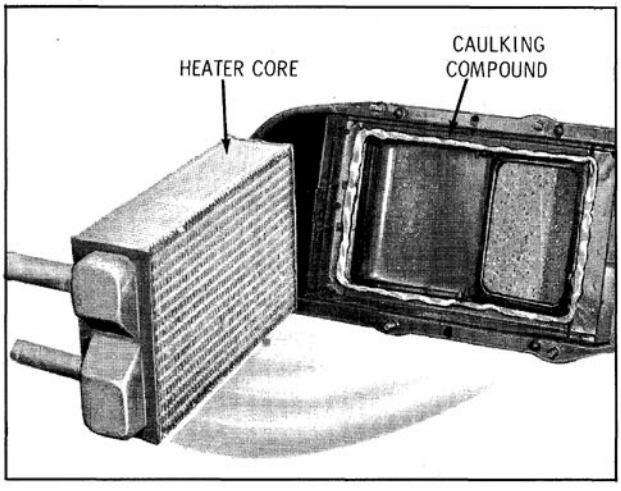


Fig. 14-35 Heater Core Sealing

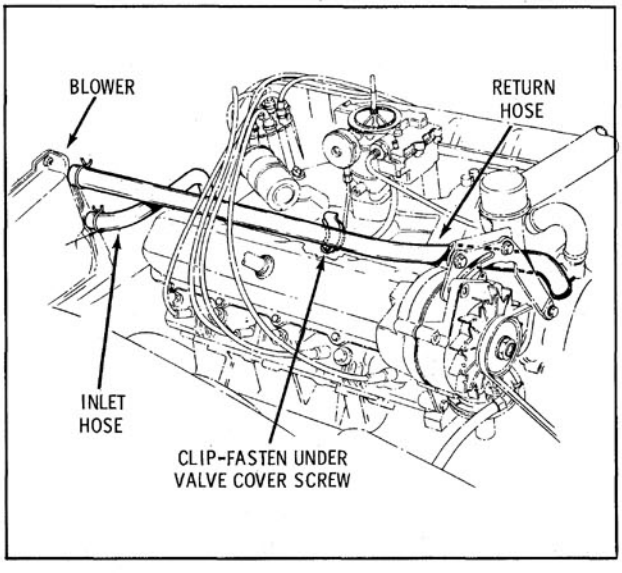


Fig. 14-36 Water Hose Routing (30 - 31 & 32 Series)

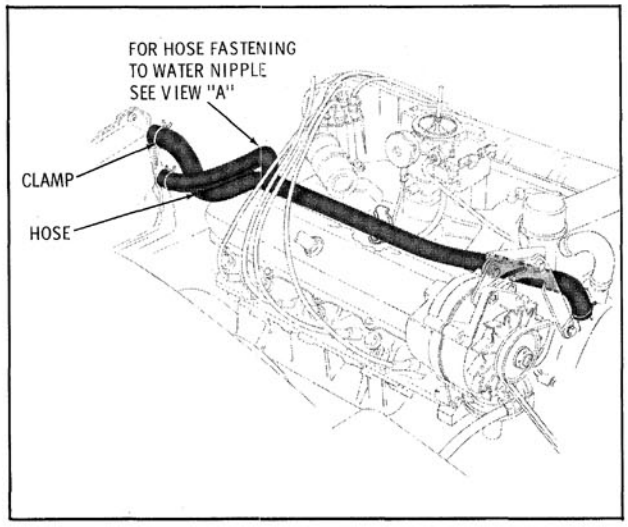


Fig. 14-37 Water Hose Routing (33 Series)

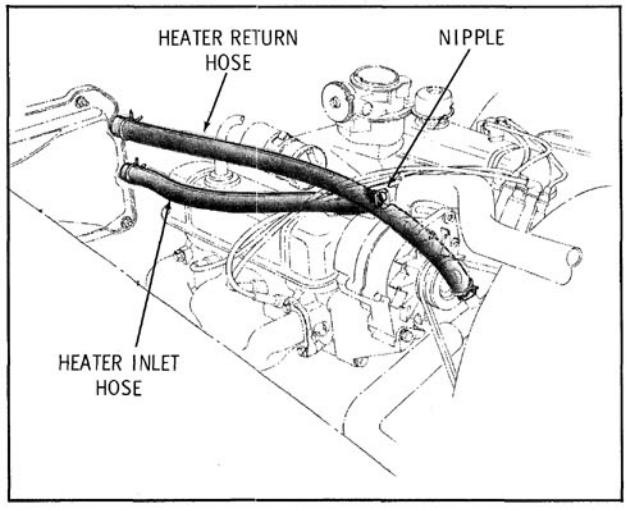


Fig. 14-38 Water Hose Routing (V-6)

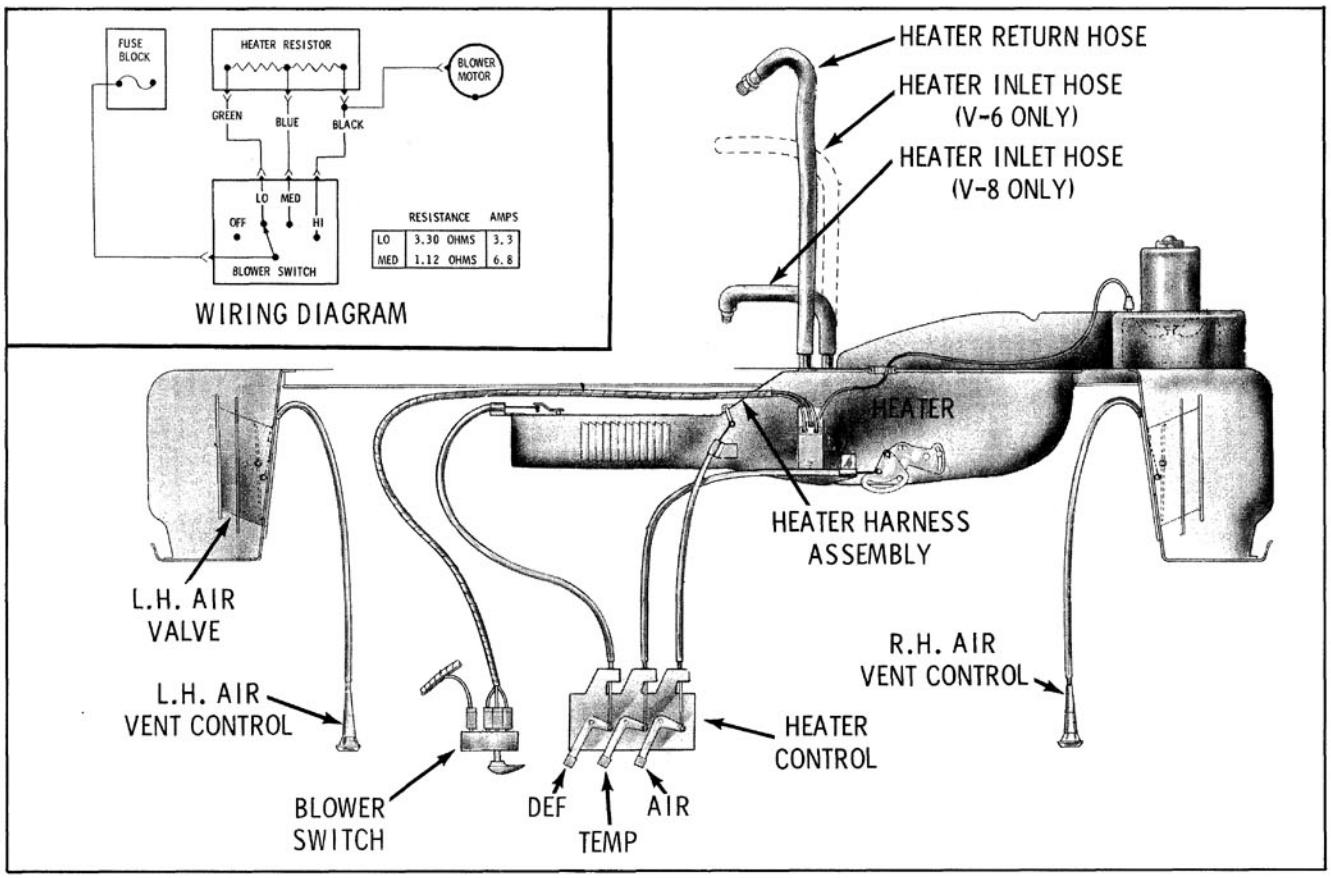


Fig. 14-39 Schematic Diagram of Heater (30 - 31 and 32 Series)

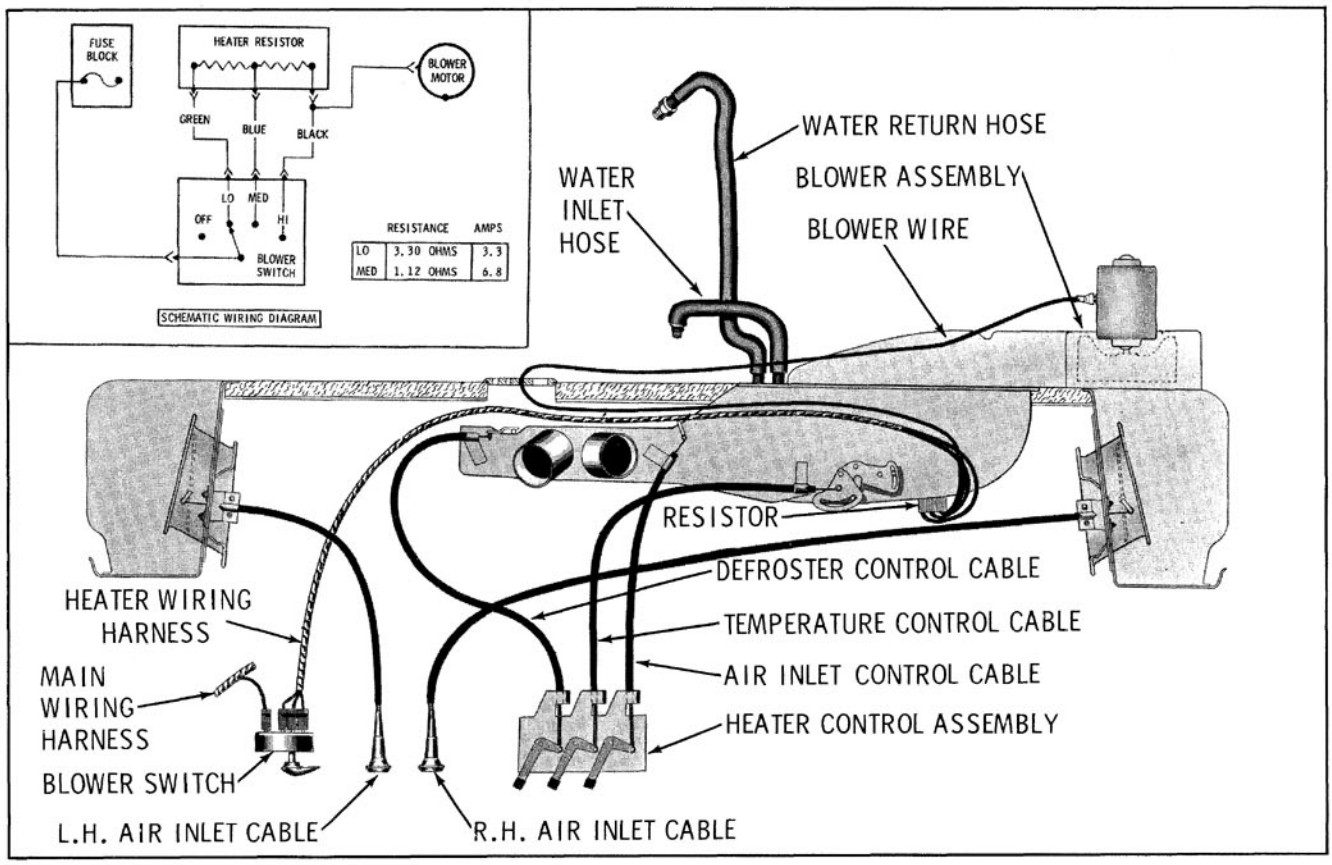


Fig. 14-40 Schematic Diagram of Heater (3300 Series)

AIR CONDITIONER

PERIODIC MAINTENANCE

Remove road accumulation from condenser at every engine oil change interval or as necessary.

Check and adjust compressor belt tension at each engine oil change interval.

The system should be operated for at least five minutes every two weeks.

Check refrigerant level and replenish as necessary at the start of every cooling season.

GENERAL DESCRIPTION

The air conditioning system provides refrigerated and dehumidified air to cool the car interior. The system uses both outside and recirculated air.

For normal cooling, A/C control set for "NORMAL", 100% outside air passes through the evaporator core. For maximum cooling, A/C control set for "RECIR", approximately 80% recirculated air and 20% outside air is directed through the evaporator core.

Air Outlets (Figs. 14-54 & 14-55)

Adjustable air outlets are located on either side of the instrument panel. The left and right air outlets may be adjusted to direct the air as desired. In addition, center outlets are provided to allow additional upper level cooling. All outlets are equipped with shut-off valves. Floor cooling is provided by discharging air directly to the floor from fixed openings in the air manifold located under the instrument panel.

The air condition control assembly is mounted in the instrument panel. A four speed blower switch is located in the control assembly.

FAST COOL DOWN

To rapidly cool a car which has been standing for a period of time in the sun, open the center outlet, set A/C control on "NORMAL", slide temperature lever to the extreme left position and turn blower speed switch on "HI". Open car windows just long enough to expel hot air. After car has cooled, adjust temperature control lever position to suit individual comfort. Air flow can be directed by adjusting the side outlets. The recommended position of the air outlets, for best over-all front and rear seat cooling, is when the side outlets are adjusted to direct the air flow along the inside roof line, and the auxiliary side and center outlets are open.

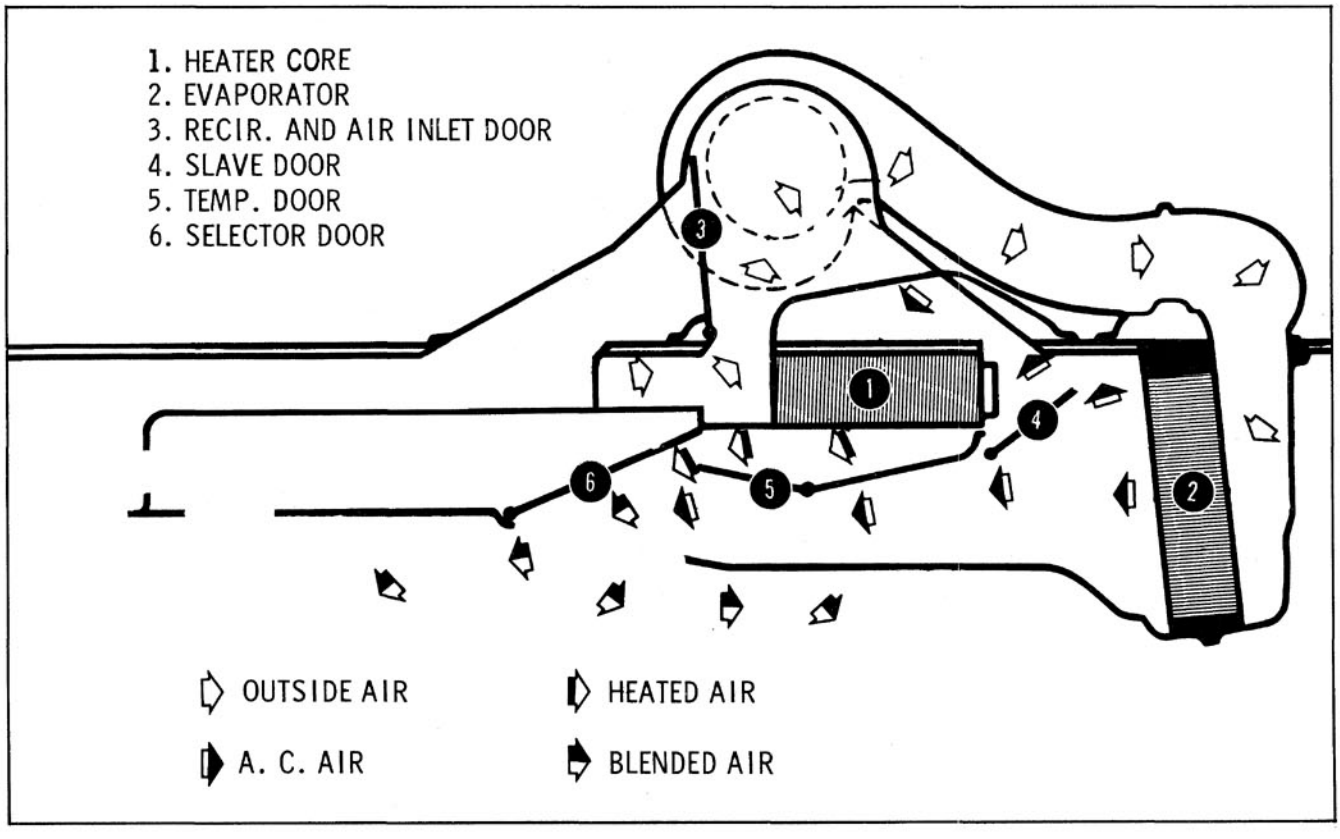


Fig. 14-50 A. C. On - Mild Weather

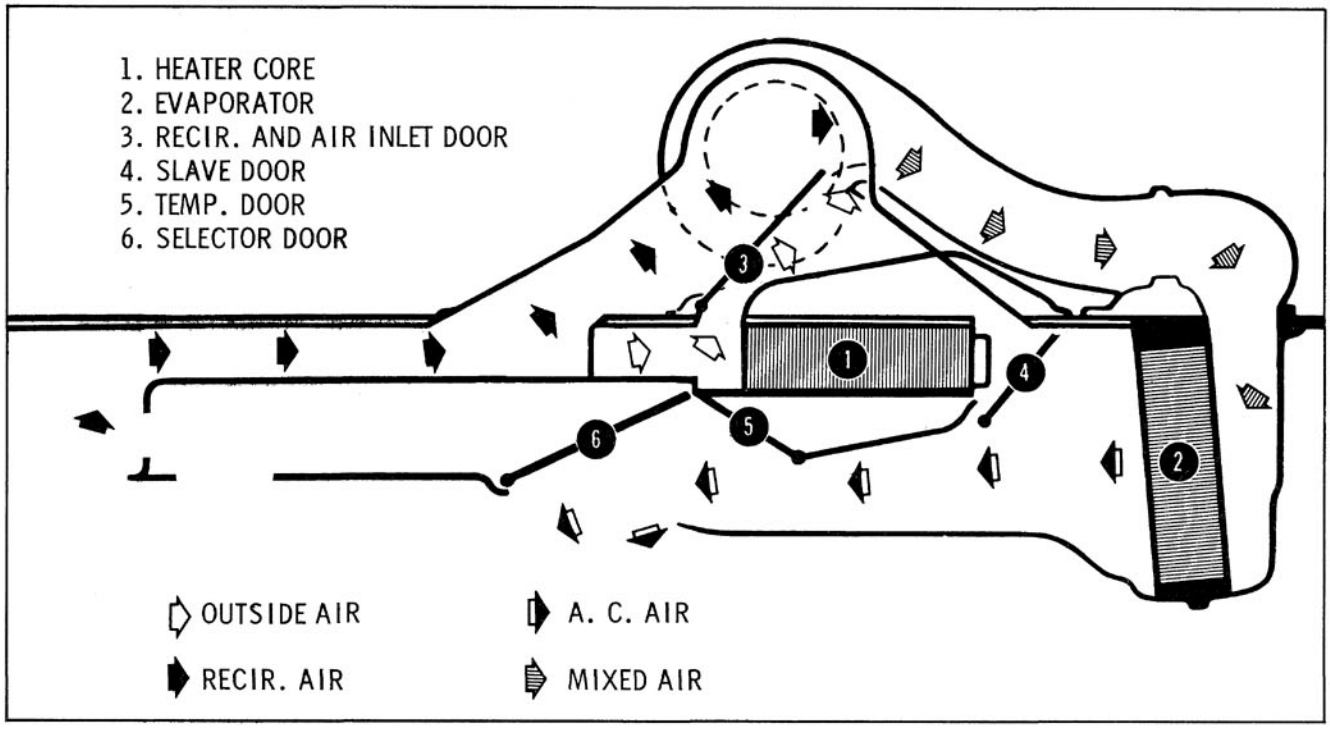


Fig. 14-51 A. C. On - Hot Weather

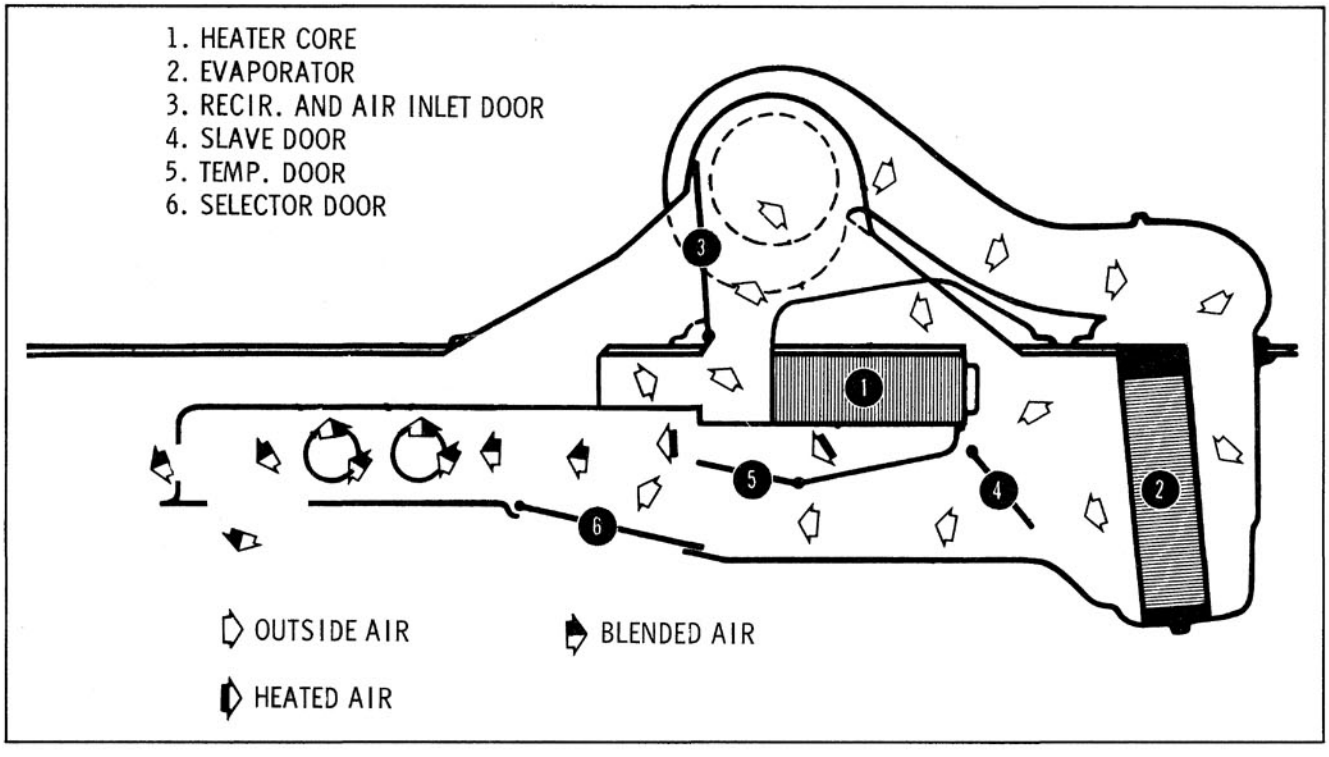


Fig. 14-52 A. C. Off - Heater On - Mild Weather

DRIVING CONDITIONS

For normal driving conditions, the driver may adjust the temperature of cool air by moving the control lever to suit individual comfort. Selection of blower speeds should be regulated according to the amount of air forced into the passenger compartment by the forward motion of the car.

When driving in heavy traffic, it may be desirable to set the blower speed switch on "HI". At higher speeds, air will be forced by the forward motion of the car into the passenger compartment in greater volume, lessening the speed requirements of the blower motor. It then may be desirable to set the blower speed switch to suit individual comfort.

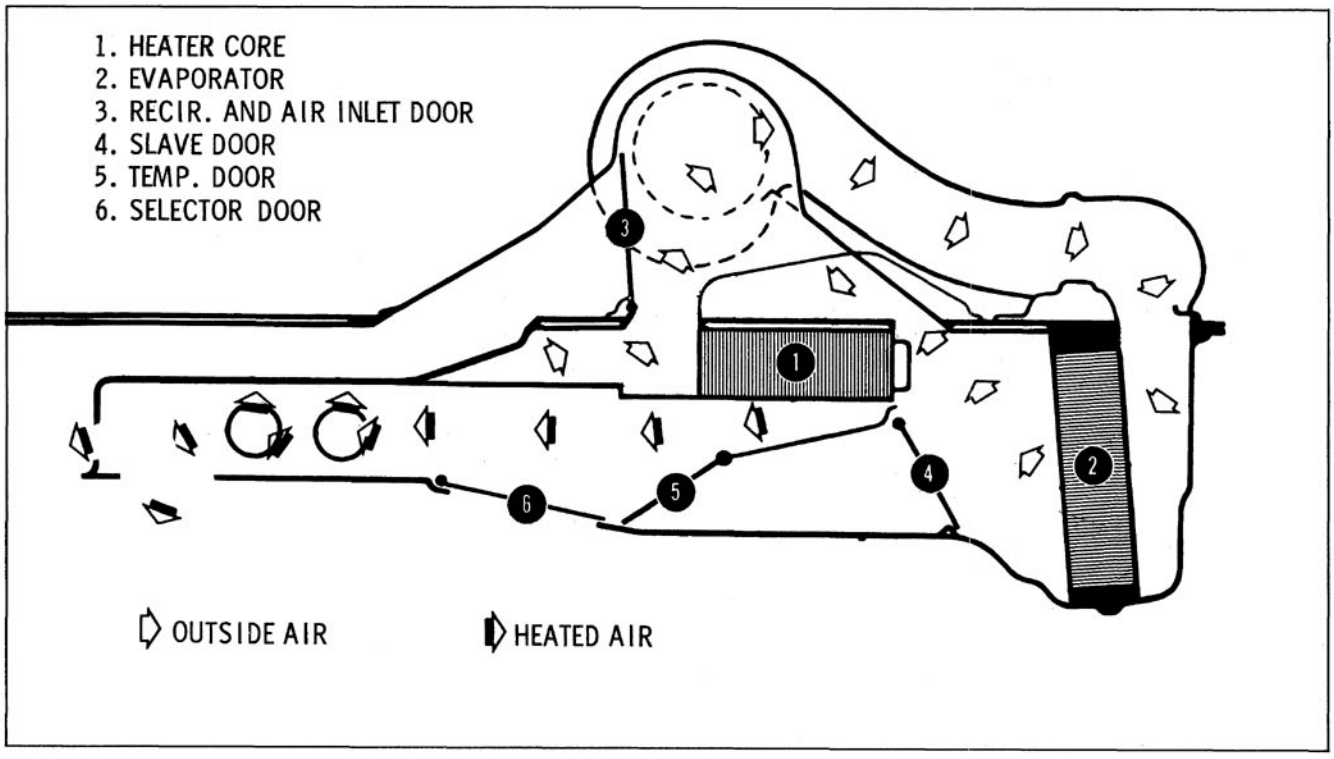


Fig. 14-53 A. C. Off - Heater On - Cold Weather

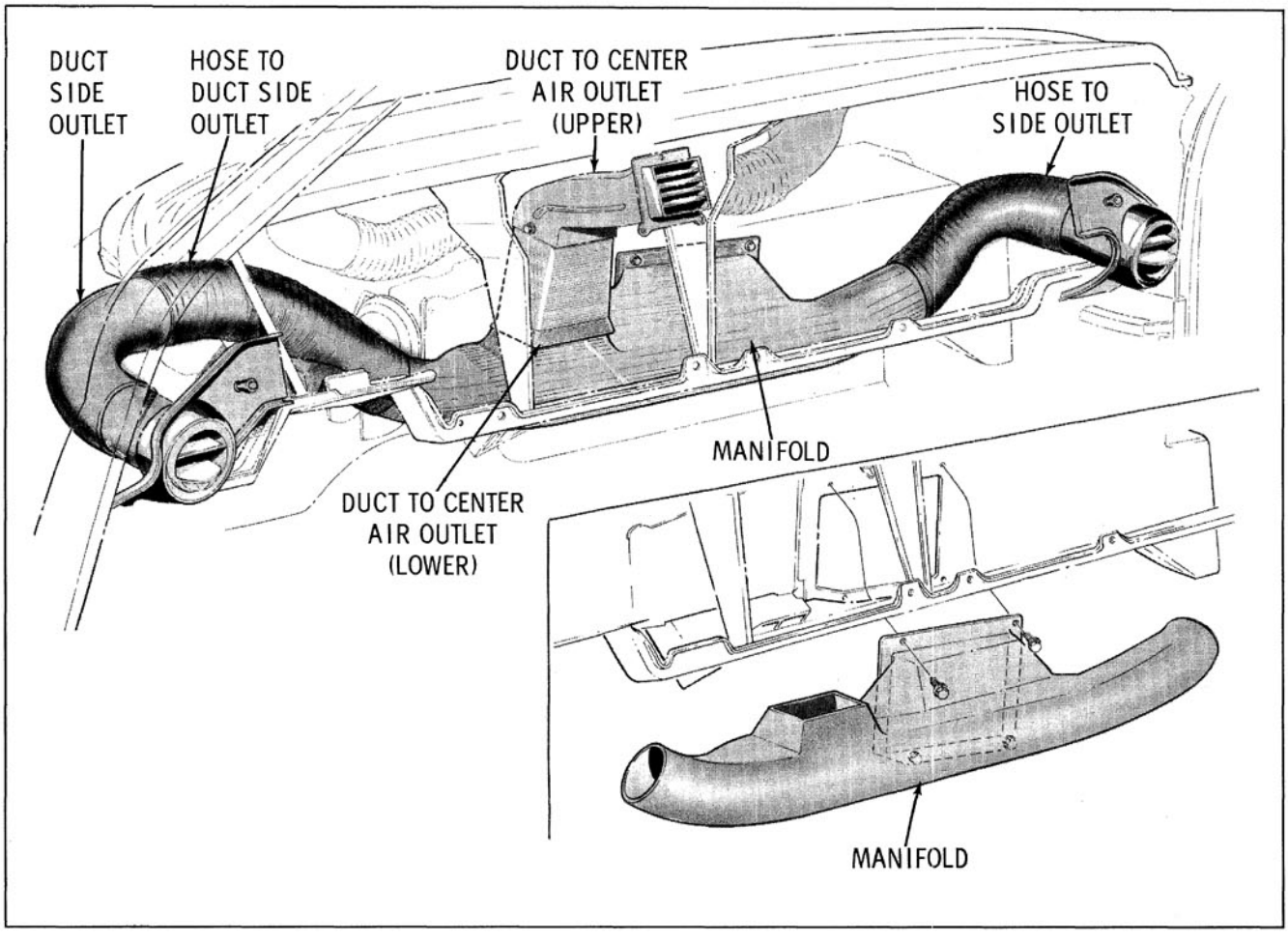


Fig. 14-54 Manifold and Duct Attachment (33 - 34 - 35 - 36 - 38 & 39 Series)

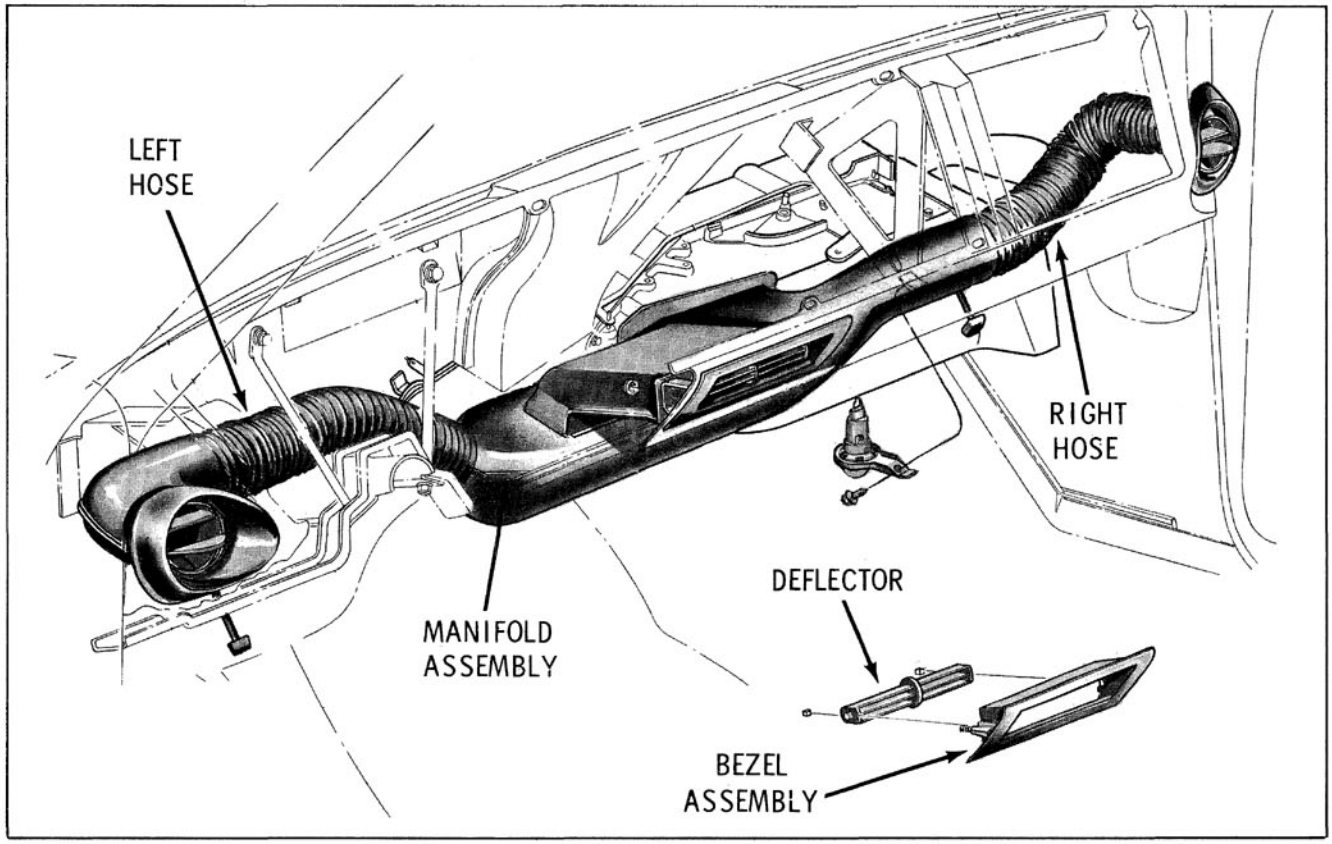


Fig. 14-55 Manifold and Duct Attachment (30 - 31 & 32 Series)

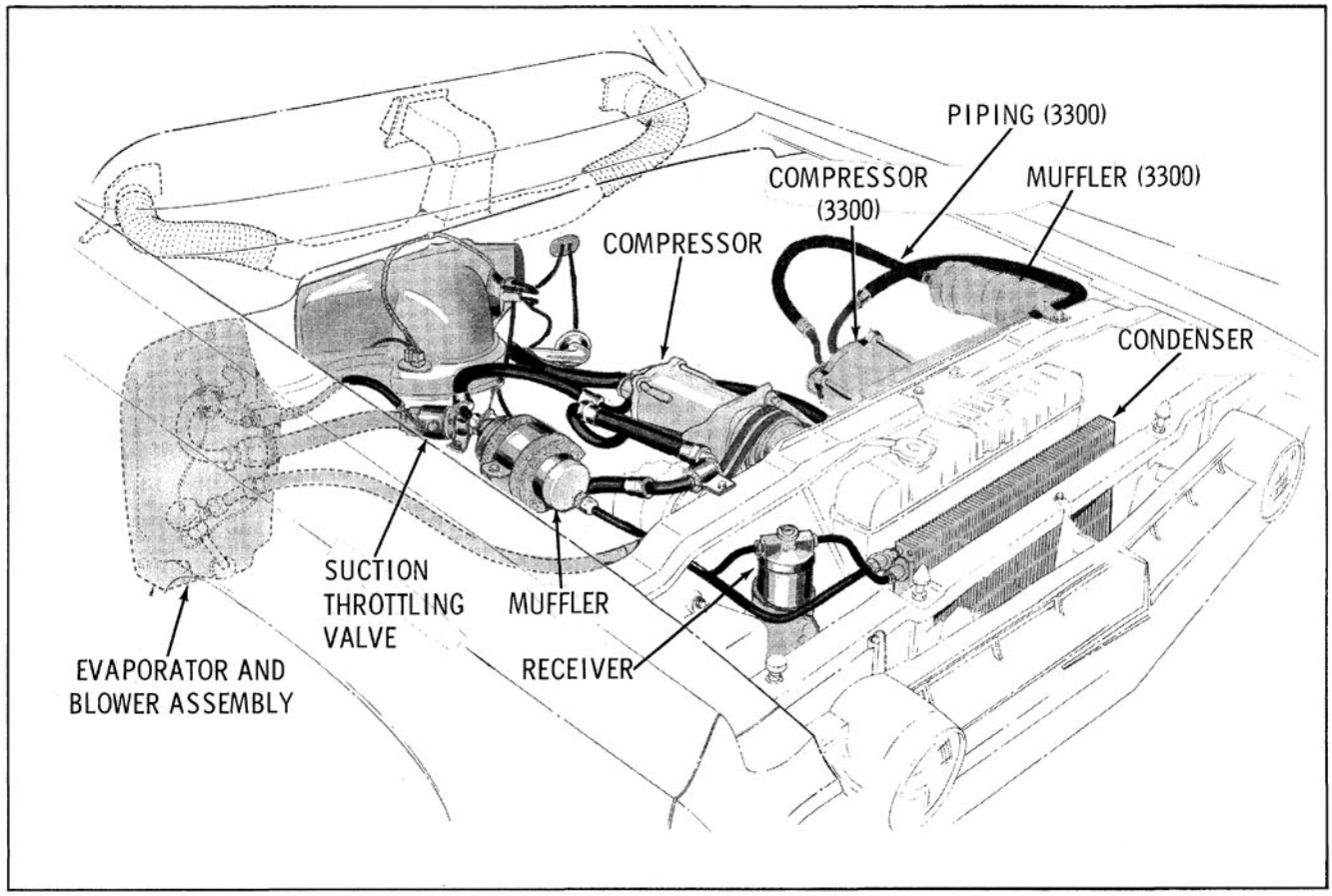


Fig. 14-56 A/C Layout (33 - 34 - 35 - 36 - 38 & 39 Series)

OPERATION OF SYSTEM

COMPRESSOR

The refrigeration system uses a recirculating axial type six cylinder compressor, with intake and discharge valve reeds for each cylinder. These valve reeds cause the compressor to have a definite separation between the discharge (high) side and the suction (low) side. Oil is picked up by the refrigerant in the compressor and is pumped through the refrigeration system. A magnetic operated clutch pulley permits the compressor to run only when refrigeration is desired. The compressor is completely serviceable.

A serial number plate is attached to the top side of the compressor and includes the Serial Number and Model Number.

IMPORTANT: ALWAYS INCLUDE BOTH SERIAL NO. AND MODEL NO. ON REPORTS.

PRESSURE RELIEF VALVE

The compressor is equipped with a pressure relief valve which is placed in the system as a safety factor. Under certain conditions, the refrigerant on the discharge side may exceed a safe operating pressure. To prevent damage, the valve is designed to open automatically at ap-approximately 440 psi. Any condition that causes this valve to open should be corrected, and the refrigerant oil and refrigerant should be replenished as necessary.

MUFFLER

Mufflers are used in the refrigerant system to reduce compressor noises and high pressure line vibrations. No repairs are to be made on the mufflers. If a muffler is defective, it should be replaced. Always install the mufflers with the outlet side down to prevent trapping refrigerant oil.

CONDENSER

The condenser assembly is made up of coils which carry the refrigerant, and cooling fins which provide rapid transfer of heat. The condenser is located in front of the engine cooling system radiator so that it receives a high volume of air from the movement of the car and from the engine fan. The air passing through the condenser cools the high pressure refrigerant vapor, causing it to condense into a liquid.

SIGHT GLASS

The sight glass (at the top of the dehydrator receiver) is provided to aid in diagnosis, by permitting the refrigerant to be observed. The appearance of a steady flow of bubbles or foam, after the compressor has run long enough to stabilize, indicates a shortage of refrigerant, when checking in temperatures above 75° F.

DEHYDRATOR RECEIVER ASSEMBLY

The functions of this unit are to absorb any moisture that may be present in the system after assembly, and to insure a solid charge of liquid refrigerant in the line feeding the expansion valve, providing the system is properly charged. This unit is not serviceable, and should be replaced when there has been a leak in the suction side of the system which permitted air and moisture to be drawn into the system.

EXPANSION VALVE (Fig. 14-57)

The expansion valve, mounted outside the evaporator, is an externally equalized valve, controlling the flow of refrigerant into the evaporator.

Spring force moves the valve toward the seat restricting refrigerant flow into the evaporator. A capillary tube filled with carbon dioxide provides the temperature regulation of the expansion valve. Carbon dioxide in the tube increases the pressure on the diaphragm when it senses an increase in temperature on the evaporator suction line. Movement of the diaphragm downward forces the operating pins to move the valve away from the seat allowing liquid refrigerant to enter the evaporator to maintain the desired temperature.

Equalizing pressure from the suction line is directed to the bottom side of the diaphragm and

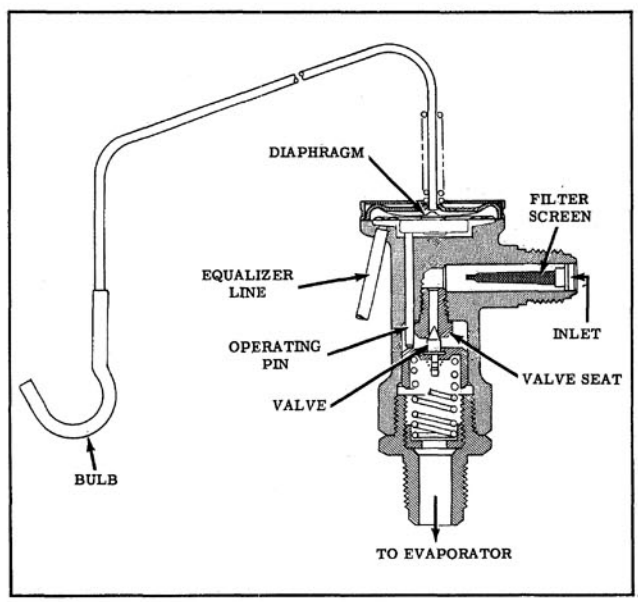


Fig. 14-57 Expansion Valve

assists the spring in opposing pressure on the top of the diaphragm, and acts as a further control on the flow of refrigerant into the evaporator.

NOTE: It is important that the expansion valve capillary bulb be tightly clamped to the suction line at the evaporator. Both the suction line and the capillary tube should be clean at the points of contact.

CAUTION: Do not kink capillary tubes when removing or installing.

EVAPORATOR

The evaporator is a device which cools and dehumidifies the air before it enters the car. High pressure liquid refrigerant flows through the expansion valve into the low pressure area of the evaporator. This regulated flow of refrigerant boils immediately. Heat from the evaporator core surface is lost to the boiling and vaporizing refrigerant, which is cooler than the core, thereby cooling the core. The heat in the air passing through the evaporator core loses its heat to the cooler surface of the core, thereby cooling the air. As the process of heat loss from the air to the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

SUCTION THROTTLING VALVE (Fig. 14-58)

The suction throttling valve limits the evaporator minimum pressure to prevent "freeze-up" of the evaporator coils.

The valve controls minimum evaporator pressure by throttling the flow of refrigerant through the suction line. The evaporator pressure is maintained by a balance of spring force, above the diaphragm, and evaporator pressure below the diaphragm.

The suction throttling valve should be adjusted to maintain a minimum evaporator pressure of 29.5 psi.

To insure return of oil to the compressor, an oil bleed line connects the bottom of the evaporator and the suction line to the suction throttling valve. A valve core, located in the equalizer line fitting, opens at 5 to 12 psi pressure difference allowing oil to return to the compressor.

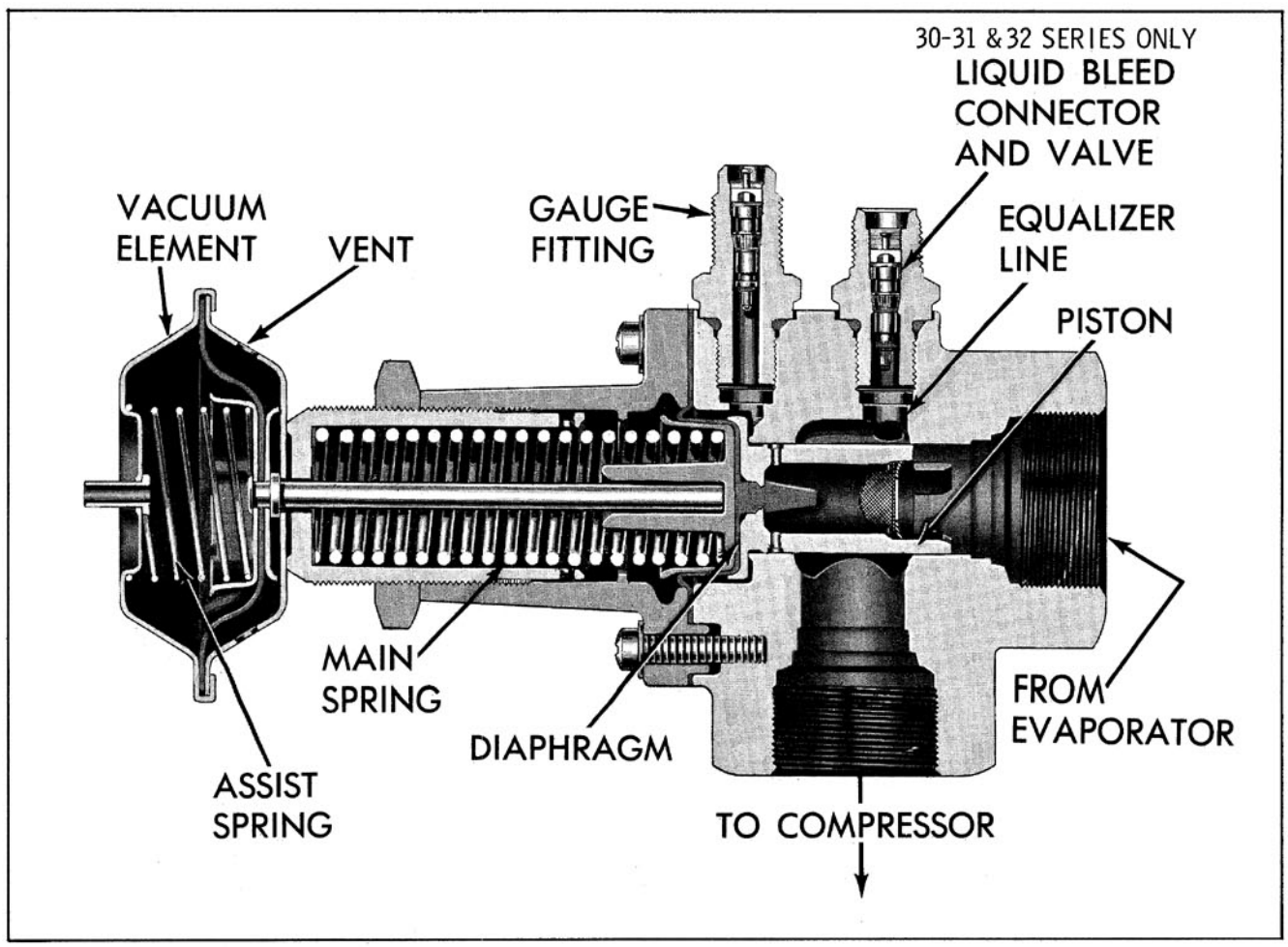


Fig. 14-58 Suction Throttling Valve

REFRIGERATION CIRCUIT (Fig. 14-59)

Heat laden, low pressure vapor refrigerant is drawn into the compressor and pumped from the compressor through the muffler to the condenser under high pressure. The vapor is heated as a result of the compression process. As it passes through the condenser, the high pressure - high temperature vapor is cooled, which causes the vapor to condense into liquid. The liquid refrigerant passes from the condenser into the dehydrator receiver which acts as a reservoir. The liquid in the receiver is still under high pressure.

Liquid refrigerant from the receiver now passes on to the expansion valve. The expansion valve meters refrigerant into the evaporator core. When the pressure in the evaporator is reduced, the liquid refrigerant immediately begins to boil at low temperature as it enters the evaporator. As the refrigerant passes through the evaporator, it continues to boil, absorbing heat from (and thereby cooling) the air passing through the evaporator core. By the time the refrigerant leaves the evaporator, it has completely vaporized and has warmed approximately 6°F.

Refrigerant returns from the evaporator through the suction pressure line to the compressor. When the evaporator pressure drops below 29.5 psi, the suction throttling valve restricts the flow of refrigerant to the compressor, thereby raising the evaporator pressure to prevent freezing of the core.

SAFETY PRECAUTIONS

Do Not Leave Refrigerant Drum Uncapped

All refrigerant drums have a metal screw cap. This cap protects the valve and safety plug from damage; therefore, the protective cap should always be replaced when the drum in not in use.

Do Not Subject Drum to High Temperature

The drum should not be exposed to the radiant heat of the sun, for the resulting increase in pressure may cause the safety plug on the drum to burst.

The refrigerant drum should never be subjected to excessive temperature when charging a system. The drum should be heated for charging purposes by placing in 125°F. water. Never heat above 125°F. or use a blow torch, radiator, or stove to heat the drum.

Do Not Weld or Steam Clean On or Near the System

Welding or steam cleaning of, or near, any of the refrigerant lines or components of the refrigerant system can build up dangerous pressures in the system.

Do Not Fill the Drum Completely

When filling a small drum from the larger one, always allow space above the liquid for expansion. If the drum were completely filled and the temperature increased, tremendous hydraulic force would develop.

Do Not Discharge Vapor Into Area Having Exposed Flame

Large quantities of refrigerant 12 should not be discharged into a closed room. The refrigerant may displace the oxygen in the air. Also, heavy concentrations of refrigerant 12 in contact with a live flame, such as a gas heater, or drawn into the intake of a running engine will produce a poisonous gas. This gas will also tarnish all bright metal surfaces.

Do Not Expose Eyes to Refrigerant

One of the most important precautions is protection of the eyes when handling refrigerant. Any liquid refrigerant which may accidentally escape is approximately 21.7°F. below zero. If any refrigerant comes in contact with the eyes, serious injury could result. Always wear goggles to protect the eyes when handling refrigerant.

If refrigerant should come in contact with the eyes:

1. DO NOT rub the eyes. Splash the eyes with cold water to gradually get the temperature above the freezing point.
2. Apply a protective film of an antiseptic oil over the eye ball to reduce the possibility of infection.
3. Consult a doctor or an eye specialist immediately.

Should liquid refrigerant come in contact with the skin, the injury should be treated the same as though the skin had been frostbitten or frozen.

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation of the air conditioning refrigeration system is dependent on the pressure-temperature relationship of pure refrigerant. As long as the system contains only pure

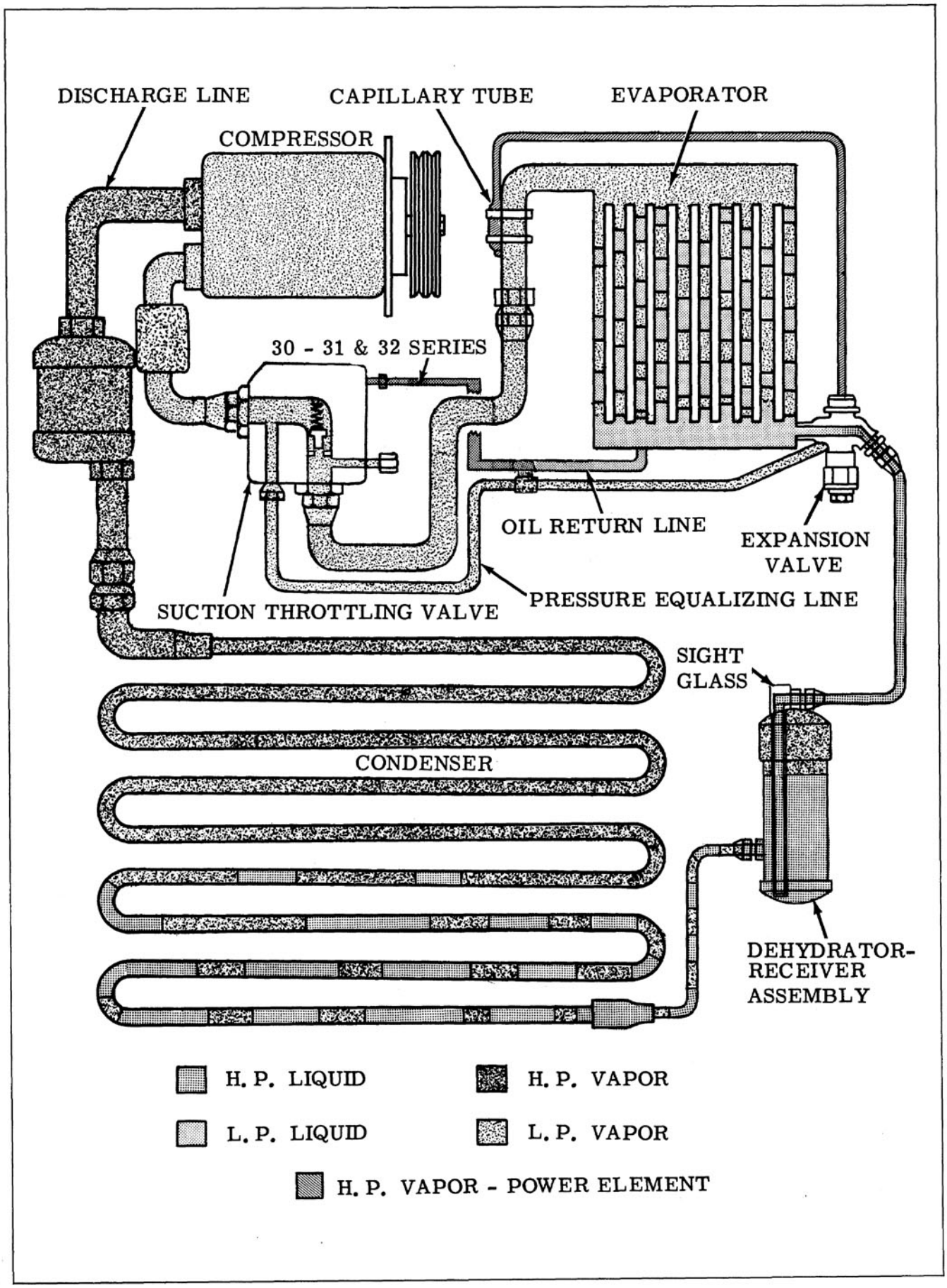


Fig. 14-59 Refrigeration Circuit

refrigerant (plus a specified amount of compressor oil which mixes with the refrigerant), it is considered to be chemically stable.

When foreign materials, such as dirt, air or moisture are allowed to get into the system, they will affect chemical stability, resulting in the formation of acids or sludge which could cause the expansion valve to freeze up, and change the pressure-temperature relationship of the refrigerant. Thus, the system will no longer operate at the proper pressures and temperatures, and the efficiency will decrease and parts deteriorate.

The following general practices should be observed to insure chemical stability in the system:

Keep Lines Sealed

When disconnecting refrigerant lines, the lines should be at, near or above surrounding room temperature to prevent formation of condensation inside the lines. The lines should also be immediately capped to prevent entrance of dirt or foreign material.

Keep Tools Clean

Tools should be kept clean and dry. This includes the gauge set and replacement parts. Keep gauge lines plugged when not in use.

Use Clean Dry Oil Container

When adding oil to compressor, the container should be exceptionally clean and dry due to the fact that refrigeration oil is as moisture-free as possible; therefore, it will quickly absorb any moisture with which it comes in contact.

Keep Oil Container Capped

The oil container should not be opened until ready for use and should be capped immediately after use to reduce the possibility of the oil absorbing moisture and dirt entering the container.

Do Not Keep System Open Longer Than Five Minutes

PRECAUTION IN HANDLING LINES

All line connections use "O" rings for sealing. Replacement lines must be checked to see if they are completely sealed and dehydrated. Refrigerant lines must be free of kinks which would restrict the flow of refrigerant and cause noise.

Insulated clamps are used to reduce vibration and it is important to reinstall all the clamps when a line is replaced. Tightening connections is very important and the proper size wrenches should be used. The opposing fitting should always be held with a wrench to prevent distortion of connecting lines or components. This is especially important in tightening a hose connection as twisting a hose stiffens it and permits it to transmit more vibration. ALWAYS USE TWO WRENCHES WHEN TIGHTENING OR LOOSENING LINE FITTINGS. "O" rings should be coated with refrigeration oil and installed on the line before the line is inserted into the fitting, to prevent damaging the "O" ring. If leaks are encountered at couplings or connectors, no attempt should be made to correct the leaks by tightening the connections beyond the recommended torque. The "O" rings are designed to seal at the specified torque and over-tightening the connection does not result in a satisfactory permanently sealed connection. The connection must be disassembled and the cause of the leak (damaged "O" ring, defective pipes, etc.) corrected. Torque "O" ring fittings as outlined in chart. Refer to Figs. 14-61 and 14-62 for "O" ring location.

TORQUE IN FT. LBS.

TUBE OD	SWIVEL NUT ON STEEL TUBE	SWIVEL NUT ON ALUMINUM TUBE
1/4"	10 to 15	5 to 7
3/8"	30 to 35	11 to 13
1/2"	30 to 35	15 to 20
5/8"	30 to 35	21 to 27
3/4"	30 to 35	28 to 33
For steel to aluminum connections, use the aluminum torque specifications.		

CAUTION: ALWAYS WEAR SAFETY GOGGLES WHEN OPENING REFRIGERANT LINES.

In the event any line is opened to atmosphere, it should be IMMEDIATELY capped to prevent entrance of moisture and dirt.

SPECIAL EQUIPMENT

REFRIGERATION GAUGE SET (Fig. 14-63)

The gauge set is used when discharging, evacuating, charging, or diagnosing trouble in the system. The low pressure gauge is graduated into pounds of pressure from 0 to 100 and in the opposite direction in inches of vacuum from 0 to

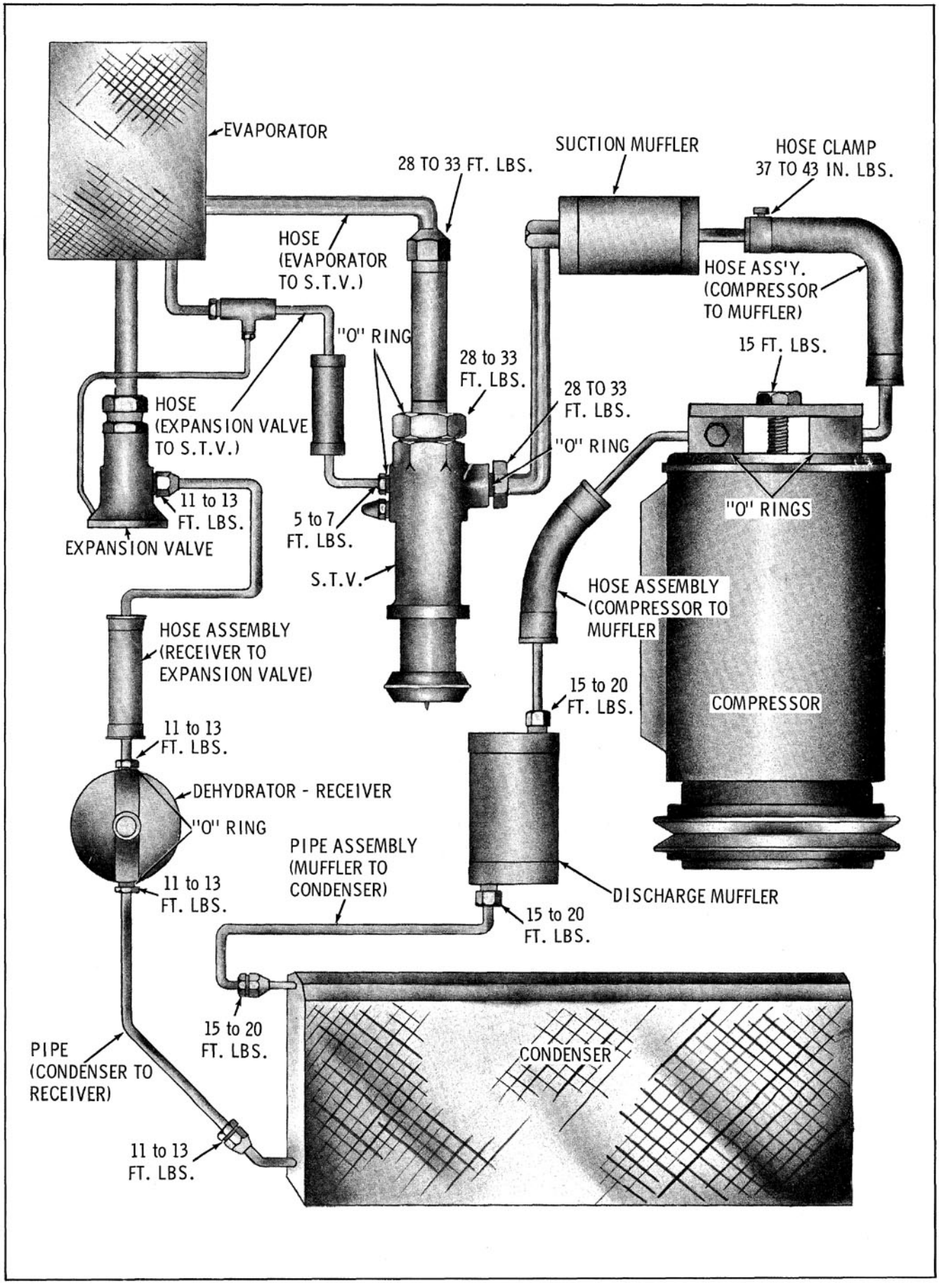


Fig. 14-60 A. C. Identification (33 - 34 - 35 - 36 - 38 & 39 Series)

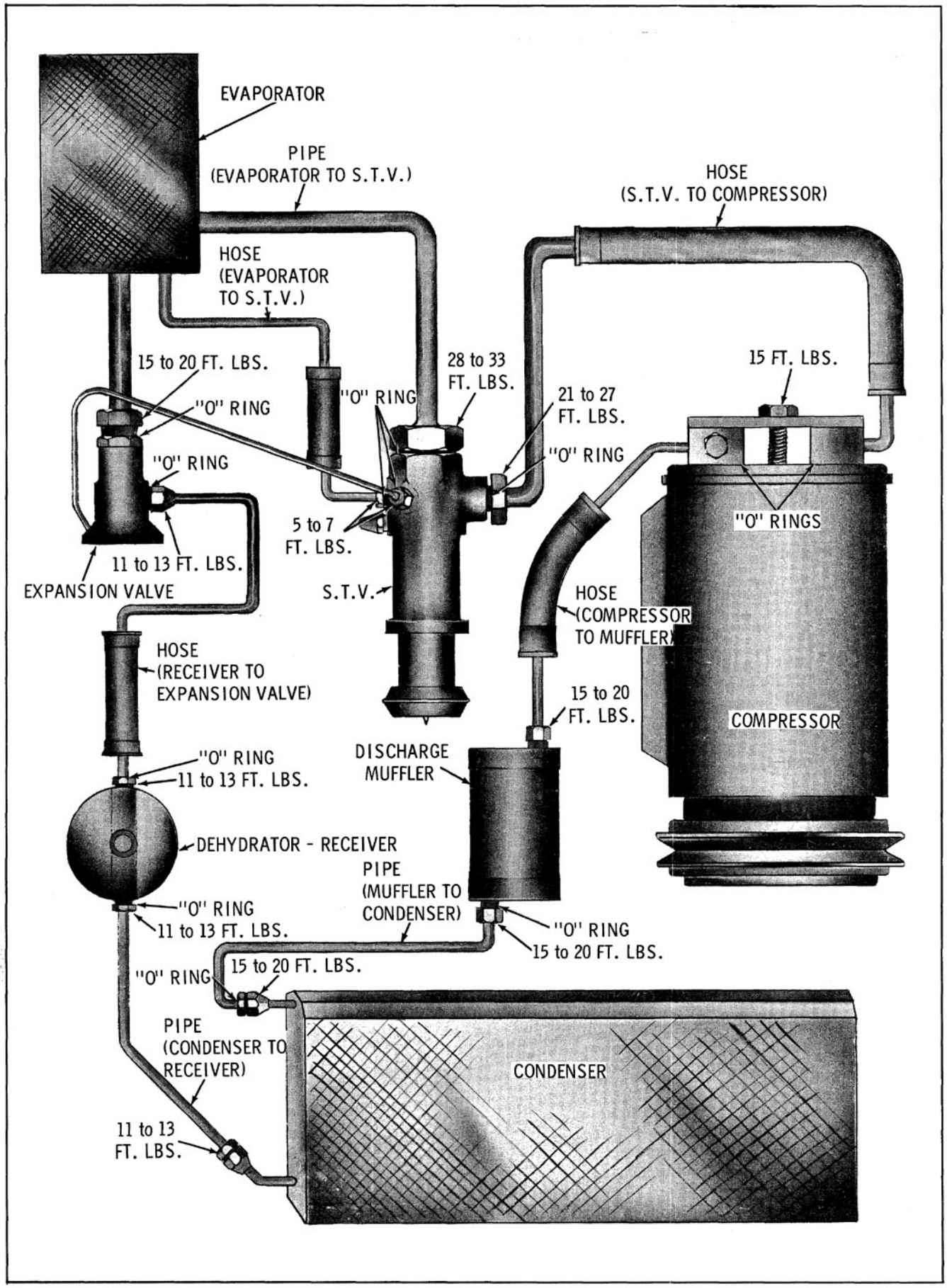


Fig. 14-61 A. C. Identification (30 - 31 & 32 Series)

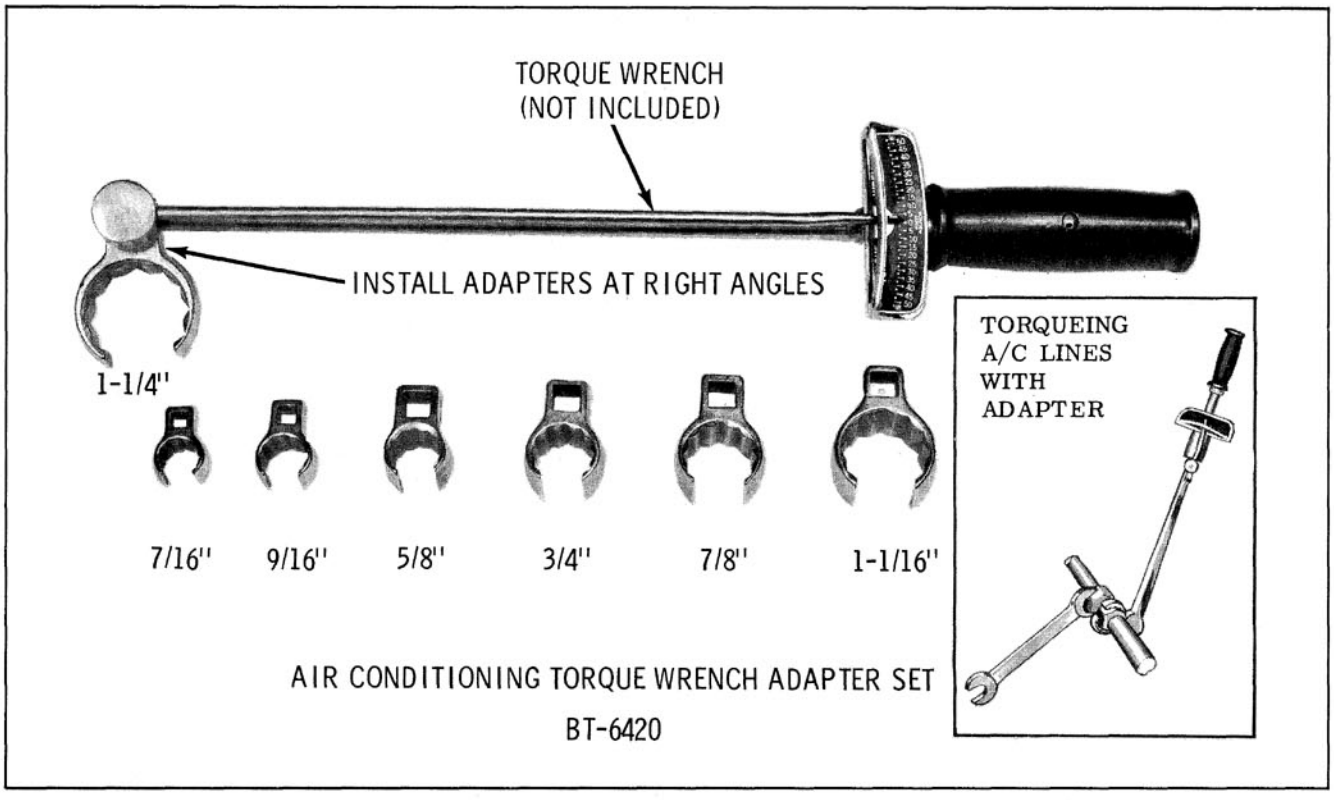


Fig. 14-62 Torque Wrench Adapter Set

30. The high pressure gauge is graduated from 0 to 300 pounds pressure. The center connection is common to both and is for the purpose of attaching a line for adding refrigerant or evacuating the system. When this connection is not required, it should be capped with a flare nut and cap.

The shut-off valves close each opening to the connector and to each other. They DO NOT open or close off pressure to the gauges.

LEAK DETECTOR J-6084

Leak Detector J-6084 is a gas operated torch type leak detector using a replaceable cylinder. It can also be used as a blowtorch by replacing the leak detector burner unit with Utility Torch Unit J-6085.

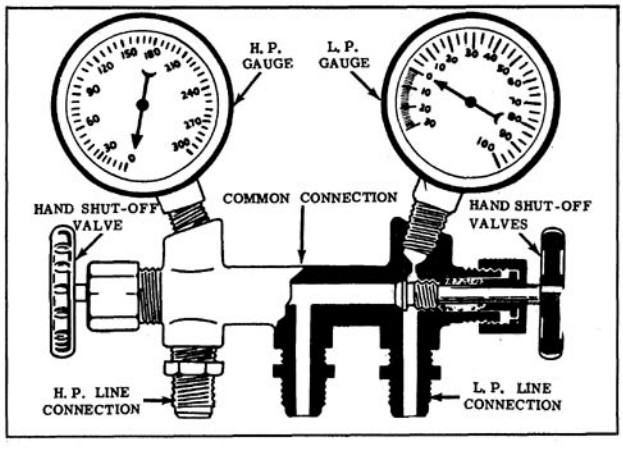


Fig. 14-63 Gauge Set

Assembling Unit

1. Remove dust cap from cylinder.
2. Close valve knob on detector unit.
3. Thread detector unit onto top of fuel cylinder. Tighten finger tight.

   NOTE: Do not use tool or wrench to tighten.
4. Attach search hose assembly to detector unit.

Lighting Detector J-6084

1. Open control valve until slight hiss of gas is heard, then light gas at opening in chimney.

   CAUTION: Do not use lighted detector in any place where combustible or explosive gases, dusts or vapors may be present.
2. Adjust the flame until the desired volume is obtained. A pale blue flame approximately 3/8" above the reaction plate is best for detecting leaks.

   NOTE: The reaction plate will be heated to a cherry red.

Correction For Yellow Flame

If the flame is yellow, insufficient air is being inspirated or the reaction plate is dirty. Insufficient air may be caused by:

1. Obstructed or partially collapsed suction tube.
2. Dirt or foreign substance in burner tube.
3. Dirty or partially clogged orifice.

Blowing air through the suction tube and back through the detector will usually clear dirt or foreign matter. If a yellow flame is caused by dirty reaction plate, allow the flame to burn for several minutes. This will usually burn the plate clean. If an oxide film appears on the reaction plate from continued use, it will reduce the sensitivity of the detector. This may be remedied by removing the plate and scraping the surface gently with a knife.

To Clean Orifice

1. Never attempt to clean orifice by passing anything through the hole.
2. Unscrew burner assembly from burner tube by applying wrench to hexagon part located immediately below search hose connection. Turn to left. This will expose orifice block which is inserted into the end of the tube.
3. Remove orifice block from tube.
4. Reverse orifice block and replace against burner tube; screw burner head onto burner tube (hand tight), then open valve quickly, admitting several short blasts.
5. To reassemble: unscrew burner head, insert orifice block into burner tube, and screw burner head onto burner tube with a wrench to form a gas-tight joint.

CHECKING FOR REFRIGERANT LEAKS

After the leak detector flame is adjusted, check for refrigerant leaks in an area having a minimum amount of air flow in the following manner:

Explore for leaks by moving end of hose or sampling tube around all connections and points where a leak may be. Check around bottom of connections, since Refrigerant-12 is heavier than air and will, therefore, be more apparent at bottom of fitting.

The color of the flame will turn to a yellow-green when a small leak is detected. Large leaks will be indicated by a change in color to brilliant blue or purple. When the suction hose is moved away from the leak the flame will clear to an almost colorless pale blue again.

CAUTION: Do not breathe the fumes and black smoke that are produced if the leak is a big one. They are poisonous! Any time an open flame is used near a car there is a certain amount of danger. Although the torch flame is small and well protected, it is recommended that a fire extinguisher be close at hand for any emergency that might arise.

LEAK DETECTOR (LIQUID)

There are a number of fittings and places throughout the air conditioning unit where leak detector solution (Part No. 564255) may be used to pinpoint leaks.

Apply the solution to the suspected area with a swab that is attached to the bottle cap. Bubbles will form within seconds if there is a large leak.

VACUUM PUMP

If a leaking system has been operated in a discharged condition, the receiver dehydrator assembly should be replaced and a vacuum pump used to thoroughly evacuate the system.

SERVICING OF INDIVIDUAL UNITS (NOT IN REFRIGERANT SYSTEM)

The following services and repairs concern parts of the air conditioning system which can be serviced without opening the refrigerant system.

COMPRESSOR BELT ADJUSTMENT

Tool 33-70M is used to check the compressor belt tension.

If belts require adjustment:

1. Loosen the Delcotron bracket bolt and link.
2. Pivot the Delcotron until the correct belt tension is obtained.
3. Tighten the Delcotron bracket bolt and adjusting link.
4. Check the other belt, if it is outside the gauge limits, replace both belts as a matched set.

SIDE OUTLETS

Adjustment (Fig. 14-64 & 14-65)

Nozzles should be free to rotate but tight enough to remain in a set position. If the tension is insufficient:

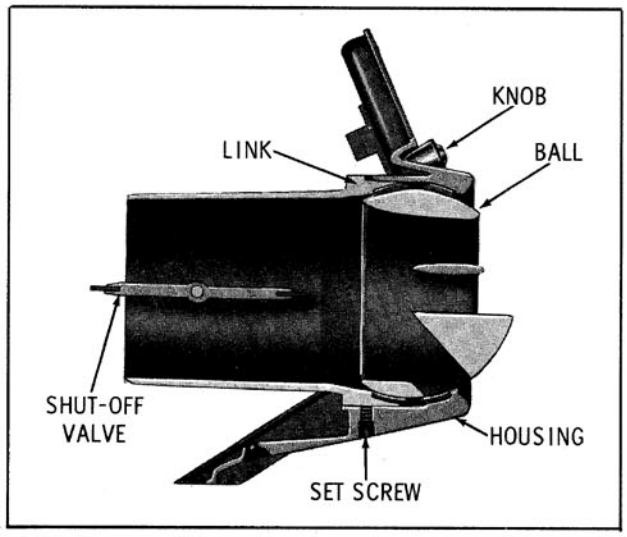


Fig. 14-64 Side Air Outlet

1. Loosen set screw at bottom through opening in housing or loosen screw at side of retainer on 30, 31 and 32 Series.
2. Push in retainer to tighten or pull out to loosen ball adjustment.
3. Tighten set screw.

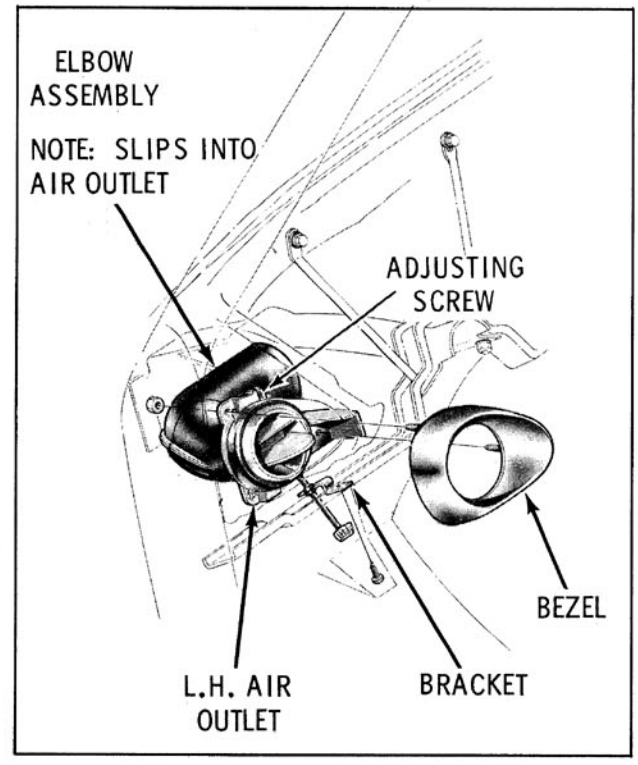


Fig. 14-65 Side Air Outlet Adjustment

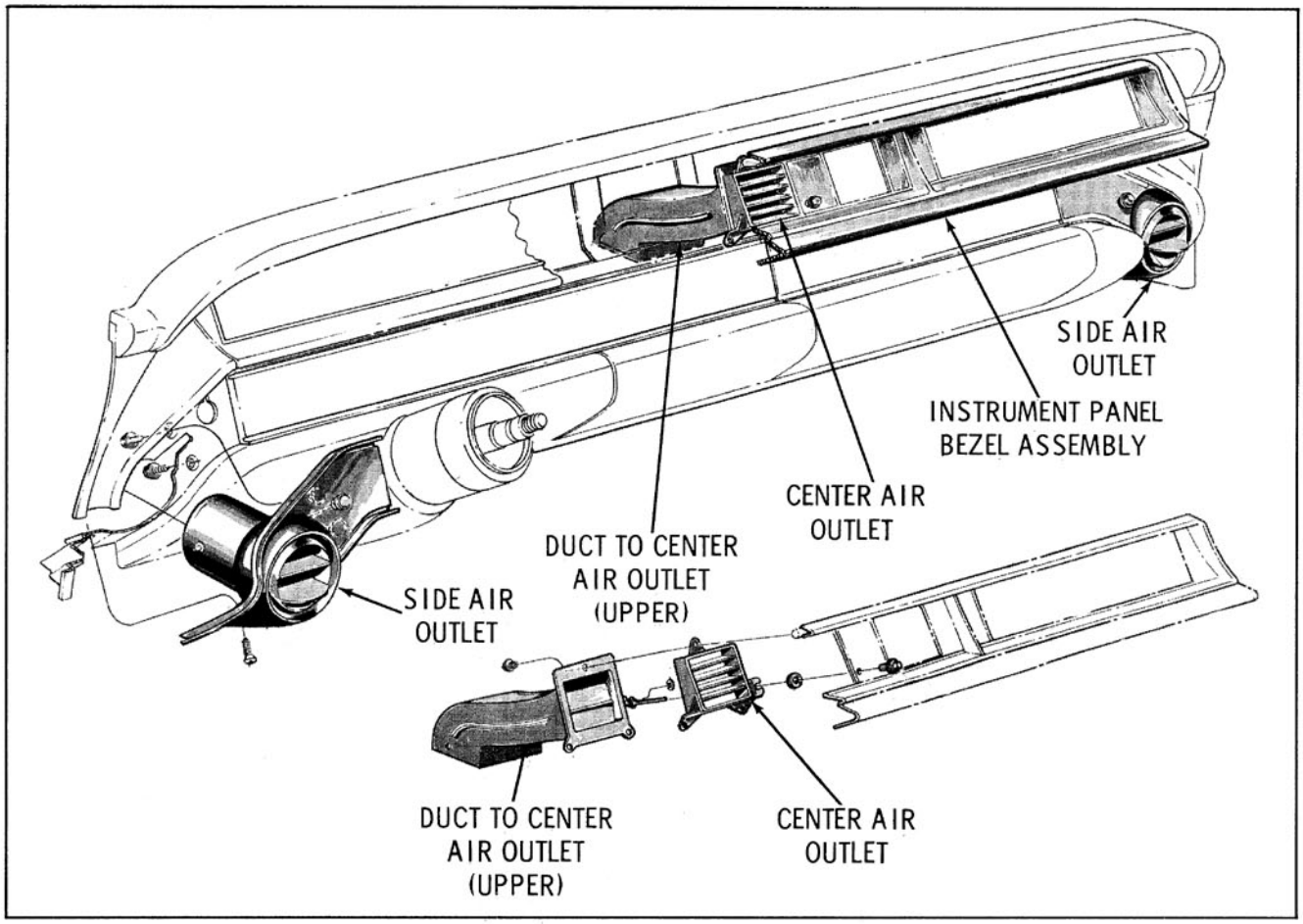


Fig. 14-66 Air Outlets and Controls (33 - 34 - 35 - 36 - 38 & 39 Series)

AIR OUTLETS

The air outlets are installed as shown in Figs. 14-66 and 14-67.

COMPRESSOR CLUTCH SWITCH

Adjustment

33, 34, 35, 36, 38 & 39 Series

The compressor clutch switch is actuated by the temperature lever in the control assembly. The switch should open when the lever is moved 2/3 of the way from the extreme left position. If necessary to adjust, loosen the two attaching screws and rotate switch into correct position. Tighten screws.

30, 31 & 32 Series

Two compressor clutch switches are mounted on the heater case. One of the switches is operated by the selector door. The other switch is operated by the temperature door.

Selector Door Switch

Loosen the switch attaching screws and rotate the switch so the switch closes when the A/C control lever is moved from the OFF to NORMAL position without excessive overtravel of the switch. Tighten the switch attaching screws.

Temperature Door Cam Switch

1. Check temperature door cable for proper adjustment.
2. Move the temperature lever 2/3 of the way from the COOL position.
3. Loosen switch attaching screws and rotate switch so that switch just opens. Tighten attaching screws.

CONTROL ASSEMBLY

The control assembly mounted in the instrument panel is attached as shown in Figs. 14-68 and 14-69.

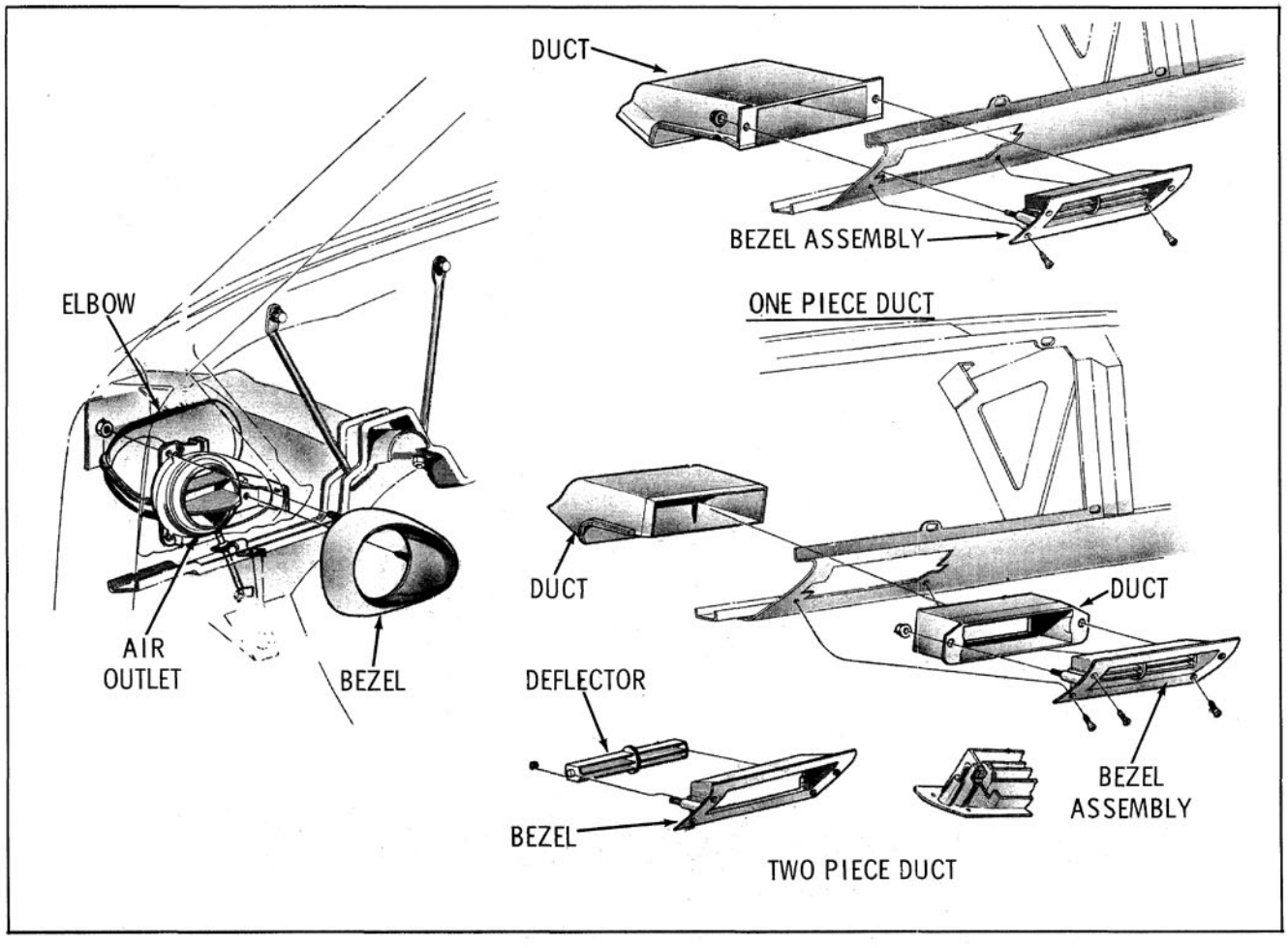


Fig. 14-67 Air Outlets and Controls (30 - 31 & 32 Series)

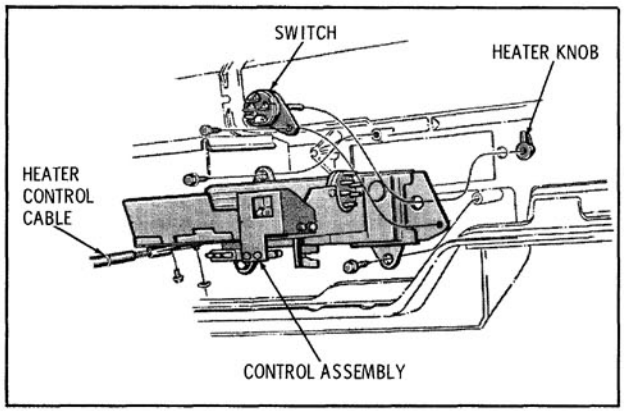


Fig. 14-68 A. C. Control Attachment (33 - 34 - 35 - 36 - 38 & 39 Series)

BLOWER MOTOR

The blower motor or duct assembly is attached as shown in Figs. 14-70 and 14-71.

BLOWER MOTOR RESISTOR

The blower motor resistor is mounted on the blower duct and can be removed by removing the two attaching screws. Figs. 14-70 and 14-71.

HEATER CASE ASSEMBLY

The heater case assembly is installed as shown in Figs. 14-72 and 14-73. The heater core can be removed after removing the heater case assembly.

VACUUM DIAPHRAGMS

Vacuum diaphragms are used to operate the air inlet and recirculate door on all series and also operate the defroster door and selector door on the 33, 34, 35, 36, 38 and 39 series. The air inlet and recirculate door diaphragm is a two-step diaphragm. When the A/C control is set for RECIR, vacuum is applied to the upper port and the door opens a predetermined distance allowing 20% outside air and 80% inside air to be drawn through the evaporator. When the A/C control is set for NORMAL, vacuum is applied to both ports and 100% outside air is drawn through the evaporator.

ADJUSTMENTS

Recirculating Air Door

To adjust the recirculating air door the blower duct assembly must be removed from the car.

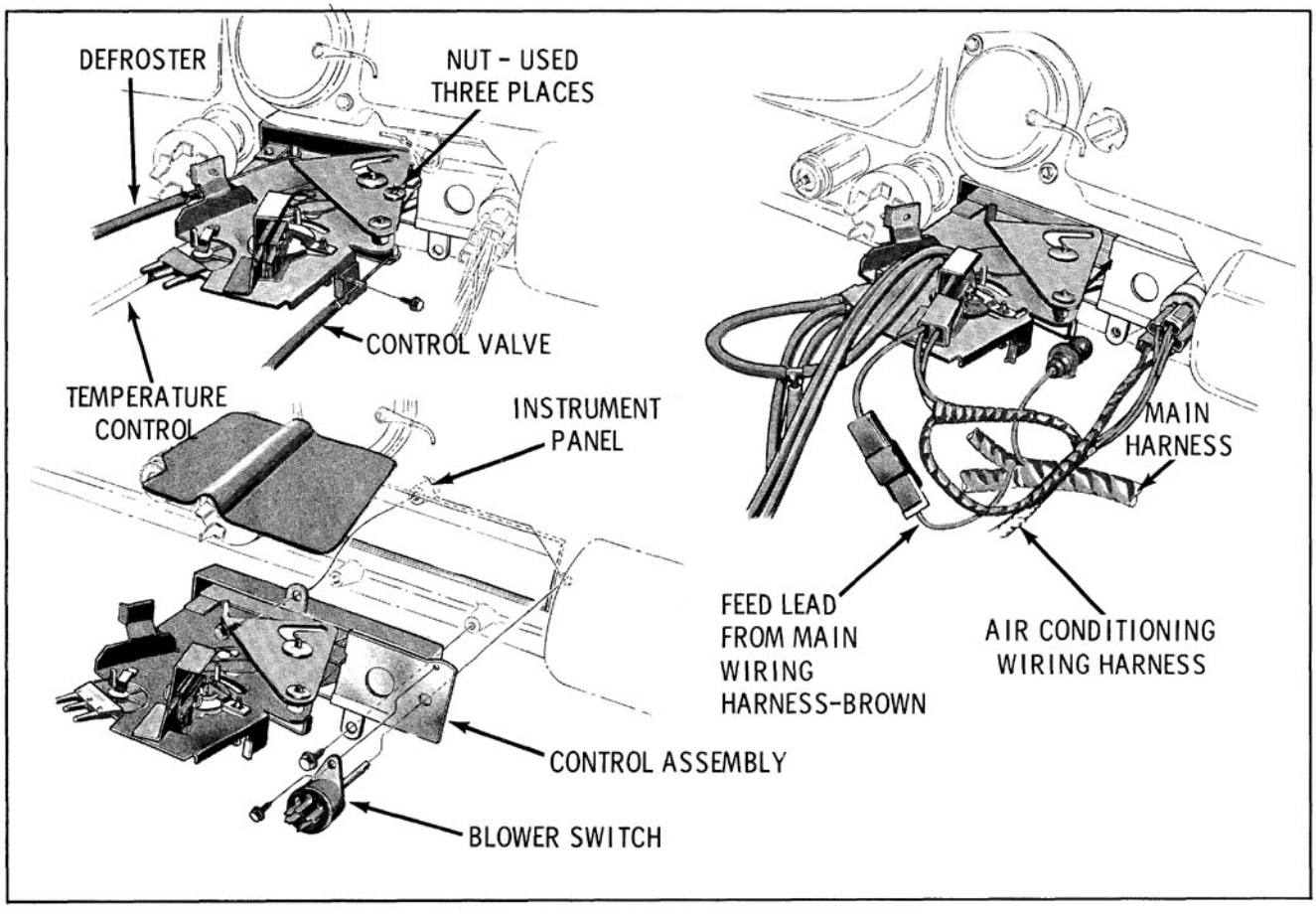


Fig. 14-69 A. C. Control Attachment (30 - 31 & 32 Series)

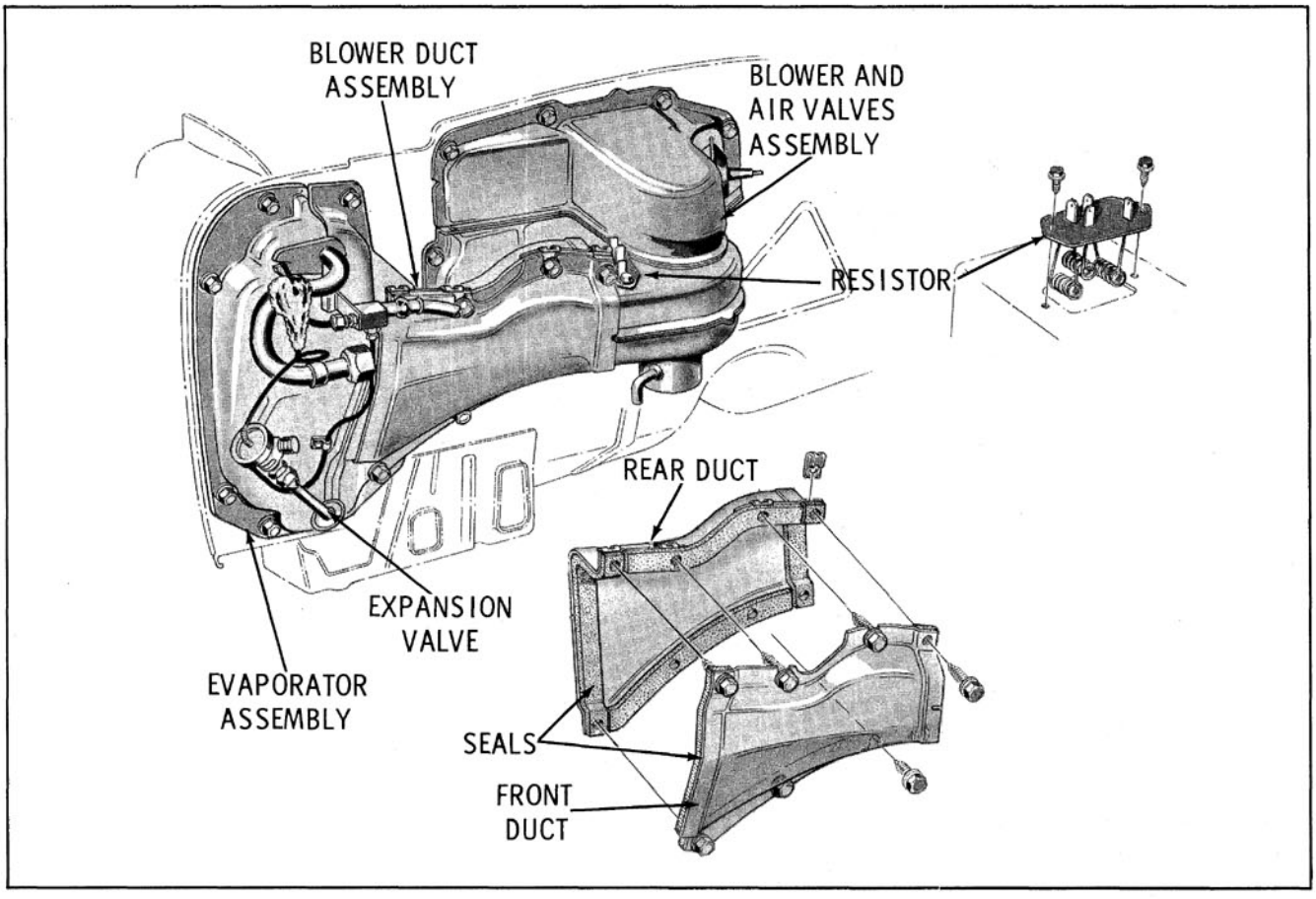


Fig. 14-70 Blower Duct Assembly (33 - 34 - 35 - 36 - 38 & 39 Series)

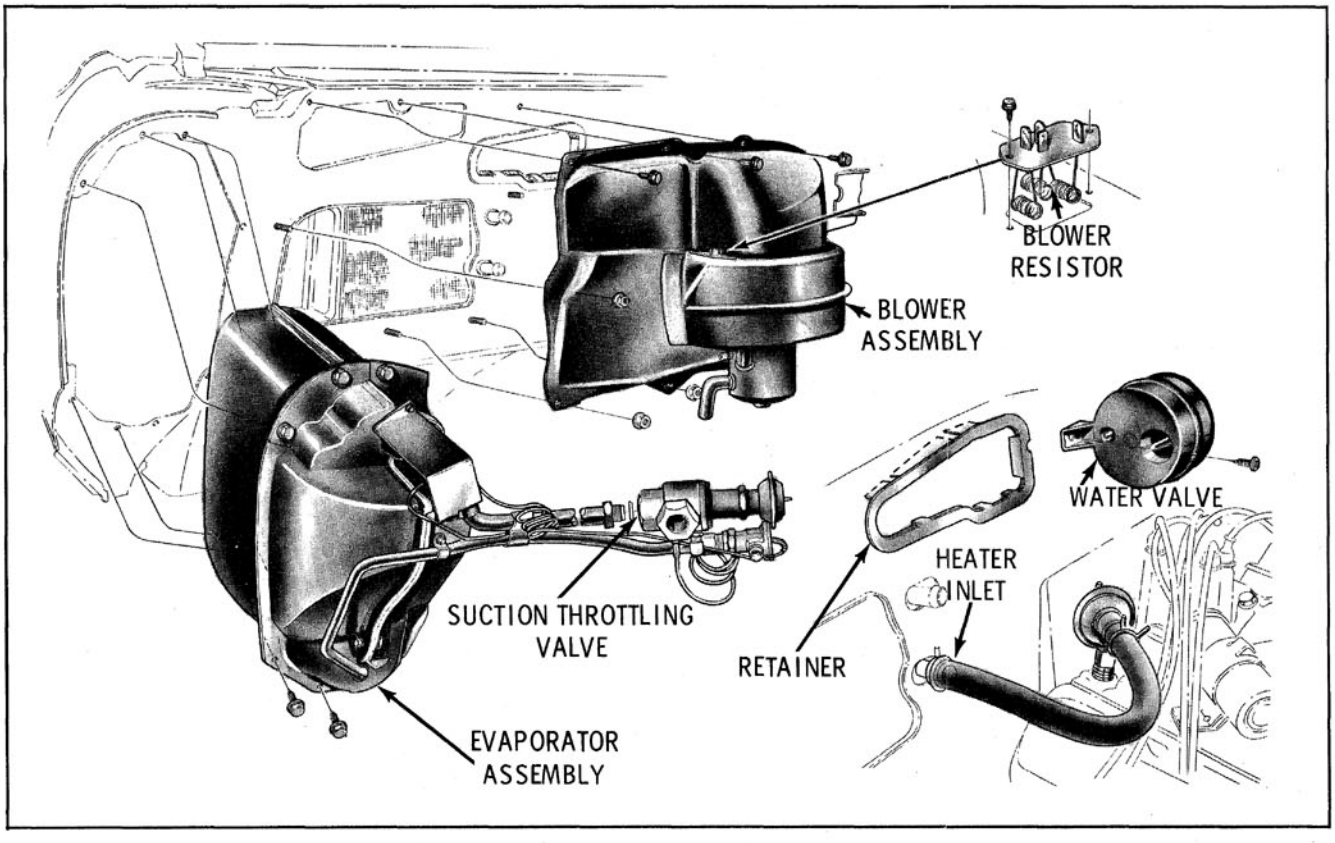


Fig. 14-71 Blower Duct Assembly (30 - 31 & 32 Series)

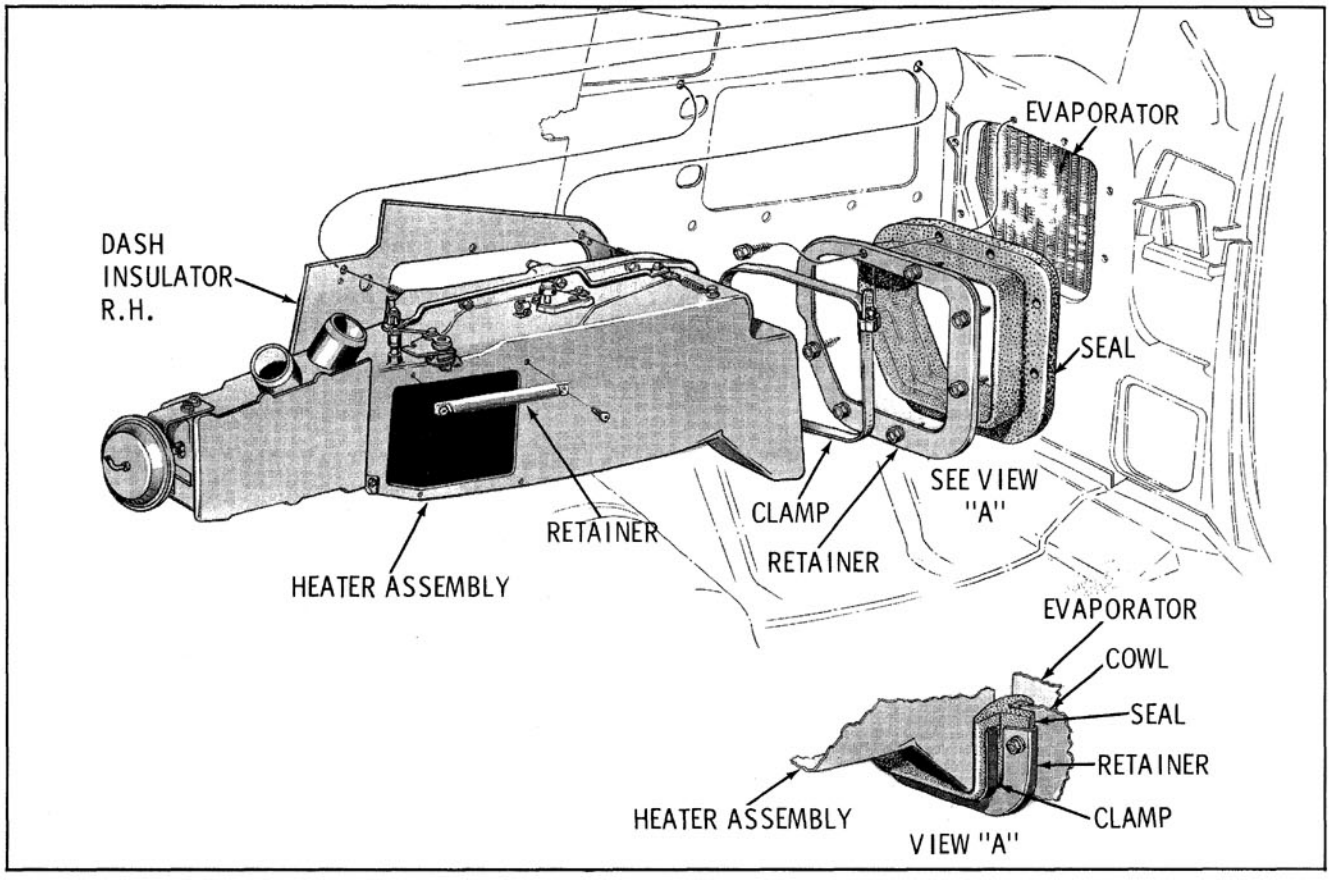


Fig. 14-72 Heater Case Assembly (33 - 34 - 35 - 36 - 38 & 39 Series)

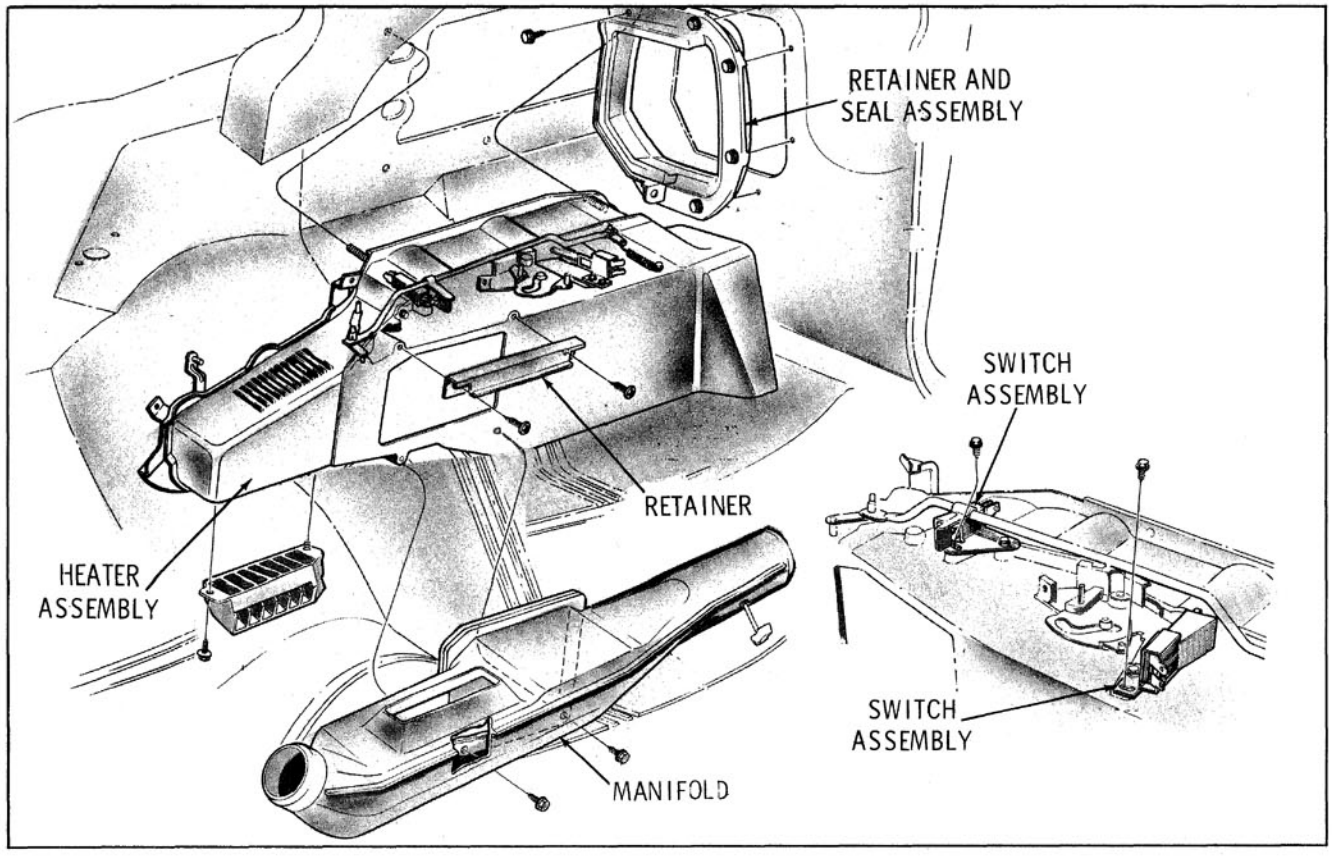


Fig. 14-73 Heater Case Assembly (30 - 31 & 32 Series)

1. With vacuum applied to the upper port, the recirculating air door should be opened 3/16" on 33, 34, 35, 36, 38 and 39 series and 11/32" on 30, 31 and 33 series. (Fig. 14-74)

2. If necessary to adjust, loosen the set screw on the diaphragm link and move link until proper adjustment is obtained.

3. Recheck adjustment.

Selector Door

The selector door diaphragm is located inside the heater case. To remove the diaphragm the heater case must be removed.

1. Remove the metal plug at the bottom of the heater case.

2. Loosen the set screw on the diaphragm link to allow the spring to fully close the door.

3. Tighten set screw and install plug into heater case.

Defroster Door

1. With vacuum applied to the defroster diaphragm, loosen the set screw on the diaphragm arm.

2. Remove heater outlet. Pull defroster door down until it contacts the rubber stop, then tighten set screw.

3. Install heater outlet.

Control Cables

Cables are used to operate the temperature door on all series and are also used to operate the defroster and selector doors on the 30, 31 and 32 series.

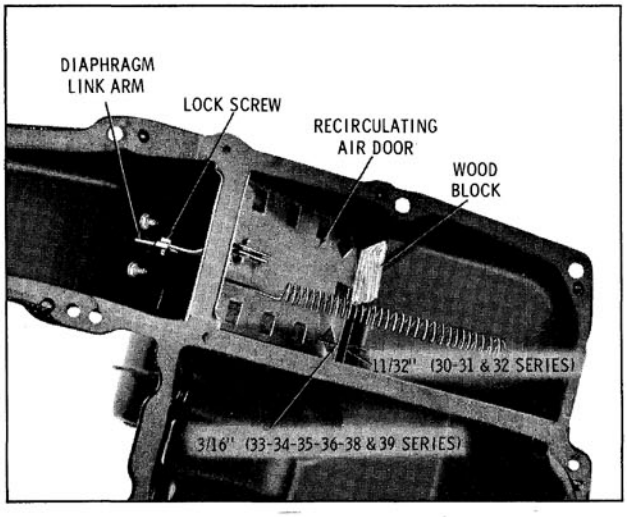


Fig. 14-74 Recirculating Air Door Adjustment

ADJUSTMENTS

Temperature Cable

1. Disconnect cable at cam on heater case.

2. Loosen cam attaching screws.

3. While holding the upper half of the cam to the extreme left position, move the lower half until a 3/16" pin can be inserted into the gauge holes. (Fig. 14-75)

4. Tighten the cam attaching screws.

5. Adjust control cable until the temperature lever is 1/8" from the extreme left position.

Defroster Cable 30-31 & 32 Series

1. Set HEAT control lever in the OFF position.

2. Loosen the cable attaching screw.

3. While holding the defroster door in the closed position, (all of the air coming out of the heater outlet), tighten the cable attaching screw.

Selector Door Cable 30-31 & 32 Series

1. Set the A/C control in the RECIR or NORMAL position.

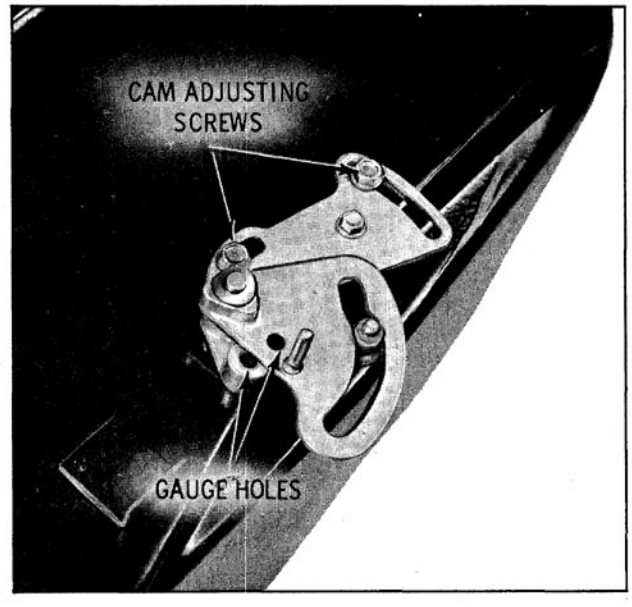


Fig. 14-75 Cam Adjustment

2. Loosen the cable attaching screw.

3. Hold the selector door fully open and tighten the cable attaching screw.

CLUTCH, PULLEY, AND COIL

The following procedures can be performed with the compressor either on or off the car. When working with the compressor on the car, the compressor should be disconnected from the mounting bracket and tipped upward to provide adequate working clearance.

DRIVEN PLATE

Removal

1. Using a thin wall socket, remove the locknut from the compressor shaft. Use Tool J-972-A to hold driven plate.

2. Install Puller J-9401 into hub of driven plate. Hold main body of tool and turn forcing screw clockwise to remove driven plate. (Fig. 14-76)

3. Remove tool from hub of driven plate.

4. Remove the retaining ring and spacer washer from inside the driven plate.

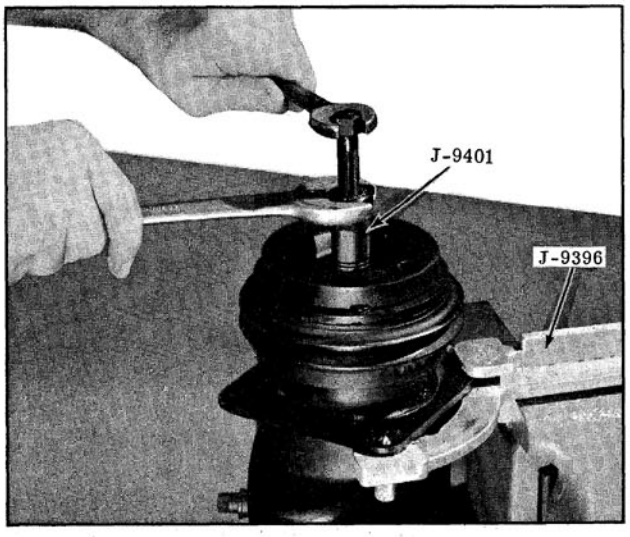


Fig. 14-76 Removing Driven Plate

5. Remove key from either the compressor shaft or the driven plate.

6. Inspect driven plate for cracks or stresses in the resilient drive. Do not replace driven plate for a scoring condition. (Fig. 14-77).

Installation

1. Insert the square drive key into the hub of driven plate, allow it to project approximately 3/16" out of the keyway.

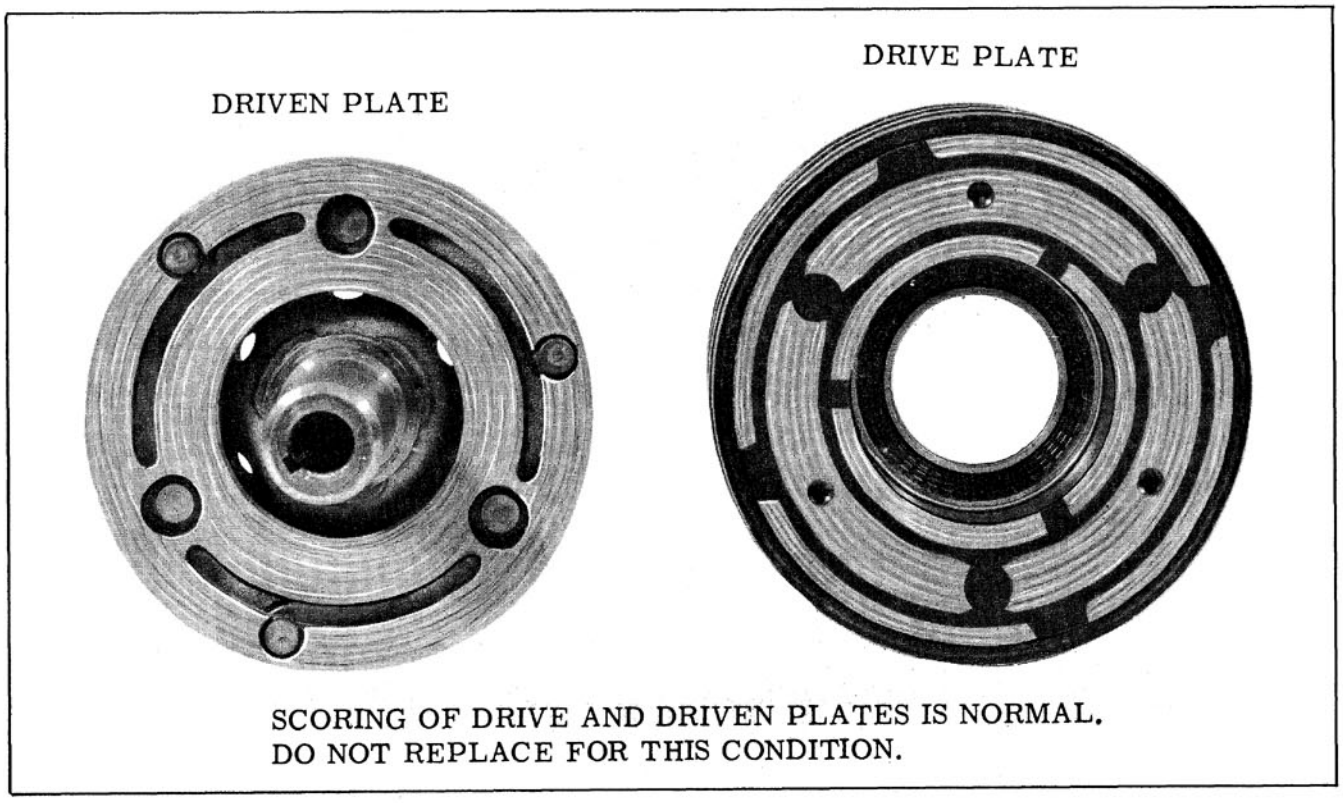


Fig. 14-77 Normal Clutch Plate Wear

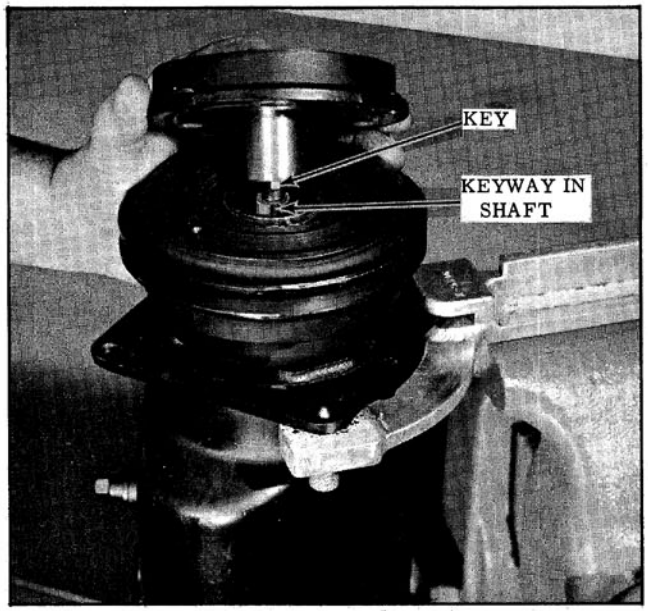


Fig. 14-78 Aligning Driven Plate Key

2. Line up the key in the hub with keyway in the shaft. (Fig. 14-78)

3. Position the Driven Plate Installing Tool J-9480 on the threaded end of the shaft. The "Free" Washer, J-9480-2, should be in place under the hex nut on the tool. This tool has a lefthand thread on the body. (Fig. 14-79).

4. Press the driven plate onto the shaft until there is approximately 3/32" space between the frictional faces of the clutch plates.

5. Remove installing tools.
6. Install hub spacer washer and snap ring.
7. Install the locknut, using a thin wall socket.

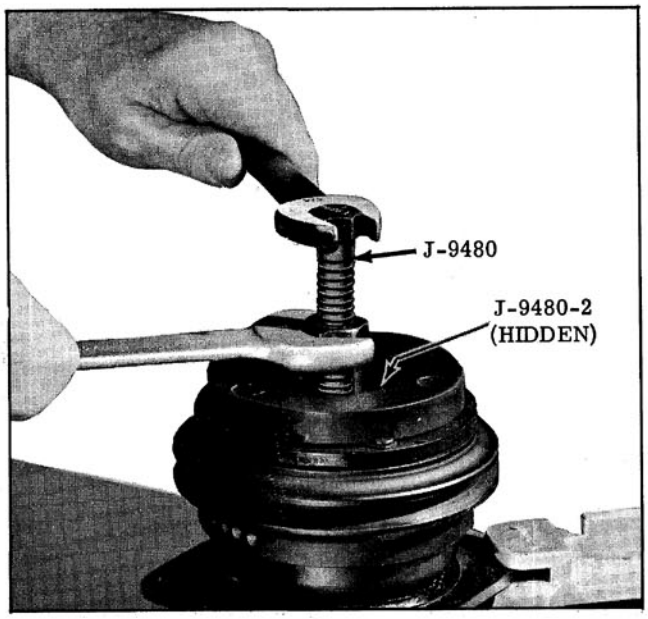


Fig. 14-79 Installing Driven Plate

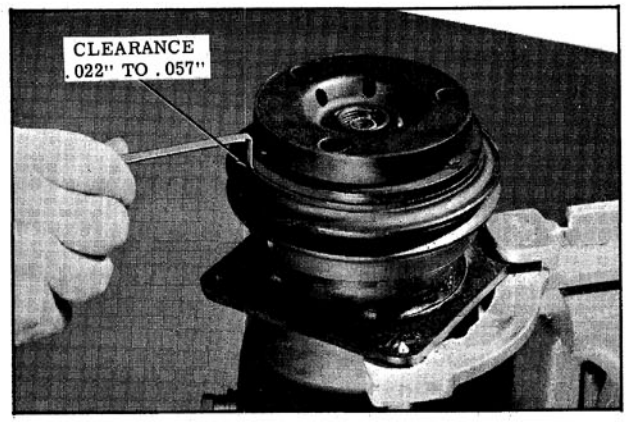


Fig. 14-80 Checking Air Gap

Tighten 14 to 16 ft. lbs. torque. The air gap between the friction faces should now be between .022" to .057" clearance. (Fig. 14-80)

DRIVE PLATE AND PULLEY ASSEMBLY

Removal

1. With the driven plate removed, remove the pulley retaining ring with Tool J-6435. (Fig. 14-81)

2. Insert Pilot J-9395 over shaft then remove pulley with Puller J-8433. (Fig. 14-82)

3. If necessary to remove the pulley bearing, proceed as follows:

   a. Remove the bearing retaining ring.

   b. Drive out bearing with brass drift.

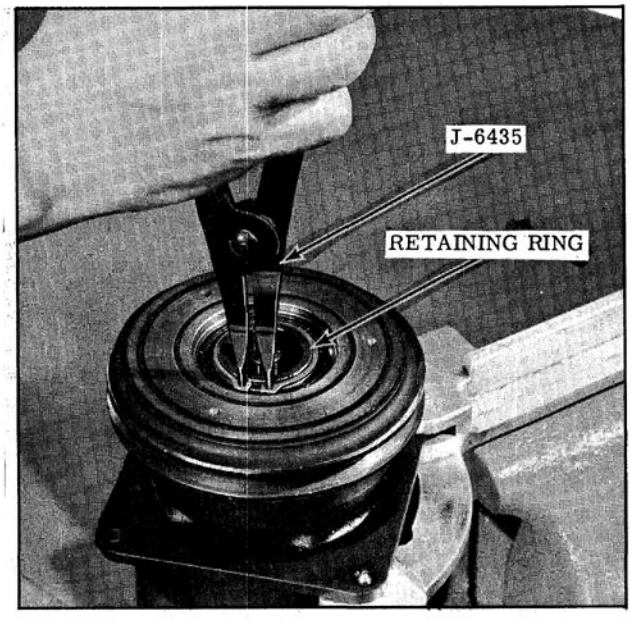


Fig. 14-81 Removing Pulley Retaining Ring

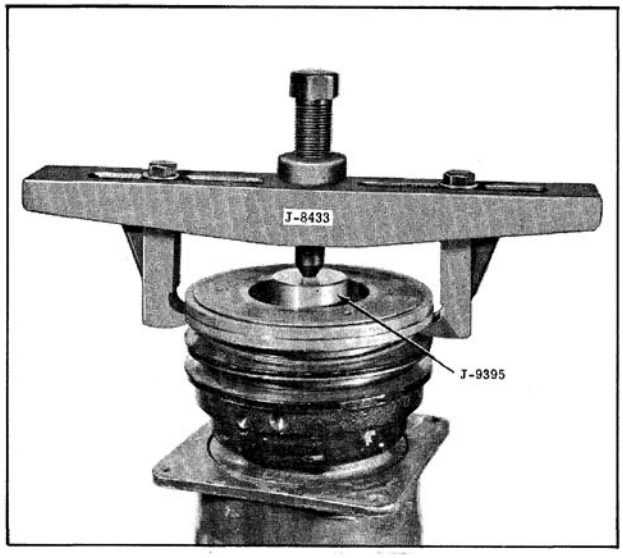


Fig. 14-82 Removing Pulley and Drive Plate

c. Install new bearing as shown in Fig. 14-83 then install retaining ring.

Installation

1. Install the pulley and bearing assembly on the end of the compressor, with Tool J-9481. (Fig. 14-84) The pulley should rotate freely.

2. Install the pulley retaining ring with Tool J-6435.

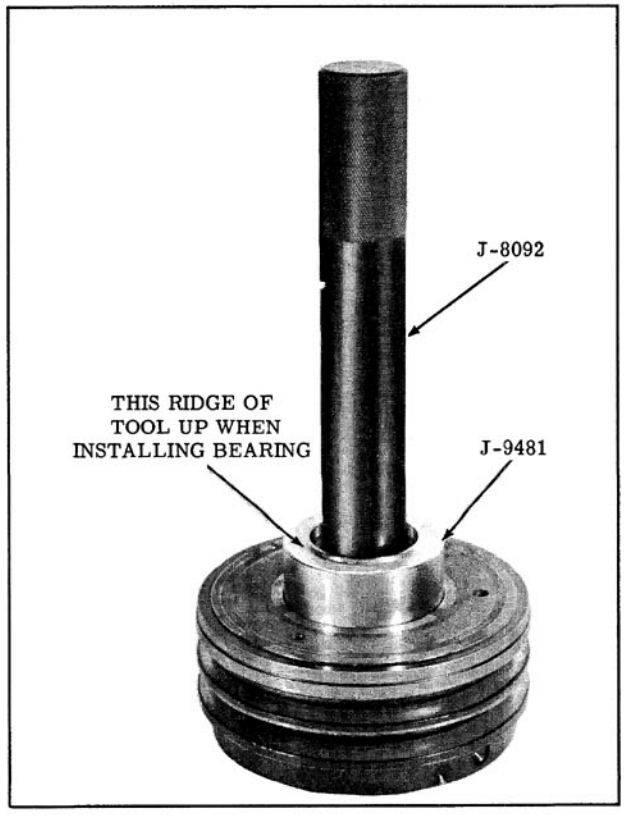


Fig. 14-83 Installing Pulley and Drive Plate Bearing

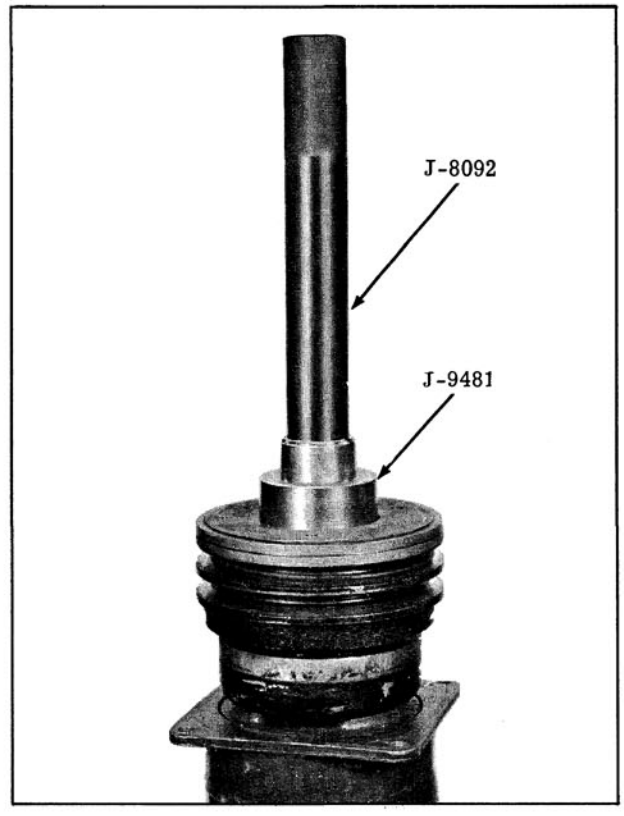


Fig. 14-84 Installing Pulley and Drive Plate on Compressor

CLUTCH COIL AND HOUSING

Removal

1. With the driven and drive plates removed, scribe the clutch coil housing and compressor housing.

2. Remove the clutch coil housing retaining ring with Tool J-6435. (Fig. 14-85)

3. Remove coil housing assembly.

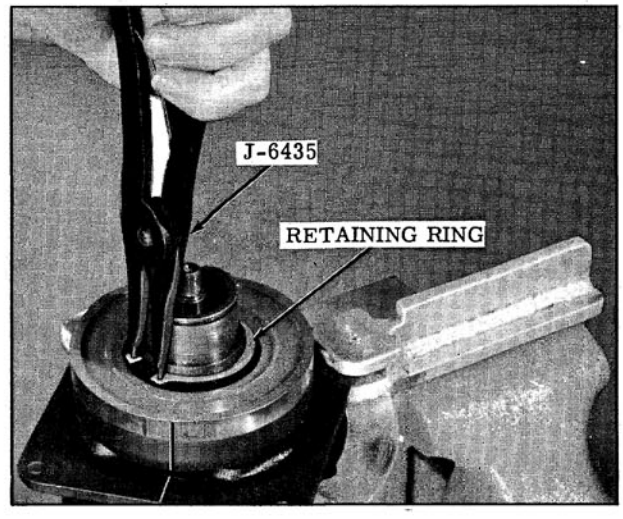


Fig. 14-85 Removing Coil Housing Retaining Ring

Installation

1. With the scribe marks aligned, locate the extrusions on the coil housing with the holes in the front head.

2. Install the coil retainer ring with Tool J-6435.

SERVICING OF THE REFRIGERANT SYSTEM

In removing and replacing any part of the refrigerant system, the following operation must be performed.

1. Discharge the system by releasing the refrigerant to atmosphere.

2. Remove and replace the defective part.

3. Evacuate the system of air and moisture.

4. Charge the system with refrigerant 12.

5. Leak test connections which were disconnected.

DISCHARGING THE SYSTEM

1. With the engine stopped, remove protective caps from compressor discharge and suction Schrader valves.

2. Connect gauge set J-5725 with Schrader valve adapters J-5420 to the suction and discharge Schrader valve fittings at the compressor.

   CAUTION: When connecting the gauge set to the Schrader valve adapters, use a cloth as a guard to divert escaping refrigerant.

3. Crack open both high and low pressure gauge valves and allow refrigerant to escape through the center outlet of the gauge set.

   NOTE: Do not open valves beyond the cracking point, or compressor oil may be discharged with the refrigerant.

After the complete system has been discharged of refrigerant, any part of the refrigeration system can be serviced.

EVACUATING THE SYSTEM

NOTE: In the following procedure, the specification of 28 inches of vacuum is used. This figure is based on performing the operation at an elevation at or near sea level. For every 1000 ft. of elevation above sea level, the specification should be lowered one inch.

1. Connect the Gauge Set J-5725, vacuum pump and refrigerant charging drum as shown in Fig. 14-86. Use J-5420 Schrader Valve adapters to connect gauge lines to suction and discharge Schrader valve fittings at the compressor.

2. Open gauge set high and low pressure valves and start vacuum pump. Pull a vacuum of 28". Close gauge set valves and vacuum pump valve. Shut off vacuum pump. If loss of vacuum exceeds 2" in five minutes, the system leaks. Check all system connections for proper tightness.

3. If system does leak, crack open refrigerant drum valve and the low pressure gauge valve and allow system to charge to drum pressure. Close drum valve. Using a refrigerant leak test torch, check system for leaks. Correct leaks and repeat procedure until leaks are eliminated.

4. When system no longer leaks, proceed to evacuate system:

   a. Discharge refrigerant from system then open both gauge set valves and start vacuum pump, then open vacuum pump valve.

      NOTE: DO NOT discharge refrigerant through vacuum pump.

   b. Allow pump to run for 15 minutes at a vacuum of 28". Close the high pressure

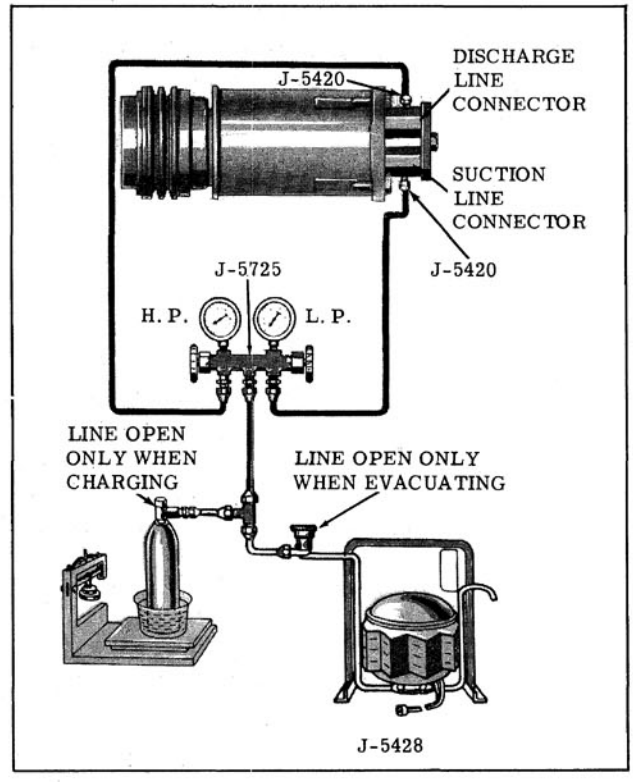


Fig. 14-86 Evacuating the System

gauge valve and vacuum pump valve, then stop vacuum pump. The system is now ready for charging.

CHARGING THE SYSTEM

After the system is evacuated, leave the gauge set and refrigerant drum connected for the charging process. Also make sure the high pressure gauge valve is closed, the low pressure gauge valve is open, and the refrigerant drum valve is closed; then proceed as follows:

1. Place an auxiliary fan in front of condenser.
2. Place drum on scales and weigh accurately.

   NOTE: It may be necessary to place refrigerant drum in a pail of warm water to facilitate the charging process. Do not use water at a temperature in excess of 125°F. Weigh pail and water with refrigerant drum.
3. Open refrigerant drum valve and allow system to charge to drum pressure.
4. With transmission in "neutral" ("park" if car has Automatic) and the parking brake applied, start engine and set speed at 1500 rpm.
5. Position A/C control on NORMAL, slide the temperature control fully to the left and turn blower speed switch to the high position.
6. Close low pressure valve in gauge set at frequent intervals to be certain pressure in low side of system is always maintained above 5 psi.
7. When 4-1/4 lbs. of refrigerant has entered the system, close the refrigerant drum valve and the low pressure gauge valve.
8. Remove the gauge set, install the protective caps on the Schrader valve and gauge fittings.

   CAUTION: When disconnecting Schrader valve adapters from system use a cloth as a guard to divert escaping refrigerant.
9. After the system is charged, a performance check should be made. Observe particularly for excessive head pressures.

SUCTION THROTTLING VALVE (Fig. 14-87)

Disassembly

1. Discharge refrigerant system.
2. Remove the valve assembly from the car. Mark relative position of diaphragm cover, locknut and diaphragm.
3. Loosen vacuum diaphragm locknut, then remove vacuum diaphragm from valve assembly.

   NOTE: Diaphragm assembly is under spring tension. Apply pressure to diaphragm when removing.
4. Remove and discard "O" ring from diaphragm.
5. Remove main spring.
6. Remove diaphragm cover attaching screws, then remove cover, retainer cup, diaphragm and piston.
7. Remove Schrader valve from fitting. On 30, 31 and 32 Series, remove the oil return line Schrader Valve.

   NOTE: Do not interchange Schrader valves as the oil bleed line Schrader valve has a special calibration.
8. Thoroughly clean valve body and piston with cleaning solvent and blow out all passages and screen with compressed air.

Assembly

1. Insert piston and diaphragm into valve body.
2. Position retainer cup into diaphragm, open end out, then install the diaphragm cover and retain loosely with the attaching screws.
3. Move piston back and forth several times to properly seat diaphragm, then tighten the attaching screws.
4. Install a new "O" ring on the vacuum diaphragm.
5. Position washer and spring into the vacuum diaphragm cavity.
6. Insert the vacuum diaphragm and spring into the diaphragm cover. Apply pressure to vacuum diaphragm and thread vacuum diaphragm into diaphragm cover.
7. Install the Schrader valve(s) into the fitting(s).

   NOTE: To determine the correct position of the Schrader valves on 30, 31 and 32 Series depress the Schrader valves. The valve with the least spring resistance must be installed in the oil return line fitting.
8. Install the valve, then evacuate and charge the system

9. Adjust suction throttling valve as outlined under SUCTION THROTTLING VALVE ADJUSTMENT.

SUCTION THROTTLING VALVE ADJUSTMENT

The suction throttling valve is adjusted to regulate evaporator pressure so that it will not fall below 29 to 30 psi. If it controls below 29 psi, the evaporator will "ice-up" and refrigeration capacity will be reduced. If the valve controls higher than this pressure, an undesirable loss of refrigeration will occur which will be especially noticeable in extremely hot weather. This is because for each pound in pressure higher than 30 psi, the discharge air temperature will be raised one degree. The controlling pressure of the valve can be checked and adjusted as follows:

1. Remove Schrader valve fitting cap at the suction throttling valve.
2. Install Adapter J-5420 on the low pressure gauge hose, and connect the adapter to the Schrader valve fitting on the suction throttling valve.
3. Purge the gauge and hose by opening the low pressure gauge valve for a few seconds.
4. Start engine and run at fast idle. Move temperature control lever to the extreme left position, turn blower speed on HIGH and set air conditioning control on RECIRC.

   NOTE: When adjusting the suction throttle valve after the system has been discharged, the temperature control lever must be moved back and forth 10 to 15 times to normalize the suction throttling valve diaphragm.

5. Allow system to operate a few minutes, then observe evaporator pressure on gauge. Continue to increase engine rpm until evaporator pressure no longer changes. If the stabilized evaporator pressure is not 20 to 30 psi, adjust valve as follows:

   a. Disconnect vacuum hose from suction throttling valve diaphragm.

   b. Loosen locknut on diaphragm and rotate diaphragm clockwise to raise evaporator pressure or counterclockwise to lower evaporator pressure.

   c. After pressure has been adjusted to specifications, tighten locknut and install vacuum hose on diaphragm.

7. Shut off engine and remove gauge assembly.
8. Install Schrader valve fitting cap.

SIGHT GLASS

Removal

1. Discharge the system as outlined under DISCHARGING THE SYSTEM.
2. Remove the sight glass retaining screw.
3. Lift out the sight glass with caulking compound.
4. Remove the "O" ring with a wire hook.

   CAUTION: When performing this operation, the system should not be left open longer than absolutely necessary as the dehydrator will absorb an excess of moisture. Refer to SERVICING OF THE REFRIGERANT SYSTEM.

To install, reverse the removal procedure and evacuate and charge the system.

EVAPORATOR ASSEMBLY

Removal (Figs. 14-88, 14-89, 14-90 & 14-91)

1. Discharge the system as outlined under DISCHARGING THE SYSTEM.
2. Disconnect all parts that attach to the right fender filler plate, then remove the filler plate.
3. Disconnect the liquid line at the expansion valve, and the low pressure and equalizer lines at the suction throttling valve. On 30, 31 and 32 Series remove the oil return line from the suction throttling valve. Tape fittings to prevent entrance of dirt and moisture.
4. Remove screws from evaporator to blower connecting duct, then remove duct.
5. Remove evaporator attaching screws and remove evaporator.

Disassembly

1. On bench, remove expansion valve from evaporator by loosening the line fittings and removing the capillary bulb.
2. Remove evaporator housing bolts, nuts and washers, then remove evaporator from housing.

   To assemble, reverse disassembly procedure.

Installation

1. With rubber gasket cemented to evaporator

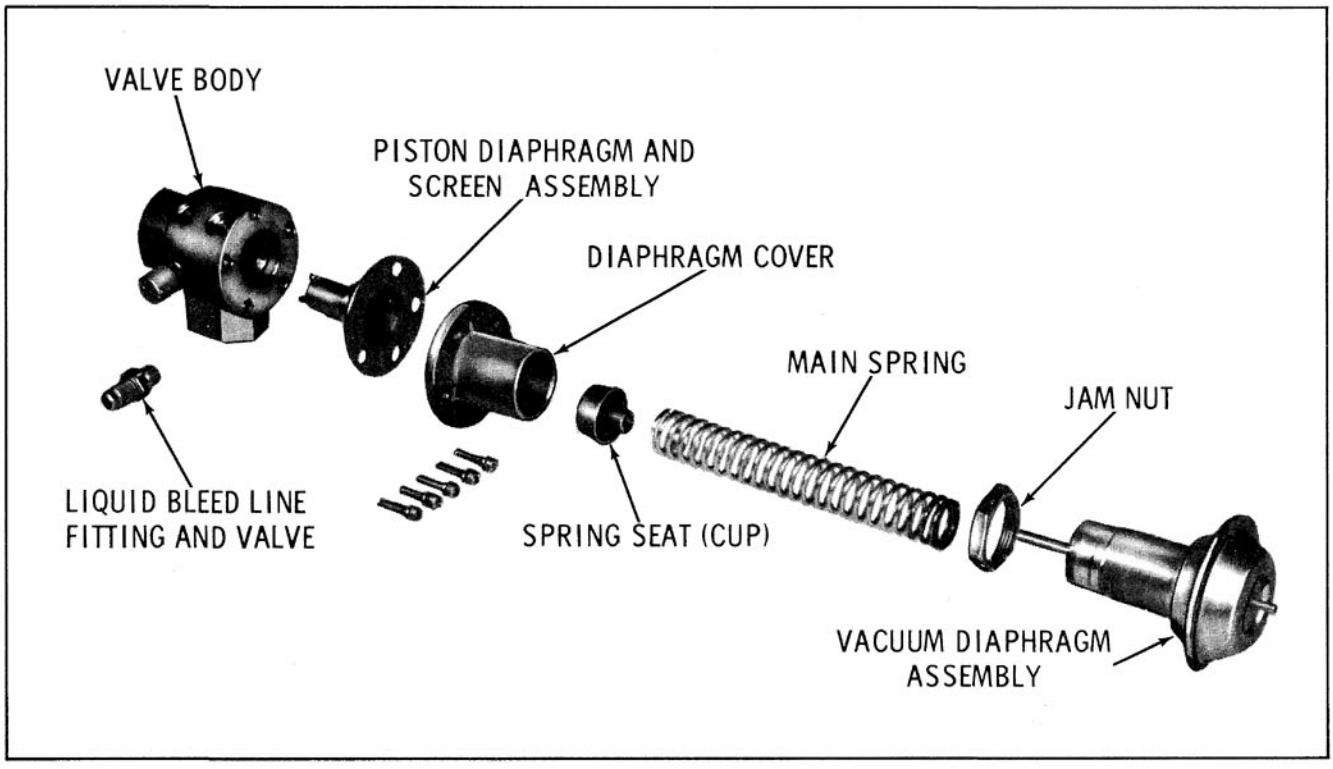


Fig. 14-87 Suction Throttling Valve

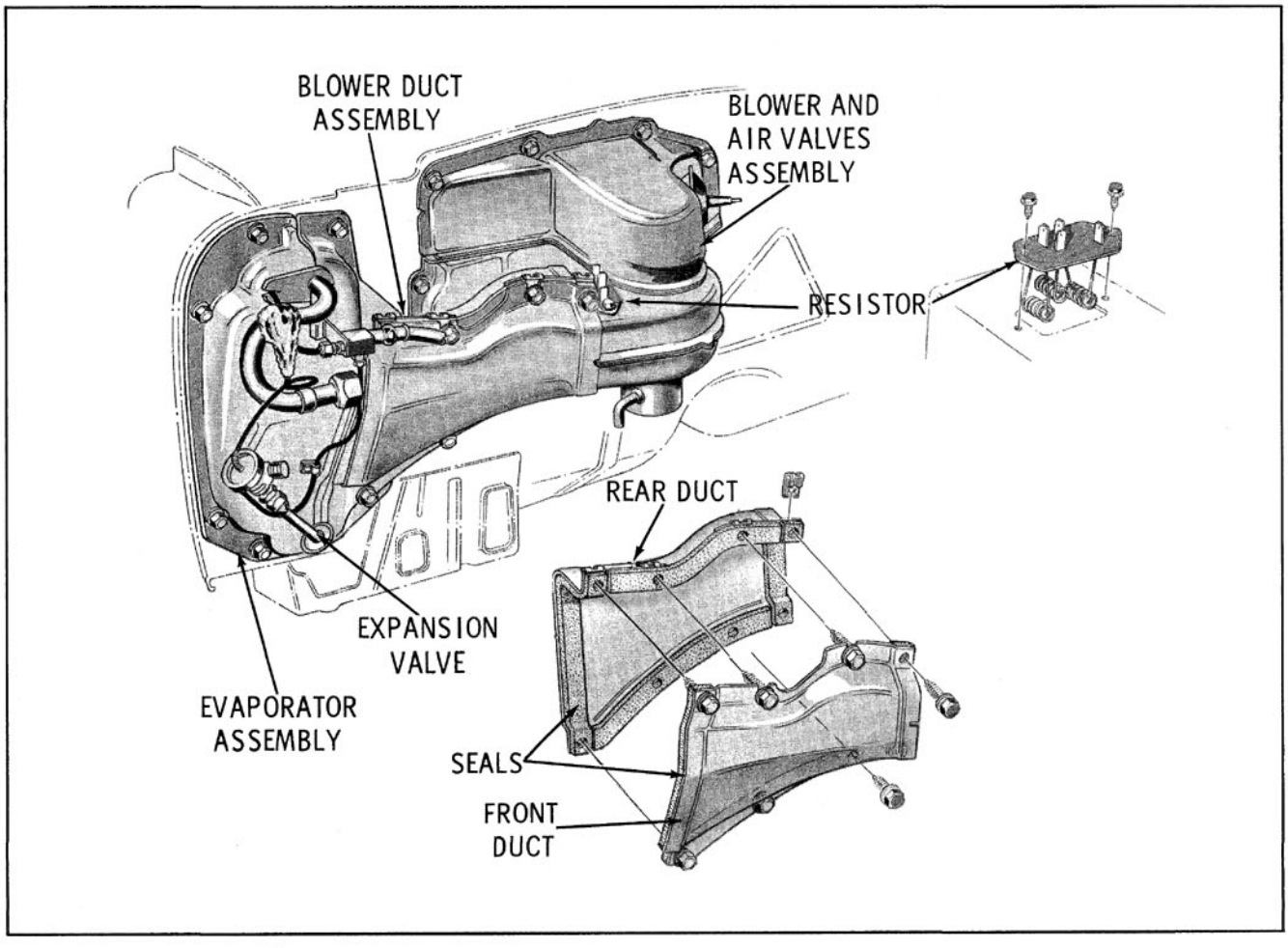


Fig. 14-88 Blower Duct Assembly (33 - 34 - 35 - 36 - 38 & 39 Series)

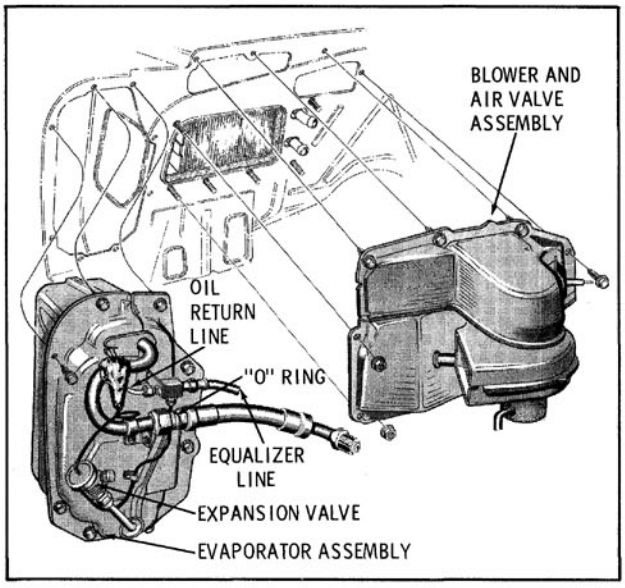


Fig. 14-89 Evaporator Removal

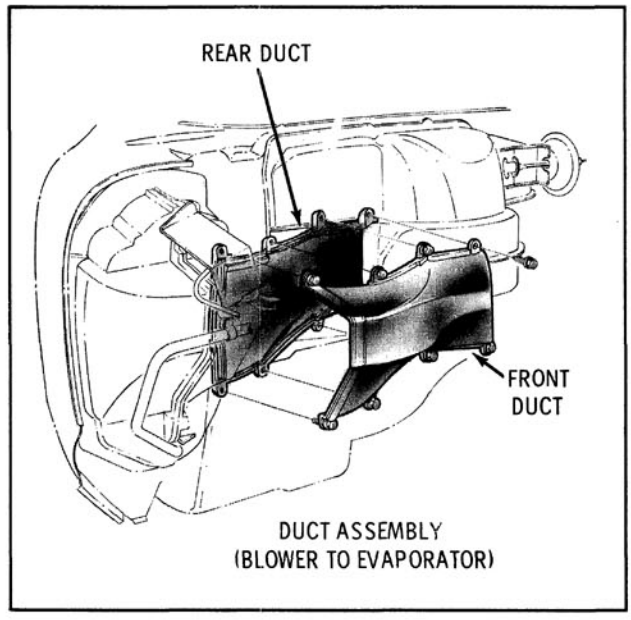


Fig. 14-90 Duct Assembly (Blower to Evaporator) 30 - 31 & 32 Series

housing, position the evaporator assembly in cowl opening and install attaching screws.

2. Install lower section of connecting duct in blower duct.
3. Place upper section of connecting duct in position, then install attaching screws.
4. Remove caps and tape from lines, oil the fittings with Frigidaire 525 Viscosity Oil, then connect the lines.
5. Install the fender filler plate, reinstall all removed parts.
6. Evacuate the system as outlined under EVACUATING THE SYSTEM.
7. Charge the system as outlined under CHARGING THE SYSTEM.

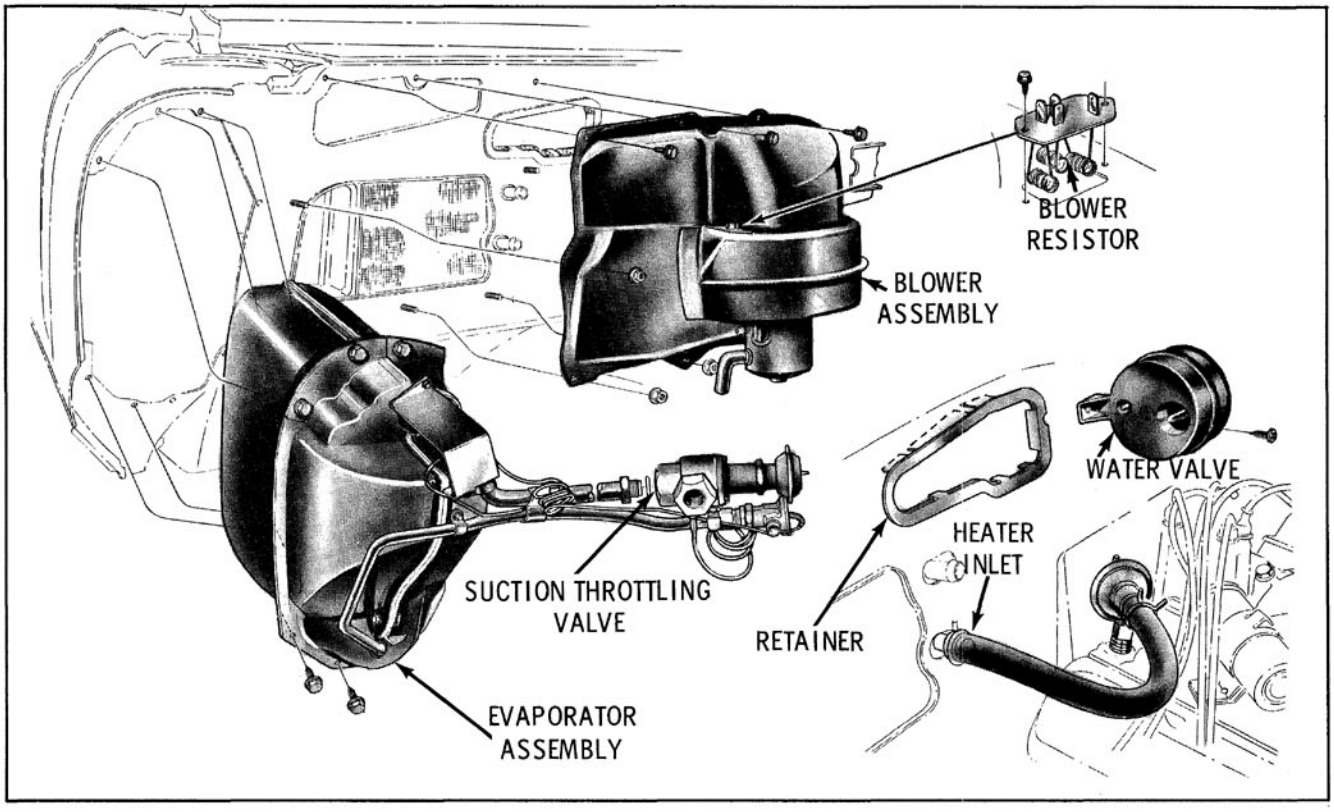


Fig. 14-91 Blower Duct Assembly (30 - 31 & 32 Series)

8. Leak test all line fittings that were disconnected. Refer to LEAK DETECTOR.

CONDENSER AND RECEIVER

The condenser and receiver are mounted in front of the radiator. After discharging the system, the condenser or receiver can be removed as illustrated in Fig. 14-92 & 14-93.

REFRIGERANT LINES

The refrigerant lines and mufflers are attached as shown in Figs. 14-94, 14-95, 14-96 and 14-97.

When installing lines, always use new "O" rings where required. Torque lines as outlined under PRECAUTION IN HANDLING LINES.

COMPRESSOR (Figs. 14-98, 14-99, 14-100 & 14-101)

Removal

1. Discharge the refrigerant system.
2. Disconnect clutch coil wire at compressor connector.
3. Remove the belts from the compressor pulley.
4. Remove the bolt holding the fittings connector to the compressor, then remove the assembly from the compressor. Install Tool J-9527, with fittings capped, on the compressor to prevent loss of oil.
5. Disconnect Delcotron from compressor.
6. Remove the compressor to bracket bolts, then remove the compressor assembly.

Installation

1. Position the compressor on the mounting bracket, then install and tighten the compressor to bracket bolts.
2. Install Delcotron and tighten the attaching bolt.
3. Install compressor clutch coil wire.
4. Remove Tool J-9527 and install two new "O" rings on the valve port openings and position the fittings connector on the compressor. Install the mounting bolt and tighten to 15 ft. lbs. torque.

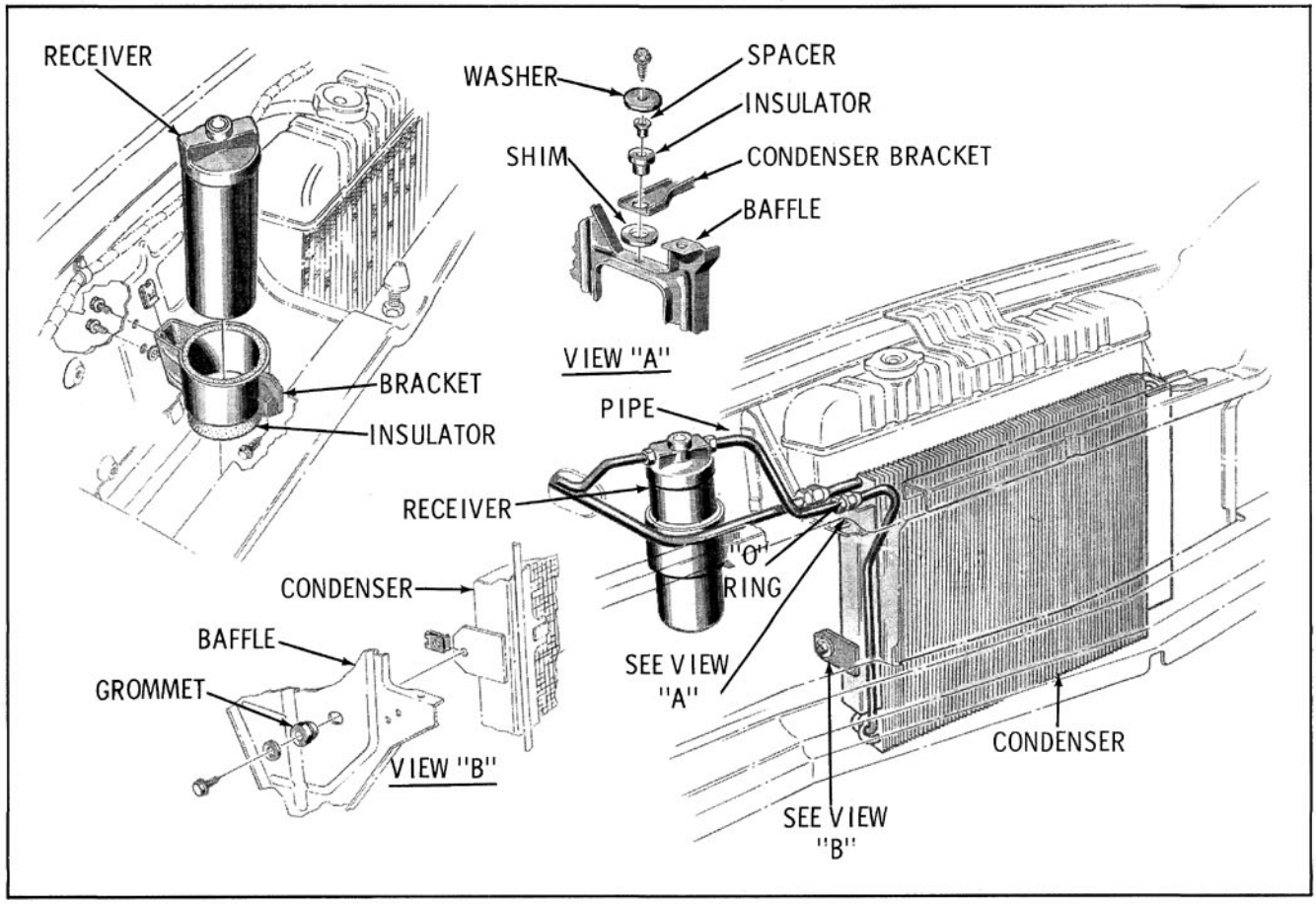


Fig. 14-92 Condenser and Receiver Attachment (33 - 34 - 35 - 36 - 38 & 39 Series)

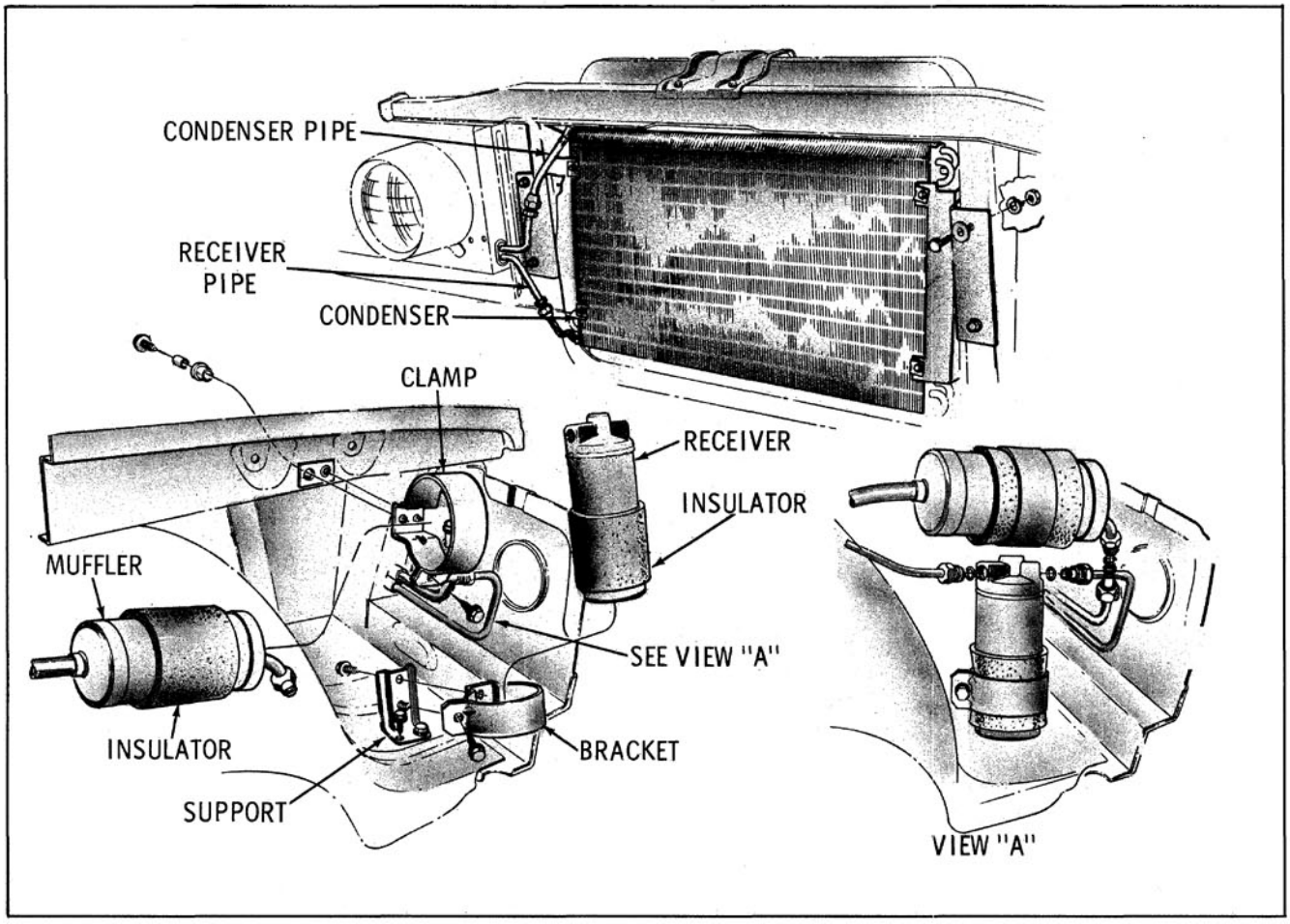


Fig. 14-93 Condenser and Receiver Attachment (30 - 31 & 32 Series)

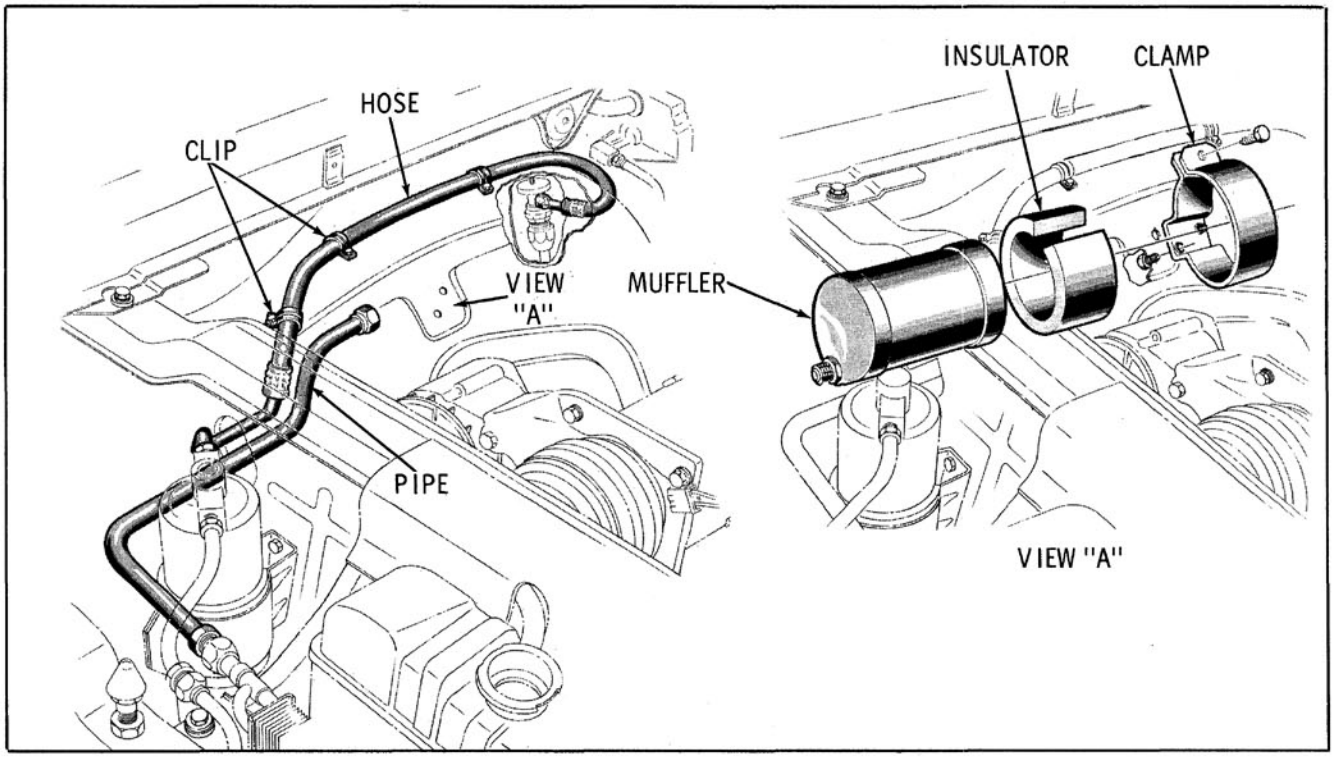


Fig. 14-94 Refrigerant Lines (34 - 35 - 36 - 38 & 39 Series)

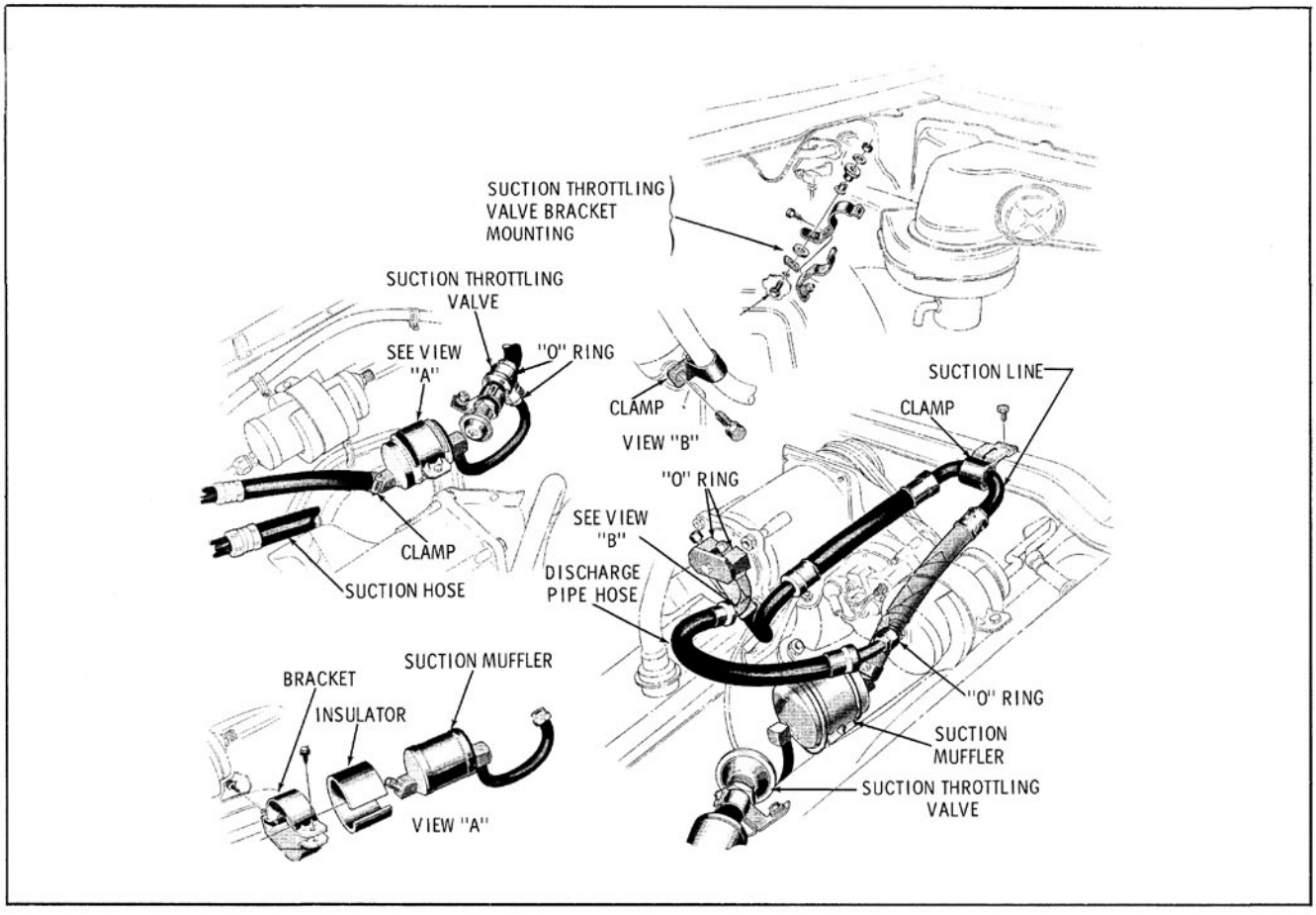


Fig. 14-95 Muffler and Line Attachment (34 - 35 - 36 - 38 & 39 Series)

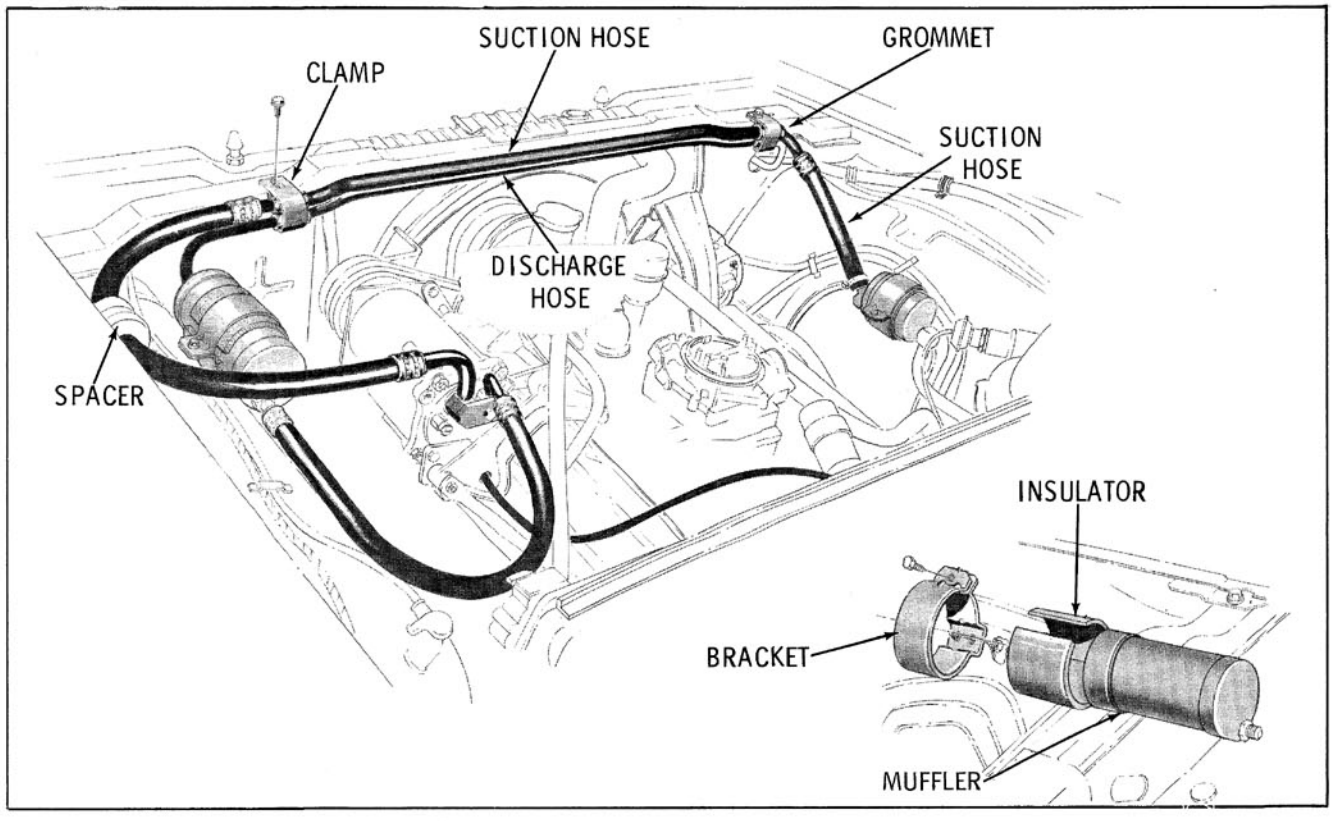


Fig. 14-96 Muffler and Line Attachment (33 Series)

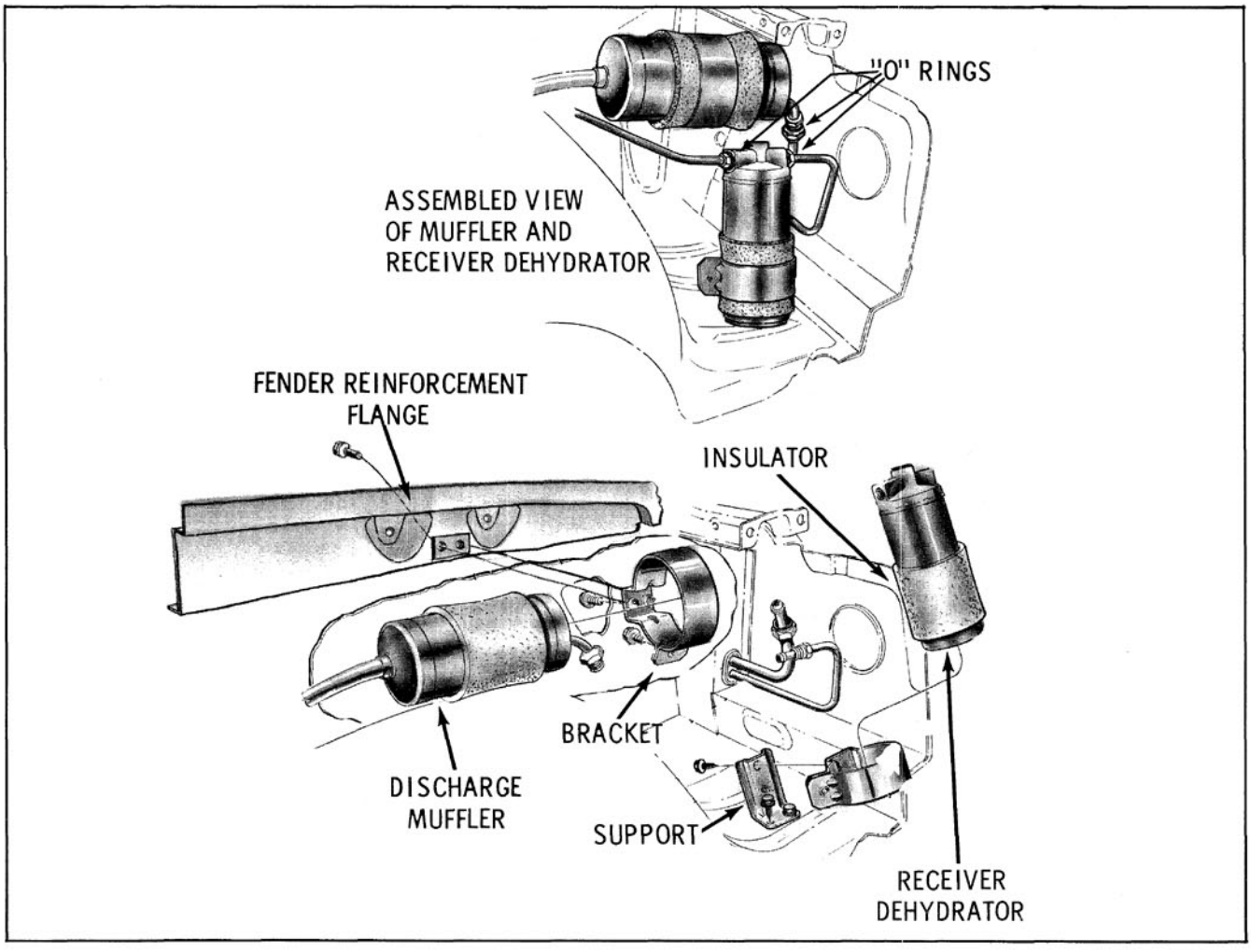


Fig. 14-97 Muffler and Receiver Attachment (30 - 31 & 32 Series)

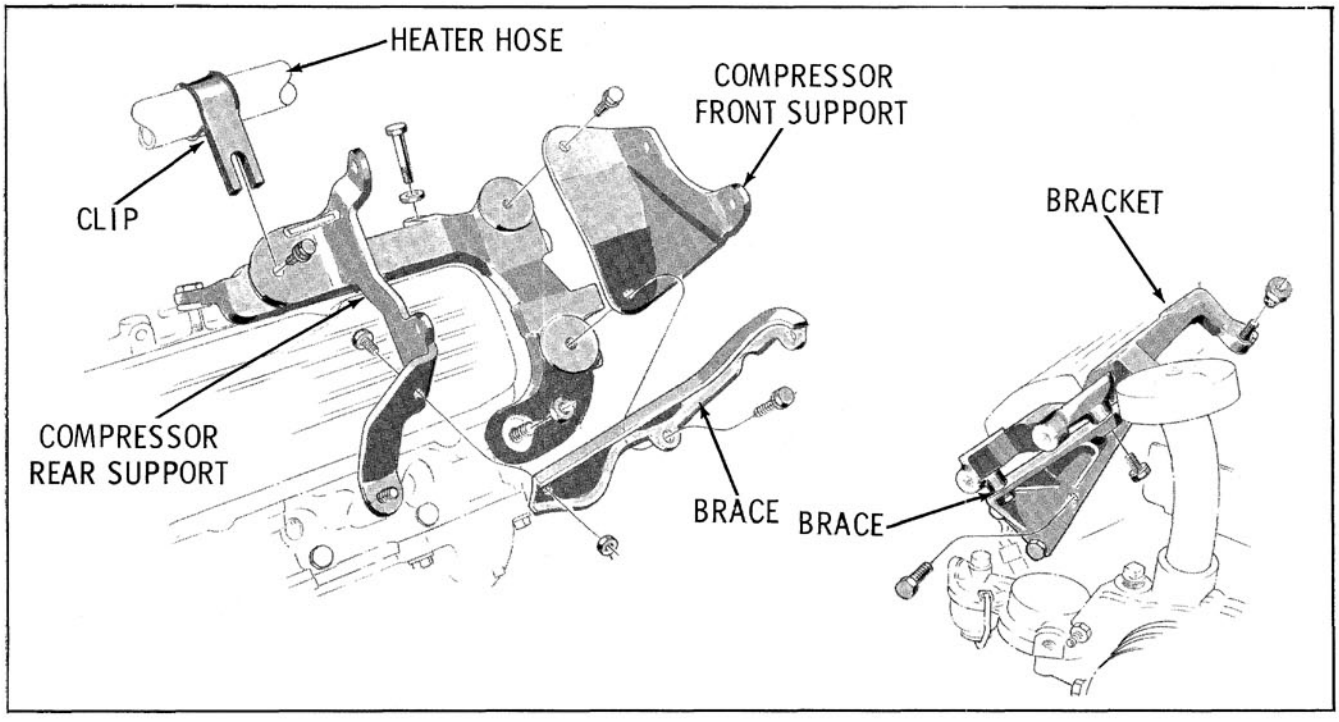


Fig. 14-98 Compressor and Delcotron Bracket Attachment (34 - 35 - 36 - 38 & 39 Series)

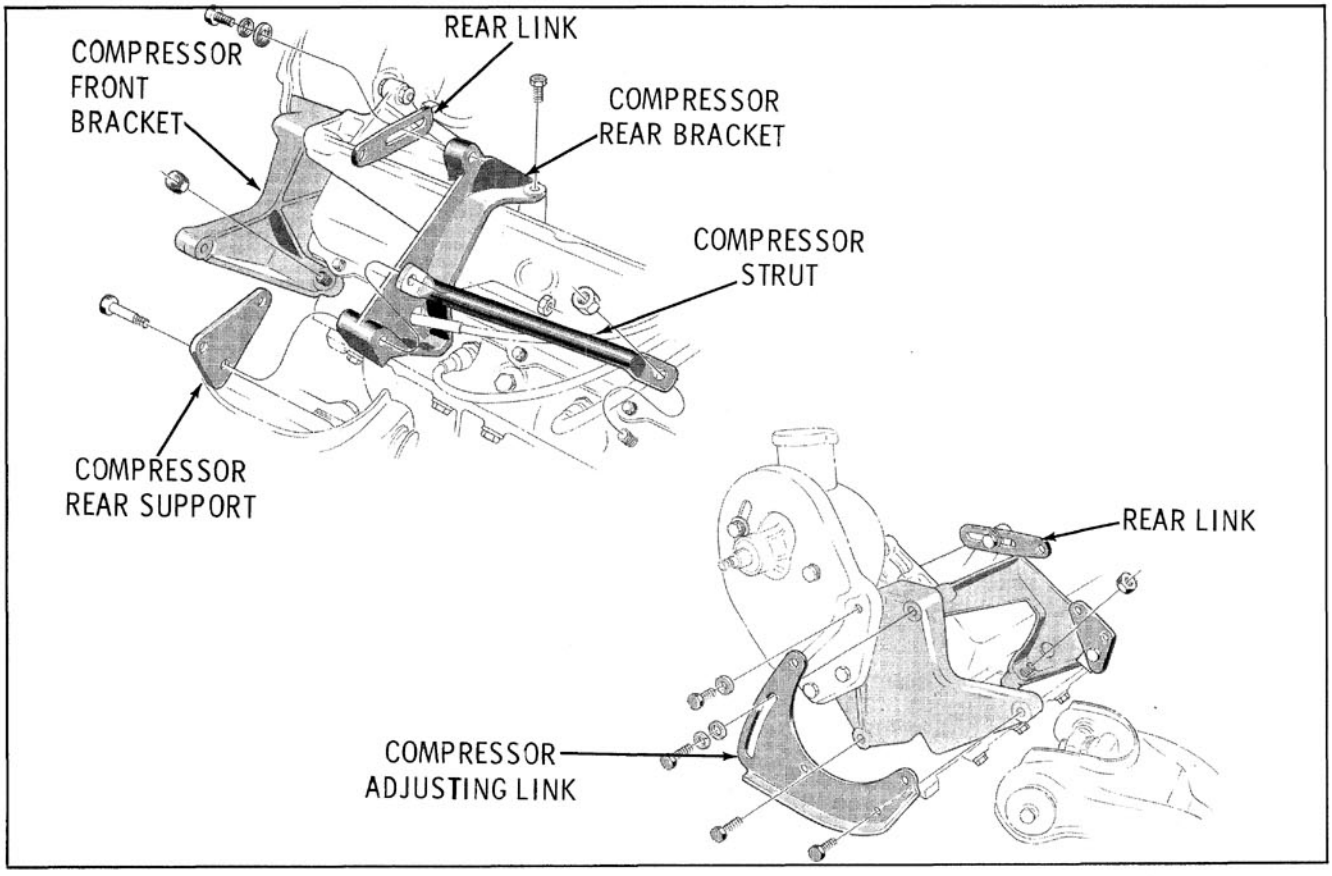


Fig. 14-99 Compressor Bracket Attachment (33 Series)

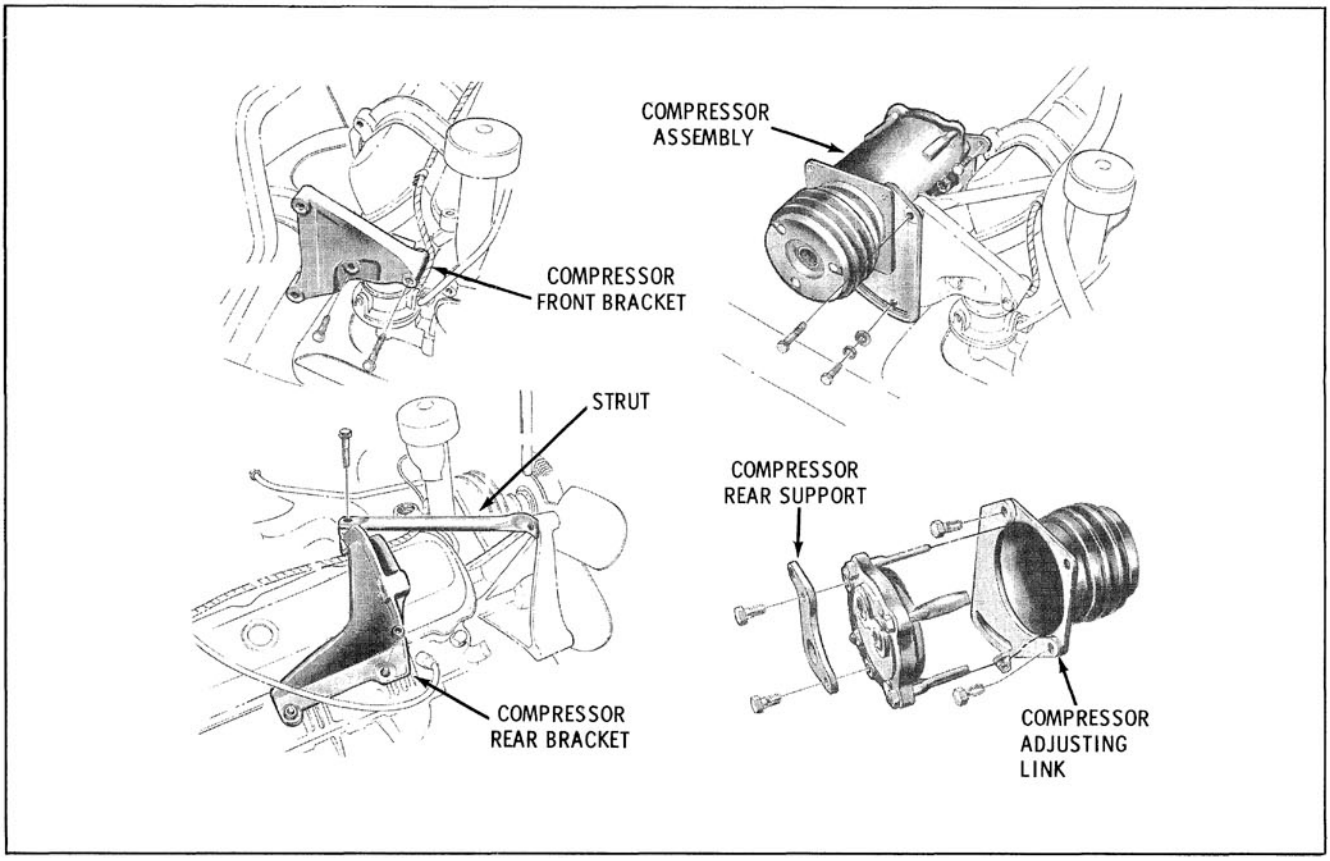


Fig. 14-100 Compressor Mounting (30 - 31 & 32 Series)

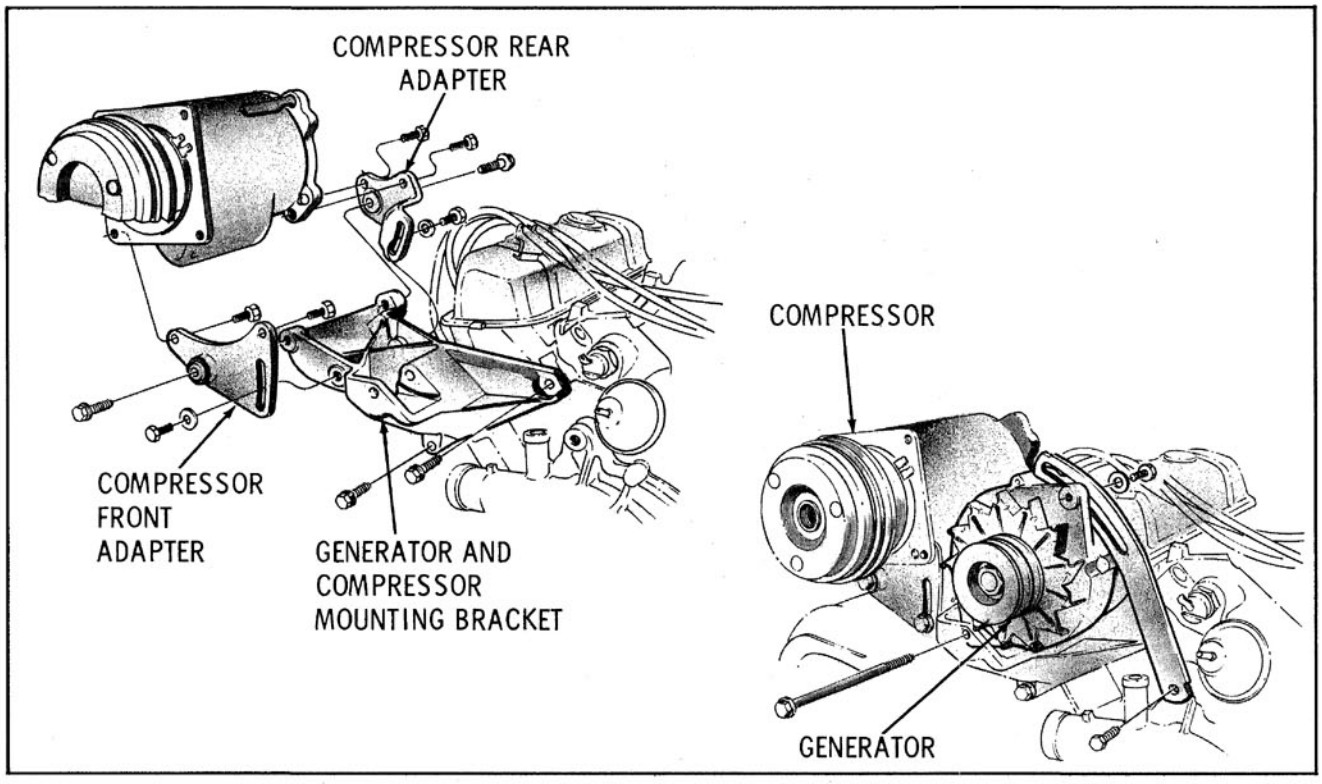


Fig. 14-101 Compressor Mounting (V-6)

5. Install belts and adjust tension using Tool 33-70M.
6. If compressor was removed for some internal malfunction and foreign material has circulated throughout the system, proceed as follows:

   a. Install a charging line to the compressor discharge Schrader valve and to a drum of refrigerant 12.

   b. Disconnect the liquid line from the dehydrator receiver assembly on the inlet side, and cap the dehydrator receiver immediately.

   c. Open the refrigerant drum valve and turn the drum upside down to allow liquid refrigerant to flush through the condenser and out the line. Use approximately 2 lbs. of refrigerant for this operation.

   d. Close the drum valve and connect the dehydrator receiver assembly.

   e. Remove the expansion valve screen and clean or replace as necessary.

   f. Remove the charging line from the compressor, install the gauge set, and evacuate the entire system as outlined under EVACUATING THE SYSTEM.

   g. Recharge the system as outlined under CHARGING THE SYSTEM.

COMPRESSOR SHAFT SEAL (Fig. 14-102)

Removal

1. Remove compressor from the car. Refer to COMPRESSOR - Removal.
2. Remove driven plate from compressor. Refer to DRIVEN PLATE - Removal.
3. Remove seal seat retaining ring with Tool J-5403.
4. Remove the seal seat with Tool J-9393 as shown in Fig. 14-103.
5. Remove the seal seat "O" ring from inside the housing.
6. Insert Tool J-9392 on top of seal. Rotate clockwise and force tool downward until tool engages tangs of seal. Remove seal by lifting tool out of housing. (Fig. 14-104)

Installation

1. Place the new seal seat "O" ring in the groove inside the neck of the compressor front head.
2. With Tool J-9392, install seal by rotating tool while applying a light pressure, until seal locks in place. Rotate tool counterclockwise slightly to release from seal, and remove tool.

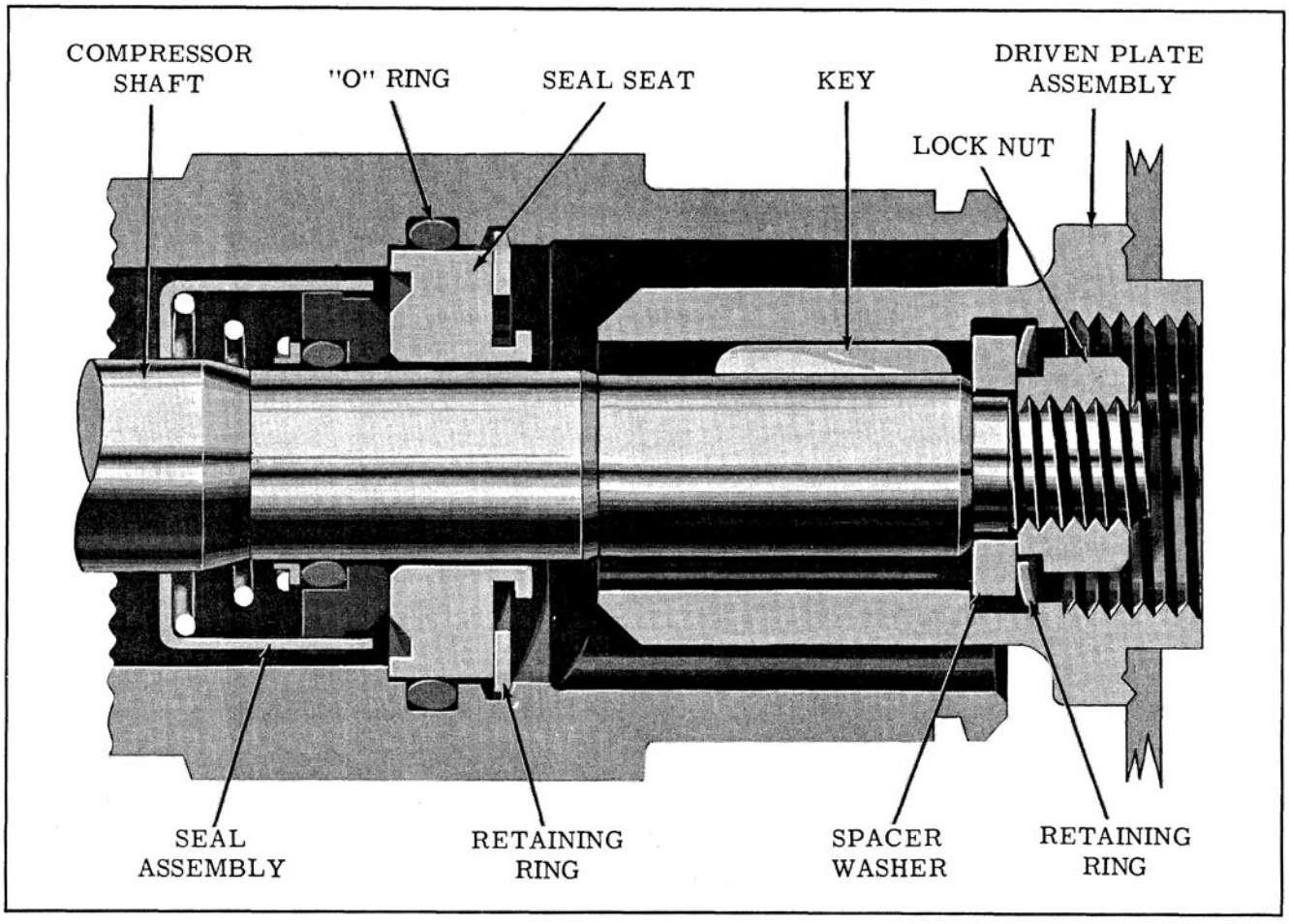


Fig. 14-102 Compressor Shaft and Seal

3. Oil the interior of the seal cavity, shaft and seal, using clean Frigidaire 525 Viscosity Oil.

4. Grip the seal seat with Tool J-9393. Push it into place so as not to disturb the "O" ring in the groove and to also effect a seal with this "O" ring.

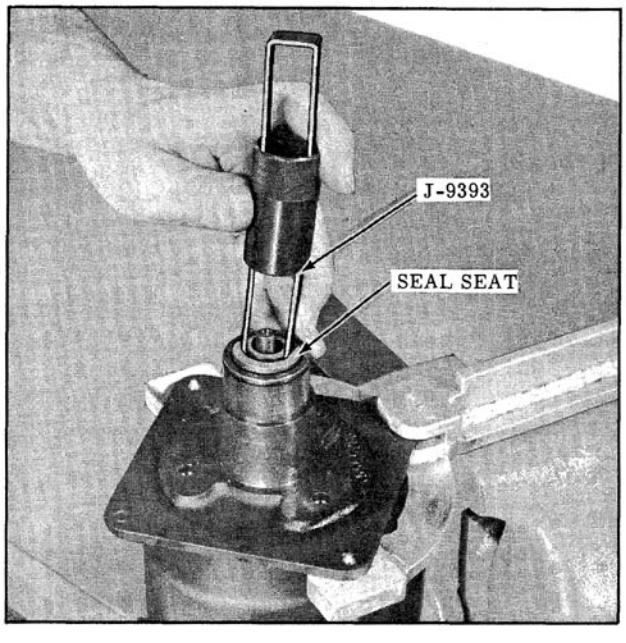


Fig. 14-103 Removing Seal Seat

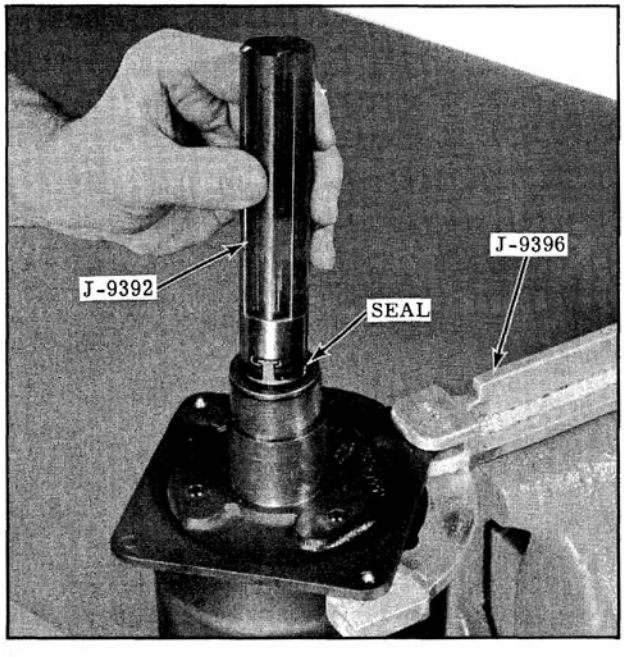


Fig. 14-104 Removing Seal

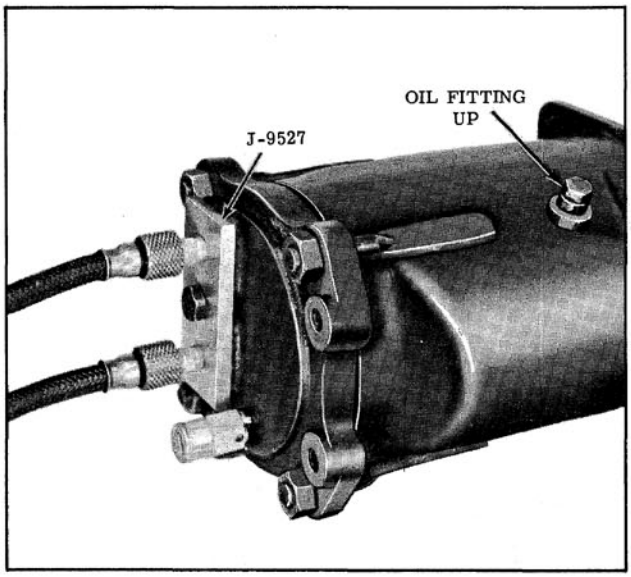


Fig. 14-105 Leak Testing Compressor

5. Install the seal seat retainer with J-5403.

6. With Tool J-9527 installed on compressor (Fig. 14-105), leak test the compressor as follows:

   a. Using the J-5725 Gauge Set, connect the center hose to the refrigerant drum and the high and low pressure hoses to the compressor.

   b. With the high pressure valve and the low pressure valve open, allow refrigerant to flow into the compressor.

   c. Open the oil plug fitting in the compressor housing and allow the air to exhaust until refrigerant starts to flow from the fitting.

   d. Close the oil plug fitting and allow the drum pressure to stabilize in the compressor.

   e. Check and correct any leaks that may exist.

   f. Remove gauge set, cap fittings on Tool J-9527 then add oil as outlined under CHECKING AND ADDING OIL.

7. Install driven plate on compressor.

8. Install compressor on car.

COMPRESSOR DISASSEMBLY (Fig. 14-106)

Before disassembling the compressor, remove the oil drain screw and allow all of the oil to drain from the compressor into a clean container. This is to determine the amount and condition of the oil.

REAR HEAD

1. With compressor mounted in a vise or in Holding Fixture J-9396, rear head up, scribe rear head and compressor housing.

2. Remove the four rear head to housing attaching nuts.

3. Remove the rear head, inspect teflon gaskets on the casting. If teflon gaskets are damaged, replace the rear head. (Fig. 14-107)

4. Remove the suction screen from the rear head.

5. Remove the oil pump gears. If gears are damaged, gears should be replaced.

6. Remove the rear head "O" ring and discard.

7. Remove the rear discharge valve plate and reed valve assembly. Separate the discharge valve plate and reed valve and inspect. (Fig. 14-108)

8. Remove the oil inlet tube and "O" ring. Discard "O" ring. (Fig. 14-109)

FRONT HEAD

1. Remove the cylinder assembly from the rear of the compressor housing by pushing on the compressor shaft. (Fig. 14-110)

2. Remove the front head by tapping it to the rear with a wood block. Discard "O" ring. Check teflon sealing surfaces of head.

3. Remove the front discharge valve plate and reed valve assembly. Separate discharge plate from reed valve and inspect. (Fig. 14-111)

CYLINDER

1. Remove the suction crossover cover and seal. (Fig. 14-112)

2. Drive the cylinder halves apart using a wood block and hammer. (Fig. 14-113)

3. Remove the rear half of the cylinder from the pistons.

4. Remove and discard the discharge tube. (Fig. 14-114)

5. If necessary to remove the drive shaft bearing from the rear cylinder half, remove the bearing with a brass drift, then install a new bearing, with manufacturers name towards tool, as shown in Fig. 14-115.

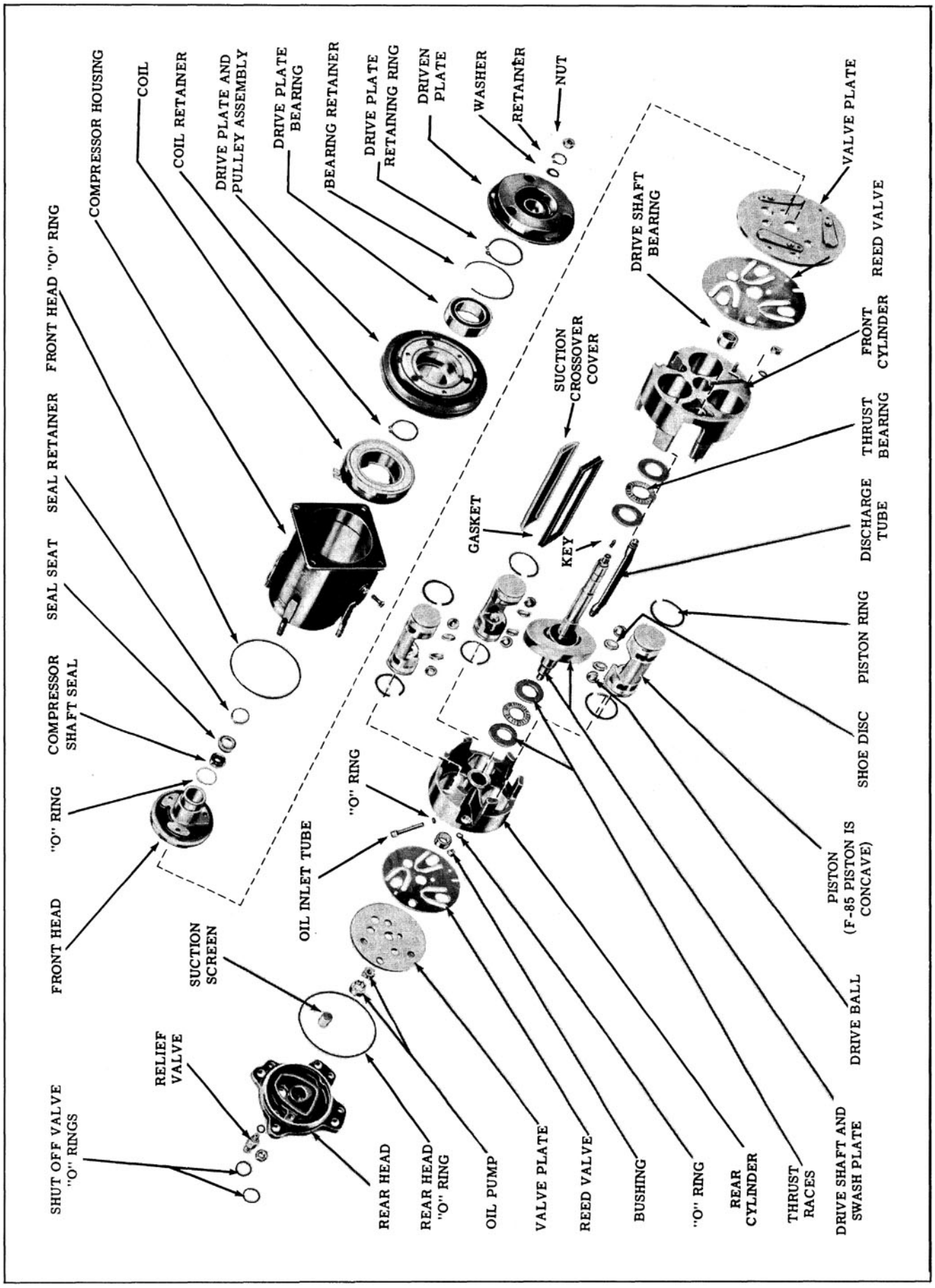


Fig. 14-106 Air Conditioning Compressor

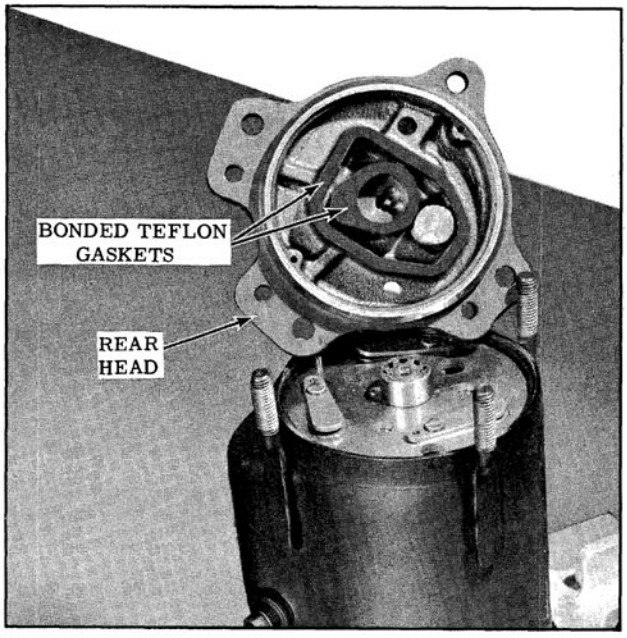


Fig. 14-107 Rear Head Removal

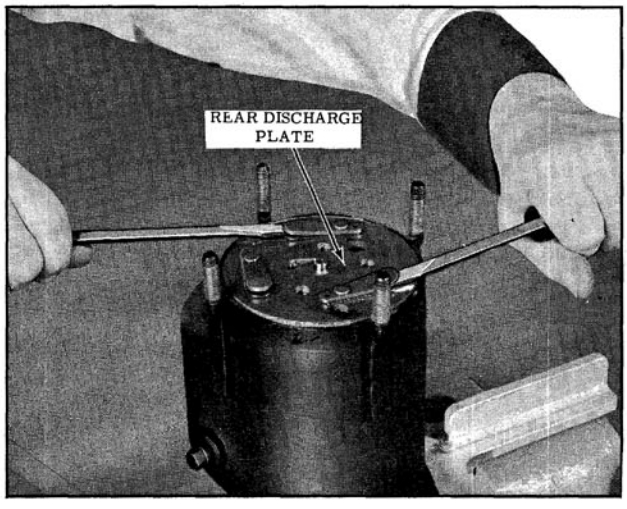


Fig. 14-108 Removing Rear Discharge Plate

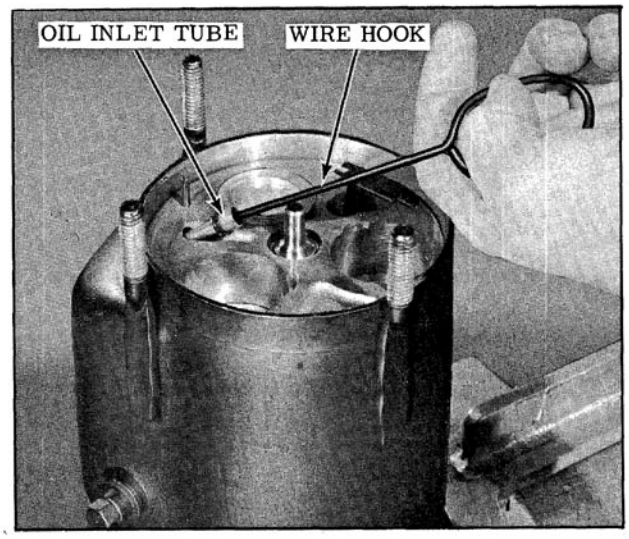


Fig. 14-109 Removing Oil Inlet Tube

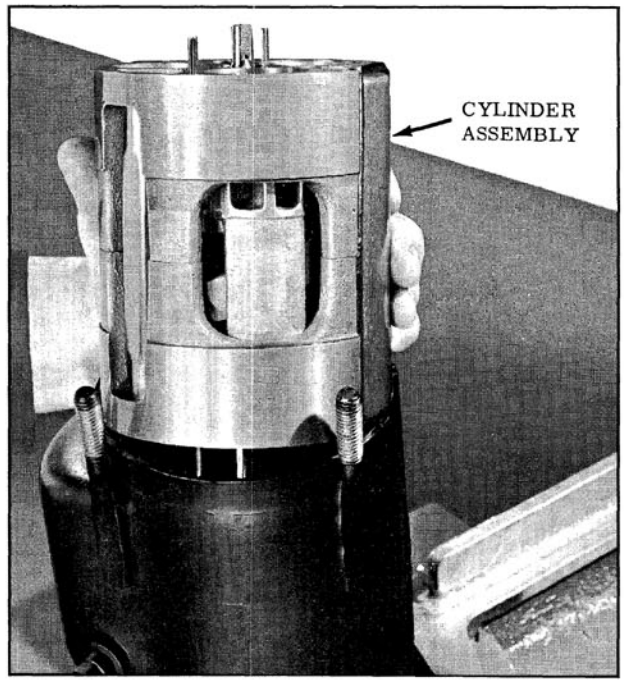


Fig. 14-110 Removing Cylinder from Housing

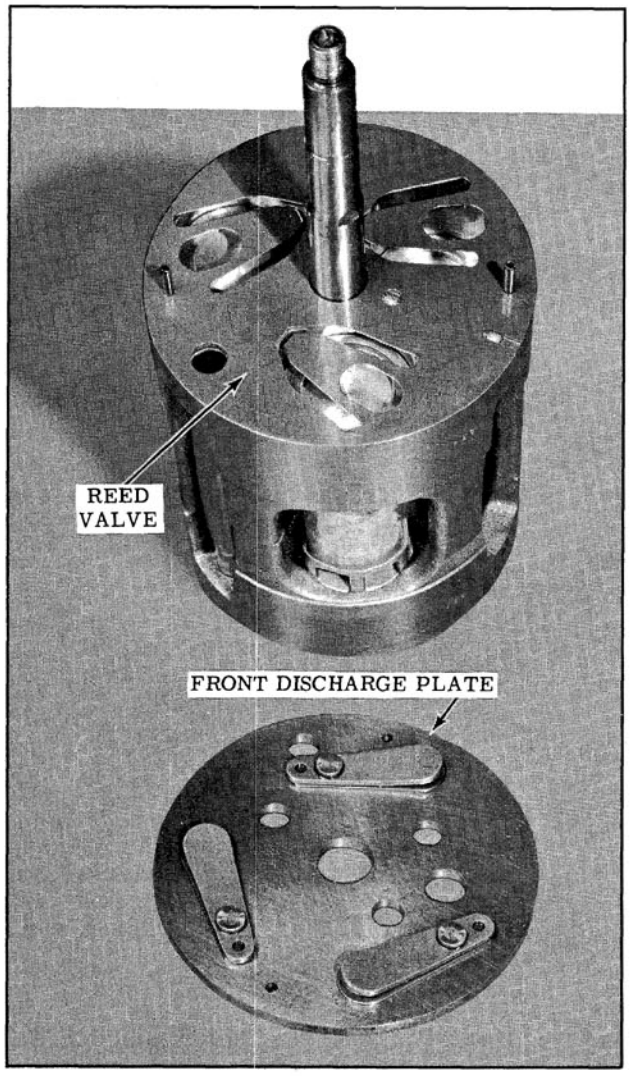


Fig. 14-111 Front Head Discharge Plate and Reed Valve

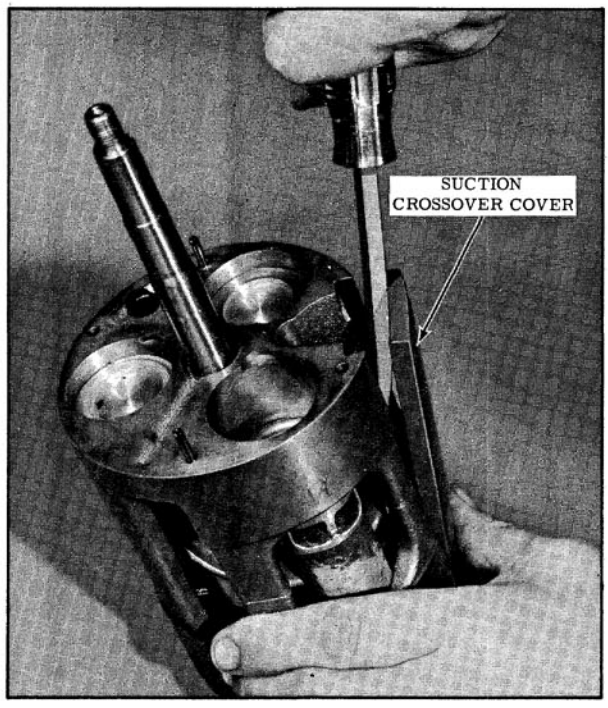


Fig. 14-112 Removing Suction Crossover Cover

6. Mark pistons with their respective cylinders, so that pistons can be reinstalled in their original position and location.

7. Rotate shaft until a piston is at its highest point. Push shaft away from head until the piston assembly can be removed. Separate the piston, piston drive balls, and piston rings and place in Tray J-9402, in compartments associated with proper end of piston. Discard all piston shoe discs.

8. Repeat procedure until all pistons are removed. (Fig. 14-116)

9. Remove shaft and swash plate assembly. Separate thrust bearings and races and discard. Inspect bearing surfaces of shaft and swash plate assembly.

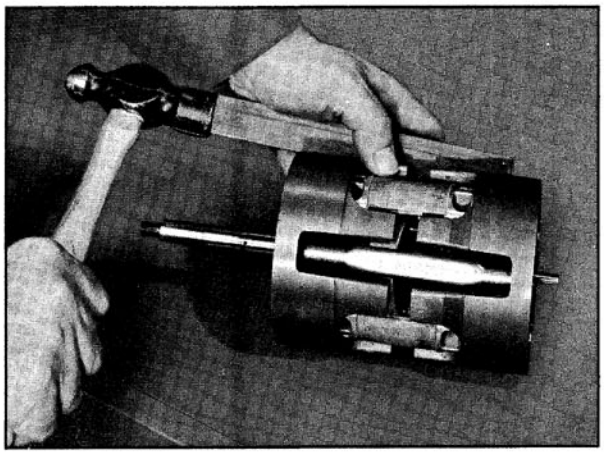


Fig. 14-113 Separating Cylinder Halves

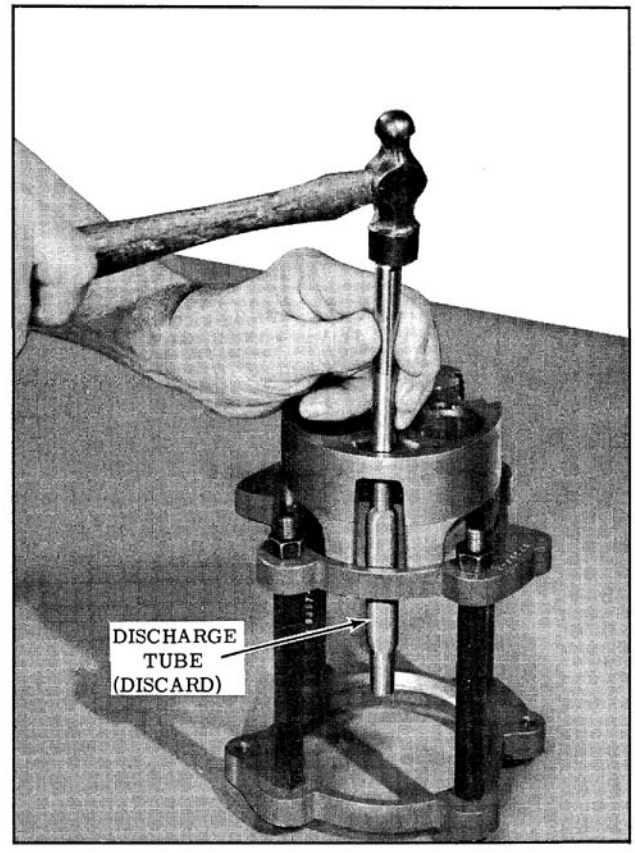


Fig. 14-114 Removing Discharge Tube

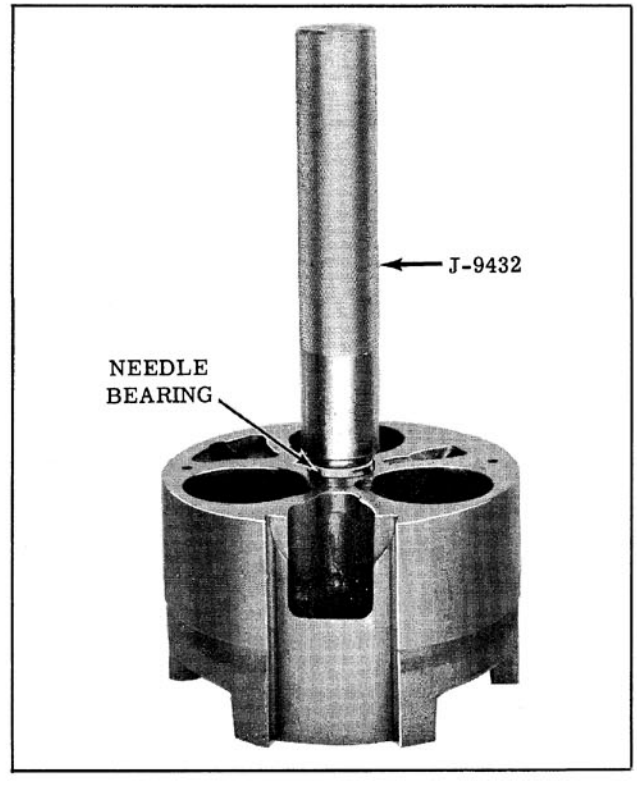


Fig. 14-115 Installing Drive Shaft Bearing

10. If necessary to replace the front cylinder half drive shaft bearing, repeat Step 5.

11. Wash all parts to be reused in clean solvent (oleum). Dry with compressed air.

COMPRESSOR ASSEMBLY

CYLINDER

1. Position front half of cylinder on the Cylinder Assembly Fixture J-9558.

THRUST BEARING RACE CHART

Service *Part Number	Identification No. Stamped on Race
6556000	0
6556050	5
6556055	5-1/2
6556060	6
6556065	6-1/2
6556070	7
6556075	7-1/2
6556080	8
6556085	8-1/2
6556090	9
6556095	9-1/2
6556100	10
6556105	10-1/2
6556110	11
6556115	11-1/2
6556120	12

*The last three digits indicate identification number on race.

2. Position a zero thrust race, a thrust bearing and another zero thrust race over the front and rear ends of the compressor shaft. Retain bearings and thrust washers with clean petrolatum. Install shaft into front cylinder, threaded end of shaft down. (Fig. 14-117)

3. Apply a light smear of clean petrolatum to the ball pockets of each of the three pistons.

4. Place the balls in the piston pockets.

5. Apply a light smear of clean petrolatum to the cavity of three new zero shoe discs.

6. Place a zero shoe over each ball in the front end of the piston. The front end of the piston has an identifying notch in the casting web. (Fig. 14-118)

7. Place a ball only in the rear ball pocket of each of the three pistons.

NOTE: Do not assemble any of the piston rings at this time.

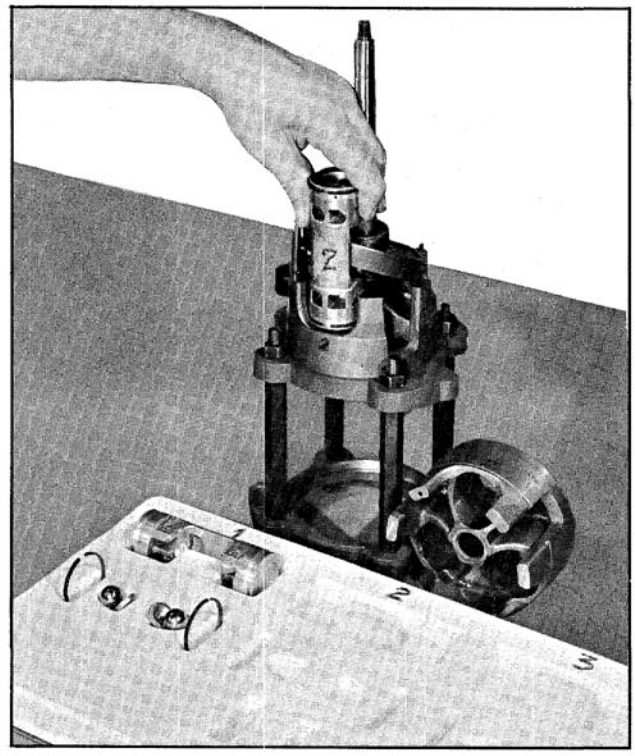


Fig. 14-116 Removing Piston

8. Rotate the shaft and swash plate until the high point of the swash plate is over the piston cylinder bore, which has been identified as

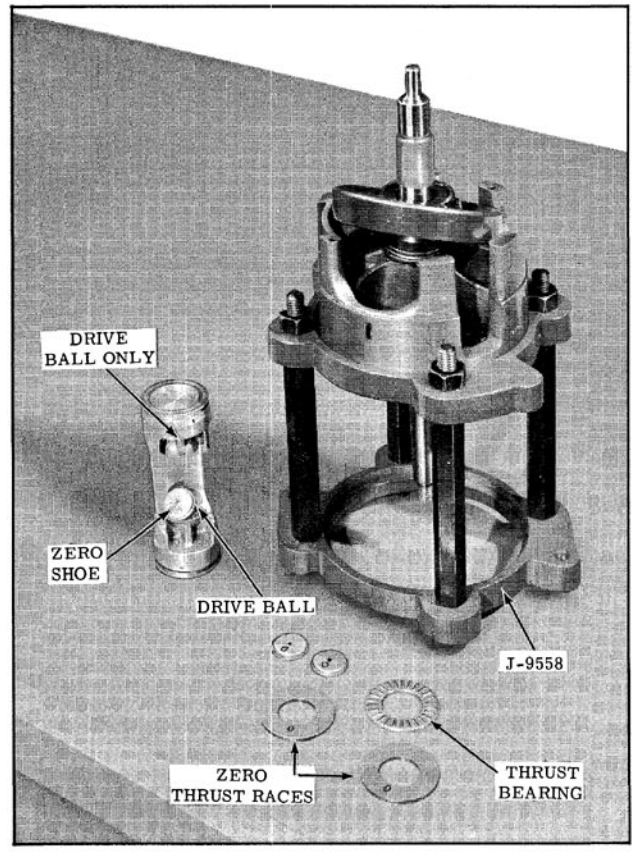


Fig. 14-117 Assembling Parts for Clearance Check

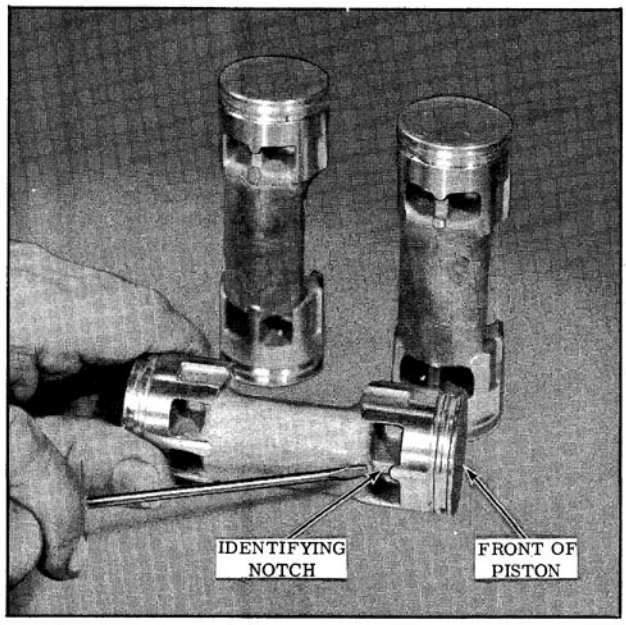


Fig. 14-118 Piston Identification

No. 1. Raise the shaft until the front end of the piston can be inserted in the cylinder bore, at the same time place the front ball and shoe and the rear ball only over the swash plate.

9. Repeat this operation for pistons No. 2 and No. 3.

NOTE: The balls and shoes must adhere to the piston during this assembly.

10. Align the rear cylinder with the front cylinder. Tap into place, using a wood block and mallet.

11. Assemble the head ring of Tool J-9558 and nuts to the fixture, tighten the nuts to approximately 15 ft. lbs. torque.

12. Measure clearance between rear ball of No. 1 piston and swash plate, in following manner:

a. Select a suitable combination of well-oiled feeler gauge leaves to fit snugly between ball and swash plate.

b. Attach a spring scale reading in 1 ounce increments to the feeler gauge. Distributor point checking scale J-5184 may be used.

c. Pull on spring scale to slide feeler gauge stock out from between ball and swash plate, and note reading on spring scale as feeler gauge is removed, Fig. 14-119. Reading should be between 4 and 8 ounces.

d. If reading in step (c) is under 4 or over 8 ounces, reduce or increase thickness of feeler gauge leaves and repeat steps (a) through (c) until a reading of 4 to 8 ounces is obtained. Record clearance between ball and swash plate that results in a 4 to 8 ounce pull on spring scale. Rotate the shaft approximately 120°, and make a second check with feeler gauge between the ball and plate. Rotate the shaft again approximately 120° and again check with a feeler gauge between the parts. Record the three readings. From the three checks, select a numbered shoe to correspond to the minimum feeler gauge reading for No. 1 piston (refer to SHOE CHART). Mark piston number on the shoe package. The shoe may be put in the assembly tray in the compartment corresponding to the piston number and rear ball pocket position. Repeat checking procedure for the remaining two pistons.

EXAMPLE

	Position 1	Position 2	Position 3	Select and Use Shoe No.
Piston #1	.019"	.0195"	.019"	19
Piston #2	.020"	.020"	.020"	20
Piston #3	.021"	.021"	.022"	21

SHOE CHART

SERVICE *PART NUMBER	IDENTIFICATION NO. STAMPED ON SHOE
6557000	0
6556175	17-1/2
6556180	18
6556185	18-1/2
6556190	19
6556195	19-1/2
6556200	20
6556205	20-1/2
6556210	21
6556215	21-1/2
6556220	22

*The last three digits indicate identification number on shoes.

13. To determine the clearance between the rear thrust bearing and the upper or outer-rear thrust race use a combination of feeler gauge leafs so that 4 to 8 oz. of force is required to pull gauge free. (Fig. 14-120)

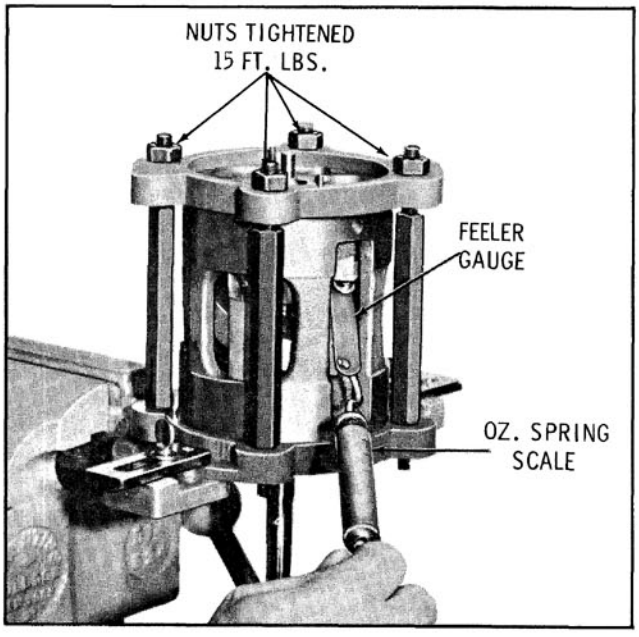


Fig. 14-119 Checking Drive Ball to Swash Plate Clearance

14. Select from stock a numbered thrust race that corresponds to the feeler gauge used. Mark the package "REAR" place it in the assembly tray corresponding to this position.

15. Loosen and remove the nuts and ring from the checking fixture. Remove the rear cylinder, pistons and rear outer thrust race.

16. Install the correct thrust race, determined in Step 14, over the compressor shaft. Apply a light smear of petrolatum to the thrust races to aid in holding them in place during assembly.

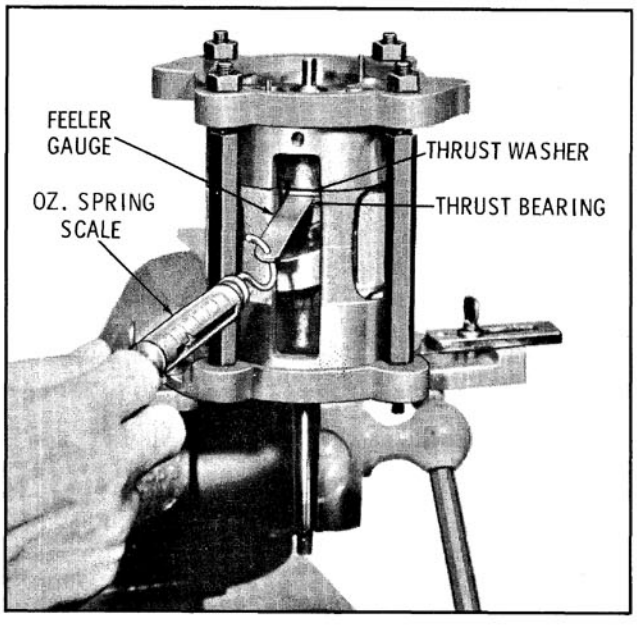


Fig. 14-120 Checking Drive Shaft End Play Clearance

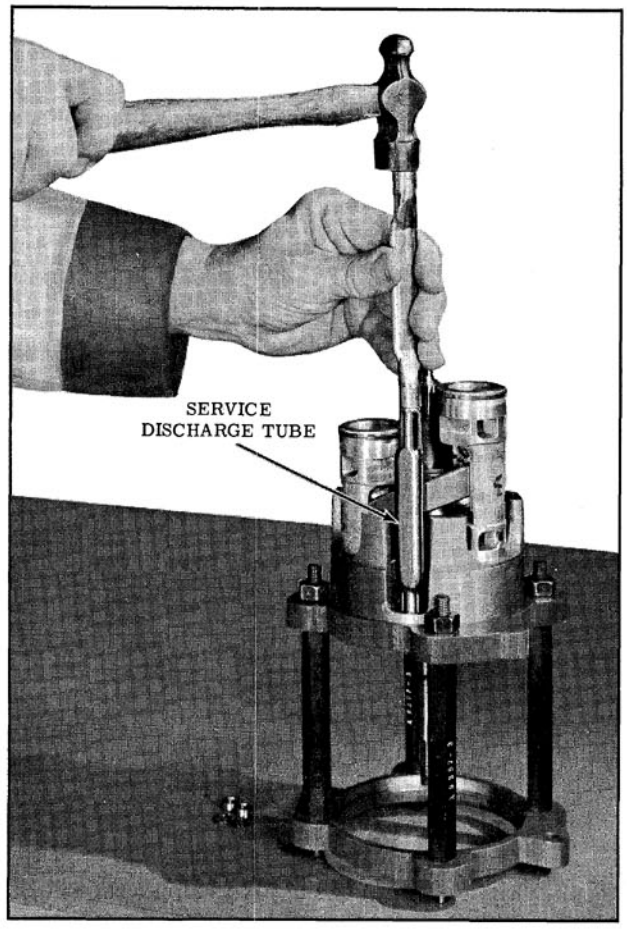


Fig. 14-121 Installing Discharge Tube

17. Assemble a piston ring, scraper groove toward the piston ball socket, to each end of the three pistons.

18. Apply a light smear of petrolatum to the numbered shoes and place them over the correct ball in the rear of the piston.

19. Rotate the swash plate so the high point is above cylinder bore No. 1. Carefully assemble piston No. 1, complete with ball and a zero shoe on the front end and ball and numbered shoe on the rear end, over the swash plate. Compress and enter the front piston ring into the front cylinder half. Repeat this operation for pistons No. 2 and No. 3.

20. Assemble one end of the service discharge crossover tube into the hole in the front cylinder. (Fig. 14-121)

21. Rotate the shaft to position the pistons in a "stair step" arrangement. Place the rear half of the cylinder over the shaft and start the pistons and rings into the cylinder bores. When all parts are in proper alignment, tap rear cylinder with a wood block and mallet to seat the rear cylinder over the locating dowel pins. (Fig. 14-122)

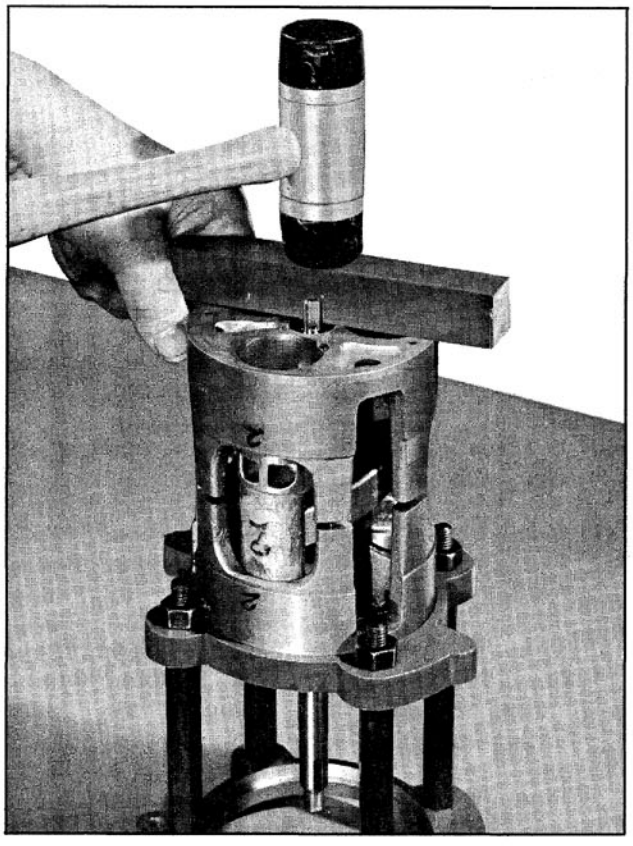


Fig. 14-122 Assembling Cylinder Halves

22. Generously lubricate all moving parts with Frigidaire 525 Viscosity Oil. Check for the free rotation of the mechanism.

23. Remove cylinder assembly from fixture.

24. Assemble a new rectangular gasket to the suction crossover cover. Coat the gasket with Frigidaire 525 Viscosity Oil. Start one side of the gasket and cover into the "dove tail" slot in the cylinder. Position Tool J-9433 between the gasket and the "dove tail" slot. Center the cover and gasket with the ends of the cylinder faces. Press down on the cover to snap it into place and remove tool. (Fig. 14-123)

25. Install "O" ring and bushing over discharge tube. (Fig. 14-124)

26. Assemble the suction reed valve and the front discharge valve plate to the front end of the cylinder. Align the dowel pin holes, suction ports and oil return slot.

    NOTE: The front discharge valve plate has a large diameter hole in the center.

27. Coat the teflon gasket surfaces on the webs of the front head with Frigidaire 525 Viscosity Oil. Examine the location of the dowel pins and contour of the webs. Rotate so as to position it properly over discharge reed retainers. Use care to avoid damaging the teflon gasket surfaces. When in proper alignment, seat with light mallet taps.

28. Apply an ample amount of Frigidaire 525 Viscosity Oil around the angle groove at the

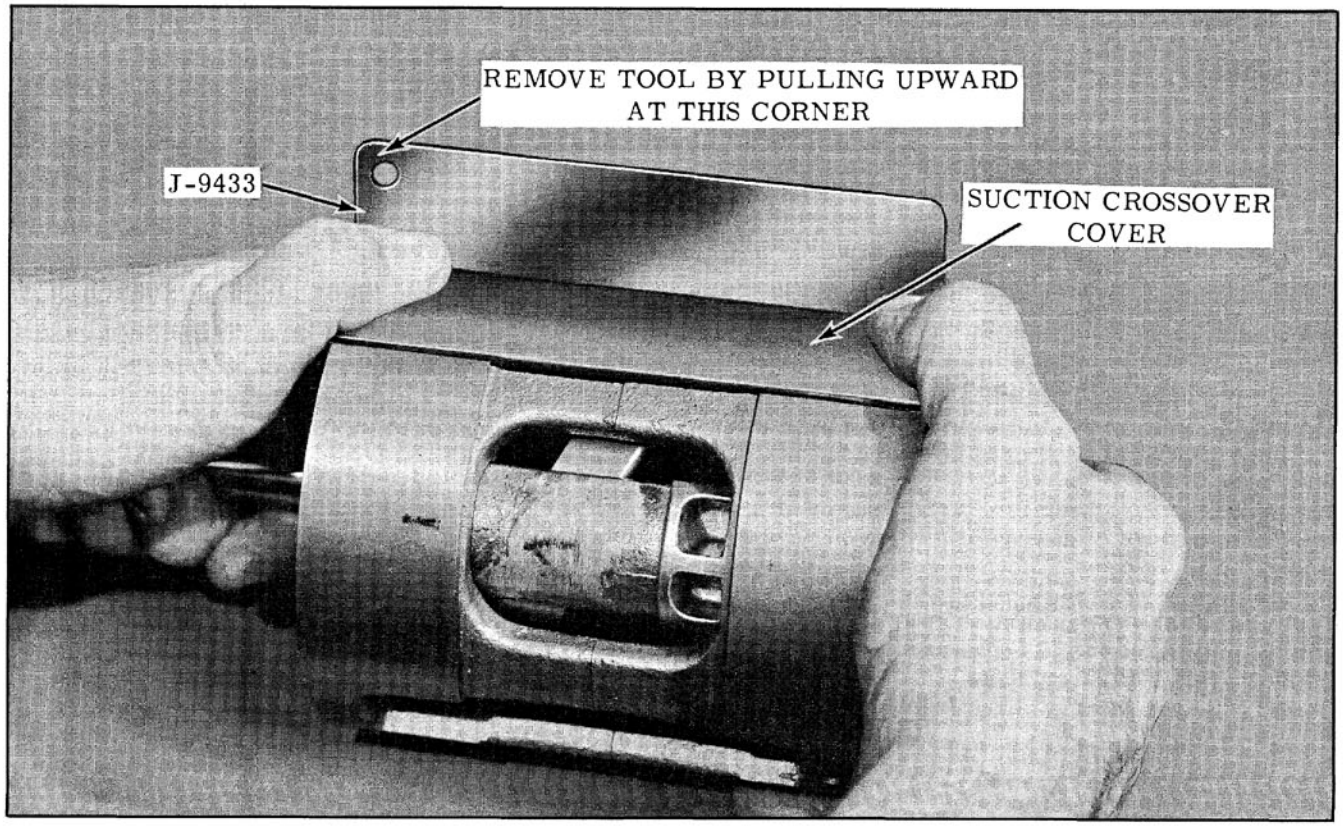


Fig. 14-123 Installing Suction Crossover Cover and Seal

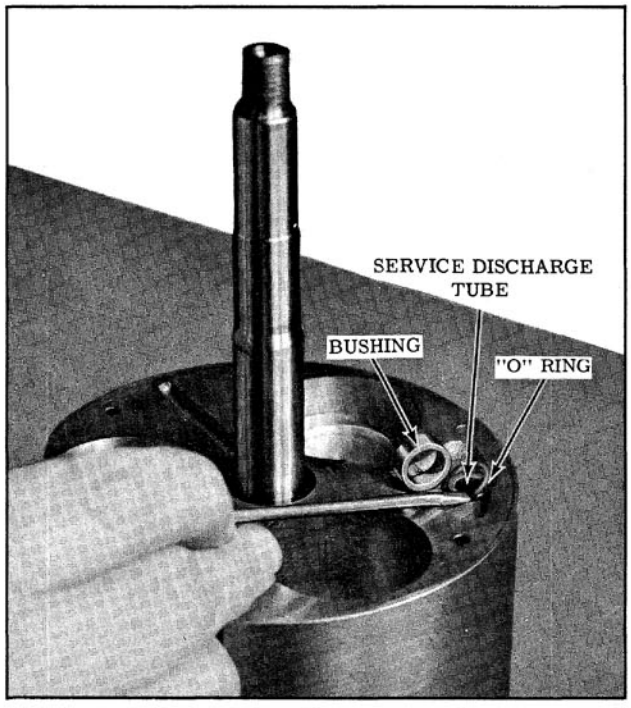


Fig. 14-124 Installing "O" Ring and Bushing

lower edge of the head and to the "O" ring. Assemble the "O" ring in the groove.

29. Mount the compressor housing on the holding fixture, attaching bolts up.

30. Coat the inside machined surfaces of the housing with Frigidaire 525 Viscosity Oil. Install the cylinder assembly into the housing. Line up the oil sump with the oil intake tube hole.

31. Position a new "O" ring on the oil intake tube, apply oil to the cavity and "O" ring. Insert the tube and "O" ring, rotating the cylinder assembly to align the tube with the hole in the housing baffle.

32. Install "O" ring and bushing over discharge tube.

33. Position the rear suction reed valve and discharge valve assembly to align with the dowel pins, then slide it into place over pins.

34. Assemble the inner oil pump gear over the "D" shaped flat on the shaft. Place the outer oil pump gear into oil pump gear cavity in the head. Retain with petrolatum.

35. Generously oil the valve plate around the outer ends where the large "O" ring will be placed. Oil the valve reeds, oil pump gears, and the area where the teflon gasket will contact the valve plate.

36. Coat the rear head to housing "O" ring with Frigidaire 525 Viscosity Oil and place it on the valve plate in contact with the housing.

37. Place the suction screen in the rear head.

38. Assemble the rear head to the compressor housing, using care not to damage the teflon gasket.

    NOTE: If oil pump gears do not mesh, a slight movement of the rear head or drive shaft will aid in meshing of the gears.

39. Assemble the nuts to the threaded housing studs. Tighten 19 to 23 ft. lbs. torque.

40. Position two "O" rings in the cavity of the rear of the compressor.

41. Install Tool J-9527 on compressor (Fig. 14-105), then leak test the compressor as follows:

    a. Using the J-5725 Gauge Set, connect the center hose to the refrigerant drum and the high and low pressure hoses to the compressor.

    b. With the high pressure valve and the low pressure valve open, allow refrigerant to flow into the compressor.

    c. Open the oil plug fitting in the compressor housing and allow the air to exhaust until refrigerant starts to flow from the fitting.

    d. Close the oil plug fitting and allow the drum pressure to stabilize in the compressor.

    e. Check and correct any leaks that may exist.

    f. Release the pressure and remove gauge set.

    g. Install caps on fittings of Tool J-9527.

42. Add oil to compressor as outlined under CHECKING AND ADDING OIL.

ADDING REFRIGERANT—PARTIAL CHARGE

The proper charge of refrigerant to insure a clear sight glass under operating conditions at various ambient temperatures is 4 lbs. 4 ozs. Since less than 4 lbs. 4 ozs. will result in a clear sight glass under some load conditions, it is necessary to consider load effects when checking and adding refrigerant to the system. The load can be varied by changing the blower speed as listed in the following chart. Be sure to operate the system for at least five minutes before checking sight glass:

Ambient Temp. (Outside of Car	Blower Switch Position	Temperature Control Setting	Control Setting	Engine RPM
70° to 80°	High	Fully To Left	Normal	2000
80° to 90°	Medium	Fully To Left	Normal	2000
90° or above	Low	Fully To Left	Normal	2000

If the system is low on refrigerant, proceed as follows:

1. Turn off the ignition.
2. Remove protective caps from Schrader valve adapters.
3. Install gauge set as shown in Fig. 14-125.
4. Crack open both gauge valves to purge the gauge hoses through the center hose, and crack open the valve on the refrigerant drum or the "Fits-All" valve on a 15 oz. refrigerant can. While refrigerant is escaping from the center hose of the gauge set and the valve fitting on the refrigerant container, connect the center hose to the refrigerant container.
5. Close the refrigerant container valve and both gauge valves.
6. Start the engine and make settings according to the preceeding chart.

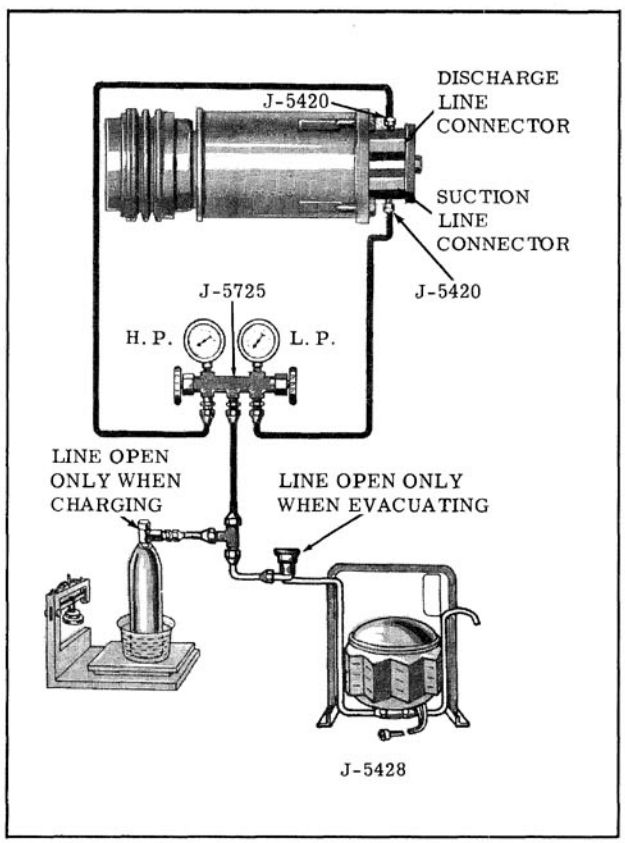


Fig. 14-125 Adding Refrigerant Partial Charge

7. Open valve on refrigerant container and the low pressure gauge valve to allow refrigerant to enter the system. When sight glass clears, close refrigerant container valve.
8. Wait two minutes, then check the sight glass. If vapor is still visible, open the refrigerant container valve and again allow refrigerant to enter the system. Add 1/4 lbs. of refrigerant after sight glass clears.
9. Shut off engine, remove gauge set, and install all protective caps.

CHECKING AND ADDING OIL

The compressor was originally charged with 10.5 ounces of Frigidaire 525 Viscosity Oil. During normal operation, because of an affinity of refrigerant 12 for oil, a certain amount of oil will circulate throughout the system along with the liquid and vapor. If any major loss of oil has occurred, such as a severe compressor seal leak, line breakage, damaged condenser, etc., proceed as follows after making the necessary repairs.

1. Remove belts and coil electrical lead.
2. Remove compressor.
3. Transfer compressor to bench and loosen the oil drain screw.
4. Allow all of the oil to drain from the compressor into a clean container. This is to determine the amount of condition of oil.

   NOTE: If the examination of the oil shows any foreign material; sludge, water, etc., flush the system as outlined under COMPRESSOR - Installation Step 6, and fill compressor with 10.5 ounces of oil.

5. If the condition of the oil indicates that the compressor is free of any contamination, position the compressor so that the oil test valve flange is on the top side and pour from a graduated bottle, new Frigidaire 525 Viscosity Oil into the compressor in the amount required as follows:
   a. If oil drained in Step 4 was more than 1-1/2 ounces, add to the compressor the amount drained in Step 4.
   b. If oil drained in Step 4 was less than 1-1/2 ounces and a major oil loss has occurred, add 6 ounces of oil to the compressor.
   c. If the compressor is overhauled, add 1 ounce in addition to the oil added in Steps 5a or 5b.
   d. If a new service compressor is to be installed, drain service compressor and fill with oil as indicated in Steps 5a or 5b.

e. If refrigeration components are replaced, add oil as follows, in addition to the oil added in Steps 5a, 5b or 5c.

Evaporator	3 Fluid Ounces
Condenser	1 Fluid Ounce
Dehydrator-Receiver	1 Fluid Ounce
Condensor-Dehydrator Receiver	3 Fluid Ounces

6. Tighten the oil drain screw.

7. Install compressor.

8. Evacuate the system to remove air and moisture, then charge the system with refrigerant.

PERFORMANCE TEST

The Performance Test should be made with the car doors open, the temperature control lever fully to the left, A/C control set at NORMAL, blower speed switch on "HI", auxiliary side outlets closed, an auxiliary fan in front of the radiator, and the car hood up.

1. Remove Schrader valve fitting cap at the suction throttling valve.

2. Install Adapter J-5420 on the low pressure gauge hose, and connect the adapter to the Schrader valve fitting on the suction throttling valve, then momentarily open low pressure gauge valve to purge gauge hose.

3. Remove the compressor high pressure Schrader valve protective cap and install high pressure gauge hose with Adapter J-5420. Be sure high pressure gauge valve is closed.

4. Momentarily open high pressure gauge to purge the gauge and hose.

5. With transmission in "park" or "neutral" and parking brake applied, adjust engine speed to 1500 rpm.

6. After temperature and humidity have been determined, compare test results with the PERFORMANCE CHART.

7. When test is completed, disconnect gauge hoses, and install protective caps.

8. Install Schrader valve fitting cap on suction throttline valve.

DIAGNOSIS OF PERFORMANCE TEST RESULTS

CONDITION AND CAUSE	CORRECTION
EVAPORATOR PRESSURE TOO HIGH	
A. Defective or improperly adjusted suction throttling valve.	A. Adjust or repair as necessary.
B. Restriction in suction line.	B. Remove, inspect, and clean or replace.
C. Loose compressor drive belts.	C. Adjust as outlined.
D. Defective clutch or coil.	D. Check or replace as necessary.
E. Defective expansion valve.	E. Replace as necessary.
F. Expansion valve capillary tube not tight to evaporator suction line.	F. Check clamp for tightness.
G. Clutch slipping.	G. Refer to CLUTCH SLIPPAGE.
HIGH PRESSURE SIDE OF SYSTEM TOO HIGH	
A. Engine overheated.	A. Check engine cooling system.
B. Restricted air flow through condenser.	B. Remove foreign material from engine radiator and condenser.
C. Air in system or overcharge of refrigerant.	C. Momentarily discharge system on discharge side with engine not running; then, operate system and recheck pressure. Repeat as necessary. Check sight glass with system under load.
D. Restriction in condenser, dehydrator receiver assembly, or any discharge or liquid line.	D. Remove parts, inspect for restricted passage, and clean or replace.
E. Too much oil in compressor.	E. Drain oil and add correct amount.
NOZZLE DISCHARGE AIR TOO WARM (With Other Readings OK)	
A. Air hoses not properly connected.	A. Inspect air hoses and manifolds.
B. Defective or mispositioned evaporator drain hoses.	B. Replace or align as necessary.
C. Poor Seal - Evaporator to cowl.	C. Correct sealing.
CLUTCH SLIPPAGE	
A. Head pressure too high.	A. Discharge system until bubbles appear in sight glass and then add one pound of refrigerant.
B. Pulley wobbles.	B. Check and replace, if necessary, the pulley bearing. If pulley has been worn by bearing, replace pulley.

DIAGNOSIS OF PERFORMANCE TEST RESULTS (Cont'd.)

CONDITION AND CAUSE	CORRECTION
VELOCITY OF AIR AT DISCHARGE NOZZLES TOO LOW	
A. Restricted evaporator core in evaporator assembly.	A. Wash evaporator core.
B. Restricted air hoses.	B. Inspect and replace if necessary.
C. Defective blower motor.	C. Check and replace if necessary.
D. Defective switches.	D. Check and replace if necessary.
E. Poor wiring connection (Low voltage at blower.)	E. Correct wiring.
EVAPORATOR PRESSURE TOO LOW	
A. Insufficient Refrigerant charge.	A. Add refrigerant.
B. Restricted air flow through evaporator.	B. Check air flow.
SWEATING OF AIR DISCHARGE NOZZLES	
A. Air leak at cowl or floor pan.	A. Properly seal all holes in cowl and floor pan.
WATER BLOWING OUT AIR DISCHARGE NOZZLE	
A. Plugged or kinked evaporator drain hose.	A. Clean or align as necessary.
INOPERATIVE CONTROLS	
A. Inadequate vacuum.	A. Check vacuum. All controls should move with 10° Hg. Check hoses.
B. Control cables improperly adjusted.	B. Adjust cables.

PRESSURE—TEMPERATURE RELATIONSHIP OF REFRIGERANT-12

Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure
-8	5.4	22	22.4	52	49.0	82	87.0	112	140.1
-6	6.3	24	23.9	54	51.0	84	90.1	114	144.2
-4	7.2	26	25.4	56	53.0	86	93.2	116	148.4
-2	8.2	28	27.0	58	55.4	88	96.4	118	153.0

PRESSURE—TEMPERATURE RELATIONSHIP OF REFRIGERANT-12 (Cont'd.)

Temp. °F.	Pressure	Temp. °F.	Pressure	Temp. °F.	Pressure	Temp. °F.	Pressure	Temp. °F.	Pressure
0	9.2	30	28.5	60	58.0	90	99.6	120	157.1
2	10.2	32	30.1	62	60.0	92	103.0	122	161.5
4	11.3	34	32.0	64	62.5	94	106.3	124	166.1
6	12.3	36	33.4	66	65.0	96	110.0	126	171.0
8	13.5	38	35.2	68	67.5	98	113.3	128	175.4
10	14.6	40	37.0	70	70.0	100	117.0	130	180.2
12	15.9	42	39.0	72	73.0	102	121.0	132	185.1
14	17.1	44	41.0	74	75.5	104	124.0	134	190.1
16	18.4	46	43.0	76	78.3	106	128.1	136	195.2
18	19.7	48	45.0	78	81.1	108	132.1	138	200.3
20	21.0	50	47.0	80	84.1	110	136.0	140	205.5

GENERAL SPECIFICATIONS

Engine Idle Speed	(Refer to Engine Tune-Up and/or Carburetion Section)
Fuse (at Fuse Block)	AGC 25 Amps.
Amount of Refrigerant 12 in System	4 Lbs. 4 Oz.
Total Amount of Oil in Refrigerant System	10.5 Fluid Oz.
Type of Oil	Frigidaire 525 Viscosity

TORQUE SPECIFICATIONS

Application	Ft. Lbs.
33-34-35-36-38 & 39 Series	
Compressor Rear Support to Compressor Bolt	22 to 26
Compressor Bracket and Rear Support to Cylinder Head Bolt Nut	45 to 55
Compressor Front Support to Compressor Bolt	14 to 17
Compressor Bracket Brace to Bracket and Front Cover Bolt and Nut	22 to 26
Compressor Support to Compressor Bracket Bolt	35 to 50
Delcotron Bracket to Compressor Housing Nuts	14 to 17
Delcotron Bracket to Delcotron Bolt	25 to 35
Adjusting Link to Bracket	22 to 26
30-31 & 32 Series	
*(Refer to Chart for Power Steering Pump, Delcotron and Compressor Mounting Brackets)	
Schrader Valve Adapter Fittings to Compressor Bolt	10 to 15
Driven Plate to Compressor Shaft Nut	14 to 16
Rear Head to Compressor Housing Nuts	19 to 23

*TORQUE CHART

Thread	Torque Lb.-Ft.
5/16 - 18	20 to 25
5/16 - 24	20 to 25
3/8 - 16	25 to 35
7/16 - 14	40 to 50
7/16 - 20	40 to 50

PERFORMANCE CHART

(30-31 & 32 SERIES)

In Front Of Condenser		Evaporator Pressure	*2260 V-6	Discharge Air Temp. R.H. Nozzle	High Pressure (Discharge)
Relative Humidity	Air Temp. °F.	At Suction Throttling Valve PSI	Engine R.P.M.	±1 °F.	±10 PSI
20	60	29	2000*	38	145
	70	29		40	180
	80	29		42	214
	90	29		43 1/2	251
	100	29 1/2		50	289
	110	39		57	340
30	60	29	2000*	38	146
	70	29		40	181
	80	29		42	220
	90	29		44	258
	100	33 1/2		54	299
	110	44 1/2		63	259
40	60	29	2000*	38	148
	70	29		40	184
	80	29		42 1/2	226
	90	29		47	265
	100	38		59	316
	110	50		69	378
50	60	29	2000*	38 1/2	150
	70	29		40	188
	80	29		43	232
	90	31		51	280
	100	43		62	340
	110	55 1/2		75	388
60	60	29	2000*	39	158
	70	29		40	196
	80	29		46	240
	90	34		34	300
	100	47		67	362
70	60	29	2000*	39	168
	70	29		41	205
	80	29		48	252
	90	36 1/2		59	324
	100	51 1/2		73	384
80	60	29	2000*	39 1/2	175
	70	29		42 1/2	211
	80	29		53	270
	90	39		65	346
	100	56		78	407
90	60	29	2000*	40	183
	70	29		46	224
	80	30		60	286
	90	41 1/2		72	369
	100	59		83	417

PERFORMANCE CHART
(33-34-35-36-38 & 39 Series)

In Front Of Condenser		Evaporator Pressure		Discharge Air Temp. R.H. Nozzle	High Pressure (Discharge)
Relative Humidity	Air Temp. °F.	At Suction Throttling Valve PSI	Engine R.P.M.	±1°F.	±10 PSI
20	70	29	2000	39	160
	80	29		42	198
	90	29		43	229
	100	31		50	266
	110	37 1/2		57	323
30	70	29	2000	39 1/2	165
	80	29		42	202
	90	29		46	235
	100	33 1/2		54	278
	110	43		62 1/2	340
40	70	29	2000	39 1/2	170
	80	29		44	207
	90	30 1/2		50	247
	100	37 1/2		58	292
	110	48		68	353
50	70	29	2000	40	175
	80	29		45	212
	90	34		54	260
	100	41		62 1/2	308
	110	52 1/2		72	367
60	70	29	2000	41	181
	80	29		47	217
	90	37		57	271
	100	45 1/2		67	326
	110	56		76	373
70	70	29	2000	42	188
	80	29 1/2		49	225
	90	39 1/2		60	280
	100	49 1/2		71	330
80	70	29	2000	44	196
	80	32		51	238
	90	42 1/2		63	289
	100	53		75	354
90	70	29	2000	45 1/2	203
	80	34 1/2		53 1/2	250
	90	45		65 1/2	298
	100	56		78	366

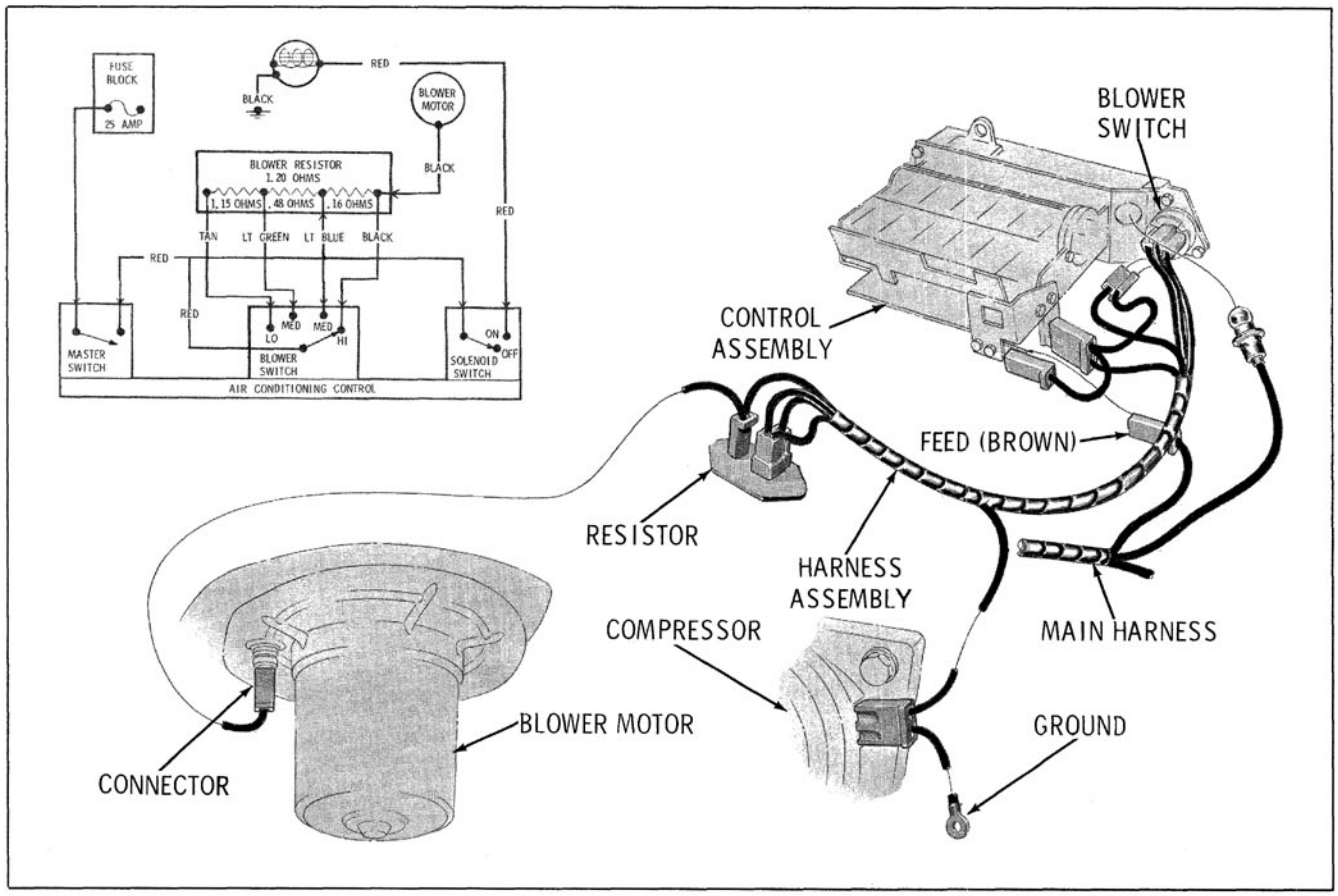
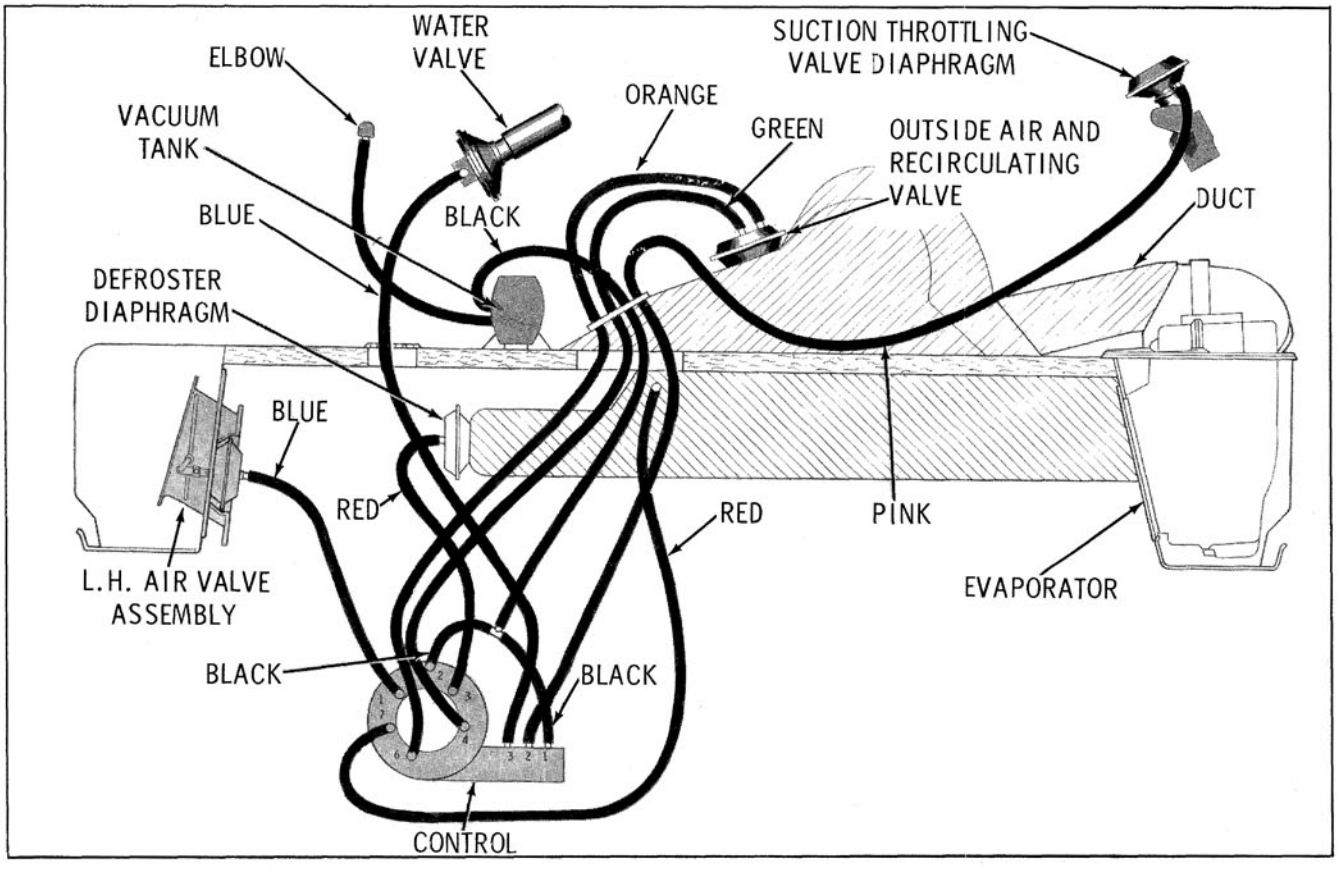


Fig. 14-126 Wiring Connections (33 - 34 - 35 - 36 - 38 & 39 Series)



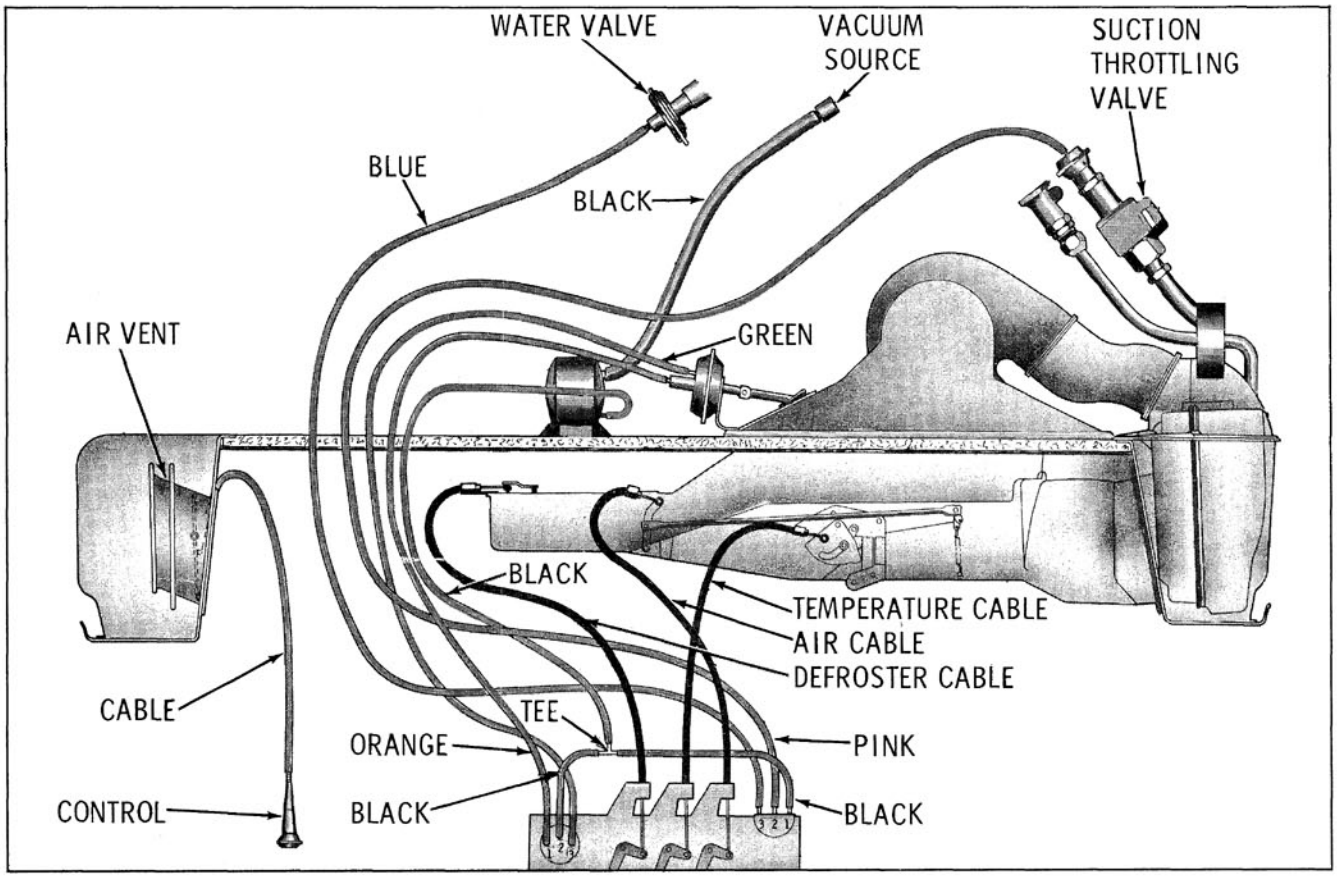


Fig. 14-128 Schematic Diagram of Air Conditioning and Heater Vacuum Hoses (30 - 31 & 32 Series)

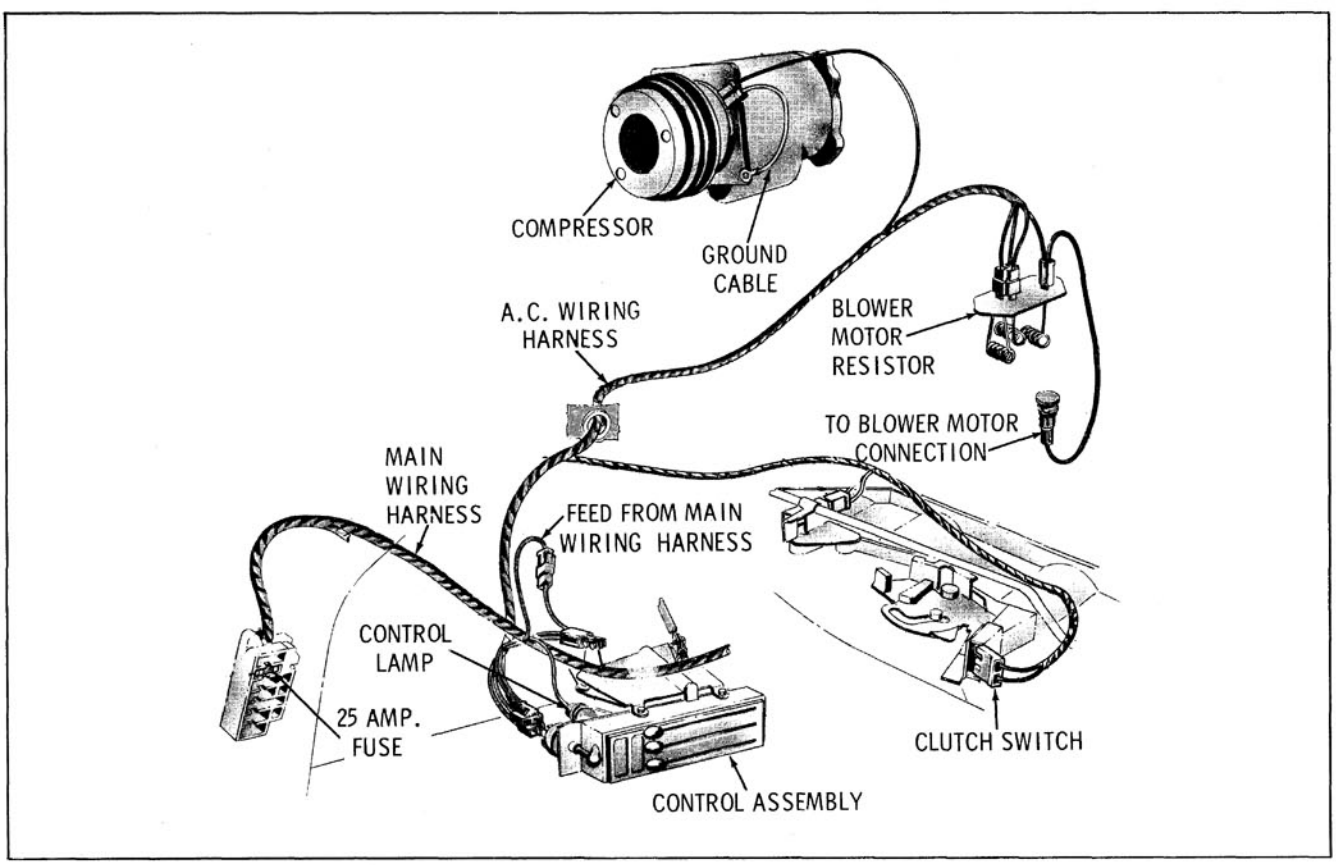
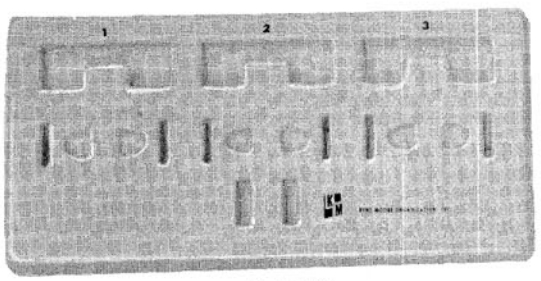
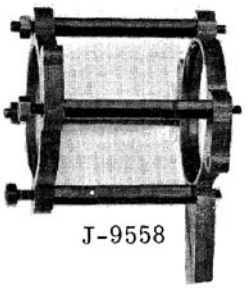
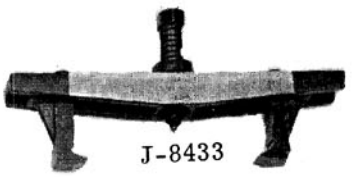


Fig. 14-129 Wiring Connections (30 - 31 & 32 Series)


J-9402


J-9558


J-8433


J-9395


J-9401


J-9480-2


J-9480

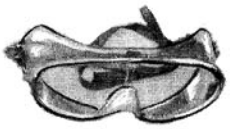

J-6435


J-5403


J-9393


J-9392


J-9481


J-5453


J-5421


J-9432


J-9527

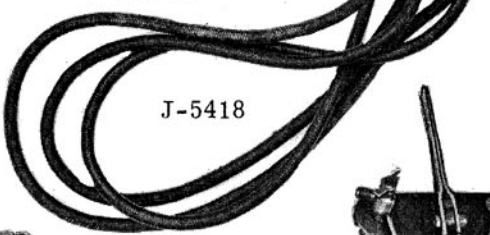

J-5420

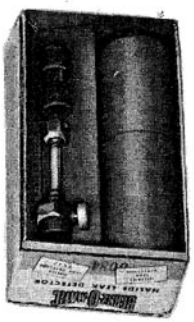

J-972-A


J-5725


J-5462

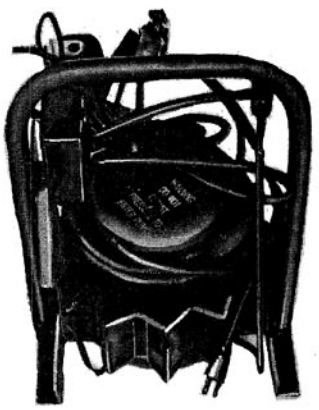

J-9433


J-5418


J-6084


J-6271


J-6272


J-5428

J-972-A	Spanner Wrench (Used for Holding Driven Plate)	J-8433	Compressor Pulley Puller
J-5403	Snap Ring Pliers	J-9392	Seal Remover & Installer
J-5418	Gauge Charging Line	J-9393	Seal Seat Remover & Installer
J-5420	Gauge Adapter	J-9395	Puller Pilot
J-5421	Pocket Thermometer	J-9401	Hub & Drive Plate Assembly Remover
J-5428	Vacuum Pump	J-9402	Cylinder Assembly Tray
J-5453	Goggles	J-9432	Needle Bearing Remover & Installer
J-5462	Refrigerant Drum Hook-Up Set	J-9433	Suction Crossover Seal Installer
J-5725	Gauge Manifold Test Unit	J-9480	Driven Plate Installer
J-6084	Leak Detector Kit	J-9481	Pulley Bearing & Drive Plate Assembly Installer
J-6271	Fits-All Valve	J-9527	Leak Test Adapter
J-6272	#3 Multi-Opener	J-9558	Checking Fixture
J-6435	Snap Ring Pliers		

Fig. 14-130 Tools