ELECTRICAL

CONTENTS

PART 1

BATTERY

SERVICE DIAGNOSIS

BATTERY TESTING CHART

Hydrometer Test (Corrected to 80°F.) See Paragraph 2	State of Charge or Battery Condition	Correction
LESS THAN 1.220 SP. GR.	Battery low.	Recharge battery. Make a high rate discharge test for capacity. If cells test O.K., recharge and adjust gravity of all cells uniformly. Test voltage regulator setting. Thoroughly test electrical system for short circuits, loose connections and corroded terminals.
CELLS SHOW MORE THAN 25 POINTS (.025 Specific Gravity) VARIATION	Short circuit in low cell. Loss of electrolyte by leakage or excessive overcharge. Improper addition of acid. Natural or premature failure. Cracked case.	Try to recharge the battery. See "Charging the Battery." See "Adjustment of Acid Gravity." Test battery for capacity. Install new battery if necessary.
CELLS SHOWING MORE THAN 1.220 SPECIFIC GRAVITY.	Satisfactory.	No correction required make a high rate discharge capacity test, if cells test O.K., adjust gravity of all cells uniformly.

Cranking Test	Possible Cause	Correction
IF THE VOLTAGE DROP IS MORE THAN 0.3 VOLTS (3/10) BETWEEN THE STARTING MOTOR CABLE AND THE VEHICLE FRAME WHILE CRANKING LOOK FOR:	Poor contact between the cable terminal and the vehicle frame or between the cable clamp terminal and the battery post or the starter switch contacts. Frayed, corroded or broken cable.	Locate the high resistance: repair or replace as necessary.

SERVICE PROCEDURES

BATTERY VISUAL INSPECTION

(1) Protect the paint finish with fender covers.

(2) Disconnect the battery cables at the battery.

(3) Remove the battery hold-down clamp and remove the battery from the vehicle.

(4) Inspect the battery carrier and fender side panel for damage caused by loss of acid from the battery.

(5) Clean the top of battery with a solution of clean warm water and baking soda. Scrub areas with a stiff bristle brush being careful not to scatter corrosion residue. Finally wipe off with a cloth moistened with ammonia or baking soda in water.

CAUTION: Keep cleaning solution out of battery cells to eliminate weakening the electrolyte.

(6) Inspect the cables. Replace damaged or frayed cables.

(7) Clean the battery terminals and the inside surfaces of the clamp terminals with the Cleaning Tool MX-75.

(8) Examine the battery case and cover for cracks.

(9) Install the battery.

(10) Tighten the battery hold-down screw nuts to 3 foot-pounds torque.

NOTE: Observe the polarity of the terminals of battery to be sure the battery is not reversed.

(11) Connect the cable clamps to the battery posts and tighten securely. Coat all connections with light mineral grease or petrolatum after tightening.

(12) If the electrolyte level is low, fill to recommended level with mineral-free water.

SPECIFIC GRAVITY TEST

A hydrometer Tool 40-B is used to measure the specific gravity of the electrolyte in the battery cells. This gives an indication of how much unused sulphuric acid remains in the solution.

A hydrometer should be graduated to read from 1.160 to 1.320, in graduations of .005 specific gravity. The graduated markings should be not less than $^1/_{16}$ inch apart and accurate to within .002 specific gravity. The graduated portion of the stem should be about two inches long. Clearance between the float and glass barrel, at the smallest diameter, should be a minimum of ⅛" around all sides and the barrel must be clean.

NOTE: Hydrometer floats are calibrated to indicate correctly only at one fixed temperature.

The liquid level of the battery cell should be at normal height and the electrolyte should be thoroughly mixed with any battery water which may have just been added by charging the battery before taking any hydrometer readings. See "Adjustment of Acid Gravity."

In reading a hydrometer, the barrel must be held vertically and just the right amount of fluid be drawn up into the gauge barrel with the pressure bulb fully expanded to lift the float freely so that it does not touch the sides, top or bottom of the barrel. Take a reading with eye on level with liquid in barrel. **DO NOT TILT** hydrometer.

The specific gravity of the battery electrolyte strength or density varies not only with the quantity of the acid in solution but also with temperature. As temperature increases, the volume of the electrolyte expands and the specific gravity is reduced. As temperature drops, the electrolyte contracts and specific gravity increases.

Specific gravity variations caused by temperatures must be considered in the analysis of the battery, otherwise specific gravity readings will not give a true indication of the state of charge.

Use a battery immersion type thermometer of the mercury-in-glass type, having a scale reading as high as 125°F and designed for not over a 1-inch bulb immersion. A suitable dairy type thermometer may prove satisfactory for the purpose.

Draw electrolyte in and out of the hydrometer barrel several times to bring the temperature of the hydrometer float to that of the acid in the cell and then measure the electrolyte temperature in the cell.

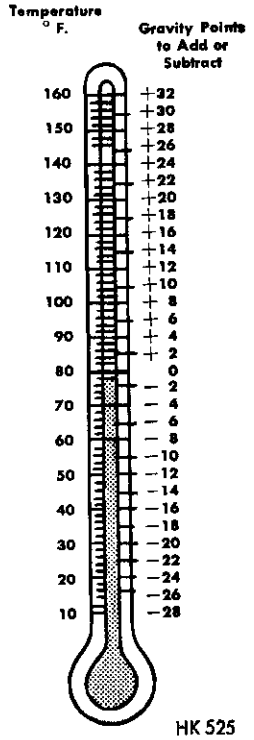

Fig. 1—Hydrometer Reading Correction Chart

The temperature correction in specific gravity reading at 80° Fahrenheit is zero. Add .004 specific gravity points for every 10° degrees over 80° F. and subtract .004 specific gravity points for every 10 degrees under 80° F. All readings must be corrected to 80 degrees Fahrenheit. Refer to Figure 1 and examples one and two as follows:

Example 1—

Hydrometer Reading	1.260
Acid Temperature	20 degrees Fahrenheit
Subtract Specific Gravity	.024
Correct Specific Gravity is	1.236

Example 2—

Hydrometer Reading	1.255
Acid Temperature	100 degrees Fahrenheit
Add Specific Gravity	.008
Corrected Specific Gravity is	1.263

A fully charged relatively new battery has a specific gravity reading of 1.260 plus .015 minus .005 (all batteries for use in temperate climates).

ADJUSTMENT OF ACID GRAVITY

Hydrometer floats usually are not calibrated below about 1.160 specific gravity and cannot indicate the condition of a battery in a very low state of charge. Therefore, it may be necessary to give the battery several hours charge before a hydrometer reading will indicate that the battery is taking a charge.

If the specific gravity of all cells are not within .015 points of the specified value, corrected to 80°F, at the end of a full charge, remove some of the electrolyte with the hydrometer and add a like amount of distilled water to reduce the gravity if too high, or add 1.400 Specific Gravity acid to raise the specific gravity, if too low. Continue the charge so as to give the electrolyte a chance to mix and then read the gravity after another hour of charge to note the effect of the additions. Continue this adjusting procedure until the gravity is brought to the desired value by charging for one hour after each adjustment.

Never adjust the specific gravity of any battery cell which does not gas freely on charge. Unless electrolyte has been lost through spilling or leaking, it should not be necessary to add acid to a battery during its life. Acid should never be added unless one is certain that the cell will not come up to normal gravity by continued charging. Always make the temperature correction for hydrometer readings, as warm electrolyte will read low and this might be mistaken for failure of the battery to rise normally in gravity. It could also be falsely concluded that the battery would not take a full charge.

HIGH RATE DISCHARGE TEST OF BATTERY CAPACITY

Satisfactory capacity tests can be made only when battery equals or exceeds 1.220 specific gravity at 80 degrees Fahrenheit. If the reading is below 1.220 the battery should be slow charged until fully charged in order to secure proper test results.

Test Procedure

(1) Turn the control knob of the battery starter tester to the **OFF** position.

(2) Turn voltmeter selector switch to the 16 volt position on test units so equipped.

(3) Connect the test ammeter and voltmeter positive leads to battery positive terminal. Connect the ammeter and voltmeter negative leads to the battery negative terminal (Fig. 2).

NOTE: The voltmeter clips must contact the battery posts or cable clamps and not the ammeter lead clips.

(4) Turn control knob clockwise until ammeter reading is equal to three times the ampere hour rating of the battery.

(5) Maintain this load for 15 seconds; the voltmeter should read 9.5 volts or more, which will indicate that the battery has good output capacity.

(6) After the 15 second test, turn control knob to the OFF position.

If the voltage in the "High Rate Discharge Test" was under 9.5 volt, the battery should be test charged to determine whether the battery can be satisfactorily charged.

Charging the BATTERY

Three Minute Charge Test (Fig. 3)

NOTE: This test should not be used if battery temperature is below 60 degrees F.

(1) Connect the positive (+) battery charger lead to

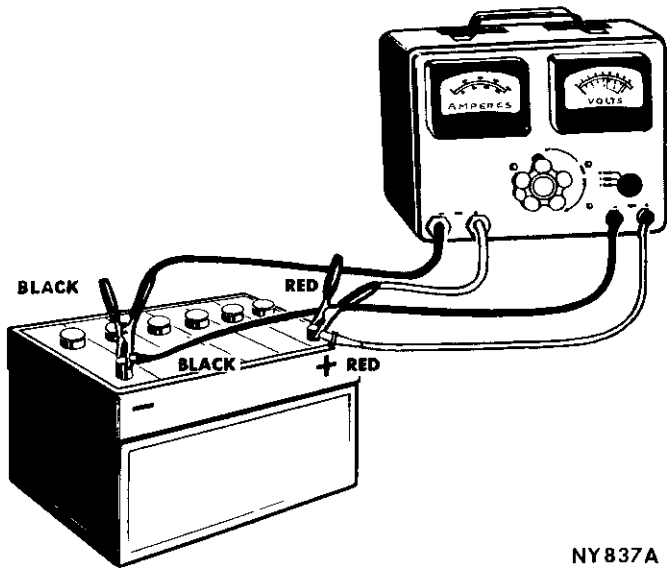

Fig. 2—High Rate Discharge Test

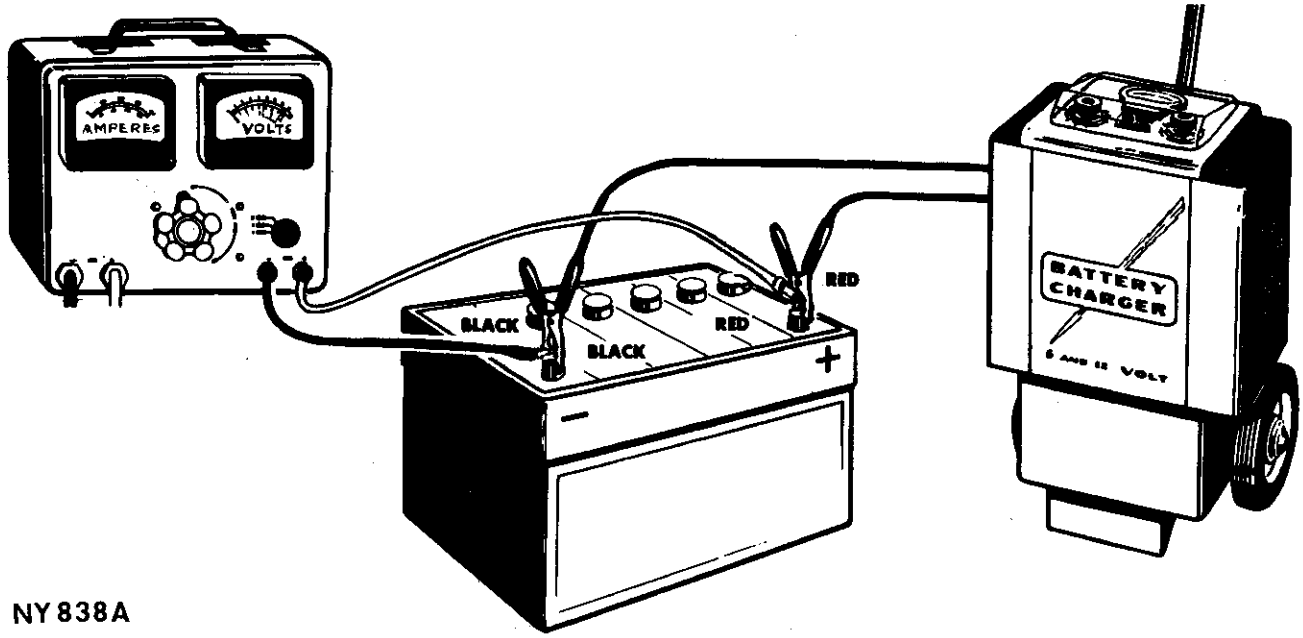

Fig. 3—Three Minute Charge Test

the battery positive terminal and negative (—) battery charger lead to the battery negative terminal.

IMPORTANT: Be sure of correct polarity when charging batteries.

(2) Trip the battery charger power switch to the **ON** position. Turn the charger timer switch past the three minute mark then back to the three minute mark.

(3) Adjust the charge switch to the highest possible rate not exceeding 40 amperes.

(4) When the timer switch cuts off at the end of 3 minutes, turn the timer switch back to fast charge.

(5) Use the 4 volt scale of the battery starter tester voltmeter on test units so equipped and quickly measure the voltage across each cell while the battery is being fast charged. A faulty cell or cells will be detected by a cell voltage variation of more than 1 volt.

(6) If the cell voltages are even within .1 volt, use the 16 volt scale of the battery starter tester and measure the total voltage of the battery posts while the battery is being fast charged. If the total voltage during charge exceeds 15.5 volts, the battery is sulphated and should be cycled and slow-charged until the specific gravity reaches 1.260 (See "Slow Charging").

NOTE: A slow charge is preferable to bring the battery up to a full charge.

If the specific gravity remains constant after testing battery at one hour intervals for three hours, the battery is at its highest state of charge.

(7) Make another capacity test. If the capacity test does not meet specifications, replace the battery.

Fast Charging the Battery (Fig. 4)

If adequate time for a slow charge is not available, a high rate (FAST) charge is permissible and will give a sufficient charge in one hour enabling the battery and alternator to continue to carry the electrical load.

Connect the positive (+) battery charger lead to the battery positive terminal and the negative (—) charger lead to the battery negative terminal. If the battery is not removed from the vehicle, **BE SURE** the ignition switch is turned off and all electrical accessories are turned off during charging.

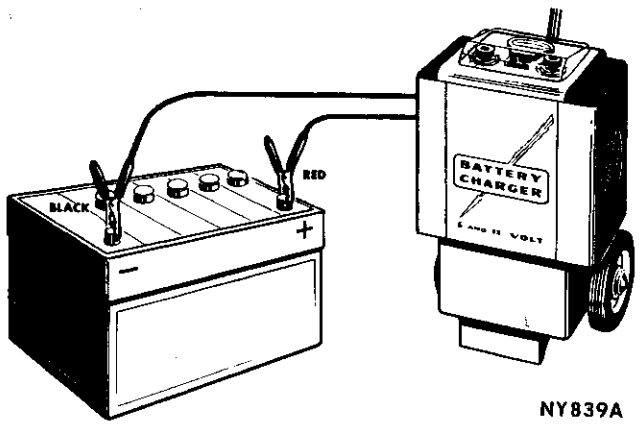

Fig. 4—Fast Charging the Battery

CAUTION: The battery can be damaged beyond repair unless the following precautions are taken:

(1) The battery electrolyte temperature must **NEVER** exceed 125 degrees Fahrenheit.

If this temperature is reached, the battery should be cooled by reducing the charging rate or remove the battery from the circuit.

(2) As the batteries approach full charge the electrolyte in each cell will begin to gas or bubble. Excessive gassing must not be allowed.

(3) Do not fast charge longer than one hour.

If the battery does not show a significant change in specific gravity after one hour of "FAST" charge, the slow charge method should be used.

Remember to use the temperature correction when checking specific gravity.

NOTE: The manufacturers of high rate charging equipment generally outline the precautions and some models have thermostatic temperature limiting and time limiting controls.

WARNING: When batteries are being charged an explosive gas mixture forms beneath the cover of each cell. Do not smoke near batteries on charge or which have recently been charged. Do not break live circuits at the terminals of the batteries on charge. A spark will occur where the live circuit is broken. Keep all open flames away from the battery.

Slow Charging Batteries

Many discharged batteries can be brought back to good condition by slow charging, especially batteries that are sulphated.

The battery should be tested with a hydrometer and a record kept of the readings taken at regular intervals throughout the charge. A voltage test should also be made, noting the voltage uniformity between cells. Any subnormal voltage in any cell may indicate a shorted cell. When a cell has a specific gravity reading that is 25 points (.025) or more below the other cells, that cell is defective and the battery should be replaced.

Safe slow charging rates are determind by allowing one ampere per positive plate per cell. The proper slow charging rate would be 4 amperes for a 48 ampere hour battery; or 5 amperes for a 59 ampere hour battery; and 6 amperes for a 70 ampere hour battery.

The rate of charge for a normally discharged battery is one ampere per positive plate per cell.

The average length of time necessary to charge a battery by the slow charge method at normal rates is from 12 to 16 hours, however, when a battery continues to show an increase in specific gravity, the battery charge should be continued even if it takes 24 hours or more.

NOTE: Watch the temperature of batteries carefully and if the temperature of any one of them reaches 110°F., lower the charging rate.

The battery will be fully charged when it is gassing freely and when there is no further rise in specific gravity after three successive readings taken at hourly intervals. Make sure hydrometer readings are corrected for temperature.

The rate of charge for a sulphated battery should be no more than ½ the normal slow charge rate. Many sulphated batteries can be brought back to a useful condition by slow charging at half the normal charging rate from 60 to 100 hours. This long charging cycle is necessary to reconvert the crystalline lead sulphate into active materials.

Batteries that are sulphated have the following characteristics:

(1) Battery temperature tends to increase rapidly while charging.

(2) Gravity under charge increases very slowly or not at all.

(3) Battery will gas excessively under normal charging rate.

(4) Excessive voltage required to obtain normal charging rate.

NOTE: When a battery takes a full charge, but is returned several times in need of a recharge, check for a cracked cell partition with a syringe to provide air pressure; bubbles will appear in an adjacent cell if a crack is present.

PART 2

STARTING MOTOR

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
STARTER FAILS TO OPERATE	(a) Weak battery or dead cell in the battery.	(a) Test specific gravity. Recharge or replace the battery as required.
	(b) Ignition switch faulty.	(b) Test and replace the switch if necessary.
	(c) Loose or corroded battery cable terminals.	(c) Clean terminals and clamps, replace if necessary. Apply a light film of petrolatum to terminals after tightening.
	(d) Open circuit, wire between the ignition—starter switch and ignition terminal on the starter relay.	(d) Inspect and test all the wiring.
	(e) Inoperative clutch unit.	(e) Replace the clutch unit.
	(f) Faulty starting motor.	(f) Test and repair as necessary.
	(g) Armature shaft sheared.	(g) Test and repair.
	(h) Open solenoid pull-in wire.	(h) Test and replace the solenoid if necessary.
STARTER FAILS AND LIGHTS DIM	(a) Weak battery or dead cell in the battery.	(a) Test for specified gravity. Recharge or replace the battery as required.
	(b) Loose or corroded battery cable terminals.	(b) Clean the terminals and clamps, replace if necessary. Apply a light film of petrolatum to the terminals after tightening.
	(c) Internal ground in the windings.	(c) Test and repair the starter.
	(d) Grounded starter fields.	(d) Test and repair the starter.
	(e) Armature rubbing on pole shoes.	(e) Test and repair the starter.
STARTER TURNS, BUT PINION DOES NOT ENGAGE	(a) Starter clutch slipping.	(a) Replace the clutch unit.
	(b) Broken teeth on the flywheel drive gear.	(b) Replace the flywheel ring gear. Inspect the teeth on the starter clutch pinion gear.
	(c) Pinion shaft rusted, dirty or dry, due to lack of lubrication.	(c) Clean, test and lubricate.
STARTER RELAY DOES NOT CLOSE	(a) Battery discharged.	(a) Recharge or replace the battery.
	(b) Faulty wiring.	(b) Test for open circuit, wire between the starter relay ground terminal post and neutral starter switch (automatic transmission only). Also test for open circuit; wire between the ignition-starter switch and ignition terminal and starter relay.
	(c) Neutral starter switch on automatic transmission faulty.	(c) Test and replace the switch if necessary.
	(d) Starter relay faulty.	(d) Test and replace if necessary.
RELAY OPERATES BUT SOLENOID DOES NOT	(a) Faulty wiring.	(a) Test for open circuit wire between the starter-relay solenoid terminal and solenoid terminal post.
	(b) Faulty solenoid switch or connections.	(b) Test for loose terminal connections between the solenoid and the starter field.
	(c) Solenoid switch contacts corroded.	(c) Test and replace the solenoid if necessary.
	(d) Broken lead or a loose soldered connection inside the solenoid switch (brush holder plate).	(d) Test and replace the solenoid if necessary.

Condition	Possible Cause	Correction
SOLENOID PLUNGER VIBRATES BACK AND FORTH WHEN SWITCH IS ENGAGED	(a) Battery low.	(a) Test for specific gravity of the battery. Replace or recharge the battery.
	(b) Faulty wiring.	(b) Test for loose connections at relay, ignition-starter switch and solenoid.
	(c) Lead or connections broken inside solenoid switch cover (brush holder plate) or open hold-in winding.	(c) Test and replace the solenoid if necessary.
	(d) Check for corrosion on solenoid contacts.	(d) Test and clean the contacts.
STARTER OPERATES BUT WILL NOT DISENGAGE WHEN THE IGNITION STARTER SWITCH IS RELEASED	(a) Broken solenoid plunger spring or spring out of position.	(a) Test and repair.
	(b) Faulty ignition-starter switch.	(b) Test and replace the switch if necessary.
	(c) Solenoid contact switch plunger stuck in solenoid.	(c) Remove the contact switch plunger, wipe clean of all dirt, place a film of SAE 10 oil on the plunger, wipe off excess.
	(d) Insufficient clearance between winding leads to solenoid terminal and main contactor in solenoid.	(d) Test and repair.
	(e) Faulty relay.	(e) Test and replace the relay if necessary.

STARTING MOTOR—REDUCTION GEAR TYPE

Description

The starting motor has an armature-to-engine crankshaft ratio of 45 to 1: a 3.5 to 1 reduction gear set is built into the motor assembly, which is housed in an aluminum die casting, Fig. 1. The starting motor utilizes a solenoid shift device, the housing of the solenoid is integral with the starting motor drive end housing.

SERVICE PROCEDURES

STARTER RESISTANCE AND CURRENT DRAW TESTING

(1) Test the battery electrolyte specific gravity. Specific gravity should be 1.220 or above. If the battery specific gravity is below 1.220, recharge the battery to full charge before proceeding with the test.

(2) Disconnect the positive battery lead from the battery terminal post. Connect an 0 to 30 scale ammeter between the disconnected lead and the battery terminal post.

(3) Connect a test voltmeter with 10 volt scale division between the battery positive post and the starter switch terminal at the starter solenoid.

(4) Crank the engine and observe the reading on the voltmeter and ammeter. The voltage should not exceed .3 volt. A voltage reading that exceeds .3 volt indicates there is high resistance caused from loose circuit connections, a faulty cable, burned starter relay or solenoid switch contacts. A current that is high and is combined with slow cranking speed, indicates that the starter should be removed and repaired.

STARTER GROUND CIRCUIT TEST

(1) Connect the voltmeter positive lead to the starter housing and the negative voltmeter lead to the battery negative post.

(2) Crank the engine with a remote control starter switch and observe the voltmeter reading. The voltmeter reading should not exceed .2 volt. A reading of .2 volt or less indicates voltage in the ground cable and connections is normal. If the voltmeter reading is more than .2 volt, it indicates excessive voltage loss in the starter ground circuit. Make the following tests to isolate the point of excessive voltage loss. Repeating the test at each connection.

(a) Starter drive housing.
(b) Cable terminal at the engine.
(c) Cable clamp at the battery.

A small change will occur each time a normal portion of the circuit is removed from the test. A definite change in the voltmeter reading indicates that the last part eliminated in the test is at fault.

Maximum allowable voltage loss is as follows:

Battery ground cable .2 volt
Engine ground circuit .1 volt
Each connection .0 volt

REMOVAL OF STARTING MOTOR

(1) Disconnect the ground cable at the battery.
(2) Remove the cable at the starter.

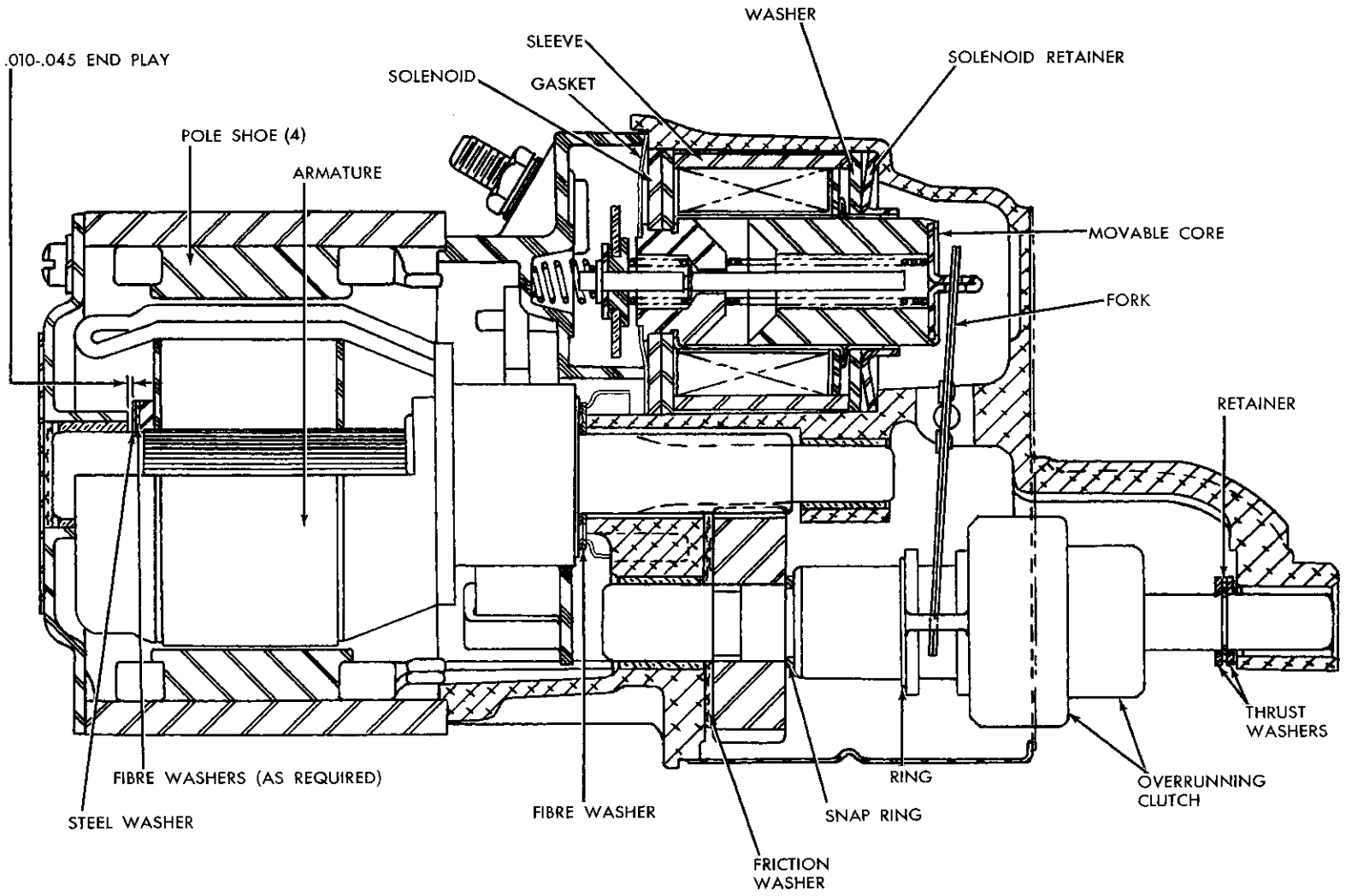

Fig. 1—Starting Motor Cross Section

(3) Disconnect the solenoid lead wire at the solenoid terminals.

(4) Remove the one stud nut and one bolt attaching the starting motor to the flywheel housing, slide the Automatic Transmission oil cooler tube bracket off the stud (if so equipped) and remove the starting motor and housing and removable seal.

TESTING THE STARTING MOTOR

(Bench Test)

Free Running Test

(1) Place the starter in a vise and connect a fully charged, 12 volt battery to the starter as follows:

(2) Connect a test ammeter (100 amperes scale) and a carbon pile rheostat in series with the battery positive post and the starter terminal.

(3) Connect a voltmeter (15 volt scale) across the starter.

(4) Rotate the carbon pile to the full-resistance position.

(5) Connect the battery cable from the battery negative post to the starter frame.

(6) Adjust the rheostat until the battery voltage shown on the voltmeter reads 11 volts. The amperage draw should be as shown in specifications.

Locked-Resistance Test

(1) Install the starter in a test bench.

(2) Follow the instructions of the test equipment manufacturer and test the starter against the following specifications.

(3) With applied battery voltage adjusted to 4 volts, the amperage draw should be as shown in specifications.

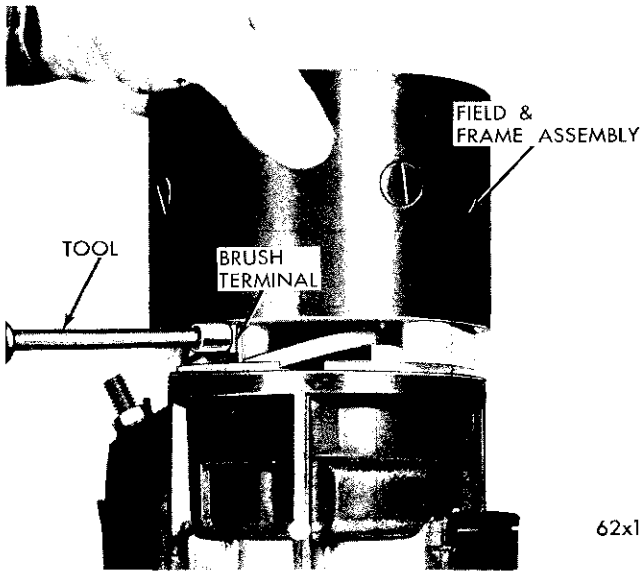

Fig. 2—Removing or Installing Brush Terminal Screw

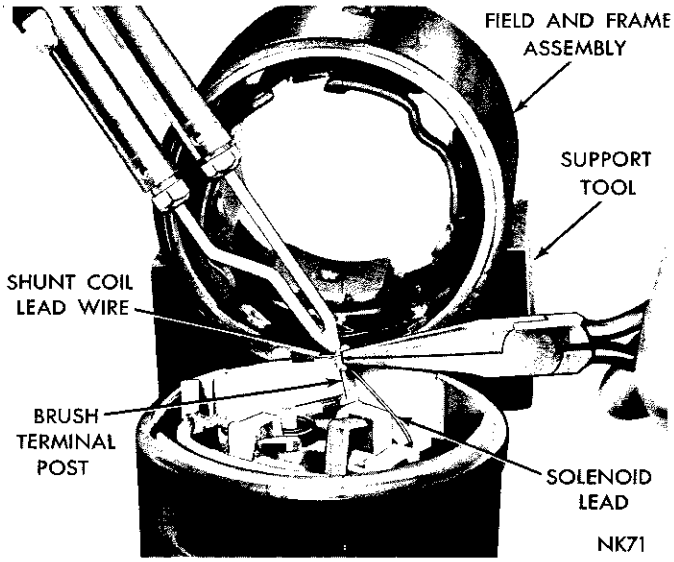

Fig. 3—Unsoldering the Shunt Coil Lead Wire

SERVICING THE STARTING MOTOR

Disassembly

(1) Place the gear housing of the starter in a vise equipped with soft jaws. Use the vise as a support fixture only. **DO NOT** clamp.

(2) Remove the two through bolts and the starter end head assembly.

(3) Carefully pull the armature up and out of the gear housing and the starter frame and field assembly. Remove the steel and fiber thrust washer.

NOTE: The wire of the shunt field coil is soldered to the brush terminal. One set of brushes are connected to this terminal. The other pair of brushes is attached to the series field coils by means of a terminal screw. Carefully pull the frame and field assembly up just enough to expose the terminal screw and solder connection of the shunt field at the brush terminal. Place two wood blocks between the starter frame and starter gear housing to facilitate removal of the terminal screw, Fig. 2.

(4) Support the brush terminal by placing a finger behind the terminal and remove the terminal screw.

(5) Unsolder the shunt field coil lead from the starter brush terminal, Fig. 3.

NOTE: The starter brush holder plate with the starter brush terminal, contact and brushes is serviced as an assembly.

(6) Remove all old sealer at the brush holder plate and gear housing.

(7) Unsolder the solenoid lead wire and unwind the wire from the starter brush terminal (Fig. 4).

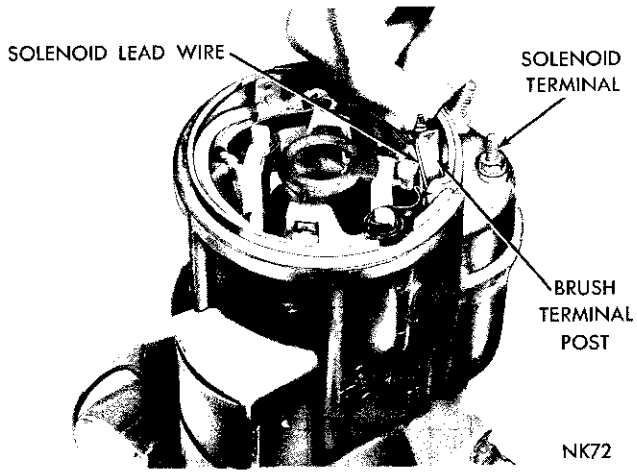

Fig. 4—Unwinding or winding the Solenoid Lead Wire

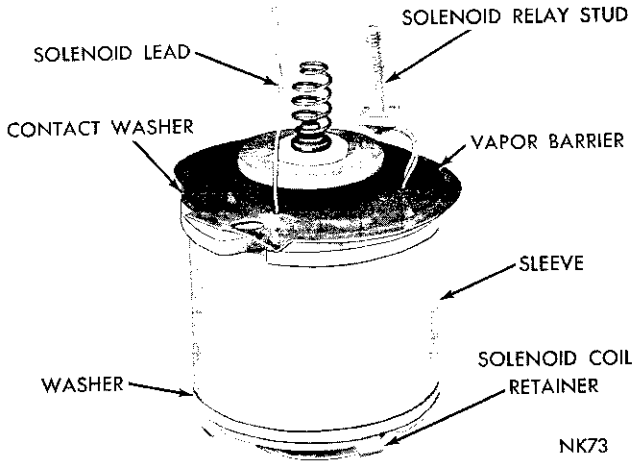

Fig. 6—Solenoid Assembly Removed

(8) Remove the screw attaching the brush holder plate to the starter gear housing (Fig. 5).

(9) Remove the nut ($^{11}/_{32}$ wrench), steel washer and insulating washer from the solenoid terminal.

(10) Straighten the solenoid wire and remove the brush holder plate with the brushes as an assembly.

(11) Remove the solenoid assembly from the gear housing well (Fig. 6).

(12) Remove the nut, steel washer and the sealing washer from the starter battery terminal.

(13) Remove the starter battery terminal from the holder plate.

(14) Remove the solenoid contact and plunger from the solenoid.

(15) Remove the solenoid return spring from the well of the solenoid housing moving core.

(16) Remove the dust cover from the gear housing, (Fig. 7).

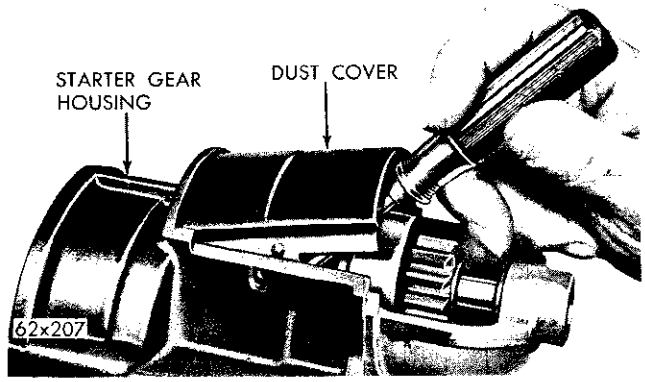

Fig. 7—Removing the Dust Cover

(17) Release the retainer that positions the driven gear on the pinion shaft (Fig. 8).

CAUTION: The retainer is under tension and a cloth should be placed over the retainer to prevent

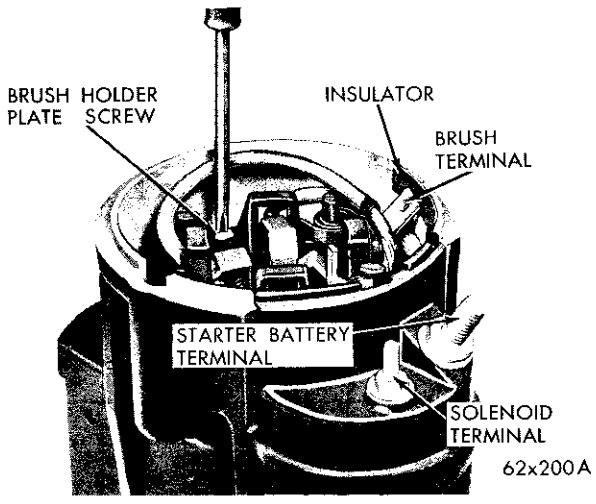

Fig. 5—Removing or installing Brush Holder Plate Screw

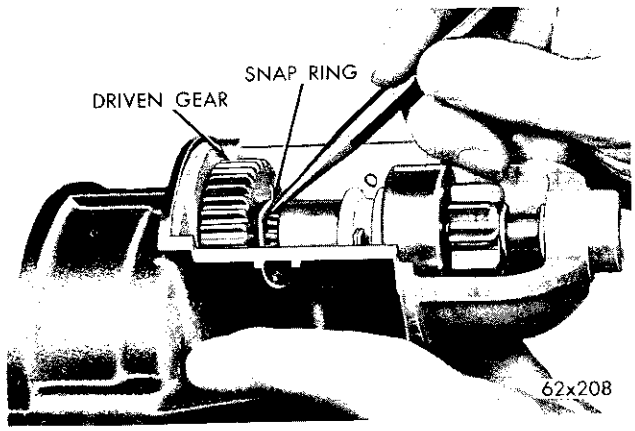

Fig. 8—Removing the Driven Gear Snap Ring

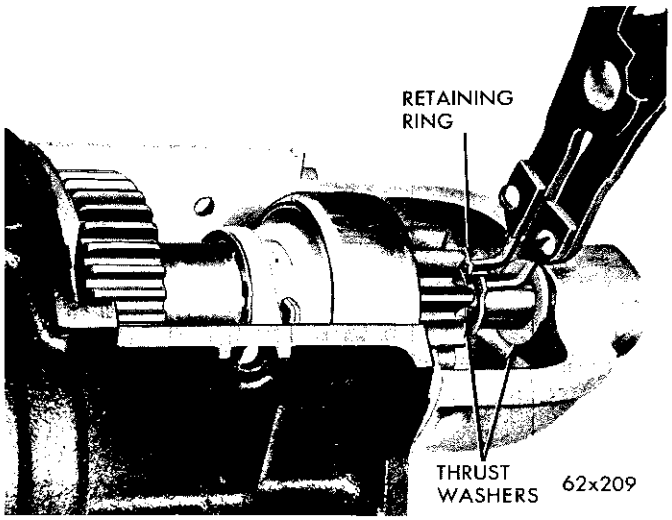

Fig. 9—Removing or Installing the Pinion Shaft Retainer Ring

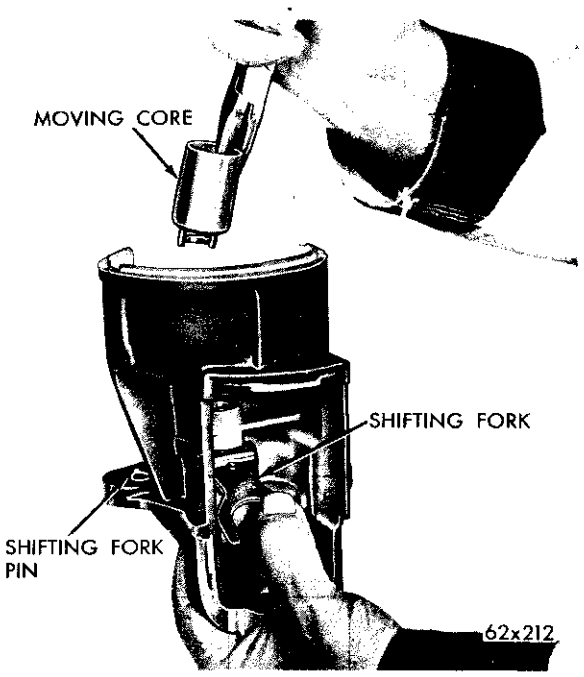

Fig. 12—Removing or Installing the Moving Core

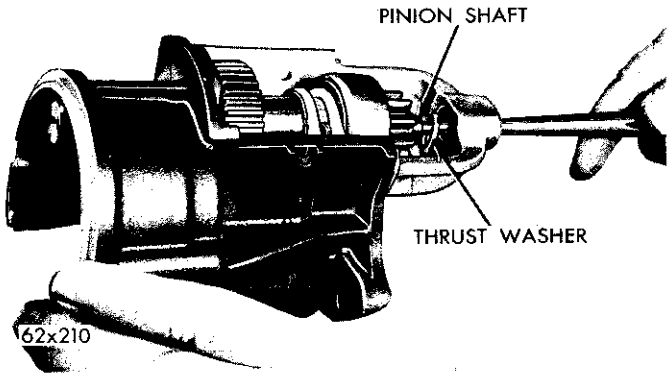

Fig. 10—Removing the Pinion Shaft

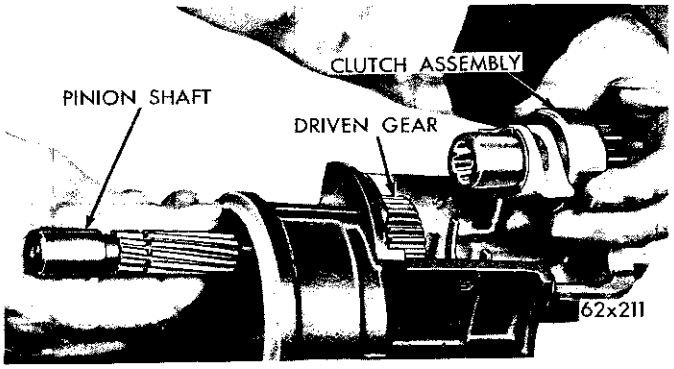

Fig. 11—Removing or Installing the Clutch Assembly

it from springing away after removal.

(18) Release the retainer ring at the front of the pinion shaft (Fig. 9).

NOTE: Do not spread the retainer ring any greater than the outside diameter of the pinion shaft otherwise the lock ring can be damaged.

(19) Push the pinion shaft towards the rear of the housing (Fig. 10) and remove the snap ring and thrust washers, clutch and pinion assembly, with the two shifter fork nylon actuators as on assembly (Fig. 11).

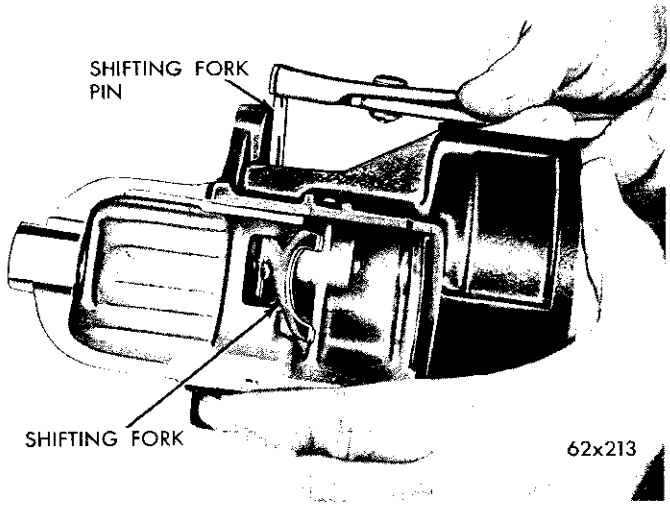

Fig. 13—Removing or Installing the Shifting Fork Pin

(20) Remove the driven gear and friction washer.

(21) Pull the shifting fork forward and remove the solenoid moving core (Fig. 12).

(22) Remove the shifting fork retainer pin (Fig. 13) and remove the clutch shifting fork assembly.

CLEANING THE STARTER PARTS

(1) Do not immerse the parts in a cleaning solvent. Immersing the field frame and coil assembly and/or armature will damage the insulation. Wipe these parts with a clean cloth **only.**

(2) Do not immerse the clutch unit in a cleaning solvent. The clutch is pre-lubricated at the factory and solvent will wash the lubricant from the clutch.

(3) The starter-clutch outer housing and pinion gear may be cleaned with a cloth moistened with a cleaning solvent and wiped dry with a clean dry cloth.

(4) Unsolder the solenoid lead wires from the solenoid terminal relay stud.

(5) Clean all corrosion from the solenoid assembly (washers, sleeve and retainer and inside of the solenoid housing). These metal parts are part of the solenoid hold-in ground circuit and must be clean.

(6) Clean the terminal contacts and contactor with crocus cloth.

(7) Thoroughly clean the outside area of the brush plate to remove all oil and dirt.

REPLACEMENT OF BRUSHES AND SPRINGS

(1) Brushes that are worn more than ½ the length of new brushes, or are oil-soaked, should be replaced.

(2) When resoldering the shunt field and solenoid lead, make a strong low resistance connection using a high temperature solder and resin flux. **Do not use acid** or acid core solder. **Do not** break the shunt field wire units, when removing and installing the brushes.

(3) Measure the brush spring tension with a spring scale hooked under the spring near the end. Pull the scale on a line parallel to the edge of the brush and take a reading just as the spring end leaves the brush. Spring tension should be 32 to 36 ounces. Replace springs that do not meet specifications.

TESTING ARMATURE

Testing the Armature for Short Circuit

Place the armature in growler and hold a thin steel blade parallel to the core and just above it, while slowly rotating the armature in the growler. A shorted armature will cause the blade to vibrate and be attracted to the core. Replace the armature if shorted.

Testing Armature for Ground

Contact the armature shaft and each of the commutator riser bars with a pair of test lamp test prods. If the lamp lights, it indicates a grounded armature. Replace a grounded armature.

Testing Commutator Run-Out, Refacing and Undercutting

Place the armature in pair of "V" blocks and measure the runout with a dial indicator. Measure both the shaft and commutator. A bent shaft requires replacement of the armature. When the commutator runout exceeds .003 inch, commutator should be refaced. Remove only a sufficient amount of metal to provide a smooth, even surface.

Testing Field Coils for Ground

(1) Remove the field frame assembly from the starter.

(2) Carefully drill out the rivet that attaches the series field coil ground lead and the shunt field coil lead to the field frame.

(3) Insulate the field coil leads from the field frame.

(4) Test for ground using a 110 volt test lamp. Touch one probe of the test lamp to the series field coil lead and the other probe to the field frame. The lamp should not light. Repeat the procedure for the shunt field coil.

If the lamp lights, it indicates that the field coils are grounded and require replacement.

REPLACING THE FIELD COILS

A pole shoe impact screwdriver Tool C-3475 should

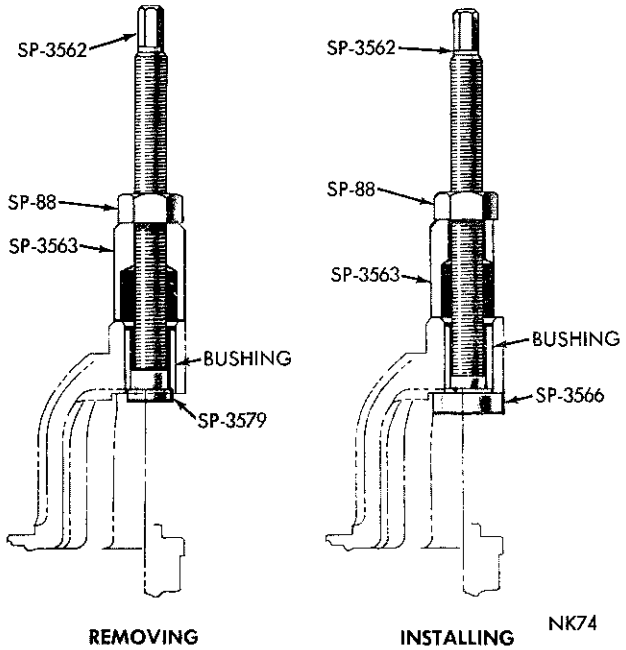

Fig. 14—Removing and Installing the Pinion Housing End Bushing

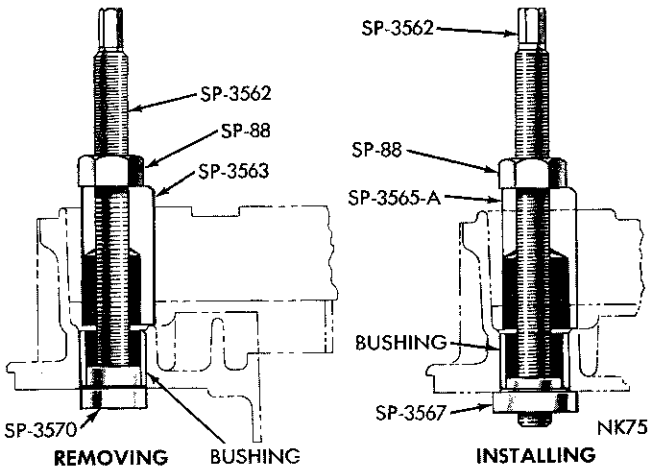

Fig. 15—Removing and Installing the Pinion Housing Drive Shaft Bushing

be used to remove and install the field coils to prevent damage to the pole shoe screws and for proper tightening. Pole shoes that are loose and not properly seated may cause the armature core to rub on the pole shoes. This will decrease starter efficiency and damage the armature core.

NOTE: Make sure the area between the leads and starter frame is clean. Peen new rivet securely to insure a good electrical contact.

SERVICING THE STARTING MOTOR BUSHINGS

Inspect the armature shaft bearing, pinion shaft surfaces and bushings for wear. Try the bushings for wear by inserting the shafts and test for side play.

NOTE: Pre-sized starting motor bushings are available as service bushings. Use Tool C-3944 to remove the old bushings and install the new. No burnishing or reaming is required to fit the pre-sized bushings.

The C-3944 Tool and its adaptors are designed to service all of the gear reduction motor bushings with the exception of the end head bushing. The end head bushing and end head are serviced as an assembly.

Remove and install bushings as shown in Figures 14 through 16.

SERVICING THE STARTER CLUTCH UNIT

Do not immerse the starter clutch unit in a cleaning solvent. The starter clutch is pre-lubricated at the factory and a solvent will wash the lubricant from the clutch.

The starter clutch outer housing and pinion gear may be cleaned with a cloth moistened with a cleaning solvent and wiped dry with a clean dry cloth.

Rotate the pinion. The pinion gear should rotate smoothly in one direction (not necessarily easily), but should not rotate in the opposite direction. If the starter clutch unit does not function properly, or the pinion is worn, chipped or burred, replace the starter clutch unit.

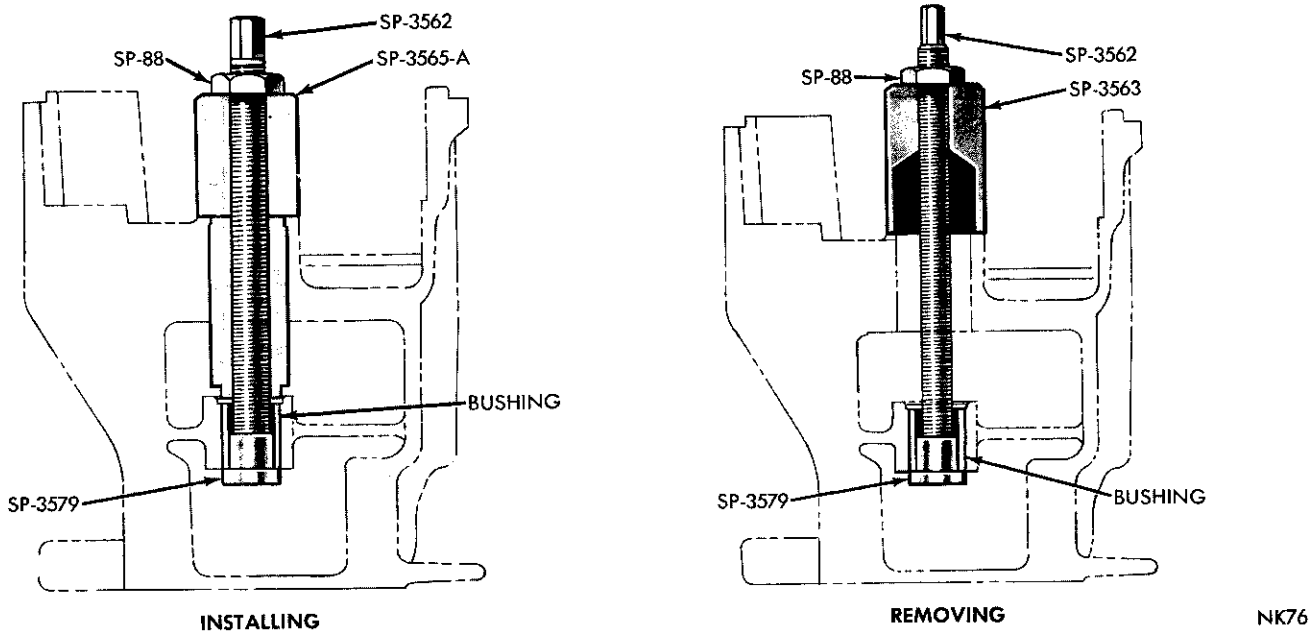

Fig. 16—Removing and Installing the Pinion Housing Armature Shaft Bushing

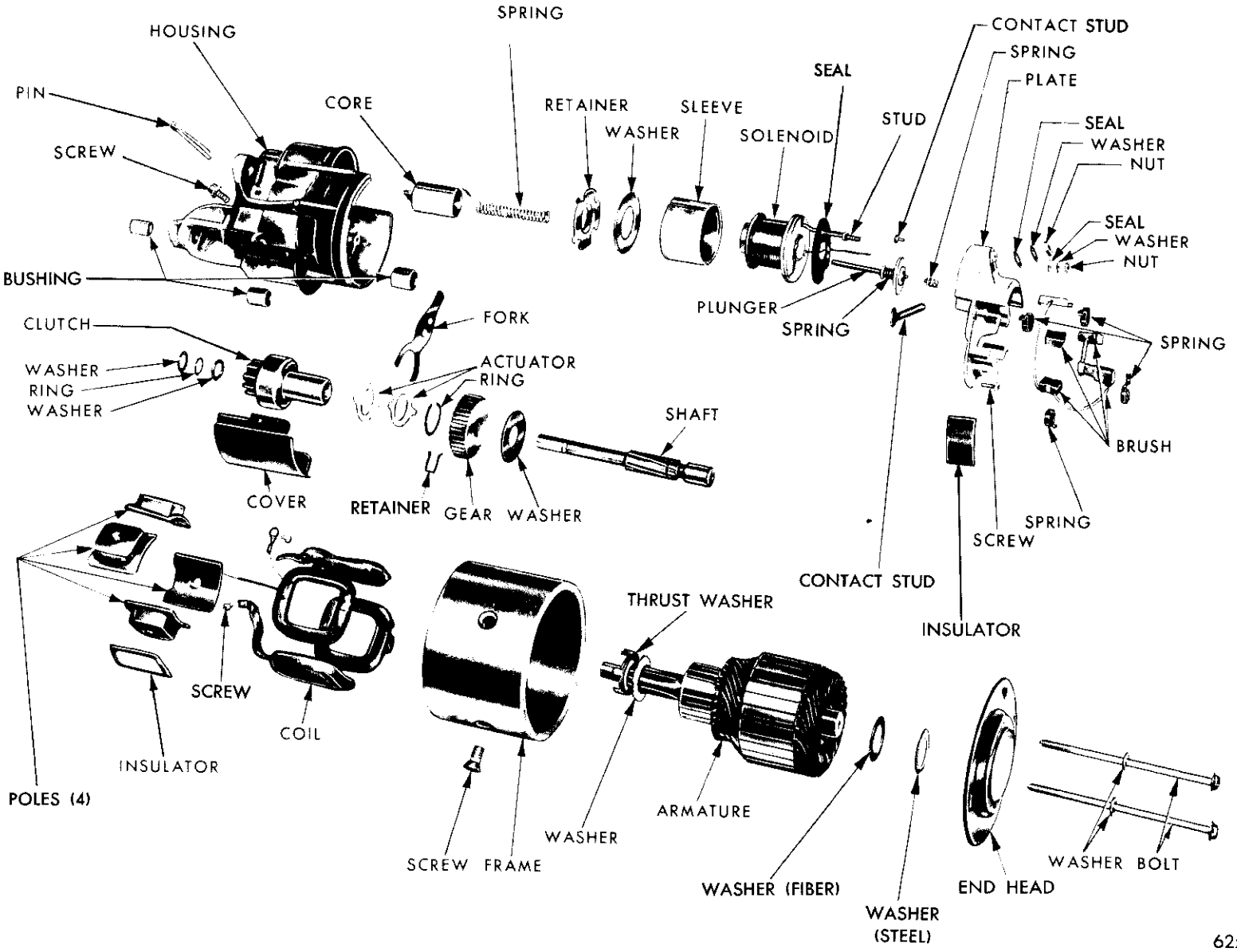

Fig. 17—Starter Motor (Exploded View)

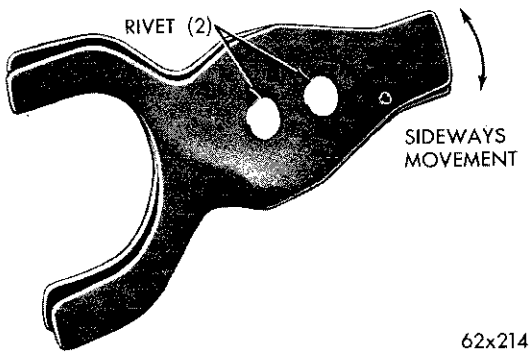

Fig. 18—Shifter Fork Assembly

ASSEMBLING THE STARTING MOTOR (Fig. 17)

NOTE: The shifter fork consists of two spring steel plates assembled with two rivets. There should be approximately $^{1}/_{16}$ inch side movement as shown in Figure 18 to insure proper pinion gear engagement. Lubricate between the plates sparingly with SAE 10 engine oil.

(1) Position the shifter fork in the drive housing and install the shifting fork retainer pin. One tip of the pin should be straight, the other tip should be bent at a 15 degree angle away from the housing. The fork and retainer pin should operate freely after bending the tip of the pin.

(2) Install the solenoid moving core and engage the shifting fork, (Fig. 12).

(3) Enter the pinion shaft into the drive housing and install the friction washer and drive gear.

(4) Install the clutch and pinion assembly, thrust washer, retaining ring and thrust washer, (Fig. 11).

(5) Complete the installation of the pinion shaft engaging the shifting fork with the clutch actuators. Figure 19 shows the correct relation of the parts at assembly.

NOTE: The friction washer must be positioned on the shoulder of the splines of the pinion shaft before the driven gear is positioned.

(6) Install the driven gear snap ring (Fig. 8).

(7) Install the pinion shaft retaining ring (Fig. 9).

(8) Bend the four (4) Tangs of the coil retainer "up" to a measurement of $^{5}/_{32}$" to $^{3}/_{16}$" above the surface of the retainer (Fig. 20), to ensure higher compression and a more positive ground.

NOTE: Space the retainer in the housing bore so that the four tangs rest on the ridge in the housing bore and not in the recesses.

(9) Install the starter solenoid return spring into the bore of the movable core.

(10) Install the solenoid contact seal over the solenoid lead wires, inserting the double wires of the terminal stud into the large hole (Fig. 6) and the solenoid winding lead wire into the small hole.

NOTE: Inspect the condition of the starter solenoid switch contacting washer, if the top of washer is burned from arcing, disassemble the contact switch plunger assembly and reverse the washer.

(11) Install the solenoid contact plunger assembly into the solenoid and reform the double wires to allow for proper entry of the terminal stud into the brush holder with the double wires curved around the contactor.

CAUTION: The contactor must not touch the double wires when the solenoid is energized after the

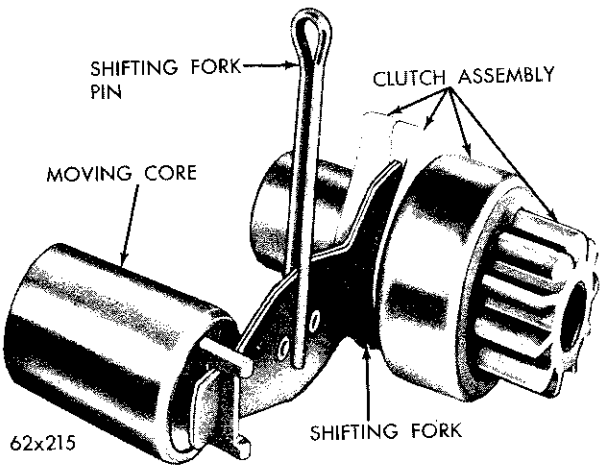

Fig. 19—Shifter Fork and Clutch Arrangement

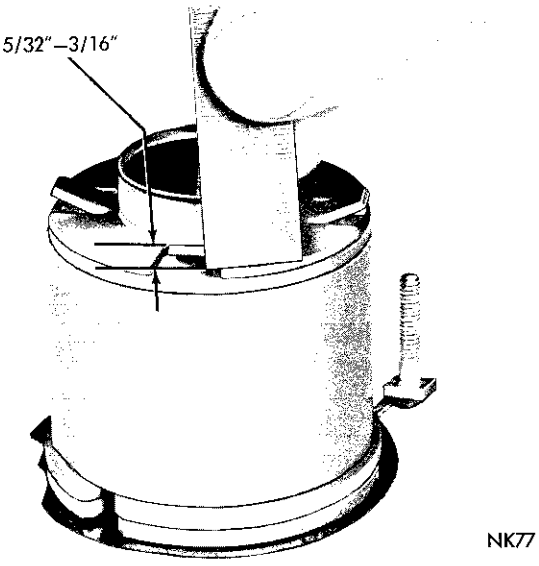

Fig. 20—Checking Height of Solenoid Coil Retainer Tangs

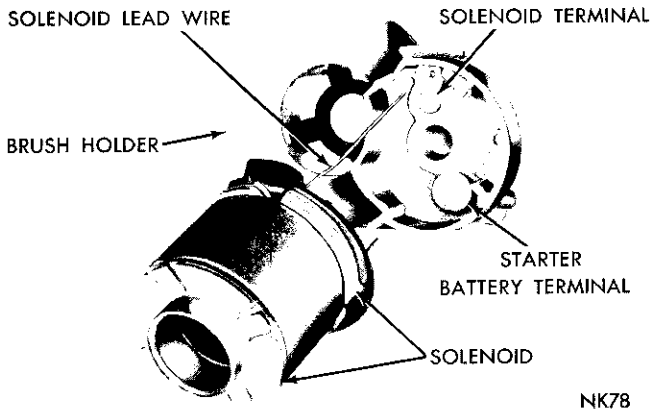

Fig. 21—Assembling Solenoid to the Brush Holder Plate

assembly is completed (Fig. 6).

NOTE: Make sure the contact spring is positioned on the shaft of the solenoid contact assembly.

(12) Assemble the battery terminal stud in the brush holder placing the sealing washer under the plain washer.

NOTE: Check the condition of the contacts in the brush holder plate. If the contacts are badly burned, replace the brush holder with brushes and contacts as an assembly.

(13) Enter the solenoid lead wire through the hole in the brush holder (Fig. 21) and install the solenoid stud, insulating washer, flat washer and nut.

NOTE: Use care when installing the solenoid contact seal over the tab on the brush plate to prevent tearing the seal.

(14) Wrap the solenoid lead wire tightly around the brush terminal post as shown in Figure 22 and solder securely with a high temperature resin core solder and resin flux.

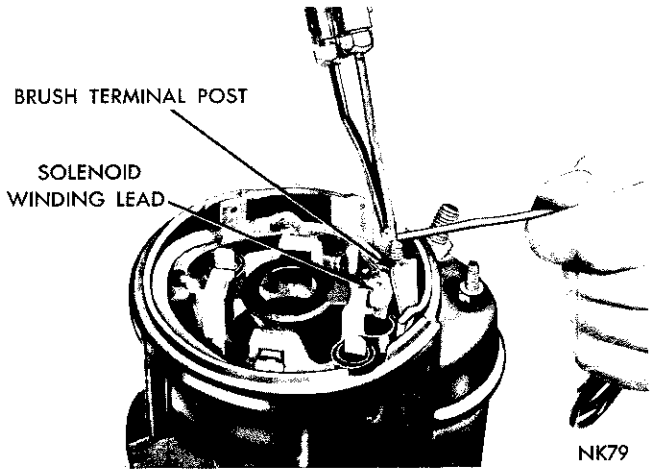

Fig. 22—Soldering the Solenoid Winding Lead to the Brush Terminal

Fig. 23—Installing the Solenoid and Brush Holder into the Gear Housing

(15) Carefully enter the solenoid coil and brush plate assembly into the bore of the gear housing and position the brush plate assembly into the starter gear housing. Align the tongue of the ground terminal with the notch in the brush holder (Fig. 23).

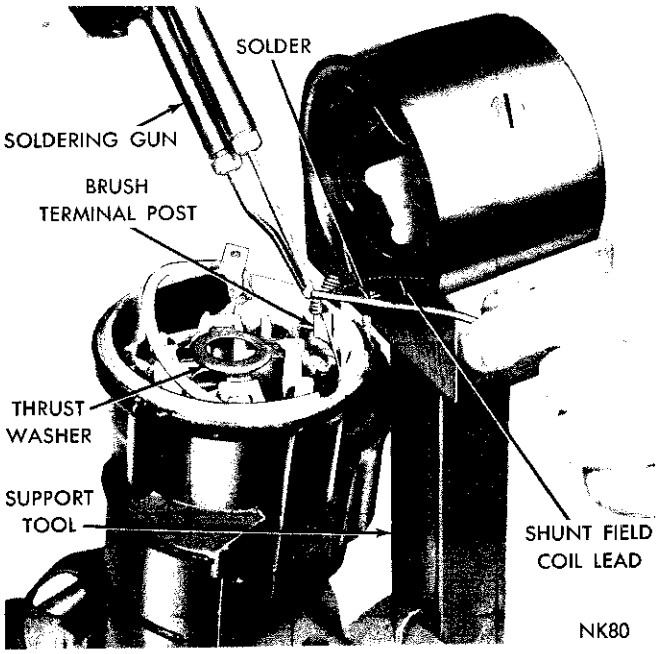

Fig. 24—Soldering the Shunt Coil Lead Wire

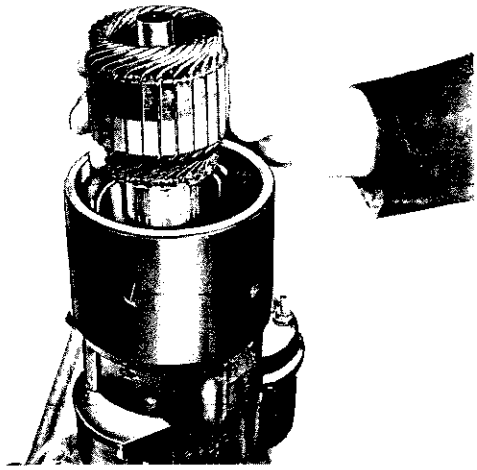

Fig. 25—Installing Starter Armature

(16) After the brush holder is bottomed in the housing, install the attaching screw (Fig. 4). Tighten the screw to 10-15 inch-pounds. Make sure the insulating tape is in position (Fig. 4).

(17) Position the brushes with the armature thrust washer as shown in Figure 22. This will hold the brushes out and facilitate proper installation of the armature.

(18) On starters so equipped, solder the shunt coil lead wire to the starter brush terminal (Fig. 24).

(19) Install the brush terminal screw (Fig. 2).

(20) Position the field frame to the exact position on the gear housing and enter the armature into the field frame and starter gear housing (Fig. 25); carefully engaging the splines of the shaft with the reduction gear by rotating the armature slightly to engage the splines.

(21) Install the thrust washer (fiber) and washer (steel) on the armature shaft.

(22) Position the starter end head assembly and install the starter frame lockwashers and through bolts. Tighten the through bolts securely.

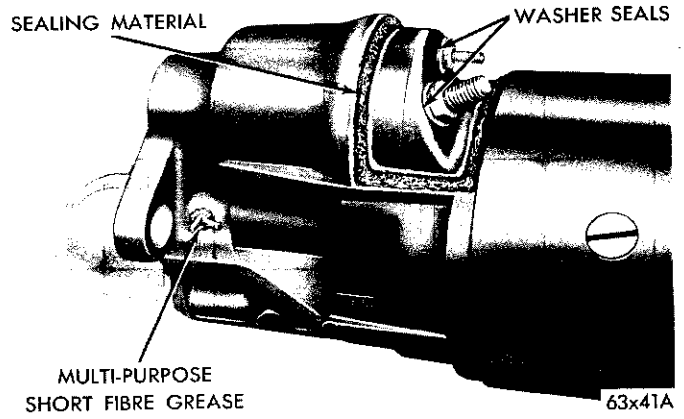

Fig. 26—Sealing the Brush Holder Plate

(23) Clean the area at the joint between the brush holder plate to the field frame and gear housing mating joint. Apply a bead of brush plate sealer Part NO. 2421847 around the four sides of the joint (Fig. 26).

CAUTION: Sealer must be flowed continuously to avoid gaps. After the bead has been flowed on, use a brush or small paddle moistened in mineral spirits to press adhesive into the joint. Be sure not to get the adhesive on the battery and/or solenoid terminals.

INSTALLATION OF THE STARTING MOTOR

(1) Before installing the starting motor, make sure the starter and flywheel housing mounting surfaces are free of dirt and oil to insure a good electrical contact.

(2) Position the starter to the flywheel housing removable seal.

(3) Install the starting motor, washer and bolt, the Automatic Transmission oil cooler tube bracket (if so equipped) and the washer and nut.

NOTE: When tightening the attaching bolt and nut be sure to hold the starting motor pulled away from the engine to insure proper alignment.

(4) Attach the wire at the solenoid switch terminal and cable to the starter terminal.

(5) Connect the battery ground cable and test the operation of the starting motor for proper engine cranking.

PART 3

ALTERNATOR AND VOLTAGE REGULATOR

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
ALTERNATOR FAILS TO CHARGE (No Output)	(a) Blown fusible wire in voltage regulator.	(a) Locate and correct the cause of the fuse blowing. Install a new fuse wire. Solder both ends of new fusible wire securely.
	(b) Alternator drive belt loose.	(b) Adjust the drive belt according to Specifications.
	(c) Worn brushes and/or slip rings.	(c) Install new brushes and/or slip rings.
	(d) Sticking brushes.	(d) Clean the slip rings and brush holders. Install new brushes.
	(e) Open field circuit.	(e) Test all the field circuit connections, and correct as required.
	(f) Open charging circuit.	(f) Inspect all connections in the charging circuit, and correct as required.
	(g) Open circuit in stator windings.	(g) Remove the alternator and disassemble. Test the stator windings. Install a new stator if necessary.
	(h) Open rectifiers.	(h) Remove the alternator and disassemble. Test the rectifiers. Install new rectifiers if necessary.
LOW, UNSTEADY CHARGING RATE	(a) Alternator drive belt loose.	(a) Adjust the alternator drive belt.
	(b) High resistance at battery terminals.	(b) Clean and tighten the battery terminals.
	(c) High resistance in the charging circuit.	(c) Test the charging circuit resistance. Correct as required.
	(d) High resistance in the body to engine ground lead.	(d) Tighten the ground lead connections. Install a new ground lead if necessary.
	(e) Open stator winding.	(e) Remove and disassemble the alternator. Test the stator windings. Install a new stator if necessary.
LOW OUTPUT AND A LOW BATTERY	(a) High resistance in the charging circuit.	(a) Test the charging circuit resistance and correct as required.
	(b) Low regulator setting.	(b) Reset the voltage regulator according to specifications.
	(c) Shorted rectifier. Open rectifier.	(c) Perform the current output test. Remove and disassemble the alternator. Test the rectifiers. Install new rectifiers as required.
	(d) Grounded stator windings.	(d) Remove and disassemble the alternator. Test the stator windings. Install a new stator if necessary.
EXCESSIVE CHARGING RATE TO A FULLY CHARGED BATTERY	(a) Regulator set too high.	(a) Reset the voltage regulator according to specifications.
	(b) Regulator contacts stuck.	(b) Install a new voltage regulator.
	(c) Regulator voltage winding open.	(c) Install a new voltage regulator.
	(d) Regulator base improperly grounded.	(d) Connect the regulator base to the ground connection.
REGULATOR CONTACTS BURNED	(a) High regulator setting.	(a) Reset the voltage regulator according to specifications.
	(b) Shorted rotor field coil windings.	(b) Test the rotor field coil current draw. If excessive install a new rotor.

Condition	Possible Cause	Correction
REGULATOR CONTACT POINTS STUCK	(a) Poor ground connection between the alternator and the regulator. Open resistor element.	(a) Correct the ground connection. Install a new regulator. Test the regulator setting, and reset if necessary.
NOISY ALTERNATOR	(a) Alternator mounting loose.	(a) Properly install and tighten the alternator mounting.
	(b) Worn or frayed drive belt.	(b) Install a new drive belt and adjust.
	(c) Worn bearings.	(c) Remove and disassemble the alternator. Install new bearing as required.
	(d) Interference between the rotor fan and stator leads or rectifiers.	(d) Remove and disassemble the alternator. Correct the interference as required.
	(e) Rotor or rotor fan damaged.	(e) Remove and disassemble the alternator. Install a new rotor.
	(f) Open or shorted rectifier.	(f) Remove and disassemble the alternator. Test the rectifiers. Install new rectifiers as required.
	(g) Open or shorted winding in the stator.	(g) Remove and disassemble the alternator. Test the stator windings. Install a new stator if necessary.
EXCESSIVE AMMETER FLUCTUATION	(a) High resistance in the field circuit to the alternator or an improperly set voltage regulator.	(a) Clean all connections and tighten all connections as necessary. Adjust voltage regulator as necessary.

SERVICE PROCEDURES

CONSTRUCTION AND OPERATION

The alternator (Fig. 1) is fundamentally an A.C. current generator, with six (6) built-in silicon rectifiers, that convert the A.C. current into D.C. current. D.C. current is available at the "output" "BAT" terminal. A voltage regulator (Fig. 2) is used in the field circuit to limit the output voltage.

The main components of the alternator are the rotor, the stator, the rectifiers, the two end shields and the drive pulley. (See Fig. 3).

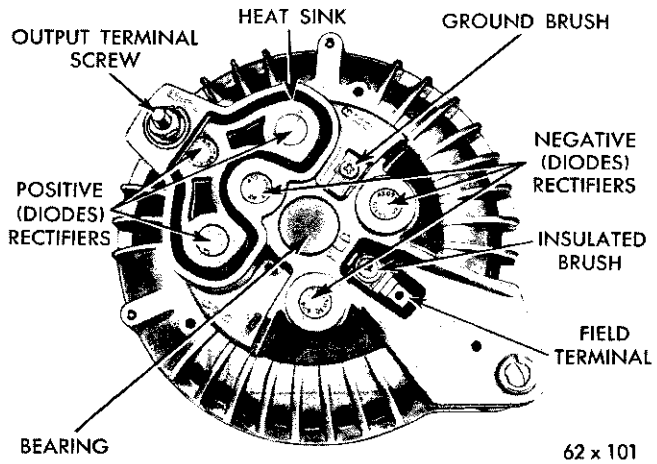

Fig. 1—Alternator Assembly

VOLTAGE REGULATOR

The only function of the regulator is to limit the output voltage. The voltage regulator accomplishes this by controlling the flow of current in the rotor field coil, and in effect controls the strength of the rotor magnetic field.

The voltage regulator is connected in the field circuit between the battery and the field terminal of the alternator. One terminal of the regulator is marked "IGN" and the other is marked "FLD." The "IGN" terminal of the regulator is connected to the coil side

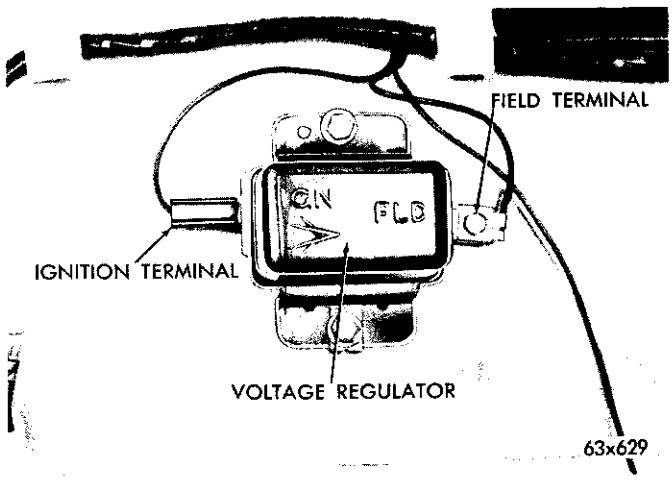

Fig. 2—Voltage Regulator Installed (Typical)

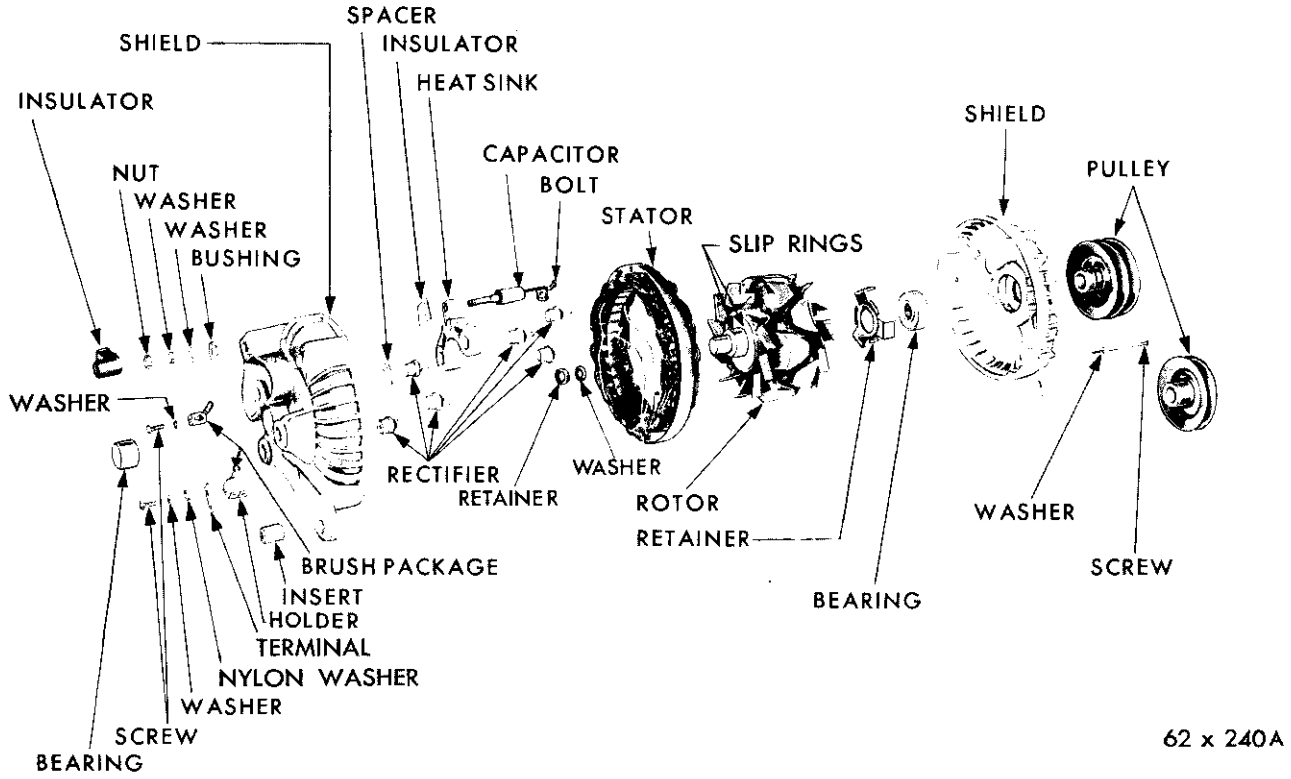

Fig. 3—Alternator (Disassembled View)

of the ignition switch so that the field circuit is completed **only** when the ignition switch is turned "ON."

The voltage regulator (Fig. 4) has two sets of contacts using a common single armature. The upper and lower stationary contact brackets are mounted on a molded plastic bracket which is attached to the regulator frame by a screw. (Fig. 5) The upper contact bracket is connected to the "IGN" terminal by a fusible wire. The lower contact bracket is connected to ground by another fusible wire. The armature is connected to the insulated "FLD" terminal.

Three resistance units are used (Fig. 6). Resistor

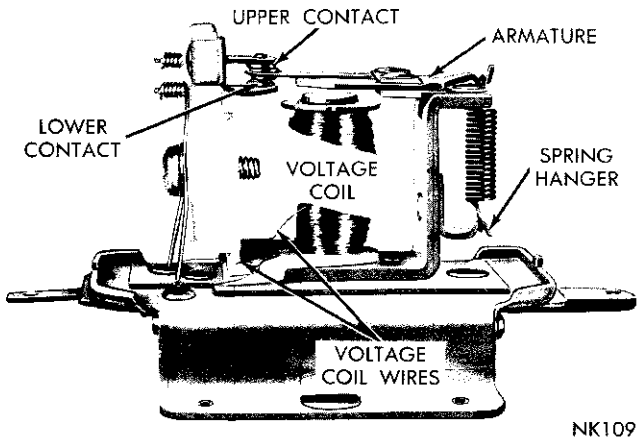

Fig. 4—Voltage Regulator (Cover Removed)

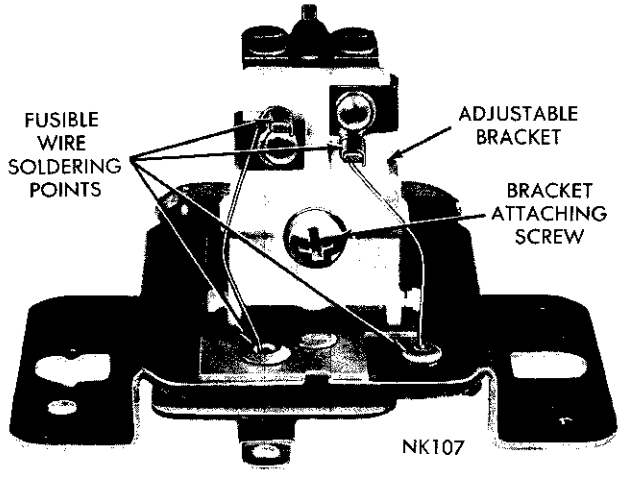

Fig. 5—Voltage Regulator Fusible Wires

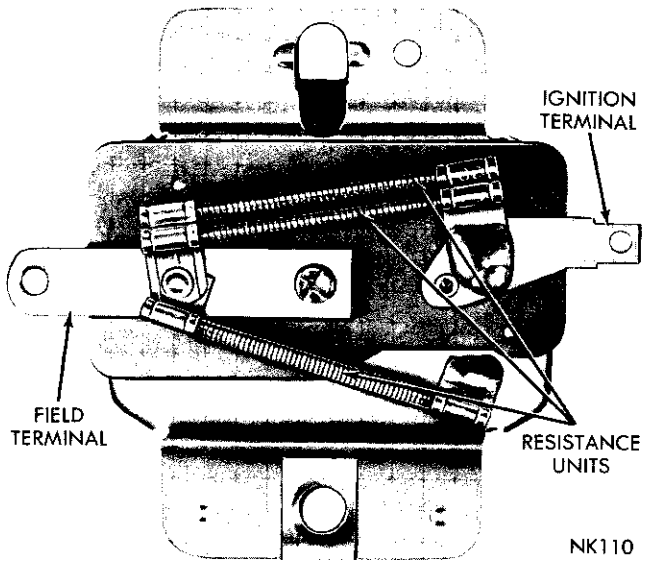

Fig. 6—Voltage Regulator Resistance Units

number "one" and number "two" are connected between the "IGN" and "FLD" terminals, in parallel with the upper set of contacts. Resistor number "three" is connected between the "FLD" terminal and ground. Its function is to reduce arcing at the regulator contacts.

A voltage coil, (Fig. 4) consisting of many turns of fine wire, is connected in series between the "IGN" terminal of the regulator and "ground." Thus, when the ignition switch is turned "ON," battery voltage applied to the windings energizes the coil and the magnetic force of the coil tends to attract the regulator armature.

REGULATOR OPERATION

(1) When the battery line voltage is relatively low, the current flow through the voltage coil will be low. The magnetic force (or pull) of the voltage coil will not be great enough to overcome the regulator armature spring tension, which is holding the armature contact against the upper stationary contact, (Fig. 6).

Battery line voltage applied to the "IGN" terminal causes current to flow through the regulator upper contacts, through the "FLD" terminal of the regulator and to the "insulated" brush and rotor slip ring. The rotor field coil circuit is completed to "ground" through the other rotor slip ring and the "ground" brush. Inasmuch as the upper contacts are "closed," the field circuit resistance is low, and maximum current will flow through the rotor field coil. The rotor field strength will be high, and the alternator output will be at its maximum for any rotor speed.

(2) As the battery line voltage increases, the magnetic pull of the voltage coil overcomes the armature spring tension, and "opens" the upper contacts. The armature contacts at this time do not touch either the upper or lower stationary contacts. Field current now flows through the regulator "IGN" terminal, through resistance number one and number two, through the "FLD" terminal, and through the rotor field to ground.

The two resistors, in series with the field circuit, reduce field current and rotor field strength, with a corresponding reduction in alternator output voltage. This momentarily reduces battery line voltage applied to the regulator voltage coil. The regulator armature spring tension overcomes the magnetic pull of the voltage coil, closing the upper contacts.

When the electrical load requirements are relatively high, the regulator armature oscillates, opening and closing the upper contacts. This alternately "puts in" and "takes out" resistance in the field circuit, and in effect limits the alternator output voltage.

(3) When the electrical load requirements are low and the engine speed is high, the alternator output voltage tends to increase. The battery line voltage (now slightly increased) causes the regulator voltage coil magnetic force to pull the armature contact against the regulator lower stationary contact.

Field current flow is now through the regulator "IGN" terminal, resistors number one and number two, to the regulator "FLD" terminal. Since the regulator armature is connected to the "FLD" terminal and the lower contacts are closed, the current path is through the regulator armature to the movable contact and then through the lower contact to ground. This is because the resistance to ground is less than the alternator rotor field coil resistance.

By-passing the alternator field coil will cause the alternator output voltage and the battery line voltage to drop. This reduction in voltage will reduce the magnetic pull of the regulator voltage coil, to the extent that it cannot hold the armature contact against the stationary lower contact.

The armature moves into a "no contact" position between the upper and lower stationary contacts. This momentarily allows the field current to flow through resistors number one and number two, and through the rotor field coil to ground. At high engine speed and low electrical load operation, the armature oscillates between the "no contact" position, and contact with the lower stationary contact, to limit the battery line voltage.

TESTING THE ALTERNATOR SYSTEM

(On the Vehicle Using the Sun Volt Ampere Tester Model VAT-20D and Sun Battery Post Adapter)

NOTE: For the sake of uniformity, one type of equipment is shown. Follow the instructions of the equipment manufacturers on comparable equipment when making the following tests:

Preliminary Checks

(1) **Test the battery condition.** Perform reliable battery tests to determine the condition and state of charge of the battery. If the battery is defective or not fully charged, install a fully charged battery for test purposes.

(2) **Test the alternator belt condition and tension.** Replace the alternator drive belt if necessary and make sure that there is adequate tension on the belt.

(3) **Inspect the condition of wires and their connections.** Before performing the test on the system, correct any problem with the wiring, such as loose connections, corroded connections, burned wiring harness, etc.

Tester Controls and Switches

(1) Set Polarity Switch to the NEGATIVE position.
(2) Set tester control knob to the DIRECT position.
(3) Set voltage switch to the 2 VOLT position.
(4) Set field control to the OPEN position.

Tester Lead Connections (Fig. 7)

(1) Disconnect the positive battery cable from the battery post and install the BATTERY POST ADAPTER between the cable and post.

(2) Connect the "BAT" lead of the tester to the stud on the adapter.

(3) Connect the "REG" lead of the tester to the binding post on the adapter.

(4) Connect the "GRD" lead of the tester to a good ground on the vehicle.

(5) Connect the negative lead of the voltmeter to the field terminal of the regulator.

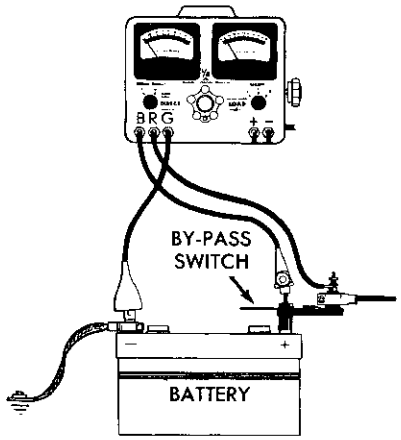

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Fig. 7—Tester Lead Connections

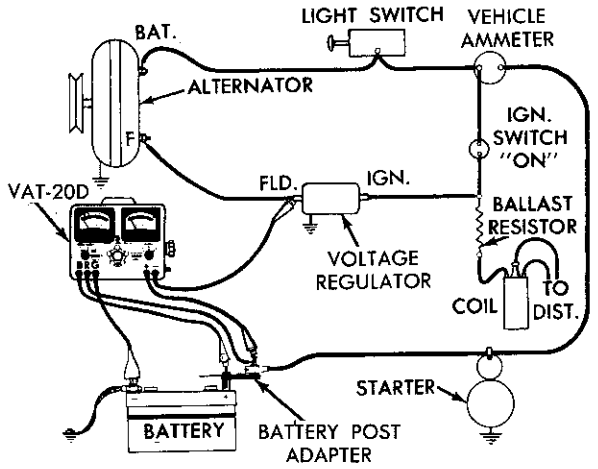

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Fig. 8—Field Circuit Resistance and Field Current Draw Test

(6) Connect the positive lead of the voltmeter to the battery end of the positive battery cable.

NOTE: The Battery Post Adapter BY-PASS SWITCH must be open for all charging system tests. It is closed only for starting the engine.

Field Circuit Resistance Test (Fig. 8)

(1) Disconnect the slip-on connector from either end of the ignition ballast resistor.

(2) Turn the ignition switch on.

(3) With vehicle doors closed and all accessories turned off, observe the Voltmeter reading. The voltage should not exceed .55 volt. A reading in excess of .55 volt indicates high resistance in the field circuit between the battery and the voltage regulator field terminal.

(4) If high resistance is indicated, move the negative voltmeter lead to each connection along the circuit towards the battery. A sudden drop in voltage indicates a loose or corroded connection between that point and the last point tested. To test the terminals for tightness, attempt to move the terminal while observing the voltmeter. Any movement of the meter pointer indicates looseness.

NOTE: Excessive resistance in the regulator wiring circuit will cause fluctuation in the ammeter, or a below normal charge rate.

Field Current Draw Test (Fig. 8)

With tester connections positioned as for the Field Circuit Resistance Test, observe the test ammeter. The test ammeter will indicate the field current draw. Refer to "Specifications."

Current Output Test (Fig. 9)

(1) With the ignition switch off, disconnect the field wire from the "FLD" terminal of the alternator and at the regulator.

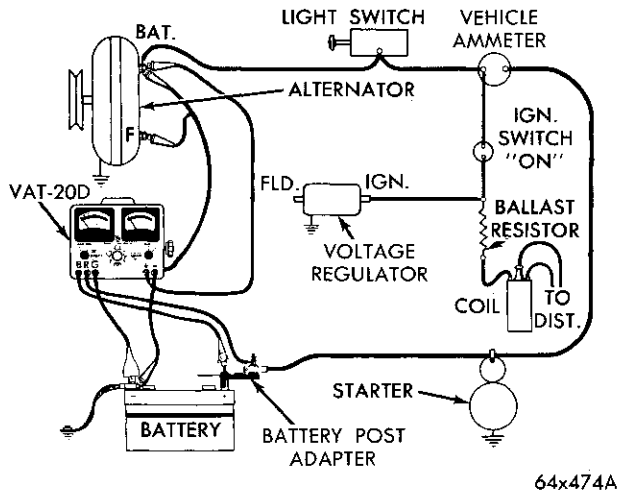


Fig. 9—Current Output Test

(2) Connect a special jumper from the "FLD" terminal of the alternator to one of the test leads of the tester Field Control.

(3) Connect the other lead of the tester Field Control to the "BAT" terminal of the alternator.

(4) Set the Tester Voltage Switch to the 16 VOLT position.

(5) Connect the positive lead of the test Voltmeter to the "BAT" terminal of the alternator.

(6) Connect the negative lead of the Test Voltmeter to a good ground.

(7) Reconnect the slip-on connector at the ignition ballast resistor.

(8) Close the BY-PASS Switch of the Battery Post Adapter.

(9) With the tester Field Control in the OPEN position, start the engine and adjust to 1250 RPM.

(10) Open the BY-PASS Switch of the Battery Post Adapter.

(11) Rotate the tester Control Knob to the LOAD position until the Voltmeter reads 6 volts.

(12) Rotate the tester Field Control to the DIRECT position and adjust the tester Control Knob until the Voltmeter reads exactly 15 volts.

(13) Observe the test ammeter. Ammeter now indicates maximum output of alternator. The current output should be within the limits shown in "Specifications."

NOTE: The current output should be within 5 amperes of the rated output as there is a total of 5 amperes supplied by the alternator that will not appear on the test ammeter. This consists of ½ ampere approximate for the instruments, 1½ amperes for the engine ignition system, and 3 amperes for field current.

If the output is slightly less (5 to 7 amperes) than that specified above, it may be an indication of possible "open" rectifier or other alternator internal problem. If the output is considerably lower than that specified above, it may be an indication of a possible "shorted" rectifier or other alternator internal problems. In either case the alternator should be removed and tested on the bench before disassembly.

(14) Return the tester Field Control to the OPEN position.

(15) Return the tester Control Knob to the DIRECT position.

Insulated Circuit Resistance Test (Fig. 10)

(1) Connect the negative lead of the Voltmeter to the battery end of positive battery cable.

(2) Set the Voltage Switch to 2 VOLT position.

(3) Adjust the Field Control until the tester ammeter reads exactly 10 amperes.

(4) Observe the voltmeter reading. Voltmeter now indicates the amount of voltage loss across the insulated circuit. The voltage loss should not exceed .3 volt. If a higher voltage loss is indicated, inspect, clean and tighten all the connections in the charging circuit. A voltage loss test may be performed at each connection to locate the connection that has excessive resistance.

Ground Circuit Resistance Test (Fig. 11)

(1) Connect the positive lead of the test voltmeter to the negative terminal of the battery.

(2) Connect the negative lead of the test voltmeter to a good ground on the alternator.

(3) With the alternator charging 10 amps, observe the voltmeter reading. Voltmeter now indicates the

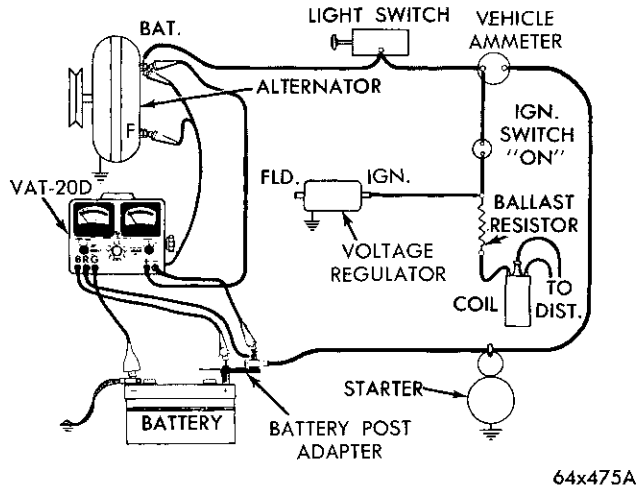


Fig. 10—Insulated Circuit Resistance Test

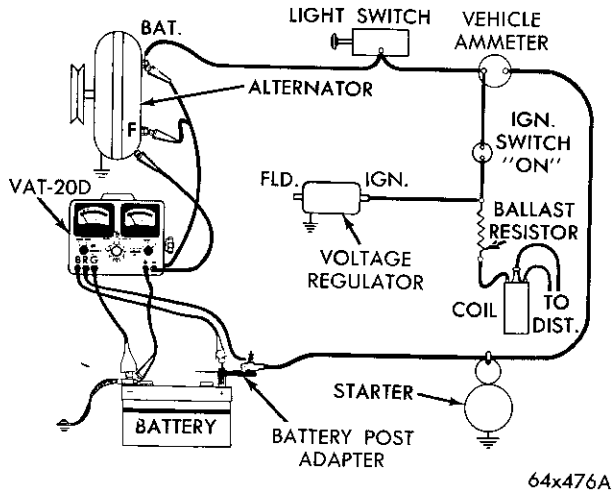


Fig. 11—Ground Circuit Resistance Test

amount of voltage loss across the ground circuit. The voltage loss should not exceed .3 volt.

(4) Rotate the tester Field Control the the OPEN position.

Voltage Regulator Test (Fig. 12)

NOTE: Regulator temperature should be normalized by operating with a 10 ampere load for 15 minutes just prior to testing.

Upper Contacts Test

(1) Remove the test lead of the tester Field Control from the "BAT" terminal of the alternator and connect to the field wire disconnected from the regulator.

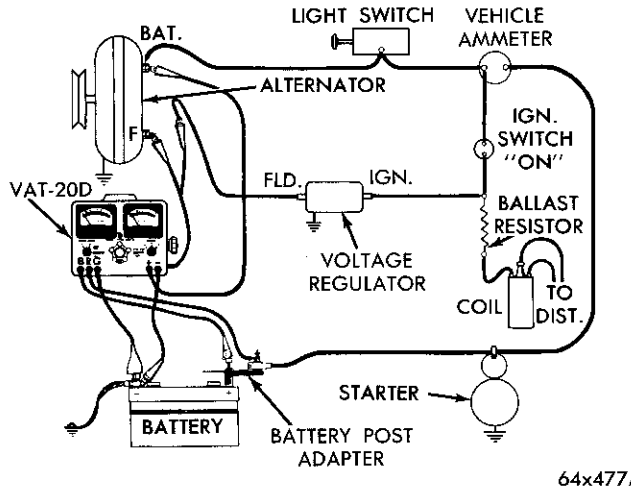


Fig. 12—Voltage Regulator Test

(2) Set the Voltage Switch to the 16 VOLT position.

(3) Connect the positive lead of Voltmeter to "BAT" terminal of alternator.

(4) Rotate the tester Field Control to the DIRECT position.

(5) With the engine operating at 1250 RPM, rotate the tester Control Knob clockwise until the Ammeter reads exactly 15 amperes.

(6) Rotate the tester Field Control from the DIRECT position to the OPEN position and then back to the DIRECT position to cycle the system.

(7) Observe the test voltmeter. The voltmeter now indicates the setting of the voltage regulator upper contacts. Refer to "Specifications."

(8) Rotate the tester Control Knob to the DIRECT position. If the regulator operates within specifications, proceed to the lower contact voltage test. If the upper contact voltage setting is not within specifications, remove the regulator cover and adjust the voltage setting as outlined in "Regulator Adjustments" step number (1).

Lower Contact Test

(1) Increase the engine speed to 2200 RPM.

(2) Rotate the tester Control Knob to the ¼ OHM position only if the tester Ammeter reads over 5 amperes.

(3) Rotate the tester Field Control from the DIRECT position to the OPEN position and then back to the DIRECT position to cycle the system.

(4) Observe the voltmeter. Voltmeter now indicates setting of voltage regulator lower contacts. Refer to specifications.

Voltage should increase not less than .2 volt or more than .7 volt above the previous operating voltage setting recorded in the upper contact set. A voltage reading of less than .2 volt or more than .7 volt is an indication of a possible wrong air gap setting, refer to "Regulator Mechanical Adjustments."

(5) Rotate the tester Field Control to the OPEN position and the Control Knob to the DIRECT position.

Upon completion of the test, reduce engine speed to idle, stop engine, and disconnect all test leads and adaptors. Be sure that all vehicle's cables and wiring connections are secure before restarting engine.

CAUTION: Be sure the negative post of the battery is always connected to ground. Incorrect battery polarity may result in wiring harness damage and may damage the alternator rectifiers. Do not ground the alternator field circuit, as this may damage the regulator.

Adjusting the Voltage Setting to Driving Conditions

The specifications called for in the voltage regulator chart indicate a tolerance of .9 volt from the low

setting to the high setting at the temperatures indicated.

To maintain the battery in a full state of charge, the voltage regulator should be adjusted to provide the proper voltage limiting setting according to the customer's driving and load requirement habits as follows:

(1) Check the entire charging system and battery as outlined in this Service Manual.

(2) If there are no defects in the charging system or in the battery and the battery was found to be in a low state of charge, increase the setting by .3 volt (do not exceed specified voltage limits) and retest for an improved battery condition after a reasonable service period (week or two). If the battery state of charge has increased to a satisfactory level, do not change the voltage setting. If the battery shows evidence of over-charge—(low electrolyte level, high water consumption, excessive dampness on top of battery), decrease the setting by .3 volt and retest for an improved battery condition after a reasonable service period (week or two).

CAUTION: Always adjust the settings in steps not to exceed .3 volt at a time. (Do not exceed specified voltage limits.)

(3) The proper setting of the voltage regulator is attained when the battery remains at least 1.225 specific gravity in the winter or 1.245 specified gravity in the summer, with a minimum water requirement (not more than an ounce of water per cell per one thousand miles).

Regulator Mechanical Adjustments

Step 1—Adjust the upper contact voltage setting as necessary by bending the regulator lower spring hanger **down** to **increase** voltage setting, **up** to **decrease** voltage setting. Use an insulated **tool** to bend the spring hanger (Fig. 13). The regulator must be installed, correctly connected, and retested after each adjustment of the lower spring hanger.

NOTE: If repeated readjustment is required, it is permissible to use a jumper wire to ground the regulator base to the fender splash shield for testing, in lieu of reinstalling the regulator each time. However, it is important that the regulator cover be reinstalled, the regulator connections correctly connected, and the regulator satisfactorily insulated by the fender cover to prevent grounding the regulator terminals or resistances. When testing, the regulator must be at the same attitude (or angle) as when installed on the vehicle. If step (1) under "Mechanical Adjustments" does not bring the voltage regulator within specifications, proceed to Step (2) following:

Step 2—Measure the lower contact point gap. The lower contact gap should be .014 inch plus or minus .002 inch. Adjust the lower contact gap as necessary by bending the lower stationary contact bracket making sure contacts are in alignment.

If the lower contact gap is correct and the voltage regulator setting is still outside the .2 to .7 volt increase, adjust the air gap as follows:

(a) Connect a small dry cell test lamp in series with

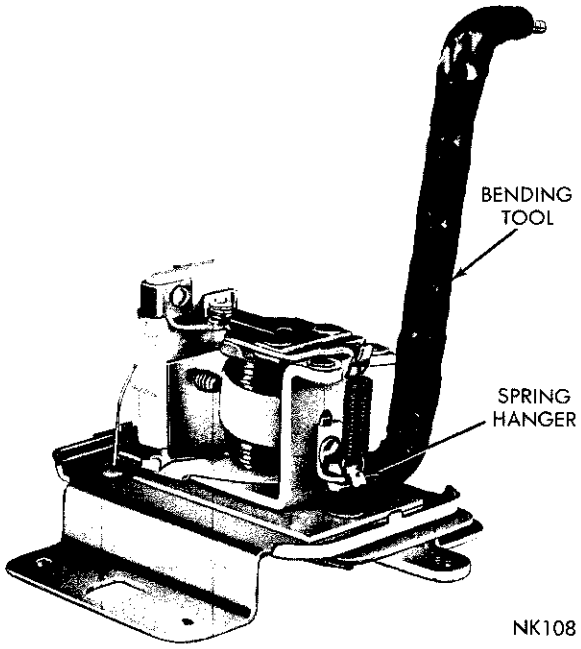


Fig. 13—Adjusting the Spring Tension

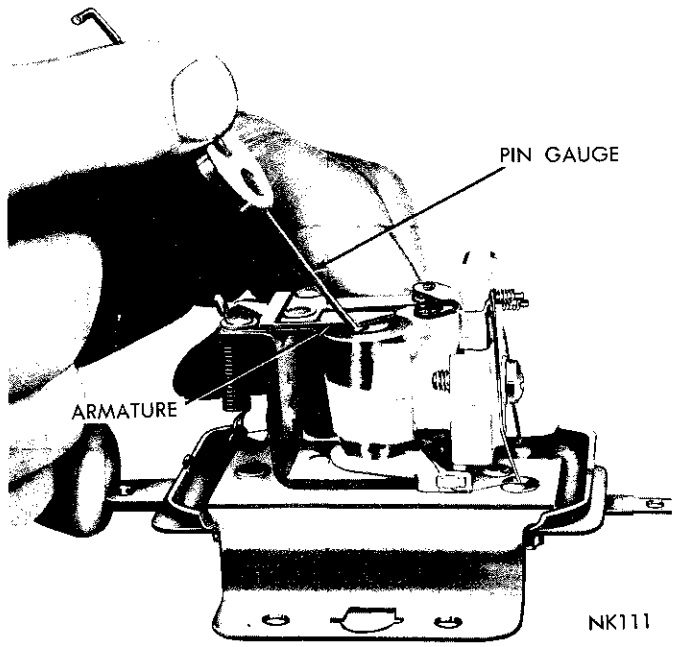


Fig. 14—Testing the Air Gap

the "IGN" and "FLD" terminal of the voltage regulator.

(b) Insert an .048 inch wire gauge between the regulator armature and the core of the voltage coil next to the stop pin on the armature (Fig. 14).

(c) Press down on the armature (not on the contact reed) until the armature contacts the wire gauge. The upper contacts should just **open** and the test lamp should be **dim.**

(d) Insert an .052 inch wire gauge between the armature and the voltage coil core, next to the stop pin on the armature.

(e) Press down on the armature until it contacts the wire gauge. The upper contacts should remain **closed** and test lamp should remain **bright.**

If an adjustment is required to obtain the difference between the upper contact voltage and the lower contact voltage of .2 volt to .7 volt; adjust the air gap by loosening the stationary contact bracket screw and moving the bracket up or down as necessary to obtain the proper air gap setting as follows:

If the difference is above .7 volt, reduce the air gap to a minimum of .045 inch with the contacts open and the test lamp dim. At .048 inch the contacts should close and the test lamp should be bright.

If the difference is below .2 volt, increase the air gap to a maximum of .055 inch with the contacts closed and the test lamp bright. At .052 inch contacts should be open and test lamp should be dim.

NOTE: Make sure the air gap is checked with the stationary contact bracket attaching screw fully tightened.

Voltage Regulator Fusible Wire Replacement

(1) Cut the fuse wire above the solder connection at the base and unwind the wire at the top bracket.

CAUTION: If an attempt is made to unsolder the old fuse, the very small wire from the voltage coil may be damaged.

(2) Tin the end of the fuse wire. **Use resin core solder only.**

(3) Holding the tinned end of the new fuse wire into the recessed rivit at the base of the regulator and against the old piece of fuse wire that remains, cause a drop of solder from a soldering iron to fall on these parts. Allow solder to cool sufficiently for fuse wires to make a good solder joint.

(4) Pull the new fuse wire up enough to remove the slack and wrap it around the bracket. Solder the coiled wire to the bracket and cut off surplus fuse wire.

NOTE: The original fuse wire is machine wound on the upper bracket. The replacement fuse should be soldered to the bracket to ensure a good electrical contact.

ALTERNATOR SERVICING

If the alternator performance does not meet current output specifications limits, it will have to be removed and disassembled for further test and servicing.

(1) Disconnect the battery ground cable at the battery negative terminal.

(2) Disconnect the alternator output "BATT" and field "FLD" leads and disconnect the ground wire.

(3) Remove the alternator mounting bolts and remove the alternator.

BENCH TESTS

Field Coil Draw

If the alternator field coil draw has not been tested on the vehicle it may be tested on the test bench as follows:

(1) Connect the test ammeter positive lead to the battery positive terminal of a fully charged battery. Connect the test ammeter negative lead to the field terminal of the alternator. Connect a jumper wire to the negative terminal of the battery, and ground it to the alternator end shield.

(2) Slowly rotate the alternator rotor by hand. Observe the ammeter reading. The field coil draw should be 2.3 amperes to 2.7 amperes at 12 volts.

NOTE: A low rotor coil draw is an indication of high resistance in the field coil circuit, (brushes, slip rings, or rotor coil). A higher rotor coil draw indicates a possible shorted rotor coil or a grounded rotor.

Testing Alternator Internal Field Circuit for Ground

(1) To test the internal field circuit for a ground, remove the ground brush. Touch one test prod from a 110 volt test lamp to the alternator insulated brush terminal and the remaining test prod to the end shield. If the rotor assembly or insulated brush is not grounded, the lamp will not light.

(2) If the lamp lights, remove the insulated brush assembly (noting how the parts are assembled) and separate the end shields by removing the three thru bolts.

(3) Again test by placing one of the test prods to a slip ring and the remaining test prod to the end shield. If the lamp lights, the rotor assembly is grounded and requires replacement. If the lamp does not light after removing the insulated brush and separating the end shields, the cause of the ground at the first ground test was that the insulated brush is grounded.

(4) Examine the plastic insulator and the screw. The screw is a special size and must not be substituted by another size.

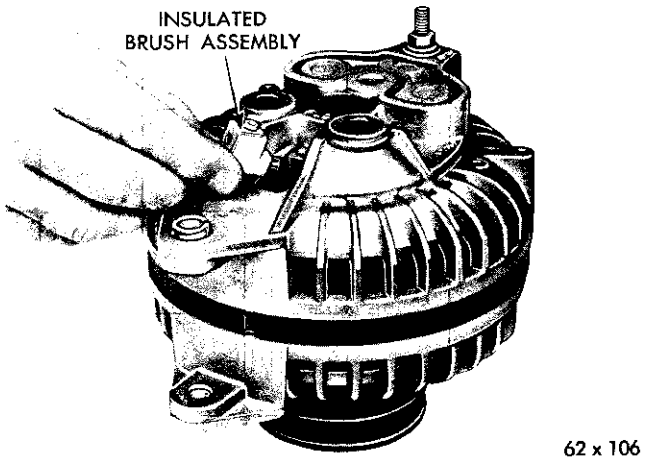


Fig. 15—Removing or Installing Insulated Brush

(5) Install the insulated brush holder, terminal, insulated washer, shake proof washer and screw. If the parts were not assembled in this order or if the wrong screw was used this could be the cause of the ground condition.

DISASSEMBLING THE ALTERNATOR

To prevent possible damage to the brush assemblies, they should be removed before proceeding with the disassembly of the alternator. The insulated brush is mounted in a plastic holder that positions the brush vertically against one of the slip rings.

(1) Remove the retaining screw lockwasher, insulated washer, and field terminal, and carefully lift the plastic holder containing the spring and brush assembly from the end housing, (Figure 15).

(2) The ground brush is positioned horizontally against the remaining slip ring and is retained in a holder that is integral with the end shield. Remove the retaining screw and lift the clip, spring and brush assembly from the end shield, (Figure 16).

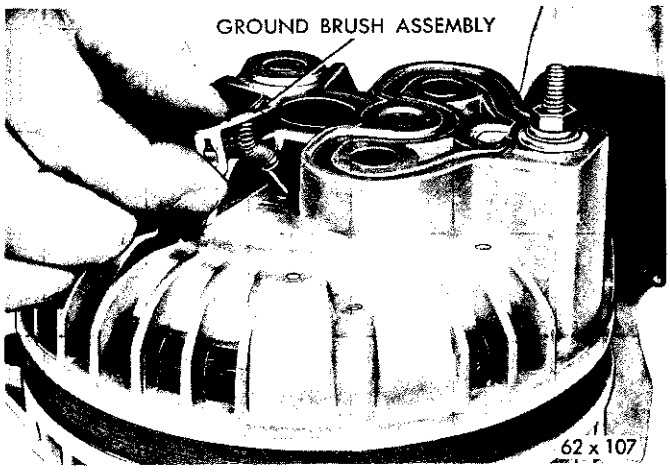


Fig. 16—Removing or Installing Ground Brush

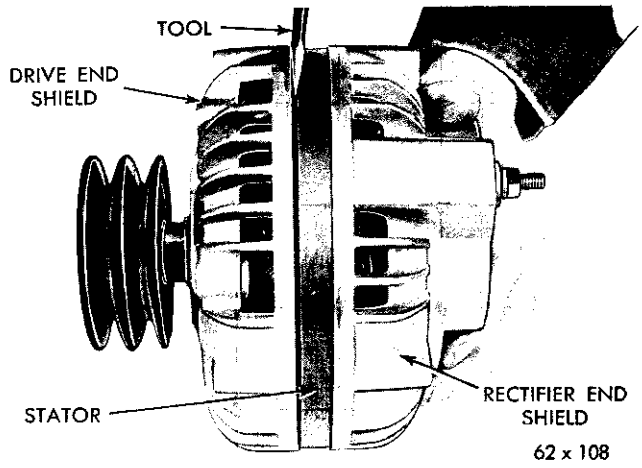


Fig. 17—Separating Drive End Shield from Stator

CAUTION: Stator is laminated, do not burr stator or end shield.

(3) Remove the through bolts and pry between the stator and drive end shield with the blade of a screwdriver, as shown in Figure 17. Carefully separate the drive end shield, pulley and rotor assembly away from the stator and rectifier shield assembly.

Testing the Rectifiers with Tool C-3829

The Rectifier Tester Tool C-3829 provides a quick, simple and accurate method to test the alternator rectifiers without the necessity of disconnecting the soldered rectifier leads. With the alternator rectifier end shield separated from the drive end housing proceed with rectifier tests as follows:

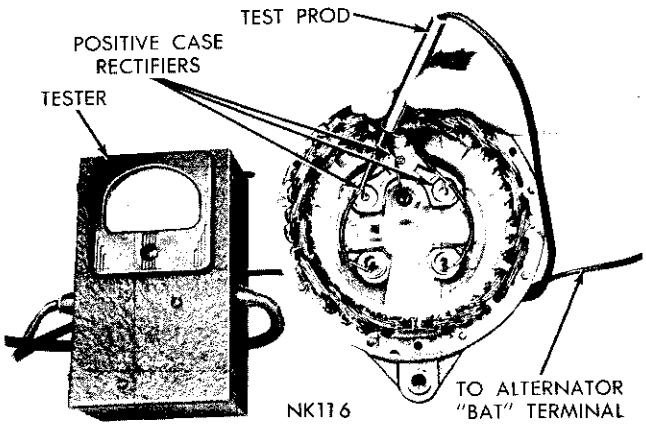


Fig. 18—Testing Positive Rectifiers

Positive Case Rectifier Test (Fig. 18)

(a) Place the alternator on an insulated surface. Connect the test lead clip to the alternator ("BAT") output terminal.

(b) Plug in the Tool C-3829 power source lead into a 110 volt A.C. power supply. Touch the exposed bare metal connections of each of the positive case rectifiers, with the test prod.

CAUTION: Do not break the sealing around the rectifier lead wire. The sealing material is for protection against corrosion. Always touch the test prod to the exposed metal connection nearest the rectifier.

The reading for satisfactory rectifiers will be 1¾ amperes or more. The reading should be approximately the same for the three rectifiers.

When two rectifiers are good and one is shorted, the reading taken at the good rectifiers will be low, and the reading at the shorted rectifier will be zero. Disconnect the lead to the rectifier reading zero and retest. The reading of the good rectifiers will now be within the satisfactory range.

When one rectifier is open it will read approximately one ampere, and the two good rectifiers will read within the satisfactory range.

Negative Case Rectifier Test (Fig. 19)

(a) Connect the test lead clip to the rectifier end housing.

(b) Touch the exposed connectio of each of the negative case rectifiers with the test prod.

The test specifications are the same, and the test results will be approximately the same as for the positive case rectifiers, except the meter will read on the opposite side of the scale.

TESTING THE RECTIFIERS AND STATOR

(When Tool C-3829 is not available)

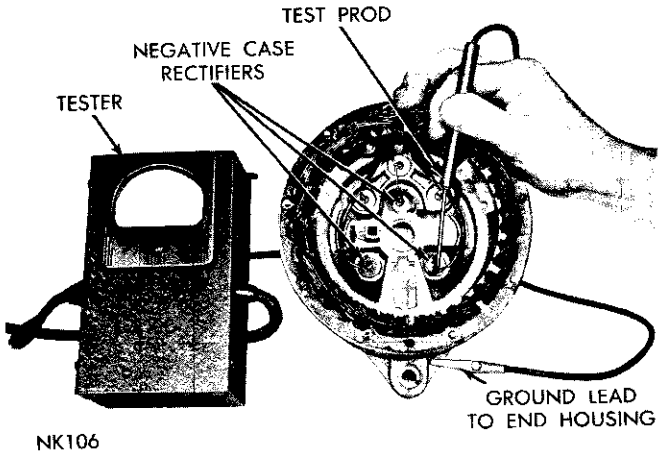


Fig. 19—Testing Negative Rectifiers

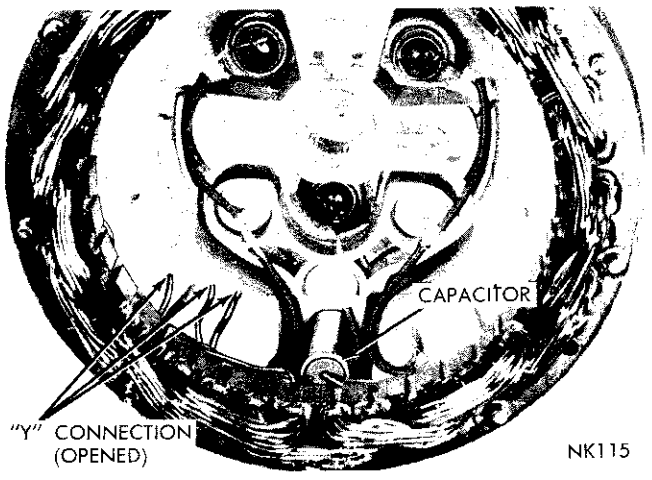


Fig. 20—Separating the Three Stator Leads

(a) Separate the three (3) stator leads at the "Y" connection (Fig. 20).

NOTE: Cut the stator connection as close to the connector as possible because they will have to be soldered together again. If they are cut too short it may be difficult to get them together again for soldering.

(b) Test the rectifiers with a 12 volt battery and a test lamp equipped with a number 67 bulb (4 candle power) by connecting one side of test lamp to the positive battery post; the other side of the test lamp to a test probe with the other test probe connected to the negative battery post.

(c) Contact the outer case of the rectifier with one probe and the other probe to the wire in the center of the rectifier. (Fig. 21).

(d) Reverse the probes, moving the probe from the rectifier outer case to the rectifier wire, and the probe from the rectifier wire to the rectifier outer case.

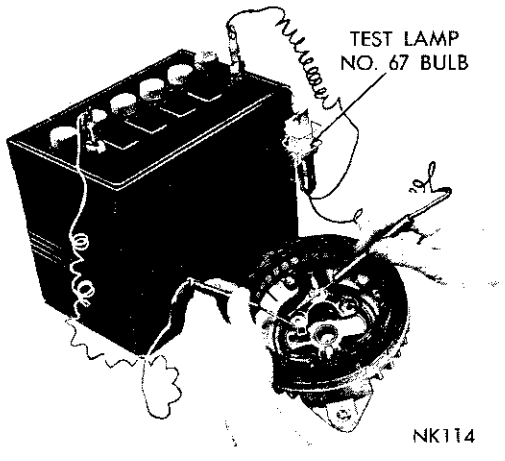


Fig. 21—Testing Rectifiers with a Test Lamp

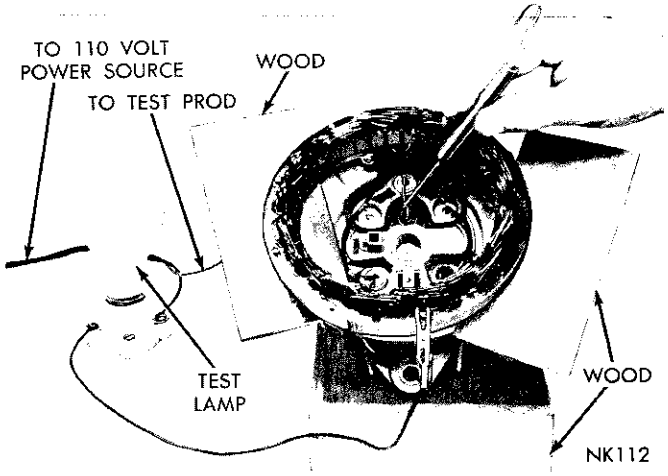


Fig. 22—Testing the Stator for Grounds

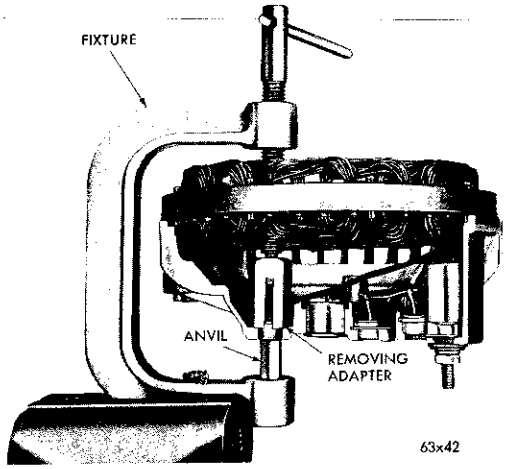


Fig. 24—Removing Rectifiers

If the test lamp "lights" in one direction but does "not light" in the other direction, the rectifier is satisfactory. If the lamp lights in "both directions," the **rectifier** is "shorted." If the test lamp does "not light" in either direction, the rectifier is "open."

NOTE: Possible cause of an open or a blown rectifier is a faulty capacitor or a battery that has been installed in reverse polarity. If the battery is installed properly and the rectifiers are open, test the capacitor capacity —.50 microfarad (plus or minus 20%).

(e) Unsolder the rectifier leads from the stator leads.

(f) Test the stator for grounds using a 110 volt test lamp (Fig. 22). Use wood slats to insulate the stator from the rectifier shield. Contact one prod of the test lamp to the stator pole frame, and contact the other prod to each of the three stator leads. The test lamp should "not light." If the test lamp lights, the stator windings are "grounded."

(g) Test the stator windings for continuity, by contacting one prod of the test lamp to **all** three stator leads at the "Y" connection. Contact each of the three stator leads (disconnected from the rectifiers). The test lamp should "light" when the prod contacts each of the three leads. If the test lamp does not light the stator winding is "open" (Fig. 23).

(h) Install a new stator if the stator tested is "grounded" or "open." If the rectifiers must be replaced unsolder the rectifier wire from the stator lead wire at the soldered joint.

NOTE: Three rectifiers are pressed into the heat sink and three in the end shield. When removing the rectifiers, it is necessary to support the end shield and/or heat sink to prevent damage to these castings.

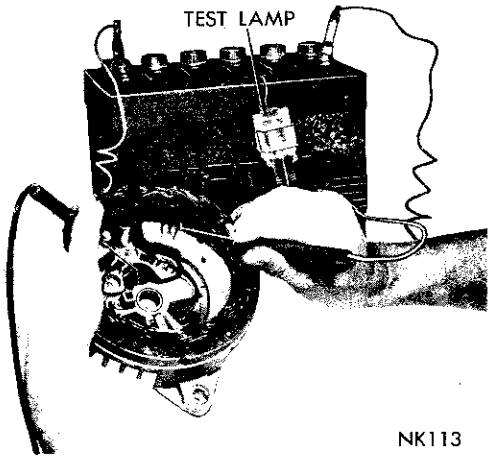


Fig. 23—Testing Stator Windings for Continuity

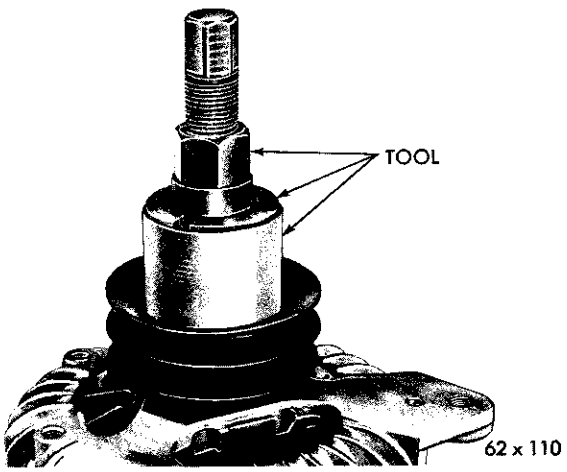


Fig. 25—Removing Pulley

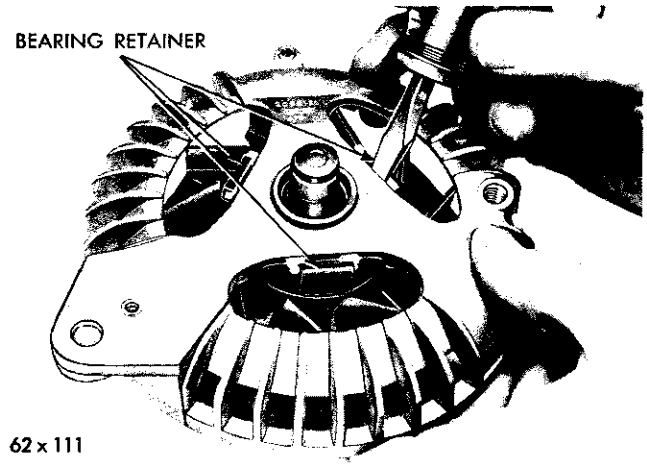


Fig. 26—Disengaging the Bearing Retainer from the End Shield

(4) Cut the lead at the malfunctioning rectifier.

(5) Place the Rectifier Removing and Installing Press in a vise and support the end shield on the clamp anvil under the rectifier to be removed (Fig. 24).

NOTE: The support tool adapter SP-3821 is cutaway and slotted to fit over the wires and around the bosses in the end shield. Make sure that the bore of the tool completely surrounds the rectifier during the removal process.

(6) Carefully apply pressure with the tool pressure screw until the support tool rectifier end shield and remover pin and remover adapter are in alignment then press the rectifier out of the end shield or heat sink.

(7) The pulley is an interference fit on the rotor shaft. Remove the pulley with Puller Tool C-3615 or C-3934 and special adapters (Fig. 25).

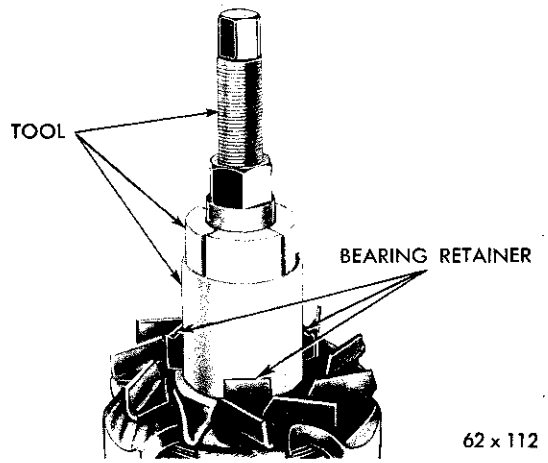


Fig. 27—Removing the Bearing from the Rotor Shaft

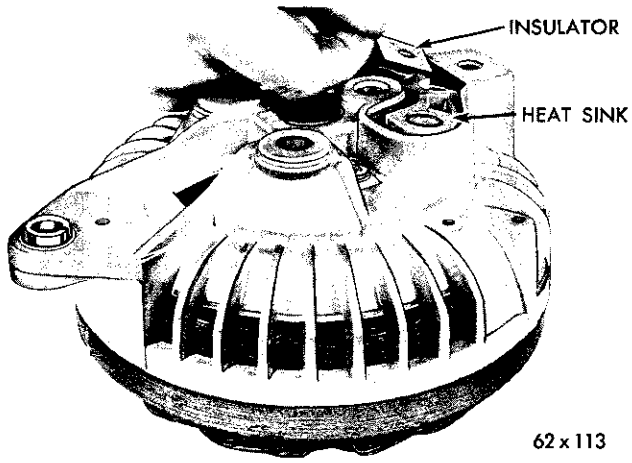


Fig. 28—Removing the Heat Sink Insulator

(8) Pry the drive end bearing spring retainer from the end shield with a screwdriver (Fig. 26).

(9) Support the end shield and tap the rotor shaft with a plastic hammer to separate the rotor from the end shield.

NOTE: The new bearing is lubricated with a predetermined amount of special lubricant and does not require additional lubrication.

(10) The drive end ball bearing is an interference fit with the rotor shaft. Remove the bearing with puller Tool C-3615 or C-3934 and adapters as follows:

(a) Position the center screw of the Tool on the rotor shaft.

(b) Place the thin lower end of the adapters SP-3375 under the bearing equally spaced with the upper end of the adapters around the center screw.

(c) Hold the adapter and center screw in position with the tool sleeve.

CAUTION: The tool sleeve must bottom on bearings, otherwise adapters may be damaged.

(d) Turning the center screw while holding the outer body of the tool (Fig. 27) will withdraw the bearing from the rotor shaft.

(11) Remove the D.C. output terminal nuts and washers and remove the terminal screw and inside capacitor.

NOTE: The heat sink is also held in place by the terminal screw.

(12) Remove the insulator (Fig. 28).

(13) The needle roller bearing in the rectifier end shield is a press fit. If it is necessary to remove the rectifier end frame needle bearing, protect the end shild by supporting the shield with Tool C-3925 when pressing the bearing out with Tool C-3770A (Fig. 29). Make sure the notches in the tool clear the raised section of the heat sink.

NOTE: The new bearing is prelubricated and no

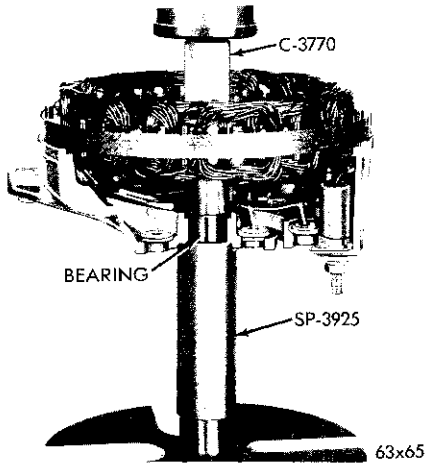


Fig. 29—Removing the Rectifier End Shield Bearing

additional lubricant should be added, as an excessive amount of lubricant will contaminate the slip rings and cause premature brush and rotor failures.

REPLACING SLIP RINGS

Slip rings that are damaged can be replaced as follows:

(a) Cut through the rotor grease retainer with a chisel and remove the retainer and insulator.

(b) Unsolder the field coil leads at the solder lugs (Fig. 30).

(c) Cut through the copper of both slip rings at opposite points (180° apart) with a chisel (Fig. 31).

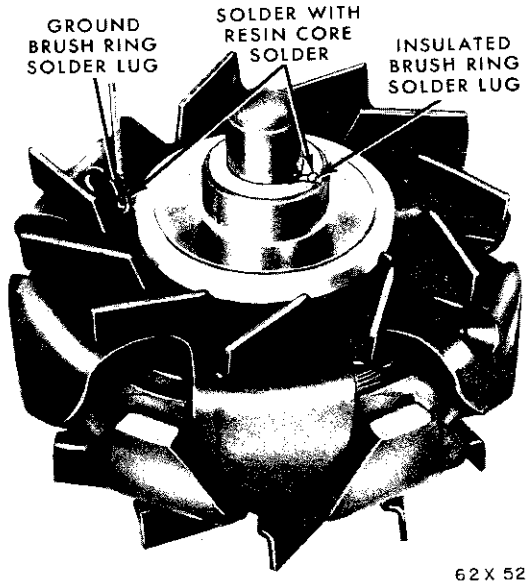


Fig. 30—Solder Points—Slip Ring Installed

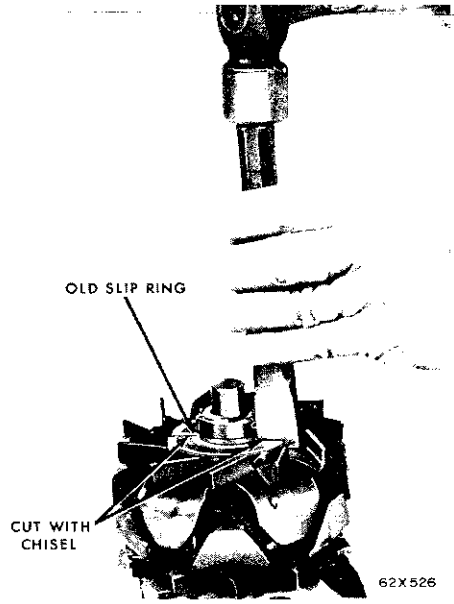


Fig. 31—Cutting the Old Slip Rings

(d) Break the insulator and remove the old ring.

(e) Clean away dirt and particles of the old slip ring from the rotor.

(f) Scrape the ends of the field coil lead wires clean for good electrical contact.

(g) Scrape one end (about $^{3}/_{16}$ inch) of a piece of bare wire (approx. 18 gauge) three inches long (to be used as a guide wire).

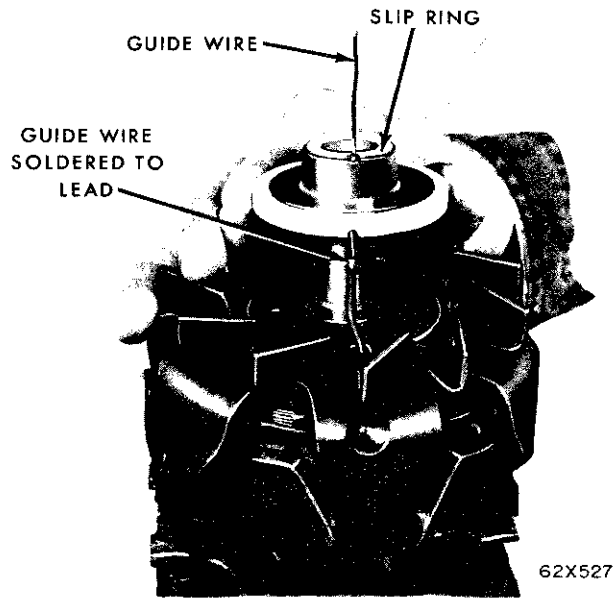


Fig. 32—Aligning Slip Ring with Field Wire and Guide Wire

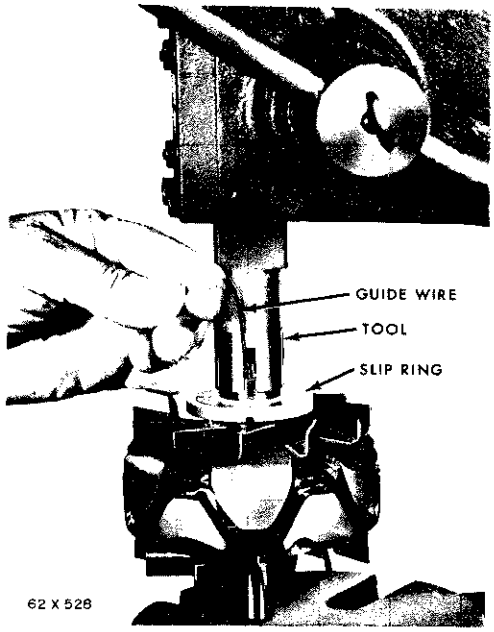


Fig. 33—Installing the Slip Ring

(h) Tin the scraped area of the guide wire with resin core solder. Lap the tinned end of the wire over the field coil lead to the insulated ring and solder the two together.

(i) Position the new slip ring carefully over the guide wire and the rotor shaft so the wire will lay in the slip ring groove (Fig. 32). The groove in the slip ring must be in line with the insulated brush field lead to provide room for the lead without damaging it.

(j) Place installing Tool C-3900 over the rotor shaft with the guide wire protruding from the slot in the tool.

(k) Position rotor, slip ring and tool assembly in an arbor press (Fig. 33). Pull up on the guide wire being careful to guide the insulated field lead into the slip ring groove. While guiding the insulated field lead through the groove, press the slip ring on the shaft. When the slip ring is bottomed on the rotor fan the end of the field lead (insulated brush ring) should be visible at the solder lug (Fig. 30).

(l) Unsolder the guide wire from insulated brush slip ring lead. Press the field lead into the solder lug and solder the lead to the lug with resin core solder.

CAUTION: Be sure the solder bead does not protrude beyond the surface of the plastic material. Do not use acid core solder as a short circuit may result and corrosion will definitely occur.

(m) Coil the ground brush ring field lead around the solder lug and solder with resin core solder.

(n) Test the slip rings for ground with a 110 volt test lamp by touching one test lead prod to the rotor pole shoe and the remaining prod to the slip rings. Test lamp should not light. If lamp lights, slip rings are shorted to ground, possibly due to grounding insulated field lead when installing the slip ring.

If the rotor is not grounded, lightly clean the slip ring surfaces with -00- sandpaper.

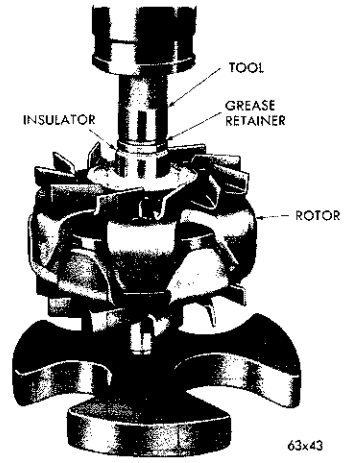


Fig. 34—Installing Bearing Grease Retainer

(o) Position the grease retainer insulator and grease retainer on the rotor shaft and press the retainer on the shaft with installer Tool C-3921 Fig. 34. The retainer is properly positioned when the inner bore of installer tool bottoms on the rotor shaft.

ASSEMBLING THE ALTERNATOR

(1) Check the rectifier identification to make sure the correct rectifier is being installed. Refer to the Parts List for rectifier identification.

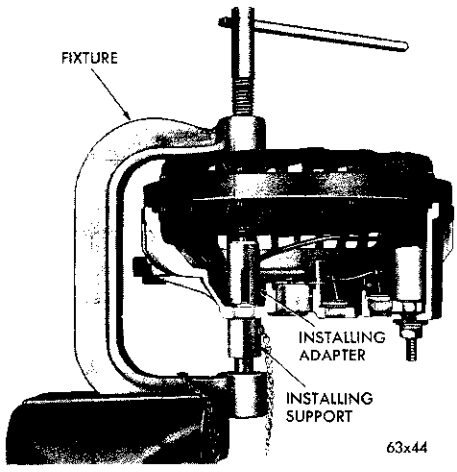


Fig. 35—Installing a Rectifier

(2) Start the rectifier squarely into the mounting hole.

(3) Support the heat sink or rectifier and shield on the installer adapter of Tool C-3928. With the installing adapter positioned on the rectifier, carefully apply pressure with the tool pressure screw until the installer tool, rectifier, rectifier end shield or heat sink are in alignment and after determining that the rectifier is started squarely in the casting, slowly apply pressure with the tool pressure screw until you feel the collar of the rectifier bottom against the casting (Fig. 35).

NOTE: Make sure that the installer support adapter fits square around the rectifier inner boss and that pressure is applied on the outer rim of the rectifier.

CAUTION: DO NOT USE a hammer to start the rectifier into its bore in the end shield. DO NOT HAMMER OR SHOCK the rectifier in any manner as this will fracture the thin silicon wafer in the rectifier causing complete rectifier failure.

(4) Clean the leads and mate the stator lead with the rectifier wire and bend the loop snugly around the stator lead to provide a good electrical and mechanical connection. Solder the wires with resin core solder. Hold the rectifier lead wire with pliers just below the joint while soldering Fig. 36. The pliers will absorb the heat from the soldering operation and protect the rectifier.

NOTE: After soldering, quickly cool the soldered connection; touch a dampened cloth against it. This will aid in forming a solid joint.

(5) After soldering, the stator leads must be pushed down into the slots that are cast into the end shield and cemented with MoPar Cement Part Number 2299314 to protect the leads against possible interference with the rotor fans. Test each replacement rectifier to make certain the rectifier was not damaged by the soldering or pressing operations.

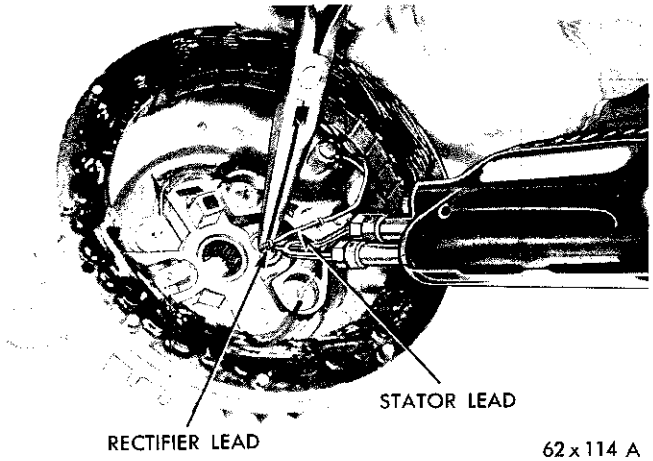


Fig. 36—Soldering Rectifier and Stator Leads

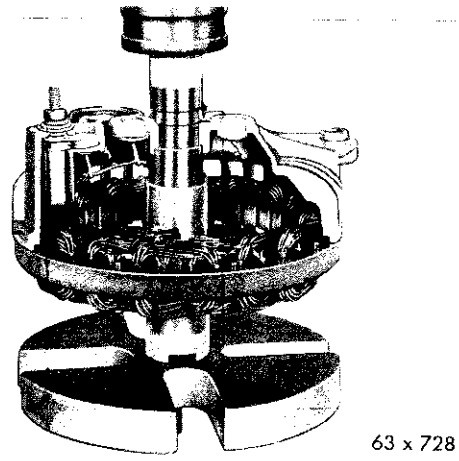


Fig. 37—Installing the Rectifier End Shield Bearings

(6) Support the end shield on Tool C-3925 so that the notches in the support tool will clean the raised section of the heat sink and press the bearing into position with Tool SP-3381 (Fig. 37).

NOTE: New bearings are pre-lubricated, additional lubrication is not required.

(7) Insert the drive end bearing in the drive end shield and install the bearing retainer plate to hold the bearing in place.

(8) Position the bearing and drive end shield on the rotor shaft and, while supporting the base of the rotor shaft, press the bearing and shield into position on the rotor shaft with arbor press and Tool C-3858 (Fig. 38).

CAUTION: Make sure that the bearing is installed squarely at installation; otherwise, damage to the bearing will result. Press the bearing on the rotor shaft until the bearing contacts the shoulder on the rotor shaft.

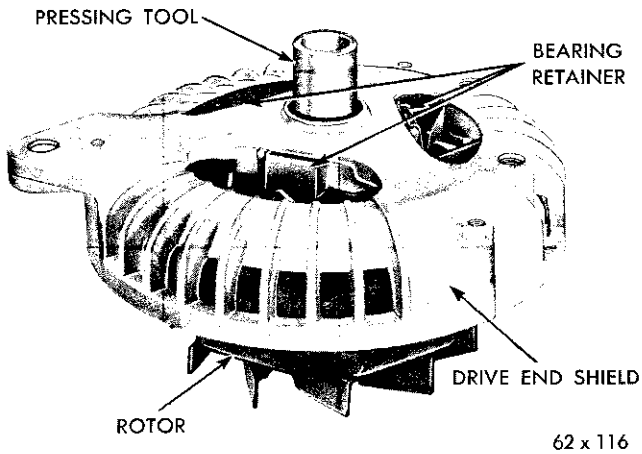


Fig. 38—Installing Drive End Shield and Bearings

(9) Install the pulley on the rotor shaft. The shaft of the rotor must be supported in a manner so that all pressing force is on the pulley hub and rotor shaft (Fig. 39).

NOTE: Press the pulley on the rotor shaft until the pulley contacts the inner race of the drive end bearing. Do not exceed 6800 pounds pressure.

(10) The alternators have the capacitor mounted internally. Make sure the heat sink insulator is in place (Fig. 28).

(11) Install the output terminal screw and the capacitor through the heat sink and end shield.

(12) Install the insulating washers, lockwashers and lock nuts.

(13) Make sure the heat sink and insulator are in position and tighten the lock nut.

(14) Position the stator on the rectifier end shield.

(15) Position the rotor end shield assembly on the stator and rectifier end shield. Align the through bolt holes in the stator, rectifier end shield and drive end shield.

(16) Compress the stator and both end shields by hand and install the through bolts, washers and nuts.

(17) Install the insulated brush in the rectifier end. Place the bronze terminal on the plastic holder with the tab of the terminal in the recess in the plastic holder.

(18) Place the nylon washer on the bronze terminal and install the lockwasher and attaching screws.

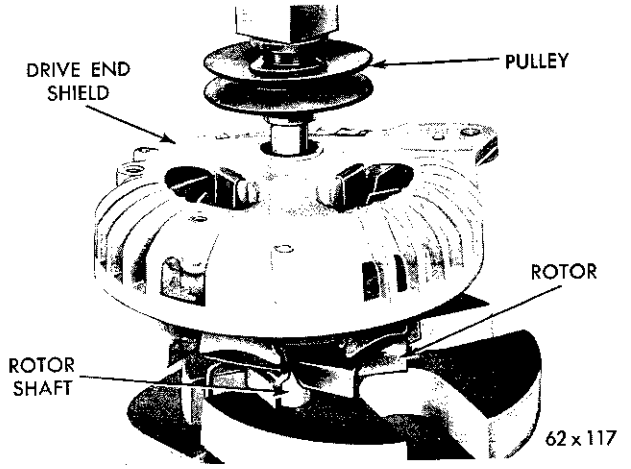


Fig. 39—Installing the Alternator Pulley

(19) Install the ground brush and attaching screw.

(20) Rotate the pulley slowly by hand to be sure that the rotor fans do not hit the rectifiers, capacitor lead, and stator connections.

(21) Install the alternator and adjust the drive belt.

(22) Connect the output "BAT" and the field "FLD" leads and connect the ground wire.

(23) Connect the battery ground cable.

(24) Start and operate the engine, and observe the alternator operation.

(25) Test the current output and regulator voltage setting, if necessary.

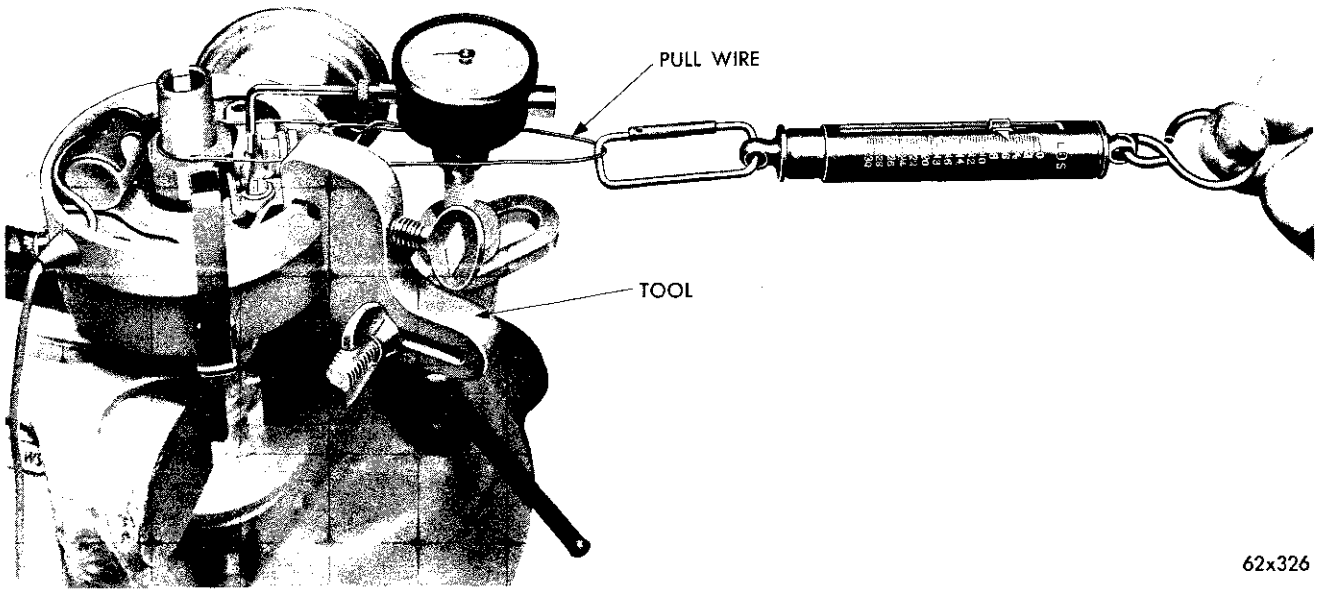


Fig. 1—Shaft and Bushing Wear Test

PART 4

IGNITION SYSTEM

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
BURNED OR PITTED DISTRIBUTOR CONTACTS	(a) Dirt or oil on contacts.	(a) If the oil is on contact face, determine the cause and correct the condition. Clean the distributor cam of dirt and grease, apply a light film of distributor cam lubricant Part No. 1473595 to cam lobes; wipe off excess. Replace the contact set and adjust as necessary.
	(b) Alternator regulator setting too high.	(b) Test the alternator voltage regulator setting, adjust as necessary. Replace and adjust the distributor contacts.
	(c) Contacts misaligned or gap too small.	(c) Align and adjust contacts.
	(d) Faulty coil.	(d) Test and replace coil if necessary. Replace and adjust contacts.
	(e) Ballast resistor not in circuit.	(e) Inspect conditions, and correctly connect the coil.
	(f) Wrong condenser or faulty condenser.	(f) Test the condenser and replace if necessary. Replace and adjust the contacts.
	(g) Faulty ignition switch.	(g) Replace the ignition switch.
	(h) Bushings or distributor shaft worn.	(h) Recondition the distributor.
	(i) Touching of contacts with hands during installation.	(i) Replace and adjust the contacts.
IGNITION COIL FAILURE	(a) Alternator regulator setting too high.	(a) Test the alternator setting and adjust as necessary. Inspect the condition of the distributor contacts.
	(b) Coil damaged by excessive heat from engine.	(b) Replace coil. Inspect the condition of the distributor contacts.
	(c) Coil case or tower cracked.	(c) Replace the coil.
	(d) Oil leak at tower.	(d) Replace the coil.
	(e) Coil tower carbon-tracked.	(e) Wipe the tower clean. Test the coil, replace if necessary.
CONDENSER FAILURE	(a) Normal fatigue.	(a) Test and replace the condenser. Inspect distributor contacts for pitting.
	(b) Damaged by excessive engine heat or moisture.	(b) Test and replace the condenser. Inspect distributor contacts for pitting.

Description

The ignition system consists of two separate circuits. The battery, ammeter, ignition switch, ballast resistor, primary winding of the ignition coil, distributor contacts and condenser, vehicle frame, and the primary wiring make up the low voltage primary circuit. The secondary high voltage circuit includes the coil secondary winding, the distributor cap and rotor, the spark plug cables, the spark plugs and the vehicle frame.

SERVICE PROCEDURES

SECONDARY CIRCUIT INSPECTION

The coil to distributor cap wire and the spark plug wires should make good, clean contact in the ignition coil, the distributor cap towers and on the spark plugs. Wires that are loose or are not inserted all the way into the towers or on the plugs will corrode and increase the resistance as well as cause carbon tracking of the coil or cap towers.

Make sure the cap nipples and spark plug covers are in good condition and that they are tight on the

spark plug terminals and around the plug insulator.

The ignition coil tower, if oily or dirty should be wiped clean and inspected for cracks, carbon tracking or oil leaks. Replace the coil if faulty.

Inspect the distributor cap for oil film, dirt or metal particles on the inside surface. Any contamination, however slight, can become conducting and cause hard starting in wet weather. Thoroughly wash the cap and rotor in a weak solution of liquid soap or non-flammable detergent in warm water. Do not use a concentrated solution or soak the cap in the solution. Scrub the inner surfaces with a stiff bristle nylon brush to clean between the ribs and the crevices. Rinse well in hot water, shake out excess water and dry thoroughly. Do not use compressed air to dry or blow out the water. Carefully inspect for cracks or carbon tracking on the inner or outer surfaces. Replace the cap if faulty.

Old, cracked, or damaged wires should be replaced. The secondary cables, cap and rotor should be tested, using Tool C-3296. This tester provides high voltage which is sufficient for testing secondary insulation.

Replace the cable if resistance is more than 30,000 ohms or if the terminal has pulled off the cable.

NOTE: Jerking the wires to disconnect them from the plugs can stretch them and increase secondary resistance. To remove the wire, grasp the boot at the end of the wire and rotate the boot slightly to break the adhesion between it and the spark plug insulator, then use a straight pull to remove the spark plug.

Resistor type wire is identified by the word "Radio" stamped on the insulating jacket. No additional resistors are necessary.

The rotor and distributor cap electrodes should be inspected for burning. Replace the rotor if the electrode is burned on the top or if electrode is worn too short.

DISTRIBUTOR RESISTANCE TEST

This test indicates the resistance of the ignition primary circuit from the distributor side of the coil, through the contacts and the distributor ground. Excessive resistance in this portion of the ignition system will prevent the coil from producing sufficient output for good over-all ignition. To perform test, proceed as follows:

(1) Turn the Selector Switch of a tach-dwell unit to the CALIBRATE position and adjust the Dwell Calibrator until the Dwell Meter reads on the set line (test leads separated).

(2) Leave the Selector Switch in the CALIBRATE position, connect the tach-dwell red lead to the distributor terminal of the coil and the black lead to a good ground.

(3) Turn the ignition switch "ON." Observe dwell meter reading. The meter pointer should be well within the black bar marked "DISTRIBUTOR RESISTANCE." If the reading is zero or outside of black bar, crank the engine with the starter until the meter pointer moves as far to the right as possible. (This will indicate that the contacts are closed.) A reading now within the black indicates a normal distributor primary circuit.

If the reading is outside the black bar, high resistance is present in the distributor primary circuit.

(4) Remove the test lead from the distributor terminal of the coil and connect to the following points:

(a) Distributor primary terminal (outside).

(b) Distributor primary terminal (inside).

(c) Contact point terminal bracket (insulated bracket).

(d) Ground side of the contacts.

(e) Distributor housing.

(5) Repeat the test at each connection until a noticeable change occurs in the meter reading. If a poor connection or faulty lead is indicated, clean, tighten or replace as necessary and repeat test (3).

If faulty contacts are indicated, remove the distributor for complete inspection, service, testing and calibration.

IDLE RPM TEST

The engine idle rpm setting should be tested and recorded as it is when the vehicle is first brought into the shop for testing. This will assist in diagnosing complaints of engine stalling or complaints of creeping and hard shifting on vehicles equipped with automatic transmissions.

Test procedures are as follows:

(1) Turn the Selector Switch to the CALIBRATE position and adjust Dwell Calibrator until the Dwell Meter reads on the SET line (test leads separated).

(2) Connect the red lead of the test unit to the distributor primary terminal at the coil and the black lead to a good ground.

(3) Turn the Selector Switch to the 8 LOBE position.

(4) Turn the tachometer rpm switch to the 1000 rpm position.

(5) With engine at normal operating temperature (off fast idle), momentarily open the throttle and release to make sure there is no bind in the linkage and that the idle speed screw is against its stop.

(6) Note engine rpm on 1000 rpm scale and adjust carburetor idle speed to specifications shown in "Fuel System Specifications."

DISTRIBUTOR CONTACT DWELL

The degrees of distributor dwell are the degrees of

rotation through which the breaker contacts remain closed. This is also commonly referred to as "dwell angle" or "cam angle."

Correct distributor contact dwell is essential for good ignition performance and contact life.

Test procedures are as follows:

(1) Connect the Tach-Dwell red lead to the distributor terminal of coil and black lead to a good ground.

(2) Turn the selector Switch to the 8 LOBE position.

(3) Start the engine and operate at idle speed.

(4) Observe the dwell meter reading. If the dwell reading is within "Specifications" the contact gap, cam rubbing block and contact arm are all in satisfactory condition.

If the dwell reading is not within specifications, incorrect contact gap, worn cam, worn rubbing block or distorted movable contact arm may be indicated.

DUAL CONTACTS

Block one set of contacts with a clean insulator and adjust the opposite set of contacts on the dwell meter to specifications. **Loosen the stationary contact lock screw just enough, so that the stationary contact can be moved with a slight drag; otherwise it will be difficult to set the contacts accurately.**

When the one set of contacts has been adjusted for the correct clearance, tighten the stationary contact lock screw.

Block the adjusted set of contacts with an insulator and adjust the remaining set of contacts in the same manner as the first set. Remove insulator and recheck tightness of the stationary contact lock screw.

If the contacts have been properly adjusted, the dwell should be as specified for two contact sets.

DWELL VARIATION

This test indicates the mechanical condition of the distributor. Excessive wear in distributor mechanical parts causes dwell variations which will affect ignition timing.

Test procedures are as follows:

(1) With the engine at idle speed, vacuum hose disconnected, and with the test leads connected as in the contact Dwell Test, turn the Tachometer rpm Switch to the 5000 rpm position.

(2) Slowly increase the engine speed to 1500 rpm, then slowly reduce to idle speed while observing the dwell meter reading.

If the dwell reading varies more than 2 degrees from the initial reading between idle speed and 1500 rpm, probable wear in the distributor shaft, bushings or contact plate bearing or pivot pin is indicated. Remove distributor for complete inspection and testing on a distributor tester.

NOTE: Dwell variation at speeds above 1500 rpm does not necessarily indicate distributor wear.

IMPORTANT: Dwell and gap of the contacts must both be within their specified tolerance at the same time. If this cannot be accomplished, it is probable that wrong contacts are installed, rubbing block or the cam lobes are badly worn, or the movable contact is distorted.

IGNITION TIMING

To obtain maximum engine performance, the distributor must be correctly positioned on the engine to give proper ignition timing.

The ignition timing test will indicate the timing of the spark at NO. 1 cylinder at idle (only).

Test procedures are as follows:

(1) Disconnect the vacuum hose at the distributor.

(2) Connect the secondary lead of Power Timing Light to the NO. 1 spark plug, red primary lead to the positive terminal of the battery and the black primary lead to the negative battery terminal.

NOTE: Do not puncture the wires, boots or nipples with test probes. Always use adapters. Puncturing spark plug wires with a probe will damage the wires. The probe can separate the conductor and cause high resistance. In addition breaking the rubber insulation may permit secondary current to arc to ground.

(3) Start the engine and set the idle to "Specifications" rpm, engine at normal operating temperature (transmission in neutral).

(4) Using a timing light, observe the position of the timing mark on the crankshaft damper and check against the specifications.

(5) Loosen the distributor hold down clamp screw and rotate the distributor housing so that the specified timing mark on damper aligns with the specified "BTC" mark on timing plate. (Moving distributor housing against shaft rotation advances timing and with shaft rotation retards timing).

(6) Tighten the distributor hold down clamp screw after the timing has been set and recheck the timing adjustment with a Power Timing Light.

(7) When the ignition timing is correct, connect the vacuum hose to the distributor.

NOTE: As the engine speed is increased, the timing mark should move down on the vibration dampener below the pointer if advance units are functioning.

DISTRIBUTOR REMOVAL

(1) Disconnect the vacuum hose at the distributor.

(2) Disconnect the primary lead wire at the coil.

(3) Unfasten the distributor cap retaining clips and lift off the distributor cap.

(4) Scribe a mark on the edge of the distributor housing to indicate position of the rotor as reference when reinstalling the distributor.

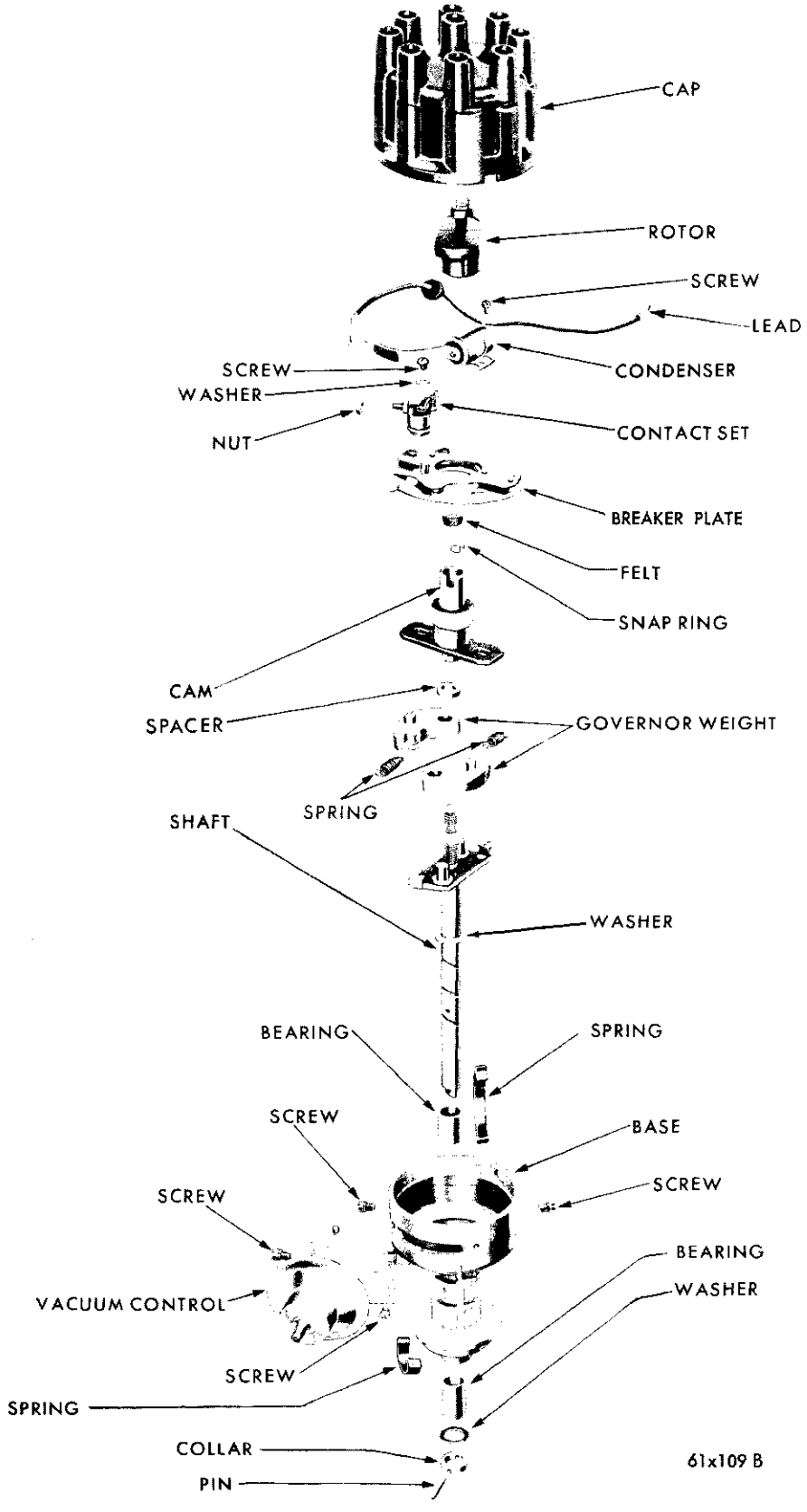


Fig. 2—Distributor—Disassembled View

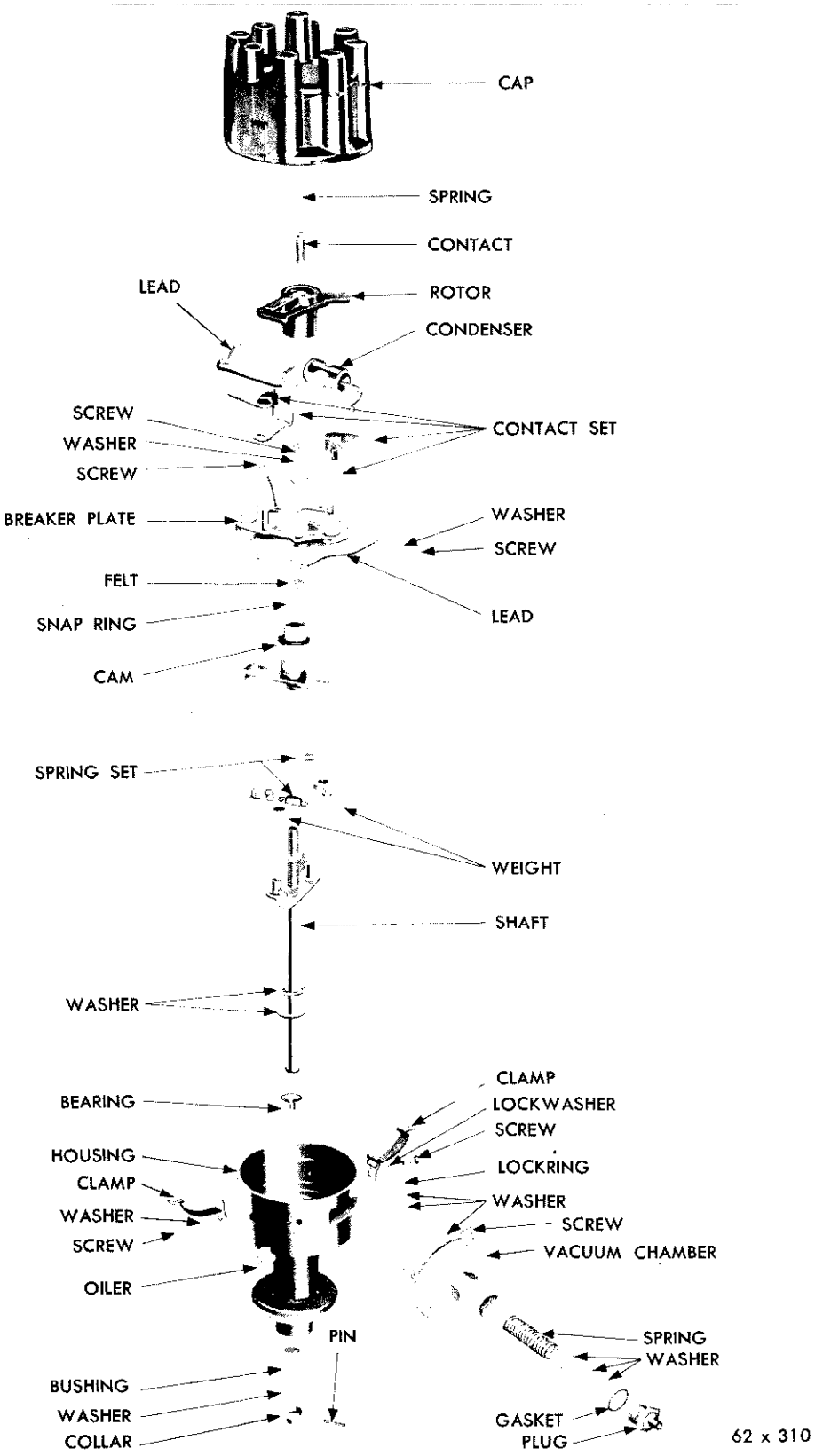


Fig. 3—Distributor—Disassembled View (Prestolite)

(5) Remove the distributor hold-down clamp screw and the clamp.

(6) Carefully lift the distributor from the engine.

Shaft and Bushing Wear Test

(1) Remove the distributor rotor.

(2) Disconnect the primary lead wire at the distributor terminal. DO NOT LOOSEN the inner nut that holds the movable contact arm tension spring to the terminal post.

(3) Clamp the ribbed section of the distributor housing lightly in a vise equipped with soft jaws and attach the dial indicator to the body of the distributor with the indicator plunger arm resting against the movable contact arm at the rubbing block and with the rubbing block of the contact arm on the highest point of the cam lobe (Fig. 1).

(4) Place one end of a wire loop around the top of the distributor shaft. Hook a spring scale in the other end of the wire loop and pull on a line with the plunger of the indicator gauge. Be sure the wire loop on shaft end is down on the shaft to insure a straight pull and also that the wire loop does not interfere with the indicator or holding bracket. Apply a five pound pull and read the movement of the plunger on the indicator dial. (Be sure the rubbing block of the contact arm is on the highest point of the cam lobe during this test). If the plunger movement exceeds .006 inch, replace the bushings and/or distributor shaft, see "Distributor Disassembly."

DISASSEMBLY OF THE DISTRIBUTORS

(1) Remove the distributor rotor.

NOTE: The distributor cap clamp springs on Chrysler built distributors are held in place by peened metal around the openings and should not be removed.

(2) Remove the retainer attaching the vacuum advance unit to the contact plate advance arm.

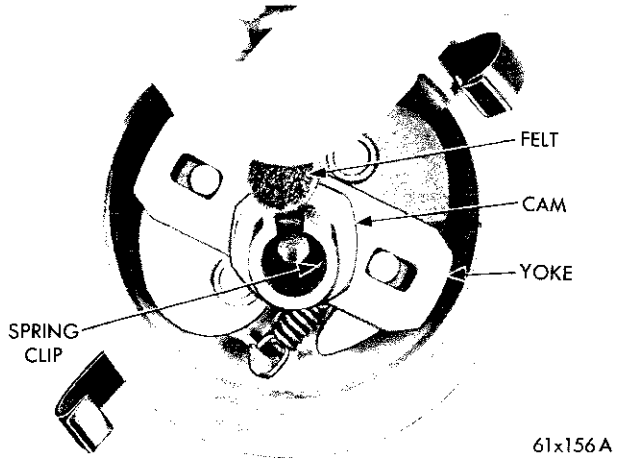


Fig. 4—Removing or Installing Cam Felt Wick

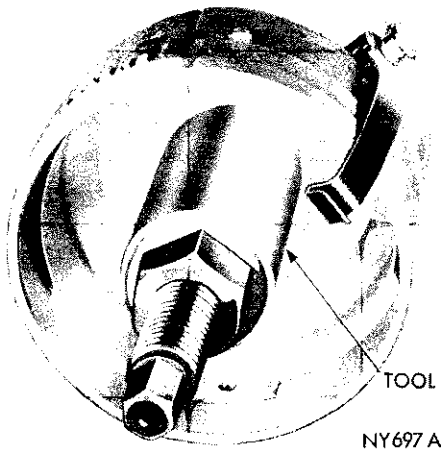


Fig. 5—Removing Distributor Housing Upper Bushing

(3) Remove the two screws and lockwashers attaching the vacuum advance unit to the distributor housing and remove the unit.

(4) Remove the primary lead wire and rubber grommet as an assembly. Push the grommet towards the inside of the distributor to remove. Do not pull the wire.

(5) Remove the two screws, and lockwashers attaching the contact plate to the housing and lift out the contact plate, contacts and condenser as an assembly.

(6) Remove the oil wick from the distributor cam (Fig. 3). Remove the spring clip from the oil well in the cam (Fig. 4) and remove the cam and yoke assembly and spacer.

(7) If the side play exceeded .006 inch in the "Shaft and Bushing Wear Test," replace the bushings and/or distributor shaft as follows:

(a) Remove the distributor drive collar retaining pin and slide the collar off the end of the shaft.

(b) Use a fine file to clean the burrs from around the pin hole in the shaft and remove the lower thrust washer.

(c) Push the shaft up and remove it through the top of the distributor body. Remove the upper thrust washer.

(d) Remove the shaft oiler and lift out the oiler wick.

CAUTION: On Chrysler Built distributors, do not drive the bushings out of the housing.

(e) Remove the upper bushing with Tool C-3744 (Fig. 5) by threading the tap securely into the bushing. Place the spacer over the tap. Install the tool nut and, while holding the tap, tighten the tool nut to remove the bushing. Invert the housing and remove the lower bushing in the same manner.

On Prestolite built distributors, place the housing in an arbor press and press out the upper and lower bushings from the bottom of the housing using driver Tool C-3041.

(f) Soak the new bushing in light engine oil for approximately 15 minutes.

(g) Position the new upper bushing with the hole in the bushing **up** and in line with the oil hole in the housing, then press the bushing into the distributor housing with Tool C-3041 and adapter (Fig. 6). The bushing will measure .094 inch below the top of the housing bore for Prestolite distributors. For the Chrysler built distributors use Tool C-3041 with the flat face of adapter contacting the bushing then press the bushing into the distributor until top of bushing is 1.1613 inches from the top of the machined face of distributor housing. Place a straightedge on the machined surface of the housing and measure from the bottom face of the straightedge to the top of the bushing. Invert the housing and install the other bushing (Fig. 7) flush with the face of the distributor base.

(h) Insert a $^{3}/_{32}$ inch rod through the housing oiler hole to see if the hole in the bushing indexes with the oiler hole in the housing. If the rod cannot be inserted through the housing and the bushing, drill a ⅛" hole through the upper bushing by drilling through the oil wick hole. Remove burrs caused by the drilling operation.

(i) Install the burnishing tool part of Tool set C-3041 and force the burnisher through both the bushings (Fig. 8). The correct bushing inside the diameter is .4995 to .5000 inch.

ASSEMBLING THE DISTRIBUTOR

(1) Test the operation of centrifugal weight and inspect the weight springs for distortion. Lubricate the

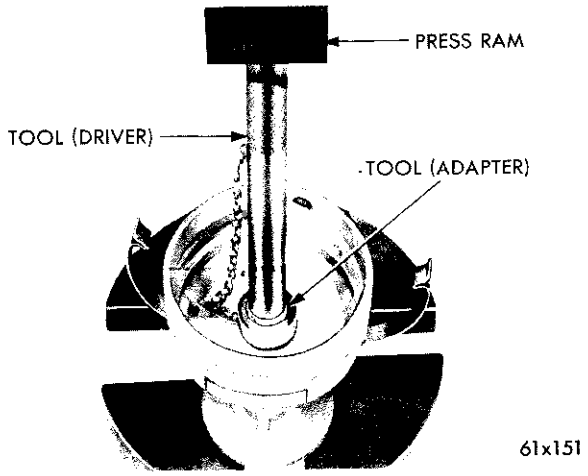


Fig. 6—Installing Distributor Housing Upper Bushing

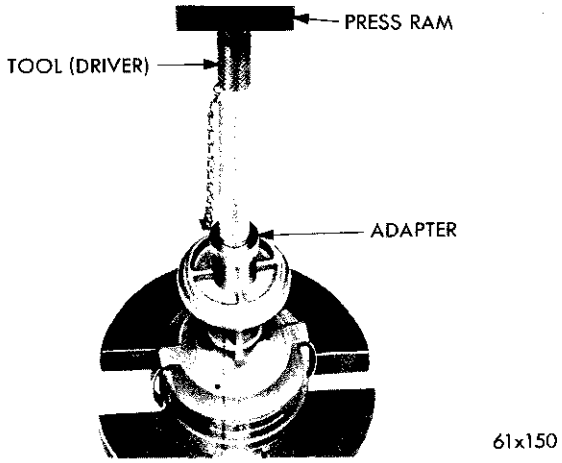


Fig. 7—Installing Distributor Housing Lower Bushing

governor weights.

(2) Inspect all bearing surfaces and pivot pins for roughness, binding or excessive looseness.

(3) Install the cam spacer, chamfered end down on the distributor shaft.

(4) Slide the cam and yoke on the distributor shaft, engage the weight lugs with the slots in the yoke. Install the cam retaining spring clip. Be sure it is properly seated in the groove of the distributor shaft.

(5) Lubricate and install the flat thrust washer. Position the washer on the distributor shaft and slide the shaft into the distributor body. Position the lower thrust washer and drive the collar on the lower end of the shaft. Install the retainer pin.

(6) Install the oiler wick and oiler.

(7) Install the contact plate assembly. Align the condenser lead, contact point spring, primary lead and install the attaching screw.

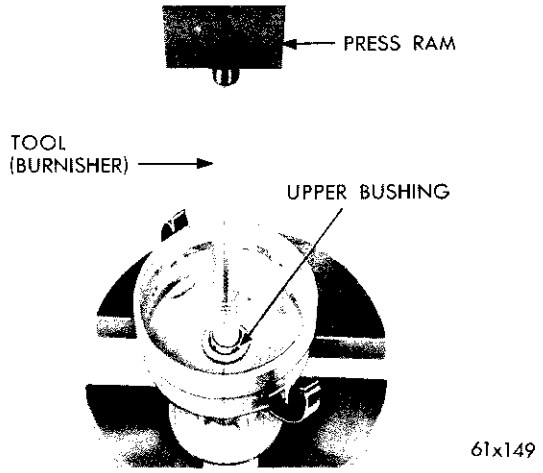


Fig. 8—Burnishing Distributor Housing Bushings

(8) Install the felt wick in the top of the distributor cam.

(9) Attach the vacuum advance unit arm to the contact plate. Install the vacuum unit attaching screws and washers.

(10) Test the contact arm spring tension, and adjust the contact gap.

(11) Lubricate the felt pad in the top of the distributor cam with 3 to 5 drops of light engine oil and install the rotor.

TESTING CONTACT ARM SPRING TENSION

(1) Hook a spring scale Tool MTU-36 on the contact arm and pull in a straight line at right angles to the contact surfaces (Fig. 9). Take a reading as the contacts start to separate under the slow and steady pull of the scale. The spring tension should be 17 to 20 ounces. If the reading is outside these limits, loosen the screw which holds the end of the movable arm contact spring and slide the end of the spring in or out, as necessary to adjust tension.

(2) Tighten the screw and measure the spring tension.

NOTE: Spring tension that is too great, will cause excessive wear on the distributor cam and on the nylon block of the movable contact arm. Spring tension that is too weak, is unable to keep the contacts in contact with each other when they close. This is particularly true as engine speed is increased, causing high-speed misfiring.

INSTALLING AND ALIGNING CONTACTS

(1) Remove the old contacts and install a new set.

NOTE: Touching the contact faces with fingers during installation will cause burning of contacts during operation.

(2) Align the contacts to obtain center contact, by bending the stationary contact bracket only. **Never bend** the movable arm to obtain alignment.

(3) After aligning the contacts, readjust the contact

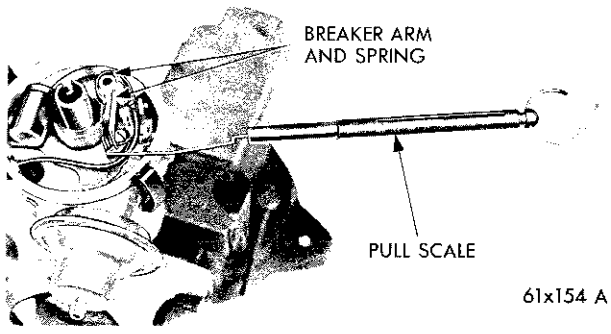


Fig. 9—Testing Breaker Arm Spring Tension

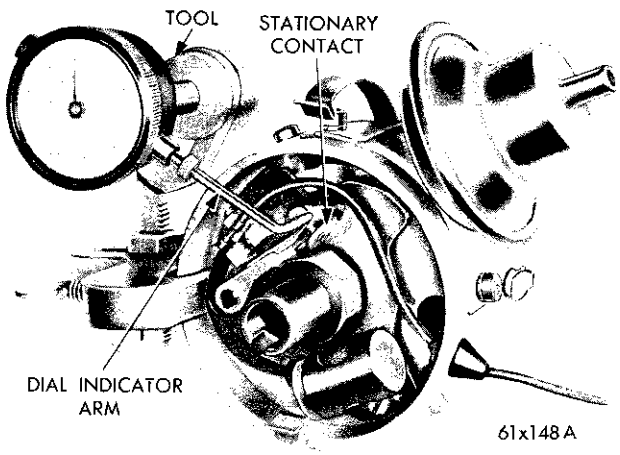


Fig. 10—Adjusting Point Clearance with Indicator

clearance to specifications using a dial indicator (Fig. 10).

(4) Test the dwell angle to show proper degrees of closure. See Paragraph "Distributor Contact Dwell." The lock screw should be loosened just enough so that the stationary bracket can be moved with a slight drag; otherwise, it will be difficult to set the contacts accurately. After setting the contacts to correct the gap, tighten the lock screw.

DISTRIBUTOR LUBRICATION

(1) Add 3 to 5 drops of SAE 10W oil to the oiler on the outside of the distributor base.

(2) Lubricate the felt pad under the rotor in the top of the distributor cam with 3 to 5 drops of SAE 10W oil.

(3) Wipe all old grease from surface of the distributor cam. Apply a light film of new distributor cam lubricant number 1473595.

Do not over-lubricate. Excess grease will be thrown from the distributor cam when the engine is running. Should this grease strike the contact faces, arcing and burning of the contacts will result and ignition trouble will be experienced.

TESTING DISTRIBUTOR ADVANCE

Centrifugal Advance Curve

Note the model number of the distributor and refer to the specifications before making this test.

Mount the distributor assembly (less cap and rotor) in a reliable stroboscope-type distributor tester and proceed with tests as follows:

NOTE: Clamp around the rib section of the distributor housing. The bottom section of the distributor housing is not a machined surface and concentricity would be affected, causing a wobble.

(1) Turn the Tach-Dwell switch to the 8 "LOBE"

position and the Motor Switch to correct direction of rotation. Refer to "Distributor Advance Specifications" in this Manual.

(2) Turn the battery switch "ON."

(3) Regulate the tester speed control to operate the distributor at 200 distributor rpm.

(4) Hold the distributor contact plate in the full retard position and align the "O" of the distributor tester degree ring with any one of the arrow flashes.

(5) Adjust the tester speed control to operate the distributor at speeds called for under "Specifications" and observe arrow flashes opposite tester degree ring to determine degrees of advance.

(6) If the advance is not according to specifications, corrections can be made by bending the primary and secondary spring tabs to increase or decrease the spring tension. The governor spring tabs can be reached through the access hole at the breaker plate. Rotate the shaft until the proper spring and tab lines up with the access holes. Insert a screwdriver blade through the access hole and bend the spring tab toward the distributor cam to decrease spring tension and advance the spark, or away from the distributor cam to increase the spring tension and retard the spark.

NOTE: The light tension spring controls the lower end of the advance curve, and the heavier spring controls the upper end of the advance curve.

Vacuum Diaphragm Leak Test

With distributor mounted in distributor tester and with the vacuum unit attached to the distributor, proceed as follows:

(1) Place the thumb over the end of the vacuum pump and hose and adjust the regulator control knob to give a reading of 20 inches with hose closed off to be sure tester hose does not leak.

(2) Attach the tester vacuum pump hose to the tube on the distributor vacuum unit. The vacuum gauge should hold on maximum vacuum obtainable if no leak exists.

(3) Observe the contact plate while performing the leak test to test response of the contact plate. There should be instant response to the pull of the diaphragm, moving the plate without a drag or bind.

(4) If leakage is indicated, replace the vacuum unit assembly.

Vacuum Advance Curve

Connect the tester vacuum pump hose to the distributor vacuum advance unit and perform operations 1 through 5 under "Centrifugal Advance Curve." Then proceed as follows:

(1) Turn the tester vacuum pump "ON." Adjust the vacuum pump regulator to vacuum test specifications. See "Specifications" and observe the arrow flashes on the tester degree ring to determine the degrees of advance.

(2) If the vacuum advance is above or below specifications, replace the vacuum advance unit. Retest the vacuum advance curve.

INSTALLATION OF DISTRIBUTOR

(1) Position the distributor on the engine. Align the rotor with marks previously scribed on the distributor housing.

(2) Engage the tongue of the distributor shaft with the slot in the distributor and the oil pump drive gear.

NOTE: If the engine has been cranked while the distributor is removed, it will be necessary to establish the proper relationship between the distributor shaft and the NO. 1 piston position as follows:

(a) Rotate the crankshaft until the number one piston is at top of the compression stroke.

(b) Rotate the rotor to the position of the number one distributor cap terminal.

(c) Lower the distributor into the opening, connect the primary lead and install the distributor cap. Make sure all high tension wires "snap" firm in the cap towers. Install the distributor hold-down clamp screw. Tighten the screw finger tight.

(d) Connect the secondary lead of a Power Timing Light to the NO. 1 spark plug (using proper adapter). Connect the red primary lead to the positive terminal of the battery and the black primary lead to the negative battery terminal.

(e) Start and operate the engine at idle speed. Rotate the distributor housing so that the specified timing mark and the pointer are in alignment. (Moving the distributor housing against the shaft rotation advances the timing and with the shaft rotation retards the timing.)

(f) At low altitudes, with any good grade of the recommended gasoline, either "regular" or "premium," the engine will give its best performance if timed according to specifications.

When using low grade fuels, or after carbon has accumulated, objectionable spark ping may occur with the specified timing. In case of this nature, ignition timing should be retarded, but not to exceed 5 degrees of crankshaft rotation later than specified.

At high altitudes or when using higher quality gasoline, for example, "premium" where "regular" is specified or "super premium" where "premium" is specified, there is less tendency for spark ping. In such cases, improved performance may be obtained by advancing the spark not to exceed 5 degrees of crankshaft rotation ahead of specified timing.

Within the foregoing limits, namely, from 5 degrees ahead to 5 degrees later than specified timing, a good rule to follow is to advance the spark until a slight ping is heard when accelerating to 15 mph in direct drive at wide open throttle, with hot engine.

(g) Tighten the distributor clamp screw after the timing has been set and recheck the timing adjustment with a Power Timing Light.

(h) If the timing is correct, connect the vacuum hose to the distributor and remove the timing light from the engine.

Ignition Timing (with C-744 Test Lamp)

(1) Connect the C-744 test lamp between the distributor primary terminal and the battery positive post.

(2) Turn engine until the number 6 exhaust valve is just closing; continue turning the engine slowly until the specified degree mark on the crankshaft pulley is at the pointer.

(3) Loosen the distributor clamp bolt so that the distributor housing can be rotated with a slight drag, then turn the distributor in the normal rotation until the test lamp lights.

(4) Turn the distributor against normal distributor rotation until the test lamp goes out.

NOTE: If the test lamp lights immediately when connected, turn the distributor against normal distributor rotation until light goes out.

(5) Tighten the distributor clamp bolt securely and remove test lamp. If the operation is performed properly the engine is timed to specifications.

NOTE: If the engine is turned beyond the timing mark, continue turning the engine for two full revolutions of the crankshaft; this will place the distributor rotor in approximately the initial position.

CAUTION: DO NOT reverse the rotation of the crankshaft if you have passed the timing mark as this would affect valve timing and distributor timing.

IGNITION COIL

The ignition coil is designed to operate with an external ballast resistor. When testing the coil for output, include the resistor in tests.

Inspect the coil for external leaks and arcing. Always make two tests when testing the coil. One when the coil is cold, the other after the coil has been warmed up.

Test the coil according to the coil tester Manufacturer's instructions. Test the coil primary resistance. Test the ballast resistor resistance. Test the coil secondary resistance. Replace any coil and ballast resistor that does not meet specifications.

Every time an ignition coil is replaced because of a burned tower, carbon tracking or any evidence of arcing at the tower, the nipple or boot on the coil end of the secondary lead should be replaced. Any arcing at the tower will carbonize the nipple so that placing it on a new coil will invariably cause another coil failure.

If the secondary lead shows any signs of damage, the lead should be replaced with a new lead with the neoprene nipple since the oil lead can cause arcing, and therefore, ruin a new coil.

Ballast Resistor

The ballast resistor is a compensating resistance in the ignition primary circuit. During low speed operation, when the primary circuit current flow is high, the ballast resistor temperature rises, increasing the resistance. This reduces the current flow, thereby prolonging ignition contact life. At high speed operation, when the primary current flow is low, the ballast resistance cools off allowing more current flow, which is required for high speed operation. During starter operation, the ballast resistor is bypassed, allowing full battery voltage to the ignition primary circuit.

SPARK PLUGS

To insure peak performance, spark plugs should be removed, cleaned, tested and regapped periodically, depending on driving conditions. Worn and dirty plugs may give satisfactory operation at idling speed but may fail under operation conditions. Spark plug appearance or conditions can reflect a wide variety of engine conditions as follows:

Normal Conditions

Normal conditions Fig. 1. This plug has been running at the correct temperature in a "healthy" engine. The few deposits present will probably be light tan or gray in color with most regular grades of commercial gasoline. Electrode burning will not be in evidence; gap growth will average not more than about .001"/1000 miles. Chances are the plug, as pictured, could be cleaned, the gap electrodes filed, regapped and reinstalled with good results.

Cold Fouling

Cold fouling or carbon deposits, (Fig. 2). This dry black appearance is fuel carbon and can be due to over rich fuel-air mixture, possibly resulting from a faulty choke, clogged air cleaner, improper carbu-

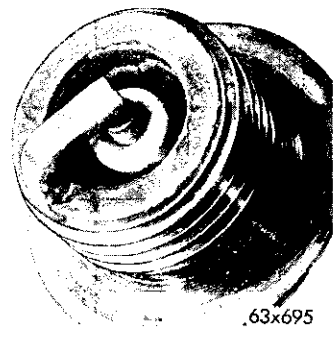


Fig. 1—Normal Conditions

Fig. 2—Cold Fouling

retor idle adjustment, or dirty carburetor. However, if only one or two plugs in a set are fouled like this it's a good idea to check for sticking valves or defective ignition leads. This condition also results from prolonged operation at idle. If the car is operated extensively at idle and low speeds, improved plug service will be obtained by using the next step hotter spark plugs.

Wet Fouling

Wet fouling, (Fig. 3) tells you that the plug has drowned in excess oil. In an old engine, suspect worn rings or excessive cylinder wear. In OHV engines, too much oil may be coming in past the valve guides. Use of a hotter plug may relieve such fouling, but plugs can't take the place of needed engine overhaul.

Fig. 3—Wet Fouling

Fig. 4—Splashed Fouling

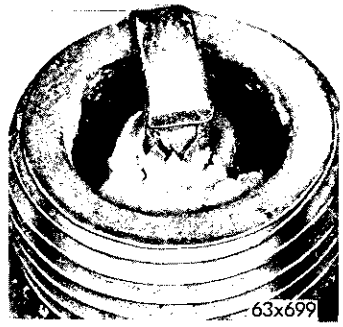


Fig. 5—Core Bridging

NOTE: Remember that "break-in" fouling of new engines may occur before normal oil control is achieved. In new or recently overhauled jobs, such fouling plugs can be cleaned and reinstalled.

Splashed Fouling

Splashed fouling, (Fig. 4) may sometimes occur after a long-delayed tune-up. Here, deposits accumulated after a long period of msisfiring may be suddenly loosened when normal combustion temperatures are restored upon installation of new plugs. During a high speed run, these materials shedding off the combustion chamber are thrown against the hot insulator surface. If they happen to short out the plug, they can be removed with regular cleaning techniques. The plugs can then be reinstalled with good results as the engine has scavenged itself.

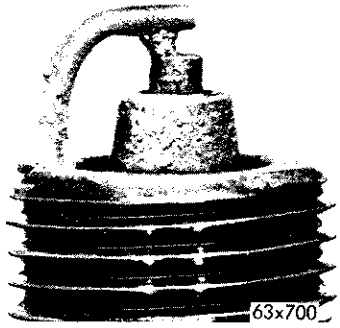


Fig. 6—Gap Bridging

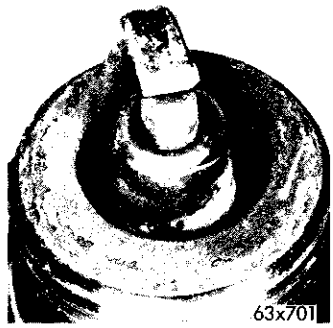


Fig. 7—High Speed Glazing

Core Bridging

Core bridging, (Fig. 5) will be encountered only rarely in automotive engines. It's usually due to the same conditions described under splashed deposits. In this case, a chunk of deposit was thrown off the piston and formed a bridge between the insulator and shell. Result: A "dead short." Such evidence of excessive combustion chamber deposits will be most common where oil control is poor . . . or where vehicles are usually driven in slow speed, start-stop service. In such instances, it usually pays to physically remove accumulated deposits from the engine.

Gap Bridging

Gap bridging, (Fig. 6) is also relatively rare in automotive engines. It also may be traced to flying deposits in the combustion chamber. In a few cases, fluffy deposits may accumulate on the plugs during in-town driving; when the engine is suddenly put under high load, this material can melt and bridge the gap.

High Speed Glazing

High speed glazing may cause misfiring at speeds above 50-60 mph. The shiny deposit, (Fig. 7) may be yellow or tan in color. It usually suggests that temperatures have suddenly risen during a hard acceleration. As a result normal deposits do not get a chance to fluff off the plug . . . instead they melt and form a conductive coating. If this continues to reoccur, suggest a colder heat range and regular spark plug cleanings.

Scavenger Deposits

Fuel scavenger deposits, (Fig. 8) may be white or yellow in color. They may **appear** to be bad, but this is a **normal** appearance with certain branded fuels. Such materials are designed to change the chemical nature of deposits to lessen misfire tendencies. Notice that accumulation on the ground electrode and shell areas may be unusually heavy, but the material is easily flaked off. Such plugs can be considered normal in condition, and can be cleaned with standard procedures.

Fig. 8—Scavenger Deposits

Fig. 9—Overheating

Overheating

Overheating, (Fig. 9) is indicated by a white or light gray insulator which appears "blistered." Electrode gap wear rate will be considerable in excess of .001"/1000 miles. This suggests that a cooler heat range should be used . . . however, overadvanced ignition timing, detonation and cooling system stoppages can also overheat the **correct** spark plug heat ranges.

Turbulence Burning

Turbulence burning, (Fig. 10) causes electrodes to wear away on one side. This is the result of normal turbulence patterns in the combustion chambers of certain engines. It can be ignored if normal plug life is being obtained. If gap growth appears excessive, review the corrective measures suggested under **overheating.**

Initial Pre-ignition Damage

Initial preignition damage may be caused by excessive temperatures, (Fig. 11) this produces melting of the center electrode and, somewhat later, the ground electrode. Remember that the spark plug is like an electric fuse . . . when it melts, it warns you to look for the causes, and for damage to the engine such as scuffed pistons, burned pistons or burned valves. Inspect for correct spark plug heat range, overadvanced ignition timing, loose spark plugs, burned

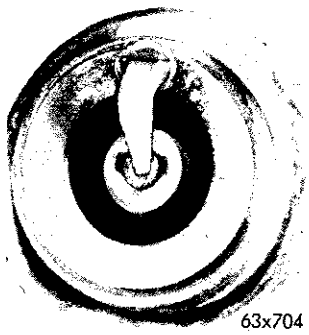


Fig. 10—Turbulence Burning

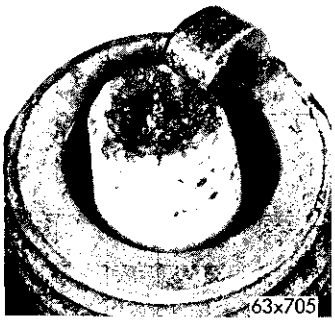


Fig. 11—Initial Pre-Ignition Damage

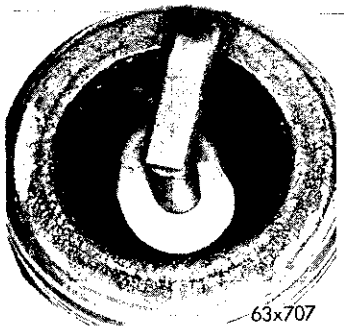


Fig. 13—Chipped Insulator

head gasket, excessive detonation due to low octane fuel and for similar causes of overheating.

Sustained Pre-ignition Damage

Sustained preignition damage, (Fig. 12) usually involves melting of the ceramic firing tip. Since this requires temperatures above 1700F, it's a good possibility that other components of the engine may have been damaged by preignition. This is another sure sign that careful inspection of the engine and its adjustments is required.

Chipped Insulator

Chipped insulator, (Fig. 13) usually results from bending the center electrode during regapping of the plug. Under certain conditions, severe detonation can also split insulator firing ends. In a four-cycle engine, a piece of ceramic like this is easily blown out through the exhaust.

Mechanical Damage

Mechanical damage to the firing end, (Fig. 14) is caused by some foreign object in the combustion chamber. Since small objects can travel from one cylinder to another, always check the other cylinders to prevent reoccurrence of damage.

Inspect the distributor cap for oil film or dirt.

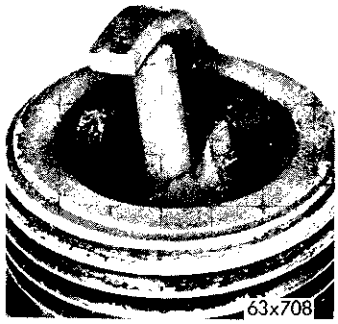


Fig. 14—Mechanical Damage

Pressure Type Gap Tool

Pressure type gap tools, if improperly used, impose a tremendously high unit pressure on the center electrode, (Fig. 15). This is because of compression being exerted between the end of the center electrode and the top of the shell. If too much force is applied thru leverage multiplication, the center electrode seal on any type or brand of spark plug is likely to be damaged. There are several of these pliers type gap tools on the market.

Reversed Coil Polarity

Reversed coil polarity can often be detected by

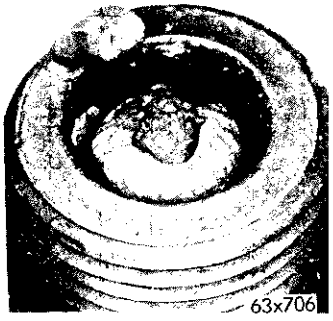


Fig. 12—Sustained Pre-Ignition Damage

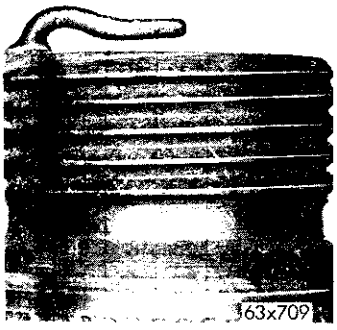


Fig. 15—Pressure Type Gap Tool Damage

"dishing" of the ground electrode. Note in (Fig. 16) that the center electrode is usually not worn badly. This source of misfiring and rough idle can be corrected by reversing the primary coil leads. An oscilloscope is the surest way to detect reversed polarity.

While these examples may not be conclusive in all instances, they may indicate possible corrective procedures and further diagnosis may be necessary.

Cleaning and Regapping

Carefully clean the spark plugs in an abrasive type cleaner. Use a pin type feeler gauge to check spark plug gap. Reset gaps to .035 inch.

Before setting spark plug gap, file center electrode flat, make adjustment by bending ground (side) electrode, never bend the center electrode.

Inspect the spark plug cables, coil secondary (high tension) cable, nipples and covers for cracks, wear and fraying. Always use the neoprene insulating nipples whenever it becomes necessary to replace high tension cables or nipples. Inspect for loose terminals.

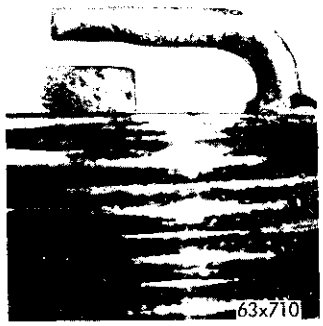


Fig. 16—Reversed Coil Polarity

When installing spark plugs, tighten to 30 foot-pounds.

PART 5

LIGHTING SYSTEM

HEADLAMPS

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
HEADLAMPS DIM (engine idling or shut off)	(a) Partly discharged battery.	(a) Charge battery.
	(b) Faulty cells in the battery.	(b) Replace battery.
	(c) High resistance in the headlamp circuit.	(c) Test headlamp circuit including ground connection. Make necessary repairs.
	(d) Faulty sealed beam units.	(d) Replace sealed beam units.
HEADLAMPS DIM (engine running above idle)	(a) High resistance in the headlamp circuit.	(a) Test headlamp circuit including ground connection. Make necessary repairs.
	(b) Faulty sealed beam units.	(b) Replace the sealed beam units.
	(c) Faulty voltage control unit.	(c) Test voltage control and alternator. Make necessary repairs.
HEADLAMPS FLICKER	(a) Loose connections or damaged wires in the headlamp circuit.	(a) Tighten connections and inspect for damaged wiring.
	(b) Headlamp wiring insulation damaged producing momentary short.	(b) Test headlamp wiring and replace or tape damaged wires.
HEADLAMPS BURN OUT FREQUENTLY	(a) High voltage regulator setting.	(a) Adjust voltage regulator.
	(b) Loose connections in the headlamp circuit.	(b) Inspect circuit for loose connections.
HEADLAMPS WILL NOT LIGHT	(a) Discharge battery.	(a) Recharge battery and correct cause.
	(b) Loose connections in the headlamp circuit.	(b) Tighten connections.
	(c) Burned out lamps.	(c) Replace bulbs or sealed beam unit.
	(d) Open or corroded contacts in the headlamp switch.	(d) Replace the headlamp switch.
	(e) Open or corroded contact in the dimmer switch.	(e) Replace dimmer switch.

PART 5
LIGHTING SYSTEM

Description

The dual headlamp system consists of four sealed beam headlamps.

The two outer lamps are of the two filament type for low and high beam and are marked by a numeral 2 moulded in the lamp lens.

The two inner lamps have only one filament and are marked with a numeral 1 moulded in the glass.

The lamps cannot be installed wrong as the mounting lugs for the number one (1) and the number two (2) lamps are offset at different angles.

The number one (1) lamp provides the high intensity "reach" down the highway and the off focus filament in the number 2 lamp provides the "body" light which illuminates the side of the road, ditches, etc.

SERVICE PROCEDURES

Pre-Aiming Instructions

(1) Test the dimmer switch for faulty operation.

(2) **Test the high beam indicator:** Indicates that high beam is in operation when lighted.

(3) **For badly rusted or faulty headlamp assemblies:** These conditions must be corrected before a satisfactory adjustment can be made.

(4) Place the vehicle on a level floor.

(5) **Measure the front suspension height:** Adjust to specifications as necessary.

(6) Inspect the tire inflation.

(7) Rock the vehicle sideways to allow the vehicle to assume its normal position.

(8) If the gasoline tank is not full, place a weight in the trunk of vehicle to simulate the weight of the gasoline normally carried in the tank (6¼ pounds per gallon).

(9) There should be no other load in the vehicle other than the driver or a substituted weight of approximately 150 pounds placed in the driver's position.

(10) Remove the headlamp front trim panel. Do not remove the seal beam retainer rims.

(11) Thoroughly clean the headlamp lenses.

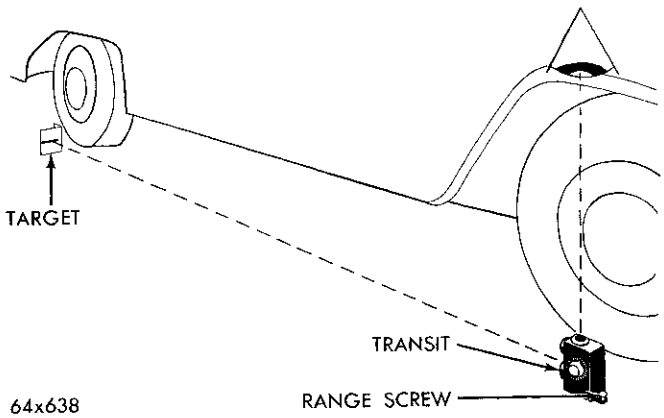


Fig. 1—Determining the Slope of the Floor

Compensating the Aimers

(1) Place the transit on the floor in line with a vertical center line of the right front wheel (Fig. 1). Place the split image target in like position at the right rear wheel.

(2) Adjust the range screw on the transit until the target split image coincides or merges into one unbroken line.

NOTE: Make sure that the line of sight is perpendicular from the eye to the viewing port of the transit and that target image is centered in the viewing port of the transit.

(3) Turn the dial on one side of the transit until the bubble in the spirit level is centered.

(4) When the bubble is centered, note "plus" or "minus" reading on the compensator scale. This figure indicates the degree of slope of the floor and must be transferred to each aimer as follows:

(5) With a screwdriver, turn the adjusting slot of the floor level compensator in each aimer, until the correct plus or minus figure (or fractional part) appears in the proper window (Fig. 2).

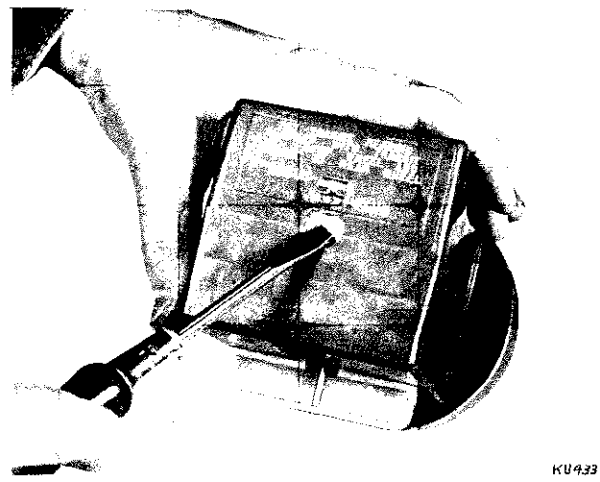


Fig. 2—Adjusting the Floor Level Compensator in the Aimers

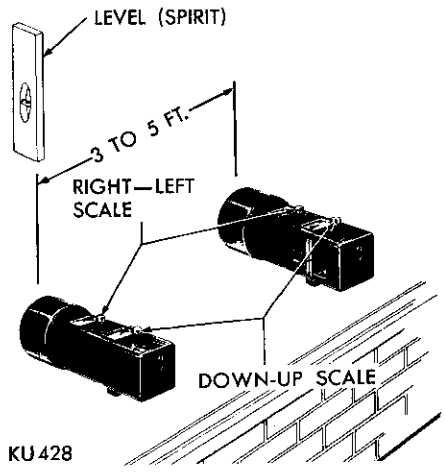


Fig. 3—Inspecting the Aimer for Calibration

Testing Aimer Calibration (Fig. 3)

(1) Using a carpenter or stone mason level of known accuracy, locate a true vertical plate glass window or smooth surface.

(2) Set the **DOWN-UP** pointer on **DOWN 2.**

(3) Set the **RIGHT-LEFT** pointer and floor level compensator at "O."

(4) Secure the aimers to the glass or smooth surface three to five feet apart so that the split image targets can be located in the viewing ports.

(5) If the bubble is centered in the vial, the vertical calibration is correct. If the bubble is not centered, make the down-up adjustment by rotating level adjusting screw until the bubble is centered in the spirit level.

(6) The horizontal aim is correct if the targets on opposite aimers are aligned in the viewing ports. If the targets are not aligned in the viewing ports, rotate the mirror adjusting screw until the target split image becomes aligned.

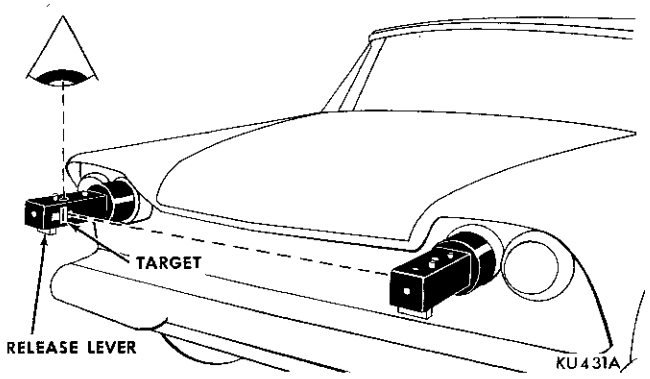


Fig. 4—Mounting and Adjusting the Aimers

Mounting and Adjusting the Aimers (Fig. 4)

If the aimers are suspected of being out of adjustment refer to Paragraph 2 "Aiming the Headlamps."

(1) While holding an aimer in alignment with the lens of one outer headlamp, bring the aimer up to and against the headlamp lens.

NOTE: Make certain that the headlamp lens pads are making full contact with the aimer mounting flange and that the aimer target is facing inboard.

(2) Push the release lever forward (to expel air from the suction cup) and while holding the aimer firmly against the headlamp aiming pads, pull the release lever back until the spring lock engages in the slot.

(3) Mount the second aimer on the other outer headlamp, in the same manner.

(4) On each aimer, set the pointer to the numeral 2 on the **DOWN** side of the **DOWN-UP** scale.

(5) On each aimer position the pointer of the **RIGHT-LEFT** scale at **2 RIGHT.**

TESTING HEADLAMP AIM

Follow the instructions as outlined in Pre-Aiming Instructions.

NOTE: Do not remove the headlamp rims.

Horizontal Test

Turn the **RIGHT-LEFT** scale knob until the split image is in alignment. If the **RIGHT** or **LEFT** portion of the scale exceeds the following values, the lamps should be aimed.

NOTE: Values given represent inches at 25 feet.

	RIGHT	LEFT
No. 1 UNIT	4	4
No. 2 UNIT	4	0

Vertical Test

Turn **DOWN-UP** scale knob until the spirit level is

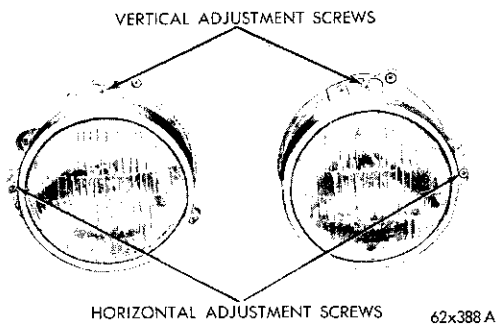


Fig. 5—Headlamp Adjustment Points

centered. If **DOWN** or **UP** portion of the scale exceeds the following values, the lamps should be aimed.

	DOWN	UP
No. 1 UNIT	½ to 3½	0
No. 2 UNIT	½ to 3½	0

ADJUSTING THE HEADLAMPS (FIG. 5)

Horizontal Adjustment

(1) With the pointer of the **RIGHT-LEFT** scale still set at **ZERO,** sight through the aimer viewing port.

NOTE: Make sure that the line of sight is perpendicular from the eye to the viewing port of the aimer and that the target image is centered in the viewing port of the aimer.

(2) While sighting through the viewing port of the aimer, turn the horizontal adjusting screw (Fig. 4) on the headlamp until the split image target line merges into one unbroken line.

NOTE: To remove the backlash, be sure to make a final adjustment by turning the headlamp horizontal adjusting screw in a clockwise direction.

(3) Make the horizontal adjustment on the other **outboard** headlamp in the same manner.

(4) Remove the aimers, from the outboard headlamps, by releasing the spring lock at the (bottom) of the aimer and pushing the release lever forward.

NOTE: Do not attempt to remove the aimers by pulling them away from the headlamp lens—slide the suction cup downward and away from the lens.

Vertical Adjustment

(1) Turn the vertical adjusting screw on the headlamp in a counterclockwise direction to bring the bubble of the spirit level on the aimer to the vehicle side of center. Use care to avoid disturbing the installed position of the aimers. Then turn the screw clockwise until the bubble is centered for correct aim and elimination of backlash.

(2) Make the vertical adjustment on the other outer unit in the same manner.

(3) Recheck the target alignment on each side and readjust the horizontal aim, if necessary.

Proceed to adjust the inner units by following the instructions as outlined for the outer headlamps. Install the headlamp trim panels, when the adjustments have been performed.

HEADLAMP SEALED-BEAM REPLACEMENT

Lens, filament and reflector are sealed into one unit which can be removed as follows:

(1) Remove the screws from the headlamp panel and remove the panel. Use care to avoid damaging the glass headlamp cover.

(2) Remove the screw from the interior retaining ring, and remove the ring.

NOTE: Do not disturb the headlamp aiming screws.

(3) Pull out the sealed-beam unit and disconnect the connector, pulling it straight off.

(4) Install the new sealed-beam unit.

(5) Install the unit retaining ring and headlamp panel.

NOTE: Each lamp in the dual headlamp assembly can be removed in the above manner.

PART 6

INSTRUMENTS—INDICATORS

INSTRUMENTS

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
ALL GAUGES READ HIGH ("against the peg") AFTER IGNITION SWITCH IS TURNED "ON"	(a) Faulty voltage limiter (stuck points or an open heater coil).	(a) Test voltage limiter.
	(b) Cluster not properly grounded to panel.	(b) Tighten cluster mounting screws.
GAUGE POINTERS DO NOT MOVE WHEN IGNITION SWITCH IS TURNED "ON"	(a) Faulty voltage limiter or an open circuit on battery side (input of limiter).	(a) Test voltage limiter. Test wiring, repair or replace as necessary.
TEMPERATURE AND OIL GAUGES* INDICATE NORMAL OPERATION BUT THE FUEL GAUGE INDICATES A HIGHER OR LOWER FUEL LEVEL THAN ACTUALLY EXISTS	(a) Fuel tank sending unit or instrument panel fuel gauge is faulty.	(a) Test sending unit and gauge.
	(b) Fuel tank is improperly grounded.	(b) Test fuel tank for a good ground. NOTE: Testing the system with the tank sending unit positioned for both "empty" and "full" is usually sufficient to determine the calibration in the range between these positions.
FUEL AND OIL GAUGES* INDICATE CORRECTLY BUT TEMPERATURE GAUGE INDICATES HIGHER OR LOWER TEMPERATURE THAN ACTUAL ENGINE TEMPERATURE	(a) Faulty instrument panel temperature gauge, wiring or faulty temperature sending unit in engine.	(a) Test wiring, repair or replace as necessary. Test gauge and sending unit.
ERRATIC TEMPERATURE GAUGE OPERATION*	(a) Loose or dirty electrical connections.	(a) Clean and tighten all electrical connections and test the gauge operation.
ERRATIC OPERATION OF FUEL GAUGE	(a) Loose or dirty electrical connections or faulty fuel tank sending unit.	(a) Test fuel gauge sending unit, and proceed as follows: (1) Clean and tighten all electrical connections. (2) Make sure that the fuel tank sending unit is grounded to the tank and that the tank is grounded to the frame.
ERRATIC OIL GAUGE OPERATION*	(a) Loose or dirty electrical connections.	(a) Clean and tighten all electrical connections and test the gauge operation.

*Oil Gauge and Temperature Gauge—Model AY-1 only.

Condition	Possible Cause	Correction

TURN SIGNALS

EXTERNAL LAMPS OPERATE NORMALLY, NO INDICATIONS ON INSTRUMENT CLUSTER	(a) Faulty pilot bulb in instrument cluster.	(a) Replace bulb.
SYSTEM DOES NOT FLASH	(a) Faulty flasher unit. (b) Faulty external bulb. (c) Faulty contact in switch.	(a) Replace flasher. (b) Replace faulty bulb. (c) Replace switch.
SYSTEM DOES NOT CANCEL AFTER COMPLETION OF TURN	(a) Broken or loose cancelling finger. (b) Improperly aligned cancelling finger. (c) Broken or faulty switch.	(a) Replace cancelling finger. (b) Align cancelling finger properly. (c) Replace switch.
ENTIRE SYSTEM DOES NOT OPERATE	(a) Open circuit in feed wire to switch. (b) Faulty fuse.	(a) Check wiring circuits. Refer to "Wiring Diagrams" (b) Replace fuse.
PILOT LAMP ILLUMINATES BRIGHTLY, EXTERNAL LAMPS GLOWS DIMLY WITH NO FLASH	(a) Loose or corroded external lamp ground connection.	(a) Clean and tighten ground connection.

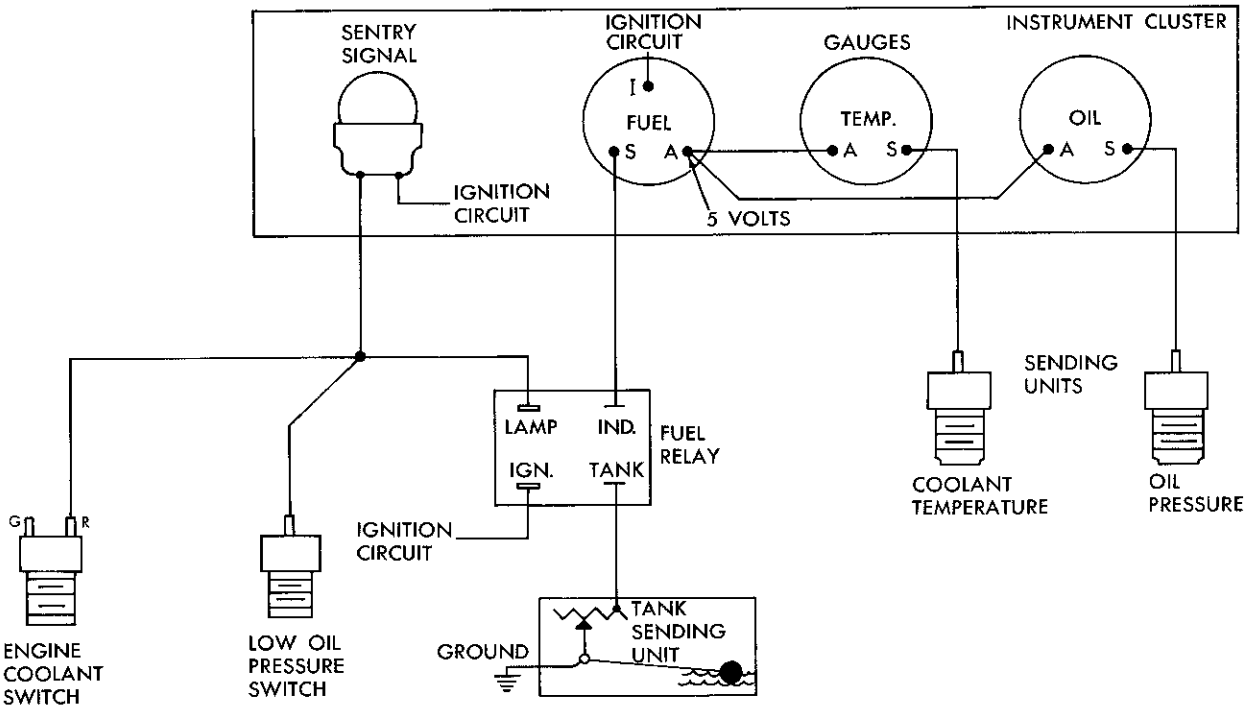


Fig. 1—Gauge Circuits—Model AY-1

Description

Gauge Operation Model AY-1 (Fig. 1)

The cluster is equipped with an oil, temperature and fuel gauge. Also, in the cluster, is a "Sentry Signal" which serves as a warning to the driver when the oil pressure is low, the engine coolant temperature is above normal or the level of fuel in the fuel tank is low.

The oil and temperature gauges use the 5 volt regulated voltage from the fuel gauge and the respective sending units on the engine. For service procedures for the oil and temperature gauges refer to "Testing Gauges."

The fuel gauge uses a tank sending unit and a fuel relay that is in series in the circuit between the fuel gauge and the fuel tank sending unit. For service procedures refer to "Testing Gauges." When the fuel level is low the movement of the float arm, in the fuel tank, causes a current flow change through the fuel relay which activates a "holding" circuit in the relay. This applies a ground to the "Sentry Signal" to light the bulb. Whenever the ignition circuit of the vehicle is activated, voltage is available to the "Sentry Signal."

For the oil pressure and engine coolant temperature operation of the "Sentry Signal" a separate pair of engine units are used. The oil pressure circuit uses an oil pressure sending switch which is electrically "closed" when the oil pressure is below the normal operating range. When the switch is "closed" a ground is applied to the "Sentry Signal" to light the bulb.

The engine coolant temperature operation of the "Sentry Signal" uses a temperature sensing switch. A bi-metal strip, inside the switch, makes contact with the "R" terminal of the switch when the coolant temperature is above normal. This applies a ground circuit to the "Sentry Signal" to light the bulb.

Gauge Operation Models AC-1, AC-2 and AC-3

The cluster is equipped with a fuel gauge, an oil pressure indicator and an engine coolant temperature indicator.

The fuel gauge is the thermal type and operates on a principle of constant voltage being applied. The gauge is sensitive to changes in fuel level only.

The oil pressure indicator is controlled by the low oil pressure switch on the engine. When the oil pressure is below normal the switch is electrically "closed" and applies a ground circuit to light the indicator bulb.

The engine coolant temperature indicator uses two bulbs in the instrument cluster and a coolant temperature sensing switch on the engine (Fig. 2). When the coolant temperature is cold the bi-metal strip, inside the switch, makes contact with the "G" terminal of the switch which applies a ground circuit to the "cold" or green bulb on the cluster. When the coolant temperature is above the normal range the bi-metal strip makes contact with the "R" terminal of the switch which applies a ground circuit to the "hot" or red bulb on the cluster. Through the action of the ignition switch the "hot" bulb of the indicator is momentarily "proofed" everytime the engine is started.

SERVICE PROCEDURES

VOLTAGE LIMITER

Model AY-1

The constant voltage is provided through the use of a voltage limiter contained inside the fuel gauge case.

The constant voltage is connected in parallel to the gauges and provides the same regulated voltage to the gauges.

The terminals on the fuel gauge are marked as follows:

"A—is the output terminal for the controlled voltage from the limiter.

"I"—is the 12 volt input voltage terminal to the voltage limiter.

"S"—is the terminal for the connection to the sending unit.

The gauges (related to the thermal system) that do not contain the limiter will have only the controlled voltage terminal and the terminal for the connection to the sending unit.

Models AC-1, AC-2 and AC-3

Constant voltage is provided through a voltage limiter mounted on the back of the instrument cluster and is connected in parallel to the gauges and provides the same regulated voltage to the gauges.

Testing the Voltage Limiter in the Vehicle

A quick test to determine if the voltage limiter is operating is to connect one lead of a voltmeter or test lamp to the temperature sending unit and the other lead to a good ground (leave the sending unit lead wire attached to the sending unit.) Turn the ignition switch to the **"on"** position. A fluctuating voltmeter or flashing lamp indicates the voltage limiter is operating.

Testing the Voltage Limiter— Instrument Cluster Removed Model—AY-1

Connect a jumper wire from the positive post of a 12 volt battery to the **"I"** terminal of the fuel gauge.

Connect another jumper wire from the battery negative post to the fuel gauge case (ground) on Chrysler Models or to the printed circuit ground strap on Imperial Models.

Connect the negative lead of a voltmeter to the battery negative post. Touch the positive lead of the voltmeter to the **"I"** terminal of the fuel gauge. A reading of 12 volts should be shown on the voltmeter. Touch the positive lead of the voltmeter to the **"A"** terminal of the fuel gauge. A fluctuating reading between 0 and 7 volts should be shown on the voltmeter. The same fluctuating reading should be shown at the **"S"** terminal of the fuel gauge. Any other readings indicate the voltage limiter is not functioning properly and the fuel gauge should be replaced.

Models AC-1, AC-2 and AC-3

Connect a jumper wire from the positive post of a 12 volt test battery to the voltage limiter input terminal. Connect another jumper wire from the battery negative terminal to the voltage limiter case (ground).

Connect the negative lead of a voltmter to the battery negative post. Touch the positive lead of the voltmeter to the input terminal of the voltage limiter. A reading of 12 volts should be shown on the voltmeter.

Touch the positive lead of the voltmeter to the output terminal of the voltage limiter. A fluctuating reading between 0 and 7 volts should be shown on the voltmeter, any other reading indicates the voltage limiter is not functioning properly and should be replaced.

FUEL LEVEL INDICATING SYSTEM

Turning the key on connects the system to the battery or charging system voltage. The voltage from the battery or charging system is regulated by a constant voltage limiter to a constant voltage of approximately 5 volts D.C.

When the fuel level is low or tank is empty, the resistance is increased which decreases the current flow and consequently positions the panel gauge pointer to low or empty.

When the tank is full, the float level is at the top, the minimum resistance is in the circuit and the flow or current in the circuit is high. The panel gauge pointer will be moved across the dial to indicate a full tank.

Tank Unit

A float arm is hinged to allow the float to raise or lower dependent on the fuel level. The float connects to a variable resistance that provides a change in the resistance with any up or down motion of the float through a wiping contact in the gauge body.

Testing Fuel Level Indicating System in the Vehicle

Raise the vehicle on a lift. Disconnect the terminal from tank unit. Attach one lead of the Gauge Tester (Tool C-3826) to the disconnected terminal. Connect the other lead of the tester to a good ground.

With the ignition switch turned on and the gauge tester in the "L" position, the fuel gauge should show "E" or minus $^3/_{32}$ inch. This tolerance permits a small reserve of fuel at the "E" position. For Models AY-1 when the tester is in the "L" position the "Sentry Signal" on the cluster should be illuminated.

With the gauge tester in the "M" position, the fuel gauge should slowly advance to the ½ position, plus or minus $^1/_{16}$ inch. With the gauge tester in the "H" position the fuel gauge should advance to "F" position, plus or minus $^3/_{32}$ inch.

Should the gauge respond to the above tests, but not operate when the terminal is attached to the sending unit, indications are of a faulty sending unit and it should be replaced. Should the gauge fail to respond to the above tests, indications are of possible loose connections, broken wire, or faulty gauge. The instrument cluster should be removed for further tests. See "Instrument Cluster."

Testing Fuel Gauge— Instrument Cluster Removed

Place the instrument cluster (Models AC-1, AC-2 and AC-3) or the printed circuit assembly (Model AY-1) on a padded service bench to protect the assembly.

To prevent a possible error that might result in burning out the gauges the following test procedures must be closely followed.

CAUTION: A direct connection from a 12 volt battery to the gauges will burn them out.

(1) Connect a jumper wire to the voltage limiter input terminal on the fuel gauge. Connect the other end of the jumper wire to the positive (+) post of a 12 volt test battery.

(2) Connect a jumper wire from the negative (—) post of the battery to the instrument cluster base (Models AC-1, AC-2 and AC-3) or to the printed circuit ground strap (Model AY-1).

(3) Connect one lead of Gauge Tester C-3826 to the fuel gauge "S" terminal.

(4) Connect the remaining lead of the gauge tester to the instrument cluster base (Models AC-1, AC-2 and AC-3) or to the printed circuit ground strap (Model AY-1).

With the gauge tester in the "L" position the fuel gauge should show "E" or minus $^3/_{32}$ inch. **The minus tolerance provides a small fuel reserve when the fuel gauge is on the "E" position.**

With the gauge tester in the "M" position the fuel gauge should advance slowly to the ½ position. With

the gauge tester in the "H" position the fuel gauge should slowly advance to the "F" position plus or minus $^{3}/_{32}$ inch. If the fuel gauge does not perform as above replace the gauge.

TEMPERATURE INDICATING SYSTEM

Model AY-1

The operation of the temperature indicating system is identical in operation with the fuel system with the exception of the method of varying the resistance of the sending unit. In this system the resistance varies in direct relation to the temperature of the coolant.

Any change in the coolant temperature causes a like change in the resistor incorporated in the engine sending unit.

When the engine is cold the resistance of the disc in the temperature sending unit is high and a low temperature will be indicated.

As the engine temperature increases the resistance of the temperature sending unit disc starts to decrease. A resultant increase in the current flow will occur causing the gauge pointer to indicate the increase in engine temperature.

Models AC-1, AC-2 and AC-3

The temperature indicating system uses two bulbs on the instrument cluster and a temperature sensing switch on the engine to indicate the temperature condition of the engine coolant. Inside the switch a bimetal strip makes and breaks contact with the "R" and "G" terminals of the switch to provide a ground circuit to either the "Hot" or "Cold" bulb of the temperature indicator. When the engine coolant is in the normal operating range of temperatures the bimetal strip does not contact either terminal of the switch so neither bulb is lit in the normal temperature range. (Fig. 2).

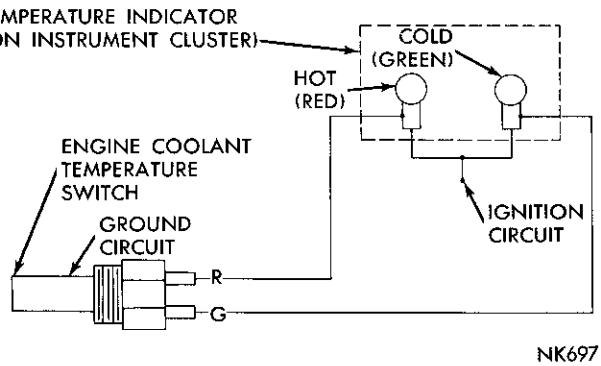


Fig. 2—Temperature Indicator Circuit—Models AC-1, AC-2 and AC-3

Testing Temperature Indicating System in the Vehicle

Model AY-1

Disconnect the terminal from the temperature sending unit on the engine. Connect one test lead of Tester C-3826 to the terminal and the other test lead to a good ground. Place the pointer of the gauge tester on the "L" position and turn the ignition switch to "on." The temperature gauge should show "C" plus or minus ⅛ inch. **Thermal gauges are slow in operation. Allow time for gauge to heat up.**

Place the pointer on the tester on the "M" position and the temperature gauge should advance to the driving range of ½ position of the dial. Place the pointer of the tester in the "H" position and the gauge should advance to the "H" position of the dial.

Should the gauge respond to the above tests, but not operate when the terminal is attached to the sending unit, indications are of a faulty sending unit and it should be replaced. Should the gauge fail to respond to the above tests, indications are of possible loose connections, broken wire, defective printed circuit board or faulty gauge. The instrument cluster should be removed for further tests. See "Instrument Cluster."

Testing Temperature Gauge— Instrument Cluster Removed (Fig. 3)

The temperature gauge is tested in the same manner as the fuel gauge with the exception that Tester Tool C-3826 is connected to the temperature gauge "S" terminal.

With the gauge tester on "L" position, the temperature gauge should show "C" or cold. With the gauge tester on "M" position, the temperature gauge should show ½ of the operating scale of the dial. With the gauge tester on the "H" position, the temperature gauge should show "H." If the gauge does not respond to the above tests test for an open printed circuit or replace the temperature gauge.

Models AC-1, AC-2 and AC-3

To test the temperature indicator turn the ignition

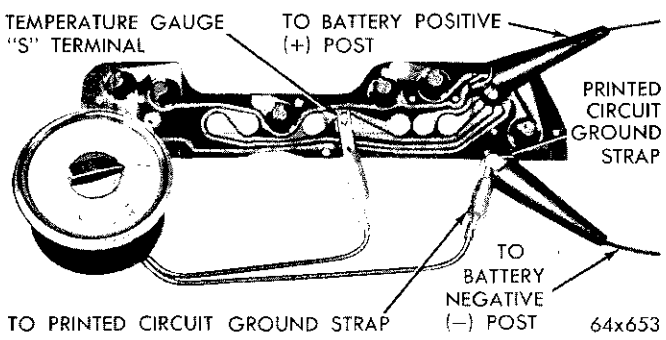


Fig. 3—Testing Temperature Gauge—Model AY-1

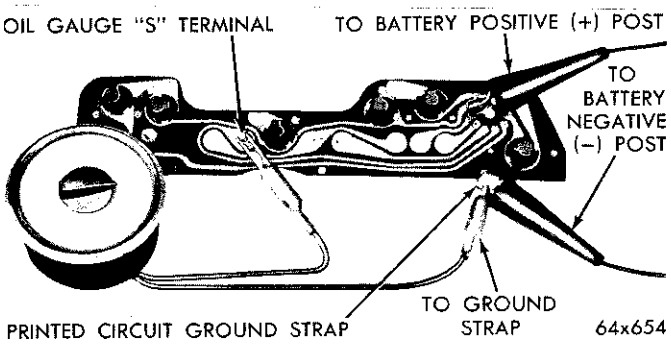


Fig. 4—Testing Oil Gauge—Model AY-1

the "Acc" or left position. Disconnect the wires from the temperature sensing switch on the engine and one at a time touch the wires momentarily to ground. When the wire from the "G" terminal is grounded the "Cold" (green) bulb of the indicator should light. When the wire from the "R" terminal is grounded the "Hot" (red) bulb of the indicator should light. If one of the bulbs fails to light the bulb that did not light is faulty and should be replaced. If both of the bulbs fail to light indications are of a faulty engine sending switch, faulty circuitry in the system or possibly both of the indicator bulbs are faulty. Repair or replace as necessary.

Oil Pressure Gauge—Model AY-1 (Fig. 4)

Disconnect the terminal and wire from the oil pressure sending unit on the engine. Connect one test lead of Tester Tool C-3826 to the removed terminal the other test lead to a good ground. Place the pointer of the gauge tester on the "L" position and turn the ignition switch to "on." The oil pressure gauge should show "L" plus or minus ⅛ inch. **Thermal gauges are slow in operation. Allow time for gauge to heat up.** When the tester is in the "L" position the "Sentry Signal" on the cluster should be illuminated.

Place the pointer on the tester on the "M" position and the oil pressure gauge should advance to the ½ position of the dial. Place the pointer of the tester in the "H" position and the gauge should advance to the "H" position of the dial.

Should the gauge respond to the above tests, but not operate when the wire and terminal are attached to the sending unit, it should be replaced. Should the gauge fail to respond to the above tests indications are of possible loose connections, broken wire, or faulty gauge. The instrument cluster should be removed for further tests. See "Instrument Cluster."

Oil Pressure Gauge Sending Unit

The sending unit, mounted on the engine, operates on a principle of varying engine oil pressure causing a resistance change in the sending unit.

When the engine oil pressure is high the resistance of the sending unit is low allowing a higher current to flow to the instrument panel gauge. This causes an indication of high oil pressure on the gauge.

When the engine oil pressure is low the resistance of the sending unit is high allowing a lower current to flow to the instrument panel gauge. This causes an indication of low oil pressure on the instrument panel gauge.

OIL PRESSURE WARNING LAMP—MODELS AC-1, AC-2 and AC-3

To test the oil pressure warning light, remove the terminal from the oil pressure sending unit. Connect one lead of the gauge tester to the terminal and the other test lead to a good ground.

With the ignition switch in the "on" position and the gauge tester in the "L" position, the indicator light should not light. With the gauge tester in the "M" position, the indicator light should show a dull glow. With the gauge tester in the "H" position, the indicator light should show full brilliance.

Should the oil pressure warning light fail to respond to the above tests, indications are of possible loose connections, broken wire, or burned out lamp.

Low Oil Pressure Warning Switch

The operation of the oil pressure warning switch, mounted on the engine, is dependent on variances in the engine oil pressure.

When the engine oil pressure is high (normal operating condition of the engine) the switch is held in the "OFF" or "OPEN" position allowing no current to flow to the oil pressure warning lamp on the instrument panel.

When the engine oil pressure is low, the switch is in the "ON" or "CLOSED" position allowing current to flow to the oil pressure warning lamp on the instrument panel. This causes the warning lamp to be illuminated.

INSTRUMENT CLUSTER—MODEL AY-1

The instrument cluster is not serviced as an assembly. The cluster contains three separate main groups:

(1) Speedometer.
(2) Printed Circuit Assembly
(3) Clock

When servicing the cluster, it is necessary to remove only the group containing the desired instrument or gauge.

Removal

CAUTION: Disconnect the battery ground cable before servicing the instrument cluster.

(1) Remove the screws that attach the instrument cluster chrome bezel to the instrument cluster. Remove the bezel.

(2) Remove the clock reset knob and the temperature control level knob.

(3) Carefully remove the lens from the cluster.

(4) Remove the screws that attach the cluster face plate to the cluster. Remove the face plate.

(5) Remove the desired main group of the cluster as follows:

Speedometer—Disconnect the speedometer and odometer reset cables from under the instrument panel. Remove the four screws that attach the speedometer to the cluster. Remove the speedometer.

Printed Circuit Assembly—Remove the screws that attach the printed circuit assembly to the instrument cluster. Pull the assembly forward slightly and disconnect the printed circuit multi-connector. Remove the assembly for service of the fuel, oil, temperature or ammeter gauges.

Clock—Remove the screws that attach the clock to the instrument cluster. Pull the clock forward and disconnect the feed wire to the clock. Remove the clock.

Installation

(1) Position the cluster assembly that has been serviced into the instrument cluster. For the printed circuit assembly, connect the printed circuit multi-connector; for the clock connect the clock feed wire; and for the speedometer connect the cable and odometer reset cable. Install the assembly attaching screws.

(2) Position the cluster face plate in the cluster and install the attaching screws.

(3) Position the cluster lens on the cluster face plate.

(4) Position the cluster chrome bezel onto the cluster and install the attaching screws. Take care to have the lens properly positioned before tightening the bezel attaching screws.

(5) Install the clock rest knob and the temperature control lever knob.

(6) Connect the battery ground cable.

Models AC-1, AC-2 and AC-3

Removal

(1) Disconnect the battery ground cable.

(2) Remove the steering column lower access panel. Disconnect the wiring to the accessory switches if so equipped.

(3) Disconnect the gear shift indicator link from the steering column and disconnect the back-up lamp switch wiring on vehicles equipped with an automatic transmission.

(4) Remove the two steering column clamp bolts and lower the steering column.

(5) Remove the steering column upper filler.

(6) Remove the ignition switch and accessory switch, if so equipped, from the panel by removing the retaining bezel and pushing the switch clear of the panel.

(7) Remove the lower cluster trim bezel.

(8) Remove the upper cluster trim bezel.

(9) Remove the four screws that mount the cluster to the panel.

(10) Lower the cluster and disconnect the ammeter (alternator) wires.

(11) Remove the cluster from under the instrument panel.

Installation

(1) From under the instrument panel, position the cluster in the lower steering column cover opening and connect the ammeter (alternator) wires.

(2) Position the cluster in the cluster opening and install the four cluster mounting screws.

(3) Install the cluster upper trim bezel.

(4) Install the cluster lower trim bezel.

(5) Install the ignition switch and accessory switch, in the panel.

(6) Install the steering column upper filler.

(7) Raise the steering column into position and install the two clamp bolts.

(8) Connect and adjust the gear shift indicator link and connect the back-up lamp switch wiring, if equipped with automatic transmission.

(9) Install the steering column lower access panel. Connect the wiring to the accessory switches.

(10) Connect the battery ground cable.

SWITCHES

Models AC-1, AC-2 and AC-3

All switches on the instrument panel or in the instrument cluster can be serviced from under the instrument panel by removing the switch knob, mounting nut or bezel and disconnecting the wiring to the switch.

Model AY-1

The instrument panel switches are located in two groups, one group on each side of the steering column. On the left of the steering column are located the headlamp and windshield wiper switches. On the right of the steering column are located the accessory and the ignition switches. To service the switches proceed as follows:

Left Group

(1) Remove the lower steering column cover plate.

(2) Remove the headlamp switch knob and stem assembly and the windshield wiper switch knob.

(3) Remove the screw that attaches the right end of the switch bezel to the instrument panel. This screw can be reached from inside the steering column opening.

(4) Remove the headlamp switch retaining nut using spanner wrench Tool C-3824.
(5) Lift off the switch bezel.
(6) Remove the headlamp and windshield wiper stem light seals.
(7) Remove the mounting nut from the desired switch (headlamp or windshield wiper).
(8) From under the instrument panel pull the switch down and disconnect the wiring.
(9) Remove the switch from under the instrument panel.

Right Group

(1) Remove the lower steering column cover plate.
(2) Remove the accessory switch knobs.
(3) Remove the screw that attaches the left end of the switch bezel to the instrument panel. This screw can be reached from inside the steering column opening.
(4) Remove the screw in the ignition switch well.
(5) Lift off the switch bezel.
(6) Remove the mounting nut from the desired switch (accessory or ignition).
(7) From under the instrument panel pull the switch down and disconnect the wiring.
(8) Remove the switch from under the instrument panel.

INSTRUMENT CLUSTER BULBS

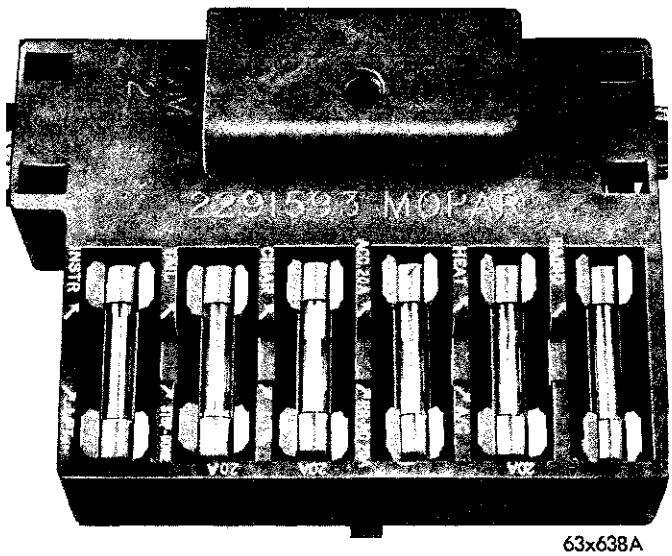
All bulbs in the instrument cluster area can be serviced from under the instrument panel. As an aid to service on Model AY-1 drop the fuse block from the instrument panel lower reinforcement.

SWITCH TITLE LIGHTING—MODEL AY-1

The switch title lenses are illuminated by bulbs located next to the switches. The bulbs can be serviced after removing the switch bezel.

Left Group

(1) Perform steps 1-5 of Switches—**Left Group.**
(2) Remove the screw that attaches the bulb diffuser to the instrument panel.
(3) Remove the diffuser.
(4) Remove the bulb from the socket.



63x638A

Fig. 5—Fuse Block

Right Group

(1) Perform steps 1-5 of Switches—**Right Group.**
(2) Remove the screw that attaches the bulb diffuser to the instrument panel.
(3) Remove the diffuser.
(4) Remove the bulb from the socket.

FUSE BLOCK (Fig. 5)

The fuse block is located at the forward edge of the instrument panel and is retained to the instrument panel lower reinforcement by a self tapping screw.

In the fuse block are mounted the radio, cigar lighter, air-conditioner or heater, tail-stop-dome light, and accessory fuses. The fuse capacity is printed on the fuse block as an aid to replacement requirements.

CIRCUIT BREAKERS

As a safety precaution, circuit breakers are used for the headlamps and wiper circuits. They insure that these essential services will continue to function if an intermittent short circuit occurs. Use only identical type and amperage value circuit breakers as replacements for service.

TURN SIGNAL SYSTEM

Description

Model AC-3 uses, as standard equipment, fender mounted turn signal indicators on the front fenders of the vehicle. The fender mounted indicators are available as optional equipment, on Models AC-1 and AC-2. When the fender mounted indicators are used the indicators in the instrument cluster are not used as the fender mounted indicators can be seen from the driver's seat of the vehicle.

SERVICE PROCEDURES

Model AY-1

Removal

(1) Disconnect the battery ground cable.

(2) Remove the two screws from the underside of the steering wheel and remove the horn blowing actuator and steering wheel cover.

(3) Loosen the steering wheel nut several turns and install steering wheel puller Tool C-3428 and remove the steering wheel nut and steering wheel.

(4) Remove the turn signal operating lever.

(5) Remove the steering column lower cover.

(6) Remove the two screws, disconnect the switch wires at the connection and remove the turn signal switch and wires.

Installation

(1) Position the turn signal switch on the steering column and install the attaching screws and wire connections.

(2) Install the steering column lower cover.

(3) Install the turn signal operating lever.

(4) Install the steering wheel and steering wheel nut, tighten the nut to 24 foot-pounds. Test the operation of the cancelling lever.

(5) Install the horn blowing actuator, steering wheel cover and attaching screws.

(6) Connect the battery ground cable.

Models AC-1, AC-2 and AC-3

Removal

(1) Disconnect the battery ground cable.

(2) Compress and turn the horn button ¼ turn counterclockwise to release the buttom from the retainer.

(3) Disconnect the horn wire at the horn blowing switch.

(4) Remove the three screws and insulators attaching the horn ring and horn blowing switch to the steering column. Remove the horn ring and switch.

(5) Loosen the steering wheel nut several turns and install the Steering Wheel Puller Tool C-3428 and remove the steering wheel nut and steering wheel.

(6) Remove the screw attaching the turn signal operating lever to the turn signal switch and remove the lever.

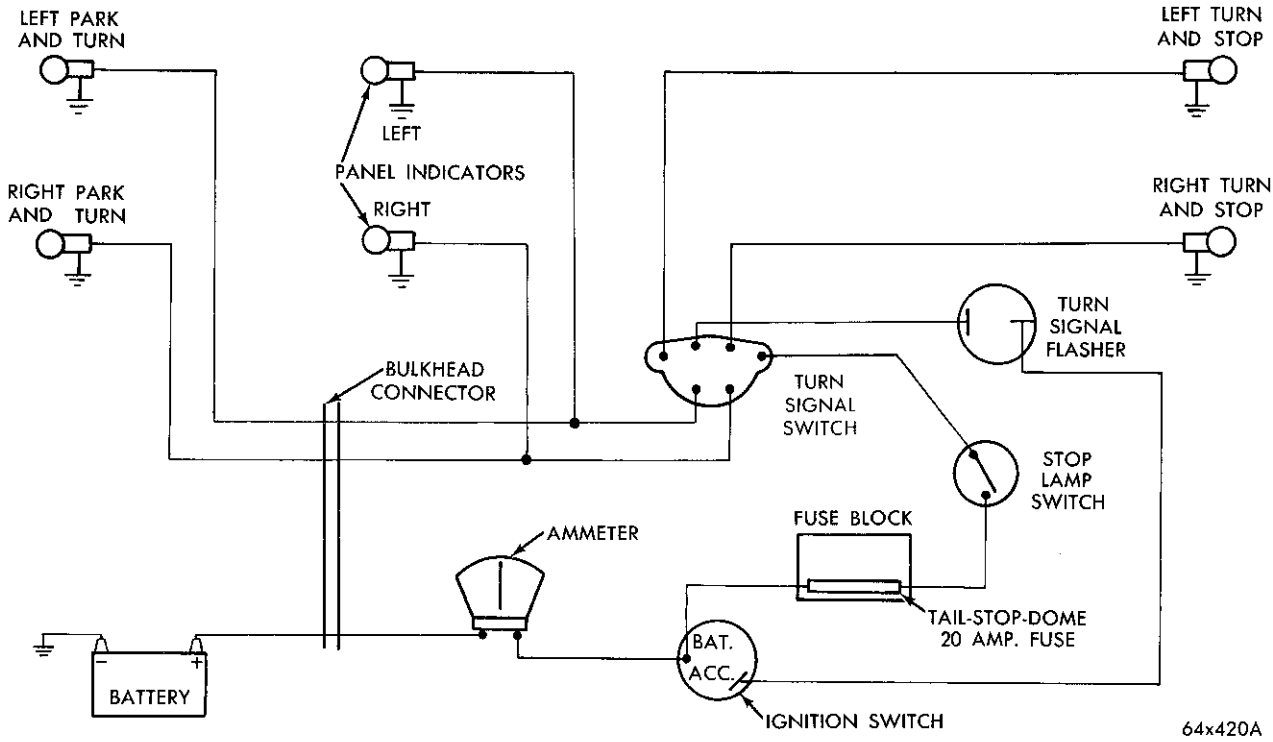


Fig. 1—Turn Signal System Wiring

(7) Disconnect the turn signal wiring at the steering column jacket tube below the instrument panel.

NOTE: Attach a piece of string or fine wire to the turn signal switch wiring before removing the switch from the steering column. When the switch is removed leave the string or wire in the steering column jacket tube as an aid to replacement of the wiring.

(8) Remove the screws attaching the turn signal switch to the steering column and remove the switch from the top of the steering column.

Installation

(1) Attach the string or wire, that was left in the steering column jacket tube during removal, to the turn signal switch wiring and carefully pull the string or wire down through the column jacket tube until the directional switch wires can be connected. Position the turn signal switch in the steering column jacket tube and install the attaching screws and connect all wire connections.

(2) Install the turn signal operating lever.

(3) Install the steering wheel and the steering wheel nut. Tighten to 24 foot-pounds. Test the operation of the cancelling lever.

(4) Install the horn blowing switch, horn ring, insulators and attaching screws. Connect the horn wire.

(5) Install the horn button by compressing and turning ¼ turn clockwise to lock the horn button on the retainer.

(6) Connect the battery ground cable.

WIRING DIAGRAM

Refer to Figure 1 for the wiring of the turn signal system for Models AC-1, AC-2 and AC-3 and Model AY-1.

PART 7

WINDSHIELD WIPERS—HORNS

WINDSHIELD WIPERS

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
WIPER FAILS TO OPERATE	(a) Binding linkage.	(a) Relieve binding condition.
	(b) Faulty instrument panel switch.	(b) Test switch. See "Wiper Switch."
	(c) Faulty motor.	(c) Test motor. See "Wiper Motor Bench Testing."
	(d) Open or grounded wiring.	(d) Test wiring for continuity. Repair as necessary.
WIPER BLADES NOT PARKING PROPERLY	(a) Arm set at incorrect position.	(a) Adjust arm. See "Wiper Arm Adjustment."
	(b) Motor park switch timing incorrect.	(b) Time park switch. See "Wiper Motor Park Switch Timing."
	(c) Broken link spring. (Variable Speed)	(c) Replace Spring. See "Wiper Link Assembly."
	(d) Link spring trip not engaging stop on linkage. (Variable Speed)	(d) Inspect "Wiper Link Assembly."
BLADES SLAP WINDSHIELD MOULDINGS	(a) Improperly adjusted wiper arm.	(a) See "Wiper Arm Adjustment."
	(b) Looseness of the motor crank or other drive parts.	(b) Replace faulty part.
BLADES CHATTER	(a) Twisted arm holds blade at wrong angle to glass.	(a) Replace wiper arm. **Do not attempt to straighten bent or twisted arm.**
	(b) Wrong type blades used.	(b) Install correct wiper blades.
	(c) Foreign substances such as body polish on glass.	(c) Clean the glass.
MOTOR WILL NOT STOP WHEN INSTRUMENT PANEL SWITCH IS TURNED "OFF"	(a) Motor park switch failure in the "closed" position.	(a) Repair or replace motor park switch.
MOTOR STOPS IN ANY POSITION WHEN INSTRUMENT PANEL SWITCH IS TURNED "OFF"	(a) Motor park switch failure in the "open" position.	(a) Repair or replace motor park switch.

HORNS

Condition	Possible Cause	Correction
HORNS WILL NOT BLOW	(a) Improper adjustment.	(a) See "Adjusting."
	(b) Broken or faulty wiring.	(b) See "Testing."
	(c) Faulty horn.	(c) See "Testing." Replace horn if necessary.
	(d) Faulty relay.	(d) See "Testing." Replace relay if necessary.
HORNS BLOW CONTINUOUSLY	(a) Shorted wiring.	(a) See "Testing."
	(b) Horn button sticking.	(b) Disconnect battery ground cable. Release horn button. After correction, connect battery ground cable.
	(c) Relay sticking.	(c) Replace relay.

WINDSHIELD WIPER SYSTEM

Description

The wiper motor is connected to the wiper switch and from the wiper switch "B" terminal to the "ACC," accessory, terminal of the ignition switch so the wiper motor can be actuated only when the ignition switch is turned to the right or left positions. The wiper circuitry is protected by a circuit breaker that is built into the wiper switch.

The variable speed wiper system has a depressed parking feature which is accomplished by reversing the direction of the wiper motor and the use of a parking cam on the motor crank pin. When the wiper switch is turned "OFF," the motor direction is reversed and at the same time the parking cam rotates 180 degrees, lengthening the drive link slightly to park the wiper blades in a depressed position. The drive link shortens when the motor runs in the wipe direction, Figs. 1 and 2.

SERVICE PROCEDURES

WIPER ARM ADJUSTMENT

Variable Speed

To determine if an adjustment is required, apply a constant **upward** force of 50 ounces, parallel to the windshield glass, at the end of the wiper arm (where the wiper blade is attached to the arm). With the 50 ounce force applied, pull the wiper blade away from the windshield glass once or twice to prevent glass friction from affecting upward movement of the wiper arm and blade. With the force applied, the clearance between the tip of the wiper blade and the windshield lower moulding should be between ¼ and 2¼ inches on the left side and between 1 and 3 inches on the right side of the vehicle for Models AC-1, AC-2 and AC-3 and between ¼ and 2¼ on the right side for Model AY-1. If the clearance is not in the specified range, use a suitable tool and reposition the wiper arm and blade assembly (Fig. 3).

Single Speed—Models AC-1 and AC-2

To determine if an adjustment is required, apply a constant downward force of 25 ounces, parallel to the windshield glass, at the end of the wiper arm (where the wiper blade is attached to the arm). With the 25 ounce force applied pull the wiper blade away from the windshield glass once or twice to prevent glass friction from affecting downward movement of the wiper arm and blade. With this force applied the clearance between the tip of the wiper blade and the windshield moulding should be between ¼ and 2¼ inches on the left side and between 1 and 3 inches on the right side of the vehicle. If the clearance is not in the specified range, use a suitable tool and reposition the wiper arm and blade assembly (Fig. 3).

Wiper Motor Park Switch Timing

The timing of the motor park switch must be:

(a) Late enough that the wiper arms come to rest at the extreme lower limit of travel on dry glass.

(b) Early enough that the wiper arms do not rise appreciably beyond the lower limit of travel on completely wet glass.

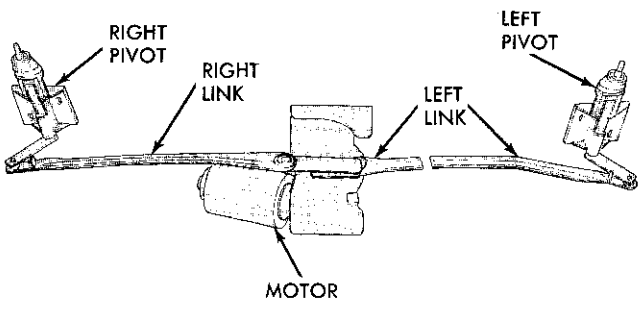


Fig. 1—Wiper System—Model AY-1

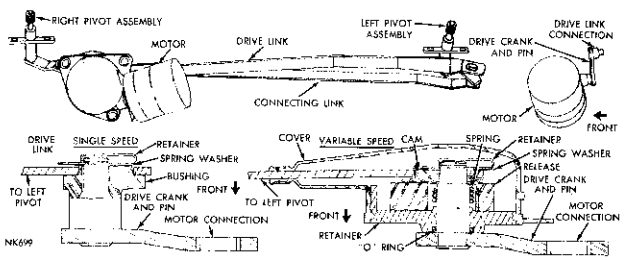


Fig. 2—Wiper System—Models AC-1, AC-2 and AC-3

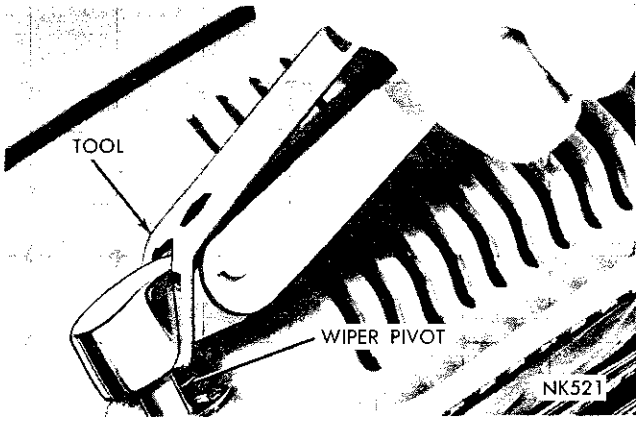


Fig. 3—Removing Wiper Arm and Blade Assembly

Adjust the timing of the park switch on the wiper motor to provide "shut off" at the lowest point of wiper blade travel under both wet and dry glass conditions.

When adjusting the timing of the variable speed park switch, note that the variable speed motor rotates in reverse at the time the park switch opens. "Early" and "Late" directions are therefore opposite to single speed motors.

Wiper Parking Operation Test—Variable Speed

(1) Turn the instrument panel switch to **ON** and allow the wiper system to run through several cycles of operation.

(2) Very slightly, after the wiper blades reach the top of the wipe pattern, turn the wiper switch to OFF to cause the blades to park in a one-half cycle of wiper motor operation.

If the blades do not park in the desired ½ cycle but require 1½ cycles to park, the procedure of going through the switching operation must be repeated as follows:

(a) Turn the switch to the "ON" position and allow the wiper system to operate for a few cycles.

(b) Turn the switch to the "OFF" position, only this time allowing the timing of operating the switch to occur at a position in respect to wiper blade travel that is slightly later than the first operation. Again, note cycle requirement to reach park.

Having parked the wiper system in ½ cycle of motor operation, note whether the wiper blades have traveled well below the normal wipe pattern. If they have not, replacement of the parking cam, spring and spring trip is indicated. If they have, but have met the requirements for proper park position wiper arm adjustment is required.

Parking Spring Lubrication—Variable Speed

To insure satisfactory life of the parking mechanism use only Led-Plate, Part NO. 2275437, to lubricate the parking spring during service. It is essential to thoroughly coat all rubbing surfaces of the spring and pin area. Use of any other lubricant than Led-Plate (such as lubriplate, etc.) will result in noisy operation, rapid wear of components and premature failure of the parking mechanism.

WIPER MOTOR

Model AY-1

Removal

(1) Disconnect the battery ground cable.

(2) From under the instrument panel remove the left spot cooler hose (air-conditioning only).

(3) Remove the right defroster hose.

(4) From under the instrument panel remove the right instrument panel lower reinforcement to windshield wiper motor mounting bracket pencil brace.

(5) Remove the remote trunk lock switch from inside the glove box. Remove the eight screws that attach the glove box to the instrument panel and remove the glove box out through the glove box opening, (air-conditioning only).

(6) From under the instrument panel remove the two nuts that attach the defroster control vacuum actuator to the mounting bracket and pivot the actuator down out of the way.

(7) Disconnect the wiring leads at the wiper motor.

(8) Disconnect the right and left wiper links at the wiper pivots.

(9) Remove the nuts that attach the wiper motor mounting bracket to the cowl panel.

(10) Remove the wiper motor, motor mounting bracket and wiper links as an assembly from under the instrument panel.

Installation

(1) Install the wiper motor, motor mounting bracket and wiper links as an assembly under the instrument panel. Position the motor mounting bracket on the studs on the cowl panel. Install the motor bracket mounting nuts.

(2) Connect the right and left wiper links at the pivot.

(3) Connect the wiring leads at the wiper motor.

(4) Position the defroster heat vacuum actuator on the actuator mounting bracket and install the mounting nuts.

(5) Install the glove box and the remote trunk lock switch (air-conditioning only).

(6) From under the instrument panel install the right instrument panel lower reinforcement to wiper motor mounting bracket pencil brace.

(7) Install the right defroster hose.

(8) Install the left spot cooler hose (air-conditioning only).

(9) Connect the battery ground cable.

Models AC-1, AC-2 and AC-3

Removal

(1) Use a suitable tool and remove the wiper arm and blade assemblies (Fig. 3).

(2) Remove the windshield lower moulding.

(3) Remove the cowl grille panel.

(4) Remove the nut that mounts the drive crank to the motor and remove the drive crank from the motor, disconnect the wiring to the motor.

(5) Remove the three nuts that mount the motor to the dash panel and remove the motor out through the cowl grille panel opening.

Installation

(1) Insert the motor in through the cowl grille panel opening and position the motor on the three studs on the dash panel. Make certain the rubber gasket, between the motor and the dash panel, is properly positioned.

(2) Install the three nuts that mount the motor to the dash panel and connect the wiring to the motor. Make certain the ground strap is screwed to the switch plate and under one of the mounting nuts.

(3) Position the drive crank on the motor and install the mounting nut.

(4) Install the cowl grille panel.

(5) Install the windshield lower moulding.

(6) Install and adjust the wiper arm and blade assemblies, using a suitable tool.

WIPER LINKS

Model AY-1

Removal

(1) Remove the clip holding the link to the crank arm.

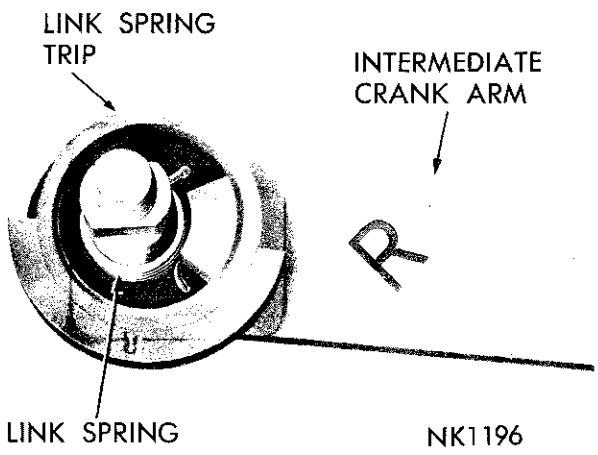


Fig. 4—Link Spring Trip Installed

(2) Remove the bevel washers and link.

(3) Remove the parking cam and spring release.

(4) Remove the coil spring by spreading the ends.

(5) Disassemble the right-hand link in same manner after removing crank arm to lever nut, spacing washers between the link crank arm and lever.

Installation

(1) Install the spring washer, concave surface toward crank arm. Install the crank pivot coil spring on the pivot. Install the spring release.

(2) Install the parking cam to index with spring release and engage spring ends, between the release and parking cam in openings at point of index (Fig. 4).

When assembling to the left link the "L" on the left crank and on the parking cam should be seen. The cam marked "R" is installed in the same manner.

NOTE: If the intermediate crank is held so that the letter "L" is visible install the cam release so that the letter "L" can be seen from this position. The opposite side will show three letters "R."

(3) Install the link arm with the stop projection on the link arm toward the cam assembly. Install the spring washer, convex surface toward the cam assembly.

(4) Install the retaining bolt and nut (Fig. 5).

(5) Assemble the left link and cam assembly in the same manner locking in place with a clip.

Models AC-1, AC-2 and AC-3

To service the drive link or connecting link it is necessary to remove the wiper arm and blade assemblies, the windshield lower moulding and the cowl grille panel to provide access to the wiper system.

Removal

(1) With the wiper system in the "park" position remove the retainer clip from the end of the motor

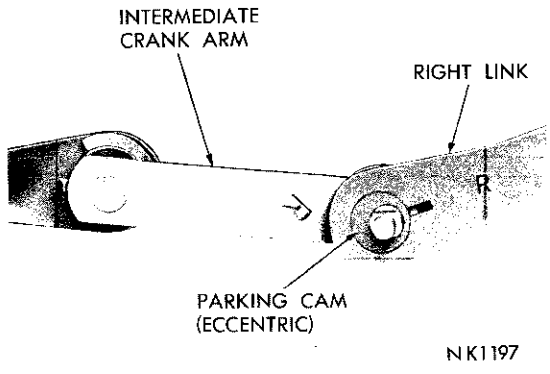


Fig. 5—Link Arm Installed

drive crank and pin. For variable speed wipers remove the cover from the mechanism to allow access to the retainer clip.

(2) Remove the spring washer and drive link from the drive crank pin.

(3) Remove the retainer clip from the connecting link pin on the right pivot.

(4) Remove the nuts that mount the left pivot to the body of the vehicle.

(5) Remove the links and left pivot out through the cowl grille panel opening. The connecting link can be serviced on the bench after the links are removed from the vehicle.

Installation

Make certain the wiper system is in the "park" position before starting the installation procedures.

(1) With the connecting and drive links assembled as a unit insert the links in through the cowl grille panel opening and position the bushing of the connecting link on the pin of the right pivot and install the retainer clip. Make certain the retainer clip is completely seated on the pivot pin.

(2) Install the left pivot.

(3) Position the motor end of the drive link on the drive crank pin of the motor. Make certain the "O" ring, release spring, retainer and cam are in the proper positions for variable speed wiper systems (Fig. 2).

(4) Install the cover on the mechanism on variable speed wiper systems.

(5) Install the cowl grille panel, windshield lower moulding and install and adjust the wiper arm and blade assemblies. Adjust as necessary.

Wiper Motor Disassembly

(1) Remove the spring retaining clip and washers on the motor output shaft, noting the sequence of removal of the washers.

(2) Remove the switch and cover plate.

(3) Remove the gear and shaft assembly.

(4) Remove the end head through bolts and pull off the end head using care to avoid damaging the lead wire to the brush holder variable speed motors.

(5) Remove the armature using care to keep the commutator free of fingerprints and oil.

Wiper Motor Inspection

(1) Thoroughly inspect the motor parts for wear, corrosion or damage.

(2) Clean the armature commutator with 00 or 000 sandpaper or if necessary due to excessive wear replace the windshield wiper motor.

(3) Replace worn or oil soaked brushes.

(4) Inspect gears for worn or broken teeth and replace those showing damage or excessive wear.

(5) Remove the seal, which is pressed into the housing at the output shaft, while being careful not to damage the inside diameter of the housing. Press in a new seal before reassembling the wiper motor.

(6) Replace the gasket under the park switch cover.

Assembly

(1) Insert the armature into the motor assembly.

(2) Install the end head and end head through bolts using care to avoid damaging the lead wire to the brush holder on variable speed motors.

(3) Install the gear and shaft assembly.

(4) Install the washers on the motor output shaft, make certain the washers are installed in the proper order, and install the spring retaining clip.

(5) Install the switch and cover plate.

WIPER SWITCH

Variable Speed

The switch contains a rheostat which provides a means of controlling the amount of current which flows to the motor. The switch is designed to provide a circuit to the motor to reverse the current to the field winding which in turn reverses the direction of the armature. A circuit breaker, built into the switch, protects the wiper motor circuitry.

To test the switch, disconnect the wiring to the switch and remove the switch from the instrument panel. Using a continuity tester or an ohmeter, test for continuity, no resistance, between the contact terminals of the switch as shown in the following chart. For test purposes the "Park" position is when the switch is in the "Off" position. The "Low" position is when the switch is just turned "On." The "High" position is when the switch knob is rotated to the high or maximum wiper speed position. In the test chart the reference "Ground" means to attach one lead of the continuity tester or ohmeter to the case of the switch. The bench test of the switch **does not** require the use of a 12 volt battery.

VARIABLE SPEED SWITCH CONTINUITY CHART

Park	Low	High
B to B/U.	B to B/U.	B to B/U.
B/U to P.	B/U to A.	B/U to A.
A to F2.	A to F1.	*A through the
F1 to Ground.	F2 to Ground.	rheostat to F1.
	P-open.	F2 to Ground.
		P-open.

*As the switch knob is rotated the resistance shown on the ohmeter should vary from a high reading to a low reading in a smooth rate of change or if a continuity tester is being used the brightness of the test lamp should vary from bright to dim.

Single Speed

The switch contains a built-in circuit breaker to

protect the motor circuitry and is serviced only as an assembly. To test the switch, refer to the proper wiring diagram, disconnect the lead wires and remove the switch from the instrument panel. Connect a test lamp between "B" terminal of the switch and the negative battery post. Connect the positive battery terminal to the "P" terminal of the post. Lamp should remain lighted in either "ON" or "OFF" position. Failure to light indicates a faulty circuit breaker.

Connect the positive battery to the "R" terminal of the switch. The lamp should light when the switch is turned "ON" and go out when turned "OFF."

End Play Adjustment

To adjust the armature shaft end play turn the adjustment screw in until it bottoms, then back-off ⅛ turn (Fig. 6).

WIPER MOTOR BENCH TESTING

Variable Speed

(1) Connect a jumper wire between the wiper motor yellow wire and the wiper motor ground strap. Connect another jumper wire between the battery negative terminal and the wiper motor ground strap. Connect another jumper wire between the wiper motor red and black wires and the battery positive terminal. The wiper motor should run continuously in the wipe direction.

(2) Connect a jumper wire between the wiper motor blue and yellow wires and the battery positive terminal. Connect another jumper wire between the wiper motor red wire and the wiper motor ground strap. The wiper motor should run in reverse and stop at the park position.

Single Speed

(1) Connect a jumper wire between the battery negative terminal and the wiper motor ground strap. Connect another jumper wire between the black wire of the wiper motor and the battery positive terminal. The motor should run continuously.

(2) Connect a jumper wire between the battery negative post and the wiper motor ground strap. Connect another jumper wire between the black wire of the wiper motor and the red wire of the wiper motor. The wiper motor should "park."

Fig. 6—End Play Adjustment

WIPER PIVOT REPLACEMENT

Model AY-1

(1) Using a suitable tool, remove the wiper arm and blade assembly.

(2) Disconnect the link from the pivot.

(3) Remove the pivot and gasket.

(4) Install a new gasket and pivot.

(5) Tighten the retaining stud nuts 75 inch-pounds.

(6) Reconnect the link to pivot crank pin and install washer and retainer clip.

(7) Install the wiper arm.

Models AC-1, AC-2 and AC-3

To service the wiper pivots it is necessary to remove the wiper arm and blade assemblies, the windshield lower moulding and the cowl grille panel to provide access to the wiper system.

Right Pivot

(1) Remove the retainer clip that holds the connecting link to the wiper pivot and remove the link from the pivot.

(2) Remove the screws that mount the pivot to the body of the vehicle and remove the pivot out through the cowl grille panel opening.

(3) Position the new or repaired pivot in the body opening and install the pivot mounting screws. Tighten the screws to 75 inch-pounds.

(4) Position the connecting link on the pin of the pivot and install the retainer clip. Make certain the clip is completely seated on the pivot pin.

(5) Install the cowl grille panel, the windshield lower moulding and install and adjust the wiper arm and blade assemblies.

Left Pivot

(1) Disconnect the drive link at the drive crank pin of the motor.

(2) Remove the retainer clip that holds the connecting link to the right pivot and remove the link from the pivot.

(3) Remove the screws that mount the left pivot to the body of the vehicle and remove the wiper links and left pivot as an assembly out through the cowl grille panel opening. The left pivot can then be removed from the links on the service bench.

(4) With the left pivot and wiper links assembled as a unit, insert the assembly in through the cowl

grille panel opening and position the left pivot in the body opening. Install the pivot mounting screws. Tighten the screws to 75 inch-pounds.

(5) Position the connecting link on the right pivot pin and install the retainer clip. Make certain the clip is completely seated on the pivot pin.

(6) Position the drive link on the drive crank pin of the motor and install the mounting nut.

(7) Install the cowl grille panel, the windshield lower moulding and install and adjust the wiper arm and blade assemblies.

WIPER BLADE REPLACEMENT

Exposure to heat and road splash tend to harden the rubber wiper refills. When the refills smear or in general do not satisfactorily clean the windshield, they should be replaced.

To replace, depress the release on the top of the blade assembly and slide out the rubber refill. Slide the new rubber refill into the blade assembly until it locks in place. Refer to the Parts List for the correct rubber blade refill.

HORNS

SERVICE PROCEDURES

Testing

Touch a jumper wire from relay "S" terminal to ground. If horn blows, difficulty is in the horn button contact ring, the grounding of the steering column or in the wire from "S" terminal to the horn button. If the horn fails to blow, connect a jumper wire from "B" to "H" terminal. Now if horns operate the relay is defective. If horns fail to operate difficulty is in wire to the horns, in the horns, the wire to horn relay "B" terminal or in the grounding of the steering column.

Adjusting

(1) Disconnect the connections at each horn to determine which horn is not operating.

(2) Remove horn and bracket assembly.

(3) With a suitable tool (Fig. 1), turn the tone adjuster counterclockwise until there is no vibration (sound).

(4) Turn the tone adjuster clockwise, approximately ¼ turn at a time until the tone has a clear mellow sound. Do not turn tone adjuster while horn is blowing.

NOTE: Adjustment will only clear up sound and cannot change horn tone frequency.

(5) Connect a test ammeter between the positive post of a 12 volt battery and horn terminal post. Connect a jumper lead from the negative battery post to the horn base. Clean the paint from the horn bracket where the connection is made. Turn the adjusting screw to obtain a reading of six amperes minimum to eight amperes maximum for Sparton horns and eight amperes minimum to ten amperes maximum for Prestolite horns at 12.5 volts.

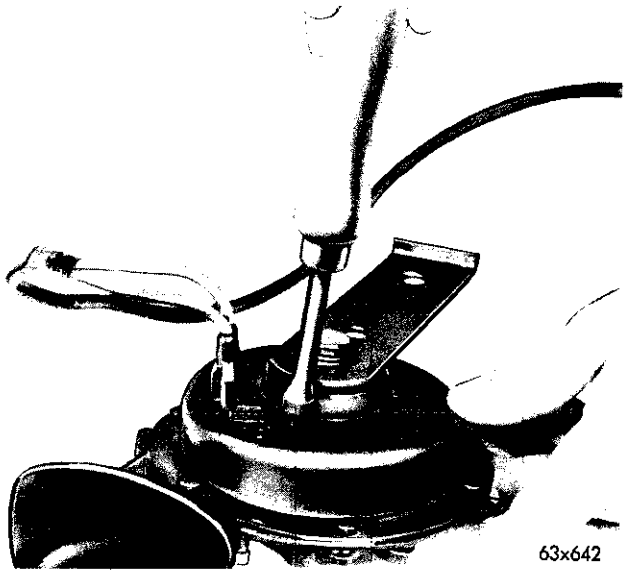


Fig. 1—Adjusting Horn (Sparton Horn Shown)

NOTE: Must not exceed eight amperes maximum for Sparton horns and ten amperes maximum for Prestolite horns.

PART 8

POWER EQUIPMENT

SERVICE DIAGNOSIS

ELECTRIC DOOR LOCKS

Condition	Possible Cause	Correction
ALL DOORS NOT LOCKING OR UNLOCKING PROPERLY	(a) Faulty control switch.	(a) Test switch for continuity. Replace if necessary.
	(b) Faulty wiring.	(b) Test wiring for continuity. Repair or replace as necessary.
INDIVIDUAL DOOR NOT LOCKING OR UNLOCKING PROPERLY	(a) Faulty solenoid.	(a) Test solenoid for continuity. Replace if necessary.
	(b) Faulty wiring.	(b) Test wiring for continuity. Repair or replace as necessary.
	(c) Improperly adjusted solenoid.	(c) Adjust solenoid to allow sufficient travel of the solenoid lever to operate the door lock.

SIX-WAY POWER SEATS

ENTIRE UNIT INOPERATIVE	(a) Broken wire or loose connections in any part of of motor control circuit.	(a) Test electrical continuity of the system. Repair as necessary.
MOTOR INOPERATIVE	(a) Short or open circuit between power source, faulty relay, switch or motor.	(a) Test the red wire at relay with a test lamp. If the test lamp does not light, check for continuity in the red feed wire, a faulty circuit breaker or a poor connection between the circuit breaker and alternator (ammeter). If the test lamp lights, connect the red feed wire with the red and black or red and green wires from the motor. If motor runs, relay is faulty.
	(b) Faulty Motor.	(b) Repair or replace motor.
SEAT INOPERATIVE (Motor Runs)	(a) Short or open circuit between the switch and affected solenoid.	(a) Jump the wire from the red feed wire to each solenoid terminal on the clutch assembly. Each solenoid should "Click" as the jumper is connected. If solenoid does not click: Test the wire in the harness for an open circuit. Repair. Test for a possible burned-out solenoid. Replace the solenoid if necessary.
SEAT INOPERATIVE (Motor Runs and Solenoid Clicks)	(a) Stripped or broken gear in the drive unit.	(a) Inspect and replace the drive unit if necessary.
SLAVE UNIT INOPERATIVE (Motor, Solenoids and Drive Unit O.K.)	(a) Broken drive cable.	(a) Inspect and replace the parts as necessary.

SIX-WAY POWER SEATS—(Continued)

Condition	Possible Cause	Correction
EXCESSIVE FREE PLAY IN THE UNIT (Seat has a Rocking Motion, Excessive Movement between the Slide and the Base of the Track assembly)	(a) Roller out of position.	(a) Repair roller as necessary.
SEAT TRACK EXCESSIVELY LOOSE	(a) Loose rivet joints.	(a) Disassemble the upper track seat support by removing the cotter keys and pins. Remove the seat support and tighten all the riveted joints by peening with a ball peen hammer.
LOOSE FRONT LEVERS	(a) Movement between the two sections comprising the front lever asembly.	(a) Arc weld the front levers to prevent movement between the two sections.
SEAT CHUCK FORE AND AFT	(a) Loose horizontal rack support arm to lower track base.	(a) Repair as follows: (1) Remove the seat track from the vehicle and arc weld the support arm to the track base. (2) Tighten the rack attaching pins by arc welding.
	(b) Loose horizontal rack in slave unit gear train.	(b) Test and replace slave unit if necessary.

FOUR-WAY POWER SEATS

ENTIRE UNIT INOPERATIVE	(a) Broken or loose wire from the circuit breaker to the control switch.	(a) Test for electrical continuity between the circuit breaker and the control switch. Repair or replace as necessary.
	(b) Faulty control switch.	(b) Test control switch. Repair or replace as necessary.
SEAT OPERATES HORIZONTALLY BUT WILL NOT OPERATE VERTICALLY	(a) Broken or loose wire between the control switch and the vertical drive motor.	(a) Test wiring for continuity between the control switch and the vertical drive motor. Repair or replace as necessary.
	(b) Faulty motor.	(b) Repair or replace the motor.
	(c) Faulty or mis-aligned coupling between the motor and the vertical drive mechanism.	(c) Inspect coupling for wear or misalignment. Repair or replace as necessary.
	(d) Faulty vertical drive mechanism.	(d) Inspect the drive mechanism. Repair or replace as necessary.
SEAT OPERATES VERTICALLY BUT WILL NOT OPERATE HORIZONTALLY	(a) Broken or loose wire between the control switch and the horizontal drive motor.	(a) Test wiring for continuity between the control switch and the horizontal drive motor. Repair or replace as necessary.
	(b) Faulty motor.	(b) Repair or replace the motor.
	(c) Faulty or mis-aligned coupling between the motor and the horizontal drive mechanism.	(c) Inspect coupling for wear or misalignment. Repair or replace as necessary.
	(d) Faulty horizontal drive mechanism.	(d) Inspect drive mechanism. Repair or replace as necessary.

POWER WINDOWS

NOTE: The window lift motor used on Model AY-1 is different than the window lift motor used on Models AC-1, AC-2 and AC-3. When bench testing the motors a separate ground wire must be attached to the Model AY-1 motor. DO NOT connect a separate ground wire to the Model AC-1, AC-2 and AC-3 motor.

Condition	Possible Cause	Correction
A WINDOW WILL NOT OPERATE FROM THE MASTER SWITCH, BUT CAN BE OPERATED FROM THE INDIVIDUAL DOOR SWITCH	(a) Faulty switch in the master switch group. (b) Break in the wire at the door opening, or at the door holding the master switch group.	(a) Replace master switch. (b) Test for continuity, see "Wiring Diagrams." Repair wiring. Avoid making a splice in the flexing sections of the wiring harness.
NONE OF THE WINDOWS WILL OPERATE FROM THE MASTER SWITCH OR FROM THE INDIVIDUAL DOOR SWITCH	(a) Faulty circuit breaker—located behind left cowl panel. (b) Open in the battery feed wire from the circuit breaker to the alternator (ammeter).	(a) Replace circuit breaker. (b) Test for continuity and repair as necessary.
A WINDOW CANNOT BE OPERATED FROM EITHER THE MASTER SWITCH OR THE INDIVIDUAL DOOR SWITCH	(a) Test for faulty circuit breaker located left cowl panel. (b) Master switch and door switch inoperative. (c) Open in wire between motor and switch. (d) Jammed gear box. (e) Coupling broken between the motor and the gear box. (f) Lift motor burned out. (g) Short in the wiring circuit.	(a) Replace circuit breaker. (b) Test master switch and door switch for continuity. (c) Test for continuity between the motor and the switch. Repair wiring as necessary. (d) Test and repair. Inspect motor to gear box alignment. (e) Replace coupling and test motor and gear box alignment. (f) Repair or replace lift motor. Test for sticking door switch as possible cause of motor failure. (g) Inspect and test wiring. See "Wiring Diagrams."
A WINDOW WILL OPERATE IN ONE DIRECTION ONLY WHEN CONTROLLED BY EITHER THE MASTER SWITCH OR BY THE INDIVIDUAL DOOR SWITCH	(a) Faulty circuit between master switch and door switch. (b) Lift motor burned out. (c) Short in wiring circuit	(a) Test master switch and door switch for continuity. Check for continuity between the motor leads and the switch. (b) Remove window lift motor and test on bench with battery voltage. See "Wiring Diagrams." Test for sticking switch. (c) Inspect and test all wiring. See "Wiring Diagrams."
CIRCUIT BREAKER CLICKS "ON" AND "OFF" CONTINUOUSLY AND WINDOW DOES NOT OPERATE	(a) Short in the feed wire that feeds the right front and rear doors. (b) Faulty switch.	(a) Test wiring, repair or replace as necessary. (b) Replace switch if necessary.

POWER EQUIPMENT

ELECTRIC DOOR LOCKS

Description

The electric door lock is operated by a push-pull, double action solenoid attached by a connecting rod to the door latch locking lever. By pressing the single pole double throw switch mounted on the right and left front door trim panel, a solenoid in each of the four doors is actuated, moving the latch locking lever into the lock or unlock position.

All doors may be locked or unlocked either mechanically or electrically. To lock mechanically, push the front door handle to the forward position and depress the rear door locking button. To lock electrically, depress the switch to the lock position.

SERVICE PROCEDURES

SOLENOID

Removal

Remove the door trim panel. Disconnect the lock to solenoid connecting rod at the solenoid. Disconnect wires and remove solenoid.

Installation

Fasten the solenoid to the door and connect the wires. Tighten the solenoid mounting screws finger tight. Connect the lock connecting the rod to the solenoid. Adjust the solenoid by moving the solenoid up or down in the slotted holes, so that the solenoid will push and pull the lever far enough to accomplish locking and unlocking. Install the trim panel.

SIX-WAY POWER SEATS

Description

The power seat can be moved six ways: forward, back, up, down and tilt. The horizontal travel is five inches and horizontal plane of seat track is inclined eleven degrees. The vertical travel is one inch at front and two inches at rear. The available tilt is 8 degrees forward and 7½ degrees rearward from neutral.

Operation (Fig. 1)

The motor operates a gear drive train which supplies power to the slave units, (located in the seat tracks,) through flexible cables. The control switch is on the left side of front seat and is wired through a relay to a 30 ampere circuit breaker, located above the left kick panel.

The wire from the bulkhead disconnect supplies power to the circuit breaker.

Power is supplied to the relay from the circuit breaker.

Six wires go to the switch. One used for power, two for motor field current, (which also actuates the relay for motor armature current) and three wires attach to solenoids controlling the movement of the front riser, rear riser and horizontal movement.

The right and left tracks are each replaced as an assembly only. They cannot be adjusted and are not interchangeable.

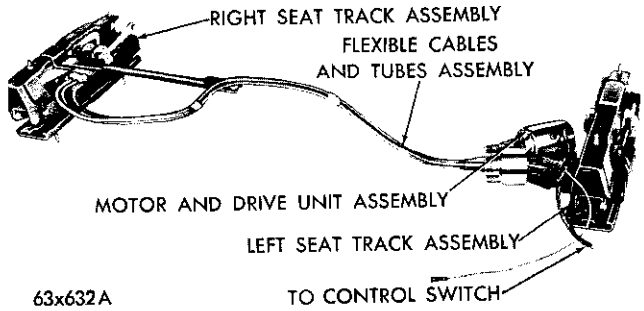


Fig. 1—Power Seat Assembly

FRONT SEAT ASSEMBLY AND ADJUSTER

Removal

(1) Disconnect the battery ground cable.

(2) Remove the four mounting stud nuts which hold the front seat to the adjuster and tilt the complete seat back assembly forward.

(3) Disconnect the switch control wires.

(4) Remove the front seat and cushion assembly.

(5) Disconnect the seat adjuster red feed wire.

(6) Remove the seat guide attaching stud nuts and remove the adjuster.

Installation

(1) Install the adjuster and seat guide stud nuts.

(2) Reconnect the seat adjuster red feed wire.

(3) Install the front seat assembly.

(4) Reconnect the control wires to the switch and tighten the mounting stud nuts securely.

(5) Reconnect the battery ground cable.

FLEXIBLE CABLES

Removal

(1) Remove the front seat assembly.

(2) Disconnect the red feed wire.

(3) Remove the retainer plate that holds the right side tubes to the drive assembly.

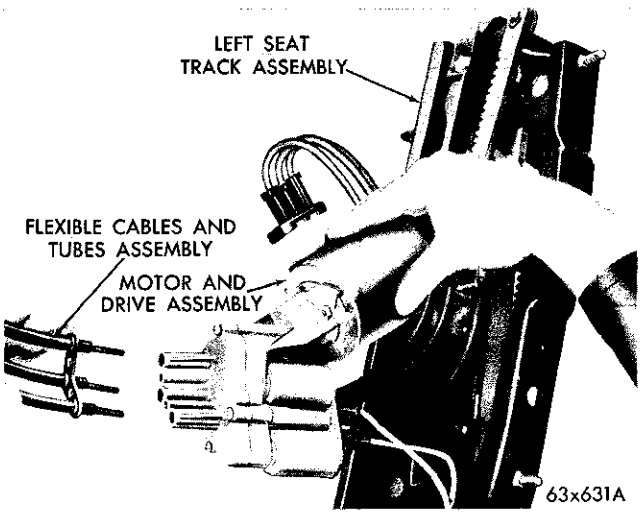


Fig. 2—Removing Cables from Drive Assembly

(4) Remove the left seat guide attaching stud nuts and remove the guide and the drive assembly (Fig. 2).

CAUTION: Be careful not to bend or damage right side tubes when sliding tubes out of drive assembly.

(5) Pull the flexible cables from the right side tubes (Fig. 3).

(6) Remove the bolts that hold the motor and drive assembly to the left guide bracket.

(7) Remove the drive assembly with tubes from left slave unit (Fig. 4).

(8) Remove the flexible cables from the tubes.

Installation

CAUTION: Seat guides should be in the up and forward position when installing cables. Make sure both guides are at the same position (in alignment).

(1) Place the three left cable tubes into the left slave unit (Fig. 5).

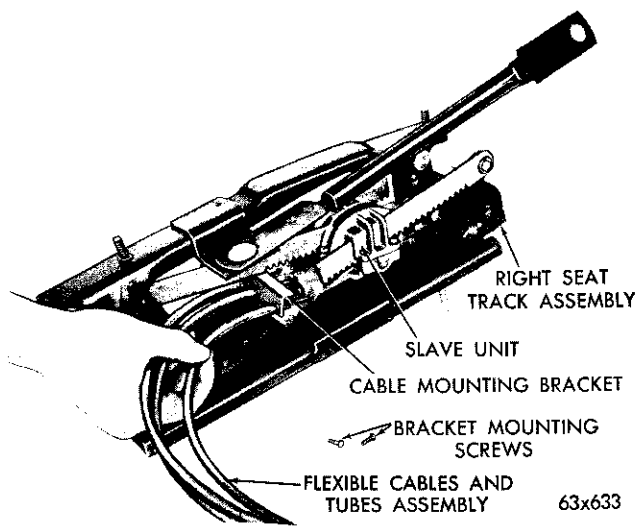


Fig. 3—Removing Cables From Right Slave Unit

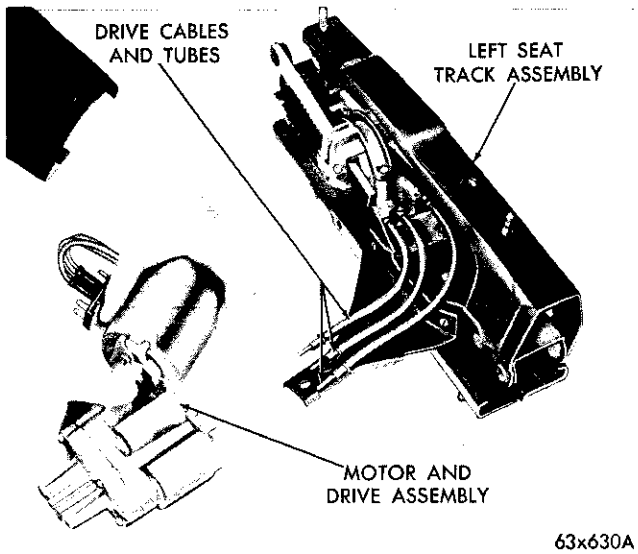


Fig. 4—Removing Drive Assembly From Left Slave Unit

(2) With the shortest tube on the inside and the longest on the outside, install the flexible cables in the tubes. Make sure the cables seat in the slave unit.

(3) Position the drive unit on the left side tubes. Make sure the flexible cables seat in the slot in the drive unit.

(4) Bolt the drive unit to the guide bracket.

(5) Place the right side flexible cables in the right side tubes.

(6) Position the left guide and drive assembly on the right side tubes. Make sure the cables seat in the drive assembly.

(7) Install the right side tubes retainer plate.

(8) Bolt the left guide assembly to the floor.

(9) Install the seat and cushion assembly.

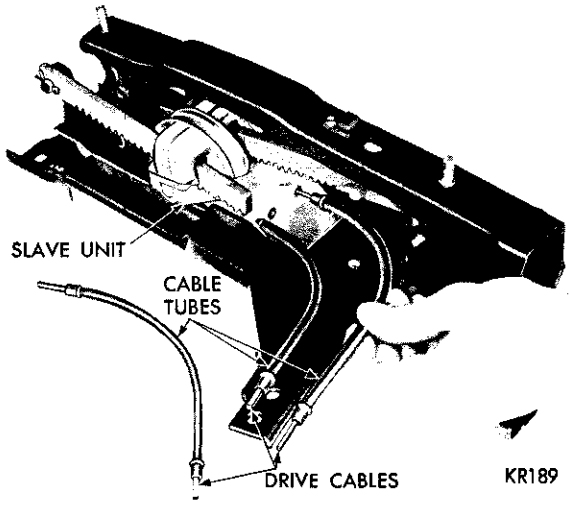


Fig. 5—Installing Left Cable Tubes in Slave

(10) Reconnect the red feed wire and test the operation of the seat.

SEAT MOTOR (Fig. 6)

Removal

(1) Remove the two mounting stud attaching nuts that hold the left side of the front seat to the seat adjuster.

(2) Prop-up the left side of the seat cushion approximately six inches.

(3) Disconnect the control switch wires from the relay on the motor.

(4) Remove the two nuts that attach the motor to the drive unit.

(5) Remove the motor and rubber coupling from the drive unit.

(6) Disconnect the motor wires from the relay.

(7) Remove the relay from the motor.

Installation

(1) Position the relay on the motor and install the attaching screw.

(2) Connect the motor wires to the relay.

(3) Install the motor and rubber coupling to the drive unit. Install the two attaching nuts.

(4) Connect the control switch wires to the motor relay.

(5) Remove the prop from the left side of the seat cushion. Position the seat on the seat adjuster and install the two mounting stud attaching nuts.

DRIVE UNIT AND SOLENOID ASSEMBLY

Disassembly

(1) Remove the drive unit from the seat assembly. Refer to "Removal of Flexible Cables" operations 1-4.

(2) Remove the two screws holding the plate and solenoids to the drive unit (Fig. 6).

(3) Remove the plate and solenoid assembly. Be careful not to lose the three springs under the solenoid.

(4) To remove the solenoid coils, bend back on the tabs of the solenoid cover. Unsolder the coil ground wire at the cover tab and remove the coil cover from the coil.

(5) Remove the screws holding the cover on the drive unit.

(6) Remove the cover and lift out the clutch lever and shaft.

Assembly

(1) Install the clutch lever and shaft. Make sure the lever is properly seated on the collar.

(2) Install the cover and screws.

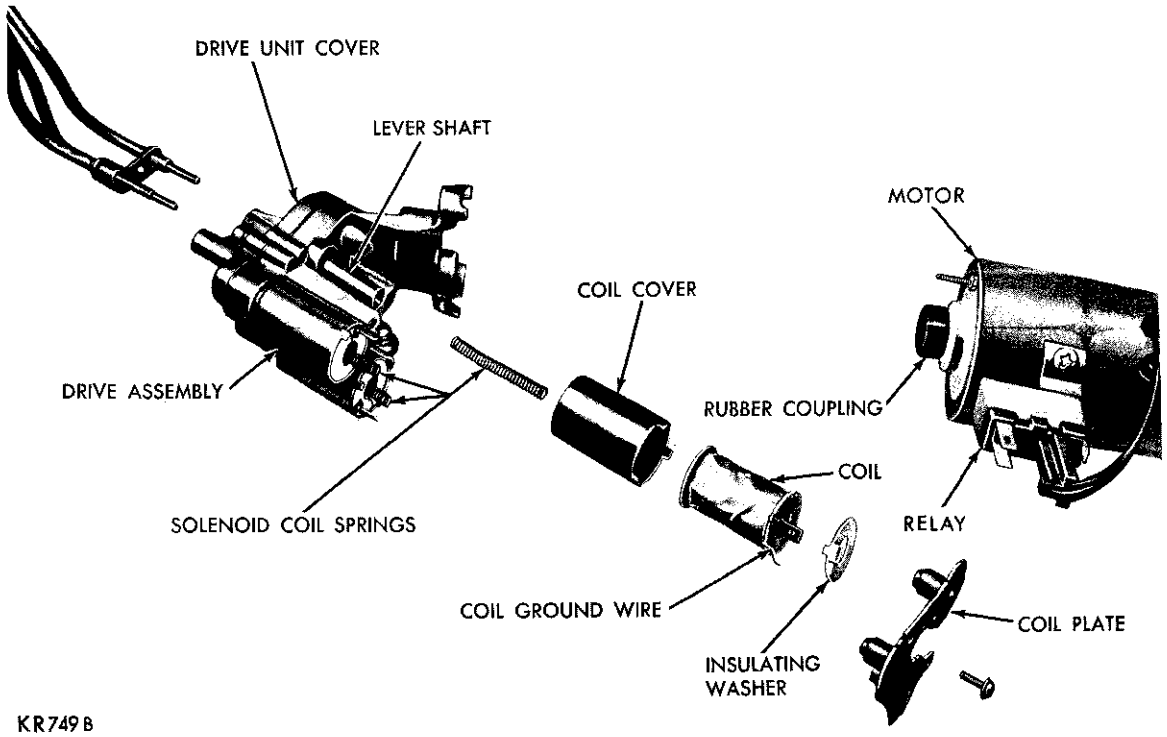


Fig. 6—Solenoid and Coil (Disassembled View)

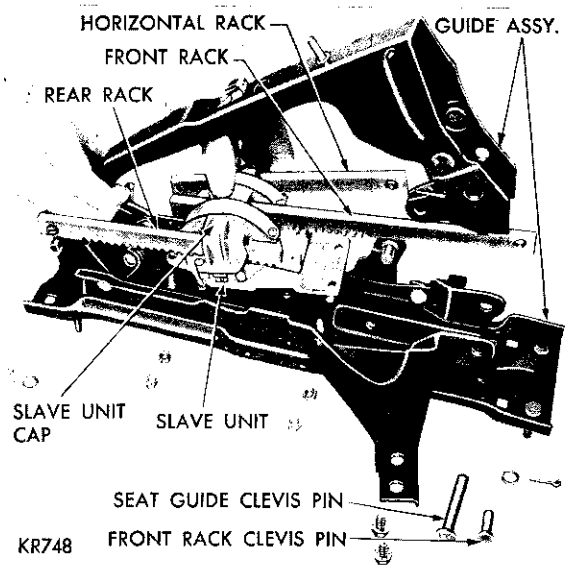


Fig. 7—Removing the Left Slave Unit

(3) Install the coil in the coil cover with the coil ground wire next to one of the cover tabs.

(4) Position the cover tabs in the slots on the coil plate.

(5) Bend over the tabs and resolder the coil ground wire to the tab and plate.

(6) Install the three solenoid springs and position the solenoids over the springs.

(7) Fasten the solenoids to the drive unit.

(8) Install the drive unit. Refer to "Installation of Flexible Cables," steps 6 through 9.

SLAVE UNIT

Removal

(1) Remove the drive unit and the cables. Refer to "Removal of Flexible Cables," operations 1-4. The seat guide should be in the up and forward position.

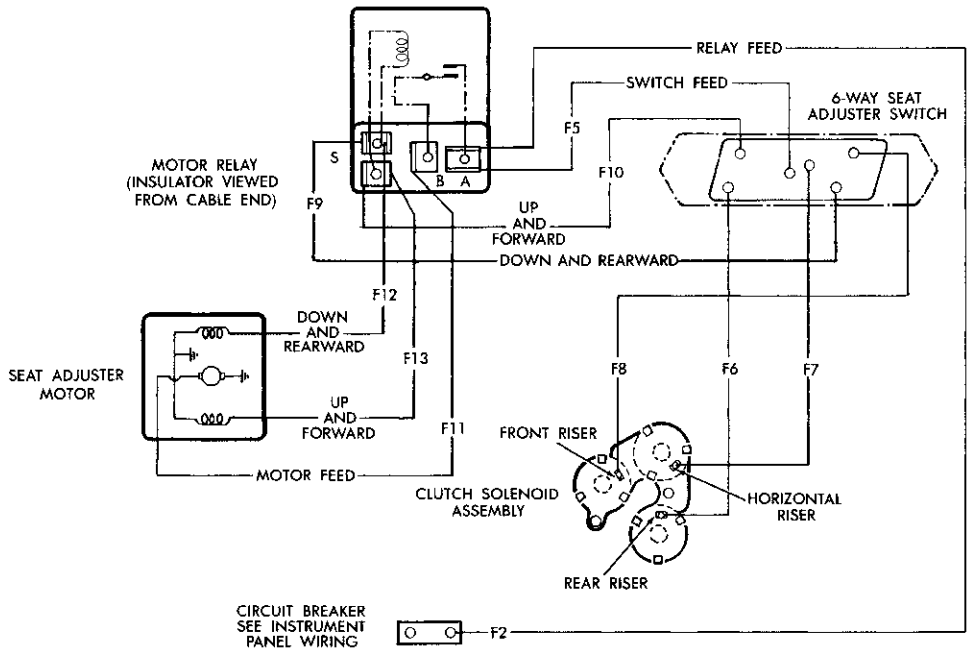
(2) Remove the long clevis pin from the front of the guide (Fig. 7).

(3) Remove the front rack clevis pin.

(4) To facilitate the removal of the slave unit, remove the slave unit cap. **Be careful not to lose the springs under the cap. The springs are between the racks and the slave cap.**

(5) Remove the nuts holding the slave unit to the guide.

(6) Remove the slave unit.



CIRCUITS		
CIR.	GA.	COLOR
F2	12	RED
F5	14	RED
F6	14	YELLOW
F7	14	DARK BLUE
F8	14	BROWN
F9	14	DARK GREEN
F10	14	BLACK
F11	14	RED
F12	16	GREEN
F13	16	BLACK

NK-319

Fig. 8—Six-Way Power Seat Wiring

Installation

(1) Position the slave unit over the studs on the guide base.

(2) Position the racks in the slave unit so they will be in the up and forward position.

(3) Fasten the racks to the guide assembly.

(4) Position the springs on the racks and install the slave unit cap.

(5) Install the slave unit mounting nuts.

(6) Install the front guide clevis pin.

(7) Install the cables in their slots and try operation of guide.

Install the drive unit and cables. Refer to "Installation of Flexible Cables" steps 6 through 9.

POWER SEAT WIRING

Refer to Figure 8 for the wiring of the power seat assembly.

FOUR-WAY POWER SEATS

Description

The seat uses two electric motors (Fig. 1) to produce a front-back travel of 5 inches and an up-down travel of 1½ inches. The control switch is located on the bottom edge of the left side of the driver's seat. Power is supplied to the control switch from the 30 ampere circuit breaker mounted behind the left kick panel.

SERVICE PROCEDURES

SEAT AND CUSHION ASSEMBLY

Removal

(1) Remove the two nuts attaching the seat assembly to the seat track at the rear of the seat track rails.

(2) Operate the seat to the extreme forward position to allow access to the two Phillips head screws attaching the seat assembly to the seat track at the front of the seat track rails.

(3) Lift the seat assembly up off of the rear studs on the seat track rails and remove the seat and cushion assembly.

Installation

(1) With the seat track in the extreme forward

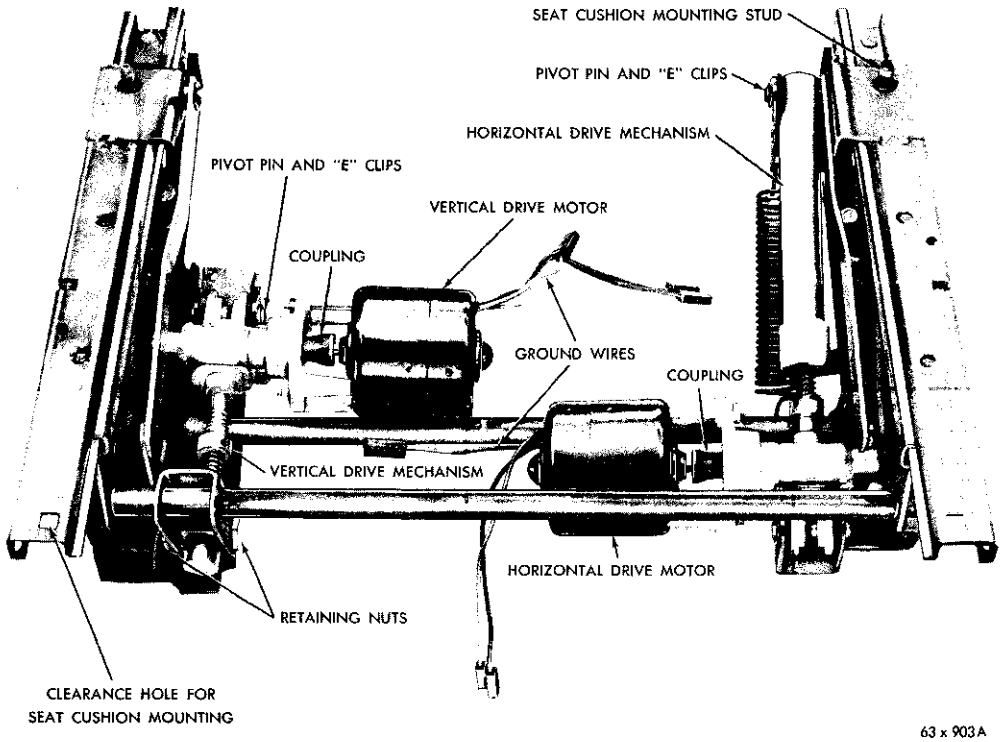


Fig. 1—Seat Track and Rails Assembly

position, place the seat and cushion assembly on the seat track making certain the studs at the rear of the seat track protrude through the clearance holes at the rear of the seat assembly.

(2) Install the two Phillips head screws that attach the seat and cushion assembly to the seat track at the front of the seat track and rails assembly.

(3) Install the two nuts that mount the seat assembly to the seat track at the rear of the seat rack. Tighten the nuts securely.

SEAT TRACK AND RAILS ASSEMBLY

Removal

(1) Remove the seat and cushion assembly.

(2) From underneath the vehicle, remove the four nuts attaching the seat track mounting studs to the floor pan of the vehicle.

(3) Disconnect the wiring terminals from the lead wires of the two electric motors.

(4) Lift the seat track and rails assembly up from the floor pan and remove from the vehicle.

Installation

(1) Position the seat track and rails assembly in the vehicle making certain the four mounting studs protrude through the clearance holes in the floor pan.

(2) From underneath the vehicle install the four nuts that attach the seat track and rails assembly to the floor pan. Tighten the nuts securely.

(3) Install the seat and cushion assembly.

ELECTRIC DRIVE MOTORS

Service of the drive motors does not require removal of the seat and cushion assembly. Service procedures for both the vertical and horizontal drive motors are identical. Refer to Fig. 2 for Model AY-1 and Fig. 3 for Models AC-1, AC-2 and AC-3 for complete electrical circuit.

Removal

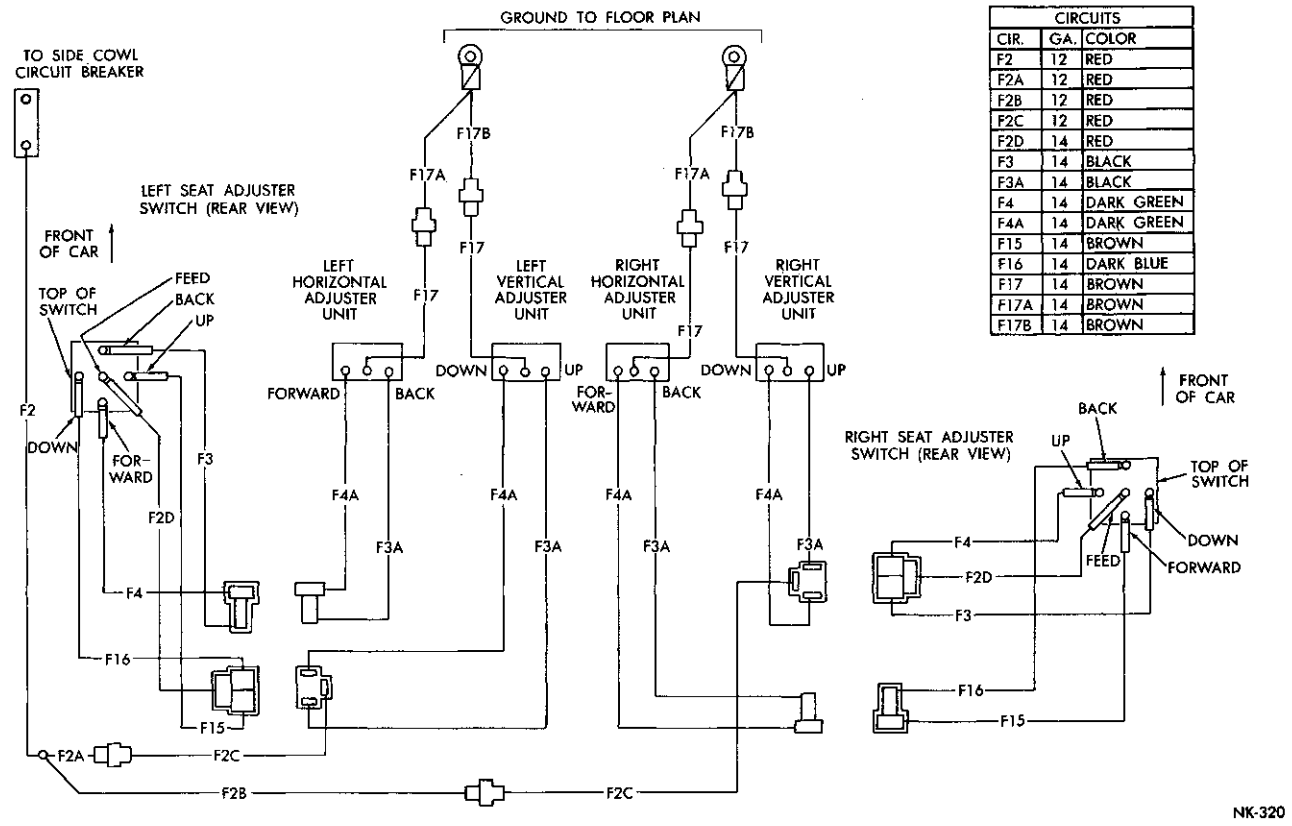
(1) Disconnect the wiring terminals at the motor lead wires.

(2) Remove the two nuts attaching the motor to the gear housing.

(3) Pull the motor out of the coupling between the motor and the gear housing and remove the motor.

Installation

(1) Position the motor on the coupling on the gear housing making certain the studs on the motor pro-



CIRCUITS		
CIR.	GA.	COLOR
F2	12	RED
F2A	12	RED
F2B	12	RED
F2C	12	RED
F2D	14	RED
F3	14	BLACK
F3A	14	BLACK
F4	14	DARK GREEN
F4A	14	DARK GREEN
F15	14	BROWN
F16	14	DARK BLUE
F17	14	BROWN
F17A	14	BROWN
F17B	14	BROWN

NK-320

Fig. 2—Four-Way Power Seat Wiring—Model AY-1

trude through the clearance holes in the gear housing.

(2) Install the two nuts that attach the motor to the gear housing. Tighten the nuts securely.

(3) Connect the wiring terminals to the lead wires on the motor. Make certain the ground lead from the motor (brown wire) has a good electrical connection.

CONTROL SWITCH

The control switch is retained to the seat assembly lower side panel by a spring clip. Inserting a screwdriver on each side of the switch will release the spring clip and allow removal of the switch.

There are two terminals connected to the control switch. A two wire terminal and a three wire terminal. The circuits of the five wires are as follows:

Red Wire—12 volt feed from the 30 ampere circuit breaker behind the left kick panel.

Dark Green Wire—"down" feed to the vertical drive motor.

Black Wire—"up" feed to the vertical drive motor.

Dark Green Wire—"forward" feed to the horizontal drive motor.

Black Wire—"back" feed to the horizontal drive motor.

Since the drive motors are interchangeable, a duplication of wire colors occurs. The three wire terminal to the control switch (Dark Green, Black, Red) contains the feed wires for the vertical drive motor. The two wire terminal to the control switch (Dark Green, Black) contains the feed wires for the horizontal drive motor (Figs. 2 and 3).

COUPLING—MOTOR TO GEAR HOUSING (Fig. 1)

The coupling transmits the power from the drive motor to the gear housing. A coupling is used on both the horizontal and vertical drive mechanisms.

Removal of the motor allows the coupling to be serviced by pulling the coupling off the end of the drive shaft of the gear housing.

Service procedures are the same for the coupling on both the horizontal and vertical drive mechanisms.

HORIZONTAL DRIVE MECHANISM

Removal

(1) Remove the seat and cushion assembly.

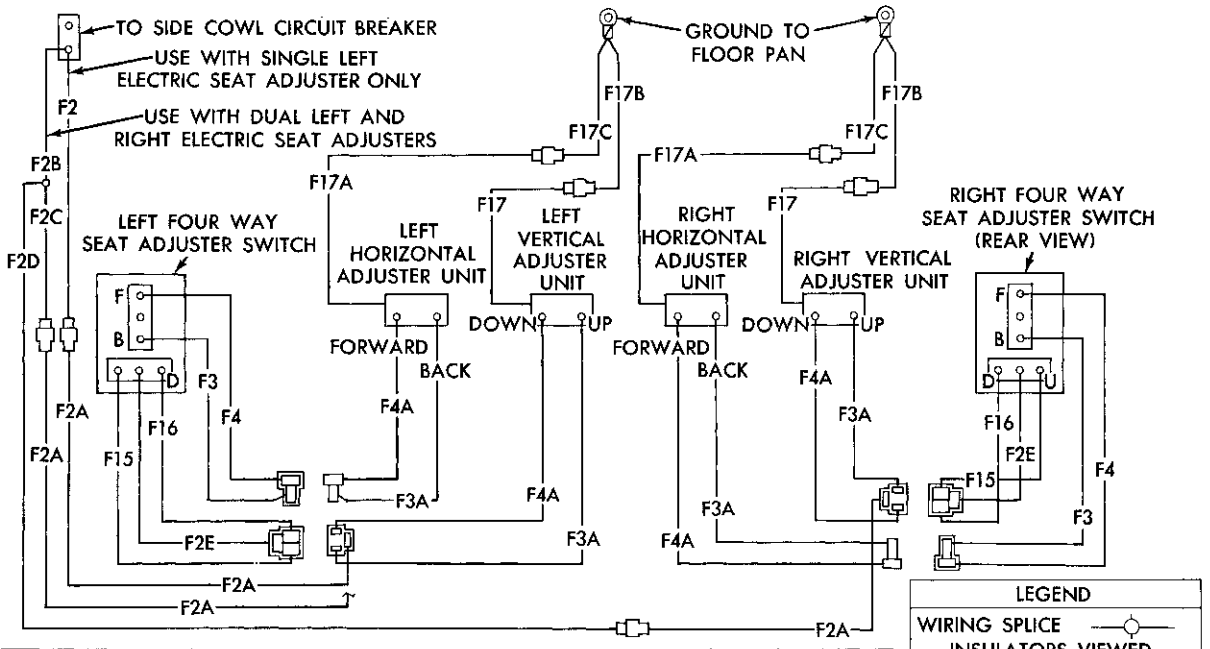
(2) Remove the two "E" clips from the track bracket pivot pin at the rearward end of the horizontal worm gear.

(3) Remove the pivot pin.

(4) Remove the two "E" clips from the track bracket pivot pin at the gear housing end of the horizontal worm gear.

(5) Remove the pivot pin.

(6) Disconnect the wiring terminals at the motor



CIRCUITS	GAUGE	COLOR	CIRCUITS	GAUGE	COLOR	CIRCUITS	GAUGE	COLOR	CIRCUITS	GAUGE	COLOR
F2	12	RED	F2D	12	RED	F4	14	DARK GREEN	F17	14	BROWN
F2A	12	RED	F2E	12	RED	F4A	14	DARK GREEN	F17A	14	BROWN
F2B	12	RED	F3	14	BLACK	F15	14	BLACK WITH TRACER	F17B	14	BROWN
F2C	12	RED	F3A	14	BLACK	F16	14	DARK GREEN WITH TRACER	F17C	14	BROWN

63 x 904

Fig. 3—Four-Way Power Seat Wiring—Models AC-1, AC-2 and AC-3

lead wire connectors.

(7) Remove the motor from the gear housing. The drive mechanism can then be removed.

Installation

(1) Position the horizontal drive mechanism and gear housing assembly into the track bracket.

(2) Install the pivot pins and the two "E" clips at both ends of the drive mechanism.

(3) Install the motor on the gear housing.

(4) Connect the wiring terminals to the motor lead wire connectors.

(5) Install the seat and cushion assembly.

VERTICAL DRIVE MECHANISM

Removal

(1) Remove the seat and cushion assembly.

(2) Remove the two nuts at the gear housing end of the vertical worm gear.

(3) Remove the two "E" clips from the track bracket pivot pin at the rearward end of the vertical worm gear.

(4) Remove the pivot pin.

(5) Disconnect the wiring terminals at the motor lead wire connectors.

(6) Remove the motor from the gear housing and remove the motor. The drive mechanism can then be removed.

Installation

(1) Position the vertical drive mechanism and gear housing assembly into the track bracket.

(2) Install the retaining nuts at the gear housing end of the drive mechanism and the pivot pin and the two "E" clips at the rearward end of the drive mechanism.

(3) Install the motor on the gear housing.

(4) Connect the wiring terminals to the motor lead wire connectors.

(5) Install the seat and cushion assembly.

POWER WINDOWS

Description

The power windows can be controlled from the master switch, on the left front door, or by the individual switches on the other doors of the vehicle.

The window lift circuitry is protected by a circuit breaker mounted behind the left cowl panel.

SERVICE PROCEDURES

MOTOR—MODEL AY-1

Removal

(1) Remove the garnish moulding and trim panel.

(2) Remove the two nuts that attach the motor to the gearbox assembly.

(3) Drop the motor down off the gear box assembly.

(4) Ground the motor through bolt to the body inner panel.

(5) Test the operation of the motor using the window lift switch. If the motor is faulty replace the motor. **Do not** attempt any internal service on the motor.

(6) Disconnect the lead wires to the motor and remove the motor.

Installation

(1) Position the motor on the gear box assembly and install the two mounting nuts.

(2) Connect the wiring to the motor.

(3) Test operation of the motor using the window lift switch.

(4) Install the trim panel and garnish moulding.

WINDOW LIFT AND/OR MOTOR
Models AC-1, AC-2 and AC-3

Removal

(1) Disconnect the battery ground cable.

(2) Remove the trim panel hardware and the trim panel. For rear quarter trim panel, remove the rear seat and seat back.

(3) Disconnect the wiring to the window left switch.

(4) Remove the clips from the regulator pins holding the lower glass channel.

(5) Raise the glass manually and prop the glass in the "up" position.

(6) Remove the regulator attaching screws, disconnect the pivot arm from the guide on the inner panel and remove the motor and regulator out through the opening in the door inner panel.

(7) Remove the two nuts from the lift motor attaching studs and remove the motor from the gear box assembly.

(8) Bench test the motor using a 12 volt test battery. Connect the leads from the battery to the terminals of the motor. With the leads connected positive to positive and negative to negative, the motor should run in one direction. By reversing the leads from the test battery, positive to negative the motor should run in the other direction. If the motor does not operate properly, replace the motor. **Do not connect a ground wire to the case of the motor.**

(9) To replace the gearbox, remove the quarter-balance spring before removing the gear box. The gear box is serviced as an assembly only.

Installation

(1) Assemble the motor to the window left regulator and install the mounting nuts.

(2) Place the motor and regulator assembly through the inner panel opening and insert the pivot arm into the guide on the inner panel.

(3) Install the regulator attaching screws finger tight. **Do not** tighten these screws at this time.

(4) Remove the glass prop and lower the glass inserting the control arms onto the glass channel. Place a leather washer on each side of the channel and secure in place with a retaining clip.

(5) Connect the wires to the lift motor and connect the battery negative cable.

(6) Operate the window several times, then stop the glass halfway.

(7) If the window operation was satisfactory, tighten the regulator attaching screws securely and insert the glass alignment.

(8) Connect a test ammeter into the electrical circuit and operate the window. The ammeter reading should be constant without fluctuation at approximately 5 to 10 amperes. A fluctuating ammeter indicates there is a bind in the glass travel or in the linkage.

(9) Adjust the down stop so that the top of the window will be flush with the top of the trim panel.

(10) Disconnect the battery negative cable.

(11) Install the water shield, repair any damaged areas to make a complete seal.

(12) Install the trim panel, connect the wires to the window lift switch and install the switch.

(13) Install the trim panel hardware.

(14) Connect battery ground cable.

WINDOW LIFT—MODEL AY-1

Removal

(1) Remove the trim panel and garnish moulding.

(2) Remove the window glass retaining clips. Push the regulator arm pins out of the window glass frame.

(3) Push the glass and frame assembly to the "UP" position and prop the glass securely.

(4) Remove the regulator attaching bolts. The bottom bolt can be removed using a socket and extension.

(5) Remove the regulator pivot arms from the regulator channels.

(6) Disconnect the wiring to the motor.

(7) Remove the regulator and motor as an assembly out through the access opening in the inner panel.

(8) The motor can then be serviced on the bench.

Installation

(1) Install the motor and regulator as an assembly in through the access opening in the inner panel and install the three regulator mounting bolts.

(2) Install the regulator pivot arms into the channels.

(3) Remove the prop that held the window glass and frame in the "UP" position and lower the assembly down until the regulator pins are in line with the openings in the window glass frame.

(4) Install the regulator pins into the window glass frame and install the retaining clips.

(5) Connect the wiring to the motor.

(6) Install the trim panel and garnish moulding.

ELECTRIC DECK LID LOCK—MODEL AY-1

Description

The electric deck lid lock allows unlocking of the rear deck lid from inside the passenger compartment of the vehicle. The system consists of a push-button switch in the glove compartment, a solenoid mounted on the underside of the deck lid and the push-button switch from the 10 ampere circuit breaker behind the left kick panel. The deck lid is locked automatically when the lid is closed securely.

SERVICE PROCEDURES

Operation

To unlock the deck lid open the glove compartment and push "in" on the switch located on the left side of the glove box. When the switch is pushed "in" voltage is fed through the switch to the solenoid which releases the deck lid locking mechanism.

Tests

If the desk lid fails to unlock when the switch is pushed "in" test for good wire connections at the switch and the circuit breaker. If the wire connections are good, test the switch for electrical continuity. If the switch is good, test for "open" or "grounded" wires in the system. If the wiring is good, test for a faulty solenoid. If the solenoid is faulty the deck lid can be opened manually by using the luggage compartment key. Repair or replace the faulty component as necessary. Refer to Figure 1 for wiring of the system.

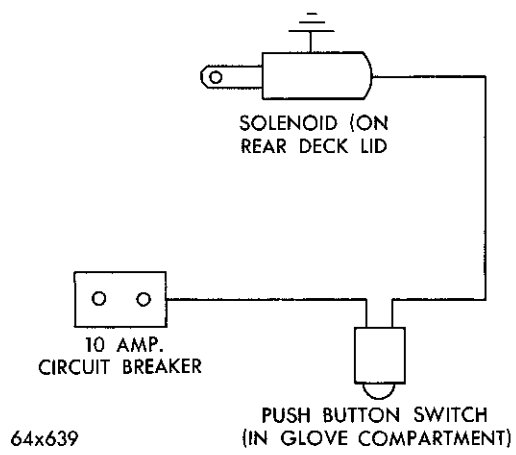


Fig. 1—Electric Deck Lid Lock Wiring

PART 9

WIRING DIAGRAMS

Figures 1 through 12 shows the various wiring diagrams for the Imperial and the Chrysler Models.

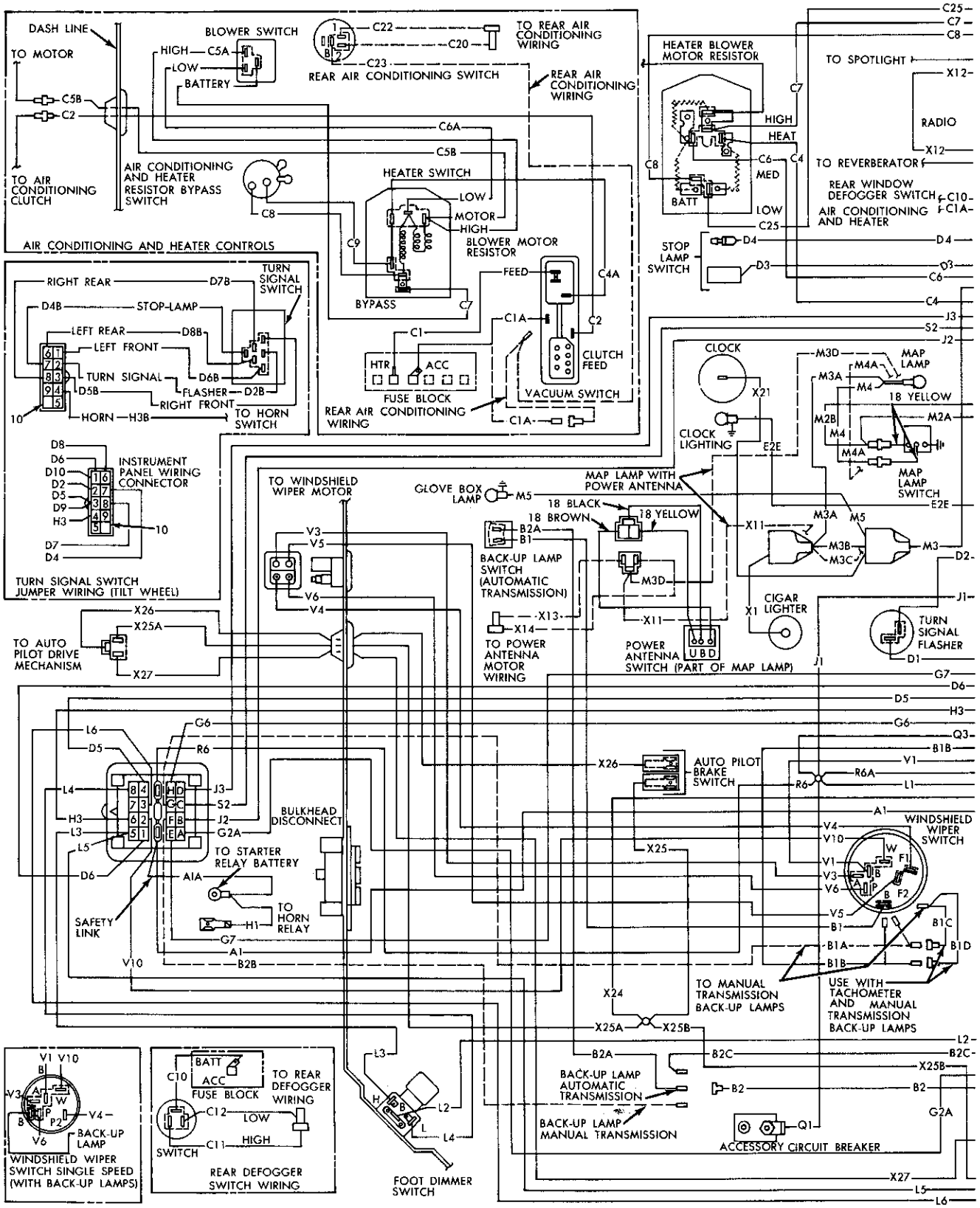
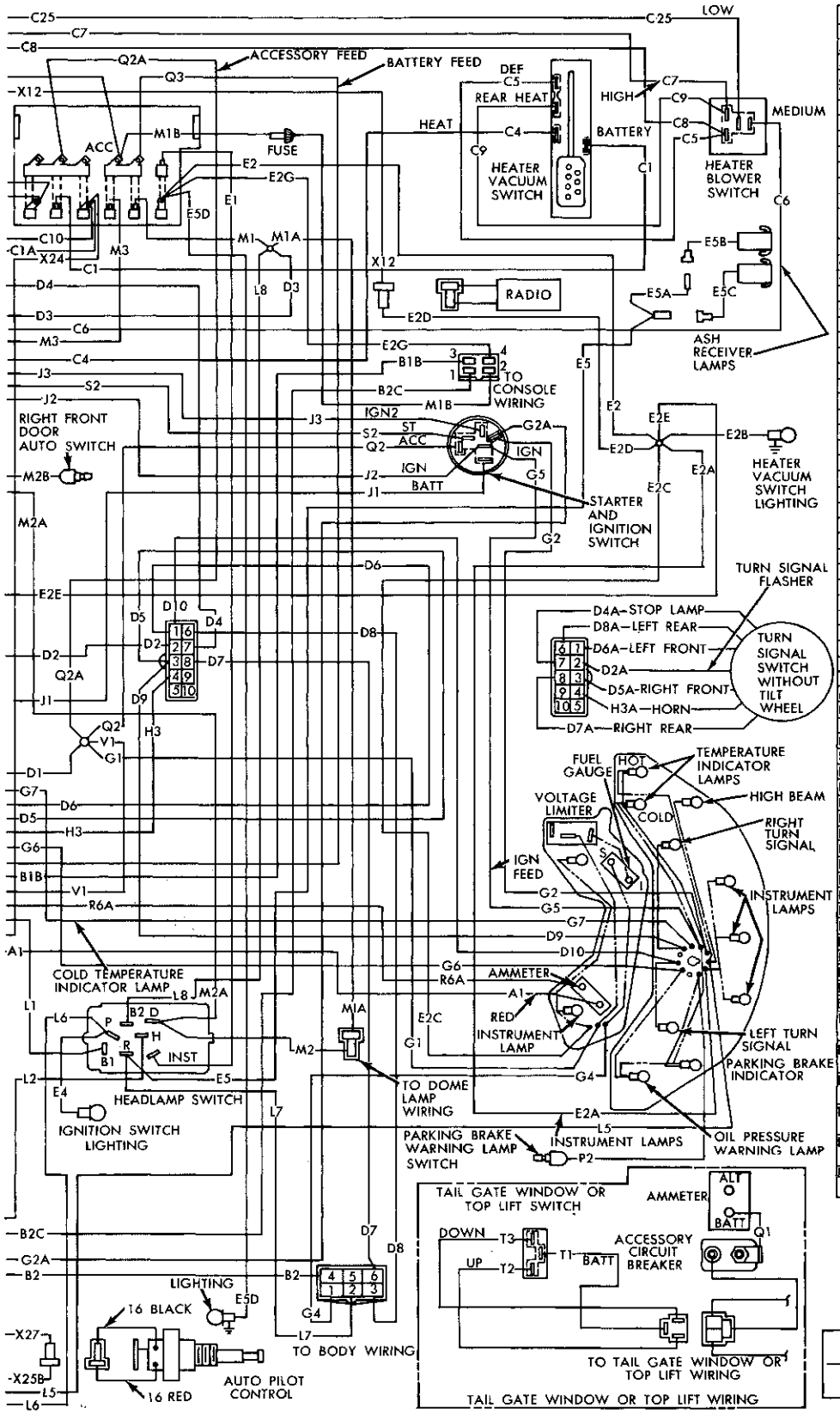


Fig. 1—Instrument Panel Wiring—Models AC-1, AC-2, AC-3



CIRCUITS			CIRCUITS		
CIR	GA	COLOR	CIR	GA	COLOR
A1	12	RED	G1	18	BLACK
A1A	16	BLACK	G2	18	VIOLET
B1	18	WHITE	G2A	18	VIOLET
B1A	18	WHITE	G4	18	DARK BLUE
B1B	18	WHITE	G5	18	DARK BLUE
B1C	18	WHITE	G6	18	GRAY
B1D	18	WHITE	G7	18	DARK GREEN
B2	18	VIOLET	H1	20	BLACK
B2A	18	VIOLET	H3	18	BLACK WITH TRACER
B2B	18	VIOLET			
B2C	18	VIOLET	H3A	18	BLACK
C1	14	BLACK WITH TRACER	H3B	18	BLACK
			J1	12	RED
C1A	16	LIGHT GREEN	J2	16	DARK BLUE
C2	18	LIGHT BLUE	J3	14	BROWN
C4	16	BROWN	L1	16	BLACK WITH TRACER
C4A	16	BROWN			
C5	16	DARK GREEN	L2	16	LIGHT GREEN
C5A	16	DARK GREEN	L3	16	RED
C5B	16	DARK GREEN	L4	16	BLACK
C6	16	LIGHT GREEN	L5	18	RED
C6A	16	LIGHT GREEN	L6	18	YELLOW WITH TRACER
C7	16	TAN			
C8	16	DARK GREEN	L7	18	BLACK
C9	16	TAN	L8	18	PINK
C10	18	LIGHT GREEN	M1	18	PINK
C11	18	BLACK	M1A	18	PINK
C12	18	WHITE	M1B	16	PINK
C20	16	BROWN	M2	18	YELLOW
C22	16	DARK GREEN	M2A	18	YELLOW
C23	16	LIGHT GREEN	M2B	18	YELLOW
C23A	16	LIGHT GREEN	M3	16	RED
C25	16	VIOLET	M3A	18	PINK
D1	18	BLACK	M3B	16	PINK
D2	18	RED	M3C	16	PINK
D2A	18	RED	M3D	18	PINK
D2B	18	RED	M4	18	YELLOW
D3	18	PINK	M4A	18	YELLOW
D4	18	WHITE	M5	18	PINK
D4A	18	WHITE	P2	18	LIGHT BLUE
D4B	18	WHITE	Q1	12	RED
D5	18	TAN	Q2	12	BLACK
D5A	18	TAN	Q2A	12	BLACK
D5B	18	TAN	Q3	12	RED WITH TRACER
D6	18	LIGHT GREEN			
D6A	18	LIGHT GREEN	R6	12	BLACK
D6B	18	LIGHT GREEN	R6A	12	BLACK
D7	18	BROWN	S2	18	YELLOW
D7A	18	BROWN	T1	12	RED
D7B	18	BROWN	T2	12	BROWN
D8	18	DARK GREEN	T3	12	YELLOW
D8A	18	DARK GREEN	V1	16	PINK
D8B	18	DARK GREEN	V3	16	BLACK WITH TRACER
D9	18	TAN			
D10	18	LIGHT GREEN	V4	16	RED
E1	18	TAN	V5	16	YELLOW
E2	18	ORANGE	V6	16	DARK BLUE
E2A	18	ORANGE	V10	18	TAN WITH TRACER
E2B	18	ORANGE			
E2C	18	ORANGE	X1	16	RED
E2D	18	ORANGE	X11	18	BLACK
E2E	18	ORANGE	X12	18	RED
E2G	18	ORANGE	X13	18	BROWN
E4	18	YELLOW WITH TRACER	X14	18	YELLOW
			X21	18	GRAY
E5	18	ORANGE WITH TRACER	X24	16	RED
			X25	16	RED
E5A	18	ORANGE WITH TRACER	X25A	16	RED
			X25B	16	RED
E5B	18	ORANGE WITH TRACER	X26	16	LIGHT BLUE
			X27	16	BLACK
E5C	18	ORANGE WITH TRACER			
E5D	18	ORANGE WITH TRACER			

Fig. 1—Instrument Panel Wiring—Models AC-1, AC-2 and AC-3

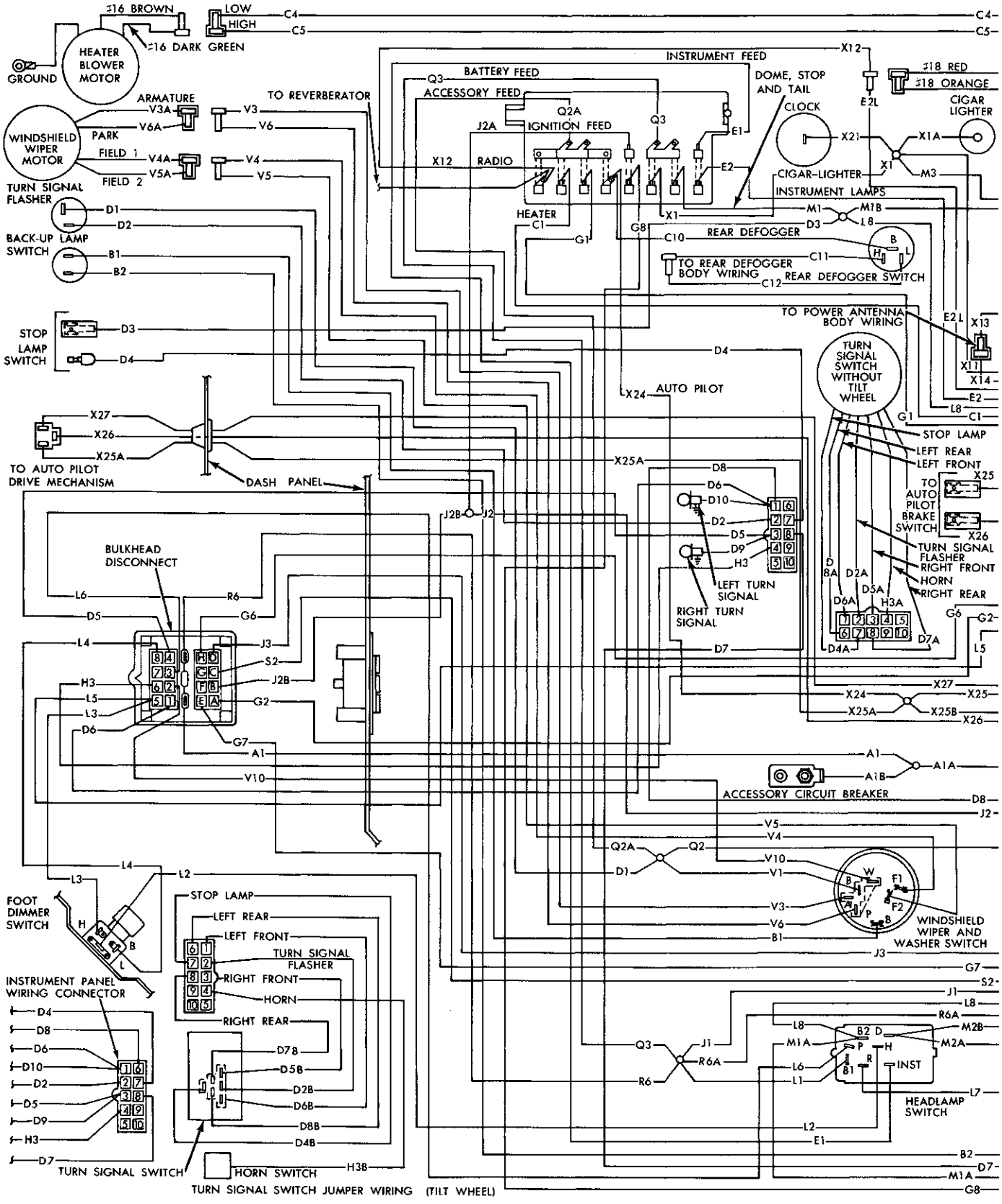
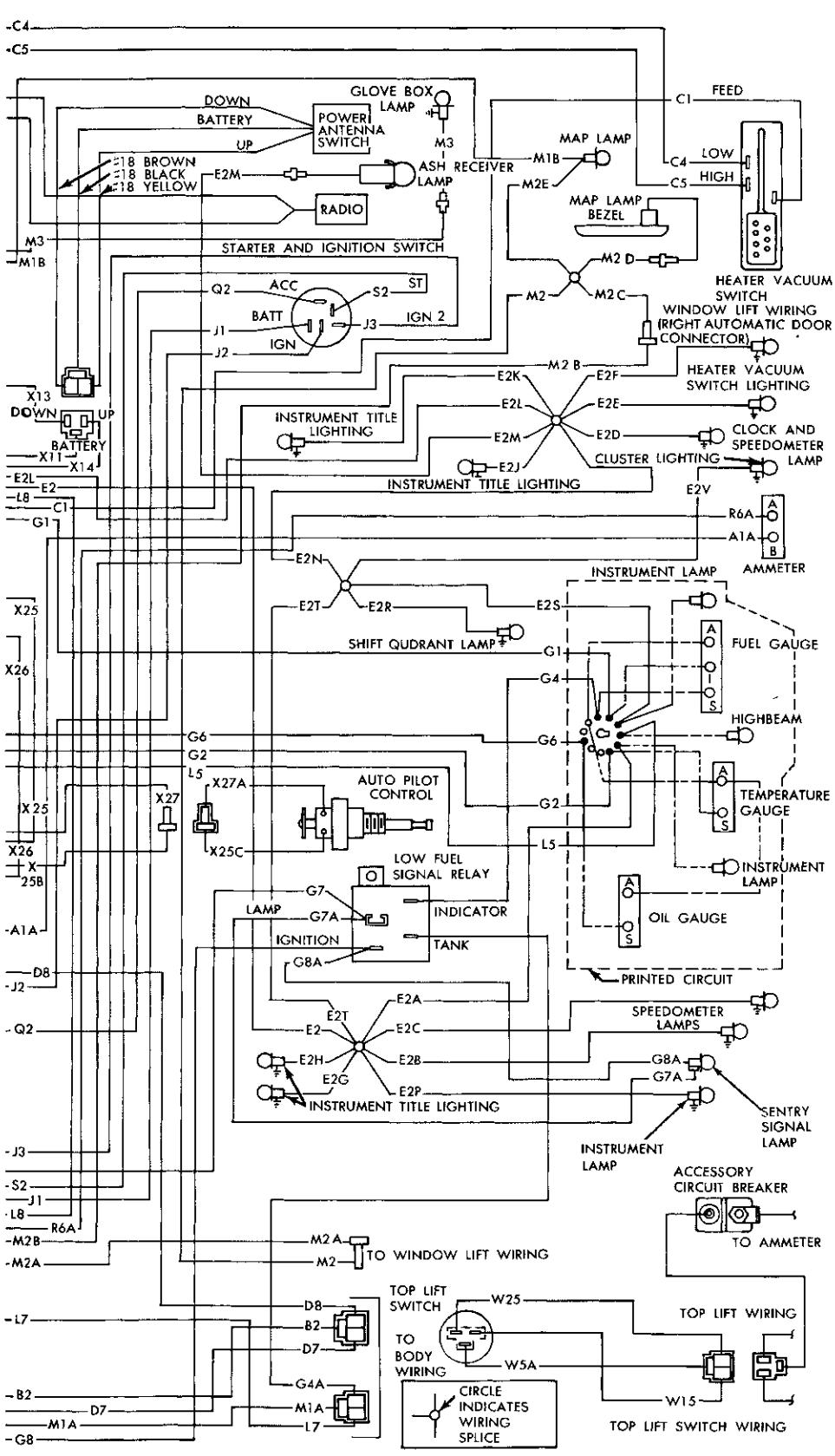


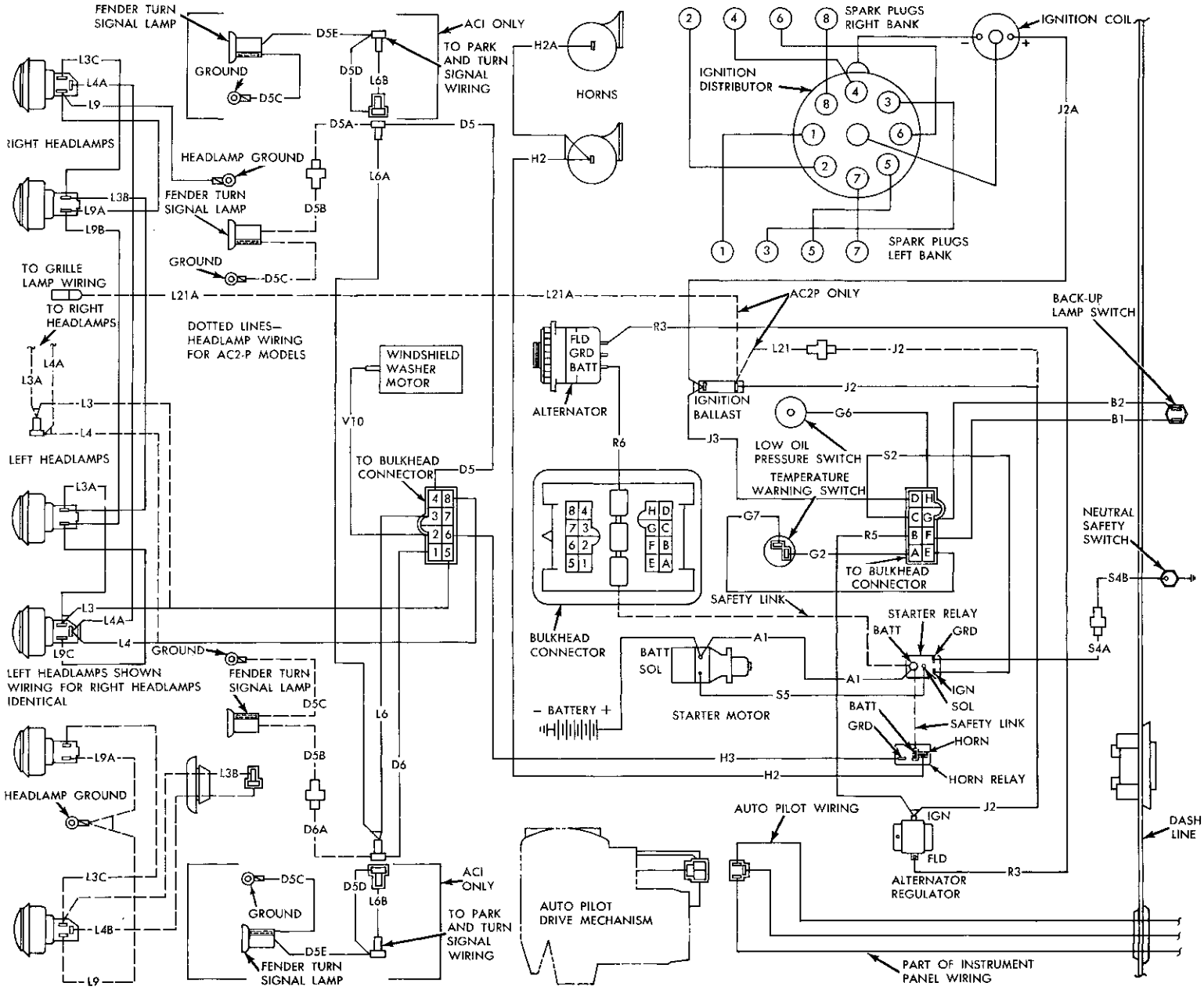
Fig. 2—Instrument Panel Wiring—Models AY-1



CIRCUITS			CIRCUITS		
CIR	GA	COLOR	CIR	GA	COLOR
A1	12	RED	H3	18	BLACK WITH TRACER
A1A	12	RED			
A1B	12	RED	H3A	18	BLACK
B1	18	WHITE	H3B	18	BLACK
B2	18	VIOLET	J1	12	RED
C1	14	BLACK WITH TRACER	J2	12	DARK BLUE
			J2A	12	DARK BLUE
C2	16	LIGHT GREEN	J2B	12	DARK BLUE
C2A	18	LIGHT BLUE	J3	12	BROWN
C4	16	BROWN	L1	12	BLACK WITH TRACER
C4A	16	BROWN			
C4B	16	BROWN	L2	16	LIGHT GREEN
C4C	16	BROWN	L3	16	RED
C4D	16	BROWN	L4	16	BLACK
C5	16	DARK GREEN	L5	18	RED
C5A	16	BLACK	L6	18	YELLOW WITH TRACER
C5B	16	DARK GREEN			
C5C	16	DARK GREEN	L7	18	BLACK
C5D	16	BLACK	L8	18	PINK
C10	18	LIGHT GREEN	M1	18	PINK
C11	18	BLACK	M1A	18	PINK
C12	18	WHITE	M1B	18	PINK
C20	14	BROWN	M2	18	YELLOW
C22	14	DARK GREEN	M2A	18	BROWN
C23	14	LIGHT GREEN	M2B	18	BROWN
C23A	14	LIGHT GREEN	M2C	18	YELLOW
D1	12	BLACK	M2D	18	YELLOW
D2	18	RED	M2E	18	YELLOW
D2A	18	RED	M3	18	PINK
D2B	18	WHITE	Q2	12	BLACK
D3	18	PINK	Q2A	12	BLACK
D4	18	WHITE	Q3	12	RED WITH TRACER
D4A	18	WHITE			
D4B	18	WHITE	R6	12	BLACK
D5	18	TAN	R6A	12	BLACK
D5A	18	TAN	S2	12	YELLOW
D5B	18	TAN	V1	12	PINK
D6	18	LIGHT GREEN	V3	18	BLACK WITH TRACER
D6A	18	LIGHT GREEN			
D6B	18	LIGHT GREEN	V3A	16	BLACK
D7	18	BROWN	V4	18	RED
D7A	18	BROWN	V4A	16	RED
D7B	18	BROWN	V5	18	YELLOW
D8	18	DARK GREEN	V5A	16	YELLOW
D8A	18	DARK GREEN	V6	18	DARK BLUE
D8B	18	DARK GREEN	V6A	16	DARK BLUE
D9	18	TAN	V10	18	TAN WITH TRACER
D10	18	LIGHT GREEN			
E1	18	TAN	W5A	12	RED
E2	18	ORANGE	W15	12	BROWN
E2A	18	ORANGE	W25	12	YELLOW
E2B	18	ORANGE	X1	16	RED
E2C	18	ORANGE	X1A	16	RED
E2D	18	ORANGE	X11	18	BLACK
E2E	18	ORANGE	X12	18	RED
E2F	18	ORANGE	X13	18	BROWN
E2G	18	ORANGE	X14	18	YELLOW
E2H	18	ORANGE	X21	18	GRAY
E2J	18	ORANGE	X24	16	RED
E2K	18	ORANGE	X25	16	RED
E2L	18	ORANGE	X25A	16	RED
E2M	18	ORANGE	X25B	16	RED
E2N	18	ORANGE	X25C	16	RED
E2P	18	ORANGE	X26	16	LIGHT BLUE
E2R	18	ORANGE	X27	16	BLACK
E2S	18	ORANGE	X27A	16	BLACK
E2T	18	ORANGE			
E2V	18	ORANGE			
G1	18	BLACK			
G2	18	VIOLET			
G4	18	DARK BLUE			
G4A	18	DARK BLUE			
G6	18	GRAY			
G7	18	GRAY WITH TRACER			
G7A	18	GRAY WITH TRACER			
G8	18	DARK BLUE WITH TRACER			
G8A	18	DARK BLUE WITH TRACER			

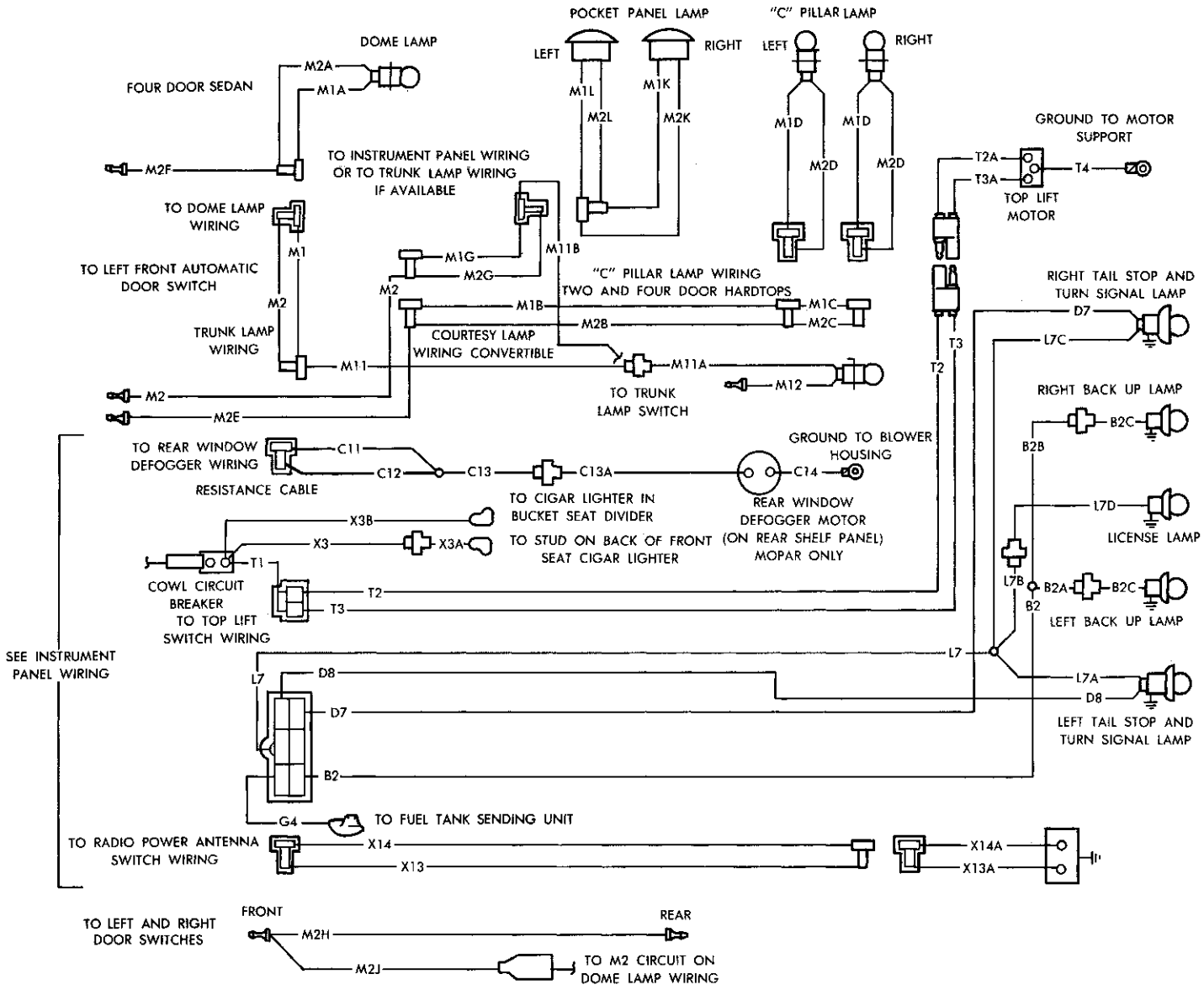
NK751

Fig. 2—Instrument Panel Wiring—Model AY-1



CIRCUITS		
CIR	GA	COLOR
A1	12	RED
B1	18	BLACK WITH WHITE TRACER
B2	18	BLACK WITH WHITE TRACER
D5	18	TAN
D5A	18	TAN
D5B	18	LIGHT GREEN
D5C	18	BLACK
D5D	18	LIGHT GREEN
D5E	18	LIGHT GREEN
D6	18	LIGHT GREEN
D6A	18	LIGHT GREEN
G2	18	VIOLET
G6	18	GRAY
G7	18	DARK GREEN
H2	16	DARK GREEN
H2A	16	DARK GREEN
H3	18	BLACK WITH TRACER
J2	16	DARK BLUE
J2A	14	DARK BLUE
J3	14	BROWN
L3	16	RED
L3A	16	RED
L3B	16	RED
L3C	16	RED
L4	16	BLACK
L4A	16	BLACK
L4B	16	BLACK
L6	18	YELLOW WITH TRACER
L6A	18	YELLOW
L6B	18	YELLOW
L9	16	WHITE
L9A	16	WHITE
L9B	16	WHITE
L9C	16	WHITE
L21	16	BLACK
L21A	20	BLACK
R3	18	DARK GREEN
R5	16	DARK BLUE
R6	12	BLACK
S2	18	YELLOW
S4A	16	BROWN
S4B	16	BROWN
S5	12	BLACK
V10	18	BLACK
V10	18	TAN WITH TRACER

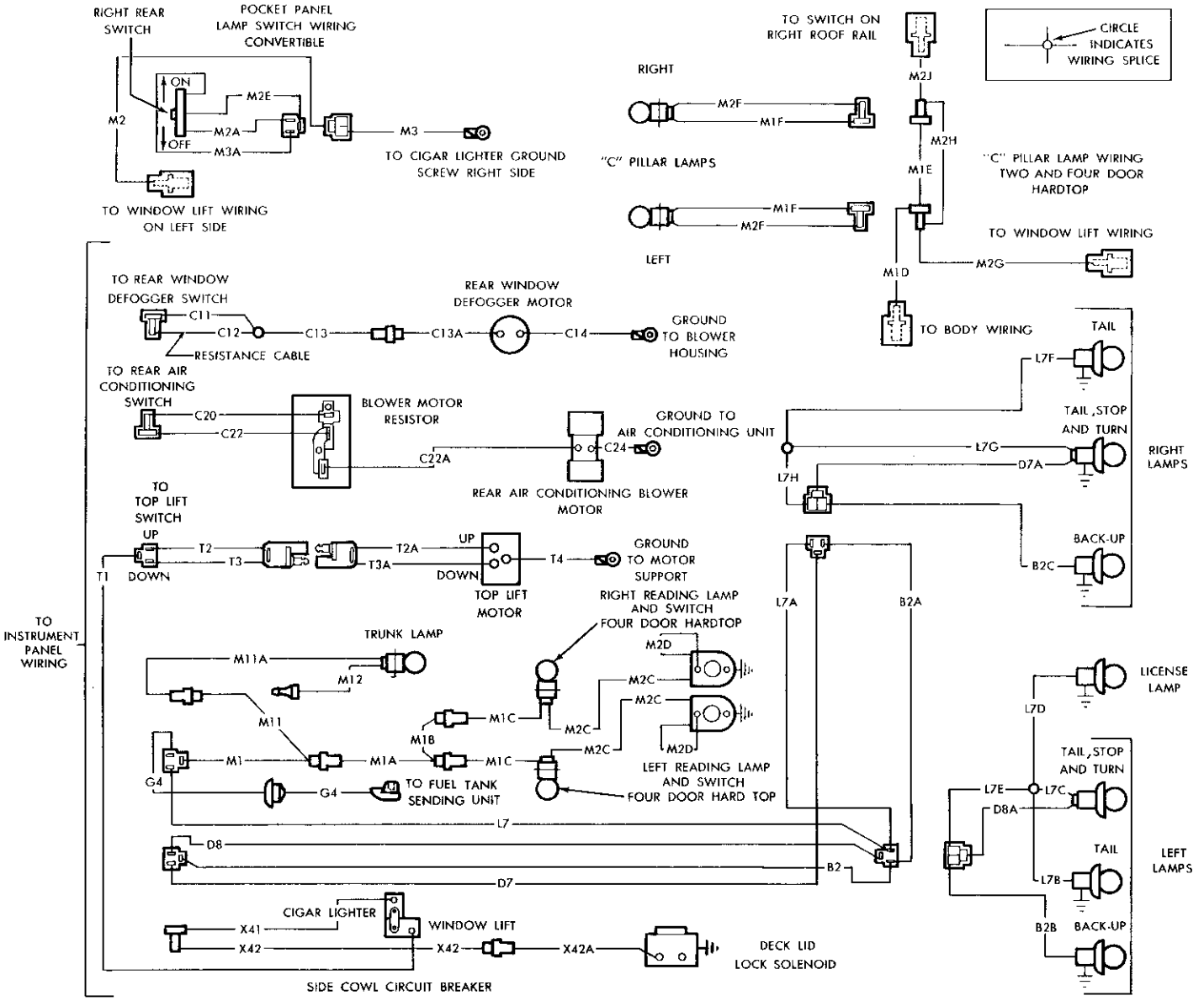
Fig. 3—Engine Compartment Wiring—Models AC-1, AC-2 and AC-3



CIRCUITS		
CIR.	GA.	COLOR
B2	18	VIOLET
B2A	18	VIOLET
B2B	18	VIOLET
B2C	18	VIOLET
C11	18	BLACK
C12	20	WHITE
C13	18	BLACK
C13A	14	BLACK
C14	14	BLACK
D7	18	BROWN
D8	18	DARK GREEN
G4	18	DARK BLUE
L7	18	BLACK
L7A	18	BLACK
L7B	18	BLACK
L7C	18	BLACK
L7D	18	BLACK
M1	18	PINK
M1A	18	PINK
M1B	18	PINK
M1C	18	PINK
M1D	18	PINK
M1G	18	PINK
M1K	18	PINK
M1L	18	PINK
M2	18	YELLOW
M2A	18	YELLOW
M2B	18	YELLOW
M2C	18	YELLOW
M2D	18	YELLOW
M2E	18	YELLOW
M2F	18	YELLOW
M2K	18	YELLOW
M2L	18	YELLOW
M2H	18	YELLOW
M2J	18	YELLOW
M2M	18	YELLOW
M11	18	BLACK
M11A	18	BLACK
M12	18	BLACK
M11B	18	BLACK
T1	12	RED
T2	12	BROWN
T2A	12	RED
T3	12	YELLOW
T3A	12	YELLOW
T4	12	BLACK
X3	14	LIGHT GREEN
X3A	14	LIGHT GREEN
X3B	14	LIGHT GREEN
X13	18	BROWN
X13A	18	BROWN
X14	18	YELLOW
X14A	18	YELLOW

NK 318

Fig. 4—Body Wiring—Models AC-1, AC-2 and AC-3



CIRCUITS		
CIR.	GA.	COLOR
B2	18	VIOLET
B2A	18	VIOLET
B2B	18	VIOLET
B2C	18	VIOLET
C11	18	BLACK
C12	20	WHITE
C13	18	BLACK
C13A	14	BLACK
C14	14	BLACK
C20	16	BROWN
C22	16	DARK GREEN
C22A	16	DARK GREEN
C24	16	BLACK
D7	18	BROWN
D7A	18	BROWN
D8	18	DARK GREEN
D8A	18	DARK GREEN
G4	18	DARK BLUE
L7	18	BLACK
L7A	18	BLACK
L7B	18	BLACK
L7C	18	BLACK
L7D	18	BLACK
L7E	18	BLACK
L7F	18	BLACK
L7G	18	BLACK
L7H	18	BLACK
M1	18	PINK
M1A	18	PINK
M1B	18	PINK
M1C	18	PINK
M1D	18	PINK
M1E	18	PINK
M1F	18	PINK
M2	18	BROWN
M2A	18	BROWN
M2B	18	YELLOW
M2C	18	YELLOW
M2D	18	YELLOW
M2E	18	BROWN
M2F	18	BROWN
M2G	18	BROWN
M2H	18	BROWN
M2J	18	BROWN
M3	16	WHITE
M3A	18	WHITE
M11	18	BLACK
M11A	18	BLACK
M12	12	BLACK
T1	12	RED
T2	12	BROWN
T2A	12	RED
T3	12	YELLOW
T3A	12	YELLOW
T4	12	BLACK
X41	16	RED
X42	16	BLACK
X42A	18	PINK

NK 867

Fig. 5—Body Wiring—Model AY-1

CIRCUITS		
CIR.	GA.	COLOR
W1	12	TAN
W1A	12	TAN
W1B	14	TAN
W2	14	YELLOW
W2A	12	YELLOW
W2B	14	YELLOW
W3	14	YELLOW
W4	14	YELLOW
W4A	14	YELLOW
W8	12	BLACK
W11	14	DARK BLUE
W12	14	PINK
W12A	14	PINK
W13	14	ORANGE
W14	14	GRAY
W14A	14	GRAY
W14B	14	GRAY
W21	14	BROWN
W22	14	VIOLET
W22A	14	VIOLET
W23	14	RED
W24	14	DARK GREEN
W24A	14	DARK GREEN
W24B	14	DARK GREEN
W30	14	DARK BLUE
W30A	14	DARK BLUE
W31	14	RED
W40	14	WHITE
W40A	14	WHITE
W41	14	DARK GREEN
X32	14	LIGHT GREEN
X32A	14	LIGHT GREEN
X32B	18	LIGHT GREEN
X32C	18	LIGHT GREEN
X32D	18	LIGHT GREEN
X32E	18	LIGHT GREEN
X32F	14	LIGHT GREEN
X32G	18	LIGHT GREEN
X33	14	ORANGE
X33A	14	ORANGE
X33B	14	ORANGE
X33C	14	ORANGE
X33D	14	ORANGE
X33E	14	ORANGE
X33F	16	ORANGE
X34	14	PINK
X34A	14	PINK
X34B	14	PINK
X34C	14	PINK
X34D	14	PINK
X34E	14	PINK
X34F	16	PINK
X35	18	ORANGE
X35A	18	ORANGE
X35B	18	ORANGE
X35C	18	ORANGE
X35D	18	ORANGE
X35E	18	ORANGE
X35F	18	ORANGE
X36	18	PINK
X36A	18	PINK

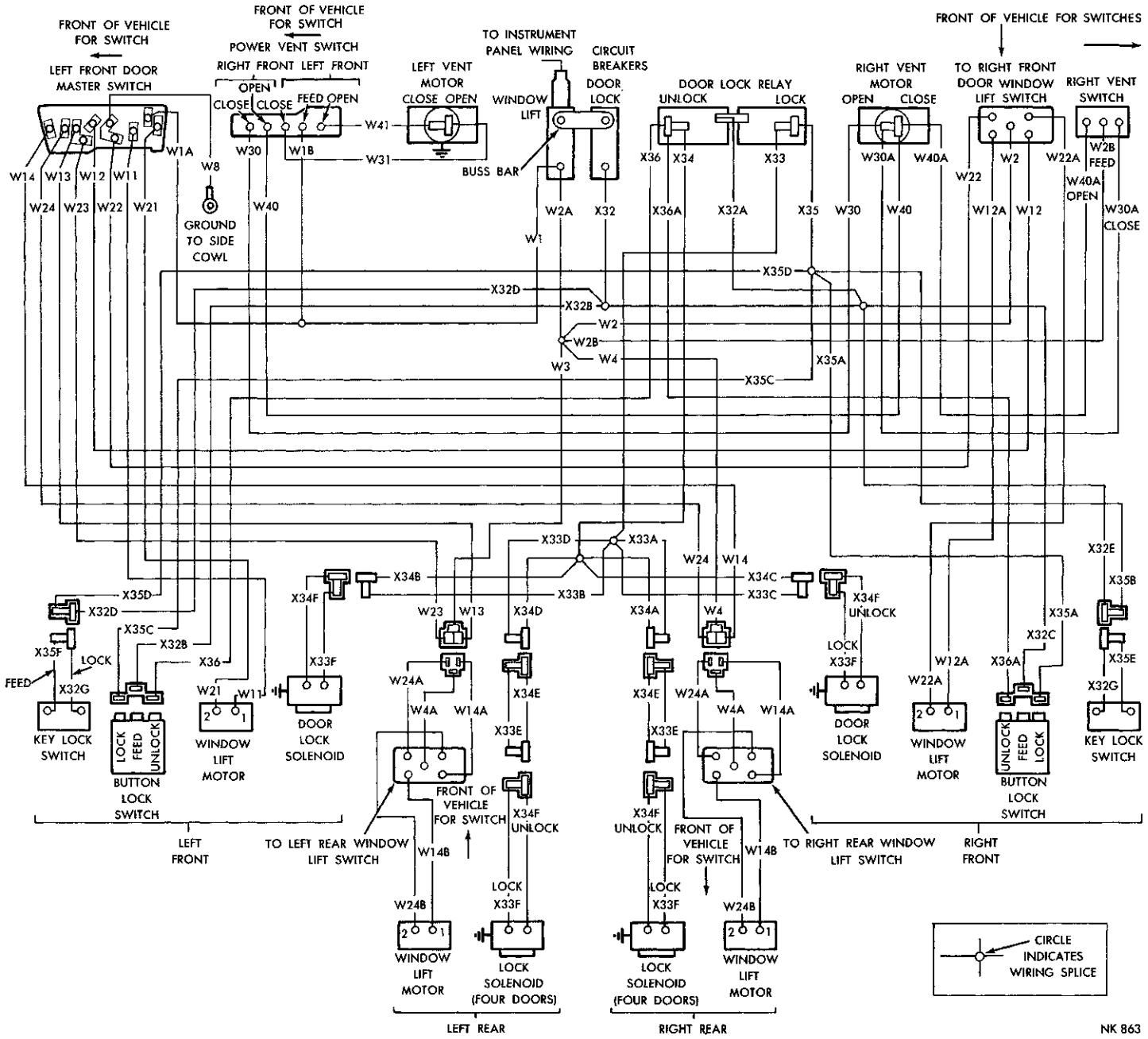
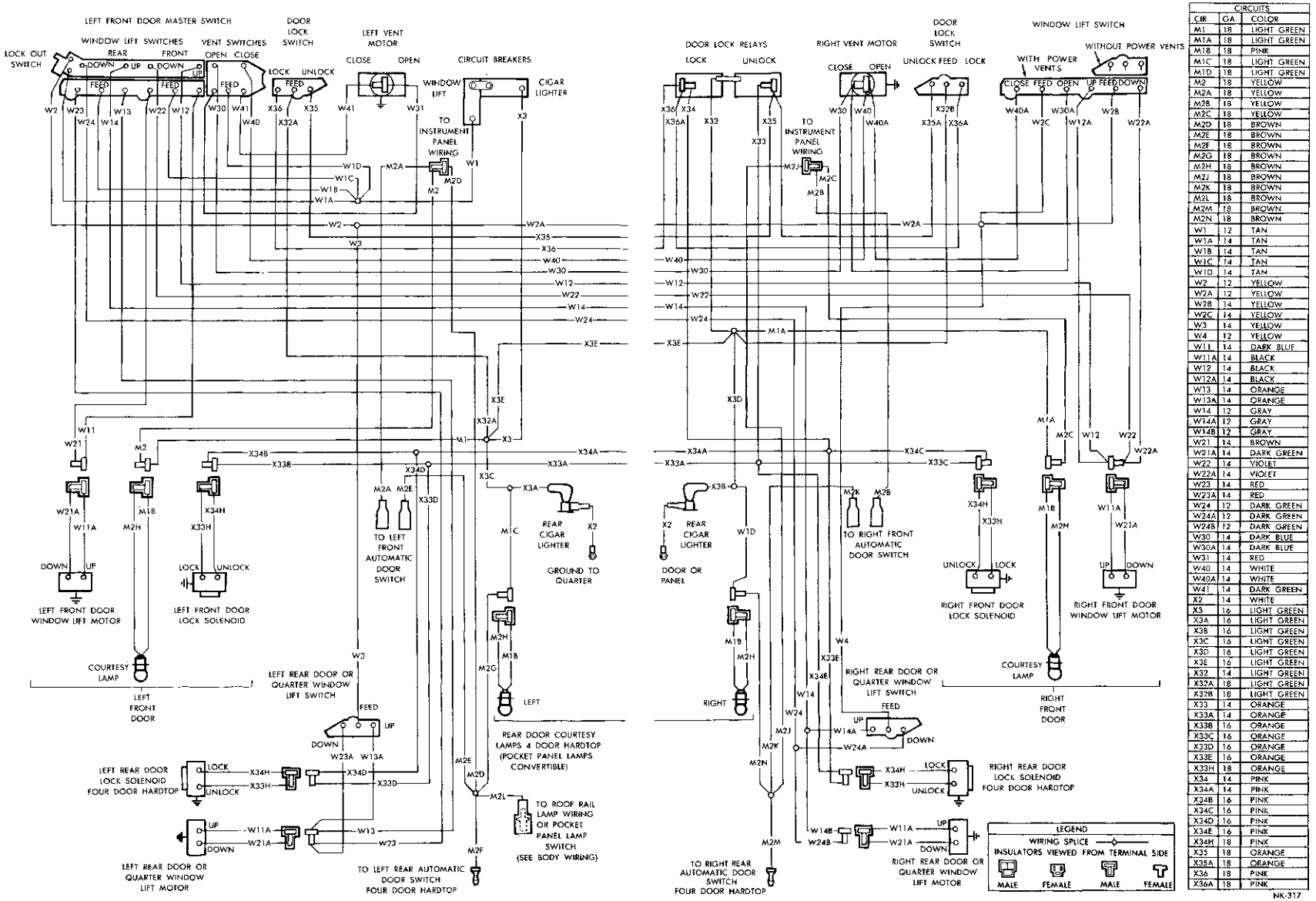
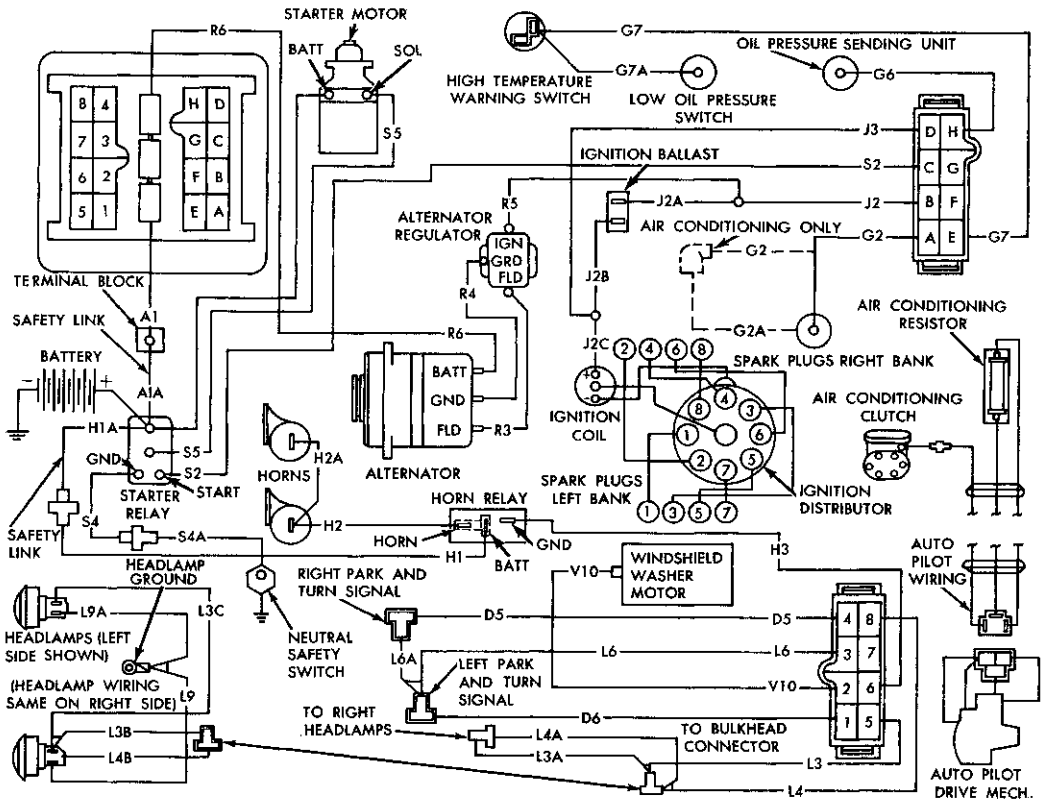


Fig. 6—Power Windows and Door Locks—Models AC-1, AC-2 and AC-3



CIRCUITS		
CIR.	GA.	COLOR
M1	18	LIGHT GREEN
M1A	18	LIGHT GREEN
M1B	18	PINK
M1C	18	LIGHT GREEN
M1D	18	LIGHT GREEN
M2	18	YELLOW
M2A	18	YELLOW
M2B	18	YELLOW
M2C	18	YELLOW
M2D	18	BROWN
M2E	18	BROWN
M2F	18	BROWN
M2G	18	BROWN
M2H	18	BROWN
M2J	18	BROWN
M2K	18	BROWN
M2L	18	BROWN
M2M	18	BROWN
M2N	18	BROWN
W1	12	TAN
W1A	14	TAN
W1B	14	TAN
W1C	14	TAN
W1D	14	TAN
W2	12	YELLOW
W2A	12	YELLOW
W2B	14	YELLOW
W2C	14	YELLOW
W3	14	YELLOW
W4	12	YELLOW
W11	14	DARK BLUE
W11A	14	BLACK
W12	14	BLACK
W12A	14	BLACK
W13	14	ORANGE
W13A	14	ORANGE
W14	12	GRAY
W14A	12	GRAY
W14B	12	GRAY
W21	14	BROWN
W21A	14	DARK GREEN
W22	14	VIOLET
W22A	14	VIOLET
W23	14	RED
W23A	14	RED
W24	12	DARK GREEN
W24A	12	DARK GREEN
W24B	12	DARK GREEN
W30	14	DARK BLUE
W30A	14	DARK BLUE
W31	14	RED
W40	14	WHITE
W40A	14	WHITE
W41	14	DARK GREEN
X2	14	WHITE
X3	16	LIGHT GREEN
X3A	16	LIGHT GREEN
X3B	16	LIGHT GREEN
X3C	16	LIGHT GREEN
X3D	16	LIGHT GREEN
X3E	16	LIGHT GREEN
X32	14	LIGHT GREEN
X32A	18	LIGHT GREEN
X32B	18	LIGHT GREEN
X33	14	ORANGE
X33A	14	ORANGE
X33B	16	ORANGE
X33C	16	ORANGE
X33D	16	ORANGE
X33E	16	ORANGE
X33H	18	ORANGE
X34	14	PINK
X34A	14	PINK
X34B	16	PINK
X34C	16	PINK
X34D	16	PINK
X34E	16	PINK
X34H	18	PINK
X35	18	ORANGE
X35A	18	ORANGE
X36	18	PINK
X36A	18	PINK

Fig. 7—Power Windows and Door Locks—Model AY-1



CIRCUITS		
CIR	GA	COLOR
A1	12	RED
A1A	16	DARK BLUE WITH TRACER
D5	18	TAN
D6	18	LIGHT GREEN
G2	18	VIOLET
G2A	18	VIOLET
G6	18	GRAY
G7	18	GRAY/ TRACER
G7A	18	DARK GREEN
H1	16	VIOLET
H1A	20	ORANGE WITH TRACER
H2	16	DARK GREEN
H2A	16	DARK GREEN
H3	18	BLACK WITH TRACER
J2	12	DARK BLUE
J2A	12	DARK BLUE
J2B	12	DARK BLUE
J2C	12	DARK BLUE
J3	12	BROWN
L3	16	RED
L3A	16	RED
L3B	16	RED
L3C	16	RED
L4	16	BLACK
L4A	16	BLACK
L4B	16	BLACK
L6	18	YELLOW WITH TRACER
L6A	18	YELLOW
L9	16	WHITE
L9A	16	WHITE
R3	18	DARK GREEN
R4	16	BROWN
R5	12	DARK BLUE
R6	12	BLACK
S2	12	YELLOW
S4	16	BROWN
S4A	16	BROWN
S5	12	BROWN
V10	18	TAN WITH TRACER

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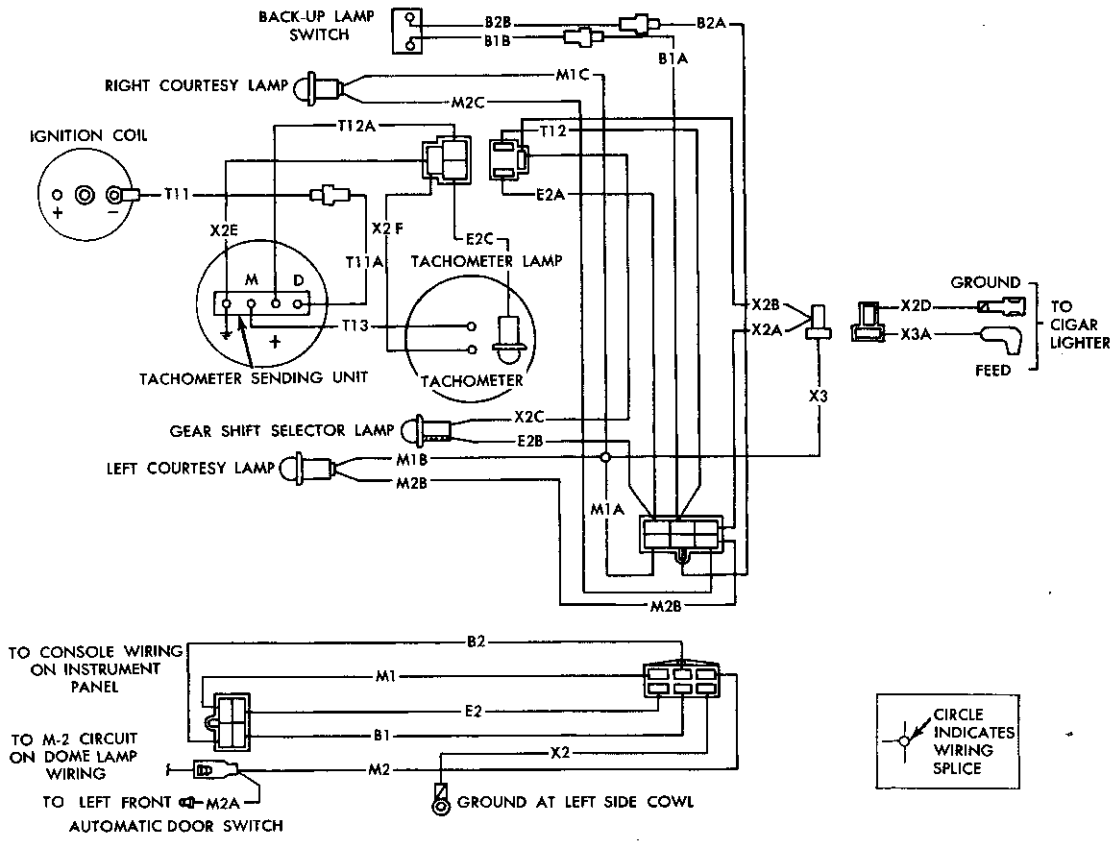
Fig. 8—Engine Compartment Wiring—Model AY-1



CIRCUITS		
CIR	GA	COLOR
B1	18	WHITE
B1A	18	WHITE
B1B	18	WHITE
B2	18	VIOLET
B2A	18	VIOLET
B2B	18	VIOLET
E2	18	ORANGE
E2A	18	ORANGE
E2B	18	ORANGE
E2C	18	ORANGE
M1	18	PINK
M1A	18	PINK
M1B	18	PINK
M1C	18	PINK
M2	18	YELLOW
M2A	18	YELLOW
M2B	18	YELLOW
M2C	18	YELLOW
T11	18	DARK GREEN
T11A	18	DARK GREEN
T12	18	DARK BLUE
T13	18	YELLOW
X2	18	BLACK
X2A	18	BLACK
X2B	18	BLACK
X2C	18	BLACK
X2D	18	BLACK
X2E	18	BLACK
X3	16	LIGHT GREEN

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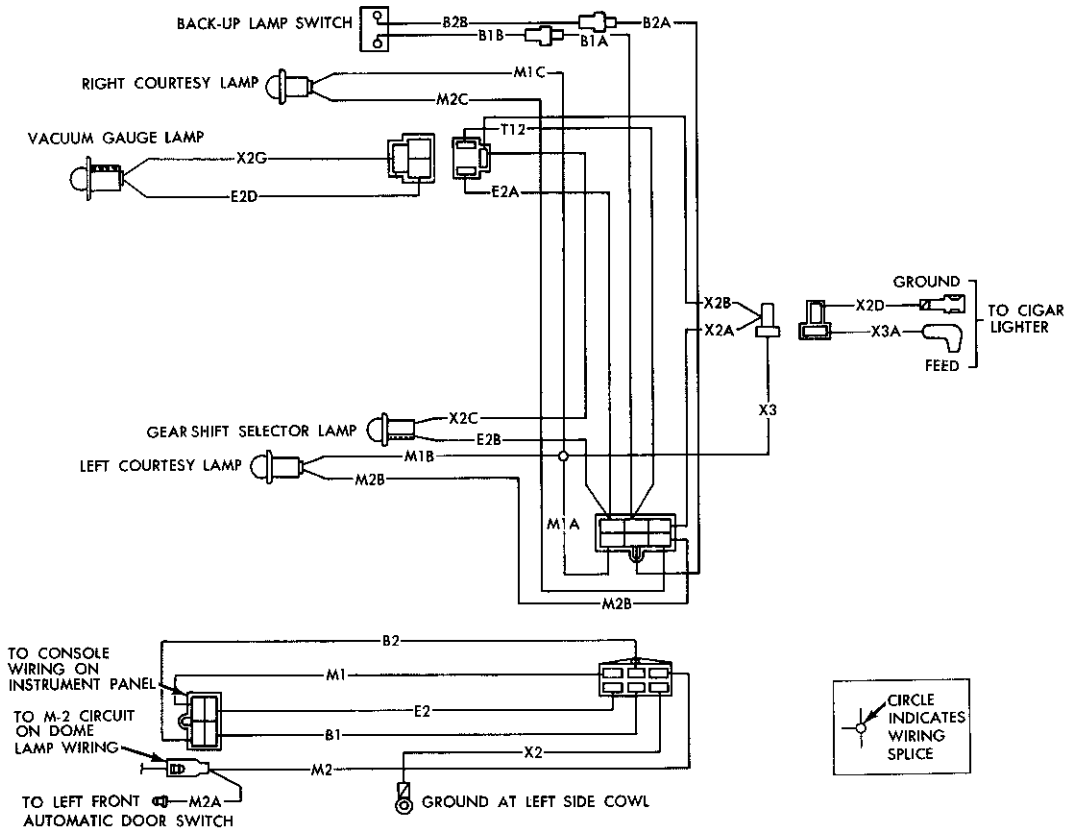
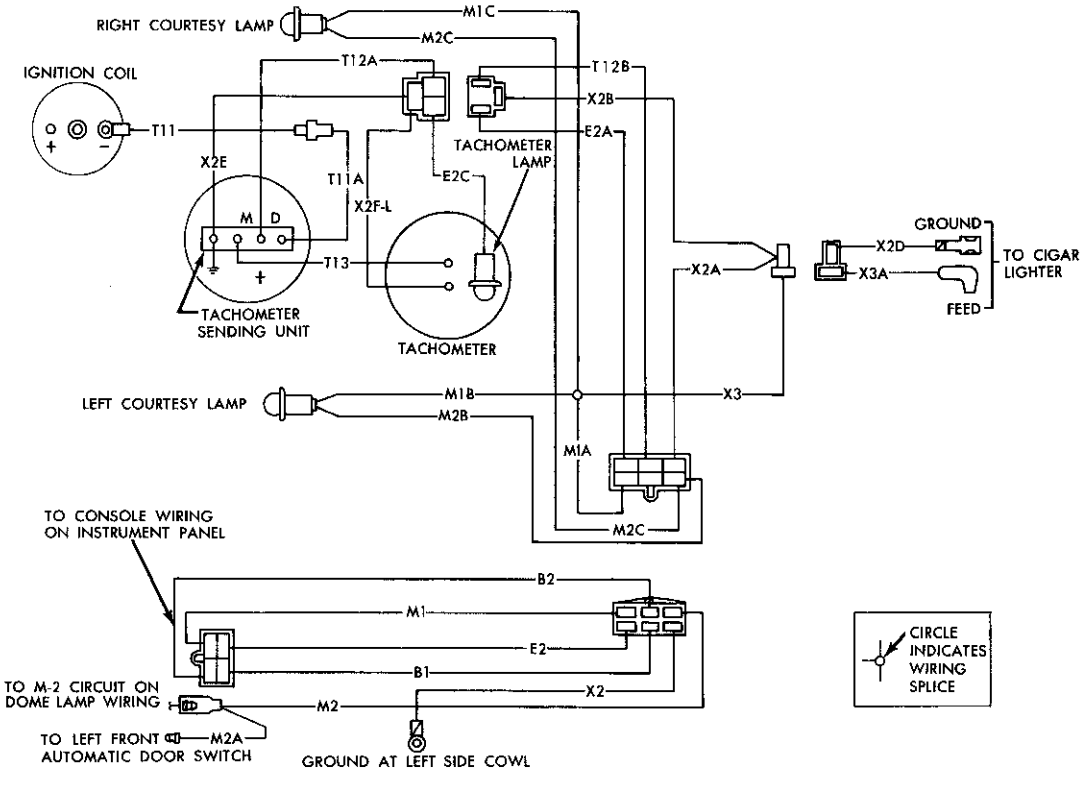
Fig. 9—Console Wiring—Automatic Transmission and Tachometer—Models AC-1, AC-2 and AC-3



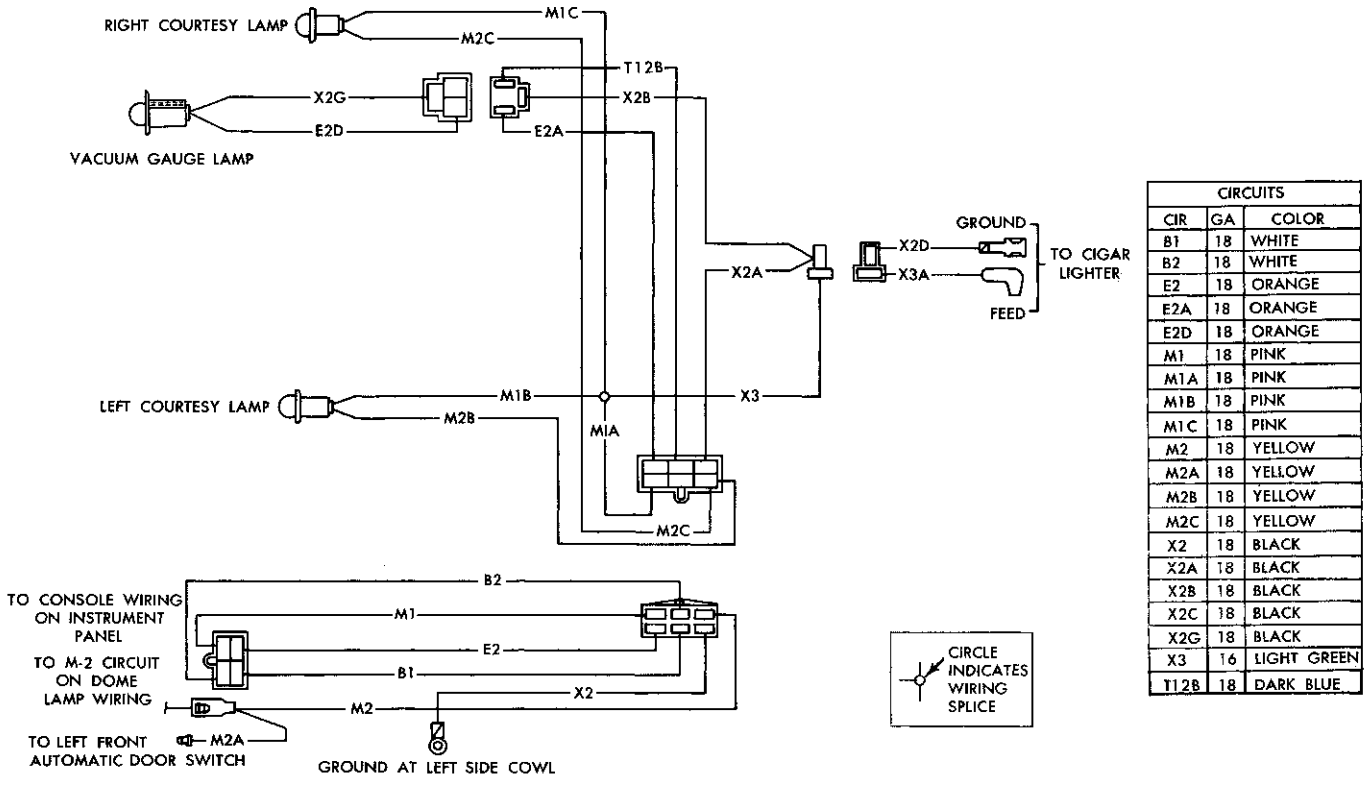
CIRCUITS		
CIR	GA	COLOR
B1	18	WHITE
B1A	18	WHITE
B1B	18	WHITE
B2	18	VIOLET
B2A	18	VIOLET
B2B	18	VIOLET
E2	18	ORANGE
E2A	18	ORANGE
E2B	18	ORANGE
E2D	18	ORANGE
M1	18	PINK
M1A	18	PINK
M1B	18	PINK
M1C	18	PINK
M2	18	YELLOW
M2A	18	YELLOW
M2B	18	YELLOW
M2C	18	YELLOW
T12	18	DARK BLUE
X2	18	BLACK
X2A	18	BLACK
X2B	18	BLACK
X2C	18	BLACK
X2G	18	BLACK
X3	16	LIGHT GREEN

Fig. 10—Console Wiring—Automatic Transmission and Vacuum Gauge—Models AC-1, AC-2 and AC-3



CIRCUITS		
CIR	GA	COLOR
B1	18	WHITE
B2	18	WHITE
E2	18	ORANGE
E2A	18	ORANGE
E2C	18	ORANGE
M1	18	PINK
M1A	18	PINK
M1B	18	PINK
M1C	18	PINK
M2	18	YELLOW
M2A	18	YELLOW
M2B	18	YELLOW
M2C	18	YELLOW
T11	18	DARK GREEN
T11A	18	DARK GREEN
T13	18	YELLOW
X2	18	BLACK
X2A	18	BLACK
X2B	18	BLACK
X2C	18	BLACK
X2D	18	BLACK
X2E	18	BLACK
X3	16	LIGHT GREEN

Fig. 11—Console Wiring—Manual Transmission and Tachometer—Models AC-1, AC-2 and AC-3



CIRCUITS		
CIR	GA	COLOR
B1	18	WHITE
B2	18	WHITE
E2	18	ORANGE
E2A	18	ORANGE
E2D	18	ORANGE
M1	18	PINK
M1A	18	PINK
M1B	18	PINK
M1C	18	PINK
M2	18	YELLOW
M2A	18	YELLOW
M2B	18	YELLOW
M2C	18	YELLOW
X2	18	BLACK
X2A	18	BLACK
X2B	18	BLACK
X2C	18	BLACK
X2G	18	BLACK
X3	16	LIGHT GREEN
T12B	18	DARK BLUE

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Fig. 12—Console Wiring Manual Transmission and Vacuum Gauge