

SECTION C

IGNITION SYSTEM

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DIVISION I SPECIFICATIONS AND ADJUSTMENTS

68-21 IGNITION SYSTEM SPECIFICATIONS

a. Ignition Coil and Resistor

| | |
|---|------------------------|
| Make | Delco-Remy |
| Coil Number (Less Bracket) | 1115202 |
| Current Draw, Amperes @ 12.6 Volts | |
| Engine Stopped | 3.8 |
| Engine Idling | 2.3 |
| Coil Resistance (Ohms) @ 80°F. | |
| Primary | 1.28 to 1.42 |
| Secondary | 7200 to 9500 |
| Resistance Wire | Part of Wiring Harness |
| Resistance, Ohms @ 80°F. | 1.80 ± .05 |
| Voltage at Coil (Ignition On and Points Closed) | 5 to 5.5 |

b. Spark Plugs

| | 250 Eng. | 350 Eng. | 400-430 Eng. |
|---|--------------|------------|--------------|
| Make and Model (for Normal Operation) | AC R46N | AC R45TS | AC R44TS |
| Thread and Shell Hex. Sizes | 14MM, 13/16" | 14MM, 5/8" | 14MM, 5/8" |
| Terminal Nut Length | 3/8" | 3/8" | 3/8" |
| Gap at Points | .035" | .030" | .030" |
| Tightening Torque (lb. ft.) | 30 | 15 | 15 |

c. Distributor

| | |
|--|-----------------------------------|
| Make | Delco-Remy |
| Drive | From Camshaft |
| Rotation, Top View | Clockwise |
| Vacuum Control Number (L-6 Engine) | 1116217 |
| Vacuum Control Number (All V-8 Engines) | 1116210 |
| Firing Order (L-6 Engine) | 1-5-3-6-2-4 |
| Firing Order (All V-8 Engines) | 1-8-4-3-6-5-7-2 |
| Contact Point Opening and Dwell Angle | |
| L-6 | .019", $32^{\circ} \pm 2^{\circ}$ |
| V-8 | .016", $30^{\circ} \pm 1^{\circ}$ |
| Dwell Variation | 3° Max. |
| Breaker Arm Spring Tension, Ounces | 19 to 23 |
| Condenser Make and Capacity, Microfarads | Delco-Remy, .18 to .23 |

| | 250 Eng. Man. Trans. | 250 Eng. Auto. Trans. | 350 Eng. 2-B. Carb. | 350 Eng. 4-B. Carb. | 400-430 Eng. |
|---|-------------------------|--------------------------|------------------------|------------------------|-----------------|
| Distributor Number (less Cap) | 1110463 | 1110464 | 1111938 | 1111334 | 1111335 |
| Timing, Crankshaft Degrees (with Vacuum Disconnected and Engine Idling) | 0° | 4° B.T.D.C. | 0° | 0° | 0° |
| Centrifugal Advance, Crankshaft Degrees and RPM | | | | | |
| Start Advance, (a RPM) | 800-1000 | 800-1000 | 750-950 | 1000-1200 | 1000-1200 |
| Medium Advance, Degrees (a RPM) | 19-23 @ 1950 | 15-19 @ 1950 | 19-23 @ 1950 | 17-21 @ 1800 | 19-23 @ 1800 |
| Max. Advance, Degrees (a RPM) | 30-34 @ 4200 | 26-30 @ 4200 | 30-34 @ 4600 | 26-30 @ 4600 | 30-34 @ 4600 |
| Vacuum Advance, Crankshaft Degrees and Inches of Vac. | | | | | |
| Start Advance, (a In. of Vacuum) | 6-8 | 6-8 | 6-8 | 6-8 | 6-8 |
| Maximum Advance, Degrees (a In. of Vacuum) | 20-24 @ 17 | 20-24 @ 17 | 14-18 @ 16 | 14-18 @ 16 | 14-18 @ 16 |

DIVISION II**DESCRIPTION AND
OPERATION****68-22 IGNITION SYSTEM
DESCRIPTION AND
OPERATION****a. Ignition System Components**

The ignition system consists of the ignition switch, ignition coil resistance wire, ignition coil, ignition distributor, spark plugs, and the low and high tension wiring. Electrical energy is obtained from the battery while cranking and from the generator after the engine is running. These supply circuits must be considered part of the ignition system.

1. *Ignition Switch.* The ignition switch has five positions: (1) Acces-

sory, (2) Lock, (3) Off, (4) On and (5) Start. The key must be in the switch to turn it to any position other than Lock and the key can be removed only in the Lock position.

(a) In Accessory, a connection is made from the battery terminal to the accessory terminal of the switch to allow accessories such as the radio, power windows, windshield wiper and washer to be operated with the ignition, fuel gauge and indicator light circuits off.

(b) In Lock, no accessory supplied through the ignition switch can be operated. Also, the steering gear is locked in position, and the transmission is locked in Park (automatic transmission) or in Reverse (manual transmission).

(c) In Off, no electrical unit supplied through the ignition switch can be

operated. This position allows the ignition system and electrical accessories to be turned off without first locking the steering gear and shifting the transmission into Park (automatic transmission) or Reverse (manual transmission).

(d) In On, a connection is made from the battery terminal to the accessory terminal so that all ignition switch supplied accessories can be operated. Also the battery is connected to the resistance wire leading to the ignition coil. From this same terminal, a lead into the instrument cluster energizes the fuel gauge and indicator lights.

(e) In Start, all ignition switch supplied accessories are temporarily disconnected to reduce electrical load on the battery for better starting. A connection is made to the starter solenoid lead. The water

temperature and metal temperature light circuits are each temporarily grounded to provide a means of checking the light bulbs. When the ignition switch is released, a spring returns it to On.

2. Ignition Coil Resistance Wire. The ignition coil resistance wire is an integral part of the engine wiring harness. This resistance wire is connected between the ignition switch and the positive terminal of the coil. The resistance wire limits to a safe maximum the primary current flow through the coil and the distributor contact points, thereby protecting the contact points during slow speed operation when they are closed for longer intervals. It also protects against excessive build up of primary current when the ignition switch is closed with engine stopped and contact points closed.

When the ignition switch is in the Start position, and the starter is cranking, a connection is made from starter solenoid directly to the positive terminal of the ignition coil, by-passing the resistance. Elimination of the resistance overcomes the effects of reduced voltage due to cranking motor drain on the battery.

3. Ignition Coil. The oil filled ignition coil is mounted on the intake manifold, adjacent to the ignition distributor. The positive (+) terminal is connected to the ignition switch through the resistance wire, and is also connected directly to the starter solenoid to by-pass the resistance wire during cranking of engine.

The negative (-) terminal is connected to the distributor. The secondary (high tension) terminal is connected by a short cable to the center terminal in the distributor cap.

4. Ignition Distributor The ignition distributor is of the external adjustment type (except L-6 engine). It is driven clockwise directly from the camshaft through cast iron gears which are automatically lubricated by the engine oiling system. Contact point opening is adjusted through a

window in the distributor cap while the engine is idling. Any accurate dwell meter may be used. See paragraph 68-23 for adjustment procedure.

The distributor is of the single contact type with a 6 or 8-lobe cam. High speed operating efficiency of the engine is obtained under all speed and load conditions by the centrifugal advance mechanism, which is located above the circuit breaker cam inside the rotor, and the vacuum advance mechanism built into the distributor. See Figure 68-29 or 30.

The rotor tip is shortened for improved radio noise suppression; rotor to cap gap is now approximately .075".

The contact point set is replaced as one complete assembly. The service replacement contact set has the *breaker lever spring tension* and *point alignment adjusted* at the factory. Only the *point opening* requires adjusting after replacement.

5. Spark Plugs. AC spark plugs having 14MM threads, short (3/8")

terminals and .030" gaps are specified (L-6 - .035"). All spark plugs are of the resistor type and are identified by an "R" prefix. For service information on spark plugs and wires, see paragraph 68-25.

6. Radio Suppression. All secondary wiring has a resistance of approximately 2000 ohms per foot so that it is unnecessary to install a suppressor on the high tension cable when a radio is installed.

b. Ignition Operating Circuits

To clarify operating principles as well as to simplify the process of tracing troubles, the parts of the ignition system should be understood to provide two separate and distinct circuits, as follows:

1. The Primary Circuit carries the low voltage current supplied by the battery or generator. In addition to these sources of electrical energy, the primary circuit contains the ignition switch, ignition coil resistance wire, primary winding of the ignition coil, distributor contact points, condenser, and all connecting low tension wiring.

2. The Secondary Circuit carries the high voltage surges produced by the ignition coil, which result in high voltage spark between the electrodes of the spark plugs in engine cylinders. This circuit contains the secondary winding of the ignition coil, coil to distributor high tension lead, distributor rotor and cap, ignition cables, and spark plugs.

c. Cycle of Operation

When the ignition switch is turned on and the distributor contact points are closed, battery or generator current flows through the primary winding of the coil and through the contact points to ground. This flow of current through the primary winding of the coil produces a magnetic field around the coil windings and thereby stores electrical energy in the coil.

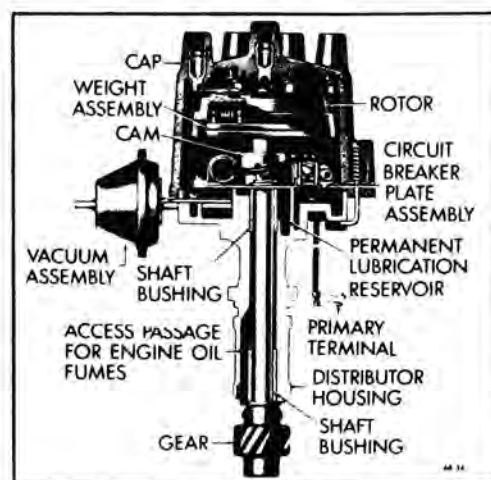


Figure 68-28 - Distributor and Cap Assembly - V-8 Engine

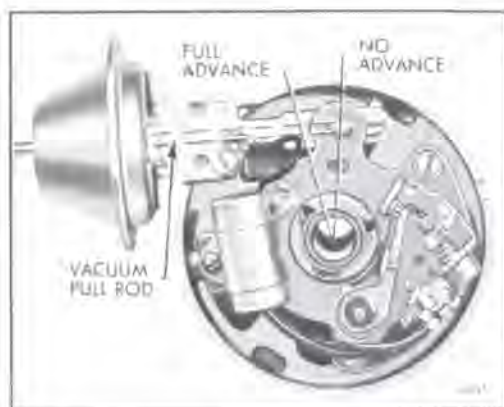


Figure 68-30 - Vacuum Advance Mechanism

movable breaker plate is held in position on the upper shaft bushing by a retainer. The vacuum unit is mounted on the distributor base and under the movable breaker plate so that the breaker plate can be rotated around the distributor cam by a link from the vacuum unit. See Figure 68-30.

The vacuum unit contains a spring-loaded diaphragm. The spring-

g-loaded side of the diaphragm is connected by a hose to an opening in the carburetor barrel. The opening is above the throttle valve at idle, so the vacuum advance unit will not begin to operate until the throttle is opened slightly, causing the edge of the throttle valve to move above the opening.

The vacuum at the opening acts on the control diaphragm, causing it to compress the spring and to rotate the breaker plate in a counterclockwise direction. This moves the contact points so that the distributor cam lobes open the points earlier in the compression stroke. The amount of throttle opening and the engine load determine the amount of intake manifold vacuum and thus the amount of spark advance obtained. The advance obtained by the vacuum control is added to the advance obtained by the centrifugal advance

mechanism as shown in Figures 68-31 through 68-34.

NOTE: Presence of engine fuel in vacuum operated components is not evidence of failed parts nor reason for parts replacement.

DIVISION III

SERVICE PROCEDURES

68-23 REPLACEMENT AND ADJUSTMENT OF DISTRIBUTOR CONTACT POINT SET - V-8 ENGINES

When inspection of the contact points shows replacement to be advisable, the following procedure should be used.

NOTE: The service replacement contact point set has the breaker spring tension and point alignment adjusted at the factory.

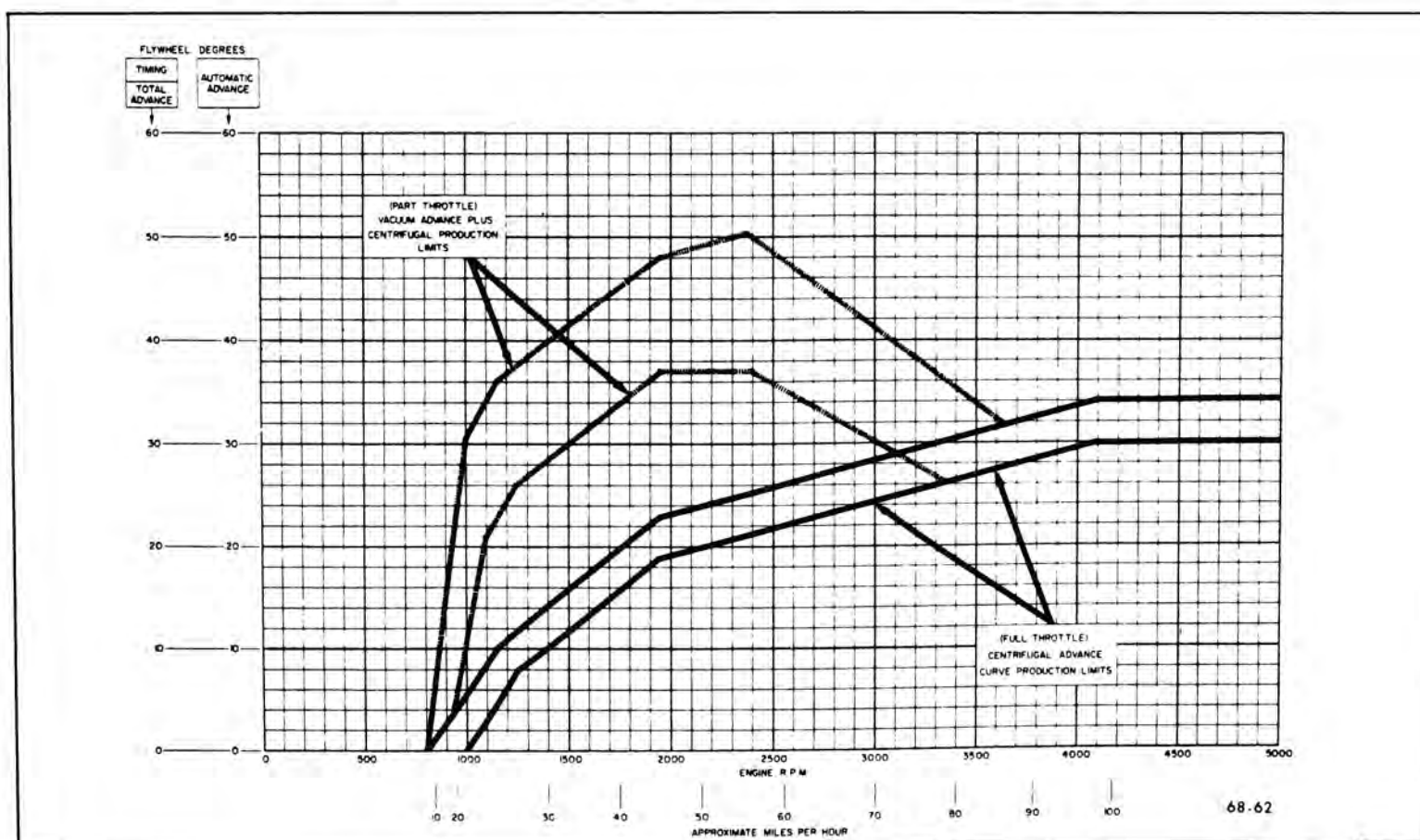


Figure 68-31 - Distributor Spark Advance Chart - 250 Engine With Manual Transmission

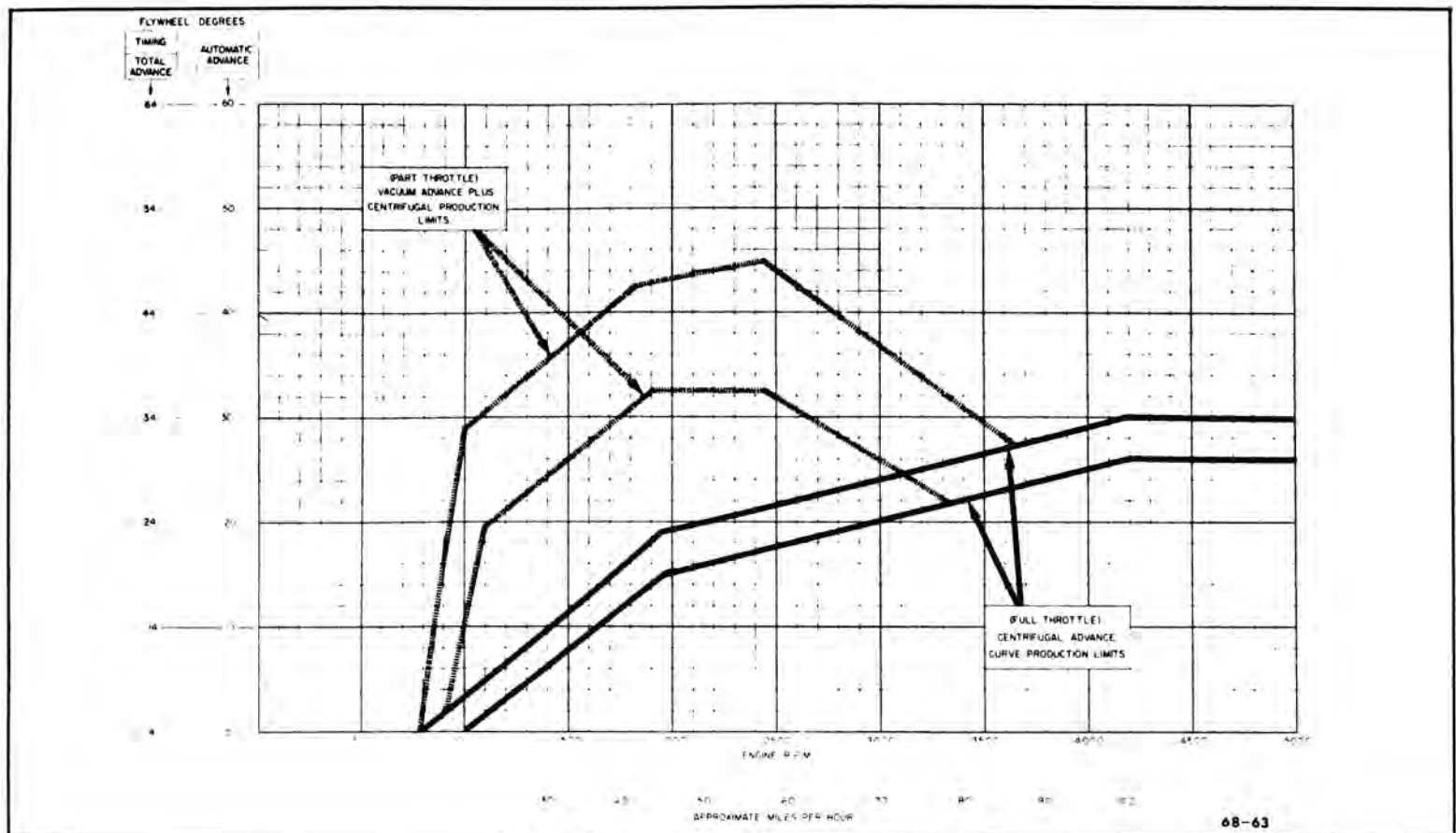


Figure 68-32 - Distributor Spark Advance Chart - 250 Engine With Automatic Transmission

a. Removal of Contact Point Set

1. Remove distributor cap by inserting a screwdriver in upper slotted end of cap retainers, press down and turn 90° counterclockwise. Push distributor cap aside and remove rotor.

2. Loosen two screws and lock washers which hold the contact point set in place. Then remove point set.

3. Disconnect the condenser and primary leads from their terminal by loosening the retaining screw. If there is no retaining screw, simply slip leads out.

b. Installation of Contact Point Set

1. Remove old cam lubricator wick and discard. Install a new lubricator, working it down over post by using a small nail in a circular direction around the post.

2. Install condenser and primary leads.

3. Slide contact point set over boss on breaker plate and under the two screw heads. Tighten two screws and lock washers.

NOTE: Leads must be properly positioned so they will not come in contact with bottom of weight base or rotor.

4. If engine does not start readily, position contact arm rubbing block on peak of cam lobe, insert a 1/8" Allen wrench in adjusting screw and turn screw in (clockwise) until contact points just close. Then back screw out (counterclockwise) 1/2 turn (180°) to obtain a point gap of approximately .016" for a preliminary setting.

c. Adjustment of Contact Points - Engine Running - V-8 Engines

NOTE: When adjusting contact point dwell angle, always follow the instructions which come with the dwell meter.

1. Connect dwell tester leads: red to distributor side of coil, black to ground.

2. Turn selector switch to position for 8-lobe cam (6-lobe cam for L-6). Turn ignition switch on.

3. Start engine. Lift adjustment window and insert 1/8" Allen wrench in adjusting screw. See Figure 68-36. Set dwell angle at 30 degrees.

4. After adjusting dwell angle, always check ignition timing.

68-24 IGNITION TIMING

a. L-6 Engines

The timing mark is a cut in the edge of the harmonic balancer. The timing indicator, a part of the timing chain cover, has a series of grooves which indicate one degree intervals. The "O" on the timing indicator is at T.D.C. and the "A" is at the five

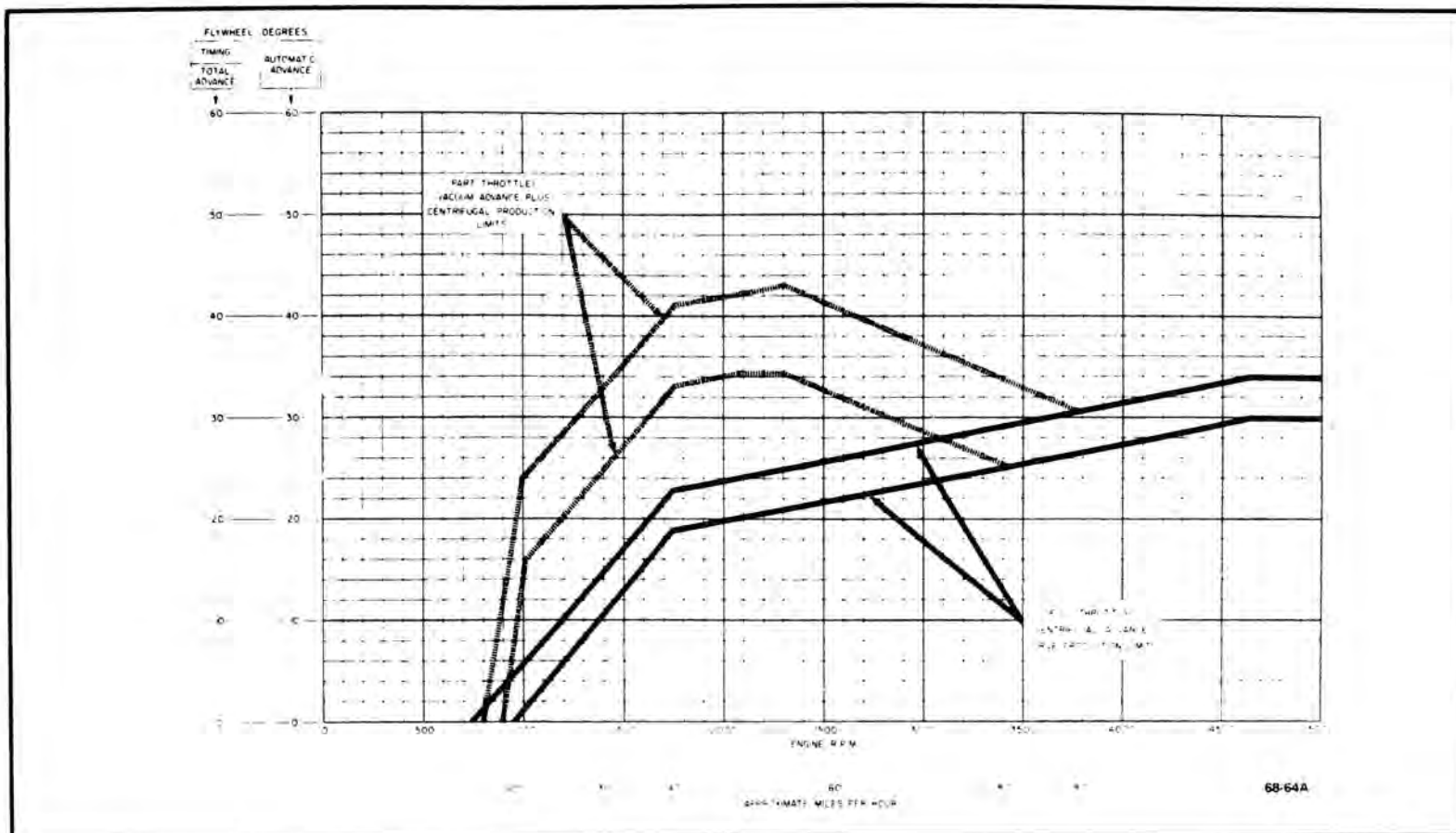


Figure 68-32A - Distributor Spark Advance Chart - 350 Engine With 2-Barrel Carburetor

degrees advance mark. See Figure 68-37.

The L-6 engine with a manual transmission is timed at "O" or T.D.C. The L-6 with an automatic transmission is timed at four degrees advance or one degree short of the "A" mark.

b. V-8 Engines

The timing mark is a groove filled with yellow paint, which is in the edge of the harmonic balancer. The timing indicator, a part of the timing chain cover, has ridges outlined with yellow paint. One of these ridges marked "O" indicates T.D.C. See Figure 68-38.

c. Preliminary Timing (Engine Won't Run)

To time the ignition on any engine which will run, use subparagraph b only. However, if the timing of an engine is completely off, the follow-

ing procedure must first be used to get the engine to run.

1. With No. 1 spark plug removed and with hole plugged, rotate crankshaft in a forward direction using a suitable wrench on the harmonic balancer to crankshaft bolt. When plug blows from No. 1 cylinder, continue rotation until timing mark on balancer is aligned with proper mark on timing indicator. See Figure 68-37 or 38. No. 1 cylinder is now in position to fire.

2. Install distributor in engine with rotor in position to fire No. 1 cylinder and with vacuum control in position to connect vacuum hose. See Figure 68-38. Install distributor clamp and bolt with lock washer, leaving bolt just loose enough to allow movement of distributor with hand pressure.

NOTE: If distributor does not seat in engine block, press down lightly on

distributor housing while cranking engine with starter. After distributor tang snaps into slot in oil pump shaft, start timing again from Step 1, leaving distributor installed.

3. Connect primary wire to coil.

4. Rotate distributor counterclockwise slightly until contact points just start to open.

CAUTION: This must be done very carefully or engine will not start.

5. Install distributor cap. Make sure that spark plug wires are correctly installed in distributor cap, through clips on rocker arm covers, and on spark plugs. See Figure 68-40 and 41.

d. Finish Timing (Engine Running)

Contact point dwell angle should always be checked before adjusting ignition timing.

1. Connect a 12-volt power timing light to No. 1 spark plug, following

the instructions of the instrument manufacturer.

CAUTION: Be careful not to puncture wire or boot as this would start a high voltage leak.

2. Connect a tach-dwell meter from distributor terminal of coil to ground.

3. Adjust contact point dwell angle. While engine is warming up, make certain that spark plug wires are pushed all the way down into the distributor cap terminal and onto the spark plugs. Nipples must be pushed firmly over the terminals and boots over the spark plugs. If any shock is received, secondary insulation is defective and must be replaced.

4. Leave engine running until upper radiator inlet is hot and choke valve is wide open. On automatic transmission cars, place a block in front of a front wheel and apply parking brake

firmly, then shift transmission into drive.

5. Adjust idle speed. See paragraph 64-2.

6. Disconnect vacuum hose from vacuum advance unit and plug with a pencil.

7. Direct beam of timing light on the timing indicator and edge of harmonic balancer. Turn distributor slowly until yellow mark on balancer is at "O" degree mark on timing indicator on any V-8 engine car or an L-6 manual transmission car. (L-6 automatic transmissions cars are timed at 4 degrees advance.) Tighten clamp bolt securely.

8. Recheck timing mark. Reset if necessary.

9. Recheck idle speed and mixture adjustments.

10. Reconnect vacuum hose.

68-25 SPARK PLUG AND WIRE SERVICE

a. Remove and Inspect Spark Plugs and Wires

1. To disconnect wires, pull only on boot because pulling on wire might cause separation of the core of the wire. Remove spark plugs and gaskets using a 13/16" deep socket on R46N plugs, or a 5/8 deep socket on R44TS or R45TS plugs. Use care in this operation to avoid cracking spark plug insulators.

2. Carefully inspect the insulators and electrodes of all spark plugs. Replace any spark plug which has a cracked or broken insulator. If the insulator is worn away around the center electrode, or the electrodes are burned or worn, the spark plug is worn out and should be discarded. Spark plugs which are in good condition except for carbon or oxide deposits should be thoroughly cleaned and adjusted.

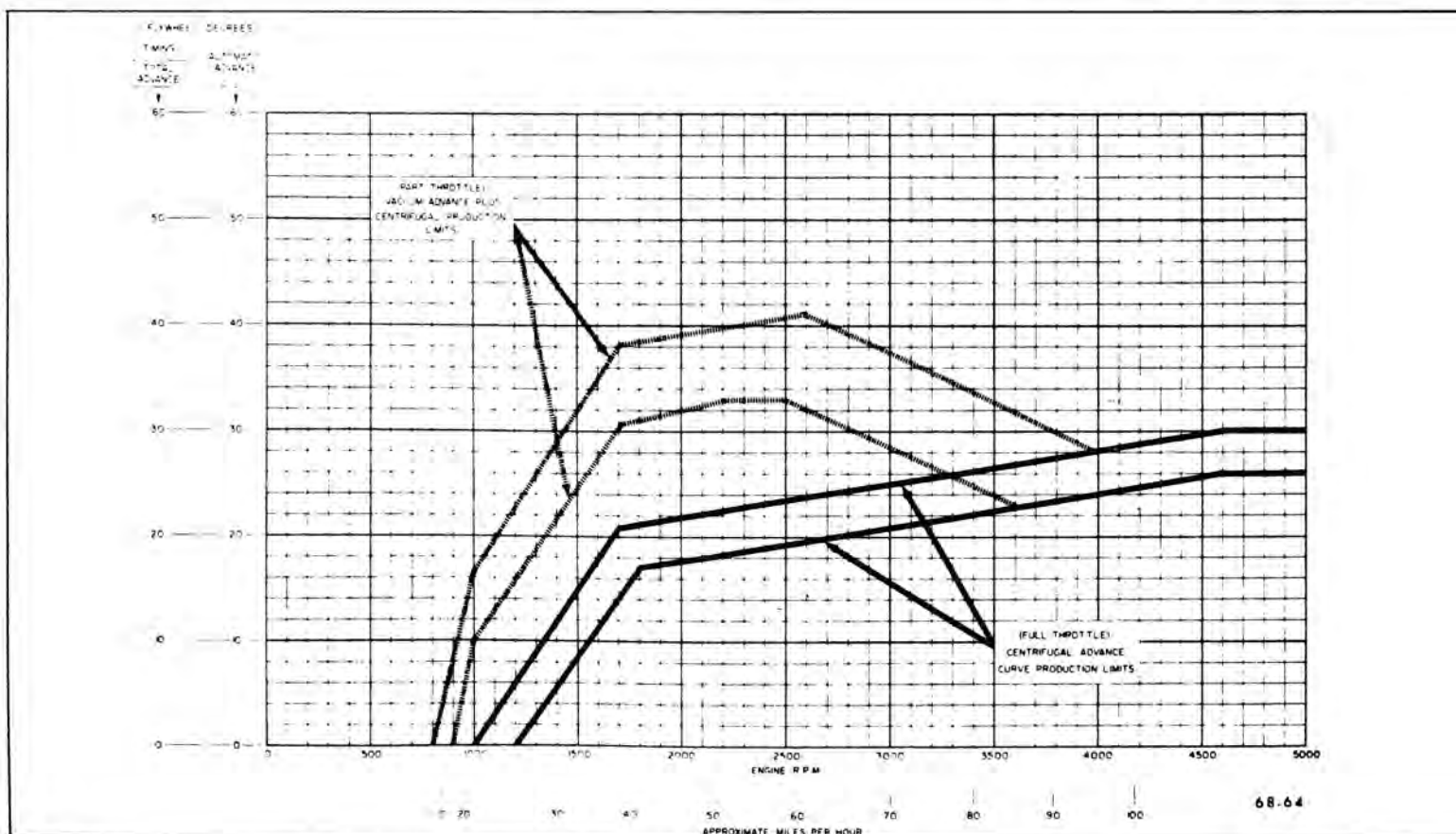


Figure 68-33 - Distributor Spark Advance Chart - 350 Engine With 4-Barrel Carburetor

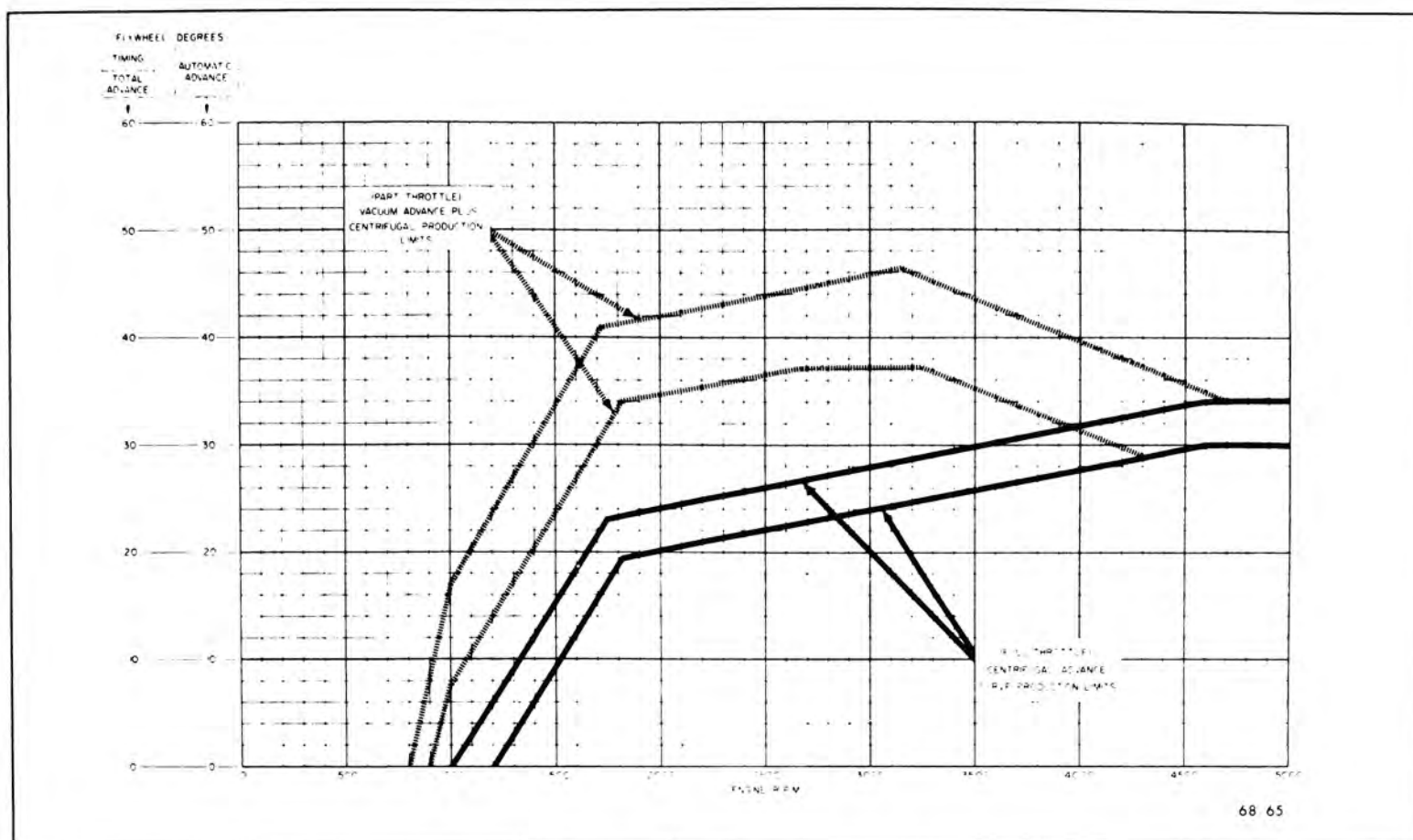


Figure 68-34 - Distributor Spark Advance Chart - 400 and 430 Engines

3. The spark plug wires are of a special resistance type. The core is carbon-impregnated linen. This wire is designed to eliminate radio and television interference radiation, but is also superior in resistance to cross-fire. The resistance type wire, however, is more easily damaged than copper core wire. For this reason care must be taken that the

spark plug wires are removed by pulling on the spark plug boots rather than on the wire insulation. Also, when it is necessary to replace a spark plug boot, the old boot should be carefully cut from the wire

and a small amount of silicone lubricant used to aid in installing the new boot. If the wire is stretched, the core may be broken with no evidence of damage on the outer insulation. The terminal may also pull off the wire. If the core is broken, it will cause missing. In the case of wire damage, it is necessary

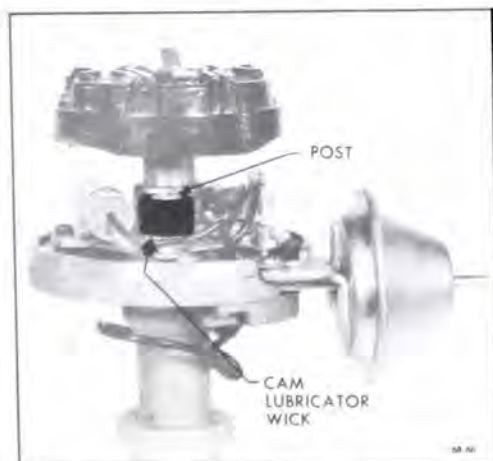


Figure 68-35 - Cam Lubricator Wick

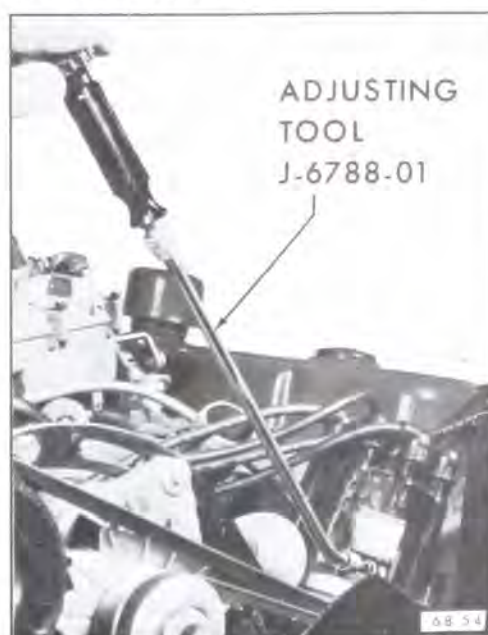


Figure 68-36 - Adjusting Contact Point Dwell Angle - V-8 Engines

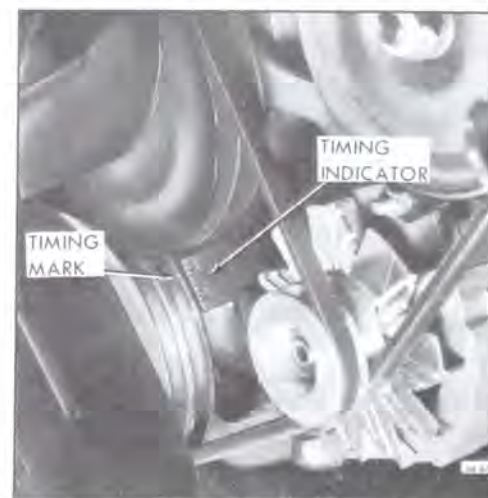


Figure 68-37 - Ignition Timing Mark and Indicator - L-6 Engine

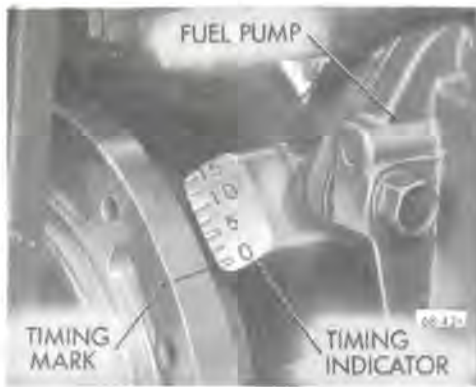


Figure 68-38 - Ignition Timing Mark and Indicator - V-8 Engines

to replace the complete wire assembly as a satisfactory repair cannot be made.

4. Wipe ignition wires with cloth moistened with kerosene, and wipe dry. Bend wires to check for brittle, cracked, or loose insulation. Defective insulation will permit missing or cross-firing of engine, therefore defective wires should be replaced.

5. If the wires are in good condition, clean any terminals that are corroded and replace any terminals that are broken or distorted. Replace any broken or deteriorated cable nipples or spark plug boots.

Spark plug wires have a built-in resistance of approximately 2000

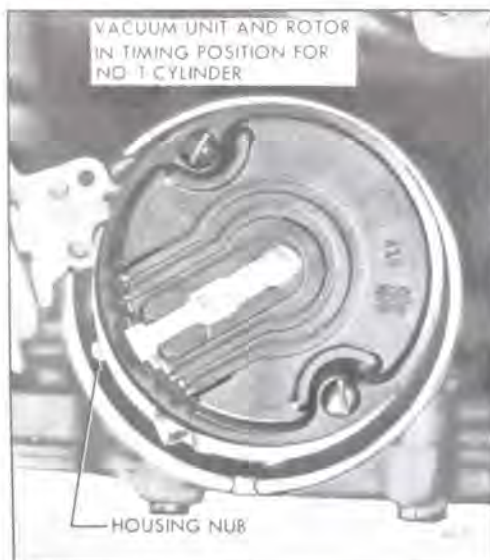


Figure 68-39 - Installing Distributor in Engine - V-8 Engines



Figure 68-40 - Installing Spark Plug Wires in Cap - L-6 Engine

ohms per foot. However, even the longer wires should never have a total resistance over 20,000 ohms; a wire having more than 20,000 ohms resistance should be replaced.

b. Spark Plug Cleaning

Spark plugs which have carbon or oxide deposits should be cleaned in a blast type spark plug cleaner. Scraping with a pointed tool will not properly remove the deposits and may damage the insulator. If spark plugs have a wet or oily deposit dip them in a degreasing solvent and then dry thoroughly with dry compressed air. Oily plugs will cause the cleaning compound to pack in the shell.

Carefully follow the instructions of the manufacturer of the cleaner being used, cleaning each plug until



Figure 68-41 - Installing Spark Plug Wires in Cap - V-8 Engines

the interior of shell and the entire insulator are clean; however, *avoid excessive blasting*.

Examine interior of plug in good light. Remove any cleaning compound with compressed air. If traces of carbon oxide remain in plug, finish the cleaning with a light blasting operation. Clean firing surfaces of center and side electrodes with several strokes of a fine file.

When spark plugs have been thoroughly cleaned, carefully inspect for cracks or other defects which may not have been visible before cleaning.

c. Adjusting Spark Plug Gap

Use round wire feeler gages to check the gap between spark plug electrodes of used plugs. Flat feeler gages will not give a correct measurement if the electrodes are worn. Adjust gap by bending the *side* electrodes only; bending the center electrode will crack the insulator. Adjust gaps to .030" (L-6 - .035"). Setting spark plug gap to any other specification to improve idle or effect other changes in engine performance is not recommended.

d. Installation of Spark Plugs

When installing R46N spark plugs, make sure that all surfaces on plugs and in cylinder heads are clean. When installing R46N spark plugs, tighten to 30 lb.ft. torque, using a 13/16" deep socket, an extension and a torque wrench. When installing R44TS or R45TS spark plugs, tighten to 15 lb.ft., using a 5/8" deep socket, an extension and a torque wrench.

CAUTION: If tapered seat spark plugs are overtightened, they will be very difficult to remove at the next tune-up.

e. Installation of Spark Plug Wires

No. 1 spark plug wire is installed in the first distributor cap tower after the adjusting window, moving in the direction of rotation (V-8), or in the foremost tower (L-6). The other

wires are then installed in a clockwise direction according to the firing order. See Figure 68-40 or 41.

68-26 DISTRIBUTOR SERVICE OPERATIONS

a. Removal and Disassembly of Distributor for Inspection - V-8 Engines

1. Disconnect the distributor primary wire from coil and disconnect hose from vacuum unit. Remove distributor cap by inserting a screwdriver in upper slotted end of cap latches; then press down and turn 90° counterclockwise.

2. Make a mark on distributor base in line with center of rotor. Then carefully note the direction the vacuum unit points in relation to the engine so that the distributor can be replaced in the exact same position after it is serviced. See Figure 68-39.

CAUTION: If engine is turned over while distributor is out, complete ignition timing procedure must be followed (par. 68-24).

3. Remove distributor clamp and lift distributor out of crankcase.

4. Remove rotor from end of distributor shaft by removing two attaching screws and lock washers.

5. Remove contact point set and condenser as described in paragraph 68-23.

6. Remove cam lubricator wick.

7. Remove two screws holding vacuum advance unit to housing. Remove advance unit.

8. Remove "O" ring seal from shaft housing.

b. Inspection of Distributor Parts

1. Wash the distributor assembly in clean solvent, holding housing horizontal to avoid getting cleaning solvent into the lubricant reservoir. Dry parts thoroughly.

2. *Cap.* Wipe out distributor cap with a clean cloth and inspect it for

chips, cracks and carbonized paths which would allow high tension leakage to ground. Such defects require replacement of cap. Clean loose corrosion from surfaces of terminal segments inside the cap. *Do not use emery cloth or sand paper.* If segments are deeply grooved, the cap should be replaced. Pull cables from terminal sockets and inspect sockets for corrosion. Clean sockets, using a stiff wire brush to loosen corrosion.

3. *Rotor.* If rotor is cracked, spring contact is badly worn, or rotor tip is badly burned, rotor must be replaced.

4. *Condenser.* Inspect condenser and primary leads for loose or frayed terminal connections. Check condenser in a reliable condenser tester as described in paragraph 68-30.

5. *Vacuum Advance Unit.* Inspect rod end for excessive wear. Push rod into unit as far as possible, hold finger tightly over nipple and then release rod. After about 15 seconds, release finger from hole and notice if air is drawn in. If not, diaphragm is leaking and unit must be replaced.

6. *Contact Points.* Carefully examine the mating surfaces of the contact points, noting whether they are flat and making good contact, or whether they are blackened, pitted, burned, or worn excessively. Contact points which have been in service for some time will appear dull and gray. This condition is normal and such points should not be replaced.

Contact points which are blackened or only slightly burned or pitted may be cleaned with a thin contact stone or a clean fine-cut contact file. Remove high points only; it is not necessary to remove all buildup or pit.

CAUTION: Do not use emery cloth or sandpaper to clean contact points because particles of these materials usually embed in contact surfaces and cause points to burn.

Excessively burned, pitted or worn

contact points cannot be cleaned up and aligned satisfactorily; therefore, they must be replaced to insure satisfactory ignition.

If contact points are excessively burned, pitted, or blackened it is advisable to check for cause and make the necessary correction so that new points will give satisfactory service. Burned or pitted points may be caused by:

(a) Ignition coil resistance wire not properly connected into circuit. With ignition on and engine not running, voltage at the coil positive (+) terminal should be 5 to 5.5 volts.

(b) Defective condenser. Test the condenser (par. 68-30).

(c) Insufficient contact point opening. Adjust contact point dwell as described in paragraph 68-23 (c).

(d) Vapors getting into the distributor and depositing on contact surfaces of points. This causes arcing and rapid burning of contact points. Oil vapor entering distributor usually produces a smudgy line under the points.

(e) High voltage, or any other condition in electrical system causing excessive current flow through contact points. This results in a blue scale forming on point surfaces. Check condenser for high series resistance (par. 68-30). Check voltage regulator (par. 68-9).

(f) Radio capacitor connected to distributor terminal. This will cause excessive pitting of contact points. Capacitor should be connected to the positive (battery) terminal of coil.

7. If any remaining parts are defective, the distributor must be completely disassembled to replace them. Before disassembling distributor further, inspect parts as follows:

(a) *Centrifugal Advance.* Inspect for excessive wear between centrifugal weights and advance cam, or pivot

pins. Turn weight base plate in a clockwise direction until weights are fully extended, then release and allow springs to return weights to retard position. Repeat several times. Springs should return weights to stop without sticking and there should be no excess free movement in the retard position.

(b) *Cam and Weight Base Plate.* Inspect cam lobes for scoring or excessive wear. Check weight base plate for bind or excessive looseness on distributor shaft.

(c) *Breaker Plate.* Attempt to rotate plate to check for excess free motion between plate and vacuum advance unit linkage. Check plate for excess looseness on O.D. of upper distributor shaft bushing. Check breaker plate ground lead for poor spot-weld at plate end or for loose or frayed terminal connections.

(d) *Distributor Shaft.* Check for excessive wear between shaft and bushings in housing.

(e) *Driven Gear.* Inspect gear for scoring of teeth or excessive wear.

8. To replace any part found to be defective in Step 7, the distributor must be completely disassembled as follows:

(a) Drive out driven gear pin using a hammer and a 1/8" straight punch. See Figure 68-42.

CAUTION: Be careful not to bend distributor shaft or damage gear when driving pin out.

(b) Slide gear off shaft and then pull the shaft, breaker cam, and centrifugal advance mechanism from the housing.

(c) Remove two advance weight springs and weights. Slide the integral weight base plate and breaker cam off the lower end of shaft.

Remove retainer from upper bushing and lift breaker plate and felt washer from upper bushing.

(e) Remove distributor primary lead and grommet from housing.

NOTE: No attempt should be made to replace the shaft bushings in the housing as the housing and bushings are only serviced as an assembly.

c. Assembly and Installation of Distributor

NOTE: The first five steps apply only if the distributor has been completely disassembled.

1. Install distributor primary lead and rubber grommet. Install vacuum advance unit with ground lead terminal from breaker plate under outer mounting screw and lock washer.

2. Install felt washer over upper bushing and apply a few drops of light oil. Then place breaker plate over upper bushing and vacuum advance link. Install retainer on upper bushing. See Figure 68-43.

3. Slide distributor cam and weight base plate on distributor shaft.

4. Install distributor shaft and breaker cam assembly in housing. Install advance weights and springs.

5. Slide driven gear on shaft. Drive roll pin through gear and shaft. Be careful not to damage gear.

6. Place condenser and bracket over bosses on breaker plate and secure with screw.

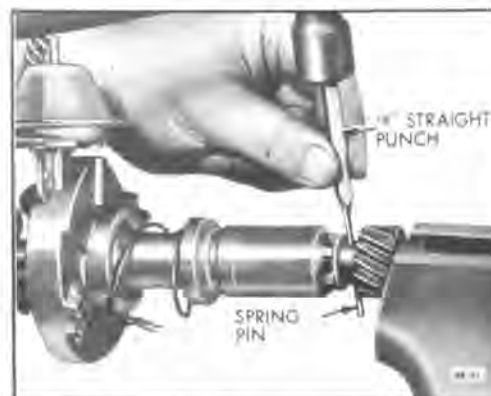


Figure 68-42--Removing Distributor Gear Pin

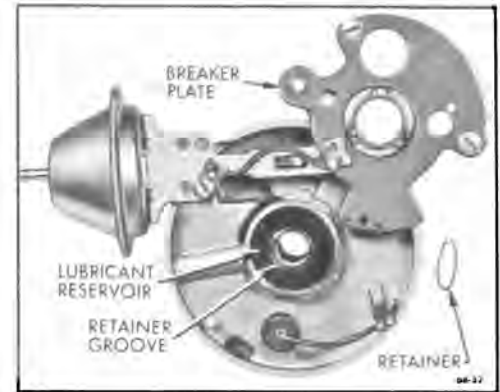


Figure 68-43--Installing Breaker Plate and Retainer

7. Place contact point set over boss on breaker plate and secure with two screws and lock washers. Apply one drop of light oil to breaker arm pivot. Then install condenser and primary leads.

8. Work a small amount of high temperature cam and ball bearing lubricant (available through U.M.S.) into a clean cloth, then hold cloth against distributor cam while turning distributor shaft.

CAUTION: Excessive grease may throw off into contact points when hot. Petroleum jelly is not suitable for temperature reached by the cam.

9. Install a new cam lubricator.

10. Make the preliminary contact point adjustment (par. 68-23, b).

11. Install rotor and secure with two screws, lock washers, and plain washers.

NOTE: The square and round lugs on the bottom of the rotor must be positioned in the corresponding holes in the weight base plate

12. If a reliable distributor tester is available, check the distributor to make certain that the centrifugal and vacuum advance mechanisms are operating according to the specifications given in paragraph 68-21.

13. Install new "O" ring seal on distributor housing. Insert distributor in engine block so that rotor is

pointing to mark made on distributor base, with vacuum advance unit pointing in exact original direction. Connect vacuum pipe to advance unit.

14. Install distributor clamp and bolt with lock washer, leaving bolt just loose enough to permit movement of the distributor with heavy hand pressure.

15. Connect primary wire to distributor side of coil. Install distributor cap.

16. If spark wires were removed, make certain that they are replaced as shown in Figure 68-40 or 41. Wires must be pushed all the way down into the distributor cap terminals and onto the spark plugs. Nipples must be pushed firmly over the terminals and boots over the spark plugs.

17. Start engine and adjust contact point dwell angle (par. 68-23, c). Then adjust ignition timing (par. 68-24, b).

NOTE: If engine was accidentally turned over while distributor was out, complete ignition timing procedure must be followed (par. 68-24, a & b).

68-27 IGNITION SWITCH AND LOCK REPAIRS

a. Ignition Switch Key

If ignition key sticks or feels rough as it is inserted into the lock, examine it for burrs and smooth with a fine cut file. Blow finely powdered graphite into lock cylinder, then work key in and out of cylinder a number of times to work graphite into tumblers. *Do not use oil in lock cylinder as this will cause tumblers to stick.*

The ignition switch key has a rectangular shaped head and also operates the door locks. The oval head key operates the glove box lock and trunk lock. The key code number for each key is stamped in the small knock-out insert.

b. Ignition Lock Cylinder Replacement

The ignition lock cylinder cannot be removed until the steering column is partially disassembled to gain access to an internal lock cylinder retainer. The steering wheel, lock plate and turn signal switch assembly must be removed. See paragraph 90-xx for detailed instructions.

c. Lock Cylinder and Key Information

All 1969 Buicks have new lock cylinders and keys. The new lock cylinder outside dimensions are not changed and there are still six tumblers per lock cylinder. The code consists of a number, a letter and two numbers. The rectangular head key fits the ignition and door locks and the oval head key fits the glove box and trunk locks; however, these new keys have different grooves to that neither can be inserted in any lock cylinder previous to 1969 and so that neither can be inserted in the other type of 1969 lock cylinder.

d. Ignition Key Buzzer

The ignition key operated buzzer is designed to warn the driver that he has left his key in the ignition switch, and his car is therefore subject to theft. The buzzer operates whenever the driver's door is opened with the ignition key left in the switch in either the Off, the Lock, or the Accessory position.

The ignition key buzzer circuit is supplied, along with the speed warning buzzer and horns, by a No. 10 red wire from the battery. A combination buzzer and horn relay is used. See Figure 68-44. The circuit passes through the buzzer, then through the ignition switch and to ground through one contact of a double contact left front door jamb switch.

The optional speed warning buzzer uses part of the same circuit, then provides a second path to ground through adjustable contacts in the speedometer head.

DIVISION IV

TROUBLE DIAGNOSIS

68-28 IGNITION SYSTEM--TROUBLE DIAGNOSIS

If engine trouble has arisen which seems to be due to improper operation of the ignition system, it may be desirable to make a quick preliminary check of the ignition system before making a complete analysis, in order to determine whether the ignition system is actually at fault. The quick checks described in this paragraph may be used but it must be understood that they are no substitute for the complete ignition system inspection. The checks to be made depend on whether the engine will or will not run.

a. Engine Will Not Run

1. Make quick check of battery and cables if cranking motor does not turn engine at normal cranking speed.

2. Pull coil high tension cable from distributor cap and hold the lead terminal about 3/16" from a clean ground point on engine. If a good spark occurs while engine is being cranked, the primary circuit and the secondary circuit to this point may be considered to be okay. Proceed with Steps 3 through 6.

3. Remove distributor cap and check interior for moisture, corroded terminal segments, and check terminal sockets for corrosion. Check rotor for corrosion. Clean off corrosion and wipe distributor cap dry. Check for a crack or carbon path in cap or rotor.

4. Inspect ignition cables for possible short circuits and corroded terminals. Remove and inspect spark plugs (par. 68-25).

5. If cause of trouble has not been found, check approximate ignition timing (par. 68-24).

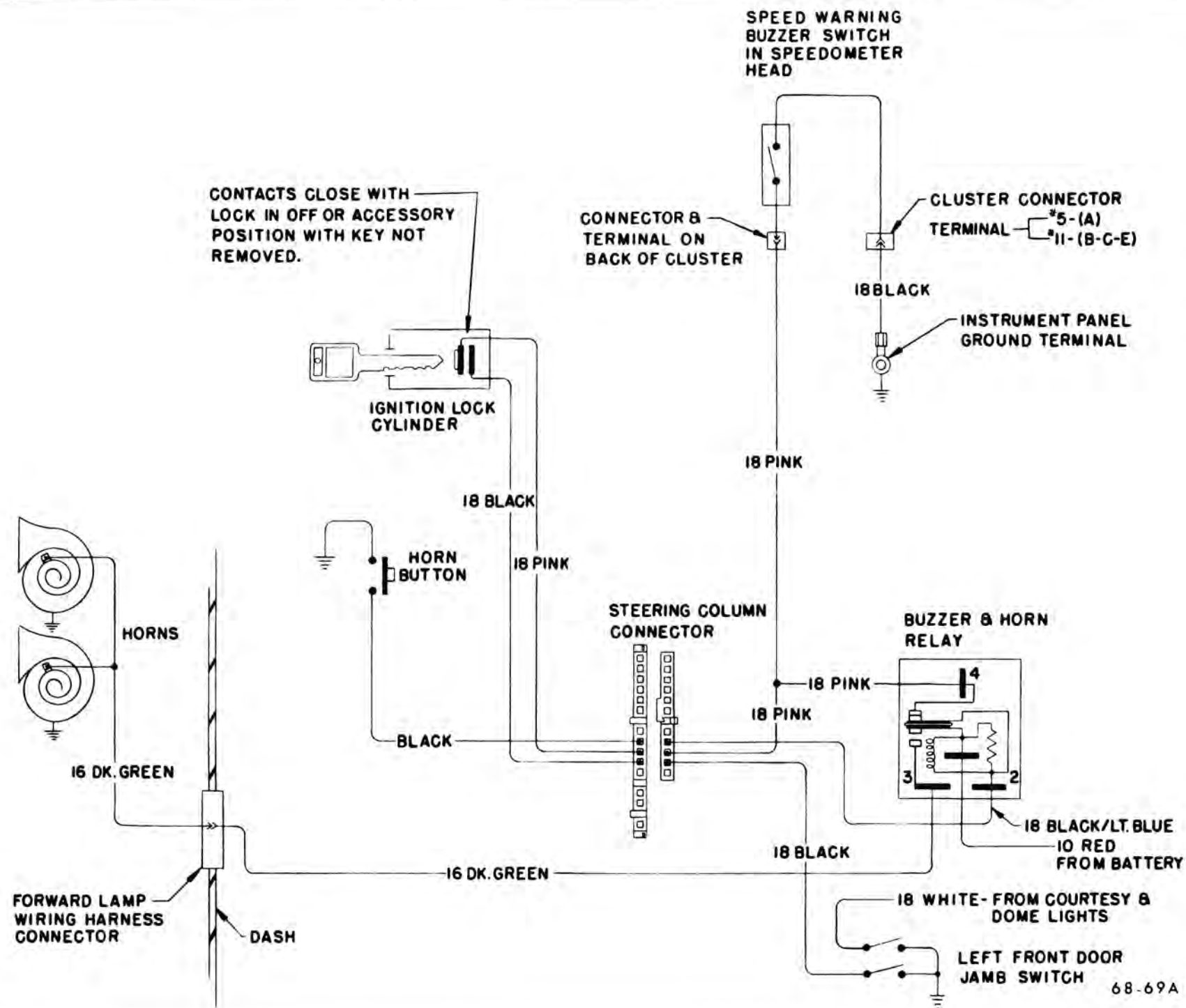


Figure 68-44 - Ignition Key Buzzer
Wiring Diagram

6. If engine still fails to run, the trouble is probably due to causes other than ignition, such as lack of fuel, carburetion, or compression loss.

7. If spark did not occur at coil high tension lead (Step 2 above) then connect 12-volt test lamp between distributor terminal of coil and ground and crank engine. If test light flickers on and off as engine is cranked the primary circuit is probably okay. Check ignition coil (par. 68-29) and condenser (par. 68-30).

8. If test light remains on as engine is cranked, contact points are not closing properly; check point opening and ground connection in distributor (par. 68-23).

9. If test light remains off as engine is cranked, the primary circuit is open or the points are not opening properly. Check for loose connections, broken leads, defective switch, contact point opening, and primary circuit winding in coil. Visual inspection of points and the use of a test lamp or voltmeter will locate the source of this trouble.

b. Engine Runs, But Not Satisfactorily

1. When missing, loss of power, or hard starting is present a complete checkup of the ignition system is in order, since these conditions may result from anything from a low battery to defective spark plugs, or from other engine conditions not related to ignition. In this case, the complete inspection of ignition system should be used.

2. Detonation may be caused by improper timing (par. 68-24), improper operation of centrifugal or vacuum advance mechanism (par. 68-22, d), worn distributor bearings or a bent shaft, dirty or wrong heat range spark plugs (par. 68-25). It may also be caused by overheating, excessive carbon in cylinders, or by low octane fuel.

3. Overheating may be caused by one or more of the conditions which

contribute to detonation, as well as by faults in engine cooling system.

68-29 IGNITION COIL TESTS

a. Weak Coils

Most ignition coils that are replaced by service stations are classified by them as weak. Many coils rejected as weak actually test up to specifications and give normal performance.

A coil that actually is weak will first affect engine performance when the ignition reserve is at a minimum. This may be in starting, low speed acceleration or top speed. Eventually the engine will fail to start.

High resistance connections in either the primary or secondary circuit wiring will react the same as a weak coil. Wide spark plug gaps, which require higher voltage than the coil can produce, put the coil under suspicion. High compression and lean carburetion increase the voltage requirements and lead to many needless coil changes. Leakage of high tension current through moisture on an unprotected coil terminal may produce carbon tracks which weaken the coil output voltage. For this reason the nipple on coil high tension terminal must be properly installed and in good condition.

When an ignition coil is suspected of being defective it should be tested as described below before being replaced.

b. Testing Coil for Open and Grounded Circuits

Before using a coil test instrument, the coil should be tested for open and grounded circuits, using a 110 volt test lamp and test points.

1. Apply test points to both primary terminals of coil. If test lamp does not light, the primary circuit is open.

2. Apply one test point to the high tension terminal, and the other test point to one of the primary terminals. If secondary circuit is not

open, the lamp will not light but tiny sparks will appear at test points when they are rubbed over terminals. If secondary circuit is open, no sparks will occur.

3. Apply one test point to a clean spot on the metal coil case and touch the other point to the primary and high tension terminals. If the lamp lights, or tiny sparks appear at the points of contact, the coil windings are grounded.

4. A coil with open or grounded windings must be replaced since internal repairs cannot be made. It is unnecessary to test such a coil with instruments. If windings are not open or grounded, a test for short circuits and other internal defects should be made with a reliable coil test instrument.

c. Coil Test Instruments

Two general types of instruments are used in testing ignition coils. One type makes use of an open or protected spark gap, while the other reports the condition of the coil on a meter.

The spark gap type of tester should always be used comparatively, that is, the questionable coil should be compared with a coil of same model that is known to be good. Both coils must be at the same temperature and identical test leads must be used.

Certain variables caused by altitude, atmosphere or spark gap electrode conditions are usually present in the spark gap type of test.

The meter type testers are usually designed to permit testing the coil without making any connection to the secondary terminal. This eliminates the variables usually present in the spark type of test and avoids the necessity for comparison with a good coil.

Some different makes and models of coil testers differ in their methods of use, as well as in the markings on meters, *the instructions of the manu-*

facturer must be carefully followed when using any coil tester. The instrument must be frequently checked to make certain that it is accurately calibrated.

Regardless of instrument or method used, the coil must be tested at normal operating temperature because internal defects often fail to show up on a cold test.

68-30 DISTRIBUTOR CONDENSER TESTS

When a condenser is suspected of being faulty it should be tested with a reliable condenser tester to determine whether it is actually the cause of ignition trouble. The condenser should be tested for (a) high series resistance (b) insufficient or excessive capacity (c) low insulation resistance.

A special condenser tester is required to make these tests. When using a condenser tester the instructions of the manufacturer must be carefully followed.

IMPORTANT: The condenser must be at normal operating temperature when it is being tested.

a. High Series Resistance

High series resistance in the condenser causes the condenser to be slow in taking the charge and, consequently, a higher than normal voltage is developed across the contact points when they first start to open. The higher voltage causes more disturbance at the contact points, which in turn causes more rapid wear and more tendency toward oxidized surfaces. The condition can become severe enough to cause complete failure of the ignition system. It would first show up during starting and low speed operation.

High series resistance may be caused by internal resistance in condenser or by resistance in the connections. Any defect caused by internal resistance should show up at low mileage since this does not change very much with time or use. *The damag-*

ing changes are in the connections, in which looseness, corrosion, or broken strands may develop.

New condensers may have a series resistance as low as .05 ohm. Some condenser testers are set to reject condensers which have a resistance of .3 ohm; however, test show that the resistance can go to .5 ohm before ignition performance is affected.

b. Insufficient or Excessive Capacity

The condenser specified for use in the Buick ignition system has a capacity of .18 to .23 microfarads.

If a condenser is used which does not have the specified capacity of .18 to .23 microfarads, excessive pitting of one contact point and a corresponding buildup of metal on the other contact point will result. A condenser having insufficient capacity will cause build-up of metal on the breaker arm (positive) point. A condenser having excessive capacity will cause build-up of metal on the contact support (negative) point.

In exceptional cases, pitting and metal buildup on contact points may be experienced even when condenser capacity is within the specified limits. In such cases the life of contact points will be improved by installing a condenser of high-limit capacity if metal build-up is on breaker arm point, or a condenser of low-limit capacity if metal build-up is on contact support point. There is usually sufficient variation in the capacities of stock condensers to permit selection of a high or low limit condenser by testing the available stock.

c. Low Insulation Resistance

A weak or leaking condenser is usually one that has absorbed water so that the insulation resistance of the winding is lowered to the extent that the condenser will not hold a charge satisfactorily. A condenser with low insulation resistance will drain sufficient energy from the ignition system to lower the second-

ary voltage seriously. The condenser specified for use in the Buick ignition system is sealed to prevent absorption of water, and no other type should be used.

A leaky condenser usually does not affect engine performance except when hot. It is unlikely that a condenser with low insulation resistance would cause missing at low or medium speeds under conditions where the condenser does not get hot. A condenser that has low enough resistance to affect engine performance when cold would probably be indicated as broken down on most condenser testers.

Condenser testers equipped to check condensers for low insulation resistance usually give a reading in megohms, a megohm being one million ohms. The scale is marked to indicate whether the condenser is good or bad.

When testing a condenser for low insulation resistance the lead should always be disconnected from the distributor. Since the distributor terminals and the connected circuit have much lower insulation resistance than the condenser, failure to disconnect the condenser lead will give a reading much too low.

68-31 IGNITION SYSTEM RESISTANCE TEST

Check for proper functioning of the resistance in the primary ignition circuit by turning on the ignition. With the engine not running, a voltmeter connected from the battery side of the coil to ground should read approximately 5 to 5.5 volts. If the reading is a full 12 volts, the ignition points may be open: "bump" the starter a few times until the engine comes to rest with the ignition points closed and again check for a 5.5 volt reading. A reading of 12 volts or over for all engine positions would indicate that the shorting switch is making contact all the time; this condition must be corrected immediately or ignition point life will be very short.

Check for proper closing of the shorting switch and also for proper functioning of the complete starting circuit by grounding the secondary coil wire so the engine won't start. With the engine cranking, a voltmeter connected from the battery side of the coil to ground should read at least 9 volts. A reading of under 5 volts would indicate that the short-

ing switch is not closing; this condition would result in hard cold starting.

Briefly, the advantages of our resistance with shorting switch system are: it sends full battery voltage to the coil for good cold weather starting, and it cuts down the voltage to the coil with the engine running

for long ignition point life.

NOTE: Discourage any attempts to measure voltage at the coil with the engine running; because of variations in current flow at high speeds and in regulated voltage, this check would be meaningless. Voltage readings on a perfectly functioning ignition system may go over 11 volts.