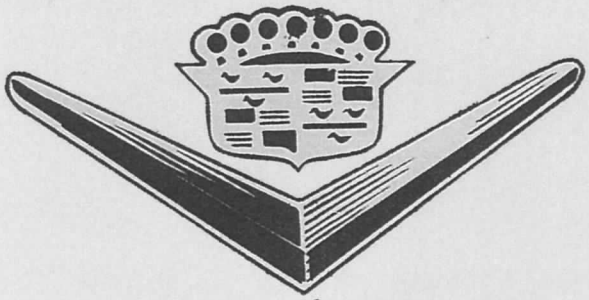


Cadillac

THORO-CHECK

1949 - 1960

ENGINE DIAGNOSIS MANUAL

CADILLAC THORO-CHECK PROCEDURE

This Thoro-Check Procedure is designed to give the engine a thorough analysis or physical examination for the same reason that a physician makes a diagnosis, to find what is wrong with the present operation or to locate any weak spots which might soon give difficulty.

WHAT WILL THE THORO-CHECK DO FOR:

1. The Mechanic?
Repair orders will be made up from a Diagnostician's recommendations, giving clear instructions to the mechanic regarding repairs and replacements for which he gets paid. He does not have to check doubtful conditions. He does not have to waste time hunting for the right thing to do or waste time inspecting units which are functioning properly. Every operation is profitable to him, to the shop and to the customer.

2. The Shop Foreman?
When the Shop Foreman has a correct Repair Order, written from the Diagnostician's Recommendations, with a copy of the Thoro-Check Report attached, he can be sure that what needs to be done is properly and efficiently handled. In addition, less of his time will be spent answering mechanic's questions, as in the past, when they were expected to "trouble shoot" and find the answers themselves.

3. The Diagnostician?
His is an entirely new position created in the shop. Because of the way it is designed, the Thoro-Check Procedure will reduce his chance for errors and omissions and permit ease and speed in the performance of his work.

4. The Service Salesman?
His selling job becomes much easier, more pleasant and more profitable to the entire shop. Where any doubts exist as to the service needed by a customer, he can avoid guesswork recommendations, which often lead to customer dissatisfaction and comeback, by concentrating his efforts on selling Scientific Thoro-Check. Then when he gets the diagnosis report from the Diagnostician he has facts, not opinions, to present to the customer. The customer will usually buy the needed repairs when he sees why he needs them. The Thoro-Check Report does most of the selling without pressure, and generally sells a much larger repair order than would be possible without the written evidence of the customer's needs.

5. The Customer?
When the Diagnostician's results are tabulated into Recommendations and into Repair Orders, he knows that he is getting what he needs and not what someone thinks he needs. He knows that when the Diagnostician's Final Check has been performed he now has an engine that has been restored to new car efficiency, and no guesswork.

HOW CAN IT DO THE JOB?

The sequence of the Thoro-Check Procedure is the result of extensive study, planning and practical application of the tests and inspections involved.

It is a logical sequence. Each step is necessary at that particular time to prepare for the completion of the next one. Because of this, no individual test should be performed and its results interpreted as authentic, unless the preceding tests indicate that the test can be made with accuracy. Also, the sequence reduces the time required to complete the Procedure, minimizes possible errors and omissions and yet produces all the evidence necessary to make an intelligent diagnosis of the difficulties present.

Extreme care should be exercised in making the tests throughout the entire Thoro-Check Procedure. Two reasons for this are evident: First, Completeness and Accuracy are necessary factors in any intelligent diagnosis; Second, customer confidence, which will result from such completeness and accuracy, will bring future service business to the Service Shop which will eventually reflect in the Sales Department.

PREPARATION OF CAR FOR DIAGNOSIS

In preparing a car for diagnosis, the following precautions must be carefully observed:

1. Always use covers to protect fenders and seats.
2. Set hand brake.
3. Chock wheels.
4. Place Transmission Selector Lever in NEUTRAL position.
5. Inspect level of fluid in radiator and correct as necessary.
6. Check oil level in crankcase.
7. Connect flexible tube of exhaust ventilating system to tail pipe of the car.
8. Start engine and allow it to reach normal operating temperature before proceding with diagnosis.

THE AUTOMOTIVE BATTERY

The purpose of the automotive storage battery is to provide energy for starting the engine and to supply for a limited period of time, electrical loads exceeding the output of the generator.

The amount of energy that a fully charged battery can produce depends primarily upon the size and number of the plates.

The total energy that a good battery can produce when at full charge is indicated by its Ampere Hour Rating. A 120 Ampere Hour battery has greater capacity for storing energy and doing work than a 100 Ampere Hour battery because the 120 A.H. battery has larger plates or a greater number of plates.

The Ampere Hour rating of a battery is usually stamped or printed on the battery case.

A battery should be maintained at not less than $\frac{3}{4}$ full charge in normal operation in the vehicle. If it is found that the battery is less than $\frac{3}{4}$ charged, it is almost certain that some condition exists which should be corrected.

COMMON CAUSES OF BATTERY FAILURE

1. Resistance in the charging system.
2. Weak generator or slipping generator drive belt.
3. Improper regulator adjustment or faulty regulator.
4. Overloads due to defective starting system, or excessive use of accessories.
5. Driver habits or driving conditions such as using the vehicle only for short drives.
6. Dirt and electrolyte on top of battery causing a constant drain.
7. Hardened battery plates, commonly called "sulphation," due to the battery being in a low state of charge over a long period of time.
8. Physical defects such as shorted cells, loss of active material from the plates, broken terminals, etc.

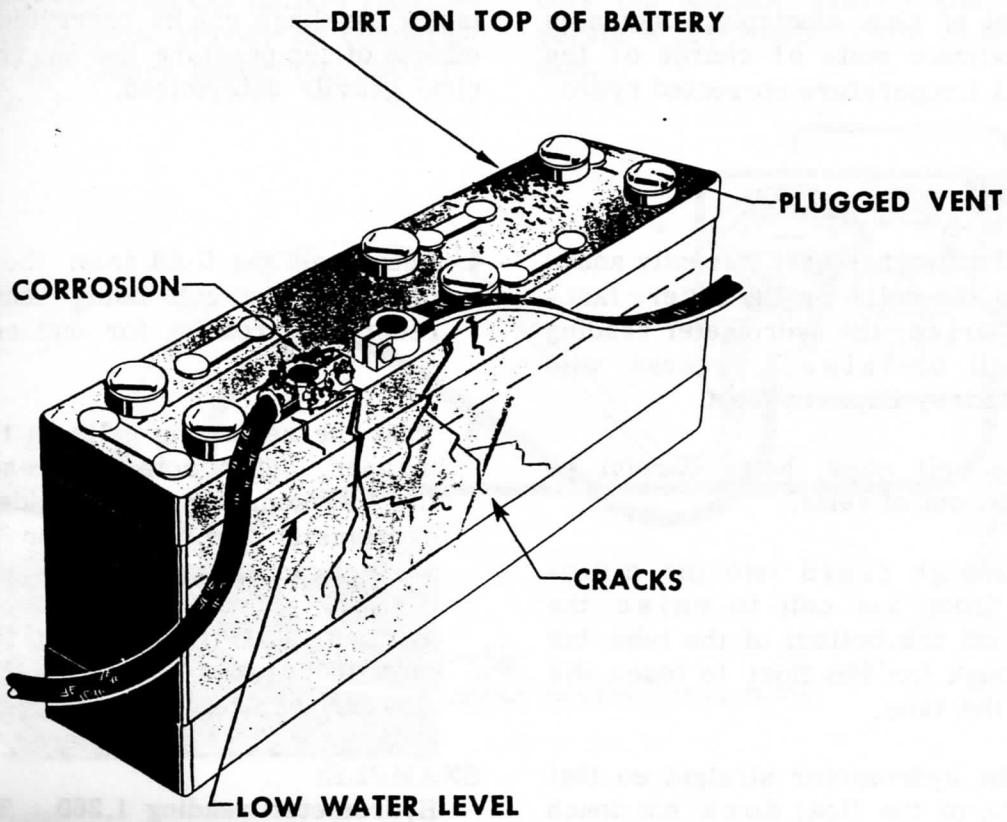
It is important to note that of the eight common causes of battery failure listed above, the first six causes are outside the battery. Any one of these conditions will result in a battery being at less than normal state of charge.

The seventh cause listed can result from any one of the first six causes. That is, sulphation occurs when any condition causes the battery to be under-charged for long periods of time. When a battery becomes sulphated, it will not accept a normal rate of charge and also, its capacity decreases. Sulphation can usually be overcome by prolonged slow charging or by discharging the battery completely, letting it stand discharged for 6 to 12 hours and then recharging it.

The causes of battery failure listed in paragraph eight are the defects that can occur in the battery itself. If shorted cells or loss of active material from the plates occurs when the battery has been in service for less than its guaranteed life, it is usually a result of overworking or overcharging of the battery. Cracked cases, broken terminals and also shorted cells can be caused by improper handling of the battery or a faulty battery carrier in the vehicle. WHEN A BATTERY FAILS, DO NOT BE SATISFIED TO MERELY RECHARGE OR REPLACE IT. FIND THE CAUSE OF FAILURE AND PREVENT RECURRENCE OF THE TROUBLE.

BATTERY VISUAL INSPECTION

The battery should always be very carefully inspected before the actual testing is done. Many undesirable conditions can be seen and corrected before they result in battery trouble. Other visible indications are very important when analyzing the hydrometer and electrical test readings.



PROCEDURE

1. Inspect the battery case for cracks and leaks.
2. Inspect battery posts, clamps and cables for breakage, loose connections, corrosion and other faults.
3. Note whether the top of the battery is clean and dry. Dirt and electrolyte on top of the battery causes excessive self-discharge.
4. Be sure that the cell vents are open.
5. Be sure that the battery carrier is solidly mounted and in good condition and that the battery hold-down is properly tightened. A loose battery carrier or battery hold-down will allow the battery to be damaged by vibration and jarring. An excessively tightened battery hold-down may buckle or crack the battery case.
6. Inspect battery for raised cell covers or warped case which may indicate that the battery has been overheated or overcharged at some time. This may be important when analyzing the results of the electrical tests.
7. Inspect electrolyte level. If electrolyte is below the top of the plates, add water. If not below the plates, make hydrometer test before adjusting electrolyte level.
8. Make note of the Ampere Hour Rating of the Battery -

12 volt - 70 Ampere Hour
6 volt - 115 Ampere Hour

NOTE: MAKE BATTERY VISUAL, HYDROMETER, AND CAPACITY TEST, THEN SEE BATTERY TEST INDICATIONS AND RECOMMENDATIONS.

SPECIFIC GRAVITY TEST

A hydrometer is used to test the specific gravity (weight) of the battery electrolyte. The weight of the electrolyte indicates the approximate state of charge of the battery. A temperature corrected hydrometer must be used when testing specific gravity of battery fluid so that the hydrometer readings can be corrected for the effects of temperature and the true specific gravity determined.

PROCEDURE

NOTE: If water has been recently added to the cells or the battery fast-charged, the hydrometer reading will be false. Proceed with Battery Capacity Test.

1. Remove cell caps, being careful to keep dirt out of cells.

2. Draw enough fluid into the hydrometer from one cell to raise the float off the bottom of the tube but not enough for the float to touch the top of the tube.

3. Hold the hydrometer straight so that the neck of the float does not touch the sides of the tube and take the reading at eye-level.

4. Return all the fluid from the hydrometer to the cell being tested and record the reading for that cell.

5. Test the remaining cells in the same manner. Then note the reading on the thermometer on the side of the hydrometer and correct for temperature if necessary.

   Subtract .004 from the readings for each 10 degrees below 80° F or add .004 for each 10 degrees above 80° F.

EXAMPLE:
Hydrometer reading 1.260. Thermometer reading 60° F. True specific gravity 1.252.

TEST INDICATIONS

12 V 1.260 to 1.280 Specific Gravity
6 V 1.265 to 1.290 Specific Gravity

represents normal state of charge.

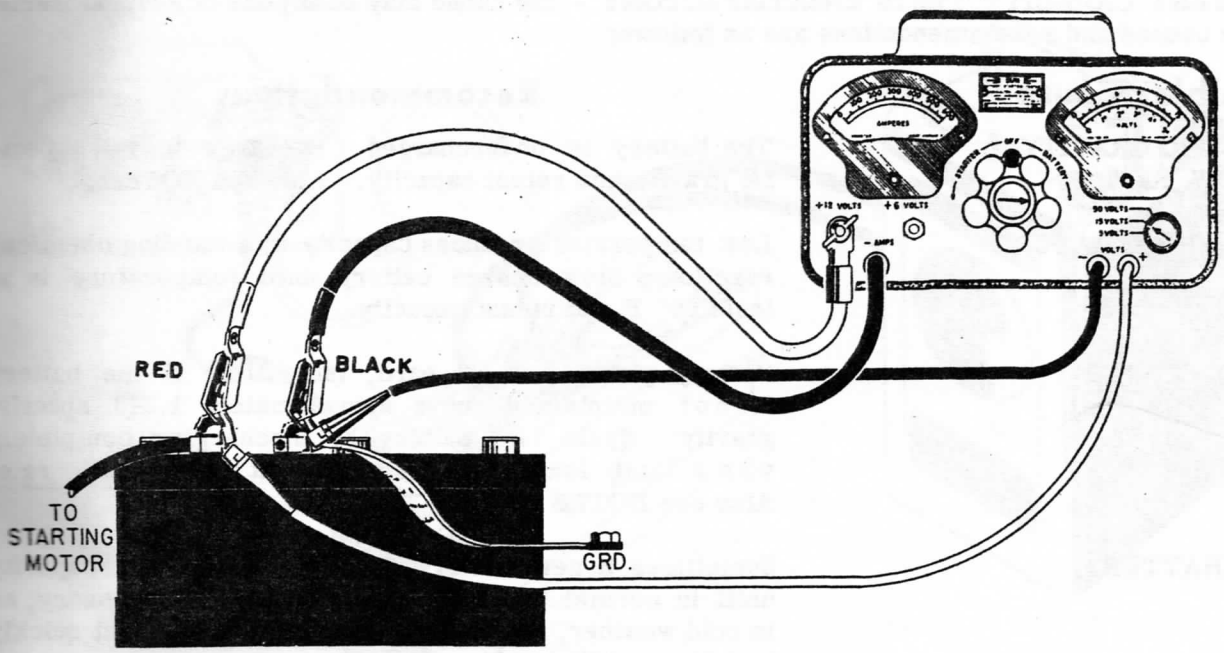
1.290 SPECIFIC GRAVITY OR ABOVE - Possible overcharging; voltage regulator setting and regulator ground must be tested.

LESS THAN 1.250 SPECIFIC GRAVITY - Undercharged; entire charging system must be tested.

SPECIFIC GRAVITY READINGS VARY .025 OR MORE BETWEEN CELLS - Loss of acid or defective cell. See Individual Cell Test.

BATTERY CAPACITY TEST

A battery that will maintain the voltage specified below, or more, during the Capacity Test is a GOOD battery regardless of its specific gravity or temperature. If the battery under test fails to maintain the voltage listed below, the battery must NOT be condemned unless both the specific gravity and the temperature are within limits at the time of test.



PROCEDURE

1. Connect the detachable AMMETER Lead to the proper Binding Post.
2. Turn Control Knob of Battery Starter Tester to OFF Position.
3. Turn VOLTMETER SELECTOR Switch to 15 VOLT position.
4. Connect Test Leads as shown.
   a. Ammeter clips must contact battery post.
   b. Voltmeter clips must contact battery post or cable clamp, not the Ammeter clips.
5. Turn Control Knob CLOCKWISE to BATTERY position until Test Ammeter reads 3 TIMES the Ampere Hour Rating of the battery.

   12 V 3 x 70 A.H. = 210 Amps.
   6 V 3 x 115 A.H. = 345 Amps.

6. With Test Ammeter reading the specified load for 15 SECONDS, note the Voltmeter reading and compare with the following:

BATTERY	GOOD	UNSATISFACTORY
12 V	9.6 V +	Under 9.6 V
6 V	4.8 V +	Under 4.8 V

7. Turn Control Knob to OFF position and refer to Battery Test Indications and Recommendations on next page.

CAUTION: Do not turn Control Knob to STARTER position when Ammeter is connected across the battery, as this would cause a DIRECT SHORT.

NOTE: If battery passes Capacity Test, it is not necessary to make the three minute test charge.

BATTERY TEST INDICATIONS AND RECOMMENDATIONS

IF BATTERY CAPACITY TESTS GOOD - the battery is electrically sound. However, there are several points to be considered in making recommendations:

a. If the specific gravity is below 1.250, see NOTE 1.

b. If the specific gravity is extremely high, see NOTE 2.

IF BATTERY CAPACITY TESTS UNSATISFACTORY - the cause may be any one of several items. Possible causes and recommendations are as follows:

Possible Cause	Recommendations
SPECIFIC GRAVITY BELOW 1.225	The battery is undercharged. Recharge to full specific gravity and retest capacity. Also see NOTE 1.
LOW TEMPERATURE	Low temperature reduces capacity by retarding chemical reaction. Slow charge battery until temperature is at least 60° F and retest capacity.
HARD PLATES	Battery plates become hard, (sulphated) if the battery is not maintained above approximately 1.240 specific gravity. Cycle the battery by discharging completely with a lamp load then recharging at a very slow rate. Also see NOTES 1 & 3.
NEW BATTERY	Sometimes a new battery does not reach full capacity until in normal use for 60 to 90 days. If necessary, as in cold weather, the battery can usually be brought quickly to full capacity cycling.
WORN OUT	A battery gradually loses active material from the plates in normal use, and more rapidly if overworked. When too much active material has been lost, the battery will not pass the capacity test even when fully charged and can be considered to be worn out. See NOTE 3.
DEFECTIVE CELLS	A defective cell or cells will result in low capacity and is indicated by wide variation in specific gravity readings between cells, and by uneven cell voltages under high rate charge.

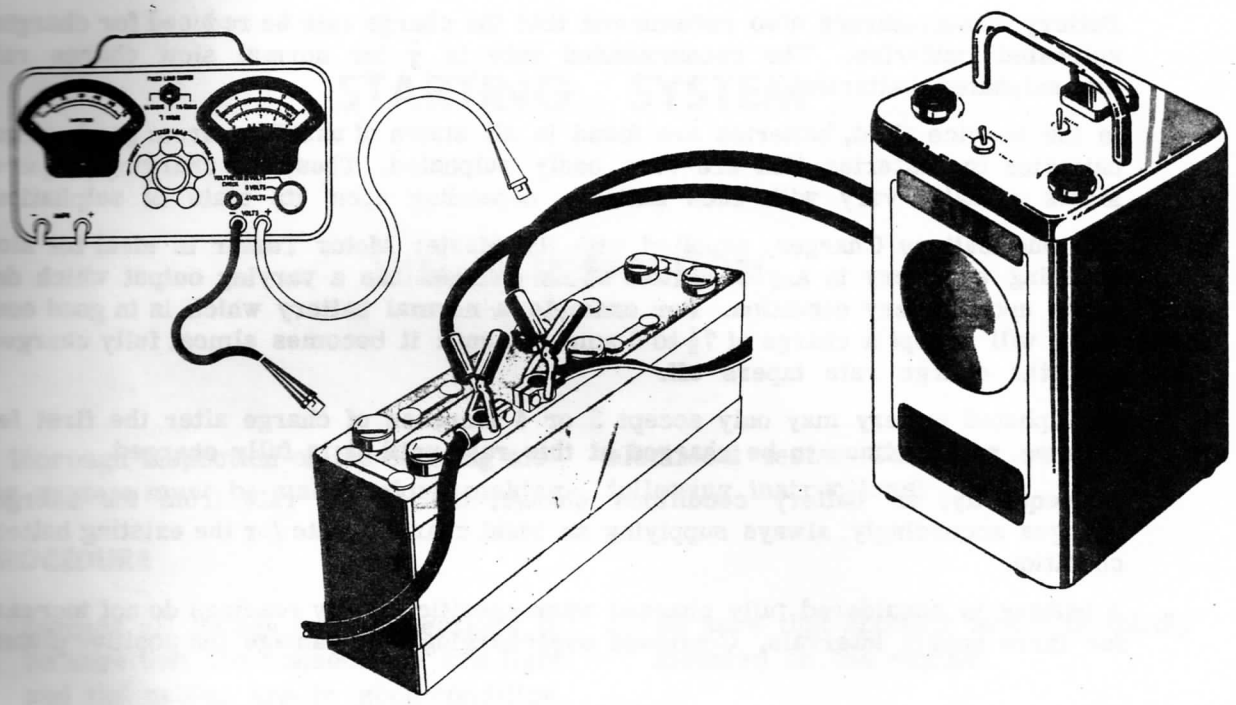
NOTE 1 . . . a battery must be maintained at a specific gravity of at least 1.250 in the vehicle to prevent sulphation (hardening) of the battery plates, to assure cold weather starting and normal battery life. Undercharging can be caused by low voltage regulator setting, high charging circuit resistance, high starting motor amperage draw, faulty generator or generator drive belt, excessive use of accessories, etc.

NOTE 2 . . . overcharging of a battery can be caused by high voltage regulator setting or the battery being exposed to abnormally high external temperatures. Overcharging is indicated by excessive use of water, extremely high specific gravity and eventually, raised cell covers and warped battery case.

NOTE 3 . . . a 6 volt battery which measures between 4.5 and 4.8 volts, and a 12 volt battery which measures between 9.0 and 9.6 volts on the battery capacity test, may provide several months of satisfactory operation under favorable temperature and operational conditions. However, any battery which measures less than 4.8 or 9.6 volts cannot be depended upon for cold weather starting or other severe operation.

THREE MINUTE BATTERY TEST

This new procedure for analyzing battery condition can be applied in approximately three to four minutes and is particularly valuable because it enables the service man to determine immediately whether a battery is good or bad even when the battery is in a discharged condition.



CAUTION: DO NOT USE THIS PROCEDURE IF BATTERY TEMPERATURE IS BELOW 60° F.

NOTE: FIGURES BEFORE PARENTHESIS, "( )" ARE FOR 6 VOLT BATTERIES, FIGURES WITHIN PARENTHESIS ARE FOR 12 VOLT BATTERIES.

Test Charge the battery as follows:

a. Connect leads as shown on side of charger.
b. Turn timer past "3 minutes," then back to "3 minutes."
c. Set charging rate to 75 (40) amperes. (See Note Below).
d. After 3 minutes of fast-charge, with charger still operating on fast-charge, test individual cell voltages of battery.

a If cell VOLTAGES ARE EVEN within .1 volt

b If cell VOLTAGES ARE UNEVEN by more than .1 volt

REPLACE BATTERY

NOTE: If 75 (40) amps cannot be obtained and the voltage is less than 7.75 (15.5) volts, low AC line voltage is indicated. In this case set charger at 50 to 60 (27 to 32) amps and use 7.5 (15) instead of 7.75 (15.5) volts as indication of sulphation.

Test total battery voltage with charger still operating on fast-charge.

a If total voltage is UNDER 7.75 (15.5) VOLTS

Test specific gravity. Battery can be fast-charged up to the times shown on the next page. Always follow the fast-charge with sufficient slow-charging to bring battery to full charge.

b If total voltage is OVER 7.75 (15.5) VOLTS

Battery is unsatisfactory in its present condition, and is probably sulphated. Battery may be serviceable after continued slow charge. Fully charge, then test capacity. If above 4.8 (9.6) volts, place back in service. If below 4.8 (9.6) volts, replace the battery.

STARTING SYSTEM

VISUAL INSPECTION

A thorough inspection of the starting motor system must be made before making electrical tests. Carefully observe the following instructions:

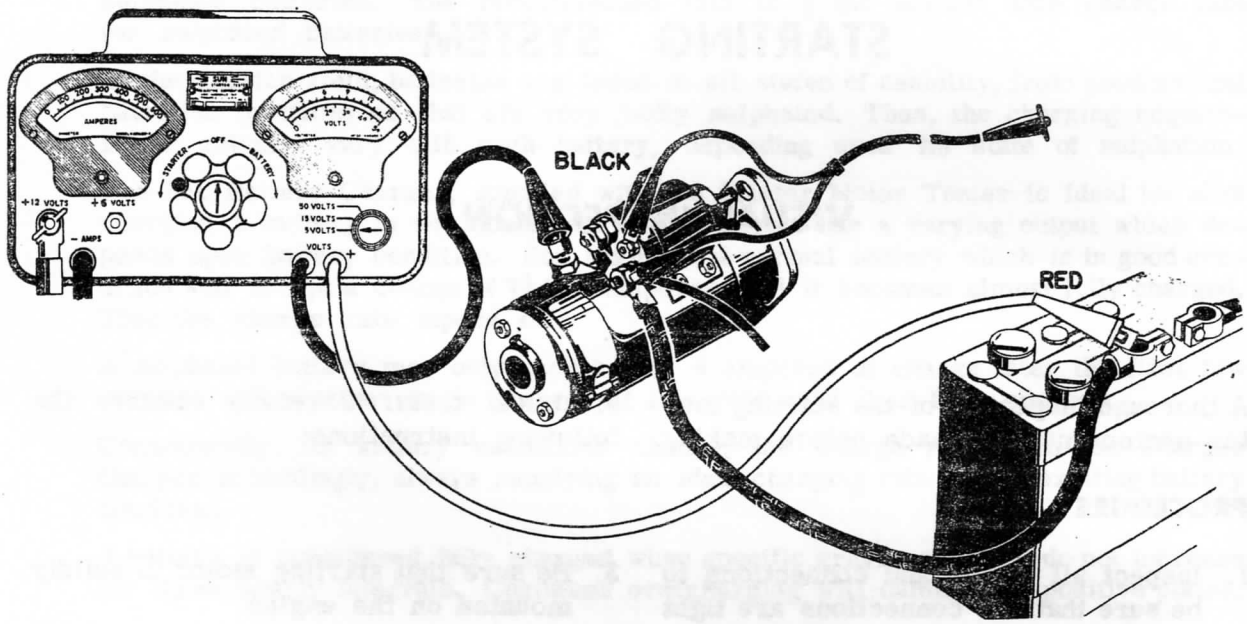
PROCEDURE

1. Inspect all cables and connections to be sure that the connections are tight and the cables are in good condition.
2. Inspect switch wiring and mechanical linkage.
3. Be sure that starting motor is solidly mounted on the engine.
4. Remove starting motor cover band and inspect for thrown solder, loose connections, worn brushes, worn or dirty commutator.

CABLES AND STARTER SWITCH

A high resistance in the starting motor circuit will result in hard starting and may seriously affect the operation of the generator and regulator if the high resistance is in the battery cables or ground cables.

INSULATED CIRCUIT TEST



PROCEDURE

1. Turn Voltmeter selector switch of Battery-Starter Tester to 5 VOLT position.

2. Connect Solenoid Starter Control Switch and test leads as shown.

3. Clean spot in center of battery post to which cable being tested is fastened.

4. Connect the positive Voltmeter lead to the center of the positive battery post to which the insulated cable is connected, and the negative Voltmeter lead to the starting motor terminal.

5. Close Solenoid Starter Control Switch and crank engine with ignition switch OFF. (On 12 volt systems, disconnect the High Tension Coil Lead.)

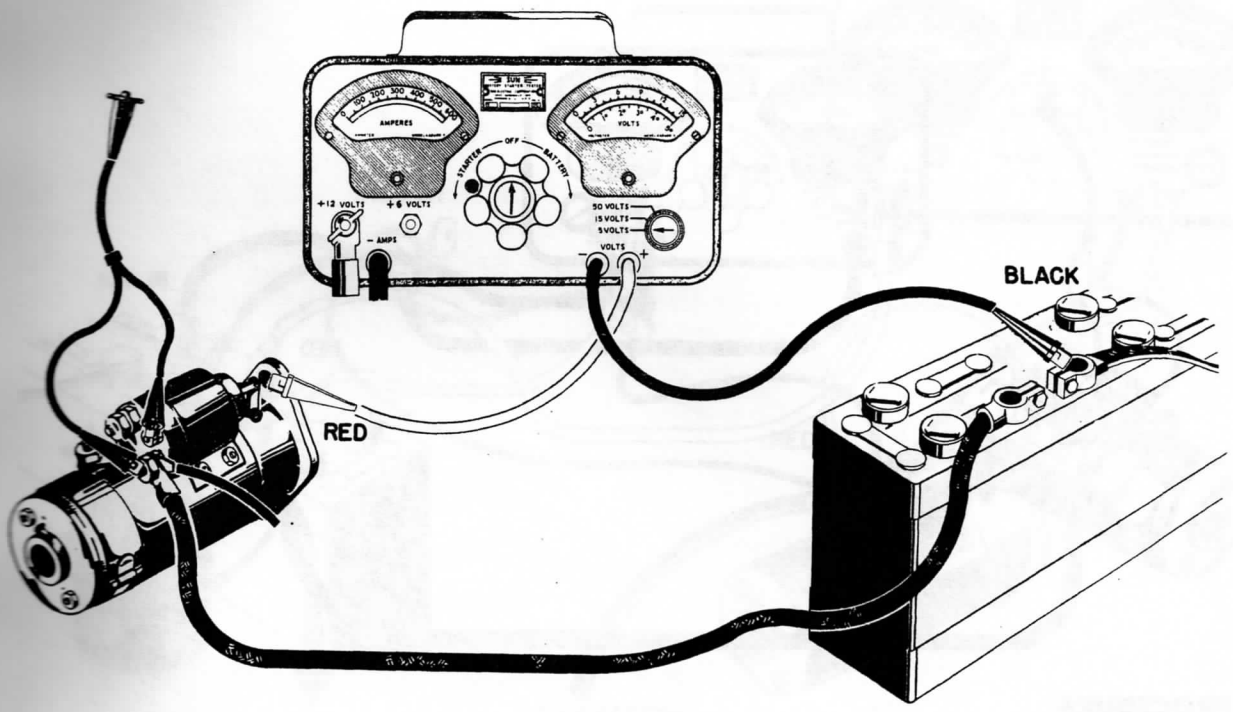
6. The Voltmeter should drop to .2 of a volt or less while the engine is being cranked by the starting motor. If the Voltmeter reads more than .2 of a volt it is an indication that the cables or connections are dirty or corroded, the cables are too small to carry the current or that the switch is defective.

   If the voltage drop across the entire insulated side of the battery starter circuit exceeds the specified .2 volt, test the individual parts of the circuit for excessive resistance. Maximum voltage drop for each should not exceed the following specifications:

a. Battery to switch	.1 volt
b. Across switch	.1 volt
c. Switch to starter terminal	none

GROUND CIRCUIT TEST

High resistance in the ground circuit of the Starting Motor system will result in hard starting and may seriously affect the operation of the generator or regulator



PROCEDURE

1. Turn the VOLTMETER SELECTOR Switch to the 5 VOLT position.
2. Connect the test leads as shown. The VOLTMETER lead at the battery must contact the Battery POST, not the cable clamp.
3. Connect Starter Solenoid Control Switch.
4. Close Starting Motor Switch and crank engine with Ignition Switch "OFF." (On 12 Volt Systems, disconnect the high tension coil lead.)
5. Voltmeter reading should not exceed .1 VOLT with the Starting Motor in operation.

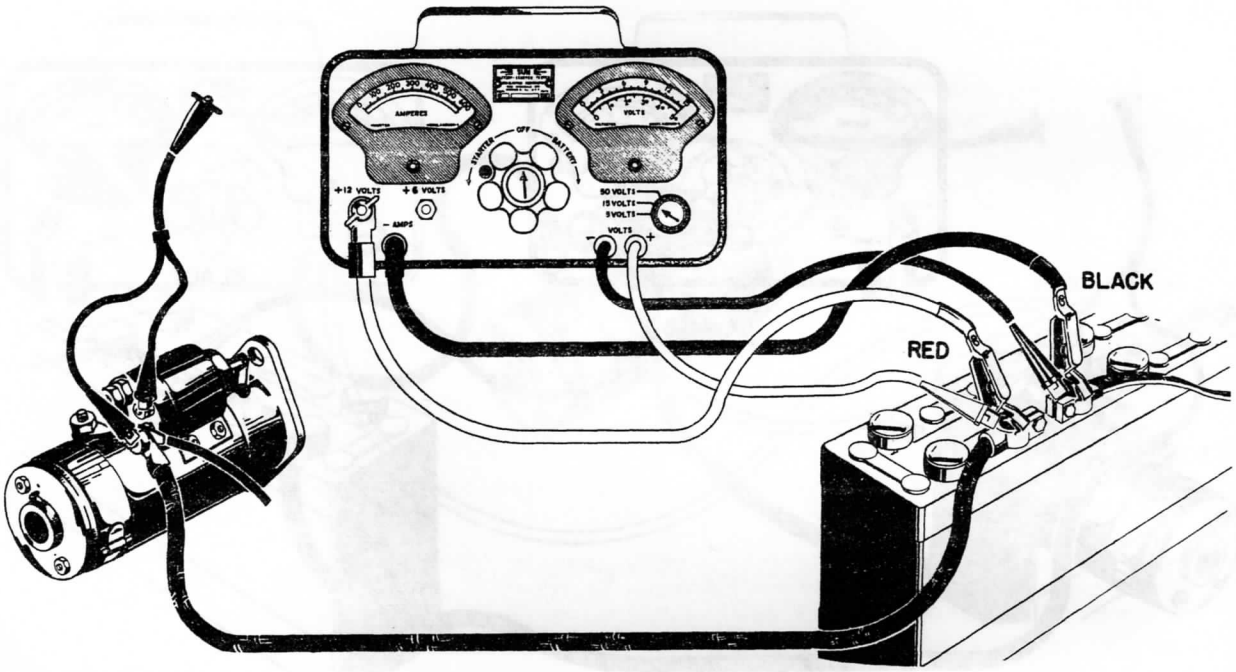
A Voltmeter reading of more than .1 VOLT is usually an indication of resistance due to loose, dirty or corroded connections or ground cables too small to carry the current.

To isolate the point of high resistance, apply the Voltmeter leads across each part of the circuit in turn with the Starting Motor in operation.

AMPERAGE DRAW TEST

Sometimes the starter will turn the engine slowly because the starter is drawing too little current. This condition may be due to poor connections within the starter, poor brush contact, etc.

When it is found that the starting motor amperage draw is higher than specified, various things within the starter could cause the trouble such as: the armature rubbing the field shoes, a grounded starting motor field coil, worn starter bushings, bent armature shaft, etc.



PROCEDURE

1. Turn Battery Starter Tester control knob to OFF position.
2. Turn Voltmeter Selector Switch to 15 Volt position and connect test leads as shown.
3. Connect solenoid control switch from Battery to Starter solenoid.
4. Disconnect high tension coil lead.
5. Close starting motor switch to crank engine and note the EXACT reading on the Voltmeter.
6. Open the starting motor switch. Turn Battery Starter Tester control knob clockwise until the Voltmeter reads EXACTLY as with starting motor Amperage Draw.
7. Read test Ammeter for Starting Motor Amperage Draw.
8. Amperage draw should be from 160 amps to 200 amps for 12 VOLT, from 175 amps to 225 amps for 6 VOLT.

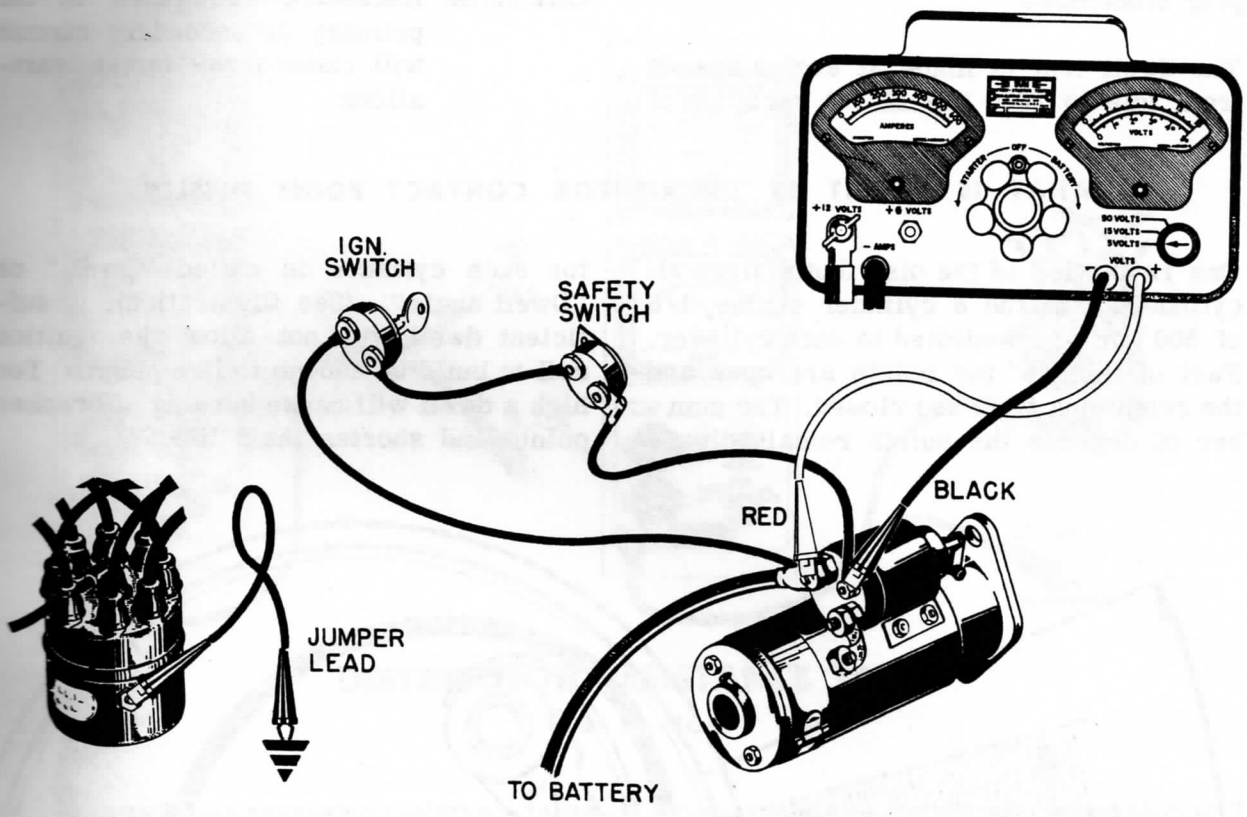
CAUTION: DO NOT TURN HANDLE OF BATTERY STARTER TESTER IN COUNTER-CLOCKWISE DIRECTION AS THIS WILL CONNECT THE AMMETER ACROSS THE BATTERY CAUSING A DIRECT SHORT.

SOLENOID SWITCH CIRCUIT RESISTANCE TEST

6 & 12 VOLT

High resistance in the Solenoid Switch circuit will reduce the current flow through the solenoid windings causing the solenoid to function improperly or not at all.

Improper action of the Solenoid Switch will, in most cases, result in burning of the main switch contacts thus reducing current flow in the starting motor circuit.



PROCEDURE

1. Turn Voltmeter Selector Switch to the 5 VOLT position.
2. Connect test leads as shown.
3. Place Transmission Selector Lever in NEUTRAL position.
4. Connect a jumper lead from the primary terminal of the distributor to ground as shown. (This is to prevent the engine from starting during the test.)
5. Turn Ignition Switch to crank engine while observing VOLTMETER reading.
6. The Voltmeter reading should not exceed .8 VOLT with the starting motor cranking the engine.

   If the Voltmeter reading is more than .8 Volt, it indicates excessive resistance in the starter switch circuit.

   Isolate the point of high resistance by repeating the test with the voltmeter leads connected across each wire and switch in turn.

   NOTE: If high resistance is noted in the Neutral safety switch, check the adjustment of the switch as outlined in the shop manual before condemning the switch.
7. Disconnect tester leads and JUMPER lead, after completing test.

DISTRIBUTOR POINT DWELL

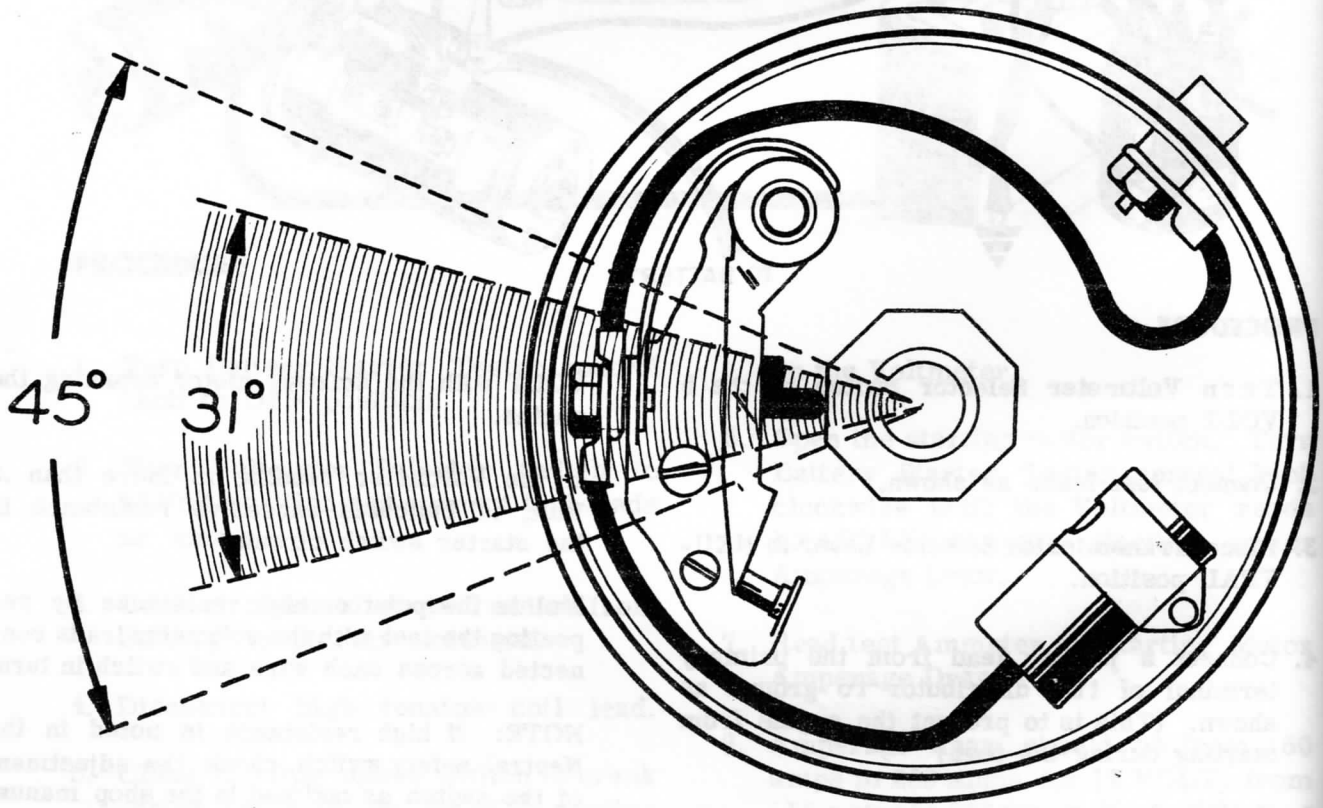
The dwell or length of time the breaker points are closed reflects strongly in the timing of the ignition as well as the quality of the spark across the spark plug electrodes.

The dwell test is made at engine speeds from idle to 2000 R.P.M. A variation of more than 2 degrees + in dwell from low to high speed will indicate worn breaker plate, shaft or bushings.

CAUTION: Excessive resistance in the primary or secondary circuit will cause dwell meter variations.

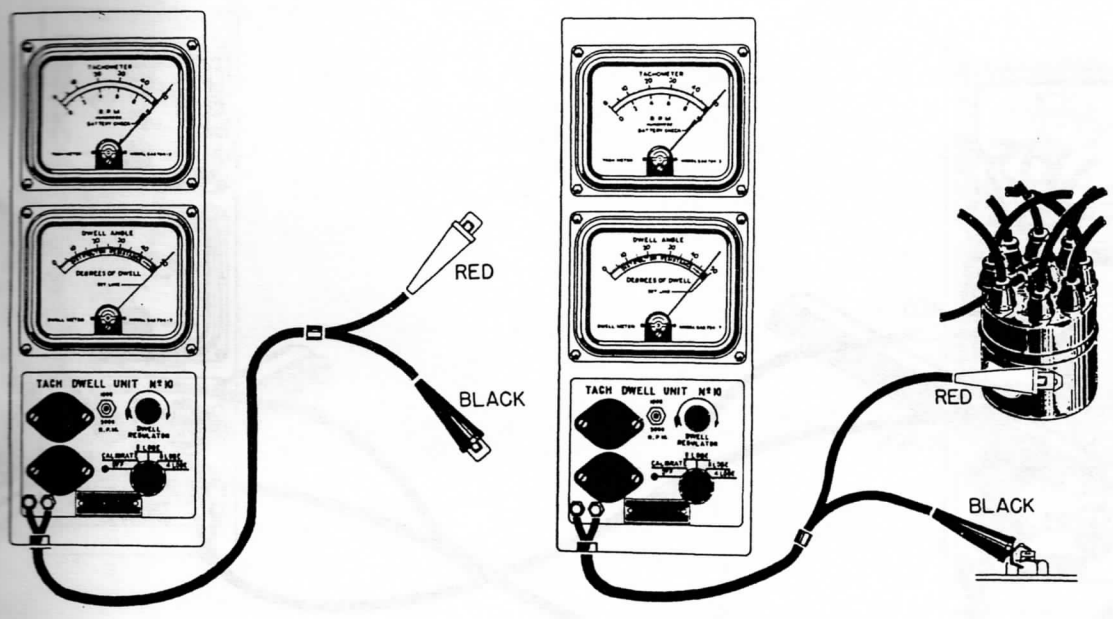
WHAT IS MEANT BY DISTRIBUTOR CONTACT POINT DWELL?

One revolution of the distributor fires all cylinders. In the 8 cylinder engine, 1/8 of 360° or 45° is alloted to each cylinder. Part of this 45° the points are open and the remaining time are closed. The number of degrees the points remain closed for each cylinder is called "Dwell" or "Dwell angle". (See illustration). Insufficient dwell will not allow the ignition coil to build up enough to fire plugs. Too high a dwell will cause burning of breaker points and shorten their life.



CALIBRATING THE TACH-DWELL UNIT

1. Zero the meters to left side of scale using the adjustment on the face of the meter.
2. Turn switch to CALIBRATE position, Tachometer pointer should read in black bar if flashlight batteries are O.K. for use.
3. Adjust dwell regulator until Dwell Meter pointer is on SET LINE with the test clips separated.



DISTRIBUTOR RESISTANCE TEST

6 & 12 VOLT

This test is to detect excessive resistance in distributor lead-in connections, wires, distributor contact points or distributor ground circuit. These defects can cause poor engine performance.

PROCEDURE

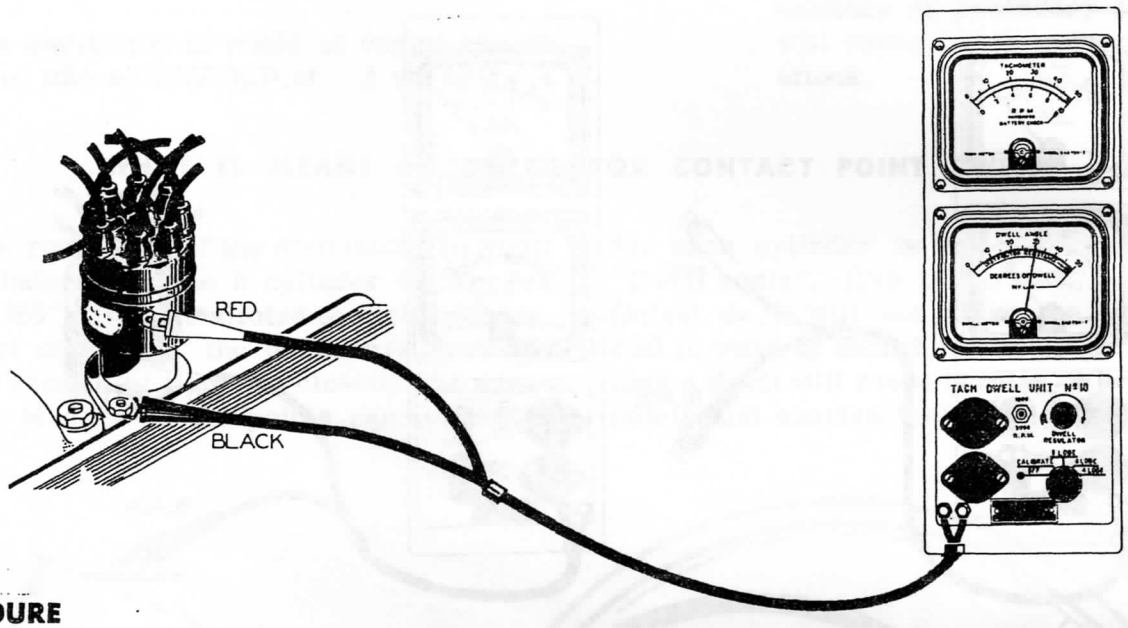
1. Calibrate Tach-Dwell Unit. Leave in CALIBRATE position to make the test.
2. Connect test leads as shown.
3. Turn the car ignition switch to ON position.
4. Using the starting motor, turn the engine a fraction of a revolution at a time until the highest reading is obtained on the Dwell Meter. This reading will occur when the points are entirely closed. The reading with the points closed should be inside the black bar at the right end of the scale. A reading outside the black bar indicates excessive resistance in the distributor primary circuit, and further tests with the distributor removed will isolate trouble.

DISTRIBUTOR POINT DWELL TEST

6 & 12 VOLT

The "Dwell Angle" is the degrees of distributor rotation through which the points are closed. If the dwell angle is less than specified, the engine may fail to run at higher speeds because the build-up time is too short causing coil output to be low.

Increasing point dwell decreases point gap, therefore, dwell must not be increased beyond the specified amount.



PROCEDURE

1. After making the Distributor Resistance Test, leave test leads connected as shown.
2. Turn the Tachometer Selector Switch to the 1000 RPM position.
3. Make sure that the Dwell Meter Selector Switch is in the 8 LOBE position.
4. Start Engine and run at 375 to 400 RPM.
5. Read DWELL METER.

   Dwell reading should be from 26 to 33°.
6. Continue with Dwell Variation Test.

DWELL VARIATION TEST

6. Turn the Tachometer Selector Switch to the 5,000 R.P.M. position.
7. Slowly increase engine speed to 2000 R.P.M. while observing the Dwell Meter Reading.

   The dwell meter reading should not vary more than 2 degrees with the change in engine speed.

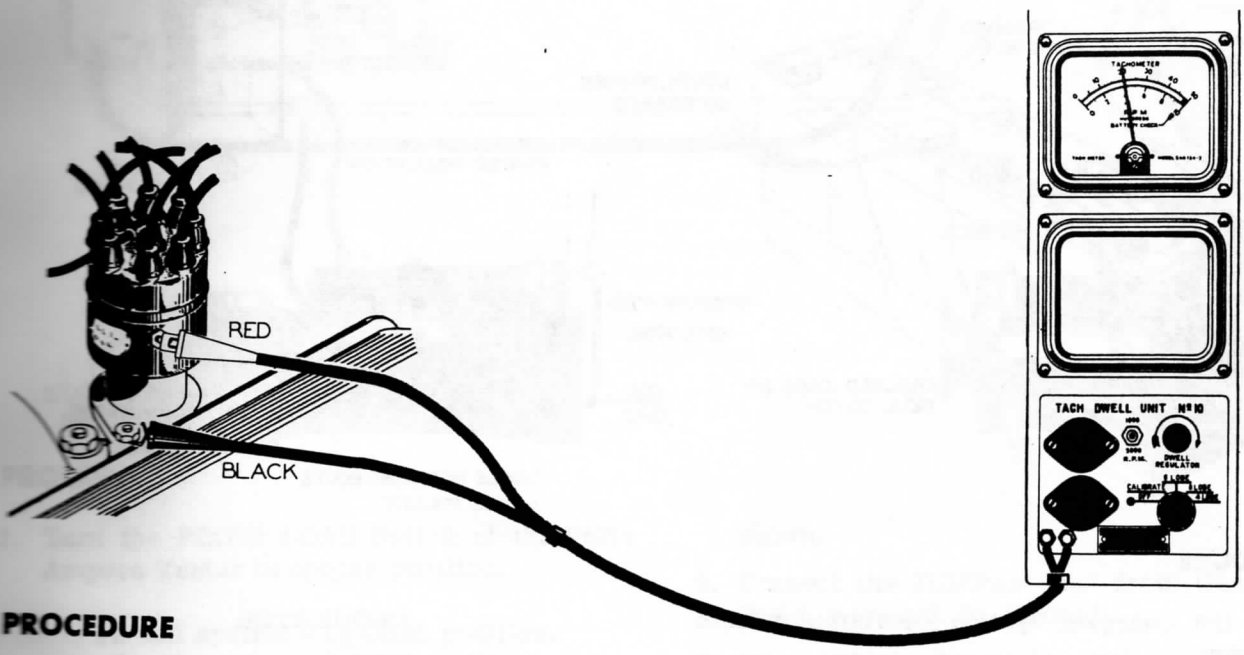
   If the engine is not misfiring, a variation of more than 2 degrees dwell indicates wear in the distributor shaft, bushings or breaker plate. These points should be very carefully checked when the distributor is removed for advance curve tests on the Distributor Tester.

   Misfiring in the engine due to ignition defects, especially above 2000 R.P.M., may cause the dwell meter reading to exceed the limits even when shaft and bushings are in good condition.

IMPORTANT: Making a distributor point dwell test does not eliminate the need for testing point gap! Both gap and dwell are important and in the case of worn parts or wrong parts, it is possible to have proper dwell and still have too little gap, etc.

IDLE R.P.M. TEST

The engine idle R.P.M. setting should be tested and recorded as it is when the vehicle is brought in the shop for testing. This is an important factor in determining the cause of complaints of the engine stalling or complaints of creeping and hard shifting on vehicles equipped with automatic transmissions.



PROCEDURE

1. After calibrating the Tach-Dwell Unit and making the Distributor Resistance Test, leave the test leads connected as shown.

2. Turn the DWELL METER Selector Switch to the 8 LOBE position.

3. Turn the TACHOMETER Switch to the 1000 R.P.M. position.

4. Start the engine and run it until normal operating temperature is reached.

5. Make sure that the Idle Speed Adjustment Screw is against the stop. (On vehicle equipped with fast idle cams, open throttle momentarily to allow the fast idle cam to move to normal operating position. Then close the throttle and make sure the idle adjustment screw is against the stop.)

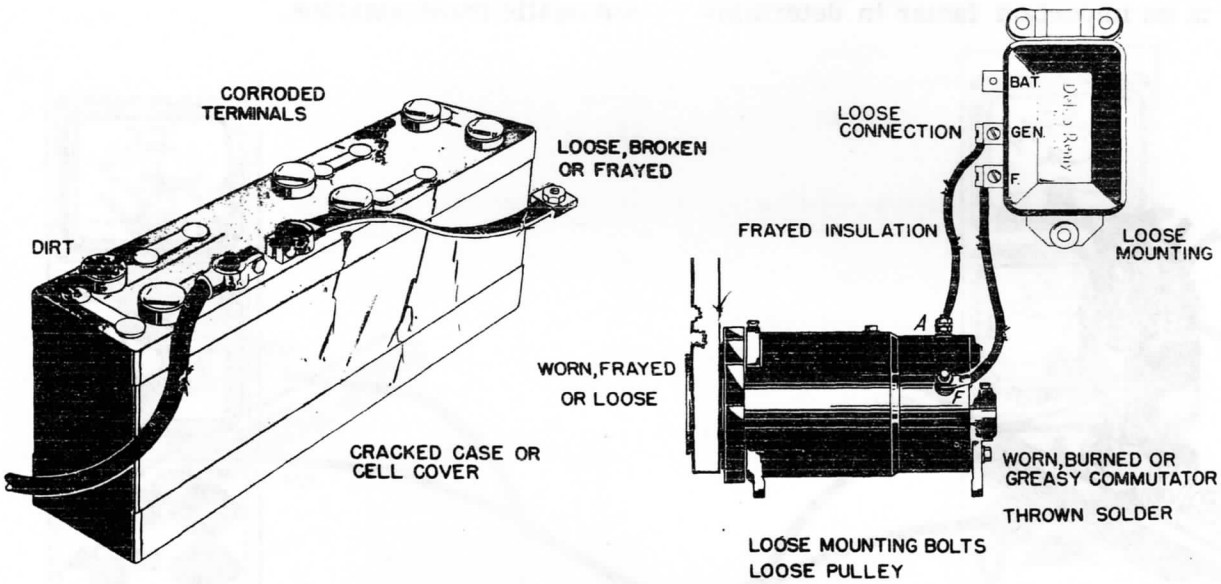
6. Engine idle should be 400 R.P.M. with transmission selector lever in "Drive" range.

GENERATOR

AND CHARGING SYSTEM

VISUAL INSPECTION

A complete visual inspection of the Charging System must be made before proceeding with electrical tests of the generator, regulator and charging circuit.



PROCEDURE

Inspect the Charging System for visible defects as follows:

BELTS

Inspect generator drive belt and/or fan belt for defects or improper tightening.

GENERATOR

Inspect commutator for dirty, worn, burned or glazed condition, or high mica between commutator bars.

Inspect generator brushes for frayed or loose leads, worn or sticky condition, or improper brush spring tension.

REGULATOR

Check regulator serial number to be sure that proper regulator is being used.

Be sure that regulator leads are properly connected and all connections are tight.

WIRING

Inspect wiring for frayed insulation, broken or partially broken leads, or wrong connections.

CONDENSERS

If a radio by-pass condenser is mounted on the generator, it should be connected to the Armature Terminal, never the Field Terminal.

CAUTION

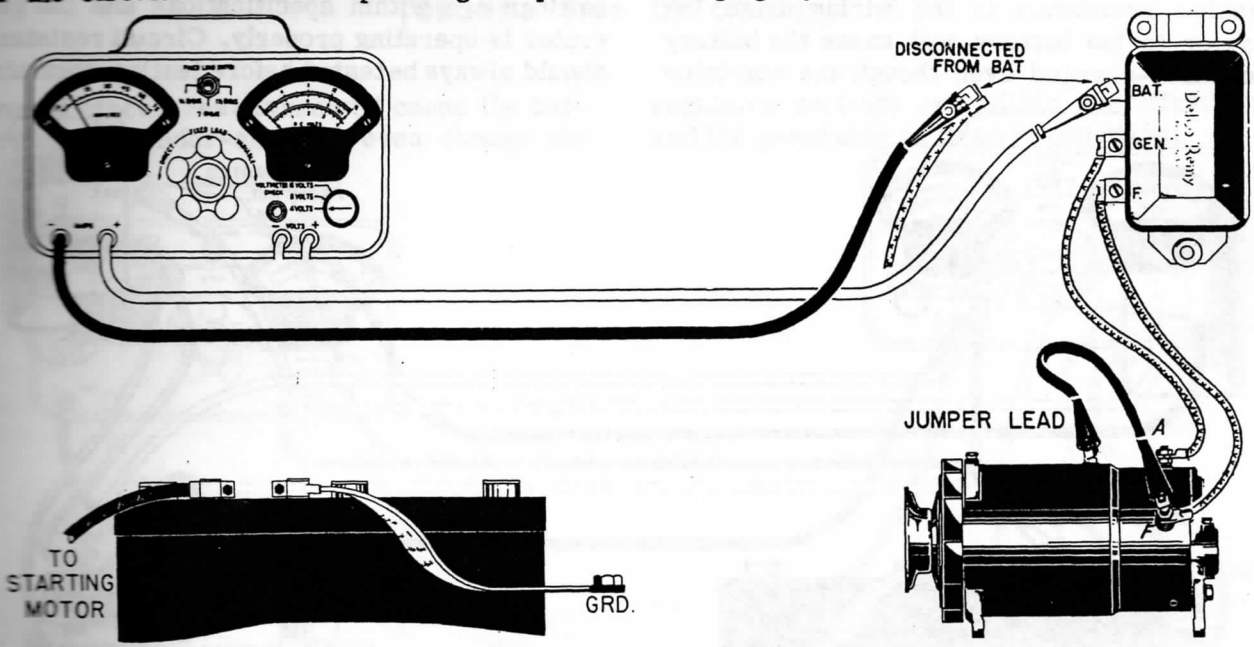
Always test charging circuit resistance and generator output before testing regulator settings. The regulator cannot be accurately tested if the charging system is otherwise defective.

The Charging system must be at normal operating temperature to obtain an accurate test and adjustment because voltage regulators are temperature compensated and stabilize only at normal operating temperature.

Also, resistance in the charging system can be more readily detected when the system is at normal operating temperature. Do not test system cold except when necessary as in the case of no output at all.

PREPARATION FOR CHARGING SYSTEM TESTS

All Electrical tests of the charging system must be made with the generator, regulator and the circuits at normal operating temperature. (A tachometer should be connected to read engine speed when making tests of the charging system.)



PROCEDURE

1. Turn the FIXED LOAD Switch of the Volts Ampere Tester to proper position.

   12 volt system - $1\frac{1}{2}$ OHM position.
   6 volt system - $\frac{3}{4}$ OHM position.

2. Turn the Control Knob of the Volts Ampere Tester COUNTER-CLOCK WISE to the "stop" in DIRECT position.

3. With engine stopped or at low idle speed, disconnect the wire from the BATTERY terminal of the regulator.

4. Connect the TEST AMMETER leads as shown.

5. Connect the JUMPER lead from Generator Field terminal to Ground.

6. Turn vehicle headlights ON.

7. Adjust engine speed until Test Ammeter reads 10 TO 15 AMPERES.

8. If engine and electrical system are cold, run engine for 15 MINUTES to normalize charging system.

9. Turn off headlights and proceed with Circuit Resistance Test.

TEST INDICATIONS

If little or no charging rate is obtained, proceed as follows:

a. Be sure that the Control Knob of the tester is in DIRECT position.

b. Check to see that the generator drive belt is not slipping.

c. Disconnect the Armature wire from the Armature terminal of the generator.

d. Connect the Voltmeter from the Armature terminal of the generator to Ground, leave jumper lead connected and slowly increase engine speed to see if the generator voltage will quickly rise above battery voltage.

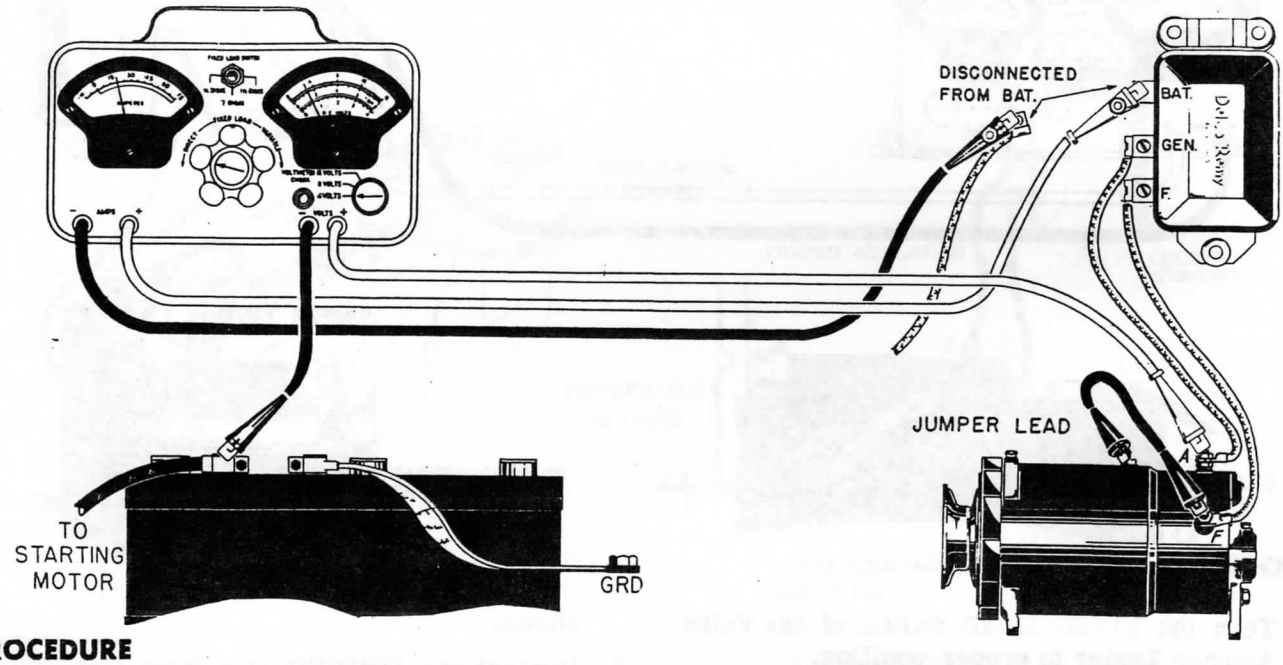
If generator voltage rises quickly, the trouble is not in the generator. Look for defective cut-out relay, open charging circuit, or grounded armature lead.

If generator voltage will not rise, the generator is defective.

GENERATOR CIRCUIT RESISTANCE TEST

(INSULATED SIDE OF CIRCUIT)

Excessive resistance in the wiring from the generator to the battery will cause the battery to be under-charged even though the regulator settings are within specifications and the generator is operating properly. Circuit resistance should always be tested before testing regulator.



PROCEDURE

1. Be sure that the Control Knob of the Tester is in DIRECT position.
2. Leave AMMETER leads and JUMPER lead connected as shown.
3. Turn VOLTMETER SELECTOR Switch to 4 VOLT position.
4. Connect the VOLTMETER leads from the Armature terminal of the generator to the Ungrounded battery post, as shown.
5. Slowly increase engine speed until Test Ammeter reads EXACTLY 20 AMPERES.
6. With Ammeter reading specified amperage the Voltmeter reading should not exceed .8 VOLT.

   If Voltmeter reading exceeds specifications, See Test Indications.
7. Leave the AMMETER leads connected and the charging rate set as in Step 5, and proceed with the Ground Circuit Resistance Test.

TEST INDICATIONS

If Voltmeter reading exceeds specifications, it indicates excessive resistance in the circuit.

With the charging rate at exactly 20 AMPERES, place the VOLTMETER leads across each part of the circuit in turn. The Voltmeter readings should not exceed the following values:

From Armature terminal of generator to Armature terminal of regulator - .15 volt.

From Armature terminal of regulator to Battery terminal of regulator - .2 volt.

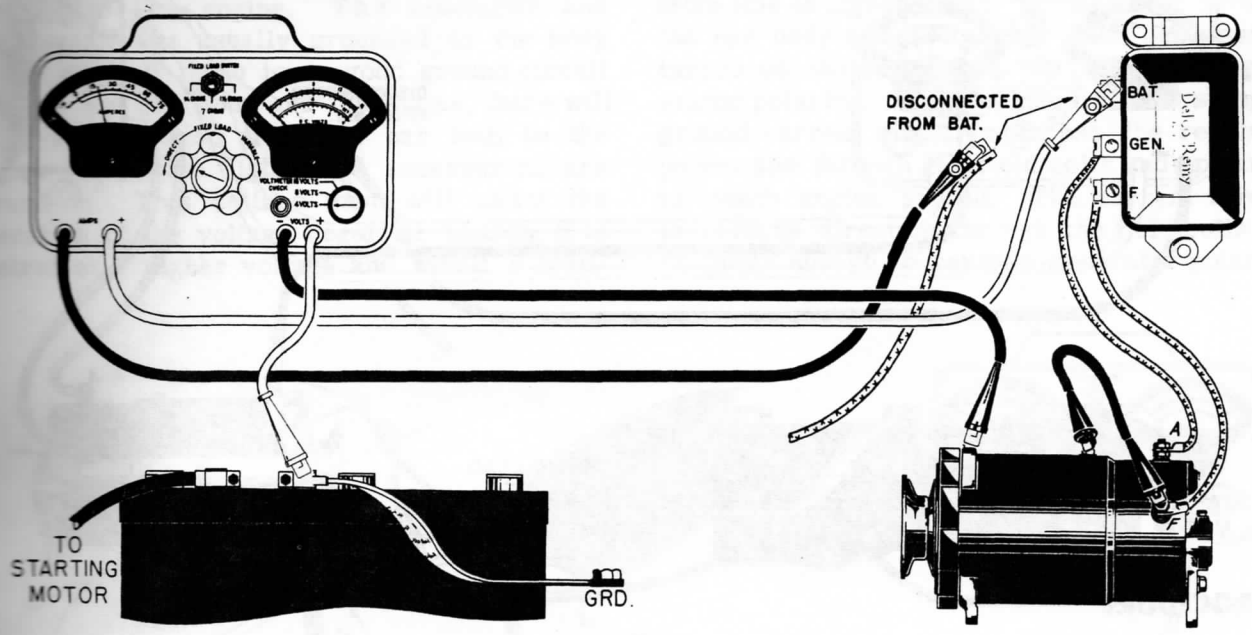
From end of Disconnected battery wire to Ungrounded post of battery - .2 volt.

NOTE: AVERAGE VOLTAGE DROP ACROSS TEST AMMETER AND LEADS IS .25 VOLTS OR LESS.

CIRCUIT RESISTANCE TEST

(GROUND SIDE OF CIRCUIT)

Ground circuit resistance will cause the battery to be under-charged even though the regulator settings are within specifications and the generator is in good condition.



PROCEDURE

1. Be sure the Control Knob is in DIRECT position.
2. Leave AMMETER leads and JUMPER lead connected as shown.
3. Leave VOLTMETER SELECTOR Switch in 4 VOLT position.
4. Connect VOLTMETER leads from Grounded battery terminal to Ground on the generator end frame, as shown.
5. With the Test Ammeter reading EXACTLY 20 AMPERES the reading on the Voltmeter should not exceed .1 volt.

   If Voltmeter reading exceeds specifications, see Test Indications.
6. Proceed with Regulator Ground Test.

TEST INDICATIONS

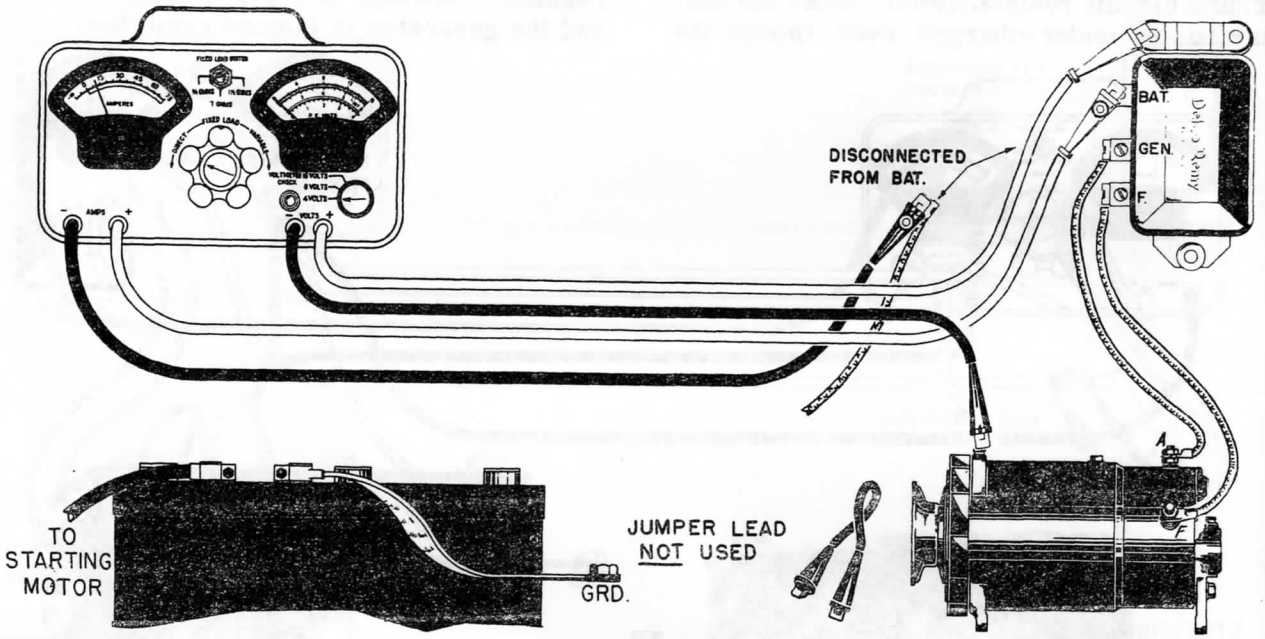
If the Voltmeter reading obtained in Step 5 is more than 1/10th of a volt, the circuit has too much resistance. Find the point of high resistance by placing the VOLTMETER leads across each part of the circuit in turn with exactly 20 AMPERES flowing. There should be no more than the slightest voltmeter deflection across any one part of the circuit.

Test voltage drop from Grounded battery terminal to Ground on engine.

Test voltage drop from Ground on engine to Ground on generator.

REGULATOR GROUND TEST

Resistance in the regulator ground circuit will affect the maximum voltage of the charging system. For example, if the voltage drop in the regulator ground circuit increases from zero to two-tenths of a volt, the maximum controlled voltage of the system will be two-tenths of a volt higher than the actual setting of the voltage regulator.



PROCEDURE

1. REMOVE THE JUMPER LEAD FROM THE GENERATOR FIELD CIRCUIT.
2. Be sure that the Control Knob is in DIRECT position.
3. Leave the AMMETER leads connected as shown and connect the VOLTMETER leads from Ground on the regulator to Ground on the generator, as shown.
4. Be sure the VOLTMETER SELECTOR Switch is in the 4 VOLT position.

Note: Increase engine speed momentarily to see if the generator charges after the jumper lead is removed. If not see Test Indication 1 below.

5. Slowly increase engine speed from IDLE to 1500 R.P.M. while observing the Voltmeter. Voltmeter reading should be less than .1 VOLT if regulator ground circuit is satisfactory.

If the Voltmeter reading is not less than .1 VOLT, see Test Indication 2 below.

TEST INDICATIONS

Test Indication 1

If the generator charges with the jumper lead on but will not charge after the jumper lead is removed, the most common causes are: the Cutout relay set too high, the voltage regulator set below the closing voltage of the Cutout relay, or a defective field circuit in the regulator.

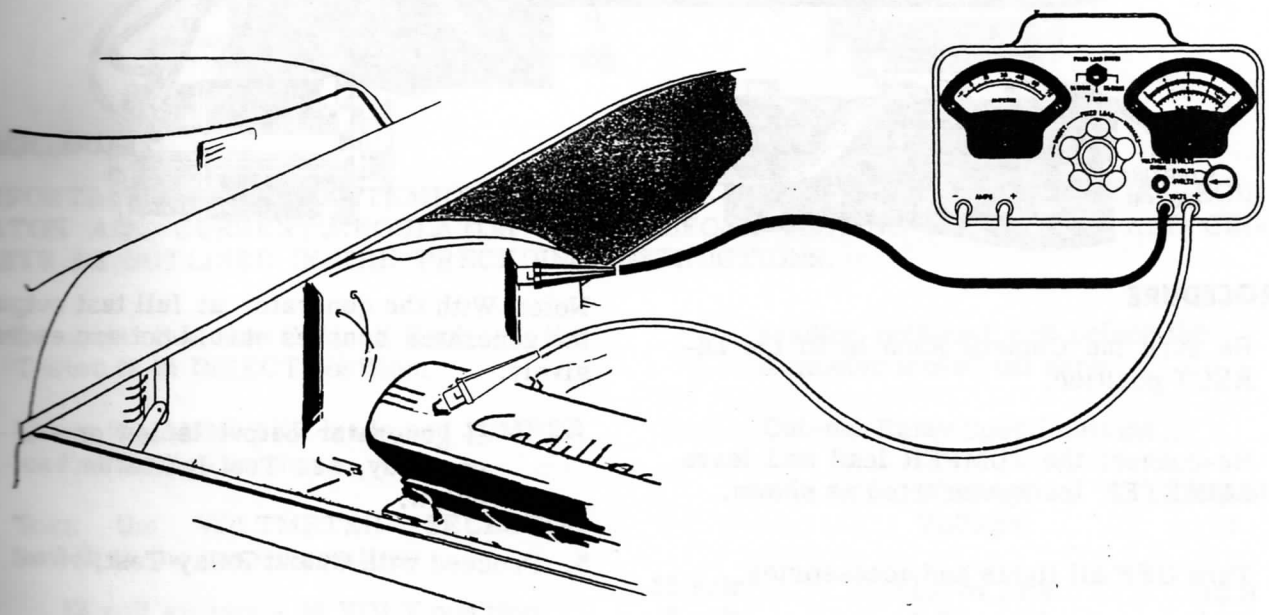
Test Indication 2

If the Voltmeter reading is as much as .1 volt in step #5 above, locate point of resistance by repeating test with voltmeter connected in turn from regulator base to car body, from car body to engine ground, and from ground on engine to generator end frame.

ACCESSORY GROUND CIRCUIT TEST

IMPORTANT: This test may show the cause of a bad headlight "flare-up" or reversed generator polarity.

In the modern automobile, the battery grounds directly to the engine. The headlights and accessories are usually grounded to the body of the car. If there is no good ground circuit between the car body and the engine, there will be a voltage drop from the car body to the engine when the lights and accessories are turned on. This voltage drop will affect the operation of the voltage regulator causing it to control at a higher voltage and result in headlight flare-up when engine speed is increased from idle to higher speed. Voltage drop between the car body and the engine with accessories turned on can sometimes cause reversed generator polarity. When the generator is stopped, ground current may flow across the regulator points and through the field coils and armature to reach engine ground. The current flowing in reverse direction through the field coils can be great enough to reverse generator polarity.



NOTE: MAKE THIS TEST WITH ENGINE STOPPED

PROCEDURE

1. Turn the VOLTMETER SELECTOR Switch of the Volts Ampere Tester to the 4 VOLT position.

2. Connect one voltmeter lead to ground on the car body and the other lead to ground on the engine as shown.

3. Turn on all lights and accessories, then note the Voltmeter reading.

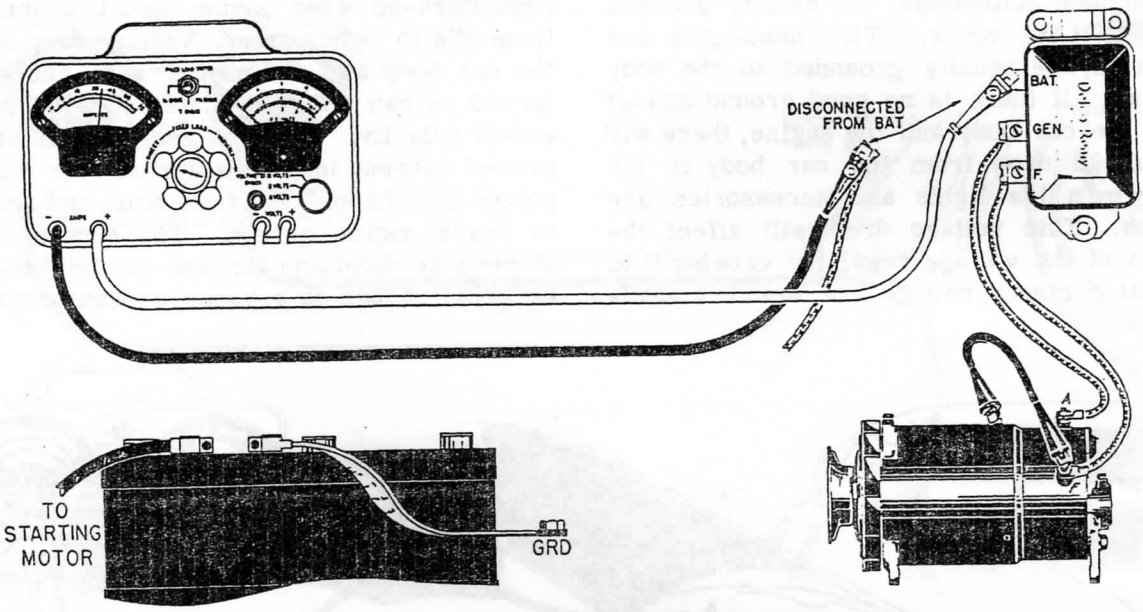
The Voltmeter reading should not exceed .1 VOLT.

If the voltmeter reading exceeds .1 VOLT test the voltage drop, at the ground strap connections between the engine and car body.

If the car is not equipped with a ground strap between the engine and body, it will be necessary to install one if the voltage drop exceeds .1 VOLT.

GENERATOR OUTPUT TEST

With a good generator, output will rise steadily and evenly with engine speed and should reach full test output.



PROCEDURE

1. Be sure the Control Knob is in the DIRECT position.

2. Re-connect the JUMPER lead and leave AMMETER leads connected as shown.

3. Turn OFF all lights and accessories.

4. Start engine and gradually increase speed until the ammeter indicates at least the test output specified below. (Test output is 25% above rated output).

YEAR	RATED OUTPUT (AMPERES)	TEST OUTPUT (AMPERES)
1949-1950	40	50
1952	45	56
1953-1956	30	38
1957 60-62 w/o AC	30	38
1957-1958 60-62 w/AC 75-86 w/o AC	35	44
1957 75-87 w/AC	40	50
1958 60-62-75-86 w/AC	45	56
1959-1960 60-62-63-64 w/o AC	35	44
1959-1960 All w/AC	45	56

Note: With the generator at full test output, the generator brushes should not arc excessively.

If generator output is low or unsteady, see Test Indication below.

5. Proceed with Cutout Relay Test.

TEST INDICATIONS

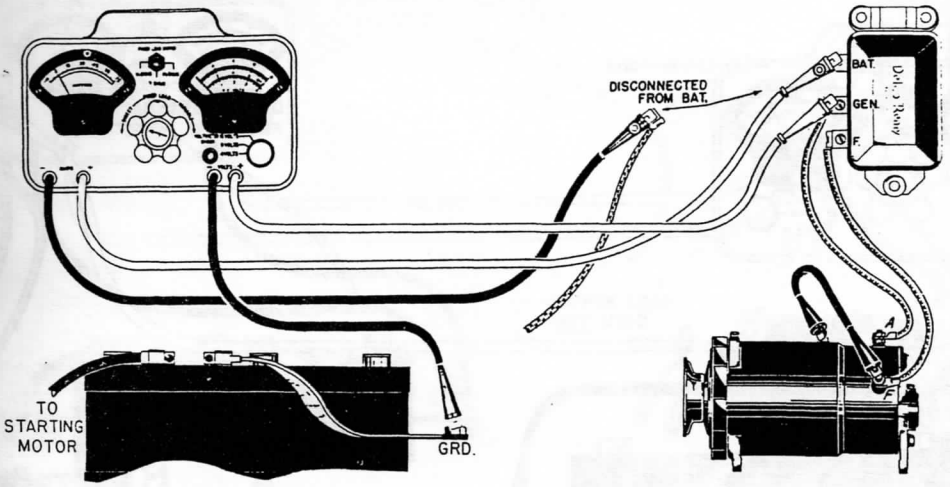
If generator output rises steadily and evenly to a certain point, then levels off or falls back, look for a slipping generator drive belt.

If generator output rises steadily and evenly, but fails to reach test output, look first for a glazed commutator. If commutator is not glazed and no other trouble is seen, the generator must be removed and bench tested.

If generator output is low or unsteady look for sticky or worn brushes, weak brush springs; rough, dirty or out-of-round commutator; or defective armature.

CUTOUT RELAY TEST

The purpose of the cutout relay (circuit breaker) is to close the circuit between the generator and battery when generator voltage is high enough to cause a charging current to flow to the battery, and to open the circuit when the generator is at low speed, or stopped, so that the battery will not discharge through the generator.



PROCEDURE

IMPORTANT: DO NOT ATTEMPT TO TEST THE CUTOUT RELAY, VOLTAGE REGULATOR AND CURRENT REGULATOR UNITS BEFORE TESTING GENERATOR AND CIRCUITS AS OUTLINED IN THE PRECEDING INSTRUCTIONS.

1. Be sure that the Control Knob of the Tester is in DIRECT position.

2. Leave the AMMETER leads and JUMPER lead connected as shown.

3. Turn the VOLTMETER SELECTOR Switch to the proper position:

   12 volt system - 16 VOLT position.
   6 volt system - 8 VOLT position.

4. Connect the VOLTMETER leads from the Armature terminal of the regulator to Ground, as shown.

5. Slow the engine until the Voltmeter reads less than battery voltage and the Ammeter reads steady on zero. The cutout relay points are now open.

6. Very slowly increase engine speed (by turning idle adjustment screw if convenient) so that the Voltmeter reading builds up a fraction of a volt at a time. Keep glancing at the Ammeter after each increase in voltage.

   The closing voltage of the cutout relay is the highest Voltmeter reading obtained just before the Ammeter moves off zero.

Cut-out Relay Specifications

	Closing Voltage	Adjust to
12 volt	11.8 to 13.6	12.8
6 volt	5.9 to 6.8	6.4

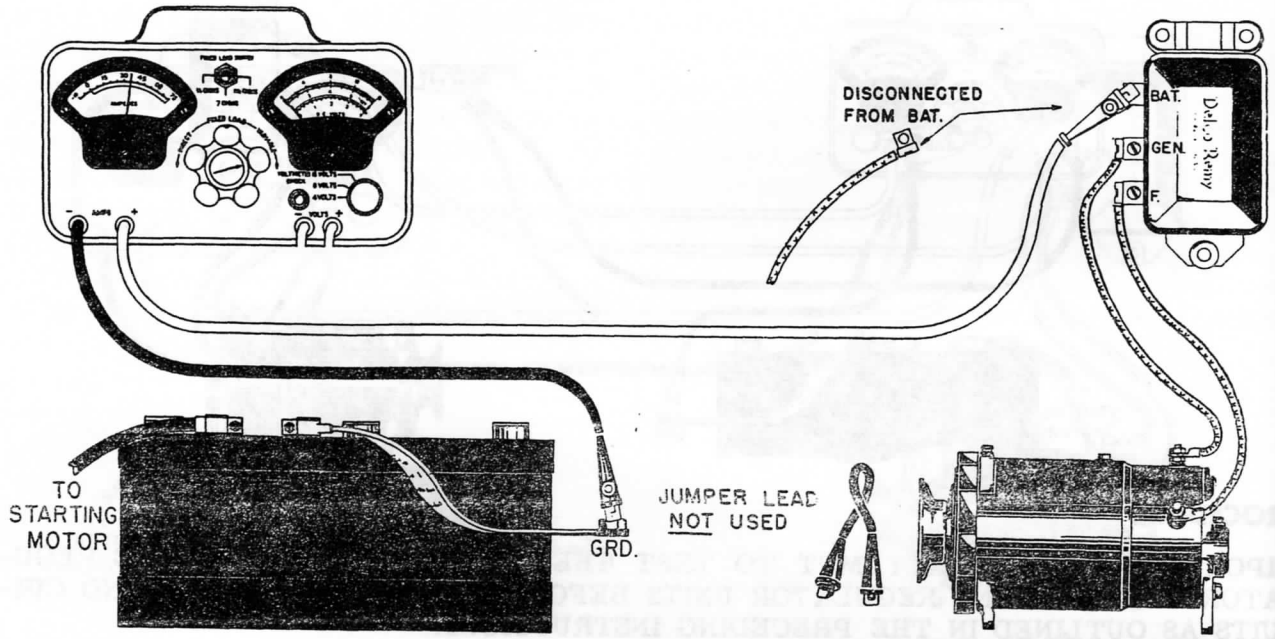
7. Continue to increase engine speed until Test Ammeter reads 8 to 10 AMPERES, then slowly decrease engine speed while watching Ammeter. The Ammeter pointer will move to the left of zero, then suddenly return to zero as speed is further decreased.

   The opening amperage of the cutout relay is the greatest discharge reading obtained before the pointer returns to zero. Normal counter-amperage is from 0 to -6 amperes.

8. Repeat Steps 6 and 7 several times to assure accurate tests, and refer to specifications for proper closing voltage and opening amperage.

CURRENT REGULATOR TEST

The current control unit of the regulator limits generator amperage to a safe maximum. Excessive amperage will cause the generator to overheat and be destroyed.



PROCEDURE

1. BE SURE THE JUMPER LEAD IS REMOVED FROM THE GENERATOR FIELD CIRCUIT.

2. Leave the AMMETER leads connected from the BATTERY terminal of the regulator to ground as shown. (Voltmeter leads not used).

3. Be sure the FIXED LOAD Switch of the tester is in proper position:

   12 volt system - 1 1/2 OHM position.
   6 volt system - 3/4 OHM position.

4. Set the engine speed at approximately 1500 R.P.M.

5. Turn the CONTROL KNOB of the tester to VARIABLE position and adjust the Control Knob to obtain the highest possible reading on the ammeter.

6. The AMMETER reading now indicates the setting of the Current Regulator which should be:

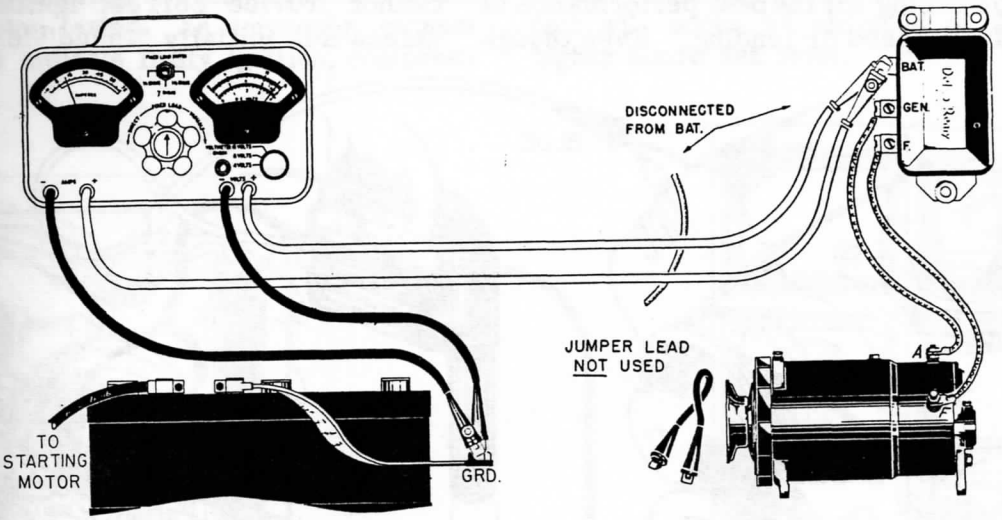
YEAR	RANGE	SET
1949-51	40-46 Amp	42 Amp
1952	45-51 Amp	47 Amp
1953-56, 1957 60-62 w/o AC	27-33 Amp	30 Amp
1957 60-62 w/AC, 75-86 w/o AC	32-37 Amp	34 Amp
1957 75-86	37-42 Amp	34 Amp
1958 60-62 w/o AC	32-37 Amp	
1958-59 All w/AC	42-47 Amp	
1959-60 60-62-63-64 w/o AC	32-37 Amp	
1960 All w/AC	42.5-47 Amp	

7. If the regulator setting is other than specified above, the cover should be removed and the adjustment screw turned clockwise to increase the current or counter-clockwise to decrease the current setting.

Note: If specified setting cannot be obtained, the points should be inspected for burning and pitting.

VOLTAGE REGULATOR TEST

The voltage control unit, of the regulator, limits charging system voltage to the value for which the unit is adjusted. This adjustment may be varied within the specified range to a point that keeps the battery properly charged but will not allow overcharging.



PROCEDURE

1. BE SURE THAT THE JUMPER LEAD IS REMOVED FROM THE GENERATOR FIELD CIRCUIT.

2. Turn the FIXED LOAD Switch of the Volts Ampere Tester to the proper position:

   12 volt system - 1½ OHM position.

   6 volt system - ¾ OHM position.

3. Lock the Tester Control Knob in FIXED LOAD position.

4. Connect the AMMETER leads and the VOLTMETER leads from the Battery terminal of the regulator to ground, as shown.

5. Be sure that the VOLTMETER SELECTOR Switch is in proper position:

   12 volt system - 16 VOLT position.

   6 volt system - 8 VOLT position.

6. Check calibration of Voltmeter.

7. Cycle the regulator by reducing engine speed until cutout relay points are open, then slowly increasing speed to approximately 1500 engine R.P.M.

8. The Voltmeter now reads the Voltage Regulator setting which should be:

YEAR	RANGE	ADJUST TO
1949-1952 6-Volt Models	7.0-7.7	7.4
1953-1956 12-Volt Models	14.0-15.0	14.5
1957 60-62, 75-86 w/o AC	13.8-14.8	14.2
1957 All w/AC	14.0-14.6	14.3
1958-59 w/o AC	13.8-14.8	
1958-60 All w/AC	13.8-14.6	
1960 w/o AC	13.8-14.7	

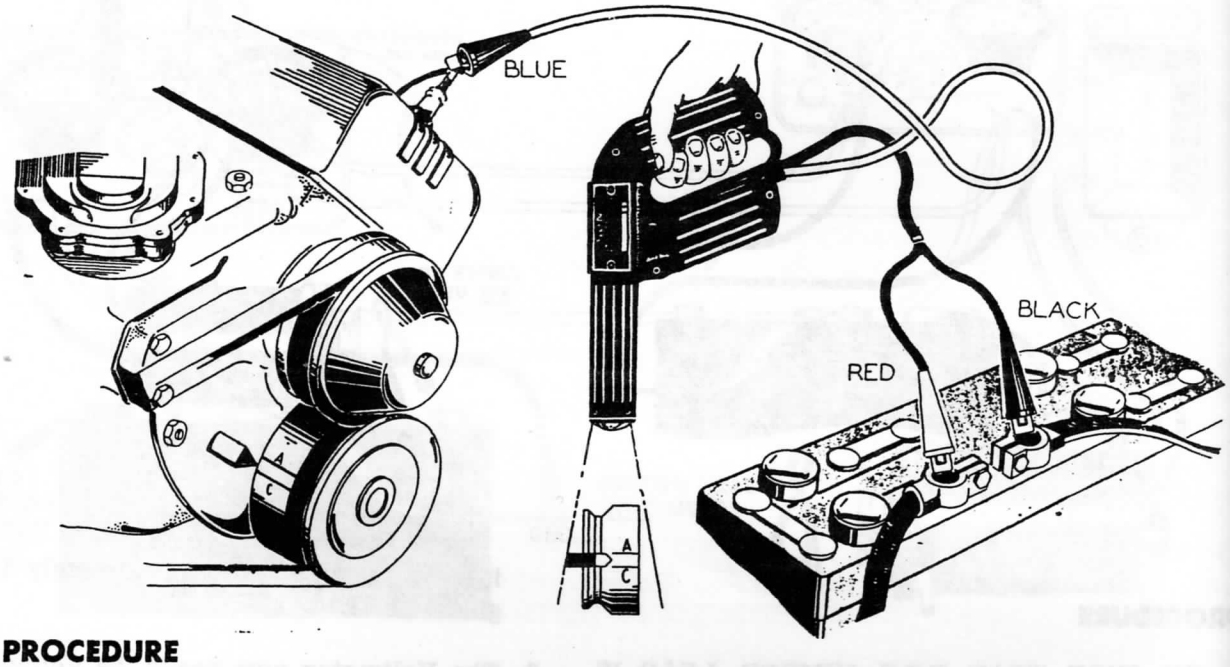
IMPORTANT: When adjusting the voltage regulator, repeat steps 7 and 8 after each adjustment and before taking final reading. Final test reading must be taken with regulator cover in place at normal operating temperature.

NOTE: After completing tests of the charging system, disconnect the test leads and reconnect the battery wire to the regulator. Be sure that all wires are properly connected and tightened and the generator cover band is in place.

Make it a habit to keep the jumper lead clipped to the handle of the tester when not in use. This will prevent accidentally leaving the jumper lead on the vehicle.

SPARK TIMING TEST

The distributor automatically varies the ignition timing for the best performance at any given speed or loading. Even though the distributor is properly calibrated it cannot provide correct ignition advance unless it is initially "timed" to the engine.



PROCEDURE

NOTE: Make sure the timing marks on harmonic balancer and the timing pointer are clean.

1. Connect primary leads of the timing light from battery terminal to ground and secondary (blue) lead to number 1 or 6 spark plug.

2. Disconnect and plug vacuum advance line to eliminate possibility of a carburetor difficulty causing timing test to be incorrect.

3. Set hand brakes.

4. Start engine and run at idle speed of 400 R.P.M. with hydramatic in Drive range. Observe timing light flashes on harmonic balancer in relation to pointer.

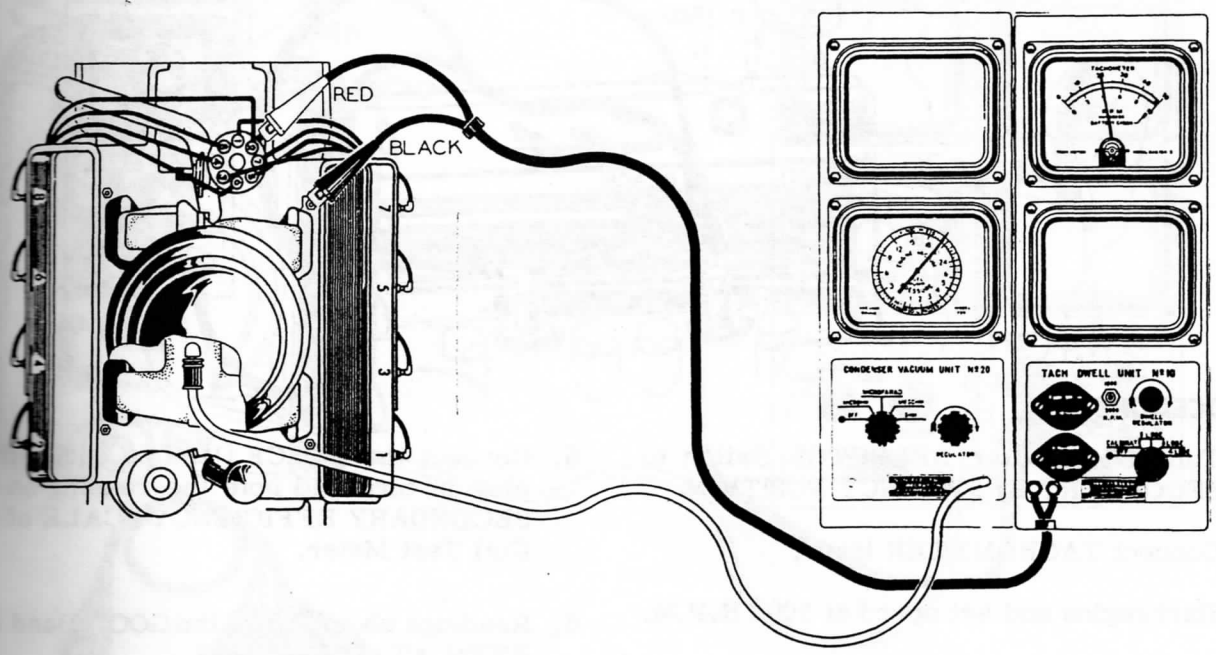
5. Reconnect vacuum line to carburetor.

NOTE: In localities where fuel of the specified octane rating is not available, the ignition timing may have been retarded toward "C" mark on harmonic balancer to eliminate "Ping" caused by detonation. Under no circumstances should the timing be set in advance of the "A" mark, regardless of the grade of fuel used.

MANIFOLD VACUUM TEST

Normal manifold vacuum will vary from 19 to 21 inches. The vacuum reading should be steady and meet the average for the particular model of engine being tested. An improper vacuum reading may indicate faulty ignition, compression or carburetion.

NOTE: A drop of 1 inch of vacuum per 1000 feet will occur at altitudes of 2000 feet or higher above sea level.



PROCEDURE

Prepare engine for Manifold Vacuum Test as follows:

1. Disconnect Booster Pump line at intake manifold.
2. Insert adapter fitting in intake manifold.
3. Attach Vacuum Pressure Gauge hose to intake manifold.
4. Connect Tachometer as shown.
5. Start engine and operate at 400 R.P.M. idle speed.
6. With engine at normal operating temperature and operating at specified idle R.P.M., Vacuum gauge reading should be steady between 19 to 21 inches.

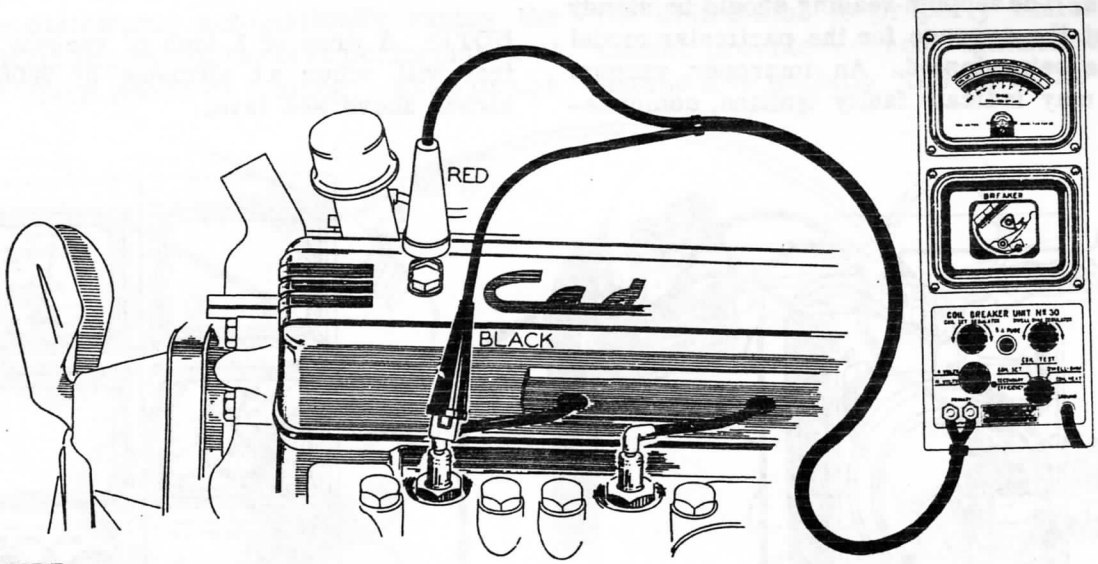
TEST INDICATIONS

Position or movement of hand will indicate following engine conditions:

Hand steady but lower than normal indicates poor rings. Hand drops 2 or more divisions when valve should close indicates leaky valve. Hand drops regularly several divisions indicates burned valve. Hand drops occasionally about 4 divisions indicates sticky valves. Fast vibration of hand between 14 and 19 indicates loose valve guides. Motor racing hand registers 10 to 22 indicates weak valve springs. Hand reads from 8 to 15 remaining steady indicates leaky intake or carburetor gasket. High reading at first, breaks to 0 and builds up slowly to about 16 indicates choked muffler. Hand floats slowly between 13 and 17 indicates that carburetor is out of adjustment.

SECONDARY EFFICIENCY TEST

This test provides an over-all indication of the performance of the entire ignition system as compared to the average for a given make and model of engine.



PROCEDURE

1. Turn Coil Tester SELECTOR Switch to SECONDARY EFFICIENCY POSITION.
2. Connect TACHOMETER leads.
3. Start engine and set speed at 1000 R.P.M.
4. Ground RED (Positive) lead of Coil Tester as shown.
5. Connect the BLACK lead to each spark plug in turn and note the reading on the SECONDARY EFFICIENCY SCALE of the Coil Test Meter.
6. Readings should be in the GOOD Band and EVEN AT ALL PLUGS.

When recording test information on a test report form, exact secondary efficiency readings can be recorded by using the numbers on the Coil Test Band.

SECONDARY EFFICIENCY TEST INDICATIONS

REVERSE METER READING (Off scale to left with leads connected as in Paragraphs 4 and 5) indicates: Coil of wrong polarity; primary wires reversed at coil; or battery connected backwards.

UNEVEN READINGS AT PLUGS indicates: defective spark plug wires or connections; corroded distributor cap towers; or a "cocked" distributor cap.

UNUSUALLY HIGH READINGS at two or more plugs indicates: a cracked distributor cap or insulation breakdown between spark plug cables.

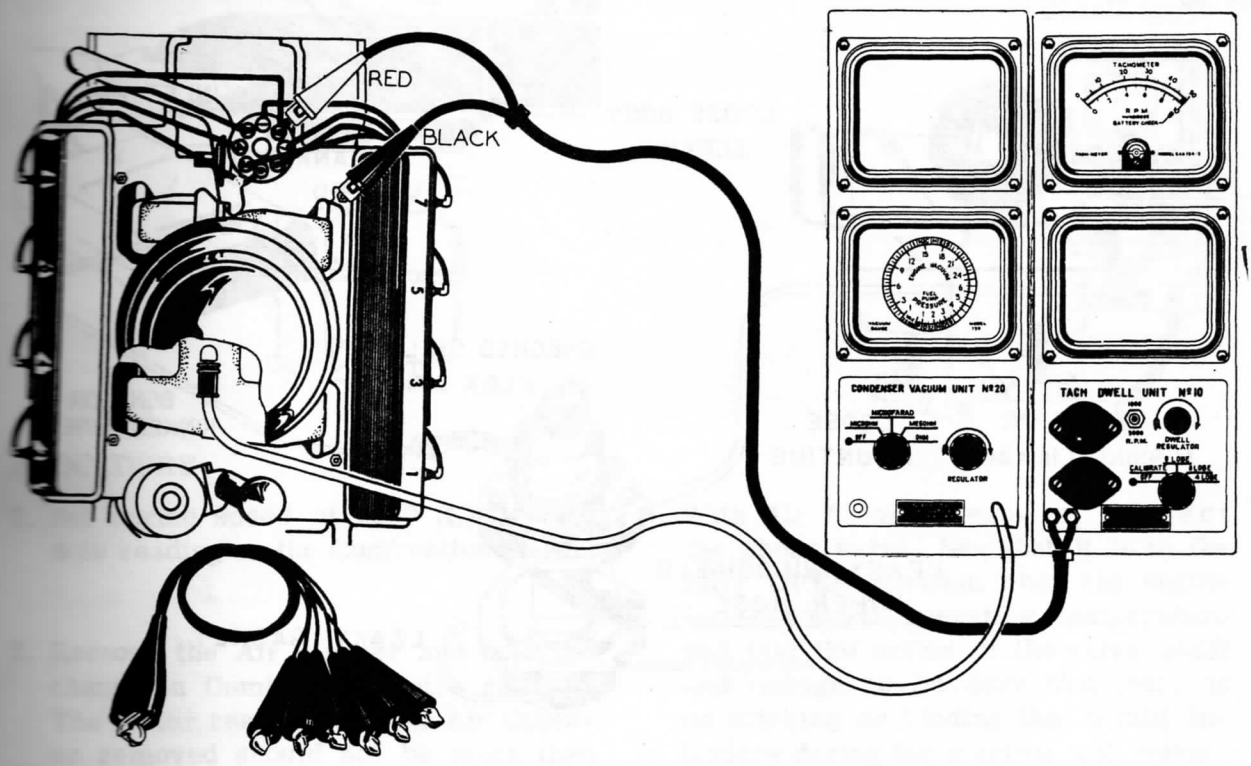
LOW READINGS AT ALL PLUGS indicates: excessive resistance in either the primary or secondary circuit; or a weak coil.

If the reading is unusually low at one or two plugs, remove the wire from the plug and again note the reading. If the reading improves with the wire removed, the plug is shorted out.

If readings are below normal on a car using secondary suppressors, test the resistance of the suppressors or cables and compare with specifications. Replace suppressors or cables if resistance is more than specified. REMOVING BUILT-IN SUPPRESSION MAY RESULT IN ABNORMAL SPARK PLUG WEAR AND POOR ENGINE PERFORMANCE.

CYLINDER BALANCE TEST

The power output from each cylinder in an engine should be the same for satisfactory performance. When the power output of each cylinder is not equal the engine will lose power and run roughly. The Cylinder Balance Test compares the power output of each cylinder in the engine.



PROCEDURE

1. Connect Tachometer and Vacuum Pressure Gauge.

2. Start engine and set to 1200 R.P.M.

3. Ground master clip and connect individual leads to all spark plugs EXCEPT the pair being tested. This shorts out all cylinders to which leads are attached, causing the engine to operate on one pair of cylinders.

4. The correct sequence for testing all cylinders is 1-6, 8-5, 4-7, 3-2. Each pair of cylinders should be operated for at least 20 to 30 seconds to obtain indications possible with this test.

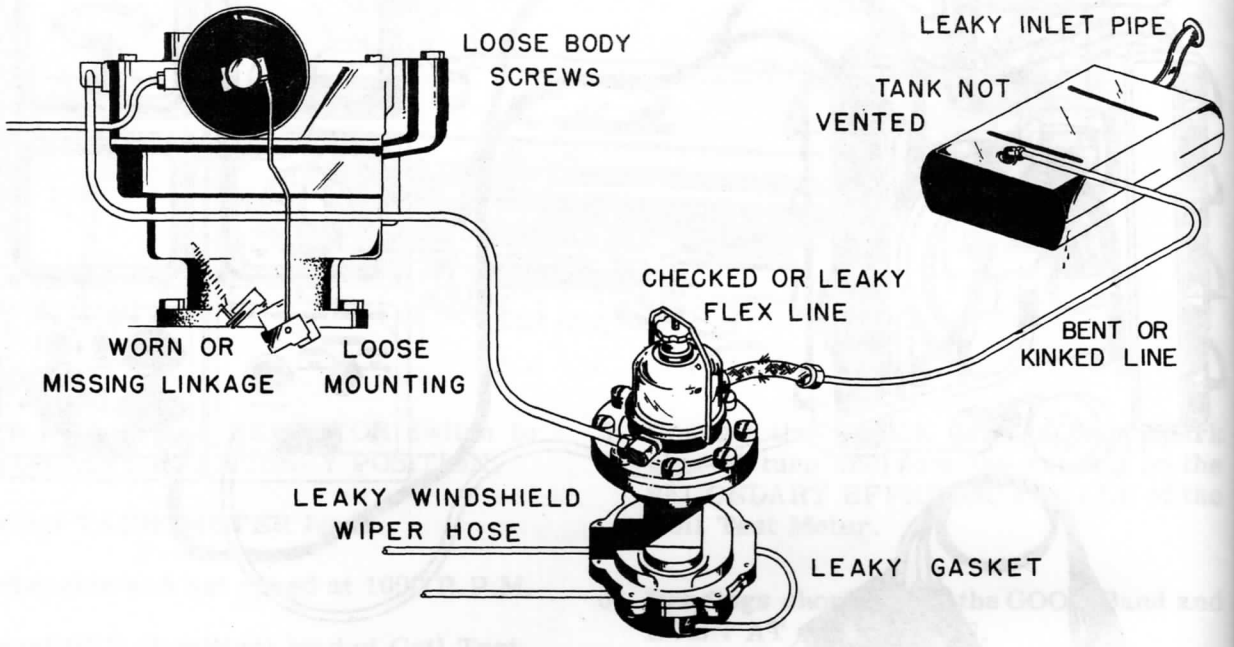
5. A variation of more than 1 inch of vacuum or 40 R. P. M. between pairs of cylinders being tested, indicates that the cylinders are off balance.

6. To isolate one weak cylinder, short out one complete bank at a time--1, 3, 5, 7, then 2, 4, 6, 8. The bank showing the better reading will be the one with the good cylinder of the pair testing weak.

FUEL SYSTEM VISUAL INSPECTION

There are several units that comprise the fuel system: the fuel tank, fuel lines (flexible and metal), fuel pump, carburetor and linkage and the manifold heat control valve.

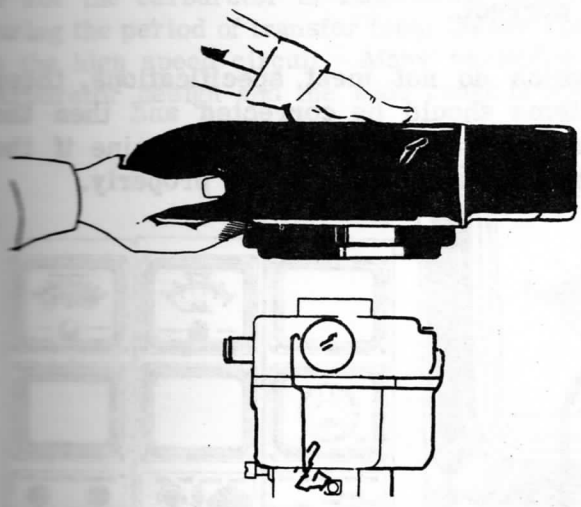
Before proceeding with any tests of the fuel system, a thorough visual inspection of each unit should be made to discover whether or not any physical defects exist.



INSPECT

1. **FUEL TANK** - for dents, leaks and proper venting of the tank.
2. **FUEL LINE** - for kinks, leaks, broken support brackets, loose connections or bad flexible lines.
3. **FUEL PUMP** - for loose mounting bolts, loose body screws, dirty or loose sediment bowl.
4. **FUEL FILTER** - for leaks or dirty filter element.
5. **CARBURETOR** - for loose body screws, worn or missing linkage.
6. **MANIFOLD HEAT CONTROL VALVE** - for frozen shaft and broken or inoperative thermostatic spring.
7. **AIR CLEANER** - for proper and secure mounting, tight cover and clean screen.

AIR CLEANER AND AUTOMATIC CHOKE TEST



PROCEDURE

1. Set engine speed at 2000 R.P.M. and note reading on the Combustion Meter.
2. Remove the Air Cleaner and note the change in Combustion Meter reading. The Meter reading with the Air Cleaner removed should not be more than 5% leaner.
3. With Air Cleaner removed, inspect the choke valve. See that it is in the fully OPEN position when the engine is at normal operating temperature and test the action of the valve, shaft and linkage to be sure that there is no sticking or binding that would interfere during the starting and warm-up period.

INTAKE MANIFOLD LEAK TEST

1. Operate engine at IDLE speed.
2. Use squirt can to apply a mixture of engine oil and kerosene to carburetor flange gaskets, intake manifold gaskets and throttle shaft.
3. Presence of leaks is indicated by a deflection of the Combustion Meter pointer at least 3% to the rich side of the scale.

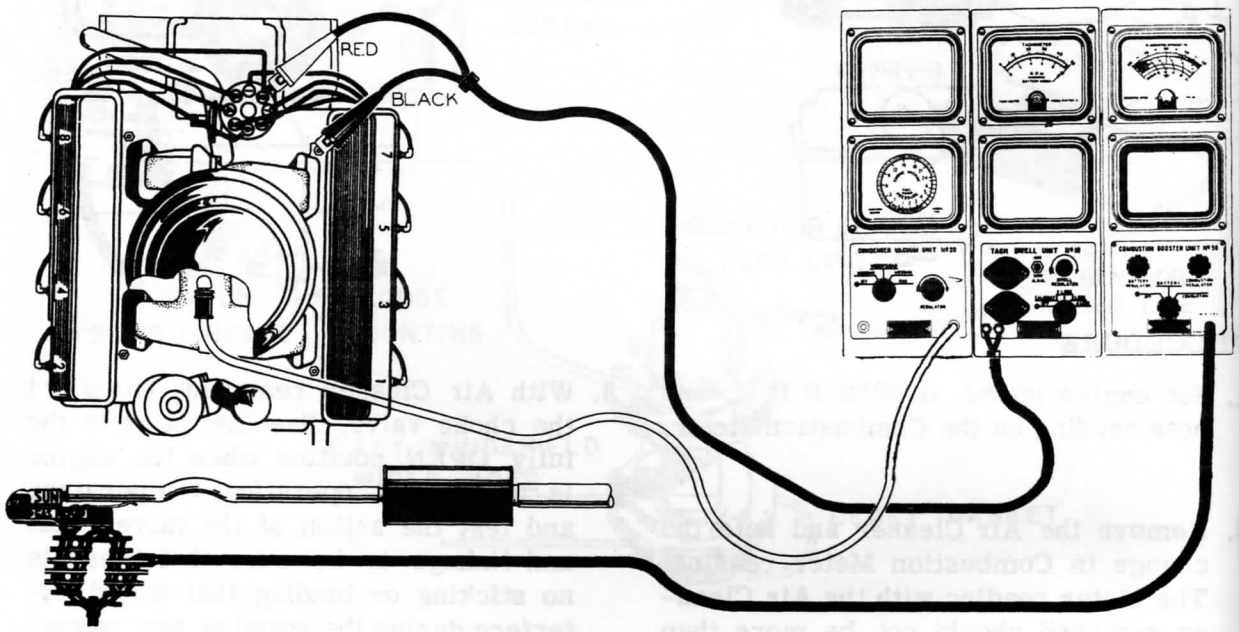
CARE MUST BE EXERCISED IN APPLYING THE KEROSENE-OIL MIXTURE. IF APPLIED EXCESSIVELY, THE MIXTURE OR HEAVY FUMES FROM THE MIXTURE CONTACTING THE HOT EXHAUST MANIFOLD, WILL ENTER THE MANIFOLD THRU THE CHOKE HEAT RISER TUBE AND CAUSE THE SAME METER REACTION AS AN INTAKE MANIFOLD LEAK.

CAUTION: Do not make Intake Manifold Leak Test near an open flame or if exhaust manifold is leaking badly. Keep fire extinguisher handy.

IDLE SPEED CIRCUIT TEST

Do not condemn a carburetor on the basis of a combustion test unless all factors of compression and ignition are known to be correct.

Combustion will be affected by any defects in compression or ignition. If, when the test report form is completed, there are factors of compression or ignition which do not meet specifications, these items should be corrected and then the combustion retested to determine if the carburetor is functioning properly.

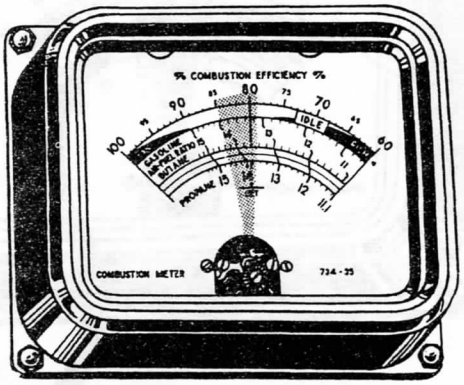


PROCEDURE

1. Connect the Vacuum Pressure gauge hose, Dwell-Tach wires and exhaust unit of the Combustion Tester as shown above and set the emergency brake.
2. Start and warm engine to operating temperature.
3. With selector lever in "DR" position, set idle at 400 R.P.M. by turning idle speed adjusting screw.
4. Turn one idle mixture adjusting screw out or in until highest R.P.M. is reached.
5. Repeat Step 4 with the other idle mixture adjusting screw.
6. Reset Idle R.P.M. as outlined in Step 3.
7. Repeat operation until turning the mixture screws will not cause an increase in engine idle R.P.M. or manifold vacuum.
8. After completing the idle adjustment read the combustion meter. It should read 79% ± 2%. Any marked deviation should be noted as it may be a guide to difficulties noted later in following combustion tests. Do not set idle mixture by means of the Combustion Tester.

INTERMEDIATE SPEED TEST

This test is invaluable in determining whether or not the carburetor is functioning properly during the period of transfer from the low speed to the high speed circuit. Many variables in carburetor design and the wide range of speed make it impossible to provide definite specifications. However, through experience, the operator can quickly learn to evaluate the test readings. Generally, the mixture will lean out progressively as engine speed is increased.



PROCEDURE

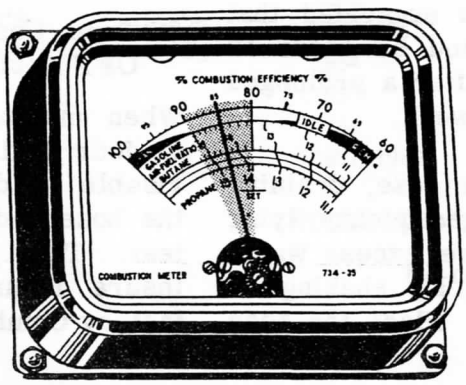
1. Slowly increase engine speed from idle to 2000 R.P.M. while observing Combustion Meter reaction.

2. Meter should indicate a progressively leaner mixture as engine speed increases.

An excessively rich mixture throughout the intermediate speed range may indicate a high float setting, a leaking power jet, leaking pump discharge jet, etc., while an excessively lean mixture through the range might indicate a low float setting, restricted jets or passages, etc.

An excessively rich mixture in the intermediate speed range may cause a "buck" or surge on closing the throttle; an excessively lean mixture may cause a "flat" spot on part-throttle acceleration.

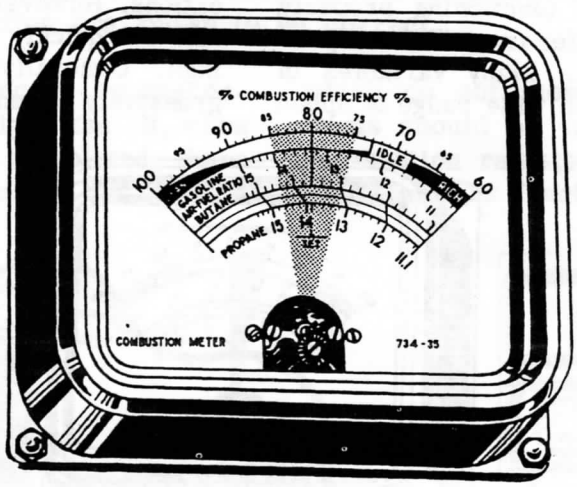
HI-SPEED CIRCUIT TEST



PROCEDURE

1. Start engine and operate at 2000 R.P.M.
2. Observe meter reading.
3. Combustion Efficiency reading should be 85% ± 5%.

ACCELERATING SYSTEM



PROCEDURE

1. Set the carburetor throttle stop so the engine will be running at about 2000 R.P.M. Push the foot throttle to the floorboard quickly and release the speed to 2000 R.P.M. If the accelerating system is working properly, the combustion meter pointer should move towards the rich band 10% or more for satisfactory extra discharge of gas going into the carburetor on the quick acceleration of the throttle.

2. If the combustion meter does not move 10% towards the rich side, it indicates that the accelerating system is not working properly, and the carburetor accelerating system should be checked in accordance with Shop Manual Procedure.

AFTER COMPLETING THE COMBUSTION TEST

1. Pull the exhaust hose off the panel fitting and allow the booster to continue running. It is suggested that this drying out period be about 10 minutes especially after a prolonged test on dynamometer work.

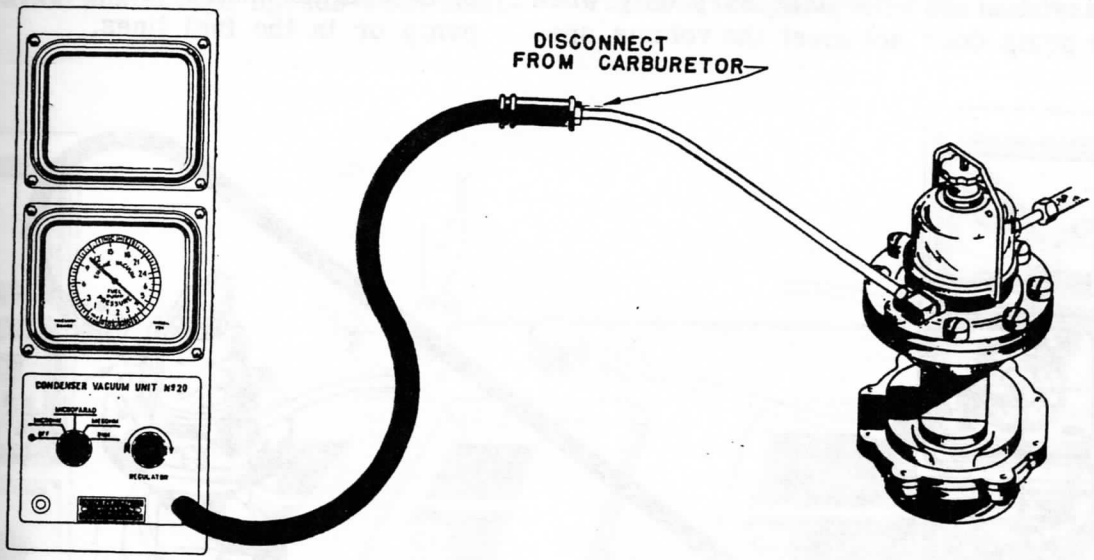
2. Roll up the exhaust hose, draining the water into the gas pickup lying on the floor. Remove excess water from the gas pickup by shaking or with compressed air. Place the hose and pickup in the right side compartment of the Tester.

3. Turn Combustion Tester switch to OFF position.

When making combustion tests of three or four engines in succession, it is advisable to drain the excess water from the hose and gas pickup unit after each test. This precaution must be taken to insure accurate test results and satisfactory Combustion Tester operation.

FUEL PUMP PRESSURE AND VOLUME TESTS

The fuel pump must be tested for the proper volume of fuel with the correct pressure at all engine speeds. Too low a pressure or volume will cause a high speed miss because of the lack of fuel delivered to the carburetor, while too high a pressure will cause carburetor flooding.



PUMP PRESSURE TEST

1. Disconnect fuel line at carburetor.
2. Attach Vacuum-Pressure Gauge hose to fuel line.
3. Operate engine at idle speed and observe reading on Vacuum-Pressure Gauge.
4. FUEL PUMP PRESSURE IN POUNDS:

YEAR	POUNDS	YEAR	POUNDS
1949-1953	4-5¼	1956	4-6½
1954	3½-4¼	1957-1958	5¼-6½
1955	4-5¼	1959-1960	5½-6½

PUMP VOLUME TEST

PROCEDURE

1. Disconnect the fuel line at carburetor and direct end of line into the graduated container.
2. Close Solenoid Starter Control Switch. Fuel discharge in pump strokes at cranking speed

FUEL DISCHARGE
IN PUMP STROKES AT CRANKING SPEED

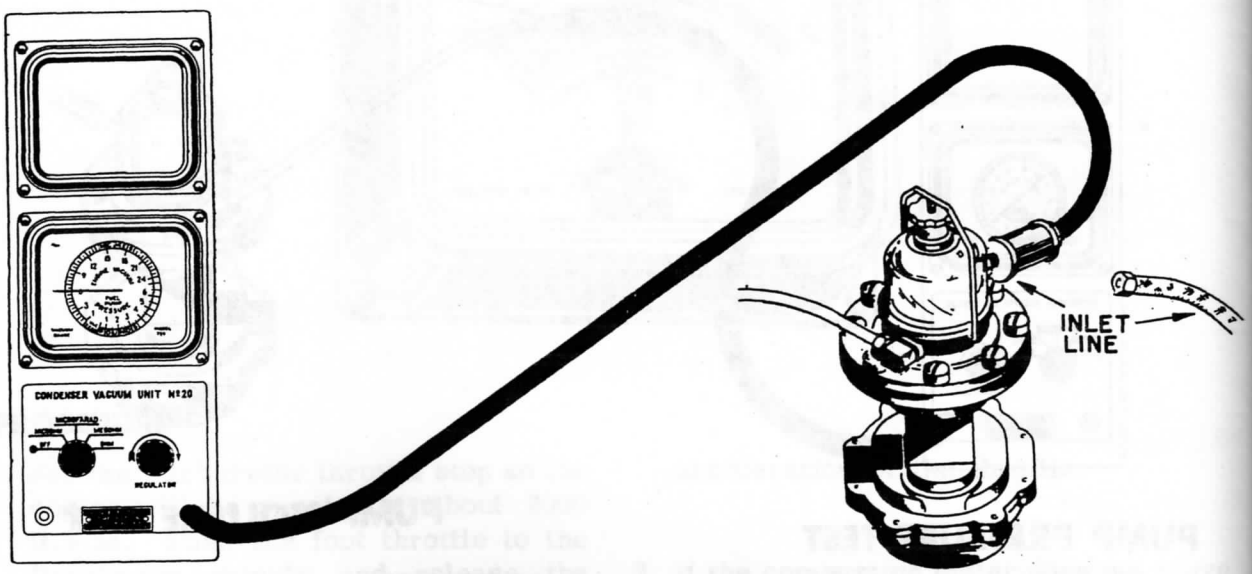
YEAR	STROKES	FUEL
1949-1953	12	½ pint min.
1954	9	½ pint min.
1955	11	½ pint min.
1956	9	½ pint min.
1957-1960	17	1 pint min.

NOTE: Use a container graduated in ounces to measure fuel delivery.

CAUTION: Do NOT operate the starting motor continuously for a period exceeding 30 seconds.

FUEL PUMP VACUUM TEST

The Fuel Pump Vacuum Test is an auxiliary test and is necessary only when the pump does not meet the volume specifications. The Vacuum Test is made to determine whether the defect is in the pump or in the fuel lines.

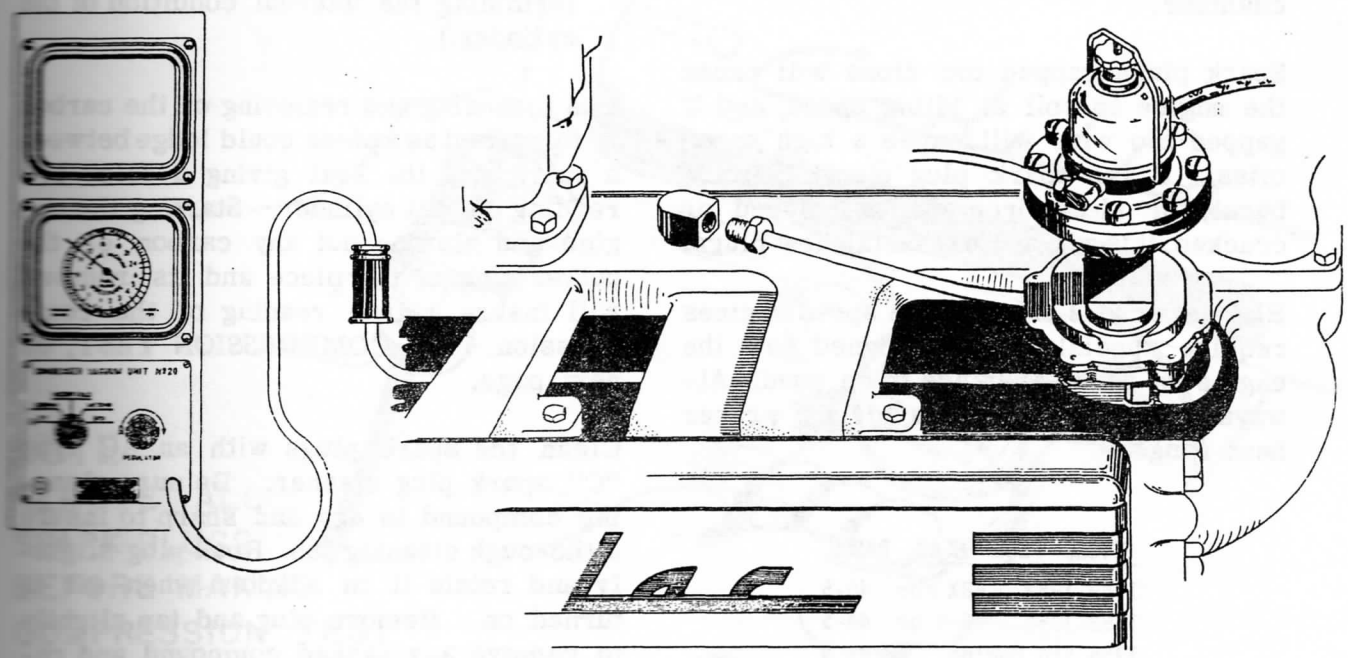


PROCEDURE

1. Disconnect INLET line to the fuel pump.
2. Insert proper adapter fitting in the pump and attach Vacuum Pressure Gauge hose.
3. Start engine and operate at IDLE speed.
4. Vacuum Gauge reading should be at least 6 inches. If not, the trouble is probably in the pump itself.
5. If pump vacuum was 6 inches or better under Step 4, proceed as follows:
6. Stop engine and reconnect line to pump.
7. Disconnect gas line at fuel tank and attach the Vacuum Pressure Gauge hose to the line.
8. Start engine and operate at IDLE speed.
9. Vacuum Gauge reading should be the same as in Step 4; if not, it indicates air leaks in the gas line between the tank and the pump.

VACUUM BOOSTER PUMP TEST

The purpose of the Vacuum Booster section of the fuel pump is to operate the windshield wipers during periods of acceleration and at high speeds when manifold vacuum is too low for proper wiper action. A complaint of improper wiper action may be due to stuck valves or ruptured diaphragm in the booster pump.



PROCEDURE

1. Remove windshield wiper hose from inlet side.
2. Disconnect manifold vacuum line.
3. Connect the vacuum pressure gauge to the inlet side of the booster.
4. Start engine and run at idle speed. The Vacuum reading should be 8" or better.

NOTE: In addition to testing the efficiency of the Vacuum Booster Pump, it is important that all lines leading to vacuum operated accessories be inspected for leaks. Any leaks present will cause pump to operate unnecessarily resulting in rapid wear of pump linkage.

SPARK PLUGS

Spark plugs should be clean, properly gapped, or replaced with new plugs, if necessary. Spark plugs with an oxide coating or gapped too wide create high resistance which cuts down the quality of the spark delivered in the combustion chamber.

Spark plugs gapped too close will cause the engine to roll at idling speed, and if gapped too wide will cause a high speed miss. If the spark plug electrodes are burnt, or the porcelain is chipped or cracked, it is advisable to install new plugs.

High compression and high speed engines require special plugs designed for the engine in which they are to be used. Always inspect spark plugs for the proper heat range.

SPARK PLUG HEAT RANGE	
1949-1952	48X or 46-5
1953-1954	46-5 or 44-5
1955 Std Engine	44-5
Eldorado Engine	43-5
1956-1960	44

NOTE: UNDER NO CONDITION USE 48X IN 1953 ENGINES!

Spark plugs are subjected to severe use in the combustion chamber of all engines. It is a very normal condition for spark plugs to wear out or become inefficient after they have been in use 10,000 miles or more. Spark plugs with the improper heat range and with excessive mileage waste gasoline.

The correct procedure for the removal of spark plugs is as follows:

1. Remove any foreign matter from around spark plug.

2. Loosen spark plugs about 1 turn to break free any accumulated carbon.

3. Start engine to blow out the carbon.

4. Stop engine and remove spark plugs placing them in the order that they were removed. (Visual inspection of the individual spark plugs aids in determining the internal condition of the cylinder.)

The loosening and removing of the carbon is important as a piece could lodge between a valve and its seat giving a false low reading on that cylinder. Starting the engine and blowing out any carbon or the pulverizing of the piece and its removal will insure a true reading of the compression. See COMPRESSION TEST, on next page.

Clean the spark plugs with an AC type "C" spark plug cleaner. Be sure cleaning compound is dry and sharp to insure a thorough cleaning job. Rock plug slightly and rotate it in adapter when air is turned on. Remove plug and tap slightly to remove any packed compound and repeat cleaning operation until insulator is clean and white.

Check the spark plug gap with a wire gauge and set gap by bending side electrode only.

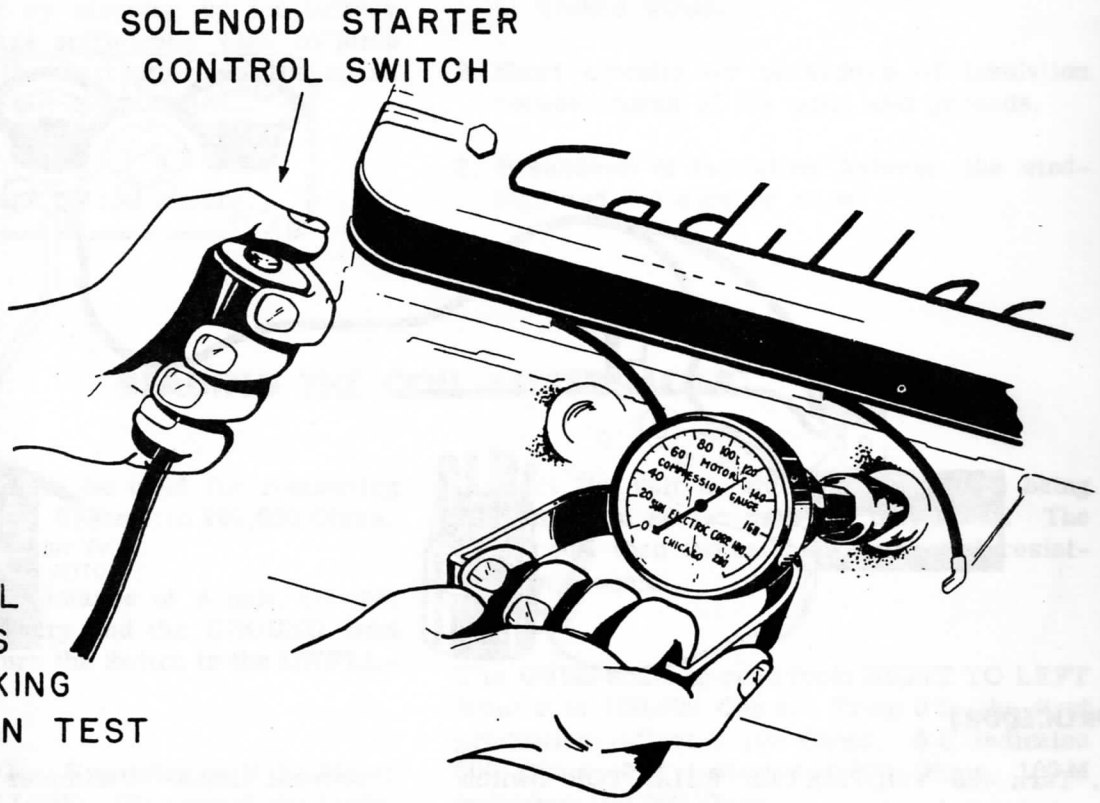
SPARK PLUG GAPS	
1949-1952	.033" - .038"
1953-1960	.035"

It is important when installing spark plugs in the engine to be sure that they are making good tight contact to the engine block to properly dissipate their heat to the engine block.

Install plugs in cylinder head, tightening them to 20 to 25 foot pounds torque.

COMPRESSION TEST

The Compression Test is necessary to determine the condition of the piston rings, valves and the entire combustion area. If the pistons, rings and valves are in good condition, the Compression pressures will conform to specifications.



NOTE:
REMOVE ALL
SPARK PLUGS
BEFORE MAKING
COMPRESSION TEST

CAUTION: ENGINE MUST BE AT NORMAL OPERATING TEMPERATURE.

PROCEDURE

1. Have ignition switch OFF.
2. Remove all spark plugs.
3. Connect solenoid starter control switch from battery to starting motor solenoid.
4. Insert Compression Tester in spark plug hole.
5. Open throttle and crank engine at least 4 compression strokes, noting the reading on the first stroke as well as the final stroke.

NOTE: All cylinders should be cranked the same number of compression strokes to insure an accurate test.

6. Compression should be:

COMPRESSION IN POUNDS:			
1949-1952	120-140	1954	150
1953	135-150	1955-1960	165-185

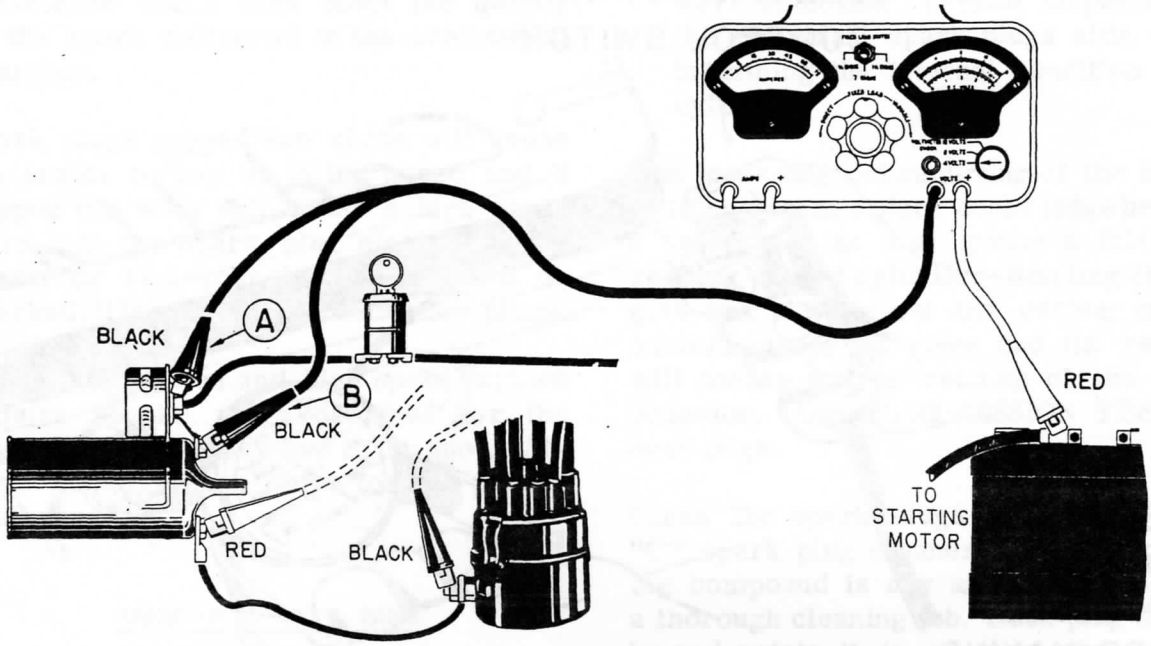
7. Permissible maximum variation between cylinders 12 pounds.

NOTE: If readings are below normal or uneven, place a small quantity of S. A. E. #30 oil on top of each piston and retest compression.

IGNITION PRIMARY CIRCUIT RESISTANCE TEST

6 & 12 VOLT

Excessive voltage drop in the primary circuit will lessen the secondary output of the ignition coil, resulting in hard starting and poor performance.



PROCEDURE

1. Turn the VOLTMETER SELECTOR Switch of the Volts Ampere Tester to the 4 VOLT position.
2. Connect test leads as shown, in solid leads.
   (A) for 12 Volt (B) for 6 Volt
3. Remove distributor cap and close breaker points by rotating engine a fraction of a revolution at a time with the cranking motor.
4. Be sure all lights and accessories are turned off.
5. Turn ignition switch ON. Voltmeter should read not more than .1 VOLT.
6. Test ignition switch by turning it off and on several times. Voltmeter should read the same each time switch is turned on.
7. Test all wires for tightness. Move them about and note any change in Meter reading.
8. Remove VOLTMETER leads and place them across the Primary wire from the coil to the distributor as shown in dotted leads. Voltmeter should read less than .1 VOLT.

NOTE: If Voltmeter readings exceed the specified maximum, isolate the point of high resistance by placing the test leads across each connection and wire in turn. The reading across a connection should be ZERO. The reading across any one wire should be proportionate to its length as compared to the length and allowable voltage drop of the entire circuit.

IGNITION COIL INTRODUCTION

The coil in the ignition circuit of an engine acts as a transformer by stepping up the battery voltage to a voltage sufficiently high to jump the rotor gap in the distributor and the spark plug gap while under compression.

The common causes of coil failure:

1. High resistance due to corroded connections or broken wires.
2. Short circuits or breakdown of insulation between turns of the coils and grounds.
3. Breakdown of insulation between the windings and the core or case.

READING THE COIL TESTER METER

The OHM scale is to be used for measuring any resistance from 0 Ohms to 100,000 Ohms.

To measure the resistance of a unit, connect the POSITIVE primary and the GROUND lead clips together. Turn the Switch to the DWELL-OHM position.

Adjust the Dwell-Ohm Regulator until the Meter reads on the SET LINE. Disconnect the leads.

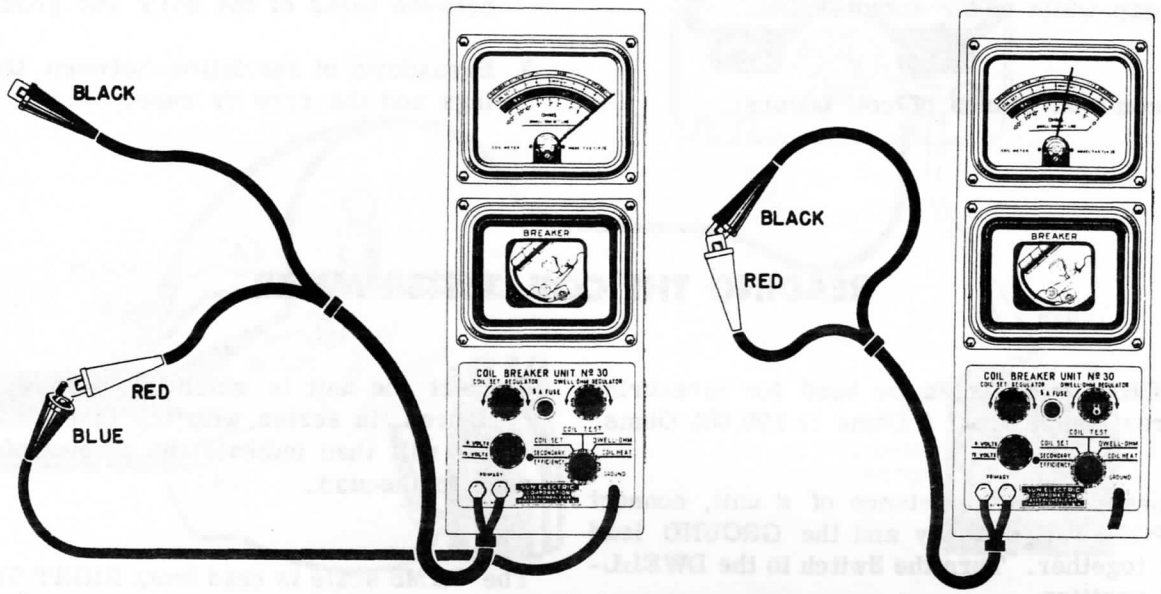
Connect the unit in which resistance is being measured, in series with the test leads. The Meter will then indicate the amount of resistance in the unit.

The OHMS scale is read from RIGHT TO LEFT from 0 to 100,000 Ohms. From 0 to the first graduation indicates 100 Ohms. 5 C indicates 500 Ohms, 1 M indicates 1,000 Ohms, 100 M indicates 100,000 Ohms.

IF A FUSE BURNS OUT ON THE COIL TESTER, REPLACE WITH 5 AMPERE FUSE ONLY.

CALIBRATING THE COIL TESTER

To assure an accurate test of the ignition coil, the Tester battery must be charged to at least 1.250 Specific Gravity. The calibration of the Coil Test Unit will vary slightly with long periods of use due to normal wear of the point rubbing block in the breaker assembly. The calibration should be checked and adjusted, if necessary, at least twice each year.



IMPORTANT: This procedure outlines the proper method of testing the calibration of the Coil Test Unit. The calibration of the Unit should be checked at least twice a year and more often if in continuous use.

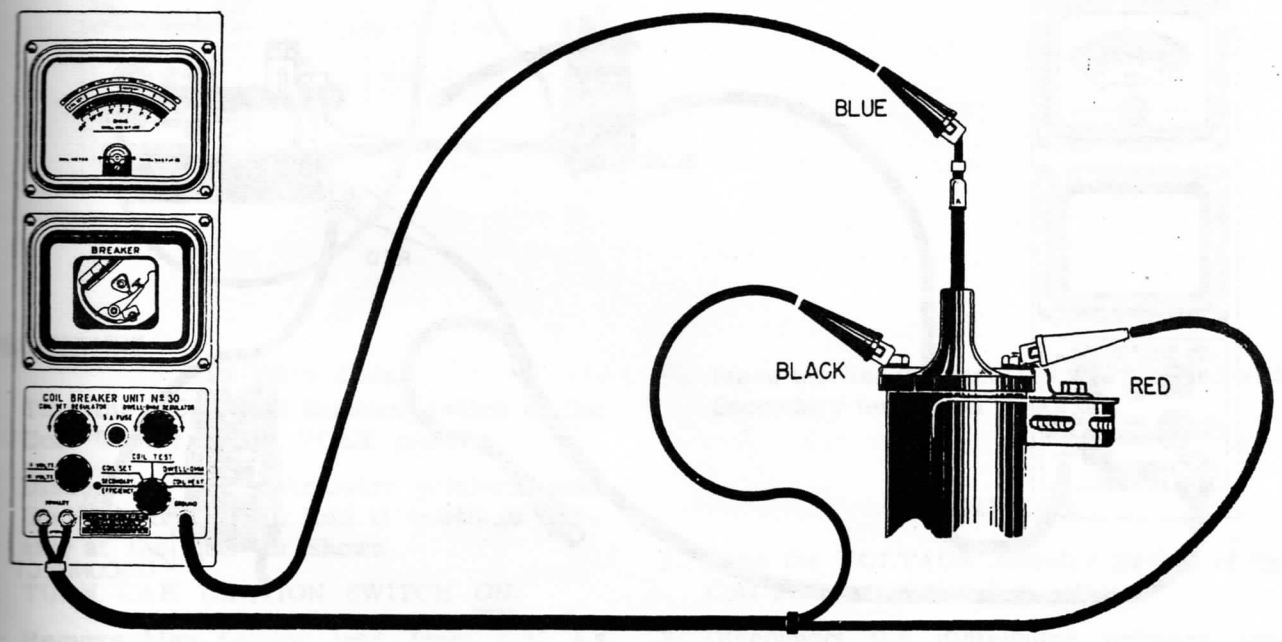
PROCEDURE

1. Zero meter to left side of scale, using adjustment on face of meter.
2. Connect BLUE ground and RED primary leads together.
3. Turn MASTER Switch ON.
4. Turn Switch of the Coil Tester Unit to DWELL-OHM position, and use Dwell-Ohm Regulator to adjust Meter needle to SET LINE.
5. Disconnect leads and connect the PRIMARY leads (red and black) together.
6. Meter now reads the dwell of the Coil Breaker Unit. It should be 6, plus or minus 1/2 division. If Meter does not read within these limits, remove cover from Coil Breaker Unit and adjust Tester distributor points, with breaker running, until proper reading is obtained.
7. Disconnect test leads and proceed with Coil tests.

COIL HEAT

ON OR OFF THE VEHICLE

Before testing any coil it should be brought to operating temperature. If the coil is on a vehicle which has been operated for a sufficient period of time to bring the coil to normal operating temperature the coil does not need additional heating before testing. If, however, the coil is not up to temperature, the coil must be heated with the Coil Heater.



PROCEDURE

1. Disconnect primary ignition lead at the distributor and remove the high tension lead from the coil tower.
2. Insert ADAPTER lead in coil tower and connect COIL TESTER leads as shown.

NOTE: Primary lead may be connected directly to coil primary terminal as shown or through the ballast resistor on a 12 volt coil.

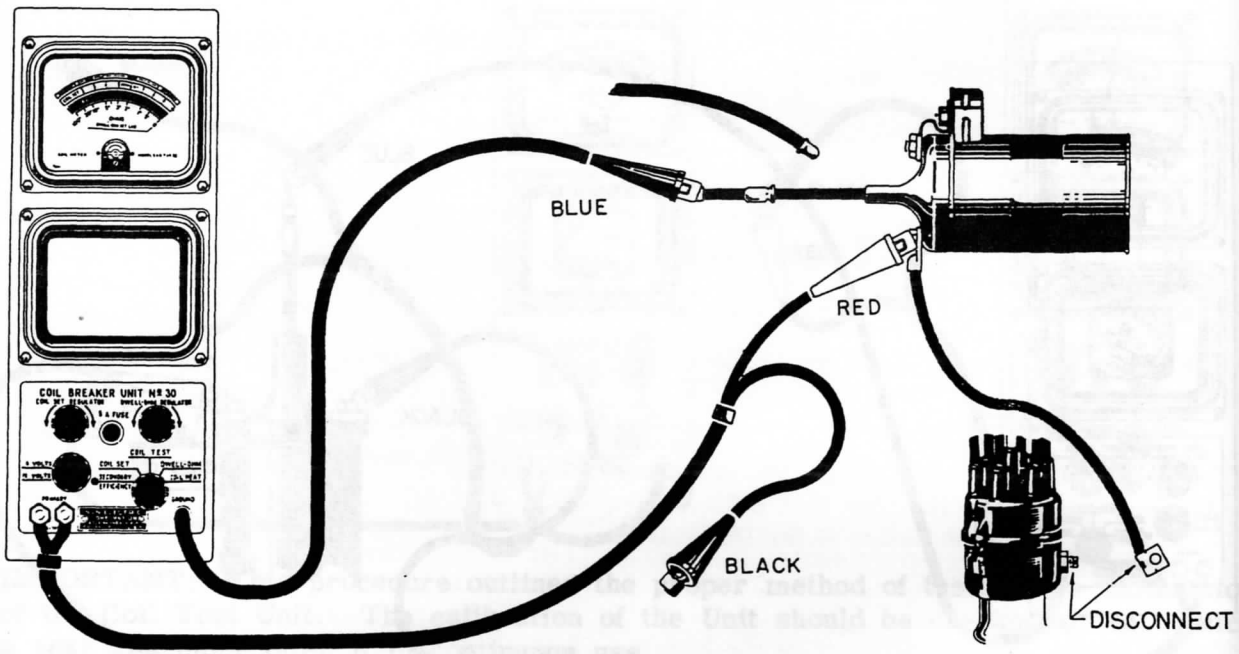
3. Turn MASTER Switch ON.
4. Turn Voltage Selector Switch to 12 or 6 volt position corresponding with Coil Primary Voltage.
5. Turn SELECTOR Switch of the Coil Tester to COIL HEAT position.
6. Heat coils 6 MINUTES only.

CAUTION: DO NOT TOUCH LEADS WHILE TESTER IS IN COIL HEAT POSITION. TURN SELECTOR SWITCH TO SECONDARY EFFICIENCY POSITION BEFORE REMOVING CLIPS.

COIL SECONDARY CONTINUITY TEST ON VEHICLE

6 & 12 VOLT

This test is made to determine the condition of the secondary windings of the coil. A high reading will indicate an open or high resistance secondary, while a low reading will indicate a shorted winding. This test, in addition to the Coil Capacity Test, is necessary for a thorough test of the Coil condition.



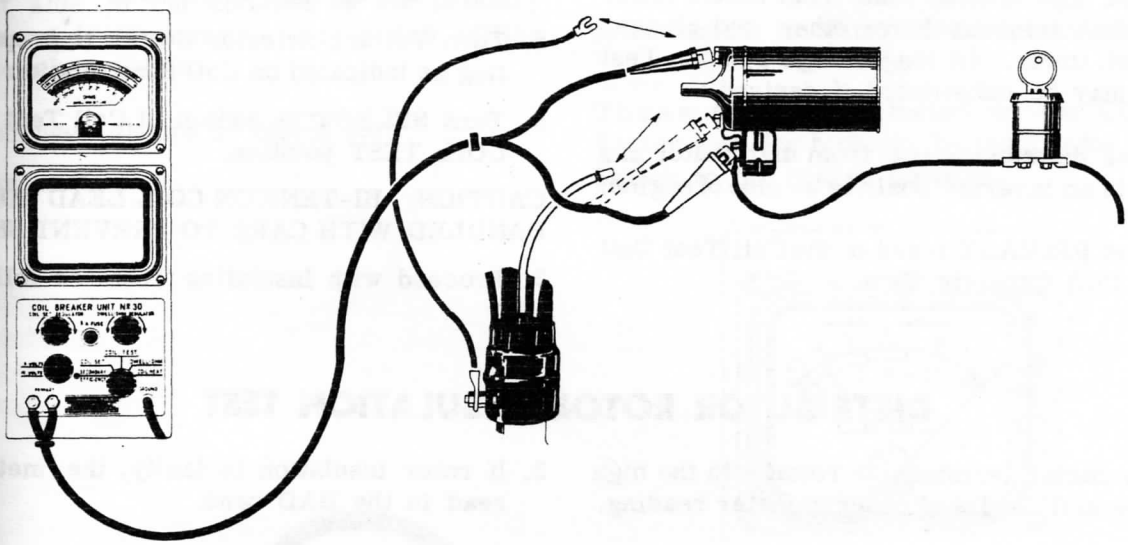
PROCEDURE

1. Disconnect distributor primary wire.
2. Turn MASTER Switch ON.
3. Turn the Switch of the Coil Tester Unit to DWELL-OHM position.
4. Connect leads as shown.
5. For 1949-1958 Models, the meter should read LESS than 20,000 OHMS resistance. A reading of MORE than 20,000 OHMS indicates a BAD coil.

   For 1959-1960 Models, the meter should read between 5,000 and 15,000 resistance.

COIL CAPACITY TEST

This test determines whether or not the coil is satisfactory for vehicle operation when used in conjunction with the Coil Secondary Continuity Test.



PROCEDURE

12 VOLT COIL

1. Turn the VOLTAGE Selector Switch of the Coil Tester to 12 VOLT position.
2. Disconnect the distributor primary lead (and TACH DWELL lead if used), preferably at the coil as shown.
3. TURN CAR IGNITION SWITCH ON.
4. Remove high tension lead from coil as shown.
5. Connect tester leads as shown in solid lines to include ballast resistor in test circuit.
6. Turn Switch of Coil Tester Unit to COIL SET position and adjust Coil Set Regulator until meter reads at set point 8.
7. Turn Switch to COIL TEST position. The coil meter should be steady in the GOOD COIL Band.

NOTE: If Coil tests BAD, reconnect positive tester lead as shown by dotted lines above, readjust Coil Set Regulator until meter reads at set point 8 and retest Coil.

If the Coil now tests GOOD, check Ballast Resistor and resistor connections.

Ballast Resistor value:
1.40 to 1.65 ohms

8. Turn TESTER Switch to SECONDARY EFFICIENCY position. If coil is good, leave test leads connected and proceed with Secondary Insulation Tests.

6 VOLT COIL

1. Turn the VOLTAGE Selector Switch of the Coil Tester to 6 VOLT position.
2. Disconnect the distributor primary lead (and TACH DWELL lead if used), preferably at the coil as shown.
3. TURN CAR IGNITION SWITCH ON.
4. Remove high tension lead from coil as shown.
5. Connect Tester Leads directly to coil primary terminals.
6. Turn Switch of Coil Tester Unit to COIL SET position and adjust Coil Set Regulator until meter reads at set point 9.
7. Turn Switch to COIL TEST position. The coil meter should be STEADY in the GOOD COIL Band.

NOTE: A bad coil is indicated by a meter reading outside the Good Coil Band, or by an erratic reading of 3 to 5 divisions inside the Good Coil Band.

8. Turn TESTER Switch to SECONDARY EFFICIENCY position. If coil is good, leave test leads connected and proceed with Secondary Insulation Tests.

SECONDARY CIRCUIT INSULATION TESTS

PREPARATION FOR TEST

1. Remove high tension lead from center tower of distributor, but leave other end plugged into coil tower. (A longer High Tension Test Lead may be substituted if desired.)
2. Remove distributor cap from distributor and place in an inverted position at side of engine.
3. Connect PRIMARY leads of the Coil Test Unit as in Coil Capacity Test.
4. Turn car ignition switch ON.
5. Turn Voltage Selector Switch to proper setting as indicated on Coil Specification Chart.
6. Turn SELECTOR Switch of Coil Test Unit to COIL TEST position.

CAUTION: HI-TENSION COIL LEAD MUST BE HANDLED WITH CARE TO PREVENT SHOCKS.

7. Proceed with Insulation Tests as follows:

DISTRIBUTOR ROTOR INSULATION TEST

1. Touch center terminal or rotor with the high tension coil lead and observe meter reading.
2. If rotor insulation is faulty, the meter will read in the BAD band.

DISTRIBUTOR CAP AND SPARK PLUG WIRE INSULATION TEST

1. Remove rotor and install distributor cap.
2. Remove spark plug wire at number one spark plug.
3. Contact the end of the plug wire with the high tension coil lead and observe meter reading.
4. If meter reads in BAD band, the wire insulation is faulty, a crack exists between that plug tower of the distributor cap and an adjacent tower, or the cap is cracked between that plug tower and distributor housing.
5. Replace plug wire on number one spark plug and repeat test on each wire in turn.
6. Reinstall rotor.

NOTE: High Tension coil lead must be in actual contact with an electrode or terminal at the time the meter is read. The small sparking and slight deflection of the meter just before contact is due to capacitance and does not indicate insulation breakdown.

COIL TOWER INSULATION TEST

1. Remove high tension lead from coil.
2. Move BLUE ground lead close around base of coil tower. A cracked tower is indicated by a meter deflection and usually by visible sparking.
3. Turn SELECTOR Switch of Coil Test Unit to SECONDARY EFFICIENCY position.

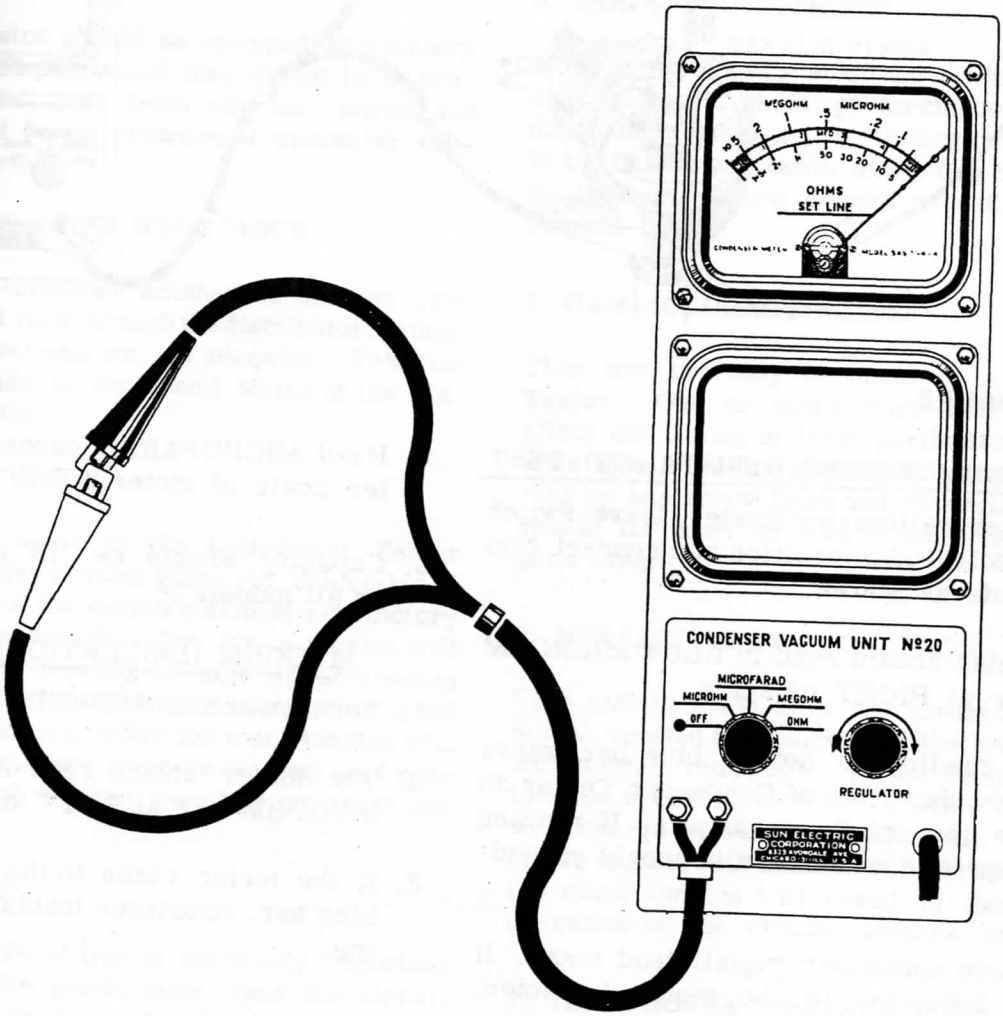
CONDENSER TESTER CALIBRATION

The condenser has two important functions: First, it aids in the collapse of the primary field: second, it prevents arcing and pitting of the breaker points.

The condenser should be tested for:

1. Series resistance.
2. Correct capacity.
3. Maximum insulation breakdown resistance.

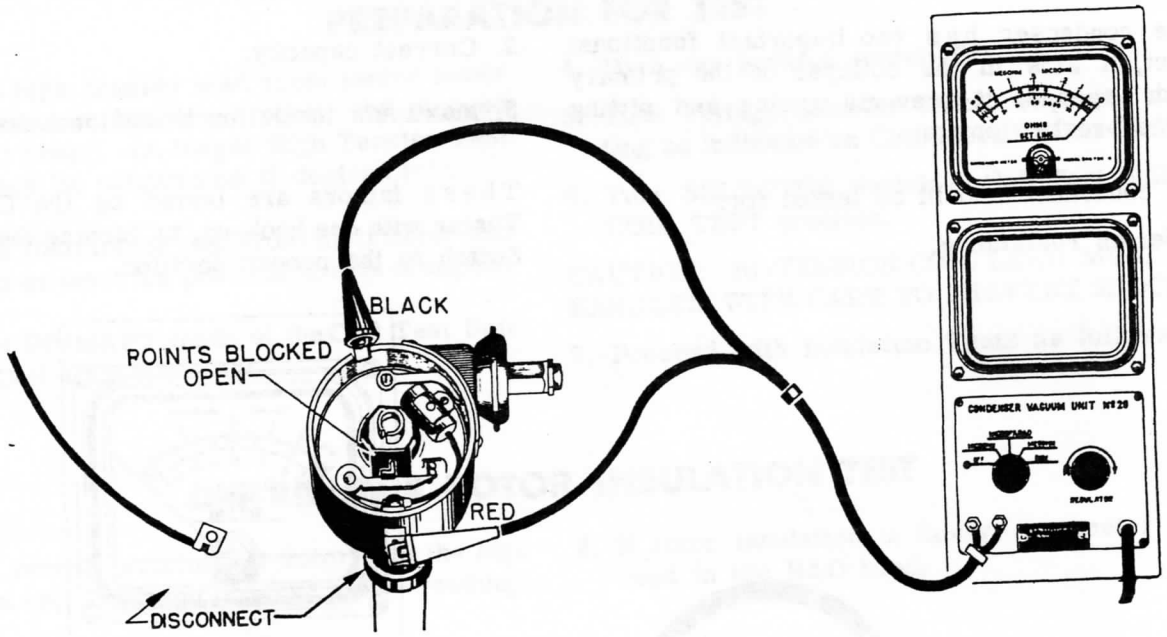
These factors are tested on the Condenser Tester with one hook-up, by turning the Selector Switch to the proper position.



PROCEDURE

1. Connect the Condenser Tester wire clips together.
2. Turn MASTER Switch ON.
3. Turn Switch of the Condenser Tester Unit to MICROHM position and allow Unit to warm up.
4. Turn Regulator Knob until Meter reads on SET LINE.
5. Leave in MICROHM position and proceed with Condenser Tests.

CONDENSER TESTS
6 & 12 VOLT



PROCEDURE

MICROHM (SERIES RESISTANCE) TEST

1. After calibrating Tester, leave switch in MICROHM position and connect test leads as shown.
2. Meter should read in BLUE MICROHM bar at RIGHT of scale.
3. If reading is not in blue bar, move grounded lead of Condenser Tester to the body of the condenser. If reading improves, condenser is poorly grounded.
4. Move condenser pigtail lead about. If a deflection of the meter is noted, lead is making poor contact; condenser should be replaced.

MICROFARAD (CAPACITY) TEST

1. Turn switch to MICROFARAD position.
2. Read MICROFARAD capacity on center scale of meter.
3. Capacity should be .18 to .23 MFD on all models

MEGOHM (INSULATION) TEST

1. Turn switch to MEGOHM position.
2. The Meter should read in the BLUE MEGOHM bar at LEFT of scale.
3. If the meter reads to the right of the blue bar, condenser insulation is leaking.

NOTE: When testing condenser off the vehicle, connect one condenser test lead to the insulated condenser terminal and the other test lead to ground on condenser body.

TESTING THE CADILLAC DISTRIBUTOR

From a diagnosis point of view the distributor is the heart of the engine and therefore must be the subject of careful and minute inspection in any Diagnosis Procedure. There are several fundamental tests which must be made on a distributor to ascertain whether or not it is properly performing its functions.

1. CONTACT POINT CONDITION

The distributor should be equipped with factory recommended points and they should be in proper alignment, free from pits and burrs, and there should be no evidence of excessive rubbing block wear.

2. CONTACT POINT RESISTANCE

This test determines whether or not the primary current flow through the distributor, points, wiring, connections etc., is adequate. This test is easily made by the Dwell Meter of the Distributor Tester.

3. SPRING TENSION

This test is made in the Distributor Tester with a suitable tension gauge to determine if the pressure of the movable arm is satisfactory for all engine speeds. Too low a tension will result in point floating at high speed causing misfiring and in some cases no ignition at all for some cylinders, while too much tension will result in premature wear on the cam and rubbing block with the net result of no point gap at all.

4. POINT GAP

The Breaker Point Gap is extremely important inasmuch as the points must open the circuit properly and quickly. As the breaker points must physically open the circuit, it is necessary to test the breaker point gap to see that they do just this. The contact point gap for both new and used points should be .016". It is preferred that a dial indicator be used when adjusting point gap, but in its absence a feeler gauge may be used.

5. POINT DWELL

Contact point spacing and contact point dwell have a direct relationship and both have a direct bearing on coil saturation.

Coil saturation is an electrical term used to explain the magnetic build-up in the ignition coil. As this is an electrical property it must be measured by an electrical gauge. This gauge is the dwell meter. If used properly, it will quickly and easily measure the ignition coil output, through any change in speed or load.

6. SHAFT AND BUSHINGS

Wear in distributor shaft and bushings will result in erratic engine performance. This condition can be detected by testing the distributor in the distributor tester and noting the variation in dwell and arrow pattern as outlined in subsequent tests.

7. CAM ACCURACY

This test can only be made in a Distributor Tester. One or more worn cam lobes will affect the timing of those particular cylinders. This test is easily made by aligning the degree ring on one arrow flash and observing the position of the other arrows in relation to the degree ring.

8. BREAKER PLATE CONDITION

This test is made after the breaker point arm spring tension to determine if the breaker plate will operate correctly. If the tension is too low the breaker plate will chatter or wobble; with change in dwell and point gap that would effect engine coil saturation and timing, while too much tension will result in the incorrect operation of the vacuum advance mechanism.

9. THE PROPER OPERATION OF ADVANCE MECHANISMS

This test, also, is made with the distributor removed from the car and installed in a test fixture in which vacuum can be controlled in exactly measured amounts for testing the vacuum advance mechanism and speed can be exactly controlled for testing the centrifugal mechanisms which react to speed only. These two mechanisms are carefully checked against manufacturer's specifications to determine whether or not the proper advance curve under all operating conditions is obtained from the distributor being tested.

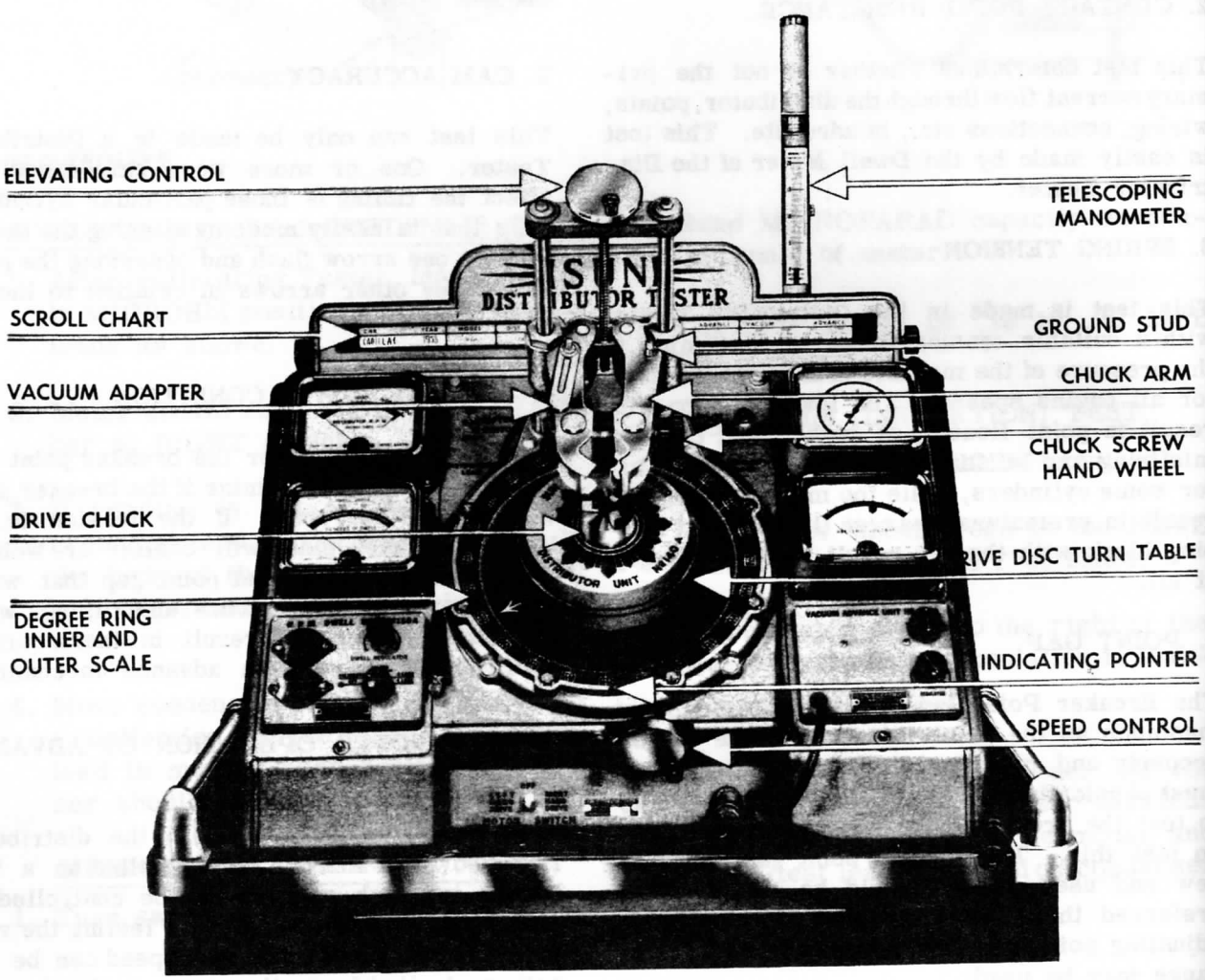
DISTRIBUTOR TEST (REMOVED)

Introduction

As one of the most important units of the modern high speed engine of today, the distributor requires precision calibration and accurate testing.

We can no longer depend entirely on feeler gauges and visual inspections to test all functions of the distributor such as, centrifugal spark advance, vacuum spark advance, loose and worn parts.

Scientific and precision construction of the distributor demand precision testing. Therefore, the testing and calibrating must be performed on a modern Distributor Tester.



DISTRIBUTOR VISUAL INSPECTION

The following points should be inspected visually before the distributor is installed in the Distributor Tester.

1. Distributor shaft side clearance and end play.
2. Distributor shaft bearings and bushings for wear and smoothness of operation.
3. Breaker plate bearings or bushings for wear and smoothness of operation.
4. Shaft lubrication.
5. Breaker cam for smoothness and lubrication.
6. Insulators, pigtails and flexible internal leads.
7. Contact points for alignment, pitting and burning, oil covering and rubbing block wear.
8. Vacuum advance linkage for alignment and wear.

INSTRUCTIONS FOR INSTALLING THE DISTRIBUTOR IN THE SUN DISTRIBUTOR TESTER

PROCEDURE

1. Adjust Scroll Chart for the distributor you are testing and check the specifications.
2. Place distributor in the distributor clamp and tighten securely with the hand wheel at the right side of clamp.
3. Adjust elevating control so distributor shaft fits down into the drive chuck. Do not permit shaft to extend far enough into the chuck to let chuck pin push shaft upward.
4. Use special wrench to tighten the distributor shaft into the drive chuck. Do not raise or lower clamp after distributor is securely fastened.
5. Connect small black-tipped ground lead to distributor holder ground stud.
6. Connect red-tipped distributor lead to primary binding post at the side of the distributor.
7. Raise the Distributor Tester turntable and rotate by hand, making sure the distributor shaft turns freely.

IMPORTANT NOTE: Always turn speed control to the lowest speed before stopping tester. If the tester is left standing in the high speed position, the machine may be temporarily noisy when next operated.

CONTACT POINT ALIGNMENT

Proper contact point alignment is one of the most important factors in contact point life. Misaligned points quickly overheat and burn. An excellent job of aligning breaker points can be done with the distributor installed in the Master Distributor Tester.

PROCEDURE

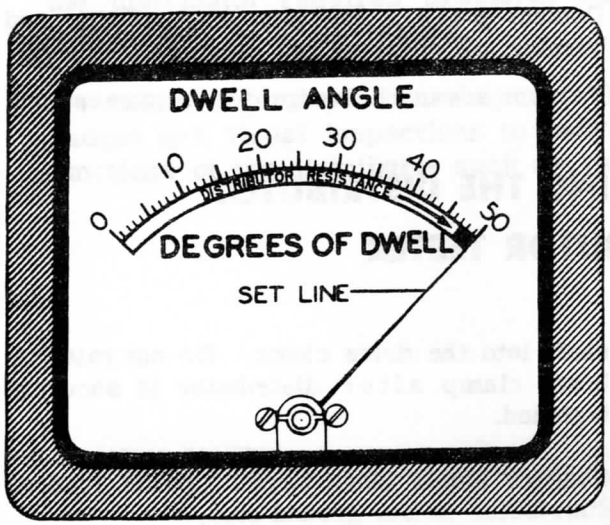
1. Install distributor in Distributor Tester.
2. Align breaker points as nearly as possible by bending the stationary point support. DO NOT BEND THE BREAKER ARM.
3. Connect the RED distributor lead to the primary terminal of the distributor, turn the Battery Switch ON.
4. Turn the Motor Drive Switch to obtain proper direction of rotation and adjust speed to approximately 500 R.P.M.
5. If the points are properly aligned, the slight arcing will appear in the exact center of the contacts when observed from above and from the side. Readjust stationary contact as necessary until the arc is centered.

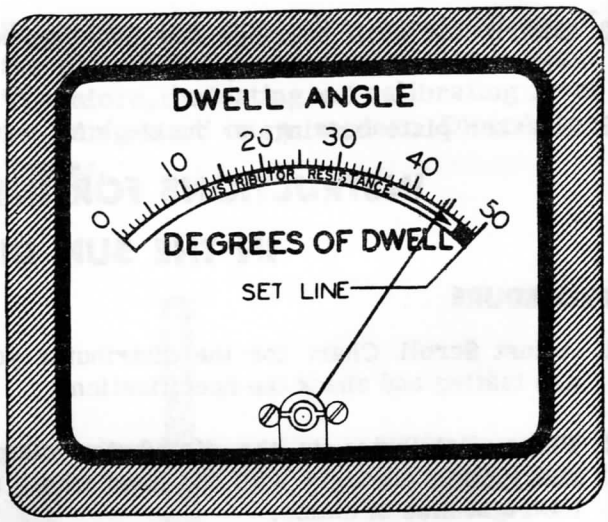
DISTRIBUTOR CIRCUIT AND POINT RESISTANCE TEST

6 & 12 VOLT

This test determines whether or not the primary current flow through the distributor, points, wiring, connections, etc., is adequate.

This test is easily made by the Dwell Meter of the Distributor Tester.





PROCEDURE

1. Turn Tach-Dwell switch to CALIBRATE position and adjust DWELL REGULATOR UNTIL THE DWELL METER READS TO SET LINE.

2. Rotate the Distributor Turntable, by hand until the breaker points are closed.

3. Turn the BATTERY switch to ON position. Dwell Meter indicating hand must now read in the Black Bar.

4. If the reading is in the Red Band it indicates dirty contact points, loose connections, or resistance within the distributor circuit. (See illustration.)

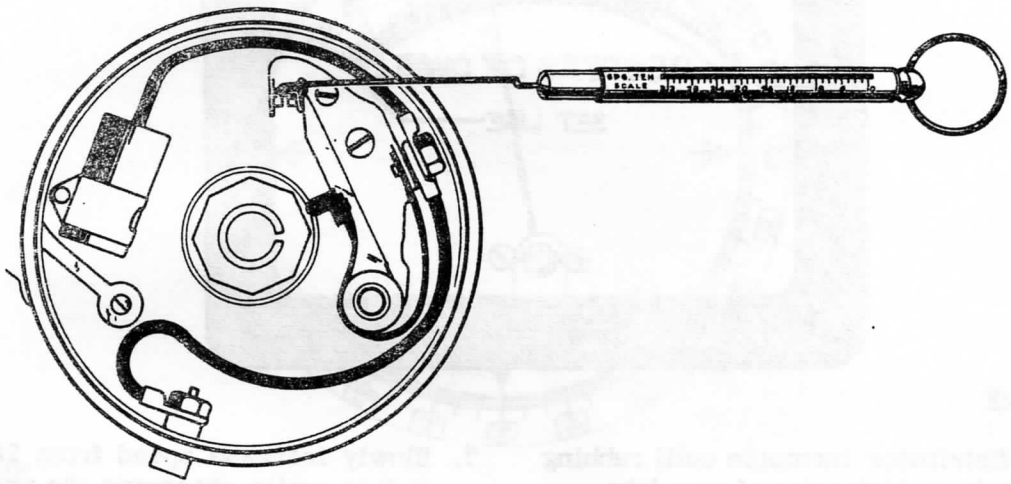
5. To locate the poor contact or loose connection, move the red tipped DISTRIBUTOR lead wire step by step through the distributor circuit until Meter reads in the Black Bar.

6. After excessive resistance has been eliminated and the meter reads within the black bar, readjust the DWELL REGULATOR knob until the dwell meter again reads on the SET LINE. This compensates the dwell meter readings for the normal resistance of the particular distributor being tested.

7. Proceed with point Spring Tension test.

BREAKER POINT SPRING TENSION TEST

This test is made in the Distributor Tester with the Spring Tension Tester to determine if the pressure of the movable arm is satisfactory for all engine speeds. Low tension will result in point-floating at high speed, causing misfiring, and in some cases, no ignition at all for some cylinders; while too much tension will result in premature wear on the cam and rubbing block with the net result of no point gap at all.



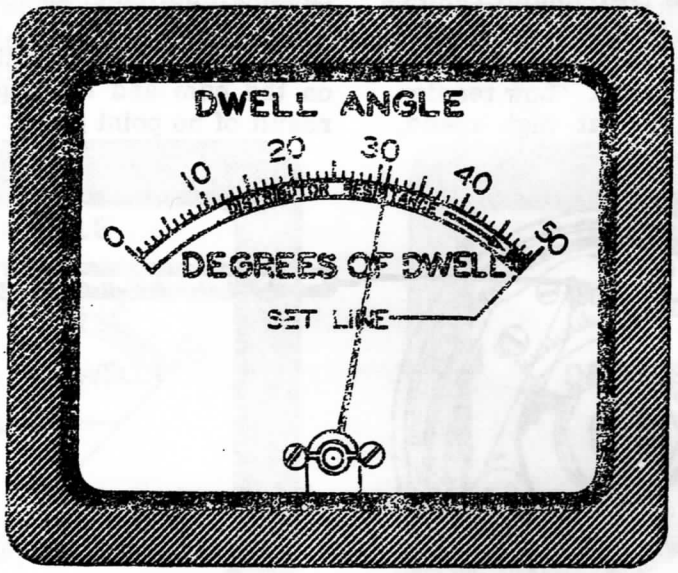
PROCEDURE

1. Rotate the Distributor Turntable by hand until the breaker points are closed.
2. Turn TACH-DWELL Switch to CALIBRATE position.
3. Turn BATTERY Switch to ON position.
4. Place eye of Spring Tension Tester over movable contact arm and at right angle to pivot.
5. Pull ring of Spring Tension Tester easily until Dwell Meter hand falls back, denoting opening of the points.
6. The indicator on the scales will now read the number of ounces required to open the points which should be 19 ozs. to 23 ozs.

CAUTION: Do not attempt to correct point floating or point bounce by changing point spring tension beyond the specified range. Point floating may be caused by friction at the pivot. Point bounce may be caused by worn bushings, worn breaker plate, etc.

CONTACT POINT GAP AND DWELL TEST

Before the operator can accurately test the ignition point dwell, the distributor point resistance, breaker point spring tension and GAP must be within specifications.



PROCEDURE

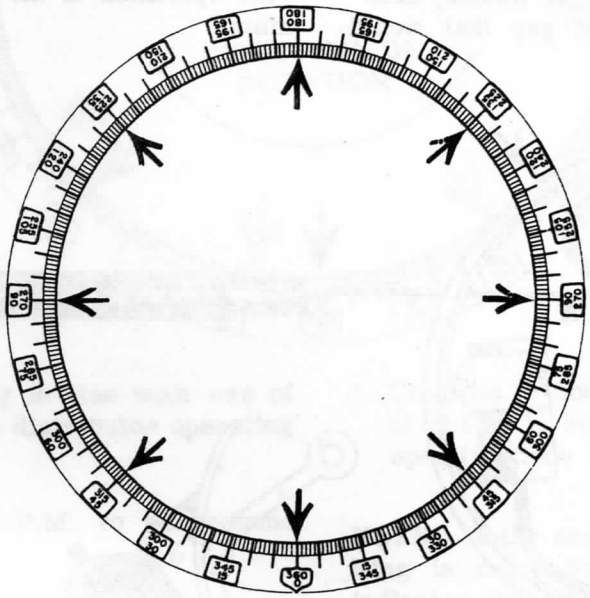
1. Rotate distributor turntable until rubbing block rests on high point of cam lobe.
2. Adjust gap to .016" on new or used points, using a dial indicator or feeler gauge.
3. Turn the Battery Switch ON and turn the TACH-DWELL Switch to the 8 LOBE position.
4. Trip Motor Drive Switch to LEFTHAND rotation.
5. Adjust speed control until the Tachometer reads 200 R.P.M.
6. The reading on the Dwell Meter should be 26° to 33°.
7. Slowly increase speed from 200 to 2000 R.P.M. while observing the arrow flashes. If extra flashes are seen at certain speeds, the breaker points are bouncing. Check for rough or dry cam, worn cam assembly, and wrong points. Try increasing or decreasing point spring tension within the specified range.

SHAFT AND BUSHING TEST

8. If point action is normal, then slowly increase speed from 200 to 2000 R.P.M. while watching the Dwell Meter. A variation of more than 2 DEGREES in the dwell reading indicates excessive bushing or shaft wear.

CAM LOBE ACCURACY TEST

A Cam Lobe Accuracy Test is necessary to insure proper ignition timing to all cylinders of the engine. One or more worn cams will cause the timing to be late on those cylinders in relation to the initial timing of number one cylinder.



PROCEDURE

1. Adjust distributor speed to 500 R.P.M. Turn graduated Degree Ring until one arrow flash appears at "0".
2. Check to see if all flashes appear at intervals of an equal number of degrees. For eight lobe distributors the flashes should appear at intervals of exactly 45 degrees.
3. If flashes appear at uneven intervals, it indicates a worn cam or bent shaft. In general practice allowable variation in cam lobe accuracy is plus or minus 1 degree.

VACUUM CONTROLLED BREAKER PLATE TEST

The breaker plate must be smooth and even in its travel or the plate will twist, changing the relationship between the cam and rubbing block and causing the dwell angle to change. Any change in dwell angle affects the ignition spark, both in quality and timing.

PROCEDURE

1. Apply Vacuum Hose to the vacuum advance unit and turn VACUUM PUMP Switch to ON position.
2. Adjust speed control to 200 R.P.M.
3. Using the Vacuum Regulator Knob, adjust vacuum to 0, then rapidly increase vacuum to 20 INCHES while watching the Dwell Meter pointer for variations.
4. If Dwell reading varies more than 2 DEGREES from 0 to 20 inches of vacuum, it indicates worn breaker plate bushings.

VACUUM CHAMBER DIAPHRAGM TEST

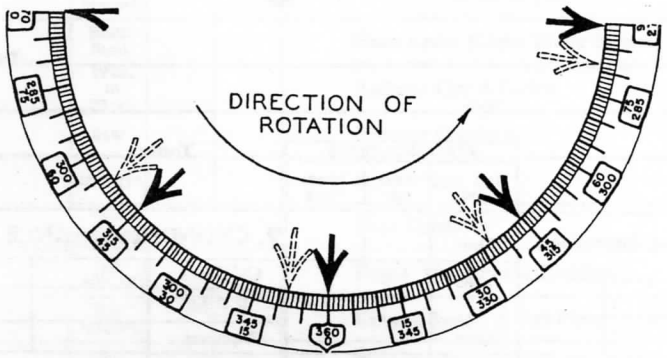
A leaking or ruptured diaphragm will not control the ignition timing properly. Consequently, maximum economy of vehicle operation will not be obtained.

PROCEDURE

1. Insert proper Adapter in the vacuum advance unit and tighten to insure a good seal.
2. Place thumb over the end of the Vacuum Hose, turn Vacuum Pump ON and adjust vacuum to 15 INCHES. Remove and replace thumb several times to be sure that Pump is accurately adjusted.
3. Apply Hose to the vacuum advance unit. Gauge should again read at least 15 INCHES.
4. If Pointer does not return to at least 15 inch reading, it indicates a leak in the diaphragm of the vacuum advance unit.

VACUUM ADVANCE TEST

This test is made to determine if the ignition timing advances or retards according to the load on the engine. An inaccurate advance, or no advance, will result in poor gasoline economy and sluggish performance.



PROCEDURE

1. Turn VACUUM Switch to ON position.
2. Adjust Regulator Knob to the extreme left. Attach Hose to chamber.
3. Run Tester at 200 R.P.M.
4. Set "0" of Degree Ring in line with one of the arrow flashes.
5. Adjust the Vacuum Regulator to each specification as listed below and check the arrow flash on the Degree Ring for conformation to specifications.

NOTE: If degree indicated on Ring is more than the specifications, the unit is advancing too quickly, showing that the return spring is weak.

If the degree indicated on the Ring is less than the specifications, the unit is advancing too slowly, showing that the return spring is too strong.

6. Turn tester Speed Control to minimum R.P.M.
7. Turn all switches to OFF positions.

VACUUM ADVANCE SPECIFICATIONS IN DEGREES:

	VACUUM	6 to 8"	10"	12"	15"			
1949	ADVANCE (Dist)	start	6	8	11			

	VACUUM	4 to 6"	10"	12"		16"		
1950	ADVANCE (Dist)	start	6	9		11		

	VACUUM	4 to 6"	10"	12"	15"			
1951	ADVANCE (Dist)	start	6.5	8.5	10			

	VACUUM	6 to 8"	10	12"	14"	16"		
1952	ADVANCE (Dist)	start	6	8	10	11.5		

	VACUUM	7 to 8"	10"	12"	14"		17"	
1953	ADVANCE (Dist)	start	3	7	10		13.5	

	VACUUM	6½"	10"	12"	14"	16"	17"	
1954	ADVANCE (Dist)	0	1.5-4.5	5.5-8.75	9-12.25	11.33-14.5	Min. 13	
1955		0	2.5-5.5	6.5-10.0	10-13.5	13.00-14.5	13-14.5	
1956		0	2.5-6.0	6.5-10.5	10.5-15	14.50-18.0	16.5-18	

	VACUUM	8"	11"	13"	14"	15"			
1957-1958	ADVANCE (DIST)	0	1.75-5.25	5.25-11.2	8-12.75	10.5-12.7			
1959		0	1.50-5.50	5.50-11.5	8-12.00	10.5-12.0			

	VACUUM	8"	11"	13"	14"	15"	16"	17"	20"
1960	**Single Carb** ADVANCE	0	2.00-4.50	4.50-7.50	5.75-8.75	7-10.5	8.5-12	10.5-12	10.5-12
1960	**Three Carb** ADVANCE	0	3.25-5.75	5.75-8.25	7.00-9.75	8.25-9.75			8.25-9.75

CADILLAC THORO-CHECK

ENGINE SECTION

Name of Owner _____ Date _____

Engine No. _____ Style _____ License _____

Mileage _____ Tester _____

	Specifications: Cad.	Your Car	Needs Work
1. BATTERY —Visual Inspection	Clean		
Specific Gravity (Pos. Cell 1 2 3 / 4 5 6)	1.260 to 1.280		
Battery Capacity 6 V	At Least 4.8V		
12 V	At Least 9.6V		
Total Cell Voltage 3 Minute Charge — 6V — Not over / 12V — Not over	7.75V / 15.50V		
2. STARTING SYSTEM —Visual Inspection			
Cables, Starter Switch	Not Over .2V		
Amperage Draw 6 V	175 to 225		
12 V	160 to 200		
3. DISTRIBUTOR			
Distributor Resistance	In Black		
Distributor Point Dwell (in car)	26° - 33°		
4. ENGINE IDLE R.P.M.	375 to 400		
5. GENERATOR —Visual Inspection			
Gen. Circuit Resistance (Insulated Side Less .8V; Ground Side 0; Regulator to Grd. 0)			
Gen. Output	See Manual		
Gen. Relay—Closes 6 V	5.9 to 6.8		
12 V	11.8 to 13.6		
Current Regulator—Amps.	See Manual		
Voltage Regulator—Volts	See Manual		
6. SPARK TIMING	A to C		
7. MANIFOLD VACUUM	19 to 21		
8. SECONDARY EFFICIENCY			
Plug Number 1 2 3 4 5 6 7 8			

	Specifications: Cad.	Your Car	Needs Work
9. CYLINDER BALANCE	Within 40 R.P.M.		
Cyl. No's.	1-6	8-5	4-7 / 3-2
R.P.M.			
Vacuum			
10. FUEL SYSTEM —Visual Inspection			
Heat Valve		Choke		Idle Speed System	
Intake Manifold Leaks		Accelerating Pump	
High Speed Circuit		Air Cleaner		
11. FUEL PUMP			
Pressure—Lbs./Sq. In.	4 to 5¼		
Volume—Per 12 Strokes	½ Pint		
Vacuum Booster—Inches	8" Min.		
12. SPARK PLUGS —Visual Inspection			
Heat Range '49 - '52 — 48 x or 46 - 5 / - '53 — 46 - 5 or 44 - 5			
13. COMPRESSION			
Dry Cyls. 1 2 3 4 5 6 7 8			
Oil Added Cyls. 1 2 3 4 5 6 7 8	Even Within 12 Pounds		
14. IGNITION PRIMARY CIRCUIT			
Resistance Test	Max. .1V		
15. COIL Test			
16. SECONDARY CIRCUIT INSULATION			
Ignition Cables Rotor			
Distributor Cap			
17. CONDENSER Test			

(OVER)

	SPECIFICATIONS				SPECIFICATIONS		
	Cad.	Your Car	Needs Work		Cad.	Your Car	Needs Work
18. DISTRIBUTOR (Removed)				Oil Pressure at Idle	15 Min.		
Contact Point Condition	See Manual			at 30 M.P.H.	25 Min.		
Contact Point Resistance	Black Band			Water Leaks (Check Entire System)			
Point Spring Tension	19 oz. to 23 oz.			Radiator Cap & Gasket			
Point Gap	.016"			Radiator Condition			
Point Dwell	26° - 33°			Water Pump Belt			
Shaft—Bushings	See Manual			Hose Condition			
Cam Accuracy	See Manual			Engine Mountings—Condition		Metal to Metal?	
Breaker Plate Condition	See Manual			Exhaust System & Tail Pipes	Left	Right	
Automatic Advance	See Manual			Clean Engine			
Vacuum Advance	See Manual			Windshield Wiper Operation			
19. OTHER INSPECTIONS				W/S Blades & Washer			
Oil Leaks				Vacuum System Leakage			

Recommendations

ESTIMATED { MATERIAL $_____
LABOR $_____

PART NO. 1097737 FORM 1 OF THE CADILLAC THORO-CHECK. USE FORMS 2 AND 3 FOR CHASSIS, BODY, AND DYNAMOMETER TESTS.