# Electrical System
# 644, 200 & 400 Tractors
## Service Manual No. 9-99772

J I Case
A Tenneco Company

# TABLE OF CONTENTS

## INTRODUCTION

DO NOT ATTEMPT EVEN MINOR ELECTRICAL ADJUSTMENTS WITHOUT THE AID OF PROPER TEST EQUIPMENT.

## SAFETY

IMPORTANT SAFETY PRECAUTIONS THAT MUST ALWAYS BE OBSERVED WHEN WORKING AROUND ELECTRICAL SYSTEMS:

ALWAYS - UNHOOK THE BATTERY GROUND CABLE FIRST - AND HOOK IT UP LAST.

NEVER - CAUSE SPARKS TO OCCUR OR SMOKE NEAR BATTERIES THAT ARE CHARGING OR HAVE BEEN RECENTLY CHARGED.

NEVER - WEAR RINGS OR METAL WATCH BANDS THAT MAY GROUND A LIVE CIRCUIT.

THINK - OUT YOUR CIRCUIT BEFORE YOU MAKE OR BREAK A CONNECTION. A WRONG CONNECTION CAN BE PAINFUL AND EXPENSIVE.

## BATTERY SERVICE AND INSPECTION

IMPORTANT! Working with storage batteries, all exposed metal surfaces are "live". Never lay a metal object on top of a battery as a short circuit may result. Sparks or open flame must be kept away from batteries due to the presence of explosive gas in and around the batteries while they are being charged or in use.

The sulfuric acid or electrolyte present in a battery is very harmful to your eyes, skin and clothing. If contact is made with it, wash it with a weak solution of baking soda and water. This will neutralize the acid.

### VISUAL INSPECTION

Check the battery terminals and cables for dirty or corroded conditions which will cause high resistance, resulting in undercharged batteries and very poor cranking speed.

The battery tray, hold-down terminals and cable ends must be cleaned when contaminated, use baking soda and water. This will help to prevent self discharge of batteries. After cleaning and drying, a thin coating of Vaseline or light cup grease on terminals will help prevent contamination.

A cracked or leaking battery case will let the electrolyte leak out and cause damage to the equipment. A battery in this condition should be replaced. When just the top sealing compound is leaking, the battery can be resealed.

Vent holes in the filler caps should always be kept open to let the battery gases escape. Never remove battery caps except to add water.

The electrolyte level should be checked each week. Never let the level drop to a point where the plates are exposed. Odorless, clear water should only be added when the electrolyte level is low. DO NOT OVERFILL, refer to Figure 1.

Normal water consumption would be approximately 1 oz. every 25 hours or weekly. If it is greater, either the case is leaking or regulator is overcharging and must be adjusted.

The most reliable way to determine the concentration of sulfuric acid in the electrolyte is to measure the relative weight or specific gravity of the solution. A hydrometer is used for this, and only enough solution is removed from a battery cell so the float is suspended freely and not touching the top, bottom or sides of the glass tube, Figure 2. Always hold the hydrometer at eye level and in vertical position when taking a reading. A hydrometer reading is only correct when the temperature of the solution is 80° F.

NOTE

Most hydrometers have a calibrated thermometer to correct this.

When it is above or below this reading, it has to be corrected either by adding .004 gravity points for every 10° above 80° F., or subtracting .004 gravity points for every 10° below 80° F., Figure 3.

When the specific gravity readings between the cells show a variation of .025, the battery should be replaced.

The battery should never be allowed to drop below 75% charge while not in use.

| State of Charge | Specific Gravity Range |
|---|---|
| 100% | 1.260 |
| 75% | 1.230 |
| 50% | 1.200 |
| Discharged | 1.110 |

When a battery is to be charged, it may be charged at a rate of 3 amps. The battery temperature should never exceed 110° F., while charging. If it does, reduce charging rate.

The charger should be left on until the specific gravity readings stay the same after three checks of an hour apart.

CAUTION: DO NOT USE FAST CHARGER!

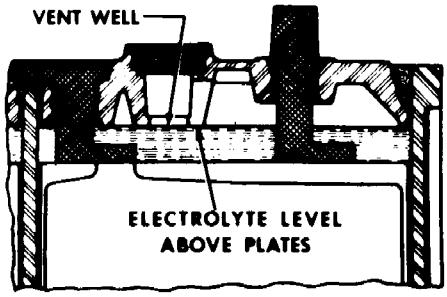



Figure 1

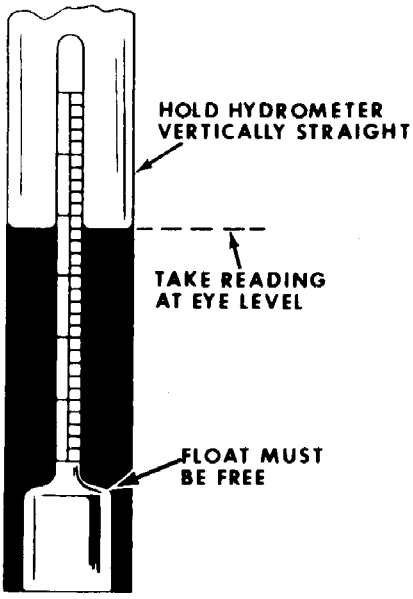



Figure 2

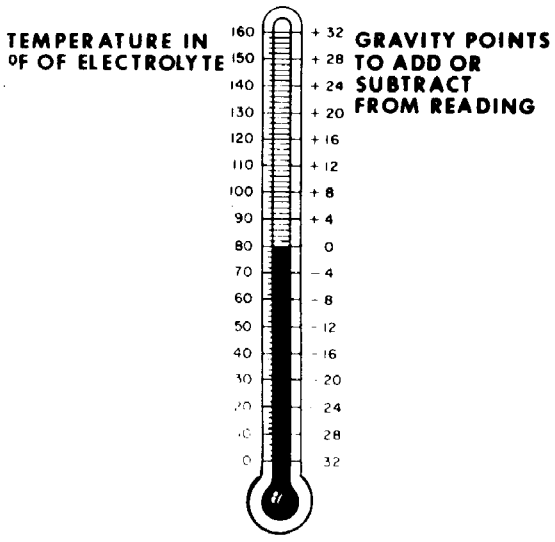



Figure 3

## STARTER - GENERATOR DRIVE BELT ADJUSTMENT

The starter - generator drive belt should be checked for excessive looseness and wear after the first ten hours of operation and each 25 hours of operation thereafter. The belt tension is correct when the belt can be depressed 1/4" (finger pressure) between the pulleys, Figure 4.

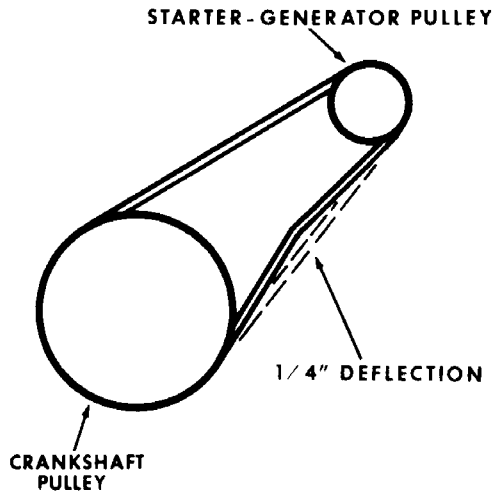



Figure 4

IMPORTANT

Under no circumstances should a pry bar be used on the starter - generator to obtain belt tension, as damage to the bearings could result.

## BATTERY CRANKING VOLTAGE - STARTER CIRCUIT TEST

Temperature: 60° F. to 80° F.

Battery specific gravity must be 1.225 or above and even within .025 points between highest and lowest cells.

NOTE:

Remove spark plug wire from spark plug and ground to engine block to prevent engine from starting and prevent coil damage.

(Complete the following 3 checks in sequence listed before troubleshooting individual circuits.)

1. Available Voltage - Battery Condition: Connect a voltmeter between the Positive and Negative Terminals of the battery. #1 - Figure 5: Crank the engine for 20 seconds and record the voltage. Should be 9.5 volts minimum (if less, recharge or replace battery).

2. Insulated Circuit Resistance Test: Move Red Voltmeter Clip to Starter - Gen. "A" Terminal #2 - Figure 5. Crank engine and record voltage. If more than .5 volts lower than in Step #1 above (check cables, connections or solenoid).

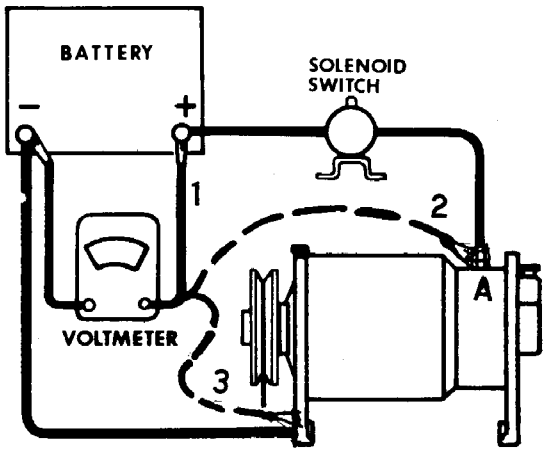



Figure 5

3. Ground Circuit Resistance Test: Move Red Voltmeter Clip to grd. on starter housing, #3 - Figure 5. Crank engine, if more than .2 volt appears on meter (check starter frame mounting at starter and at engine block, neg. cable and connections at engine and battery neg. terminal).

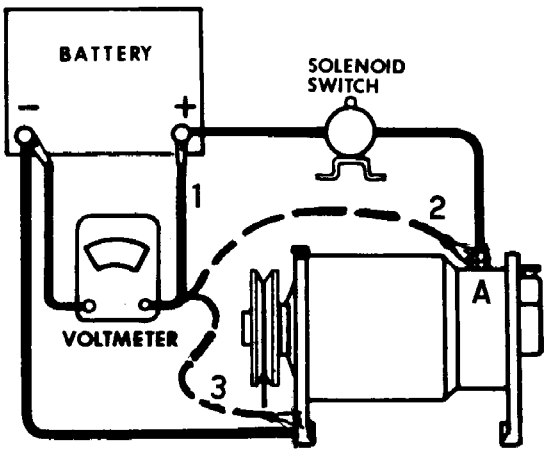



Figure 5 (continued)

## TROUBLESHOOTING CIRCUITS

1. Locating Insulated Circuit Problems - Move red voltmeter clip backwards one terminal step at a time toward battery positive while cranking the engine. A sudden change in voltage drop indicates you have located the problem area.

2. Locating Ground Circuit Problems - While cranking engine, move the red clip one step at a time - starter to bracket, to engine, to ground cable, ground cable terminal to battery negative. A sudden change in voltage drop indicates you have located the problem area.

| VOLTAGE DROPS ALLOWED - STARTER CIRCUIT | |
|---|---|
| Battery to Starter | .5V Max. |
| Each Cable | .1V Max. |
| Solenoid | .1V Max. |
| Each Connection | .0V Max. |
| Grd. Circuit | .2V Max. |

## SOLENOID ENERGIZING CIRCUIT

Disconnect spark plug lead and ground to engine block to prevent engine starting and possible coil damage. Place travel lever in neutral so safety start switch is closed.

1. Connect red voltmeter lead to battery positive terminal, black to battery negative. Crank engine and record voltage.

2. Move red clip to solenoid energizing terminal. Crank engine. Voltage should be within .3 volt of voltage recorded in step 1.

3. Move red clip to solenoid grounding terminal. Crank engine. Voltage should not exceed .2 volt.

4. If test #3 is in excess of .2 volt move red clip to ground on frame. Reading should be "0" volts. This indicates trouble in safety start switch.

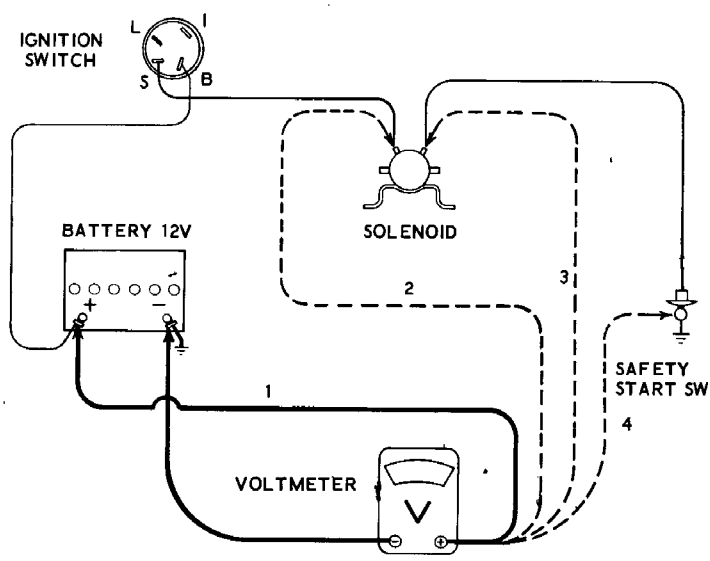



Figure 6

### INTERPRETATION

From Step 2:

a. No Voltage Drop Step #2 - Open solenoid winding, loose or dirty connections or broken wire between solenoid ground terminal and safety start switch, dirty or not making connection with travel lever, travel lever not in neutral, travel lever not grounding to frame.

b. Voltage Drop Greater Than Step #2 - Loose or dirty connections or frayed wire between battery and ignition switch, faulty switch, or loose or dirty connections or frayed wire from switch to solenoid.

From Step 3:

a. No Voltage Drop Step #3 - Loose or broken wire between solenoid ground terminal and safety start switch, safety start switch dirty or not making connection with travel lever, travel lever not in neutral, travel lever not grounding to frame.

b. Voltage Drop Greater Than Step #3 - Loose or dirty connections or frayed wire between solenoid ground terminal and safety start switch, poor connection between safety start switch and frame of tractor.

STARTER - GENERATOR CHECKS AND SPECIFICATIONS

| Delco Remy No. | Case No. | Brush Tension | NO LOAD TEST | | | | |
|---|---|---|---|---|---|---|---|
| | | | Volts | Max. | Max Amps. | RPM Min. | Av. Amps. |
| 1101970 | A70202 | 24-32 | 11 | 2900 | 18 | 2500 | 12 |

## STARTER NO LOAD TEST

Remove Starter-Generator Drive Belt. Disconnect start cable from starter "A" terminal. Connect a 75 to 100 Amp meter in series between the Starter-Generator and the 12 Volt Battery. Remove fld. wire and ground the "F" terminal of starter. Voltmeter red to "A" terminal. Black to Ground.

With the starter running, check the R.P.M. with a tachometer, maintain the voltage and check the current draw. They should meet the specifications listed above, if not the starter-generator must be serviced or replaced.

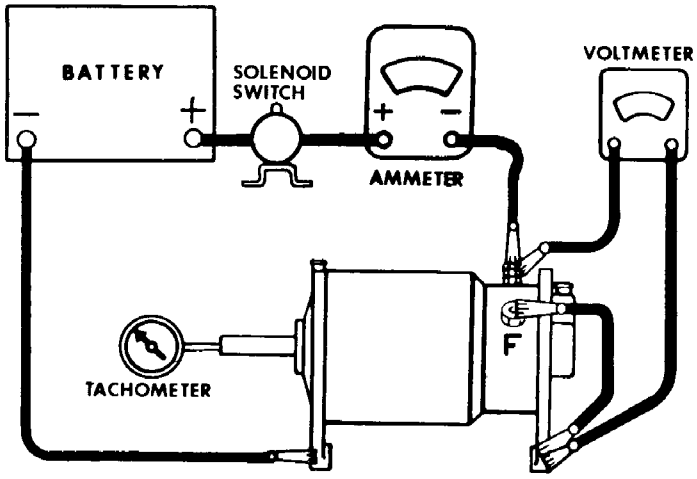



Figure 7

1. Starter Free-Running Amperage Draw Test

Manufacturer's Specifications

Controlled Volts 11 Max. Amperes 18 Min. R.P.M. 2500

Test Readings

Controlled Volts 11 Amperes _____ R.P.M. _____

Interpreting Results of Tests

a. Rated amperage draw and no-load speed indicates normal condition of the cranking motor.
b. Low free speed and high amperage draw indicates:

(1) Too much friction - tight, dirty or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag.

(2) Shorted armature. This can be further checked on a growler after disassembly.
(3) Grounded armature or fields. Check further after disassembly.

c. Failure to operate with high amperage draw indicates:

(1) A direct ground in the terminal or fields.

(2) "Frozen" bearings (this should have been determined by turning the armature by hand).

d. Failure to operate with no amperage draw indicates:

(1) Open field circuit. This can be checked after disassembly by inspecting internal connections and tracing circuit with a test lamp.

(2) Open armature coils. Inspect the commutator for badly burned bars after disassembly.

(3) Broken brush springs, worn brushes, high insulation between the commutator bars or other causes which would prevent good contact between the brushes and commutator.

e. Low no-load speed and low amperage draw indicates:

(1) High internal resistance due to poor connections, defective leads, dirty commutator and causes listed under "d".

f. High free speed and high amperage draw indicate shorted fields. If shorted fields are suspected, replace the field coil assembly and check for improved performance.

| Delco Remy No. | Case Number | Field Current Draw at 80° F. | | Cold Output at 80° F. | | |
|---|---|---|---|---|---|---|
| | | Amps. | Volts | Amps. | Volts | RPM |
| 1101970 | A70202 | 1.52-1.62 | 12 | 12 | 14 | 4950 |

## GENERATOR FIELD CURRENT

(Engine off)

1. Disconnect field wire from field terminal.

2. Hook ammeter red to battery positive, black to generator field terminal.

3. Hook voltmeter red to field terminal, black to ground with a fully charged battery. Amps should read within specification. If field amp is "0" windings are open - replace windings. If field amp is high, field windings are shorted - replace windings.

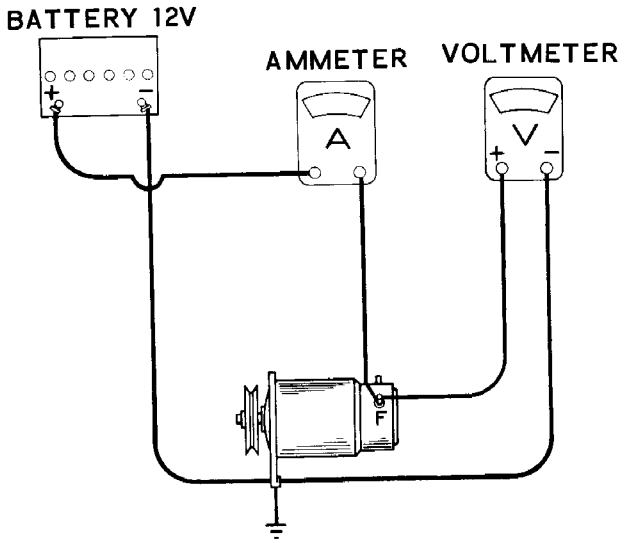



Figure 8

## GENERATOR OUTPUT CHECK

The output test can be made on the tractor using the engine to drive the unit. Be sure the drive belt is adjusted properly. Disconnect all cables and wires to generator. Connect ammeter red to the "A" terminal and black to starter cable. Connect voltmeter red to "A" terminal, black cable to the frame. Install jumper lead from the "F" terminal to the frame, Figure 7.

NOTE:

Specifications for this test are found in the chart on page 7.

Drive the unit at R.P.M. required to maintain specified voltage. When the ammeter reading is lower than specified amperage, turn on lights and maintain 14 volts. If amps rise above 12 amps, unit ok. If it fails to deliver 12 amps the unit must be serviced or replaced. If amperage output is too high, disconnect the jumper lead from the field "F" terminal. If ammeter reading is still high, unit will have to be serviced. This indicates field is grounded in the generator.

NOTE:

SHUT ENGINE OFF WHEN DISCONNECTING FIELD JUMPER.

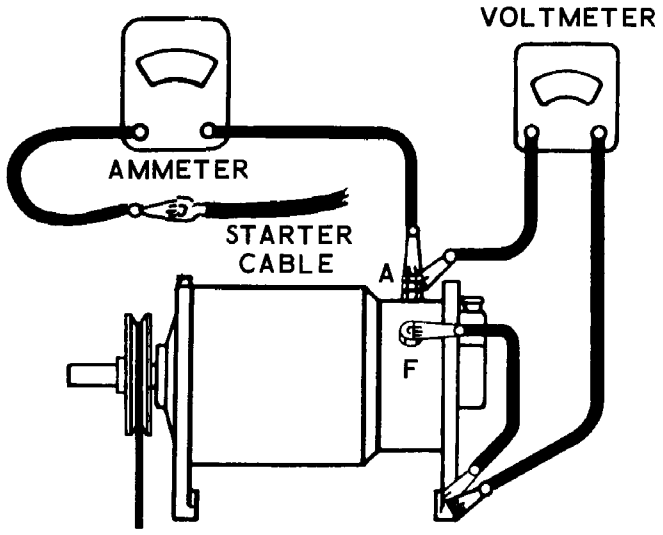



Figure 9

## REGULATOR CHECKS AND SPECIFICATIONS

| Delco-Remy Number | Case Number | | VOLTAGE CONTROL | |
|---|---|---|---|---|
| | | Air Gap | Voltage Range | Voltage Adj. |
| 118988 | A70221 | .075" | 13.6-14.5 | 14.0 |

Unhook field jumper, attach Regulator Field wire as shown. Insert 1/4 OHM Resistor in ammeter circuit. Run engine at above 1/2 throttle for several minutes and observe voltage. Reading must be in specification range shown above. Adjust or replace Regulator, as required.

If voltmeter needle wavers constantly, voltage control points require cleaning or replace regulator.

If voltmeter needle is steady, but voltage setting is high or low, adjust voltage control spring to above specifications.

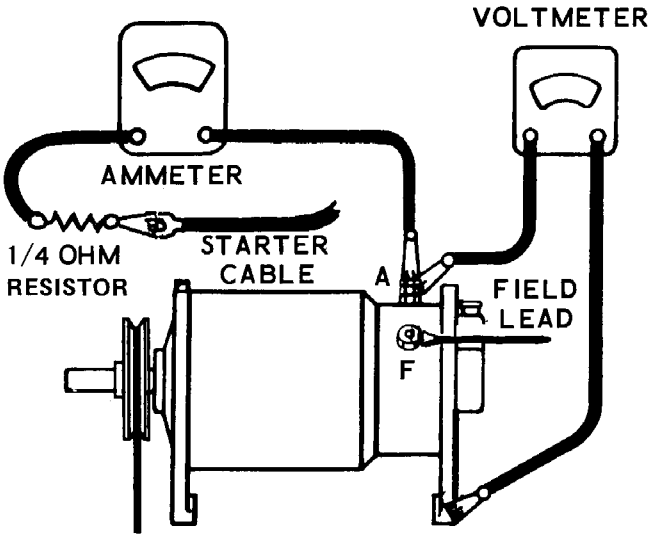



Figure 10

## CUTOUT RELAY CLOSING VOLTAGE CHECK

| Delco-Remy Number | Case Number | CUTOUT RELAY | | |
|---|---|---|---|---|
| | | Air Gap | Point Opening | Closing Voltage |
| 1118988 | A70221 | .020" | .020" | 11.8 - 14.0 |

Hook-up remains the same as Figure 10 above, except eliminate 1/4 OHM resistor.

Allow engine throttle control to remain at idle position. Slowly increase engine R.P.M. by rotating carburetor throttle shaft manually at carburetor. Observe voltmeter as it slowly rises, note the highest reading just ahead of a slight drop of meter needle. This is the closing voltage -- should be in Specification range above, or adjust to 12.8v by increasing or decreasing cut out relay control spring tension.

NOTE:

TRY THIS TEST SEVERAL TIMES TO ASSURE ACCURACY.

## IGNITION SWITCH TEST

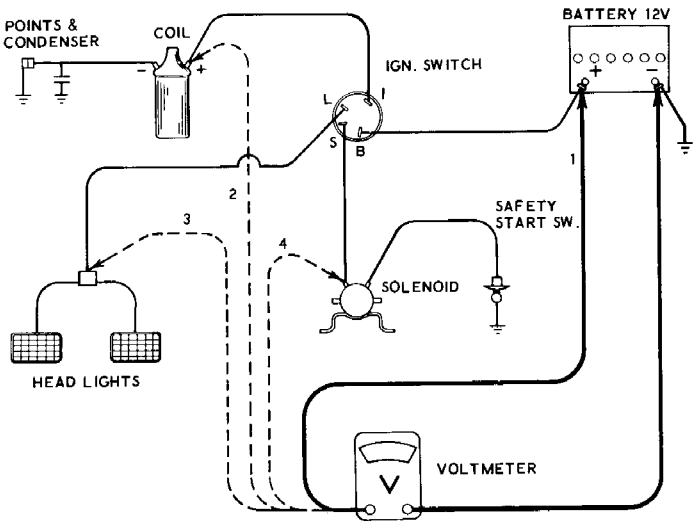



Figure 11

Place travel lever in neutral so safety start switch is closed. Disconnect coil wire from spark plug or ground to engine to keep engine from starting and possible coil damage.

1. Attach red voltmeter clip to positive battery terminal, black to negative battery terminal. Close ignition points, turn switch to ignition position. Record voltage.

2. Move red voltmeter clips to coil terminal position #2. Voltage should be within .3 volts of voltage recorded above.

3. Return voltmeter red clip to position #1. Turn switch to light position and record voltage.

4. Move red voltmeter clip to position #3. Voltage should be within .3 volt of voltage recorded in Step #3.

5. Return voltmeter red clip to position #1. Turn switch to start position and record voltage.

6. Move red voltmeter clip to solenoid start terminal position #4. Turn switch to start position. Voltage should be within .3 volt of voltage recorded in Step #5.

## IGNITION SWITCH TESTS

### INTERPRETATION

From Step 2

a. No Voltage Drop Step 2 - Coil primary winding open, coil to point wire broken, ignition points badly burned or corroded, ignition contact ground to engine faulty.

b. Voltage Drop Greater Than Step 2 - Loose or dirty connections or frayed wire between ignition switch and coil, faulty ignition switch, loose or dirty connection or frayed wires between battery and ignition switch.

From Step 4

a. No Voltage Drop Step 3 - Burned out lamp bulb, corroded socket or terminal, or lack of headlamp ground.

b. Voltage Drop Greater Than Step 3 - Loose or dirty connections, frayed wires between test point and ignition switch, ignition switch contacts, or loose or frayed wires between battery and ignition switch.

From Step 6

a. No Voltage Drop in Step 4 - Solenoid winding open or open circuit between solenoid and ground including the safety start switch or travel lever not in neutral, travel lever not grounding to frame.

b. Voltage Drop Greater Than Step 4 - Loose or dirty connections, frayed wire between ignition switch and solenoid start terminal, faulty ignition switch contacts, loose or dirty connections or frayed wires between battery and ignition switch.

## IGNITION TIMING

### ADJUSTING BREAKER POINTS

Every 100 hours of operation, the breaker point cover should be removed and the points cleaned and reset. Pitted or burned points should be replaced. Regap the points to .020 inch. Losen the point retaining screw and using a screwdriver in the adjusting slot, increase or decrease the point gap to obtain .020 inch, Figure 12. Retighten the point retaining screw.

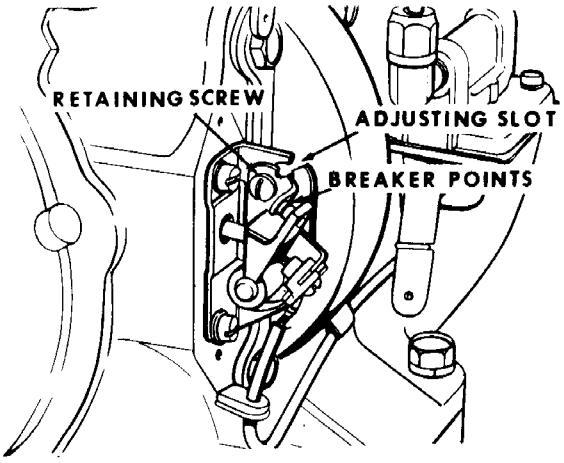



Figure 12

## RUNNING TIMING

The timing can be checked by removing the plug from the timing hole located near front edge of starter-generator mounting bracket.

1. When the running timing is checked with a timing light, the SP mark must be centered in the timing hole, Figure 13. If not, adjust the breaker points as described above.

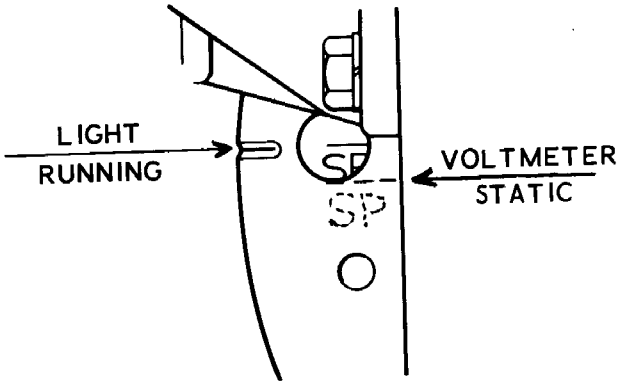



Figure 13

## OPTIONAL TIMING PROCEDURE - SUBSTITUTE FOR TIMING LIGHT

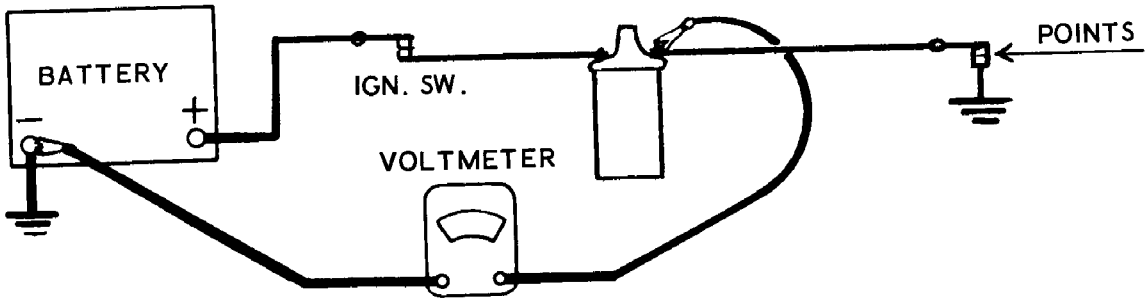



Figure 14

1. Position voltmeter leads as shown above. Black to battery negative: red to point side of coil.

2. Remove coil wire from spark plug and ground it to prevent engine starting or possible coil damage.

3. Turn ignition switch to ignition position. Rotate engine clockwise by hand with starter pulley until voltmeter drops to zero. Continue to rotate until battery voltage appears on the meter.

4. You will be on compression stroke and near SP timing mark. Rotate engine until the SP mark lines up as shown by dotted line SP mark in Figure 13.

5. If you bypass this location, back engine far enough to read SP letters in center of timing hole and advance slowly in direction engine runs to dotted line position.

6. Remove ignition point cover, loosen point lock screw. Adjust contacts until needle on voltmeter falls to zero. Adjust opposite direction until battery voltage appears - then lock retaining screw in this position.

(Try this adjustment several times while observing the voltmeter, to be sure you have locked points at the exact "breaking point".)

# IGNITION COIL AND CONDENSER SPECIFICATIONS

## IGNITION COIL SPECIFICATIONS

| Delco-Remy No. | Case No. | RESISTANCE OHMS @ 75° F. | |
|---|---|---|---|
| | | Primary | Secondary |
| 1115070 | K0231281 | 3.40 - 4.20 | 3,000 - 7,000 |

## IGNITION CONDENSER SPECIFICATIONS

| Delco-Remy No. | Case No. | CAPACITANCE |
|---|---|---|
| 1942948 | K0230722 | .18 to .23 MFD. |

## IGNITION PRIMARY CIRCUIT TEST

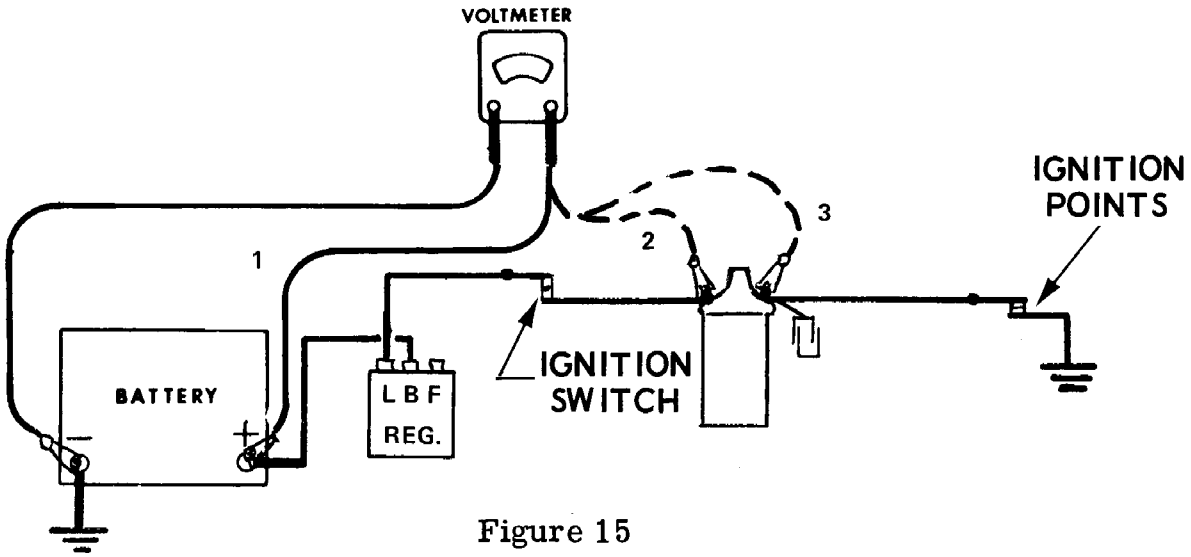



Figure 15

1. Available Voltage - Disconnect spark plug lead, connect voltmeter leads red to battery positive, black to battery negative #1. Close ignition contacts, turn ignition switch to "Ignition" position, record this reading.

2. Move red lead from battery positive to switch side of coil #2, reading should be within .3 volt of available voltage.

3. Move red lead to point side of coil, #3, meter should not read in excess of .2 volt.

NOTE:

This test performed with engine not running.

INTERPRETAION

From Step 2

a. No Voltage Drop Step #2 - Coil primary winding open, coil to point lead broken, ignition points badly burned or corroded, ignition contact to engine ground faulty.

b. Voltage Drop Greater Than Step #2 - Loose or dirty connection or frayed wires between ignition switch and coil, faulty ignition switch, loose or dirty connections or frayed wires between battery and ignition switch.

From Step 3

a. No Voltage Drop Step #3 - Loose or dirty connection, or broken wire between coil and ignition points or badly burned or corroded ignition points, points not grounded.

b. Voltage Drop Greater Than Step #3 - Loose or dirty connection or frayed wire between coil and ignition points, ignition points in poor condition, or poor ground connection between points and engine.

c. "Zero" Volts Reading Step #3 - With ignition points open, indicates a grounded condenser or ignition point lead or open coil primary winding.

## IGNITION COIL SECONDARY OUTPUT

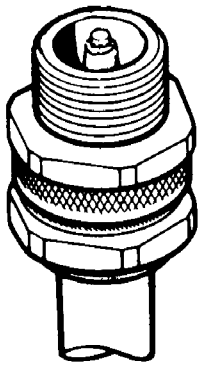


Figure 16

Grind the side electrode off of a new 18 MM spark plug. Attach coil wire to this spark plug and lay on engine block while cranking engine with the starter and regular plug in cylinder head. A blue spark should jump this gap. If spark is not blue or no spark occurs, replace coil or condenser as required.

NOTE:

Perform ignition primary circuit test before replacing above parts.

## CONTACT POINTS

INSPECTION

After each 100 hours of operation the breaker contact points should be checked for wear and adjustment.

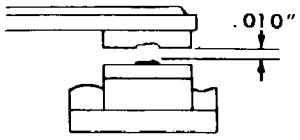
The visual inspection should be a part of the 100 hour check.

COLOR - The normal color for contact points is a light gray. If the surfaces are black, the cause is usually due to the presence of oil, dirt, or foreign matter.

If the contact point surfaces are blue, the cause is usually due to overheating because of:

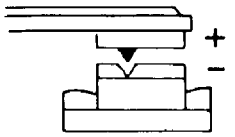
1. Improper alignment of contact points.
2. Excessive high wattage in the primary circuit of the ignition coil.
3. Poor condenser.

CONTACT SURFACE WEAR - Wear patterns that can exist and their causes.



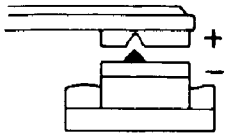

REPLACE CONTACT SET WHEN TRANSFER EXCEEDS .010"

Ideal contact point wear pattern.




TRANSFER OF MATERIALS FROM – POINT TO + POINT

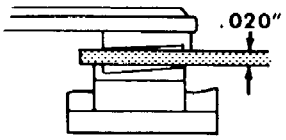
Contact point wear pattern such as this indicates condenser capacity may be too low - this is a normal wear pattern, but indicates why the condenser should always be replaced at the same time points are replaced.



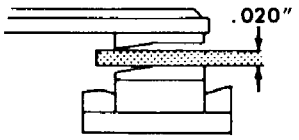

TRANSFER OF MATERIALS FROM + POINT TO – POINT

Contact point wear pattern such as this indicates condenser capacity may be too high - use only genuine case contact points and condenser replacement sets to insure the correct condenser capacity and condenser lead wire length.

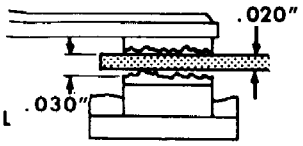
Some of the difficulties that can be encountered when trying to measure point gap with a feeler gauge.




MISALIGNED CONTACT POINTS WOULD GIVE FALSE READING

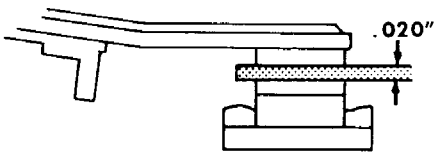



UNEVENLY WORN CONTACT POINTS WOULD GIVE FALSE READING




ACTUAL POINT OPENING

PITTED CONTACT POINTS




CONTACT POINTS THAT ARE PROPERLY ALIGNED WOULD GIVE TRUE GAP SETTING

## COIL POLARITY

In a negative grounded system, the negative or primary terminal marked with a (-) should be connected to the breaker terminal. Coil polarity refers to the direction of high tension current flow and should always be negative at the spark plug. Reversed coil polarity is almost always traced to reversed leads at the coil. A simple way to check coil polarity is to remove spark plug wire at the plug and hold it about 1/4 of an inch away from the spark plug while the engine is idling. Insert the point of a wood lead pencil between the wire end and spark plug, Figure 17 and 18.

If the spark flares or feathers and has a slight orange color on the plug side of the pencil, coil polarity is correct. If this occurs on the wire side of the pencil, coil polarity is reversed. Reverse wires at the coil.

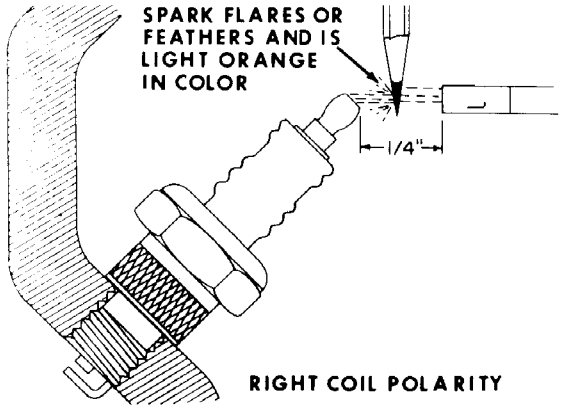



Figure 17

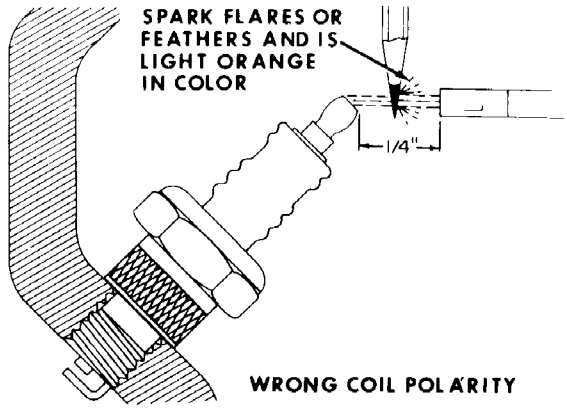



Figure 18

## SPARK PLUGS

SPECIFICATIONS

Type -----Prestolite 14 L7 or Equivalent
Thread Size ----------14 MM
Gap Setting ----------.025 Inch
Installation Torque -----27 Foot Pounds
Socket Wrench Size ---------13/16 Inch

The purpose of the spark plug is to fire or ignite the proper fuel mixture in the combustion chamber of the engine at a preset time. This is controlled by the breaker cam and points. A spark plug which does not function properly will increase fuel consumption, cause crankcase oil dilution, excessive deposit in the combustion chamber and greatly reduce the efficiency of the engine.

A close examination of the spark plug will give the service man an indication in general of the engine conditions. A fouled or burnt spark plug can be used as good visible evidence to show the customer when soliciting a valve or overhaul job.

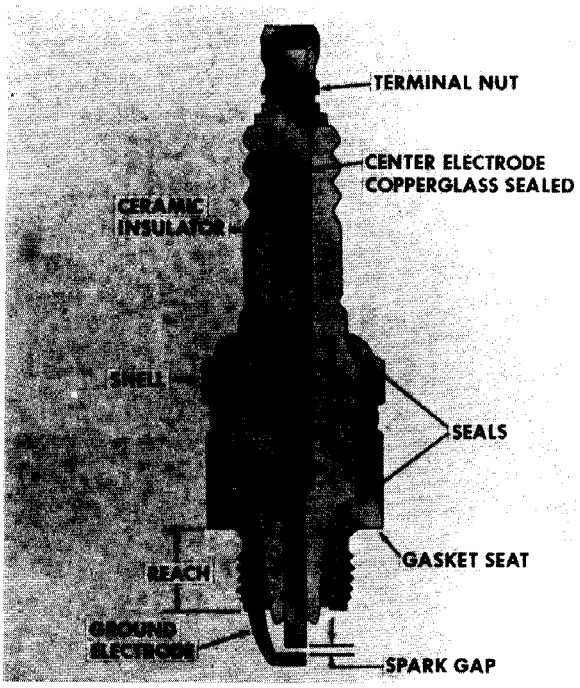



Figure 19

Remove the wire from the spark plug and use a thin wall deep socket spark plug type wrench of correct size 13/16" to remove the spark plug.

The wrong size or type socket wrench can cause distortion or insulator breakage.

## SPARK PLUG GASKET

The first thing to inspect after removal of a plug is the copper gasket. This will tell you if the spark plug was installed correctly.

A spark plug that has been properly torqued in place to 27 foot pounds will have the copper gasket compressed to 1/2 of its original thickness.

A spark plug gasket that was not compressed enough when the plug was installed can cause compression leakage. The plug will run hotter than it should as the heat will not be transferred from the plug to the cylinder head as fast.

A spark plug gasket that is compressed too much when the plug is installed will cause the plug to run colder than it should and thus will foul a lot faster. It is also possible that when the plug is installed too tight, it will cause distortion of the electrodes. Thus the plug gap would be increased beyond its original setting.

## SPARK PLUG INSULATORS

Always inspect the spark plug for a broken or cracked insulator. If a crack of any severity is found, the spark plug must be discarded, Figure 20 and 21.

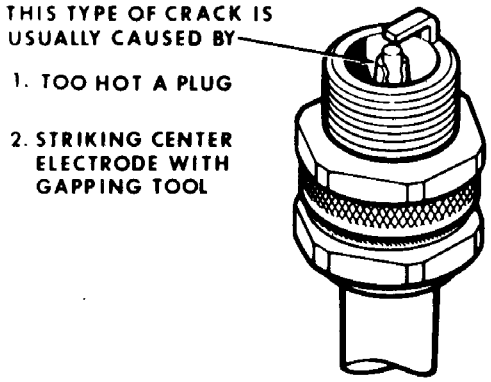



Figure 20

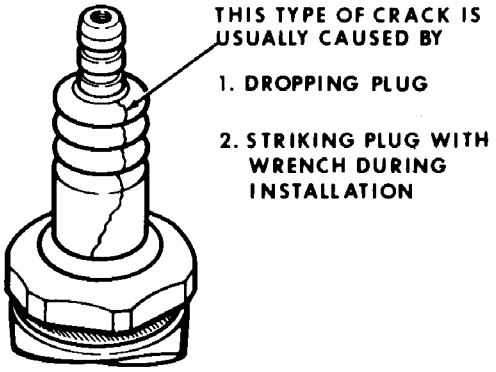



Figure 21

## SPARK PLUG HEAT RANGE

The term "Heat Range" classifies a spark plug according to its ability to transfer heat from the gap end of the plug to the cylinder head. The ability of a plug to transfer heat is determined by the length of the insulator nose, Figure 22.

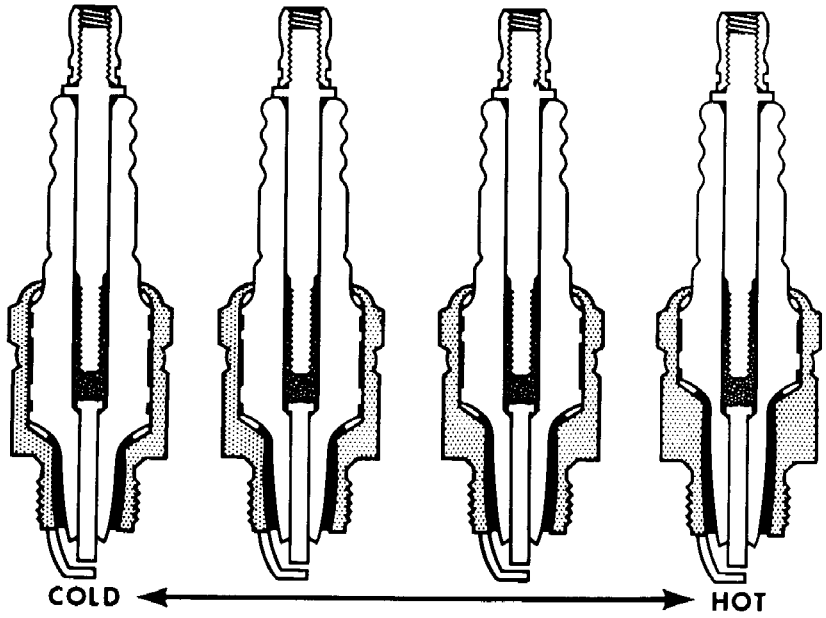



Figure 22

### COLD SPARK PLUGS

A cold plug has a short insulator nose which cools quickly. A cold plug is used where combustion chamber temperatures are higher than normal. This condition will exist when the engine is under continual heavy loads and in hot weather operation.

### HOT SPARK PLUGS

A hot plug has a long insulator nose which cools much slower and is used when engine combustion chamber temperatures are relatively low. This condition will exist in cold weather operation, prolonged idling and light loads.

## MEDIUM OR NORMAL HEAT RANGE SPARK PLUGS

The medium length insulator nose cools normally and is not subjected to constant high or low temperatures or constant light or heavy loads. This medium range plug represented a compromise to cover the widest range of operating conditions.

If a hot plug is installed in an engine for light loads or cold weather operation, it is very important that it be replaced by a colder plug when engine is operated at sustained heavy loads in hot weather. Using too hot a plug for sustained heavy load operation may result in the spark plug becoming overheated, causing pre-ignition, cracking of the plug insulator and serious engine damage.

## ELECTRODES

Examine the spark plug electrodes to determine if the plug is the proper heat range. Deposits on the electrodes will give some indication of the condition of the engine.

## OIL FOULED SPARK PLUGS

An oil fouled spark plug will have wet oily deposits on the electrode and the bottom of the shell.

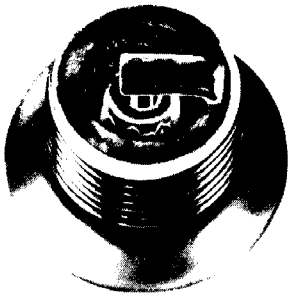


Figure 23

Oil fouling indicates an excess amount of crankcase oil is getting into the compression chanber as a result of worn piston rings, cylinder bore or valve guides.

A hotter spark plug will temporarily relieve oil fouling of the plug, but the permanent cure is to eliminate the cause of the oil getting into the compression chamber.

## BURNED OR OVERHEATED SPARK PLUGS

A burned or overheated spark plug will have a dry shiny white, glazed or badly cracked insulator nose. This can be caused by anyone of the following:

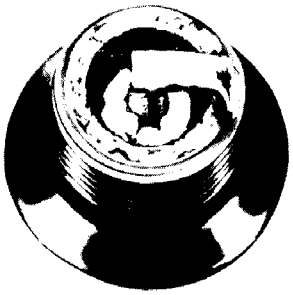


Figure 24

1. Too lean a fuel air mixture.
2. Improper ignition timing.
3. Too hot a spark plug for the type of engine service.
4. Burned or sticking valves.
5. Engine cooling system not operating properly.

## FUEL FOULED SPARK PLUGS

A fuel fouled spark plug has a dry black deposit on the electrode and bottom of the shell. It can be caused by any of the following:

1. Excessive use of the choke by the operator.
2. Too rich an air fuel mixture.
3. Prolonged engine idling.
4. The use of too cold a spark plug for the type of engine service.
5. Clogged air cleaner.
6. Poor ignition output.
7. Normally worn out spark plug.

Figure 25

## SPARK PLUG

A spark plug that has been worn out by normal service can be identified by a light brown to grayish tan dry deposit. It indicates a balanced ignition and combustion system and the plug was of the proper heat range.

NOTE

If a highly leaded fuel is used, a white powdery or yellow glazed deposit will appear. These deposits should be cleaned off regularly.

Figure 26

## CLEANING AND GAPPING SPARK PLUG

Clean spark plug with pen knife or wire brush and solvent. File the electrode sparking areas to obtain bright flat parallel surfaces and reset the gap between the electrodes to .025 inch.

Use a round type feeler gauge to measure the gap as a flat type feeler gauge will give a false reading, Figure 27.

Set the gap by bending the ground or outside electrode. Never try to bend the center electrode as the insulator will crack.

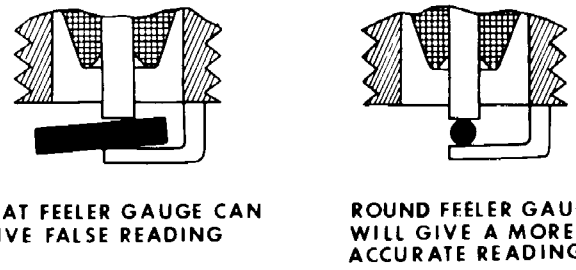



Figure 27

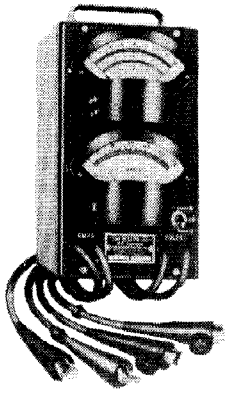
## INSTALLING THE SPARK PLUG

Make sure the cylinder head threads and the gasket seat is clean. Always install a new gasket whenever a spark plug has been removed and reinstalled. Use a thin wall deep socket type spark plug wrench (13/16") and torque to 27 foot pounds. If a torque wrench is not used, tighten the plug until the plug, gasket and head make contact and then give it 3/4 of a turn which will compress the gasket properly. Install spark plug wire.

## PURCHASE TOOLS OF EQUAL OR BETTER QUALITY FOR USE IN TESTING ELECTRICAL SYSTEMS AND ENGINE R.P.M.

### MODELS 220 - 222 - 442 - 444

VOLT-AMPERE TESTER
MODEL VAT-60

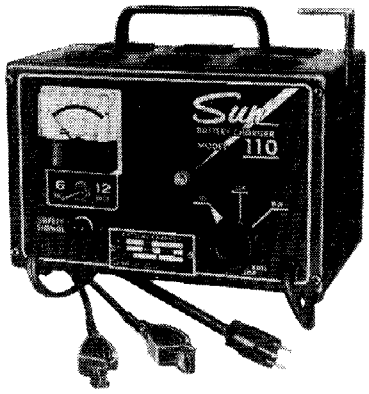


**NOTE: TESTER AND CHARGER AVAILABLE FROM SUN ELECTRIC CORP., Harlem & Avondale, Chicago, Illinois 60631**

The VAT-60 has 2% accuracy meters. The voltmeter scale ranges are 0-4, 0-8, and 0-16 volts in .1 volt steps. The ammeter scale range is 10-0-75 amperes in 2 ampere steps.

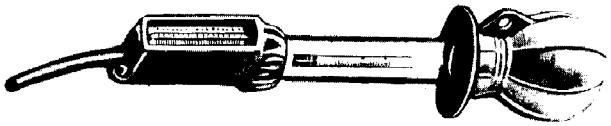
Hydrometer - Thermometer. Has float gauge printed in three colors with "Recharge," "Fair" and "Good" markings to indicate exact battery condition. Range of 1,060 to 1,320 covers all test conditions. Recessed thermometer with range of 0 to 160 degrees shows temperature and Specific Gravity corrections. Six ounce capacity red rubber filler bulb has straight stem and is 10-1/2" overall.

MODEL BC-110



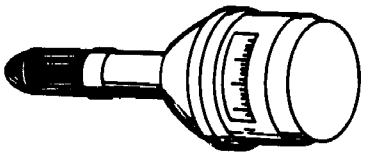

The Model BC-110 features the superior quality engineering, workmanship and materials as the larger models. This lower output charger is ideal for small shop operator or for home use. On a continuous duty basis, it will charge 6 volt or 12 volt batteries at 10 amperes. Its Charge Rate Selector permits the operator to tailor the charge rate to meet slow charge requirements of various size batteries.

HYDROMETER - THERMOMETER



## THE FOLLOWING TOOLS AVAILABLE FROM TECUMSEH PRODUCTS

TACHOMETER



TEC. No. 670110 - Tachometer
To be used for starter free run testing.

**NOTE: THESE TOOLS CAN BE OBTAINED FROM THE LOCAL TECUMSEH DISTRIBUTOR OR DEALER.**

VIBRATION TACHOMETER

TEC. No. 670156 - Tachometer
To be used to determine high and low idle speed setting, and to determine specific R.P.M. for electrical and hydraulic test procedures.

NOTE

The J I Case Company reserves the right to make improvements in design or changes in specifications at any time without incurring any obligations to install them on units previously sold.

MJRBB

Printed in U.S.A.

Printed in U.S.A.