SECTION

F

ELECTRICAL SYSTEM

THE CHARGING CIRCUIT

THE STARTING CIRCUIT

IGNITION SYSTEM

TABLE OF CONTENTS

INTRODUCTION

Section F contains the specifications and wiring diagrams necessary to diagnose and make minor adjustments on the electrical components on the garden tractors.

All major adjustments and overhaul of electrical components should be performed by an Authorized Electrical Service Station (Delco-United Motors Service) where specialized equipment and trained personnel are available.

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

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, holdown 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, light cup grease or paint 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. Pure or distilled water should only be added when the electrolyte level is low. DO NOT OVERFILL, refer to Figure F-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.

Specific Gravity Check

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 F-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 F-3.

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

Specific gravity readings will change depending upon climate.

State of Charge	Specific Gravity Range for Climate Zone		
	Frigid	Temperate	Tropical
100%	1.280	1.260	1.225
75%	1.230	1.215	1.180
50%	1.180	1.170	1.135
Discharged	1.080	1.070	1.045

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

When a battery is to be charged, it may be charged at any rate which does not allow the battery terminal voltage to exceed 15.5 volts (12 volt battery) while charging. 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.

A fast charge method is used only to give the batteries a boost for starting. This type of charge puts out a very high amperage until the battery temperature is up to 110°F., then it shuts off.

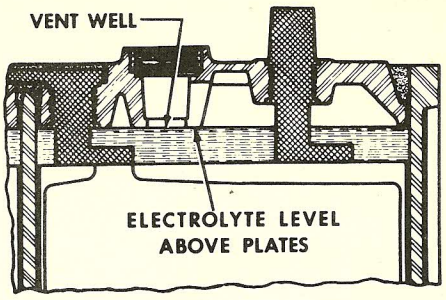


Figure F-1

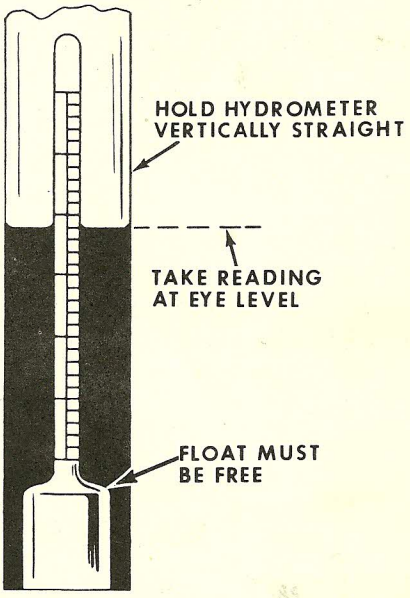


Figure F-2

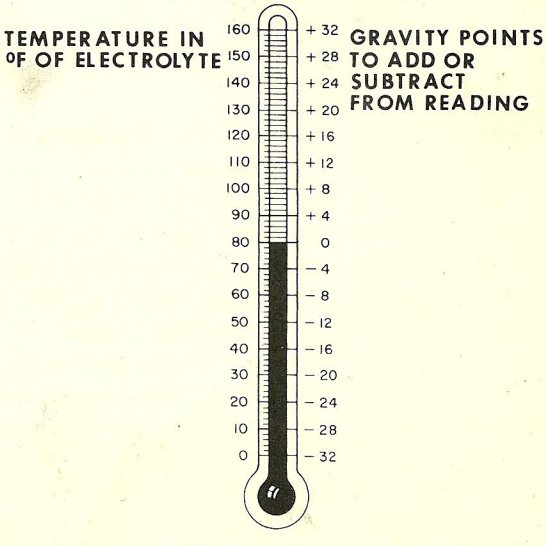


Figure F-3

Individual Battery Cell Check

Place a light load on the battery by cranking engine (do not start engine) for 3 seconds. Turn on headlights, after one minute proceed with check. Using a 4 volt voltmeter check the voltage of each cell, refer to Figure F-4.

If cell voltage varies more than .05 volts replace battery. If cell voltage is below 1.95 volts, charge battery and recheck the cell voltages. If cell voltage is still below 1.95 volts or varies .05 volts replace battery.

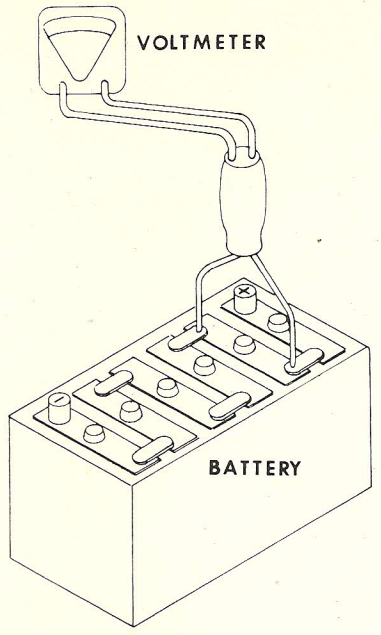


Figure F-4

Battery Cranking Voltage Test

To perform the cranking voltage check;

NOTE On Spark Ignition engines remove the center coil wire to prevent engine from starting.

1. Connect a volt meter (12 volt) between the positive and negative terminals of the battery, Figure F-5.

   Crank the engine for 15 seconds and record voltage.

2. Connect voltmeter (12 volt) between the starter generator "A" terminal and ground on starter generator frame, Figure F-5.

   Crank the engine and record voltage. If voltage is not the same or varies more than .5 volt, check the battery cables, clean and tighten connections.

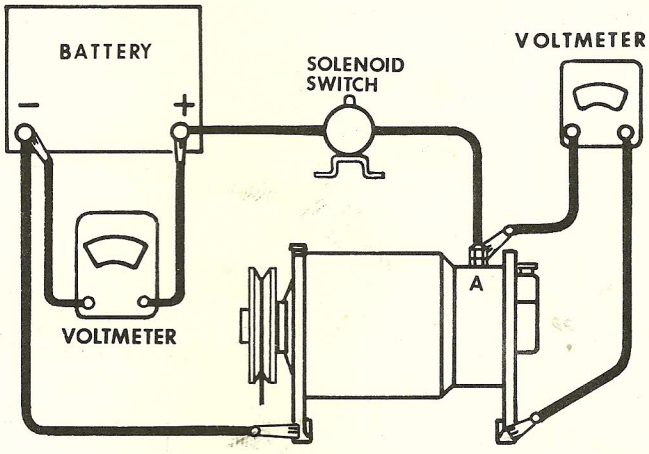


Figure F-5

Battery Bench Load Test

When battery is removed from the tractor, connect a volt meter (12 volt) between the negative and positive post, Figure F-6.

A load equal to 3 times the amp hour rating of the battery should be connected between the positive and negative posts and after 15 seconds, check the volt meter reading.

If it is less than 9.5 volts (12 volt battery) the battery should be replaced.

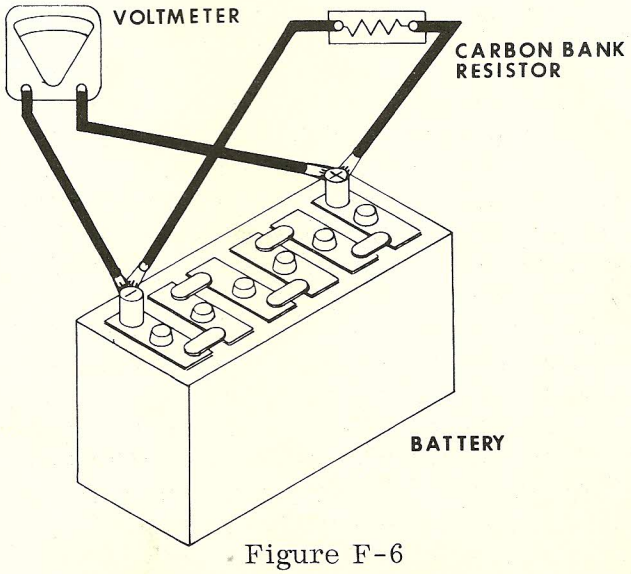


Figure F-6

SOLENOID SWITCH CHECK AND SPECIFICATIONS

Delco-Remy No.	Case No.	Amperage Draw both windings	Voltage Draw both windings
1498	A21481	2.1 - 2.3	8

Specifications given at temperature of 80°F.

Make hook up, Figure F-7 and slowly decrease the load with the variable resistor until the specified voltmeter reading is obtained. The Ammeter at this time should show specified amperage draw of both windings. A noticeable click (closing of the switch contacts) will be heard when this specified voltage and amperage is reached. If solenoid switch does not meet these specifications, it must be replaced with a new switch.

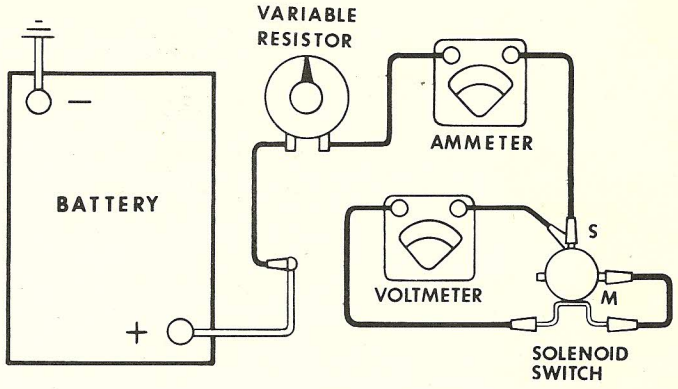


Figure F-7

STARTER-GENERATOR CHECKS AND SPECIFICATIONS

Delco Remy No.	Case No.	Brush Tension	No Load Test				
			Volts	Av. Amps.	Max. Amps.	RPM Min.	Max.
1101970	A70202	24-32	11	12	18	2500	2900

Delco Remy No.	Case No.	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

STARTER NO LOAD TEST

For the no load test, connect the starter-generator in series with a 12 volt battery, 300 amp. ammeter, a variable resistor connected to the "A" terminal. Ground the "F" terminal, Figure F-8. With the starter running, check the RPM with a tachometer. Check the current draw and voltage draw. They should meet the specifications listed above. If the starter-generator does not meet these specifications, it must be serviced or replaced.

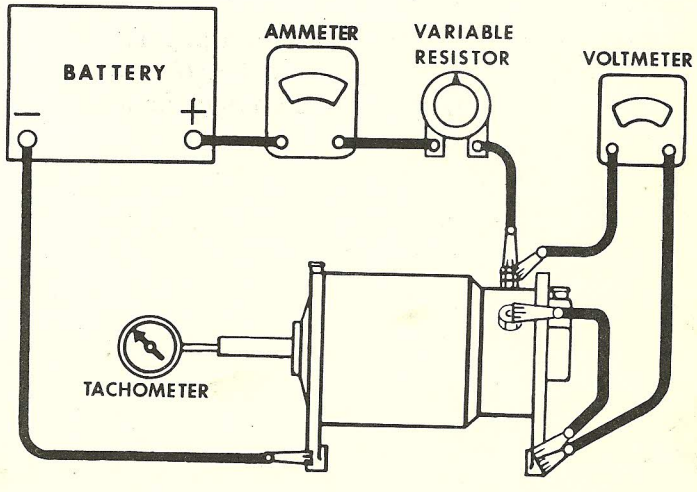


Figure F-8

GENERATOR OUT-PUT CHECK

The output test can be made on the tractor using the engine to drive the unit. When test is made on the bench, some means of driving the unit will be necessary. Be sure the drive belt is adjusted properly. Disconnect all cables and wires to generator. Connect ammeter and variable resistance in series between the "A" terminal and generator frame. Connect voltmeter from the "A" terminal to the frame. Install jumper lead from the "F"terminal to the frame, Figure F-9.

Drive the unit at specified RPM, adjust to specified voltage by varying the resistance. When the ammeter reading is lower than specified amperage, 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.

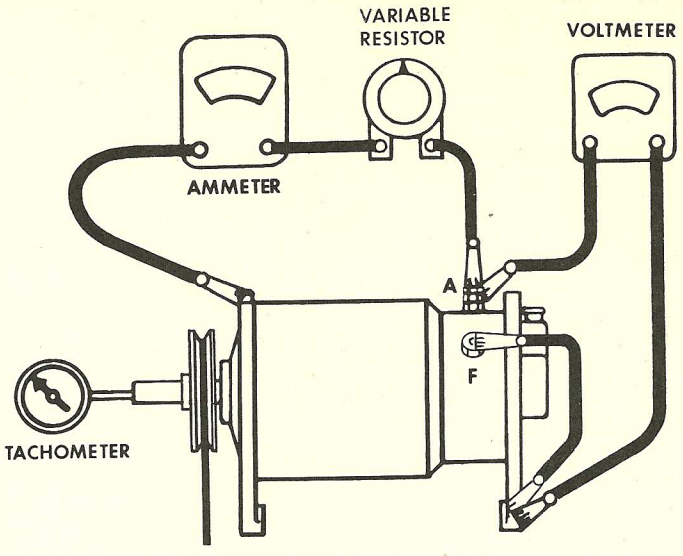


Figure F-9

STARTER-GENERATOR DRIVE BELT ADJUSTMENT

The starter - generator drive belt should be checked for excessive looseness and wear after the first 10 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 F-10.

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.

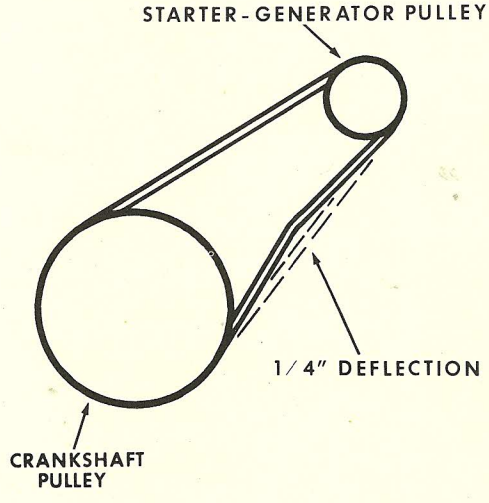


Figure F-10

REGULATOR CHECKS AND SPECIFICATIONS

Delco Remy No.	Case No.	Cutout Relay			Voltage Control			
		Air Gap	Point Opening	Closing Voltage	Voltage Adj.	Air Gap	Voltage Range	Voltage Adj.
1118988	A70221	.020"	.020"	11.8-14.0	12.8	.075"	13.6-14.5	14.0

The regulator can be checked on the tractor. Disconnect and tape the wire to the "B" terminal at the regulator and disconnect the wires to the "L" terminal of the regulator. Connect test equipment, Figure F-11. Start the engine and run at 1000 RPM or run the generator at 2500 RPM for 15 minutes to let regulator warm up to operating temperature. The variable resistance must have an open position and during warm up must be in the open position. Turn variable resistance slowly until all resistance is cut out. Note voltage setting. If test is repeated, always turn variable resistance back to the open position before the voltage is again raised.

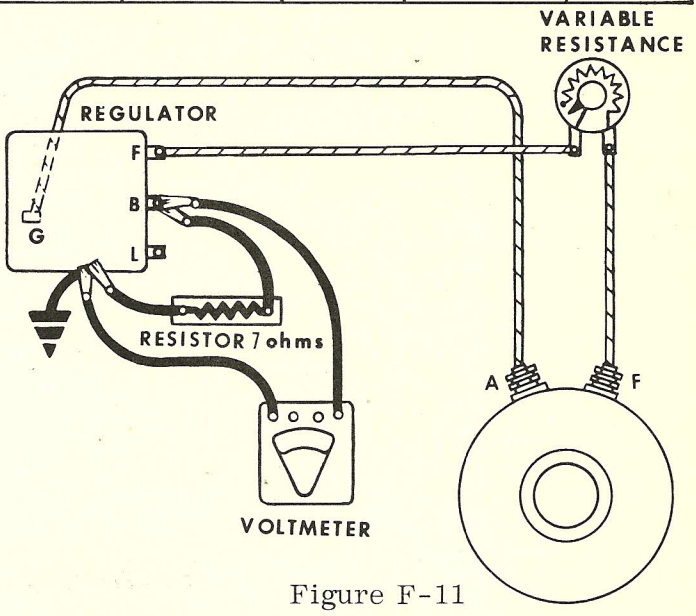


Figure F-11

CUTOUT RELAY CLOSING VOLTAGE CHECK

This check should be made after the voltage regulator check has been made. Disconnect and tape the wire from the "B" terminal. Disconnect the wires from the "L" terminal. Make connections of test equipment, Figure F-12. This is the same hook up as the voltage regulator check except the voltmeter is connected to the "A" terminal of the starter-generator. Turn the variable resistance to cutout all resistance. Run at same speed as regulator check above. Turn the variable resistance slowly to the open position and then back slowly to cutout resistance until the relay closes (sharp drop on the voltage reading). If test is to be repeated always return to the open position before test.

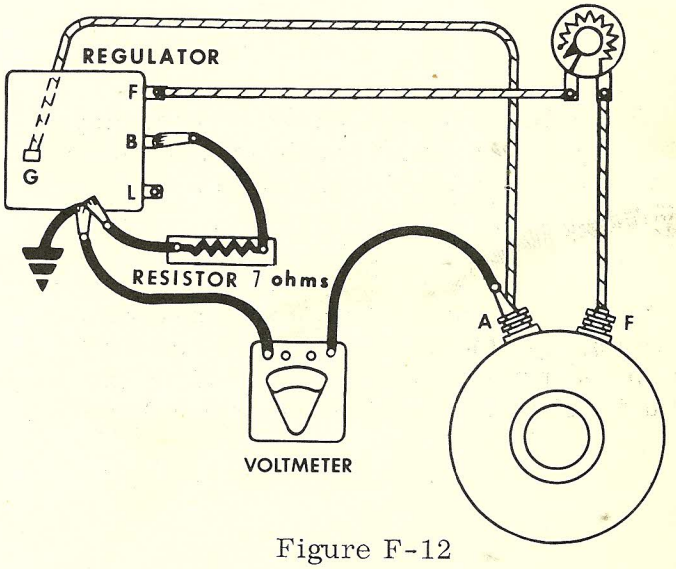


Figure F-12

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. Loosen the point retaining screw and using a screwdriver in the adjusting slot, increase or decrease the point gap to obtain .020 inch, Figure F-13. Retighten the point retaining screw.

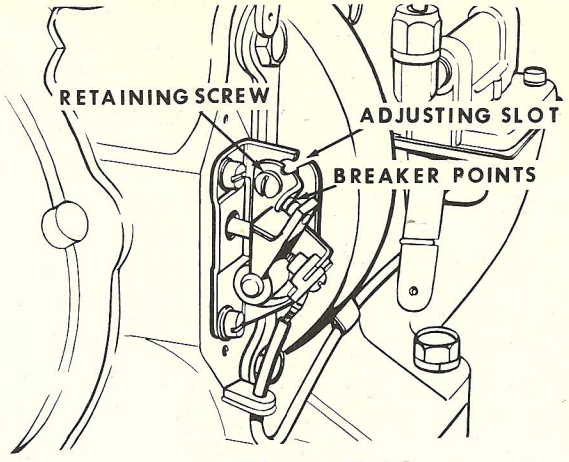


Figure F-13

Running Timing

The timing can be checked by removing the plug from the timing hole located on the left hand side of the bearing plate.

When the running timing is checked with a timing light the SP mark must be centered in the timing hole, Figure F-15. If not, adjust the breaker points as described above.

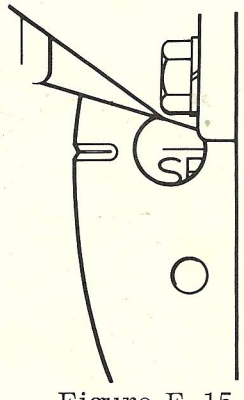


Figure F-15

IGNITION COIL SPECIFICATIONS

Delco Remy No.	Case No.	Resistance, OHMS at 75° F.	
		Primary	Secondary
1115070	KO 231281	3.40-4.20	3000 - 20,000

IGNITION CONDENSER SPECIFICATIONS

Delco Remy No.	Case No.	Capacitance
1942948	KO 230722	.18 to .23 MFD.

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.

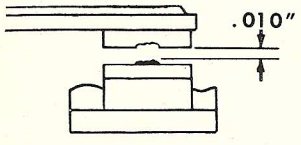
If the contact point surfaces are blue, the cause is usually due to overheating because of:

1. Improper alignment of contact points.

2. Excessive high wattage in the primary circuit of the ignition coil.

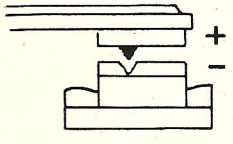
3. Poor condenser.

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



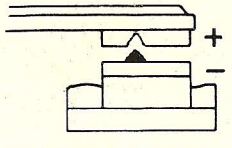
REPLACE CONTACT SET WHEN TRANSFER EXCEEDS .010"

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.

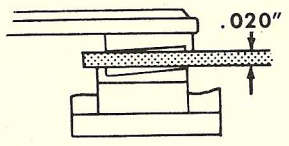


TRANSFER OF MATERIALS FROM + POINT TO – POINT

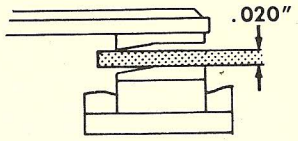
CONTACT POINT WEAR PATTERN SUCH AS THIS INDICATES CONDENSER CAPACITY MAY BE TOO HIGH- USE ONLY GENUINE CASE CONTACT POINTS - CONDENSER REPLACEMENT SETS TO INSURE THE CORRECT CONDENSER CAPACITY AND CONDENSER LEAD WIRE LENGTH.

CONTACT POINTS

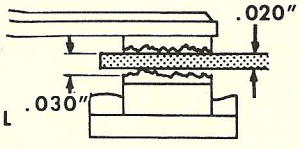
Some of the difficulties that can be encountered when trying to measure point gap with a feeler gauge.



MISALIGNED CONTACT POINTS WOULD GIVE FALSE READING

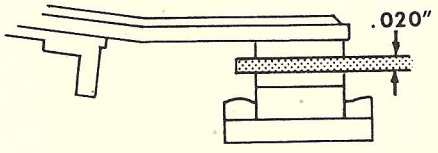


UNEVENLY WORN CONTACT POINTS WOULD GIVE FALSE READING



ACTUAL POINT OPENING

PITTED CONTACT POINTS

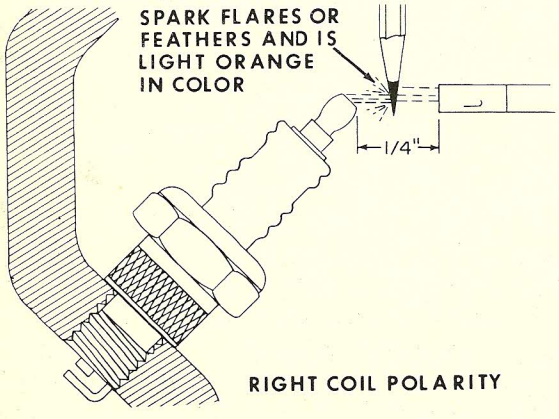


CONTACT POINTS THAT ARE PROPERLY ALIGNED WOULD GIVE TRUE GAP SETTING

COIL POLARITY

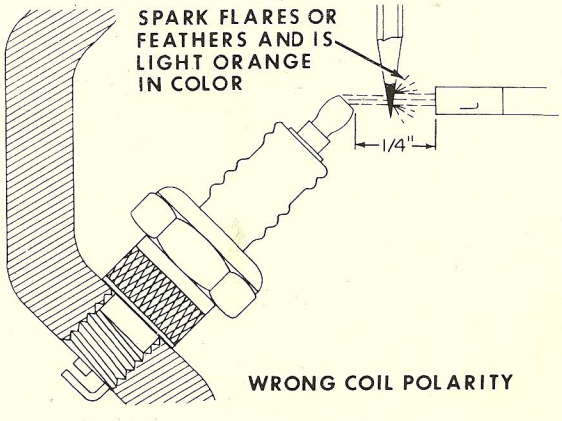
In a negative grounded system, the negative or primary terminal marked with a (-) should be connected to the breaker terminal. Coil polarity refers to the direction of high tension current flow and should always be negative at the spark plug. Reversed coil polarity is almost always traced to reversed 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 F-16 and F-17.

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.



RIGHT COIL POLARITY

Figure 16



WRONG COIL POLARITY

Figure 17

SPARK PLUGS

Specifications

Type ---------- Prestolite 14 L7 or Equivalent
Thread Size ---------- 14 MM
Shank Length ---------- 7/16" Inch
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.

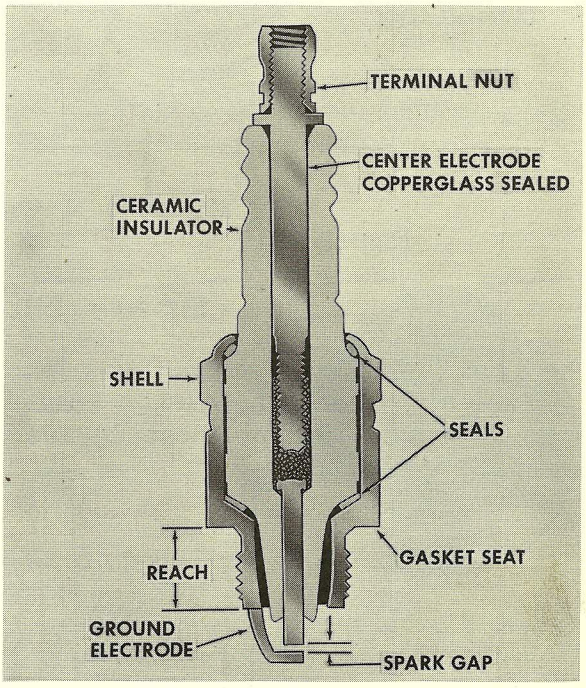


Figure F-18

Removal and Inspection

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 then 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 then 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, Figures F-19 and F-20.

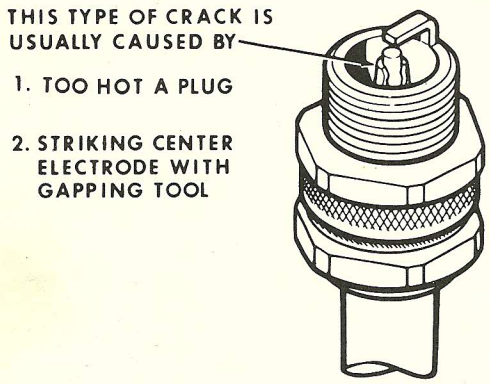


Figure F-19

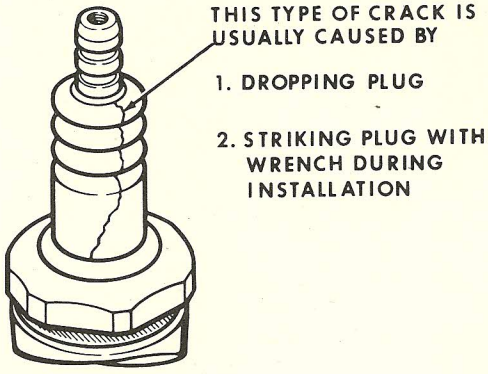


Figure F-20

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 F-21.

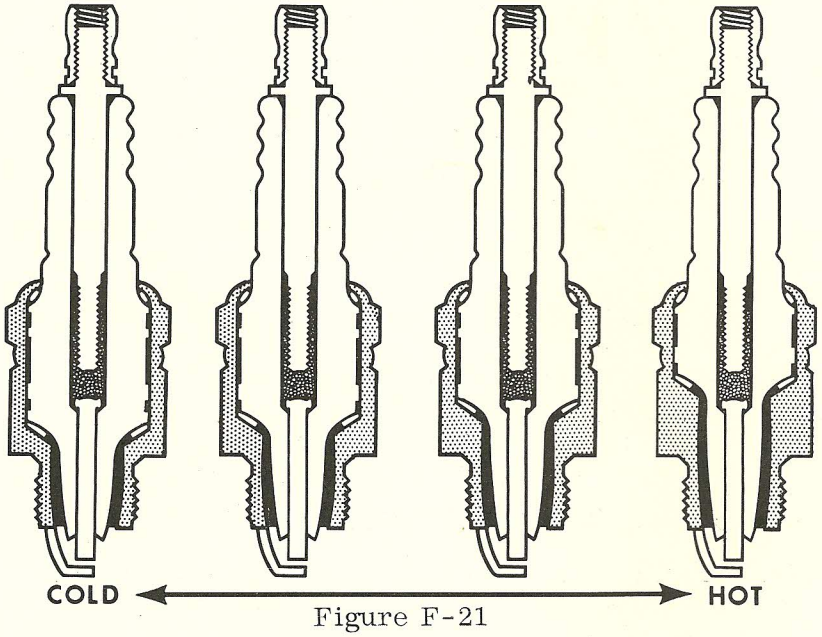


Figure F-21

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 then 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 lightloads 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 over heated, 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.

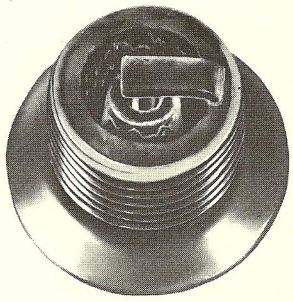


Figure F-22

Oil fouling indicates an excess amount of crankcase oil is getting into the compression chamber 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:

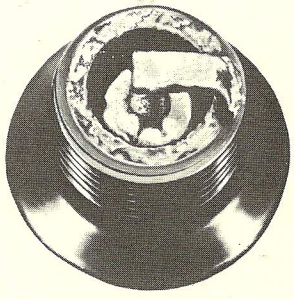


Figure F-23

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:

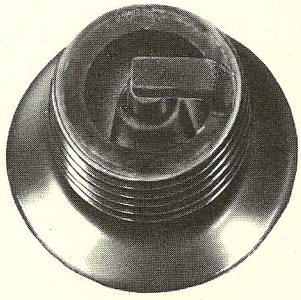


Figure F-24

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.

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.

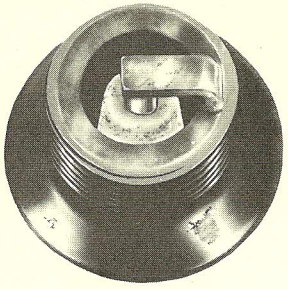


Figure F-25

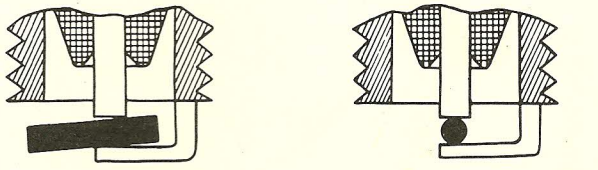
Cleaning and Gapping Spark Plug

Use an abrasive type cleaning machine (if available) to remove the deposits on the plug, after this has been done, wire brush the threads.

File the electrode sparking areas to obtain bright flat parallel surfaces. The plug should be washed in a good cleaning solvent and blown dry with air pressure. Reset the gap between the electrodes to .025 inch.

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

Use a round type feeler gauge to measure the gap as a flat type feeler gauge will give a false reading, Figure F-26.



FLAT FEELER GAUGE CAN GIVE FALSE READING

ROUND FEELER GAUGE WILL GIVE A MORE ACCURATE READING

Figure F-26

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.

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