

Model A Ford Roadside Repairs

How It Works and What to Check When It Doesn't



MAFCA Beaver Chapter Technical Seminar

Car to Car Variations

We all understand that after 88-91 years of use and repairs there will likely be several differences between our cars. Many times those differences can be functionally equivalent, and have no safety or performance impact. Other differences, like the installation of fuses, or additional electrical components can have a potentially large impact.

Surprisingly, there are over 10 Million possible combinations of parts between the battery and the spark plugs for a Model A with a 6 volt system. This number grows to over 400 Million using the judging standards as a reference for original component variations.

The result is that what works well for one car might not be a workable solution for another.

So You Find Yourself On the Side Of The Road...

- Sight, sound, and smell are your primary initial tools.
- Many problems can be traced to loose wires and components.
- Those sounds and smells that occurred coincident with the problem can be used to help determine its cause i.e. back fire, high speed misfire, sudden loss of power, smell of gas. Other considerations are outside air temperature, engine load, and driving speed.
- The internal combustion engine is basically an air pump requiring three components to operate
 - ✓ Air
 - ✓ Fuel
 - ✓ Spark

Roadside Seminars

Maintenance of the Model A is largely a common sense process. Usually a systematic review of the fault leads to a successful outcome. Generally the problems are minor: loose wire, point gap, or obstructed fuel supply.

There will be times when internal failures make roadside repair unlikely, but usually repairs are pretty straight forward. The engine needs three things to run: air, fuel, and spark.

- Fuel
 - None – out of gas, blocked fuel filter, float valve
 - Too little – GAV too lean, fuel filter, float level
 - Too much – stuck choke, GAV too rich, defective float valve
- Spark
 - None – failed condenser, armor cable shorted in distributor, broken wire between distributor plates
 - Too little – point gap
 - Wrong time – poor timing, loose distributor cam

Check For Air

- Remove the distributor cap and have someone turn over the engine. If the rotor is turning, so is the camshaft and the valves are opening and closing.
- If you doubt the timing of those openings and closings, remove a spark plug and cover the hole with your finger and feel for compression as someone cranks the engine. You have air.

Check For Fuel

- Pull the choke and crank the engine. After four or five rotations you are likely to see fuel coming out of the carburetor intake. You have fuel.
- If the step above fails:
 1. Are you out of gas?
 2. Loosen the gas cap and listen for a hissing noise. Vent holes in caps can become blocked creating a vacuum.
 3. Is the blockage in the carburetor float valve or screen?
 4. Is the blockage at the sediment bowl?
 5. Is the blockage in the tank screen?
- Solve and fix the problem

Check For Spark

- Observe the amp meter to confirm that the primary ignition circuit is working. Then find a not so bright friend to touch a spark plug while you crank the engine with the ignition switch on. Based on the reaction of your friend – You have spark.
- If the step above fails, it is on to the ignition system to find and fix the problem.

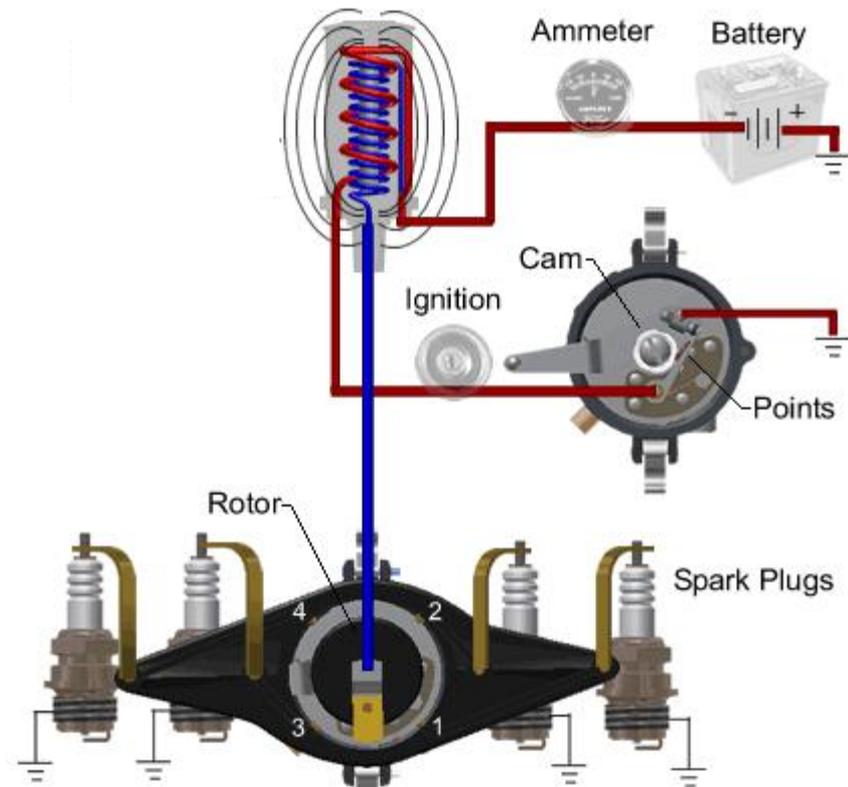
General Electrical Comments

There is a good chance that your car is in some way non-standard

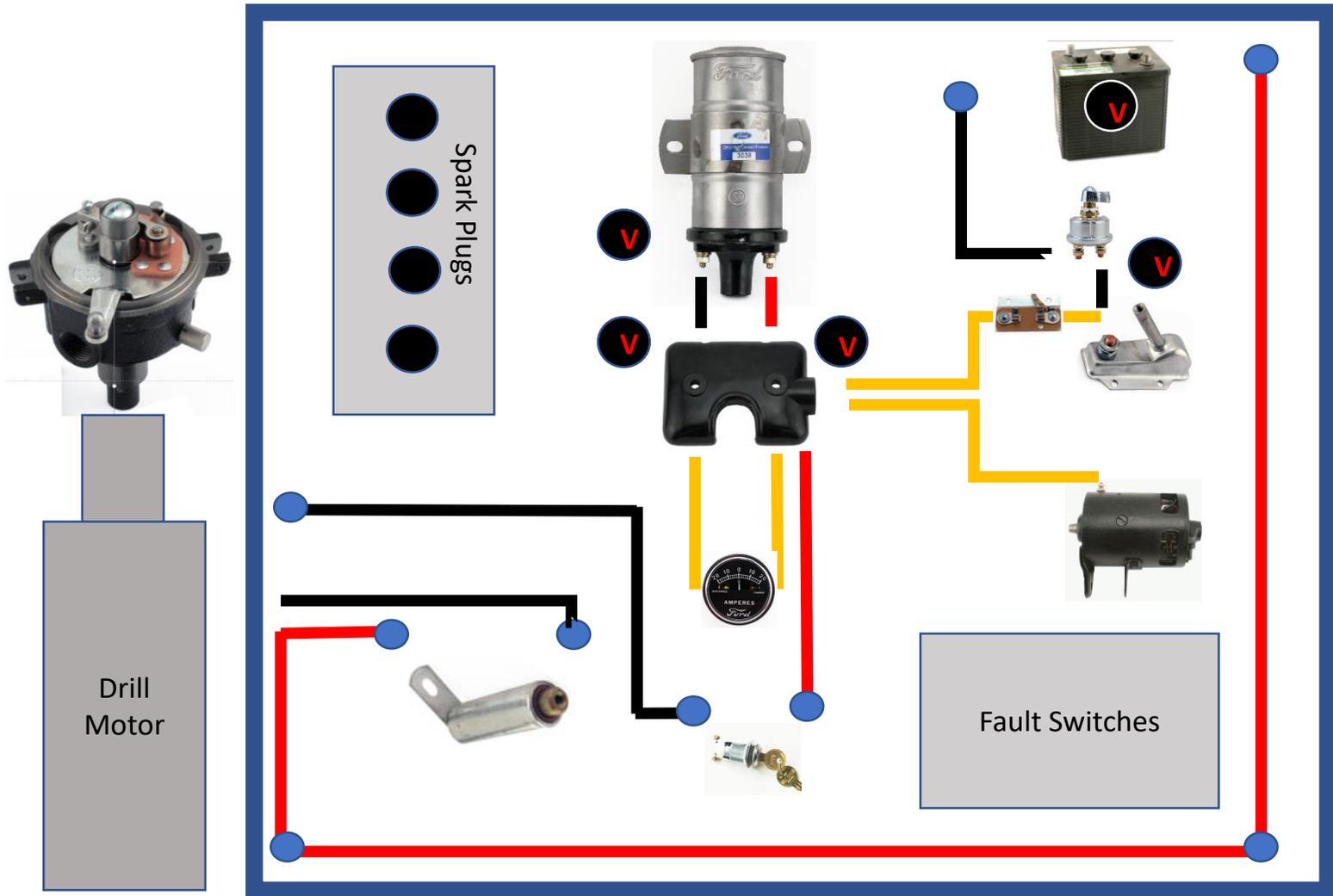
- Shop manuals, internet references, and this presentation, refer to original equipment configuration, wire colors and voltages.
- The Model A Ford uses a 6 volt, positive ground, electrical system.
 - Yellow wires are generally battery supply or charging.
 - Red wires are generally grounded.
 - Green wires are brake lights.
 - Black wires are generally a power source.
- The positive battery cable is (grounded) bolted to the cross member.
- All circuits must electrically connect to the battery ground point on the cross member
- The grounding path for the primary ignition circuit – coil, ignition switch, armor cable, lower distributor plate, plate connecting wire, points, upper distributor plate, distributor housing, engine, rear motor mounts, frame, and finally the positive post of the battery. Quite the trip.
- Model A ground faults are common

Ignition Circuit Components

1. Battery
2. Fuse / Battery cutout
3. Amp meter
4. Coil
5. Ignition switch
6. Distributor
7. Spark plug connectors
8. Spark plugs



Model A Ignition Simulator



Built- In Fault Simulation

Fault Mode Switches

Plate Wire

Amp Meter

Coil

Engine Ground

Fuse

Normal

Normal

Normal

Normal

Normal



Open



Open



Open



Open

Shorted

Shorted

Shorted

6 Volt Battery

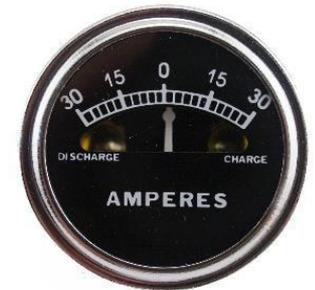
- Model A's use a positive ground system. A good ground is required to supply full voltage.
- Battery voltage should be measured at rest.
- For longer battery life, batteries should remain in the green zone (40% or more). Generally speaking, the less you discharge the battery before recharge, the longer the battery will last.
- Battery terminals and cables should be kept clean of corrosion.
- Non-sealed batteries should be filled with distilled water.
- Battery voltage drops during a load, and running the starter motor counts as a load. This translates to a lower voltage to the coil.
- The starter motor is grounded through the engine to the frame. If this is not a good ground, the additional resistance will result in a lower voltage to the starter.

<u>charge</u>	<u>6-V battery</u>
100%	6.37
90%	6.31
80%	6.25
70%	6.19
60%	6.12
50%	6.05
40%	5.98
30%	5.91
20%	5.83
10%	5.75

Ampere Meter

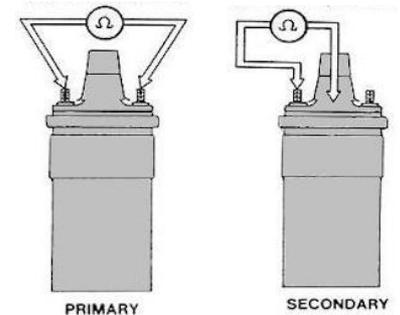
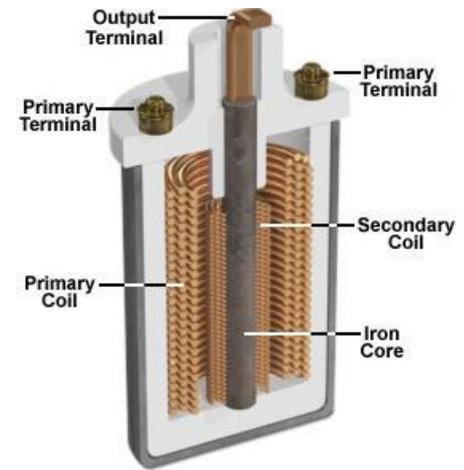
- Simple method to measure current flow to and from the battery
- Ford script / non-script
- 20 amperes / 30 amperes
- Amp meter wires should be installed using insulated meter nuts.
- The meter is connected with two yellow wires, one to each side of firewall terminal block.
- Left side of meter scale indicates battery discharge.
- Reverse wires to achieve correct polarity.

Note: During engine start, the amp meter will indicate a slight discharge as the points close and return to zero as they open. This is good indication that the primary ignition circuit is working correctly.



Coil

- Coils basically consist of a primary winding, a secondary winding, an iron core and an isolation housing.
- The primary windings is switched on/off by the points.
- The secondary winding is a high voltage circuit supplying power to the spark plugs via the distributor.
- The primary winding is made of thick copper wire with approx. 200 windings. The secondary winding is made of thin copper wire with approx. 20,000 windings.
- The primary coil terminals are marked positive and negative. The negative terminal (black wire) provides power from the amp meter. The positive terminal (red wire) connects to the ignition switch. **Polarity Matters**
- Primary circuit resistance
 - Les Andrews 1.6 – 1.8 Ohms. This equates to 3.7 – 3.3 Amps.
 - Steve Pargeter 1.0 – 3.0 Ohms. This equates to 6 - 2 Amps.
- Secondary circuit resistance 6K – 12 K Ohms



Ignition Switch and Armor Cable

- The ignition switch function is to electrically connect the positive terminal of the coil to the armor cable.
- When the switch is off, there is no electrical ground for the coil primary circuit – and no spark
- The armor cable's function is to provide an electrical connection between the ignition switch and the distributor lower plate.
- Original pop-out switch
- Reproduction Re-pop switch
- Other reproduction switches

Note: Reproduction switches have exposed connections. Care should be taken with these switches to ensure that the gas tank area behind the switch is electrically insulated.



Distributor

- Distributor housing
- Shaft type
- Shaft bushings
- Lubrication requirements
- Lower plate type
- Upper plate type
- Condenser type
- Cam type
- Rotor
- Distributor cap
- Distributor body



Original Distributor Components

- The points on an original top plate are easier to adjust than a modern points upper plate. Points are set at .018 to .022"
- The Model A distributor weak point is the unreliable nature of the wiring between the upper and lower plate.
- Failure of the plate connecting wire results in an open circuit, or a short to ground.
- An open circuit has the same effect as turning off the ignition switch – no spark
- A direct short also results in no spark, but has the added problem of over heating the coil as current is continuously flowing as long as the ignition switch is on.



Modern Distributor Components

- The points on a modern top plate can be a little more challenging to adjust.
- The sometime troublesome wire link between the upper and lower plate is eliminated.
- The two plates are electrically connected by a friction foot. If not adjusted correctly this foot can result in intermittent connection between the upper and lower plate.
- Failure of the foot generally results in an open circuit.
- An open circuit has the same effect as turning off the ignition switch – no spark
- I have found that I get better results if I remove the distributor from the car and make the point and foot adjustment on the bench. A meter can be used to verify continuous electrical contact across the spark advance range.



Modern Is Not Always Better

The points and condenser used with the modern top plate were designed and manufactured for something other than a Model A Ford. Modern points offer two major benefits, the points are always aligned, and the condenser is inside of the distributor body away from the exhaust manifold. The capacitor will perform well as long as it has the correct value. Unlike original points, modern points rely on the two mounting screws to maintain the correct point gap setting.



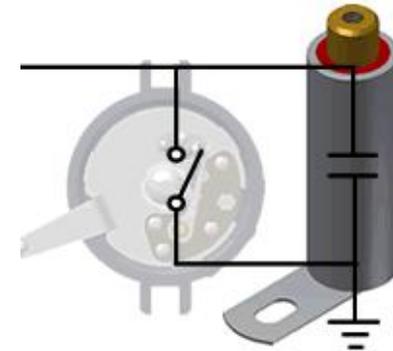
Condenser

- Original style condensers are subjected to high heat.
- Early condensers used oiled paper as an insulator and suffered high failure rates.
- Currently available condensers use a plastic film for insulation and are very reliable.
- The most likely failure mode is an internal short resulting in loss of spark.
- Good condensers should have a value of about .3 microfarads.



Good
Quality

Poor
Quality



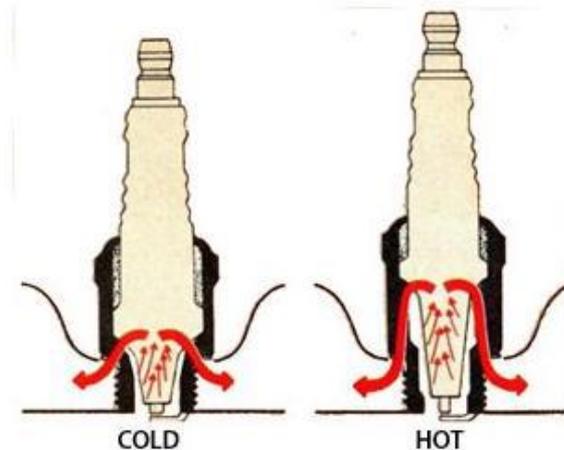
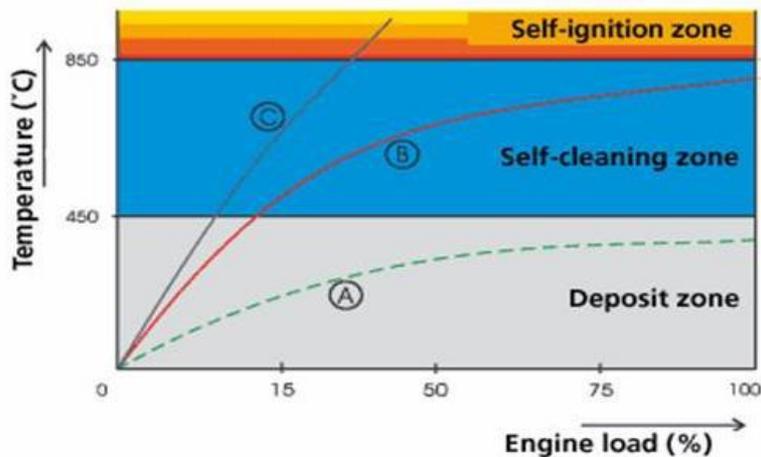
Distributor Cap and Body

- The distributor cap electrically connects the high voltage coil wire to the rotor.
- The rotor connects the cap to the body. The spring top should make good connect with the cap. The rotor should also be free of pitting and maintain a .025" clearance at all four contact points.
- The distributor body connects the rotor and the spark plug connectors.
- Modern distributor caps use modern spark plug wires, but are functionally equivalent to original components. The use of a modern cap and wires will greatly reduce radio interference.
- Both styles of distributor bodies are designed to limit upper plate spark advance. Remember that 20 degrees distributor advance equals 40 degrees of crankshaft advance.

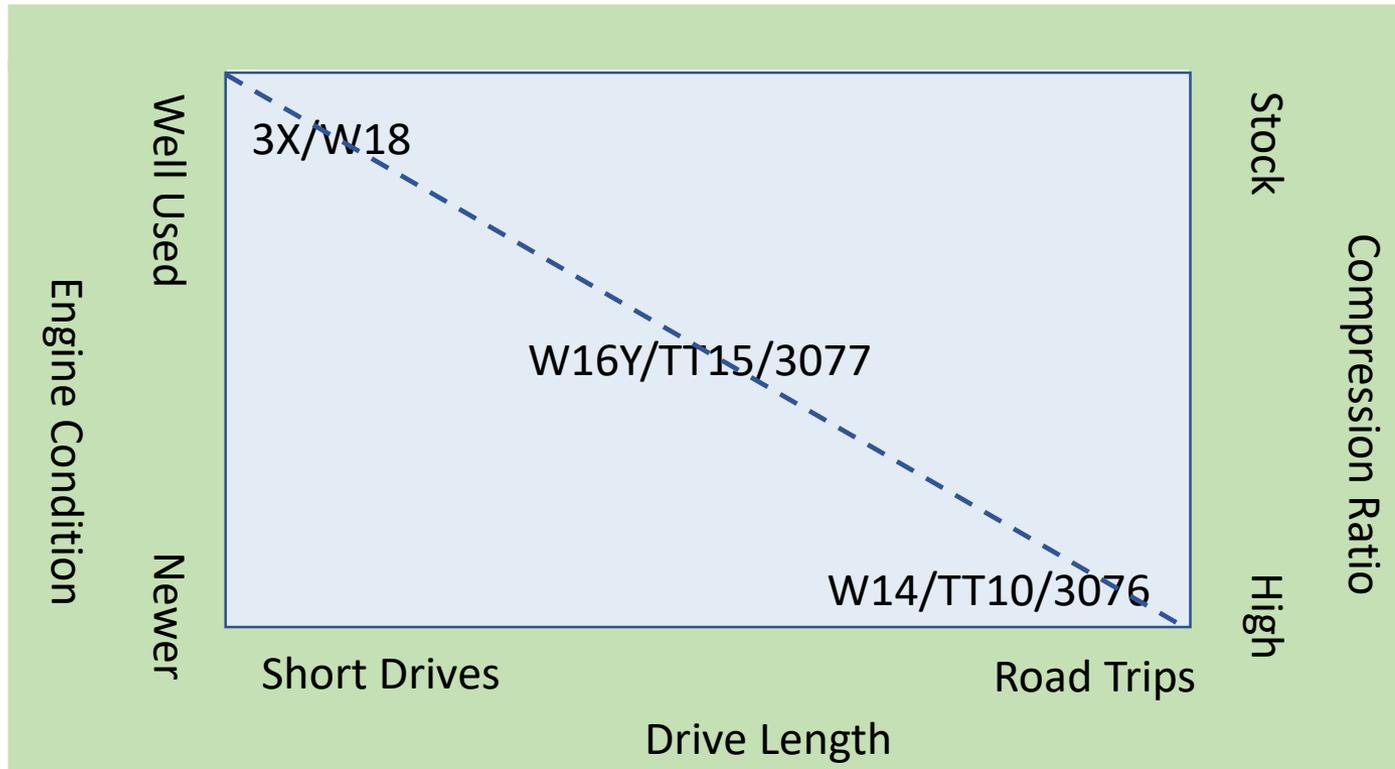


Spark Plugs

- Match your spark plug heat range to your engine and driving style. The objective is a clean plug with limited carbon build up.
- Higher spark plug heat range – stock head, rich fuel mixture, worn rings, short or low speed drives
- Lower spark plug heat range – higher compression head, correct fuel mixture, low oil consumption, long or high speed drives.
- Center electrode should be filed flat with a points file. Spark gap is 0.032” and 0.035.” Gap can be reduced to 0.030” for higher compression heads. Remember the larger the gap, and higher compression ratio, the higher the required voltage to generate a spark.



Popular Spark Plug Brands

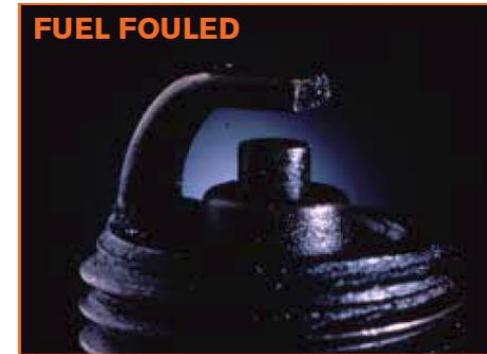
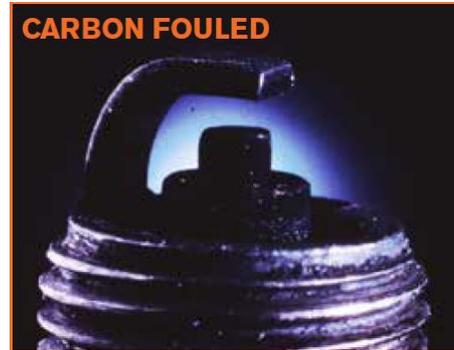
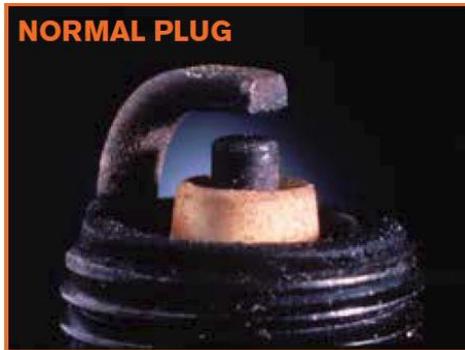


Champion = W14, W16Y, W18, X3

Autolite = 3076, 3077

Motorcraft = TT10, TT15

Understanding Spark Appearance



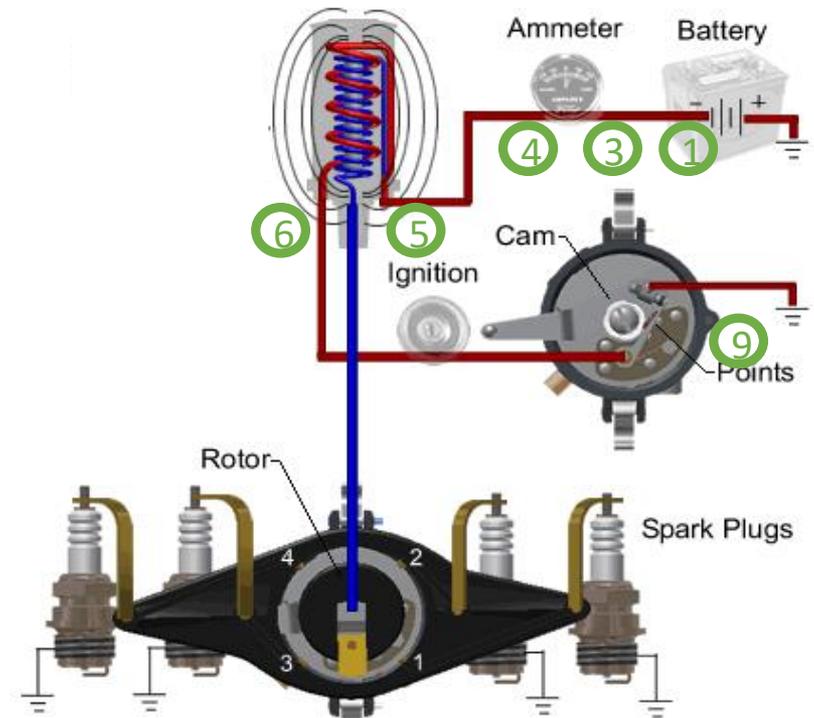
Normal – Grayish-tan to white in color. No unusual signs of deterioration or coatings.

Carbon fouled – Dried, soft, black, sooty coating. There are a number of possible causes for this condition: Spark plug heat range is too cold; extensive low-speed/short-distance driving; weak ignition system; rich fuel mixture; vacuum leaks; valve problems.

Fuel fouled – Firing tip may be damp with gasoline, and usually the odor of gasoline is present on the spark plug. The insulator is often tinted the color of charcoal. This indicates that gasoline is not being burned properly in this cylinder. Check for faulty or sticking choke, overly rich fuel mixture, ignition problems, or a spark plug heat range that is too cold.

Troubleshoot Primary Circuit

1. Voltage at the starter motor – battery good
2. Fuse condition – if installed
3. Voltage at left (driver side) terminal post – fuse good
4. Voltage at right (passenger side) terminal post – amp meter good
5. Voltage at black wire on coil – wire good
6. Voltage at red wire on coil – primary coil winding good
7. Turn on ignition switch and remove distributor cap and body.
8. Hold points open
9. Voltage at movable points arm – ignition switch, armor cable connection, lower plate wire are good



Troubleshoot Secondary Circuit

1. Points and primary circuit are normal
2. Coil should be warm to the touch
3. Coil wire – copper tips in place and firmly seated
4. Distributor cap – not cracked and no sign of carbon trail. Black tip on underside in place,
5. Distributor rotor – tip not burned or pitted. Upper spring contacting the cap.
6. Distributor body – not cracked and no sign of carbon trails.
7. Spark plug connectors – ensure solid connection with distributor body posts.
8. Spark plugs – should have all four



Meters Options

- Fluke 117 - \$147.00
 - Voltage
 - Resistance
 - Amperage
 - Capacitance
- Auto Multimeter MST2800B - \$25.73
 - Voltage
 - Resistance
 - Amperage
 - Capacitance
 - Dwell
 - Tachometer
 - Temperature
- Honeytek A6013L - \$15.98
 - Capacitance only
- Harbor Freight - \$5.99 or free
 - Voltage
 - Resistance
 - Limited amperage



Voltage Tester Options

- Deluxe test probe - \$10
 - 6, 12 volt detection
- Standard test probe - \$4
 - 6, 12 volt detection
- Home made light - \$3
 - 6, 12 volt (bulb dependent) detection
- Not overly bright friend - \$0
 - Need to tell him to touch an electrical part, but no to worry because the key is off. Good for any voltage.



Modern High Voltage Tester Options

- Spark tester – measures the spark plug firing voltage - \$20
- Coil polarity tester – checks polarity of primary coil circuit - \$25
- Ignition spark tester - measures the spark plug firing voltage - \$8
- Ignition spark tester – displays that high voltage is present - \$3



Parts Recommendation

The Model A is a pretty simple, reliable, machine. Like all machines it requires preventive maintenance, and from time to time repair. Many of us carry spare parts and tools. What parts you carry should be limited to what you are comfortable replacing, along with the tools required to complete the job. It is easier to build, test, and time, a distributor in your garage than it is on the side the road.

You are unlikely to need a hub puller and axel shims. You might however have need of a meter, some fuses, a distributor, some oil, and the hand tools needed for the task. The most important tool I carry is my extended towing AAA card.

Credits and References

- Model A Basics - <http://modelabasics.com/ignition.htm>
- Model A Ignition Primer & Restoration Guidelines – Steve Pargeter
- Snyder’s web site – component pictures
- Mac’s web site – component pictures
- Dykes Automotive and Gasoline Engine Encyclopedia
- Timing a Model A - Les Andrews YouTube videos
- Model A Ford Mechanics Handbook – Les Andrews
- Ford Garage web site - <http://www.fordgarage.com/>