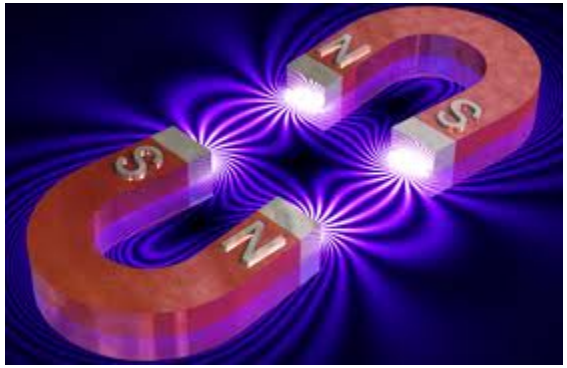
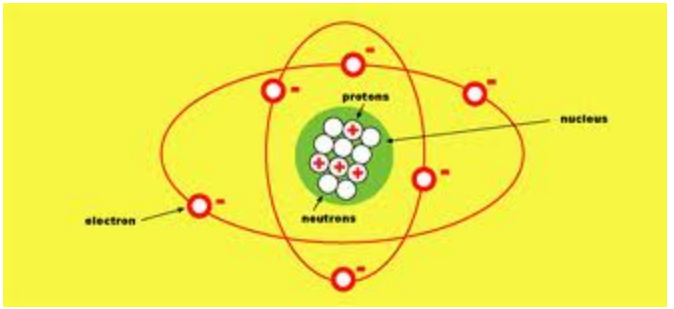
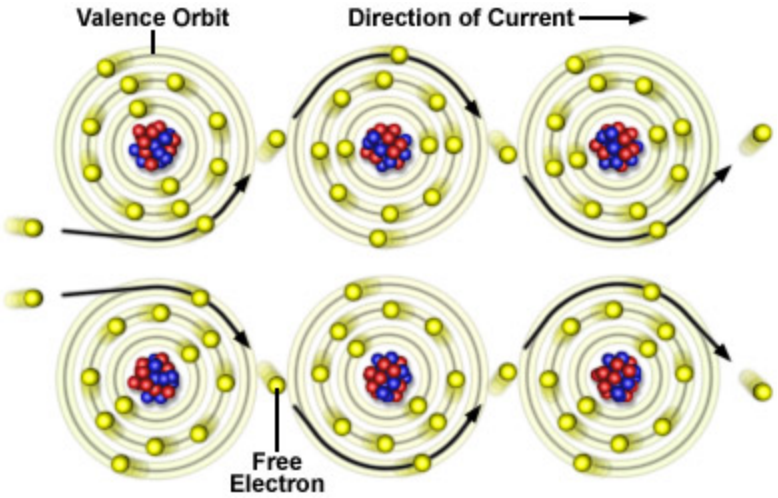
Fundamentals of Electricity, Magnetism, and Electronics

Chapter #4

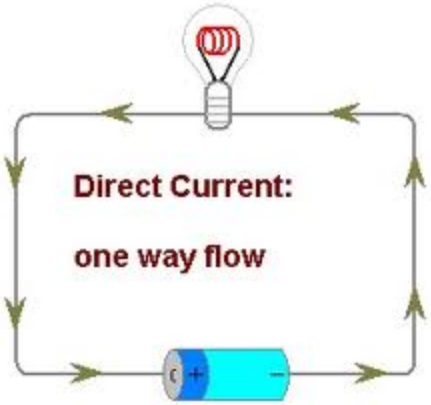


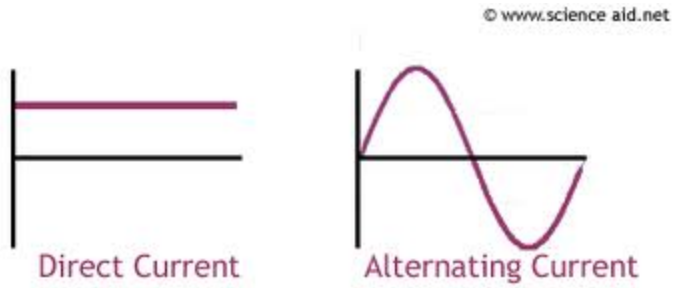
Atoms and Electricity

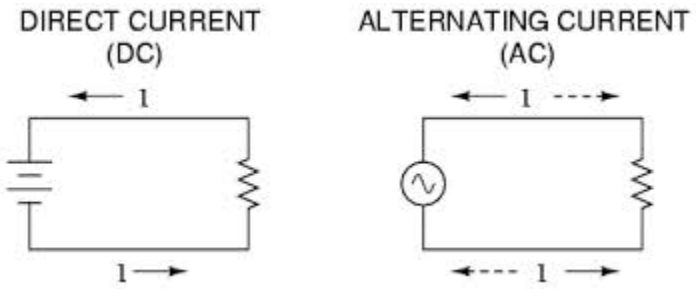


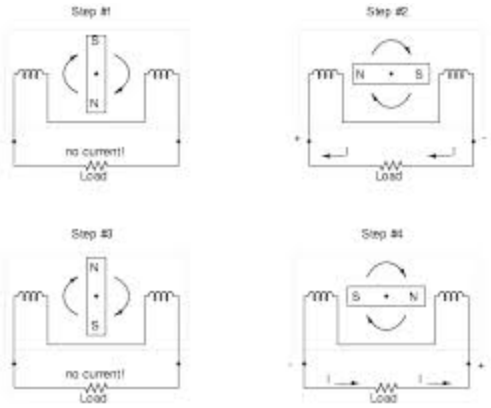


Direct Current & Alternating Current





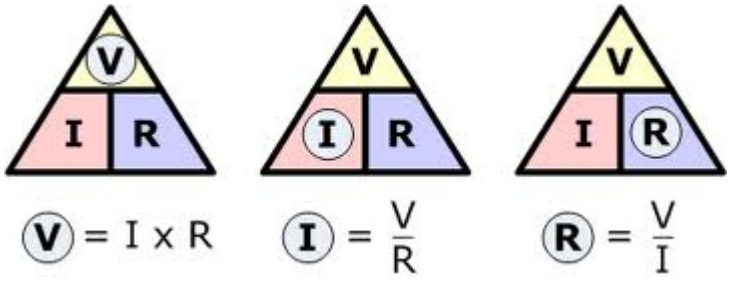


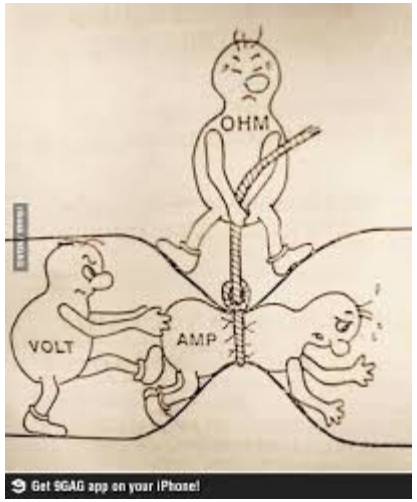


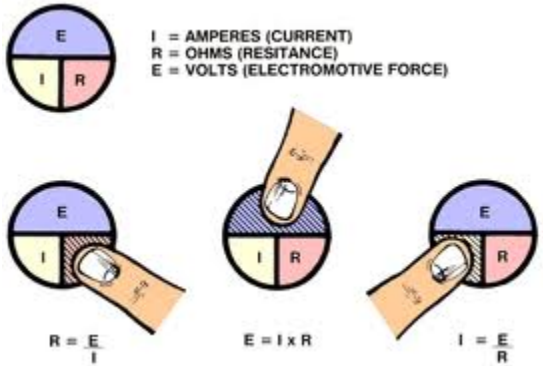
Electrical Units of Measurement

- Ampheres
- Volts
- Ohms

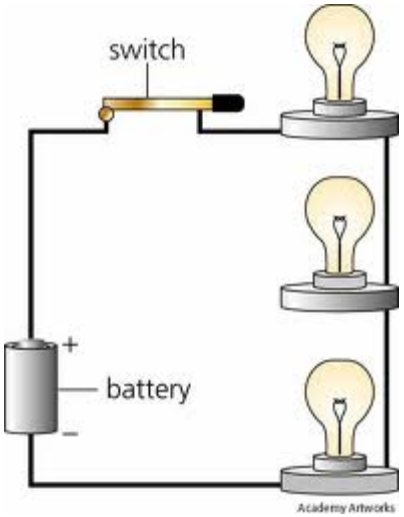
Ohm's Law

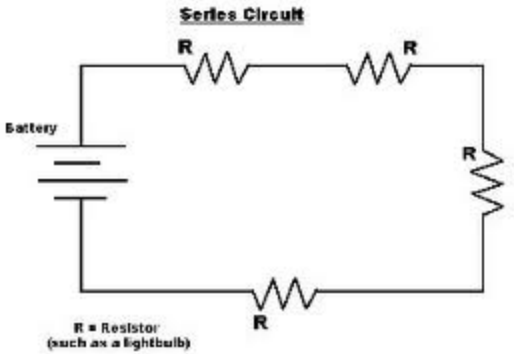

V
I R
V = I x R
I = V/R
R = V/I

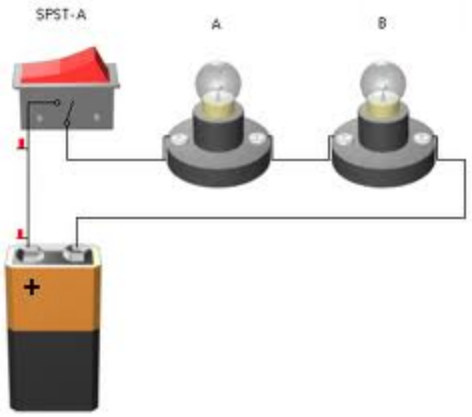

OHM
VOLT
AMP
Get 9GAG app on your iPhone!


E
I R
I = AMPERES (CURRENT)
R = OHMS (RESITANCE)
E = VOLTS (ELECTROMOTIVE FORCE)
R = E/I
E = I x R
I = E/R

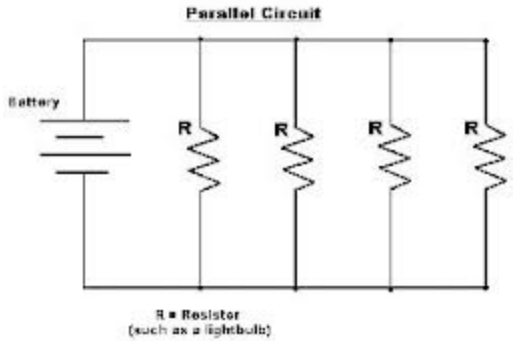
Electrical Circuits - Series

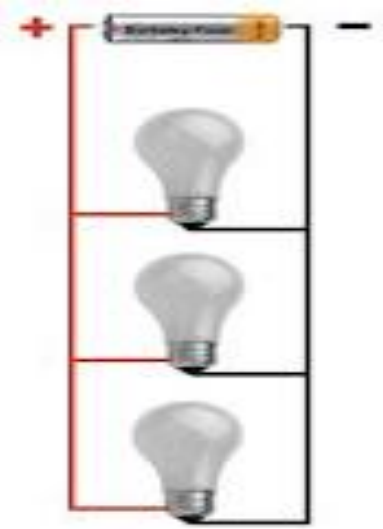


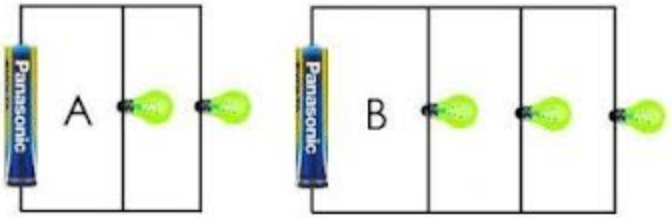




Electrical Circuits – Parallel







Electrical Circuits – Series/Parallel

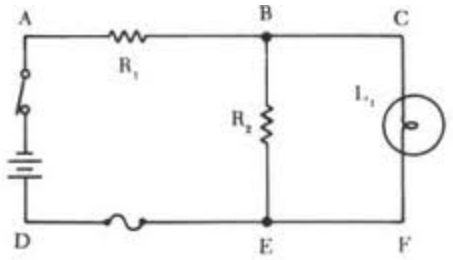
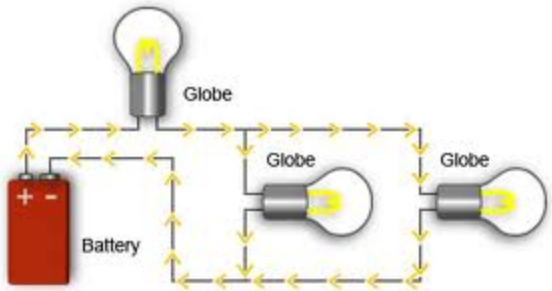
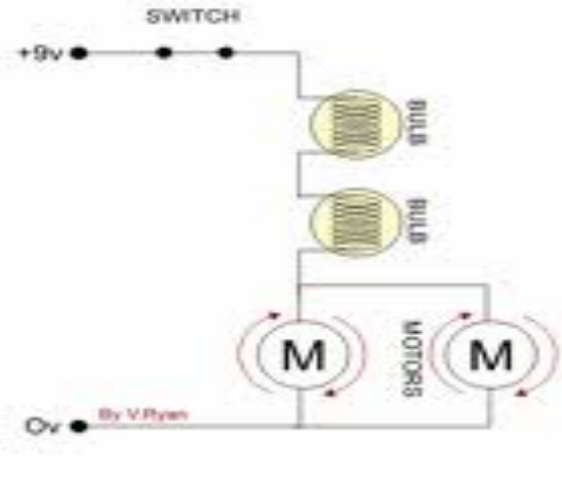
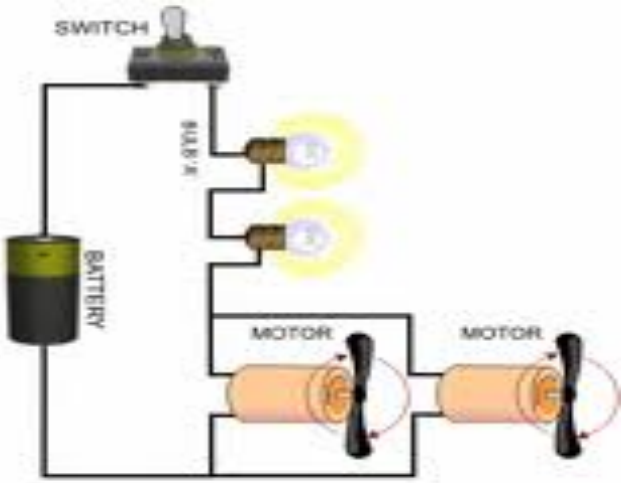


FIGURE 8–158. Using the voltmeter to trouble-shoot a series-parallel circuit.



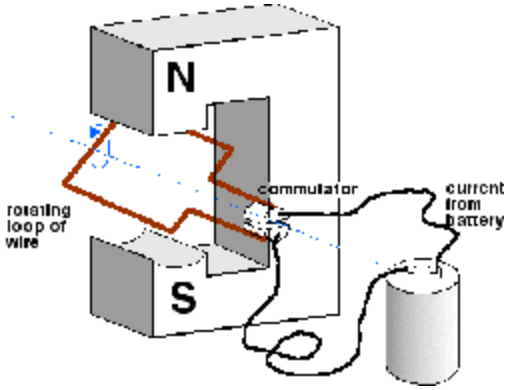




Magnetism

- Magnetic Fields
- Permanents Magnets
- Magnetic Attraction and Repulsion

Magnetism and Electricity



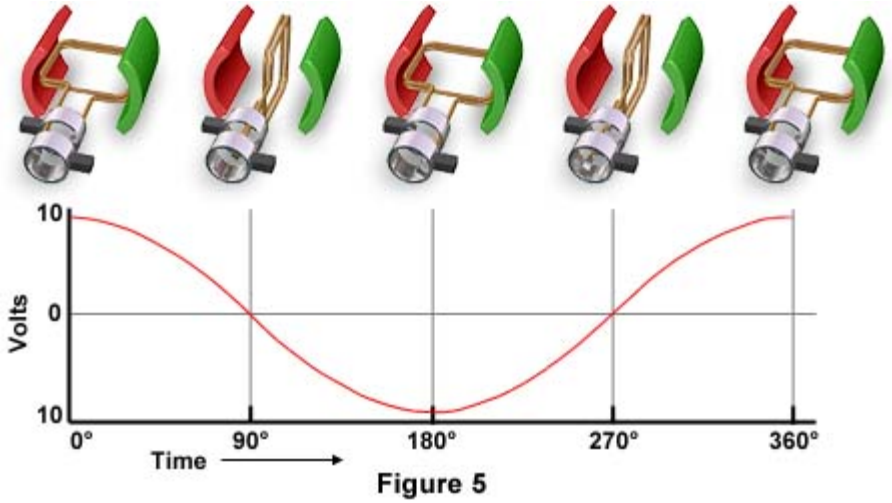
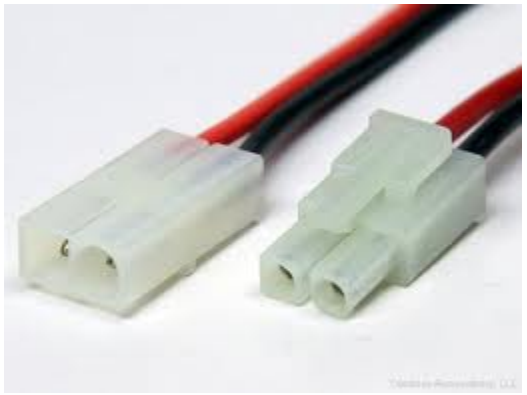
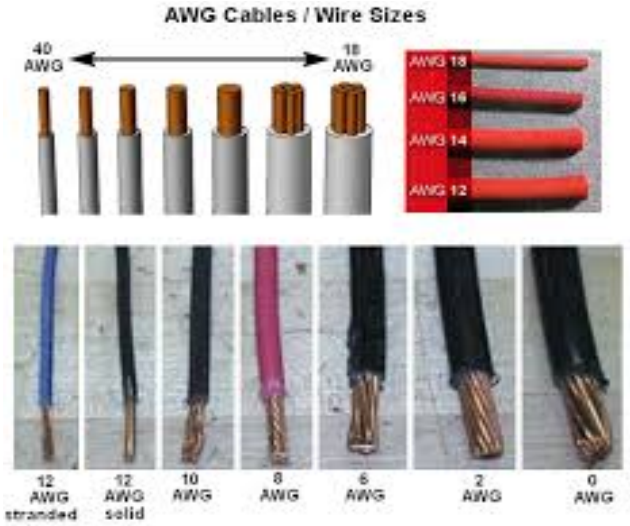


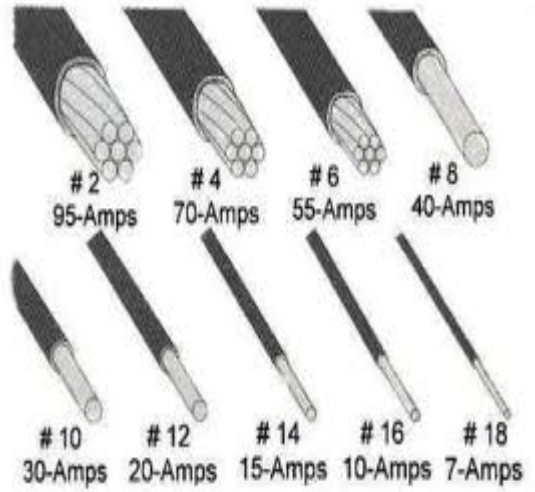
Figure 5

Electrical Components

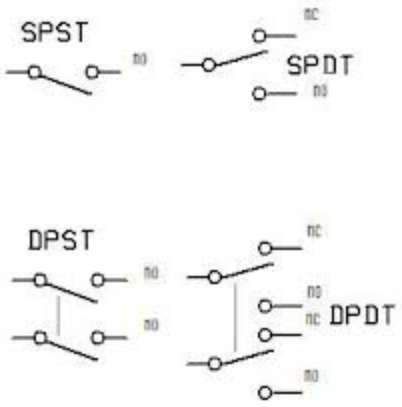
- Wires and Connectors
  - SAE wire size (gauge)



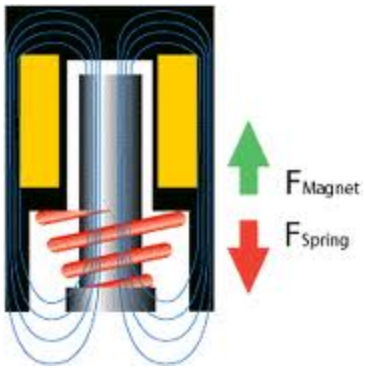


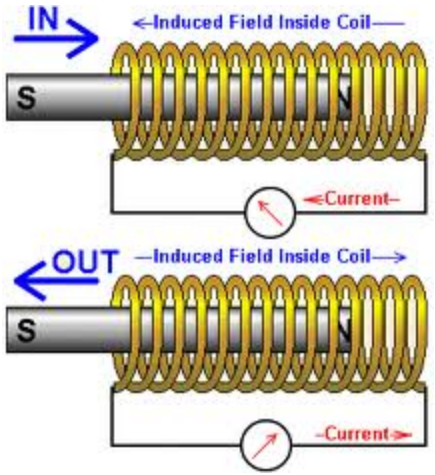


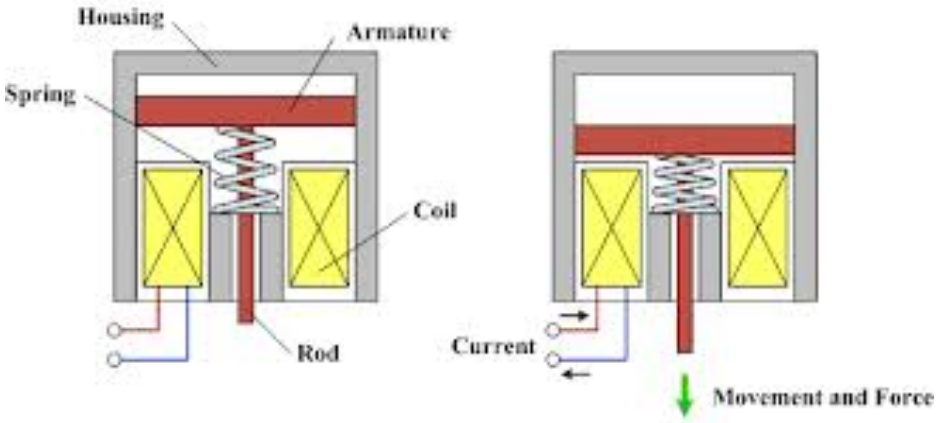
- Switches



- Solenoids

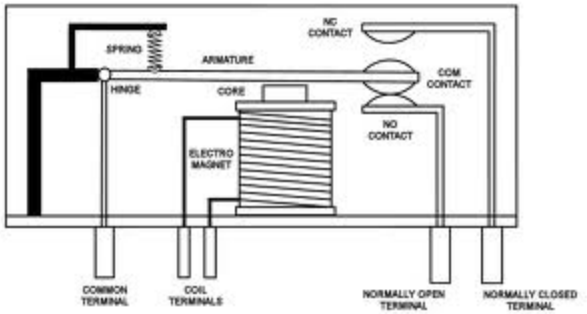

F Magnet
F Spring

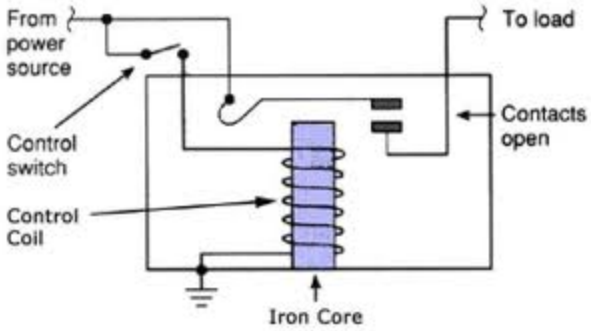

IN
Induced Field Inside Coil
S
N
Current
OUT
Induced Field Inside Coil
S
N
Current


Housing
Armature
Spring
Coil
Rod
Current
Movement and Force


SW-3

- Relays

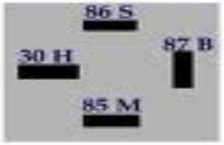




Bottom view of a relay.

86 S - From controlling switch.

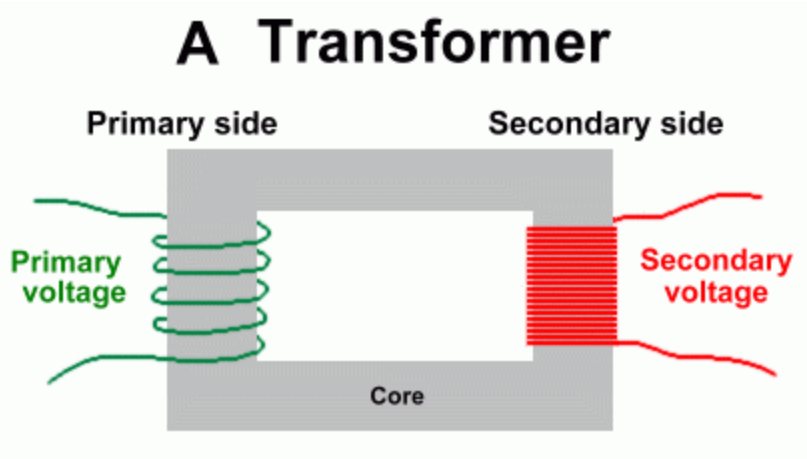
30 H -To lights.

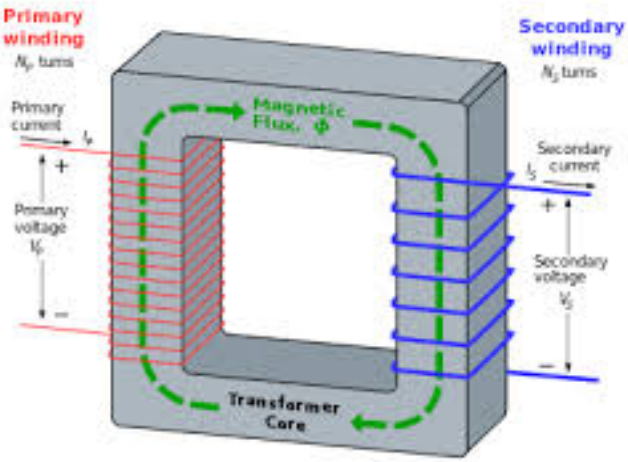


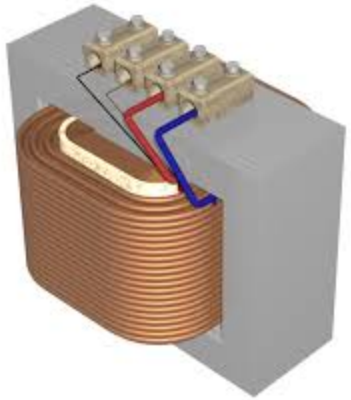
87 B - + power lead.

85 - Relay ground.

- Transformers

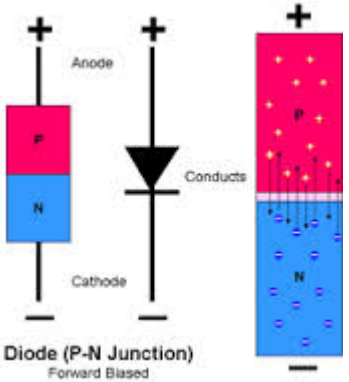




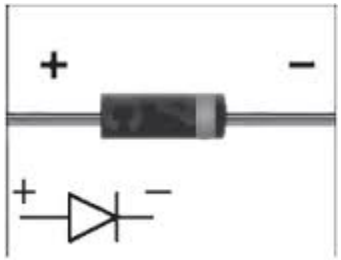


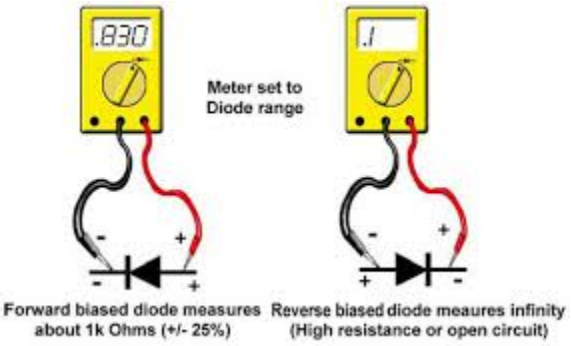
Electronics

- Semiconductor Diodes



Diode	Symbol	Information
Zener		Designed to have a very low reverse breakdown (zener) voltage, at which they allow high current to pass.
Schotty		Have a low capacitance metal-N junction and low forward voltage drop.
Tunnel		In part of the forward bias characteristics, current decreases with increasing voltage.
LED (Light Emitting Diode)		Emits light when forward biased. Light frequency is controlled by makeup of P-N junction.
Photodiode		Produce current flow in response to being exposed to light. Used in solar cells.
Varactor (Varicap)		The capacitance varies with reverse bias.

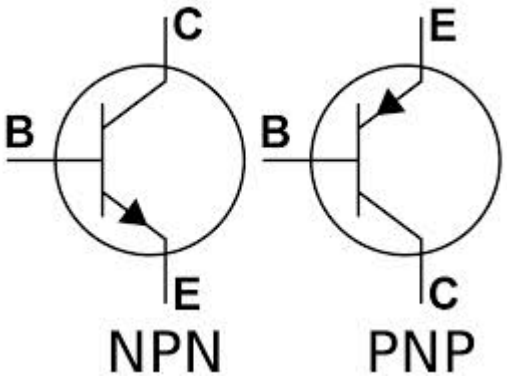


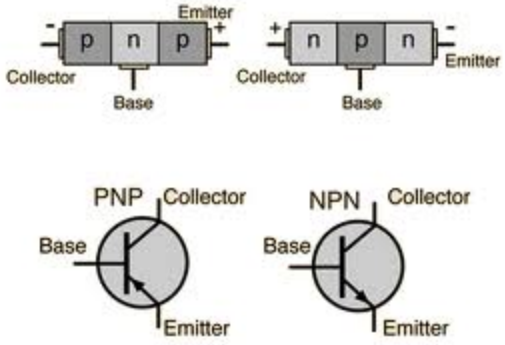


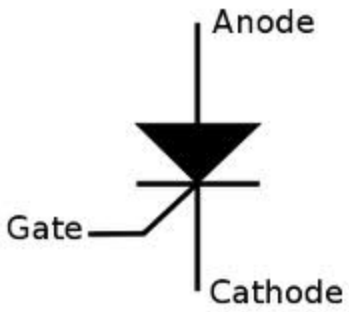
Forward biased diode measures about 1k Ohms (+/- 25%)

Reverse biased diode meaures infinity (High resistance or open circuit)

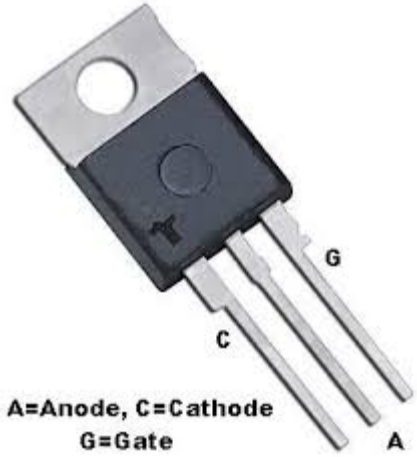
- Transistors

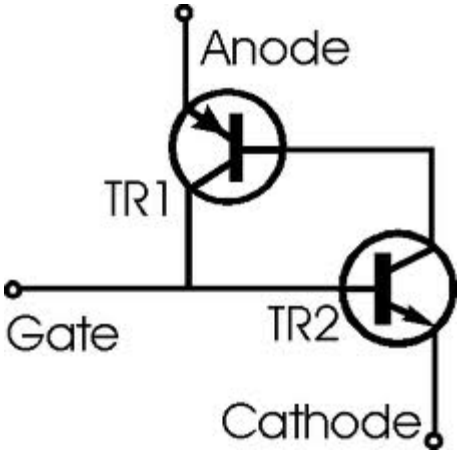


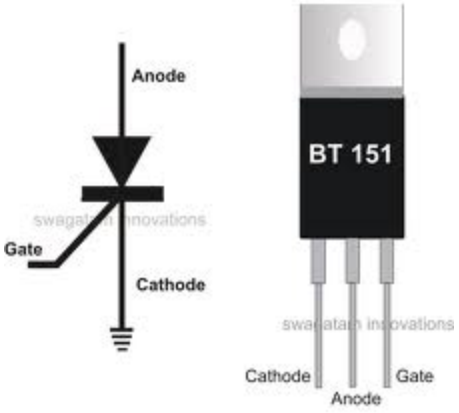




- Silicon Controlled Rectifiers
  - Combines two diodes

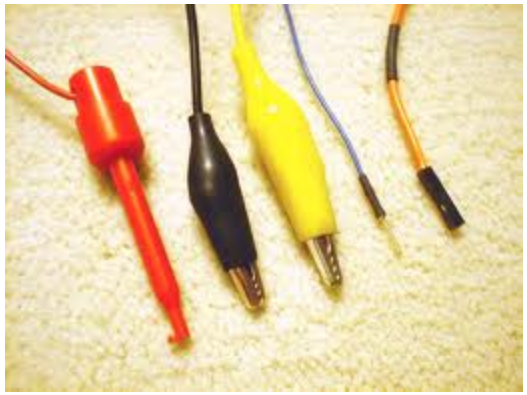






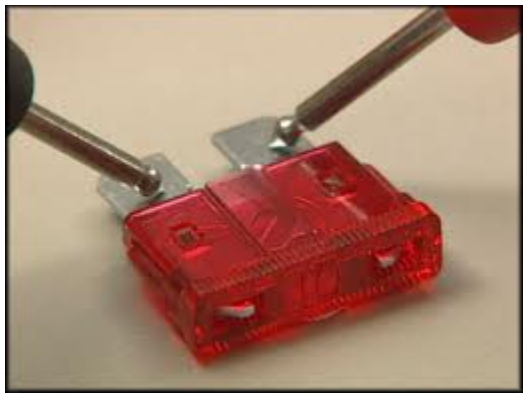
Electrical Test Equipment

- Jumper wires

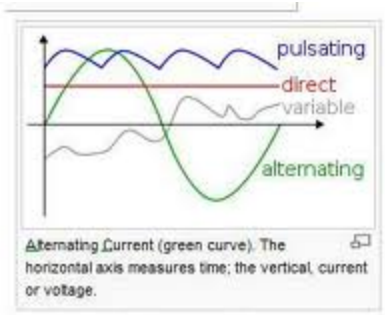


- Test Lights

- DVOM
  - Measuring Voltage – in parallel/over circuit
  - Measuring Current – in series/in circuit
  - Measuring Resistance – out of circuit
    - Mathematically – factor = heat…

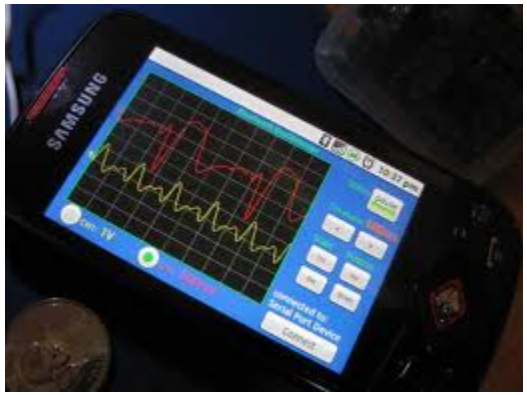


- Scope (Oscilloscope)
  - Waveforms



Alternating Current (green curve). The horizontal axis measures time; the vertical, current or voltage.

The horizontal axis = zero voltage or current & the peaks of the waveforms represent the maximum voltage, above (+)or Below (-) zero voltage or current. The green line Represents the ideal waveform for the AC power in your homes

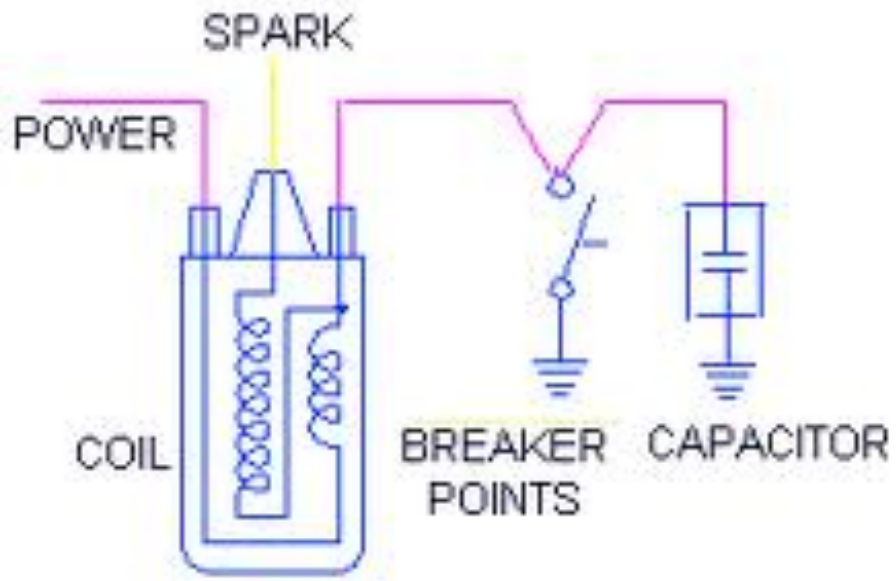


Ignition Systems

Chapter #10

Basic Ignition System Operation

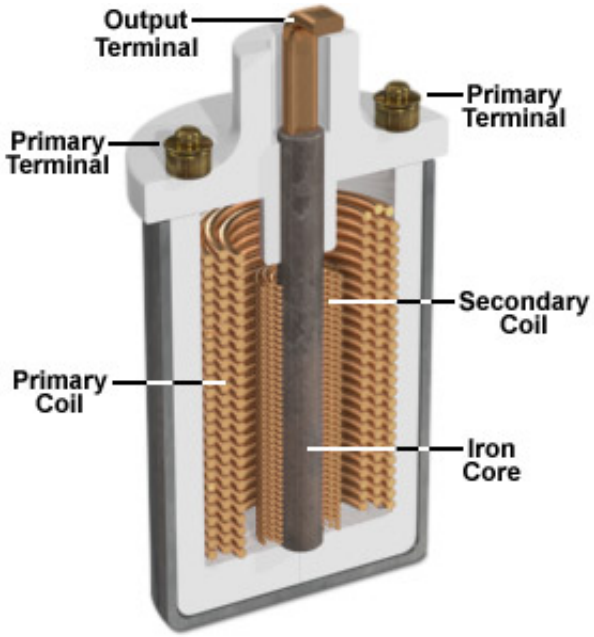
- To provide sufficient voltage to discharge a spark between the electrodes of a spark plug.

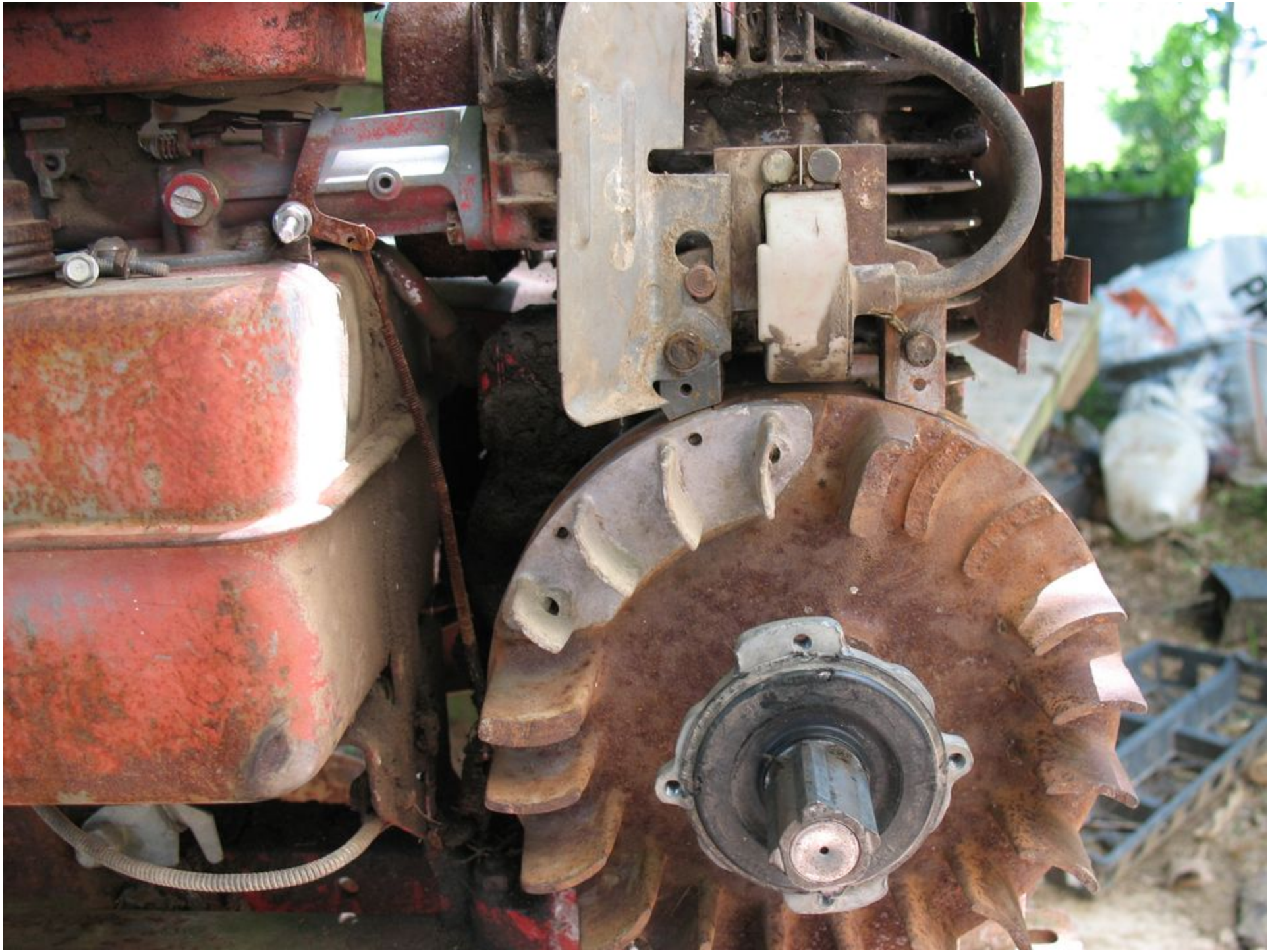


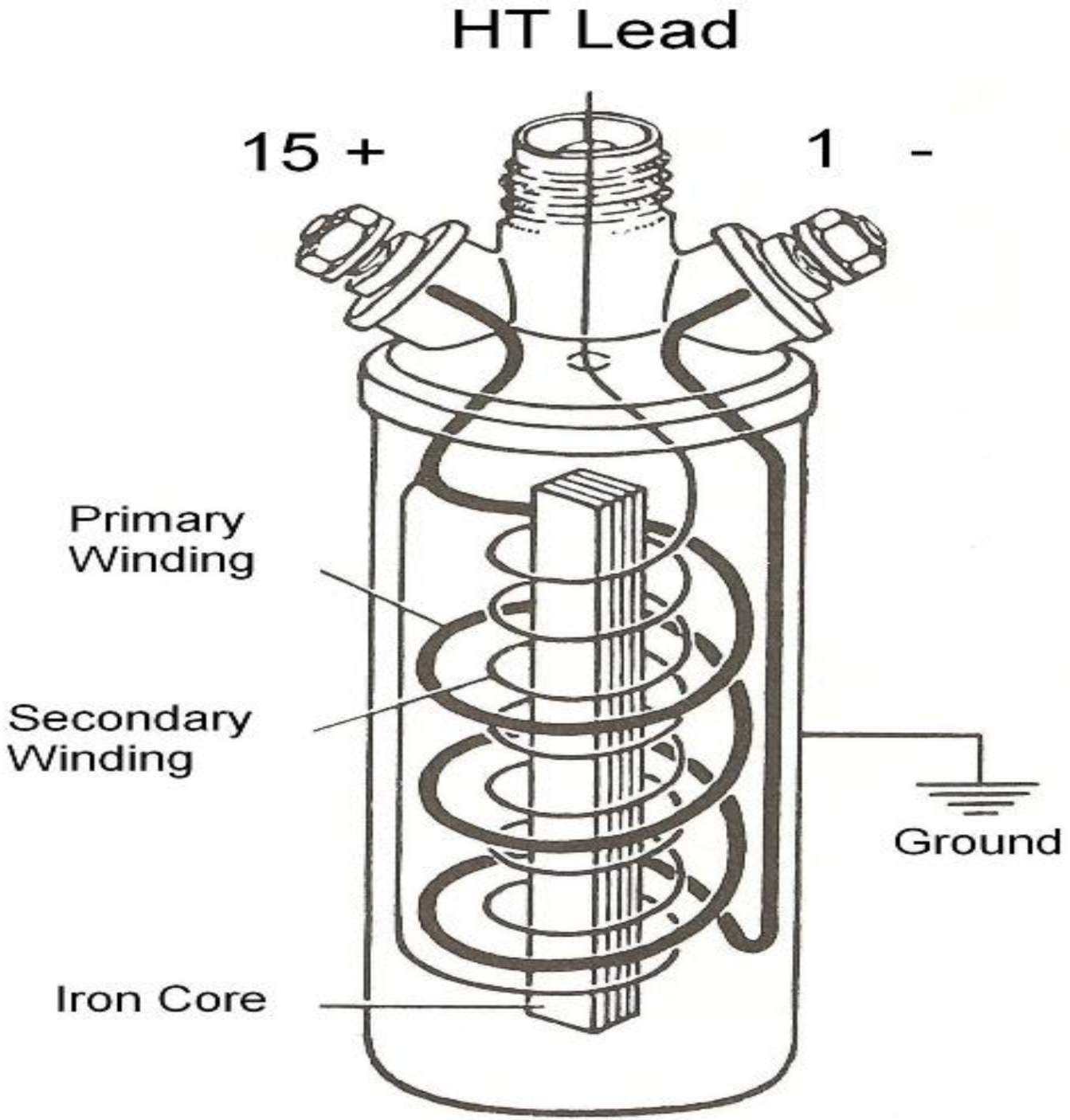
Ignition System Components

- Most small engine use a magneto system or variation. Magneto is specific to a points system, but is used universally to describe various ignition systems. You decide what language you want to use… Control module… Ignition module…
  - Permanent magnet
  - Spark plug
  - Sparkplug wire
  - Ignition coil
  - Switching device

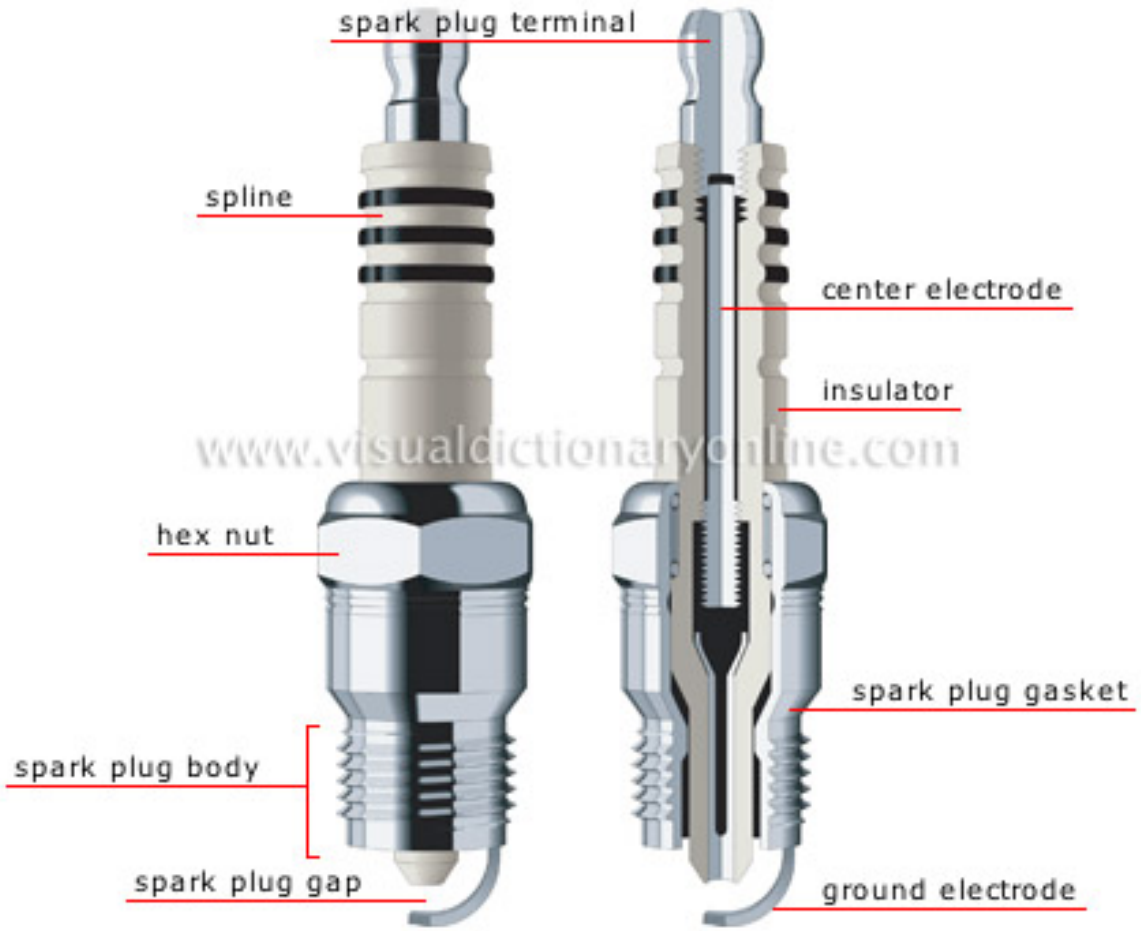
Ignition Coil



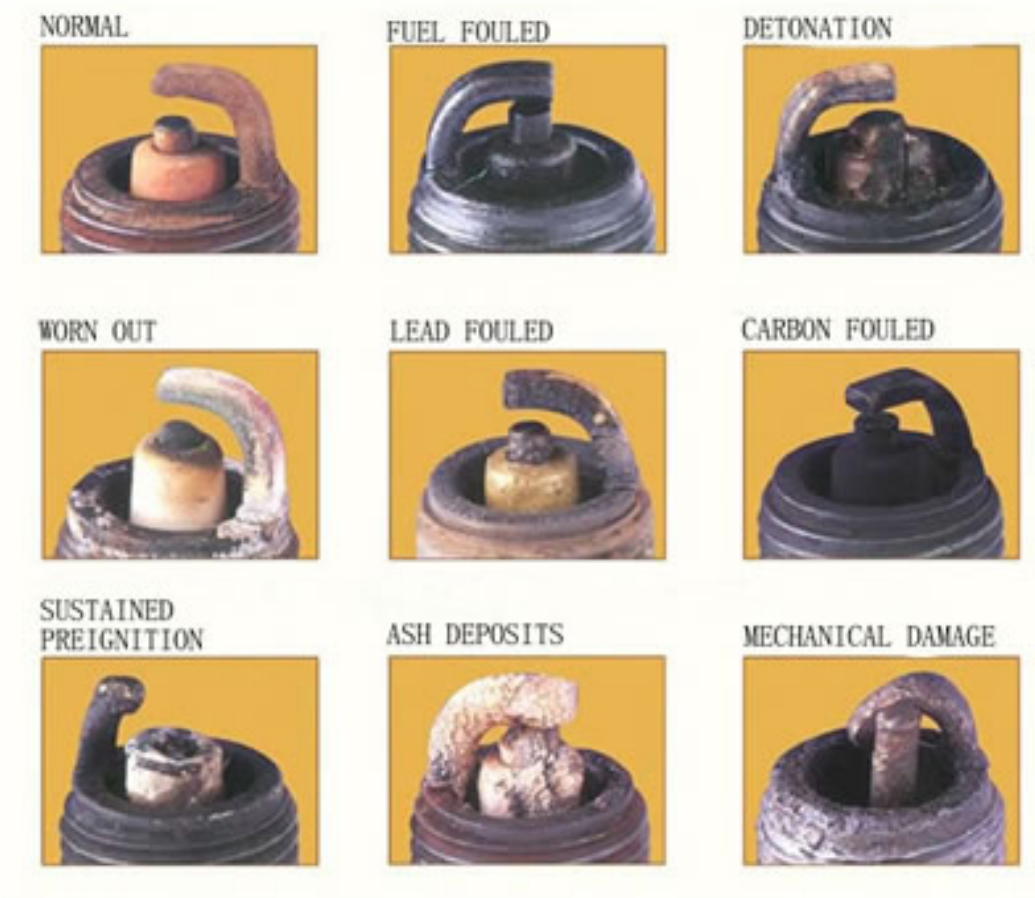



HT Lead
15 +
1 -
Primary Winding
Secondary Winding
Iron Core
Ground

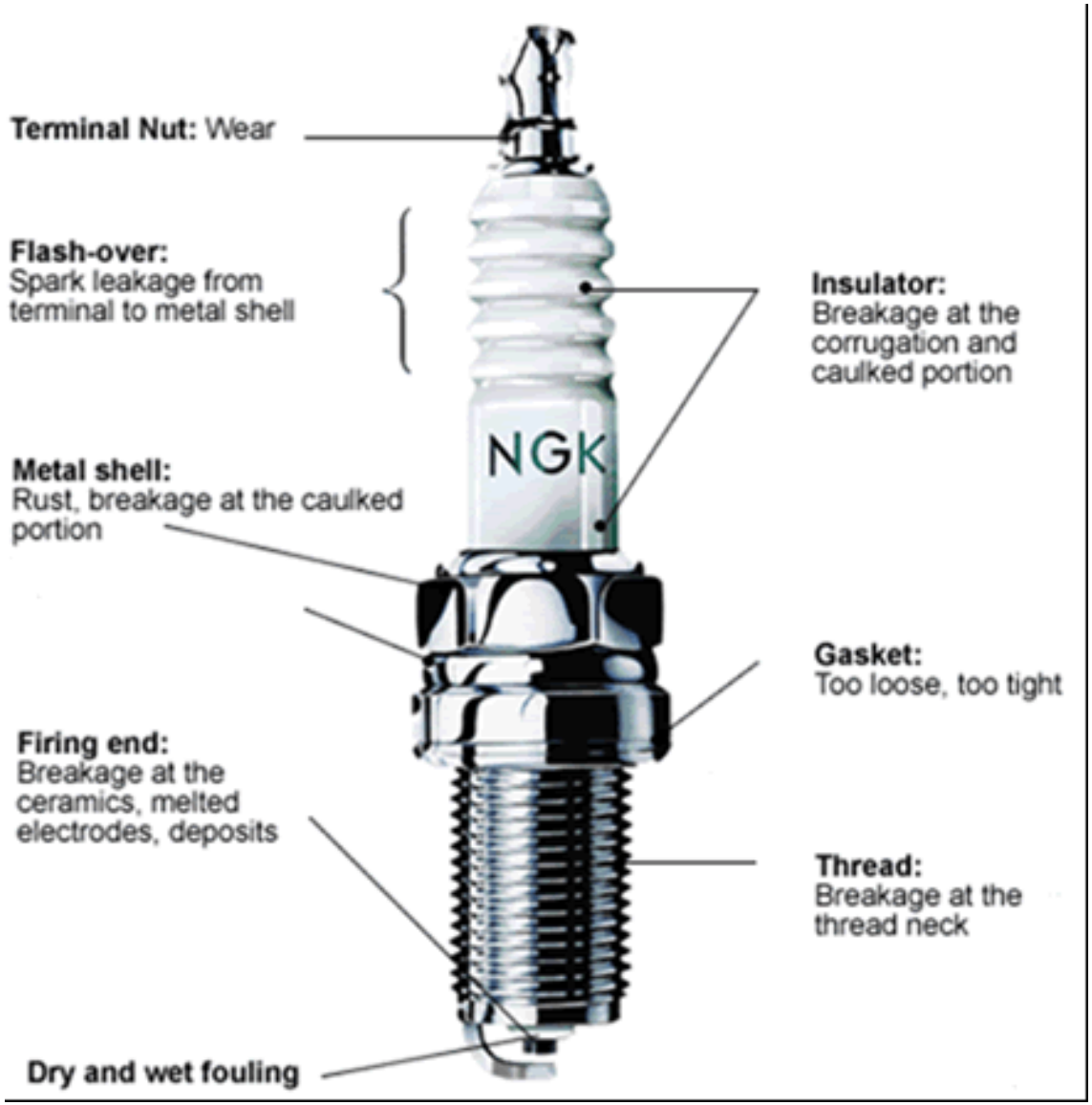
Spark Plugs


spark plug terminal
spline
center electrode
insulator
www.visualdictionaryonline.com
hex nut
spark plug gasket
spark plug body
spark plug gap
ground electrode

Spark Plugs


NORMAL
FUEL FOULED
DETONATION
WORN OUT
LEAD FOULED
CARBON FOULED
SUSTAINED PREIGNITION
ASH DEPOSITS
MECHANICAL DAMAGE


Lean
Perfect
Rich/Oil


Terminal Nut: Wear
Flash-over:
Spark leakage from terminal to metal shell
Insulator:
Breakage at the corrugation and caulked portion
NGK
Metal shell:
Rust, breakage at the caulked portion
Gasket:
Too loose, too tight
Firing end:
Breakage at the ceramics, melted electrodes, deposits
Thread:
Breakage at the thread neck
Dry and wet fouling

What is the gap?

- Look it up… .023-.030 ???

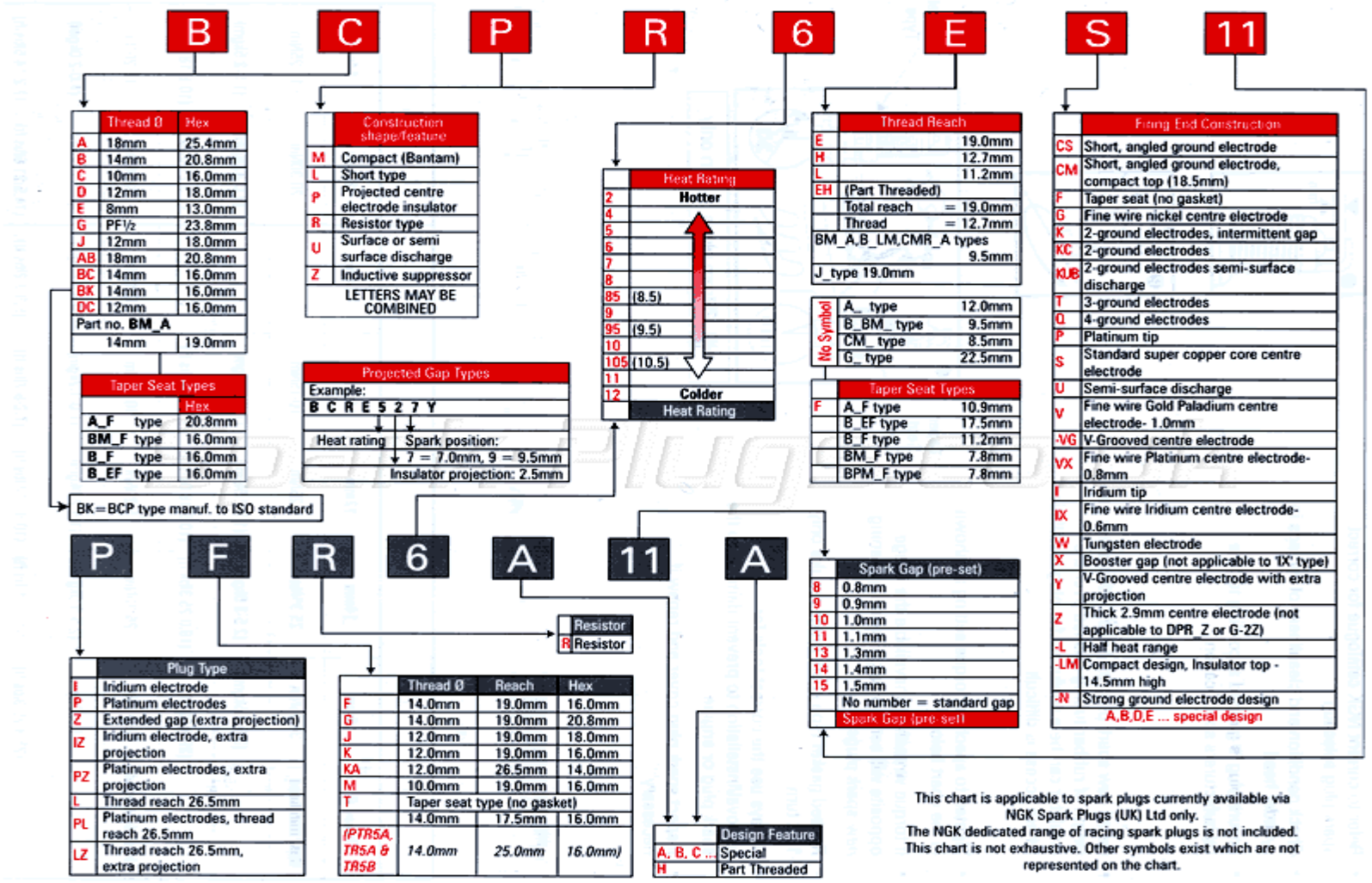

BRIGGS & STRATTON®


CHECK CHART

COMMON SPECS FOR ALL POPULAR ENGINE MODELS

						Torque Specifications				Crankshaft Reject Size						
Model Series	Idle Speed	Armature Air Gap	Valve Clearance Intake	Valve Clearance Exhaust	Valve Guide Reject Gage	Flywheel Nut Ft. Lbs.	Cylinder Head In. Lbs.	Conn. Rod Torque In. Lbs.	Crankcase Cover/ Sump In. Lbs.	Mag Journal	Crankpin Journal	PTO Journal	Crankshaft End Play	Main Bearing Reject Gage Or Reject Dimension	Cylinder Bore Standard	NOTES
L-HEAD ALUMINUM/CAST SLEEVE SINGLE CYLINDER																
60000	1750	.006 .010	.005 .007	.007 .009	19122	55	140	100	90	.873	.870	.873	.002 .008	19166	2.374 2.375	
80000	1750	.006 .010	.005 .007	.007 .009	19122	55	140	100	90	.873	.996	.873	.002 .008	19166	2.374 2.375	
90000	1750	.006 .010	.005 .007	.007 .009	19122	55	140	100	90	.873	.996	.873	*.002 .030	19166	2.5615 2.5625	* Horizontal Crankshaft – .002 – .010"
10A000 thru 10M000	None	.006 .010	.005 .007	.007 .009	19122	55	140	100	90	.873	.872	.873	.002 .030	19166	2.5615 2.5625	
110000	1750	.006 .010	.005 .007	.007 .009	19122	55	140	100	90	.873	.996	.873	.002 .008	19166	2.7802 2.7812	
120000	1750	.006 .010	.005 .007	.007 .009	19122	55	140	100	90	.873	*.996 **1.097	1.060	.002 .030	19166 Mag. 19375 PTO	2.6875 2.6885	* Before 97011300 ** After 97011200
130000	1750	.010 .014	.005 .007	.009 .011	19122	55	140	100	120	.873	.996	.998	*.002 .030	19166 Mag. 19178 PTO	2.5615 2.5625	* Horizontal Threaded Crankshaft – .002 – .008"
170000	1750	.010 .014	.005 .007	.009 .011	19151	65	165	165	140	.997	1.090	1.179	*.002 .030	19178	2.999 3.000	* Horizontal Threaded Crankshaft – .002 – .008"
171700	1750	.010 .014	.005 .007	.009 .011	19151	65	165	165	140	1.179	1.122	1.179	.002 .030	19178	2.999 3.000	
190000	1750	.010 .014	.005 .007	.009 .011	19151	65	165	185	140	.997	1.122	1.179	*.002 .030	19178	2.999 3.000	* Horizontal Threaded Crankshaft – .002 – .008"
191700	1750	.010 .014	.005 .007	.009 .011	19151	65	165	185	140	1.179	1.122	1.179	.002 .030	19178	2.999 3.000	
220000 250000	1750	.010 .014	.005 .007	.009 .011	19151	65	165	185	140	1.376	1.247	1.376	.002 .030	19219	3.4365 3.4375	
280000	1750	.010 .014	.005 .007	.009 .011	19151	85	185	* **	Torque Varies By Type Of Screw See Fig. 1	1.376	1.247	1.376	.002 .023	19219	3.4365 3.4375	* Both Rod Screws Same Size: Torque to 185 In. Lbs. ** Torque Small Rod Screw First: 160 In. Lbs. Torque Large Rod Screw Second: 260 In. Lbs.
L-HEAD CAST IRON SINGLE CYLINDER																
230000	1200	.010 .014	.007 .009	.017 .019	19151	145	190	190	90 Mag 190 PTO	1.377	1.1844	1.377	.002 .008	1.382	2.999 3.000	
240000	1200	.010 .014	.007 .009	.017 .019	19151	145	190	190	90 Mag 190 PTO	Ball	1.3094	Ball	.002 .008	Ball	3.0615 3.0625	
320000	1200	.010 .014	.007 .009	.017 .019	19151	145	190	190	90 Mag 190 PTO	Ball	1.3094	Ball	.002 .008	Ball	3.5615 3.5625	
L-HEAD OPPOSED TWIN CYLINDER																

Spark Plug Code Interpretation



R V 15 Y C 4

RESISTOR

Letter	Description
B	Standard Height
C	Bantam Height
D	Bantam Height
E	Shielded 5/8"—24
G	1"—20 Female Connector
H	Shielded 3/4"—20
K	Resistor
M	Shielded 5/8"— 24 Ordnance
Q	Resistor—CDI
R	Resistor
S	Shielded 11/16" —24 Whitworth
T	13/16"—20 Thread Above Hexagon
U	Auxiliary Gap
X	Resistor

SHELL DESIGN

Letter	Thread Size	Reach	Hex
A	12mm	3/4"	11/16" or 18mm
B	18mm	13/16"	7/8"
C	14mm	3/4"	5/8"
D	18mm	1/2"	7/8"
E	14mm	1.0" Taper Seat	5/8"
F	18mm	.460" Taper Seat	13/16"
G	10mm	.750"	5/8"
GC*	7/8"-18	All	7/8"
GM*	18mm	All	7/8"
H	14mm	7/16"	13/16"
J	14mm	3/8"	13/16"
K	18mm	All	1"
L	14mm	1/2" or .472"	13/16"
M	18mm	1/2"	7/8" or 11/16"
N	14mm	3/4"	13/16"
P	12mm	.492"	11/16"
R	12mm	3/4"	3/4" or 11/16"
S	14mm	.708" Taper Seat	5/8"
S	1-1/8"	5/8"	1"
U	18mm	1-1/8"	7/8"
V	14mm	.460" Taper Seat	5/8"
W	7/8"-18	All	15/16" or 1
X	14mm	.500"	5/8"
Y	10mm	1/4"	5/8"
Z	10mm	.492"	5/8"

*1"-20 Female Connector

Letter	Thread Size	Reach	Hex
BL or V	14mm	.460" Taper Seat	5/8"
BN or S	14mm	.708" Taper Seat	5/8"
CJ	14mm	3/8"	3/4" or 13/16"
DJ	14mm	.325" Taper Seat	5/8"
DZ	10mm	.500" Taper Seat	5/8"
FN or C	14mm	.750" w/gasket	5/8"

HEAT RANGE/ APPLICATION

Ref.#	Description
1-25	Automotive, Small Engine & Ordnance
26-50	Aviation
51-75	Hi-Performance
75-99	Industrial & Special Applications

FIRING END DESIGN

Letter	Description
None or A	Conventional
B	Two Ground Electrodes
C	Copper Plus Design
D	Protruding Nose, Round Ground Electrode
E	.290" Core Nose Projection
F	Three Ground Electrode
G	Fine Wire—Semi-Precious Electrode
H	.030" Core Nose Projection
J	Outback Ground Electrode, Includes Modified Gap
L	Skirted Shell Firing End .200" Core Nose
M	Projected Core Nose
N	Four Ground Electrode
P	Platinum Electrode
R	Push Wire
S	Single Ground Electrode at Side of Center Electrode
V	Surface Gap
X	Fine Wire
Y	Standard Projected Core Nose
Z	Skirted Shell
CC	Double Copper
*PP	Double Platinum
PEP	Double Platinum Projected
PLP	Double Platinum Extended Electrode
PMP	Double Platinum Projected
PYC	Single Platinum Projected
*PYP	Projected Double Platinum
WPC	Iridium/Platinum/Copper
WPCC	Iridium/Platinum/ Double Copper

*Includes Copper Plus Design

Letter	Description	Reach	Hex
BY	Multiple Ground Electrode w/Projected Core Nose	.472"	13/16"
CM	14mm (Special for Mopeds)		
GY	Fine Wire (Semi-precious Electrode) w/Projected Core Nose		
LM	14mm (Special for Lawn Mowers)	3/8"	13/16"
LY/E	Extended Electrode Gap & Core Nose Projection		

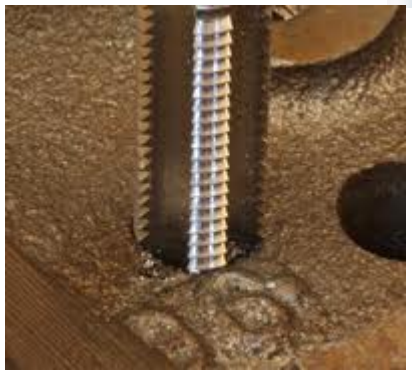
WIDE GAP DESIGNATION

No.	Description
4	Wide gaps required
5	to meet Federal
6	and California
8	requirements.

The sales symbol on a spark plug is composed of a basic "Heat Range" number with letters and numbers to indicate major features of the plug design. The charts above contain a detailed example of the Champion Sales Symbol.

Plugs???

- Replace every 100 hrs. or first sign of hard starting.
- Torque: Alum. head 210 in/lbs
  Cast iron head 300 in/lbs
- Battered or clogged threads M14 X1.25 metric tap
- Heli-coil - Thread insert

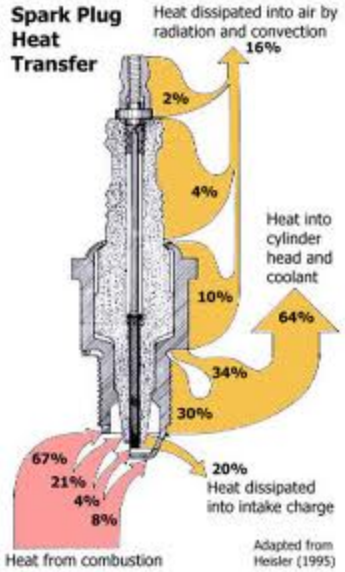


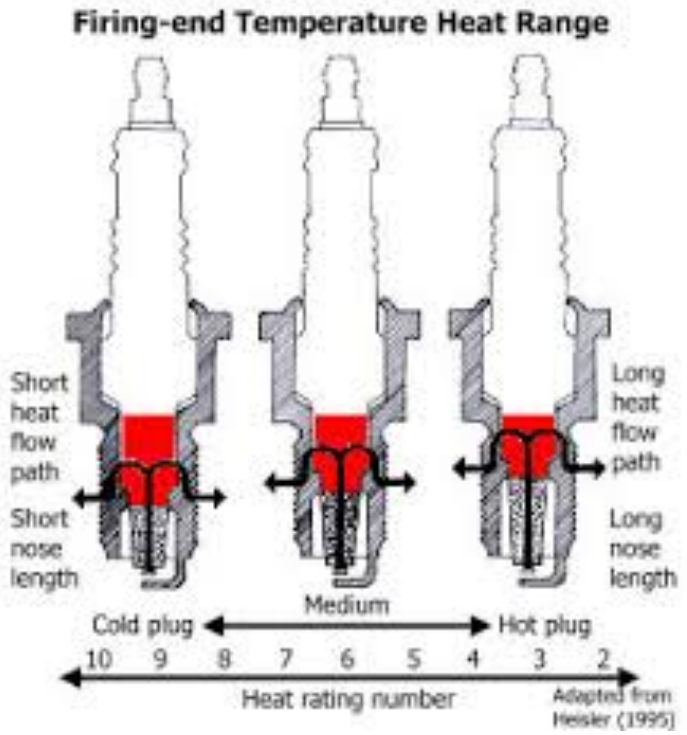
Plug Brand?

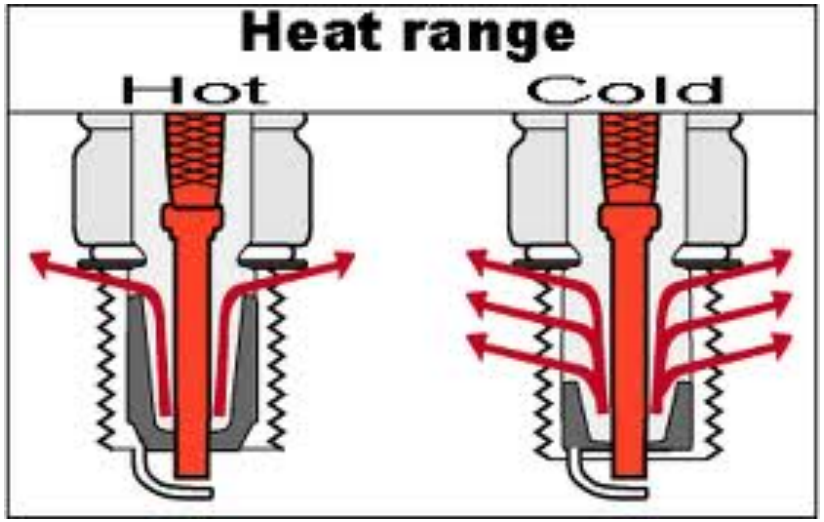
- Briggs uses Champion.
- I use NGK or Bosch.
- What will you use?

Spark Plug Heat Transfer

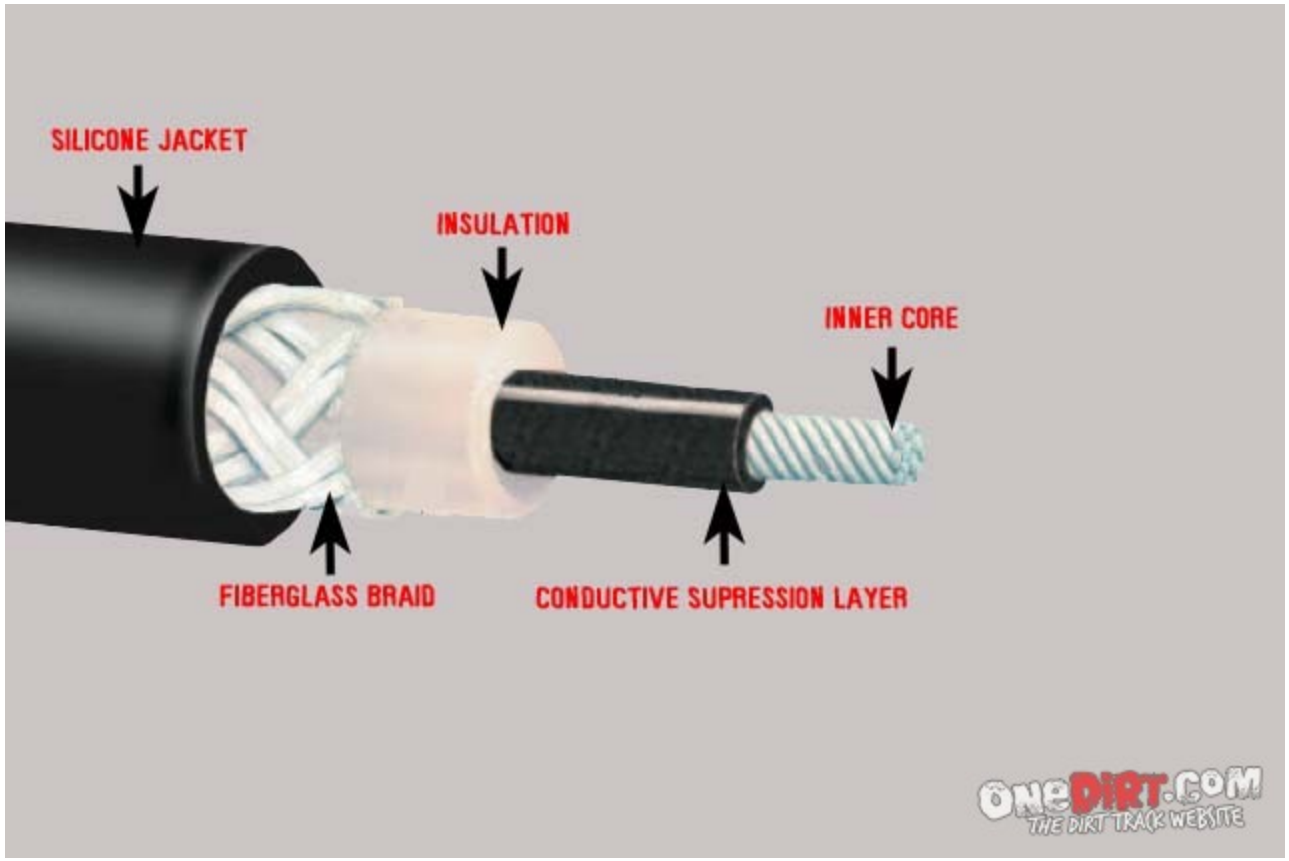
- Heat range

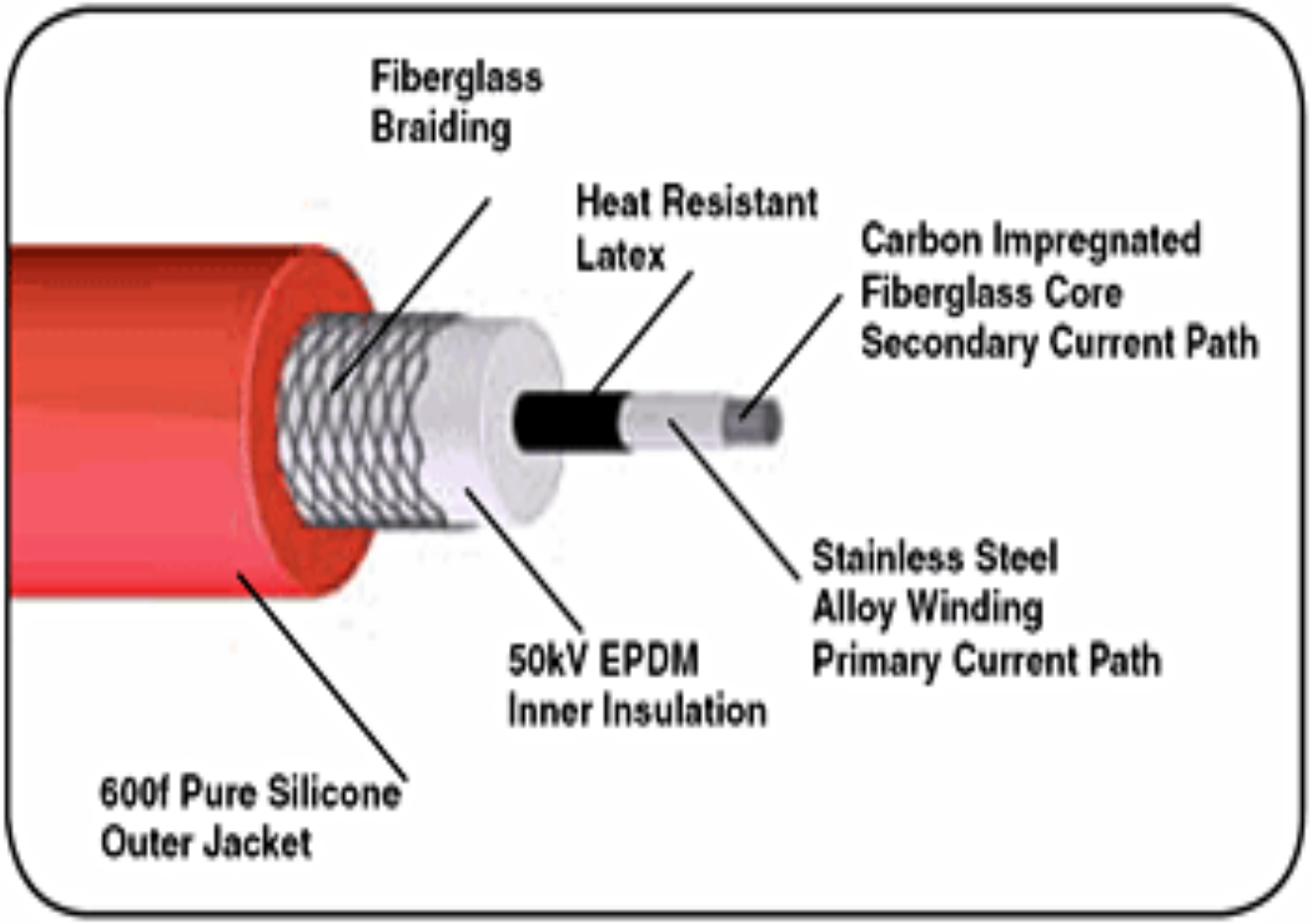






Spark Plug Wire




Fiberglass
Braiding
Heat Resistant
Latex
Carbon Impregnated
Fiberglass Core
Secondary Current Path
Stainless Steel
Alloy Winding
Primary Current Path
50kV EPDM
Inner Insulation
600f Pure Silicone
Outer Jacket

Switching Devices

- Trigger collapsing field in primary coil – inducing a high voltage in secondary coil – firing plug – igniting fuel/air mixture – driving piston down on power stroke
- Mechanical
- Electronic

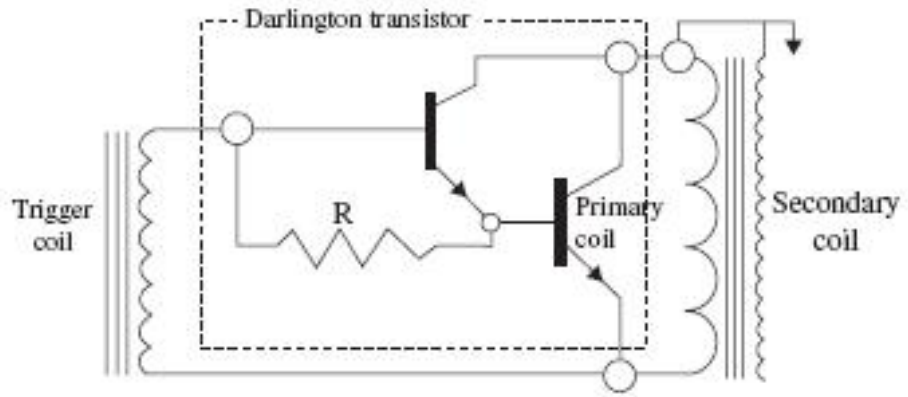


FIG. 3-18. *The Magnetron trigger circuit is similar to those used in many automotive applications.*

Flywheel - it's magnetic…

Removal - Flywheel

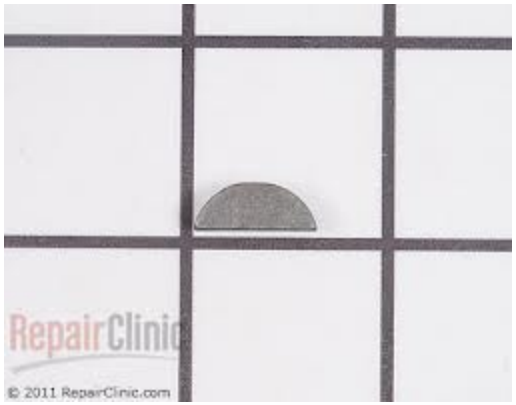
- Starter drive – tool 19163

- Puller

- Shocker

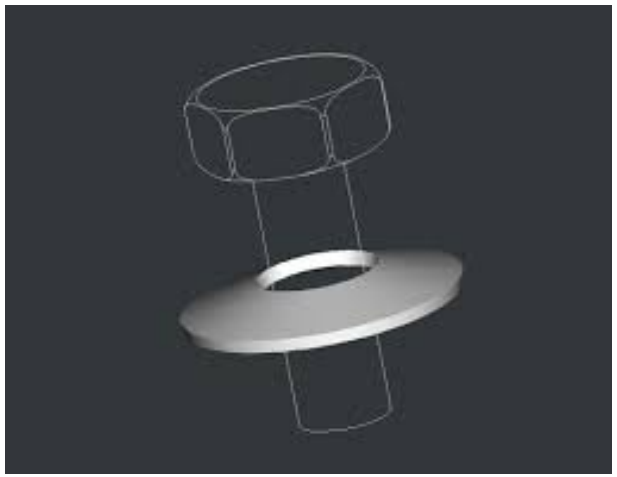
Key and keyway

- Briggs uses soft aluminum
- Other manufactures use steel
- Replace flywheel or hub
  if worn.
  Magnets seldom wear out.
  Should attract screwdriver
  5/8”away.
  CDI uses weaker magnets.

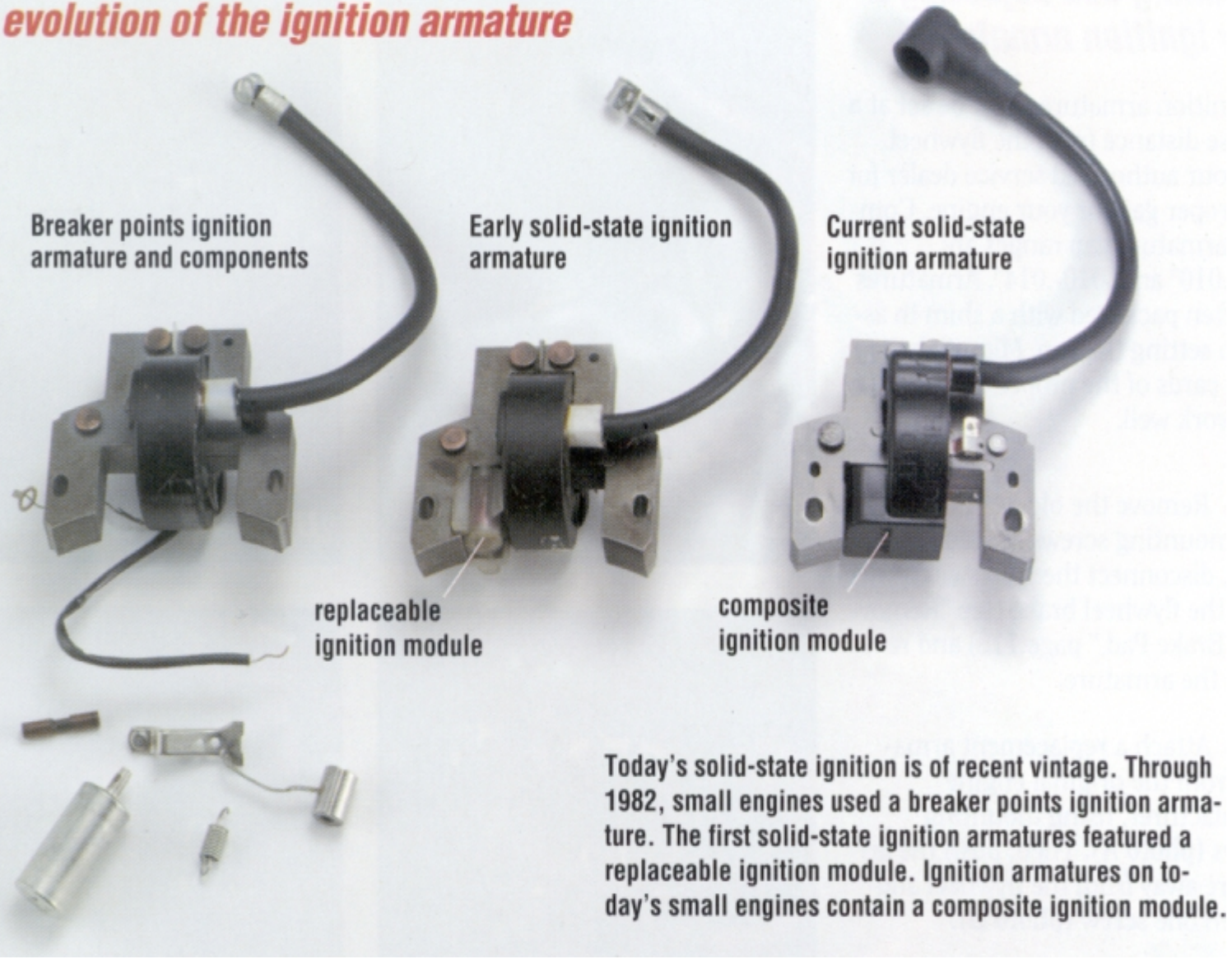


Installing Flywheel

- Clean crankshaft
- Bellville washer convex side up
- 30 wt. oil on bolt threads
- Torque
  - Engines >6 CID – 40 ft/lbs
  - 6 to 10 CID – 55 to 60 ft/lbs
  - 11 to 20 CID – 85 to 90 ft/lbs



The evolution of the ignition armature



Today's solid-state ignition is of recent vintage. Through 1982, small engines used a breaker points ignition armature. The first solid-state ignition armatures featured a replaceable ignition module. Ignition armatures on today's small engines contain a composite ignition module.

Use a business card

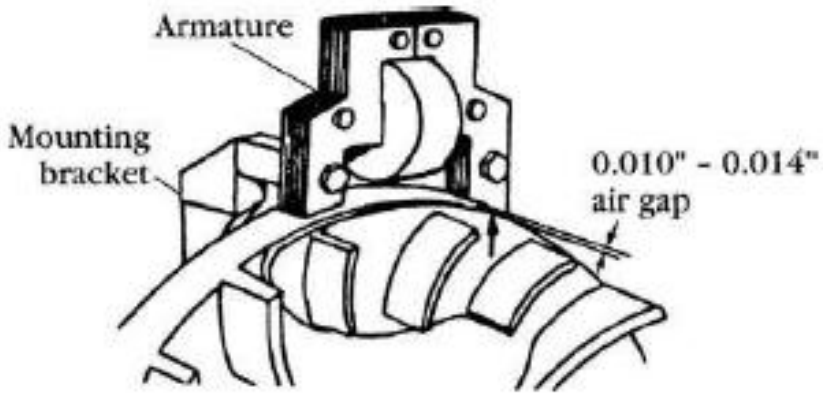
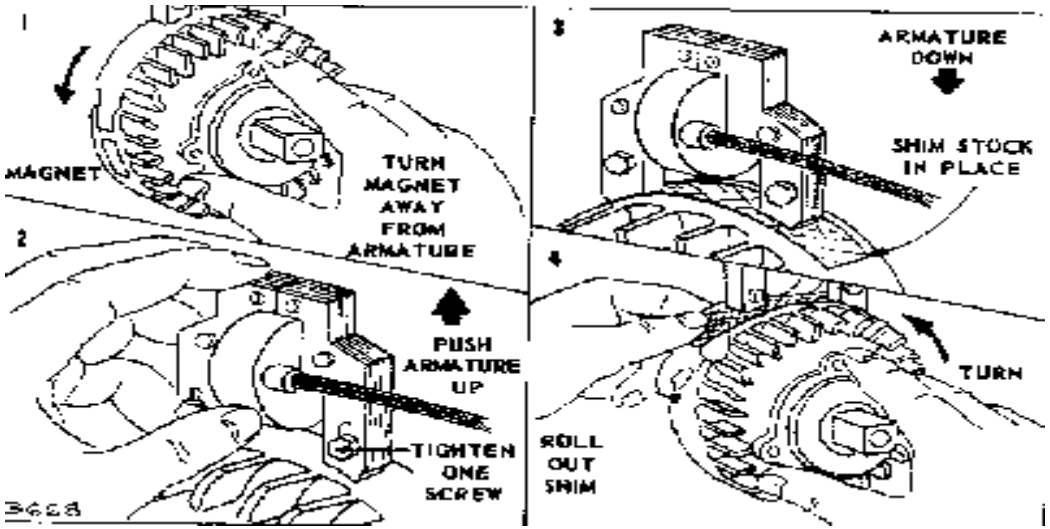
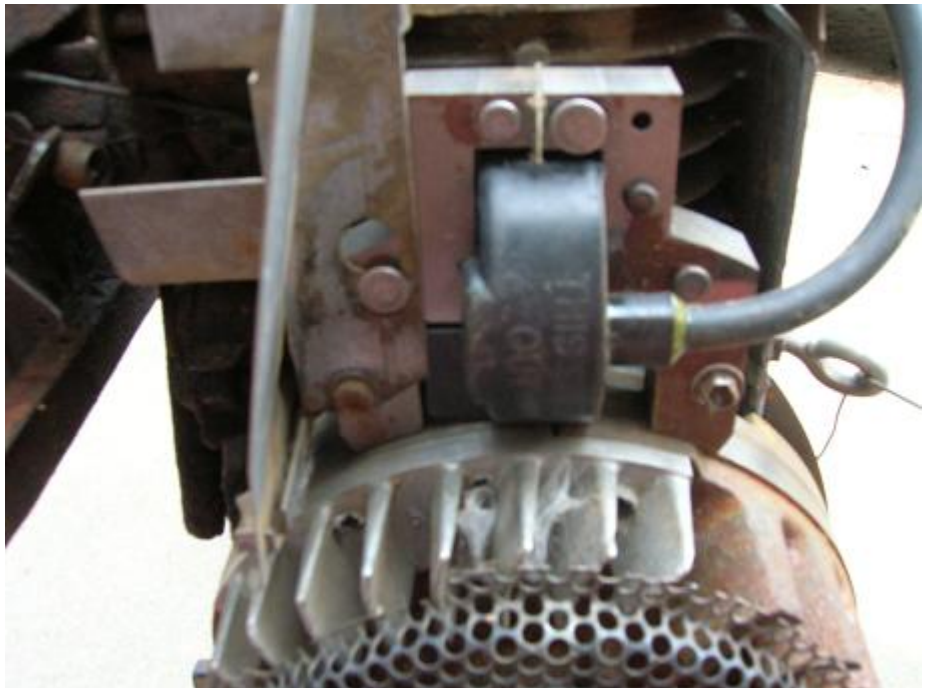
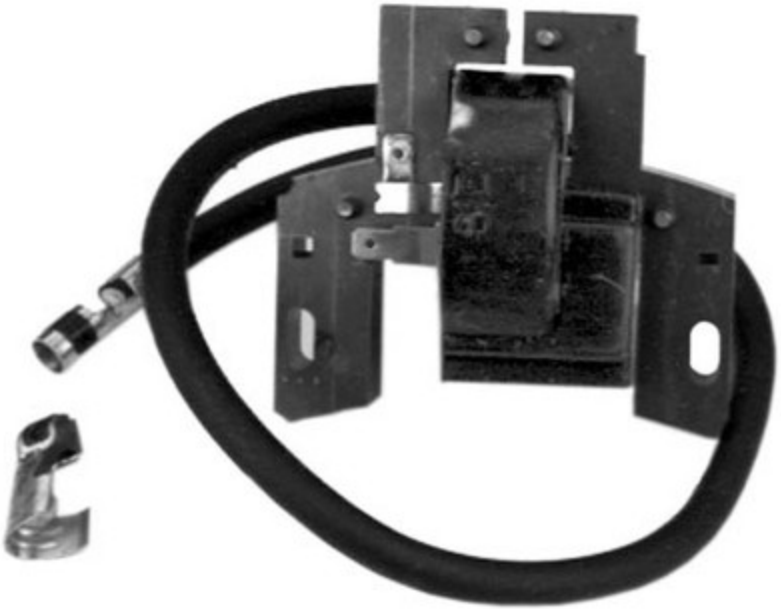


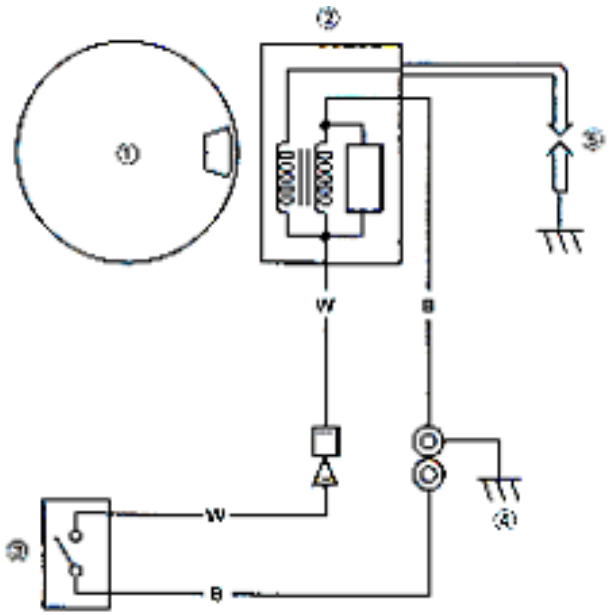
FIG. 3-15. *Shim stock can be used to set the air gap as shown.* Briggs & Stratton Corp.



Magneto Ignition Systems







Wiring diagram for ignition system.

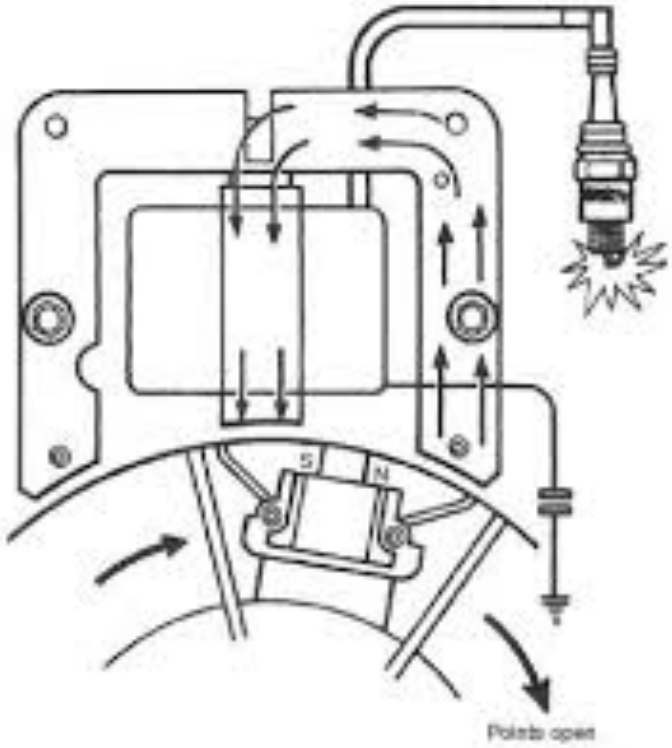


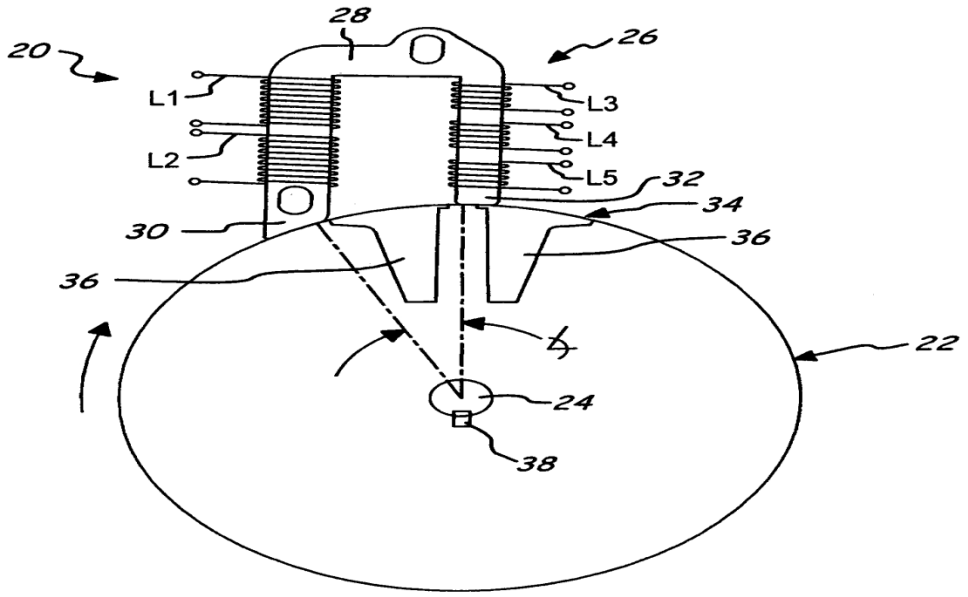
FIG. 3-9. A few degrees of additional flywheel movement cause a sudden reversal in flux direction through the center leg. The points open and the spark plug fires.

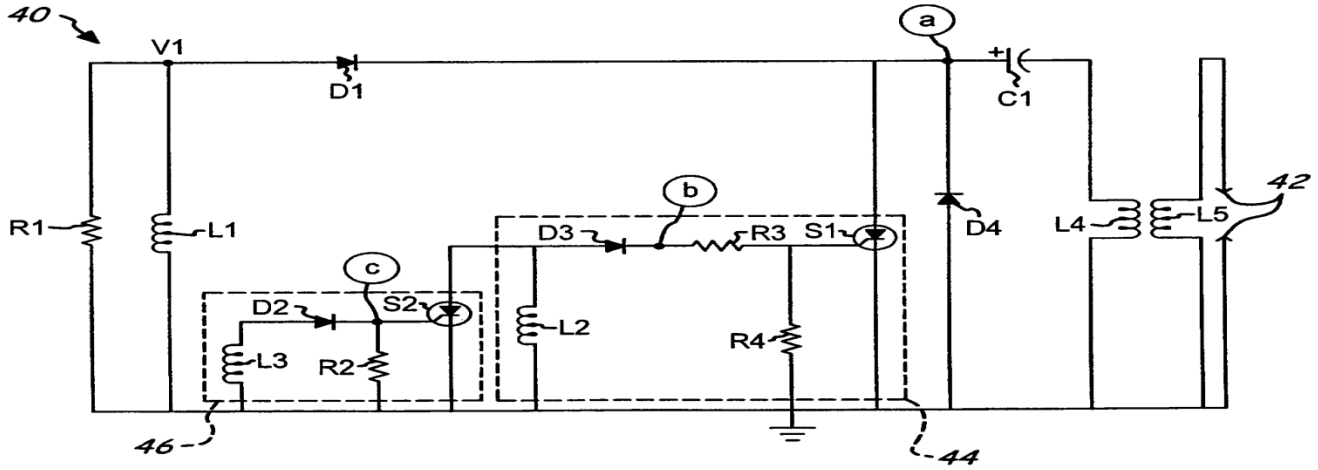
Table 3-2
Flywheel torque and air gap, single-cylinder engines

Engine type/ model name	Cubic-inch displacement (1st one or two digits of model number)	Armature air gap—two legged (in.)	Armature air gap—three legged (in.)	Flywheel-nut torque (lb/ft)
Side-valve, aluminum block	6, 8, 9, 10 (except as noted below), 12	0.008	0.014	50–55
	100200, 100900, 13	0.012	0.014	60–65
	17, 19, 22, 25	0.012	0.014	70–75
	28	0.012		100–105
Side-valve, cast-iron block	23, 24, 30, 32	0.012	0.023	140–145
Europa OHV	9	0.008–0.009		60–65
Intec OHV	11, 12	0.010–0.012		60–65
Intec OHV	20	0.008–0.009		110–115
Intec OHV	31	0.010–0.012		95–100
PowerBuilt *	28	0.012–0.014		95–100

* No data on other PowerBuilt models.

Capacitive Discharge Ignition (CDI)





CDI Ignition…

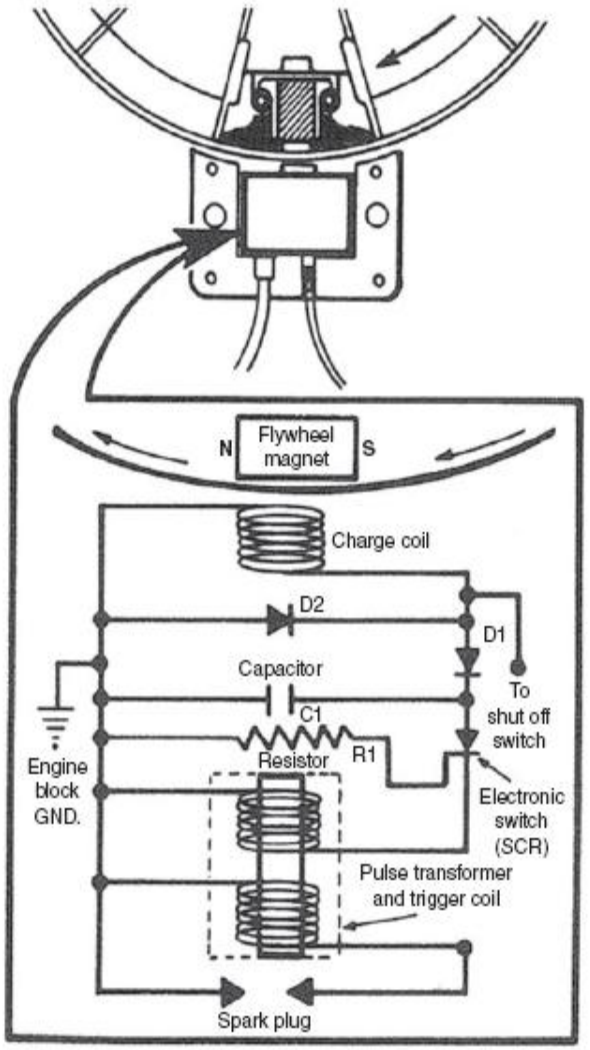


FIG. 3-12. *Tecumseh CDI circuitry is typical, although some battery-operated systems include diodes to protect components from reversed polarity.*

Do not run with battery

Kohler Smart Spark CDI

Do not run with plug wire disconnected.

- Flywheel magnets generate 200 VAC in the input coil
- The Rectifier converts the AC output to DC storage in the capacitor
- The SCR (silicon controlled rectifier) remains non-conductive to block capacitor discharge
- About 180 degrees later flywheel magnet sweeps past the trigger coil to generate signal voltage across the resistor – this causes the SCR the conduct
- The stored charge on the capacitor discharges through the primary side of the pulse transformer
- Current flow in the primary side of the pulse transformer (actually the ignition coil) generates a 25K Volt potential in the secondary windings that goes to ground across the spark-plug electrodes

- Caution: Solid-state components are vulnerable to stray and reversed-polarity voltage

Troubleshooting

- Replace plug
- Replace key is distorted or sheared
- Check wiring, dielectric grease on contentions
- Ignition interlock
- Test unit (special tool) or replace with know good unit

Transistor-Controlled Ignition (TCI)

- Magnetron

- Plug terminal and engine ground 3K – 5K Ohms.

Darlington Transistor

Used for amplification…

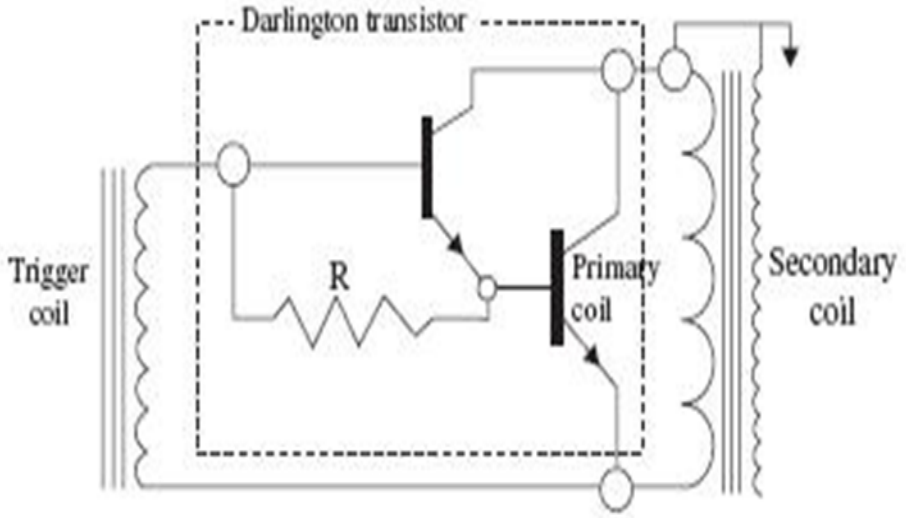
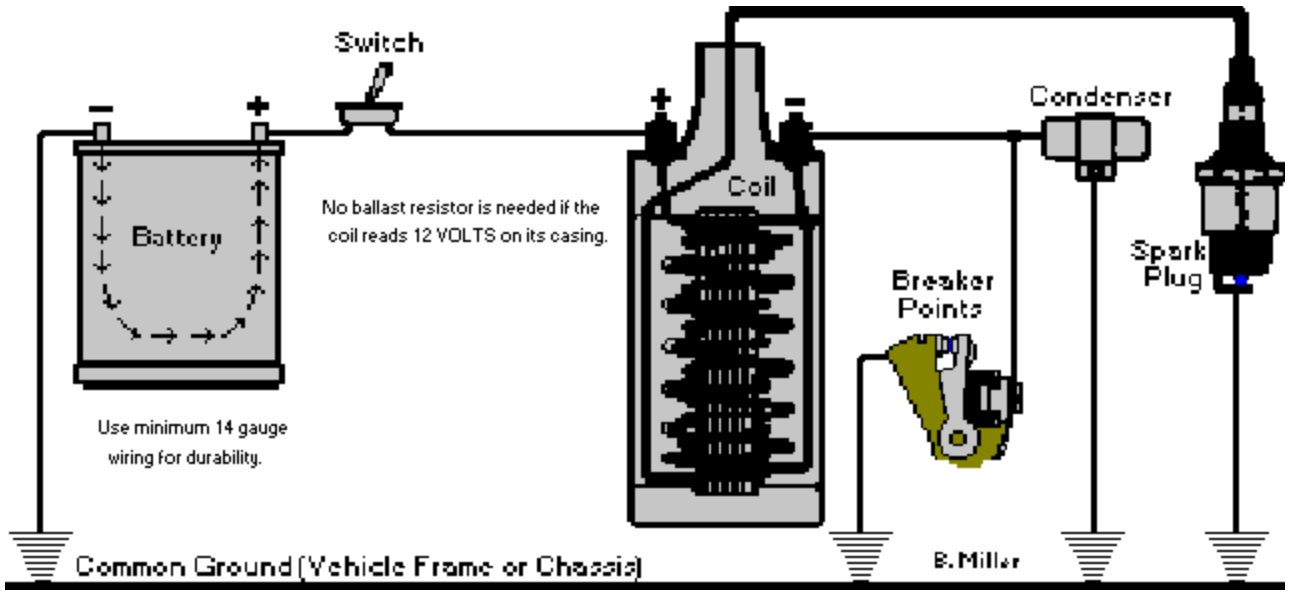
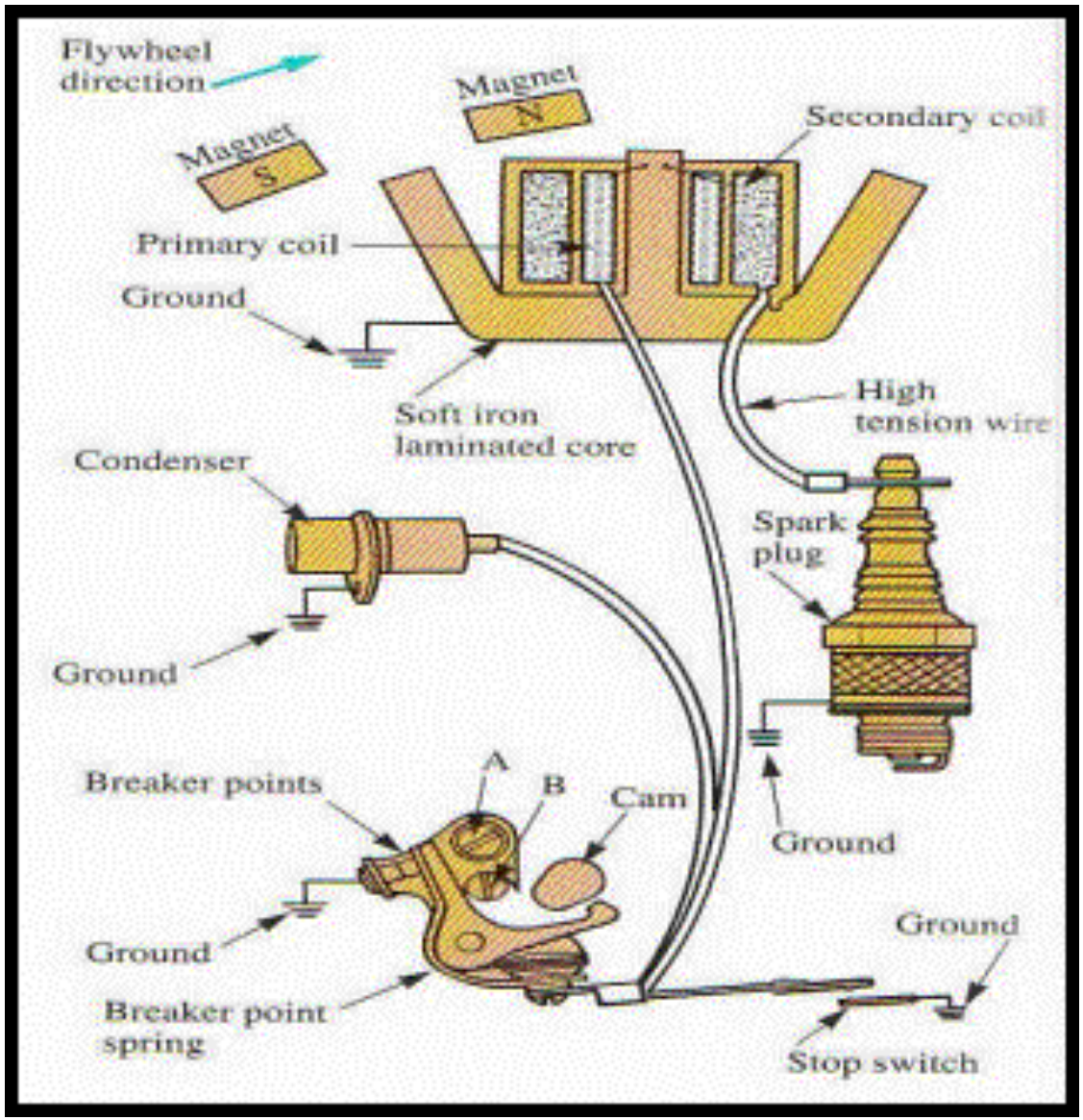
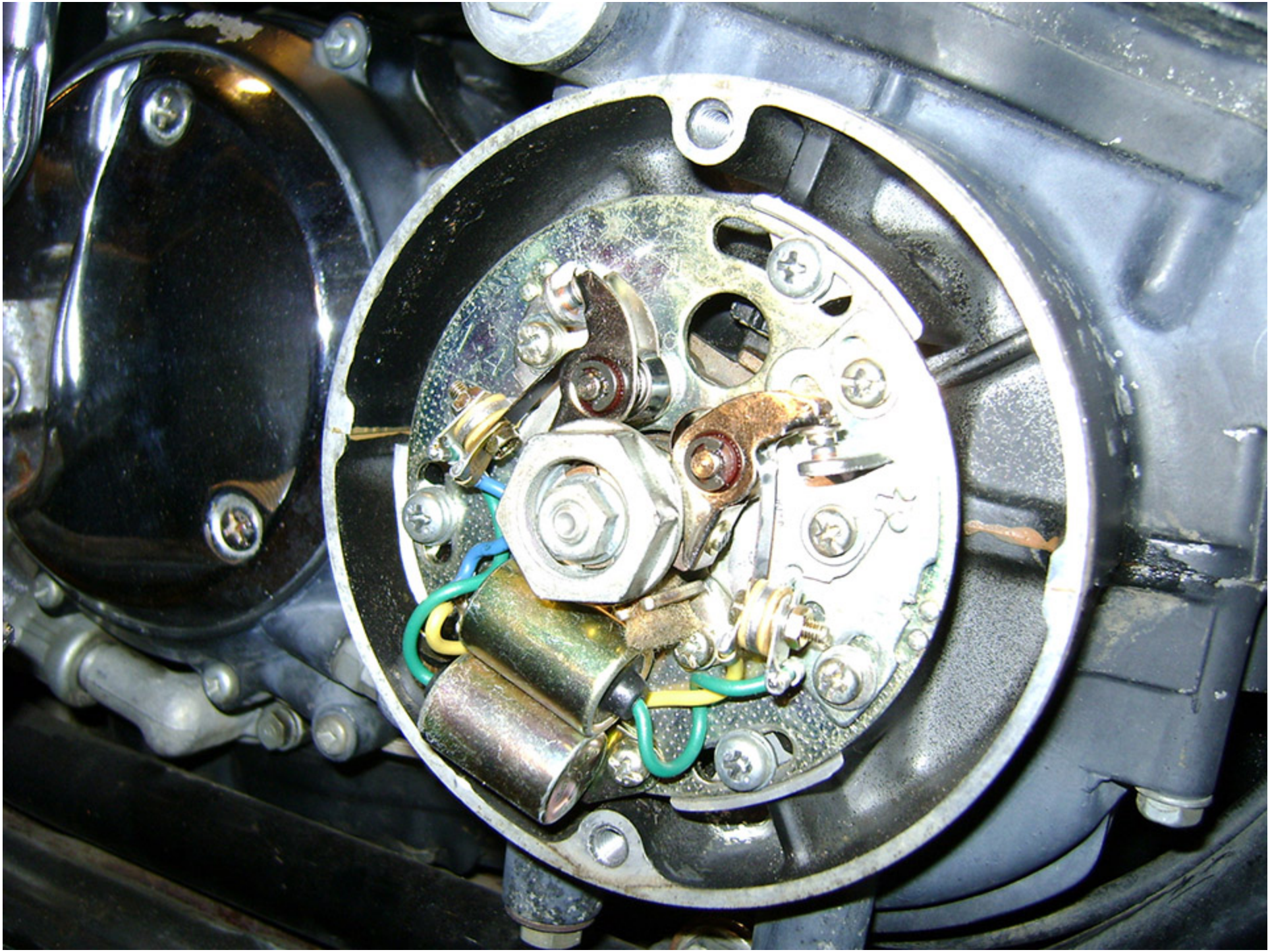


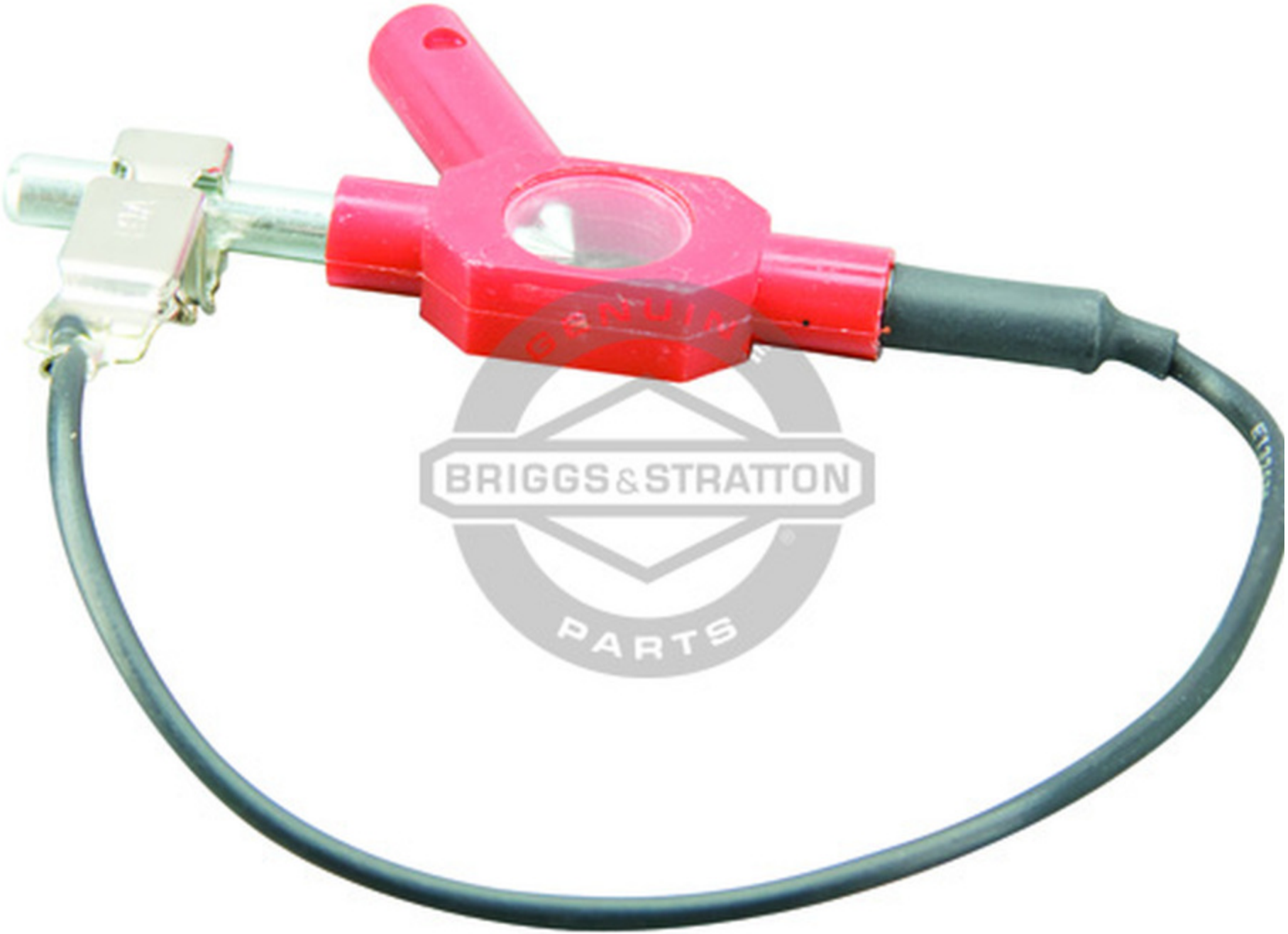
FIG. 3-18. *The Magnetron trigger circuit is similar to those used in many automotive applications.*

Mechanical Breaker Point Ignition (MBI)m




Flywheel direction
Magnet
N
Magnet
S
Secondary coil
Primary coil
Ground
Soft iron laminated core
High tension wire
Condenser
Spark plug
Ground
Ground
Breaker points
A
B
Cam
Ground
Ground
Breaker point spring
Stop switch




GENUINE
BRIGGS&STRATTON
PARTS

- Test ign. Circuit
- W or W/O plug

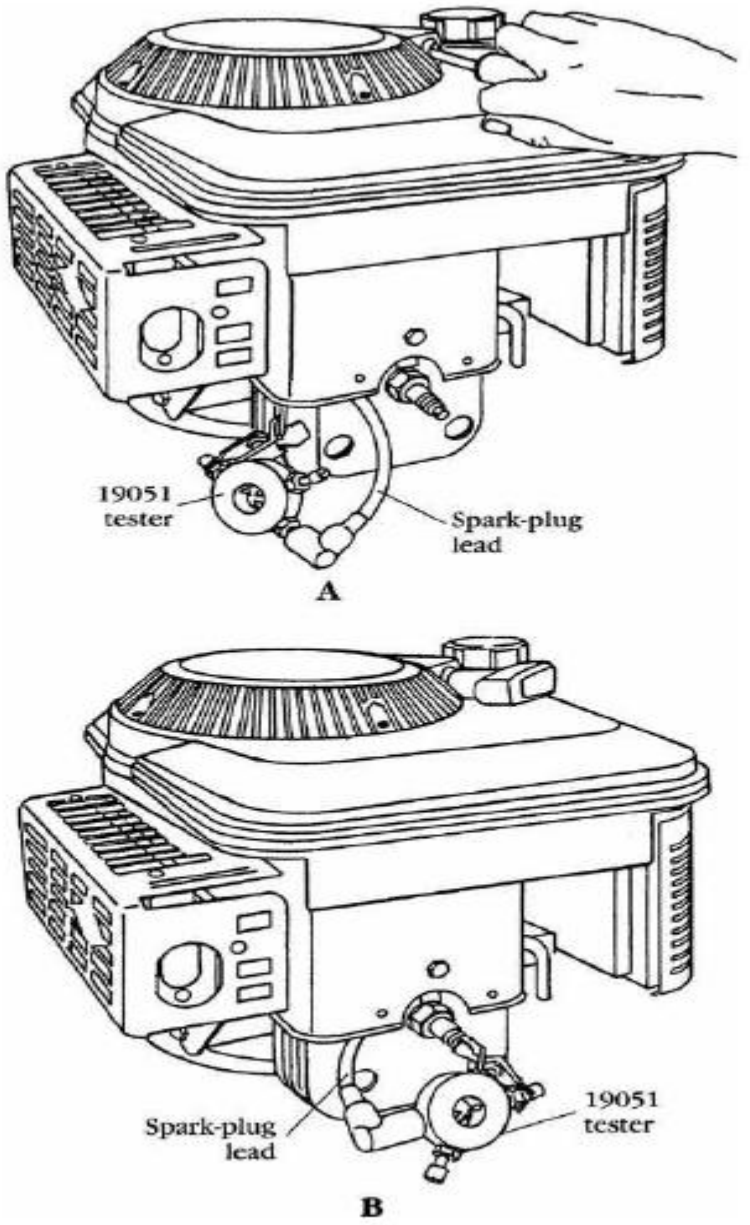


FIG. 2-1. *PN 19051 can be used to register the presence of ignition voltage during cranking (A) and to detect voltage interruptions in a running engine (B). In neither case does the tool say anything about spark-plug performance, which can only be determined by substitution of a known good plug. Also note that a spark gap in series with the plug (B) boosts voltage to help clear flooded engines.*

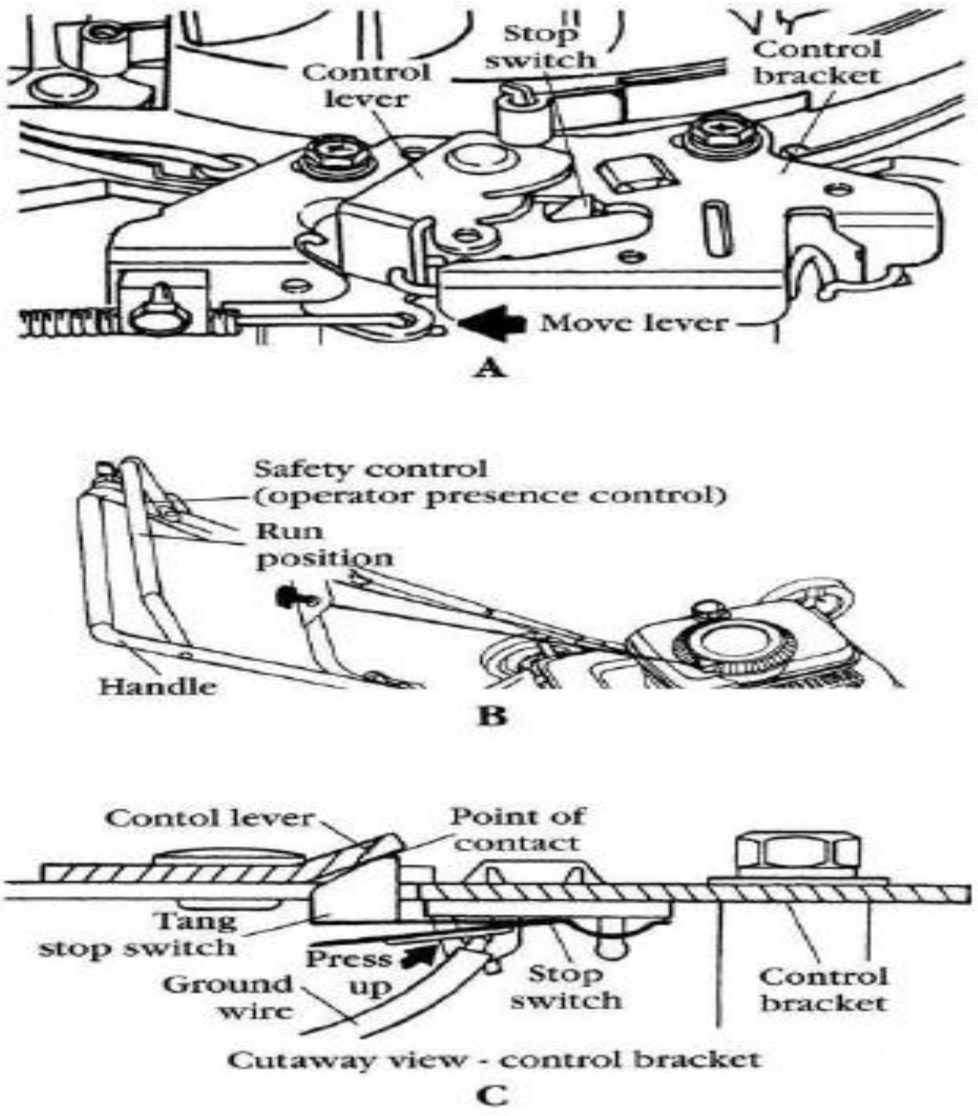
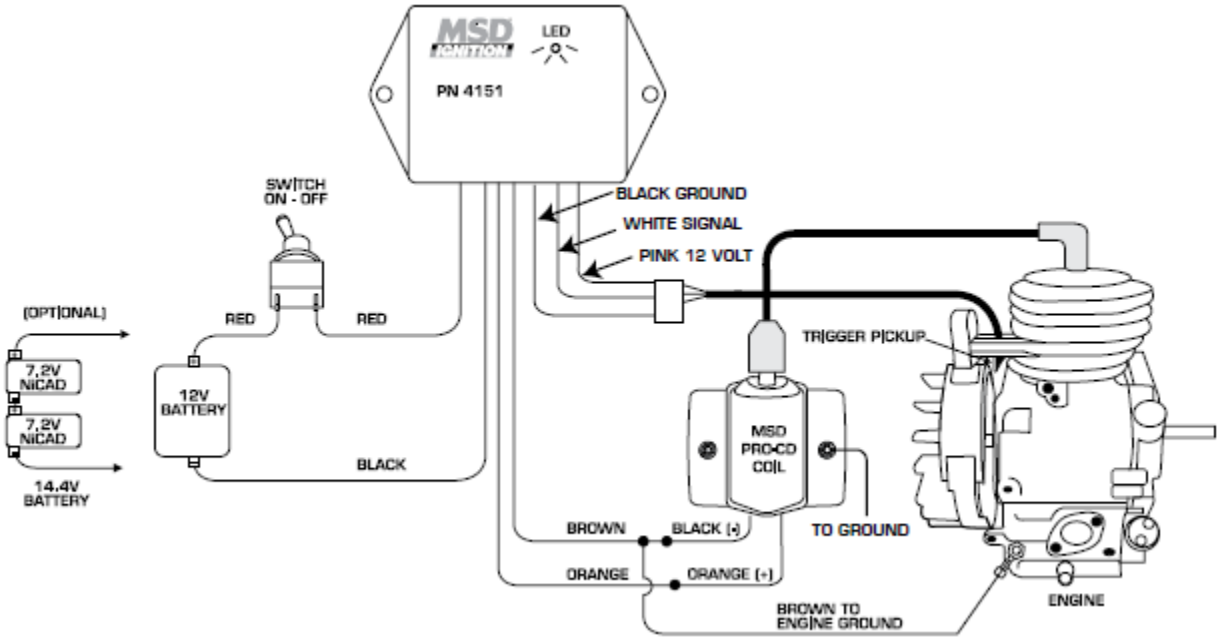


FIG. 3-25. *One approach Briggs took to the "compliance engine" was to integrate the handlebar safety control with the existing stop switch mounted on the carburetor. To test, place the safety-control lever in the "Run" position (A) remove hands (B) and verify that the control lever makes contact with the stop-switch tang (C). The same verification can be made on models with the stop switch integrated into the flywheel brake mechanism by removing the cooling shroud.*

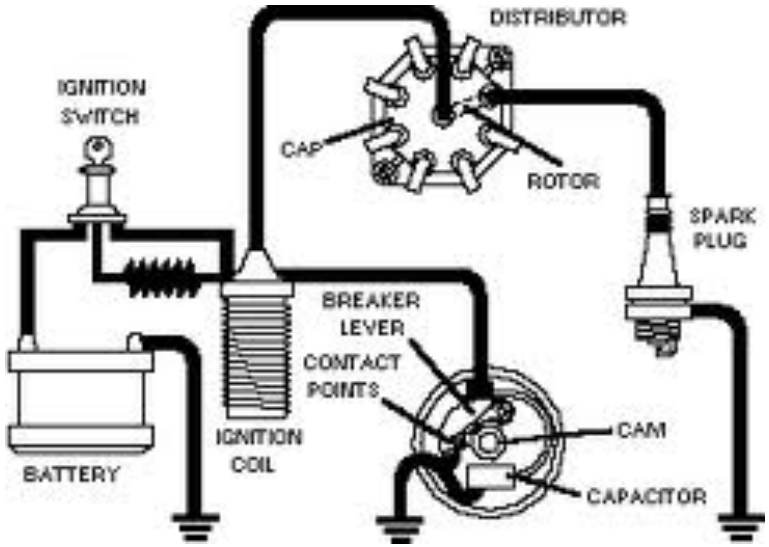
MSD

- The MSD Enhancer system for the Briggs & Stratton/Tecumseh is designed as a complete system. The system has 12 Volts DC operating voltage, 14,000 (1 Cylinder) rpm range, 100 MJ energy output maximum, 14° – 18° (1 Cylinder) multi spark duration, 1.5 AMPS @ 10,000 RPM current requirements, Primary 450 Volts voltage output, and 30,000+ VOLTS with MSD Coil secondary voltage. The following schematic shows the **MSD Briggs & Stratton/Tecumseh Ignition System Wiring Diagram**.



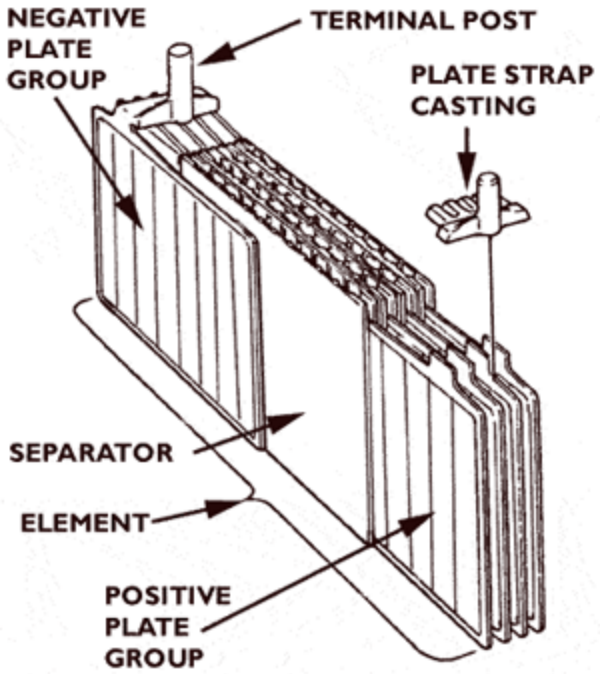
Battery Ignition Systems

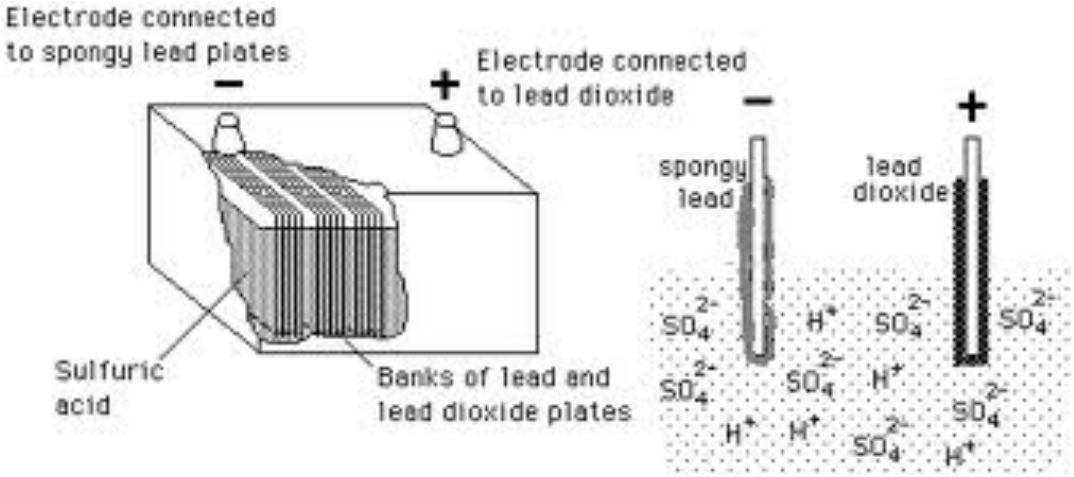
- Textbook pages 208-209
  - Figure 10-24, 10-25, & 10-26



The Lead-Acid Battery

- 6 cells, each cell 2.105V
- Discharge rate 3-20% month
- 500-800 cycles

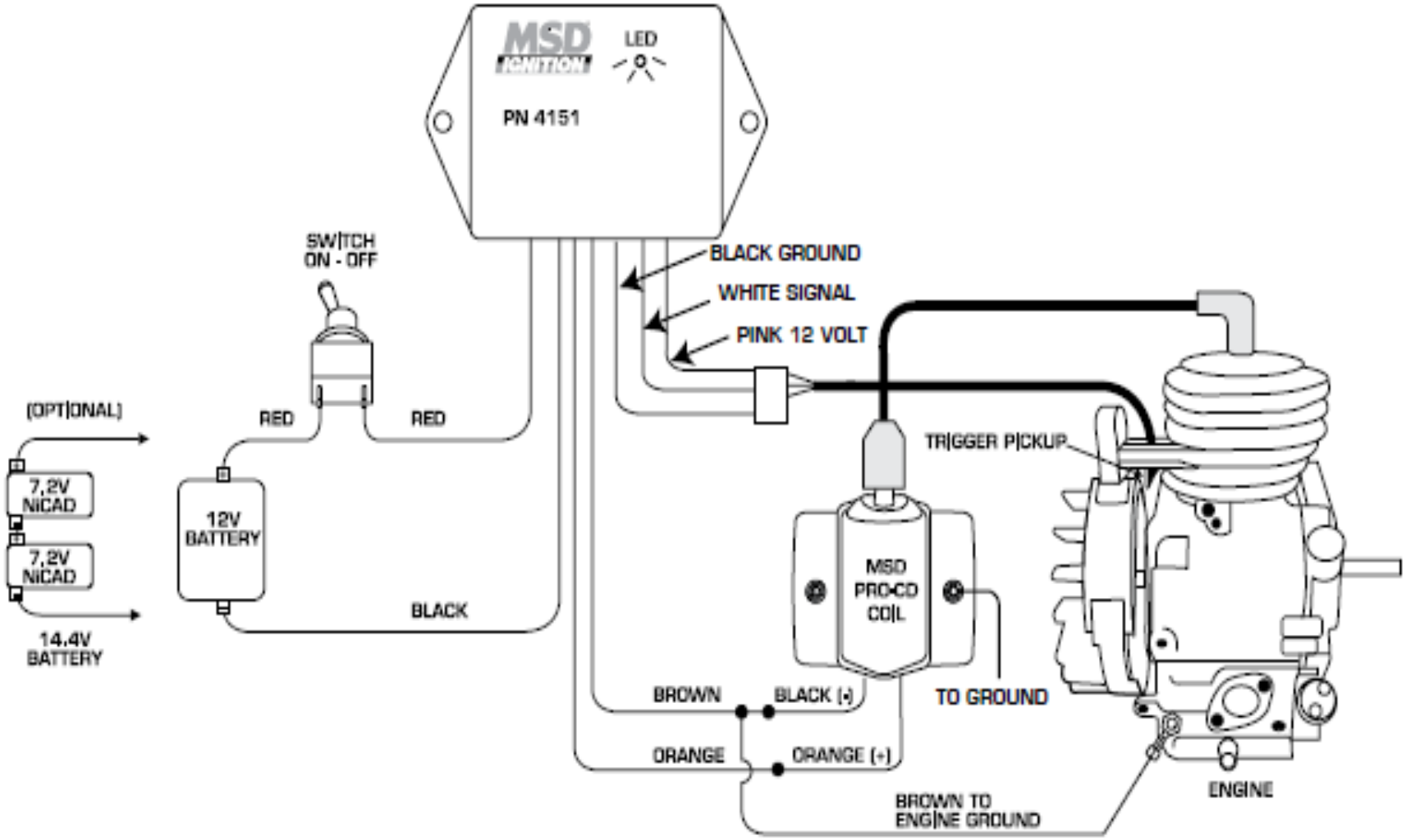




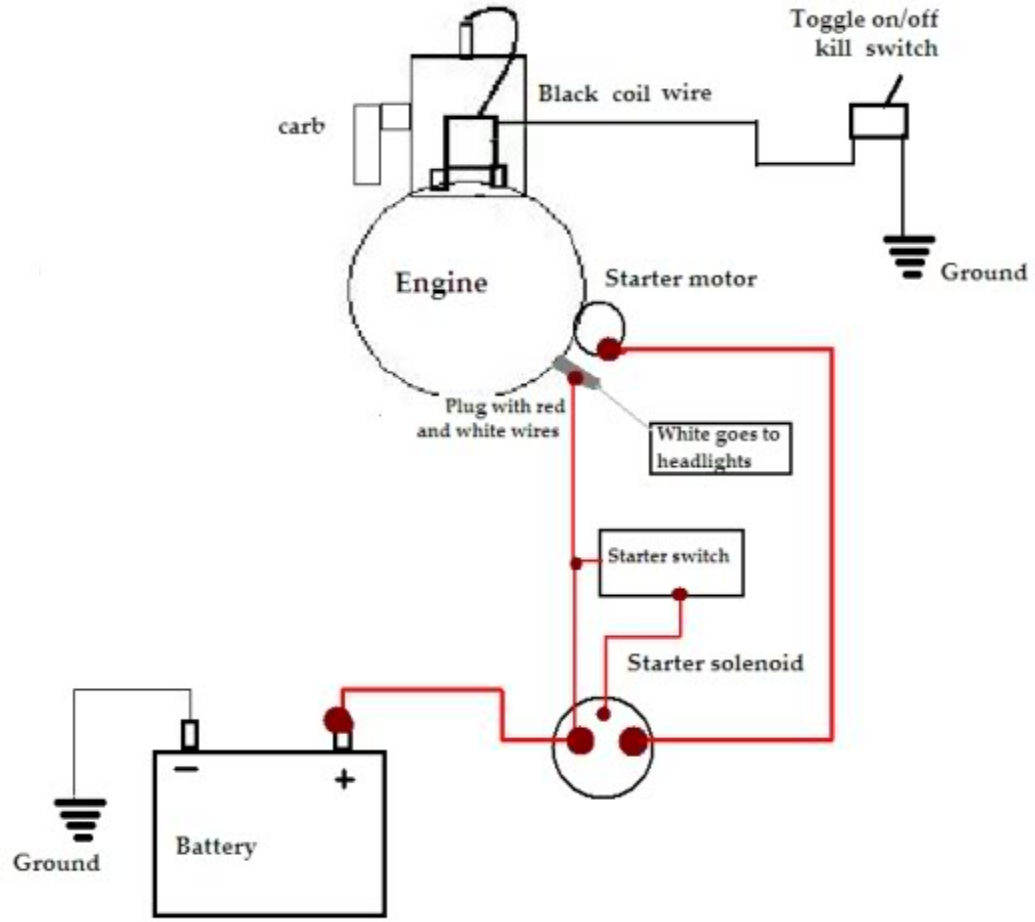
Batteries Cont.

- Explosion – Hydrogen
- Recycling
- Baking soda or ammonia
- Sulfating and DE sulfating
- Types of Batteries

State of Charge	Specific Gravity	Voltage	
		12V	**6V**
100%	1.265	12.7	6.3
75%	1.225	12.4	6.2
50%	1.190	12.2	6.1
25%	1.155	12.0	6.0
Discharged	1.120	11.9	6.0


MSD IGNITION
LED
PN 4151
SWITCH
ON - OFF
BLACK GROUND
WHITE SIGNAL
PINK 12 VOLT
(OPTIONAL)
RED
RED
7.2V NiCAD
7.2V NiCAD
14.4V BATTERY
12V BATTERY
BLACK
TRIGGER PICKUP
MSD PRO-CD COIL
TO GROUND
BROWN
BLACK (-)
ORANGE
ORANGE (+)
BROWN TO ENGINE GROUND
ENGINE

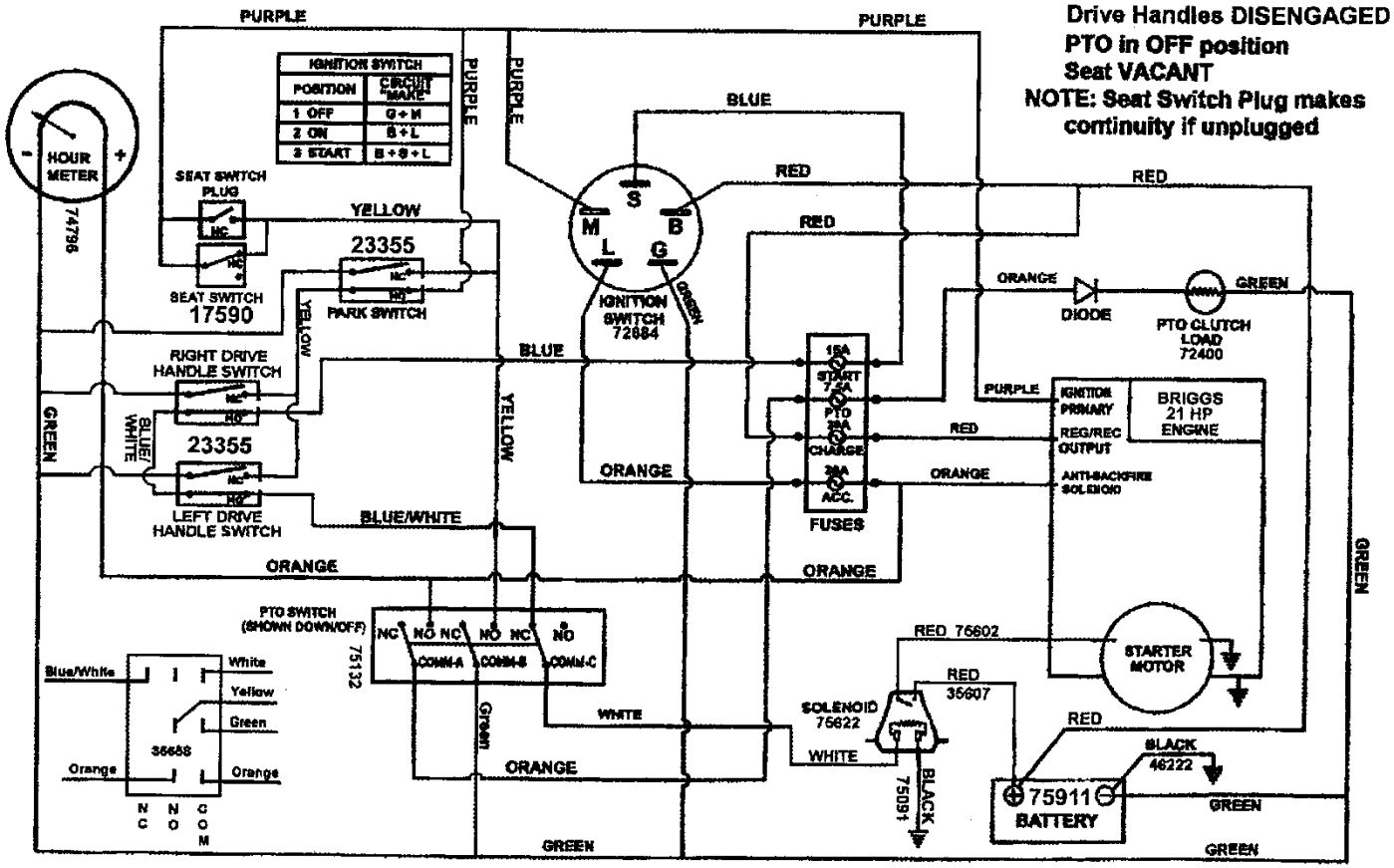
Electrical System Simplified



NOTES:

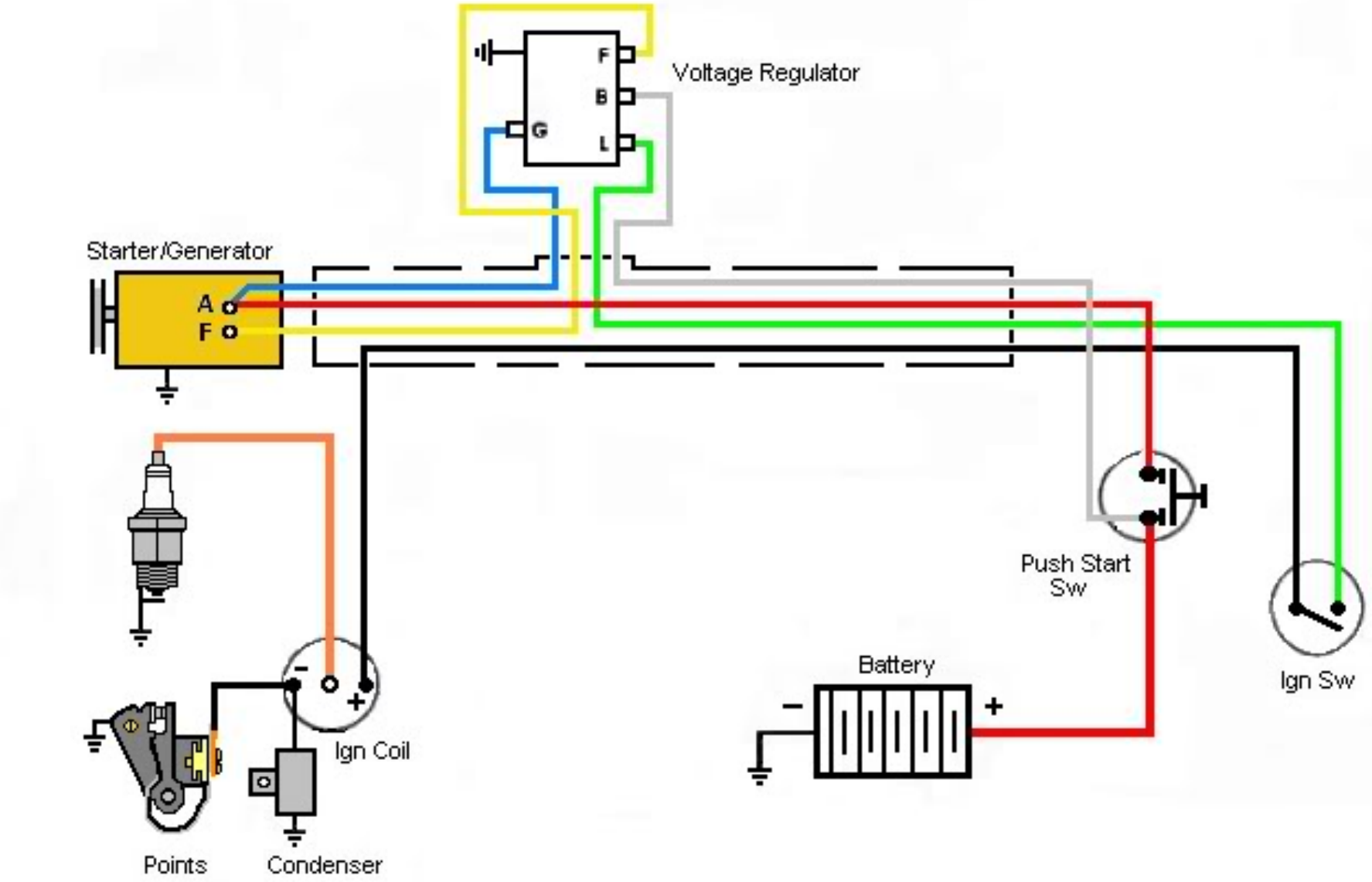
Shown with all switches in a safe starting position.
If not in seat, Park must be set, and PTO switch OFF.
Both Drive Handles must be out to start.
If either Drive Handle is put into drive before unsetting Park Brake the engine will die (you can't drive through Park).

NOTE: Switches shown with,
Park Lever in PARK
Drive Handles DISENGAGED
PTO in OFF position
Seat VACANT
NOTE: Seat Switch Plug makes continuity if unplugged

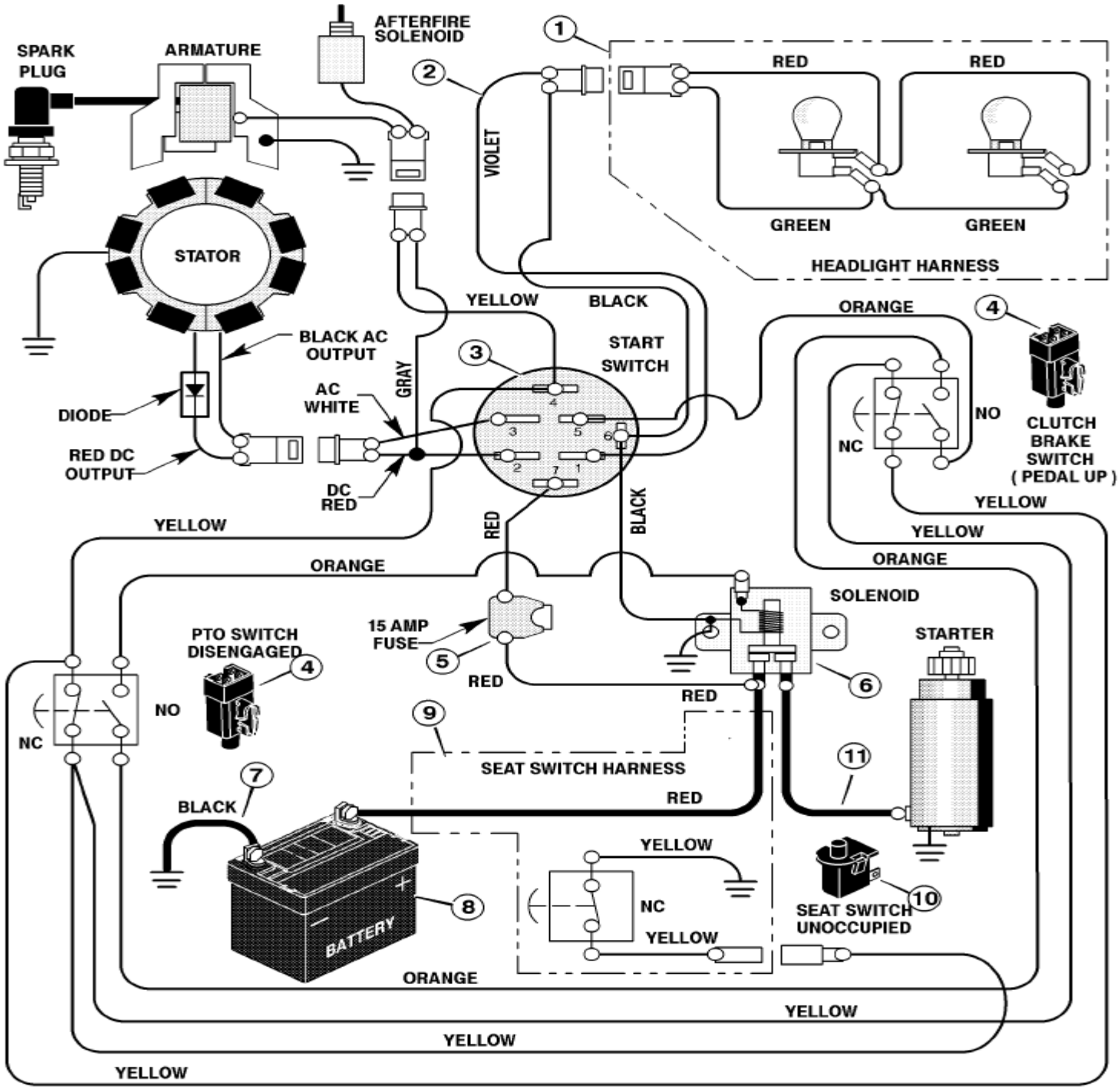


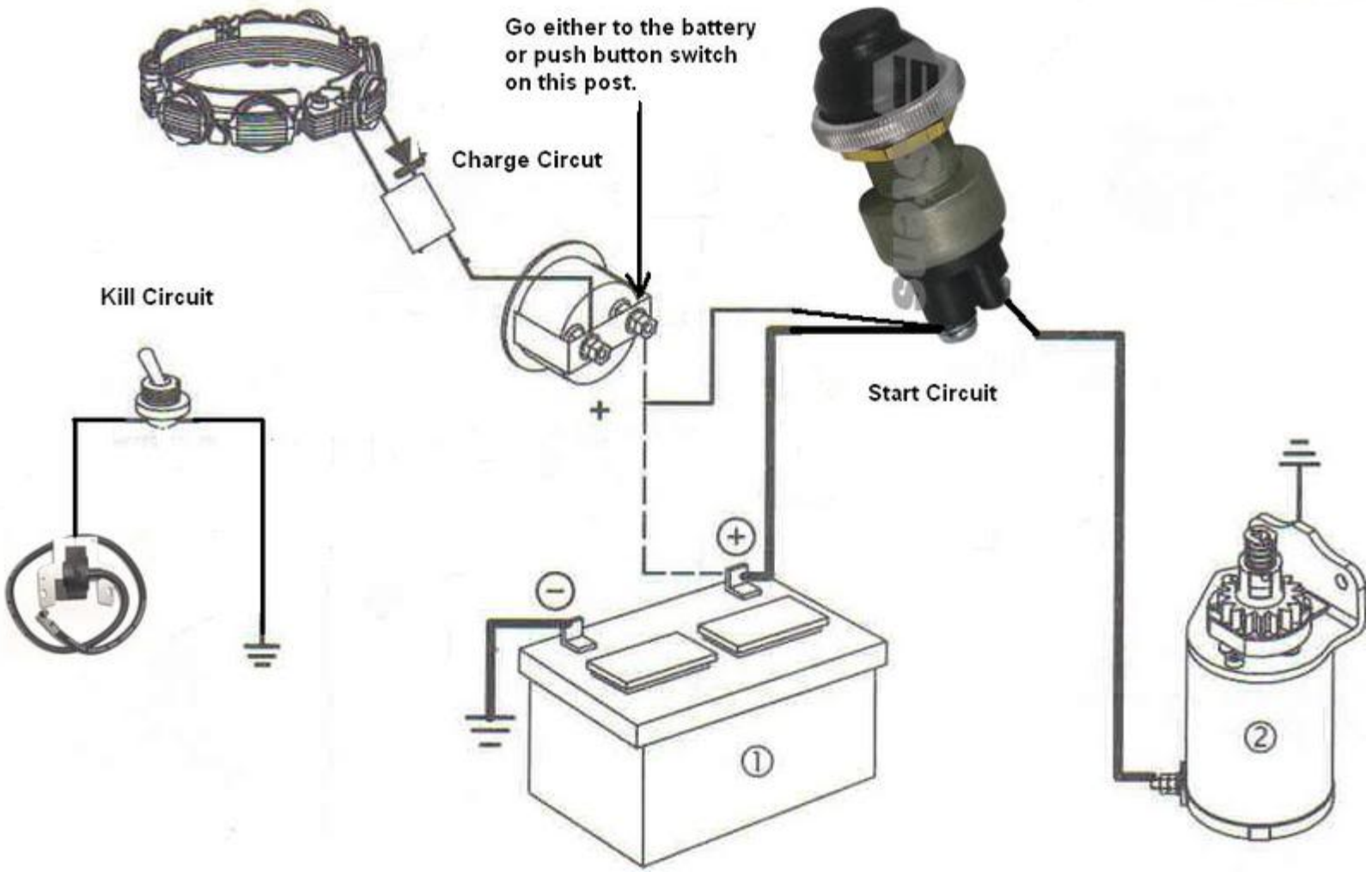
SCHEMATIC - WIRING HARNESS P.N. 78157

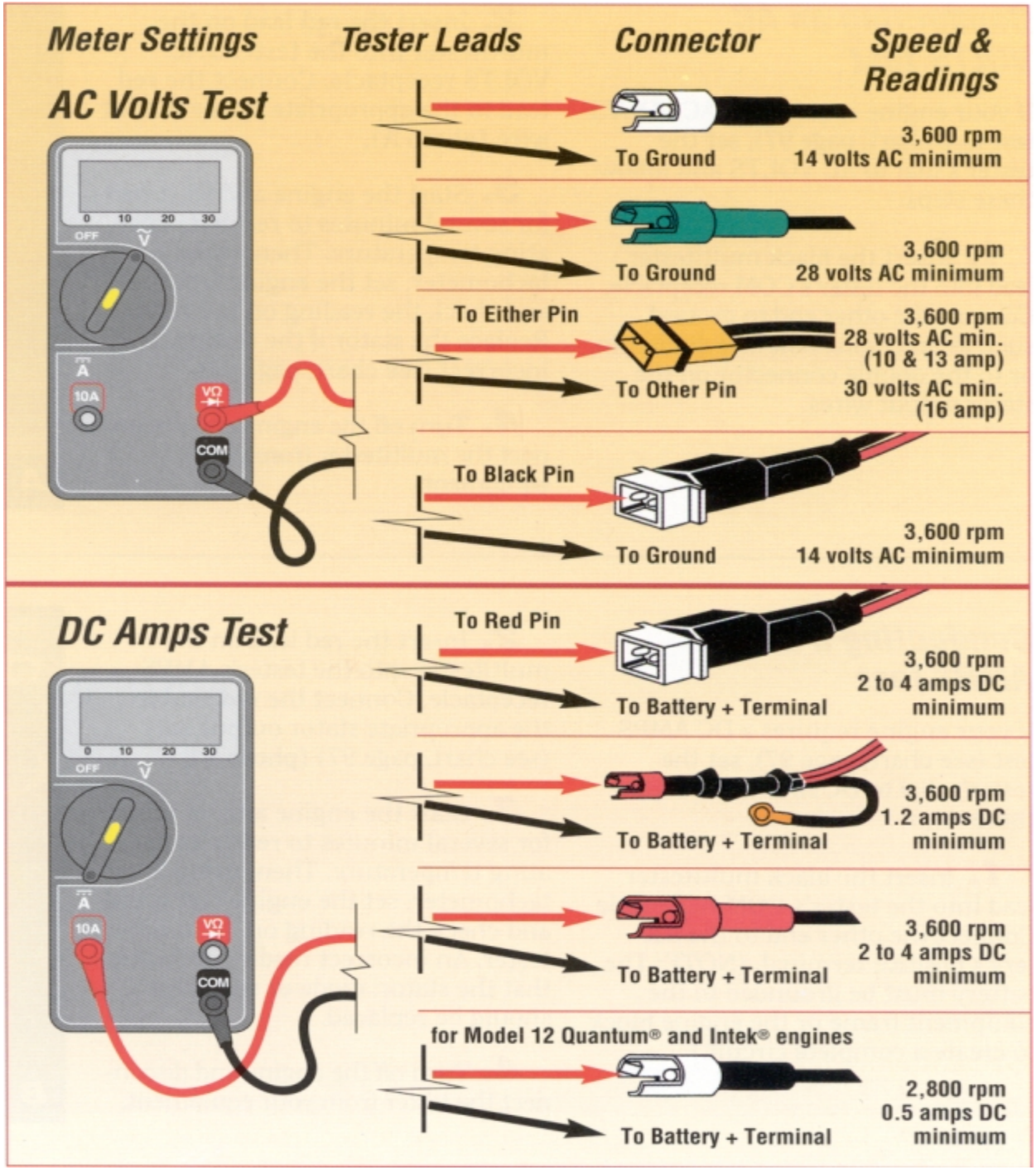
Cub Cadet Original



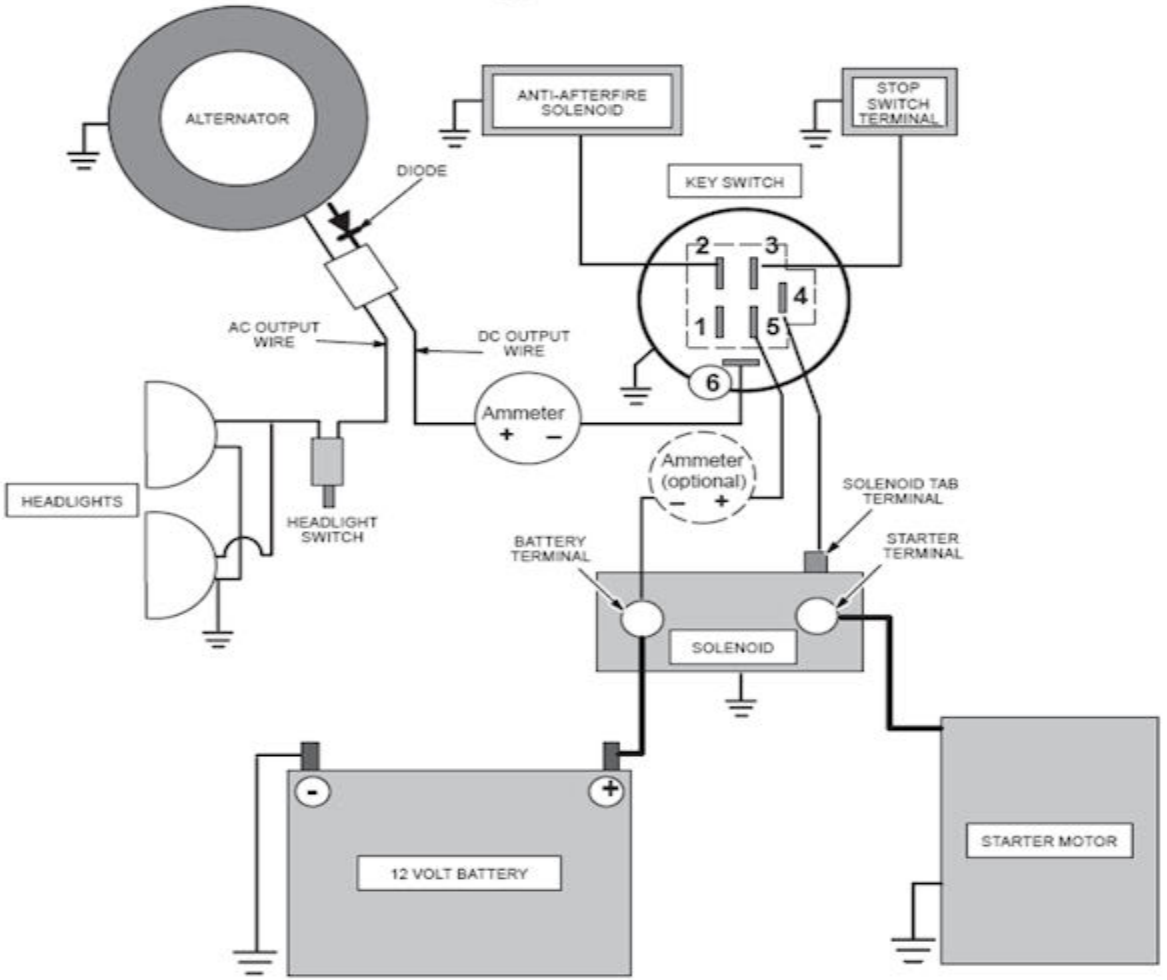
Revised By: R Bedell
March 2006


SPARK PLUG
ARMATURE
AFTERFIRE SOLENOID
1
2
RED
RED
VIOLET
GREEN
GREEN
HEADLIGHT HARNESS
STATOR
YELLOW
BLACK
START SWITCH
ORANGE
4
BLACK AC OUTPUT
3
GRAY
AC WHITE
DIODE
RED DC OUTPUT
DC RED
NO
NC
CLUTCH BRAKE SWITCH (PEDAL UP)
YELLOW
YELLOW
ORANGE
RED
BLACK
SOLENOID
STARTER
PTO SWITCH DISENGAGED
15 AMP FUSE
5
RED
6
RED
NO
NC
9
SEAT SWITCH HARNESS
11
7
BLACK
RED
YELLOW
NC
YELLOW
SEAT SWITCH UNOCCUPIED
10
BATTERY
8
ORANGE
YELLOW
YELLOW
YELLOW


Go either to the battery
or push button switch
on this post.
Charge Circut
Kill Circuit
Start Circuit
+
⊕
⊖
①
②


Meter Settings
Tester Leads
Connector
Speed & Readings
AC Volts Test
0 10 20 30
OFF
A
10A
VΩ
COM
To Ground
3,600 rpm
14 volts AC minimum
To Ground
3,600 rpm
28 volts AC minimum
To Either Pin
To Other Pin
3,600 rpm
28 volts AC min.
(10 & 13 amp)
30 volts AC min.
(16 amp)
To Black Pin
To Ground
3,600 rpm
14 volts AC minimum
DC Amps Test
To Red Pin
To Battery + Terminal
3,600 rpm
2 to 4 amps DC
minimum
To Battery + Terminal
3,600 rpm
1.2 amps DC
minimum
To Battery + Terminal
3,600 rpm
2 to 4 amps DC
minimum
for Model 12 Quantum® and Intek® engines
To Battery + Terminal
2,800 rpm
0.5 amps DC
minimum

Typical Dual Circuit Alternator Wiring Diagram
6 Pole Switch – Briggs & Stratton Part No. 493625



Key Switch Test

Switch Position	Continuity
1. OFF	*1 + 3 + 6
2. RUN	2 + 5 + 6
3. START	2 + 4 + 5

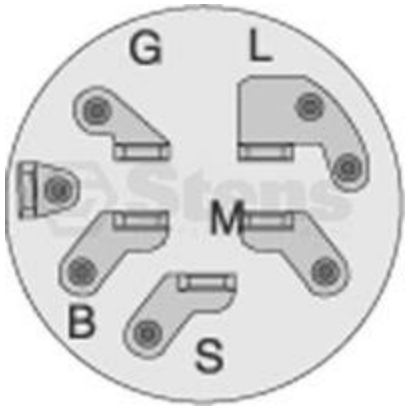
*Terminal 1 Grounded Internally To Key Switch Case

With ammeter shown in optional position, note that – and + symbols are reversed. The + symbol must always be connected to the alternator side.

Terminal No.	Function
1	To Ground (used only with insulated panel)
2	To Carburetor Solenoid.
3	To Stop Switch Terminal On Engine
4	To Solenoid (tab terminal)
5	To Battery (battery terminal on solenoid)
6	To Alternator (DC Output)

Ignition and Electrical System Service

Chapter #15



Ignition System Service

- Performing a Spark Test
- Analyze plug
- Cleaning plug
- Gapping plug
- Plug installation – anti seize

Magneto Service

- Most components can not be serviced
- Inspect flywheel (key)
- Test magnet – should hold an ½” socket
- Air gap between module and flywheel
- Disconnect kill switch wire and recheck
- Some manufactures give directions to check resistant of module and wires – some suggest tell you to replace with known good unit

- Servicing points

- Servicing Battery Ignition Systems

- Distributor Service

Battery Service

- Covered in earlier lesson
- Cause of failure
- Charging
  - Storage
  - Jump starting/jump pack

Checking Starting and Charging System Circuits

- Inductive amp clamp – Charging (alternator) output & starter draw
- Maintenance
  - Brushes
  - Diodes
  - Rectifier

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