244 TRACTOR ELECTRICAL DEMYSTIFICATION GUIDE

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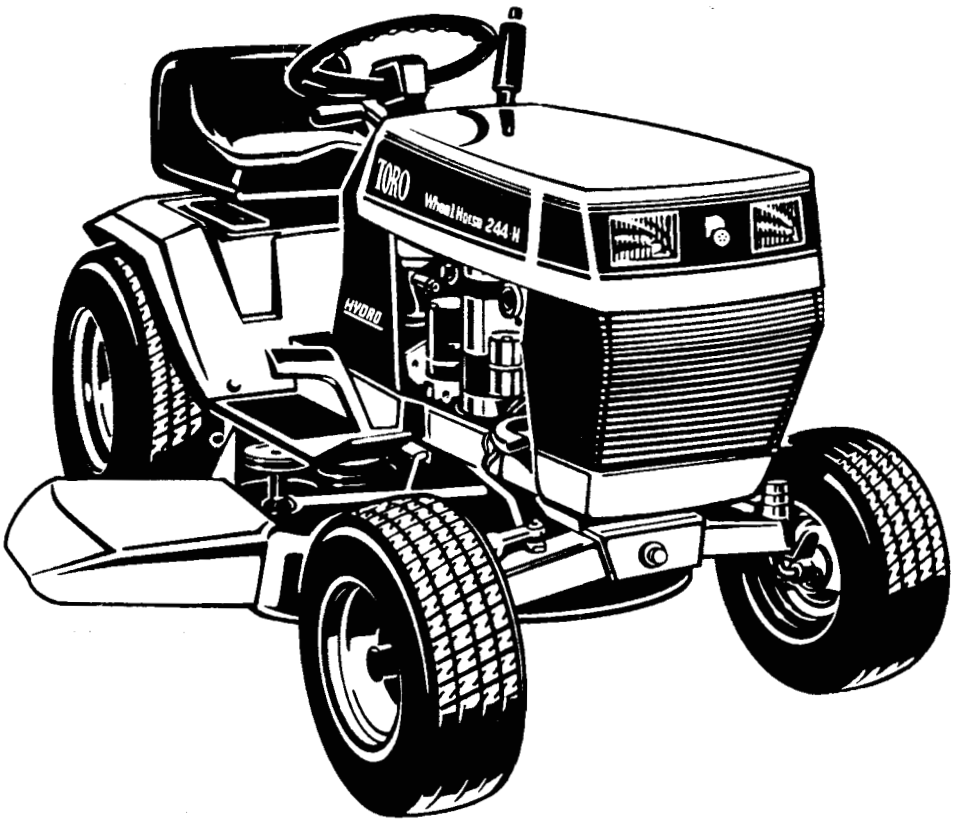
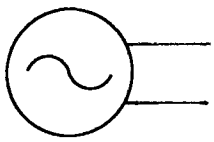


244
ELECTRICAL DEMYSTIFICATION BOOKLET

Contents

Parts List

Alternator



Alternator

Part Number
NN10734

Purpose
To produce current for battery charging, electric clutch and any other electrical accessories on the tractor. Capacity: 20 Amps.

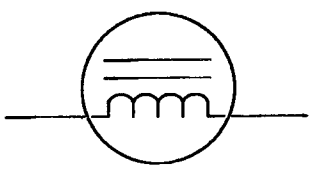
How It Works
The alternator (or stator) is simply a coil of fine wire wrapped on an iron core. As the magnet in the flywheel passes by it, current is produced.

Because a magnet has a north and south pole, half of the current produced is in one direction and half is in the other. This type current is AC or alternating current. There are no electronic components inside, so this alternator relies on an external regulator/rectifier to change the output to DC (direct current.)

Testing
1. Disconnect the two wires coming from the alternator.
2. Start the engine, making sure that the alternator wires do not touch.
3. Measure the voltage across the two alternator leads. If it is within 10% of the voltage called out below, it is OK. Otherwise, go to step 4.
4. With the engine off, measure the resistance across the two alternator leads. It should fall in the range specified below. If not replace the alternator.
5. With the engine off, measure the resistance between one alternator lead and the iron core. It should show infinite resistance (no continuity). Repeat this test for the other alternator lead. If either test shows continuity replace the alternator.

Test	Reading
Voltage @ 1800 rpm	29 Volts
Voltage @ 3600 rpm	57 Volts
Alternator Resistance	0.10 to 0.19 Ohms

Clutch, Electric



Electric Clutch

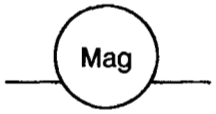
Part Number
78-6990

Purpose
Engages blade.

How It Works
A coil inside the clutch becomes an electro-magnet when energized. This draws the clutch plate to the clutch disk to set the blade turning.

Testing
1. Insure that the gap between clutch plate and clutch disk is .015".
2. Apply twelve volts to clutch wires. Clutch plate should be drawn to disc. If not, check resistance of coil.
3. Connect volt/ohmmeter to clutch wires. Set scale to R X 1. Resistance should be 2.6 - 3.2 ohms. If not, replace clutch coil.

Coil, Ignition



Part Number

NN10730

Purpose

Provides voltage necessary to fire spark plug.

How It Works

Magnets on the flywheel passing by the primary windings in the coil create a changing field around the coil to generate current. A second coil, called the secondary, is also wound around the same iron core. This second coil is used to "step up" the voltage. It uses smaller wire and more windings to do this.

The two coils alone are not enough to produce the 20,000 volts necessary to fire the plug. The trigger module is what actually does the job. The electronic equivalent of points, it breaks the primary circuit just as the magnets are passing by. This causes a VERY rapid change in the field produced by the primary which results in the secondary producing the necessary 20,000 volts.

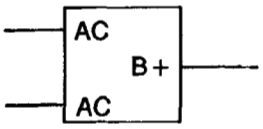
Testing

1. Insure that the flywheel magnets are OK.
2. Insure that core of coil is well grounded.
3. Disconnect kill wire and attempt to start.* If spark is produced, coil is OK.
4. Resistance check: Check primary coil resistance by connecting VOM leadsd to kill wire and iron core. Check secondary coil by connecting between spark plug lead and core. See below for proper resistance.

Test	Reading
Primary Coil Resistance	1.0 ohms
Secondary Coil Resistance	9.5K ohms

*Note: Disconnecting the kill wire will defeat the safety circuit and the key switch. Be sure that unit is in NEUTRAL and the PTO is OFF before starting. To turn off the engine, ground the kill wire.

Regulator, Voltage



Regulator

Part Number

NN10261

Purpose

Rectifies (changes AC current to DC) and regulates the output (limits the voltage) of the alternator. Capacity: 20 amps.

How It Works

Rectification: The full wave current supplied by the alternator is converted to full wave rectified by a bridge rectifier. The result is a pulsating current that never has a below zero value.

Regulation: As mentioned above, the DC provided by the rectifier pulses like AC, but never goes below zero. The regulator takes advantage of the pulses by "lopping" the top off the wave. The result is a lower average voltage.

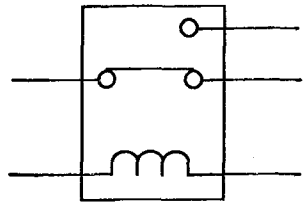
Testing

1. Insure that battery is fully charged and in good condition.
2. Start the engine and measure the voltage at the battery terminals with a voltmeter. It should read between 13.6 and 14.7 volts DC.

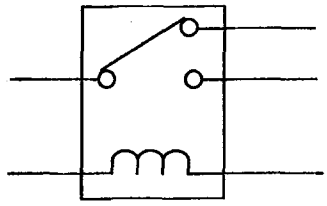
   If Higher: Replace Regulator.

   If Lower: Check for proper ground connections, broken wires or terminals, and/or blown fuses. Start engine and test again. If still lower, check the alternator for proper output.

Relay



Switching Relay (energized)



Switching Relay (not energized)

Part Number

116397

Purpose

Uses current in one circuit to flip a NO (normally open) or NC (normally closed) switch in another independent circuit.

How It Works

A relay is actually two simpler parts working together:

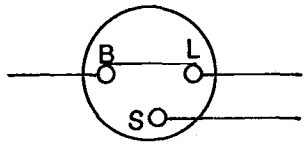
1. **Coil:** Terminals 85 and 86 are connected to a coil. Applying 12 volts to these terminals energizes the coil turning it into an electromagnet.
2. **SPDT Switch:** Terminals 30, 87a and 87 are all actually part of a single pole, double throw switch. Terminal 30 is the common lead. The switch is spring loaded so that 30 and 87a are closed when the coil is not energized. When the coil is energized, the switch is "thrown", and 30 and 87 are connected. For a simpler explanation, see below:

Coil	Terminals 30 + 87	Terminals 30 + 87a
Not Energized	Open	Closed
Energized	Closed	Open

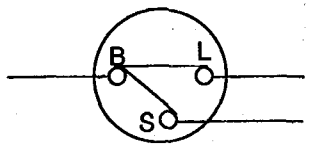
Testing

1. Disconnect the relay from the circuit.
2. Verify the "not energized" conditions above with a volt/ohmmeter.
3. Apply 12 volts to terminals 85 and 86 to energize coil.
4. Verify the "energized" conditions above with a volt/ohmmeter.

Switch, Ignition



Ignition Switch (shown in run position)



Ignition Switch (shown in start position)

Part Number

116338

Purpose

Provides switching for starting and running.

How It Works

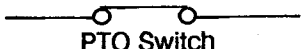
Contacts inside connect various terminals depending on the position of the key. The conditions are as follows:

Position	Connections
Off:	None
Run:	B + L
Start:	B + L + S

Testing

1. Disconnect the switch from the circuit.
2. Use a VOM to verify the above connections.
3. If you are experiencing intermittent problems, be sure to wiggle the key during testing.

Switch, Light



PTO Switch (on)

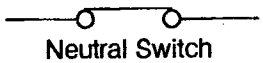
Part Number
102138

Purpose
Provides switching for lights.

How It Works
Contacts inside the switch electrically connect the two terminals.

Testing
Check the resistance between the two terminals with the switch disconnected from the circuit. Resistance should be 0 ohms when on and infinity when off.

Switch, Neutral



Neutral Switch (in neutral)

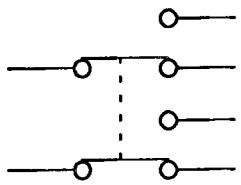
Part Number
115230

Purpose
Determines if shift lever or traction lever is in neutral.

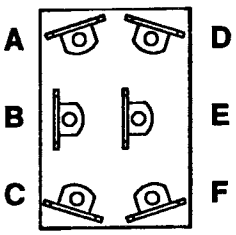
How It Works
Contacts inside the switch electrically connect the two terminals.

Testing
1. Disconnect the switch from the circuit.
2. With the unit in neutral, the switch should be closed (0 resistance.)
3. With the unit in gear, the switch should be open (infinite resistance.)
4. If either of the conditions is not met, replace the switch.

Switch, PTO



Switch
(D.P.D.T.)



Part Number

78-3030

Purpose

Provides switching for two circuits: PTO clutch and the safety circuit. Handle on switch requires the operator to provide two step input to help prevent accidental engagement.

How It Works

Contacts inside the switch electrically connect various terminals. This switch is a double pole, double throw (DPDT) switch. Here's what this fancy terminology means:

Double Pole: Think of this as the number of input lines. Notice that the switch shown at left has two input lines.

In most applications, Toro makes use of the two input lines, by placing pole in the PTO circuit, and the other half in the safety circuit.

Double Throw: Think of this as the number of outputs lines per pole. Notice that this switch has two per pole.

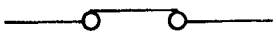
The double throws give this switch the versatility to be used as a NO (normally open) or NC (normally closed) switch. This is advantageous in our tractor applications, because the NC portion is used in the safety circuit, while the NO portion is used in the PTO circuit.

Testing

Disconnect the switch from the circuit and verify the following connections with a volt/ohmmeter.

Switch Position	Connections
Off (lever down):	A + B, D + E
On (lever up) Run:	B + C, E + F

Switch, Seat



Seat Switch
(operator on)

Part Number

114240

Purpose

To close switch when operator sits on seat.

How It Works

The switch is open without an operator and closed with an operator.

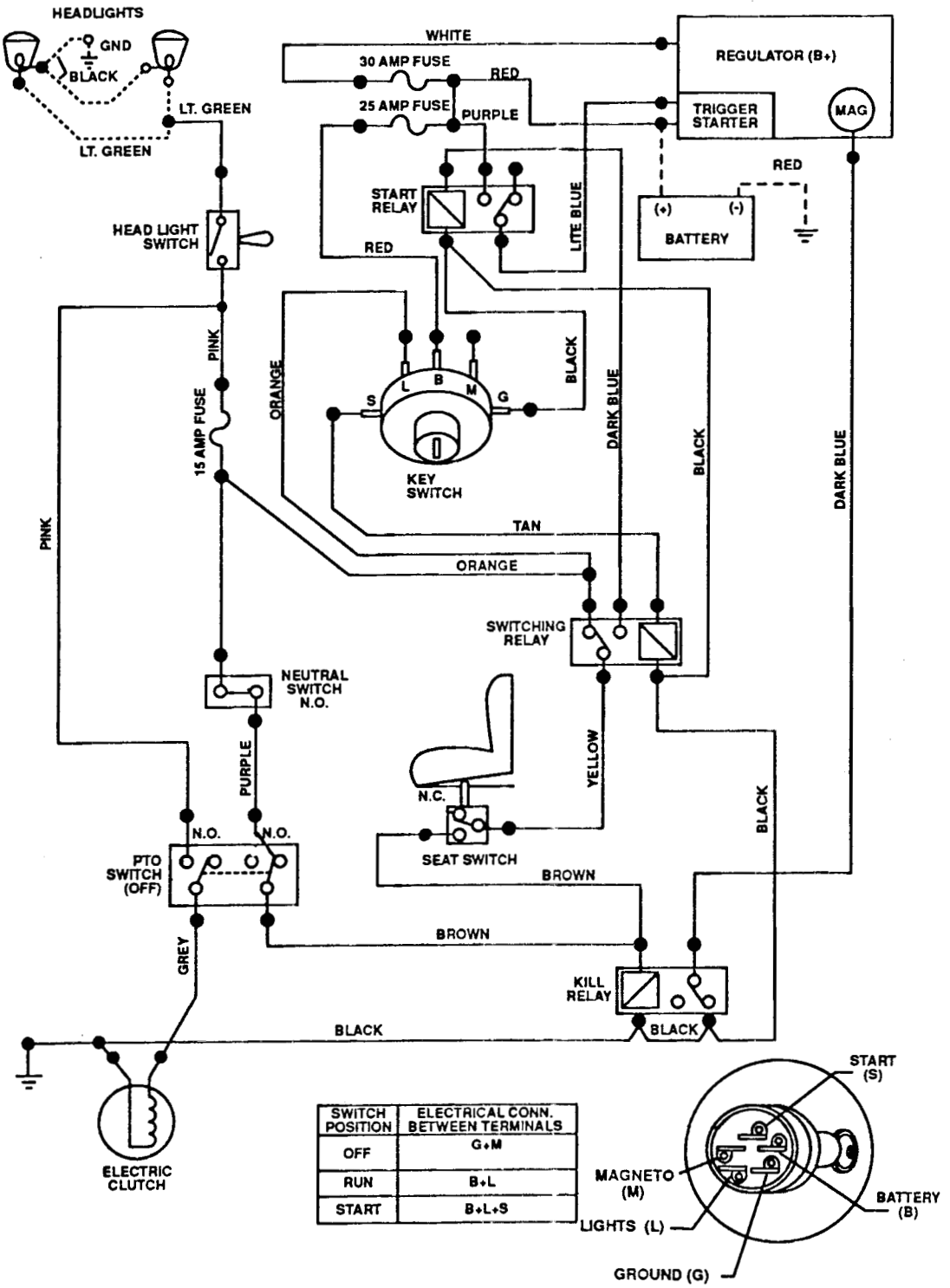
The ribbon operates a friction type mechanism which, in turn, activates the switch. A removable cover provides access to the switch contacts.

Note: Because of the friction mechanism, it is possible to get false readings with the switch removed from the seat. Perform testing with the switch in place.

Testing

Use a volt/ohmmeter to test for continuity.

1. Disconnect the switch from the circuit.
2. Leave the switch installed in the seat as false readings are possible if it is removed.
3. The switch should test open (infinite resistance) without anyone on the seat and closed (0 resistance) with an operator. If not, replace the switch.

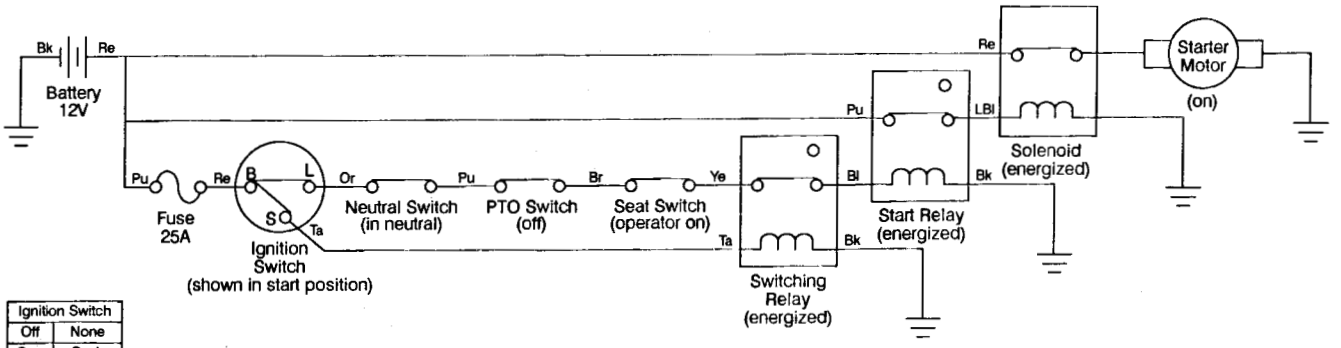


SWITCH POSITION	ELECTRICAL CONN. BETWEEN TERMINALS
OFF	G+M
RUN	B+L
START	B+L+S

Circuit Diagrams

Starter Motor Circuit

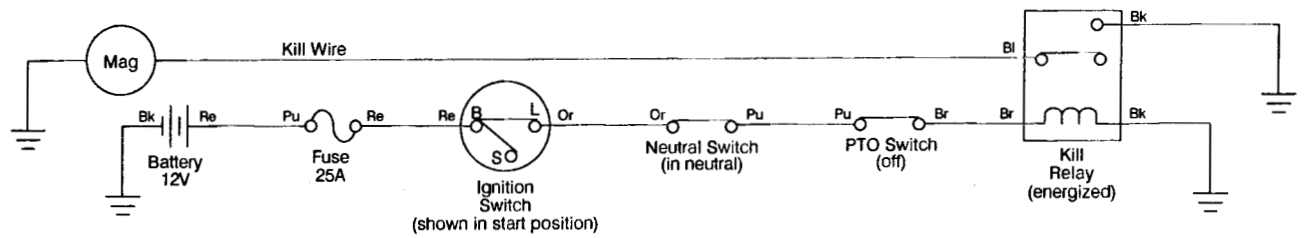
(ignition switch in start position)



Ignition Switch	
Off	None
Run	B+L
Start	B+L+S

Spark Circuit

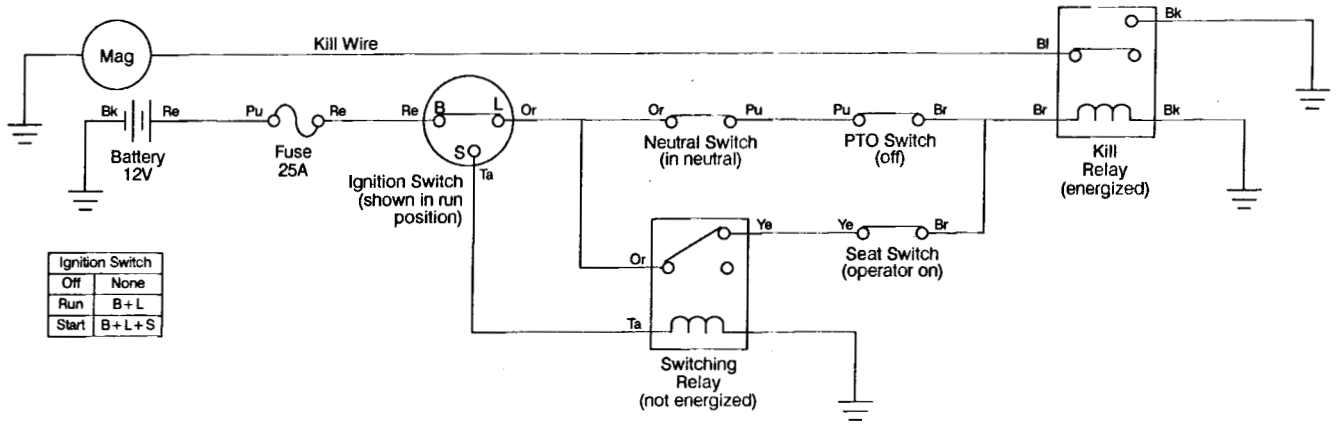
(ignition switch in start position)



Ignition Switch	
Off	None
Run	B+L
Start	B+L+S

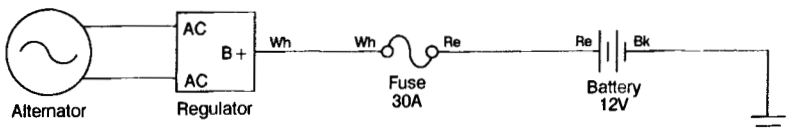
Legend	
Black	Bk
Blue	Bl
Brown	Br
Green	Gn
Grey	Gr
Light Blue	LBl
Orange	Or
Pink	Pi
Purple	Pu
Red	Re
Tan	Ta
White	Wh
Yellow	Ye

Spark Circuit
(ignition switch in run)



Ignition Switch	
Off	None
Run	B+L
Start	B+L+S

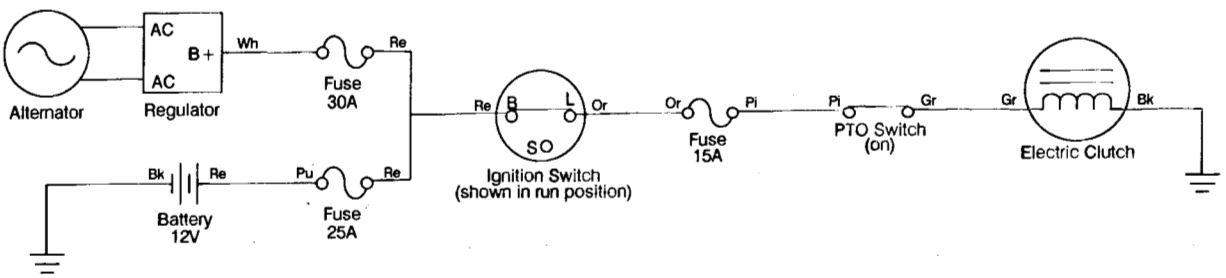
Charging Circuit



Legend	
Black	Bk
Blue	Bl
Brown	Br
Green	Gn
Grey	Gr
Light Blue	LBl
Orange	Or
Pink	Pi
Purple	Pu
Red	Re
Tan	Ta
White	Wh
Yellow	Ye

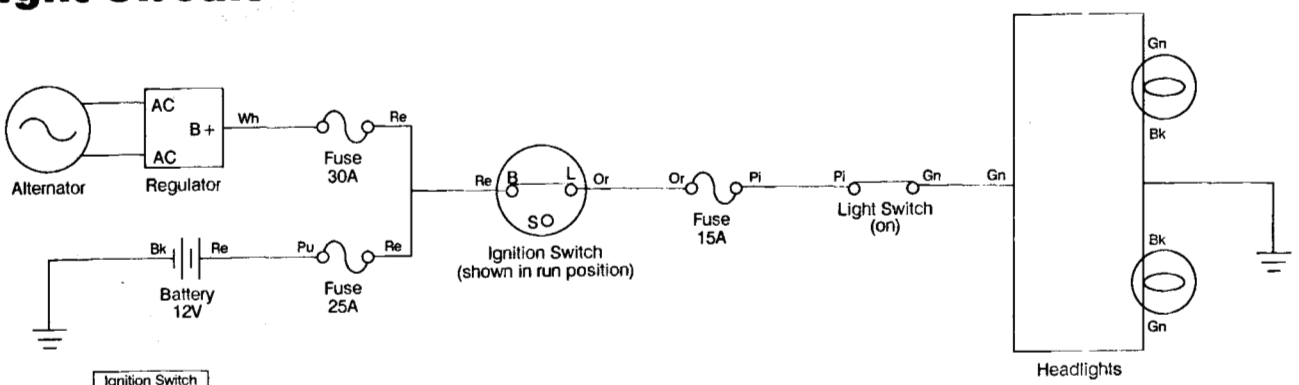
Circuit Diagrams

Electric Clutch Circuit



Ignition Switch	
Off	None
Run	B+L
Start	B+L+S

Light Circuit



Ignition Switch	
Off	None
Run	B+L
Start	B+L+S

Legend	
Black	Bk
Blue	Bl
Brown	Br
Green	Gn
Grey	Gr
Light Blue	LBl
Orange	Or
Pink	Pi
Purple	Pu
Red	Re
Tan	Ta
White	Wh
Yellow	Ye