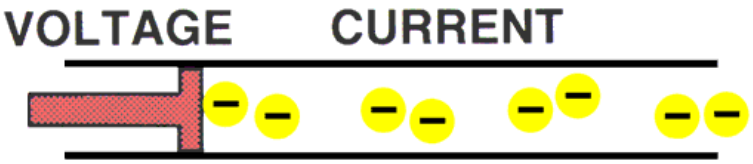
WELCOME TO GREAVES COTTON LIMITED

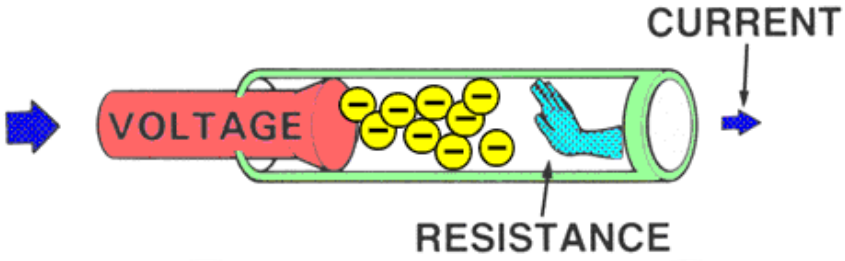
BASIC LEVEL TRAINING ON GENSET

TRAINING COURSE CONTENT

1) Basics of Electrical.
2) Basics of Generator
3) Components of Generator & their functions
4) Minor troubleshooting

BASICS OF ELECTRICAL

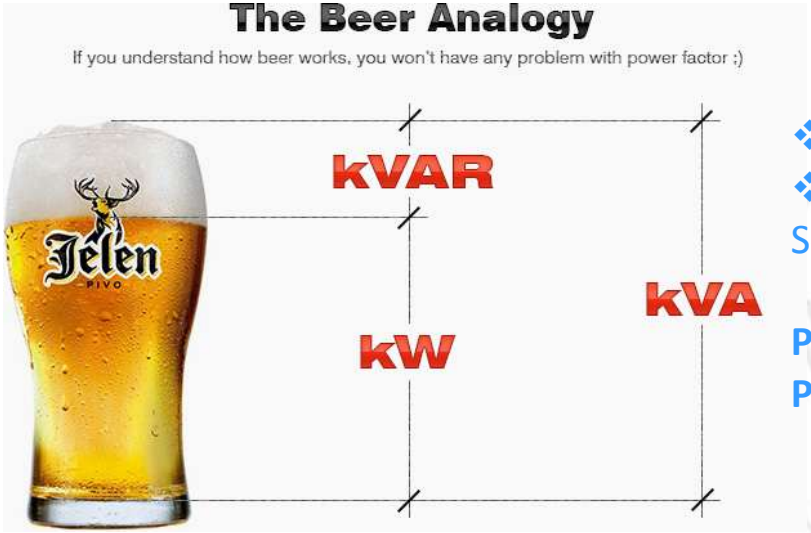




Refer below website to make participants understand basic electrical

http://www.bbemg.be/files/EN/BNelectricity.html

POWER FACTOR



- The total contents of mug = KVA,
- KVA is summation of KW (***the beer***) and KVAR (***the foam***).

So, now that we understand some basic terms,

Power Factor (P.F.) is the ratio of Working Power to theoretical Power

$$P.F. = \frac{KW}{KVA}$$

To understand power factor, understand definition of some basic terms:

- **kW** is **Working Power** (also called Actual Power or Active Power or Real Power). It is the power that actually powers the equipment and performs useful work.
- **kVAR** is **Reactive Power**. It is the power that magnetic equipment (transformer, motor, relay etc.) needs to produce the magnetizing flux.
- **kVA** is **theoretical Power**. It is the sum of KVAR and KW.

GENERATOR

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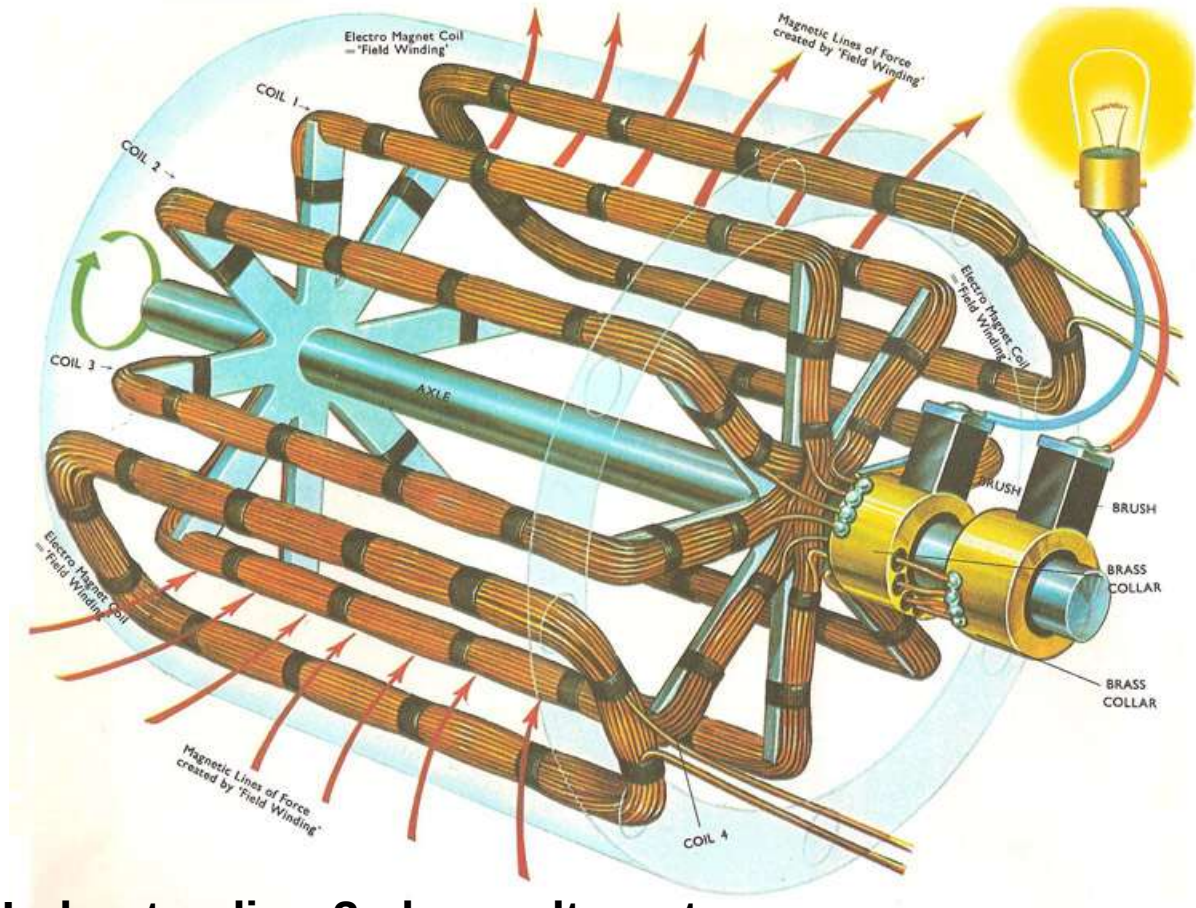

Understanding 3 phase alternators....
http://www.dnatube.com/video/11775/How-AC-Generators-Work

http://www.windstuffnow.com/main/3_phase_basics

GENERATOR

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BASICS OF ELECTRICAL

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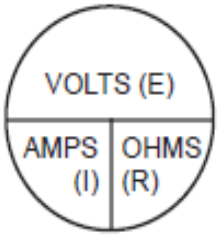
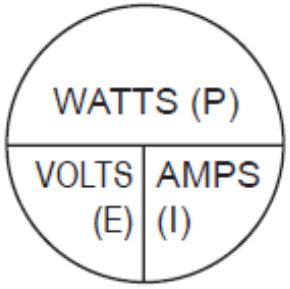
MEASURING UNIT - SYMBOL	EQUATIONS	RELATION OF UNITS*
CURRENT FLOW - AMPERES = I DIFFERENCE ON POTENTIAL - VOLTS = E RESISTANCE - OHMS = R	AMPERES = $\frac{\text{VOLTS}}{\text{OHMS}}$ VOLTS = AMPERES X OHMS OHMS= $\frac{\text{VOLTS}}{\text{AMPERES}}$	

CURRENT FLOW IN A CIRCUIT IS DIRECTLY PROPORTIONAL TO THE VOLTAGE AND INVERSELY PROPORTIONAL TO THE RESISTANCE.

WATTS - THE MEASURING UNIT OF ELECTRICAL POWER



EQUATIONS

WATTS = VOLTS x AMPERES

AMPERES = $\frac{\text{WATTS}}{\text{VOLTS}}$

VOLTS = $\frac{\text{WATTS}}{\text{AMPERES}}$

ESTIMATING ELECTRICAL LOAD

- To estimate electrical load, total the wattage of all the Equipment customer operate at one time.
- The wattage needed to run a given piece of equipment is usually listed on its Name plate.
- If only amperage is listed, use this formula to figure wattage:
- **Amps x Volts = Watts (Single Phase)**
- **Amps x Volts x 1.73 = Watts (Three Phase)**

GLOSSARY ELECTRICAL TERMS

1) **AC** -Alternating current, which varies from zero to a positive maximum to zero to a negative maximum to zero, a number of times per second, the number being expressed in cycles per second or **Hertz.**

2) **Alternator** - A generator which produces alternating current.

3) **Capacitor** - A device capable of storing electric energy consisting of tow conducting surfaces separated by an insulating material. It blocks the flow of direct current while allowing alternating current to pass.

4) **Circuit** - A path for an electric current.

5) **Circuit Breaker** - A switching device for opening and closing an electric circuit.

6) **Conductor** - A wire or cable for carrying current.

7) **Diode** - A two terminal solid-state device which allows current to flow in one direction, but not in the other.

GLOSSARY ELECTRICAL TERMS

1) **Distribution panel** - The output of a generator is supplied to the distribution panel, where it is divided for supplying different loads. Generally contains circuit breakers and protective devices.

2) **Double pole switch** - A switch which opens or closes two circuits at the same time.

3) **Double throw switch** - A switch which has a normally open and a normally closed contact with a common terminal.

4) **Excitation** - The input of DC power into the field coils of a synchronous generator, producing the magnetic flux required for inducing voltages in the armature coils.

5) **Exciter** - A device for supplying excitation to generator fields. It may be a rotating exciter, that is a DC generator or AC generator with rectifiers, or it may be a static device using solid-state components.

6) **Exciter current** - The field current required to produce rated voltage at rated load and frequency.

7) **Exciter voltage** - The voltage required to cause the exciter current to flow through the field winding.

GLOSSARY ELECTRICAL TERMS

1) **Frequency** - The number of complete cycles of an alternating voltage of current per unit of time, usually per second. So expressed in CPS, cycles per second, or Hertz (hz).

2) **Hunting** - A phenomenon occurring upon load changes, in which the frequency or the voltage continues to rise above and fall below the desired value and does not reach a steady-state value. Caused by insufficient damping.

3) **KVA** - 1000 volt amperes

4) **KW** - Unit of electric power, equal to 1000 watts

5) **KW hr.** - One KW of electric power used for 1 hour. Unit of electric energy.

6) **Megger** - A high range ohmmeter having a built-in hand operated generator used for measuring insulation resistance.

GLOSSARY ELECTRICAL TERMS

1) **Parallel connection** - An electrical connection in which the input electrode of one element is connected to the input electrode of another element, and the output electrodes are similarly connected together, thereby providing two paths for current flow.

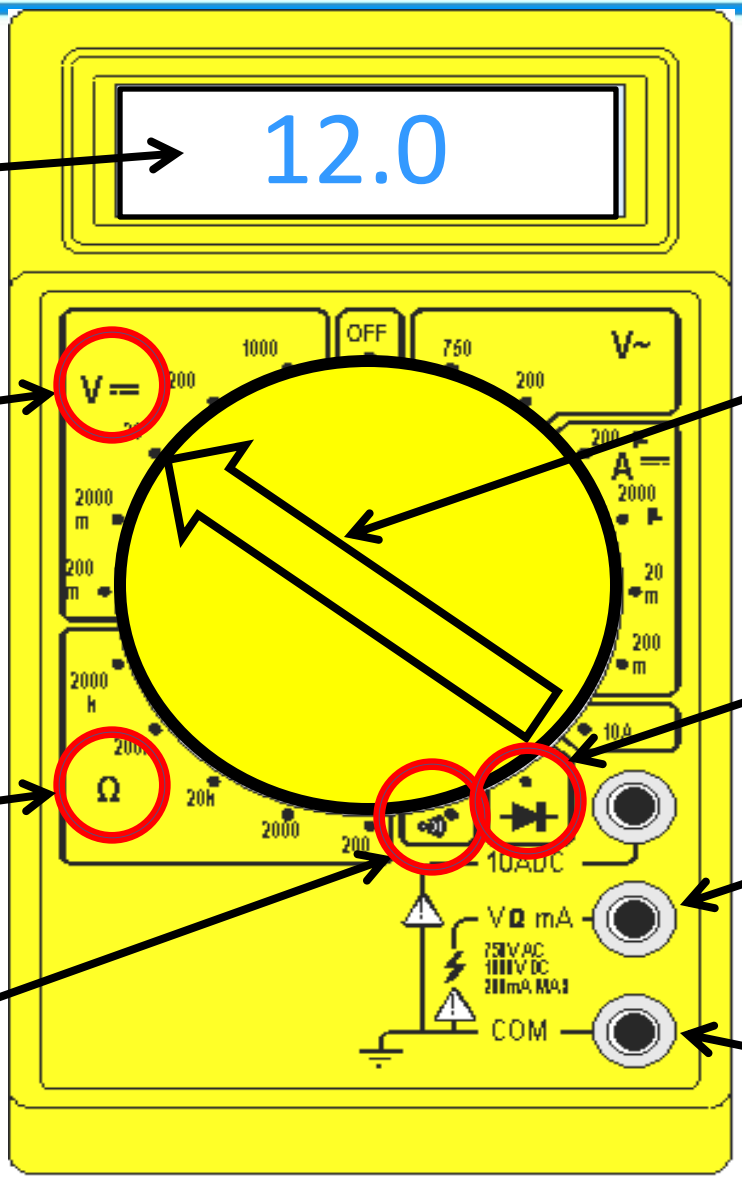
2) **Parallel operation** - Two or more generators of the same voltage and frequency characteristics connected to the same load.

3) **Paralleling** - The procedure used to connect two or more generators in parallel, that is, connect them to a common load.

4) **Phase** - The windings of an AC generator. In a three phase generator there are three windings with their voltages 120 degrees out of phase, meaning that the instants at which the three voltages pass through zero or reach their maximums are 120 degrees, if one complete cycle is considered to contain 360 degrees. In single-phase generators, only one winding is present.

5) **Pole** - A part of a magnetic structure, there being two such parts called a North pole and a South pole.

MULTIMETER



Display

DC Voltage

Range selector

Diode checking

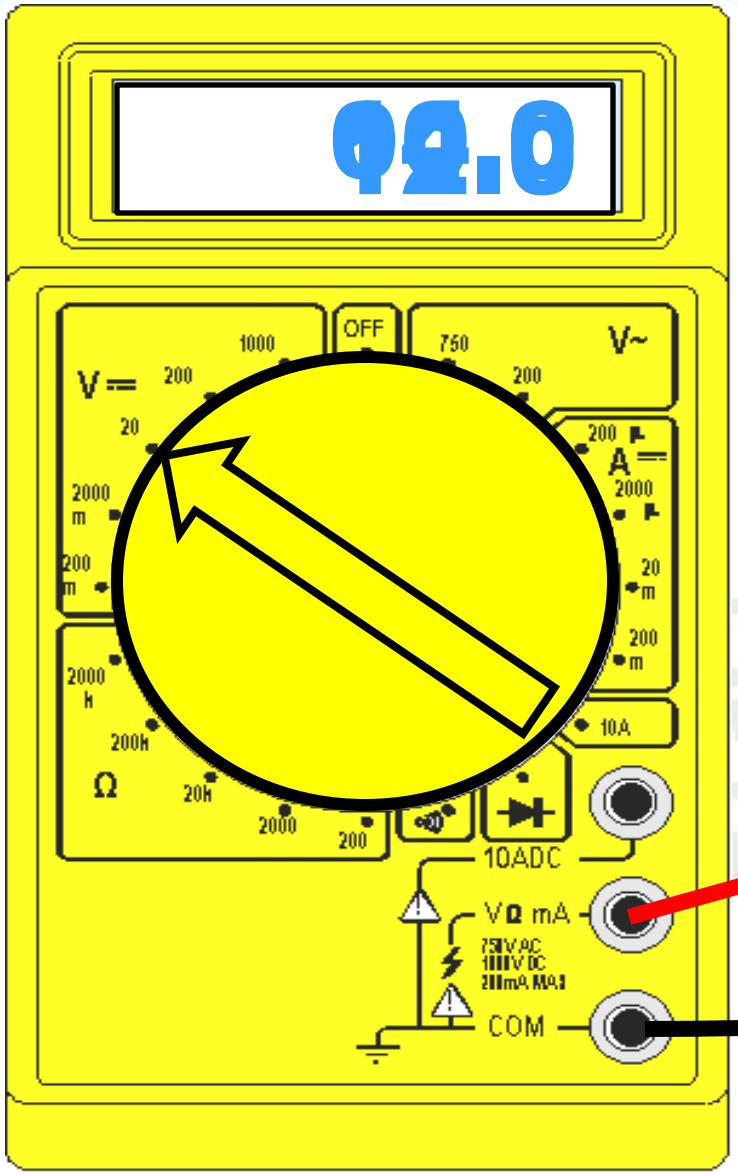
Resistance

Measuring terminal for V, I & R

Continuity

Ground Port

CHECKING VOLTAGE



1. Fix up both measuring probe in proper measuring terminals.
2. Set the red probe to the positive end of terminal
3. Set the black probe to the negative end of terminal.
4. Check the display for the reading
5. If engine is in stop condition reading should be 12 V
6. If engine is in running condition reading should be 14 V

QUICK & EASY STEPS FOR TROUBLESHOOTING

3 basic points for functioning of any electrical circuit

B : Battery…….. Supply directly from battery/power source

I : Ignition …….. Supply when Ignition turns to ON position

E : Earth…….. Ground /negative/ 0 voltage point

RELAY WORKING

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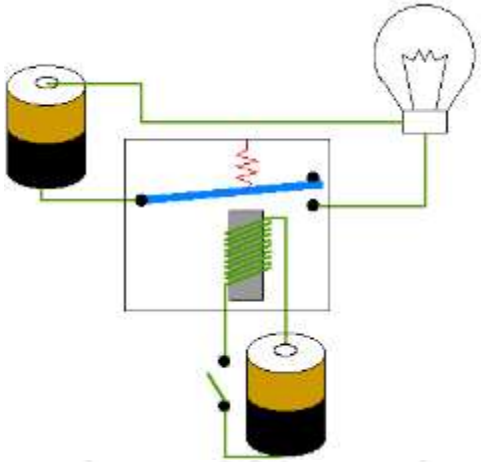
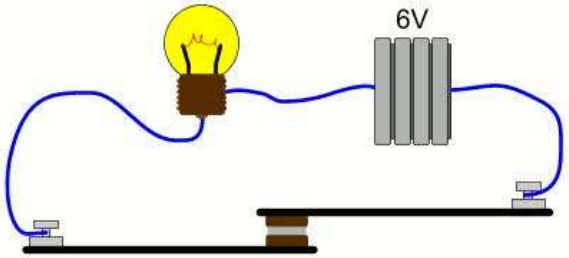
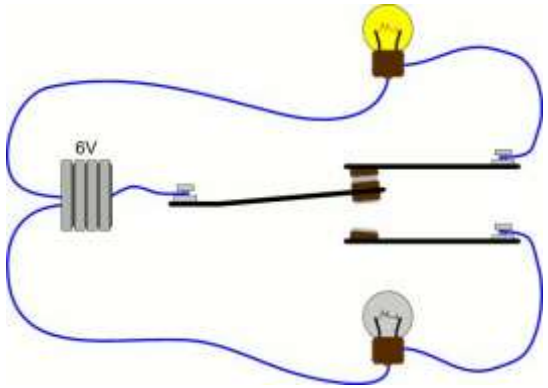


Normally Open relay

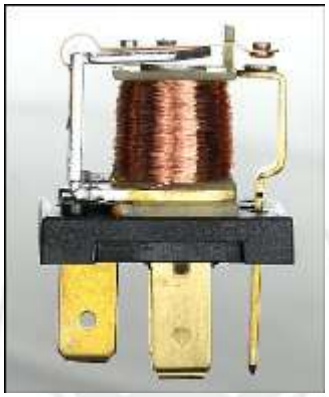


Normally Open cum close relay

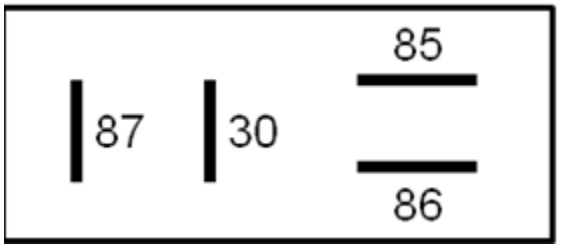


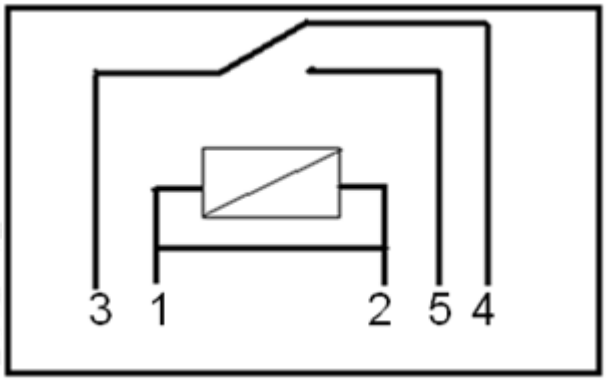
RELAY

85 &86 - Coil Point
30 & 87 - Switch point
30 - Pole (Power Supply)
87 - Normally Open



1 & 2- Coil Terminals
3 - Pole (Power Supply)
4 - Normally close
5 – Normally open





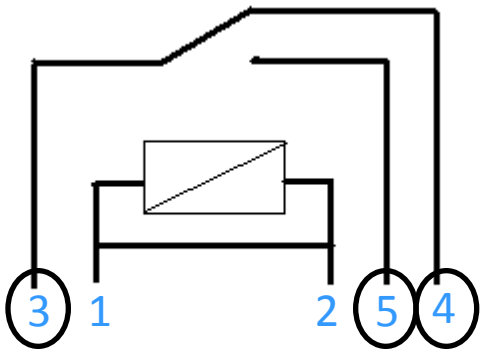
CHECKING RELAY FOR CONTINUITY

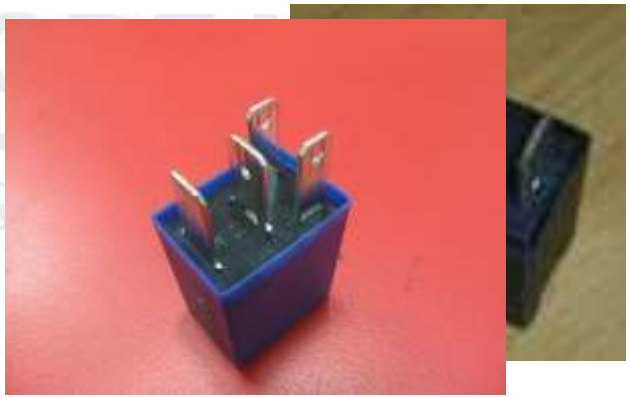
Keep the multimeter in the continuity mode and check mode.

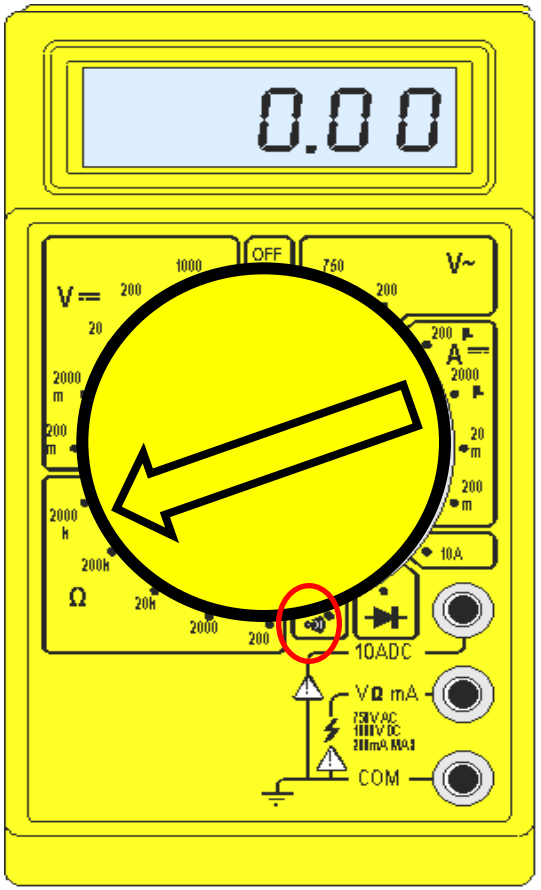
Checking continuity between the switch point N/O & N/C Relays

- In blue color relay there will be continuity between N/O switch point (85 & 86) & No continuity b/w 30 & 87

- In black color relay there will be continuity between N/C switch point (3 & 4) and No continuity between N/O switch point (3 & 5)

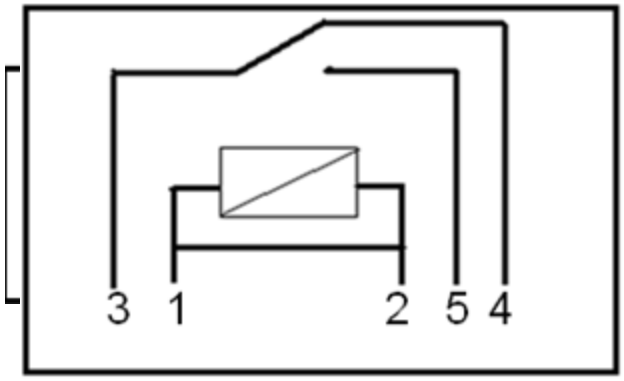


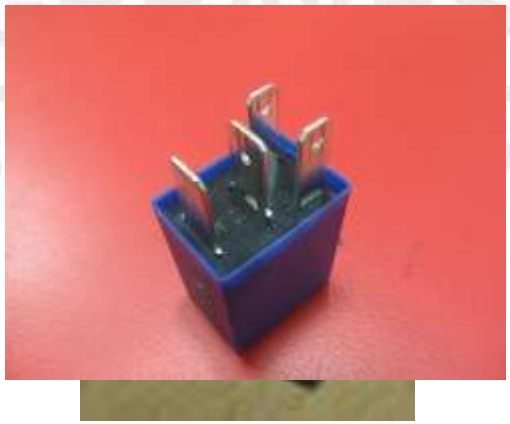


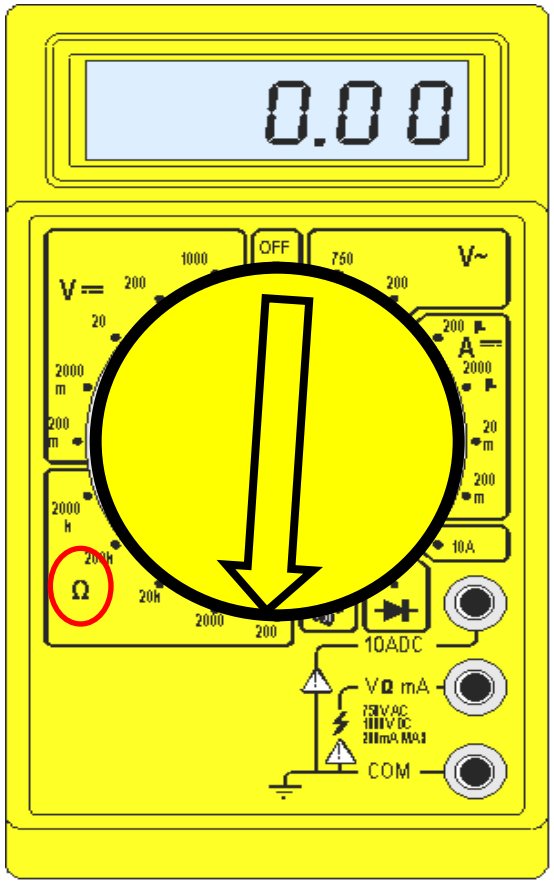


CHECKING RELAY FOR RESISTANCE

- Keep the multimeter in the resistance mode.
- Measure the resistance of the relay coil point.
- In blue color relay 85 & 86 is the coil point
- In black color relay 1 & 2 is the coil point
- Ensure whether it is matching to the value stated by the manufacturer.







UNDERSTANDING BASIC CIRCUIT

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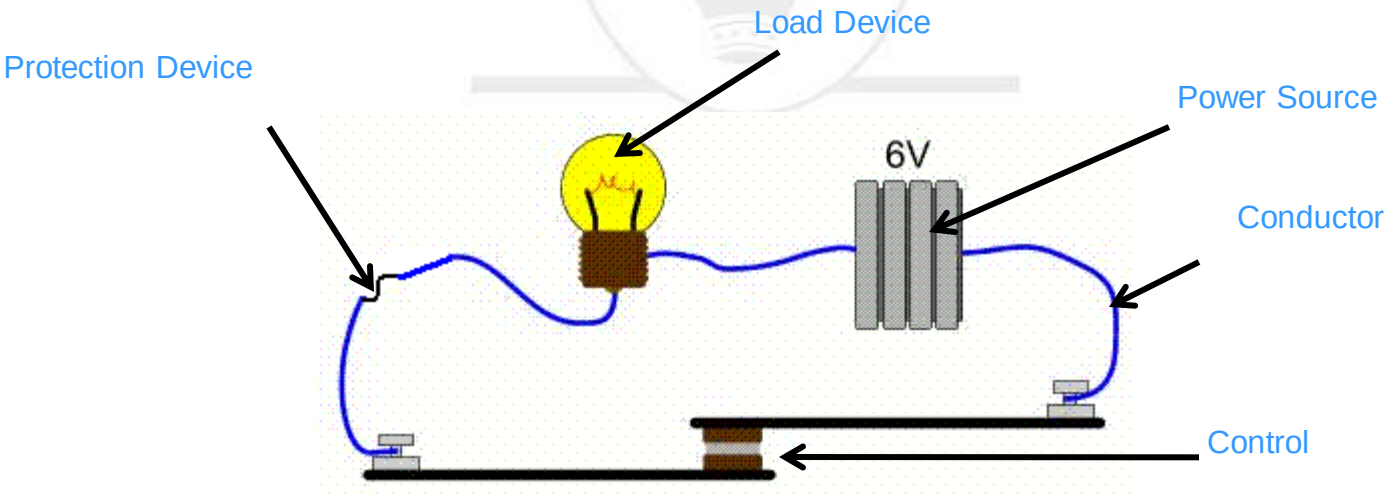
BASIC CIRCUIT CONSTRUCTION

1) Power Source (Battery, Alternator, Generator, etc.)
2) Protection Device (Fuse, Fusible Link, or Circuit Breaker)
3) Load Device (Lamp, Motor, Winding, Resistor, etc.
4) Control (Switch, Relay, or Transistor)
5) Conductors (A Return Path, Wiring to Ground)



BASICS OF ELECTRICAL

Purpose of Battery:

- Provide Electrical energy to the Vehicle electrical system.
- Supply power to the starter and ignition system to crank the engine.
- Supply extra power when the equipment load exceed the supply from the alternator.
- Acts as a voltage stabilizer in the electrical system.

MAINTENANCE TIPS FOR BATTERY

- Secure the battery firmly on the cradle.
- Ensure the cable terminals tightly fitted on the battery posts.
- Do not hammer down terminals onto posts.
- Keep the battery top clean and dry.
- Clean the terminals and the posts regularly to avoid corrosion.
- Apply Petroleum jelly / Vaseline on the terminals and posts. never apply grease.
- Top up only with distilled water and maintain the level corresponding to the maximum level, never add Acid.
- Keep vent plugs tightly closed.
- Ensure the fan belt tension.

BATTERY TERMINALS SHOULD BE PROTECTED FROM CORROSION

CHECKING BATTERY SPECIFIC GRAVITY WITH MULTI METER

Hydrometer

Specific Gravity Checking

Specific Gravity Value :-

1.270-1.240 (Yellow Region)– Fully Charged

1.240-1.200 (Blue Region) – 70% Charged

1.200- and below (Red Region) – Needs Recharge

ALTERNATOR

- An Alternator is a machine that converts mechanical energy to Electrical energy
- The Alternator output is used to charge the battery.
- The inbuilt Rectifier converts the A.C output to D.C.
- The inbuilt Regulator controls the output and it depends on the battery charge status .
- The capacity of the Alternator for a vehicle / equipment is decided based on the total electrical loads of the vehicle.
- Initial excitation of Rotor field from battery through charge warning lamp creates magnetic flux in the Rotor.
- Rotor rotation produces rotating magnetic flux.
- A.C. output induced in Stator winding.
- Rectification by Positive & Negative main diodes for battery charging.
- Rectification by Auxiliary diodes for field excitation.
- Output controlled by the in-built Regulator

EXPLODED VIEW OF ENGINE ALTERNATOR

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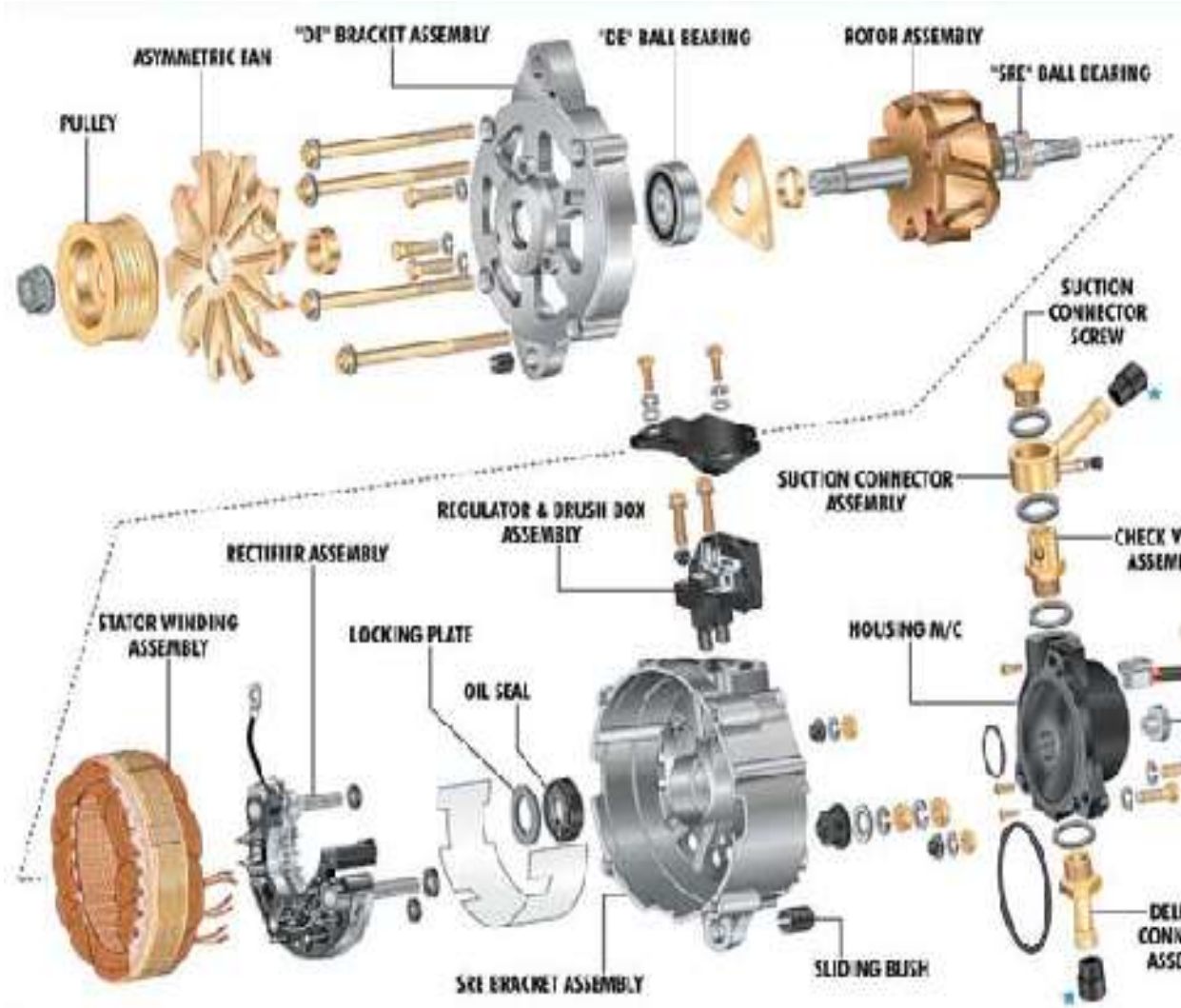

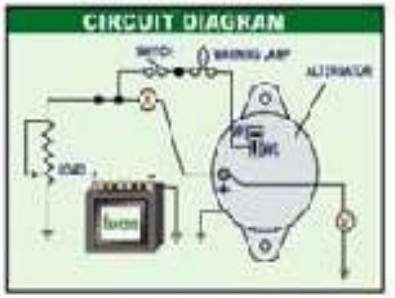

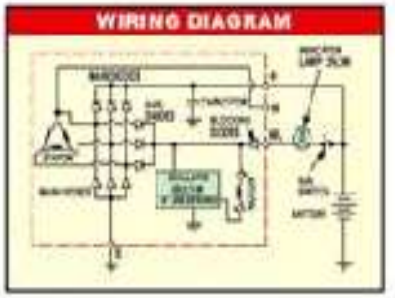

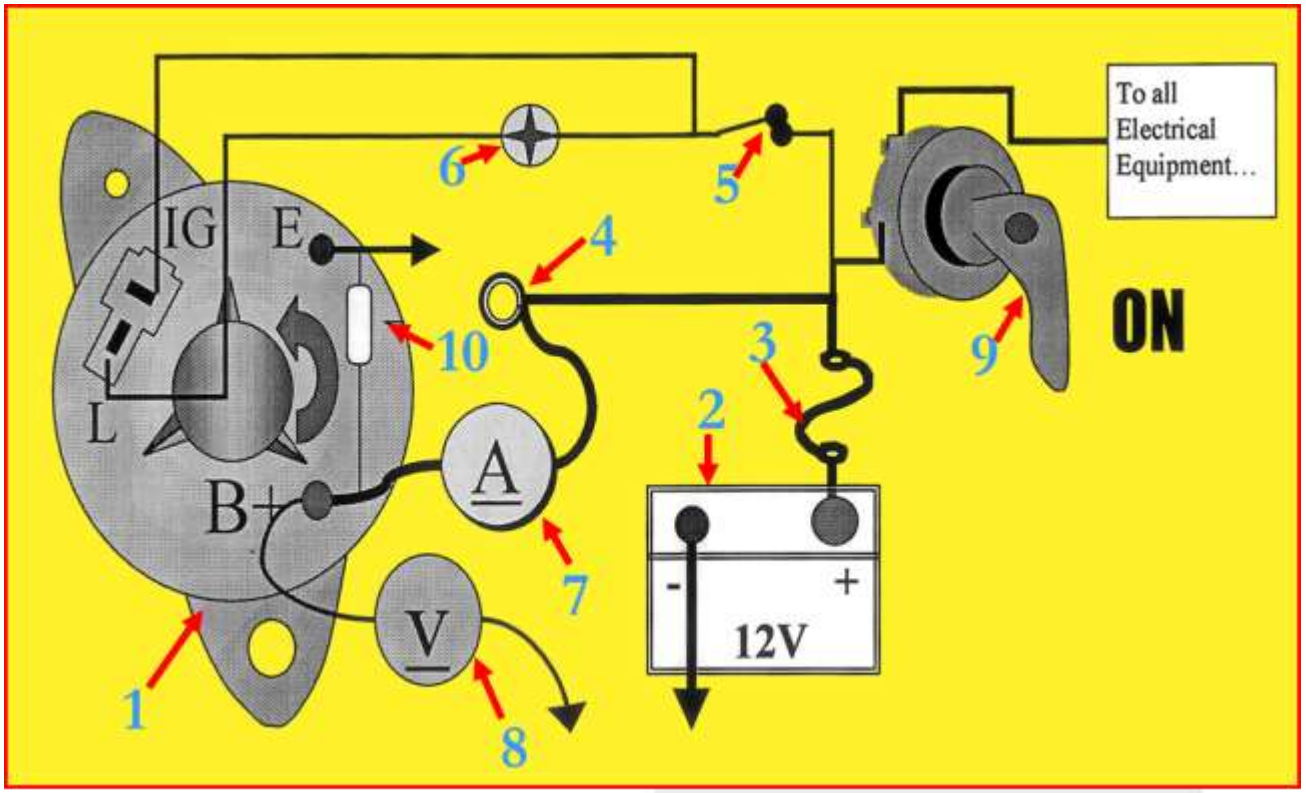

1. Alternator
2. Battery
3. Fuse Link
4. B+Lead
5. Ign. Switch
6. Charge Warning lamp
7. Ammeter
8. Volt Meter
9. Switch Electrical Load
10. Radio suppression capacitor

- Put Clamp Meter on the negative cable of the battery.
- Connect Volt Meter to B+ on alternator and chassis.
- Switch on all electrical loads except Heater and Wiper motor.
- Run Alternator at maximum engine r.p.m. and read Ammeter and Volt Meter.

ALTERNATOR DO'S AND DONT'S

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DO's

- ✓ Observe correct Polarity when refitting vehicle Battery, or slave Battery to aid starting. Always Battery (-) to earth.
- ✓ Use Multi meter or test lamp to check continuity of wiring.
- ✓ Keep the Engine off when you disconnect or reconnect wiring during electrical service.
- ✓ Isolate Alternator while carrying out electric welding on the vehicle
- ✓ Use special tester for checking electronic Regulator and Multimeter for Diodes

Don'ts

- × Don't run the Alternator without the Battery in the system.
- × Don't flash the Alternator output leads to check output.
- × Don't disconnect Battery cable or charging system wiring while the Engine is running.
- × Don't use high voltage instrument like Meggar on Alternator or wiring for insulation check.
- × Don't run Alternator integral with Vacuum pump without oil for more than a minute.

ALTERNATOR TEST ON EQUIPMENT WITH CLAMP / MULTI METER

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Charging Voltage without Load

Spec: 14.0 ± 0.2 volts
Depends on Battery charge status

Charging Voltage with Load

Readings may vary depends on Battery charge status

FAULT DIAGNOSIS - ALTERNATOR

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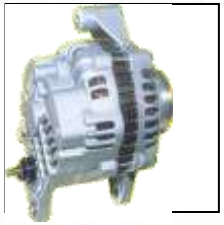
S.No.	Defect	Procedures	Check Points	Corrective Actions
1	Frequent discharge of battery	1. Connect a voltmeter across the Alaternator positive and negative terminals. 2. Switch OFF all the vehicle loads. 3. Raise the engine speed to about 2500 rpm.	If the voltage is found between 14.2 ± 0.4 volts	1. Remove the battery from the vehicle for bench charging. 2. Check for any leakage on the vehicle wiring.
			If the voltage is below the above reading check for loose / worn-out fan belt.	Tighten / Replace fan belt.
			If the fan belt is found OK	Remove the Alternator from the vehicle for further inspection.
2	Warning lamp does not glow when the ignition switch is ON	1. Remove the WL socket from the Alternator, 2. Ground the Warning Lamp wire (Wiring Harness Side)	If the bulb does not glows	Check & replace the WL circuit fuse or bulb.
			If the bulb glows	Remove the Alternator from the vehicle for further inspection.
3	Warning bulb glows dim when the ignition switch is ON	1. Remove the WL socket from the Alternator, 2. Use a separate WL bulb and connect between the Alternator WL terminal and the battery positive	If the bulb glows brightly and goes of after starting	Check the WL ciruit wiring on the vehicle. Check for defective dasboard panel or WL bulb holder.
			If the bulb glows dim	Remove the Alternator from the vehicle for further inspection.
4	WL bulb glows while the vehicle is running	1. Remove the WL socket from the Alternator. 2. Use a separate WL bulb and connect between the Alternator WL terminal and the battery positive	If the bulbs glows	Check for loose fan belt if found OK, Remove the Alternator from the vehicle for further inspection.
5	WL bulb flickers while the vehicle is running	1. Remove the WL socket from the Alternator. 2. Use a separate WL bulb and connect between the Alternator WL terminal and the battery positive	If the bulb flickers	Remove the Alternator from the vehicle for further inspection.
			If the flickering not found	Check and rectify the WL wiring
6	Battery gases and excess lose of electrolyte	Connect a voltmeter across the battery positive and negative terminals	If the voltage is more than 14.2 ± 0.4 volts	Remove the Alternator from the vehicle for further inspection.
			If found within the above reading	Check the battery for internal damage

Fault Diagnosis
Charging System



Warning lamp does not appear when ignition switch is '*ON*'.

Warning lamp glows dim when ignition switch is *'ON'*

Warning lamp '*ON*' while engine is running and no output.

Warning lamp reamins '*OFF*' while engine is running & reduced output.

Warning lamp flashes and ammeter flickers.

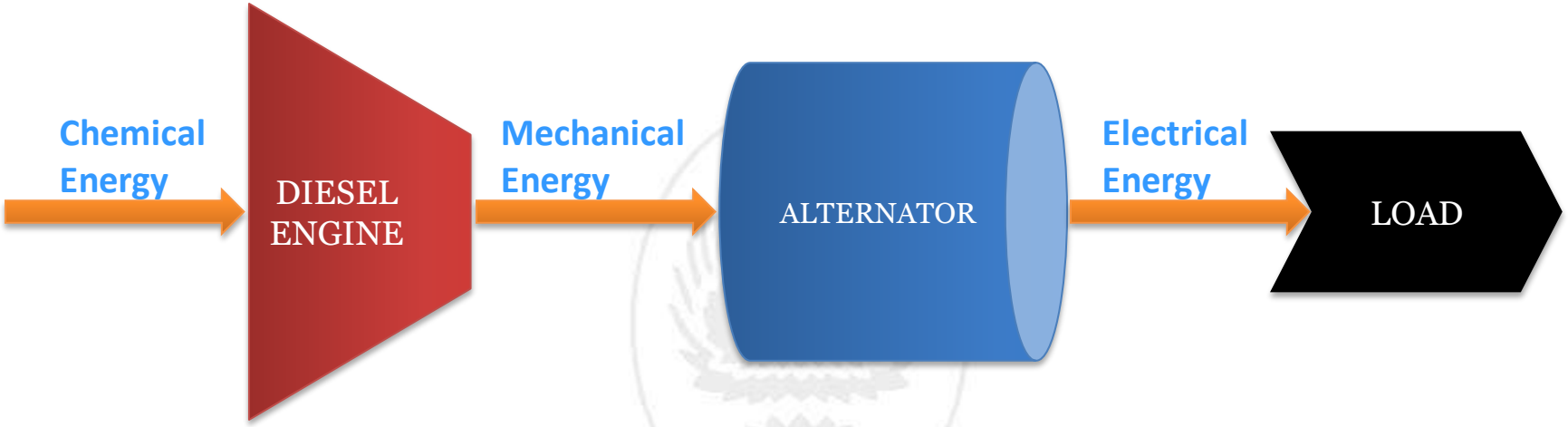
Warning lamp '*ON*' or '*DIM*' while engine is running but ammeter indicates charging.

Battery overcharging (pungent acid smell) & constant high output.

Fault	Cause	Check & Correct
● ●	Battery in poor state of charge.	Switch on loads. Check battery specific gravity & cell voltage. Replace if necessary.
● ●	Warning lamp bulb fused.	Replace with new bulb.
● ●	Bad connections.	Check for loose / rusty connections. Clean-up if found dirty
●	Fuse blown.	Replace fuse.
● ● ●	Loose belt.	Tighten the belt to the limits (deflection 8 to 12 mm).
● ●	Battery open circuit or ignition switch defective.	Ensure correct connections for battery circuit. Replace ignition switch if necessary.
● ●	Aux. Diode lead "A" open.	Check diode connections; repair if necessary.
● ●	Rotor short / earthed.	Trace fault; rectify or replace rotor if necessary.
● ● ● ● ●	Stator open / short.	Replace stator assy if necessary.
● ● ● ●	Faulty rectifier bridge.	Replace defective heatsink assy.
● ● ● ●	High resistance in the warning lamp.	Check connection and ensure use of recommended wire.
● ● ● ●	Slip ring dirty / jammed brush.	Clean the slip ring & brush box and re-check. Free the brushes
● ● ● ● ●	Faulty regulator	Check with ART-D and replace if necessary.
● ●	Reconditioned rotor; difference in OD.	Check clearance between rotor, stator & claw fingers; replace if not within spec.
●	High resistance in -ve line	Check -ve main terminal.
● ●	Improper "regulator lead earthing".	Ensure correct earthing asper circuit.
●	Auxliary diode open. Main diode short / open	Check diodes; replace if necessary.

Note : The 'dots' denote the fault appearing in the corresponding (vertical) column and the cause & corrective action to be carried out as mentioned in that (horizontal) row.

GENERATOR SET



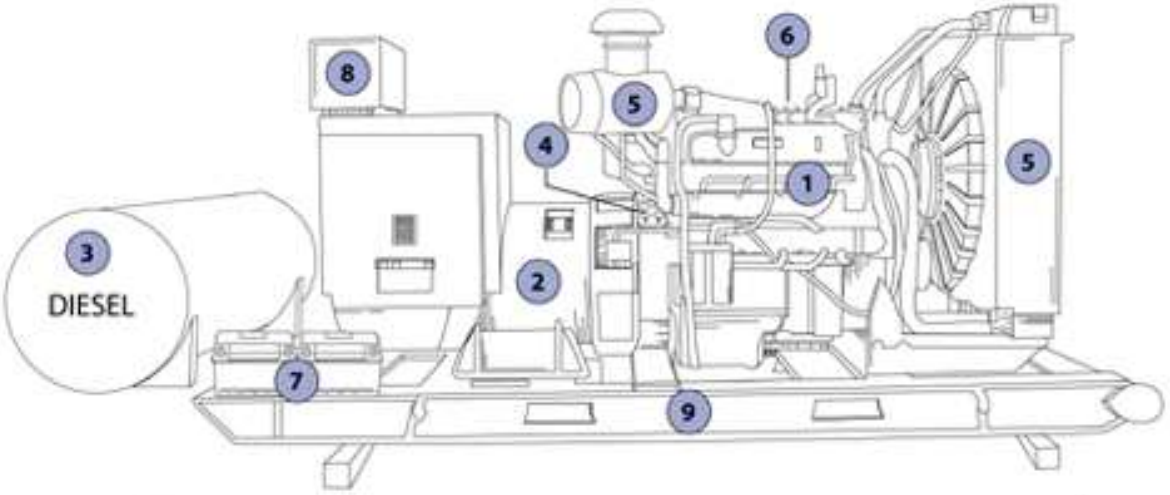
Three main components of a generator set are

1. **Diesel or gas "engine" which drives**
2. **an electrical "generator" and**
3. **Is monitored/governed by various "controls."**

- **The alternator used in Greaves is self-excited, self-regulated and brushless design.**
- **The alternator is fitted with an Automatic Voltage Regulator (AVR) that gives excellent voltage regulation.**
- **The Control Panel is fitted with an Electronic Controller for display and protections.**

GENERATOR SET

Illustration2: Main Components



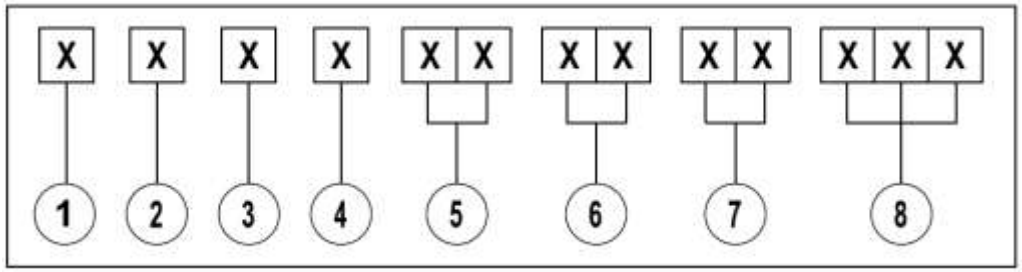
(1) Engine	(4) Voltage Regulator	(7) Battery Charger
(2) Alternator	(5) Cooling and Exhaust Systems	(8) Control Panel
(3) Fuel System	(6) Lubrication System	(9) Main Assembly / Frame

(1) Engine
(2) Alternator
(3) Voltage Regulator
(4) Battery Charger
(5) Control Panel
(6) Main Assembly / Frame

GENERATOR TYPES & FEATURES

- Generator sets produce either single or three phase power.
- single phase set if you do not have any motors above five horsepower.
- Three phase power is better for motor starting and running.
- Most homeowners will require single phase whereas industrial or commercial applications usually require three phase power.

GEN SET NUMBERING



1	**Canopy Type**		5	**No. of Cylinders**	
	3 – Genset			02 – 2 cylinders	04 – 4 cylinders
	5 – Open set			03 – 3 cylinders	06 – 6 cylinders
2	**Aspiration Mark**		6	**Manufacturing Year**	
	1 – Naturally Aspirated			08 – 2007	
	2 – Turbocharged			09 – 2009	
	3 – Turbocharged Aftercooled			10 – 2010	
3	**Mark**		7	**Manufacturing Month**	
	0 – NIL	2 – MK2		01 – January	03 – March
	1 – MK1	3 – MK3		02 - February	04 - April
4	**Series**		8	Engine Serial No.	
	8 – G11	9 – G22			

PRIME OR STANDBY POWER SYSTEM

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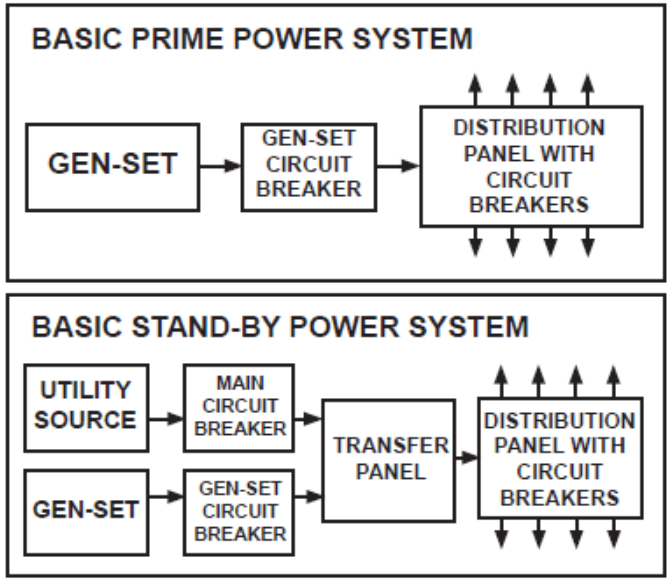
PRIME or STAND-BY ?

- A Prime power is required when you have no other source of power.
- A stand-by set steps in and picks up designated loads when your main power supply is not available.



EXPECTED OUT PUTS FROM GENERATOR

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- **Voltage**
  - External voltage regulators control the output voltage of the generator by controlling the field excitation current.
  - Internally regulated generators are used for special purpose applications and are not adjustable.
  - **Voltage regulation is achieved by AVR.**

- **Current & Frequency –**
  - Engine for AC generators must run at a speed that generates the proper electrical frequency & Current.
  - The speed at which an engine runs to produce the desired output frequency & current is the **synchronous speed.**
  - **Desired output frequency & Current can be achieved by governing engine speed by using Mechanical or Electronic Governor.**

OPERATING SPEED

Electric equipment is designed to use power with a fixed frequency

- 60 Hertz (Hz) in the United States and Canada
- 50 Hertz in Asia, Europe and Australia.

The frequency output of a generator depends on a fixed engine speed. To produce 60 Hz electricity, most engines operate at 1800 or 3600 RPM.

ENGINE SPEED GOVERNOR

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Need of Engine speed governor : to maintain the engine speed in relation to varied load requirements.

Why the engine speed varies : As the alternator load increases, the engine speed tends to reduce. The governor maintains engine speed within limits regardless of the load on the alternator.

How the Governor works : governor senses the engine speed and controls the engine fuel rate in order to maintain practically constant speed.

CONTROL PANEL

SRCP
(Single Running Control Panel)

AMF
(Auto Mains Fail)

SYNCHRONIZATION

Control panel is the user interface of the generator and contains provisions for electrical outlets and controls.

(a) Electric start and shut-down – Auto start control panels automatically start your generator during a power outage, monitor the generator while in operation, and automatically shut down the unit when no longer required.

(b) Engine gauges – Different gauges indicate important parameters such as oil pressure, temperature of coolant, battery voltage, engine rotation speed, and duration of operation. Constant measurement and monitoring of these parameters enables built-in shut down of the generator when any of these cross their respective threshold levels.

(c) Generator gauges – The control panel also has meters for the measurement of output current and voltage, and operating frequency.

(d) Other controls – Phase selector switch, frequency switch, and engine control switch (manual mode, auto mode) among others.

ROLE OF CONTROL PANEL

- The control panel's job is to detect a power failure and initiate procedures to start the new or used generator's engine.
- Once the generator reaches the correct voltage and frequency, the control system signals the switch to transfer from the normal source of power to the generator.
- **Frequency and Voltage Sensing :** One of the main functions of the control panel is the detection of a drop in voltage or a complete failure of the normal source of power.

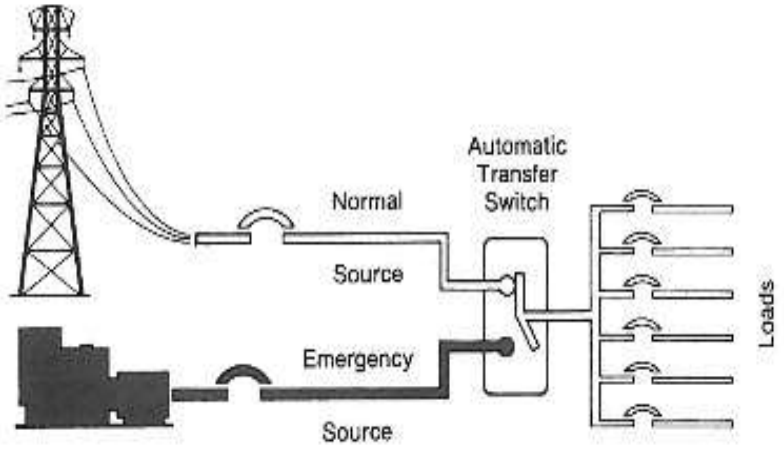
HOW CONTROL PANEL WORKS

- ✓ Control panel consists of a microprocessor that gets input from sensors to give feedback to the engine to manage itself.
- ✓ One such feedback could be the temperature, indicating overheating, other examples would be over/under speed and low/high oil pressure.
- ✓ Microprocessor will also take effective measures to regulate the performance of the engine including shutdowns if, for example, the oil pressure is too low or the coolant temperature is too high, leading to build-up of heat.
- ✓ Control panel can be combined with an Automatic Transfer Switch (ATS) to maintain the continuity of electrical power.
- ✓ The ATS detects an no supply of power when Electrical Board power supply fails. It signals the control panel to start the generator.

AUTOMATIC TRANSFER SWITCH

- Power from a Generator can be either manually or automatically transferred to the onsite application via a transfer switch.
- A transfer switches' primary job is to redistribute power from a grid to a backup source of power.

Manual transfer switch is operated by onsite personnel and are used in situations where the load is not of an emergency nature requiring immediate restoration of the power supply.

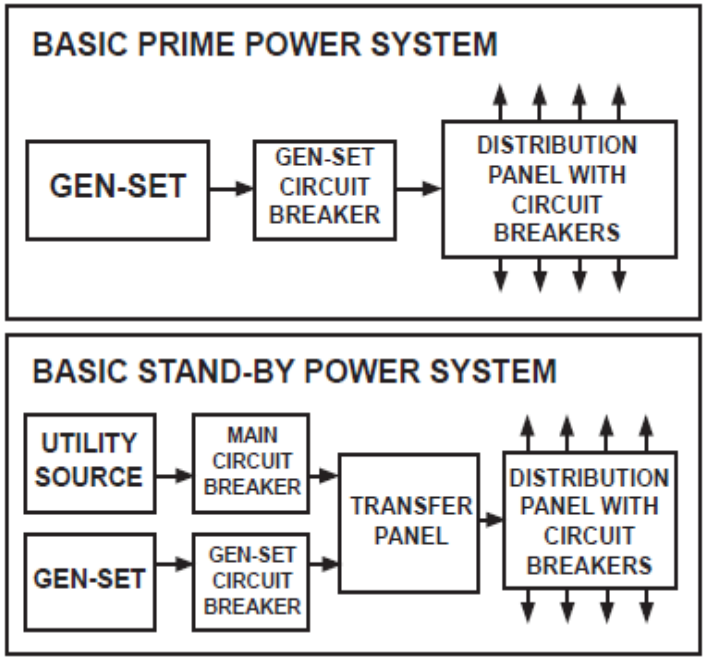


Automatic transfer switch, power failures are detected immediately and the transition from utility power to generator power is seamless.

CONTROL PANEL COMPONENTS

AC SWITCHGEAR AND CONTROLS

- All generator systems require a circuit breaker and a distribution panel.
- The circuit breaker protects the generator set from short circuit and unbalanced electrical loads.
- The distribution panel divides and routes the connected loads and includes circuit breakers to protect these loads.



TYPES OF CONTROLLER

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TYPES OF CONTROLLER

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CONTROL SYSTEM

The Control System consists of:

- A Control Panel provides a means of starting and stopping the genset.
- Monitoring Genset operation and output.
- Protects the engine by automatically shutting it down, in case of any faults communicated by protection controls such as low oil pressure, high coolant temperature, over speed etc.
- An Alternator Circuit Breaker providing a means of switching the Generator output, and automatically disconnecting the load in event of short circuit.

TYPES OF CONTROLLER

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GENERATOR OPERATION

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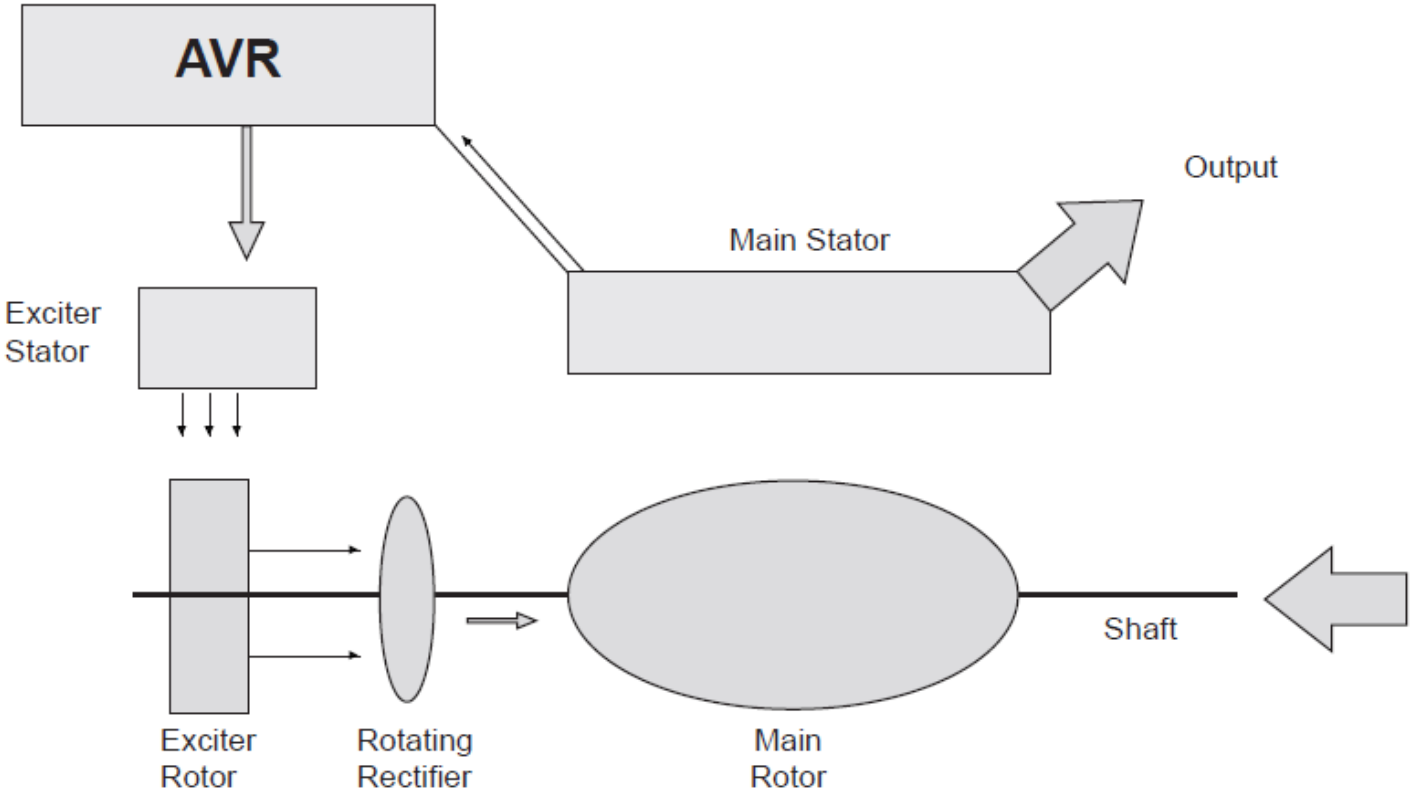
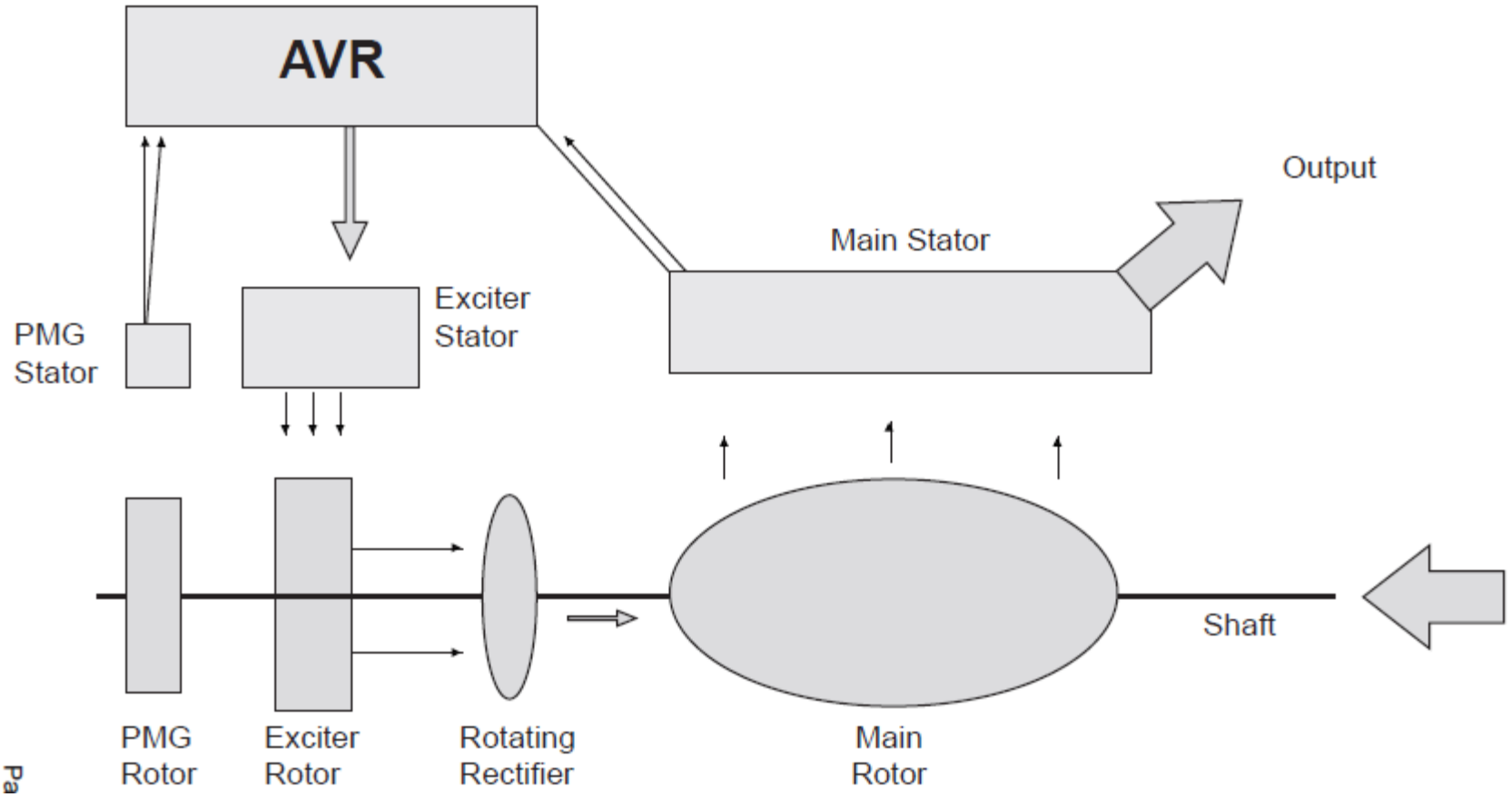
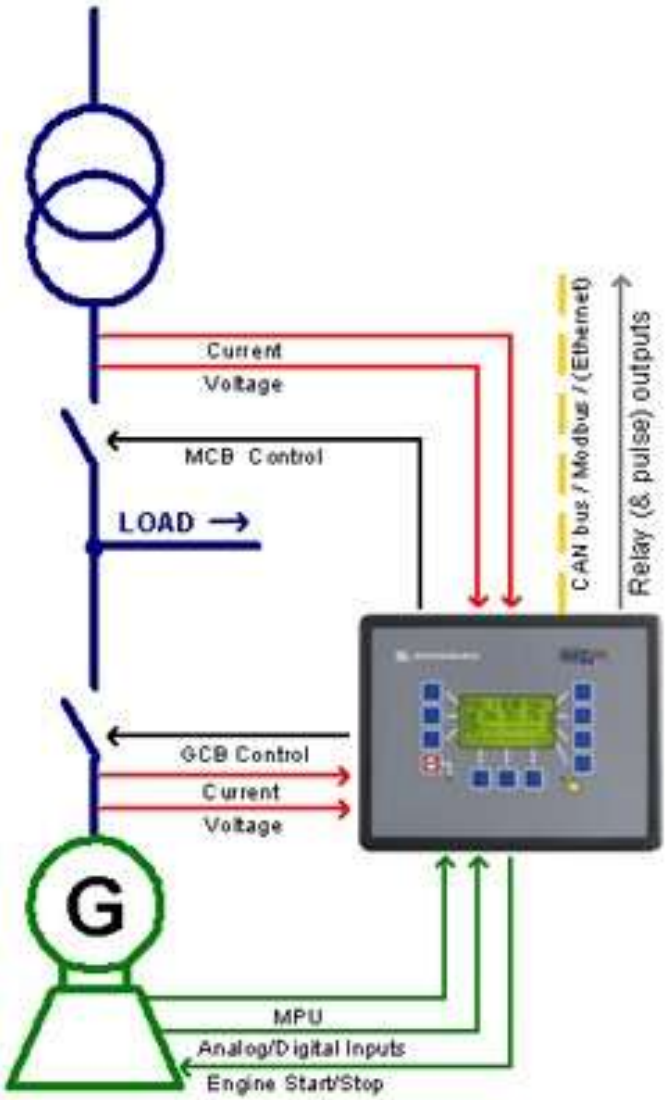
Principle of Generator Operation



GENERATOR


AVR
Output
Main Stator
Exciter
Stator
PMG
Stator
Shaft
PMG
Rotor
Exciter
Rotor
Rotating
Rectifier
Main
Rotor



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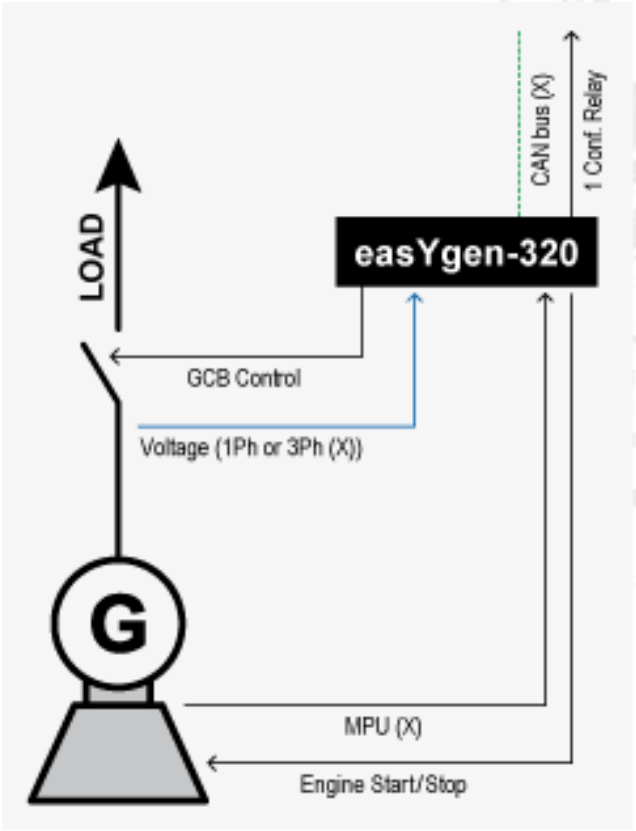
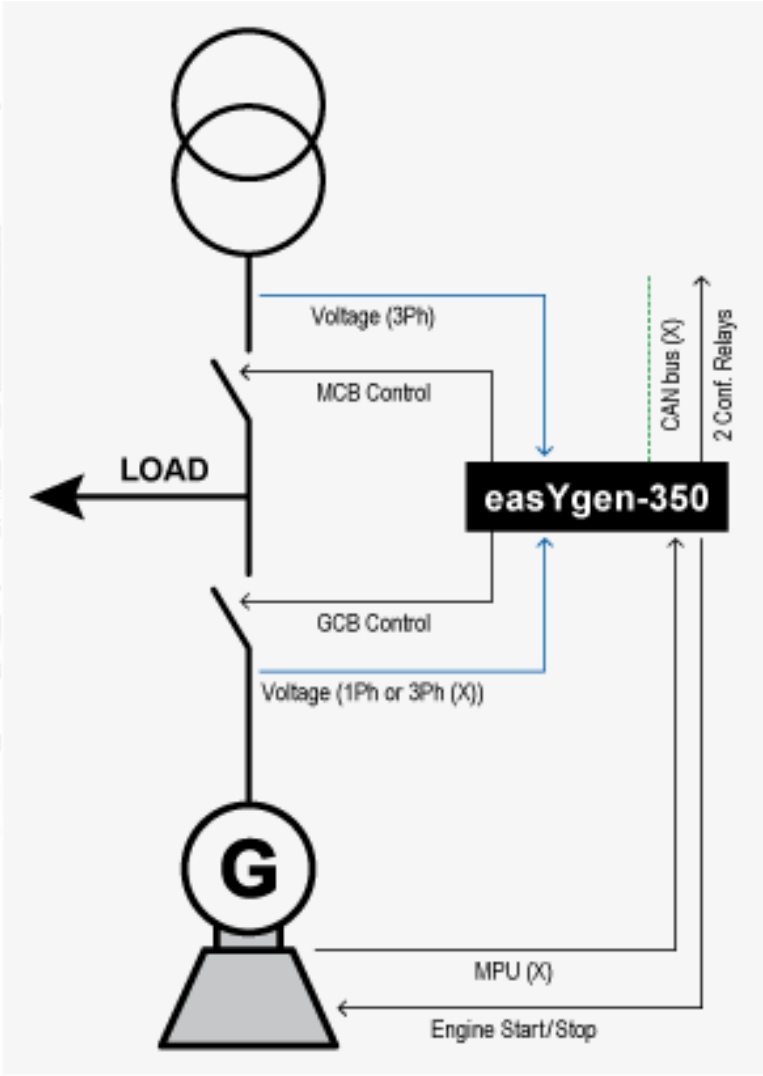
Application Formulas

Desired Data	Single Phase	Three Phase
Kilo Volt - Amperes (KVA)	$\frac{\text{Volts x AMPS}}{1000}$ $\frac{\text{KW}}{\text{P.F.}}$	$\frac{\text{1.73 x volts x AMPS}}{1000}$ $\frac{\text{KW}}{\text{P.F.}}$
Kilowatts (KW)	$\frac{\text{Volts x AMPS x P.F.}}{1000}$ or KVA x P.F.	$\frac{\text{1.73 x Volts x AMPS x P.F.}}{1000}$ or KVA x P.F.
Power Factor (P.F.)	$\frac{\text{KW}}{\text{KVA}}$	$\frac{\text{KW}}{\text{KVA}}$
Amperes - When KW is known	$\frac{\text{KW x 1000}}{\text{Volts x P.F.}}$	$\frac{\text{KW x 1000}}{\text{1.73 x Volts x P.F.}}$
Amperes - When KVA is known	$\frac{\text{KVA x 1000}}{\text{Volts}}$	$\frac{\text{KVA x 1000}}{\text{1.73 x Volts}}$
Required Prime Mover H.P.	$\frac{\text{KW}}{\text{Alternator Efficiency x .746}}$	
Frequency (Hertz)	$\frac{\text{Number of Poles x RPM}}{120}$	
Revolutions Per Minute (RPM)	$\frac{\text{Hertz x 120}}{\text{Number of Poles}}$	
Voltage Regulation (in %)	$\frac{\text{No Load Voltage - Full Load Voltage x 100}}{\text{Full Load Voltage}}$	
Speed Regulation (in %)	$\frac{\text{No Load RPM - Full Load RPM x 100}}{\text{Full Load RPM}}$	
Voltage Dip Factor (motor starting)	$\left(\frac{\text{100\% - Voltage Dip \%}}{100}\right)^2$	


LOAD
CAN bus (X)
1 Conf. Relay
easYgen-320
GCB Control
Voltage (1Ph or 3Ph (X))
G
MPU (X)
Engine Start/Stop


Voltage (3Ph)
MCB Control
LOAD
CAN bus (X)
2 Conf. Relays
easYgen-350
GCB Control
Voltage (1Ph or 3Ph (X))
G
MPU (X)
Engine Start/Stop


Thank you