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Experimental Study on Auto- Electrical Centre (VEC)

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Abstract :-With the complex electronic sensors, controls and conveniences in today's 21st century designs , the modern vehicles has become a massive collection of electrical wiring and hardware. Consequently, the electrical wiring content in a vehicle has become a significant factor in the overall cost and major factor in vehicle safety and reliability. Quality and Reliability terms are often used in relation to each other in reference to produce quality. Because, of the numerous issue relating to wire management in complex electrical system, design must be carefully planned and developed. To eliminate, these problems in today's power distribution systems has developed as the series 3000 Vehicle Electrical Centre or VEC. The compact series 3000 offers components density up to 32 device and is ideal for distributed power approaches n, " add-on" situation and applications where space is at a premium. Because the VEC is modular, it can be stacked to accommodate large and more complex distributions systems.

Key Words:-Current Regulator, Electronic Sensors, Ignition Timing Sensor, Magnetic pull, Reluctance sensor Safety and Reliability, Voltage Regulator, Wire management,

1. INTRODUCTION:

The numerous issues relating to wire management in complex electrical system, design must be carefully planned and developed. The modern concept of Quality Assurance (QA) is normally used to achieve a balance of by reliability and maintainability as alternative mantra.

Interconnections within the distribution box and interconnections to the wire harness create an unmanageable bundle of wire. This consumes valuable space and requires costly manual point – to-point wiring. Manual wiring not only reduces production efficiency but can cause wiring errors. Entangled wire bundles are often a potential hazard for shorts or other type of electrical fault.

3. LITERATURE REVIEW:

Quality and Reliability terms are often used in relation to each other in reference to produce quality product. Through both the terms seems to have independent meaning, but are interdependent while using these terms in reference to produce quality of product. So, we must consider both the terms carefully so as to provide an integrated and total view of all aspects which form quality consciousness at all stage (conception, design) in the life cycle of a product.

For example, as per data, many automobiles products i.e. mainly electronics ones, some time fail totally or operate unsatisfactory at lower functional efficiency and effectiveness or indifferently over a period of time. Often, the period of time over the acceptable level of satisfactory service obtained from an equipment or product. The features of the definition can be quantified, measured and controlled when features and changes in the

product or service can be engineered into a product at its design stage taking into account predicative behavior reliability simulation on computers of field tests. Therefore, the reliability of a product will remain a probability. From the above point of view, reliability was sought to be assured primarily through design mechanics to ensure non – failure of any of the components under the expected stress system. Modern reliability engineering formulates and carries the analysis of the data collected on field tests and also analysis the failure modes, effects and uses on operational information so as to make available to develop and modify designs to ensure improved reliability.

4. METHODOLOGY:

The VEC is a cost effective alternative for harness design. Because hard wiring is not required, harness design can be simplified and costs reduced. Connections to the VEC are made through externally keyed connectors.

The module (Series 3000 VEC with 2.8 mm terminal blade connectors) offers uniform components terminal spacing which accepts standard 2.8 mm wide terminal blades for all components connections. Top connector points are arranged in 8.0 mm spacing to accept standard components including mini fuse, mini circuit breakers, diodes, flashers and /or mini or micro relays. For flexible input and output connections and to meet any requirement, series 3000 offers four 8 – way, 280 series color code connectors. Two each are on two sides of the module and two, 2-pole input 800 series metri – pack connectors are on the rear of the module. Connectors are on the rear of the module. Connectors snap in and out instantly for plug-in simplicity.

The VEC uses a patented 3-D Matrix technology. Jumpers and splices are eliminated by programming them into matrix. The fundamental element is a copper alloy grid which can be efficiently reproduced using high volume stamping. This standard grid can cut production times from 3 to 4 months to as little as one week. Each horizontal grid layer is a matrix of stamped rings and connecting webs.

However, in automobiles, there are two types of wire is generally used and that is Cotton braided wire and Polyvinyl chloride wire (P.V.C.).

Cotton braided wire have good insulation and for example copper wire, rubber or plastic moulded under the copper braided wire. This wire is most costly and this type of wire does not used in modern automobiles. Polyvinyl chloride wire (P.V.C.), is a copper wire and lesser cost and this type of wire is generally used in modern automobiles

The following current ratings of various cables:

Sl No. drop or	Cable size	Current rating	Feet run 1 volt Rated current
1.	23/0.0076	5.75	21
2.	9/0.012	5.75	21
3.	14/0.010	6.00	21
4.	36/0.0076	8.75	21
5.	14/0.012	8.75	21
6.	28/0.012	17.5	21
7.	35/0.012	21.75	21
8.	44/0.012	27.5	21

Table No. 4(a) current ratings of various cables:

Automobiles cables are consist by seven colors and connecting towards various accessories of the automobile parts. For example:

4.1. Black (B): it is use for return and earth lead connection.

4.2. Brown (N): use for battery:

4.2.1. From Battery to Ammeter,

4.2.2. From Battery to Regulator.

4.2.3. From Battery to lighting system as well as to ignition system.

4.2.4. from Battery to Fuses or Switches or others electrical items which is directly connecting from the battery, etc.

4.3. Yellow (y): Yellow colour for Dynamo circuit. This is connecting to regulator circuit through Control box.

4.4. Blue (u): It is connecting from switch of lighting to head lamp, and therefore, it is called lighting circuit.

4.5. Red(R) : Red colour is connecting to the lighting switches i.e. Tail lamp, Fog Lamp, Panel Lamp, and Number Plate respectively.

4.6. Purple (P): This colour goes to accessories, towards the Control Box.

4.7. White (W): White colour is connecting to the ignition switch only.

The following cable colour code:

B: Black	GB : Green Black	NY: Brown Yellow
G : Green	GP : Green Purple	RG : Red Green
N : Brown	GR: Green Red	RW : Red White
P: Purple	GW: Green White	RY: Red Yellow
R : Red	GY: Green Yellow	UR: Blue red
U: Blue	NB: Brown Black	WB: White Blue
Y: Yellow	NG: Brown Green	YG: Yellow Green
		BG: Black Green
		NW: Brown White

Table: 4(b) cable colour code (Automobiles):

5. RESULT &DISCUSSION:

The purpose of the generator regulator is to limit the generator output to a safe maximum and to permit the output to vary according to the requirements of the battery and the connected electrical load of other electrical systems. Apart from cut-out relay, the charging system employs voltage regulator and current regulator.

5.1. Current Regulator:

It controls the maximum amperage out-put of the generator and prevents it from exceeding 30 to 35 Amps which is obtained by setting it. The current regulator is similar to that of a voltage regulator except that the winding consists of a few turns of heavy wire through which the fall output the generators passes. When the generator output reaches the rated maximum, the current passing through the regulator winding is sufficient to overcome the armature spring tension and separate contact points. This inserts the resistance into the generator field circuit, causing the generator output to fall. The magnetic pull of the regulator winding is also reduced due to fall in generator output. The contact points are them no longer held open. As soon as the points close the generator field circuit is directly grounded and the output rises. This cycle is repeated very rapidly resulting in the current regulation to limit the current output of the generator to the related value. The current and voltage regulator operates when the load requirements are high and the battery is low. It then prevents the generator output from exceeding its safe maximum.

For example, in an AC circuit a 20 ohm resistant a coil of 0.2 Henry and a capacity and a capacity of 100 H.P. are connected in series and are connected to a 250 volt 50 cycles/sec supply. Find the current and power of the circuit.

Solution:

R = 20 ohms.

XL = 2π FL

= $2 \times 3.14 \times 50 \times 0.2$

= 62.8 ohms,

XL = $\frac{(10)4}{2\pi FC}$

= $\frac{(10)4}{2\times3.14\times50\times100}$

= 31.8 ohms.

Z = $\sqrt{(R)2 + (XL - XC)2}$

= $\sqrt{(20)2 + (62.8 - 31.8)2}$

= $\sqrt{400 + 961}$

= 37 0hms.

I = $\frac{250}{37}$

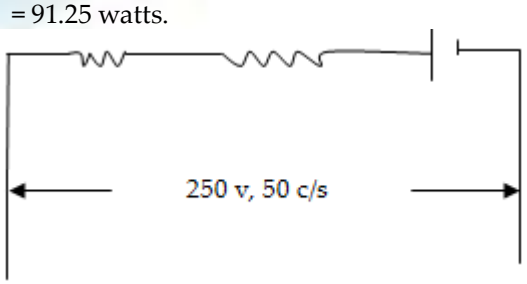
= 6.75 amp.

Cos θ = $\frac{20}{37}$

Power of circuit P = V $\times$ $I \times cos\theta$

= $2.0 \times 6.75 \times 0.54$

= 91.25 watts.



Here, inductance means electro- motive force is actuated which resist the supply of voltage. This

actuated electromotive force is due to self induction or inductance in current of the coil. This resistance is called inductive Resistance. This is represented by XL and its units are ohms.

$$XL = 2\pi FL$$

In which F = Frequency/Sec.

L = Inductance Henry.

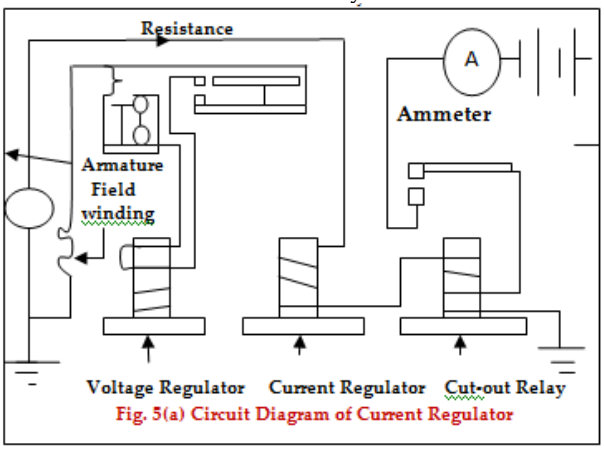


Fig. 5(a) Circuit Diagram of Current Regulator

Sl No.	Electrical symbol Symbol	Represents
1.	ALT	ALTERNATOR
2.	A	AMMETER
3.		Battery – one cell
4.		Battery- Multi cell
5.	+ 12v -	Battery voltage
6.	+ - BAT	Battery voltage box
7.		Bi-Metal Strip
8.		Cable connected
9.		Cable not connected
10.		Circuit Breaker
11.		Connector-Female Contact
12		Connector male Contact
13.		Diode
14.	H E I	Distributor
15.		Fuse
16.	Fuel	Gauge Fuel
17.	TEM	Gauge Temperature
18.		Ground chassis frame (preferred)
19.		Ground chassis frame (Acceptable)
20.		Horn
21		Lamp or Bulb (preferred)
22.	MOT	Motor-Electric
23	—	Negative
24	+	Positive
25.		Relay

6. TYPE OF DATA:

Ignition Timing Sensor:

In automobiles, a magnetic reluctance sensor can be used to set ignition timing. A variable reluctance sensor is mounted on the engine block near a harmonic damper. A harmonic damper is a steel disk-shaped device connected to the crankshaft at the end of opposite the flywheel. The damper has a notch cut in its outer surface. As a notch in the rotating damper passes by a variable reluctance sensor, the decrease in magnetic flux generates a voltage pulse in the sensor circuit. This voltage pulse is used to set ignition timing.

The diagnostics, for the electrical characteristics of the ignition sensor may deteriorate resulting in incorrect output, out of stuck at high signal and intermittent failure. OBD II DTCs, the failure modes of ignition timing sensor are diagnostic by OBD II.

The ignition actuators receive its control pulse from an ignition timing sensor. An ignition timing sensor measures the engine angular position to calculate the position at which the spark should occur. The ignition timing sensor generates a pulse that triggers an electronic circuit that in turn drives the coil primary, thereby initiating the spark. The concept of an engine position sensor used as an ignition timing sensor is described previously.

In another scheme, a permanent magnet couples to a ferromagnetic element which mounted on the distributor shaft and rotates with it. As this element rotates, the time varying magnetic field induces voltage in the coil that is proportional to the rate of change of magnetic field. Each time one of the cogs on the ferromagnetic wheel passes under the coil axis, one of the saw tooth-shaped pulses is generated. This wheel has one cog for each cylinder and the voltage pulses provide a timing pulse for calculating corresponding cylinder.

The basic difference between the contact-point and the electronic ignition systems is in the primary circuit. The primary circuit in the contact point system is opened and closed by contact points. In the electronic system, the primary circuit is opened and closed by the electronic control unit (ECU).

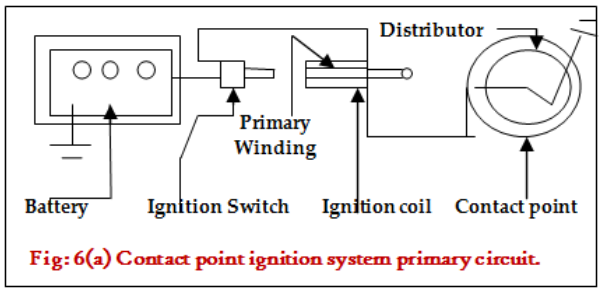


Fig: 6(a) Contact point ignition system primary circuit.

7. CONCLUSION:

The major components of the automobile electrical systems are that starting systems, charging systems, ignition system and Accessory systems. In terms of atoms and electricity, atoms are the basic "building blocks" of the world. They are extremely tiny. There are about 100 billion billion atoms in a single drop of water.

The following discussion of Atoms and Electricity :

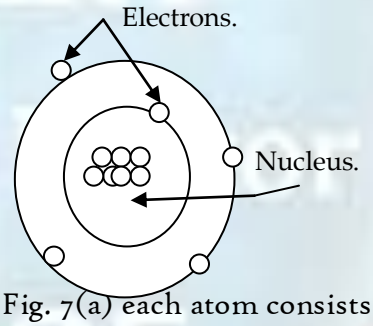


Fig. 7(a) each atom consists of s core nuclease and Electronics circling around the nuclease.

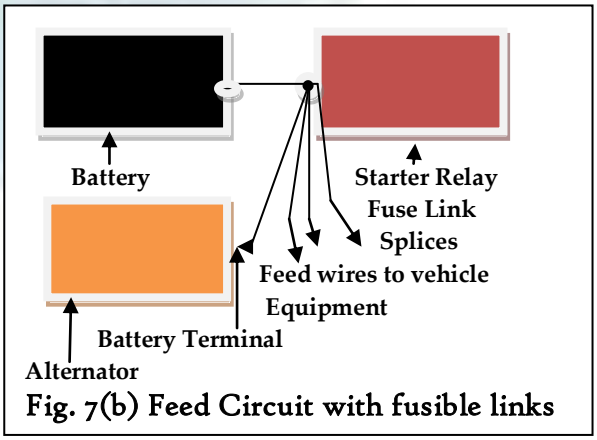


Fig. 7(b) Feed Circuit with fusible links

Electronics is an integral part of modern technology. The modern automobiles use several

electronic devices in the charging system, ignition system, and instrument panel indicating device, fault detectors and verbal warning systems. The diode and transistors is two major devices in auto-electrical systems.

Diode- a solid electronics device which allows the passage of an electric current is one direction only. It is used in the alternator to convert Alternating Current (AC) Direct Current (DC) for the charging the battery.

Transistor an electronic device that can be used as an electric switch, used to some ignition system to reduce B point. The compact series 3000 offers component density up to 32 devices and is ideal for distributed power approaches, "add-on" situation and applications where space is at a premium. Because the VEC is modular, it can be stacked to accommodate large and more co complex distributions systems.

Engineering is a complex field. Due to the globalization impact, modern technology is advanced in all the fields i.e. covering Engineering, chemical, Electronics & Electrical Engineering, Aviation, Automobile, Shipping, Space Technology etc. In the concept of compact design, efficiency and accuracy is playing a major role towards quality of design by introducing ISO 14001and as a result, equipments are more sophisticated, costly and repairs and maintenance cost have also gone high. During the running , there may be or not, major Electrical/Mechanical breakdown due to short circuit, defective design /material fatigue, faulty operation , negligence etc. and as a result , into heavy financial losses due to behavioral of metals.

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