Design & Construction Of A Ring Circuirt Using Surface Wiring

BY

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DESIGN AND CONSRUCTION OF A DOMESTIC RING CIRCUIT USING SURFACE WIRING

BY

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APPROVAL PAGE

This is to certify that this project was a true work of Kuzanah Bege N\EEET\06\8040 undertaken in the Department of Electrical\Electronics Engineering Technology Nuhu Bamalli Polytechnic Zaria.In accordance with presentation of project.

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DEDICATION

This project is dedicated to all my family members who by in any means supported me in one way or the other towards the successful completion of this programme (Academic activities). May God reward them abundantly.

ABSTRACT

The objective of this project is a construction of a domestic ring circuit using surface wiring. It is important to follow all the regulations of an electrical installations in order to achieve the purpose of the project. This project work will enlighten the benefit and advantage of a domestic ring circuit, the precautions and protective device used in an electrical installation. The objective of the ring circuit is to make sure power is maintained in the whole system and failure of one end will not interrupt the supply of the other part of the circuit.

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CHAPTER ONE

INTRODUCTION

1.1 CONSTRUCTION OF A DOMESTIC RING CIRCUIT USING SURFACE WIRING.

The domestic ring circuit can be defined as a sub-circuit in which the current carrying an earth continuity conductor is connected in the form of loop, both ends of which are connected to a single way in a distribution board or it's equivalent.

The conductors should be unbroken to ensure electrical continuity. This circuit should be used where maximum demand is not expected to exceed the rating of the circuit fuse. In this project, a 13 a socket outlet is used in connecting the ring, the plugs used with the outlet must be fused and non-interchangeable with non-fused plug. Fixed appliances rated at 13 A may be connected to the ring by a fixed plug or by a way of local fuse or circuit breaker.

Hence, ring circuit is wired in loop form, a breakage or disconnection in socket would not interrupt the function of the others; this is because of the parallel connection in loop.

1.2 METHOD OF CONNECTION OF FINAL SUB-CIRCUIT

There are two different methods of connecting a final sub- circuit conductors, the 'Ring final sub-circuit' and the Radial final sub-circuit (Radial circuit.)

In a ring circuit, each socket outlet is served for two other socket outlets, so that any fault in one socket outlet will not affect the supply to the other socket outlet and hence appliances using this outlet are interrupted.

1.3 PRINCIPLES OF OPERATION

Since the domestic ring circuit is connected in a loop form, current flow through all the socket outlets at the same time.

The 13 A plug is connected to the main supply, which will then carry the current across the ring circuit containing the 13 A socket outlets, which the appliances take their supply.

A leakage or open circuit in one socket does not affect the others, since the connection is made to supply current in a loop form as shown below.

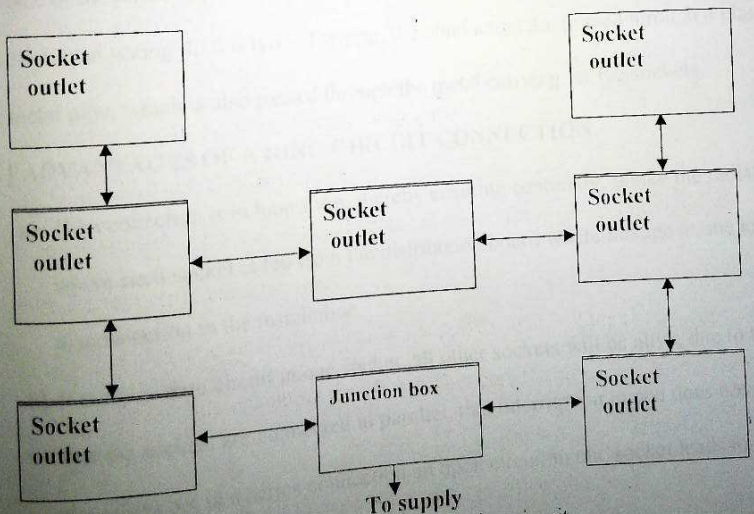

Fig. 1 Block diagram of a domestic ring circuit

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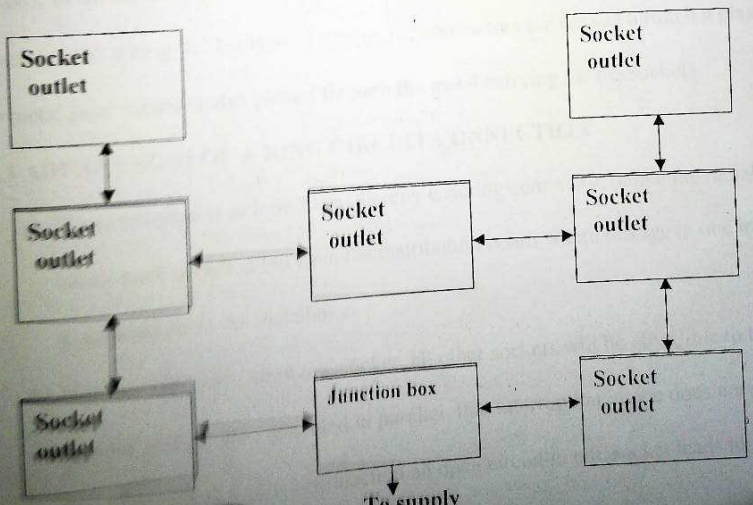

Fig. 1 Diagram of a domestic ring circuit

CHAPTER TWO

LITERATURE REVIEW

This project work is done taken into considering the method of wiring.

The common wiring pattern used in the construction of a ring circuit are as follows:

(i)Surface wiring pattern

(ii) Plastic\metal conduit wiring and

(iii) Trucking conduit wiring.

Surface wiring: This is a type of wiring whereby the conductors (wire) are placed on the surface of the board without any protection.

Plastic\metal wiring: In this type of wiring, the conductors are passed through a plastic or metal pipe, which is also passed through the metal carrying for the sockets.

2.1 ADVANTAGES OF A RING CIRCUIT CONNECTION

a) The connection is in loop form, thereby ensuring continuity, unlike the radial where each socket is fed from the distribution board where linkage in one lead to disconnection in the installation.

b) If there is open circuit in one socket, all other sockets will be alive, due to the fact that the sockets are connected in parallel, that interruption in one does not affect the others but in a series connection an open circuit in one socket leads to disconnection of supply in all other sockets.

c) All sockets are controlled by one fuse while in the radial circuit, where sockets are distributed among the phase as well.

d) To take advantage of the fact that all outlet in a domestic installation are operated at the same time or simultaneously. This is known as diversity of an installation.

2.1 DIVERSITY FACTOR

This is used to diversify the load as a percentage of the connected load. Diversity factor may be applied to installations in order to estimate the maximum demand at any time. Note that diversity is not an application to final sub- circuit, the exception being the 30 A circuit.

2.2 IEE REGULATIONS RELATING TO RING CIRCUIT

a) Maximum number of socket outlet allowed should be unlimited in floor area

b) 13 A plugs fuse should be used at the socket outlet supplying portable appliance.

c) 30 A should be used to protect the ring circuit.

d) Fixed appliances must be protected by local fuse, e.g. fuse spur box.

2.3 THE SPUR

A spur of a ring circuit shall be a branch cable having conductors of cross section of area (C.S.A.) not smaller than that of the conductor forming the ring.

2.4 IEE REGULATION ON SPUR

a) Maximum number of socket outlets for spur are two.

b) The cross sectional area of spur must be the same as rest of the ring.

c) Spur should be evenly distributed

CHAPTER THREE

PLANNING AND CONSTRUCTION

In order to choose a suitable wiring system for any installation, the electrical engineer must be familiar with the merit of alternative system, which are available.

In this project, socket outlets are used to form the ring; it's also constructed based on the IEE regulation specification guiding domestic ring circuit.

3.1 MATERIALS NEEDED

For the installation of a ring main circuit certain materials are needed according to specification with respect to IEE regulations.

Some of materials include: socket outlets, wiring board, wood casing, screw nails, cable conductor, and clips etc.

The choice of materials for this project was based on durability, conductivity, availability, ease of handling, resistance to corrosion and cost.

3.2 CABLE SIZE SELECTION

When selecting the size of cable to be used in a fussy project (circuit) there are two main factors to be considered, the cable must be successfully carry the required current and the load without undue heating which might cause damage to the circuit. And also the voltage drop caused by the resistance of the case must not be excessive.

CABLE SIZE AND RATING

C.S.A = 1.5MM^2

3.3 CABLES CONNECTION

The socket outlets used in respect to this project has three terminals L, N and E which has their respective functions:

L, is the live terminal and this serves the purpose of collecting the power from the source to the device. The point "N" is the neutral terminal while "E" is the earth terminal, designed for collecting faulty current to the general mass of the earth: hence with that the circuit is securely protected. It should be noted that current flows in a complete circuit. Therefore, the neutral complete the circuit with the live.

3.4 IEE REGULATION GUIDING SOCKET OUTLETS

a) Any socket outlet used for ring main circuit should be of the British standard specification.

b) The terminals of the socket outlet should always be kept sound and clean.

c) And socket outlet should be properly connected.

d) It should not be installed in a place where there is presence of moisture.

THE CIRCUIT DIAGRAM DESCRIBING A RING CIRCUIT WITH A SPUR WAY

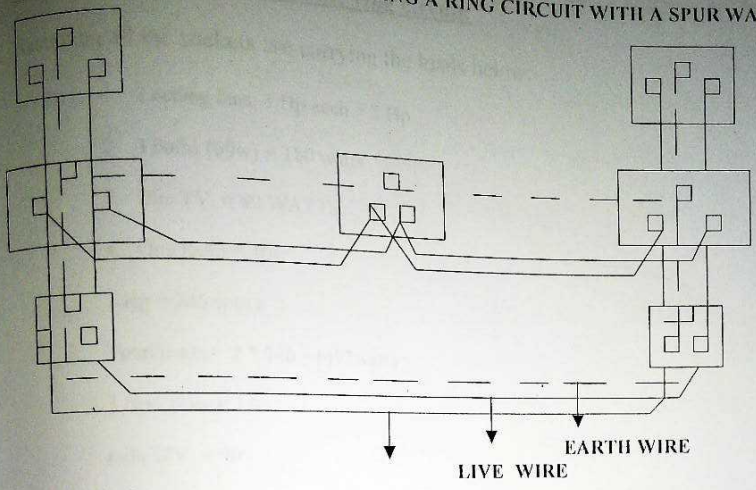

FIG. 2

3.5 CONSTRUCTION

The construction of the domestic ring circuit was carried out by drawing the block diagram, it was followed by collecting of data, that is, the type of socket, fuse rating, where the ring is intended to be used, the required current and voltage it will carry, the type of wiring system and material needed.

The construction was carried out by carefully placing the sockets at their required position considering their distance apart, and connecting the conductor to the socket in order to ensure continuity across the distribution of the ring.

The cable used is of three wires, the earth, the Live and the Neutral. The Live is the current carrying conductor, the Neutral ensures a return path for the current while the Earth takes the unwanted current back to the ground.

To calculate the total load in the ring circuit:

Assuming all the sockets are carrying the loads below:

1. 2 ceiling fans: 1 Hp each = 2 Hp
2. 3 bulbs (60w) = 180 watts
3. One TV. = 80 WATTS
4. One radio = 10w

1 Hp = 746 watts

Total loads = 2 * 746 =1492watts

.3 Nos. 60w = 180

radio\TV. = 90

Total watts = 1762w

Power = 1762w =IV

Therefore, I = 1762/240 = **7.34Amp.**

CHAPTER FOUR

PROTECTION

Protection of an electrical installation, an electrical is subjected to damage either by excess current, wrong cable size, misuse of installation, or over load, it is essential to adopt some protective measures by incorporating some device used for protection of electrical installation to ensure safety of installation.

There are two basic devices used for protection against excess current and over load.

They are:

a) Fuses and

b) Circuit breaker

Fuses: This is a protective device used for protection of electrical installation, it opens the circuit by means of a conductor (element) designed to melt when an excessive current flows.

In a domestic ring circuit, since the installation takes its supplies from a source it is important to incorporated a fuse that will guide against over load and excess current in the ring connection.

There basically three type of fuse:

a) Re-wirable fuse

b) Catridge fuse and

c) High breaking capacity fuse (HBC)

The re- Wireable fuse , just as the name implies, it can rewired if the element got burnt, it consist of porcelain bridge, the bridge consist of two sets of copper which fits into the contacts on base. The fuse element is made up of copper wire, which is connected between terminals of the bridge. An asbestos tube or pad is usually fitted in the fuse to minimize the effect when fuse element melts.

Catridge fuse: This type of fuse is usually used in the 13A fused as a high performance in its ability to interrupt the circuit in a short time that excess current cannot reach high value before the element melt as it would when using rewireable fuse. Note that the time, which a fuse will operate, varies with design and current rating. The real connection as stated earlier is a loop connection that ensure current flow across its conductors and socket at all times, a linkage or open circuit in one of the sockets do not prevent others from having supply.

3.6 COST ESTIMATE OF THE INSTALLATION

The cost of any finish product depends on the cost of production the minimum cost of material should be increased in order to ensure success in the production.

3.7 BILL OF QUANTITY FOR ESTIMATING AN ELECTRICAL INSTALLATION

This is method of calculating the number items used in an electrical installation

Table 3.1 Bill of quantity table of a ring circuit

Item No.	Material	Quantity	Unit price	Total
1.	Socket outlets	7	180	1260
2	Twins cable	10 yards	80	800
3	Wood casing	1	850	850
4	Fuse	1	60	60
5	Other materials			200
6	Total			3170

3.8 PRECAUTIONS

In the construction of a ring circuit it is important to take the necessary precautions to enhance good output. The following are the precautions:

i. it is important to ensure that the sockets are well fixed to the board in order to ensure unnecessary movement that may lead to disjoint.

ii. The conductors or wires. Should be connected in order to ensure continuity in the ring.

iii. Since the plastic conduit does not form its own earth continuity like the trucking an insulated wire should be used for this purpose.

iv. Ensure that the conductors are well insulated to prevent short circuit that may lead to fire outbreak and electric shock.

4.1 FUSE RATING

This is the current the fuse will carry without undue deterioration.

4.2 FUSE FACTOR

This is the ratio between fuse rating and the fuser current i.e.

fuse factor = fuse current/fuse rating.

4.3 FUSE CURRENT: This is the current which the fuse will suddenly melt.

4.4 IMPORTANCE OF PROTECTING ELECTRICAL INSTALLATION

It is essential to protect electrical installation against the following:

i. Damage by fire and electrical shock

ii. Protection against excess current.

iii. Protect installation against damage.

iv. To ensure continuity to other outlets when one is faulty.

v. Protection against short circuit, excess voltage, leakage of current etc.

4.5 EARTHING

It is one of the important device in electrical installation that is employed to protect against earth fault.

4.6 DURABILITY

It is the important factor to be considered when constructing an electrical installation, because it tells how long the installation will last.

The durability of an installation depends on the following:

i. Material used: This is a very important factor when constructing any installation, because the nature of the material used will determine how long the installation will last. When quality material is used with correct specification, there is every possibility that such installation will last for longer period.

ii. The location used: this is needed to be considered since it tells where the installation are to be constructed and used. If it is used other than the specified area, it is bound to fail.

iii. Usage: this the description of how the installation should be used, if any installation is used other than the way it is intended it stand a chance of not lasting.

iv. Ratings: To ensure durability is better and mandatory to use the correct rating of the appliance, e.g. if a domestic ring circuit 13 A fuse is suppose to take a current not more than 13 A if a sudden increase in current above the specific rating the fuse will blow out.

4.8 PURPOSE OF EARTHING: The break of insulation between live parts an earth is referred to as Earth fault.

The raise in potential due to Earth fault is passed down to the general mass on the ground through Earth electrode.

The wood casing: this is a rectangular wood design to house the socket outlets and the connection of the ring circuit.

CHAPTER FIVE

CONCLUSION\ RECOMMENDATION

5.1 CONCLUSION

Since the objective of this project is involve an effective maintenance strategies in light of the existing system, a detail consideration will be given as per the factors considered in the chapter analyzed. From what we have seen from the above analysis, one will safely conclude that for effective maintenance strategy, sufficient time needs to be devoted to the care of the ring main circuit. However, economically viable in that more manpower is required lost would increase in the event unnecessary outage time. So the ideal thing is to maximize effectiveness and minimize economic consequences. This brings us to consideration of how to effectively utilize the factors affecting the ability to achieve this purpose.

The ring main circuit unlike the radial serves as a great advantage for the less use of the cables, un interrupt manner to adjacent socket and the application of a diversity factor. The cable needed for a ring main circuit is therefore of a lower rating than that required for direct connection to the main and the cost.

5.2 RECOMMENDATION

The wiring of a domestic ring circuit is very important because of its high protecting devices. Therefore, emphasis should be laid on this method to reduce failure rate. The standard electrical material for the completion of this project should be used which also reduce failure rate.

REFERENCES

1. Michael N. (1982): Electrical Installation Technology Third Edition Butterworth & Co publish London. Pp 76, 127, 141 - 145
2. Smith and Hosie (1989): Basic Electrical Engineering Science Third Edition Longman published. Pp97, 212.
3. Hughes (1997): Electrical Technology Fifth Edition Publisher Longman. pp 43, 78