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EARTH FAULTED EQUIPMENT INDICATION SYSTEM FOR ISOLATED NEUTRAL SYSTEM

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ABSTRACT

One of the major challenge in marine transport system is to find out and locate the position of earth fault on board ship. At present there is no standardized indication system to locate the position of earth faulted system. This paper introduces a method to find out exact location of earth fault affected system on board ship.

KEYWORDS: Earth fault, isolated, ship, hull, MSBD, ESBD.

I. INTRODUCTION

The power distribution on ashore (land) has neutral line that means the system is earthed as a neutral system as shown in fig 1. In earth neutral system, neutral is connected to earth and the priority is to get immediate isolation from the single earth fault equipment.

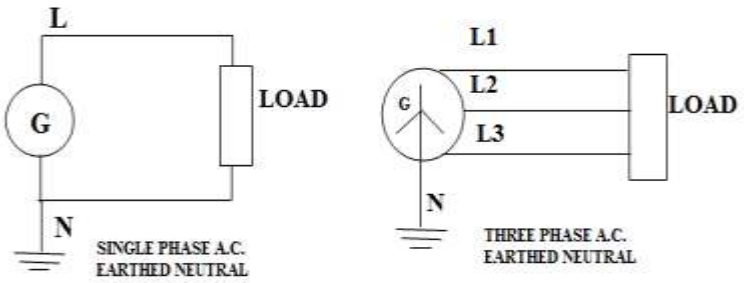

Fig. 1: Earth neutral system.

The person getting accidental contact with the current carrying conductor in absence of earth neutral maybe fatal. Shore facilities makes extensive use of the neutral line to protect the person from getting shock. When earth fault made by the level of fault current that is high enough to operate a trip circuit breaker and protect the person from getting unwanted shock and thus system gives importance to person's life rather than machine.[1]

On board ship there is a converse situation than ashore power distribution and it gives importance to machine but not person's life because power loss create loss of control on ship due to this it may create accident of ship or loss of whole life on board ship. On board ship it uses isolated neutral system, in which there is no direct connection between neutral lines of alternator to earth (ship hull). This power is distributed to the number of electrical and electronics systems working on AC 440 V, AC 220V and DC 24V respectively. Fig 2 shows the on board power generation system that illustrates isolated neutral system. In this system, it has no neutral line and all conductor having equal potential with respective each other. In this system single earth fault does not create any problem to running machine but double earth fault will create blackout situation on board ship.

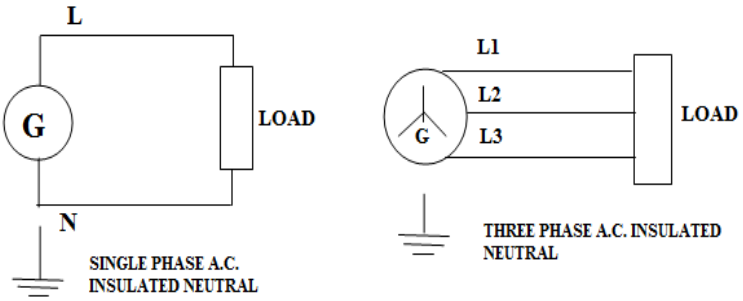

Fig 2: Isolated neutral system.

The isolated neutral distribution system is more commonly used on board ship for the following reasons.

1. This system avoids the risk of loss of essential services. E.g. steering gear
2. One earth fault does not interrupt the supply.
3. It lowers the risk of fire and explosion on board ship

To locate the earth fault with existing technology is time consuming and tedious. This paper presents a method to locate the earth fault efficiently and consuming less time.

A. *General concept of earth fault*

The earth fault means solely to create physical connection between conducting carrying wire and the earth.[1]

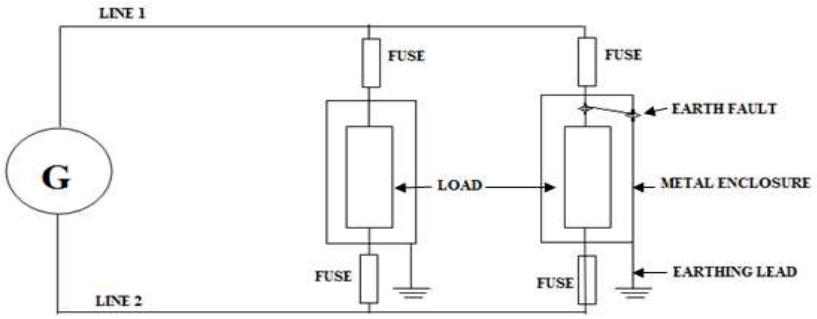

Fig 3: Single earth fault system.

Fig.3 shows the single earth fault system in which single current carrying wire connected to earth and it has no effect on running machine because there is no neutral line to complete the path and hence there is no effect of single earth fault. If any person contact with the single earth fault condition equipment there will be small current flow through the body but it is not fatal for person's life and ship hull having same potential as earth fault wire.

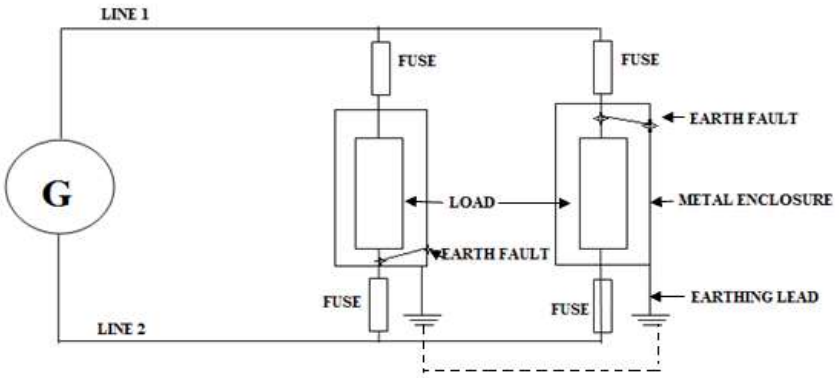

Fig 4: Two earth fault system.

Fig 4 shows the double earth fault system in which two current carrying wire connected to earth and it creates short circuit and due to this black out situation occurs on board ship. This condition becomes dangerous for ship and ship person's life.[1]

A majority of earth faults occurs within the equipment. Generally insulation failure occurs which leads to the current carrying wire getting in contact with the body of the metal enclosure. Insulation failure happens due to vibration, ageing, heat and moisture.

II. EXISTING METHODOLOGIES

The fig 5 shows the internal circuit diagram of lamp earth fault indication system which is connected to main switch board and emergency switch board for detecting the earth fault on respective line.[1]

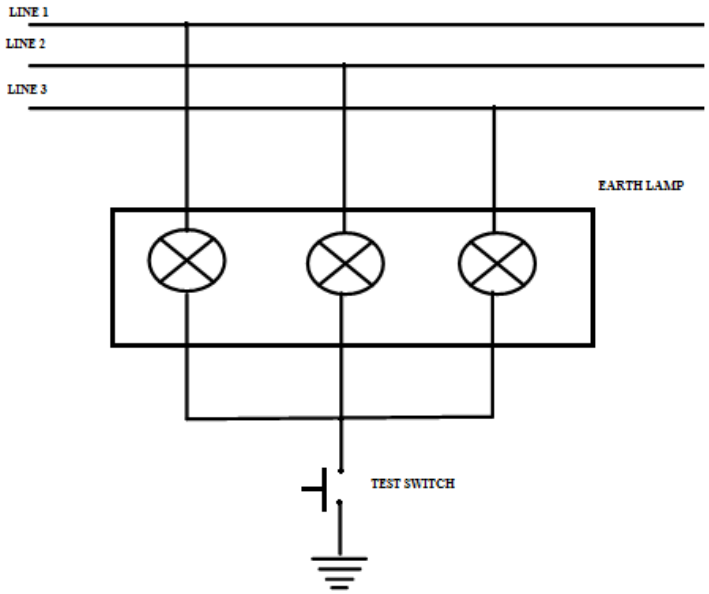

Fig 5: Earth fault indicator using lamp.

Fig 6: Earth fault indicator on switch board with ohmmeter.

Fig 6 shows the earth fault indicator lamp on switch board with ohm meter in the range of mega ohm. This is the conventional method used on board ship from long time. The working of earth lamp indicator circuit is as follow:

B. No earth fault / Normal condition

This lamp will glow continuously when the push button is unpressed or pressed and mega ohm meter shows the infinity resistance between conducting wire and earth.

C. Earth fault

This lamp will glow continuously when push button is unpressed and when the push button is pressed in case of earth fault in any phase the lamp for that phase will not glow because there is no potential difference between the conducting wire and earth. The mega ohm meter also shows insulation zero between earth fault conducting wire and earth.

After getting earth fault indication on MSBD or ESBD following steps are carried out.

1. Isolate the complete Group start panel.
2. Check the Earth Fault indicator for status (still faulty or normal).
3. If faulty, then put on the breaker which is put off earlier and isolate other group start panel.
4. Once the group start panel is identified, then individual system switches are turned off one by one and checked for the earth fault indicator status condition.
5. When any switch when turned off and thus the condition becomes normal, then this system circuit is marked and then inspection is done on the particular system for abnormalities.

The above steps are time consuming and tedious one.

III. PROPOSED METHODLOGIES

The purpose of this system is to improve the earth fault detection technique. This system consists of indication bulb/ lamp that are connected to metal enclosure of electrical system with earth. This technique shows the exact earth fault affected equipment.

D. Basic System design

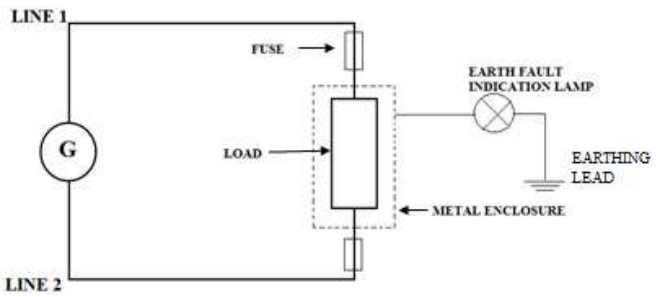

Fig 7: Basic circuit for earth fault indication of equipment.

Fig 7 illustrates the basic earth fault detection equipment. When any one of the current carrying wire is connected to the metal enclosure or create single earth fault in the system then there will be current flow through this bulb and it will glow. This glowing bulb indicates the system affected by earth fault.

IV. RESULTS

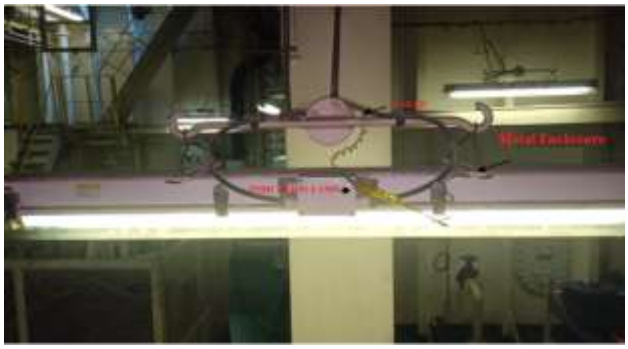

Fig 8: Circuit for earth fault indication of equipment.

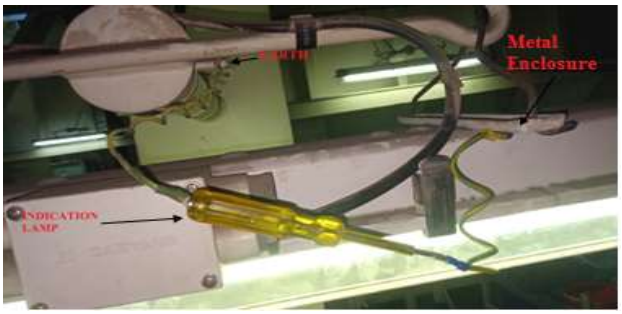

Fig 9: Connection of indication lamp with metal body and earth.

In fig 8 and fig 9 it shows the connection of earth fault indicating lamp. Here we have used line tester for indication lamp. When there is an earth fault it will glow and indicate the equipment having earth fault.

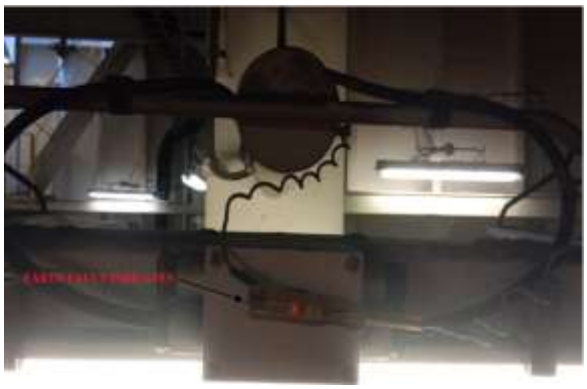

Fig 10: Earth fault detection in affected equipment.

Fig 10 shows the earth fault detected in the equipment. In this equipment one of the current carrying wire connected to metal enclosure. Due to insulation failure this causes current flow through the line tester and it will glow. This line tester glow indication shows the equipment having earth fault.

The following table shows the result of earth fault indication system for affected equipment.

Table 1: Result of earth fault indication system for affected equipment.

Sr. No	Equipment having earth fault	Indication lamp glowing
1	No	No
2	Yes	Yes

V. CONCLUSION

As we know it is an important task to find out earth fault on board ship. Previous method is time consuming and tedious and it may lead to blackout over the entire ship. This paper shows the technique to find out the earth faulted equipment very easily and without wastage of time. The circuit proposed in this paper is easy to install on equipment of on board ship. It is cost effective and any person on board ship can find out earth faulted equipment by this indication lamp.

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