International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

"Protection Scheme for High Voltage Sphere Gap Arrangement"

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Abstract **–** *After performing high voltage sphere gap experiment, there will be some charges stored in spheres, in that situation if any person touches that it will cause to shock hazard so to avoid that we made arrangement of cage and electrical connections for protection. Here we are providing indication lamps, one lamp for entry and another lamp for prohibition of entry and if any enters in restricted time, high voltage supply gets turned off with the help of limit switch and contactor arrangement.*

I. INTRODUCTION

High voltage is a term that refers to any level of voltage which is high enough to inflict harm to living organisms, particularly humans. Voltages greater than 50KV applied across dry unbroken human skin can cause heart fibrillation. Accidental contact with any high voltage supplying sufficient energy may result in severe injury or death. This can occur as a person's body provides a path for current flow, causing tissue damage and heart failure. Safety equipment used by electrical workers includes insulated rubber gloves and mats. These protect the user from electric shock. Safety equipment is tested regularly to ensure it is still protecting the user. Test regulations vary according to country. Testing companies can test at up 300000 volts and offer services from glove testing to Elevated Working Platform (or EWP) testing.

Even voltages insufficient to break down air can be associated with enough energy to ignite atmospheres containing flammable gases or vapours, or suspended dust. For example, hydrogen gas, natural gas, or petrol/gasoline vapor mixed with air can be ignited by sparks produced by electrical apparatus. Examples of industrial facilities with hazardous areas are petrochemical, refineries, chemical plants, grain elevators, and coal mines.

Measures taken to prevent such explosions include:

Intrinsic safety by the use of apparatus designed not to accumulate enough stored electrical energy to trigger an explosion. Increased safety, which applies to devices using measures such as oil-filled enclosures to prevent sparks.

II. LITERATURE SURVEY

1. A. S. Pillai and R. Hackam, "Electric field and potential distributions for unequal spheres using symmetric and asymmetric applied voltages", IEEE Transactions on electrical insulation, vol. EI-18, No.5, October 1983
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4. J. L. Davidson, T.J. Williams and A. G. Bailey, "Electrostatic discharges between charged insulators and grounded spheres", Journal of electrostatics, Electrical power engineering research group, department of electronics and computer science, university of Southampton, Hampshire, UK SO17 IBJ.

III. PROPOSED METHODOLOGY

In this project it is intended, to arrange a faraday's cage with the width of 15'*6' & breadth of 11'*6'. The faraday cage door shall be of 2.5 feet width which shall be automatically controlled using limit switches, contactors, MCB and indicating lamp.

The specifications and functions of these components are as mentioned below

Faraday cage

If a charge is placed inside an ungrounded Faraday cage, the internal face of the cage becomes charged to prevent the existence of a field inside the body of the cage, however, this charging of the inner face re-distributes the charges in the body of the cage, this charges the outer face of the cage with a charge equal in sign and magnitude to the one placed inside the cage. Since the internal charge and the inner face cancel

each other out, the spread of charges on the outer face is not affected by the position of the internal charge inside the cage. So, for all intention and purposes, the cage generates the same DC electric field that it would generate if it were simply affected by the charge placed inside.

Limit switch

A limit switch detects the physical motion of an object by direct contact with that object. The original use for limit switches as implied by their name was to define the limit or endpoint over which an object could travel before being stopped. Consists of a mechanical actuator linked to a series of electrical contacts. By using limit switch we can protect the cage such that power should cut off when door gets closed.

Contactor

A contactor is a relay that is used for switching power. They usually handle very heavy loads like an electric motor, lighting and heating equipments and so on. Here it gets the feedback from limit switch and break the power to experimental unit.

Indicating lamp

Green and red lamps are used.

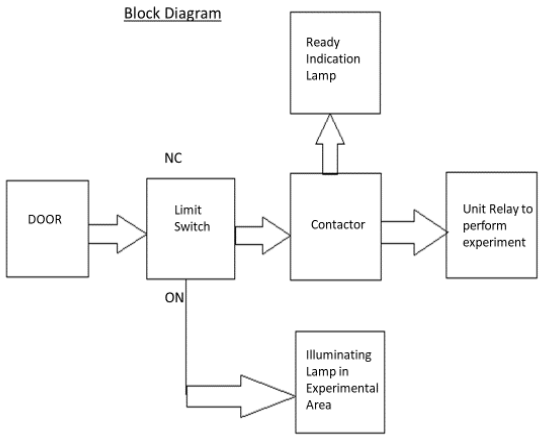
Green indicates that human can enter inside the cage.

Red indicates no entrance

MCB

A miniature circuit breaker (MCB) automatically switches off the electrical circuit during an abnormal condition of the network means in overload condition as well as faulty condition. Nowadays we use an MCB in a low voltage electrical network instead of a fuse. MCB is much more sensitive to overcurrent than a fuse. Handling an MCB is electrically safer than a fuse. Quick restoration of supply is possible in case of a fuse as because fuses must be re-wirable or replaced for restoring the supply, Restoration is easily possible by just switching it ON

IV. BLOCK DAIGRAM



Working

Above block diagram contains the components like Door limit switch, contactor and indicating lamps. Door limit switch acts as feedback device, it gives the feedback regarding the door condition. The position of open and close feedbacks will be given according to the condition of the door. From contactor 'NO' and 'NC' connections are utilized to indication lamp, illuminating lamp and unit ready arrangement. From this arrangement we can provide the interlock such that unit will turnoff automatically if any one enters the cage. Here door limit must be closed while doing experiment, in this position the door unit will get ready then we can perform the experiment. After the breakdown voltage, spark over occurs unit will turn off, such that green light indication will appears at the door to open the door then we can enter inside the chamber to discharge the stored electricity and for adjusting gap between spheres. In open conduction of the door, the door limit will help the contactor to open so that unit will not get ready until we close the door. As the Contactor gets picked up then the unit will get ready to perform next experiment. Here illuminating lamp is provided to illuminate the inside area of cage when door gets open.

V. ADVANTAGES

- Rigid construction
- Less chance of failure
- Not effected by power cut
- Easy to identify fault
- Long life
- Medium cost
- Simple construction
- Not effected by environmental conditions like dust and dirt
- No chance of interference with high voltage

- Less maintenance
- Provides high and perfect protection
- System holds good even on frequent operations

VI. DISADVANTAGES

- Considerable cost required for gauge
- The problem of limit switch effects the system availability

VII. EXPECTED RESULT

It is desire to successfully provide the metal cage and allows the entry of person inside the cage at safe condition.

ACKNOWLEDGEMENT

We would like to extend our sincere thanks to **Principal & HOD EEE of the RYMEC** institution, We would like to express our deepest appreciation to **Mrs. Anusuya patil** for encouraging our project proposal for paper publishing work, We extremely grateful for **Institute lecturers**, We would also like to extend our deepest gratitude to **friends, & family members** for useful discussions.

REFERENCES

The project deals with the protection scheme for high voltage sphere gap arrangement by referring the functions of the apparatus used.

- The functions of the relay, MCB and contactors are referred from the text book of Badri Ram and D.N Vishwakarma.
- The functions of limit switches and Faraday cage are referred with the help of google search.