iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4302

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Sustainable Capacity Improvement in Fuse Holder a Switchgear Unit

Gunjan S Chaudhari[1], Ashwini D Jagtap[2], Pratiksha S Deore[3], Poonam S Malgave[4], Prof. Rahul J Nikam[5]
[1, 2, 3, 4, 5]*Dept of Electrical Engineering, MET'S IOE, Nashik, Maharashtra, India.*

Abstract: ***The switchgear equipment are used for protection purpose, fuse and fuse holder is one of them. In substation if any fault occurs, the system voltage may rise beyond the certain level due to which the fuse holder may damage and it happens due to low quality of insulation or dielectric material. Nowadays ring main unit are their which consists of number of switchgear equipment one of them is fuse which is having fuse holder. The project deals with the increase in the sustainable capacity of fuse holder. By reducing the amount of stress on the fuse holder we can increase the stress handling capacity of the fuse holder. To check the capacity we analyse the results with the help of simulation which helps to reduce time of remanufacturing and retesting. The software used in basically works on the principle of electric field theory. And here different test are carried out on the fuse holder to check the performance the test are partial discharge test and high voltage test. Keywords: - Fuse holder, Dielectric material, Ring main unit, electric field theory, Partial Discharge test, simulation.***

I. INTRODUCTION

Nowadays the high voltage power equipment are used in various places such as substation, in RMU i.e ring main unit. And that power equipment are made of different types of high quality insulation material so as to protect the equipment against high voltage stress. Most widely used solid insulation material is Epoxy resin. It is very tedious issue to check the quality of the insulation when the equipment is under operation for long time.

The equipment used at the secondary distribution is nothing but ring main unit which consists of fuse and fuse holder. Nowadays the problems are faced when the equipment suffers from high voltage stress which results into damage of insulation, which causes partial discharge. Here we are mainly focusing on partial discharge effect and likewise we are going to increase the sustainable capacity of fuse holder by doing analyse with the help of software so the time required as well as cost required will be less i.e with the simulation we are going to study the different parameters, designing of the fuse holder and its results. And like wise results are observed.

A. Ring Main Unit

It is an assembly of switchgear equipment enclosed in metallic cubicle. It is used at the secondary distribution side. It is totally sealed gas insulated unit which is a compact switchgear unit. The ring main unit is fully insulated with the gas and the range of voltage is depends on the pressure of insulation. It assure prompt supply restoration, network flexibility, higher reliability. It is used for medium voltage networks. The another name for ring main unit is floufix. RMU is enabling to install on medium voltage distribution network and mainly used for protection of transformers in compact substations. It is used for medium voltage distribution in compact substations, small buildings, residential housing complex, large shopping malls, airports, wind power, etc. comprising medium voltage networks. The concept of RMU is offering a choice of other switch-fuse combination or circuit breaker with relay for protection of the transformer. RMU is a compact ring main unit combining all MV functional units to enable to supply and protect transformers on the secondary distribution network. RMU can be supplied in various and different configurations suitable for most switching applications in 12/17.5/24/36 kV distribution networks.

B. Fuse Holder

Fuse holder is the part of fuse. Fuse is used for the protection purpose of the system and the fuse holder is the device for mounting the fuse and protecting the person form direct contact. The fuse holder should be waterproof, vibration resistant. The insulation material used recently is epoxy resin material, and to increase the sustainable capacity of the fuse holder material some modification are done to increase the dielectric strength of the insulation and analysis is done with the help of software. Mainly partial discharge effect is the most prominent effect which is taken into consideration while analysis. Here two test are carried out on the fuse holder via partial discharge test and high voltage test.

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

II. TEST TO BE CARRIED OUT

A. Partial Discharge Test

Partial discharge is the localized electrical discharge that partially bridges the insulation between conductors. Generally it occurs on the surface of the insulation. Such discharge can be impulsive and the duration of this discharge is less than 1sec. The partial discharge rate should be less but the voltage at which the discharge occurs should be more. Most the the insulator contains some impurities due to which some void are formed which results into occurrence of partial discharge effect. In this test the material is subjected to high voltage for 1sec and in between that time the discharge rate is observed.

B. High Voltage test

High voltage test is carried out the ring main unit. In this test the fuses along with fuse holder in the ring main unit are subject to high voltage for the particular time most probably 1sec. The voltage is gradually increased and the tripping is observed the value at which fuses trip is the maximum voltage that the system can handle .For the analysis purpose following amount of voltage is given to the system for 1 min.

Rating of RMU in KV	Voltage Applied
17.5	38
24	50
36	70

III. SIMULATION

Simulation based projects are comes into existence only because the task done in the software instead of being done practically. It helps to reduce time of remanufacturing and retesting to check the performance of the equipment until desired results we get. Simulation is the most helpful thing for the engineers. The Software name of software is ELECTRO .This software is used for designing and analysis purpose on electrical parameters and electrical equipment. It is a two dimensional software which acts as electric field resolver. To operate this software we should have some knowledge of Electromagnetic theory. It is an integrated engineering software which combines the efficiency of boundary element method with powerful user interface. It is also used for solving the Electric field designs. ELECTRO is used to solve the specific problem inherent in the design and analysis of electrical equipment.

IV. METHODOLOGY USED

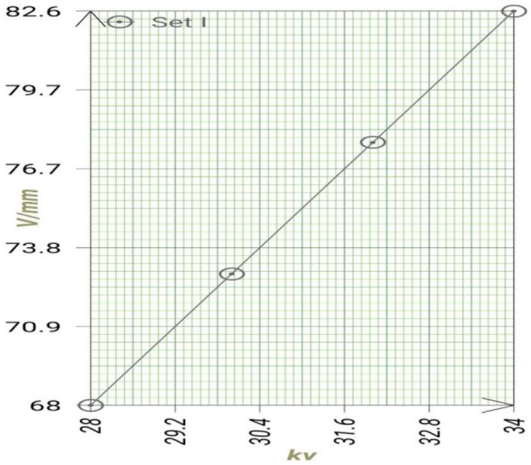
Before going to the actual modelling of the fuse holder, we have done few examples such as microstrip , HV isolator and capacitor to get familiarize with the software. This software has multiple options to get accurate approximate result as output. It has stages to build a system or component in the software like,

A. Geometry access
B. Element placement
C. Material assigning
D. Assigning boundary conditions
E. Analysis and results

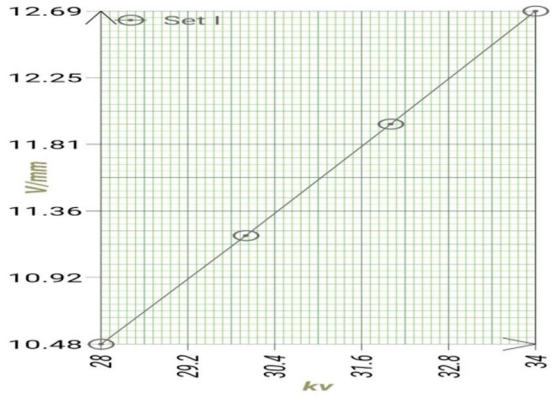
The aim of the topic is to increase sustainable capacity of fuse holder. We have realize the issue related fuse holder is that Nowadays the issue is faced in the RMU, is that the partial discharge effect is more in the fuse holder. When high voltage stress is applied on material of fuse holder, the breakdown voltage level is very less i.e. it will break down at very low voltage which is not good and economical. So that we have analysed the model and divided its methodology in two cases i.e fuse holder outer side grounded and the fuse holder with ring grounded. In former case there is no ring inserted in the fuse holder and we have done field analysis. After analysis we conclude that the stress level is more in this case which is not good for the fuse holder. While in later case, as we have inserted the ring which is grounded , the stress level after the analysis is comparatively less as in previous case.
While analysing a standard 36kv fuse holder we had tested it for different voltages to get accurate approximate results. The material applied to the fuse holder is the conductor as aluminium and the insulator as epoxy resin with the addition of hardner and silica. As a result we have concluded , at lower voltage it has less electrical stress. The ring which is inserted is made up of silicon rubber.
With the help of different results of analysis we compare the effect of added ring in a fuse holder with the help of graphs.

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com



(1) Graph of outer surface grounded fuse holder



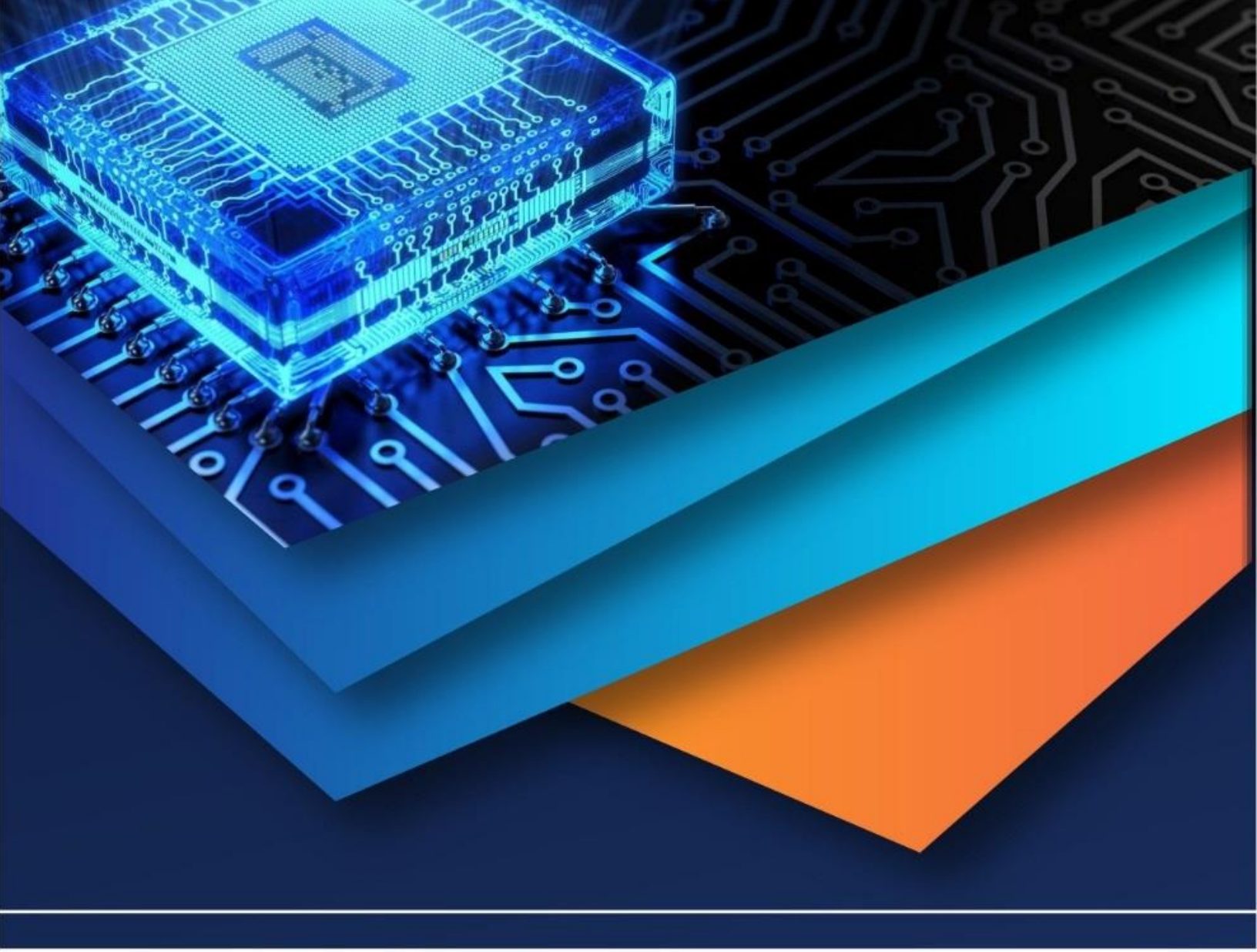
(2) Graph of ring grounded fuse holder

Following graph 1 shows point field values of electric stresses for respected applied voltages for without ring or outer surface grounded fuse holder. Where x-axis shows applied voltage in Kv , and y-axis shows electric stress at point field value in volt per mm. Following graph 2 shows point field values of electric stress for respected applied voltages for ring grounded fuse holder, where x-axis shows applied voltage in Kv and y-axis shows electric stress at point field value in volt per mm.

V. CONCLUSION

With the help of this we could obtain a protecting equipment with good dielectric strength as well as low partial discharge rate. Also we can work on its critical part and analyse it in a better way. This analysis will assure the design engineer and testing engineer to forecast the operational performance and quality of a fuse holder.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)