

To Study of Earthing Problem at 33/11 KV Substation

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Abstract:- Focus of the paper is to study the earthing and earthing problem at 33/11 KV Pandare substation. Successful operation of power system depends on performance of substations. Substations is heart of power system. In substation, a well made earthing takes an important role. Non-appearance of safe earthing system can result in Bad-operation of control and protective devices, Earthing system design deserves appreciable attentiveness for all the substations. Earthing system has to be secure as it is directly consider with safety of persons working within the substation.

Keywords:- Earthing, Earth electrodes, Power systems, Safety, Touch and Step voltages.

I. INTRODUCTION

Earthing means an electrical connection to the general mass of earth to provide safe passage to fault current to enable to operate protective devices and protect workers and Equipments[1]. Earth is like a Electrical conductor but its characteristics are that its conductivity is variable. The resistance of an earth connection varies with earth's composition, chemical contents, moisture, temperature, season of the year, depth and diameter of rod and other reasons. However as there are too many variables such as temperatures, season, moisture contents etc., it is usually measured in practice rather than calculated[3]. Earthing is the concept of connecting a thing to the earth. In Power systems, engineering, ear thing is the one concept that cannot be dispensed with. An electrical substation is a serious source in a power system. Safe process of a substation appeals for a well-designed and properly installed grounding system. A well-designed grounding system will safeguard reliable performance of the substation over its entire service life[6].

II. EARTHING

The basic purpose of the earthing system is provide protection to human body from electric shock and stop the current flow in the circuit. Earthing is done to make the line dead. If due to failure of insulation, some parts of the electrical equipment which do not normally carry current are raised to a dangerous potential w.r.to general mass of the earth.

A. *Main functions of earthing are :*

- To maintain to the potential of any part of the system at definite value with respect to Earth.
- To allow current to in case of fault



Fig.1:- Earthing system

B. *Touch Voltage (E touch):*

It is a potential difference between a person hand, touching an earthed structure, and his foot. A distance normally assumed to be 1 metre.

C. *Step Voltage :*

It is a potential difference between a persons two outstretched legs, without the person touching any earthed structure.

D. *Equipment earthing :*

Equipment earthing means the body or metallic frame of the any current carrying equipment is connected to the earth.

E. *Earth resistance :*

It is a resistance between an earth electrode and the general mass of the earth is called earth resistance. Earth resistance is different in different condition .In rainy season it is low because of moisture is present in the soil and in summer the it is high.

Sr.No	Type	Resistance in ohm
1	Large Power Substation	0.5
2	Major Sub Station	1
3	Small substation	2
4	Factory Substation	1

Table 1. Maximum Permissible Value Of Earth Resistance

F. Factors affecting on the earth resistance

- Soil condition.
- Moisture present in soil.
- Temperature.

III. DATA NEEDED FOR DESIGN OF EARTHING.

- Substation area
- Soil resistivity.
- Maximum grid current

IV. CHOICE OF MATERIAL FOR CONDUCTORS

A. Copper

Copper is a highly material used for earthing. It have a high conductivity.

B. Copper-clad steel

C. Aluminium

D. Steel

V. SUBSTATION DATA

- 33/11 KV substation.
- Three 5 MVA transformer.
- 7 outgoing feeder.

A. Earthing system at substation

Installed earthing system at substation is Grid pipe earthing. Grid earthing is not better for the substation. In grid earthing all the equipment are connected to the only one earthing system. One plate of the earthing system is not properly grounded. When the fault is produce on the feeder then the spark is produce in the plate. Resistance of the damage plate is 4 ohms. Resistance of the substation ground is 14 ohm at normal condition. Area of substation is Rocky.



Fig.2:- Earthing system at substation

B. Earth resistance tester WACO DET mid



Fig 3:- Digital Earth Tester.

Model	DET mid
Earth ground Resolution	0/10/1000
Resolution	0.1
Soil Resistivity	Yes
Charging LED indicator	Yes
Power Source	AA 1.2 V* 9 Rechargeable

Table 2. specification of tester

C. Earth resistance test at substation :

Sr.No	Distance between electrode (M)	Resistance (ohm)
1	1	9
2	2	8
3	4	7.9
4	6	6
5	8	4
6	10	3

Table 3. Test Reading In Rainy Season

Sr.No	Distance between electrode (M)	Resistance (ohm)
1	1	14.3
2	2	13.7
3	4	11.1
4	6	9.3
5	8	8.9
6	10	8.2

Table 4. Test Reading In Normal Season

VI. DESIGN EARTHING FOR SUBSTATION

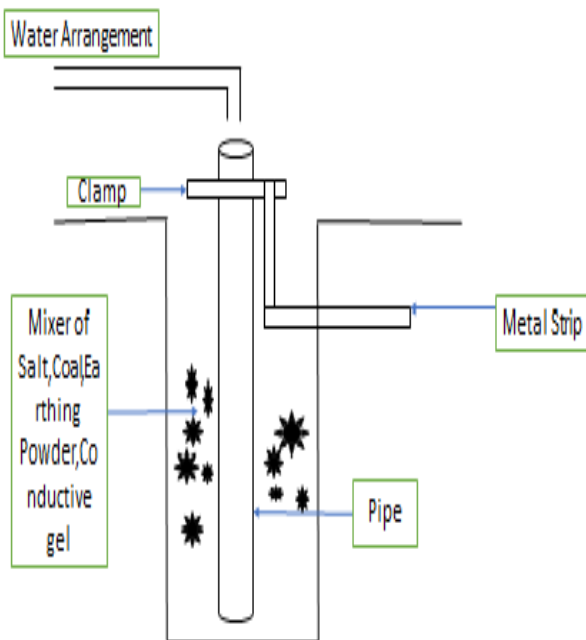


Fig 4:- Design Earthing system at 33/11 KV Pandare substation.

At substation 16 earthing point are marked. All the 16 point are buried upto 10 feet. In all earthing point a GI pipe is fit in the holes. These GI pipe are full-fill from outside by the mixture of salt, earthing powder, coal, conductive gel,

For each earthing point mix the 50 kg earthing powder, 10 ltr conduction gel, related salt and coal.



Fig 5:- Design Earthing system at 33/11 KV Pandare substation

A. Material

- GI pipe 10 feet.
- Earthing powder.
- Earthing strip.
- Conduction gel.
- Clamps.

GI pipe has a l= 10 ft, diameter d= 3 inch

Earthing powder 25 kg bag

Earthing strips 12 ft*8 mm*50mm

18 ft*8 mm*50mm

VII. MATERIAL USED IN CHEMICAL EARTHING

A. Copper clad steel earth electrode

It is made with steel core and a copper exterior. To provide increase conductivity and corrosion resistance copper exterior and steel core is used. Length 3m 17mm diameter with copper coating of 250 microns[7]. Adherence of copper to steel rod is achieved through a pioneered bright acid copper plating process using proper current densities, temperature and brightener additives to achieve copper plating with finer grain structure and a smoother, harder and more uniform surface.

B. Earth enhancement chemical "LOHM"

LOHM is an advanced backfill compound, which lowers the contact resistance of the earth electrode to earth by over 60 %. It produces low impedance to surges resulting in faster transient dissipation. It performs in all soil condition even during dry weather, does not depend on continuous presence of water .It is available in 10/25 kg bags.

Features of the LOHM:

- Absorbs and retains moisture for long time.
- Reduce soil resistivity.
- Dissipate fault current very fast.
- Maintain compatibility of soil and rod contact.
- Earth resistance remains same for longer time even large temperature variation.

C. Conductive Gel

It is having a very good conductivity.

VIII. CONCLUSION

In this paper, we discussed about earthing and problem in earthing system at substation by the earth resistance test. We observed that earth resistance of the substation area is very high. So need to reduce the earth resistance of the substation area by using various earth resistances decreasing component like

- Conduction gel.
- LOHM solution.
- Copper Rods.

REFERENCES

- [1]. Ashwini kumar ,hans r. Seedhar,16th national power system conference, “Grounding system for high resistivity limited area substation” 2010.
- [2]. O.P.Rahi, Abhas kumar singh,shashikant gupta, shilpa goyal “Design of earthing system for a substation ” december 2012
- [3]. Swapnil. G. Shah1 and Nitin. R. Bhasme , P.G.Student, Associate Professor . Department of Electrical Engineering, Government College of Engineering, Aurangabad, (M.S), India. “Design of earthing system for HV/EHV Ac substation” Jan 2014
- [4]. Nevil Jose, Substation Design Department National Contracting Company Emirates Ltd.Dubai, UAE “Design of Earth Grid for a 33/11kV GIS Substation at a High Soil Resistivity Site”. October 2014.
- [5]. Anjaly Subhash1 M.Tech, Dept. of ECE, Rajagiri School of Engineering and Technology, Kakkanad, Ernakulum, Kerala, India .” Chemical Earthing for Lightning Arrester” March 2016.
- [6]. Akshay Patil, Electrical and Electronics Engineering, Navrachana University, India.” Substation Earthing Design”. Jan-Feb 2017.
- [7]. Truepoewreearthing.pvt.ltd.
- [8]. IEEE std 81-1983 “IEEE guide for measuring earth restivity ,Ground impedance ,earth surface potential for ground system”.
- [9]. IEEE guide for safty in AC substation Grounding ,IEEE 80-2000.
- [10]. B.Thaper and S.K.Madan, “Current for design of grounding system” IEEE Trans.On PAS 1984.