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ScienceDirect

Energy Procedia 89 (2016) 110 – 119

Energy Procedia

CoE on Sustainable Energy System (Thai-Japan), Faculty of Engineering, Rajamangala University of Technology Thanyaburi (RMUTT), Thailand

Influences of Relative Humidity on the Electric Field and Potential on Suspension Insulator String

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Abstract

This paper described to study the influences of relative humidity on the electric potential and electric field around the suspension insulators string which used in the 115 kV transmission system associated with ANSI standard. The suspension insulators string was used by Provincial Electricity Authority (PEA) in Thailand. Thailand is located in the tropics near the equator. It is hot and humid all year covered unless the area is in the central region and up. Relative humidity is lower in winter and summer. The summer Relative humidity is the lowest ebb in years. In such an average relative humidity is 72-74 percent, and down to 62-69 percent in the summer. The Finite Element Analysis (FEA) program was used to simulate the electric potential and electric fields. This simulation was compared the characteristic of suspension insulator due to different humidity between 75-80 %RH. The Relative Humidity was based on mean of 5-year, average from 2010-2014 relative humidity by region since 2010-2014 .The combination of humidity of the fog, rain, or dew and pollutant conductivity may cause insulator flashover. So, moisture thus influencing the behavior of the dielectric insulators has been investigated to reduce the impact of the system. This paper reports the simulation results on the investigation on the effects of humidity on potential and electric field of suspension insulator.

Peer-review under responsibility of the organizing committee of the 12th EMSES 2015

*Keywords:*potential field, electric field, relative humidity, finite element analysis;

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Peer-review under responsibility of the organizing committee of the 12th EMSES 2015
doi:10.1016/j.egypro.2016.05.017

1. Introduction

Nowadays, PEA had a problem of suspension insulator string in the transmission line due to pollution .It is one of the main problems that affect the insulator and the cause of flashover of insulators. The insulators string begins to fail when pollutants in the air and mixed with moisture, vapor, rain or dew around the insulator disc. Mixture of pollutants includes the moisture to become conductor that will facilitate the conditions of flashover. This is due to a decrease of the resistance on the surface of the insulator. Transmission line system will be affected by a flashover and damage the insulators in transmission line.

Suspension insulator disc is assembly to the suspension insulator set of the transmission lines, it can be said that it is important to support power transmission conductors. Therefore, it is necessary to study the flashover effects on the suspension insulator set that is caused by contaminants in the air and also prevents a breakdown in transmission system. The electric potential and electric field around the insulators is important to the design of suspension insulator set. Also the knowledge of electric potential and electric field is important to study the effects that occur with insulators. In this paper, the insulators have been simulated with pollution levels at the surface of the insulator. The surface pollution levels can divided into three levels which consist of light, moderate, and heavy pollution level follow to IEC standard.

2. Suspension Insulator

Suspension insulator is an assembly of one or more shells. It can be divided into clevis & tongue type and ball & socket type. This structure connected in series by fitting into themselves in the form of a string. The top of the suspension insulator set is fixed to the cross arm and the bottom of suspension insulator set is attached by the conductor. The suspension insulator disc is ANSI class 52-3. The dimension of suspension insulator is used for the study as shown in Fig.2. Technical data of suspension insulator is as summarized in Table 1.

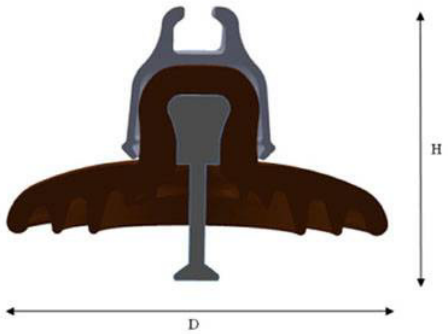

Fig.1. The dimension of suspension insulator string

Table 1. Technical data of suspension insulator

Class ANSI	
Main Dimensions D	273 mm
Main Dimensions H	146 mm
Creepage distance	292 mm
Power frequency puncture voltage	110 kV
Frequency dry flashover voltage	80 kV
Frequency wet flashover voltage	50 kV
Critical impulse flashover pos	125 kV
Critical impulse flashover Neg	130 kV
Test voltage to ground	10 kV
Maximum RIV at 1000HZ	50 kV
Electromechanical Load	6750 kg
Mechanical Impact Strength in-1b(N-m)	55
Time Load Test Value1b	4500 kN
Weight	4.6 kg