CHAPTER 1

INTRODUCTION

1.1 General

The determination of flashover voltages of external insulation is usually performed under atmospheric conditions in high voltage laboratory and is also performed according to national or international standard test method. The atmospheric conditions are different from laboratories to laboratories and even in a single laboratory the atmospheric condition are vary through out the year. The flashover voltage test results under laboratory atmospheric condition are therefore converted to the test results under standard condition, e.g. pressure p_0 = 1013mbar, temperature t_0 = 20°C and absolute humidity h_0 = 11g/m^3. The purposed of this conversion are: 1. to compare the test results with the requirement of standard and 2. to compare the test results from one laboratory with others laboratory.

Thus, a successful comparison of test results is greatly depended on the method that we use to convert the test results.

1.2 Problem Statement

To convert the test results under laboratory atmospheric conditions to the test results under standard condition, we use air density correction factor and humidity correction factor[1-3]. The humidity correction factor has a limit of used as it is applicable only in the range of absolute humidity reduced relative air density, h/δ, between 1 to 15g/m^3. However, most of h/δ through out the year in Thailand is much higher than the limit of used, as shown in figure 1.1 and appendix A.

The problem is therefore occurred, whether can we still used the recommended humidity correction factor in Thailand? And if we can not used the recommended humidity correction factor, can we establish a new set of humidity correction factor that is applicable for high h/δ of Thailand ?

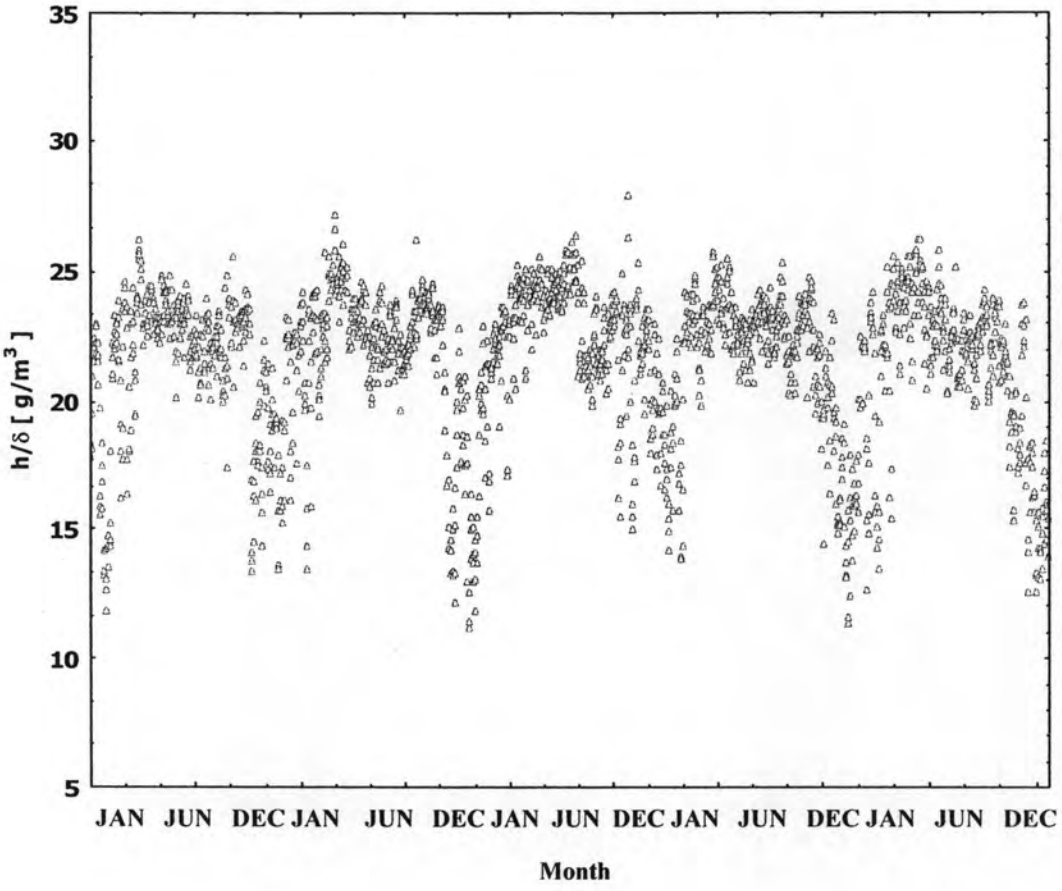

Figure1.1 Monthly h/δ in Bangkok, Thailand, during year 2000-2004

1.3 Objective

The purpose of this research is to review the effect of humidity on the flashover voltage in air under different atmospheric condition, in the high voltage laboratory, Chulalongkorn University.

The main of objectives are:

1. Verify the applicability of humidity correction factor for lightning impulse and AC voltage test, that is recommended by the international standard[1-3], whether can it be used at $h/\delta > 15$ g/m^3?

2. If the recommended humidity correction factor can not be used, establish a new set of humidity correction factor that is applicable for high h/δ that occurs in Thailand.

1.4 Literature Review

Many researches [5-13] studies have been carried out to improve the validity of the humidity correction factor. Summarized of selected investigations are as follow:

D. R. Mello and **S.D.C Souza** [5] reported a comparison of the results of dielectric tests (lightning impulse and power frequency voltage tests), performed on 2 meters post insulators, corrected to standardized atmospheric conditions according to IEC 60060-1 (1989) and ANSI C29.1 (1988). They summarized that the use of ANSI correction factors had a better result than the use of IEC ones.

C. de Salles, **J. P. Pennacchi** and **M. L. B. Martinez** [6] presented the new humidity correction factor during lighting impulse. In this, the developed procedure is based on testing results obtained with Sphere-Sphere and Rod-Rod gaps carried out in setups assembled inside of a fog room under controlled atmospheric conditions. The data is obtained by the critical flashover voltage and humidity, and used statistically considering a 3rd degree polynomial regression.

P.A. Calva [7] reported the effect of humidity on the lightning flashover in case of specific humidity greater than 15g/m^3 of rod-plan gap. The results presented a method to the corrected correction factor k by using humidity coefficient a, which can be found from a slope of linear regression line.

1.5 Scope of the study

The scope of this research encompasses the following areas:

- Test by using standard lightning impulse 1.2/50 μs with both polarities and AC voltage under different atmospheric conditions.
- Object under test: three line-post porcelain insulators type 57/2, 57/3, 57/4 and three pin-post porcelain insulators type 56/57-2, 56/57-3, 56/57-3.
- Applied the IEC 60060-1:1989/IEEE4:1995, IEEE4 Amendment1 Std4a: 2001 and ANSI C29.1:1988 to convert the flashover voltage at different atmospheric conditions to the flashover voltage at standard atmospheric conditions
- Comparison of the result.

1.6 Research benefit

The benefits of this research were to:

1. Confirm that standard IEC publication 60060-1:1989/IEEE4:1995, IEEE4 Amendment1 Std-4a: 2001 and ANSI C29.1: 1988 could be applied to high voltage testing under high atmospheric condition.

2. If 1. is not applicable established a new humidity correction factor (K_2) for flashover voltage test on insulator type 57-2, 57-3, 57-4 and 56/57-2, 56/57-3, 56/57-4.