# RESEARCH ON AMPACITY TESTING FOR MIDDLE-VOLTAGE CROSS-LINKED POLYETHYLENE (XLPE) CABLE

Chengliang **CAI**, Yongqin **WANG**, Hubei Electric Power Testing and Research Institute,Wuhan,Hubei, PRC
cai_chengliang@163.com, wangyq@hb.sgcc.com.cn

## *ABSTRACT*

*This paper introduce the ampacity testing of 10kV Middle-voltage XLPE cable proceeded by Hubei Electric Power Testing and Research Institute.*

*The curves between the Cable ampacity and temperature of conductor, metal sheath and non-metal sheath are conclude from the test. The testing result can be considered as the reference confirming the cable ampacity according to the cable sheath temperature in order to control cable ampacity.*

## KEYWORDS

Middle-voltage XLPE cable, The Cable ampacity, cable conductor Temperature, non-metal sheath Temperature .

## INTRODUCTION

Current ampacity of Cross-linked Polyethylene（XLPE） Cables is influenced deeply by many factors such as operational environment and laying mode. In engineering design, the thermal resistance, loss and current ampacity calculation are used to figure out the nominal current ampacity according to laying modes and operational environment, in order to select the XLPE cable. Due to restricted by calculation conditions and operational environment, the nominal current of cable may be selected as insufficient ampacity. On the condition that the power cable is overloaded, the temperature of conductor will be higher than the allowed, which will accelerate the aging of cable insulation, shorten the cable lifetime, and even cause thermal breakdown. Otherwise the power cable is light loaded, which will cause the waste of investment. This is a major problem of operational safety of power cables in Hubei province. If this problem is solved, the operational safety will be assured, accompany with the investment of power cables saved.

The relationship between the temperature of conductor, insulation, non-metal non-metal sheath and the current ampacity of cables is investigated based on the experiments of cables current ampacity under different laying modes, in order to determine the relationship between the surface and conductor temperature when the cables approach the thermal stability limitation. Based on the research above, a temperature monitoring system for power cables is developed to control the cable load in a reasonable range according to the temperature distribution of power cables. When the cable load increases, the cable can be in short-term overload operation on condition that the temperature of cable doesn't exceed the allowed, which increase apparently the cable ampacity without additional investment compared with the existing methods.

## TEMPERATURE MEASUREMENT AND ANALYSIS SYSTEM

The temperature measurement and analysis system consists of hardware and software. The system has a function of monitoring the real time environmental temperature, soil temperature, cable conductor temperature, cable non-metal sheath temperature and cable metal shield temperature, and saving the measurement data conveniently..

The application of cable temperature monitoring is emphatically considered while designing the system. In addition to monitoring the temperature, the current ampacity of cables can be monitored as well. The system can automatically generate the temperature-time curve, current ampacity-time curve and temperature-current ampacity curve; it also can display the cable temperature momentarily, and alarm while the temperature exceeds the allowed temperature.

### Hardware of temperature measurement and analysis system

#### Computer

The computer is used to realize data acquisition, parameter setting, running log, data query, data backup, etc.

#### Temperature sensor

The temperature sensor is Dallas DS18B20. The 3-conductor shielded cable (tensile resistance > 200kg, water-proof) is used as the temperature measuring cable.

The one-wire bus is used to transmit the temperature signal, which reduces the cables, and improves the stability and capability of the system.

#### Temperature acquisition module

The function of the temperature acquisition module is to realize the communication between the two networks. The dual-CPU technology is used in the temperature acquisition module, which ensures the high-efficient communication and data acquisition, and enhances the reliability of the system.

RS232/485 convector is used for the communication between the temperature acquisition module and the computer. The RS232/485 convector has characteristics of over-voltage protection, over-current protection, surge protection, isolation protection and lightning protection.