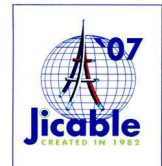




APPLICATION RESULTS OF REAL-TIME AMPACITY ESTIMATION SYSTEM AND INTELLIGENT POWER CABLE SYSTEM



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ABSTRACT

In this paper, first two projects applying real-time ampacity estimation system (R-TAS™) on 345kV cable system in Korea will be introduced focusing on specification and operation results. And as an essential part of the future “intelliGrid”, intelligent power cable system functions and operation results will be explained.

KEYWORDS

R-TAS™, rating current, DTS, CTM, DRS, intelligent power cable system

INTRODUCTION

Recently, the studies on thermal transient behaviour inside and outside power cable and its rating current applying DTS (Distributed Temperature Sensor) technology have been carried out around the world for the purpose of monitoring cable temperature and increasing current carrying capacity [1~3].

Furthermore just like new word “intelliGrid” from EPRI, future EHV cable system will be required not only conventional mission such as reliable energy transmission but also new functions such as self diagnostics, communication and sensing means etc [4].

This worldwide trend can be thought to derive from utilities’ new needs which are real-time monitoring present condition and finally increasing operation efficiency of their assets safely.

In Korea, to prepare this future cable system, national R&D project centred on LS Cable have started in 2001, and the team have developed R-TAS™ after testing it in live transmission cable system in 2003 [1], and finally in 2005 this new system could be successfully applied in first two KEPCO projects [5]. One was Shinyangjae-Gwachon 345kV underground cable system and the other was Bukbusan-Nambusan 345kV cable system.

On the meanwhile the extension of this monitoring system has accelerated the development and application of optical fibre composite power cable and accessory. In Korea, applying this cable system, new transmission cable system named intelligent power cable system was successfully installed in Gumi in 2005 [6].

The reason why we named intelligent power cable system is that it does not just transport electric power but it has optical fibre temperature sensor and optical communication media transporting monitoring information

such as partial discharge signal, moving image, and submergence information and remote control signal for water pump and ventilation fan and so on.

In this paper, first two projects applying R-TAS™ on 345kV oil filled cable system in Korea will be introduced focusing on specification and operation results. And as an essential part of the future “intelligrid”, intelligent power cable system functions and operation results will also be explained.

SPECIFICATION OF R-TAS™ IN KOREA

The specification of R-TAS™ in Korea was firstly made by KEPCO and revised in 2006 [7]. Main characteristics of this specification are that optical sensor fibre forms a loop configuration which one part of it is installed on cable jacket to measure cable jacket temperature and the other part of loop is installed on tunnel ceiling to measure ambient temperature and monitor fire. Table 1 shows specification of R-TAS™ in Korea.

Table 1 Main specification of R-TAS™ in Korea

| Item | Specification |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DTS* | <ul style="list-style-type: none"> •Measurement processing: Double-ended •Number of channel: 6 (12 connectors) •Applicable fibre: Multimode GI 50/125um •Temperature accuracy: within $\pm 1.5\%$ •Temperature resolution: within 1.5% •Spatial resolution: typical 2m •Sampling resolution: typical 1m •Outdoor cabinet: IP 62 grade (Automatic temperature/humidity control) •DTS PC: Industrial type (> CPU 3.6GHz) •UPS: More than 2 hours back-up •Main alarm <ul style="list-style-type: none"> - Fire: within 10 sec (> 70%) - Abrupt overheating: within 30 sec (> 10% between two measurements) - Joint overheating: within 30 sec (> 5% between two phases of joints) •Real time self diagnostics <ul style="list-style-type: none"> - Optical power of laser - Optical loss of sensor fibre •Automatic change to single-ended measurement when fibre breaks |