CABLE SHEATH DIAGNOSIS IN CROSS BONDING CABLE SYSTEMS

Marina A. **SHOKRY**, Abderrahim **KHAMLICHI;** (UPM), (Spain); madel@lcoe.etsii.upm.es, ak@lcoe.etsii.upm.es,
Fernando **GARNACHO;** (LCOE-FFII), (Spain); fgarnacho@lcoe.etsii.upm.es
Julio **MARTÍNEZ;** (UPM), (Spain); julio.martinezm@upm.es
Ángel **GONZALO**, Diego **PRIETO;** (UFD), (Spain); agonzaloc@ufd.es, dprieto@ufd.es
Jorge **ROVIRA**; (LCOE-FFII), (Spain); jrovira@lcoe.etsii.upm.es
Jesús **LLANDRES;** (UFD), (Spain); jjlandres@gasnatrural.com

ABSTRACT

On-line monitoring is now getting more focus on detecting defects in HV insulated cable system in order to prevent failures. Cross Bonding (CB) configurations are widely used in long power transmission land lines in order to reduce the circulating currents through cable metal sheath. This paper presents a general criterion for detecting defects in cable sheaths in CB configuration. Three types of defects are studied in this paper; open circuit fault in sheath loop, two phase short circuit in linkboxes (breakdown between sectionalized sheaths) and flooding in linkboxes. ATP software is used for the simulation of these defects on the modelled system. The criterion developed is studied on a real double circuit cable system in order to show the influence of varying the load of each one of the parallel lines. Real measurements have been performed on this cable system under normal condition; there is a good agreement between the measured and simulated results.

KEYWORDS

Condition monitoring, current measurements, electric breakdown, cable shielding, sheath current.

INTRODUCTION

On-line diagnostic techniques are gaining more focus by utilities, in order to save up the life time of insulated power cables. The main advantage of applying on-line monitoring for the assessment of the cable sheath condition is that the interruption of power supply is not required, while in off-line measurements a planned shutdown is needed [1-4].

The feasibility of detecting a fault in the cable over-sheath by monitoring the sheath currents to ground at the end of the cross-bonded sections is presented in [4]. A method has been developed by Mingzhen Li et al to detect and localize faults in CB configuration by monitoring sheath currents [2].

Different criteria (depending on the type of the defect) were developed by Xiang Dong et al. [1] to detect defects in cable sheaths by measuring sheath currents when CB configurations without transposition in flat formation are adopted.

In long underground cable systems, CB configuration or a combination between CB and Single Point (SP) are usually used [5-8]. Most cable systems are installed between two substations. Each substation may feed more than one underground transmission line so that there are more than one underground line connected in parallel and sharing some kilometres from the beginning substation. In this case, the load current applied on each of the connected lines may affect and have an influence on the other which certainly affects the sheath current at each measuring point.

This paper presents the application of the criterion developed in [9] on a real double circuit cable system. The criterion applied is based on simple codes from 0 to 4, representing the level of change in the cable sheath currents in case of defect. This paper studies the influence of changing the load current on each one of the parallel lines on the sheath current obtained at each measuring point on the two parallel lines. Real measurements have been performed under normal condition. There is a good agreement between the measured and simulated results.

PROBLEM STATMENT

The CB configuration as shown in Fig.1, consists of three minor sections. The cable sheaths of each minor section are interconnected together through linkboxes. The sheath current can be measured at four positions along the CB configuration at the terminal T_o and T_e and at linkboxes (LB_1 and LB_2). Sensors are fastened around unipolar cables at the terminals (I_o, I_e) while they are fastened around coaxial cables at linkboxes (I_1 and I_2).

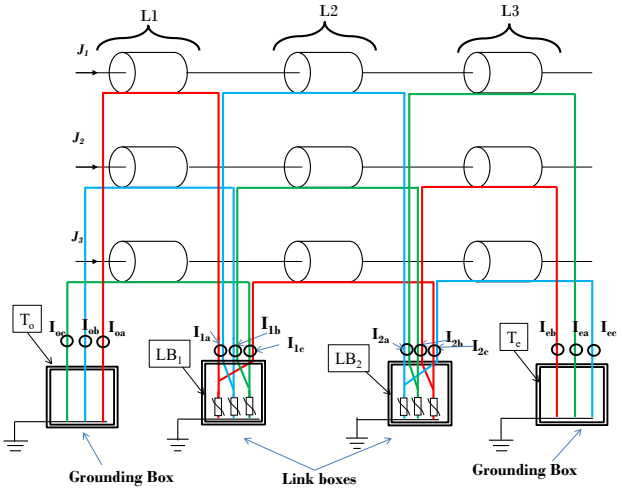

Fig. 1: CB configuration

Sensors at linkboxes (I_1 and I_2) are measuring the difference in the current between two sheath loops interconnected together. Sensors at the terminal (I_o and I_e) are measuring the current in one sheath loop. However in some practical situation where two CB are connected in series, the beginning terminal of one is interconnected to the other ending terminal through unipolar cables. In this situation, the measured current will be the subtraction of both.