

Location of Micro Leaks in FFLP Cables with Bi Directional Bridge.

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ABSTRACT

The device known as *bi directional of hydraulic application* refers to a technique of measurement of micro-leaks of insulating oil in cables of type SCOF ("Self Contained Oil filled") "Cables" used since 1923 in electrical power systems. The *bi directional bridge* is an evolution of the *unidirectional bridge*, developed for locating submarine cable ends cut offshore. The purpose of using the one-way bridge for land cables was to save a lot of soil drilling on the avenues when locating with freezing techniques. However, considering that leaks in directly buried cables were much smaller than leaks in submarine cables when cut, the location took a long time because the volumes of lost oils were small and the hydraulic transit time was very high. The *unidirectional bridge* location mode requires a lot of time (about 3 to 5 days) depending on the entity of the loss and this is considered too high to keep a transmission line off. In addition, meters of small flows with adequate accuracy are scarce. *Bi-directional bridge* oil mist location technology has come to address all constraints with hydraulic methods: (1) The line may be in operation during measurements; (2) The collected data can be processed in real time while they are acquired; (3) Transformation in the frequency domain makes it possible to verify the existence of more than one leakage point. This paper presents the theoretical content of this technology and the application on actual cases.

KEYWORDS

Hydraulic Methods; FFLP cables; Oil Leaks; Bi Directional Bridge; Frequency Domain.

INTRODUCTION

Cables insulated in paper impregnated with HIGH or LOW PRESSURE are the most durable in history, either for reliability over time or for expected reliability compared to the latest solutions. The problem of oil leakage that occurs after dozens of years of use must be solved by locating and repairing them. In general the location in case of cables directly buried has been a problem that requires effort and a lot of perseverance, not to mention experience and training. Hydraulic or chemical tracer methods can be used to locate leaks in FFHP or FFLP cables, but there are preferences and adjustments in each case. When pressurized oil at high or low pressure is in contact with the steel tube or metal sheath the methods with chemical tracers have some attractiveness. However, when the oil feed the driver's channel the hydraulic methods are more effective and safe.

This work is dedicated to hydraulic methods, especially the so-called "bi-directional hydraulic bridge in stochastic approach".

METHOD OF TRACERS

The tracer method [01] was developed for American type pipe cables. These cables have the semi-insulated

insulation for external contaminants the shielding of each cable and when the tracer leaks through some fault in the tube, it finds the nature directly, where it will be identified and located.

The most commonly used tracer is PFCs (perfluorocarbons). This tracer is inoculated in the insulating oil and diffuses throughout the extension of the cable.

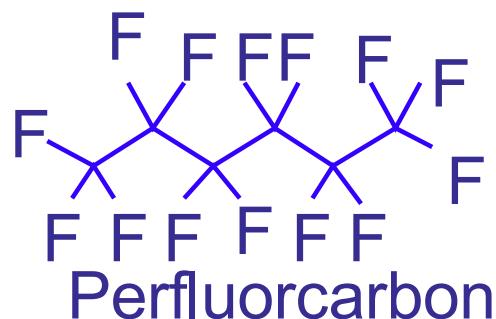


FIGURE (01) PERFLUCABONOS LIQUIDS

(Source: Wikipedia)

When a leak occurs, it passes into the surrounding nature and can then be located by the C-F functional group by gas chromatography or by any other detection method.

The location will be so much easier and more precise the lower the diffusion barrier of the PFC to the environment. For this reason it will always be better applied on PIPE cables and OF three-pole constructions.

HYDRAULIC METHODS.

Hydraulic methods can be classified in 2: (1) Freezing method and (2) Hydraulic bridge method.

The freeze method is the oldest and much used for terrestrial cables, even today. The concept used is that the cable is an approximate hydraulic line through a U-tube and any leakage point can be located by successive iteration of sectioning in the half in half of the hydraulic line [02].

The hydraulic bridge method was developed for submarine cables. Oil leaks in undersea cables are usually caused by total cable cut. In this case, using a sound cable, it is possible to locate the leakage point with good precision. This technique was implemented for micro-leaks and shown in [02] and [03].

HEURISTIC METHODS

"Heuristics is a diffuse boundary between intuition and the scientific method in the discovery of truths." It is a capacity found only in humans, sometimes developed after much experience. In the case of locating leaks in cables directly