

Restoring Lead Alloy Solder on Cable Joints for Fluid Filled Low Pressure 145 KV with Increasing Pressure Class.

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ABSTRACT

After 50 years of service some fluid filled low pressure cables has brought in this country small oil leaks in solder joints on the casing and the metal sheaths of those cables. Instead of replacing the cables FFLP, the Utilities has decided to restore the joints sleeves and increase the pressure class of the Pb-Sn alloys weldings. For such, a Research and Development project was sponsored by AES ELETROPAULO under ANEEL supervision that enabled the develop a model to study and to establish the aging of welding joints of cable housing and creating solution to increase the pressure class of the joints as well. The study and development was planned with accelerated experiment using the Arrhenius theory with a simplified physical model, where the weldings and the various possible types of reinforcements were simulated.

KEYWORDS

Cables, Underground, Cable Joints, Materials, Ageing

INTRODUCTION

Oil fluid cables have in the region of joints sleeve soldering made with lead alloy that possess the function of sealing leakage of oil for an indefinite time. The soldering process is completely manual, requiring great skill and mastery. In general, the life expectancy exceeds 30 years and thereafter the majority of the defects resulting from over temperature due to short-circuiting across the life and temperature due to overloads. The mode of thermal fault is shown in Figure 1, where a lateral protrusion visually observed occurred due to the insulating oil pressure exactly in the joint sleeve.



FIGURE - 1
FAILURE MODE FOR INTERNAL PRESSURE

After 30 years of service, the majority of OF cable lines in the concession area of AES Eletropaulo operating in the capacity of current threshold and so when the above mode is present, a warning that all other sleeves joins can

be in limit of exhaustion. Thus this evidence requires corrective action upon sleeve joints remaking their geometries for its effective performance. This work was carried out within an R & D program ANEEL managed by AES Eletropaulo in order to determine the aging mode of welding with lead alloy and developing technology that increase their lives.

JOINTS AND SOLDERING

The self contained system (SCOF CABLE - Self Contained oil filled cable), which is the OF cable, have upon the joints the weakest points regarding mechanical sealing pressure. These points are the soldering of joint sleeves by which are made handily. This chapter is devoted to the characterization of the joint sleeves of the OF cables in its fundamental concepts and construction and assembly skills.

JOINTS COMPONENTS

Straight Joints of an OF cable have the same conceptual characteristics of the cables. However, unlike the industrial construction of the cables, the joints have a fully dependent construction of labor quality (handmade). Figure 2 illustrates some of the main components of a normal joint for OF cable type with particular reference to the positioning of the lead alloy sleeve joints.

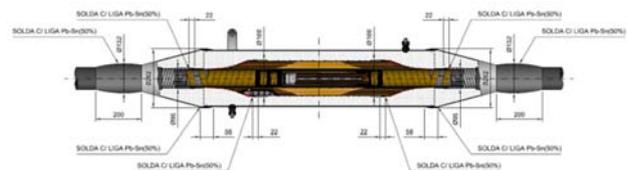


FIGURE - 2
JOINT LONGITUDINAL VIEW

In Figure 2, two conical casing geometry mechanical conformed to tinned copper substrates (to became easy the welding operation) and there is formed sort of interpenetration between the two substrates as shown in Figure 2 above. These two half carcasses are placed on the cables when they are cut to the pressing operation of the electrical connection. Thereafter, craft welds are performed as shown in Figure 2. Then the assembly of the joints by applying artisan adjusted sheets of paper, the whole is subjected to vacuum and the oil drained into the vacuum operation is disposed at the bottom of housing, as shown in the previous figure. The set operation after treatment is completely sealed after impregnation remaking the whole pressure vessel.