FIRST PILOT INSTALLATION OF A 380KV DIRECTLY BURIED GAS INSULATED LINE (GIL)

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ABSTRACT

A pilot installation of a directly buried GIL consisting of a double circuit system about one km in length was realised in the 420 kV network of Amprion in the area of Frankfurt airport. In the course of this pilot installation, different aspects were analysed in detail: design features, prefabrication of components and installation onsite as well as onsite testing and loading and overloading capability. The experience collected is presented in this report. By the described GIL pilot installation momentum was gained to collect further knowledge of this technology in particular as an alternative to cable solutions.

KEYWORDS

Underground lines, gas insulated lines (GIL), N2/SF6 gas mixture, installation, on-site testing, loading and over-loading capability, directly buried GIL

INTRODUCTION

Regarding the increasing interest in underground transmission in EHV systems, gas insulated lines (GIL) represent an attractive alternative to cable solutions. Changes in the regulatory framework with respect to the planned extension e.g. of the German EHV system have intensified the demand for underground transmission lines in general. GIL are applied mainly above ground (e.g. in sub-stations) or in underground tunnels.

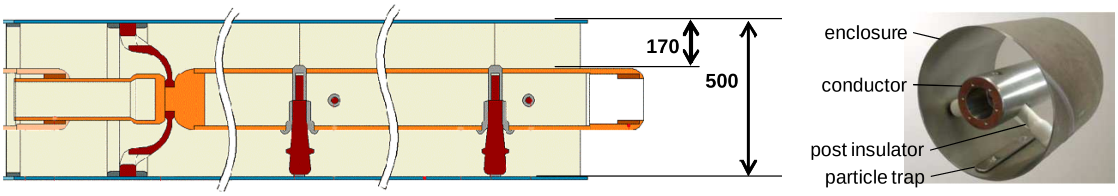

Fig. 1: Basic design of GIL

However, the option of a directly buried GIL which does not need the expenditure of a tunnel, was not realized up to now in the EHV voltage range, although it exhibits several advantages as high current carrying capacity, low losses, low charging capacity and low electromagnetic field radiation.

Caused by the necessity to install the last kilometer of an incoming overhead line (OHL) underground due to the vicinity to a newly planned runway at the Frankfurt airport, the German network operator Amprion decided to consider the ability of this technology more thoroughly and decided to install a pilot installation of a directly buried GIL with a length of about one kilometer.The GIL containing an N_2/SF_6 gas mixture is at one end directly connected to a gas insulated substation (GIS). At the other end the GIL joins the incoming OHL via gas insulated bushings. [1].

DESIGN PRINCIPLE OF THE GIL

The design principle of a GIL can be seen in Fig. 1. The straight element, consists of an aluminum tube with a wall thickness of 8.5 mm. Slight changes in direction are verified by elastic bending of the tubes. For larger changes in direction elbow elements come into use. The inner conductor is supported by post insulators able to glide on the outer tube. After app. 100 meters and at changes in directions conical insulators permeable to gas are installed. To capture particles which cannot totally be avoided during assembly and installation the outer tube is fitted with a particle trap. For corrosion protection the exterior wall of the tube is protected with a plastic coating of app. 4 mm. Additionally, active corrosion protection measures are provided.

INSTALLATION

Pre-assembly and assembly

In this pilot project the installation over longer distances was subject of detailed investigations. The laying procedure was considered systematically and rationalized as far as possible. The different steps of mounting, i.e. welding and laying in the trench are illustrated in the following sequence.

The pre-assembly was carried out in an installation tent which was located in the middle of the trench and can be considered to be the logistical main hub at site (Fig. 2).

Fig. 2: Installation tent