A.5.3. Coordination d'isolement d'une liaison triphasée à isolation gazeuse (TPGIL) avec les niveaux de surtensions et les caractéristiques des parafoudres à ZnO associés

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A.5.3. Coordination of three-phase gas insulated line (TPGIL) insulation with levels of affecting overvoltages and characteristics of ZnO arresters

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Résumé

L'utilisation de parafoudres à oxyde de zinc pour la limitation des surtensions importantes placés à chaque extrémité des liaisons triphasées à isolation gazeuse (LIG) permet de dimensionner l'isolation principale de ces dernières uniquement pour des conditions d'exploitation fiable en régime normal (c'est-à-dire à "l'optimum de la norme"). Ce choix conduit à un rapport optimal des dimensions des différents constituants ($r/R = 0,2$ $b/R = 0,5$) correspondant à un champ électrique minimum au niveau de la gaine extérieure de la liaison lorsque R (rayon de la gaine) est inférieur ou égal $5U/E_{n.c.adm}$. ($E_{n.c.adm}$ est le champ électrique admissible en régime permanent dans le SF6).

Abstract. With deep overvoltages limitation by means of ZnO-arresters mounted at both ends of gas insulated line (GIL) insulation can be chosen proceeding only from reliable service requirement in normal operating condition (i.e. can be "reduced to the norm"). With the choice of insulation the optimal relationship between the design dimensions $r/R=0.2$; $b/R=0.5$ corresponds to minimum intensity of electric field, the sheath radius - to the admissible intensity of electric field in normal operating conditions $R \leqslant 5U/E_{n.c.adm}$.

Introduction.

Overall dimensions any equipment with inner insulation should be chosen proceeding from the reqiurement of insulation reliable service in normal operating conditions. This requirement is ensured by the admissible intensity of continuously applied electric field. The limitations of short-time overvoltages (switch and lightning) up to the admissible values corresponding to the design chosen dimensions, should be obtained by the special arresters or scheme measures. In the paper with the choice of high-voltage three-phase gas insulated lines dimensions (GIL TP) and the system of protecting measures the above approach called in [1] "reducing insulation to the norm" was accepted.

Choice of insulation dimensions GIL.

The problem of choosing insulation dimensions GIL includes two stages: 1. the choice of relationship between GIL design parameters proceeding from minimum intensity of electric field; 2. the radius choice of GIL outer sheath proceeding from admissible intensity of electric field in normal operating condition.

The first problem stated was solved with the help of conformal mapping theory. For generalizing methods of field calculation for the case of acting switch overvoltages the authors give the methods of field calculation with the unbalanced system of charges on conductors. In the methods given in [2] relating to the balanced system of charges the optimal dimensions were the ones at which intensities modulus at the points of the conductor the nearest and the most remote from the outer sheath appeared the same. With the unbalanced system the maximum intensity appears at the point shifted at an angle relative to the axis of real ones (point M in fig.1). Using the method of superposition the intensity of phase A conductor surface can be defined as:

$$\underline{E}=\underline{E}_A+\underline{E}_B+\underline{E}_C, \tag{1}$$

where E_γ - intensity at the investigated point defined by the phase γ conductor charge if assumed the absence of charges on the other conductors (γ=A,B,C).

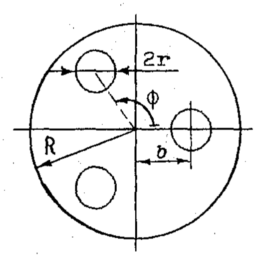

Fig.1. Draft of GIL TP design.

Using the method of conformal mapping the charged conductor and the earthed sheath are mapped in the concentric system. When defining the intensities the following assumptions were accepted: in the case if the phase A conductor is mapped in the centre of the system, the intensity is defined on the surface of the phase the induced potentials on two other conductor are not taken into account. When mapping to the system center of phases B and C conductors the charge induced in the rated phase A is accepted not to change the source of the field (in the regarded case of the phases B and C).

When defining intensity in the conductor rated point of the phase A due to the phases B and C charges the author took into account the fact that the normal component of the electric field intensity on the surface of the phase A conductor can be defined as the doubled normal component at the desired point when changing the phase A conductor by the dielectric:

$$\underline{E}_M=\underline{E}_{MA}+2\underline{E}_{MB}+2\underline{E}_{MC}, \tag{2}$$

The function mapping conductors of all phases to the centre of co-axial systems