A.10.1

H.V. Cable pulling improvemens with unwinding machines

A. HERBRETEAU (Omnium Technique du Câble)
85, rue du traité de Rome - B.P. 1225, 84911 AVIGNON Cedex9
H. THEVENON (Consultant)
288, rue André Philip, 69003 LYON

H.V. cable pulling with unwinding machines attains one's end by sharing the pull among all the machines. Compared to a winch pulling tension stresses are reduced. The difficulty consists in the laying out of the unwinding machines to be sure that no H.V. cable section between machines may be submitted to compressive stresses inducing buckling and uncontrolled bending radius.

To lay out the unwinding machines use is made of a friction coefficient which is not a well defined quantity and which may vary during H.V. pulling cable. So the choice of the value of the friction coefficient must be conservative to be sure to have at one's disposal a sufficient resulting pull to unwind the H.V. cable and overcome pull fluctuations.

This article while describing some aspects for carrying out unwinding machines presents a new process which holds everywhere the H.V. cable out of compressive forces and prevents from any buckling effect during pulling.

The basis for the laying out of the unwinding machines assume that all the machines are identical and supplied by the same voltage. With this assumption all the machines having the same rotating speed develop the same pull.

To lead to tension stress in H.V. cable the section length between machines may be downstream progressively reduced. So the first upstream section is the longest and determines the pull which has to be developped by the machines. In addition the voltage supply may be downstream.

Nethertheless the The H.V. cable pulling tension remains nil at the last downstream machine output and only progressively increase at the upstream machine outputs with the result that H.V. cable may be submitted to compession stresses due to the fluctuations of the pull.

This new process leads to maintain a constant pull in H.V. cable at all machine outputs. To obtain this effect the first upstream section is lengthened as to establish a pull $T_e = T_s + T_g$ at the input of the first upstream machine where T_s is the H.V. cable pull at the output of the first machine and T_g the developped pull by the machine. The lay out of the following machines is such as the developped friction stresses between machines are approximatively equal to T_g. By doing so the H.V. cable pull may vary between T_e et T_s et under the condition that an auxiliary mean is used to develop the pull T_s at the last downstream machine output. This result is obtained by the use of an auxiliary flexible cable which is jointly attached to the head of the H.V. cable and pulled by the downstream machines in front of the H.V. cable.

The length T_c of the auxiliary flexible cable is given by $L_c = \frac{d.\ T_s}{(1-k).\ T_g}$ where k is the ratio between the auxiliary flexible cable mass and the H.V. cable mass and where d is the mean section length between machines. The auxiliary flexible cable mass has to be as reduced as possible while its diameter remains sufficient and compatible with the machine requirements.

Addtional machines which in fact are linked to the lengthening of the first upstream section and whose quantity is $\frac{T_s}{(1-k).\, T_g}$ are set out to complete the H.V. cable pulling.

With this new process the H.V. cable is everywhere under a pull which is higher than a choosen pull for maintaining the H.V. cable with tension stresses in spite of the friction coefficient and developped machine pull variations. This process can be used in conjonction with the progressive reduction of the section lengths and the downstream voltage supply.