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GREENGATE AND FABREEKA BELT PERFORMANCE IN A 3.5 MV TANDEM

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Résumé. — On compare différents types de courroies utilisées dans le Tandem 3,5 MV de C.I.S.E.

Abstract. — We compar different type of belts used in the 3.5 MV Tandem of C.I.S.E.

The aim of this paper is to provide information about the experiences we have with Fabreeka and Greengate belts.

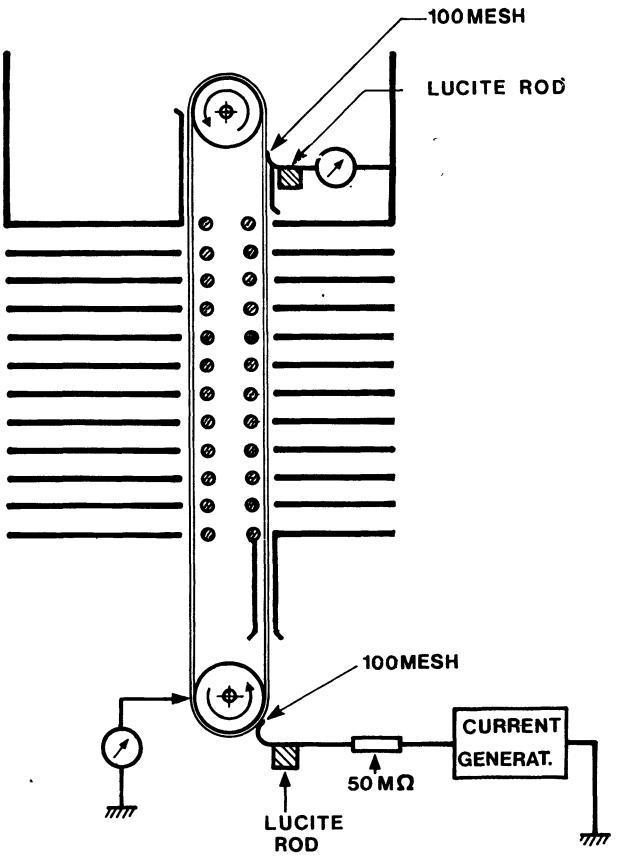
Unfortunately there is little information regarding the performance of these belts in the literature (some information can be found in the Proceedings of the Conference held in Daresbury in 1973). In general the belt performance is influenced by so many parameters that it is difficult to compare the results and to give absolute rules valid in any condition.

The first belt we used for the tests of the 3.5 MV Tandem built in Milan, was a 5 ply spliced Fabreeka belt, about six meters long (effective column length of 2.2 meters). The charging system consisted of a set of needles mounted in line with and facing motor pulley. During the tests the electrostatic generator reached 4 MV without tubes and 3.8 MV with an accelerated proton beam. After the tests, the belt worked at 3 MV for about 500 hours but later the operating voltage was limited to under 2 MV by sparking along the belt. The belt showed longitudinal rips of about one meter long: some rips ended with surface tracking in random directions. Two more Fabreeka belt were used with lives respectively of 100 hours and 50 hours. The type of the failure was about the same.

It was then decided to try a different make of belt and one manufactured by Greengate was installed. At the same time the spray comb was replaced by a coarse stainless steel mesh: this decreased the spray voltage and avoided the variations of the voltage with time due to the needles becoming blunted. The Greengate belt immediately showed a very poor performance: at very low spray current, some surface sparks appeared on the belt, even in the field free region between motor and generator column: moreover a lot of dust was produced. At this point a drastic reexamination of the problem was made in the light of an exchange of information with the Oxford and Harwell groups and with the help of suggestions from F. Howe and D. Shepherd (Megavolt) following a visit to the laboratory.

The operations carried out were:

a) the same Greengate belt which showed only surface tracks was mechanically abraded with alumina powder to remove all the surface rubber and tracking



Belt charging system scheme.

marks. It was then cleaned with freon TF and degassed in vacuum oven at 50 °C for about 30 hours;
b) the charging system was replaced by a softer 100 mesh stainless steel gauze lapping the belt. Care was paid to eliminate other metal parts facing the belt and which could lead to a possible discharge. The mesh width was 2 inches less than the belt width. The charging system is schematically shown in the figure.

In these conditions the belt was run in for about 50 hours and carefully conditioned before charging; a further 50 hours were used in reaching 1.5 MV. A programme of work using 3 MeV proton beam gave us the opportunity to use the same voltage for 500 hours.
The belt can now support 3.5 MeV without trouble and has operated for more than 1 000 hours at 3 MV.

One may try to draw the following conclusions:
a) Greengate and possibly also Fabreeka belts can be used with this kind of accelerators, but a preparatory treatement of the belt is of major importance: the rubber surface layer should be cleaned off in order to eliminate within a reasonable time the water from the cotton warp. The other advantage of this cleaning is that of eliminating of a lot of dust in the initial operational period.
b) Soft meshes are better than needle comb, although not so important as the preparatory treatment of the belt. Care is necessary in the geometry of the charging and collecting system to avoid stray corona discharges on the belt in this critical area.