PAPER NO: 12

ON THE CALCULATION OF ECONOMIC CURRENT DENSITY OF ALUMINIUM CELL BUSBARS (*)

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The calculation of economic cross section for D.C. busbars, based on the minimisation of total costs e.g. cost of conductor and a stream of costs for power losses in the conductor, is quite well known. Certain complications arise in quantifying the cost of conductor and cost of the power lost. In the literature it is customary to express the cost of conductor in terms of an equivalent annual cost. In this paper the investment in conductors and the cost of power losses, over the life of the project, are discounted to the base year at a continuous interest rate. This method apart from being fundamentally more rigorous affords some advantages in calculation. The cash flow calculations are formulated mathematically and a compact formula for economic cross section is derived based on factors applicable to Indian conditions. This would spare an engineer the need to be familiar with cash flow calculations. Another advantage of this derivation is that sensitivity of the economic cross section to changes in various factors could be readily investigated.

For aluminium smelters, under certain conditions, the economic cross section based on minimisation of total costs only determines the lower limit of cross section. By increasing the cross section of the busbars, there would be a decrease in the voltage drop between the cells and, the total line voltage being constant, more cells could be installed. The increase in output of the line would fetch additional revenue. The decision to increase the cross section of busbars, should be based on the rate of return expected on the total incremental investment in busbars and additional cells. This concept is explored in the paper.

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