

A LABORATORY METHOD FOR COMPARING THE ROLLING LOSS OF TYRES BY SINGLE LOOP HYSTERESIS MEASUREMENT

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ABSTRACT

A simple laboratory method using the universal testing machine, to compare the rolling resistance values of tyres of different design has been developed using the concept of single loop hysteresis energy loss $e(h)$. The $e(h)$ value is calculated from the loop area enclosed between the loading/unloading curves as the tyre footprint goes through one compression / relaxation cycle. The $e(h)$ values for a number of P195/75R14 and P225/60R16 size tyres of different design from two manufacturers were obtained. Individual $e(h)$ values as well as $e(h)$ ratio of tyre pairs of different design showed one to one correspondence with the respective R and R ratio values. These results indicated that the $e(h)$ could be considered a measure of R. The directional change in $e(h)$ with design variation agreed with the directional change in R. This simple test method, rather than the conventional one using heavy duty test machine, is helpful for preliminary comparison of rolling loss values of tyres of different designs.

Keywords: Tyre, $e(h)$ values, Rolling loss measurement, Tyre designs, UTM method.

INTRODUCTION

Rolling loss or rolling resistance R is a performance property of interest to tyre manufacturers. Presently the R values are determined by the standard SAE procedure (1985) which is accepted by both tyre and automotive industries. In this method the designers use a dynamometer machine (1.7 m dia) for measuring the R values of passenger and truck tyres. This test machine has a load capacity of 5000 to 10000 kg per station with different accessories and is generally used for performing different types of tests such as rolling resistance, tyre durability, belt edge failure, stepwise loading, force/deflection

testing, puncture testing etc. The machine can be programmed to the required speed and load/pressure conditions. The expensive heavy-duty machine is usually set up as an outside test facility rather than in a research laboratory.

A tyre design engineer normally approaches the problem of developing tyres of low rolling resistance either by chemical modification and/or by changing the component parameter. A few experimental tyres are designed accordingly by incorporating the changes and the designer sends these experimental tyres and a similar reference tyre (same size) to an outside test facility for performing the rolling resistance