The test should then continue for 3 h and may then be interrupted. The average temperature rise during the last hour is taken as the result of the test. With T_o = 3 h this theoretically leads to a truncation error of about 1 K. If the time constant is shorter the error is smaller and vice versa.

The time constant T_o may be estimated in different ways.

The following formula is based on information available on the transformer rating plate:

$$T_o = \frac{5 \times [\text{total mass}] + 15 \times [\text{mass of oil}]}{[\text{total loss}]} \times \left(\frac{\Delta\theta_u}{60}\right) \text{ hours} \qquad (6)$$

where

masses are in tonnes and loss is in kilowatts;

$\Delta\theta_u$ is the estimated ultimate top oil temperature rise.

The mass of the oil in the conservator should be subtracted from the total mass of oil – it does not take part in the changes of temperature.

An experimental estimation of the time constant in the course of the test may be made from successive temperature readings at equal time intervals *h*.

Given three successive readings $\Delta\theta_1$, $\Delta\theta_2$ and $\Delta\theta_3$, if the exponential relation, equation (2), is a good approximation of the temperature curve, then the increments will have the following relation:

$$\frac{\Delta\theta_2 - \Delta\theta_1}{\Delta\theta_3 - \Delta\theta_2} = e^{h/T_o}$$

$$T_o = \frac{h}{\ln \dfrac{\Delta\theta_2 - \Delta\theta_1}{\Delta\theta_3 - \Delta\theta_2}} \qquad (7)$$

The readings also permit a prediction of the final temperature rise:

$$\Delta\theta_u = \frac{(\Delta\theta_2)^2 - \Delta\theta_1 \Delta\theta_3}{2\Delta\theta_2 - \Delta\theta_1 - \Delta\theta_3} \qquad (8)$$

Successive estimates are to be made and they should converge. In order to avoid large random numerical errors the time interval *h* should be approximately T_o and $\Delta\theta_3/\Delta\theta_u$ should be not less than 0,95.

A more accurate value of steady-rate temperature rise is obtained by a least square method of extrapolation of all measured points above approximately 60 % of $\Delta\theta_u$ ($\Delta\theta_u$ estimated by the three point method).