Table 2 – Thermal characteristics used for the calculation of loading tables in section 3

			Distribution transformers	Medium and large power transformers		
			ONAN	ON..	OF..	OD..
Oil exponent	x		0,8	0,9	1,0	1,0
Winding exponent	y		1,6	1,6	1,6	2,0
Loss ratio	R		5	6	6	6
Hot-spot factor	H		1,1	1,3	1,3	1,3
Oil time constant	τ_o	(h)	3,0	2,5	1,5	1,5
Ambient temperature	θ_a	(°C)	20	20	20	20
Hot-spot rise	$\Delta\theta_{hr}$	(K)	78	78	78	78
Average winding rise	$\Delta\theta_{Wr}$	(K)	65	63	63	68
Hot-spot to top-oil gradient	Hg_r	(K)	23	26	22	29
Average oil rise	$\Delta\theta_{imr}$	(K)	44	43	46	46
Top-of-winding oil rise[1)]	$\Delta\theta_{ir}$	(K)	55	52	56	49
Bottom-oil rise	$\Delta\theta_{br}$	(K)	33	34	36	43

1) For ON cooling, $\Delta\theta_{ir}$ is taken to be equal to $\Delta\theta_{or}$.

2.4 Steady-state temperature equations

2.4.1 *ON cooling*

For ON cooling, the ultimate hot-spot temperature under any load K is equal to the sum of the ambient temperature, the top-oil temperature rise and the temperature difference between the hot-spot and the top-oil:

$$\theta_h = \theta_a + \Delta\theta_{or} \left[\frac{1 + R K^2}{1 + R}\right]^x + Hg_r\ K^y \qquad (1)$$

2.4.2 *OF cooling*

For OF cooling the calculation method is based on the bottom-oil and average oil temperature for the reason explained in 2.3.2. Thus the ultimate hot-spot temperature under any load K is equal to the sum of the ambient temperature, the bottom-oil temperature rise, the difference between the top-oil in the winding and the bottom-oil and the difference between the hot-spot and the top-oil in the winding:

$$\theta_h = \theta_a + \Delta\theta_{br} \left[\frac{1 + R K^2}{1 + R}\right]^x + 2\ [\Delta\theta_{imr} - \Delta\theta_{br}]\ \ K^y + Hg_r\ K^y \qquad (2)$$