

M502 : THERMAL ENVIRONMENT

KATA THERMOMETER CALCULATIONS

The measurement of air velocity using a Kata thermometer can be derived from the following equations:

$$A = \frac{K}{t} = \alpha (36.5 - t_1) + \epsilon \sigma [(273 + 36.5)^4 - T_{mr}^4]$$

A = Kata value = K/t

K = Kata thermometer constant, mkal/cm²

t = time for cooling from 38°C to 35°C, s

α = convective heat transfer coefficient, mkal/cm²•s•°C

σ = Stefan-Boltzmann constant (0.138 · 10⁻⁸ mkal/cm²•s•K⁴)

t₁ = air temperature, °C

T_{mr} = mean radiation temperature, K (t₁ and T_{mr} < 30°C)

Air velocity can then be calculated (silvered Kata thermometers only) by using:

$$v = \left(\frac{\frac{A}{36.5 - t_1} - 0.124}{0.385} \right)^2 \quad \left(v \leq 1 \frac{m}{s} \right)$$

$$v = \left(\frac{\frac{A}{36.5 - t_1} - 0.024}{0.485} \right)^2 \quad \left(v \geq 1 \frac{m}{s} \right)$$

$$\text{Where } A = \frac{\text{Kata thermometer constant (mkal/cm}^2\text{)}}{\text{Cooling time of Kata (seconds)}}$$

t₁ = air temperature (°C)

v = air velocity (ms⁻¹)

Note: For non-silvered Kata thermometers change the values 0.124 to 0.205 and 0.024 to 0.105