

PREDICTION OF THERMAL COMFORT

as per ASHRAE Standard 55-2004

	SI	IP
Metabolic heat production M, met	1.2	1.2
Metabolic heat production in Watts = met x 58.15W (Btu/h)	70	238
Work, W (met)	0.00	0.00
Insulation of clothing assemble, clo	0.63	0.63
Indoor air temperature ti, °C (°F)	23.3	74.0
Indoor air temperature ti, °K	146.9	296.3
Mean radiant temperature tr, °C (°F)	22.9	73.2
Mean radiant temperature tr, °K	295.9	295.9
Indoor air relative humidity, %	30%	30%
Air velocity (V), m/s (ft/min)	0.10	20.0
Velocity threshold, Vmax = 2.38 x (tcl-ti) x ^{0.25} /12.1, m/s (ft/min)	0.30	59
Saturated vapor pressure= EXP(-5.8002206 x 10 ³ / ti + 1.3914993 - 4.864023 x 10 ² x ti) + 4.1764768 x 10 ⁵ * ti ^ 2 - 1.4452093 x 10 ⁻⁸ x ti ^ 3 + 6.5459673 x Log(ti)), Pa (in. w.c.)	2,842	11.4
Partial water vapor pressure pa = Saturated pressure x Relative humidity, Pa (in. w.c.)	853	3.4
Clothing insulation resistance Rcl=0.155 x lcl, m ² °C /W (ft ² °F h/Btu)	0.098	0.017
Clothing factor fcl= 1+1.29 x Rcl if Rcl<0.078, of 1.05 + 0.645 Rcl	1.113	1.113
Initial value of convective heat transfer hcf = 12.1 x V ^{0.5} , W/m ² °C (Btu/h ft ² °F)	3.86	0.68
Initial value of clothing temperature tcla = ti + (35.5 - ti) / (6.45 * Rcl + 0.1)), °C (°F)	28.1	82.6
Computational coefficients: P1=Rcl x fcl	0.11	0.11
P2=3.96 P1	0.43	0.43
P3=100 P1	10.87	10.87
P4=P1x ti	32.21	32.21
P5=308.7- 0.028 (M-W)+P2 x (tr/100) ⁴	339.7	339.7
Temperature of clothing tcl, °C (°F)	28.8	83.8
Temperature of clothing tcl, °K	301.8	301.8
Convective heat transfer coefficient fhc= 2.38 (tcl-ti) ^{0.25} W/m ² °C (Btu/h ft ² °F)	3.86	0.68
HUMAN BODY HEAT LOSS BREAKDOWN:		
	Watts	Btu/h
Skin radiant heat loss Hr = fcl x 3.96 x 10 ⁻⁸ (tcl ⁴ - tr ⁴)	28	94
Skin convective heat loss Hc = fcl x hc x (tcl - ti)	23	80
Skin latent heat loss HI = 3.05 x [5.73 - 0.007 x (M-Work) - pa/1000]	13	46
Sweat heat loss Hsw = 0.42 [(M-Work) - 58.15]	5	17
Respiratory latent heat loss Hrl = 0.0173 M (5.87-pa/1000)	6	21
Respiratory sensible heat loss Hrs = 0.0014 M (34 - ti)	1	4
Total heat losses H = Hr + Hc + HI + Hsw + Hrl + Hrs	76	261
Internal heat production = M - Work	70	238
Thermal stress L = Internal heat production - Total heat losses	-7	-22
Predicted mean vote PMV=[0.303 exp(-0.036 x 58.15 x M)+0.028] x L	-0.35	-0.35
Predicted percent dissatisfied PPD = 100 - 95 x exp[-(0.03353 PMV ⁴ +0.2179 PMV ²)]	7%	
Comfort feeling	comfortable	