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APPENDICES

APPENDIX A

WORKING FLUID PROPERTY

Properties listed:

- Latent heat of evaporation
- Liquid density
- Vapour density
- Liquid thermal conductivity
- Liquid dynamic viscosity
- Vapour dynamic viscosity
- Vapour pressure
- Vapour specific heat
- Liquid surface tension

WATER

Temp.	Latent Heat	Liquid Density	Vapour Density	Liquid Thermal Conductivity	Liquid Viscos.	Vapour Viscos.	Vapour Press.	Vapour Specific Heat	Liquid Surface Tension
^{o}C	kJ/kg	kg/m^3	kg/m^3	$W/m^{o}C$	cP	$cPx10^2$	Bar	$kJ/kg^{o}C$	$N/mx10^2$
20	2448	998.2	0.01	0.612	1.00	0.96	0.02	1.85	7.40
40	2402	992.3	0.05	0.630	0.65	1.04	0.07	1.86	6.96
60	2359	983.0	0.14	0.649	0.47	1.12	0.20	1.87	6.62
80	2309	972.0	0.29	0.668	0.36	1.19	0.47	1.88	6.26
100	2258	958.0	0.60	0.680	0.28	1.27	1.01	1.88	5.89
120	2200	945.0	1.12	0.682	0.23	1.34	2.02	1.89	5.50
140	2139	928.0	1.99	0.683	0.20	1.41	3.90	1.90	5.06
160	2074	909.0	3.27	0.679	0.17	1.49	6.44	1.91	4.66
180	2003	888.0	5.16	0.669	0.15	1.57	10.04	1.92	4.29
200	1967	865.0	7.87	0.659	0.14	1.65	16.19	1.93	3.89

APPENDIX B

THERMAL CONDUCTIVITY OF HEAT PIPE CONTAINER AND WICK MATERIALS

Material	Thermal Conductivity ($W/m^{\circ}C$)
Aluminium	205
Brass	113
Copper (0 - 100°C)	394
Glass	0.75
Nickel (0 - 100°C)	88
Mild Steel	45
Stainless Steel (Type 304)	17.3
Teflon	0.17

APPENDIX C

DIMENSIONAL EQUIVALENTS AND PHYSICAL CONSTANTS

DIMENSIONAL EQUIVALENTS

Length	1 ft = 12 in. = 30.48 cm = 0.3048 m 1 m = 100 cm = 39.37 in. = 3.28 ft
Mass	1 lbm = 0.03108 slug = 453.59 g = 0.45359 kg 1 kg = 1000 g = 0.06852 slug = 2.205 lbm
Time	1 hr = 3600 sec 1 sec = 2.778×10^{-4} hr
Force	1 lbf = 4.448×10^{5} dyne = 4.448 N 1 N = 10^{5} dyne = 0.2249 lbf
Angle	1 degree = 1.745×10^{-2} rad 1 rad = 57.30 degrees
Temperature	1 deg F = 1 deg R = 0.5556 deg C = 0.5556 deg K 1 deg K = 1 deg C = 1.8 deg R = 1.8 deg F deg F = 1.8 deg C + 32 deg C = 0.5556(deg F − 32) deg R = deg F + 459.69 deg K = deg C + 273.16 deg R = 1.8 deg K deg K = 0.5556 deg R
Energy	1 Btu = 777.66 ft-lbf = 252 cal = 1.054×10^{10} erg = 1054 J 1 J = 10^{7} erg = 0.239 cal = 0.7375 ft-lbf = 9.485×10^{-4} Btu
Power	1 Btu/hr = 2.778×10^{-4} Btu/sec = 2.929×10^{6} erg/sec = 0.2929 W 1 W = 10^{7} erg/sec = 9.481×10^{-4} Btu/sec = 3.414 Btu/hr
Pressure	1 lbf/ft^2 = 6.944×10^{-3} lbf/in.^{2} = 478.8 dyne/cm^2 = 47.88 N/m^2

	1 lbf/in.^{2} = 144 lbf/ft^2 = 68,948 dyne/cm^2 = 6894.8 N/m^2
	1 N/m^2 = 10 dyne/cm^2 = 1.450 X 10^{-4} lbf/in.^{2} = 2.089 X 10^{-2} lbf/ft^2
Area	1 ft^2 = 144 in.^{2} = 929 cm^2 = 0.0929 m^2
	1 m^2 = 10^4 cm^2 = 1550 in.^{2} = 10.76 ft^2
Volume	1 ft^3 = 1728 in.^{3} = 2.832 X 10^4 cm^3 = 0.02832 m^3
	1 m^3 = 10^6 cm^3 = 6.102 X 10^4 in.^{3} = 35.31 ft^3
	1 gal (U.S. liquid) = 0.13368 ft^3 = 0.003785 m^3
Density	1 lbm/ft^3 = 0.03108 slug/ft^3 = 1.602 X 10^{-2} g/cm^3 = 16.02 kg/m^3
	1 kg/m^3 = 10^{-3} g/cm^3 = 0.00194 slug/ft^3 = 0.06242 lbm/ft^3
Viscosity (dynamic)	1 lbm/ft-hr = 8.634 X 10^{-6} slug/ft-sec = 4.134 X 10^{-3} g/cm-sec = 4.134 X 10^{-4} kg/m-sec
	1 kg/m-sec = 10 g/cm-sec = 2.089 X 10^{-2} slug/ft-sec = 2.419 X 10^3 lbm/ft-hr
Thermal conductivity	1 Btu/ft-hr-F = 2.778 X 10^{-4} Btu/ft-sec-F = 1.730 X 10^5 erg/cm-sec-K = 1.730 W/m-K
	1 W/m-K = 10^5 erg/cm-sec-K = 1.606 X 10^{-4} Btu/ft-sec-F = 0.578 Btu/ft-hr-F
Surface tension	1 lbf/ft = 1.459 X 10^4 dyne/cm = 14.59 N/m
	1 N/m = 10^3 dyne/cm = 0.06854 lbf/ft
Latent heat of vaporization	1 Btu/lbm = 32.174 Btu/slug = 2.32 X 10^7 erg/g = 2.324 X 10^3 J/kg
	1 J/kg = 10^4 erg/g = 1.384 X 10^{-2} Btu/slug = 4.303 X 10^{-4} Btu/lbm
Heat transfer coefficient	1 Btu/ft^2-hr-F = 5.674 X 10^3 erg/cm^2-sec-K = 5.674 W/m^2-K
	1 W/m^2-K = 10^3 erg/cm^2-sec-K = 0.1762 Btu/ft^2-hr-F

PHYSICAL CONSTANTS

Gravitational acceleration (standard), g = 32.174 ft/sec^2 = 980.7 cm/sec^2 = 9.807 m/sec^2

Universal gas constant, $\bar{R}$ = 1545.2 ft-lbf/lbm-mol-R = 1.987 Btu/lbm-mol-R = 8.314 X 10^7 erg/g-mol-K = 8.314 X 10^3 J/kg-mol-K

Mechanical equivalent of heat, J = 777.66 ft-lbf/Btu = 4.184 X 10^7 erg/cal = 1 N-m/J

Stefan-Boltzman constant, $\bar{\sigma}$ = 0.1713 X 10^{-8} Btu/ft^2-hr-R^4 = 5.670 X 10^{-5} erg/cm^2-sec-K^4 = 5.670 X 10^{-8} W/m^2-K^4