

ABBREVIATIONS			
A	Area	lx	Lux
ACH	Air Changes per Hour	M	Mass
A _k	Effective Area	ma	Mixed Air
AVG	Average	m	Meters / Metres
BHP	Brake Horsepower	m/s	Meters Per Second
BP	Brake Power	m ³ /s	Volumetric Flow: Cubic Meters Per Second
Btu	British Thermal Unit	mbh	1000 Btu/hr
Btu/hr or Btuh	British Thermal Unit Per Hour	NLA	No Load Amperage
CL	Center Distance (used in belt formula)	NP	Nameplate
°C	Degrees Celsius	NPSHA	Net Positive Suction Head Available
C	Friction Loss Coefficient (For Duct Fittings)	oa	Outside Air
CCF	100 Cubic Foot	% _{oa}	% of Outside Air
CFLA	Corrected FLA or Corrected Nameplate Amps	Ω	Ohm
CFM	Volumetric Flow: Cubic Feet Per Minute	P	Pressure
C _p	Specific Heat	P _a	Atmospheric Pressure
C _v	Flow Constant (IP)	P _{ab}	Absolute Pressure
ρ	Density	Pa	Pascals
d	Diameter	π	Pi = 3.14
Δ	Difference or Change (Final - Initial)	PD	Sheave Pitch Diameter
d _{imp}	Impeller Diameter	P _f	Friction Pressure in the Suction Line
E	Volts	P _s	Pressure at Pump Centerline
Eff	Efficiency	ppm	Parts Per Million
EP	Pump Efficiency	psi	Pounds Per Square Inch
°F	Degrees Fahrenheit	psia	Pounds Per Square Inch Absolute
f	Friction Factor	psig	Pounds Per Square Inch Gauge
fc	foot-candle	P _{vp}	Absolute Vapor Pressure at Pump Temperature
FLA	Full Load Amps	Q (flow)	Volumetric Fluid Flow Rate
FPM	Feet Per Minute	Q (heat)	Heat Flow Rate
ft	Foot	°R	Degrees Rankine
g	Acceleration of Gravity	r	Radius
gal	Gallons	% _{ra}	% of Return Air
gm	Grams	R	Resistance
GPM	Gallons Per Minute	ra	Return Air
gr	Grains	rad	Radians
h	Enthalpy	RH	Relative Humidity
H	Head	RPM	Revolutions Per Minute
Hg	Mercury	R _{value}	Thermal Resistance
h _{ma}	Mixed Air Enthalpy	s	Second
h _{oa}	Outside Air Enthalpy	SHR	Sensible Heat Ratio
HP	Horsepower	SME	Sash Movement Effect Performance Rating (SME-XX yyy)
hr	Hour	SP	Static Pressure
h _{ra}	Return Air Enthalpy	SpGr	Specific Gravity (for water use 1.00)
HT	Height	T	Temperature
in	Inch	T _a	Absolute Temperature (460° + T) or °R
I	Amps	T _{ma}	Mixed Air Temperature
J	Joules	T _{oa}	Outside Air Temperature
K	Kelvin	TP	Total Pressure
K _v	Flow constant (SI)	T _{ra}	Return Air Temperature
kcal	kilocalorie	TS	Tip Speed
kg	Kilogram	U	Heat Transfer Coefficient
kJ	Kilojoule	μ	Viscosity, Dynamic
kPa	Kilopascal	V	Velocity
kW	Kilowatt	VP	Velocity Pressure
l	Liter (Litre)	W	Watt or J/s
l/s	Volumetric Flow: Liters Per Second	WD	Width
lb	Pounds	wg or wc	water gauge or water column
lm	Lumens	WHP	Water Horsepower
ln	natural log	WP	Water Power
LG	Length	ω	Humidity Ratio

EQUATIONS				
TOPIC	US Equation (IP)	US Unit (IP)	Metric Equation (SI)	Metric Unit (SI)
AIRFLOW & VELOCITY	$Q = V \times A$	CFM, ft ³ /min	$Q = V \times A$	l/s (or) m ³ /hr
	Duct Fitting Loss = C × VP	in. wg	Duct Fitting Loss = C × VP	Pa
	TP _(in wg) = VP + SP	in. wg	TP _(Pa) = VP + SP	Pa
	$V_{(\text{std air})} = 4005 \times \sqrt{VP}$	FPM, ft/min in. wg	$V_{(\text{std air})} = \sqrt{(1.66 \times VP)}$	m/s, Pa
	$V = 1096 \times \sqrt{\left(\frac{VP}{\rho}\right)}$	in. wg	$V = 1.414 \times \sqrt{\left(\frac{VP}{\rho}\right)}$	Pa
	$ACH = \frac{Q \times 60}{(LG \times WD \times HT)}$	air changes/hr	$ACH = \frac{Q \times 3.6}{(LG \times WD \times HT)}$	air changes/hr
	$Area_{\text{Round}} = \frac{\pi \times \left(\frac{d}{2}\right)^2}{144} = \frac{(\pi \times r^2)}{144}$	in ² , ft ²	$Area_{\text{Round}} = \pi \times \left(\frac{d}{2}\right)^2 = (\pi \times r^2)$	m ²
	$Area_{(\text{square/rectangular})} = \frac{(HT \times WD)}{144}$	in ² , ft ²	$Area_{(\text{square/rectangular})} = (HT \times WD)$	m ²
	$Area_{\text{Oval}} = \frac{\left(HT \times (WD - HT) + \left(\pi \times \left(\frac{HT}{2}\right)^2\right)\right)}{144}$	in ² , ft ²	$Area_{\text{Oval}} = \left(HT \times (WD - HT) + \left(\pi \times \left(\frac{HT}{2}\right)^2\right)\right)$	m ²
AIR TEMPERATURE	$^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32^{\circ}$	$^{\circ}\text{F}$	$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \div 1.8$	$^{\circ}\text{C}$
	$^{\circ}\text{R} = (^{\circ}\text{F} + 460)$	$^{\circ}\text{R}$	$\text{K} = (^{\circ}\text{C} + 273)$	K
	$T_{\text{ma}} = (\%_{\text{oa}} \times T_{\text{oa}}) + (\%_{\text{ra}} \times T_{\text{ra}})$	$^{\circ}\text{F}, ^{\circ}\text{R}$	$T_{\text{ma}} = (\%_{\text{oa}} \times T_{\text{oa}}) + (\%_{\text{ra}} \times T_{\text{ra}})$	$^{\circ}\text{C}, \text{K}$
	$h_{\text{ma}} = (\%_{\text{oa}} \times h_{\text{oa}}) + (\%_{\text{ra}} \times h_{\text{ra}})$	Btu/lb _{dry air}	$h_{\text{ma}} = (\%_{\text{oa}} \times h_{\text{oa}}) + (\%_{\text{ra}} \times h_{\text{ra}})$	kJ/kg _{dry air}
	$\%_{\text{oa}} = \left(\frac{T_{\text{ra}} - T_{\text{ma}}}{T_{\text{ra}} - T_{\text{oa}}}\right) \times 100$	%	$\%_{\text{oa}} = \left(\frac{T_{\text{ra}} - T_{\text{ma}}}{T_{\text{ra}} - T_{\text{oa}}}\right) \times 100$	%
	$\%_{\text{oa}} = \left(\frac{h_{\text{ra}} - h_{\text{ma}}}{h_{\text{ra}} - h_{\text{oa}}}\right) \times 100$	%	$\%_{\text{oa}} = \left(\frac{h_{\text{ra}} - h_{\text{ma}}}{h_{\text{ra}} - h_{\text{oa}}}\right) \times 100$	%
HEAT TRANSFER (AIR)	$Q_{\text{total}} = 4.5 \times \text{CFM} \times \Delta h$ <small>(Standard Air)</small>	Btu/hr	$Q_{\text{total}} = 1.2 \times \frac{1}{s} \times \Delta h$ <small>(Standard Air)</small>	W
	$Q_{\text{total}} = 60 \times \rho \times \text{CFM} \times \Delta h$ <small>(Non-Standard Air)</small>	Btu/hr	$Q_{\text{total}} = \rho \times \frac{1}{s} \times \Delta h$ <small>(Non-Standard Air)</small>	W

EQUATIONS				
TOPIC	US Equation (IP)	US Unit (IP)	Metric Equation (SI)	Metric Unit (SI)
HEAT TRANSFER (AIR)	$Q_{\text{sensible}} = 1.08 \times \text{CFM} \times \Delta T_{\text{air}}$ <small>(Standard Air)</small>	Btu/hr	$Q_{\text{sensible}} = 1.23 \times \frac{1}{s} \times \Delta T_{\text{air}}$ <small>(Standard Air)</small>	W
	$Q_{\text{sensible}} = 60 \times C_p \times \rho \times \text{CFM} \times \Delta T_{\text{air}}$ <small>(Non-Standard Air)</small>	Btu/hr	$Q_{\text{sensible}} = C_p \times \rho \times \frac{1}{s} \times \Delta T_{\text{air}}$ <small>(Non-Standard Air)</small>	W
	$Q_{\text{latent}} = 0.69 \times \text{CFM} \times \Delta \omega_{\text{gr of H}_2\text{O}}$ <small>(Standard Air)</small> <small>lb dry air</small>	Btu/hr	$Q_{\text{latent}} = 3.0 \times \frac{1}{s} \times \Delta \omega_{\text{gm of H}_2\text{O}}$ <small>(Standard Air)</small> <small>kg dry air</small>	W
	$Q_{\text{latent}} = 4840 \times \text{CFM} \times \Delta \omega_{\text{lb of H}_2\text{O}}$ <small>(Standard Air)</small> <small>lb dry air</small>	Btu/hr	$Q_{\text{latent}} = 3.0 \times \frac{1}{s} \times \Delta \omega_{\text{gm of H}_2\text{O}}$ <small>(Standard Air)</small> <small>kg dry air</small>	W
	$Q_{\text{latent}} = \frac{1073}{7000} \times 60 \times \rho \times \text{CFM} \times \Delta \omega_{\text{gr of H}_2\text{O}}$ <small>(Non-Standard Air)</small> <small>lb dry air</small>	Btu/hr	$Q_{\text{latent}} = 2.5 \times \rho \times \frac{1}{s} \times \Delta \omega_{\text{gm of H}_2\text{O}}$ <small>(Non-Standard Air)</small> <small>kg dry air</small>	W
	$Q_{\text{latent}} = 1073 \times 60 \times \rho \times \text{CFM} \times \Delta \omega_{\text{lb of H}_2\text{O}}$ <small>(Non-Standard Air)</small> <small>lb dry air</small>	Btu/hr		
	$\text{SHR} = Q_{\text{sensible}} \div Q_{\text{total}}$	unitless	$\text{SHR} = Q_{\text{sensible}} \div Q_{\text{total}}$	unitless
	$Q_{\text{total}} = Q_{\text{latent}} + Q_{\text{sensible}}$	Btu/hr	$Q_{\text{total}} = Q_{\text{latent}} + Q_{\text{sensible}}$	W
	$Q_{\text{Btuh}} = A_{\text{ft}^2} \times U \times \Delta T \text{ (}^\circ\text{F)}$	Btu/hr	$Q_{\text{W}} = A_{\text{m}^2} \times U \times \Delta T \text{ (}^\circ\text{C)}$	W
FAN	$\frac{\text{CFM}_2}{\text{CFM}_1} = \frac{\text{RPM}_2}{\text{RPM}_1}$	ft ³ /min, rev/min	$\frac{1/s_2}{1/s_1} = \frac{\text{m}^3/s_2}{\text{m}^3/s_1} = \frac{\text{rad}/s_2}{\text{rad}/s_1}$	1/s, m ³ /s, rad/s
	$\frac{P_2}{P_1} = \left(\frac{\text{CFM}_2}{\text{CFM}_1}\right)^2$	in. wg, ft ³ /min	$\frac{P_2}{P_1} = \left(\frac{1/s_2}{1/s_1}\right)^2 = \left(\frac{\text{m}^3/s_2}{\text{m}^3/s_1}\right)^2$	Pa, 1/s, m ³ /s
	$\frac{\text{BHP}_2}{\text{BHP}_1} = \left(\frac{\text{CFM}_2}{\text{CFM}_1}\right)^3$	HP	$\frac{\text{kW}_2}{\text{kW}_1} = \left(\frac{1/s_2}{1/s_1}\right)^3 = \left(\frac{\text{m}^3/s_2}{\text{m}^3/s_1}\right)^3$	kW, 1/s, m ³ /s
	$\text{SP}_2 = \left(\frac{\rho_2}{\rho_1}\right) \times \text{SP}_1$	in. wg, lb/ft ³	$\text{SP}_2 = \left(\frac{\rho_2}{\rho_1}\right) \times \text{SP}_1$	Pa, kg/m ³
	$\text{BHP}_2 = \left(\frac{\rho_2}{\rho_1}\right) \times \text{BHP}_1$	BHP, lb/ft ³	$\text{kW}_2 = \left(\frac{\rho_2}{\rho_1}\right) \times \text{kW}_1$	kW, kg/m ³
	$\text{Tip Speed} = \text{TS} = \frac{(\pi \times d \times \text{rpm})}{12}$	FPM, ft/min	$\text{Tip Speed} = \text{TS} = \frac{(\pi \times d \times \text{rpm})}{60}$	m/s
SHEAVE	$\text{RPM}_{\text{fan}} = \left(\frac{\text{PD}_{\text{motor}}}{\text{PD}_{\text{fan}}}\right) \times \text{RPM}_{\text{motor}}$	rev/min, in	$\frac{\text{RPM}_{\text{fan}}}{\text{RPM}_{\text{motor}}} = \frac{\text{PD}_{\text{motor}}}{\text{PD}_{\text{fan}}}$	rev/min, mm
	$\text{Fan Belt Length} = (\text{CL} \times 2) + (1.57 \times (\text{PD}_{\text{large}} + \text{PD}_{\text{small}})) + \left(\frac{(\text{PD}_{\text{large}} - \text{PD}_{\text{small}})^2}{4 \times \text{CL}}\right)$			in (IP), mm (SI)

EQUATIONS					
TOPIC	US Equation (IP)	US Unit (IP)	Metric Equation (SI)	Metric Unit (SI)	
ELECTRICAL		$E = I \times \Omega$		Volts	
		$\Omega = E \div I$		Ohms	
		$\%E_u = 100 \times \frac{E_d}{E_a}$ <small>E_u=Voltage unbalance E_d=Maximum voltage deviation from average voltage E_a=Average voltage of three legs</small>		Volts	
		$\%I_u = 100 \times \frac{I_d}{I_a}$ <small>I_u=Amperage unbalance I_d=Maximum amperage deviation from average amperage I_a=Average amperage of three legs</small>		Amps	
POWER	$W_{1 \text{ phase}} = E \times I$	W	$kW_{1 \text{ phase}} = \frac{(E \times I)}{1000}$	kW	
	$W_{3 \text{ phase}} = E \times I \times 1.732$	W	$kW_{3 \text{ phase}} = \frac{(E \times I \times 1.732)}{1000}$	kW	
	$BHP_{1 \text{ phase}} = \frac{(E \times I \times PF \times Eff)}{746}$ <small>PF=Power Factor = 0.8 & Eff=0.9; if not given</small>	HP	$kW_{1 \text{ phase}} = \frac{(E \times I \times PF \times Eff)}{1000}$ <small>PF=Power Factor = 0.8 & Eff=0.9; if not given</small>	kW	
	$BHP_{3 \text{ phase}} = \frac{(E \times I \times PF \times Eff \times 1.732)}{746}$ <small>PF=Power Factor = 0.8 & Eff=0.9; if not given</small>	HP	$kW_{3 \text{ phase}} = \frac{(E \times I \times PF \times Eff \times 1.732)}{1000}$ <small>PF=Power Factor = 0.8 & Eff=0.9; if not given</small>	kW	
	$BHP = HP \times \left(\frac{(I_{\text{actual}} - (NLA \times 0.5))}{(CFLA - (NLA \times 0.5))} \right)$	HP	$BkW = kW \times \left(\frac{(I_{\text{actual}} - (NLA \times 0.5))}{(CFLA - (NLA \times 0.5))} \right)$	kW	
	$CFLA = \frac{(FLA_{NP} \times E_{NP})}{E_{\text{actual}}}$ <small>CFLA (Corrected FLA or Corrected Nameplate Amps) NP (Nameplate)</small>				Amps
	$Fan \text{ HP} = \frac{(CFM \times TP \times SpGr)}{(6356 \times Eff)}$	HP	$Fan \text{ kW} = \frac{(m^3/s \times TP \times SpGr)}{(1000 \times Eff)}$	kW	
RESISTANCE	$\frac{1}{R_{\text{Total Parallel}}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$			Ohms	
	$R_{\text{Total Series}} = R_1 + R_2 + R_3 + \dots + R_n$			Ohms	
	$E_{\text{primary}} \times I_{\text{primary}} = E_{\text{secondary}} \times I_{\text{secondary}}$			Volts, Amps	
	Voltage Drop = $I \times R_{\text{Total}}$			Volts	
PUMP	$\frac{GPM_2}{GPM_1} = \frac{RPM_2}{RPM_1}$	gal/min, rev/min	$\frac{1/s_2}{1/s_1} = \frac{m^3/s_2}{m^3/s_1} = \frac{RPM_2}{RPM_1}$	l/s, m ³ /s, RPM	
	$\frac{GPM_2}{GPM_1} = \frac{d_{\text{imp}2}}{d_{\text{imp}1}}$	gal/min, in	$\frac{1/s_2}{1/s_1} = \frac{m^3/s_2}{m^3/s_1} = \frac{d_{\text{imp}2}}{d_{\text{imp}1}}$	l/s, m ³ /s, mm	

EQUATIONS				
TOPIC	US Equation (IP)	US Unit (IP)	Metric Equation (SI)	Metric Unit (SI)
PUMP	$\frac{H_2}{H_1} = \left(\frac{GPM_2}{GPM_1}\right)^2$	in wc, ft wc, psi, gal/min	$\frac{H_2}{H_1} = \left(\frac{l/s_2}{l/s_1}\right)^2 = \left(\frac{RPM_2}{RPM_1}\right)^2$	kPa, l/s, RPM
	$\frac{BHP_2}{BHP_1} = \left(\frac{GPM_2}{GPM_1}\right)^3$	HP, gal/min	$\frac{BkW_2}{BkW_1} = \left(\frac{l/s_2}{l/s_1}\right)^3 = \left(\frac{RPM_2}{RPM_1}\right)^3$	BkW, l/s, RPM
	$WHP = \frac{(GPM \times H_{ft\ wc} \times SpGr)}{3960}$ <small>SpGr = 1.0, unless given</small>	HP	$WP_{kW} = 9.81 \times m^3/s \times H_m \times SpGr$ <small>SpGr = 1.0, unless given</small>	kW
	$WHP = \frac{(GPM \times H_{ft\ wc} \times SpGr)}{3960}$ <small>SpGr = 1.0, unless given</small>	HP	$WP_W = \frac{(l/s \times H_{Pa} \times SpGr)}{1000}$ <small>SpGr = 1.0, unless given</small>	W
	$BHP = \frac{(GPM \times H_{ft\ wc} \times SpGr)}{(3960 \times EP)}$ <small>SpGr = 1.0, unless given, EP use 0.7 if not given</small>	HP	$BP = \frac{WP}{EP}$ <small>SpGr = 1.0, unless given, EP use 0.7 if not given</small>	kW
$EP_{in\ \%} = \frac{(WHP \times 100)}{BHP}$	%	$EP_{in\ \%} = \frac{(WP \times 100)}{BP}$	%	
HYDRONIC	$\text{Coil } \Delta P: P_2 = P_1 \times \left(\frac{GPM_2}{GPM_1}\right)^2$	in wc, ft wc, psi	$\text{Coil } \Delta P: P_2 = P_1 \times \left(\frac{l/s_2}{l/s_1}\right)^2$	kPa, m wc
	$C_v = \frac{GPM \times \sqrt{SpGr}}{\sqrt{\Delta P_{psi}}}$ <small>SpGr = 1.0, unless given</small>	unitless	$K_v = \frac{m^3/h \times \sqrt{SpGr}}{\sqrt{\Delta P_{Bar}}}$ <small>SpGr = 1.0, unless given</small>	unitless
	$GPM = \frac{C_v \times \sqrt{\Delta P_{psi}}}{\sqrt{SpGr}}$ <small>SpGr = 1.0, unless given</small>	GPM, gal/min	$m^3/h = \frac{K_v \times \sqrt{\Delta P_{Bar}}}{\sqrt{SpGr}}$ <small>SpGr = 1.0, unless given</small>	m ³ /h
	$\Delta P_{psi} = SpGr \times \left(\frac{GPM}{C_v}\right)^2$ <small>SpGr = 1.0, unless given</small>	psi	$\Delta P_{Bar} = SpGr \times \left(\frac{m^3/h}{K_v}\right)^2$ <small>SpGr = 1.0, unless given</small>	bar
	$NPSHA = P_a \pm P_s + \left(\frac{V^2}{2g}\right) - P_{vp} - P_f$	ft wc	$NPSHA = P_a \pm P_s + \left(\frac{V^2}{2g}\right) - P_{vp} - P_f$	kPa, m wc
HEAT TRANSFER (HYDRONIC)	$Q_{Btu} = 500 \times GPM \times \Delta T_{\text{°F}}$ <small>(Standard Water)</small>	Btu/hr	$Q_{kW} = 4.190 \times l/s \times \Delta T_{\text{°C}}$ <small>(Standard Water)</small>	kW
	$Q_{Btu} = C_p \times 60 \times \rho \times GPM \times \Delta T_{\text{°F}}$ <small>(Non-Standard Water)</small>	Btu/hr	$Q_W = 4190 \times l/s \times \Delta T_{\text{°C}}$ <small>(Standard Water)</small>	W
	$Q_{Btu} = C_p \times 60 \times \rho \times GPM \times \Delta T_{\text{°F}}$ <small>(Non-Standard Water)</small>	Btu/hr	$Q_W = C_p \times \rho \times l/s \times \Delta T_{\text{°C}}$ <small>(Non-Standard Water)</small>	W
BOILER	Output Btu = Input Btu × %Eff	Btu	Output kW = Input kW × %Eff	kW
	Boiler Operating Cost = Fire Rate _{gal/hr} × hrs Burned × \$Cost/gal	Currency	Boiler Operating Cost = Fire Rate _{l/hr} × hrs Burned × \$Cost/l	Currency
	Fire Rate = $\frac{\text{Input Btu}}{\text{Fuel Btu}_{\text{gal/hr}}}$	gal/hr	Fire Rate = $\frac{\text{Input MJ}}{\text{Fuel MJ}_{\text{l/hr}}}$	l/hr

METRIC EQUIVALENTS		
Unit of	Metric Unit (SI)	Equivalent US Unit (IP)
acceleration	1 m/s ²	3.281 ft/sec ²
acceleration of gravity at STP (Standard Atmospheric Pressure)	9.8 m/s ²	32.2 ft/sec ²
area	1 m ²	10.764 ft ²
area	1 mm ²	0.0016 in ²
energy	1 kcal	3.968 Btu/hr
energy	1 W	3.413 Btu/hr
energy	1 kW	3,413 Btu/hr
length	1 m	3.281 ft
length	1 m	39.37 in
length	1 cm	0.39 in
length	1 mm	0.039 in
lighting intensity	1 lx	0.093 fc
lighting intensity	1 lm/m ²	0.0931 fc
mass	1 kg	2.2 lb
power (motor)	1 kW	1.34 HP
power (energy)	1 J/hr	0.000948 Btu/hr
pressure	1 Pa	0.004 in wg
pressure	1 kPa	0.145 psi
pressure	1 kPa	0.3345 ft wc
pressure	1 kPa	0.296 in Hg
velocity	1 m/s	196.9 fpm
velocity	1 m/s	3.28 fps
volume	1 m ³	35.31 ft ³
volumetric flow rate (air)	1 m ³ /s	2,118.88 cfm
volumetric flow rate (air)	1 l/s	2.12 cfm
volumetric flow rate (air)	1 m ³ /hr	0.589 cfm
volumetric flow rate (water)	1 l/s	15.85 GPM
volumetric flow rate (water)	1 m ³ /s	15,850 GPM

ENGINEERING CONSTANTS		
Definition	US Units (IP)	Metric Units (SI)
Atmospheric Pressure @ Sea Level	1 atm = 29.92 in Hg = 14.7 psi	101.325 kPa
Atmospheric Pressure @ Sea Level (coil)	1 bar = 14.5 psi = 29.53 in Hg	100 kPa
Heat of Evaporation / Condensation @ 212°F (100°C)	970 Btu/lb	2,257 kJ/kg
Heat of Vaporization @ 68°F (20°C)	1,073 Btu/lb	2,496 kJ/kg
Heat of Fusion	144 Btu/lb	335 kJ/kg
Mass (1 lb of moisture)	7,000 grains	N/A
Density of Air (Std)	0.075 lb/ft ³	1.204 kg/m ³
Density of Water (Std)	62.4 lb/ft ³	1,000 kg/m ³
Density of Water (Std)	8.33 lb/gal	1,000 kg/m ³
Specific Heat (Cp) of dry air	0.24 Btu/(lb x °F) @ 68°F	1.005 kJ/(kg x K) @ 20°C
Specific Heat (Cp) ice	0.50 Btu/(lb x °F) @ 32°F	2.05 kJ/(kg x K) @ 0°C
Specific Heat (Cp) vapor	0.45 Btu/(lb x °F) @ 68°F	1.996 kJ/(kg x K) @ 20°C
Specific Heat (Cp) water	1.00 Btu/(lb x °F) @ 68°F	4.187 kJ/(kg x K) @ 20°C
Standard Temperature & Pressure (STP)	68°F at Sea Level (14.7 psi)	20°C at Sea Level (101.325 kPa)
Standard Temperature & Pressure (STP)	68°F at Sea Level (29.92 in. Hg)	20°C at Sea Level (101.325 kPa)
Ton of refrigeration	12,000 Btu/hr	3.516 kW
Ton of refrigeration (evaporator)	12,000 Btu/hr	3.516 kW
Ton of refrigeration (condenser)	15,000 Btu/hr	4.395 kW
Volume	1 CF = 7.49 gallons	N/A

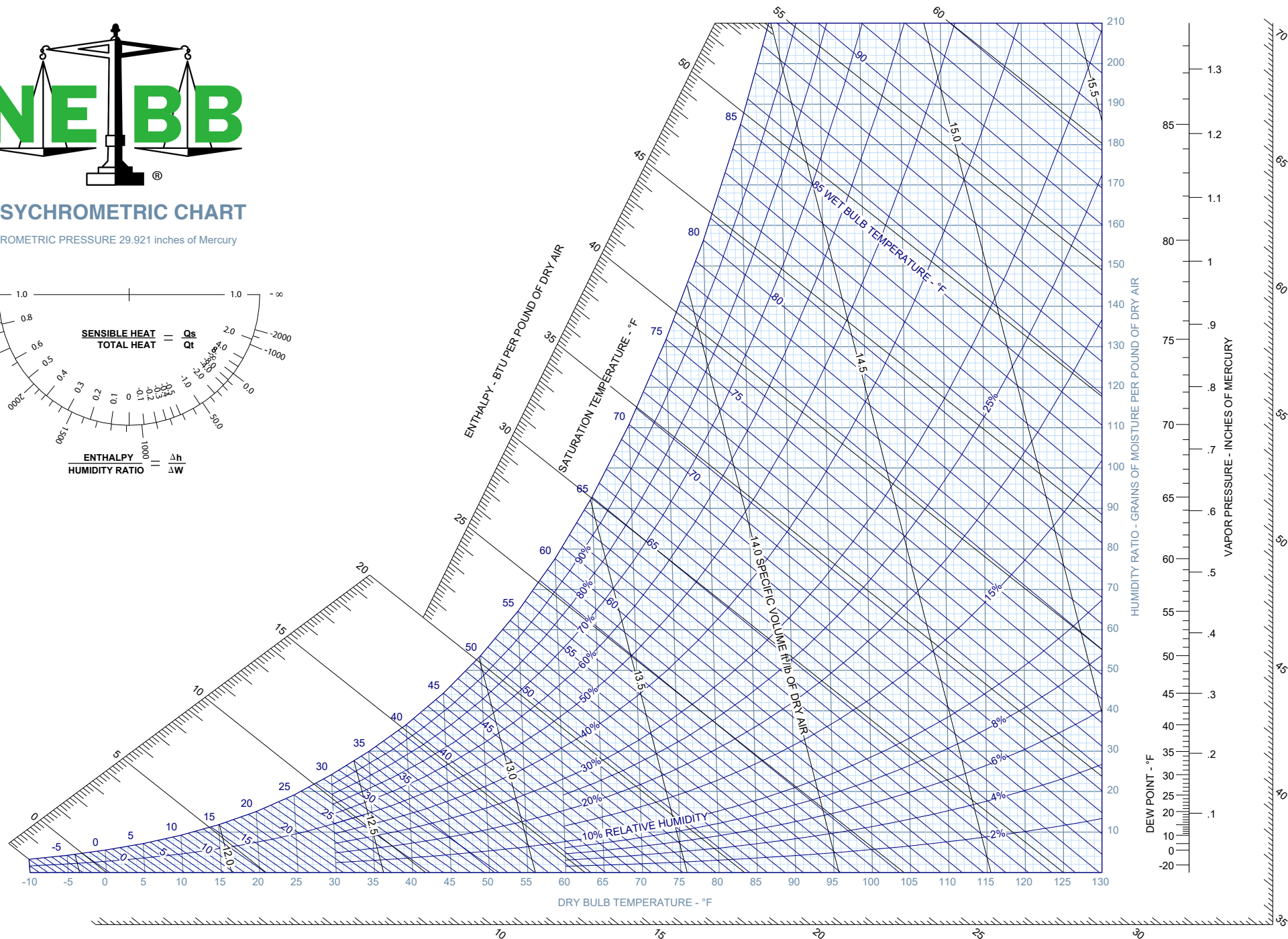
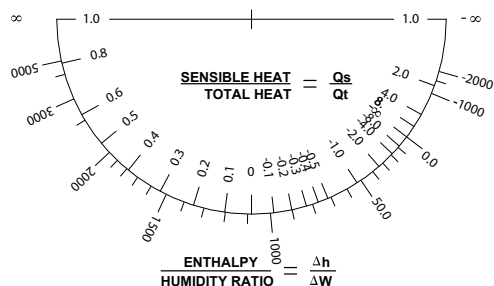
CONVERSIONS			
Unit of	To Convert	Into	Multiply by
energy	CCF	Btu	100,000
energy	mbh	Btu/hr	1,000
power	HP	Btu/hr	2,545
power	HP	watts	746
pressure	ft. wc	psi	0.434
pressure	psi	ft. wc	2.31
pressure	psi	in. Hg	2.036

NEBB Fundamental Formulas



PSYCHROMETRIC CHART

BAROMETRIC PRESSURE 29.921 inches of Mercury



NEBB Fundamental Formulas

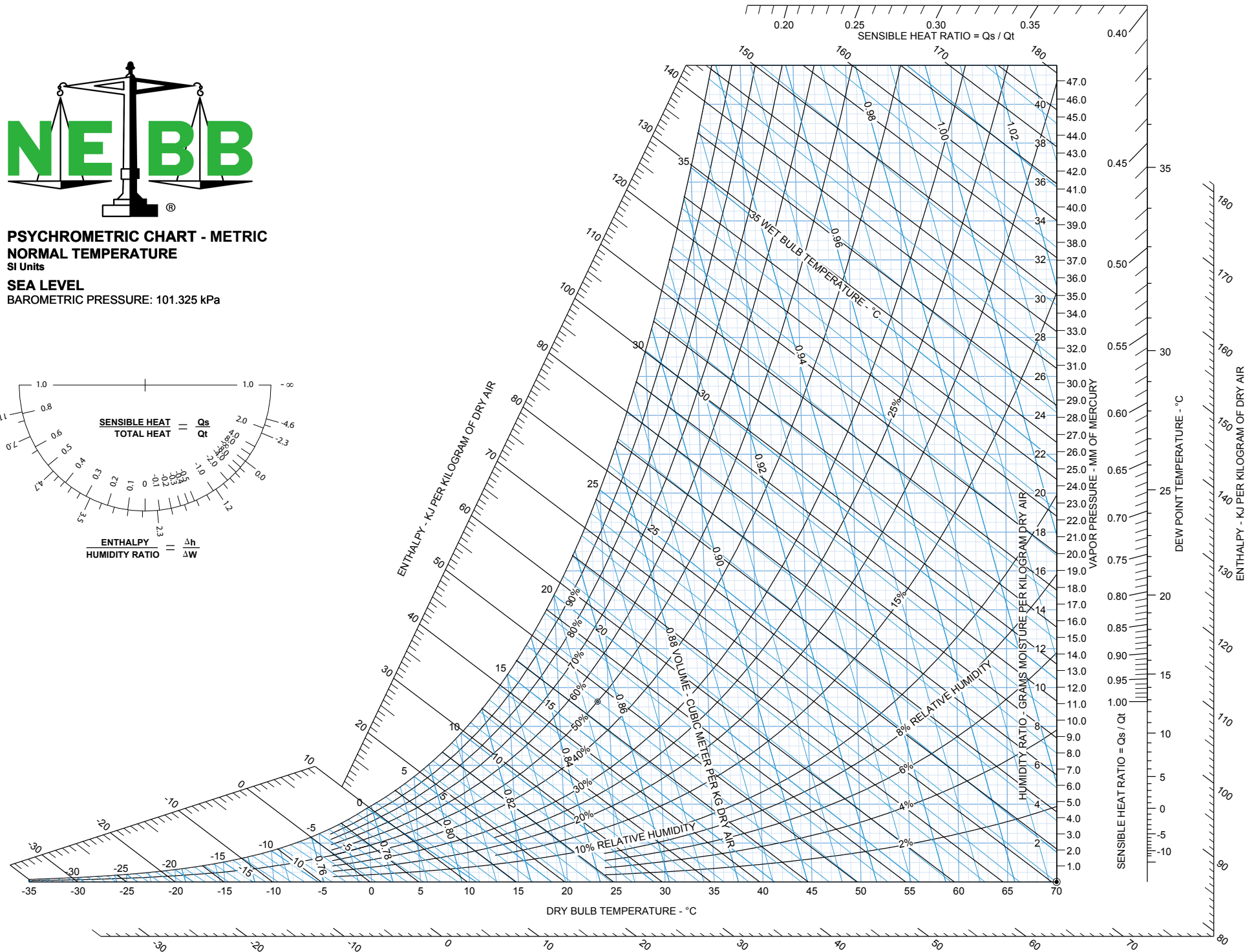
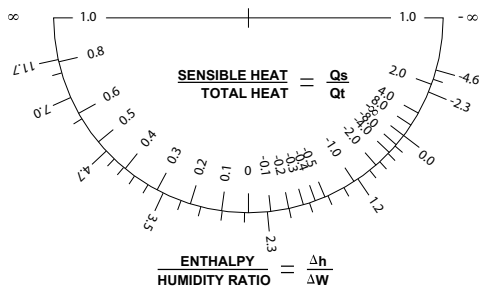


PSYCHROMETRIC CHART - METRIC NORMAL TEMPERATURE

SI Units

SEA LEVEL

BAROMETRIC PRESSURE: 101.325 kPa



Air Density Correction Factors (US Units) Standard Air Density (Sea Level & 70°F) = 0.075 lb/ft ³ @ 29.92 in Hg												
Altitude (ft)		Sea Level	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
Barometer (in Hg)		29.92	28.86	27.82	26.82	25.84	24.90	23.98	23.09	22.22	21.39	20.58
(in wg)		407.50	392.80	378.60	365.00	351.70	333.90	326.40	314.80	302.10	291.10	280.10
Air Temperature °F	-40°	1.26	1.22	1.17	1.13	1.09	1.05	1.01	0.97	0.93	0.90	0.87
	-0°	1.15	1.11	1.07	1.03	0.99	0.95	0.91	0.89	0.85	0.82	0.79
	40°	1.06	1.02	0.99	0.95	0.92	0.88	0.85	0.82	0.79	0.76	0.73
	70°	1.00	0.96	0.93	0.89	0.86	0.83	0.80	0.77	0.74	0.71	0.69
	100°	0.95	0.92	0.88	0.85	0.81	0.78	0.75	0.73	0.70	0.68	0.65
	150°	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.67	0.65	0.62	0.60
	200°	0.80	0.77	0.74	0.71	0.69	0.66	0.64	0.62	0.60	0.57	0.55
	250°	0.75	0.72	0.70	0.67	0.64	0.62	0.60	0.58	0.56	0.54	0.51
	300°	0.70	0.67	0.65	0.62	0.60	0.58	0.56	0.54	0.52	0.50	0.48
	350°	0.65	0.62	0.60	0.58	0.56	0.54	0.52	0.51	0.49	0.50	0.45
	400°	0.62	0.60	0.57	0.55	0.53	0.51	0.49	0.48	0.46	0.44	0.42
	450°	0.55	0.56	0.54	0.52	0.50	0.48	0.46	0.45	0.43	0.42	0.40
	500°	0.58	0.53	0.51	0.49	0.47	0.45	0.44	0.43	0.41	0.39	0.38
	550°	0.53	0.51	0.49	0.47	0.45	0.44	0.52	0.41	0.39	0.38	0.36
600°	0.50	0.48	0.46	0.45	0.43	0.41	0.40	0.39	0.37	0.35	0.34	
700°	0.46	0.44	0.43	0.41	0.39	0.38	0.37	0.35	0.34	0.33	0.32	
800°	0.42	0.40	0.39	0.37	0.36	0.35	0.33	0.32	0.31	0.30	0.29	
Water Temperature °F							60°	150°	200°	250°	300°	340°
Feet head differential per inch Hg differential							1.046	1.070	1.090	1.110	1.150	1.165

Air Density Correction Factors (Metric Units) Standard Air Density (Sea Level & 20°C) = 1.204 kg/m ³ @ 101.325 kPa												
Altitude (m)		Sea Level	250	500	750	1000	1250	1500	1750	2000	2500	3000
Barometer (kPa)		101.33	98.30	96.30	93.20	90.20	88.20	85.10	83.10	80.00	76.00	71.90
Air Temperature °C	0°	1.08	1.05	1.02	0.99	0.96	0.93	0.91	0.88	0.86	0.81	0.76
	20°	1.00	0.97	0.95	0.92	0.89	0.87	0.84	0.82	0.79	0.75	0.71
	50°	0.91	0.89	0.86	0.84	0.81	0.79	0.77	0.75	0.72	0.68	0.64
	75°	0.85	0.82	0.80	0.78	0.75	0.73	0.71	0.69	0.67	0.63	0.60
	100°	0.79	0.77	0.75	0.72	0.70	0.68	0.66	0.65	0.63	0.59	0.56
	125°	0.74	0.72	0.70	0.68	0.66	0.64	0.62	0.60	0.59	0.55	0.52
	150°	0.70	0.68	0.66	0.64	0.62	0.60	0.59	0.57	0.55	0.52	0.49
	175°	0.66	0.64	0.62	0.62	0.59	0.57	0.55	0.54	0.52	0.49	0.46
	200°	0.62	0.61	0.59	0.57	0.56	0.54	0.52	0.51	0.49	0.47	0.44
	225°	0.59	0.56	0.56	0.54	0.53	0.51	0.50	0.48	0.47	0.44	0.42
	250°	0.56	0.55	0.53	0.52	0.50	0.49	0.47	0.46	0.45	0.42	0.40
	275°	0.54	0.52	0.51	0.49	0.48	0.47	0.45	0.44	0.43	0.40	0.38
	300°	0.51	0.50	0.49	0.47	0.46	0.45	0.43	0.42	0.41	0.38	0.36
	325°	0.49	0.48	0.47	0.45	0.44	0.43	0.41	0.40	0.39	0.37	0.35
	350°	0.47	0.46	0.45	0.43	0.42	0.41	0.40	0.39	0.38	0.35	0.33
	375°	0.46	0.44	0.43	0.42	0.41	0.39	0.38	0.37	0.36	0.34	0.32
	400°	0.44	0.43	0.41	0.40	0.39	0.38	0.37	0.36	0.35	0.33	0.31
	450°	0.41	0.40	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.29
500°	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.28	0.27	
Water Temperature °C							15.5°	65.5°	93.2°	121°	148.7°	170.9°