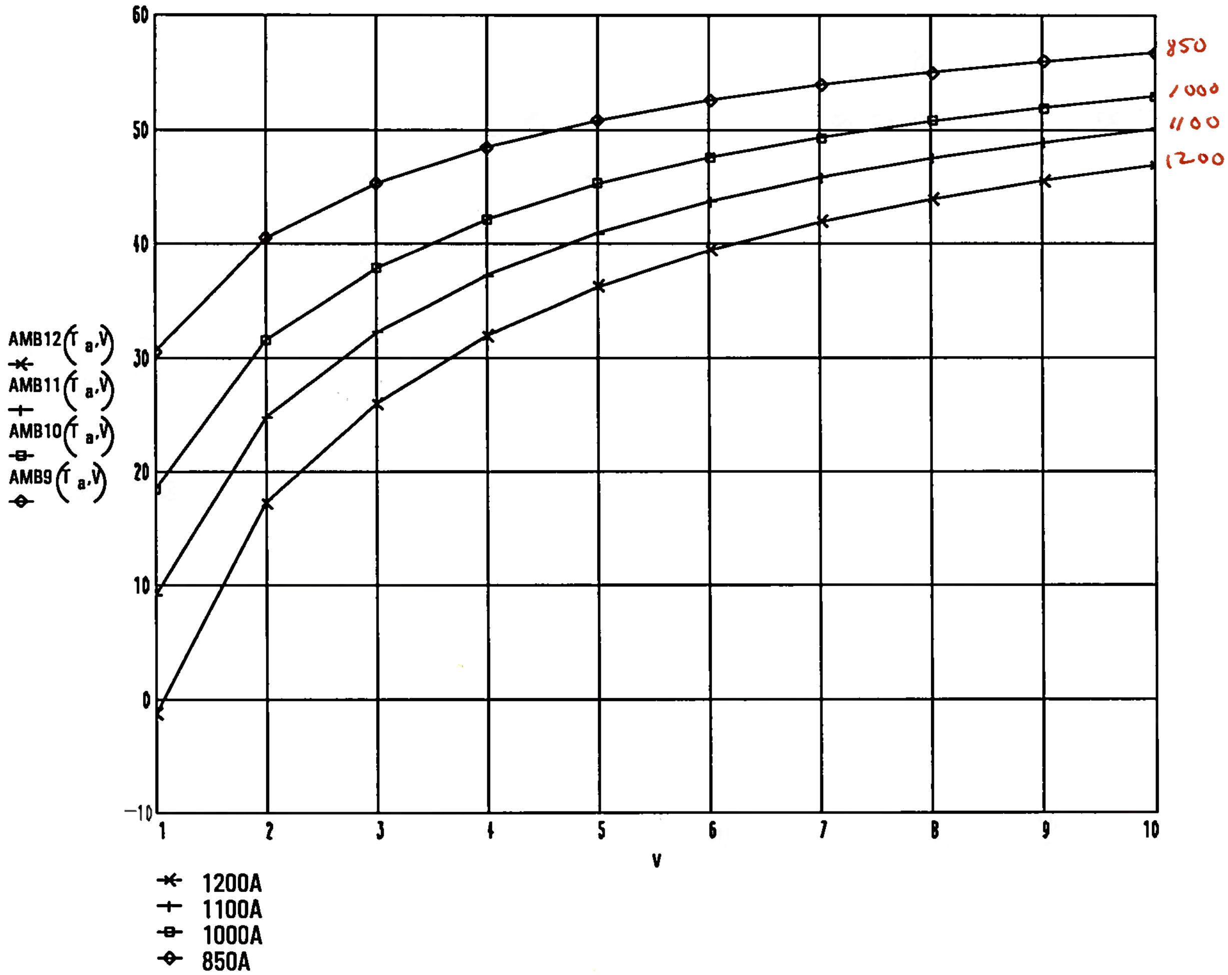
Attached are two graphs showing the required wind and ambient temperature conditions to obtain a certain ampacity of 1272 ASC (each graph shows four different current levels). One graph uses the DC resistance at 20 degrees Celcius, as used in our standard ampacity tables, and the second graph uses the AC resistance at 70 degrees Celcius. As is seen the ampacity for the "worst case" condition consisting of a 40 deg C ambient with a 2 foot/sec wind, the maximum ampacity is 950 A for the DC resistance case and 850 A for the AC resistance case. The ampacity tables currently being used have a maximum current value of 930 A.

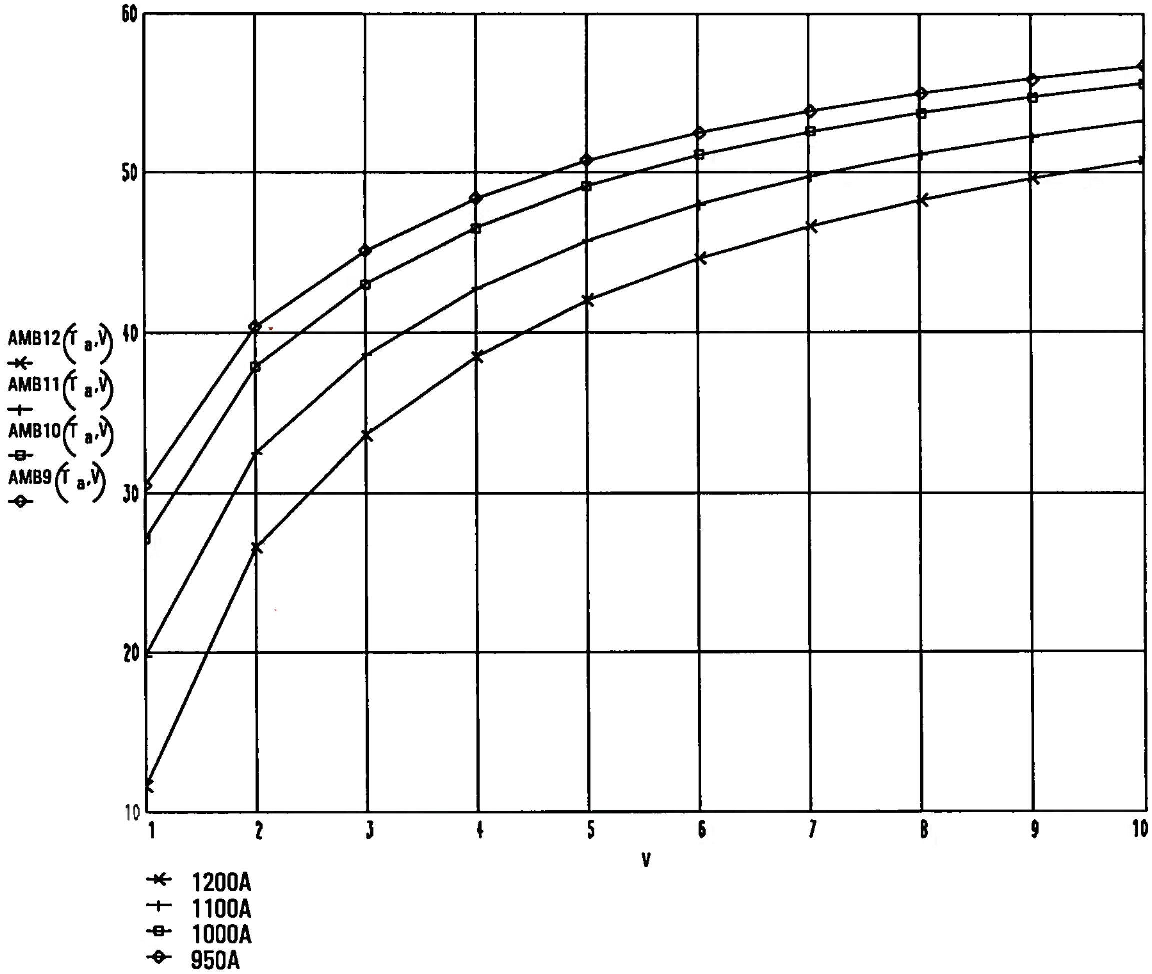
The calculations used to determine the ampacities are derived from IEEE Std. 738-1986.

AMBIENT(deg. C) VS WIND VELOCITY(FT/SEC) FOR 1272 ASC



$R \equiv 1.703 \cdot 10^{-5}$	Ac resistance per lineal foot, ohm/ft @70 deg Celsius.
$d \equiv 1.300$	Conductor diameter, inches.
$location \equiv 1$	Zero location indicates a conductor shaded from the sun.
$T_a \equiv 40$	Ambient temperature in degrees Celcius.
$V \equiv 1..10$	Wind speed in feet/sec.
$H_e \equiv 600$	Elevation of conductor above sea level, ft.
$e \equiv 0.4$	Coefficient of emissivity, 0.23 - 0.91
$a \equiv e$	Coefficient of solar absorbtion, 0.23 - 0.91
$T_c \equiv 70$	Maximum allowable conductor temperature.
$L \equiv 49$	Line latitude.
$H_c \equiv 59.323$	Altitude of Sun in degrees.
$Q_s \equiv 92.87$	Total solar and sky radiated heat.
$Z_{c1} \equiv 153.441$	Azimuth of Sun in morning and afternoon.

AMBIENT(deg. C) VS WIND VELOCITY(FT/SEC) FOR 1272 ASC



$R \equiv 1.363 \cdot 10^{-5}$	Dc resistance per lineal foot, ohm/ft @20 deg Celsius.
$d \equiv 1.300$	Conductor diameter, inches.
$location \equiv 1$	Zero location indicates a conductor shaded from the sun.
$T_a \equiv 40$	Ambient temperature in degrees Celcius.
$V \equiv 1 .. 10$	Wind speed in feet/sec.
$H_e \equiv 600$	Elevation of conductor above sea level, ft.
$e \equiv 0.4$	Coefficient of emissivity, 0.23 - 0.91
$a \equiv e$	Coefficient of solar absorbtion, 0.23 - 0.91
$T_c \equiv 70$	Maximum allowable conductor temperature.
$L \equiv 49$	Line latitude.
$H_c \equiv 59.323$	Altitude of Sun in degrees.
$Q_s \equiv 92.87$	Total solar and sky radiated heat.
$Z_{c1} \equiv 153.441$	Azimuth of Sun in morning and afternoon.

Temperature and Ampacity Under Steady-State Conditions

-based upon IEEE standard 738-1986

$$T_f(T_a) := \frac{T_c + T_a}{2} \qquad K_a(T_a) := 273 + T_a \qquad K_c := 273 + T_c$$

Density of air

$$p_f(T_a) := \frac{0.080695 - 0.2901\cdot 10^{-5}\cdot H_e + 0.37\cdot 10^{-10}\cdot H_e^2}{1 + 0.00367\cdot T_f(T_a)}$$

Absolute viscocity of air.

$$u_f(T_a) := 0.0415 + 1.2034\cdot 10^{-4}\cdot T_f(T_a) - 1.1442\cdot 10^{-7}\cdot T_f(T_a)^2 + 1.9416\cdot 10^{-10}\cdot T_f(T_a)^3$$

Thermal conductivity of air at temp. t.f

$$k_f(T_a) := 0.007388 + 2.27889\cdot 10^{-5}\cdot T_f(T_a) - 1.34328\cdot 10^{-9}\cdot T_f(T_a)^2$$

Forced convection heat loss Qc1 and Qc2. The maximum of the two values is used.

$$Q_{c1}(T_a, V) := \left[1.01 + 0.371\cdot\left(\frac{d\cdot p_f(T_a)\cdot V\cdot 3600}{u_f(T_a)}\right)^{0.52}\right]\cdot k_f(T_a)\cdot(T_c - T_a)$$

$$Q_{c2}(T_a, V) := 0.1695\cdot\left(\frac{d\cdot p_f(T_a)\cdot V\cdot 3600}{u_f(T_a)}\right)^{0.6}\cdot k_f(T_a)\cdot(T_c - T_a)$$

$$Q_c(T_a, V) := \text{if}\left(Q_{c1}(T_a, V) \ge Q_{c2}(T_a, V), Q_{c1}(T_a, V), Q_{c2}(T_a, V)\right)$$

Natural convection heat loss (ie with no wind) at altitudes above sea level.

$$Q_{c3}(T_a) := 0.283\cdot p_f(T_a)^{0.5}\cdot d^{0.75}\cdot(T_c - T_a)^{1.25}$$

$$Q_c(T_a, V) := \text{if}\left(V = 0, Q_{c3}(T_a), Q_c(T_a, V)\right)$$

Radiated heat loss of conductor.

$$Q_r(T_a) := 0.138\cdot d\cdot e\cdot\left[\left(\frac{K_c}{100}\right)^4 - \left(\frac{K_a(T_a)}{100}\right)^4\right]$$

$$Z_c := \frac{Z_{c1} + 180}{2} \qquad A := \frac{d}{12}$$

$$\theta := \text{acos}\left[\cos\left(H_c\cdot\frac{\pi}{180}\right)\cdot\cos\left[(Z_c - 90)\cdot\frac{\pi}{180}\right]\right]$$

$$q_s := a\cdot Q_s\cdot\sin(\theta)\cdot A\cdot \text{location}$$

$$K(T_a, V) := \sqrt{\frac{Q_c(T_a, V) + Q_r(T_a) - q_s}{R}}$$

$$AMB12(T_a, V) := \text{root}\left[(K(T_a, V)) - 1200, T_a\right]$$

$$AMB11(T_a, V) := \text{root}\left[(K(T_a, V)) - 1100, T_a\right]$$

$$AMB10(T_a, V) := \text{root}\left[(K(T_a, V)) - 1000, T_a\right]$$

$$AMB9(T_a, V) := \text{root}\left[(K(T_a, V)) - 950, T_a\right]$$

Determines the ambient temperature necessary for the conductor to pass 1200 of current (at each individual wind velocity), and maintain its maximum temperature of 70 deg Celcius.
Note: When the wind velocity becomes excessively high, the root function will become imaginary causing errors. This occurs because the conductor temperature will not be able to maintain the 70 deg Celcius constraint imposed in the equations, its temperature will drop below 70.

Temperature and Ampacity Under Steady-State Conditions

-based upon IEEE standard 738-1986

$$T_f(T_a) := \frac{T_c + T_a}{2} \qquad K_a(T_a) := 273 + T_a \qquad K_c := 273 + T_c$$

Density of air

$$p_f(T_a) := \frac{0.080695 - 0.2901 \cdot 10^{-5} \cdot H_e + 0.37 \cdot 10^{-10} \cdot H_e^2}{1 + 0.00367 \cdot T_f(T_a)}$$

Absolute viscocity of air.

$$u_f(T_a) := 0.0415 + 1.2034 \cdot 10^{-4} \cdot T_f(T_a) - 1.1442 \cdot 10^{-7} \cdot T_f(T_a)^2 + 1.9416 \cdot 10^{-10} \cdot T_f(T_a)^3$$

Thermal conductivity of air at temp. t.f

$$k_f(T_a) := 0.007388 + 2.27889 \cdot 10^{-5} \cdot T_f(T_a) - 1.34328 \cdot 10^{-9} \cdot T_f(T_a)^2$$

Forced convection heat loss Qc1 and Qc2. The maximum of the two values is used.

$$Q_{c1}(T_a, V) := \left[1.01 + 0.371 \cdot \left(\frac{d \cdot p_f(T_a) \cdot V \cdot 3600}{u_f(T_a)}\right)^{0.52}\right] \cdot k_f(T_a) \cdot (T_c - T_a)$$

$$Q_{c2}(T_a, V) := 0.1695 \cdot \left(\frac{d \cdot p_f(T_a) \cdot V \cdot 3600}{u_f(T_a)}\right)^{0.6} \cdot k_f(T_a) \cdot (T_c - T_a)$$

$$Q_c(T_a, V) := \text{if}\left(Q_{c1}(T_a, V) \ge Q_{c2}(T_a, V), Q_{c1}(T_a, V), Q_{c2}(T_a, V)\right)$$

Natural convection heat loss (ie with no wind) at altitudes above sea level.

$$Q_{c3}(T_a) := 0.283 \cdot p_f(T_a)^{0.5} \cdot d^{0.75} \cdot (T_c - T_a)^{1.25}$$

$$Q_c(T_a, V) := \text{if}\left(V = 0, Q_{c3}(T_a), Q_c(T_a, V)\right)$$

Radiated heat loss of conductor.

$$Q_r(T_a) := 0.138 \cdot d \cdot e \cdot \left[\left(\frac{K_c}{100}\right)^4 - \left(\frac{K_a(T_a)}{100}\right)^4\right]$$

$$Z_c := \frac{Z_{c1} + 180}{2} \qquad A := \frac{d}{12}$$

$$\theta := \text{acos}\left[\cos\left(H_c \cdot \frac{\pi}{180}\right) \cdot \cos\left[(Z_c - 90) \cdot \frac{\pi}{180}\right]\right]$$

$$q_s := a \cdot Q_s \cdot \sin(\theta) \cdot A \cdot \text{location}$$

$$K(T_a, V) := \sqrt{\frac{Q_c(T_a, V) + Q_r(T_a) - q_s}{R}}$$

$$AMB12(T_a, V) := \text{root}\left[(K(T_a, V)) - 1200, T_a\right]$$

$$AMB11(T_a, V) := \text{root}\left[(K(T_a, V)) - 1100, T_a\right]$$

$$AMB10(T_a, V) := \text{root}\left[(K(T_a, V)) - 1000, T_a\right]$$

$$AMB9(T_a, V) := \text{root}\left[(K(T_a, V)) - 850, T_a\right]$$

Determines the ambient temperature necessary for the conductor to pass 1200 of current (at each individual wind velocity) , and maintain its maximum temperature of 70 deg Celcius.

Note: When the wind velocity becomes excessively high, the root function will become imaginary causing errors. This occurs because the conductor temperature will not be able to maintain the 70 deg Celcius constraint imposed in the equations, its temperature will drop below 70.