Btus/Hr and the 1.08 & 4.5 constants

These Constants in HVAC calculations vary as air density varies with altitude

q ... BTUs/Hr in a stream (cu ft/min) of air

q = mass flow (lb/hr) x specific heat (btu/lb/deg) x delta T

in order to convert from mass flow to cfm you need to multiply by density and by 60 mins/hr.

so.... q = volumetric flow (cubic feet/min) x 60 (mins/hr) x 0.075 lb/cubic foot x 0.24 (btu/lb) x delta T

so . . . from above . . . 60 mins/hr x 0.075 lb/cubic foot x 0.24 (btu/lb) = 1.08
or
at 5,500 ft altitude the “1.08" constant becomes 60 mins/hr x 0.0613 lb/cubic foot x 0.24 (btu/lb) = 0.88
therefore . . .

q at sea level = 1.08 x CFM x ΔT
q at 5,500 ft alt = 0.88 x CFM x ΔT

Δq ... BTUs/Hr added or removed from a stream (cu ft/min) of air

q (btu/hr) = mass flow (lb/hr) x enthalpy change (btu/lb)

mass flow (lb/hr) = volume flow (cf/hr) x density (lb/cf)

60 mins = 1 hour
air density at standard conditions = 0.075 lb/cf (see graph below)

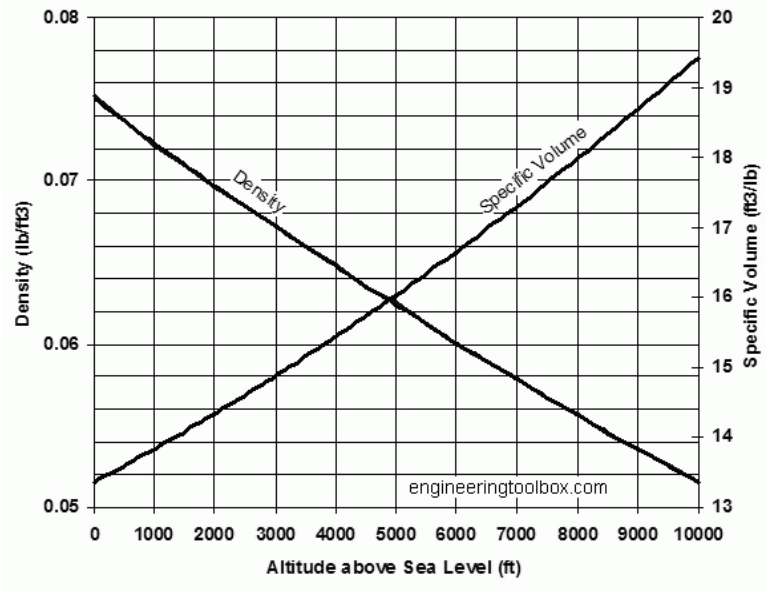
so...

q (btu/hr) = volume flow (cf/min) x 60 (min/hr) x 0.075 (lb/cf) x enthalpy change

so . . . from above 60 (min/hr) x 0.075 (lb/cf) = 4.5 at sea level
or
at 5,500 ft alt the “4.5" constant becomes 60 (min/hr) x 0.0613 (lb/cf) = 3.68
therefore . . .

Δq at sea level = 4.5 x CFM x enthalpy change
Δq at 5,500 ft alt = 3.68 x CFM x enthalpy change

(Altitude, moisture content, and temperature will all affect the 4.5 constant because they all affect density.)



AWW - March 18, 2010