Please do not change any of the values in this sheet

Patm	Atmospheric air pressure - (As recorded from engine data)	972	[mBar]
Patm		97200	[Pa]
Tatm		15	[C]
Tatm		288	[K]
Relative Humidity		75	[%]

$$\rho_{\text{humid air}} = \frac{p_d}{R_d T} + \frac{p_v}{R_v T} = \frac{p_d M_d + p_v M_v}{RT}$$ [1]

where:

$\rho_{\text{humid air}} =$ Density of the humid air (kg/m³)

$p_d =$ Partial pressure of dry air (Pa)

$R_d =$ Specific gas constant for dry air, 287.058 J/(kg·K)

$T =$ Temperature (K)

$p_v =$ Pressure of water vapor (Pa)

$R_v =$ Specific gas constant for water vapor, 461.495 J/(kg·K)

$M_d =$ Molar mass of dry air, 0.028964 (kg/mol)

$M_v =$ Molar mass of water vapor, 0.018016 (kg/mol)

$R =$ Universal gas constant, 8.314 J/(K·mol)

$\rho_{\text{humid air}} =$ **1.169922** Kg/m3

0.495620912

$$\rho = \frac{p}{R_{\text{specific}} T}$$ **1.17572** [kg/m3]

R = 287.058 J/Kg K

T = Temperature in degrees Kelvin

P = Absolute Pressure in Pa

The vapor pressure of water may be calculated from the saturation vapor pressure and relative humidity. It is found by:

$$p_v = \phi p_{\text{sat}}$$

Pu = **1278.921** [Pa]

Where:

$p_v =$ Vapor pressure of water

$\phi =$ Relative humidity

$p_{\text{sat}} =$ Saturation vapor pressure

The saturation vapor pressure of water at any given temperature is the vapor pressure when relative humidity is 100%. One formula [1] used to find the saturation vapor pressure is:

$$p_{\text{sat}} = 6.1078 \times 10^{\frac{7.5T}{T+237.3}}$$

Psat = **17.05228** hPa

Psat = **1705.228** [Pa]

where T is in degrees C. Note:

This will give a result in hPa (100 Pa, equivalent to the older unit millibar, 1 mbar = 0.001 bar = 0.1 kPa)

p_d is found considering partial pressure, resulting in:

$$p_d = p - p_v$$

Pd= **95921.08** [Pa]

Where p simply denotes the observed absolute pressure.