

WET AIR PROPERTIES CALCULATION SHEET AT LOW PRESSURE

INPUT GIVEN CONDITION OR QUANTITY IN RED COLOR CELLS

Condition or designation	Symbol	Values	Unit	Note	
Dry bulb temperature	t_{DB}	27	$^{\circ}C$		
Relative humidity	%RH	85	%		
	T_{DB}	329	$^{\circ}K$	$= t + 273$	
	RH	0.85		$RH = \%RH/100$	
Wet bulb temperature	twb	26	$^{\circ}C$	From psychrometric chart	
Barometric pressure	p_{ATM}	1.013	bar A		
Saturated pressure of water	pg	0.0336	bar A	See table below	
Water partial pressure	pw	0.02856	bar A	$pw = 0.01 (\%RH)(pg)$	
Dry air partial pressure	pa	0.97940	bar A	$pa = patm - pg$	
Mole fraction of dry air	Xa	0.96683		$Xa = pa / patm$	
Mole fraction of water	Xw	0.02819		$Xw = pw / patm$	
MW dry air	MWda	28.97	kg/kgmol	Table 1. Pure Gas Properties	
MW water	MWw	18.02	kg/kgmol	Table 1. Pure Gas Properties	
MW wet air	MW	28.517	kg/kgmol	$MW = Mwda \times Xa + MWw \times Xw$	
MCp	MCp	29.10	$kJ/kgmol.^{\circ}K$	$MCp = (Mcpda)(Xa) + (MCpw)(Xw)$	
Gas constant	R	0.292	$kJ/kg^{\circ}K$	Table 1. Pure Gas Properties	
k	k	1.400		$k = MCp / (MCp - 8.314)$	
Density	DS	1.056	kg/m ³	$T_R = T / T_{cr}$	
Normal density	DSn	1.273	kg/m ³	$DS_n = 101.3 / (273 \times R)$	
Flowrate conversion at above condition					
If flowrate given in :		kgmol/hr	If flowrate given in :		
			Nm³/hr		
Molecular flow, G_{mol}	600	kgmol/hr	Normal flow, Q_n	13430	Nm ³ /hr
Normal flow, Q_n	13443.6	Nm ³ /hr	Molecular flow, G_{mol}	599.4	kgmol/hr
Actual flow, Q	16201.2	m ³ /hr	Actual flow, Q	16184.9	m ³ /hr
Mass flow, G	17110.3	kg/hr	Mass flow, G	17093.0	kg/hr
If flowrate given in :		kg/hr	If flowrate given in :		
			m³/hr		
Mass flow, G	17110	kg/hr	Actual flow, Q	16200	m ³ /hr
Molecular flow, G_{mol}	600.0	kgmol/hr	Normal flow, Q_n	13442.5532	Nm ³ /hr
Normal flow, Q_n	13443.3	Nm ³ /hr	Molecular flow, G_{mol}	599.95	kgmol/hr
Actual flow, Q	16200.9	m ³ /hr	Mass flow, G	17109.00	kg/hr

Saturated pressure of water (H2O), pw

Temperatur e(°C)	15	20	25	30	35	40	45	50
Saturated pres.(bar A)	0.01704	0.02337	0.03166	0.04241	0.05622	0.07375	0.0958	0.1233

Temperatur e(°C)	55	60	65	70	75	80	90	100
Saturated pres.(bar A)	0.1574	0.1992	0.2501	0.3116	0.3855	0.4736	0.7011	1.0133

MCp of dry air

Temp. (C)	MCp
27	29.123

MCp of water vapor

Temp. (C)	MCp
27	33.506

