BARCHARD ENGINEERING LTD.

NOTES ON VOLUMES AT PRESSURE, TEMPERATURE & HEAT VALUES

Volumes at Pressure and Temperature

Gas density changes with pressure and temperature, therefore, it is important to use standards when referring to quantities of gas. Standardized volumes are commonly used in the natural gas industry. Volumes of gas at pressures and temperatures must be converted to standardized volumes.

The two common standardized volumes are standard cubic feet (scf) and normal cubic metres (Nm^3). A standard cubic foot corresponds to 1 cubic foot of gas at 60 °F (15.6 °C) and 14.73 PSIA, and a normal cubic metre of gas corresponds to 1 cubic metre at 15°C at 101.325 kPaA. It is important to list the temperature and pressure being used as standard, since many standards are used worldwide. The ones listed above are commonly used in Canada.

*Note that neither a scf nor a Nm^3 are a unit of volume; rather they are a measure of quantity. As a result, converting standard cubic feet to normal cubic meters is not the same as converting cubic feet to cubic metres (0.0283168) since the standard temperature and pressure used can are different. In Canada, where the conditions used are essentially the same, the conversion rate is the same to 4 decimal places. Internationally Nm^3 typically refers to 0°C and 101.325 kPaA, making a standard cubic foot equivalent to 0.026853 normal cubic metres.

To convert from gas at pressure and temperature, use the following formulas:

$$[\text{Volume}_S] = [\text{Volume}_L]*[\text{Pressure}_L/\text{Pressure}_S]*[\text{Temperature}_S/\text{Temperature}_L]$$

Subscript $_L$ for line,
Subscript $_S$ for Standard

*All pressures and temperatures must be in Atmospheric and Absolute units

0° C = 273.15 ° K	0° F = 459.67 °R
15°C = 288.15°K	60°F = 519.67 °R

Example 1 (SI Units): 1000 m^3 gas at 200 kPaA and 40° C

[Volume in Nm^3] = [1000 m^3] * [200kPaA/101.325 kPaA] * [288.15 °K /315.15°K] = 1805 Nm^3

Example 2 (Imperial Unit): 10000 cuft gas at 30 psig, with atmospheric pressure of 13.6 psia at 50 °F

[Volume in scf] = [10000 ft^3] * [(30psig+13.6psia) / 14.73 psia] * [519.67°R/509.67 °R]= 30180 sfc

Heat Values

The gross heat natural gas is approximately

38 MJ/ Nm3 = 0.038 GJ/ Nm3 = 1030BTU/ scf = 1.1 MJ/ scf = 0.0011 GJ/ scf

Heat values vary because they are based on the composition of the natural gas.