

Combustion Terms

Absolute Pressure: Gauge pressure plus barometric pressure in consistent units.

Absolute Temperature: Also called degrees Rankine ($^{\circ}\text{R}$). Add 460 to degrees Fahrenheit to get absolute temperature, or $^{\circ}\text{R}$.

Air-Fuel Ratio: Ratio of fuel supply to air supply when both are expressed at the same conditions and dimensions.

Available Heat: The gross heat released in the combustion process minus the heat in the dry flue gases plus the water loss. It is the useful heat.

British Thermal Unit(Btu) : The quantity of heat required to raise one pound of water one degree Fahrenheit.

Bunsen Type Burner: A burner having a straight tube with a gas orifice at one end, primary air being entrained by the jet of gas and the partial premix of fuel and air being delivered to the discharge end of the tube. The basic design for a so-called "atmospheric burner".

Burner: A device which positions, shapes, and retains the flame.

Carbon Dioxide Ultimate %:The percentage of carbon dioxide in the **dry** flue gases when a stoichiometric mixture of fuel and air is burned to completion.

Coefficient of Discharge: A dimensionless number which expresses the relative efficiency of flow through an orifice, and varies between 0 to 1. In gas combustion devices it generally is within the range of 0.5 and 0.95.

Combustion Air: Air supplied to a burner for the combustion reaction. It includes all the required air regardless if premixed with the fuel before ignition or enters through the flame envelope.

Combustion Products: The result of the reaction between fuel and air (oxygen) usually consisting of CO_2 , H_2O and N_2 in industrial gas practice.

Dissociation: A reverse chemical reaction which involves the products of combustion at elevated temperatures. It is a factor in limiting the maximum flame temperature for any set of conditions.

Draft: The pressure differential which results due to difference in densities between hot flue gases in a stack or chimney and the ambient air. It accounts for the natural venting of combustion gases.

Dry Flue Gas: The products of combustion less the water vapor formed in the burning process.

Efficiency: In combustion engineering the percentage of the gross heat input which is useful in a given process.

Excess Air: That portion of the air which is mixed with the fuel and does not react. It tends to lower the temperature of the combustion products.

Exothermic Reaction: One which liberates heat and is descriptive of the combustion of fuels.

Flame Lifting: Caused when the flame becomes detached from the burner or flame holder. Sometimes called “blow-off” and generally defines an upper combustion system limit.

Flame Front: The base of the flame; generally that portion of the flame adjacent to the flame holder.

Flash-Back: A condition which occurs when the burning rate exceeds the exit velocity of the fuel-air mixture. Establishes a lower combustion system limit.

Flue Gas Loss: The sensible heat carried away by the combustion products.

Gross Heating Value: The total heat resulting from combustion of a unit of fuel when both reactants and combustion products when initial and final state at 60°F.

Ignition Temperature: The minimum temperature at which a critical mass of fuel-air mixture must be in order for a self-sustaining combustion reaction to take place.

Impact Tube: A pressure sensing device which points upstream in a flow conduit and measures total pressure; i.e., static pressure plus velocity pressure.

Inches Mercury(" Hg): Inches of pressure measured with a column of mercury.

Inches Water Column(" H₂O): The vertical displacement of a column of water due to pressure acting against the water head.

Inflammability Limits: The minimum and maximum percentage of fuel in air which will burn at specified temperature and pressure conditions.

Lean Mixture: A fuel-air mixture which contains more air than is necessary to completely burn the fuel portion.

L.P.G.: Liquid Petroleum Gas. Generally refers to commercial propane and butane.

Lower Heating Value: The heat released by a unit of fuel from and at 60°F less the latent heat of the water vapor formed in the combustion process. (Also called Net Heating Value.)

Low Pressure: An arbitrary term used in combustion engineering referring to air or fuel at 2 psi or less.

Orifice: Any restriction in a flow conduit, usually circular in cross section, but sometimes takes other shapes.

Orsat Analyzer: A primary gas absorption type instrument used to measure the relative volumes of CO₂, O₂ and CO gases in flue products.

Oxidizing Atmosphere: Combustion gases which contain an excess of air and cause oxidation of process materials with which they come in contact.

Percent Excess Air: That air expressed as a percentage which is available but not required for the complete combustion of the fuel.

Pitot Tube: A device used to measure the flow velocity in a conduit. It is a combination impact and static pressure measuring device which gives a read-out which represents the difference between the two pressures, commonly called “velocity pressure”.

Primary Air: That portion of the required air which is premixed with the fuel before entering the burner nozzle, head or flame retention means.

Reducing Atmosphere: Products of combustion which result due to a deficiency of air in the air-fuel mixture. Sometimes done intentionally to prevent oxidation of process materials.

Rich Mixture: A fuel-air mixture which contains an excess of fuel with respect to the air needed for complete combustion.

Secondary Air: Air used in the combustion process which does not pass through the primary burner nozzle or flame retention means.

Specific Gravity: In dealing with fuel gases the relative weight of any gas compared to the weight of an equal volume of dry air, both being at the same pressure and temperature conditions. The specific gravity of air is arbitrarily set at 1.0.

Specific Heat: The amount of heat (Btu) to raise one unit weight of substance (pound) one degree (°F).

Standard Cubic Foot: Basis on which fuel gas is sold by utilities based on volume at standard gas conditions.

Standard Conditions: Volume of any gas measured at 60°F and 29.92" Hg.

Static Pressure: The force exerted by a gas against the walls of its container or the walls of a conduit through which it may be flowing.

Stoichiometric Mixture: A mixture of fuel and air whose proportions are determined by an exactly balanced chemical equation of the reaction. Example: $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

Total Pressure: The sum of the static pressure and the velocity pressure. If total pressure equals static pressure there is a no-flow condition.

Velocity Pressure: The difference between the total pressure and the static pressure. Often measured by use of a pilot tube arrangement.

Venturi: A flow tube having a smooth converging section followed by a smooth diverging section. Used in gas engineering to convert high velocity pressure to static pressure with minimum total pressure loss.

Volume, Combustion: The space required to complete the combustion reaction. Can also refer to the ratio of heat input to combustion chamber volume.

Wall Loss: The heat lost through the walls (including roof and floor or hearth) of the enclosure in which the heating takes place.