

Glossary Of Boiler Terms

A

ABSOLUTE PRESSURE - Pressure above zero pressure; the sum of the gauge and atmospheric pressures.

ACCUMULATOR - (STEAM) A pressure vessel containing water and/or steam, which is used to store the heat of steam for use at a late period and at some lower pressure.

ACID CLEANING - The process of cleaning the interior surfaces of steam generating units by filling the unit with dilute acid accompanied by an inhibitor to prevent corrosion, and subsequently draining, washing and neutralizing the acid by a further wash of alkaline water.

ACIDITY - Represents the amount of free carbon dioxide, mineral acids and salts (especially sulphates of iron and aluminum) which hydrolyze to give hydrogen ions in water and is reported as milliequivalents per liter of acid, or ppm acidity as calcium carbonate, or pH the measure of hydrogen ions concentration.

ADIABATIC FLAME TEMPERATURE - The theoretical temperature that would be attained by the products of combustion provided the entire chemical energy of the fuel, the sensible heat content of the fuel and combustion above the datum temperature were transferred to the products of combustion. This assumes: No heat loss to surroundings and no dissociation.

AIR - The mixture of oxygen, nitrogen, and other gases, which with varying amounts of water vapor, forms the atmosphere of the earth.

AIR ATOMIZING OIL BURNER - A burner for firing oil in which the oil is atomized by compressed air, which is forced into and through one or more streams of oil which results in the breaking of the oil into a fine spray.

AIR DEFICIENCY - Insufficient air, in an air-fuel mixture, to supply the oxygen required for complete oxidation of the fuel.

AIR-FREE - The descriptive characteristic of a substance from which air has been removed.

AIR-FUEL RATIO - The ratio of the weight, or volume, of air to fuel.

AIR INFILTRATION - The leakage of air into a setting or duct.

AIR, SATURATED - Air which contains the maximum amount of water vapor that it can hold at its temperature and pressure.

AIR VENT - A valved opening in the top of the highest drum of a boiler or pressure vessel for venting air.

ALARM - A suitable horn, bell, light or other device which when operated will give notice of malfunction or off normal condition.

ALKALINITY - Represents the amount of carbonates, bicarbonates, hydroxides and silicates or phosphates in the water and is reported as grains per gallon, or ppm as calcium carbonate.

ALLOWABLE WORKING PRESSURE - See design pressure.

AMBIENT AIR - The air that surrounds the equipment. The standard ambient air for performance calculations is air at 80 °F, 60% relative humidity, and a barometric pressure of 29.921 in. Hg, giving a specific humidity of 0.013 lb of water vapor per lb of dry air.

AMBIENT TEMPERATURE - The temperature of the air surrounding the equipment.

ANALYSIS - Quantitative determination of the constituent parts.

ANALYSIS, ULTIMATE - Chemical analysis of solid, liquid or gaseous fuels. In the case of coal or coke, determination of carbon, hydrogen, sulfur, nitrogen, oxygen, and ash.

AQUASTAT - Water limit temperature control, a safety device often used on boilers.

ARRESTER - A device to impede the flow of large dust particles or sparks from a stack, usually screening at the top.

AS-FIRED FUEL - Fuel in the condition as fed to the fuel burning equipment.

ASH - The incombustible inorganic matter in the fuel.

ASH-FREE BASIS - The method of reporting fuel analysis, whereby ash is deducted and other constituents are recalculated to total 100%.

ASH PIT - A pit or hopper located below a furnace where refuse is accumulated and from which refuse is removed at intervals.

ASME - The American Society of Mechanical Engineers.

ASPIRATING BURNER - A burner in which the fuel in a gaseous or finely divided form is burned in suspension, the air for combustion being supplied by bringing into contact with the fuel, air drawn through one or more openings by the lower static pressure created by the velocity of the fuel stream.

AS-RECEIVED FUEL - Fuel in the condition as received at the plant.

ATMOSPHERIC AIR - Air under the prevailing atmospheric conditions.

ATMOSPHERIC PRESSURE - The barometric reading of pressure exerted by the atmosphere. At sea level 14.7 lb per sq in. or 29.92 in. of mercury.

ATOMIZER - A device by means of which a liquid is reduced to a very fine spray.

AVAILABLE DRAFT - The draft which may be utilized to cause the flow of air for combustion or the flow of products of combustion.

AVAILABILITY FACTOR - The fraction of time during which the unit is in operable condition.

AXIAL FAN - Consists of a propeller or disc type of wheel within a cylinder that discharges air parallel to the axis of the wheel.

B

BAFFLE - A plate or wall for deflecting gases or liquids.

BAFFLE TILE - A tile for deflecting gases.

BAFFLE-TYPE COLLECTOR - A device in gas paths utilizing baffles so arranged as to deflect dust particles out of the gas stream.

BAG FILTER - A device containing one or more cloth bags for recovering particles from the dust laden gas or air which is blown through it.

BAG-TYPE COLLECTOR - A filter in which the cloth filtering medium is made in the form of cylindrical bags.

BAROMETRIC PRESSURE - Atmospheric pressure as determined by a barometer usually expressed in inches of mercury.

BASE LOAD - Base load is the term applied to that portion of a station or boiler load that is practically constant for long periods.

BEADED TUBE END - The rounded exposed end of a rolled tube when the tube metal is formed over against the sheet in which the tube is rolled.

BLIND NIPPLE - A nipple, or a short piece of pipe or tube, closed at one end.

BLOWDOWN - Boiler water that is removed from the boiler in order to maintain the desired

concentration levels of suspended and dissolved solids in the boiler and removal of sludge.

BLOWDOWN SAFETY VALVE - The difference between the pressure at which a safety valve opens and at which it closes.

BLOWDOWN VALVE - A valve generally used to continuously regulate concentration of solids in the boiler, not a drain valve. (Often called continuous blowdown.)

BLOW-OFF VALVE - A specially designed, manually operated, valve that connects to the boiler for the purpose of reducing the concentration of solids in the boiler or for draining purposes. (Often called bottom blowdown.)

BLOWER - A fan used to force air under pressure.

BOILER - A closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the application of heat from combustible fuels, electricity or nuclear energy.

BOILER EFFICIENCY - The term boiler efficiency is often substituted for combustion or thermal efficiency. True boiler efficiency is the measure of fuel-to-steam efficiency.

BOILER HORSEPOWER - The evaporation of 34-1/2 lbs of water per hour from a temperature of 212 °F into dry saturated steam at the same temperature. Equivalent to 33,475 Btu/hr.

BOILER RATING - The heating capacity of a boiler expressed in boiler horsepower, Btu/hour, or pounds of steam/hour.

BOILER SHELL- The outer cylindrical portion of a pressure vessel.

BOILER WATER - A term construed to mean a representative sample of the circulating boiler water, after the generated steam has been separated and before the incoming feed water or added chemical becomes mixed with it so that its composition is affected.

BOILING - The conversion of a liquid into vapor with the formation of bubbles.

BOILING OUT - The boiling of highly alkaline water in boiler pressure parts for the removal of oils, greases, etc.

BOOSTER FAN - A device for increasing the pressure or flow of a gas.

BREECHING - A duct that transports the products of combustion between parts of a steam generating unit or to the stack.

BRIDGEWALL - A wall in a furnace over which the products of combustion pass.

BRITISH THERMAL UNIT (Btu) - The mean British Thermal Unit is 1/180 of the heat required to raise the temperature of 1 lb of water from 32 °F to 212 °F at a constant atmospheric pressure. A Btu is essentially 252 calories.

BUCKSTAY - A structural member placed against a furnace or boiler wall to restrain the motion of the wall.

BUNKER C OIL - Residual fuel oil of high viscosity commonly used in marine and stationary steam power plants. (No. 6 fuel oil)

BURNER - A device for the introduction of fuel and air into a furnace at the desired velocities, turbulence and concentration.

BURNER WINDBOX - A plenum chamber around a burner that maintains an air pressure sufficient for proper distribution and discharge of secondary air.

BURNER WINDBOX PRESSURE - The air pressure maintained in the windbox or plenum chamber measured above atmospheric pressure.

BY-PASS - A passage for a fluid, permitting a portion of the fluid to flow around its normal pass flow channel.

C

C - Carbon element, the principal combustible constituent of all fuels.

CaCO₃ - Calcium Carbonate.

CALORIE - The mean calorie is 1/100 of the heat required to raise the temperature of 1 gram of water from Zero C to 100 °C at a constant atmospheric pressure. It is about equal to the quantity of heat required to raise one gram of water 1 °C. Another definition is: A calorie is 3600/860 joules.

CALORIMETER - Apparatus for determining the calorific value of a fuel.

CAPACITY FACTOR - The ratio of the average load carried to the maximum design capacity.

CARBON - Element. The principal combustible constituent of all fuels.

CARRYOVER - The chemical solids and liquid entrained with the steam from a boiler.

CASING - A covering of sheets of metal or other material such as fire resistant composition board used to enclose all or a portion of a steam generating unit.

CENTRAL STATION - A power plant or steam heating plant that generates power or steam.

CENTRIFUGAL FAN - Consists of a fan rotor or wheel within a housing that discharges air at a right angle to the axis of the wheel.

CHEMICAL ANALYSIS - Determination of the principal chemical constituents.

CHEMICAL FEED PIPE - A pipe inside a boiler drum through which chemicals for treating the boiler water are introduced.

CHIMNEY - A brick, metal or concrete stack.

CIRCULATION - The movement of water and steam within a steam generating unit.

CIRCULATION RATIO - The ratio of water entering a circuit to the steam generated by that passes that circuit in a unit of time.

CIRCULATOR - A pipe or tube to pass steam or water between upper boiler drums usually located where the heat absorption is low. Also used to apply to tubes connecting headers of horizontal water tube boilers with drums.

CLEANOUT DOOR - A door placed so that accumulated refuse may be removed from a boiler setting.

CO - Carbon monoxide.

CO₂ - Carbon dioxide.

COLLECTOR - A device used for removing gas borne solids from flue gas.

COLLOID - A finely divided organic substance which tends to inhibit the formation of dense scale and results in the deposition of sludge, or causes it to remain in suspension, so that it may be blown from the boiler.

COMBUSTIBLE LOSS - The loss representing the unliberated thermal energy occasioned by failure to oxidize completely some of the combustible matter in the fuel.

COMBUSTIBLES - The heat producing constituents of a fuel.

COMBUSTION - The rapid chemical combination of oxygen with the combustible elements of a fuel resulting in the release of heat.

COMBUSTION AIR - Air used in the combustion process. Air contains oxygen which is required to combust fuel.

COMBUSTION CHAMBER - See Furnace.

COMBUSTION EFFICIENCY - The effectiveness of the burner to completely burn the fuel. A well designed burner will operate with as little as 10 to 20% excess air, while converting all combustibles in the fuel to useful energy.

COMPLETE COMBUSTION - The complete oxidation of all the combustible constituents of a fuel.

CONCENTRATION - (1) The weight of solids contained in a unit weight of boiler or feed water. (2) The number of times that the dissolved solids have increased from the original amount in the feedwater to that in the boiler water due to evaporation in generating steam.

CONDENSATE - Condensed water resulting from the removal of latent heat from steam.

CONDUCTION - The transmission of heat through and by means of matter unaccompanied by any obvious motion of the matter.

CONDUCTIVITY - (1) A material property relating heat flux (heat transferred per unit area per unit time) to a temperature difference. In American units, it is typically defined as the amount of heat (Btu) transmitted in one hour through one square foot of material 1 inch thick, with a temperature difference of 1°F between the two surfaces of the material. (2) The property of a water sample to transmit electric current under a set of standard conditions. Usually expressed as microhms conductance.

CONTINUOUS BLOWDOWN - The uninterrupted removal of concentrated boiler water from a boiler to control total solids concentration in the remaining water.

CONTROL - Any manual or automatic device for the regulation of a machine to keep it at normal operation. If automatic, the device is motivated by variations in temperature, pressure, water level, time, light, or other influences.

CONTROL VALVE - A valve used to control the flow of air, gas, water, steam or other substance.

CONVECTION - The transmission of heat by the circulation of a liquid or gas. It may be natural, with the circulation caused by buoyancy affects due to temperature differences, or forced with circulation caused by a mechanical device such as a fan or pump.

CORROSION - The wasting away of metal due to chemical action. In a boiler, usually caused by the presence of O₂, CO₂, or an acid.

CROWN SHEET - In a firebox boiler, the plate forming the top of the furnace.

CRUDE OIL - Unrefined petroleum.

CSD-1 - Abbreviation for the ASME standard for Controls and Safety Devices.

D

DAMPER - A device for introducing a variable pressure drop in a system used for regulating the volumetric flow of a gas, such as air.

DAVIT - The structure on large firetube boilers from which the front and rear doors are suspended when opened.

DEAERATION - Removal of air and gases from boiler feed water prior to its introduction to a boiler.

DEGASIFICATION - Removal of gases from samples of steam taken for purity test. Removal of CO₂ from water as in the ion exchange method of softening.

DELAYED COMBUSTION - A continuation of combustion beyond the furnace. (See also Secondary Combustion.)

DESIGN LOAD - The load for which a steam generating unit is designed, considered the maximum load to be carried.

DESIGN PRESSURE - The pressure used in the design of a boiler for the purpose of calculating the minimum permissible thickness or physical characteristics of the different parts of the boiler.

DESIGN STEAM TEMPERATURE - The temperature of steam for which a boiler is designed.

DEW POINT - The temperature at which condensation starts.

DISENGAGING SURFACE - The surface of the boiler water from which steam is released.

DISSOCIATION - The process by which a chemical compound breaks down into simpler constituents, as do CO₂ and H₂O at high temperature.

DISSOLVED SOLID - Those solids in water which are in solution.

DISTILLATE FUELS - Liquid fuels distilled usually from crude petroleum.

DISTILLATION - Vaporization of a substance with subsequent recovery of the vapor by condensation. Often used in less precise sense to refer to vaporization of volatile constituents of a fuel without subsequent condensation.

DISTILLED WATER - Water produced by vaporization and condensation with a resulting

higher purity.

DOWNCOMER - A tube or pipe in a boiler or waterwall circulating system through which fluid flows downward.

DOWNTIME - Amount of time a piece of equipment is not operational.

DRAFT - The difference between atmospheric pressure and some lower pressure existing in the furnace stack or gas passages of a steam generating unit.

DRAFT DIFFERENTIAL - The difference in static pressure between two points in a system.

DRAFT GAUGE - A device for measuring draft, usually in inches of water.

DRAIN - A valved connection at the lowest point for the removal of all water from the pressure parts.

DRUM - A cylindrical shell closed at both ends designed to withstand internal pressure.

DRY AIR - Air with which no water vapor is mixed. This term is used comparatively, since in nature there is always some water vapor included in air, and such water vapor, being a gas, is dry.

DRYBACK BOILER - Firetube boiler with a refractory lined back door. Door opens to allow maintenance and/or inspection.

DRY GAS - Gas containing no water vapor.

DRY-GAS LOSS - The loss representing the difference between the heat content of the dry exhaust gases and their heat content at the temperature of ambient air.

DRY STEAM - Steam containing no moisture. Commercially dry steam containing not more than one half of one percent moisture.

DUCT - A passage for air or gas flow.

E

ECONOMIZER - Utilizes waste heat by transferring heat from flue gases to warm incoming feedwater.

EDR - Equivalent direct radiation is the rate of heat transfer from a radiator or convector. It is equivalent to the square feet of surface area necessary to transfer heat at the same rate at which it is produced by a generator. A single boiler horsepower equals 140 ft² EDR.

EFFICIENCY - The ratio of output to input. See also Combustion, Fuel-to-Steam and Thermal Efficiency.

EJECTOR - A device which utilizes the kinetic energy in a jet of water or other fluid to remove a fluid or fluent material from tanks or hoppers.

ELECTRIC BOILER - A boiler in which electric energy is used as the source of heat.

ELECTROSTATIC PRECIPITATOR - A device for collecting dust, mist or fume from a gas stream, by placing an electrical charge on the particle and removing that particle onto a collecting electrode.

ENTRAINMENT - The conveying of particles of water or solids from the boiler water by the steam.

EQUALIZER - Connections between parts of a boiler to equalize pressures.

EQUIVALENT EVAPORATION - Evaporation expressed in pounds of water evaporated from a temperature of 212 °F to dry saturated steam at 212 °F.

EVAPORATION - The change of state from a liquid to a vapor.

EVAPORATION RATE - The number of pounds of water that is evaporated in a unit of time.

EXCESS AIR - Air supplied for combustion in excess of that theoretically required for complete oxidation.

EXPANSION JOINT - The joint to permit movement due to expansion without undue stress.

EXPLOSION DOOR - A door in a furnace or boiler setting that is designed to be opened by a pre-determined gas pressure.

EXTERNAL TREATMENT - Treatment of boiler feed water prior to its introduction into the boiler.

F

FAN - A machine consisting of a rotor and housing for moving air or gases at relatively low pressure differentials.

FAN PERFORMANCE - A measure of fan operation in terms of volume, total pressures, static pressures, speed, power input, mechanical and static efficiency, at a stated air density.

FAN PERFORMANCE CURVES - The graphical presentation of total pressure, static pressure, power input, mechanical and static efficiency as ordinates and the range of volumes as abscissa, all at constant speed and air density.

FEED PUMP - A pump that supplies water to a boiler.

FEEDWATER - Water introduced into a boiler during operation. It includes make-up and return condensate.

FEEDWATER TREATMENT - The treatment of boiler feed water by the addition of chemicals to prevent the formation of scale or to eliminate other objectionable characteristics.

FGR - Flue Gas Recirculation or the recirculation of flue gas with combustion air to reduce NO_x emissions.

FILTER - Porous material through which fluids or fluid - and solid mixtures are passed to separate matter held in suspension.

FIN - A fin is an extended surface, a solid, experiencing energy transfer by conduction within its boundaries, as well as energy transfer with its surroundings by convection and/or radiation, used to enhance heat transfer by increasing surface area.

FIN TUBE - A tube with one or more fins.

FIRED PRESSURE VESSEL - A vessel containing a fluid under pressure exposed to heat from the combustion of fuel.

FIRE TUBE - A type of boiler design in which combustion gases flow inside the tubes and water flows outside the tubes.

FIRING RATE CONTROL - A pressure temperature or flow controller which controls the firing rate of a burner according to the deviation from pressure or temperature set point. The system may be arranged to operate the burner on-off, high-low or in proportion to load demand.

FIXED CARBON - The carbonaceous residue less the ash remaining in the test container after the volatile matter has been driven off in making the proximate analysis of a solid fuel.

FLAME - A luminous body of burning gas or vapor.

FLAME DETECTOR - A device which indicates if a fuel (liquid, gaseous, or pulverized) is burning, or if ignition has been lost. The indication may be transmitted to a signal or to a control system.

FLAME PROPAGATION RATE - Speed of travel of ignition through a combustible mixture.

FLAME SAFEGUARD - A control that sequences the burner through several stages of operation to provide proper air purge, ignition, normal operation, and shutdown for safe operation.

FLAMMABILITY - Susceptibility to combustion.

FLASHING - The process of producing steam by discharging water into a region of pressure lower than the saturation pressure that corresponds to the water temperature

FLASH POINT - The lowest temperature at which, under specified conditions, fuel oil gives off enough vapor to flash into a momentary flame when ignited.

FLUE - A passage for products of combustion.

FLUE GAS - The gaseous product of combustion in the flue to the stack.

FOAMING - The continuous formation of bubbles which have sufficiently high surface tension to remain as bubbles beyond the disengaging surface.

FORCED CIRCULATION - The circulation of water in a boiler by mechanical means external to the boiler.

FORCED-DRAFT FAN - A fan supplying air under pressure to the fuel burning equipment.

FOULING - The accumulation of refuse in gas passages or on heat absorbing surfaces which results in undesirable restriction to the flow of gas or heat.

FM - Factory Mutual.

FREE ASH - Ash which is not included in the fixed ash.

FUEL - A substance containing combustible used for generating heat.

FUEL-AIR MIXTURE - Mixture of fuel and air.

FUEL-AIR RATIO - The ratio of the weight, or volume, of fuel to air.

FUEL OIL - A liquid fuel derived from petroleum or coal.

FUEL-TO-STEAM EFFICIENCY - The ratio of heat added to boiler feedwater to produce the output steam to the amount of energy inputted with fuel.

FURNACE - An enclosed space provided for the combustion of fuel.

FURNACE PRESSURE - Pressure occurring inside the combustion chamber; positive if

greater than atmospheric, negative if less than atmospheric, and neutral if equal to atmospheric.

FURNACE VOLUME - The cubic contents of the furnace or combustion chamber.

FUSIBLE PLUG - A hollowed threaded plug having the hollowed portion filled with a low melting point material.

G

GAS ANALYSIS - The determination of the constituents of a gaseous mixture.

GAS BURNER - A burner that uses gas or fuel.

GAS PRESSURE REGULATOR - A spring loaded, dead weighted or pressure balanced device which will maintain the gas pressure to the burner supply line.

GAUGE COCK - A valve attached to a water column or drum for checking water level.

GAUGE GLASS - The transparent part of a water gauge assembly connected directly or through a water column to the boiler, below and above the water line, to indicate the water level in a boiler.

GAUGE PRESSURE - The pressure above atmospheric pressure.

GRADE - Oil classification according to quality, generally based on ASTM specifications.

GRAINS PER CU-FT - The term for expressing dust loading in weight per unit of gas volume (7000 grains equals one pound).

GRAINS (WATER) - A unit of measure commonly used in water analysis for the measurement of impurities in water (17.1 grains = 1 part per million - ppm).

GRAVITY - Weight index of fuels: liquid, petroleum products expressed either as specific, Baume or A.P.I. (American Petroleum Institute) gravity; weight index of gaseous fuels as specific gravity related to air under specified conditions; or weight index of solid fuels as specific gravity related to water under specified conditions.

H

HANDHOLE - An access opening in a pressure part usually not exceeding 6 inches in its longest dimension.

HANDHOLE COVER - A handhole closure.

HARDNESS - A measure of the amount of calcium and magnesium salts in water. Usually expressed as grains per gallon or ppm as CaCO_3 .

HARD WATER - Water which contains calcium or magnesium in an amount which require an excessive amount of soap to form a lather.

HEAT AVAILABLE - The thermal energy above a fixed datum that is capable of being absorbed for useful work.

HEAT BALANCE - An accounting of the distribution of the heat input, output and losses.

HEAT EXCHANGER - A vessel in which heat is transferred from one medium to another.

HEAT RELEASE RATE - Rate that describes the heat available per square foot of heat-absorbing surface in the furnace or per cubic foot of volume.

HEATING SURFACE - Those surfaces which are exposed to products of

combustion on one side and water on the other. This surface is measured on the side receiving the heat.

HEATING VALUE - The quantity of heat released by a fuel through complete combustion. It is commonly expressed in Btu per lb, per gallon, or cu-ft.

HIGH GAS PRESSURE CONTROL - A control to stop the burner if the gas pressure is too high.

HIGH OIL TEMPERATURE CONTROL - A control to stop the burner if the oil temperature is too high.

HYDROCARBON - A chemical compound of hydrogen and carbon.

HYDROSTATIC TEST - A strength and tightness test of a closed pressure vessel by water pressure.

I

IGNITION - The initiation of combustion.

IGNITION TEMPERATURE - Lowest temperature of a fuel at which combustion becomes self-sustaining.

ILLUMINANTS - Light oil or coal compounds that readily burn with a luminous flame, such as ethylene, propylene and benzene.

INCOMPLETE COMBUSTION - The partial oxidation of the combustible constituents of a fuel.

INDUCED DRAFT FAN- A fan exhausting hot gases from the heat absorbing equipment.

INERT GASEOUS CONSTITUENTS - Incombustible gases such as nitrogen which may be present in a fuel.

INHIBITOR - A substance which selectively retards a chemical action. An example in boiler work is the use of an inhibitor, when using acid to remove scale, to prevent the acid from attacking the boiler metal.

INJECTOR - A device utilizing a steam jet to entrain and deliver feed water into a boiler.

INSULATION - A material of low thermal conductivity used to reduce heat losses.

INTEGRAL BLOWER - A blower built as an integral part of a device to supply air thereto.

INTEGRAL-BLOWER BURNER - A burner of which the blower is an integral part.

INTERLOCK - A device to prove the physical state of a required condition, and to furnish that proof to the primary safety control circuit.

INTERMITTENT BLOWDOWN - the blowing down of boiler water at intervals.

INTERNAL TREATMENT - The treatment of boiler water by introducing chemicals directly into the boiler.

ION - A charged atom or radical which may be positive or negative.

IRI - Industrial Risk Insurers.

L

LAGGING - A light gauge steel covering used over a boiler, usually combined with insulation, to provide a low temperature outer surface.

LEAKAGE - The uncontrolled quantity of fluid which enters or leaves through the enclosure of air or gas passages.

LIBERATION - See Heat Release.

LIMIT CONTROL - A switching device that completes or breaks an electrical circuit at predetermined pressures or temperatures. Also known as an interlock. See interlock.

LINING - The material used on the furnace side of a furnace wall. It is usually of high grade refractory tile or brick or plastic refractory material.

LOAD - The rate of output required; also the weight carried.

LOAD FACTOR - The ratio of the average load in a given period to the maximum load carried during that period.

LOW GAS PRESSURE CONTROL - A control to stop the burner if gas pressure is too low.

LOW OIL TEMPERATURE CONTROL - (Cold Oil Switch) A control to prevent burner operation if the temperature of the oil is too low.

LOW WATER CUTOFF - Safety device that shuts off the boiler/burner in the event of low water, preventing pressure vessel failure.

LUG - Any projection, like an ear, used for supporting or grasping.

M

MAKE-UP - The water added to boiler feed to compensate for that lost through exhaust, blowdown, leakage, etc.

MANHOLE - The opening in a pressure vessel of sufficient size to permit a man to enter.

MANIFOLD - A pipe or header for collection of a fluid from, or the distribution of a fluid to a number of pipes or tubes.

MANUAL GAS SHUTOFF VALVE - A manually operated valve in a gas line for the purpose of completely turning on or shutting off the gas supply.

MANUFACTURED GAS - Fuel gas manufactured from coal, oil, etc., as differentiated from natural gas.

MAXIMUM ALLOWABLE WORKING PRESSURE - The maximum gauge pressure permissible in a completed boiler. The MAWP of the completed boiler shall be less than or equal to the lowest design pressure determined for any of its parts. This pressure is based upon either proof tests or calculations for every pressure part of the boiler using nominal thickness exclusive of allowances for corrosion and thickness required for loadings other than pressure. It is the basis for the pressure setting of the pressure relieving devices protecting the boiler.

MAXIMUM CONTINUOUS LOAD - The maximum load which can be maintained for a specified period.

MAXIMUM INSTANTANEOUS DEMAND - The sudden load demand on a boiler beyond which an unbalanced condition may be established in the boiler's internal flow pattern and/or surface release conditions.

MECHANICAL ATOMIZING OIL BURNER - A burner which uses the pressure of the oil for atomization.

MECHANICAL DRAFT - The negative pressure created by mechanical means.

MICRON - One millionth of a meter, or 0.000039 in. or 1/25400 in. The diameter of dust particles is often expressed in microns.

MINIATURE BOILER - Fire pressure vessels which do not exceed the following limits: 16 in. inside diameter of shell; 42 in., overall length to outside of heads at center; 20 sq ft water heating surface; or 100 psi maximum allowable working pressure.

MMBtu - Millions of Btus (British Thermal Units).

MOISTURE - Water in the liquid or vapor phase.

MOISTURE IN STEAM - Particles of water carried in steam, expressed as the percentage by weight.

MOISTURE LOSS - The boiler flue gas loss representing the difference in the heat content of the moisture in the exit gases and that at the temperature of the ambient air.

MULTIFUEL BURNER - A burner by means of which more than one fuel can be burned.

MULTIPOINT BURNER - A burner having a number of nozzles from which fuel and air are discharged.

N

NATURAL CIRCULATION - The circulation of water in a boiler caused by differences in density.

NATURAL GAS - Gaseous fuel occurring in nature.

NET POSITIVE SUCTION HEAD (NPSH) - The liquid pressure that exists at the suction end of a pump. If the NPSH is insufficient, the pump can cavitate.

NO_x - Abbreviation for all of the family of oxides of nitrogen.

NOZZLE - a short flanged or welded neck connection on a drum or shell for the outlet or inlet of fluids; also a projecting spout through which a fluid flows.

O

OIL BURNER - A burner for firing oil.

OIL HEATING AND PUMPING SET - A group of apparatus consisting of a heater for raising the temperature of the oil to produce the desired viscosity, and a pump for delivering the oil at the desired pressure.

OPERATING CONTROL - A control to start and stop the burner - must be in addition to the high limit control.

OPERATING PRESSURE - The pressure at which a boiler is operated.

ORGANIC MATTER - Compounds containing carbon often derived from living organisms.

ORIFICE - (1) The opening from the whirling chamber of a mechanical atomizer or the mixing chamber of a steam atomizer through which the liquid fuel is discharged. (2) A calibrated opening in a plate, inserted in a gas stream for measure velocity of flow.

ORSAT - a gas-analysis apparatus in which certain gaseous constituents are measured by absorption in separate chemical solution.

OVERPRESSURE - Minimum operating pressure of a hot water boiler sufficient to prevent the water from steaming.

OXIDATION - chemical combination with oxygen.

OXIDIZING ATMOSPHERE - An atmosphere which tends to promote the oxidation of immersed materials.

OXYGEN ATTACK - Corrosion or pitting in a boiler caused by oxygen.

P

PACKAGED BOILER - A boiler supplied with all of its components - burner, controls and auxiliary equipment, designed as a single engineered package, and ready for on-site installation.

PACKAGED STEAM GENERATOR - See Packaged Boiler.

PARTICLE SIZE - A measure of dust size, expressed in microns or per cent passing through a standard mesh screen. **PASS** - A confined passageway, containing heating surface, through which a fluid flows in essentially one direction.

PERFECT COMBUSTION - The complete oxidation of all the combustible constituents of a fuel, utilizing all the oxygen supplied.

PETROLEUM - Naturally occurring mineral oil consisting predominately of hydrocarbons.

pH - The hydrogen ion concentration of a water to denote Acidity or Alkalinity. A pH of 7 is neutral. A pH above 7 denotes alkalinity while one below 7 denotes acidity. This pH number is the negative exponent of 10 representing hydrogen ion concentration in grams per liter. For instance a pH of 7 represent 10^{-7} grams per liter.

PILOT - (See also Ignitor.) A flame which is utilized to ignite the fuel at the main burner or burners.

PITOT TUBE - An instrument which will register total pressure and static pressure in a gas stream, used to determine its velocity.

PITTING - A concentrated attack by oxygen or other corrosive chemicals in a boiler, producing a localized depression in the metal surface.

PORT - An opening through which fluid passes.

POST PURGE - A method of scavenging the furnace and boiler passes to remove all combustible gases after flame failure controls have sensed pilot and main burner shutdown and safety shut-off valves are closed.

ppm - Abbreviation for parts per million. Used in chemical determinations as one part per million parts by weight.

PRECIPITATE - To separate materials from a solution by the formation of insoluble matter by chemical reaction. The material which is removed.

PRECIPITATION - The removal of solid or liquid particles from a fluid.

PREHEATED AIR - Air at a temperature exceeding that of the ambient air. **PRESSURE** - Force per unit of area.

PRESSURE DROP - The difference in pressure between two points in a system, caused by resistance to flow.

PRESSURE VESSEL - A closed vessel or container designed to confine a fluid at a pressure above atmospheric.

PRIMARY AIR - Air introduced with the fuel at the burner.

PRIMING - The discharge of steam containing excessive quantities of water in suspension from a boiler, due to violent ebullition.

PROCESS STEAM - Steam used for industrial purposes other than for producing power.

PRODUCTS OF COMBUSTION - The gases, vapors, and solids resulting from the combustion of fuel.

PULSATION - Rapid fluctuations in pressure.

PURGE - To introduce air into the furnace and the boiler flue passages in such volume and manner as to completely replace the air or gas-air mixture contained therein.

R

RADIATION LOSS - A comprehensive term used in a boiler-unit heat balance to account for the conduction, radiation, and convection heat losses from the boiler to the ambient air.

RATED CAPACITY - The manufacturer's stated capacity rating for mechanical equipment; for instance, the maximum continuous capacity in pounds of steam per hour for which a boiler is designed.

RATE OF BLOWDOWN - A rate normally expressed as a percentage of the water fed.

RATING - See "Load."

RAW WATER - Water supplied to the plant before any treatment.

REACTION - A chemical transformation or change brought about by the interaction of two substances.

REASSOCIATION - The recombination of the products of dissociation.

RECIRCULATION - The reintroduction of part of the flowing fluid to repeat the cycle of circulation.

REDUCING ATMOSPHERE - An atmosphere which tends to 1) promote the removal of oxygen from a chemical compound; 2) promote the reduction of immersed materials.

REDUCTION - Removal of oxygen from a chemical compound.

REFRACTORY - Brickwork or castable used in boilers to protect metal surfaces and for boiler baffles.

RELATIVE HUMIDITY - The ratio of the mass of water vapor present in a unit volume of gas to the maximum possible mass of water vapor in unit volume of the same gas at the same temperature and pressure.

RELIEF VALVE (Safety Relief Valve) - An automatic pressure relieving device actuated by the pressure upstream of the valve and characterized by opening pop action with further increase in lift with an increase in pressure over popping pressure.

RESIDUAL FUELS - Products remaining from crude petroleum by removal of some of the water and an appreciable percentage of the more volatile hydrocarbons.

RESIN - A bead-like material used in chemical exchange for softeners and dealkalizers.

RESISTANCE - Impediment to gas flow, such as pressure drop or draft loss through a dust collector. Usually measured in inches water column (iwc).

RETURN FLOW OIL BURNER - A mechanical atomizing oil burner in which part of the oil supplied to the atomizer is withdrawn and returned to storage or to the oil line supplying the atomizer.

RINGELMANN CHART - A series of four rectangular grids of black lines of varying widths printed on a white background, and used as a criterion of blackness for determining smoke density in stack gas streams.

ROTARY OIL BURNER - A burner in which atomization is accomplished by feeding oil to the inside of a rapidly rotating cup.

S

SADDLE - A casting, fabricated chair, or member used for the purpose of support.

SAFE WORKING PRESSURE - See "Design Pressure."

SAFETY VALVE - A spring loaded valve that automatically opens when pressure attains the valve setting. Used to prevent excessive pressure from building up in a boiler.

SAFETY SHUT-OFF VALVE - A manually opened, electrically latched, electrically operated safety shut-off valve designed to automatically shut off fuel when de-energized.

SAMPLING - The removal of a portion of a material for examination or analysis.

SATURATED AIR - Air which contains the maximum amount of water vapor that it can hold at its temperature and pressure.

SATURATED STEAM - Steam at the temperature and pressure at which evaporation occurs.

SATURATED TEMPERATURE - The temperature at which evaporation occurs at a particular pressure.

SATURATED WATER - Water at its boiling point.

SCALE - A hard coating or layer of materials on surfaces of boiler pressure parts.

SECONDARY AIR - Air for combustion supplied to the furnace to supplement the primary air.

SECONDARY TREATMENT - Treatment of boiler feed water or internal treatment of boiler-water after primary treatment.

SEDIMENT - (1) Matter in water which can be removed from suspension by gravity or mechanical means. (2) A non-combustible solid matter which settles out at bottom of a liquid; a small percentage is present in residual fuel oils. **SEGREGATION** - The tendency of refuse of varying compositions to deposit selectively in difference parts of the unit.

SELF-SUPPORTING STEEL STACK - A steel stack of sufficient strength to require no lateral support.

SERVICE WATER - General purpose water which may or may not have been treated for a special purpose.

SHELL - The cylindrical portion of a pressure vessel.

SLUDGE - A soft water-formed sedimentary deposit which normally can be removed by blowing down.

SLUG - A large "dose" of chemical treatment applied internally to a steam boiler intermittently. Also used sometimes instead of "priming" to denote a discharge of water out through a boiler steam outlet in relatively large intermittent amounts.

SMOKE - Small gas borne particles of carbon or soot, less than 1 micron in size, resulting from incomplete combustion of carbonaceous materials and of sufficient number to be observable.

SOFTENING - The act of reducing scale forming calcium and magnesium impurities from water.

SOFT WATER - Water which contains little or no calcium or magnesium salts, or water from which scale forming impurities have been removed or reduced.

SOLUTION - A liquid, such as boiler water, containing dissolved substances.

SOOT - Unburned particles of carbon derived from hydrocarbons.

SOOT BLOWER - A mechanical device for discharging steam or air to clean heat absorbing surfaces.

SPALLING - The breaking off of the surface of refractory material as a result of internal stresses.

SPECIFIC HEAT - The quantity of heat, expressed in Btu, required to raise the temperature of 1 lb of a substance 1°F.

SPECIFIC HUMIDITY - The weight of water vapor in a gas water-vapor mixture per unit weight of dry gas.

SPRAY ANGLE - The angle included between the sides of the cone formed by liquid fuel discharged from mechanical, rotary atomizers and by some forms of steam or air atomizers.

SPRAY NOZZLE - A nozzle from which a liquid fuel is discharged in the form of a spray.

STACK - A vertical conduit, which due to the difference in density between internal and external gases, creates a draft at its base.

STACK DRAFT - The magnitude of the draft measured at the inlet to the stack.

STACK EFFECT - That portion of a pressure differential resulting from difference in elevation of the points of measurement.

STACK EFFLUENT - Gas and solid products discharged from stacks.

STAGNATION - The condition of being free from movement or lacking circulation.

STANDARD AIR - Dry air weighing 0.075 lb per cu ft at sea level (29.92 in. Barometric Pressure) and 70 °F.

STANDARD FLUE GAS - Gas weighing 0.078 lb per cu ft at sea level (29.92 in. Barometric Pressure) and 70 °F.

STATIC PRESSURE - The measure of potential energy of a fluid.

STEAM - The vapor phase of water, unmixed with other gases.

STEAM ATOMIZING OIL BURNER - A burner for firing oil which is atomized by steam. It may be of the inside or outside mixing type.

STEAM BINDING - A restriction in circulation due to a steam pocket or a rapid steam formation.

STEAM GAUGE - A gauge for indicating the pressure of steam.

STEAM GENERATING UNIT - A unit to which water, fuel, and air are supplied and in which steam is generated. It consists of a boiler furnace, and fuel burning equipment, and may include as component parts water walls, superheater, reheater, economizer, air heater, or any combination thereof.

STEAM PURITY- The degree of contamination. Contamination is expressed in ppm.

STEAM QUALITY - The percent by weight of vapor in a steam and water mixture.

STEAM SEPARATOR - A device for removing the entrained water from steam.

STRAINER - A device, such as a filter, to retain solid particles allowing a liquid to pass.

STRATIFICATION - Non-homogeneity existing transversely in a gas stream.

STUD - A projecting pin serving as a support or means of attachment.

SUPERHEATED STEAM - Steam with its temperature raised above that of saturation. The temperature in excess of its saturation temperature is referred to as superheat.

SURFACE BLOWOFF - Removal of water, foam, etc. from the surface at the water level in a boiler. The equipment for such removal.

SURGE - The sudden displacement or movement of water in a closed vessel or drum.

SUSPENDED SOLIDS - Undissolved solids in boiler water.

SWINGING LOAD - A load that changes at relatively short intervals.

T

TERTIARY AIR - Air for combustion supplied to the furnace to supplement the primary and secondary air.

THEORETICAL AIR - The quantity of air required for perfect combustion.

THEORETICAL DRAFT - The draft which would be available at the base of a stack if there were no friction or acceleration losses in the stack.

THEORETICAL FLAME TEMPERATURE - See "Adiabatic Flame Temperature."

THERM - A unit of heat applied especially to gas. One therm = 100,000 Btu.

THERMAL EFFICIENCY - The efficiency of a boiler, based on the ratio of heat absorbed to total heat input. This does not include heat loss from the boiler shell.

THERMAL SHOCK - A cycle of temperature swings that result in failure of metal due to expansion and contraction.

THERMOCOUPLE - A temperature measuring instrument.

TILE - A preformed refractory, usually applied to shapes other than standard brick.

TOTAL AIR - The total quantity of air supplied to the fuel and products of combustion. Percent total air is the ratio of total air to theoretical air, expressed as percent.

TOTAL PRESSURE - The sum of the static and velocity pressures.

TOTAL SOLIDS CONCENTRATION - The weight of dissolved and suspended impurities in a unit weight of boiler water, usually expressed in ppm.

TRAP - A receptacle for the collection of undesirable material.

TREATED WATER - Water which has been chemically treated to make it suitable for boiler feed.

TRIM - Ancillary boiler components, like water level controls, pressure controls, and temperature controls.

TUBE - A hollow cylinder for conveying fluids.

TUBE HOLE - A hole in a drum, heater, or tube sheet to accommodate a tube.

TURBULENT BURNER - A burner in which fuel and air are mixed and discharged into the furnace in such a manner as to produce turbulent flow from the burner.

TURNDOWN RATIO - Ratio of maximum to minimum fuel or steam input or boiler output.

U

ULTIMATE ANALYSIS - See "Analysis Ultimate."

UL LISTED - Product certification that indicates the product meets safety standards determined by Underwriters Laboratories. (ULC and cUL indicate Canadian requirements.)

UNACCOUNTED-FOR LOSS - That portion of a boiler heat balance which represents the difference between 100 per cent and the sum of the heat absorbed by the unit and all the classified losses expressed as per cent.

UNBURNED COMBUSTIBLE - The combustible portion of the fuel which is not completely oxidized.

UNFIRED PRESSURE VESSEL - A vessel designed to withstand internal

pressure, neither subjected to heat from products of combustion nor an integral part of a fired pressure vessel system.

USE FACTOR - The ratio of hours in operation to the total hours in that period.

V

VA - Volt amperes.

VAPOR - The gaseous product of evaporation.

VAPORIZATION - The change from liquid or solid phase to the vapor phase.

VELOCITY PRESSURE - The measure of the kinetic energy of a fluid.

VENT - An opening in a vessel or other enclosed space for the removal of gas or vapor.

VERTICAL FIRING - An arrangement of a burner such that air and fuel are discharged into the furnace in practically a vertical direction.

VISCOSITY - Measure of the internal friction of a fluid or its resistance to flow.

VOLATILE MATTER Those products given off by a material as gas or vapor, determined by definite prescribed methods.

VOLUME OF AIR - The number of cu ft of air per min expressed at fan outlet conditions.

W

WASTE HEAT - Sensible heat in non-combustible gases discharged to the environment.

WATER - A liquid composed of two parts of hydrogen and sixteen parts oxygen by weight.

WATER COLUMN - A vertical tubular member connected at its top and bottom to the steam and water space respectively of a boiler, to which the water gauge, water level controls, and fuel cutoff may be connected.

WATER GAUGE - The gauge glass and its fittings for attachment.

WATER HAMMER - A sudden increase in pressure of water due to an instantaneous conversion of momentum to pressure.

WATER LEVEL - The elevation of the surface of the water in a boiler.

WATER SOFTENER - Removes hardness (CaCO_3) from water through an ion exchange of sodium with calcium and magnesium.

WATER TUBE - A tube in a boiler having the water and steam on the inside and heat applied to the outside.

WATER VAPOR - A synonym for steam, usually used to denote steam of low absolute pressure.

WEEP - A term usually applied to a minute leak in a boiler joint which forms droplets (or tears) of water very slowly.

WETBACK BOILER - Firetube boiler design wherein the back portion of the boiler has a water jacket.

WET-BULB TEMPERATURE - The lowest temperature which a water wetted body will attain when exposed to an air current. This is the temperature of adiabatic saturation, and can be used to measure humidity.

WETNESS - A term used to designate the percentage of water in steam. Also used to describe the presence of a water film on heating surface interiors.

WET STEAM - Steam containing moisture.

WINDBOX - A chamber below the grate or surrounding a burner, through which air under pressure is supplied for combustion of the fuel.

WINDBOX PRESSURE - The static pressure in the windbox of a burner or stoker.

