

# Glossary of Process Technology Terms

## A

**Absolute Pressure** – Gauge pressure plus atmospheric pressure. Normal pressure gauges are set at zero and do not include atmospheric pressure but can be converted to absolute pressure by adding the barometric or atmospheric pressure.

**Absolute Temperature Scale** – A temperature scale on which ice melts at 273°C, and water boils at 373°C. Also known as the Kelvin Scale, and is denoted by °K (sometimes °A). Also see "Rankine."

**Absolute Zero (Temperature)** – A hypothetical temperature characterized by the complete absence of heat and equivalent to -273.16°C or -459.69°F.

**Absorber** – A tower or column that causes contact between a rising gas and falling liquid so that part of the gas may be taken up (absorbed) by the liquid.

**Absorption** – The taking up of a gas or vapor by a liquid, the taking up of a liquid by a solid, or the taking up of energy (heat, light, x-ray) by another material.

**Absorption Oil** – The oil used in an absorption tower, usually in the range of kerosene or heating oil.

**AC (Alternating Current)** – Electric current that reverses direction periodically, usually sixty times per second. This is the primary type of electrical current used in processing plants.

**Acceleration** – A measure of how fast an object changes speed.

**Acceleration Head** – The fluctuations of suction pressure created by the intake stroke of a reciprocating pump.

**Accident** – A happening that is not expected, foreseen, or intended; frequently resulting from negligence and ending in injury, loss or considerable damage.

**Accumulation** – The delta pressure ( $\Delta P$ ) between initial lift and full lift on a safety valve.

**Accumulator** – A vessel for the temporary storage of a liquid or gas, usually used for collecting sufficient material for a continuous charge or reflux.

**Accuracy** – Exactness, the quality of being exact.

**Acetic Acid** – A common industrial organic acid with the odor of vinegar. Weak solutions are made into household vinegar.

**Acetone** – A common, organic, industrial solvent employed in the dewaxing of petroleum.

**Acetylene** – A colorless, highly flammable gas that is explosive when compressed; the simplest compound containing a triple bond; used in organic synthesis and as a welding fuel.

**Acetylide** – An organic compound formed from acetylene where one or more of the hydrogen atoms are replaced by a metal such as copper. Such compounds are very dangerous, especially when dry.

**Acid** – A chemical substance that has the ability to react with a base to form a salt. A compound or ion that can donate hydrogen ions to another substance. An acid has a pH of less than 7.0. Common acids are sulfuric acid, hydrochloric, hydrofluoric, phosphoric, and acetic acids. Acids are corrosive to metals and flesh.

**Acid Hood** – A protective hood worn by a person when working on equipment to keep acid or any other toxic/corrosive liquid or fumes from getting on the face or into the eyes.

**Acid Sludge** – A gummy acid material which separates from the oil after treating it with sulfuric acid.

**Acid Test** – A test using nitric acid that assists in the identification of an unknown metal.

**Acid Wash** – A procedure where a piece of equipment is washed with acid for cleaning purposes, or for the purpose of neutralizing any possible caustic contaminants.

**Acidic** – A material having the characteristic of an acid, that is, a pH between 1 and 7, and reacts with basic materials such as sodium hydroxide (caustic).

**Acidity** – Having a pH below 7. The ability to turn litmus paper red.

**Acidize** – A maintenance procedure used to clean equipment or piping with an acid solution. Consists of circulating an acid solution through a piece of equipment with a pump.

**Actual Capacity** – The volume of gas admitted into the cylinder during compression, usually expressed in cubic feet per minute (CFM).

**Actuator** – A device mounted on a valve that is capable of adjusting the valve in response to a command from a controller.

**Acute Effect** – An effect that is severe.

**Additive** – A compound added to a semi-finished product in very small quantities to improve some characteristic of the product, or to prevent certain undesirable reactions from occurring in its use.

**Adiabatic Flame Temperature** – The maximum temperature (theoretical) which results when the total heat of combustion is used to increase the temperature of all products formed. This is a calculated value that assumes no heat is released to the surroundings (adiabatic).

**Adiabatic Process** – A process carried out under conditions such that no heat escapes or enters the system from the surroundings.

**Administrative Controls** – Methods for controlling employee exposure to hazardous materials using programs and activities.

**Adsorb** – Adsorption is the attraction of molecules of a liquid or gas to the surface of a solid. For example: activated carbon granules adsorb H<sub>2</sub>S from methane gas.

**Adsorber** – A device (reactor, dryer, etc.) filled with a porous solid designed to remove unwanted gases or liquids from a mixture.

**Adsorption** – The attraction of a gas, liquid, or solid to the surface of a solid. Example: The adsorption of poison gases by the activated charcoal in gas masks.

**Aerate** – To bubble air or gas into a solution. This saturates the solution with the air or gas.

**Aerators** – Devices used to agitate and add oxygen to a microbiological system, such as a waste treatment pond.

**Aerobic** – Referring to an organism or process requiring the presence of free oxygen.

**Aerosols** – Liquid droplets or solid particles dispersed in air.

**A-Frame Furnace** – A type of furnace that has an A-frame type exterior structure.

**Afterburning** – The chemical reaction (combustion) of carbon monoxide (CO) with oxygen (O) to form carbon dioxide (CO<sub>2</sub>).

**Aftercooler** – A shell and tube heat exchanger located on the discharge side of a compressor with the function of removing excess heat from the system created during compression.

**AGA** – American Gas Association

**Agitate** – To shake or to mix as in the preparation of a solid-liquid mixture.

**Agitator** – A device for keeping liquids and solids in motion by mixing, stirring, or shaking. (Sometimes refers to a person that stirs up trouble).

**AIHA** – American Industrial Hygiene Association.

**Air Binding** – A situation in which air fills a trap (such as a float trap) and prevents it from operating.

**Air Damper** – A type of hand-operated or mechanically-operated valve which controls both the air flow to the furnace burners and/or the flue gas to the ID fan suction.

**Air Dryer** – A chamber containing filters which is used to remove dirt and moisture from compressed air.

**Air Intake Louvers** – Parallel vent boards (louvers) located on the side of a cooling tower.

**Air Motor Valve** – A valve that uses an air powered motor to position the valve.

**Air Mover** – An electrically driven fan or blower used to force air into a vessel.

**Air Permits** – Permits which must be obtained for any project which has the possibility of producing air pollutants.

**Air Pollution** – The contamination of the atmosphere, especially by industrial waste gases, fuel exhausts, smoke or particulate matter (finely divided solids).

**Air Pre-Heater** – A device used to heat the air before it enters the furnace at the burners. A cost-saving method used by manufacturers is to run the pre-heater lines through the upper convection section of a furnace to capture as much heat from the hot flue gases before it is lost to the surrounding atmosphere.

**Air Registers** – These are located at the burner and are used to adjust the primary and secondary airflow to the burner. Air registers are the main source of air to the furnace.

**Air Ring** – One or more circular air distribution devices, usually located in the bottom portion of an FCC regenerator, which are used for improving fluidization and more evenly dispersing burning air.

**Air Venturi** – A device which uses compressed air and the Venturi principle to displace air in a vessel. Air horns suck air out of a vessel when operated properly.

**Alarm** – A device (either light, horn or both) which indicates that some function in the unit has exceeded its predetermined limit. For instance, high temperature, high pressure, low and high liquid level, etc.

**Alarm Panel** – That portion of a control panel used for mounting alarm lights, etc.

**Alcohol** – A compound which may be regarded as being derived from a hydrocarbon in which one or more hydrogen atoms have been replaced by hydroxyl (OH) radicals. Often used to indicate grain alcohol (ethanol).

**Algae** – Seaweeds, pond scums, plankton, and a variety of microscopic plants inhabiting fresh and salt waters.

**Alignment** – The positioning of two or more pieces of equipment to form a line. Example: Motor and Pump, Turbine and Compressor, Column sections.

**Alkali** – Any substance having the chemical properties of a base. Commonly thought to be hydroxides of ammonia, and the alkali and alkaline earth metals such as sodium and calcium. A chemical compound capable of neutralizing an acid.

**Alkaline** – Refers to a material which is caustic in nature, such as lye (sodium hydroxide). Any material which has a pH between 7.1 and 14 is considered to be alkaline.

**Alkalinity** – The amount of alkaline substance in a material. The opposite of acidity.

**Alkane** – A member of the saturated series of hydrocarbons with the general formula  $C_NH_{2N+2}$ , where N = number of carbons. Being saturated, alkanes do not have double or triple bonds. Example: Ethane  $C_2H_6$      $CH_3 - CH_3$

**Alkene** – A member of the unsaturated, olefin series of hydrocarbons. General formula is  $C_NH_{2N}$ , where N = number of carbons. Being unsaturated, alkenes have one or more double bonds and the chemical name ends in ene. Example: Ethylene  $C_2H_4$      $CH_2 = CH_2$

**Alkylation** – Formation of complex saturated molecules by a chemical reaction between a saturated and an unsaturated molecule. The adding of an “alky” group, such as an alkane or alkene.

**Alkylation Unit** – A processing unit that uses a strong acid (hydrochloric sulfuric acid) to catalyze alkylation reactions to obtain gasoline range materials.

**Alloy** – Any of a large number of substances having metallic properties and consisting of two or more elements; with few exceptions, the components are usually metallic elements.

**Alumina** – A desiccant, aluminum oxide ( $Al_2O_3$ ) used in traps for drying gases and liquids.

**Alumina Trap** – A small vessel filled with alumina desiccant used for drying gases, such as instrument air.

**Ambient Temperature** – The temperature in the outside environment.

**Amine** – One of a class of organic compounds which can be considered to be derived from ammonia by replacement of one or more hydrogens by organic radicals. Chemically, they react as bases and are hazardous; being corrosive, an irritant and a sensitizer. Example: Ethylene + Ammonia = Ethyleneamine.

**Ammeter** – An instrument for measuring the magnitude of electric current flow.

**Amperes (AMPS)** – A unit of measure of the electrical current flow in a wire. Similar to “gallons of water” flow in a pipe.

**Amplitude** – The magnitude of a vibration, voltage, or current wave forms.

**Anaerobic** – An organism or process that does not require free oxygen.

**Analog Input** – A continuous electronic signal from an external device such as a transmitter to a microprocessor. May vary in magnitude. Normally 10-50 milliamps.

**Analog Output** – A continuous electronic signal from a microprocessor to an external device. May vary in 1-5 volts normally.

**Analog Signals** – Signals (generally electrical) that are continuously changing. These signals typically are associated with one of the four process variables, temperature, pressure, flow or level.

**Analysis** – A statement of findings concerning the chemical properties of a material.

**Analyzer** – A device used to measure physical and/or chemical compositions of materials.

**Anemometer** – A device for measuring the speed and direction of wind.

**Angle Valves** – Valves that are designed to change the flow direction 90 degrees in a pipe run.

**Anhydrous** – Without water. Usually applied to the products obtained by the dehydration of hydrates. Example: Anhydrous Copper Sulfate.

**Anions** – Negatively charged ions. An ion is an atom that has lost or gained one or more electrons.

**Annealing** – The process of heating and slowly cooling in various ways to modify the physical properties of metal or glass.

**Anode** – The positive terminal of an electrolytic cell. An anode can be made of carbon, zinc, or magnesium. Used to slow corrosion or to electroplate.

**ANSI** – American National Standards Institute

**Anti-Oxidant** – A material added to a mixture to prevent or severely restrict possible reactions with oxygen.

**Anti-Seize Compound** – A lubricant used on valve threads.

**Anti-Surge** – Since compressor surge can only occur when certain pressure and flow conditions are met, an “anti-surge” device generally consists of automatic instrumentation designed to prevent these conditions. It may be actuated by flow or pressure conditions, or both, and it may control either flow, pressure or both.

**AO** – American Optical.

**API** – American Petroleum Institute.

**API Gravity** – Arbitrary scale for measuring the density of oils adopted by the American Petroleum Institute. It runs from 0.0 (equivalent to a specific gravity of 1.076) to 100 (equivalent to a specific gravity of 0.6112). The greater the API gravity, the lighter the oil. Water has an API gravity of 10.

**Aqueous Solution** – A solution that uses water as the solvent.

**ARA** – Amsterdam-Rotterdam-Antwerp Petroleum Markets

**Arb** – arbitrage; a practice of taking advantage of a price differential between two or more markets.

**Aromatics** – A generic term applied to hydrocarbons having a benzene ring as part of their basic structure.

**Ash** – An analytical test. Ash is determined by burning a sample of oil to obtain an ash residue which is composed mainly of metallic salts. The ash residue is then analyzed spectroscopically to determine the particular constituents of the ash.

**Ash Content** – Solid material left on combustion of an oil sample. The ash content indicates the concentration of inorganic matter in the oil.

**ASME** – American Society of Mechanical Engineers.

**Asphalt Base Crude** – Crude oil containing asphalt (naphthenes) and practically no wax.

**Asphyxia** – The loss of consciousness as a result of too little oxygen and too much carbon dioxide in the blood.

**ASSE** – American Society of Safety Engineers.

**ASTM** – American Society for Testing Materials.

**Atmosphere** – The mass of air surrounding the earth, composed principally of nitrogen and oxygen.

**Atmospheric** – Referring to the air that surrounds the earth. Also used to define terms such as atmospheric pressure; which is related to the pressure of the air upon earth.

**Atmospheric Pressure** – The pressure of the atmosphere due solely to the weight of the atmospheric gases above the point concerned. It is 14.7 psia at sea level.

**Atom** – The smallest particle of an element that can combine with other elements.

**Attapulugus** – A type of clay found in, and around the town of Attapulugus, Georgia.

**Auto. (Automatic)** – Operating without human assistance as compared to manual operation, which requires human effort.

**Autoclave** – An airtight vessel for heating its contents under pressure; used for industrial processing, sterilizing, and cooking with moist or dry heat at high temperatures.

**Auto-Ignition** – Self-igniting. The amount of heat required to ignite a vapor-air mixture.

**Automatic Control** – Using instrumentation and controls to sense or measure the value of a variable and hold it at a desired value.

**Axial Compressor** – A dynamic type compressor using a series of blades with a set of stator blades between each rotating wheel. In this type of compressor, the gas flow is axial, or straight through, parallel to the compressor shaft.

**Azeotropic Distillation** – A distillation technique whereby a second distillation tower is operated under different conditions in order to separate additional materials.

**Azeotropic Mixture** – A solution of two or more liquids; the composition of which does not change upon distillation.

# B

**Back Flush** – Wash by reversing the normal flow.

**Back Off** – To close a fully opened valve just a little to prevent damage from jamming. To decrease the setting on an instrument; to reduce the tension on a spring; or to reverse the direction of adjustment of an instrument or valve.

**Back Pressure Regulator** – A control valve operated by a control device that opens and closes to keep a set pressure on its upstream side.

**Back Seat** – The seat of a hand valve that the plug closes against when the valve is full open. This takes the pressure off the packing; therefore, prolonging its life.

**Back-Up** – A duplicate device used so if the primary device fails, the back-up is still available or will take over.

**Backwardation** – Falling forward prices in the futures markets

**Back Wash** – See “**Back Flush.**”

**Back Weld** – To place a weld overlay over a non-welded joint. Also, to weld inside of a pipe connection which has been welded on the outside.

**Baffles** – Partitions located inside a shell and tube heat exchanger that increase turbulent flow and reduce hot spots.

**Bag-House** – A pollution control device that removes particles from a stream of air or gas.

**Balance** – A counter-balancing weight force or influence. An instrument for weighing.

**Ball Mill** – A device for grinding solids into a fine powder. Uses a rotating vessel containing hard balls.

**Ball Valve** – A valve with a ball-shaped element in the center. Ball valves provide very little restriction and can be fully opened or closed with a quarter turn of the valve handle.

**Ballast** – To give steadiness to, or to keep steady; a form of counter-weight.

**Ballast, Permanent** – Compartments set aside solely for the carriage of ballast.

**Barge** – A large, unpowered, flat bottom boat, usually with tanks built on it, used to haul material over inland waterways.

**Barium Soap Grease** – Grease prepared from lubricating oil and barium soap.

**Barometer** – An instrument for determining atmospheric pressure.

**Barrel** – Standard volumetric measure for oil; equivalent to 42 gallons.

**Base** – A substance which neutralizes an acid and has a pH greater than 7.0; an alkali. See “**Alkaline.**”

**Baseline Data** – Information collected for use for comparison with future readings.

**Basic** – Having the characteristics of a base.

**Batch** – The quantity of a product made in a single operation.

**Battery Limits** – The boundaries of the area of responsibility of a process unit.

**Baume Gravity** – An arbitrary scale of specific gravity derived by the French chemist Antoine Baume. The measurement is given in Baume degrees; °Bé

**Bauxite** – Naturally occurring mineral containing aluminum oxide.

**BB** – Butane-Butylene FCC product

**BCF** – Billion Cubic Feet

**Beaker** – Laboratory glassware roughly resembling a short, stubby drinking glass; used to transfer and mix various solutions and chemicals.

**Bearing** – A machine part that supports another part, which rotates, slides, or oscillates in or on it.

**Bellows** – Any of several types of enclosures which have accordion-like walls, allowing the volume to vary.

**Bellows Pressure Element** – A corrugated metal tube that contracts and expands in response to pressure changes.

**Bellows Trap** – A thermostatic steam trap that operates by opening and closing a bellows as the temperature changes. This movement opens and closes a valve plug.

**Bernoulli's Principle** – A principle in hydrodynamics: the pressure in a stream of fluid is reduced as the speed of the flow is increased.

**Best Practices** – Successful models or examples that can be used by others.

**BFW (Boiler Feed Water)** – The high quality water fed into boilers to make steam.

**Bias** – An offset applied to an instrument signal to make it read more accurately. The amount of offset remains constant even though the instrument signal may change.

**Binary Mixture** – A mixture containing two components.

**Black Light** – Ultra-violet light used in the inspection of equipment to be used in oxygen service. Oils fluoresce under black light.

**Blank** – See "Blind."

**Blanketing** – The process of putting nitrogen into the vapor space above the liquid in a tank to prevent air leakage into the tank. Often referred to as a "nitrogen blanket."

**Bleed** – To withdraw a small portion of the contained material from a line or vessel. Bleeding is usually accomplished by slightly opening a valve in the line or the vessel.

**Bleeder** – A small valve or item of equipment used to vent liquid or gas from the enclosed system. Bleeders are manually controlled.

**Blend** – The controlled mixing of two or more fluids, liquids, or granular materials.

**Blind** – A solid plate or cover, installed between pipe flanges, designed to prevent the flow of fluids through the opening or pipe.

**Blind Flange** – A circular plate with bolt holes used to cap the flange on the end of a pipe or valve.

**Block In** – To isolate a piece of equipment by closing the valves in all the lines to and from that piece of equipment. To close a valve.

**Block Valve** – Any valve that is intended to positively block (stop) flow. Also known as an isolation valve.

**Blowdown** – Taking material out of a vessel or tower to reduce the level or impurity concentration.

**Blower** – A fan or compressor which operates where the resistance to gas flow is predominantly downstream.

**Blowing** – The process of adding a compressed gas (nitrogen or air) into a line in order to clear the line of an unwanted material.

**Blowout** – A sudden or violent escape of gas, vapor, or liquid.

**BOD (Biological Oxygen Demand)** – A measure of water pollution. A test in which oxygen consumed in the biological stabilization of a sample is measured.

**Boil Up** – When heat is applied to vaporize a liquid, as in distillation, the vapor evolved is termed “boil up.” The boil up rate is directly proportional to the heat added.

**Boiler** – A vessel in which water is boiled and converted into steam under controlled conditions.

**Boiler Load** – Plant demand for steam.

**Boiler Scale** – A chemical deposit or residue consisting primarily of magnesium and calcium salts left in the boiler when water is vaporized.

**Boiling Point** – The temperature at which a liquid boils.

**Boiling Range** – The range of temperature over which the boiling or distillation of a mixture starts, proceeds, and finishes.

**Bomb (Sample)** – A metal (or in some cases glass) cylinder with a valve on each end used to take gas or liquid samples. Some bombs are designed for high pressures (1500 psia or greater) and others for low pressures (10-25 psia).

**Bomb Calorimeter** – A variety of calorimeter in which the combustion is carried out under pressure in an atmosphere of oxygen, within a steel bomb, immersed in water. The extent of rise of temperature of the latter is used to measure the amount of heat generated.

**Bonded Flange** – A flange that has a ground wire attached to both sides of the flange to prevent static electricity from setting off explosive gas mixtures.

**Bonding** – The description of forces that hold two or more objects together; e.g., chemical bonding.

**Bonnet** – (1) The portion of a valve body through which the stem leaves the body. The bonnet contains the stem packing. The bonnet may be extra long for cold service or finned for hot service. (2) A bell-shaped dome mounted on the body of a valve.

**Booster Pump** – A pump used to raise the pressure level of any fluid stream which has been previously subjected to a pumping operation.

**Boss Fitting** – A union type hose fitting used on plant steam hose.

**Bottled Gas** – See "Liquefied Petroleum Gas."

**Bottom Layer** – The heaviest of two or more immiscible (non-mixing) liquids. Usually occurs in tanks when heterogeneous mixtures are involved.

**Bottom Settlings & Water (BS&W)** – Analytical term for emulsions of oil, water, and mud which settle out of crude oil during storage.

**Bottoms** – Residue left in the flask after an endpoint distillation.

**Bourdon Pressure Gauge** – A mechanical pressure-measuring instrument employing as its sensing element, a curved or twisted metal tube, flattened in cross section and closed on one end.

**Bourdon Tube** – A hook-shaped, thin-walled metal tube that is used to detect changes in pressure. The device changes shape in response to pressure changes as it expands and contracts.

**Boyles Law** – The relationship between the pressure and volume of a gas at constant pressure. As the pressure on a gas is increased, its volume is decreased provided the temperature remains constant.

**Breaker** – Electrical device to open or close electrical circuits to equipment either manually or electrically. Some breakers are automated to open to protect electrical equipment from overcurrent, high temperature, etc.

**Break Through** – Exceeding the allowable concentration of reactants in the reactor outlet or blow-off.

**Breathing** – The movement of gas (oil vapors or air) in and out of the vent lines of storage tanks, due to alternate heating and cooling, or from changes in liquid level.

**Bridge Crane** – See "Overhead Crane".

**Brine** – An aqueous solution of calcium or sodium chloride used in a refrigeration system, which after being cooled, is circulated to the space to be refrigerated

**British Thermal Unit (BTU)** – The amount of heat required to raise the temperature of one pound of water, one degree Fahrenheit.

**Bromine Number** – A measure of the degree of unsaturation of a liquid hydrocarbon. It is the number of grams of bromine absorbed by 100 grams of the substance under test when the reaction is carried out under standard conditions. A good indicator of the presence of alkenes in a substance.

**Brushes (Elec.)** – Usually made of carbon and ride on the commutator or slip rings of motors and generators to supply current to the rotating element (rotor or armature).

**BS&W** – Abbreviation for bottom sediment and water.

**BTX** – Benzene, Toluene, Xylene

**Bubble Cap** – A metal cap that covers a riser in a bubble tray. Upcoming gases pass through slots and contact liquid flowing across the tray causing intimate mixing.

**Bubble Tower** – A vertical cylindrical vessel containing bubble trays or plates. Its purpose is to affect a separation of the feedstock into fractions having narrower boiling ranges.

**Bubble Tray** – A horizontal tray or baffle fitted to the inside of a fractionating tower on which the risers and bubble caps are fixed.

**Bucket (Turbine)** – A section on the circumference of a turbine wheel that the steam is directed into from the steam nozzle or jet.

**Buffer Solutions** – A substance capable in solution of neutralizing both acids and bases and thereby maintaining the original acidity or basicity of the solution used for standardizing pH meters.

**Bundle (Heat Exchanger)** – A term given to the cluster of tubes, baffles, tie rods, and the attached tube sheet(s) of a heat exchanger. See “**Tubes**” and “**Tube Sheet**” definitions for more information.

**Bunker Fuel** – Normally refers to the fuel oil used to fire ship boilers for propulsion, etc.

**Burette** – A graduated glass tube with a stopcock (valve) at the bottom used for delivering measured quantities of a liquid, and accurately measuring the volume delivered.

**Burner** – A device used to introduce, distribute, mix, and burn a fuel. Usually associated with a boiler, incinerator, heater, furnace, flare, etc.

**Burner Ring** – A doughnut-shaped piece of pipe with several rows of evenly spaced holes generally around the interior diameter of the ring; a component of the burner.

**Burning Air Rate** – The air rate, usually measured in standard cubic feet per minute (SCFM) required to oxidize the coke deposit on the FCC catalyst to near its original fresh activity.

**Burning Oil** – An illuminating and heating oil, such as kerosene, of such gravity and degree of cleanliness that it may be burned through a wick.

**Bus** – Common term to describe the network of energized sections of switchgear.

**Bus Bar** – A copper, aluminum, silver, etc., bar of various sizes used to carry current in electrical switchgear.

**Butadiene** – An alkene (olefin) with the formula  $C_4H_6$ . The prefix buta means four, indicating four carbon atoms; diene indicates two double bonds.

**Butane** – A low boiling hydrocarbon with the formula  $C_4H_{10}$ . Note the prefix buta.

**Butterfly Valves** – Valves characterized by their disc-shaped flow control element that pivot about its center as it rotates. This type of valve can be used for either on/off or throttling service. It can be opened 100% with a quarter turn of the valve handle.

**Button Up** – To close a vessel or pipe with its associated piping or flanges.

**Butyl Mercaptan** –  $C_4H_9SH$  – An odorizing agent with a disgusting smell used in natural and LP gases. Mercaptans are sulfur compounds. The prefix butyl also indicates four carbons.

**Butyl Rubber** – A co-polymer of isobutylene and butadiene; it is especially suitable for the manufacture of inner tubes.

**Butyls** – Refers to a number of organic compounds containing four carbons. Example: Butane, Butaldehyde, Butadiene or Butane.

**BV (Block Valve)** – Valve that is used to stop flow.

**Bypass** – A piping arrangement that provides an alternate path of flow around certain equipment.

**By-Product** – A product from a chemical process that is not considered the principle material.

# C

**Cable (Electric)** – Electrical conductor of copper, aluminum, etc. Can be either insulated or bare and of many sizes.

**Cable Pit** – A concrete pit in the ground in which underground conduit and cable systems are installed for pulling cables, splicing cables, or terminations.

**Cable Tray** – A ladder-type tray of aluminum, installed in piping and electrical systems, to support wires and cables. Insulated cables or wires lay fastened in the tray without conduit.

**CAER (Community Awareness and Emergency Response)** – CAER is a program designed to inform the community of potentially hazardous situations at local plant sites, such as spills, gas releases, fires, etc. It is also a means of working with a community to develop emergency response programs and open the lines of communication between industry and the surrounding community.

**Caged Ladder** – A fixed, immovable ladder surrounded by a metal cage as a safety feature.

**Calandria** – A heat exchanger used to boil up the process material in the base of a distillation column.

**Calibration** – The determination of the accuracy of an instrument by finding its variation (manufactured bias, drift, etc) from true measurement

**Calorie (Small)** – The quantity of heat required to raise the temperature of one gram of water 1°; (from 4°C to 5°C. precisely).

**Calorific Value** – The number of calories generated by the combustion of 1 gram of substance. Calories per gram x 1.8 = BTU per lb.

**Calorimeter** – An apparatus for measuring the quantity of heat generated during controlled combustion.

**Capacitor** – Electrical device to store electrical charge.

**Capillary Tubing** – Small inside diameter tubing used to restrict flow or to absorb pressure drop.

**CARB** – California Air Resources Board

**Carbenes** – Hydrocarbons soluble in carbon disulfide and insoluble in carbon tetrachloride.

**Carbon Black** – A pure, finely divided form of carbon obtained by the carefully controlled combustion of gas or oil in a restricted supply of air. Employed as a filler in the rubber industry and as a pigment in inks and paint.

**Carbon Burning Rate** – The weight per hour of carbon burned off the catalyst in the FCC regenerator.

**Carbon Residue** – Residue left after heating and evaporating an oil.

**Carboy** – A large cylindrical container for liquids generally made of glass or plastic. Used for shipping.

**Carcinogen** – Any substance that incites or causes cancer.

**Carry-Over** – Unwanted liquid or solid material that is carried out of a fractionating column, absorber, or vessel in the overhead.

**Carseal** – A wire loop used on the hand wheels of certain critical valves. The wire loop is not to be broken except within safety guidelines.

**Cascade** – In series, one to another.

**Cascade Control** – This kind of control ties the operation of one controller to the operation of a second controller. When the two controllers are in cascade control, the output of one controller is used as the set point for the other.

**Casing, Axially Split** – A term applied to a pump case that is split horizontal (parallel) to the pump shaft.

**Casing, Radially Split** – A term applied to a pump case that is split vertical (perpendicular) to the pump shaft.

**Cat Cracker** – See “**Fluid Catalytic Cracking Unit.**”

**Cat Walk** – Name given to walking areas on top of structures or tanks.

**Catalyst** – Any substance which affects the rate of a chemical reaction but is not part of the reaction. The catalyst remains unchanged at the end of the reaction.

**Catalyst Activity** – The measure of the ability of the catalyst to accelerate the desired chemical reaction.

**Catalyst Carbon** – The carbon or coke which is produced as an unwanted secondary reaction product. It is a function of feed stock quality, conversion, and catalyst quality.

**Catalyst Reduction** – A controlled process of activating the reactor catalyst to a reduced state with hydrogen. After reduction is complete, the catalyst is active for the desired reaction.

**Catalyst Selectivity** – The property of the catalyst that directs the reaction to particular type of product yield.

**Catalyst, Impregnated** – A catalytic medium, consisting of a solid porous particle, serving as a carrier for the activating salt with which it has been impregnated.

**Catalytic Cracking** – The term applied to the decomposition of hydrocarbons by heat in the presence of suitable catalysts. The products resulting are of lower molecular weight than the feedstock. “Cracking” breaks long chain hydrocarbons into groups of short chain hydrocarbons. As an example, a  $C_{14}$  hydrocarbon might be “cracked” into a  $C_2$ , two  $C_3$ s, and a  $C_6$ .

**Catalytic Reforming** – The process of reforming low octane number paraffins and naphthenes to higher octane number olefins by heat and catalyst. The extent to which the reaction occurs depends on the catalyst and the operating conditions.

**Catch Basin** – A tray or other type of shallow vessel for capturing water or spills of other liquids.

**Cathode** – The negative pole of an electrical circuit (battery).

**Cathodic Protection** – System by which a D.C. charge is induced across underground pipes to retard corrosion.

**Cation** – Positively charged ions.

**Caustic** – Sodium hydroxide or **caustic soda**, chemical formula NaOH. Generally used to neutralize acids. Caustic has a sharp odor, is a heavy liquid, and is extremely corrosive (destroys tissue) to the skin and eyes. It is a white, deliquescent (water absorbing), solid which dissolves in water to yield a basic solution; used extensively in refinery processes.

**Caustic Neutralization** – The chemical reaction in which acidic materials are rendered neutral by the addition of caustic.

**Caustic Wash** – A term applied to a washing operation with a dilute solution of caustic.

**Cavitation** – A condition inside a pump wherein the liquid being pumped partly vaporizes due to temperature, pressure drop, etc. Cavitation occurs when the pressure on the eye of a pump impeller falls below the boiling pressure of the liquid being pumped. It can be identified by noisy operation and erratic discharge pressure. It can cause excessive wear on the impeller and case. This can often be remedied by increasing the suction pressure on the pump, usually by raising the level of liquid in the suction line.

**CDC** – Center for Disease Control.

**Celsius** – An alternative name for the Centigrade temperature scale and which has been recommended for universal adoption in place of the term "**Centigrade**".

**Centi** – Latin prefix meaning one-hundredth. Example: centimeter, which is one one-hundredth of a meter.

**Centigrade** – A thermometer scale based on the freezing point 0°, and boiling point 100° of water. It was originated by Celsius and is sometimes referred to in his name. To convert Fahrenheit to Centigrade, subtract 32°, and multiply by 5/9; to convert Centigrade to Fahrenheit, multiply by 9/5 and add 32°.

**Centipoise** – The practical unit of absolute viscosity; see **Viscosity** for additional information.

**Centistoke** – The practical unit of kinematic viscosity.

**Centrifugal** – Proceeding or acting in a direction away from a center or axis.

**Centrifugal Compressor** – A dynamic type compressor using a series of impellers in which the gas flows from the inlet located near the shaft to the outer tip of the impeller blade. Flow is then routed from the outer edge of one stage back to the inlet port of the next stage – the flow areas get progressively smaller so that the velocity pressure of the gas is increased.

**Centrifugal Moisture Separator** – A cyclone-type, moisture-removing device.

**Centrifugal Pump** – A pump that imparts velocity to liquid by centrifugal force and then converts some of the velocity to pressure.

**Centrifuge** – An apparatus for separating two liquids of different specific gravities, or a liquid and a solid, by means of centrifugal force.

**CERA** – Cambridge Energy Research Associates.

**Cetane Number** – A rating for diesel fuel comparable to the octane number for gasoline. It is the percentage of cetane (C<sub>15</sub>H<sub>32</sub>) in a mixture which must be mixed with heptamethylnonane to give the same ignition performance, under standard conditions, as the fuel in question.

**CFD** – Cubic Feet per Day.

**CFH** – Cubic Feet per Hour.

**CFM** – Cubic Feet per Minute. A measurement of the volume flow rate.

**CFR** – Code of Federal Regulations

**CFR Engine** – The standard engine for the determination of the octane number of a motor gasoline.

**CFTC** – Commodity Futures Trading Commission.

**CGP** – Chemical Grade Propylene (92-98% Propylene)

**Chain Reaction** – A series of reactions in which each reaction is initiated by the energy produced in the preceding reaction.

**Chain Wheel** – An attachment to a regular valve handwheel, which allows movement of the valve wheel by a chain running over a sprocket-like drum, used for operating elevated valves.

**Channel Head** – A device mounted in the heads of a shell and tube heat exchanger that is used to channel flow in a multi-pass heat exchanger.

**Channeling** – Flow through process equipment where most of the fluid, due to poor distribution, coking, etc., flows only through certain portions of the bed or equipment.

**Channel Locks** – The name given to a pair of pliers that have adjustable jaws.

**Charge** – A term used to describe the act of filling or the feed material to a process unit.

**Charles' Law** – A gas law stating if pressure is held constant the volume of a given weight of gas increases proportionately with increases in the temperature of the gas. Expressed as  $V_1 / V_2 = T_1 / T_2$

**Chart** – A sheet of paper ruled and suitably graduated for use in a recording instrument so that process changes can be recorded.

**Cheater** – Extension used on wrenches, etc., to give more leverage. Can result in excessive force, which can damage equipment.

**Check Valve** – A valve, which permits fluids to flow in only one direction by automatically closing when the flow attempts to reverse.

**Chelation** – The formation of a closed ring of atoms by the attachment of compounds or radicals to a central polyvalent metal ion. Chelating agents are used for "locking up" unwanted ions.

**Chemical Change** – A change in the composition of substances with accompanying changes in properties.

**Chemical Reaction** – A reaction in which a substance is changed into one or more new substances.

**Cherry Picker** – A type of crane or lifting device powered by a gasoline or diesel engine with a short boom and capacity of up to 12 tons.

**Chicago Coupling** – A type of coupling with two prongs and sealing gasket used primarily to connect air or water supplies to a hose. Also: Crows Foot.

**Chlorides** – This term refers to the compounds of chlorine. Chlorides are contaminants in refined chemicals and affect their purity. They are also catalyst killers.

**Chlorine** – A chemical non-metallic element. At normal temperature and pressure, chlorine is a gas. Chlorine is used to bleach and disinfect. A highly reactive chemical used in water purification, and also in various chemical processes. **Cl (Chlorides)** – Chemical symbol for the chloride ion. **Cl<sub>2</sub> (Chlorine)** – Chemical symbol for chlorine gas; a highly reactive and hazardous gas.

**Chock** – A wedge used to block the movement of a wheel of a railroad car or a tank truck. Also the act of placing such wedges.

**Choker** – A given length of wire cable with spliced loops on each end looped around equipment in order to lift it.

**Chromatography** – An analytical technique used by the laboratory and unit analyzers for determining the individual components in a sample of liquid or gas.

**Chronic** – A problem that frequently reoccurs or lasts a long time.

**CIF** – Cost after insurance and freight.

**Circuit** – A system of one or many electrical components to accomplish a specified purpose.

**Circulate** – To mix or stir up material, usually with a pump.

**Clarifier** – A vessel used to make a liquid visually clear by freeing it from suspended matter.

**Classifier** – A device that separates solids according to size. In the plastic pellet industry, it is used to separate good pellets from oversized or misshaped pellets.

**Claus Process** – The oxidation of hydrogen sulfide to sulfur, using dry bed catalytic conversion.

**Clay** – A naturally occurring mixture of hydrated aluminum silicates widely employed in the petroleum industry as a decolorizing agent.

**Clay Treatment** – Method used to improve color or odor of an oil by agitating the oil with Fuller's earth or similar clay.

**Clean Air Act** – A federal governmental decree designed to enhance the quality of the nation's air; to accelerate a national research and development program to prevent air pollution; to provide technical and financial assistance to state and local governments, and to develop regional air pollution control programs.

**Clean Water Act of 1972** – Legislation adopting the Best Available Technology (BAT) strategy for all water cleanups.

**Cleveland Open Cup Apparatus** – An American form of open cup flash point tester. Tests for the flash point of hydrocarbons.

**Closed Loop** – A control system that uses a sensing device for measuring a process variable and making control decisions based on that feedback.

**Cloud Point** – The temperature at which paraffin waxes or other solid substances begin to crystallize out, or separate from solution when an oil is chilled under specified conditions.

**CO** – Symbol for carbon monoxide, a poisonous gas composed of carbon and oxygen. It is rapidly absorbed in the blood stream and may cause death if inhaled in large quantities.

**CO<sub>2</sub>** – The chemical symbol for carbon dioxide. This gas is found in numerous process streams and is a combination of carbon and oxygen.

**CO<sub>2</sub> (Extinguisher)** – A fire extinguisher using liquid carbon dioxide stored under pressure for use as an extinguishing agent. Principally used on electrical fires because it does not conduct electricity and does not destroy equipment or instrumentation.

**Coagulation** – A term used in water treating whereby a chemical additive creates a flocculent precipitate which traps small, finely dispersed sediment and causes it to settle with the floc.

**Coalesce** – To cause small droplets to combine to form larger drops which settle by gravity.

**Coalescer** – A type of mechanical filter that assists in the separation of two components, such as a gas and liquid, or oil and water.

**COD** – Chemical Oxygen Demand. A measure of water pollution in which the sample is chemically oxidized. Oxygen in the water is consumed by chemical processes rather than biological processes.

**Cogeneration (Cogen)** – A utility plant that produces both electricity and steam from a stationary gas-fired turbine.

**Coke** – Residue obtained from certain cracking processes. It includes the amount of carbeneous material which is burned in the regenerator. This is composed of carbon from cracking, hydrogen absorbed, and various hydrocarbons entrained with the catalyst.

**Coking** – The coking process extends the period of cracking so that coke is formed rather than minimized. Preferentially, residual bottoms of low sulfur content are charged in order to produce low sulfur coke. Although the coking process derives its name from the coke made, the gasoline and gas oils produced are the more valuable products.

**Collection Header** – A header that has several lines connected to it.

**Color** – Generally refers to the color of liquid chemicals. The clarity and hue of yellow represents a poor quality. A high quality is water-white or clear.

**Color Stability** – The property of an oil to maintain its original color when subjected to heat, light and prolonged storage.

**Colorimeter** – An instrument for measuring color.

**Color-Saybolt** – A test for determining the color of gasoline and burning oils; values range from +30 for gasoline to -16 for furnace oils. +30 is water white.

**Combined Gas Laws** – Boyle's Law and Charles' Law together address the three variables likely to affect a gas sample: pressure, temperature, and volume. These laws have been combined into one law, the Combined Gas Law, expressed as:  $P_1V_1 / T_1 = P_2V_2 / T_2$

**Combustion** – Any chemical reaction producing noticeable light and heat.

**Come Along** – A hand-operated, lever-type chain hoist used to raise small equipment.

**Community-Right-to-Know** – Legislation that provides for community awareness of the chemicals manufactured or used by local chemical plants or businesses; it involves the

community in emergency response plans, improves communication and understanding, and identifies potential hazards.

**Compatible** – Capable of coexisting in harmony.

**Compound** – A substance made up of two or more elements which may be decomposed into two or more elements by a chemical reaction.

**Compress** – To press or to squeeze together.

**Compressibility Factor** – A factor used as a multiplier to adjust ideal gas laws to the actual gas mixtures that do not consist primarily of methane or mixtures that are at a high pressure or high temperature.

**Compression** – The process that reduces the volume of a gas through pressure.

**Compression Cycle** – The point in compressor operation where the gas is actually compressed from suction pressure to discharge pressure.

**Compression Ratio** – The discharge pressure of a cylinder divided by the suction pressure with both pressures expressed in absolute pressures.  $R = P_2 / P_1$  where  $P_2$  equals absolute discharge pressure and  $P_1$  equals absolute suction pressure.

**Compressor** – A mechanical device to increase the pressure of a gas or vapor.

**Computer Control** – The use of a computer to control process conditions.

**Concentrate** – To increase the concentration of dissolved substance by evaporation of the base liquid.

**Condensate** – Liquid resulting from cooled or condensed vapor. Frequently refers to condensed stream.

**Condensation** – The conversion from a gas/vapor to a liquid.

**Condensation Reaction** – A type of chemical reaction in which two or more molecules combine, with the separation of water, alcohol, or other simple substances.

**Condense** – To transform from the gaseous state to the liquid state. For instance, steam is cooled and condensed to water to form condensate.

**Condenser** – A heat exchanger that is used to condense vapor to a liquid.

**Condenser (Electrical)** – Same as Capacitor. See "**Capacitor**."

**Conduction** – The flow of heat through a solid.

**Conductivity** – The measurement of a substance's ability to conduct heat or an electrical current.

**Conduit** – Metallic or plastic pipe, either rigid or flexible, used to contain electrical wiring.

**Condulet** – One of many types of fittings used when installing an electrical conduit system. Tees, ells, etc.

**Confined Space** – Safety term, indicating an area with limited opening for entry and exit that makes egress difficult in an emergency.

**Conradson Carbon** – Determined by placing an oil sample in a crucible and heating until the oil is vaporized and the vapors burned. The weight of the residue, expressed as percent weight of the original oil, is the "Conradson Carbon" of the oil. This test gives an indication of the amount of carbon which oils may be expected to deposit when subjected to high temperatures.

**Console** – A panel containing gauges, monitors, and controls for operating a process.

**Consolidate** – To join together in one place. To unite.

**Contamination** – The act of making a material impure. It occurs when unwanted material is added to another material.

**Contango** – Rising forward prices in Futures markets.

**Control Charts** – Graphical presentation of statistical data that can be used to follow and identify process variations and problems.

**Control Circuit** – The wiring used to transmit control signals in an instrument system.

**Control Loop** – A collection of instruments that work together to automatically control a process.

**Control Point** – The point at which the controller actually regulates the process.

**Control Room** – A room from which operators and technical personnel control the unit.

**Control Valve** – Automated valve used to regulate and throttle flow.

**Controller** – An instrument device which maintains a process variable at a specific condition.

**Convection** – One of the three methods of heat transfer. It requires a fluid medium (e.g., a gas) to transfer heat from a heat source.

**Convection Section** – That upper portion of a furnace where heat transfer is primarily through convection.

**Convert** – To change one thing to another.

**Converter** – A vessel in which a reaction takes place; sometimes referred to as reactor.

**Cooler** – A heat exchanger that uses a cooling medium to lower temperature of a process material.

**Cooling Tower** – A structure designed to lower the temperature of a water stream by evaporating part of the stream. The towers are usually made of wood, with various types of plastic/wood designed to promote maximum contact of the water with the air.

**Copolymer** – A mixed polymer; the product linkage of two or more different substances at the same time.

**Copper** – A metallic element highly resistant to attack from most chemicals used for wires, coins and many alloys, such as brass, bronze and various copper-nickel alloys.

**Copper Acetylides** – A highly explosive chemical compound formed by the combination of copper metal and acetylene gas. Copper acetylides are sometimes found in process systems and are removed by treatment with a mineral acid such as hydrochloric acid which renders them nonexplosive. This type of compound is the same type of compound used in the manufacture of dynamite priming caps and primer for shotgun and rifle shells.

**Corrosion** – The gradual destruction of a metal by chemical processes.

**Corrosion Rack** – A rack used to hold coupons of various metals to measure the corrosion rate of these metals in a process stream.

**Corrosion Test** – Indicates the presence of substances which will corrode metals. A well-polished copper or other metal strip is placed in the oil under test and the oil maintained at a prescribed temperature for a given length of time. The strip is then removed and its staining or change in color is measured and given a corrosion value.

**Corrosive Sulfur** – In the petroleum industry, this term is usually taken as referring to sulfur and compounds of sulfur, present in an oil, which attack copper.

**Counter Flow** – A term used to describe flow in which two fluids are passing each other going in opposite directions. In a shell and tube heat exchanger the fluid passing on the shell side of the tubes is moving in the opposite direction to that moving within the tubes.

**Coupling** – A fitting used to connect shafts, or to connect pipe or tubing sections together. Also, a device used to connect hoses together.

**Coupling (Machinery)** – The connection device between two pieces of rotating equipment such as between an electric motor and a pump.

**Coverall Goggles** – A protective goggle worn over safety glasses (Spectacles) to further guard eyesight while working in a hazardous area.

**CP** – Contract price.

**CPG** – Cents per gallon.

**Crack Spread** - the differential between the price of crude oil and petroleum products extracted from it - that is, the profit margin that an oil refinery can expect to make by "cracking" crude oil (breaking its long-chain hydrocarbons into useful shorter-chain petroleum products).

**Crack Open** – To open slightly. The term "crack open" is commonly used to refer to a valve.

**Cracking** – A process of causing hydrocarbons to fracture, resulting in the formation of other hydrocarbons of lower molecular weight, gas, and carbon. See **Fluid Catalytic Cracking**.

**Crane** – A gasoline or diesel powered lifting device with a long boom and capacity for lifting high tonnage loads.

**Cresol** – An organic alcohol, derived from benzene, employed as a solvent in petroleum refining.

**Critical Speed** – The R.P.M. at which a rotating piece of equipment shakes or vibrates at its natural frequency, as it passes through different speed ranges. Usually occurs on startup.

**Crows Foot** – A quick connect type hose fitting used on plant air and water hoses.

**CRT (Cathode Ray Tube)** – A CRT is used in a computer monitor to display information in a graphic or printed form.

**Crude** – (1) In the oil industry, an abbreviation for crude petroleum, i.e., the material gained from the wells prior to processing. (2) Organic product that is not refined.

**Crude Product** – A partially processed material that is feedstock to another processing unit.

**Cryogenics** – Extremely cold gases and liquids which are at a temperature of -148°F or colder. Oxygen, nitrogen, argon, helium, hydrogen, and methane are some of the most common cryogenic materials.

**Crystallizer** – A piece of process equipment used to control conditions such that solid material can be separated as crystals.

**Cubic Centimeter (cc)** – A metric measurement of volume.

**Cubicle** – The steel cabinet that encloses electrical breakers or other electrical devices.

**Current** – Rate of flow of electricity measured in amperes.

**Cursor** – An electronic pointer used to position data on the Cathode Ray Tube (CRT) screen of a computer terminal.

**Cut** – A term signifying an individual fraction obtained during the distillation of petroleum products.

**Cut (Reduce)** – To reduce a flow.

**Cut Point** – The control temperature that is used in a distillation column to obtain the desired product. Altering the heat balance in a column to produce more or less of a particular product is called changing the cut point.

**Cut to Pad** – To change a flow from its normal path and direct the flow to the ground or to the sewer.

**Cutting Oil** – An oil which is used as a lubricant and cooling medium in the cutting of metal. It usually consists of a light oil such as spindle oil mixed with an emulsifying base such as sulfonated soap, so that the oil will form a stable emulsion with water. Some heavy cutting oils contain sulfur compounds which form a lubricating film of sulfide on the surface of the metal.

**CWR (Cooling Water Return)** – A line through which cooling water is returned.

**CWS (Cooling Water Supply)** – A line supplying cooling water.

**Cycle** – An alternation or switching of something such as equipment or machinery.

**Cyclic** – (1) A term applied to certain hydrocarbons whose carbon atoms are connected in a ring or in several rings (polycyclic). (2) A process in which a pattern is followed, i.e., from process to regeneration and back to process.

**Cyclization** – An exothermic chemical reaction in which paraffins are converted to naphthenes (cyclic saturates) with the liberation of hydrogen.

**Cyclone** – A cone-shape vessel for separating solids or liquids from a gas.

**Cyclone Separator** – A separator which creates a vortex, within a flow, allowing entrained matter to be separated from flow by use of centrifugal force.

**Cylinder Oil** – Term used with respect to the heaviest grades of lubricating oil, such as are employed to lubricate the cylinders of steam engines.

**Cylinder Stock** – See "Cylinder Oil."

# D

**Daily Note or Orders** – Operating instructions written by departmental supervisors. The purpose is to set conditions or to ask for changes on a day-to-day basis.

**Dalton's Law** – A law of physics stating the total pressure exerted by gases is the sum of the pressures of the individual gases.

**Damper** – A valve or movable plate for regulating the flow of air or draft in a furnace or fireplace.

**Dampney Black** – Paint used on stainless steel pipe to reduce the possibility of chloride stress cracking.

**Dash Pot** – A device used to dampen vibration or oscillation and is similar in operation to automobile shock absorbers.

**Dated Brent** – Prompt Brent Crude (UK North Sea)

**DC (Direct Current)** – A current that always travels in the same direction.

**DCO** – FCC decanted or slurry oil.

**DEA (Diethanolamine)** –  $(\text{HOCH}_2\text{CH}_2)_2\text{NH}$  – an alkaline organic chemical derived from ethanol and amine groups. Used to remove hydrogen sulfide from gas streams.

**Deactivator** – A substance that renders another substance inactive. A negative catalyst.

**Deadleg** – A section of pipe or a piece of equipment which contains stagnant material.

**Deaerator (DA)** – A vessel used to remove gases from boiler feed water.

**Deasphalting** – A process for removing asphalt from reduced crude using liquid propane. The propane dissolves non-asphaltic compounds (deasphalted oil) from the asphalt. Propane deasphalting is an extraction process. Extraction is much like absorption with the exception that one liquid is used to take into solution some components of another liquid stream, whereas in absorption a liquid takes into solution some components from a gas stream.

**Deblooming** – The removal or masking of fluorescence.

**Debutanizer** – A fractionating tower used to remove butanes from heavier hydrocarbons.

**Decalin** – Decahydronaphthalene, a high boiling solvent.

**Decant** – To separate two or more insoluble liquids by allowing them to separate in a container and then drawing off, usually, the top layer.

**Decantation** – Act of drawing off a liquid body from one container to another without disturbing the lower layer(s).

**Decanter** – A vessel used to decant.

**Decibel** – The unit of sound level.

**Decomposition** – A chemical change in which a substance breaks down to form two or more simpler substances.

**Decontaminate** – To clean out undesirable materials.

**Degasser** – A vessel designed to strip dissolved gas from a liquid using heat or a stripping medium.

**Dehydrate** – To render free from water.

**Dehydration** – The process of removing water from a compound.

**Dehydrator** – Apparatus for removing water from oil or gas.

**Dehydrogenation** – The removal of hydrogen. The most common cases are usually associated with polymerization or alkylation reactions in the presence of a catalyst.

**Delta P ( $\Delta P$ )** – A symbol used to express a difference between two pressures.

**Delta T ( $\Delta T$ )** – The difference in temperature between two points in a process system.

**Deluge System** – A term used to describe a water spray system used in controlling fires or heat.

**Deluge Valve** – A control valve admitting water on to cooling systems, which can be actuated manually or by a heat-responsive device.

**Demineralized Water** – Water with no mineral impurities, usually obtained by means of ion exchange in resin beds.

**Demister** – Equipment used to remove mist from evolving vapor by coalescing the small particles into drops large enough to separate by gravity difference.

**Demulsifier** – A chemical, mechanical or electrical system that either breaks liquid-liquid emulsions or prevents them from forming.

**Denature** – (1) To mix a small amount of ethyl acetate with ethyl alcohol to make the alcohol unfit for drinking without impairing its usefulness for other purposes. (2) To change the nature or make-up of something.

**Density** – The weight of a material for a given volume. Example: Water = 62.4 pounds per cubic foot or 8.33 pounds per gallon.

**Departmental** – Meaning that the occurrence or responsibility is within the particular department in question.

**Dephlegmator** – An item of refinery, or general industrial distillation equipment enabling a separation of mixed vapors to be made by partial condensation. The term is also (less correctly) used in connection with cracking plants to denote a fractionating tower.

**Depressure** – To remove the pressure from a vessel or line.

**Desalting** – The removal of salts, primarily calcium, magnesium and sodium chlorides, from crude oil. This is done by making a very intimate mix (emulsion) of the crude oil and hot fresh water, which enters the desalting vessel and flows past an electric field which causes the water droplets to combine and settle. The water, which contains most of the salt, is drawn off the bottom of the desalter and the crude oil goes over the top.

**Desiccant** – A drying agent, such as mol sieves, silica gel, calcium chloride, etc., used to dry instrument air, process gas, etc.

**Design Conditions** – The conditions under which a piece of equipment is designed to operate.

**Desulfurization** – The removal of sulfur compounds from an oil. Desulfurization methods include amine treating and hydrodesulfurization (HDS.)

**Desuperheat** – The act of cooling down a superheated hot steam. See "**Steam, Desuperheated.**"

**Desuperheater** – A mechanical jet mixing device that, through a spray nozzle, injects atomizing steam/water as a means of cooling and controlling superheated steam temperatures.

**Detergent** – As applied to oils, an additive used to maintain in suspension, fine particles of insoluble material, such as carbon, sludge, etc.. Strictly speaking, the term should indicate that the oil has the power of removing such materials from engine parts to which they adhere, i.e., that it has a cleansing effect.

**Detonation** – A powerful explosion; see **Knocking**.

**Deviation** – An instrument term for any instantaneous difference between set point and the present value.

**Dewpoint** – The temperature at which a vapor or gas begins to condense to a liquid.

**Diagnosis** – The finding or identification of the cause of a problem. See **Troubleshoot**.

**Diaphragm** – A thin, flexible sheet of material used as a transmission media in pumps, valves, switches, and meters.

**Diaphragm Pump** – A reciprocating, positive displacement pump that uses a flexible diaphragm to move the fluid.

**Diaphragm Valve** – A valve that uses a flexible diaphragm to regulate flow.

**Diatomaceous Earth** – A fine powder made of siliceous shells of diatoms and used mainly as an abrasive, absorbent, and filter agent.

**Diels-Alder Reactor** – A three-tube reactor surrounded by a heated jacket.

**Diesel Engine** – An internal combustion engine in which only air is drawn in by the suction stroke, and the air is so highly compressed that the heat generated ignites the fuel which is automatically sprayed into the cylinder under high pressure.

**Diesel Engine Oil** – Oil used as lubricant for a diesel engine.

**Diesel Index** – A test providing an indication of the ignition quality of diesel fuel. Based on the specific gravity and aniline point of the sample.

**Diesel Oil** – Oil used as fuel for a diesel engine.

**Diethanolamine (DEA)** – See **DEA**.

**Differential Pressure** – Pressure difference ( $\Delta P$ ) between inlet and outlet pressures or at two differing points.

**Differential Pressure Cell (DP Cell)** – Device used to measure the pressure difference between two points, such as the pressure on either side of an orifice plate.

**Differential Temperature** – Temperature difference ( $\Delta T$ ) between inlet and outlet temperatures, or at two differing points.

**Diffusion** – The tendency of a gas or vapor to disperse into or mix with another gas or vapor.

**Digital Control System (DCS)** – A subsystem of a supervisory control system used to control a process unit.

**Dike** – A wall (earthen, shell or concrete) built around a piece of equipment to contain any liquids should the equipment rupture or leak badly.

**Dike Drain** – A line through a dike that is used to drain the contents from within a dike.

**Dilution** – The process of reducing the concentration of a substance by adding a second substance.

**Dimensional Analysis** – A mathematical units analysis. Done to make sure the mathematical operation is consistent with the desired result (e.g. in the conversion of units from one system to another; Metric to English.)

**Dimer** – A substance composed of two identical monomers (molecules). For example: two ethylene molecules,  $C_2$ , combined would form a  $C_4$  dimer.

**Dimersol** – A unit which dimerizes propylene into a high-octane gasoline blending component.

**Dimetcote** – A protective coating for machinery and steel.

**Dip Tube** – A tube that extends down into a vessel usually used for level or interface measurement or for sampling a particular location in a vessel.

**Direct Cost** – The cost of the raw materials used directly in the manufacturing of a product.

**Disc** – A device (part of a valve) made of metal or ceramic that fits snugly in a valve seat to stop flow.

**Discharge** – Outlet.

**Discharge Head** – The resistance or pressure on the outlet side of a pump, expressed in feet.

**Dispersion** – The breaking up or scattering of a material.

**Displacement of a Compressor** – The volume swept per unit of time by the piston and is usually expressed in either cubic feet per minute (CFM) or cubic feet per day (CFD).

**Distillate** – The products of distillation formed by condensing vapors.

**Distillation** – (1) Distillation is the separation of the constituents of a liquid mixture by partial vaporization of the mixture and separate recovery of vapor and residue. In general, distillation is the term applied to vaporization processes in which the vapor evolved is recovered, usually by condensation. (2) A laboratory method for characterizing a liquid by its boiling range.

**Distillation (Batch)** – Distillation, where the entire batch of liquid feed is placed into the still at the beginning of the operation. Used primarily when materials are hard to separate or when small amounts of a product are needed.

**Distillation (Continuous)** – A distillation in which a material is continuously fed into a still. Part of the material is distilled off and the remainder of the material is drawn out as tails.

**Distillation Range** – The temperature range in degrees Centigrade or degrees Fahrenheit at which a given amount of chemicals will vaporize. It is bracketed by an initial boiling point and a final boiling point or dry point.

**Distillation Tower** – A vessel constructed to permit separation of fluids according to boiling point or boiling point ranges.

**Distilled Water** – Water which has been evaporated and condensed leaving behind all of its major impurities. Distilled water is used for boiler feedwater (condensate) and in the laboratory for preparation of high purity solutions.

**Diverter Valve** – An automatic valve used to direct the flow of solids.

**DNG** – Debutanized natural gasoline.

**Doctor Test** – A qualitative method of detecting undesirable sulfur compounds (mercaptans) in petroleum distillates.

**DOE** – Department of Energy.

**DOT** – Department of Transportation

**Double-Acting Compressor** – A reciprocating compressor that compresses gas on both sides of the moving piston.

**Double Block and Bleed** – To close off two valves in the same line and vent between these valves.

**Double Bond** – A chemical bond between two atoms, usually carbon atoms; reactive. See **Unsaturated**.

**Double-Pipe Exchanger** – A heat exchanger made up of two concentric pipes as compared with a tube and shell arrangement.

**Downcomer** – A downcomer, sometimes referred to as a downspout, is a conduit or pipe provided for passing liquid from one distillation tray to the tray below.

**Downstream** – A point in the direction of flow away from the point in question.

**Down Time** – The proportion of time (usually days per year) during which a plant is inoperative by reason of repair or overhaul.

**D/P (Differential Pressure)** – See **Differential Pressure**.

**Draft** – The difference between atmospheric pressure and some lower pressure in a confined space that causes air to flow, such as exists in the furnace or gas passages of a steam-generating unit or in a chimney.

**Draft Eliminators** – Devices used in a cooling tower to keep water from blowing out.

**Drain** – A low point bleeder.

**Draw Off** – A connection which allows liquid to flow from the side or bottom of a vessel.

**Drier (Dryer)**– A vessel filled with a desiccant that air or gas can pass through and have its moisture absorbed by the drier material.

**Drift** – A reading or value change that occurs over a long period of time that may be due to temperature changes, component aging, line voltage, etc.

**Drip Lines** – Pipes in a system connected to the lowest point of steam lines or process equipment for the purpose of collecting condensate.

**Dripolene** – A liquid by-product consisting of heavy ends resulting from olefin cracked gas, principally consisting of aromatic type hydrocarbons.

**Drop Valves and Lines** – Valves and lines, inboard of a vessel manifold, allowing cargo to be "dropped" into cargo tanks.

**Dry Cell** – A voltaic cell (Battery) whose contents are not spillable.

**Dry Gas** – Petroleum gas with all condensables removed, usually by absorption with a sponge oil. It includes hydrogen, methane, ethane, ethylene, propane, propylene and hydrogen sulfide, but excludes the various inert gases such as carbon dioxide, carbon monoxide and nitrogen.

**Dry Point** – A term used in laboratory distillation analysis to indicate the temperature at which the last drop of liquid evaporates from the bottom of the distillation flask.

**Dry Powder Extinguisher** – A fire extinguisher using base powders as an extinguishing agent and high-pressure air/CO<sub>2</sub> in a cartridge as the expellant gas.

**Dry Screw Compressor** – A classification of compressor that works by accelerating the gas to very high speeds, which gives the gas a high dynamic energy, and then slowing down the gas velocity to convert this dynamic energy to static pressure. Rotating screws are non-lubricated.

**Dryer** – See **Drier**.

**Duclean** – An inhibited hydrochloric acid solution used to remove rust and scale from pipes and vessels.

**Ductility** – A term denoting the maximum elongation (stretchability) of materials under prescribed conditions. The term represents the length (in cms) a given sample can be extended without breaking.

**Dump** – An operating condition where a stream is being sewerred normally for a short period of time.

**Dutchman** – A thick ring of metal bolted between a set of flanges usually used to correct problems of poor fit at the flange.

**DWT** – Dead weight ton.

**Dynamic Pressure** – The sum of the static pressure and the velocity pressure at the point of measurement.

## E

**Economizer** – That section of a boiler used to preheat feed water before it enters the main boiler system.

**Edeleanu Process** – A method of refining petroleum products by selective solution in liquid sulfur dioxide or in a mixture of liquid sulfur dioxide and benzole.

**Eductor** – A device that uses high-pressure gas or liquid as a driving force to pull a lower pressure gas or liquid into a vent and through the eductor. The high pressure drive gas or liquid causes a vacuum in the eductor which also pulls the low pressure gas or liquid along.

**Efficiency** – How well a unit operates at converting and recovering materials?

**Effluent** – The finished stream from a treating process, especially from a wastewater treating facility.

**EFP** – Exchange of Futures for physicals.

**EIA** – U.S. Energy Information Agency.

**Electrical Signal** – When voltage and current are applied to a circuit, it is called a signal.

**Electrolysis** – The production of chemical changes by passing an electric current through an electrolyte. The word literally means “a breaking apart by electricity.”

**Electrolyte** – A chemical compound in solution (molten or dissolved), usually water, conducts an electric current. Examples: Sulfuric acid solution, battery acid, salt in water.

**Electromagnetic Spectrum** – The entire range of wavelengths or frequencies of electromagnetic radiation. This range extends from gamma rays to the longest radio waves.

**Electrostatic Precipitator** – A device which removes solid particulate impurities from a gas stream with the aid of a high voltage field.

**Element** – The smallest particle of a material which contains the unique characteristics of that material. A substance which cannot be decomposed into simpler substances by ordinary chemical means; essentially, an atom. Example: Hydrogen atom.

**Elevation** – (1) The height to which anything is elevated above a datum, such as sea level. (2) The height above sea level of the compressor location, which must be known to obtain absolute pressure and for derating the engine.

**Elution** – The process of extracting (taking out) one chemical from another chemical.

**Emergency Air** – Usually, bottled air provided during emergency conditions.

**Emergency Power** – Electricity provided during emergency conditions from generators, batteries, etc.

**Emergency Trip** – A device (either electric push button or manual) installed to shutdown a machine or system in an emergency.

**Emergency Vent** – A vent system set to vent when the pressure of a vessel reaches the maximum safe pressure.

**Emulsion** – A fluid consisting of a microscopically homogeneous mixture of two phases, such as a mixture of oil and water, in which one liquid forms minute droplets suspended in the other liquid. Emulsions generally are difficult to separate into two separate phases.

**End Point** – (1) Analytical term. The highest temperature indicated on the distillation thermometer when an oil is subjected to an end point distillation. (2) Analytical term. The point at which a titration ends, generally indicated by a color change of an indicator.

**Endothermic** – Any process or reaction which requires an input of energy or heat.

**Endothermic Reaction** – A chemical reaction which absorbs or takes in heat.

**Energy Balance** – Term to describe the conservation of energy associated with a process. That is, heat in equals the heat out for a given process.

**Engine** – A mechanical driver with rotational output, usually gas operated or fueled by gas.

**Engineering** – The department in the plant responsible for detailing changes, additions, deletions, and modifications to the plant. It also completes necessary cost estimates for various projects.

**Engineering Controls** – Design, engineering, and construction activities to minimize safety, health and environmental hazards.

**Engineering Package** – Accumulation of drawings and instructions completed by Engineering, such that maintenance can complete the described work.

**Engineers Console** – A computer work station used by engineers to change control schemes and modify control systems.

**Entrainment** – Liquid droplets or solid particles carried along in a vapor stream, generally due to the velocity or turbulence of the vapor.

**Entrainment Separator** – A vessel in which the velocity of a vapor stream is slowed to a point that entrained liquids or solids drop out and can be separated from the vapor.

**Entry** – Concerned with safety and defined as the introduction of the entire person into a vessel or equipment or insertion of any portion of the body into a vessel or equipment where there is possibility of injury.

**EPA (Environmental Protection Agency)** – A Federal agency charged with authority to make and enforce the national environmental policy.

**Equilibrium** – A condition in which opposite forces equal or balance each other.

**Ergonomics** – The science that seeks to adapt work or working conditions to better suit the health of the worker.

**Erlenmeyer Flask** – Glass vessel conical in shape used in laboratory work.

**Erosion** – The wearing away of material, often metal, by fluid moving at relatively high velocity across the surface.

**Error** – The difference between a correct or desired value and the actual value observed.

**Ester** – A product other than water, often sweet smelling, produced by the reaction between alcohol and an acid.

**Ethane** – A saturated hydrocarbon gas with the formula  $\text{CH}_3\text{CH}_3$ .

**Ethanol** – Ethyl alcohol.  $\text{C}_2\text{H}_5\text{OH}$ . A colorless, flammable liquid with a boiling point of  $78.5^\circ\text{C}$  that serves as a solvent and chemical reactant.

**Ether** – A compound obtained by the condensation of an alcohol with the elimination of water. Sharp to sweet smelling and highly flammable.

**EtOH** – Abbreviation for ethanol.

**Evacuate** – (1) Remove or clean out a system or vessel. (2) The process of removing personnel from an area due to a hazardous condition.

**Evaporate** – An endothermic process in which a liquid is changed into a gas

**Evaporation Test** – A test applied to volatile petroleum products to determine the completeness or rapidity of evaporation.

**Evaporator (Evap.)** – A device used to vaporize part or all of the solvent from a solution; the valuable product is usually either a solid or concentrated solution of the solute.

**Exceedance** – A pollutant emitted in excess of regulatory standards into the community's atmosphere.

**Exchanger** – A piece of equipment, usually comprised of shell and tube bundle or fin-fans, for transferring heat from one medium to another.

**Exciter** – A source of D.C. voltage applied to the rotation field of A.C. generators or synchronous motors.

**Exothermic** – A chemical reaction which gives off heat.

**Exothermic Reaction** – A chemical reaction in which heat is given off. Examples: fire or explosion.

**Expansion** – Physical characteristic of materials which makes them increase in size as their temperature increases.

**Expansion Cycle** – The point in a compressor operation where the pressure in the cylinder is reduced from discharge pressure back to suction pressure.

**Expansion Joint** – A type of joint used in piping. It usually contains a telescoping section or a bellows to absorb strain caused by expansion or contraction due to changes of temperature or other forces.

**Explosimeter (Gas meter)** – A portable instrument used to measure the concentration of combustible gas or vapors.

**Explosion** – A chemical reaction or change of state which is effected in an exceedingly short space of time with the generation of a high temperature and generally a large quantity of gas.

**Explosion Limit** – The range of mixtures of air (or oxygen) with flammable vapors within which combustion (an explosion) is possible. In the case of gasoline, a mixture with air in the proportion between 1.5 and 6.0 volume percent is explosive. See "**Flammable Limits.**"

**Explosion Proof** – Tightly sealed, gas-proof housings containing electrical components, which may give off electrical arcs but which, cannot cause an explosion because explosive vapors cannot enter the housing.

**Explosive Check** – To check for explosive gases, usually with a portable gas meter.

**Explosive Mixture** – See "**Flammable Limits.**"

**Extraction** – The removal of a compound from a liquid mixture by contacting the mixture with another liquid called the solvent. In a liquid-liquid extraction, two liquids which are not miscible (don't mix) are combined and then mixed together. The compound of interest will move out of one liquid and into the solvent where it may be more easily separated. As an example, caffeine

is extracted from an aqueous solution of coffee by chloroform because caffeine is more soluble in chloroform.

**Extraction Turbine** – A steam turbine that has more than one exhaust outlet. Steam may be extracted from these outlets at various stages in the turbine for other unit purposes. The extraction steam is the steam that is extracted (exhausted) between the inlet and low-pressure exhaust stages.

**Extractive Distillation** – When a separating agent or solvent that is much less volatile than the feed components is used to facilitate a separation, the process is often called extractive distillation. In an extractive distillation, the solvent always goes down the column and out the base.

**Extruder** – A device that forces ductile or semi-soft solids through die openings of appropriate shape to produce a continuous film, strip, or tubing.

**Extrusion** – The making of long, regular shapes by forcing material through a die plate.

**Eye Bath** – A piece of safety equipment designed to flush the eyes with water in case the eyes were exposed to harmful chemicals.

## **F**

**°F (Fahrenheit)** – See "Fahrenheit."

**Face Shield** – A head or hat-mounted clear plastic shield used to protect the face in performing certain types of work.

**Facility** – Something that is built or installed to serve a specific purpose.

**Fahrenheit** – Referring to a thermometer scale based on the temperature at which water freezes (32°F), and boils (212°F at atmospheric pressure).

**Fail Safe** – A control system built into equipment with the purpose of shutting down the equipment before a hazardous condition arises or damage can be caused to equipment.

**Falling Film Heat Exchanger** – A heat exchanger in which the material on the tube side is allowed to flow down the walls of the tubing in a thin film, rather than filling the tube completely.

**FAS** – Free alongside ship.

**Fat** – Chemically, this is identical with fatty oil. It usually refers to fatty oils which are solid at 25°C.

**Fatty Acids** – Monobasic acids of the aliphatic series occurring in animal and vegetable fats.

**Fatty Oil** – An oil obtained from animal or vegetable sources and consisting of the esters of various organic acid (fatty acids) with glycerol.

**Fault (Electrical)** – A short or ground in electrical cables or equipment.

**FC** – Flow Controller.

**FCC** – Fluid catalytic cracker.

**FCV** – Flow Control Valve.

**FD Fan (Forced Draft Fan)** – A large centrifugal fan that forces atmospheric air into a furnace or boiler.

**Feed** – The stream or material introduced into a vessel for processing.

**Feed Forward** – The process of feeding a process stream to the next processing area.

**Feed Gas** – A vapor feed to a processing vessel.

**Feed Tray** – The tray located immediately below the feed line in a distillation tower.

**Feedback Control** – In a control loop, feedback control is information about the status of the controlled variable which is compared with what we want to control at, which we want to get them to be the same.

**Feed Forward Control** – In a control loop, it is the application of a controlled action to a process before a deviation occurs in the controlled variable.

**Feeder** – Term commonly referring to cables in conduit, duct, cable tray, etc., feeding power from one area to another.

**Feedstock** – The material sent to a processing unit to be converted into a different material or materials.

**Ferrule** – A short bushing installed in the inlet end of tubes of heat exchangers for distribution or strength purposes.

**FI** – Flow Indicator.

**FIC** – Flow Indicator Controller.

**Field** – An area or space in which a given physical effect (such as magnetism) exists.

**Filter** – (1) Any porous article, such as cloth, paper, sand or charcoal, through which water or other liquid is passed to separate from it matter held in suspension. (2) A mechanical device used to clean foreign materials from a fluid.

**Filtering** – The separation of solids from a carrier liquid by allowing the liquid to pass through a porous medium. Typical filtering media are filter clay, chemically treated paper, felt, canvas, woven wire, and synthetic cloth.

**Final Boiling Point (FBP)** – The maximum temperature required to boil the heaviest component of a complex mixture; also known as the endpoint.

**Final Control Element** – The device in a control loop that actually controls (makes the adjustment) the process. This is usually a valve in the process industry.

**Fin-Fan** – A type of large heat exchanger with fans which force cool air through the fins of the exchanger core. The air cools the contents contained within the core of the heat exchanger. The operation of the fin-fan is similar to the operation of a car radiator.

**Fire Box** – The area in a furnace where the burners are located and radiant heat transfer is designed to take place.

**Fire Classes** – Classification of types of fires: Class A is ordinary combustibles like wood or paper; Class B is flammable liquids or gases; Class C is electrical fires; Class D is combustible metals.

**Fire Extinguisher** – Any of various portable devices used to extinguish a fire by the ejection of a fire-inhibiting substance, such as water, carbon dioxide, or chemical foam.

**Fire Eye** – A device used to detect the interruption in a fire or flame. Used in boilers and furnaces.

**Fire Point** – The minimum temperature at which a liquid evolves vapors fast enough to support continuous combustion; autoignition point. See "**Flash Point.**"

**Fire Pump** – Used for furnishing water to plant fire lines in an emergency.

**Fire Tube Boiler** – A device that uses (passes) hot gases in tubes to heat up and vaporize water.

**Fire Walls** – Earthen banks or concrete walls built around oil storage tanks to contain the oil in case of a spill or rupture. Also called bund.

**Fire Watch** – An employee who continually or periodically checks the area where welding or some other hot work is going on in a restricted and hazardous area.

**Firebox** – (1) The portion of a boiler/furnace where burners are located and radiant heat transfer occurs. (2) A box containing an apparatus for transmitting fire alarms.

**Fired Heaters** – Heating device that consists of a battery of tubes that pass through a firebox.

**Firewater** – Water from plant fire water lines used for emergencies.

**Firing Level** – The level of water normally maintained when operating a boiler.

**Fischer-Tropsch** – A process for the manufacture of hydrocarbons by the reduction of carbon monoxide with hydrogen. The usual raw material is coal but natural gas may also be used.

**Fishers Reagent** – See "**Karl Fisher Reagent.**"

**Fixed Carbon** – The carbonaceous material remaining when oil is heated in the absence of air. See "Conradson, Ramsbottom."

**Fixed Head** – The end of a shell and tube heat exchanger bundle that has the tube sheet attached firmly to the shell, which limits expansion flexibility.

**Fixed-Bed Reactor** – A reactor in which the catalyst bed is stationary as the reactants are passed over it.

**Flame Arrestor** – An in-line device installed under equipment vents, to prevent flame propagation through the line. The need for flame arrestors is dependent on the flash point of the material handled.

**Flame Impingement** – Condition when the flames from a burner touch tubes in a furnace.

**Flameout** – When the burner flame goes out during operation.

**Flammable Limits** – A flammable mixture of a vapor and air may be diluted with either constituent until it is no longer flammable. Too much air and the mixture is too lean to burn; too much flammable vapor and the mixture is too rich to burn. The lower and upper limits represent; respectively, the percent by volume of the vapor and air below and above which combustion can not occur. The flammable limits are all compositions between the upper and lower range. See **Explosive Limits.**

**Flange** – A flat plate used to join two pieces of pipe or a valve to a piece of pipe.

**Flapper** – The swinging seat in a check valve.

**Flare** – A device designed to safely burn excess hydrocarbons. It is generally a tall pipe located some specified distance from the processing unit.

**Flare Header** – A pipe that connects several vents to the flare.

**Flash Back** – When gas vapors ignite and return to the source of the vapors.

**Flash Point** – The temperature to which flammable liquids must be heated before an ignition source will cause the heated vapors above the surface of the material to ignite.

**Flash Tank** – A tank used to remove volatile components from a mixture by preheating the feed and operating the tank at a lower pressure than the feed.

**Flask** – A glass vessel used in laboratory work.

**Flat Head** – Large blind flanges usually on the end of heat exchangers.

**Float Test** – A method for determining the consistency of solid petroleum products; it is a measure of the time required for a sample to soften to a certain degree under specified conditions.

**Float Trap** – A steam trap that operates with a float that opens a valve as the steam condensate level rises within a chamber.

**Floating Head** – The end of a heat exchanger bundle not attached to the shell so as to allow for expansion.

**Floating Roof** – A type of roof (steel or plastic) used on storage tanks which floats upon the surface of the stored liquid and is used to decrease the vapor space and reduce the potential for evaporation.

**Flocculation** – A process of clarifying water by adding chemicals that cause a precipitate to form. The precipitate traps suspended matter (dirt) and settles out.

**Flood (N<sub>2</sub> - CO<sub>2</sub>)** – Inert gases utilized to safely purge out a reactor of compounds that may be reactive or hazardous.

**Flooding (Column)** – When the rate of liquid flowing down a column exceeds the capacity of a downcomer, the result is an increase in liquid level on the tray. This increases the pressure differential across the tray, which in turn causes more liquid to backup through the downcomer. Ultimately, the column will fill with liquid and cease to operate.

**Flow-Chart** – A graphical representation of activities that take place in a process.

**Flow Control Element** – The part of a valve that regulates flow, e.g., a disc, plug or gate.

**Flow Sheet Diagram** – A drawing that describes the flow of materials through a given unit or plant.

**Flue Gas** – The mixture of hot gases formed in the combustion of the fuel-air mixture in the burner sections of a furnace.

**Fluid** – A substance tending to flow or conform to its container. (Gases, liquids, and fine solids).

**Fluid Catalytic Cracking Unit (FCCU)** – A processing unit in which hydrocarbons are cracked to smaller molecules using a catalyst and/or temperature. The unit is designed to permit a continuous flow of the cracking catalyst in a reactor/regenerator loop.

**Fluid Coking** – A process in which crude bottoms are subjected to reaction conditions designed to produce the maximum amount of lighter products.

**Fluid Flow** – A term used to describe the motion of a fluid; generally described as either laminar or turbulent.

**Fluidized Bed** – A bed of finely divided solid (usually catalyst) aerated to about the point where all particles are in free but suspended motion in the aerating medium.

**Fluidized Bed Reactor** – A reactor in which finely divided solids are suspended by an upward flow of gas.

**Fluid Pressure** – The pressure exerted by a confined fluid. Such pressure is exerted equally and perpendicularly to all surfaces confining it.

**Fluorescence** – A type of luminescence in which a molecule emits visible radiation in passing from a higher to a lower electronic state.

**Flushing** – The removal or reduction to a permissible level of dissolved or suspended contaminant in a line, tank, or vessel.

**Flux (Flux Oil)** – Applied to oils used as solvents for heavier petroleum products, and particularly to oils used for softening bitumen and asphalt.

**FOB** – Free on board.

**Foam** – A froth of bubbles on the surface of a liquid often caused by an organic contaminant or high pH.

**Foamite** – A preparation used to extinguish fires. It consists of two solutions which, on mixing, produce thick foam which will cover a surface and smother a fire.

**Forced Draft** – Air supplied to a furnace, cooling tower, or exchanger, by means of a fan or blower, which forces air through the equipment.

**Forced Draft Fan** – A fan which forces fresh air into boilers or other equipment.

**Foreman** – A term used to describe the immediate supervisor of hourly personnel.

**Fouling** – A build-up of a foreign material on the surface of the containing vessel or tube. In heat exchangers, fouling reduces heat transfer and leads to plugging of the exchanger tubes if it occurs on the inside of the tube.

**Four-Way Valve** – A valve having four ports usually used to reverse flows as in backwashing connections.

**FR** – Flow Recorder.

**Fraction** – A portion of distillate having a particular boiling range separated from other portions in the fractional distillation of petroleum products.

**Fractionate** – To separate a mixture, such as a liquid, by distillation into fractions having more or less fixed properties but which are a combination of many chemicals within a given boiling range.

**Fractionating Tower** – The vertical cylindrical vessel that separates components of a liquid mixture in a distillation process.

**Frasch Process** – A desulfurizing process consisting of distilling oil over copper oxide followed by refining with sulphuric acid. Now obsolete.

**FRC** – Flow Recorder Controller

**Free-Up** – Unstick; to make turn or move as it is supposed to do.

**Freeze Point** – An analysis for measuring the purity of various refined chemicals. The higher the purity, the higher the freeze point temperature. The purest form of acetic acid freezes at a temperature of 16.7°C. Various impurities cause this temperature to be reduced.

**Fresh Air Equipment** – Breathing equipment providing a flow of breathable air from cylinders of compressed air to the individual.

**Fresh Feed** – All oil feed to the unit that comes from a source outside the processing unit, i.e. is not recycled.

**Friction Brake** – A form of dynamometer for measuring the power a motor exerts.

**FTC**- Federal Trade Commission

**Fuel Gas** – Gas used as fuel in boilers and other types of furnaces.

**Fuel Oil** – Typically, any liquid petroleum product used as fuel for the generation of power or heat. The term is often restricted to petroleum products heavier than gasoline which may be middle distillates (distillate fuel oils) or residua.

**Full Face Gasket** – A gasket which has the same inside and outside diameter as the flange with holes cutout to allow the stud bolts to go through the gasket.

**Fuller's Earth** – (Also called bentonite or diatomite) A porous colloidal aluminum silicate (clay) with a high natural absorption. Employed as a decolorizing medium in oil refining.

**Fumes** – Vapors or smoke given off by materials.

**Fuming Sulfuric Acid** – A strong solution of sulfuric acid (106%). So named because it gives off fumes. See "Oleum."

**Furfural** – An oxygen-containing, heterocyclic organic compound employed as a solvent in lube oil refining.

**Furnace** – An apparatus in which heat is liberated and transferred directly or indirectly to a fluid mass for the purpose of effecting a physical or chemical change.

**Furnace Oil** – A light fuel oil primarily used in home heating systems.

**Fusel Oil** – An acidic, oily liquid that has an unpleasant odor and is a by-product of methanol formation. It contains alcohols, such as isopentyl, amyls, iso-butyl, and normal propyl alcohols.

# G

**Gag** – A clamp used to prevent a safety valve from relieving during pressure testing.

**Gain** – The ratio of change in controller output divided by the change in input, which caused it.

**Gallon** – Unit of Volume. In Great Britain, the Imperial Gallon contains 277.42 cubic inches or 10 lbs distilled water at 62°F and 30" barometer. In the United States, the US Gallon contains 231 cubic inches or 8.3389 lbs distilled water at 62°F and 30" barometer.

**Galvanizing** – The process in which a thin coating of zinc is applied as a protective coating to iron or steel.

**Gas** – A phase of matter in which molecules are widely separated. A gas does not have a definite volume or shape.

**Gas Black** – A superior kind of lamp-back.

**Gas Blanket** – A slightly positive gas pressure maintained on a vessel or tank to keep out air. Usually, an inert gas such as nitrogen.

**Gas Chromatograph** – An analytical instrument used to separate and quantify the individual components of a gas or liquid mixture. Some analyzers on process streams are specialized gas chromatographs.

**Gas Chromatography** – A method of identifying and quantifying the compounds of a gas by their boiling point. It consists of an oven, column, autosampler and detector. The autosampler injects the sample into the column which is packed with special material to help separate the components of the sample. A carrier gas sweeps the sample through the column while the oven adds temperature to speed the sample along. The mixture separates in the column and elutes as individual compounds into the detector where it is quantified. As a result, each component leaves the column separately and in a predictable sequence and rate.

**Gas Detector** – A safety device to show the presence and levels of flammable gas.

**Gas Lock** – The interruption of the gasoline supply to an engine, owing to the formation of a pocket of gas in the fuel feed line, due to the excessive volatility of the fuel.

**Gas Oil** – The petroleum distillate obtained after the removal of kerosene from crude oil. It is employed as a cracking stock for increasing the quantity of gasoline and diesel fuel from crude oil.

**Gas Turbine** – A device that consists of an air compressor, combustion chamber, and turbine. Hot gases produced in the combustion chamber are directed towards the turbine blades causing the rotor to move. The rotation of the connecting shaft can be used to operate other equipment.

**Gas-Freeing** – A term denoting the purging of an empty vessel of hazardous fumes, thus allowing entrance for work and hot-work equipment to be used within it. The term is also employed to denote the inspection and certification of a vessel as being gas free.

**Gasket** – A compressible material used between two flanges as a leak-proof sealing medium.

**Gate** – The control element found in a gate valve.

**Gate Valve** – A positive shutoff valve utilizing a gate or guillotine which when moved between two seats causes tight shutoff.

**Gauge** – (1) To measure; such as to gauge the level in a tank. (2) A measuring instrument, such as a pressure gauge.

**Gauge Pressure** – Pressure read on a gauge; normally does not include atmospheric pressure.

**Gear Pump** – A pump with gears inside a housing. As the gears turn, cavities are created which allows the liquid to be moved from the suction of the pump to the discharge. A positive displacement pump.

**Gel** – See "Silica Gel."

**Gen. (Generator)** – A machine which produces electrical power.

**GHV** – Gross heating value.

**Gland Oil** – Oil injected into the shaft packing at pumps to prevent escape of the material being pumped (i.e., seal oil).

**Globe Valve** – A valve with a moving seat, usually circular which moves into a circular opening to shutoff. Usually used in throttling service.

**Glycerol** – A thick sweetish liquid soluble in water (BP 290°F) used as an antifreeze.

**Governor** – A device used to control the speed of a piece of equipment such as a turbine.

**GPM** – Gallons Per Minute.

**Grab Sample** – Some sampling systems have automated samplers. When the autosampler fails samples have to be collected manually or "grabbed." Can refer to any manually collected sample.

**Graduate** – This is a cylindrical glass laboratory vessel with graduated marks indicating the volume of a liquid.

**Grams** – A measure of weight in the metric system. A gram is equivalent to .0353 ounces. One kilogram is equivalent to 1,000 grams, or approximately 2.2 pounds; 454 grams equal one pound.

**Grating** – Structural steel used to make walking areas and/or make platforms in buildings.

**Gravity** – Generally means the specific gravity or relative density of a liquid.

**Grease** – A mixture of mineral oils with soaps, forming a semi-solid material used as lubricant. The soaps of various metals may be employed in grease manufacture, the most common being calcium, sodium, lead and lithium soaps.

**Gross** – Total; undiminished by depreciated deductions.

**Ground (Electrical)** – (1) Cable installed from frame of electrical equipment to prevent possibility of shock. (2) A phase of circuit which has shorted to ground.

**Ground Burner** – A burner located in the plant used to dispose of organic residues that cannot economically be burned for power.

**Gum** – A term used in the petroleum industry to denote the sticky sediment to be found deposited on standing in certain motor fuels; gum formation occurs almost exclusively in cracked fuels.

**Gunk** – (1) An insoluble heterogeneous precipitate or residue. (2) A caustic substance used as a cleaner or degreaser.

**Gunnite (Gunite)** – A coating for solid surfaces, consisting of a mixture of sand, cement, and water. The mixture is applied by blowing it through a hose and nozzle. Also, a trade name of a "graphitic steel" produced by the Gunite Corporation and used for automobile brake drums and machine parts, where resistance to sliding wear is required.

## H

**H<sub>2</sub>O** – The chemical formula for water.

**H<sub>2</sub>S** – The chemical formula for hydrogen sulfide; an extremely toxic and noxious gas.

**H<sub>2</sub>SO<sub>4</sub>** – The chemical formula for sulfuric acid.

**HAD (Heat Actuated Device)** – A temperature rate-of-rise detector, used for automatic operation of water spray system deluge valves.

**Half-White Oils** – Oils similar to white oils, but not refined to quite the same extent.

**Hammer** – A condition in piping that is caused by the contact of an extremely hot substance with a much cooler substance or surface. For example, hammer may occur in the case of steam coming in contact with a cold pipe. This contact produces a temperature shock which makes a sound like that made by a hammer hitting a pipe.

**Hand Control** – To control a flow by adjusting a valve by hand.

**Hand Jack** – A mechanical jack operated with a lever by hand and not hydraulic pressure.

**Hand Wheel** – A device attached to the stem of a valve that permits the opening and closing of the valve.

**Hard Asphalt** – A term used in petroleum specifications to designate those hydrocarbons which are insoluble in aromatic-free petroleum ether, and soluble in benzene. See "Asphaltene."

**Hardness** – A term referring to dissolved minerals in water which can precipitate and form a scale, primarily calcium and magnesium.

**Hazard** – Something that poses a risk, danger, or peril.

**Hazardous Incident Report** – A written report used to inform management of all significant injuries, fires, or explosions, plus hazardous or potentially hazardous incidents that could lead to personal injury or major equipment damage.

**HAZCOM** – The hazard communication standard, also known as the workers right-to-know law. It ensures that hazards of chemicals are evaluated and requires that employers and employees be informed about the hazards of those chemicals.

**HAZWOPER** – Hazardous Waste Operations and Emergency Response; OSHA’s Regulation 29 CFR 1910.120.

**HCN** – Heavy FCU Naphtha.

**HDA** – Hydrodealkylation (toluene to benzene)

**Head** – (1) Pressure of a fluid upon a system due to the height at which the surface on the fluid stands above the point where the pressure is taken. The discharge pressure of a pump is sometimes referred to as the pump head and expressed as feet of fluid. (2) The removable bolted plate over a tower or tank opening. (3) The removable end cap of a heat exchanger.

**Head Temperature** – The temperature measured at the top or head of a vessel.

**Header (Hdr.)** – A line which has several lines adding or removing flow.

**Heads** – Amount of material boiled overhead on a column or still.

**Heads Cut** – A portion of the material that is boiled overhead on a column or still.

**Hearing Conservation** – A Federal standard for noise exposure.

**Heat** – Added energy that causes an increase in the temperature of a material (sensible heat) or a phase change (latent heat).

**Heat Exchanger** – A device used to transfer heat from one substance to another.

**Heat Interchange** – The transfer of heat from a hotter to a cooler medium, such as occurs in a heat exchanger or condenser.

**Heat of Cracking** – The amount of heat required to crack heavy gas oil feed into lighter products. It is the difference between the heat of formation of the feed products and the reactants. It represents the net energy required between breaking the bonds in the feed molecules and the formation of new product molecules.

**Heat of Reaction** – The heat caused (either endothermic or exothermic) by the reaction of two or more compounds.

**Heat Soaking** – A procedure designed to remove steam condensate from a turbine to warm the internal parts and slow roll the turbine by bringing up the speed slowly.

**Heat Test** – A test applied to lubricating and other oils to determine their stability to heat and also to detect incomplete or improper refining.

**Heat Transfer Area** – Area projected by a mechanical device to expose it to a temperature differential.

**Heat Treatment Oils** – Oils employed in the steel industry for the cooling of steel during the tempering process (hardening oils, quench oils) or else for the maintaining of the steel at some definite temperature during tempering (tempering oils).

**Heater** – See "Furnace."

**Heavy Alcohols** – By-product alcohols produced in the synthesis reaction, such as iso-propyl, normal propyl, secondary butanol, normal butanol, and iso-amyl. These are concentrated in the purification towers and removed by the way of side stream draw-offs.

**Heavy Duty** – As applied to lubricating oils, indicates oils that contain additives not only to control oxidation and bearing corrosion, but also to act as peptizing agents and detergents so that impurities are kept in suspension in the oil. Heavy duty oils are chiefly intended for compression ignition engines (diesel), particularly those employed for high speed operation as in road vehicles.

**Heavy Ends** – A distillation term related to oils meaning the material boiling at the highest temperature.

**Heavy Oils** – Oils having a hydrocarbon chain length greater than 20 carbon atoms, but less than that for a paraffin wax.

**Heavy Virgin Naphtha (HVN)** – Naphtha distilled directly from the crude usually fed to catalytic reforming for octane improvement.

**Hertz** – Electrical unit of frequency.

**Heterogeneous** – Lack of uniformity; unlike; dissimilar.

**HHCGO** – Heavy-Heavy Coker Gas Oil.

**High Limit (Alarm)** – A term used in computer language to describe a predetermined upper alarm point of a process.

**High-Speed Compressor** – A multiple cylinder compressor with an even number of cylinders mounted in a horizontal plane with the cylinders mounted in opposing pairs, balancing the reciprocating mass of the opposing cylinders resulting in reducing the horizontal force to near zero. Sometimes referred to as balanced, horizontal, or opposed compressors.

**High-Speed Trip** – A mechanical device actuated by centrifugal force, which in turn activates a switch or trip valve, to shut down a turbine, engine, should it overspeed.

**Histograms** – A type of graphical presentation of data.

**Homogeneous** – Uniform; of a like kind; similar.

**Homogenizer** – A piece of equipment used to thoroughly mix streams of two or more materials to make sure the result is the same throughout.

**Hopper** – A container (box, rail car, etc.) often tunnel-shaped, from which the contents can be emptied slowly and evenly.

**Horsepower** – A unit for measuring power or rate of doing work; equal to raising 33,000 pounds to a height of one foot in one minute.

**Horton Sphere – Horton Spheroid** – A patented, spherical tank generally used for storage of liquids under pressure, e.g. butane or iso-pentane.

**Hose (Chemical, Utility)** – A flexible tube that carries fluids; made of plastic, rubber, fiber, metal or usually a combination of materials to withstand the service designed for. Chemical hose

is usually made of flexible stainless steel. Utility hose is of fiber and rubber used for nitrogen, air or water.

**Hot Alignment** – Work necessary to check shaft and face positions of rotating equipment involving the shutdown of the equipment, dismantle couplings, installing dial indicators, and adjustment of the equipment into perfect alignment. Only done when equipment has reached operating temperature

**Hot Check** – When equipment has reached operating temperatures. Turbine, compressor bearings and seals may be checked for operating clearances. Usually predetermined and set by equipment manufacturer.

**Hot Spot** – (1) A furnace tube, refractory or area within a furnace that gets too hot. (2) An area in a reaction catalyst bed where the reaction is taking place faster than the rest of the bed causing higher localized temperatures.

**Hot Work** – Any mechanical work, which can generate sufficient energy to ignite a combustible mixture.

**Hot Work (Electrical)** – Work that must be done with equipment energized, using all safety equipment to prevent damage or shock.

**Hotwell** – A small tank-like vessel attached to a vacuum condenser that catches the liquid and gives a controllable liquid level (LL) to keep a liquid flow to a pump or to prevent steam blowing through along with the condensate.

**Hourly** – A term used to describe employees who are paid by the hour.

**Housekeeping** – The act of keeping a work area and equipment in a safe, clean, usable condition.

**HUF** – Heavy Ultraformate.

**Hunting** – A term used to describe the condition when a turbine's speed fluctuates while the controller is searching for the correct operating speed.

**Hurricane Alert** – Where a hurricane path is known and the area where it will hit has been alerted to prepare for high winds.

**Hurricane Committee** – A committee composed of plant personnel whose function is to coordinate plant activities before, during, and after a hurricane or storm.

**Hurricane Inspection** – An inspection held for the purpose of aiding all departments in locating items that need to be corrected or cleaned up, prior to the arrival of a hurricane.

**Hurricane Watch** – Means that a hurricane has been spotted; but its landfall still can not yet be determined.

**HVN** – See "Heavy Virgin Naphtha."

**HWP (Hazardous Work Permit)** – A permit used plantwide for all work involving a source of ignition in a hazardous area or when physical entry into equipment is to take place.

**HX (Heat Exchanger)** – A vessel (usually shell and tube) used to transfer heat from one substance to another. Examples: calandrias, condensers, vaporizers, heaters, and coolers.

**Hydrant** – Fire hydrants on plant fire water distribution system.

**Hydrate** – A solid compound which has water molecules associated with it.

**Hydro** – (1) Shortened from the word "hydrotest," referring to a pressure test using a liquid as the testing medium; (2) Concerning hydrogen.

**Hydroblast** – To clean an object using water under very high pressures as the cleaning agent.

**Hydrocarbon** – A compound containing only hydrogen and carbon atoms. Examples: methane  $\text{CH}_4$ , Benzene,  $\text{C}_6\text{H}_6$ .

**Hydrocracking** – A catalytic process in which hydrogenation and cracking takes place at high pressure and temperature.

**Hydrodesulphurization (HDS)** – A process used primarily for the removal of sulfur compounds from untreated residual streams. The sulfur is reacted, in the presence of a catalyst, with hydrogen to form hydrogen sulfide which is easily removed by flashing.

**Hydrogen Producing Unit** – A catalytic process in which hydrogen is produced by reacting ( $\text{H}_2\text{O}$ ) with fuel gas (primarily methane,  $\text{CH}_4$ .) The reaction also produces carbon monoxide ( $\text{CO}$ ) and carbon dioxide ( $\text{CO}_2$ ). Carbon dioxide is removed by carbonate treating and ( $\text{CO}$ ) is converted back to methane and water in a hydrogenation reactor called a methanator. It is undesirable to have carbon monoxide present in the hydrogen produced because it is poisonous to many of the catalysts in units where the hydrogen is used.

**Hydrogenation** – The chemical addition of hydrogen to an unsaturated compound.

**Hydrolysis** – The interaction of a compound with water resulting in breaking down the compound into basic or acidic constituents or both.

**Hydrometer** – A floating instrument for determining specific gravities of liquids.

**Hydroscopic** – Having the property of readily absorbing moisture from the atmosphere.

**Hypersorption** – Name of a proprietary process for the separation of mixtures of lighter (gaseous) hydrocarbons by selective adsorption on activated charcoal whereby the heavier components of the mixture are retained.

**Hypochlorite ( $\text{HOCl}$ )** – When used in the oil industry, the term usually refers to calcium hypochlorite, a weak acid; used as a refining agent for white spirit and kerosine.

**Hypoid** – A form of gearing for the axles of motor vehicles, allowing a lowering of the axle; but, owing to the high gear loading, requiring special EP lubricants.

## I

**IA (Instrument Air)** – Plant air that has been filtered and/or dried for use by instruments.

**I Beam** – A structural member (usually steel) whose cross section resembles the alphabetical character "I". Usually used as structural beam or trolley beam.

**iC4** – Isobutene.

**IBP (Initial Boiling Point)** – A laboratory analytical term related to distillation. It is the boiling point temperature at the time the first drop of material distilling falls into the distillation receiver. This is a criteria for determining the amount of low boiling material in a chemical.

**ID Fan (Induced Draft Fan)** – A fan used to create air flow (a draft) in a specific direction, often to remove vapors or fumes from a vessel or area.

**IEA** – International Energy Agency.

**Ignition Accelerator** – A substance added to diesel fuel with the object of reducing the ignition delay period. Nitro-compounds are frequently employed (e.g., ethyl nitrate, ethyl nitrite). Care has to be exercised in the selection of ignition accelerators due to the risk of corrosive action. While ignition accelerators are used to a certain extent, this type of additive is far less common than the addition of knock inhibitors to fuel for spark-ignition engines.

**Ignition Quality** – A measure of tendency of a compression-ignition engine fuel to ignite when injected into hot compressed air. Ignition quality is usually denoted by cetane number and is a measure of fuel quality analogous to the measurement of anti-knock value in the case of spark-ignition engine fuels.

**Ignition Source** – An energy source, such as flame, spark, or heat that will cause the ignition of an explosive mixture of vapor and air.

**Illuminating Oils** – Oils used for illuminating purposes. These are petroleum products heavier than gasoline.

**Immiscible** – Two or more liquids insoluble in one another and unable to form a homogenous mixture.

**Impeller** – The moving part of a centrifugal pump or compressor consisting of a set of vanes attached to a central hub.

**Impingement** – The contact of flame with the tubes in a furnace, usually undesirable.

**Impingement Baffle** – A plate used to divert or change the path of flow of fluids as they enter a heat exchanger or vessel.

**Impurity** – An unwanted substance in another substance.

**Inboard** – A term used to describe the location of a seal, bearing, shaft end, etc. For example, when referring to a double seal, the inboard seal would be the one next to the product. The inboard bearing would be the bearing next to the coupling.

**Incidence Rate** – A safety term indicating the number of injuries and/or illnesses or lost-work days per 100 full-time employees per year of 200, 000 hours of exposure.

**Incident** – A safety term indicating any event that leads to or could have led to a catastrophic release or accident.

**Incinerator** – A permitted device used to burn industrial wastes.

**Indicating Controller** – An instrument that indicates a variable reading and actuates a secondary device to effect the process.

**Indicator** – Analytical. A chemical compound which changes color at a certain pH change.

**Induced Current** – A current picked up from one circuit to another by induction.

**Induced Draft** – A term used to describe the act of mechanically assisting a natural draft.

**Induction** – The property of a circuit that causes a voltage to be induced in the circuit by a change of current in the circuit (measured in Henry units).

**Induction Motor** – A motor that has no electrical connection from rotor to another source of power. Voltage and current in the rotor are produced by induction from stator winding.

**Induction Period** – The time interval under given conditions in which an oil does not absorb oxygen to form a gum.

**Industrial Hygiene** – The recognition, evaluation, and control of environmental factors or stresses that affect employees or residents of a community.

**Inert** – Not chemically active.

**Inert Gas** – A gas, which is not chemically active, such as helium, argon, and nitrogen. Because they are inert, they may be excellent carrier gases for gas chromatographs.

**Inert Gas System (IGS)** – Many large vessels, especially in the crude trade, have IGS installed for safety reasons. An inert gas will not support combustion. Most ship's systems use air with the oxygen burned out of it, i.e., impure nitrogen. This is pumped into the ship's tanks to replace the air present above the oil, thus making it impossible to support combustion. A low pressure (about 2 psi) is normally maintained in the tank.

**Inertia** – The ability of a body to resist motion or to keep it in motion.

**Influent** – The stream flowing into a process or system.

**Inhibitor** – A substance which slows or stops a chemical reaction.

**Initial Boiling Point (IBP)** – See "IBP."

**Initial Color** – The color of a liquid before any solution is added during analysis.

**Injection** – A liquid added to a stream or another liquid to produce the desired result or mixture.

**Inlet** – The point where something enters.

**Innage** – A measure of the depth of liquid in a tank or other container. Normally, tank gauges are innage gauges unless otherwise specified.

**Inorganic** – Chemical compounds that do not contain carbon as the principal element.

**Insoluble** – Incapable of being dissolved in a solvent.

**Instrument** – Any device used to measure or control flow, temperature, level pressure, analytical data, etc.

**Instrument Air** – See "IA (Instrument Air)."

**Instrument Lead** – The electrical wire or pneumatic tubing that carries a signal to and/or from an instrument.

**Instrument Purge** – Either a gas or liquid used to purge the leads of an instrument.

**Instrument Tap** – A connection point fitted with a valve used for the installation of some type of instrument or transmitter to measure process pressure, level, etc.

**Insulating Oils** – Usually restricted to hydrocarbon oils used on electrical equipment such as cables, transformers, etc., but also chlorinated oils used as substitutes for hydrocarbon oils.

**Insulation** – Material used in walls, ceilings, and around pipe and machinery to retard the passage of heat and sound.

**Insulator** – A device made from a material that will not conduct electricity. The device is normally used to give mechanical support to electrical wire or electronic components.

**Intake Pressure** – The absolute total pressure at the inlet flange of the compressor.

**Integral Condenser** – Condenser inserted inside of a column or still.

**Intensity** – A numerical expression of the severity of the operating conditions existing in the reactor; the higher the intensity, the greater the severity. It is completely independent of the feed stock quality, but is dependent on other normal reactor conditions; catalyst activity, reactor holdup and feed rate, catalyst to oil ratio, temperature and pressure, and catalyst hydration effect.

**Interchanger** – One of the process-to-process heat exchangers in a reactor loop.

**Intercondenser** – Normally a small heat exchanger utilized on vacuum jets to partially condense the steam and evacuated gas from the preceding jet.

**Intercooler** – Cooling device between heat causing motive forces. Example: Removes the heat of compression between stages of a compressor. An aftercooler cools after the high pressure stage.

**Intercooling** – The removal of heat from the gas.

**Interface** – The point at which two liquids phases meet (i.e., oil and water).

**Interfacial Tension** – The tension existing at the interface between two phases, usually oil/water. The value for pure oil and water is in excess of 40 dynes/cm and lower values may indicate contamination of the oil.

**Interlock** – A device or system used to prevent a return to original condition after an interruption has occurred. Often used on shutdown valves and shutdown systems. Usually requires a manual reset to overcome the interlock.

**Intermediate Base Crudes** – Any crude having properties falling between those of the paraffin and naphthene classifications.

**Intermediate Product** – A product from a processing unit that will be used to make a different final product.

**Interrupt** – To stop.

**Interstage** – The point or points between discharge and suction of a stage or between stages of a compressor, pump, etc.

**Inventory** – A list of all finished goods in stock, goods in process of manufacture, raw materials and supplies on hand.

**Inversion Point Test** – Analytical. A test devised to determine the point at which water-in-oil emulsion changes to an oil-in-water type of emulsion. The test is carried out by successively adding small amounts of water to a water-in-oil emulsion until inversion occurs.

**Inverted Bucket Trap** – A steam trap that operates with an inverted bucket inside a casing. It is effective on condensate and non-condensing vapors.

**Iodine Value** – Analytical. A measure of the unsaturation of a compound. It is the number of grams of iodine which combine with 100 grams of the material under examination.

**IOI** – Initial Occupational Injury

**IOIFR** – Initial Occupational Injury Frequency Rate

**Ion** – An atom or molecule carrying a positive or negative electric charge as a result of the loss or gain of one or more electrons.

**Ion Exchange** – A process using a resin, either natural or synthetic, in which ions are transferred from the resin to the aqueous stream being treated and vice versa; used in softening water.

**IPE** – International Petroleum Exchange.

**Iron** – A metallic element having magnetic properties. Iron may be combined with other metals, such as chromium, to form an alloy, stainless steel. Iron is also a common contaminant or impurity in refined chemical products.

**Isolate** – To separate from others. Prevent material from entering or leaving a piece of equipment.

**Isomer** – One of two or more chemical substances having the same elements and molecular weight; but differing in structure and properties.

Example: N-butane:  $\text{CH}_3(\text{CH}_2)_2\text{CH}_3$       Iso-butane:  $\text{CH}_3\text{CH}(\text{CH}_3)_2$

**Isomerization** – A process in which straight-chain molecules are changed to branch chain molecules. In an Isomerization Unit, natural gasoline is fractionated to recover normal pentane for reactor charge. In the reactor, normal pentane is converted to iso-pentane, which has a higher octane rating.

**Iso-Octane** – An isomer of octane used in defining octane number, an important property of gasolines. Reference material with an octane rating set to equal 100 (arbitrary).

**Isothermal** – A process that maintains a constant temperature.

## J

**Jet** – Simplified type of vacuum pump which has no moving parts. It consists essentially of a steam nozzle that discharges a high velocity jet across a suction chamber.

**Jet Fuel** – Fuel suitable for gas turbines used for aircraft propulsion. Such fuels may vary widely in scope, but the most usual specifications cover materials of the kerosine type. Low freezing point is an important requirement.

**Job Map** – A listing of skills and knowledge critical to successful job performance.

**Journal** – That part of a shaft or axle which rotates in or against a bearing.

**Jumper-Pipe** – A pipe connection which temporarily or permanently connects two existing pipelines. (Jump-over).

**Junction Box** – A box used for the termination of electrical wires or pneumatic instrument leads.

**Justify** – To prove something is worthwhile.

**JV** – Joint venture.

## K

**Karl Fischer Reagent** – A chemical solution used to determine the quantity of water in refined chemicals.

**Kauri Butanol Value** – Test procedure that measures the aromatic content, and hence, the solvent power, of a petroleum fraction.

**Kelvin Temperature** – A scale of temperature measurement that has an absolute zero base. The Kelvin scale is based on the Celsius scale. To convert from Celsius to Kelvin, add 273° to Celsius.

**Kerosene** – A petroleum distillate of boiling range about 350° to 525°C employed as an illuminating lamp fuel or as a fuel for internal combustion engines (power kerosene.)

**Kettle** – Vessel used for boiling liquid.

**Kettle-Type Reboiler** – A type of heat exchanger that uses a tubular bundle to heat and flash a liquid in an oversized shell with a specially designed vapor space cavity. The flashed vapor is returned to the tower, and the bottoms liquid product flows over a baffle to storage of further processing.

**Key Fractions** – Term used in a method for crude classification published by NIST (formerly NBS-National Bureau of Standards.) Key fraction I distills between 250° - 275°C (at 760 mm) and key fraction 2 between 275° - 300°C (at 40 mm). API gravities of over 40 for key fraction I denote a paraffinic type, under 33 a naphthenic type and 33-40 an intermediate type; the corresponding figures for key fraction 2 are 30 and 20, thus allowing for a total of nine classes of crude oil when classified by this procedure.

**Kilogram** – The metric unit of weight equivalent to 2.20 lbs.

**Kilovolt Ampere (KVA)** – A unit of measure of the total electrical power in a circuit. This includes the power that is converted into mechanical work (KW) and the electrical losses in the circuit.

**Kilowatts (KW)** – A measure of electrical power. 1 kilowatt=1000 watts or 1 kilowatt=3/4 horsepower.

**Kinematic Viscosity** – The ratio of the absolute viscosity of a liquid to its specific gravity at the temperature at which the viscosity is measured.

**Kinetic Energy** – Energy in motion.

**KMnO<sub>4</sub>** – A chemical formula for potassium permanganate.

**Knocker Wheels** – A patented wheel that is attached to the normal wheel of a valve that has a knocking effect and helps to open or close stubborn valves.

**Knocking** – The phenomenon of pre-detonation, as opposed to normal combustion, of a fuel in an internal combustion engine.

**Knocking Inhibitor** – A substance, acting as a catalyst, which when added to a fuel intended for use in an internal combustion engine has the effect of regulating the speed of combustion.

**Knock-Out Drum** – Vessel located between the flare header and the flare. It is designed to separate liquid hydrocarbons from vapors being sent to the flare for burning.

**Knockout Pot** – Is a small vessel used to remove (or knock out) liquid droplets or impurities from a gas stream.

## L

**Laboratory** – (1) A place equipped for experimental study in science (2) or for testing or analysis of samples.

**Labyrinth Seal** – A shaft seal designed to stop flow consisting of a series of ridges and intricate paths along the shaft.

**Lachman Process** – A process for the refining of cracked motor spirit by the treatment of the vapors with zinc chloride solution.

**Laminar Flow** – Fluid flow that is smooth and unbroken. Viewed as a series of laminations of fluid slipping past one another inside a tube.

**Lard Oils** – Animal oils prepared from chilled animal fat (lard.) They are compounded with mineral oils to yield lubricants of special properties.

**Latent Heat** – The thermal equivalent of the energy expended in producing a phase change, such as in vaporizing a liquid.

**Lbs. (Pounds)** – A unit of measure of weight or pressure. Pressure is referred to as pounds per sq. inch.

**LCCO** – Light catalytic cycle oil.

**LCV** – Level Control Valve.

**Leaching** – The removal of soluble material from a solid with a solvent.

**Lead** – See "Instrument Lead."

**Lead Naphthenate** – The lead soap of naphthenic acids. It is highly soluble in mineral lubricants and imparts to them unusually high film strength.

**Leak Test** – A procedure for locating leaks in process equipment by filling the equipment with compressed air or nitrogen and applying liquid soap to the exterior area to be tested.

**Lean Oil** – Stripped oil used in an absorption plant to extract a component from a gas stream.

**Leg** – Vertical line on the bottom of larger lines. Used to drain large line.

**LEL** – Lower Explosive Limit.

**Lens Ring** – A metal ring type gasket used in high pressure piping for pressures of 2000 psig and above.

**Letdown Vessel** – A vessel in which the pressure drop between a high pressure and a low pressure region occurs.

**LGO** – Light Gas Oil.

**LHSV** – Liquid Hourly Space Velocity; a measure of flow rate through a fixed bed. A SV of 1.0 is equal to a volume of liquid equal to the volume of the bed passing through the bed in one hour.

**LI** – Level Indicator.

**LIC** – Level Indicator Controller.

**LICV** – Level Indicator Control Valve.

**Life Line** – A safety harness with rope used as a piece of personal safety equipment.

**Light Ends** – The lighter fractions in a hydrocarbon mixture.

**Lightening Holes** – These are holes cut in any deep frame, to reduce the weight of steel without weakening the frame.

**Lime** – Calcium hydroxide, a chemical used in water treatment and other processes requiring a source of alkalinity.

**Lime-Based Grease** – A preparation of mineral oil and a soap containing lime which has been manufactured in grease form.

**Limit Switch** – A mechanically actuated switch (electric or pneumatic) which: (1) Through its action prevents further travel by the variable to which it is attached. (2) Is actuated when the variable to which it is attached reaches its travel limit.

**Limitorque** – Operator for a high-pressure shutoff valve. An electric motor.

**Line** – Pipe from one point to another. Used for transferring material or gas from one place to another.

**Line Up** – To open the necessary valving in a piping system prior to placing in service.

**Lined Out** – A processing unit that is operating properly and producing good product. A properly functioning process unit is said to be "lined out."

**Liquid Level (LL)** – The height to which liquid has accumulated in a container.

**Liquid Paraffin** – A moderately viscous mineral oil, which is highly refined so as to be absolutely colorless, tasteless and odorless. It is used as an intestinal lubricant and in pharmaceutical preparations.

**Liquid Phase** – Material that is in the liquid state.

**Liquefied Petroleum Gas (LPG)** – Liquefied condensates from natural gas or refinery gases liquified by either compression or absorption processes. Usually a mixture of butane and propane stored in cylinders under sufficient pressure to maintain it in the liquid state. Release of the pressure causes the liquid to boil, making the contents available in gaseous form.

**Liter** – A metric unit of volume which equals the volume of a kilogram of pure water at 4°C.

**Lithium-Based Grease** – A grease prepared from lubricating oil and lithium soap.

**Litholine (Grease)** – A multipurpose grease that is used to lubricate bearings which are not in very high heat or very low temperature service.

**Litmus Paper** – Chemically-treated paper which is color sensitive to pH changes; turns red when dipped in acid solutions and blue in basic solutions.

**LLC** – Liquid Level Controller.

**LLS** – Light Louisiana Sweet Crude

**LNG** – Liquefied Natural Gas. A mixture of hydrocarbons predominantly methane, in liquid state at low pressure and extremely low temperature. Used as a fuel.

**Loaded (Column Condition)** – A condition of reaching or exceeding the liquid capacity of a column. A higher than normal liquid level on the column trays.

**Lobe Compressor** – A rotary, positive displacement compressor that contains specially shaped impellers to compress the gas.

**Lobe Pump** – A rotary-type positive displacement pump that contains specially shaped impellers to pump the liquid.

**Local Flooding** – When excessive liquid flowing down a tower blocks vapor flow up the tower in one section of the tower.

**Local Reset** – (1) A field-mounted relay or solenoid that must be manually reset before the control valve will operate. (2) The control or isolation valves that must be manually reset in the field to activate the solenoids for the valve to operate.

**Lock Out** – A safety term used to describe the locking out of equipment for maintenance. This is a federally mandated safety precaution.

**Long Residuum** – A term applied to the residue obtained from the distillation of paraffinic crudes.

**Long Time Burning Oil** – A petroleum fraction intermediate between kerosine and gas oil which is employed in certain types of lamps such as those used in railway signals, etc.

**Loop** – Instrumentation nomenclature: either an electronic or pneumatically linked group of instruments in a circuit concerned with one primary variable.

**Loop Seal** – An offset in a pipe in the shape of a "U" or "S" for the relief of pressure at a specific limit.

**Louvers** – One of a series of overlapping, sloping boards, slats, etc., arranged to help control air flow; most often seen on cooling towers.

**Lovibond** – A test to determine the color of oils to which dyes have been added.

**Lovibond Colorimeter** – An instrument for measuring the color of a material by comparison with yellow, red and blue glasses of fixed color intensity.

**Low Limit** – Instrumentation nomenclature: describes relay or switch designed in the circuitry to prevent the variable from decreasing below the preset lower limit.

**Lox** – Liquid Oxygen.

**LPG** – Liquified Petroleum Gas.

**LR** – Level Recorder.

**LRC** – Level Recorder Controller.

**LTA** – Lost Time Accident.

**Lube Box** – A reservoir that contains high-pressure injection pumps to lubricate compressor cylinders and packing with crankcase oil.

**Lubricant** – Any substance interposed between two surfaces in motion for the purpose of reducing the friction and/or the wear between them.

**Lubricity** – See "**Oiliness**."

**LUF** – Light Ultraformate.

**LVN (Light Virgin Naphtha)** – The unstabilized overhead stream from a crude tower.

**Lye** – An aqueous solution of sodium or potassium hydroxide.

## M

**M (Thousand)** – The letter "M" is used to designate thousands. 100M CF means "one hundred thousand cubic feet."

**Machinist** – (1) One who uses machine tools (lathe, drill press, mill, etc.) to reproduce machine parts from metal, plastics, etc. (inside). (2) One who repairs, installs machinery (outside).

**Magneto** – A small generator of alternating current using permanent magnets, used in the ignition systems of some internal combustion engines.

**Make** – Normally referred to as the final product.

**Makeup** – Feed needed to replace that which is lost by leakage or normal use in a closed-circuit, recycle operation.

**Management** – The collective body of those who manage and direct all plant activities.

**Manhead** – Cover plates on manways that are removable and allow for internal inspection and/or repair. See "**Manway**."

**Man-Hours** – A term used to describe the number of hours that it will take to do a particular job.

**Manifold** – A piping arrangement allowing one stream to be divided into two or more streams.

**Manometer** – A gauge for measuring the pressure of gases or vapors.

**Manual** – (1) Mode of operation requiring manual adjustment, opposite of automatic. (2) Book specifying operational instructions and procedures.

**Manual Indicator Controller (MIC)** – Generally used where automatic control is not needed or not practical. This device can be manually operated to control a process variable. It indicates the state of process at the same time. For instance, it might be used to control pressure, flow or temperature. It would also indicate whichever of these variables being controlled.

**Manway** – An opening in a vessel to permit entry for inspection, repair.

**Mass Spectrometer** – A laboratory instrument similar to a gas chromatograph used to determine the composition of chemical mixtures.

**Master Tag Procedure** – A procedure designed to protect individuals from injury when it is necessary to work on any process equipment which has been removed from service.

**Mastics** – Bituminous materials which are used for making watertight flexible joints, usually between various types of building materials.

**Material Balance** – The condition where the sum of the products leaving equals the feed entering.

**Matter** – Anything that has weight or occupies space.

**MAWP** – Maximum Allowable Working Pressure

**Maximum (Max.)** – The greatest quantity or value attained or allowed in a given case.

**Maximum Rotating Speed** – Maximum speed at which a compressor may be operated.

**MB** – Thousand barrels, in American (US) usage.

**MCA** – Manufacturing Chemist Association

**MCFD** – Abbreviation for thousands of cubic feet per day.

**MCFH** – Abbreviation for thousands of cubic feet per hour.

**MEA** – Monoethanolamine; an organic chemical used in treating for the removal of sulfur.

**Mean Average Boiling Point** – A function of the average volumetric boiling point and the slope of an ASTM distillation curve.

**Measured Variable** – A signal that is a measure of the process variable, generally, the output of a measuring instrument or transmitter.

**Mechanical Efficiency** – The ratio of the horsepower consumed to the horsepower delivered by a machine. It is a measure of the power lost due to mechanical friction.

**Mechanical Seal** – (1) Used primarily on rotating equipment in place of packing to keep product from going to the atmosphere. (2) Mechanical assembly that forms a leakproof seal between rotating surfaces to prevent leakage.

**Mechanical Trip** – A mechanical device that is activated or tripped at a predetermined setting. Example: A centrifugal device which will shut steam to a steam driven turbine at a given speed.

**Medicinal Oil** – See "**Liquid Paraffin.**"

**Mega** – Metric prefix for million; example: Megawatts =1,000,000 watts. Also used to mean very large.

**Megger** – An instrument to produce a DC voltage to test and read the dielectric strength of electrical equipment in ohms for megohms.

**MEK (Methyl Ethyl Ketone)** – A colorless liquid, with a sweetish acetone-like odor. Can react with oxidizing materials. Primary use is as a solvent.

**Melting Point** – (1) The temperature at which a change from solid to liquid state occurs. (2) A laboratory analysis with the same name.

**Mercaptan** – An organic compound containing sulfur in a hydrocarbon group. They are present in the more volatile petroleum distillates and are responsible for their bad odor. Mercaptans are frequently referred to as being sour.

**Mercury** – A chemical element; a silver colored liquid at ordinary temperatures used extensively in some instrument, such as: thermometers, manometers, gauges, etc. It is much heavier than water and has a specific gravity of 13.5.

**Merox Process** – A process developed by Universal Oil Products as a combination of mercaptan extraction and sweetening. Either process may be carried out independently if desired, in which case the processes are referred to respectively as Merox Extraction and Merox Sweetening.

**MESA** – Mining Engineering Safety Administration

**Mesh** – The size opening in a screen, indicated by numbers that typically represent the number openings in a 1” by 1” piece of screen.

**Meter** – (1) Instrument or means for measuring. (2) A metric unit of length (1 meter = 9.37 inches).

**Meter Constant** – The numerical constant which must be multiplied by the number of meter divisions to determine the flow through the meter.

**Methane** – The simplest hydrocarbon, CH<sub>4</sub>. It forms the main constituent of natural gas; also found in firedamp, marsh gas, and sewage gas.

**Methanol** – Methyl alcohol. A colorless, poisonous liquid with a faint smell and boiling point of 64.4°C, (wood alcohol).

**Metric Ton (MT)** – 1000 kilograms or 2204 lbs.

**MG** – Mechanical Gear.

**Mho** – A unit of measurement for conductivity of dissolved solids in water.

**Micro** – A metric prefix meaning Millionth. It is combined with other words to give the meaning of millionth, as in microgram, one one-millionth of a gram. Micro is also used to mean very small.

**Micro-Crystalline Wax** – A type of paraffin wax in which the crystals are very small; such waxes are obtained by solvent extraction from certain kinds of petroleum residues. Films of micro-crystalline wax are more pliable than those of ordinary (i.e., macro-crystalline) wax and are used in packaging.

**Micro-Liter** – A measurement which means one-millionth of a liter.

**Micromhos** – Unit of measure of the conductivity of dissolved solids in water.

**Micron** – (1) A term used to designate pressure in the metric system. This is equivalent to the pressure exerted by the atmosphere of .001 millimeters of mercury. (2) The micron is also a unit of length equivalent to 1/1,000,000 of a meter.

**MICV** – Manual Indicating Control Valve.

**Mid Boiling Point** – Another term for average volumetric boiling point.

**Middle Distillate** – Distillate collected between kerosene and lubricating oil fractions. Most commonly used as fuel for domestic burners and diesel engines.

**Milli** – A metric prefix meaning one-thousandth. It is combined with other words to give the meaning of thousandth, as in millimeter, which is one-thousandth of a meter.

**Milliamp** – 1/1000 of one amp.

**Milliliter (ml)** – 1/1000 of a liter (.06 cubic inches).

**Mills** – 1/1000 of a volt, amp, inch, etc.

**Mineral Celza** – See "**Long Time Burning Oil.**"

**Mineral Oil** – A wide range of products derived from petroleum and within the viscosity range of products referred to as oils.

**Mineral Seal Oil** – A cut between kerosine and gas oil, used as absorbing oil in a gasoline absorption process.

**Miner's Wax** – A refined paraffin wax with a melting point of about 50°C.

**Minimum (Min.)** – The least acceptable amount.

**Minimum Governor Control** – The minimum rpm that a governor will control the turbine speed.

**Miscible** – Mixes easily; soluble.

**Mixed Base Crude** – Crude petroleum containing both naphthenes (asphalt) and paraffins (wax).

**Mixture** – A combining of two or more substances in which each substance retains its chemical nature and identity.

**ml** – Milliliter, metric unit of volume.

**mm** – Millimeter, metric unit of length.

**MM (Million)** – An abbreviation symbol for a million. In roman numerals, M is 1000. Therefore, MM is equal to 1000 x 1000, or one million.

**MMSCFD** – Abbreviation for millions of standard cubic feet per day; the commonly used term for gas volumes in the US.

**Mole** – Chemical term. A gram molecular weight for any given substance.

**Molecule Sieves** – Agglomerates of crystalline sodium and calcium alumino-silicates that have been heated to remove their water of hydration. Their pore size can be controlled accurately within a small range of molecular dimensions. They facilitate the separation of gaseous or liquid mixtures by two mechanisms: adsorption, whereby they have a strong preference for components such as water, H<sub>2</sub>S etc; and separation by size, whereby only those molecules are retained which fit into the pore openings of the sieve. For example, a molecular sieve with an average pore diameter of 4 Angstroms (A) will absorb ethane but pass propane. 1 Angstroms = 10<sup>-10</sup> Meter.

**Molecular Weight** – The sum of the atomic weights of the atoms in a molecule.

**Molecule** – The smallest unit into which a substance can be divided and retain all of its chemical and physical properties.

**MON** – Motor Octane Number.

**Monitor** – (1) Nozzles on fire hydrants, or individual risers to provide fixed firewater stream; for cooling or fire fighting without hose. (2) To observe or watch.

**Mono Rail** – A steel "I" beam for equipment to travel on.

**Monomer** – The simplest form of a compound which is capable of undergoing polymerization.

**Montan Wax** – A naturally occurring wax which can be extracted from brown coal (lignite) by means of solvents. Practically the entire world production is from Germany.

**Motor** – A mechanical driver with rotational output. A motor is usually electrically operated.

**Motor Shaft** – A round piece of steel with rotor mounted, suspended in two bearings.

**Motor Spirit** – See "Petrol."

**Motor Starter (Switchgear)** – A device used to control current to an electric motor.

**Motor Valve** – A remote operated valve, actuated by air or electricity.

**MOV** – Motor-Operated Valve.

**MPH (Thousand Pounds per Hour)** – Rate of production or usage per hour in thousands of pounds.

**MSA** – Mine Safety Appliances

**MSDS (Material Safety Data Sheet)** – A document that contains information related to the safety, hazards and handling of a specific material.

**MT (Shorthand for Empty)** – Containing nothing or unoccupied.

**Mud Drum** – (1) The lower drum of a boiler that is used as a junction area for boiler tubes. (2) A low place in a boiler where heavy particles in the water will settle out and can be blown down.

**Multiple Cylinder Compressor** – A compressor having more than one cylinder.

**Multi-Port Valve** – Valve with more than two openings.

## N

**Naphtha** – A loose term which is indiscriminately applied to light petroleum distillates boiling below kerosene.

**Naphthene Base** – A term used to denote certain types of crude oil characterized by the presence of a large proportion of hydrocarbon belonging to the naphthene series.

**Naphthenes** – Saturated hydrocarbons possessing a cyclic structure. The carbon atoms are linked together to form a ring.

**Naphthenic Acids** – Acids derived from the naphthene series of hydrocarbons and found in almost all crude oils. In many cases, they are recovered from the oil or from refining wastes and employed in the manufacture of cheap soaps and of paint dryers.

**Naphthenic Crudes** – Class designation of crude oils containing predominantly naphthenes or asphaltic compounds.

**Natural Gas** – An inflammable gas associated with gas and oil fields and consisting principally of methane and the lower saturated paraffin hydrocarbons. It may also include impurities such as water vapor, hydrogen sulfide and carbon dioxide.

**Natural Gasoline** – Light liquid product obtained by extracting gasoline vapors (casing head gasoline) present in natural gas.

**NEC** – National Electrical Code

**Needle Valve** – A valve constructed for accurate control at low flow rates. It has a needle shaped element that fits into the valve seat.

**Neoprene** – A type of synthetic rubber which is highly resistant to oils.

**Nessler** – A laboratory test that uses Nessler reagent to find out the amount of acetone present in methanol.

**Net Positive Suction Head (NPSH)** – The equivalent head in feet of liquid above the inlet of a pumps impeller. “NPSH Required” is the head that prevents vaporization of the fluid in the impeller (cavitation).

**Network** – A system of separate parts joined together for a common purpose.

**Neutral Oil** – A somewhat loose term applied to low viscosity lubricating oil distillates.

**Neutral Solutions** – One that is neither acidic nor basic but has a pH of 7.0.

**Neutralization Value** – Analytical term. The milligrams of potassium hydroxide required to neutralize the acidity of one gram of oil.

**Neutralize** – To make a solution neutral (neither acidic nor basic, pH of 7) by adding a base to an acidic solution or an acid to a basic solution.

**NFPA** – National Fire Protection Association

**NGL** – Natural Gas Liquids.

**NIOSH** – National Institute for Occupational Safety and Health

**Nitrobenzene** – An organic solvent obtained by the nitration of benzene; employed in petroleum refining.

**Nitrogen** – An odorless, invisible, inert gas, forming approx. 80% of the atmosphere. An important purging and blanketing medium.

**Noise** – Unwanted electrical signals, sound having an irregular vibration of the ear.

**Noncondensable Gas** – A gas that is not easily condensed by cooling; consists mostly of nitrogen, light hydrocarbons, carbon dioxide, or other low boiling point compounds.

**Non-Return** – A valve most commonly used in steam lines from boilers. A combination stop and check valve.

**Non-Toxic** – Referring to a compound non-poisonous to humans or animals. Generally used with reference to poisons.

**Norgren Oiler** – A device (cup) used in pressurized air lines to inject a measured amount of oil into the air stream for providing lubrication for air operated equipment.

**Nozzle** – The extension on a hose or pipe that controls the flow from them; a small spout.

**NRC** – Nuclear Regulatory Commission.

**NST** – National Standard Thread.

**NYMEX** – New York Mercantile Exchange.

## O

**Occlusions** – Adhesion of gas or liquid on a solid mass, or the trapping of a gas or liquid within a mass.

**Octane Number** – The octane number of a fuel is the proportion percent of isooctane in a mixture of the latter with n-heptane (octane number = 0); which when tested in a prescribed manner, has the same detonating characteristics as the fuel under examination.

**Off-Color** – Description of a process stream or product which is darker than normal or darker than specification.

**Off-Load** – To transfer materials from shipping containers to storage areas.

**Off-Spec** – Referring to a product which does not meet purity specifications or standards.

**Ohm** – A unit of electrical resistance equal to the resistance of a circuit in which an electromotive force of one volt maintains a current of one ampere.

**OIA** – Oil Insurance Association.

**Oil Drum** – A container in which chemicals are often shipped, usually having a capacity of 55 gallons.

**Oil Gas** – A gas obtained by the cracking of gas oil and used as a portable source of heat and light (e.g., for railway coaches and lighthouses) when compressed into cylinders.

**Oil Mist Lubrication** – A piece of equipment designed to provide minute, microscopic air-borne oil particles that lubricate the mechanisms served by the system.

**Oil Separator** – A device that is used to separate oil from compressed gases.

**Oiler** – A device that supplies oil to the seal space between the cylinder wall and piston rings.

**Oiliness** – A somewhat vaguely defined property. A characteristic by which an oil with a greater oiliness will give a lower coefficient of friction than another of the same viscosity. Fatty oils have considerably greater oiliness than mineral oils.

**OJT** – On-the-job training.

**Olefin** – A family of unsaturated, chemically active hydrocarbons with one or more carbon-carbon double bond. Examples are: ethylene and propylene. See "**Unsaturates**" ( $C_nH_{2n}$ ).

**Oleum** – Also known as fuming sulphuric acid and Nordhausen acid. A heavy, oily, strongly corrosive solution of sulfur trioxide in anhydrous sulfuric acid (106%). Sulphuric acid containing dissolved sulfur trioxide.

**On-Stream** – The proportion of time (usually days per year) during which a unit is operating.

**On-Test** – Description of products which are within specifications.

**Open Circuit** – A circuit where continuity has been broken. No current flow.

**Open Flame** – Any fire, a form of welding or burning, or any operation involving flame.

**Open Loop** – A control system with no sensory feedback.

**Operating Discipline** – Following procedures and policies in order to ensure operating consistency, reduce variability in the process, reduce waste, and prevent process safety incidents.

**Operating Factor** – The ratio of the total "on-stream" time of a unit to the total time that it could have been on-stream if it did not have to be shut down for cleaning, repair, or stand-by service.

**Operator (Oper.)** – One who actually does the controlling of flows, temperatures, and pressures of the production equipment.

**Operator Training** – The training required in Process Technology to prepare the employee to have the knowledge and skills to work as an operator in a petrochemical plant.

**Operator's Console** – The operator's link with the computer from which he can read and input data, control instruments, demand logs, etc.

**Optical** – Relating to or about vision. A microscope is an optical instrument that helps us see very small things.

**Optimize** – To maximize or to get the most from.

**Organic** – Chemical compounds based on carbon chains or rings and also containing hydrogen with or without oxygen, nitrogen, or other elements.

**Orifice** – A device to restrict flow through a pipe line.

**Orifice Flange** – (1) Precise pipe flange with pressure sensing hole drilled and tapped perpendicular to the axis of the pipe. (2) One of the two flanges between which an orifice plate is installed.

**Orifice Meter** – An instrument, which measures the flow through a pipe by means of measuring the difference in pressure on the upstream and downstream sides of an orifice plate.

**Orifice Nipple** – A pipe nipple which has a precision hole in it much smaller than the usual hole through a pipe nipple. Used to restrict a flow; to allow a calibrated flow at one pressure drop.

**Orifice Plate** – A thin metal plate with an opening in it used to cause a precise calibrated pressure drop in a flowing stream.

**Orifice Run** – The length of straight pipe immediately preceding and following a pair of orifice flanges.

**O-Ring** – A gasket in the form of a ring, usually oval in cross sectional and made of resilient material like rubber or soft metal.

**O-Ring Joint** – Grooves in a flange enabling it to accept an "O" ring type gasket.

**OSHA** – Occupational Safety and Health Administration.

**OSP** – Official Selling Price.

**Outage** – The distance from the top of a container to the surface of the contained material.

**Outboard** – (1) In conjunction with double seal, seal next to atmosphere. (2) In conjunction with bearings, away from the coupling.

**Outfall** – The outlet or place of discharge of a river or drain or pipe.

**Output** – (1) Production. (2) The quantity or amount produced in a given time.

**Output Meter** – An indication of the instrument output; a PSI gauge on pneumatic controllers and an electric meter on electronic control.

**Over Current** – Current which is above the capability of the electrical equipment.

**Over Current Relay** – A protective device installed in a switchgear to open the electrical circuit if a preset over current exists.

**Overall Flooding** – Condition in which local flooding expands to the entire distillation tower.

**Overhead** – The product or stream which comes off the top of a fractionation tower.

**Overhead Crane** – A lifting device built over machinery or in a shop to handle heavy objects.

**Overhead Make** – The process stream leaving the top of a column.

**Overhead Vapors** – The vapors leaving the top of a distillation tower.

**Overlap** – The incomplete separation of the components of a mixture by distillation.

**Overloading** – Operating a distillation tower above maximum design conditions.

**Override** – A device which interrupts the path of a signal and usually takes over control of the end variable.

**Overspeed** – To go beyond safe or top operating speed on a piece of rotating equipment.

**Overspeed Trip** – An automatic device that cuts power off of a rotating machine if it reaches preset trip point.

**Oxidation** – To combine with oxygen. Chemically, the reaction in which an element loses electrons.

**Oxide** – A compound of oxygen with another element or with a radical.

**Oxygen** – A non-metallic gaseous element that is colorless, odorless, and tasteless. It is non-combustible but supports combustion. The atmosphere contains about 20.6% oxygen.

**Oxygen Clean** – (1) Cleaned thoroughly of all particles of dirt, lint, oil, etc., and does not fluoresce. (2) Clean enough to be installed in oxygen service.

**Ozokerite** – Earth-wax; a natural mixture of solid hydrocarbons.

# P

**P-A** – Pentane-Amylene FCC Product.

**PA System** – Public Address System.

**Packed Tower** – A tower that is filled with specialized packing material instead of trays.

**Packing** – (1) A device or material used to prevent leakage of pressure. Primarily used in valves and pumps to seal a product from the atmosphere. Examples: Asbestos, Teflon, lead, hemp, and carbon. (2) Material used in towers to effect separating.

**Packing Gland** – A mechanical device that contains and compresses the packing.

**Pad** – A concrete slab.

**Panic Button** – A manual emergency shutdown button.

**Paraffin** – Chemically, a pure saturated hydrocarbon having a non-cyclic structure. Often used synonymously with paraffin wax.

**Paraffin Base** – A term used to denote certain types of crude oil characterized by the presence of solid hydrocarbons in solution and having a high pour point.

**Paraffin Wax** – Solid hydrocarbons which can be separated from paraffin-based crude oils.

**Parallel Flow** – The description of flow in a heat exchanger where tube-side flow and shell-side flow is in the same direction.

**Partial Condenser** – A condenser (heat exchanger) that furnishes sufficient cooling medium to condense a part of a vapor stream. The condensed portion is usually drawn off or separated in a separator downstream from the partial condenser.

**Partial Pressure** – The amount of pressure attributable to a particular gas present in a confined gas mixture.

**Passed Specs.** – Referring to a material which has met the requirements for purity.

**PCV** – Pressure Control Valve.

**Pecker Head** – Term used to describe the terminal box on an electric motor.

**Peepholes** – Holes mounted in the sides of furnaces to allow visual inspection inside the furnace.

**PEL** – Safety term: permissible exposure limit.

**Pelletizer** – A device with rotating knives that cut the strands of polymer as they leave the die holes at the exit point of an extruder creating pellets of the polymer.

**Penetration** – A method for expressing the "hardness" of solid petroleum products; being the distance in tenths of a millimeter which a standard needle loaded with a prescribed weight (usually 100 grams) will penetrate the material in the space of five seconds at a standard temperature (usually 25°C.)

**Pensky-Martens Flash Point Apparatus** – The common laboratory apparatus for the determination of the closed flash point of the less volatile petroleum products. Unlike other flash point testers, it contains an automated stirrer.

**Pentane** – A volatile, saturated hydrocarbon with the general formula  $C_5H_{12}$ .

**Percent Off** – A term to describe the distillation characteristics of a sample; particularly the volatility of a gasoline. The percent off at 158 refers to the percent of the sample which has distilled overhead at 158°F.

**Performance Number** – A method for the rating of spark-ignition engine fuels whereby the power output of the engine is compared with that of iso-octane, taken as 100.

**Period Costs** – All expenses other than raw material costs, such as labor allocated and apportioned expense, repairs, taxes, and insurance are called Period Costs.

**Permanent Hardness** – Refers to that amount of calcium and magnesium ions in excess of equivalent bicarbonate ions, usually present as chlorides or sulfates.

**Permanganate Test** – A laboratory test conducted on methanol using a potassium permanganate solution to check primarily for the various ketones that are by-product impurities in methanol.

**Permissives** – A special type of interlock that controls a set of conditions that must be satisfied before a piece of equipment can be started.

**Peroxide** – A highly reactive compound containing two oxygen atoms slightly linked. The loosely held oxygen may oxidize and attack other chemical compounds or metals.

**Persuader or Cheater** – An extension used to give more leverage. Used mostly in turning stubborn valve wheels.

**Petrol** – Also known as gasoline. Originally, a trademark for a volatile petroleum distillate, but now generally used to designate those petroleum fractions employed as fuel for high-speed, spark-ignition internal combustion engines.

**Petrolatum** – A semi-solid, salve-like material obtained by the refining of the residue from the distillation of paraffin base crudes. Used in pharmacy as an ointment base.

**Petroleum** – The name given to the liquid oils found in the earth. Petroleum is a mixture consisting almost exclusively of hydrocarbons.

**Petroleum Ether** – A somewhat loose term applied to light petroleum fractions employed in the laboratory as solvents and in general boiling below 129°C.

**Petroleum Spirit** – Also known as naphtha. A volatile hydrocarbon having a flash point below 32°F.

**Petrox** – A multipurpose additive with the unusual ability of providing many desirable properties while avoiding side reactions. It is a complex organic, ash-free petrochemical in an oil carrier.

**PGP** – Polymer grade Propylene.

**pH** – A symbol for the measured strength of an acid or base. Pure water has a pH of 7. Acids have pH values from 0 to 7, and bases have pH values from 7 to 14

**pH Indicator** – A group of organic substances which turn different colors at different pH ranges. Used to indicate the strength of acid or alkaline solutions.

**Phase (Electrical)** – A term used to describe one component of electrical power.

**Phase (Liquid, Vapor)** – One of three states or conditions in which a substance can exist, i.e., solid, liquid, or gas (vapor).

**Phenolphthalein** – An organic compound employed in the laboratory as a pH indicator. It is colorless in acid solution and pink to red in alkaline solution.

**Physical Change** – A change that does not bring about the breakdown or restructuring of a substance's molecules.

**PI** – Pressure Indicator.

**PIC** – Pressure Indicator Control.

**Pickle (Pipe, Etc.)** – To clean or passivate by soaking in a solution (usually acid) to remove rust, scale, oil, etc.

**Pig** – A short tubular, brush or ball-like device pressured through pipes to clean them.

**Pigtail** – (1) A splice in electrical wires where a short piece of wire is brought out to connect to electrical devices. (2) A curved loop of piping used as a seal for pressure indicators.

**Pigtail Boxes** – The insulated metal boxes covering each of the pigtail headers and pigtails.

**Pilot** – An initiating device, such as a pilot burner on a furnace burner, or a pilot valve on a pressure safety valve.

**Pilot Plant** – An exploratory process unit operated on a scale somewhat larger than laboratory experiments, but smaller than plant scale operations.

**Pinch Back (Off)** – To partially close a valve.

**Pipe** – A long tube or hollow body used to conduct a fluid, gas or finely divided solid.

**Pipe Still** – A type of still in which the oil is heated as it passes through tubes; also called a tube still.

**Pipefitter** – A plant maintenance classification of work centered about pipe and/or tubing installation or removal.

**Piperack** – Support for overhead pipe.

**Pipette** – Analytical. A calibrated piece of glass labware used to measure the volume of a solution added to another solution.

**Piston** – That portion of a reciprocating pump, which receives force from the power medium and, in turn, transfers it to the fluid being handled.

**Pitch** – This term is not generally used in the petroleum industry, as it should refer only to the solid residues obtained in the distillation of coal tar, fatty acids, and similar substances.

**Plant** – A term used to describe the combination of units comprising a manufacturing location. Also used to designate a single unit.

**Plant Air** – The supplied air system used for pneumatic tools, air hoists, and other air operated equipment. Also called, “service” or “utility air”.

**Plant Procedures** – A term used to describe formal procedures followed plant wide.

**Plastic** – A material which may be molded into desired shapes while soft, and then hardened by heat, cooling, or exposure to air. Many plastics are synthetic polymers.

**Plate (Tray)** – Horizontal structure supported in a vertical cylindrical chamber and adapted for intimately contacting vapors or gases rising from below the structure to bubble through the retained liquid. The plate types include bubble cap, perforated plates, and valve types.

**Plate-Fin Exchanger** – A multi-pass exchanger made of aluminum alloys used in low temperature heat transfer service.

**Platforming** – A catalytic process (developed by UOP) for the upgrading of gasoline and naphtha for the production of aromatics. For motor fuel operation, straight-chain molecules in natural and/or straight run gasoline are converted to isomers and cyclic compounds, which have higher octanes. For aromatics operation the principal reaction is the conversion of naphthenes to aromatic compounds.

**PLC (Controller)** – Programmable logic controllers are microprocessors (minicomputers) used in industrial process control.

**Plenum Chamber** – A chamber at the top of a vessel into which all separator gases discharge and from which the collected gases exit through a common line.

**Plug Valve** – A valve that uses a tapered plug for the control element. On-off control can be accomplished with a quarter turn of the valve handle.

**Plumb Bob** – A pointed weight attached to a line used for vertical measuring.

**Pneumatic** – Of, pertaining to, or using air or wind.

**Pneumatic Oiler** – A device that emits oil into an air stream; used to lubricate air tools.

**Pneumatic Solenoid Valve** – An electrically powered valve which is used to interrupt or divert a pneumatic signal.

**Pointer** – A manually or pneumatically adjusted pointer on the chart that indicates the position of the set point.

**Poise** – A unit of absolute viscosity.

**Pollution** – Destruction or impairment of the purity of the environment.

**Polyethylene** – A solid polymer of ethylene; widely used in manufacturing and as an insulator (on account of its excellent dielectric properties).

**Polyisobutylene** – Solid material of a rubbery consistency produced by the polymerization of isobutylene. It is soluble in petroleum and is used as a VI improver in motor oils.

**Polymer** – A macro (large) molecule formed by the chemical union of five or more identical chemical units called monomers. The name means “many parts.”

**Polymerization** – The process, usually carried out with heat and a catalyst, in which a large number of small, similar molecules join to form a chain.

**Polystyrene** – A hydrocarbon plastic made by polymerization of styrene (dehydrogenated ethyl benzene). Used as an electrical and thermal insulation material.

**Popvalve** – A valve used to relieve or reduce pressure.

**Pore Diameter** – The average diameter of the pores expressed in angstrom units. Pore diameter is calculated from the surface area assuming the pores to be cylindrical in shape.

**Positive Displacement Pump** – A pump that moves a constant amount of liquid through a system at a given pump speed.

**Post Supported Trays** – Describes a method of supporting distillation column trays from each other.

**Potable Water** – Safe to drink and use for cooking.

**Pounds Per Hour (PPH)** – Usage per hour, measured in pounds.

**Pour Point** – Analytical. The lowest temperature at which a liquid, examined under prescribed conditions, will flow under the influence of its own weight.

**Pour Reversion** – The phenomenon whereby oils that have had a pour point inhibitor added will, after repeated cooling and heating, show a marked rise in pour point, as compared with that observed when the inhibitor was first added.

**Power Factor (PF)** – Ratio of energy applied to work to energy generated (electricity).

**PP** – Propane-propylene FCC product.

**PPM (Parts Per Million)** – An analytical term usually associated with water analyses for the detection of minute contamination. It equals 1 milligram per liter, or another way of stating it, one-thousandth of a gram in a thousand liters.

**PR** – Pressure Recorder.

**PRC** – Pressure Recorder Controller.

**Precipitate** – To cause to form large droplets or particles so they will drop out of the solution or atmosphere. To separate solid particles from a liquid as a result of a chemical or physical change.

**Precipitation Number** – A method for the extension of hard asphalt by centrifuging the oil with a specified solvent and noting the volume of insoluble material.

**Precipitator** – An apparatus in which droplets of liquid or solid particles are deposited from liquid, vapor or gas streams by physical means.

**Predictive/Preventive Maintenance** – Preventing a problem from occurring by observing trends in the equipment's condition over time. Based on the trend observed one can predict when the equipment will begin to have problems and make corrections to prevent the problem from occurring.

**Preheat** – Heat added to some substance prior to a process operation.

**Pre-Ignition** – The ignition of a charge in the cylinder of an internal combustion engine before the piston cycle has been completed; caused by hot spots in the cylinder. Also known as “knocking.”

**Premium Grade** – As applied to lubricating oils indicates oils intended to operate in conditions varying from moderate to severe. Premium grade lubricants should contain anti-oxidation and anti-corrosion inhibitors.

**Pressed Distillate** – Oil obtained after removing wax by cold pressing.

**Pressure** – The force exerted on a surface divided by its area.

**Pressure Distillate** – The light unstabilized petroleum distillate obtained from the cracking process.

**Pressure Distillation** – If the operative pressure of a distillation column is greater than atmospheric, it is called pressure distillation.

**Pressure Drop** – (1) The difference in pressure between two given points. (2) The decrease in pressure due to friction which occurs when a liquid or gas passes through a pipe, vessel, or other piece of equipment.

**Pressure Gauge** – A device used to measure pressure which has an element, such as a flexible curved tube (bourdon tube) or a flexible diaphragm, which deforms under fluid pressure.

**Pressure Profile** – A series of pressure reading points on a line or process system.

**Pressure Purge** – See "Purging."

**Pressure Rating** – The operating (allowable) internal pressure of a vessel, tank, or piping used to hold or transport liquids or gases.

**Pressure Regulating Valve** – A valve that releases or holds process-system pressure (that is, opens or closes) either by preset spring tension or by actuation by a valve controller to assume any desired position between full open and full closed.

**Pressure Regulator** – See "Pressure Regulating Valve."

**Pressure Relief** – A valve or other mechanical device (such as a rupture disk) that eliminates system overpressure by allowing the controlled or emergency escape of liquid or gas from a pressured system.

**Pressure Seal** – A seal used to make pressure-proof the interface (contacting surfaces) between two parts that have frequent or continual relative rotational or translational motion.

**Pressure Storage** – The storage of a volatile liquid or liquefied gas under pressure to prevent evaporation.

**Pressure Switch** – (1) A device which interrupts or diverts either an electrical or a pneumatic signal when motivated by a change in input signal pressure. (2) A switch that is actuated by a change in pressure of a gas or liquid.

**Pressure Tap** – A small, perpendicular connection in the wall of a pressurized fluid-containing pipe or vessel; used for connection of pressure-sensitive elements for the measurement of pressure.

**Pressure Test** – Testing of equipment using a gas or liquid under pressure as a testing medium.

**Pressure Transmitter** – A device that sends pressure measurement data to a controller, recorder or other indicator.

**Pressure Vessel** – An enclosed vessel in which a pressure greater than atmospheric is maintained.

**Preventive Action** – Not allowing a particular problem to occur.

**Prime** – To displace air or vapor from a pump with a liquid.

**Priming** – (1) A violent intermittent action resulting in the throwing of slugs of boiler water over with the steam, similar to the agitation when water is boiled in an open vessel. (2) Filling the liquid end of a pump with liquid to remove vapors present and eliminate the tendency to become vapor bound or lose suction.

**Priority-Precedence** – Relative importance.

**Process Safety Management (PSM)** – An OSHA standard, 29CFR1910.119, concerning Process Safety Management of highly hazardous chemicals.

**Process Side** – That part of the equipment which comes in contact with the organics being produced.

**Process Technician** – The new term used in place of process operator, to reflect the increased competence and skills required.

**Process Variable** – A varying operational condition that is associated or goes with a chemical processing operation such as temperature, pressure, flow rate, level, composition, etc.

**Product** – The desired end components from a particular process.

**Production** – Output, such as units made in a factory, oil from a well, or chemicals from a processing plant.

**Production Control** – The procedure for planning, routing, scheduling, dispatching, and expediting the flow of materials, parts, subassemblies, and assemblies within a plant, from the raw state to the finished product, in an orderly and efficient manner.

**Production Records** – Records of production and usage of material in the manufacturing of various products.

**Propane** – A straight chain hydrocarbon of the paraffin series (saturated) and having a boiling point of -54°F. The prefix “prop” means three, indicating a three-carbon compound.

**Proportional and Reset Action** – A controller response that is proportional to deviation, and to duration of deviation.

**Proportional and Reset and Derivative Action** – A controller that is proportional to deviation, duration of deviation, and the rate of change of deviation.

**Proportional Band** – The adjustment on an instrument controller that determines the change in controller output for a change in controller input or set point.

**Propylene** – A straight chain hydrocarbon of the olefin series (unsaturated) having a boiling point of -44°F. The prefix “prop” indicates three carbons in the compound.

**PRV (Pressure Relief Valve)** – An automatic pressure relieving device for overpressure protection of equipment.

**PSI (Pounds per Square Inch)** – Measurement of pressure above atmospheric pressure in units of pounds.

**psia** – An abbreviation for pounds per square inch absolute. A pressure measurement which includes atmospheric pressure.

**psig** – An abbreviation for pounds per square inch gauge, the pressure reading on a gauge (where atmospheric pressure is zero).

**PSV (Pressure Safety Valve)** – A device used to protect equipment from over pressuring.

**PTA** – Purified Terephthalic Acid (product made from paraxylene, used to make polyester)

**Puking** – A condition that occurs when the vapor pressure of a liquid is so great that it forces the liquid up a distillation tower or out the overhead line.

**Pulsation Bottles** – Provide additional volume of gas at the cylinder connections to help dampen the effect of gas pulsation.

**Pump** – A device that adds energy to liquids to increase pressure and permit flow.

**Pump Casing (Volute)** – The casing that covers the impellers and also contains the discharge outlet in a centrifugal pump.

**Pump Discharge** – (1) The discharge opening of the pump. (2) The pressure of the fluid leaving the pump.

**Pump Suction** – (1) The inlet side of a pump. (2) The pressure of the fluid entering the pump.

**Pump, Centrifugal (Volute Type)** – A pump that consists of one or more impellers mounted on a rotating shaft. The liquid enters the impeller at the center, or eye, and is thrown outward at high velocity into the volute of the pump casing. The function of the volute is to catch the impeller discharge and to convert velocity head into pressure head while moving the liquid to the discharge nozzle of the pump casing.

**Pump, Diaphragm** – A metering pump which uses a diaphragm to isolate the operating parts from pumped liquid in a mechanically actuated diaphragm pump, or from hydraulic fluid in a hydraulically actuated diaphragm pump.

**Pump, Duplex** – A reciprocating positive displacement pump that has two or more liquid cylinders, each having its own individual drive. Duplex pumps have a more steady discharge pressure than do simplex pumps.

**Pump, Multi-Stage** – A centrifugal pump which has two or more impellers mounted on the same shaft. The discharge from one impeller is conducted to the suction eye of the next impeller. This type is used to obtain high pressure.

**Pump, Oil** – A pump of the gear, vane, or plunger type, usually an integral part of an engine. It lifts oil from the sump to the upper level in the splash and circulating systems, and in forced-feed lubrication it pumps the oil to the tubes leading to the bearings and other parts.

**Pump, Positive Displacement** – See "**Reciprocating**" or "**Rotary Pump**."

**Pump, Power** – A reciprocating pump in which the liquid piston is driven by means other than direct acting steam piston and rods.

**Pump, Reciprocating** – A positive displacement type of pump consisting of a plunger or piston moving back with every stroke of a double acting pump. Liquid is pumped only when the piston is moving in one direction (every other stroke) in a single acting pump. With each stroke of the plunger or piston, a definite volume of liquid is pushed out through the discharge valves.

**Pump, Rotary** – A positive displacement pump used mainly to pump liquids that are either too viscous or too difficult to pick up suction with a centrifugal pump. There are many types of rotary pump designs, one of the most common being the gear type, in which two gears mesh and rotate toward each other within a very close fitting casing. The liquid is trapped between the gear

teeth and the casing and carried around to the discharge side of the pump. The meshing gear teeth prevent the liquid from returning to the suction side.

**Pump, Simplex** – A reciprocating pump that has one liquid cylinder on a single drive. Usually used on lube oilers, chemical injectors, etc.

**Pump, Vacuum** – A pump for drawing off gas from an enclosed chamber in order to lower the pressure below atmospheric.

**Pumparound** – A means of removing heat from the middle or lower part of a fractionating tower by pumping a drawn off component through exchangers and back into the tower.

**Purge** – (1) To displace the toxic or flammable vapors in a line or vessel with an inert gas. (2) The cleaning or removal of existing materials by displacing with another medium.

**Purity** – Free from contamination hence containing no other substances; for instance, a 99.5% purity chemical will contain 0.5% impurities.

**Pycnometer** – A calibrated container by which the specified gravity of a substance can be determined by weighing.

**Pyranol** – A proprietary term for a chlorinated hydrocarbon used as a substitute for transformer oil.

**Pyrene** – A proprietary type of fire extinguisher containing carbon tetrachloride as the active agent. Pyrene is also the name of a hydrocarbon to be found in coal tar.

**Pyrolysis** – Decomposition by heat. Usually, high very temperatures are involved.

**Pyrometer** – Any of a broad class of temperature-measuring devices. Originally designed to measure high temperatures, but now used in any temperature range; includes radiation pyrometers, thermocouples, and thermistors.

**Pyrophoric** – Capable of igniting spontaneously when exposed to air.

## Q

**Quality** – Conforming to all aspects of customer requirements.

**Quenching Oil** – An oil used in the heat treatment of metals, for the rapid cooling of the latter. Also known as tempering oil or hardening oil; the expression "quench oil" is also employed, with regard to cracking processes, for oil which is used to cool hot cracked oil rapidly, thus controlling the duration of the cracking process.

## R

**Rack Out** – To positively open an electrical circuit by rolling (or racking) out the breaker section of the switchgear.

**Rack, Steam** – A series of cams on a shaft that controls positions valves to the flow of steam to a turbine.

**Radial Bearing** – A bearing that supports a rotor and keeps a shaft from moving in a radial direction.

**Radiant Tube** – Tubes located in the firebox that receive heat primarily through radiant heat transfer.

**Radiation** – Energy in the form of electromagnetic waves. Examples are: light beams, x-rays, radio waves, microwaves.

**Raffinate** – That part of a liquid mixture remaining after soluble components have been extracted by a solvent.

**Raised Face** – The section of a pipe flange that is thicker than the bolt hole section; made to fit the gasket.

**Ramp** – A programmed rise in the temperature of a system.

**Ramsbottom Carbon** – A method for determining the carbon residue of a lubricating oil. A known weight of the oil is heated in a special bulb for 20 minutes at 550°C and the weight of residue determined. Also see "Conradson."

**Range** – The limits, from minimum point to maximum, for any operating condition or specification. Usually used to refer to temperature, pressure, level, specification, flow, or product purity.

**Rankine** – A temperature scale on which ice melts at 492°F and water boils at 672°F (e.g. the absolute temperature scale expressed in degrees Fahrenheit).

**Raschig Rings** – Small cylindrical rings used in packed-type fractionating, absorption and extraction towers to increase vapor to liquid contact due to large surface areas. They are available in the range 1/4" to 3 1/2" in diameter and made of metal, ceramic or plastic materials.

**Ratio** – The amount of one material or component in relation to another material or component.

**Ratio Control** – To regulate one variable in proportion to another variable.

**Raw Material** – A crude, unprocessed or partially processed material used as feedstock for a processing operation.

**RCRA (Resource Conservation and Recovery Act)** – Enacted into law in 1976. Its purpose is to protect human health and the environment. A secondary goal is to conserve natural resources. It completes this goal by regulating all aspects of hazardous waste management; generation, storage, treatment, and disposal. Referred to as cradle to grave.

**RdOI (Road Octane Index)** – A formula for predicting the road anti-knock quality of a gasoline.

**Reach Rod** – An extension on a valve wheel or stem so it may be operated from a few feet away.

**Reactant** – A chemically active substance that will undergo a chemical change, often in a reactor type vessel.

**Reaction** – The interaction of a material with itself or other materials to form one or more new compounds.

**Reaction Rate** – The amount of time required for a given amount of reactants to form a product.

**Reactivate** – To regenerate, renew or return to a usable condition.

**Reactive Chemical** – A material that will vigorously decompose, condense, polymerize, or otherwise react with itself in the pure state or in the presence of some other catalytic material, or which will react violently with water.

**Reactor** – A vessel utilized to mix two or more components together and initiate and sustain a desired, controlled reaction.

**Reactor Beds** – The areas of the catalyst in the reactors in which the thermocouples measure the catalyst and reactor temperatures of the converters.

**Reactor Effluent** – The product or products leaving a reactor.

**Readings** – Collecting of data related to the operating conditions; flow rates, temperatures, pressures, compositions, etc.

**Reagent** – A chemical used in the laboratory to detect, measure, or otherwise examine other chemicals.

**Reamur** – A temperature scale on which ice melts at 0°C and water boils at 80°C.

**Reboiler** – A tubular heat exchanger placed at the bottom of a distillation column or stripper to supply the necessary column heat. The liquid from the bottom tray passes through the reboiler where it is heated by indirect exchange with a hotter medium. The heated liquid and vapors then return to the bottom of the column.

**Receiver** – A vessel that “receives” a product.

**Receiver Gauge** – A pressure gauge which is actuated by the pneumatic output of an instrument. Its primary element usually has a range of 3 to 15 pounds per square inch, but its dial may be calibrated in the same units as the pneumatic transmitter sending the signal.

**Reciprocating** – Back and forth; up and down; in and out.

**Reciprocating Compressor** – A type of positive displacement compressor consisting of a cylinder that contains a piston that travels back and forth (reciprocates) in a cylinder containing suction valves and discharge valves.

**Recirculation** – The recycle of one or more of the components of a process (e.g. unreacted material back to the inlet of the reactor).

**Reclaimed Oil** – Oil, usually crankcase oil, which has been purified after use, usually by the user, so as to be fit for a further period or service. See "**Re-Refined Oil.**"

**Recorder** – A mechanical recording instrument for registering pressure, speed, flow, electrical units, etc.

**Recording Controller** – An instrument that provides a printed chart of variable readings and actuates a secondary device to effect the process.

**Rectification** – A form of distillation by passing vapor through liquid on a tray which has collected by condensing the vapor previously passing through the tray.

**Rectifier** – An electrical device for rectifying, as the half-wave rectifier which utilizes only half of each cycle of the alternating current or the full-wave rectifier which utilizes both halves of each cycle.

**Rectify** – The enrichment or purification of a vapor during the distillation process.

**Rectifying Section** – That portion of a fractionating tower located between the feed tray and the top of the tower. The area in which the overhead product is purified.

**Recycle** – (1) That portion of the products of a process, which is resubmitted to the process. (2) To route a stream back to a location where it came from.

**Reduce** – To remove light fractions by distillation.

**Reduced Crude** – A crude oil from which the more volatile fractions (usually up to and including gas oil) have been distilled off.

**Reducing Station** – A valve installation used to lower a pressure. Common in steam, air and methane service.

**Reduction** – Chemically speaking, the opposite of oxidation. (1) The removal of oxygen from a compound in a chemical reaction. (2) The acceptance of one or more electrons by an atom.

**Reference Fuel** – A fuel whose Octane (or Cetane) number is carefully determined, and certified by the manufacturer, for use in engine testing. Due to the decreased cost of the pure standards, reference fuels are now less commonly employed.

**Refine** – A term referring to the extracting of a final product out of a crude material which has several elements in it. It is pure enough to meet certain specifications.

**Reflux** – That portion of the condensed vapor that is returned to the top tray of a distillation column.

**Reflux Rate** – The flow rate of the reflux stream.

**Reflux Ratio** – The ratio of the amount of condensed vapor returned as reflux to the amount removed from the system as make.

**Reflux Tank or Drum** – A vessel containing condensed vapors that are pumped back to the top of the column as reflux and taken off as make.

**Reformat** – Catalytically upgraded straight-run gasoline with improved octane number.

**Reforming** – A variation of the cracking process for the manufacture of motor gasoline.

**Refractive Index (RI)** – Analytical. The refractive index of a substance is the ratio of the velocity of light in a vacuum to its velocity in the substance. In simple terms, it is a measure of the amount of refraction or "bending" which light rays undergo on passing through a transparent material, such as a hydrocarbon. Because of the ease with which it can be measured, and its constancy for pure substances under reproducible conditions, it is a useful aid in the identification of these substances.

**Refractometer** – An instrument used to measure the bending of light rays through a liquid, as compared to the ratio of the bending of light in air under the same conditions.

**Refractory** – A form of insulation used in high temperature boilers, incinerators, heaters, reactors, furnaces, etc. Generally two forms, brick and castable.

**Refrigerator Oil** – A lubricating oil produced for use in refrigerators and which is specially selected and refined so as to have a low pour point and be resistant to the action of refrigerants.

**Regenerated Catalyst** – Catalyst after the carbon has been burned off.

**Regeneration** – In general, any process by which a spent material is made available for reuse.

**Regenerator** – The vessel in which regeneration of used catalyst or other material takes place.

**Regular Grade** – Applied to lubricating oils, it indicates a straight mineral oil, not containing any additives which is satisfactory for use in internal combustion engines operated under moderate conditions.

**Regulate** – To control, direct, or to adjust for accurate and proper functioning.

**Regulator** – (1) Electrical: an automatic device for maintaining or adjusting the current, speed, etc., of a machine, transformer or the like. Machinery: a governor. Pneumatics- A balance valve for controlling pressure. (2) A valve which directly controls the flow of liquid or gas through a line; usually actuated by an instrument to control pressure, temperature, or flow conditions.

**Reid Vapor Pressure Test** – Analytical. A method for the determination of the vapor pressure of fuels for spark-ignition engines. It is of special importance in relation to aircraft fuels.

**RFG** – Reformulated Gasoline.

**Relative Catalyst Activity** – The amount of fresh catalyst which would produce the same conversion as the regenerated catalyst under equivalent conditions.

**Relative Density** – The modern term for specific gravity. The ratio of the weight of a metal or liquid compared to an equal volume of water; the ratio of weight of a vapor compared to an equal volume of air at specified temperatures

**Relative Humidity** – A measurement (%) of the amount of water contained in air relative to the maximum amount that can be absorbed.

**Relay** – (1) An electrical fixture used to perform certain control functions. (2) A device that is operated by a variation in the conditions in one electric circuit and serves to make or break one or more connections in the same or another electric circuit.

**Relief (Shift Workers)** – Oncoming shift who will take over duties from the shift on duty.

**Relief Valve** – An automatic pressure relieving device which opens in proportion to the increase in pressure over the set opening pressure. See "PSV."

**Remote/Local Set Switch** – A pneumatic or electric switch that is capable of transferring the set point of a controller from a local control to a remote control.

**Re-Refined Oil** – Oil, usually crankcase oil, which, after use has been completely re-refined, usually by the oil manufacturer, so as to comply in every respect with the specification of new oil of the same grade. The distinction between reclaimed oil and re-refined oil is important.

**Rerun** – To reprocess.

**Reset (Instrumentation)** – That function of an instrument which allows it to change its air output as the demand, or load, on the system changes.

**Reset Button** – An electrical switch designed to restore another switch to its original position when actuated.

**Residence Time** – The time a component or a mixture of components remains in a given vessel.

**Residue** – Material which remains after evaporation of a liquid. This is a criteria for determining the purity of various chemicals.

**Residuum** – The thick viscous oil left on removal of the more volatile fractions from crude or cracked petroleum.

**Resistance** – Resistance in electrical equipment is measured in ohms. One ohm is the amount of resistance where one volt produces a flow of one amp.

**Resistive Temperature Detectors (RTD)** – Temperature detector based on the relationship between the resistance of a wire and its temperature.

**Respirator** – Safety. A device worn over the mouth and nose to prevent the inhaling of harmful substances.

**Respiratory Protection Standard** – Legislation that requires employers to provide adequate margins of safety to anyone that may use respirators for protection against airborne contaminants.

**Restriction Orifice** – A fitting or plate installed to restrict the flow of material.

**Retention Pond** – A pond designed to capture contaminated rainwater runoff and prevent it from getting into a nearby body of water or soaking into the ground.

**Reverse Current Relay** – A protective relay to trip electrical switchgear in case the current should flow in the wrong direction.

**RGP** – Refinery Grade Propylene (65% Propylene)

**Rheostat** – A variable resistor, usually manually operated, to increase or decrease resistance in an electrical circuit.

**Rigger** – A plant maintenance classification of work involving the lifting/moving of heavy equipment, heat exchanger, bundles, etc.

**Ring Analysis** – A method of analysis for heavier hydrocarbon oils which indicates the proportions of aromatic rings and paraffinic side chains which are present. The method does not give the structure of the compounds present, merely the distribution of the carbon atoms among the groups.

**Ring and Ball** – The official British (IP) method for determining the melting point of bituminous materials.

**Ring Burner** – See “Burner Ring.”

**Ring Supported Trays** – Trays that are supported from rings welded to the inside wall of a distillation column.

**Riser** – (1) A pipe used to carry the catalyst in an FCCU to a higher level under the lifting force of an aeration medium such as air, steam or oil vapors. (2) Piping going into the side of a vessel or drum, or out the top in which a gas or liquid flows upward. For example: risers that go from waste heat boilers back to the steam drum. (3) One of a number of small, vertical pipes extending slightly above the surface of a bubble plate through which vapors from the next lower plate pass upward.

**Road Oil** – A moderately viscous petroleum residual oil which is employed in road construction.

**ROB (Remaining on board)** – The quantity of cargo left on a vessel on completion of discharge as determined at the discharge port.

**Rollout (Electrical Breaker)** – A circuit breaker in switchgear which operates on "plug-in" principle and can be rolled out on runners (rails) for maintenance or lockout.

**Root Cause** – The cause, which when identified, eliminates a problem forever.

**Rotameter** – A device which presents a continuously varying size orifice, proportional to the flow through it, by means of a tapered tube containing a float. The position of the float is proportional to the flow.

**Rotary Compressor** – A type of positive displacement compressor using a rotating motion to move the gas. There are three basic designs: screw compressor, sliding vane compressor, and lobe compressor.

**Rotating Shift** – The changing schedule worked by shift workers

**RTV** – A Room Temperature Vulcanizing silicone rubber used as a sealer on threads and gaskets. (Produced by General Electric Corporation).

**Run-Away Reaction** – An undesirable, uncontrolled reaction in which the instrumentation and/or personnel have lost the ability to control the reaction.

**Rundown** – The finished product or compound being pumped from a process unit to storage.

**Rundown Line** – Piping from a unit to storage tanks.

**Rundown Tanks** – Small tanks, sometimes called "day tanks," used to hold the current unit production that allow the product purity to be determined before the product is moved to large field storage tanks.

**Run-In (Break-In)** – (1) When a new or reconditioned piece of equipment is run under no load or lightly loaded conditions. (2) After prolonged shutdown to bring to operating temperatures. Generally applied to reciprocating machinery.

**Running Gauge** – A tank gauge taken when material is being pumped into or out of the tank.

**Running Tank** – A tank to which a product from a unit is continuously pumped or from which a unit is charged.

**Rupture Disc** – A pressure relief device that will break or tear if the pressure reaches its bursting limit. Usually a thin piece of metal or a composition material designed to rupture (split) at a given pressure.

## S

**SAE** – The (American) Society of Automotive Engineers.

**Safety** – Eliminating or avoiding hazards in your work area or work procedures.

**Safety Conscious** – The act of being critically aware of how safety relates to everything done on or off the job.

**Safety Equipment** – Various equipment used by an individual for personal protection. Examples: hardhat, coverall goggles, safety glasses, and safety shoes.

**Safety Inspection** – An inspection made for the purpose of finding and correcting unsafe items or conditions, thereby making the area safe to work in.

**Safety Meeting** – Meetings held for the purpose of stimulating interest in safety and dissemination of safety information.

**Safety Orientation** – A session held with all new employees.

**Safety Rules** – Rules established to prevent injuries and protect the lives of employees.

**Safety Shower** – A shower that can supply large quantities of potable water to wash chemicals, etc. off a person.

**Safety Valve Seal** – Usually a wire sealed with a piece of lead which is secured/attached to the shutoff valve below a safety valve. Note: Always seal in the OPEN position.

**Safety Valves** – See "PSV" – Are pressure relieving devices placed on equipment and pipelines operating under pressure. Their purpose is to protect the equipment and personnel from disastrous failures resulting from possible excess pressure. They are spring or weight loaded and set to open at a specific excess pressure. They are designated for specific installation as to material handled, material of construction, temperature, capacity, pressure, etc.

**Saline** – A solution containing small amounts of sodium chloride (salt) similar in composition to the fluids of the body. A saline solution is used to wash chemicals from the eyes or from abrasions and cuts to the skin.

**Salt** – (1) An ionic solid formed when the hydrogen of an acid is replaced by a metal or its equivalent. Can be produced as the neutralization product of an acid-base reaction. (2) Often used as the name of the most common salt, sodium chloride, which is ordinary table salt.

**Salt H<sub>2</sub>O** – See "Brine."

**Sample** – A representative portion of a material collected for analysis.

**Sample Tap** – A connection provided for collection of a sample.

**Sandblast** – To project sand at high speed by the use of compressed air for the purpose of removing scale, rust, or paint from metal.

**Sanitary Sewer** – Sewers originating in restrooms, sinks, or drinking fountains, that dispose of waste or used water.

**Saponifiable Matter** – That part of an oil which consists of substances which are decomposed on boiling with alkali: in practice saponifiable matter is almost always a fatty oil.

**Saponifiable Value** – The number of milligrams of potassium hydroxide required to hydrolyze one gram of a sample of an ester the material under test. In petroleum analysis the saponification value is used as a test for the presence of fatty oils. Very roughly the saponification value of the majority of common fats and oils can be taken as being 200.

**Saponification** – The process by which the fatty substances of an oil are combined with alkali to form a soap.

**Saturate** – To add one substance to another until no more can be absorbed, dissolved, or retained.

**Saturated** – To dissolve a sufficient amount of substance, either a solid or a gas, in a solution, so that no more of that substance can be dissolved.

**Saturated Hydrocarbon** – A hydrocarbon with only single bonds and which does not readily react with other substances.

**Saturated Index** – A number related to the scale-forming or corrosive properties of a water. It is expressed as the difference between the pH of the sample and the calculated saturation pH, which is a complex function of the total dissolved solids, calcium ion concentration, total alkalinity, and temperature. A positive index indicates that the water tends to deposit a calcium carbonate scale, whereas a negative index indicates a corrosive tendency.

**Saturated Solution** – A solution which has dissolved as much solute (that substance dissolved in a solution) as it can under the existing conditions. See "Saturated."

**Saturated Steam** – Purge steam at a temperature corresponding to its boiling point at the existing pressure; does not contain water droplets.

**Saturation Vapor Pressure (Thermo)** – The vapor pressure of a thermodynamic system, at a given temperature, wherein the vapor of a substance is in equilibrium with the surface of the substance's pure liquid or solid phase.

**Saybolt Chromometer** – One of several types of colorimeters used to determine the color of petroleum products.

**Saybolt Viscometer** – One of several types of commercial viscometers used for the determination of the viscosity of petroleum products.

**Saybolt Viscosity** – The time in seconds required for 60 cc of oil at given temperature to flow through a calibrated orifice.

**SC (Steam Condensate)** – The water which is formed when steam is condensed.

**Scaffold** – A temporary platform used to reach inaccessible areas and provide a safe platform to work from.

**Scale** – A mixture of mineral deposits, corrosion products, and other contaminants that precipitate out on piping and heat transfer surfaces.

**Scale Wax** – Paraffin wax which has been de-oiled but which has not been fully decolorized, i.e. it requires a further clay treatment.

**Scan** – Computer inputs, temps, pressures, flows are reviewed by the computer at specific time intervals or "scanned." The readout is the same until the next scan.

**SCBA (Scott Airpack, Survivair Pack)** – A self-contained breathing apparatus for use in contaminated areas or emergency situations.

**SCF (Standard Cubic Foot)** – A unit of volume under standard conditions, 60°F and 14.7 psia or 0°C and 1 atmosphere.

**SCFH (Standard Cubic Feet per Hour)** – A measurement of volume flow rate at standard conditions.

**SCFM (Standard Cubic Feet per Minute)** – A measurement of volume flow rate at standard conditions.

**Schematic** – A drawing of the relationship of all parts of a system; similar to a blue print.

**Screw Compressor** – A compressor consisting of two inter-meshing “screws” mounted in a horizontal plane. As the screws turn, the volume between the two screws becomes smaller and compresses any gas trapped between them.

**Screw Conveyor** – A conveyor consisting of a helical screw that rotates upon a single shaft within a stationary trough or casing, and which can move bulk material along a horizontal, inclined, or vertical plane. Also known as an auger, spiral, or worm conveyor.

**Screw Feeder** – A mechanism for handling bulk (pulverized or granulated solids) materials, in which a rotating helicoid screw moves the material forward, toward and into a process unit.

**Screw Pump** – A rotary pump that displaces liquid with a screw.

**Scrubber** – (1) A device for the removal or washing out of entrained liquid droplets or dust, or for the removal of an undesired gas component from process gas streams. (2) A piece of equipment designed to remove a particular component from a gas or vapor stream usually by counter current contact with a liquid.

**Scrubbing Column/Tower** – A vessel designed to act as a scrubber.

**Seal** – (1) Any device or system that creates a nonleaking connection between two mechanical or process-system elements; for example, gaskets for pipe connection, mechanical seals for rotating members such as pump shafts, and liquid seals to prevent gas entry to or loss from a gas-liquid processing sequence. (2) A tight, perfect closure or joint.

**Seal Flush** – Used in conjunction with mechanical seal to minimize or dilute possible product leakage. Also acts as a cooling medium.

**Seal Oil** – Oil used as the sealing medium to prevent the passage of fluid or gas from one chamber to another or to atmosphere.

**Seal Pot** – A small tank or vessel designed to relieve vacuum or pressure at a specific point by employing a liquid as the relief device; usually on the base of a column.

**Seal Tank** – A receptacle designed to prevent the return of air or gas into a pipe or container within specified pressure limits.

**Seal Weld** – A weld usually between a tube and a tube sheet to make it leak tight.

**Sealing Liquid** – A liquid used to fill the seal pots and lines connecting differential pressure taps and a meter, when it is necessary to prevent the fluid being measured from reaching the meter.

**Seat** – (1) Support or holder for a mechanism, or for a part of one. (2) To fit correctly in or on a holder, or prepared position, such as to seat a valve in a compressor.

**Sectional Valve** – See "Post Indicating Valve."

**Selectivity** – A term applied to describe the ability of a catalyst to optimize a desired yield. For example, a FCC catalyst with good selectivity is one that produces high gasoline yields, low coke and gas yields.

**Sensible Heat** – The amount of heat required to raise or lower the temperature of matter without a change of state.

**Sentinel Valve** – A small warning valve that makes a high-pitched sound when its set point is reached.

**Separator** – A device, usually a drum, employed for the division of a multiphase system (usually two-phase) into its constituent phases. May be used to separate vapors from liquids, or liquids of different densities.

**Separator Drum** – A synonym for "separator" but is more specifically applied to small, cylindrical-shaped containers. Drums usually contain internal valves or mesh to effect separation.

**Series** – A sequence of events or things coming one after another.

**Series Flow** – A term that describes the fluid flow that is directed into one piece of equipment before exiting and entering another.

**Servomotor** – A device (mechanical or electrical) which positions another device according to an input signal.

**Set Point** – (1) The point or place where the control index of a controller is set. (2) The point at which the controller is adjusted to regulate the process. The set point is defined in the same units of measurement as is the measured variable.

**Setting Point** – Analytical. (1) A form of cold test for oils, consisting of determining the temperature at which the oil ceases to flow under slight pressure. Setting point is generally lower than pour point. (2) The expression "setting point" is also used for the solidification temperature of paraffin wax.

**Sewer** – An underground collection system for liquid waste material, rain water, etc.

**Shaft** – Pump shaft: a round piece of steel, impeller mounted, suspended in bearings.

**Shaft Bow** – A deviation from a straight line. Can cause problems in turbines, compressors, gas turbines, and motors.

**Shale** – A type of rock from which hydrocarbon oil (shale oil) can be recovered by destructive distillation.

**Shell** – The outer housing of a heat exchanger; covers the tube bundle.

**Shell Side** – Referring to heat exchanger, the space or area between the tubes and outside shell.

**Shift** – Group of employees assigned to work the same hours.

**Shift Differential** – An amount of money added to an operator's earnings to compensate him for the inconvenience of working evenings/nights.

**Shock Bank** – Tubes located directly above the firebox in a furnace. They receive both radiant and convective heat.

**Shop Order (or Work Order)** – A work request or written request for work by Maintenance.

**Short (Electrical)** – Term used when two phases of electrical circuit get together or one phase goes to ground.

**Shut Down** – To stop operation. Also refers to the time period when a unit is not in operation.

**Shutdown Button (Device)** – A switch that stops supply of power (electricity, steam, etc.) to machinery or process equipment.

**Shutdown Point** – The point or place where, once the measured variable passes going either positively or negatively, a shutdown sequence is initiated.

**Side Make** – Any point between the base and top of a column where product is withdrawn from the system. It can be in either the liquid or vapor phase.

**Side Stream** – A term applied to the removal of product from the side of a tower or pipe.

**Sieve Tray** – A plate with a large number of small holes drilled in it. The tray has weirs and downcomers similar to the bubble cap tray, but no bubble caps. The vapor passes through the plate holes, through the liquid level maintained by the weir, and on to the next tray. Sieve trays allow for much higher column capacities for the same diameter vessel than do bubble caps.

**Sight Glass** – A measurement device attached to the side of a vessel in which the liquid level can be visually detected.

**Signal** – An electrical or pneumatic signal from the process equipment to a control instrument.

**Silica Gel** – A form of silica ( $\text{SiO}_2$ ) with a highly porous structure capable of adsorbing 40% of its weight of water from a saturated vapor. Used in gas drying.

**Single Pass** – When used in conjunction with heat transfer equipment, single pass means that the medium on the tube side flows in one direction. Multiple passes may be had on both shell and tube sides by a baffle arrangement.

**Single Phase** – Describes a type of low voltage electrical power used in residences and small industrial motors.

**Single Seal** – A single mechanical seal, either inside or out to keep product from going to the atmosphere.

**Single Stage Compressor** – A machine that affects overall compression of a gas or vapor from suction to discharge conditions without any sequential multiplicity of elements, such as cylinders or impellers.

**Single Stage Pump** – A pump in which the head is developed by a single impeller.

**Single Train** – See "Train."

**Skills** – Actions which demonstrate ability to perform tasks required in a job situation.

**Skimmer** – A device, usually metal, across the top of a lateral ditch or canal to catch floating objects and materials, or to skim the oil phase off the top of the water in the ditch.

**Skirt** – The section at the bottom of a tank or vessel that supports the tank or vessel and is bolted to the foundation.

**Slack Wax** – Paraffin wax obtained after it is separated from oil; but; still containing large quantities of oil which may be freed by sweating.

**Slave** – A control that receives its set point signal from some other device referred to as the master.

**Sleeve Bearing** – A bronze, babbitt, aluminum, or plastic sleeve supporting and restricting a rotating or reciprocating shaft.

**Sliding Vane Compressor** – A compressor consisting of a horizontal cylinder that has a solid steel rotor mounted off-center in the bore of the cylinder. The rotor has radial slots machined in it that contain “vaness” which can move in and out in the slots. As the rotor turns, the volume between vanes becomes smaller as it reaches the area where there is minimum clearance between the rotor and the cylinder.

**Slinger Rings** – Used in pumps or compressors that do not have force-feed lubrication. A ring that rotates with the shaft, taking oil from the sump and supplying it to the bearing.

**Slip** – The percentage of fluid that leaks or slips past the internal clearances of a pump over a given time.

**Slip Blind** – A piece of steel plate cut out to a pipe gasket size and used between two pipe flanges to prevent a flow or to isolate a line from a vessel.

**Slow Oxidation** – Oxidation, such as rusting, in which no noticeable light or heat is involved. Heat is produced, but slowly.

**Slow Roll** – The operation of a piece of rotating equipment at a speed substantially below its normal speed.

**Sludge** – Solid or semi solid matter produced by chemical processes.

**Slug** – A condition that occurs in a column when either the vapor or liquid handling capacity is exceeded at any point in the column.

**Slurry** – A fluid mixture of insoluble matter.

**Slurry Settler** – A vessel in which the fractionator bottoms/catalyst slurry is allowed to separate (settle). The clear overhead product is decanted oil.

**Soap** – Originally considered as the alkali metal salts of high molecular weight fatty acids. The term has since been generalized to include not only other metal salts of these acids, but salts of other acids which in solution exert a pronounced effect on the surface tension of the solvent.

**Soap Test** – Test method used to detect gas leaks. Leaking vapor passing through a liquid soap film produces bubbles.

**Soda Ash** – Sodium carbonate; a high-volume chemical used for many purposes throughout industry.

**Soda Based Grease** – A preparation of mineral oil and a soap containing soda or sodium hydroxide.

**Sodium Hydroxide (Caustic Soda, NaOH)** – A very strong base and common chemical used in the petrochemical industry.

**Soft Water** – Water, which has been softened. See "**Softening.**"

**Softening** – The removal of hardness, usually caused by calcium and magnesium ions, from water by ion exchange or by chemical treatment.

**Solenoid** – An electrical device that uses an electromagnet to activate a valve.

**Solid** – That state of matter which is characterized by a definite crystalline shape. Matter in its most concentrated form.

**Solubility** – The amount of solute that can dissolve in a given amount of solvent at given conditions.

**Soluble** – Capable of being dissolved in a solvent.

**Soluble Oil** – A mineral oil containing an emulsifier which makes it capable of mixing easily with water to form a metal cutting coolant.

**Solute** – The substance dissolved in a solution.

**Solution** – A homogeneous mixture of two or more components.

**Solvent Extraction** – The refining of petroleum oils by means of a selective solvent, which will dissolve certain undesirable constituents and will not appreciably affect the remainder.

**Soot Blower** – A device used in the convection section of a boiler or furnace to blow and remove soot from the outside of a convection tube.

**SOP (Standard Operating Procedure)** – A standard operating procedure is a set of directions or instructions that has a recognized and permanent value, and that defines the particular steps to take when a certain situation or condition occurs.

**Sour** – Foul smelling; a petroleum fraction or gas having a bad odor caused by mercaptans or by hydrogen sulfide.

**Sour Gas** – Natural gas containing hydrogen sulfide or carbon dioxide.

**SOV** – Solenoid Operated Valve.

**Space Velocity** – The relationship between feed rate and reactor volume in a flow process; defined as the volume or weight of feed (measured at standard conditions) per unit time per unit volume of reactor (or per unit weight of catalyst.)

**Span** – The area in between two limits in which a quantity or value is measured.

**Spare** – A back-up device that can be put in service if the primary device should fail. Usually, pumps in critical service have spares.

**Specific Gravity** – The ratio of the density of a substance to the density of another substance at a standard temperature and pressure. Liquids and solids are compared with water, and gases are compared with air.

**Specific Heat** – Quantity of heat required to increase a unit volume of a substance 1°F or 1°C.

**Specs** – Abbreviation for specifications; the quality limitations for a product.

**Spent Acid** – A weak acid solution that has been used and is usually contaminated with a process by-product.

**Spent Catalyst** – Catalyst after its activity has decreased to an unacceptable level.

**Spill** – To accidentally release a substance from lines, equipment, or areas.

**Spindle Oil** – Lightest lubricating oil fraction used for lubrication of small high-speed bearings of machine tools.

**Spiral Wound Gasket** – A gasket that contains a spiral wound metal. These gaskets are usually impregnated with a filler of conventional gasket material such as teflon or asbestos.

**Splash Bars** – A device used in a cooling tower to break-up and re-direct the flow of falling water.

**Split Tube** – A crack or break in a heater or exchanger tube due to mechanical failure, corrosion or overheating.

**Splitter** – A fractionating tower for separating two close-boiling chemicals such as propylene (overhead) from propane (bottoms).

**Sponge Oil** – The oil used in an absorber tower for absorbing condensables from wet gas.

**Spontaneous Combustion** – Active burning started by the accumulation of heat resulting from slow oxidation; autoignition.

**Spray System** – A fixed pipe system with open spray nozzles which sprays water on equipment for fire extinguishment and equipment protection.

**Sprinkler System** – A fixed pipe system, with closed sprinkler nozzles that will spray water from any nozzle when heat from a fire melts the soldered orifice cover on the nozzle.

**Spud** – A group of gas filled-tubes in a natural gas burner.

**Spud Burner** – A lance type nozzle, usually installed in a circle, with holes or orifices in the ends of the lance. Used to introduce fuel into a boiler, incinerator or heater.

**Spud Wrench** – Usually a single open-end wrench with pointed opposite end.

**SRN (Straight Run Naphtha)** – The distilled naphtha fraction from a crude still.

**Stability** – The quality, state, or degree of being stable (resistance to chemical change).

**Stability Index** – The stability index is a method of characterizing the scale forming capacity of a given water, quantitatively. It is closely related to the "Saturated Index" of the water.

**Stabilize** – To separate light gases from petroleum or gasoline.

**Stabilizer** – A tower that separates high vapor pressure hydrocarbons from gasoline so that the gasoline will meet vapor pressure specifications.

**Stack** – Cylindrical outlet at top of a furnace which remove flue gas from the furnace.

**Stagnant** – Motionless, not flowing or moving, such as stagnant water.

**Stainless Alloy** – Any of a large and complex group of corrosion-resistant iron-chromium alloys (containing 10% or more chromium), sometimes containing other elements, such as nickel, silicon, tungsten, and niobium. Commonly known as stainless steel (SS).

**Standard Operating Conditions** – Conditions that do not change routinely. They have a recognized and permanent value. In operations, it is desirable to maintain a certain condition constant for an extended period of time. This would then be a standard operating condition.

**Standby** – A machine or equipment which is in a state of readiness for use, but which is not presently needed.

**Start-Stop Switch** – A pushbutton control usually located at a motor, to start and stop the motor.

**Start-Up** – To bring into operation a piece or pieces of equipment or a process facility.

**Statistical Process Control (SPC)** – Statistical procedures that keep track of a process in order to reduce variation and improve quality.

**Static Energy (Potential Energy)** – Energy at rest.

**Static Head** – Pressure of a fluid due to the height of fluid above some reference point.

**Static Pressure** – Acting by mere weight without motion; bodies or forces at rest or in equilibrium.

**Steam** – Water vapor, or water in its gaseous state. The gas or vapor into which water is converted when heated to the boiling point.

**Steam Boiler** – A pressurized system in which water is vaporized to steam by heat transferred from a source of higher temperature, usually the products of combustion from burning fuels. Also known as steam generator.

**Steam Chest** – Area where steam enters a steam turbine.

**Steam Distillation** – The introduction of steam into a still during petroleum distillation to lower the boiling point of the oils and to minimize cracking.

**Steam Drive** – Any device which uses power generated by the pressure of expanding steam to move a machine or a machine part.

**Steam Drum** – The top drum of a boiler where all of the generated steam gathers before entering the separating equipment.

**Steam Hose** – A hose used only for low-pressure steam service, with special fittings.

**Steam Jet** – Essentially a steam nozzle that discharges a high velocity jet and used to create a particular pattern of spray steam.

**Steam Jet Ejector** – A device using steam as the motive force which lifts a liquid from a sump or creates a vacuum. Also called a vacuum jet.

**Steam Strainer** – A mechanical device that filters solid impurities from steam.

**Steam Tracing** – Tubing that is installed adjacent to a pipeline and is enclosed with the pipeline by insulation. Steam is then passed through the tubing providing heat.

**Steam Trap** – A device used to remove condensate from the steam system or piping.

**Steam Turbine** – (1) A prime mover for the conversion of heat energy of steam into work on a revolving shaft, utilizing fluid acceleration principles in jet and vane machinery. (2) A turbine that is driven by the pressure of steam discharged at high velocity against the turbine vanes.

**Steam, Desuperheated** – Steam cooled to just above the condensation point.

**Steam, Dry** – Steam that does not contain water droplets.

**Steam, Superheated** – Steam heated above the saturation temperature at a given pressure.

**Steam-Exhaust** – Steam that has already been used for some purpose as from turbine exhaust.

**Steam-Live** – Steam that does not contain entrained water droplets (usually high pressure).

**Steam-Wet** – Steam containing entrained water.

**Steel** – An iron base alloy, malleable under proper conditions, containing a small amount of carbon.

**Stem** – A metal rod attached to the hand wheel and flow control element in a valve.

**Still** – A piece of equipment in which distillation takes place. It permits the use of countercurrent flow of the vapor and liquid phases.

**Stoichiometry** – The part of chemistry dealing with the composition of substances; more particularly with the determination of combining proportions or chemical equivalents.

**Stopcock** – A valve-type device used in laboratory equipment; similar to plug valve.

**Straight Run** – A material produced by distillation of crude oil without appreciable cracking or alteration of the molecules in the product.

**Strainer** – A device used to remove entrained solids from a process stream.

**Strapping Gauge Tape** – A steel measuring tape with a plumb bob attached to the tape's free end. The tape is used to measure liquid levels in tanks and vessels.

**Strapping of Tank** – To measure the amount of liquid in a tank; to prepare a table of tank height versus capacity.

**Straw Oil** – A term used to designate gas oil employed for this absorption of light oils from town gas.

**Stress Cone** – A terminator for hi-voltage (above 5000 volts) which is necessary to keep down corona effect, which if not controlled, can cause the cables to blow up.

**Stress Cracking** – The attack of chloride ions (usually from sodium chloride) on stainless steel resulting in cracks on the stainless steel used in process equipment.

**Strip Chart** – Chart on which a measured variable is continuously recorded.

**Strip Heater** – An electric heater used to keep equipment warm and dry. Used mainly in switchgear and large motors and generators.

**Strippable Carbon** – The amount of carbon associated with the hydrocarbons that are entrained with the catalyst as it leaves the stripper in a FCCU. It is a function of the steam stripping rate and the catalyst circulation rate and is independent of conversion, feed stock quality and catalyst quality.

**Stripper** – An evaporative device for the removal of vapors from liquids; can be a distillation column, a vacuum vessel, or an evaporator.

**Stripper (FCCU)** – The bottoms section of the reactor that the spent catalyst enters where it is met by counter-current flow of steam that removes the hydrocarbons from the catalyst.

**Stripping Section** – The section of a distillation tower below the feed tray where the heavier components are located.

**Stroke** – (1) To move a motor valve from 0 to 100% and back. (2) The distance a reciprocating engine or compressor will travel through a 180° rotation of crankshaft.

**Stroke a Valve** – To test a control valve to see whether it can be accurately controlled. To stroke a valve, the Board Operator adjusts the valve controller in 25% increments. The outside operator checks to make sure that the valve responds to the controller.

**Structural Formula** – A system or notation used for chemical compounds in which the exact structure is given in schematic representation.

**Structure** – The steel works are used to hold up or support an area of elevated equipment. Usually has stairs or ladders leading to the different levels from the ground.

**Stuffing Box** – The area around a moving shaft or stem that contains packing material designed to prevent the escape of process fluids.

**Sub Cool** – The further cooling of condensed material to the desired temperature.

**Sub Station** – An assembly of equipment in an electric power system through which electric energy is passed for transmission, transformation, distribution, or switching.

**Subcooler** – A piece of equipment designed to cool liquids, after they have been condensed, to a lower temperature. A heat exchanger.

**Sublimation** – The transformation of a solid to a vapor or, under certain conditions, condensation of vapor to the solid state. It differs from distillation in that the solid does not pass through the liquid state. It is used to purify various substances. An example is carbon dioxide, (dry ice).

**Substance** – Physical matter. A substance may be a solid, liquid, or gas.

**Suction** – Normally refers to the inlet side of a pump, compressor, fan or jet. Also the pipe duct that forms the suction.

**Suction Head** – The height of a column of liquid that would exert a pressure equal to the suction pressure.

**Suction Line** – The pipe or tubing feeding into the inlet of a fluid-impelling device (for example, pump, compressor, or blower).

**Suction Pressure** – The pressure in the line leading into the pump.

**Suction Pump** – A pump that raises, liquids by the force of atmospheric pressure pushing it into a partial vacuum created by a piston on the upstroke.

**Suction Screen** – Normally a cone shaped or flat metal strainer in the suction line to a pump.

**Suction Stroke** – The piston stroke that draws a fresh charge into the cylinder of a pump, compressor, or internal combustion engine.

**Sulfide** – Sulfur combined with another element. Example: hydrogen sulfide, H<sub>2</sub>S.

**Sulfonic Acids** – A group of organic acids containing the sulfonic group formed as by-products in the refining of petroleum.

**Sulfur** – A non-metallic element, found throughout the world.

**Sulfur Recovery** – A catalytic process for the production of sulfur from hydrogen sulfide gas (H<sub>2</sub>S). The gas is burned in air where one-third is converted to sulfur dioxide (SO<sub>2</sub>). The

resulting mixture of H<sub>2</sub>S and SO<sub>2</sub> is charged to a converter where it reacts to form sulfur and water.

**Sump** – A pit or tank which receives and temporarily stores drainage at the lowest point of a circulating or drainage system.

**Sump Pump** – A pump used to remove accumulations of liquid from a sump pit.

**Superficial Velocity** – The rate at which the gas passes through a vessel. It is found by dividing the gas flow in cubic feet per second by the cross sectional area of the vessel in square feet.

**Superheat** – Heat added to a vapor above the dew point at its boiling point at the existing pressure. The term is also applied to the temperature difference between the vapor and its boiling point. Also used to denote the amount of extra heat contained in superheated steam.

**Superheater** – A heating apparatus (usually tubes) which imparts to a material more heat than is required for vaporization. A coil or pipe section through which steam from a drum pass to be superheated.

**Surge** – A sudden change in a flow, liquid level, temperature, pressure, etc. Normally refers to electrical or to compressor train malfunction. Electrical surge usually consists of a large variation in voltage or amperage in a system. Damage is relative to the magnitude of the surge. When compressed fluid flows back toward the compressor, rather than away from it, it is said to be in "surge."

**Surge Chamber, Drum, or Tank** – A vessel or accumulator which serves as a reservoir for liquid flowing through a system.

**Surge Pot** – Specifically, a small metal cylinder with a rubber bladder inside with pressure between the bladder and the pot. It is placed on the discharge line of a pump to hold the pressure constant. General: A greatly increased section of line, as a small tank that provides volume to smooth out the flow.

**Swap** – Agreement to exchange cash flows in the future as part of a prearranged formula.

**Sweet** – (1) Not sour odor. (2) For the Doctor Test; having a negative result, which means having low concentrations or no sulfur compounds present.

**Sweet Gas** – Natural gas that does not contain hydrogen sulfide or carbon dioxide.

**Sweetening** – The removal or conversion of undesirable hydrogen sulfide, mercaptans, and elemental sulfur contained in light distillates or gasoline.

**Swing Check Valve** – Moving through the line, pressure automatically swings the disc open to full flow as in a gate valve. Should flow reverse, the reversed pressure and the disc weight close the disc against the seat, and backflow is stopped. Flow through swing checks is in a straight line and without restriction at the seat, similar to the gate valve. This similarity in effect on flow is the reason for generally using swing checks in lines in combination with gate valves.

**Swing Line** – An internal section of pipe which may be raised or lowered for pumping into or from a tank.

**Switch** – To change from one to another, usually involving pumps. This can relate to other equipment that is duplicated and can be alternated in service. Example: Switch from the north pump to the south pump. Switch from a dryer that is in service to a fresh dryer.

**Switchgear** – A piece of electrical equipment that stops or allows the flow of electricity.

**Switch Rack** – (1) A panel containing electrical switches and breakers for motors and pumps.  
(2) A central location for the termination of pipes, where any pipe can be connected to another by the use of a flexible metallic hose.

**Switch Room** – A room or building containing nothing but electrical switches and breakers for motors and pumps.

**Switch Tanks** – To switch material flow from one tank into another.

**Symbol** – Letters used to designate chemical elements, equipment classes. Figures used to designate types of equipment.

**Synchronize** – The act of connecting two electrical generating systems together. It is imperative that both systems have identical electrical characteristics at the time they are connected together.

**Synchronous** – In step or in phase, as applied to circuits, motors, devices, or machines.

**Synthesis** – The chemical combination of various substances to form a new substance.

**Synthesis Gas** – A gas used to synthesize a product. A gas that is reacted to form a product.

**Synthesis Gas (Syn-Gas)** – A mixture of gases prepared as feed-stock for a chemical reaction, for example, carbon monoxide and hydrogen to make hydrocarbons or organic chemicals.

**Synthetic Lubricant** – A lubricant produced by synthesis rather than by extraction or refinement.

## T

**Tag-Out** – Procedure of tagging valves, breakers, etc. in preparation of equipment for maintenance.

**Tag-Robinson Colorimeter** – An instrument used to determine the color of oils.

**Tails** – The process flow that is taken off the bottom of a column, sometimes referred to as "bottoms."

**Tails Flow** – The flow from the bottom of a column to another column or vessel.

**Tank** – A vessel. A large container for holding liquid or gas.

**Tank Car (T/C)** – A railroad car with a tank built on it, used for hauling liquids or liquefied gases.

**Tank Farm** – An area with tanks for storage materials.

**Tank Log** – A list of tanks showing their levels, temps, etc.

**Tank Truck (T/T)** – A truck with a tank on it for hauling liquid or liquefied gases.

**Tape Gauge** – A tank gauge taken with a tapeline.

**Tar** – A somewhat loose term applied to viscous oil residues. It is generally restricted to nearly black organic residues from distillation operations other than those connected with petroleum.

**TDP** – Toluene Disproportionation (to Xylene and Benzene)

**TEA (Triethanolamine)** – Used in amine treating. To remove contaminants from streams.

**Teflon** – Polymerized tetrafluorethylene; a chemically resistant material used for gaskets, packing, and coatings.

**Temperature** – The degree of hotness or coldness measured on a definite scale. See "Centigrade and Fahrenheit."

**Temperature Control** – Temperature is the control variable from which a control output is determined. The output, in turn, controls a heating or cooling medium to maintain the desired temperature.

**Temperature Gradient** – The difference in temperatures between two points; i.e. ( $\Delta T$ )

**Temperature Profile** – A series of temperatures taken at various points across process equipment.

**Tempering** – Heat treatment of hardened steels to temperatures below the transformation temperature range, usually to improve toughness.

**Temporary Hardness** – Refers to that amount of calcium and magnesium in solution as bicarbonate.

**Tension Load** – External forces acting on a structure. Tension tends to stretch a component, while compression forces tend to shorten the component.

**Thermal Cracking** – Process of decomposing crude oil by heating it to a high temperature. Initially, the aim of thermal cracking processes was to increase the yield of gasoline from a given crude by decomposing the heavier, less valuable fractions. For this purpose the more efficient and better-controlled catalytic cracking processes have replaced them. However, the production of low molecular weight olefins (ethene, propene, butenes) by thermal cracking of refinery gases, naphthas, etc., is increasing in importance to provide raw materials for the petrochemical industry. This is the process used by ethylene units around the world.

**Thermal Shock** – Sudden expansion or contraction of a material when subjected to a large temperature change. This can introduce stresses in the material being shocked and cause it to fail.

**Thermal Value** – Calories per gram or BTU per pound produced by burning fuels.

**Thermistor** – A temperature sensor made up of a ceramic material having a resistance sensitive to changes in temperature.

**Thermocompressor** – A piece of equipment that uses high-pressure steam to raise a lower pressure steam to a higher pressure.

**Thermocouple** – A means of measuring temperature using parallel wires of different metals. The wires are coupled together at the end near the temperature to be measured. The voltage potential created by dissimilar metals increases as temperature rises and decreases as temperature falls. This rise and fall is measured, calibrated and indicated on a meter or dial.

**Thermometer** – An instrument for determining temperature consisting typically of a glass bulb attached to a fine tube of glass with a numbered scale and containing a liquid (as mercury or colored alcohol) that is sealed in and rises and falls with changes of temperature.

**Thermopile** – Several dissimilar metals arranged alternately which generate an electric current when the junctions are heated; more sensitive than a thermocouple.

**Thermostatic Steam Trap** – A type of steam trap that is controlled by temperature changes.

**Thermowell** – A tube housing, one end closed and inserted into a vessel, pipe, or furnace, as protection for a thermocouple or temperature bulb.

**Thief** – A device for drawing samples of oil from a tank at various levels.

**Thief Rod** – A rod used to measure the depth of water in a tank.

**Three-Way Valve** – A valve that has three ports.

**Threshold Limit** – A safety and biological term referring to the level of exposure, either by breathing or skin contact, of chemical compounds which may injure a human or animal's health. Limits have been determined for the amount of material, usually measured in parts per million.

**Throttle** – To control a flow through a line with a valve; usually refers to the manual operation of a hand valve.

**Throttling** – To regulate fluid flow, especially below the maximum flow rate.

**Thrust** – The force exerted endwise through a shaft to give forward motion.

**Thrust Bearing** – A bearing that prevents axial movement of a shaft.

**TIC** – Temperature Indicator Controller.

**Time Card** – Cards on which the hours worked by employees are recorded.

**Tintometer** – An instrument used for determining the color of oils.

**Titrate** – To perform a titration.

**Titration** – A method to determine volumetrically the concentration of a substance in solution by adding a standard solution of known volume and strength until the reaction is completed. Completion of the reaction can be indicated by a color change, conductivity change or a precipitate.

**Top Layer** – The liquid withdrawn from the top of a vessel or decanter after the heavier portion of the liquid has been allowed to settle to the bottom.

**Topped Crude** – Crude petroleum from which the more volatile fractions (usually up to and including gas oil) have been removed by distillation.

**Topping** – The distillation of crude oil to remove light fractions only.

**Topping Up** – This is an expression used on tankers to denote the process of finishing off loading a set of tanks. Frequently tanks are filled to 98% capacity. The bulk of cargo is loaded into the tanks collectively, and the final 3 or 4 feet is loaded into the set of tanks at the end. It is a period of time when tank overflows are most likely to happen, and is therefore a period when ships frequently ask for a reduced loading rate, and on multi-product ships, for the loading of another grade to be suspended. Both are quite legitimate in the interests of reducing pollution risks.

**Torque** – The moment of force, a measure of its tendency to produce torsion and rotation about an axis. Broadly, a turning or twisting force.

**Total Feed** – All feed to the unit including any that is recycled into the feed from within the unit.

**Total Head** – The difference between the suction head and the discharge head.

**Total Organic Carbon (TOC)** – An analytical test that measures impurities due to organic contamination.

**Total Reflux** – When all overhead vapors are condensed and returned to the column as reflux so that no distillate product or make is withdrawn, the column is said to be operating under total reflux. Under total reflux, no feed is introduced to the column nor bottoms withdrawn.

**Tower** – A column; a vertical, cylindrical vessel with trays or packing.

**Toxic Gas** – A gas that has poisonous or injurious effect on the human body.

**Toxic Gas Alarm** – Is triggered when a dangerous quantity of toxic (harmful) gas is released to the atmosphere.

**Toxicity** – The ability of a substance to cause injury to living tissue.

**TR** – Temperature Recorder.

**Tracer** – A chemical entity, almost always a radioactive isotope, added to reacting compounds in a chemical process, which can be traced through the process by appropriate detection methods.

**Train** – Components of a system. A series of related equipment components, all in an orderly procession or in a line, necessary to accomplish a specific task, i.e., distillation or compressor train.

**Transducer** – A device to change one form of energy to another, as electric to pneumatic, electric to mechanical, etc. Used primarily in instrumentation.

**Transfer** – To move material from one place to another, usually done with a pump.

**Transfer Line** – A term used to describe a pipeline used to move (or transfer) process material from one point to another. Frequently used to designate the effluent line from a furnace.

**Transformer** – There are two common types of transformers; one changes the current potential (voltage) up or down, the other changes the type of current as from alternating current to direct current.

**Transformer Oils** – Highly refined thin lubricating oils employed as cooling and insulating media in electrical transformers.

**Transmitter** – A device that issues an intelligible, usually modulated, signal. Its source of power can be either pneumatic or electronic. Its input signal, which modulates or controls its output is usually a physical force, i.e., pressure, differential pressure, electrical power.

**Trap** – A device installed in a line to remove condensate and to conserve steam. It can be thermostatic, disc, float or bucket.

**Tray** – A part of a fractionation tower containing a liquid level. Vapors rise through the liquid to form a dynamic equilibrium mixture. The number of trays varies with the degree of fractionation required.

**TRC** – Temperature Recorder Controller.

**Treater** – Equipment for removal of mercaptans, hydrogen sulfide, absorbed water, salt and other undesirable constituents from gas or liquids.

**Trend** – A direction in a set of statistical data at a particular time. Also, a computer program which allows process variables to be monitored for a set period of time.

**Trim** – The control element of a valve assembly.

**Tri-Methyl Pentane** – See "Iso-Octane."

**Trip** – Term used when a piece of electric or mechanical gear is stopped either manually or automatically.

**Trip Initiator** – A piece of equipment that causes a system to shut down automatically if the processing limits are violated.

**Trip-Throttle Valve** – An inlet valve on a piece of equipment, most typically a steam turbine. The valve can be slowly opened or closed (this is the throttling section) or it can be closed quickly (this is the trip section).

**Troubleshoot** – To find the cause of a problem and correct it.

**Troubleshooter** – A person seeking solutions to problems.

**TSCA** – Toxic Substance Control Act.

**Tube Bundle** – A group of fixed parallel tubes, such as is used in a heat exchanger. The tube bundle includes the tube sheets, the tubes, the baffles, and the spacer rods.

**Tube Sheet** – A flat plate to which the tubes in a heat exchanger are fixed.

**Tube Side** – A term used to describe the flow through the tubes in a heat exchanger.

**Tube Still** – A still in which heat is applied to the oil while being pumped through a coil or series of coils or tubes arranged in a suitable firebox.

**Tubing** – Small copper or stainless steel pipe used extensively in instrument work. Plastic tubing is also used. A seamless type of steel pipe is referred to as tubing.

**Turbidity** – Not clear, muddy, containing particles and extraneous matter.

**Turbine** – A machine for producing power. Activated by the expansion of steam on a series of curved vanes on an impeller attached to a central shaft.

**Turbine Oils** – Oils which are employed in the lubrication of steam turbines. They must possess a very rapid rate of separation from aqueous emulsion.

**Turnaround** – The shutdown period for an operation unit, usually for mechanical reconditioning. The period from the end of one run to the beginning of the next, i.e., the off-stream to on-stream period.

**TVO (Tractor Vaporizing Oils)** – A special type of kerosene used in spark-ignited agricultural tractors. Fast becoming obsolete for this use, since practically all modern tractors are diesel powered.

**Two-Stage** – The compression of gas in two stages. Accomplished by the gas passing through a low-pressure cylinder for the first stage compression, then through an intercooler, a scrubber, and finally, a high-pressure cylinder for additional compression. This is usually done in two separate

cylinders; however, it can be accomplished by a step-cylinder or tandem cylinder having two different sized pistons on one rod and in one cylinder.

## U

**Ultimate Analysis** – An expression to denote the analysis of a substance into its constituent elements. In the case of petroleum products, this consists in the determination of the proportions of carbon, hydrogen, oxygen, and (sometimes) nitrogen present. The process is somewhat complicated and is of most importance in the case of fuel oils in connection with the analysis of the combustion gases.

**Ultra-Fining** – A patented process for catalytically removing sulfur from petroleum streams.

**Ultra-Forming** – A patented process of for catalytically upgrading gasoline components to a higher octane.

**Uncontrolled Reaction** – A reaction which takes place at a rate such that heat evolution and/or pressure build-up cannot be controlled without emergency measures.

**Undercurrent Relay** – A protective relay that senses a low current flow and in turn operates the proper electric equipment.

**Unit** – An integrated group of process equipment used to produce a give product or products. All equipment contained in a department.

**Unreacted** – A component of a reaction which passes through the reaction unchanged.

**Unsaturated Compound** – An organic compound in which carbon atoms are joined by double or triple bonds, which makes them more reactive than saturated compounds.

**Unsaturated Solution** – A solution which can still dissolve more solute at the given temperature.

**Unsaturation** – Hydrocarbons belonging to the aliphatic series possessing one or more double or triple bonds which have the property of taking on addition atoms.

**Unstable Compound** – One that readily decomposes or changes into another compound.

**Upset** – To disturb the normal unit operation.

**Upstream** – The location of objects in the incoming flow. Materials on the inlet side of any given piece of equipment are upstream of that particular piece of equipment.

**USCG** – United States Coast Guard.

**Utilities** – One of the non-process (support) facilities for a manufacturing plant; usually producing or responsible for steam, cooling water, de-ionized water, electric power, refrigeration, compressed and instrument air, and effluent treatment.

**Utility Drop** – Central locations or stations throughout a unit where plant utilities are readily accessible to Operators and Maintenance personnel. For example: water, nitrogen, air, and steam.

**Utility Hose** – A hose used for air, nitrogen, or water service, with special fittings.

# V

**Vacuum** – A space entirely void of matter. Subatmospheric pressure.

**Vacuum Breaker** – Any device used to prevent a vacuum from occurring in a piece of equipment.

**Vacuum Breaking Valve** – A valve which acts inversely to a pressure relief valve; if the exterior pressure is higher than the pressure within a vessel the valve will open to equalize the pressures.

**Vacuum Distillation** – A term referred to when a distillation is conducted at pressure less than atmospheric. See "**Vacuum.**"

**Vacuum Gauge** – A device for measuring pressure below atmospheric pressure.

**Valence** – The number of hydrogen atoms an atom will combine with or replace; i.e., a carbon atom combines with four hydrogen atoms and therefore carbon is said to have a valence of four.

**Valve** – Any of numerous mechanical devices by which the flow of liquid, gas (as air), or loose material in bulk may be started, stopped, or regulated by a movable part that opens, shuts, or partially obstructs one or more ports or passageways.

**Valve (3-Way)** – A valve (usually ball or plug type) having three ports usually flowing into bottom and out either of the other two, depending on handle setting.

**Valve, Angle** – A type of valve which effectively utilizes globe valve seating principle while providing for a 90 degree turn in piping. It is less resisting to flow than the globe valve it displaces. Requires fewer joints; saves make-up time and money.

**Valve Arrester** – A type of lightning arrester which consists of a single gap or multiple gaps in series with current-limiting elements; gaps between spaced electrodes prevent flow current through the arrester except when the voltage across them exceeds the critical gap flashover.

**Valve, Ball** – Unique in design, this valve controls the flow of a wide variety of fluids. It can be opened or closed in a quarter-turn of the operating handle. The name "ball" is derived from the ball-shaped disc located within the body. A hole through the center of this disc provides the straight-through flow which is characteristic of ball valves.

**Valve Body** – The base housing or main part of a valve to which the piping is connected.

**Valve, Butterfly** – A valve that is extremely durable, efficient, and reliable. The butterfly valve derives its name from the wing-like action of the disc which operates at right angles to the flow. Its chief advantage is a seating surface which is not critical. The reason for this being the disc impinges against a resilient liner to provide bubble tightness with low operating torque.

**Valve Capacity** – The total amount of fluid a valve will pass when it is fully open.

**Valve, Check** – Sometimes referred to as the non-return valve, the check valve stops backflow in piping. Unlike the gate and globe valves, this simplest of types operates automatically.

**Valve, Deluge** – A control valve holding backwater on water spray systems which can be actuated manually or by a heat responsive system.

**Valve Follower** – Linkage between the cam and push rod of a valve train.

**Valve, Gate** – Commonly used in industrial piping, this type of valve, as a rule, should be used as a stop valve... to turn on and shut off the flow, as opposed to regulating flow. It gets its name from the gate-like disc, which operates at a right angle to the path of flow.

**Valve, Globe** – The flow through globe valves follow a changing course, thereby causing increased resistance to flow and considerable pressure drop. Because of the seating arrangement, globe valves are the most suitable for throttling flow. The valve is named after its globular body.

**Valve Guide** – A channel which supports the stem valve for maintenance of alignment.

**Valve Head** – The disk part of a poppet valve that gives a tight closure on the valve seat.

**Valve, Needle** – Are designed to give fine control of flow in small diameter piping. Their name is derived from their sharp-pointed conical disc and matching seat. They come in globe and angle patterns, in bronze and steel, and find usage on steam, air, water, gas, light liquid and similar services.

**Valve, Plug** – A valve fitted with a plug that has a hole through which fluid flows and that is rotatable through 90° for operating in the open or closed position. Also known as plug cock.

**Valve Positioner** – A device that is used to move the valve stem to the correct position.

**Valve Seats** – Internal parts of a valve against which the plug or gate effects the seal. Usually integral with the body.

**Valve Stem** – The rod by means of which the disk (gate) or plug is moved to open and close a valve.

**Valve Stroke or Lift** – The actual travel of a valve from a closed position to a fully opened position; or visa-versa.

**Valve Trays** – A valve tray is one of several tray designs used in distillation columns. The tray deck has holes, approximately 1-1/2" in diameter, uniformly spaced throughout the deck. Lifiable caps, about 2" in diameter, cover each hole and are retained on the tray by spiders or clips. As the vapor velocity or boil-up increases the cap rises, opening a greater area for vapor flow. The spider limits the height that the cap can travel. The vapor velocity between the hole and the cap prevents the liquid from draining back through the hole.

**Valve Trim** – Accessory parts of a valve such as stem, seats, gate, and/or plug. Different metals are sometimes used for the trim parts.

**Valve Wrench** – A common tool used on operating units to assist in turning valve wheels.

**Vane Pump** – A rotary pump having either flexible or rigid vanes to displace fluids.

**Vaness** – In a centrifugal pump, projections from the casing. They direct the flow of fluid from the rotating impeller to the discharge from the casing minimizing turbulence.

**Vapor** – A substance in the gaseous state that can be condensed by cooling or compression.

**Vapor Bound** – An interruption of liquid flow as a result of vapor being formed in a liquid line; also called vaporlock.

**Vapor Cloud (Release)** – Normally, the term refers to an accidental release of a large cloud of gas which may be toxic or highly flammable.

**Vapor Density** – The ratio of the weight of a certain volume of gas to that of an equal volume of hydrogen at the same condition.

**Vapor Line** – The pipe through which the vapors of a material/product are transported.

**Vapor Lock** – Occurrence of gas pockets or formation of vapor in a line or pump causing interruption of flow or loss of suction

**Vapor Phase** – Any product in the gaseous state.

**Vapor Pressure** – The pressure exerted by a vapor which is in a state of equilibrium with a solid, liquid, or solution at a specified temperature (expressed in millimeters of mercury or PSIA).

**Vapor Rate** – In distillation, the upward flow rate of vapor through a distillation column.

**Vaporization** – The conversion of a chemical substance from a liquid or solid state to a gaseous or vapor state by the application of heat, by reducing pressure, or by a combination of these processes. Also known as volatilization.

**Vaporizer** – A process vessel in which a liquid is heated until it vaporizes; heat can be indirect (steam or heat transfer fluid) or direct (hot gases or submerged combustion).

**Vaporizing Oil** – An alternative name for kerosene which is used for power purposes.

**Varec Gauge** – An instrument that measures the level (height) of a liquid in a tank.

**Variable** – A quantity or other condition which is subject to change; this may be measured or regulated.

**Variable Flow** – Fluid flow in which the velocity changes both with time and from point to point.

**Variable-Speed Drive** – A mechanism transmitting motion from one shaft to another that allows the velocity ratio of the shafts to be varied continuously.

**Variance** – Differences between actual costs incurred and standard or budgeted costs.

**Vaseline** – A proprietary name attached to a particular brand of petroleum jelly (petrolatum).

**VDU** – Virgin Distillate Ultra-finer.

**Velocity** – Rate of linear motion in a given direction.

**Vent** – (1) To release or depressurize into the atmosphere. To equalize the interior of a vessel with the outside atmosphere. (2) To remove the non-condensable material from a tank or vessel to the atmosphere or to a vent system.

**Vent Condenser** – A heat exchanger tied into the venting system of a piece of equipment that condenses the light material that did not condense in the normal condenser of a system.

**Vent Header** – A line used to carry vent gases from several pieces of equipment.

**Vent Tank** – A small tank that captures the liquid out of a vent before passing the vent gas to the atmosphere.

**Vent Valve** – A valve provided for the discharge of pressure from tanks, vessels, reactors, processing equipment, etc.

**Ventilate** – Use an air mover to force air into a vessel that is already open to the air and ventilate until only fresh air is in the equipment.

**Venturi Tube** – A constriction that is placed in a pipe and causes a drop in pressure as fluid flows through it, consisting essentially of a short straight pipe section or throat between two tapered sections; it can be used to measure fluid flow rate (a venturi meter), or to draw fuel into the main flow stream, as in a carburetor.

**Vessel** – A container in which materials are processed, treated, or stored. See "**Receiver.**"

**Vessel Entry** – See "**Entry.**"

**VFA (Vapor Fraction Analyzer)** – See "**Chromatograph or Gas Chromatography.**"

**VGO** – Vacuum Gas Oil.

**Vibration** – A continuing periodic change in a displacement with respect to a fixed reference.

**Vinyl Acetate** – A colorless, water-insoluble, flammable liquid that boils at 73°C and is used as a chemical intermediate and in the production of polymers and copolymers (for example, polyvinyl resins).

**Vinyl Chloride** – A flammable, explosive gas with an ether-like aroma; an important monomer for polyvinyl chloride and its copolymers; used in organic synthesis and in adhesives.

**Vinyl Chloride Resin** – A white-powder polymer made by the polymerization of vinyl chloride; used to make chemical-resistant pipe (when unplasticized) or bottles and parts (when plasticized).

**Vinyl Polymerization** – Addition polymerization where the unsaturated monomer contains a vinyl ( $\text{CH}_2=\text{C}$ -)group.

**Virgin** – A term referring to a component separated from crude by distillation before other processing.

**Viscosity** – The resistance to flow displayed by a fluid (liquid or gas).

**Viscosity (Absolute)** – The resistance of fluid or semi-solid materials to shear stress. Absolute viscosity is expressed in poises (dynes/sq cm).

**Viscosity (Kinematic)** – This is expressed in stokes and is equivalent to the absolute viscosity divided by the density of the material at the temperature of test.

**Viscosity Index** – A measure of the rate of change in viscosity with temperature. A numerical method of denoting the slope of the viscosity temperature curve of a lubricating oil. Oils with a small viscosity coefficient will have a high viscosity index, and vice versa.

**Viscosity Pole Height** – A method of determining the viscosity temperature relationship of an oil.

**Volatile** – Term used to describe a substance that easily vaporizes or evaporates.

**Volatile Component** – A component whose vapor pressures is high enough to allow it to evaporate easily.

**VOC** – Volatile Organic Carbon

**Volatile Fluid** – A liquid with the tendency to become vapor at specified conditions of temperature and pressure.

**Volatility** – A measure of the ease with which a liquid is converted to the vapor state.

**Volt** – 1 volt shall be taken as that electromotive force which will establish a current of one amp through a resistance of one ohm.

**Voltage Dip** – A momentary or prolonged drop in voltage.

**Volume** – The space occupied by a substance.

**Volume Flow Rate** – The volume of the fluid that passes by a given point in a unit of time.

**Volumetric Efficiency** – Measure of the actual volume of gas compressed by a cylinder compared to the displacement of the cylinder.

**Volute** – A spiral casing for a centrifugal pump, designed so that speed will be converted to pressure without shock.

**Vortex** – The cone formed by a swirling liquid or gas.

**VPC (Vapor Phase Chromatograph)** – See "Gas Chromatography."

**VRU** – Vapor Recovery Unit.

## W

**Walk the System Down** – To walk from the beginning of a system to the end of the system to make sure that everything in that system looks correct and sounds correct.

**Warning Tag** – A tag used in critical places usually with written instructions on it to follow before operating the "tagged" equipment.

**Washed Distillate** – A lighter grade of vaporizing oil so blended as to be just outside the definition of "light oils" given in the Finance Act 1928.

**Water Curtain** – A wall of water used to block the entry of flammable materials into an area where potential ignition sources exist, or to help contain or knockdown fumes (acid).

**Water Hammer** – (1) Hydraulic action associated with a non-compressible fluid in a pipe. Sounds like some one hit a pipe with a hammer. (2) The energy developed by the sudden stoppage of fluid in motion.

**Water Hardness** – See "**Hardness**."

**Water White** – (1) The best color grade in an oil. (2) A laboratory term for being bright and clear like water.

**Waterside** – Refers to the side of the heat exchanger tube that water (most often cooling water) flows on.

**Watt** – Work is being done at the rate of 1 watt when a constant current of 1 amp is maintained through a resistance by an electromotive force of 1 volt.

**Wax** – Scientifically speaking this term is restricted to esters of fatty acids with alcohols other than glycerol; in practice it is often employed to denote solid or semi-solid substances, both naturally occurring and artificial, of "wax-like" nature.

**Wax Distillate** – A neutral oil distillate before the separation of paraffin wax.

**Wear Ring** – Wear rings allow the impeller and casing suction head to seal tightly together without wearing each other out.

**Weathering** – The deterioration caused by exposure to nature's elements.

**Weephole** – Drilled hole used to allow leaking fluids to escape to the atmosphere so that they can be detected and/or won't be trapped and pressurize a joint where pressure is not desired.

**Weeping (Column)** – When the vapor velocity or boilup in a distillation column is too low, liquid is allowed to drain back through the perforations (see "**Sieve Tray**"). This is called weeping. During normal operation, the vapor velocity is high enough to prevent this occurrence.

**Weight** – A measure of the force of attraction between the earth and an object. Weight varies with distance from the earth whereas mass remains constant. Mass is the quantity of matter contained in a body.

**Weir** – A weir is a flat or notched dam or barrier to liquid flow and is normally used for either the measurement of fluid flows or to maintain a given depth of fluid as on a tray of a distillation column.

**Weld** – A joint made between two or more pieces of metal by melting their edges together and causing melted metal to flow into the seam.

**Westphal Balance** – A special type of hydrometer which is connected to a pivoted arm on which weights are placed to counterbalance the float. The amount of the weights serves to measure the density of the liquid under test.

**Wet Bulb Temperature** – The temperature as measured using a thermometer bulb that is covered with a wick that has been saturated with water. It is used in conjunction with dry-bulb temperature values to determine the relative humidity of the air.

**Wet Gas** – Natural gas containing condensable liquids such as water or condensed hydrocarbons.

**WHB (Waste Heat Boiler)** – A heat exchanger (HX) utilized to conserve heat from combustion gases or process stream. Normally, it has condensate on the shell side and produces steam at various pressure levels.

**White Oils** – Highly refined thin lubricating oils employed for such purposes as hair creams, lubricating materials used in the handling of food and fine fabrics, etc..

**WHSV (Weight Hourly Space Velocity)** – A measure of the rate of flow through a fixed bed, based on weight of throughput to weight of bed per hour.

**Wildcat** – A well that has been drilled in the expectation of finding oil, but without scientific evidence to support the selection of the site.

**Wind Box** – The section of a boiler surrounding the burners that distributes the combustion air evenly to each boiler.

**Wind-Up** – To finish or complete.

**WTI** - West Texas Intermediate Crude.

**WTS** – West Texas Sour Crude

## **X, Y & Z**

**X-Amount** – X denotes an unknown quantity. Example: X gallons, X lbs. Per hour

**Zero** – (1) The lower end of the measuring instrument scale. (2) Also slang for "calibrate," i.e. Zero the instrument.0