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PLANT MANAGERS, PURCHASING AGENTS,
INVENTORY PERSONNEL, DRAFTSMEN
AND STUDENTS



GLOSSARY OF FILTRATION TERMS



INTRODUCTION

This glossary defines terms used in the filter industry and explains how these terms are applied. Filter Industry is a general term intended to include such products as filters, coalescer/separators, pre-filters, clay treators, etc.

Because this list contains many words that may be considered colloquial or expressions coined by equipment manufacturers, it may also be considered as a vocabulary of filter terms. While many of these terms may have other definitions in other industries or other engineering usages, the definitions used herein are limited to the use or application as they relate to the Filter Industry.



A

ABRASION—Migration of foreign material which enters the fluid stream from system components that wear from close tolerances, vibration, or shock.

ABSOLUTE—An arbitrary term used to describe or define a degree of filtration. The filtration industry uses various methods of determining absolute ratings that are not necessarily interchangeable. Generally, absolute references 100% removal of solids above a specified micron rating on a single pass basis. *See nominal.*

ABSOLUTE FILTER—In liquid filtration, absolute is frequently used to imply the size above which no particles will be found in the filtrate, e.g., a one-micron absolute filter. It has been applied to air filters of high efficiency — greater than 95% against submicron particles — but is now less frequently used. Modern terminology prefers HEPA filter (High Efficiency Particulate Air), but a better form is probably HESPA (High Efficiency Submicron Particulate Air).

ABSOLUTE RATING—The diameter of the largest hard spherical particle that will pass through a filter under specified test conditions. This is an indication of the largest opening in the filter element.

ABSORB—To intercept, or drink in. To suck in, as a sponge sucks in water.

ABSORPTION—A physio-chemical process in which a substance associates with another to form a homogeneous mixture presenting the characteristics of a solution.

ACCELERATOR—To hasten action. Also used to describe an auxiliary valve to hasten fluid action.

ACFM—Actual Cubic Feet Per Minute. Measured at operating temperature and pressure.

ACID—A large class of compounds which contain the element hydrogen (H+) in its formula which may be replaced by metallic salts. Of primary concern is the deleterious effect most acids may have on filter medium and housings.

ACIDITY—The quality, state or degree of being acid. In lubricating oils, acidity denotes the presence of constituents whose concentration is usually defined in terms of a neutralization number. The constituents vary in nature and may or may not markedly influence the behavior of the fluid.

ACTIVATED ALUMINA—A highly porous and granular form of aluminum oxide having preferential adsorptive capacity for moisture from gases, vapors, and some liquids. May be regenerated for extended use under specified conditions.

ACTIVATED CARBON—Any form of carbon characterized by high adsorptive capacity for gases, vapors, or colloidal solids. The carbon or charcoal is produced by destructive distillation of wood, peat, lignite, nut shells, bones, vegetable or other carbonaceous matter, but must be activated by high temperature steam or carbon dioxide which creates a porous particle structure.

ACTIVATED CHARCOAL—*See activated carbon.*

ACTIVATED CLAY—An adsorbent clay that removes color, odor, free fatty acids and surfactants, etc. from oils and hydrocarbons.

ACTIVATED SILICA—colloidal silica dispersed in an aqueous medium to produce sol. In this condition the silica is considered to be in the *active* form and if no further precautions are taken polymerization will ensue until the *gelation point* is reached. At this stage *silica gel* is created, rather than the desirable *sol*. Gelation may be prevented by copious dilution after the appropriate aging period, dependent on the mode of preparation. The active sol is a valuable aid to coagulation and the subsequent sedimentation process in the treatment of water supplies and aqueous effluents. Prepared by neutralizing the alkali present in sodium silicate solutions by acids, or salts which yield an acid reaction due to hydrolysis in aqueous solution, and thus precipitate metasilicic acid (H_2SiO_3). An aging period at this stage results in the active SiO_2 sol.

ACTIVATED SLUDGE—Biologically active floc from aeration and settling sewage and/or organic matter.

ADAPTOR—An attachment or adjunct to condition an apparatus or component part for a use not intended originally. Example: a device used to permit the mounting of a cartridge on cartridge mounting plate.

ADDITIVE—A material, usually chemical, added to a product to impart new or unusual characteristics or to improve existing characteristics.

ADDUCT—To draw forward; to bring together similar parts.

ADHESION—Intermolecular forces which hold matter together. Also applied to the sticking together of a particle to a surface, a fiber or another particle. The main factors affecting adhesion of particles are 1) London-van der Waals forces which are electrical in origin, 2) electrostatic forces and 3) surface tension due to films of moisture on particles or on the surface. Other factors influencing adhesion are the nature of the surfaces, surface contaminants, particle size, shape and roughness and time of contact.

ADHESIVES—Used in the essential bonding process between cylinders of pleated filter paper and end caps in paper filter element production. Types used include air drying synthetic rubber/solvent/resin mixtures, two part epoxide and/or polyurethanes and heat curing adherent plastisols.

ADIABATIC—Insulated and neither heated nor cooled; as in an *adiabatic change*, wherein a condition is altered without gain or loss of heat.

ADSORB—The physio-chemical phenomenon involved to attract and hold a gas, vapor, or liquid on the surface of a solid, particularly on a finely divided material.

ADSORBATE—The material which is adsorbed; i.e., the gas, vapor, or liquid which adheres, or is chemically attracted to, the surface of the solid.

ADSORBENT—The material which adsorbs; i.e., the solid which attracts and holds on its surface the gas, vapor or liquid. Also materials added to liquors to decolorize or purify by adsorbing the color or impurity. Fuller's earth, activated carbon, activated alumina, etc., are all adsorbents.

ADSORPTION—The natural phenomenon of a gas, vapor, or liquid being attracted to, and held on, the surface of a solid. To some extent, adsorption takes place on any solid surface, but certain materials have sufficient adsorbent capacity because of the finely divided material to make them useful in such industrial applications as the purification and separation of gases and liquids.

AEROSOL—A liquid or solid particle suspended in air, gas, or vapor.

AFFLUENT—Fluid entering the filter or filter separator. More commonly described as influent. Opposite of effluent.

AGGREGATE—Fluid mixture of concentrated solids to be filtered.

AIR ELIMINATOR—Float-operated valve to evacuate air or gas from a housing or chamber.

AIR-GARD—A small three-stage air/gas entrainment filter separator marketed by Facet.

AIR/GAS—A product line of Facet. Air in this case is restricted to compressed air, vacuum and atmospheric intake filters.

ALKALI—A term that applies to the type of compounds which have basic properties and which will neutralize acids. Some alkaline materials are hydroxides, carbonates, caustics, etc.

ALKYLATION—A petroleum refining process.

ALPHA CELLULOSE—That portion or fraction of cellulose which is extracted and purified by various chemical means to form fibers used in the manufacture of fine chemicals, pharmaceuticals, fine grade papers, etc.

AMBIENT—Surrounding. Example: ambient operating temperature of a housing is temperature essentially the same as that surrounding the housing.

AMINE—A class of organic compounds of nitrogen that may be considered as derived from ammonia. May be a gas, liquid or solid. All amines are basic in nature and will usually combine readily with hydrochloric or other strong acids to form salts.

AMMONIA—A colorless gas with characteristic pungent odor. Most ammonia is now produced by direct combination of nitrogen and hydrogen gases. Present usage is not restricted to a pure gas or compressed liquid but also includes solutions such as aqua ammonia. Used for refrigeration, fertilizer, chemical manufacturing, and many other uses.

AMORPHOUS—Non-crystalline, having no determinable form or crystalline form. Solids to be removed by filtration may be amorphous.

AMPCO—Trade name for a series of aluminum-iron-copper alloys.

ANCHOR BOLT PLAN—Arrangement of mounting devices to hold a housing in position. Specific location of bolting to anchor a housing.

ANGSTROM—A unit of length 10^{-10} meter used primarily to express wave lengths of optical spectra. Abbreviated as A. Also known as tenthmeter.

ANHYDROUS—Free from water.

API—American Petroleum Institute

API GRAVITY—An arbitrary scale expressing the gravity or density of liquid petroleum products. The relation between API scale and specific gravity of petroleum oil is expressed by the formula:

$$\text{Degrees API} = \frac{141.5}{\text{Sp. Gr.}} - 131.5$$

APPARENT DIRT CAPACITY—The actual weight of contaminate injected into the filter test system at the time the terminal press drop is reached.

AQUEOUS CONTAMINANT—Water contaminant.

AREA—The available apparent surface exposed to the flow of a fluid for maximum utilization. Function of area in filtration is related to initial pressure drop, rate of flow, and solids retention capacity. In many applications, proper utilization of area of medium produces greater efficiency and solids retention. This is accomplished by pleating of material into an accordion form to produce increased surface area much greater than in a cylindrical form.

ARIZONA TEST DUSTS—Standardized air cleaner test dusts classified from natural Arizona dust and generally referred to as A.C. Fine and A.C. Coarse test dusts. The nominal particle size distribution of A.C. Fine test dust is:

Size (microns)	% by weight
0-5	39 ± 2
5-10	18 ± 3
10-20	16 ± 3
20-40	18 ± 3
40-80	9 ± 3

The nominal particle distribution of A.C. Coarse test dust is:

Size (microns)	% by weight
0-5	12 ± 2
5-10	12 ± 3
10-20	14 ± 3
20-40	23 ± 3
40-80	30 ± 3
80-200	9 ± 3

Used also for testing liquid filters, e.g., for hydraulic fluids.

AROMATIC COMPOUNDS—Compounds related to six-carbon membered rings as benzene or its derivatives.

ARTIFICIAL CONTAMINATION—Powders used as test contaminants in filter testing and usually selected to have similar properties and size distribution as those encountered naturally. *See Arizona test dusts.*

ASBESTOS—A group of impure magnesium silicate minerals which are found in fibrous form. Serpentine type is used for insulation linings and gaskets. Amphibole type is used as filter material or filter aids in chemical applications.

ASME—American Society of Mechanical Engineers. Published code which governs the design of pressure housings.

ASSEMBLY—A general term to describe the combination of a number of items used to make up a whole. Example: a cartridge mounting assembly for a filter would include the cartridges and all items needed to install the assembly in the filter housing. Final assembly would be used to name the action of assembling all items into an end product.

ATMOSPHERIC PRESSURE—The pressure of approximately 14.7 pounds per square inch exerted at sea level in all directions by the atmosphere.

ATTAPULGUS—A vein of mineral clay mined primarily in Georgia and Florida; the active ingredient in most fuller's earth. Activated by specific thermal treatment and ground to fine particle size.

ATTRITION—Wear caused by rubbing or friction. Produces fine particles that usually contaminate liquids which surround the point of attrition. Sometimes referred to as scouring or scoring.

AVERAGE PARTICLE SIZE—When, as a result of experimental observations, the size distribution of a particulate system has been established on the basis of any two of its normal characteristics—number, length, area or volume—the group values obtained may be represented by an average value. The relative percentage frequency curve provides a means of establishing a mode, the most commonly occurring value; a median, the line dividing the area under the curve into equal parts; a mean, the vertical at the mean value passing through the center of gravity of a sheet of uniform thickness cut to the shape of the distribution. For a symmetrical distribution these values coincide, while for slightly skewed distributions an approximate relationship is:

$$\text{mean} - \text{mode} = 3 (\text{mean} - \text{median}).$$

If it is assumed the particles are all of the same shape then a number of expressions for mean diameter can be evaluated:

Number length mean diameter
 Number surface mean diameter
 Number volume mean diameter
 Length surface mean diameter
 Length volume mean diameter
 Surface volume mean diameter
 Volume moment mean diameter

Generally, the choice of a particular mean diameter is related to the method used experimentally for size determination. *See mass distribution, particle size distribution.*

AV GAS—Abbreviation for aviation gasoline used for piston engines.

AVOGADRO'S LAW—The law which states that under the same conditions of pressure and temperature, equal volumes of all gases contain equal numbers of molecules. Also known as Avogadro's hypothesis. *See Boyle's Law and Charles' Law.*

B

BACK PRESSURE—In an air flow, the resistance at any point of the remainder of the downstream circuit or of any nominated sections of the circuit. In liquid filtration the back pressure can be due to a hydrostatic head, e.g., pumping from a filter to a tank at a higher level. Back pressure is also applied to keep CO₂ in solution in the filtration and handling of carbonated beverages.

BACKWASH—To reverse flow air, steam, or fluid through the medium to effect solids removal. Sometimes referred to as blowback.

BAFFLE—Component of a housing which constitutes a stage when used; removes liquid and solids by impingement; may be either upstream or downstream of the basic filter medium. May also be a plate to protect filter elements from the velocity of flow into a housing.

BARREN LIQUOR—Liquor for cake washing which contains little or no valuable liquor; as barren cyanide solution in gold cake slimes washing.

BASE SUPPORT—The porous support upon which the medium rests.

BASKET—Element for a basket strainer. A device normally using a screen as its medium for removal of coarse bulk solids.

- BASKET STRAINER**—Housing for the removal of coarse bulk solids from liquid, air, or gas; element is a basket covered with a screen of a given mesh.
- BATCH**—The quantity of material prepared or required for one operation. Example: a batch may be exemplified as a discontinuous process, such as batch processing of paint, soap, etc.
- BAUMÉ GRAVITY**—An arbitrary scale expressing the gravity or density of a liquid. Water is 10° Bé.
- BAUXITE**—A natural aggregate of aluminum bearing materials, more or less impure. Natural hydrated alumina, $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$.
- BAY HOUSE**—A air filtering device that removes particulates.
- BCP**—A design code for pressure housings based on the manufacturer's best commercial practice.
- BENTONITE**—A naturally occurring clay containing appreciable amounts of the clay mineral montmorillonite. Mined extensively in Wyoming, the Dakotas, Mississippi, Texas, and California.
- BEST COMMERCIAL PRACTICE**—Standard to which a housing may be designed by the manufacturer. Indicates the housing has not been designed to ASME code.
- BETA**—is calculated by dividing the number of particles entering the filter by number of particles exiting the filter. B10 represents the filtration ratio at 10 micrometers of the ratio of the upstream to downstream particles larger than 10 micrometers. *See filtration beta ratio.*
- BETA EQUALS 75**—Multi-pass testing has shown that this is beta ratio which corresponds to hard spherical particle definition of the absolute filter rating.
- BETA FACTORS**—A system for measuring filters effectiveness by particle size.
- BLIND SPOTS**—Places in medium where no filtering occurs. Also referred to as dead areas. Opposite of effective area.
- BLINDING**—Where filtered-out particles fill the openings in the medium to the extent of shutting off the flow of product; the loading up of the medium so as to reduce capacity. Also referred to as blocking or plugging.
- BLOWBACK**—To reverse flow air, steam, or fluid through the medium to effect solids removal. Sometimes referred to as backwash.
- BLOWDOWN**—The action to evacuate liquids or solids from a housing by use of pressure.
- BODY**—A housing containing the filter medium. Also referred to as a housing.
- BOIL POINT**—The differential gas pressure following the bubble point pressure at which gas bubbles are profusely emitted from the entire surface of a wetted and submerged filter medium. Also known as foam all over, mass bubble point, open bubble point.
- BOMB KIT**—A kit designed for field use by the manufacturer, Millipore Filter Company. Contains materials for obtaining and analyzing liquid samples to determine solid contaminant level.
- BOYLE'S LAW**—If the temperature of a given kind of gas is held constant, the volume of a sample of gas varies inversely with the pressure. *See also Avogadro's law and Charles' Law.*

BREAKING STRENGTH—Average force required to break a test specimen by tension.

BREAKTHROUGH—Used to describe the passing of solids through the cake built up on a filter medium. Also referred to as the breakpoint.

BRIDGING—Where particles being removed form an arch over the individual opening in the medium.

BTU (BRITISH THERMAL UNIT)—A standard measure of heat content in a substance that can be burned to provide energy.

BUBBLE POINT—The differential gas pressure at which, under specified test conditions, the first steady stream of gas bubbles is emitted from a horizontal disc of wetted filter medium or a filter cartridge when immersed in a liquid.

BUBBLE RING—A device sometimes fitted to a pressure leaf filter so that air or other gas can be introduced to the filter tank to bubble through the liquor in which the dislodged filter cake will be carried away.

BUBBLE TEST—Measurement of the largest opening in an element by determining the minimum pressure required to force air or a gas through the element while submerged in alcohol or other liquid. Used as a quality control benchmark to determine if a surface type separator or filter cartridge meets the same value as the prototype cartridge.

BULK DENSITY RATIO—Ratio of total mass or weight of the material divided by the volume.

BUNA-N—Gasket material. A synthetic rubber frequently used for housing closures, flanges, and filter elements.

BURST PRESSURE—The maximum pressure a housing will safely withstand.

BURSTING STRENGTH—Force required to burst a housing. Example: burst pressure may be 100 psi, while bursting strength may be 175 psi.

BYPASS—Condition resulting from the product flowing through a housing without flowing through the medium. Also a filtering system which filters only part of the stream, on a continuous basis. Opposite of full flow.

BYPASS INDICATOR—Indicator which signals alternate flow.

BYPASS VALVE—Valve to pass the flow around the media or the housing, usually activated at a given differential pressure setting.

C

CAKE—Solids deposited on the filter medium during filtration in sufficient thickness to be removed in sheets or sizable pieces. In many cases, cake may provide its own filter medium by adding to the surface of medium. Also referred to as discharged solids or residue.

CAKE RELEASE—Ability of medium to allow clean separation of the cake from the medium.

CAKE REPUDDLING—Breaking cake structure for reformation.

CALIBRATING TANK—A tank for calibrating capacity to provide volumetric proof of the delivery of liquids by positive displacement meters. Also referred to as meter proving tank.

CANISTER—Container or mounting mechanism for elements. May be an actual

part of and performing a function of the elements, or may be used to hold the element in position.

CAP, ELEMENT—Component which covers one end of an element and holds the element in place in the housing. Sometimes called a yoke.

CAP, END—The end of many types of filter cartridges. In particular, the shallow annular dish into which the ends of a pleated paper filter cylinder are adhesively bonded to form a pleated paper cartridge.

CAPACITY—Volume of product which a housing will accommodate expressed in gallons or similar units. Also amount which will filter at a given efficiency and flow rate, expressed in gallons per minute or similar units.

CAPILLARY—Fine, hairlike tube having a very small opening.

CARRYING BODY—Liquid in which the solid particles are suspended. Example: water borne solids.

CARTRIDGE—Medium used in a housing to perform the function of coalescing, filtering, or separating. Also referred to as element, media, repack, etc. Made in a specified physical shape, to be mounted by use of hardware designed for that purpose.

CATALYST—A substance which accelerates a chemical reaction without itself taking part in the reaction. Example: alkylation will not take place unless some substance such as sulfuric acid is present; such a substance is called a catalyst.

CAUSTIC—A class or a name given to a group of chemicals, usually caustic soda or sodium hydroxide. A substance which has the power to burn, corrode, or eat away. Used in chemical manufacture, petroleum refining, pulp and paper, detergents, soap, textiles and vegetable oil refining.

CELLULOSE—The preponderant and essential constituent of all vegetable tissues and fibers. Basic in the textile and paper making industries. Three types exist in alpha-cellulose, beta-cellulose and gamma-cellulose. Material used in filter medium is bound by impregnation, usually a phenolic resin. Process of manufacture controls the basic weight and pore size to specification. Filter paper, when impregnated with other properties, produces an excellent hydrophobic membrane which is non-water wetting and is used in the second stage of two stage filtration separation equipment. Ideal cellulose material provides for a variety of filtration efficiencies, low initial pressure drop, high wet strength and solids retention.

CENTER CORE—Material formed into a tube or cylinder for structural purposes to permit a cartridge to retain its original physical form. May also be the basic medium, formed with sufficient strength so as to serve the purpose of a center tube. Example: a tube of glass fibers may be formed and cured to such a degree that a center core is not required. Sometimes referred to as a center tube.

CENTER PIPE—Component of a housing which is used as a mount for cartridges. Made with perforated effect to accommodate flow. A center rod is used for the same purpose but is not perforated and does not accommodate flow.

CENTER ROD—Component of a housing used for mounting cartridges in the housing. Usually made of a round bar material. A center pipe may also be used for the same purpose but is made with perforated effect and directs flow through the cartridge.

CENTER SEAL—Part which forms seal between two elements when one element is one the top of another element. May also be called an adaptor.

CENTER TUBE—Component of an element or cartridge which supports the medium at the center of smallest diameter.

CENTIPOISE—One one-hundredth of a poise. A poise is the unit of viscosity expressed as one dyne per second per square centimeter.

CENTISTOKE—One one-hundredth of a stoke. A stoke is equal to the viscosity in poises times the density of the fluid in grams per cubic centimeter.

CENTRAL PROCUREMENT—Government procedure of combining the activities of many buying offices into one central operation wherein filtering equipment is purchased for many locations and may be for one or more of the military services.

CHANNEL—To cut grooves or lines in or through the solids deposited on the medium, or through the medium itself. Also may be described as a breakthrough in the medium which would result in a bypass.

CHARLES' LAW—If the pressure on a given kind of gas is held constant, its density is inversely proportional to its absolute temperature. *See Avogadro's Law and Boyle's Law.*

CHEMICAL POLARITY—An attribute of a chemical, or family of chemicals, whose arrangement of atoms around the nucleus is not symmetrical making them much more chemically reactive than symmetrical chemicals.

CHLORINATE—To combine chemically with chlorine.

CLARIFICATION—Filtration of liquids containing small quantities of suspended solids; filtration takes out most of these solids and increases the clarity of the liquids.

CLARITY—Amount of contaminants left in a filtered liquid; the absence generally indicates the liquids to be free of contamination to an unspecified degree.

CLASSIFICATION—Condition in which the larger particles settle out below the finer ones. Also referred to as stratification. May also be referred to as the action to sort out particles by various size groups or to some other established criteria.

CLAY—Medium used in some elements; usually a blend of attapulgas and montmorillonite clays.

CLAYSLIP—Clay in a liquid state such as a sludge. May also be clay suspended in a liquid.

CLEAN PRESSURE DROP—Differential pressure (drop) across a housing, measured in pounds per square inch at rated flow on new elements with clean product.

CLEAN ROOM—Room in which elaborate precautions are employed to reduce dust particles and other contaminants in the air, as required for assembly of delicate equipment.

CLOTH—A type of woven filter septum made from natural or synthetic yarns.

COAGULANT—That which produces coagulation or agglomeration of suspended solids.

COAGULATION—Growing together of minute particles to form larger ones, which are called flocs and are easier to filter. Also referred to as flocculation.

COALESCER—Mechanical device which unites discrete droplets of one phase prior to being separated from a second phase. Can be accomplished only when both phases are immiscible. Requires a tight medium which is preferentially wettable and, by its nature of being tight, is also a good filtering material. Good coalescing permits gravity separation of the discontinuous phase. Coalescing may be accomplished by only a coalescer cartridge when the specific gravities of the two phases are widely separated. As the gravities' difference becomes less, the two stage principle is generally required where finely coalesced discontinuous droplets are repelled by the second stage separator cartridges.

COALESCING—Action of uniting of small droplets of one liquid preparatory to its being separated from another liquid.

CODE—Generally refers to housing design. A standard to which a housing may be fabricated. Example: the design may meet the requirements of Section VIII, ASME Code for unfired pressure housings. When used in referring to other standards, the full code title should be given.

COLLOID—Very small, insoluble non-diffusible solid or liquid particles that remain in suspension in a surrounding liquid. Solids usually on the order of 0.2 μ or less.

COLLOIDAL PARTICLES—Gelatinous substance of minute particles which remain in suspension.

COLOR BODIES—Form of deposit which may appear as producing colors. Term frequently used in the petroleum industry is hydrocarbon color bodies.

COMPATIBILITY—Capability of two or more materials or substances to be used together without ill effect. Must be considered when choosing the medium to be used with any fluid stream.

COMPOSITE MEDIA—Media made up of more than one material.

COMPRESSIBILITY—Degree of physical change in filter cake particles when subjected to normal pressures. Also a factor when selecting gasket material.

CONCENTRATE—Material to be filtered. Also referred to as feed, influent, intake, liquor, mud, prefilter, pulp, slimes, or sludge.

CONDENSATION—Process of cooling a vapor below its boiling point in order for it to be liquefied.

CONDITIONING—Improving the filtering qualities of the filter feed.

CONLEY WELD—Trade name for an epoxy type adhesive.

CONSISTENCY—Degree of density or firmness, especially of thick liquids. A product of light consistency is almost fluid, while a product of heavy consistency is thick, and in some liquids may be hard.

CONSISTENCY OF FEED—Usually refers to the ratio of solids to liquid in the feed.

CONTACT TIME—The length of time an absorbent is in contact with a liquid prior to being removed by the filter.

CONTAMINATE—Foreign matter in a fluid which is accumulated from various sources such as system dirt, residue from wear of moving parts, atmospheric solids which settle in an open system. Contaminates tend to discolor a liquid, cause additional wear on moving parts, cause system upsets in process streams, or reduce the efficiency of a fluid. Water, as well a solid, may be considered a

contaminate when the presence of water causes adverse results. The presence of contaminants, whether liquid or solid, is the basis on which the use of filters or filter separators are sought.

CONTINUOUS PHASE—Basic product flowing through a filter or filter separator which continues on through a system after being subjected to solids and/or other liquid separation.

CONVERSION—Change of type of elements in a housing to vary the efficiency. May also refer to the adaptor hardware to provide for use of elements in competitive equipment, sometimes called retrofit. In general, refers to the changing of one type of medium to another type for a specific purpose.

CONVERSION KIT—Materials required to convert a housing to the use of another type of element or to perform a different function. Example: convert filter to a filter separator.

CONVOLUTION—Used to described one pleat of a pleated surface type element, usually in the shape of a V. Also refers to the twisting or coiling of a cotton material as well as the irregular spiral or screwlike condition of mature cotton.

CONVOLUTIONS—Twistings or coilings. Used to describe one complete pleat of an element.

COOLANT—Cooling agent used in many operations.

CORE—Material used for the center of an element, generally of the wound design. May also be called a center tube when used in the coalescer, separator, or other type filter element. May also be a tube of fibers formed into an element which has sufficient strength to provide its own center core.

CORROSION—Conversion of metals into oxides, hydrated oxides, carbonates, or other compounds due to the action of air or water, or both. Salts and sulphur are also important sources of corrosion. Removal of solids and water reduces the effect or speed of corrosion in many cases; and in other cases, corrosion inhibitors are used to reduce the effect or corrosion.

CORRUGATIONS—Fine ribbing sometimes applied to filter paper following resin impregnation and before pleating to form a pleated paper filter element. Corrugations which run at right angles to the main pleats help to hold the pleats apart against the action of differential pressure encountered in use. Discontinuous corrugation or dimples are sometimes alternately employed.

COUNT—Used in the term *particle count* to tabulate number and sizes of solids in specified groups.

CRENELATED—Indented.

CRIMP—*In fibers*, the waviness in certain fibers, particularly in fine wools and in certain rayon staple fibers. The difference in distance between two points on a yarn as it lies in a fabric and the same two points when the yarn has been removed and straightened, and expressed as percentage between the two points as the yarn lies in the fabric. *In wire cloth*, crimp is the corrugations in warp and fill wires to lock the wires in place. Sometimes referred to as double crimp.

CRITICAL OPERATING PRESSURE—Pressure above which filtration or separation equipment may produce reduced efficiency or fail to function properly.

- CRITICAL STATE**—Unique condition of pressure, temperature, and composition wherein all properties of coexisting vapor and liquid become identical.
- CRITICAL TEMPERATURE**—Temperature above which a gas cannot be liquefied.
- CRYOGENICS**—Field of science dealing with matter at very low temperatures. In filtration, the extremely low temperature negates the use of many media, gaskets, and certain type housings.
- CYCLE**—Actual interval of filtration, expressed in units of time; e.g., hours or days.
- CYCLICALLY or CYCLICLY**—Operating in cycles.
- CYCLONE**—Liquid or gas filter using the principle of centrifugal force which causes the contaminate to settle to the bottom of the housing without the use of filter medium.
- CYLINDRICAL**—Having round sides, the ends being equal circles. Opposite of pleated when used to describe elements.
- D**
- DALTON'S LAW**—If several types of gas are put into the same container, the total pressure exerted is the sum of the partial pressures that each type of gas would exert if it alone occupied the container.
- D.E.**—A commonly used abbreviation for diatomaceous earth.
- DEAD AREAS**—Places in medium where no filtering occurs. Also referred to as blind spots. Opposite of effective area.
- DEAD HAND**—Indicator sometimes used on differential pressure gauge to record maximum differential pressure reached between settings.
- DEAD VOID VOLUME**—Volume of voids unavailable to liquid flow.
- DEFORMABLE**—Used to describe suspended solids that extrude into the interstices of a filter cake and cause rapid filter plugging.
- DEGRADATION**—Wearing down, or reduction in the efficiency of medium.
- DEGREE OF FILTRATION**—Level of cleanliness of a fluid, usually measured in milligrams in a given volume such as quart, liter, gallon, etc.
- DEHYDRATION**—Removal of water or hydrocarbon in vapor form from an air or gas; also water from another immiscible liquid. Differs from entrainment removal in that the dew point of a gas stream will be lowered by vapor removal. A form of purification.
- DELIVERY**—Opening through which effluent flows, as open delivery press.
- DELTA () P**—A commonly used symbol denoting the pressure drop across a filter.
- DENSITY**—Compactness or thickness; ratio of weight of medium to the weight of an equal volume of fiber. In general, mass per unit volume, usually expressed in grams per cubic centimeter or pounds per cubic foot, or gallons.
- DEPTH FILTER MEDIUM**—Filter medium which primarily retains contaminant within tortuous passages, e.g., fibrous or granular. Retention efficiency is achieved by means of a series of low efficiency particle captures.

DEPTH TYPE FILTRATION—Filtration accomplished by flowing a fluid through a mass filter medium providing a tortuous path with many entrapments to stop the contaminants. Flow may be cross flow such as from the outside to inside and then down the center of an element, or from end to end. Certain types of solids, or combinations of solids, do not lend to surface filtration where depth type filtration is found to be more suitable.

DESALINATION—Production of fresh (potable) water from sea water, salt or brackish water by one of several processes, e.g., distillation, flash distillation, electrodialysis or reverse osmosis if salt content is not too high.

DESICCANT—Drying agent or medium used in dehydration of air, gas, or liquids. Examples: silica gel, activated alumina, molecular sieve, etc.

DETERGENT OILS—Lubricating oils possessing special sludge dispersing properties for use in internal combustion engines. These properties are usually conferred on the oil by the incorporation of special additives.

DEWATER—Removal of water from solids.

DEW POINT—Temperature at which air is saturated with moisture or, in general, the temperature at which a gas is saturated with respect to a condensable component.

DIAPHRAGM—As used on valves, a diaphragm is a flexible material which permits the movement of internal parts without the loss or redistribution of pressure in the chamber.

DIATOMACEOUS EARTH—Soft, earthy rock composed of the siliceous skeletons of small aquatic plants call diatoms (algae). Frequently used as material for a precoat of filter medium. Capable of absorbing 1.5 to 4 times its own weight in water. Insoluble in acids except hydrofluoric, and soluble in strong alkalies.

DIESEL FUEL—Petroleum product used as fuel for diesel engines.

DIFFERENTIAL PRESSURE—Difference in pressure between two given points of a filter, filter separator, etc.

DIFFERENTIAL PRESSURE INDICATOR—Indicator which signals the difference in pressure at two points.

DIFFERENTIAL PRESSURE SWITCH—Electrical switch operated by the difference between two pressures and often used to give warning of the end of a filtration cycle.

DIFFERENTIAL RATING—Differential pressure specified as the maximum an element will withstand without structural failure.

DIFFUSION—In cake washing, removing the original liquor around the individual particles by mixing with the wash liquor.

DIGESTED SLUDGE—Sludge or thickened mixture of water with sewage solids in which the organic matter has been decomposed by anaerobic bacteria.

DIMENSIONAL STABILITY—Ability of a material to retain its original dimensions.

DIRECT READING DIFFERENTIAL PRESSURE GAUGE—Type of pressure gauge which automatically shows the differential pressure reading between two points.

- DIRECTION OF FLOW**—Direction in which product flows through element; may be from inside to outside, from outside to inside, or end to end, depending on the design of the element.
- DIRT HOLDING CAPACITY**—Volume of contaminate an element can hold before reaching the maximum allowable pressure drop. Volume will vary depending on the size and design of the element and the density of the solid particles. Usually reported by weight such as grams or pounds per element. Also called solids retention or solids holding capacity.
- DISC PACK ELEMENT**—Filter element constructed by packing alternate discs of filter medium and flow distributor plates into a compact cylindrical form.
- DISCHARGE**—Liquid that leaves the housing after passing through the medium. May be different from filtrate; e.g., wash water discharge.
- DISCHARGE LIQUOR**—Liquid which has passed through the filter. Also referred to as effluent, filtrate, mother liquor, solute, strong liquor, product, clean and dry product, etc.
- DISCHARGE VALVE**—Valve to allow the effluent stream to flow out of the housing; may be closed by the operation of a pilot valve, in which case product would not leave the housing. Also called a slug valve. Generally used on petroleum products at terminals and airports.
- DISCHARGE SOLIDS**—Solids deposited upon the filter medium during filtration in sufficient thickness to be removed in sheets or sizable pieces. Sometimes referred to as cake or residue.
- DISCONTINUOUS PHASE**—Separated phase or product from the continuous phase. Example: water may be the discontinuous phase when separated from a hydrocarbon, air or gas.
- DISCRETE**—Composed of distinct units; separate from others. Usually referred to in describing the discontinuous phase.
- DISPERSION**—Operation which results in solid or liquid particles entering into suspension in a fluid. Also applied to a two phase system in which one phase, known as the disperse phase, is distributed throughout the other, known as the continuous phase.
- DISPOSABLE**—Describes element which is to be discarded after use and replaced with an identical element. Same as replaceable. Opposite of reusable.
- DISSOLVED SOLIDS**—Any solid material that will dissolve in the liquid that is being filtered, such as sugar in water.
- DISTILLATE**—Condensed product of distillation, as certain petroleum products.
- DISTILLATION**—Process of vaporizing a liquid and collecting the vapor, which is then usually condensed to a liquid. In industry, this process is widely used to separate the components in a liquid solution. Since every pure compound boils at a specific temperature, it is often possible to boil off one liquid while most of the higher boiling point material remains in its liquid state. It is extremely difficult and sometimes impossible to separate materials in this way when they boil at the same, or near the same, temperature.
- DIVIDER**—Component of a housing: metal plate used to create chambers such as inlet and outlet chambers.

DOWNSTREAM—Portion of the product stream which has already passed through the system; portion of a system located after a filter, filter separator, etc.

DRAIN VALVE—Valve for draining off material which has been separated from a fluid stream. Also a diaphragm type valve that operates as part of a system to evacuate a discontinuous phase automatically.

DROP—Quantity of fluid which falls into one spherical mass; a liquid globule. May also be described as several to many droplets.

DROPLET—Minute drop which mates to form larger drops capable of falling by gravity.

DUAL GRAVITY VALVE—Float operated valve which operates on the interface of two immiscible liquids of different specific gravities and which operates to release one of the liquids.

DUPLEX FILTER—Assembly of two filters with valving for selection of either or both filters.

DURO-GARD—Facet trade name for pleated paper filter elements which are a member of the extended area family and are interchangeable with competitive elements of like dimensions. Characteristics: high solids holding capacity, large filtration area, and no unloading characteristics.

DUROMETER (SHORE)—Measurement of the resiliency of gasket material.

DYNAMIC ADSORPTION—Adsorption process in which there is constant relative motion between the material being treated and the adsorbent. In most cases, the gas or liquid being treated is made to flow through a fixed bed of adsorbent. Example: the drying of annealing gas. The gas is pumped through an adsorber where it is dried and then, with the moisture removed, it is pumped into the bright annealing furnace.

DYNE—The amount of force that causes a mass of one gram to alter its speed by one centimeter per second for each second during which the force acts.

E

EFFECTIVE AREA—Area of medium exposed to flow and usable for its intended purpose: coalescing, filtering or separating. Opposite of blind spots or dead area.

EFFICIENCY—Degree to which element will perform in removing solids and/or liquids.

EFFICIENCY CURVE—Graph showing the performance of a filter when challenged by specified artificial or natural contaminants under controlled conditions. Penetration or efficiency may be plotted against particle size at constant face velocity.

EFFLUENT—Stream of fluid at the outlet of a filter or filter separator. Opposite of affluent or influent.

ELEMENT—Medium used in a housing to perform the function of coalescing, filtering or separating. Also referred to as cartridge, repack, etc.

ELEMENT CAP—Component which covers one end of an element and holds the element in place in the housing. Sometimes called a yoke.

ELONGATION—Deformation caused by a tensile force, expressed as a percentage of the original length.

ELUTRIATION—Washing of suspended solids in sludges.

EMISSIONS—Gases and/or particulates discharge into the environment, usually the atmosphere.

EMULSIFICATION—Dispersion of one substance in the form of minute drops within another substance.

EMULSION—Dispersion of fine liquid particles in a liquid stream which do not necessarily dissolve in each other but are held in suspension. Many emulsions may be broken by coalescing if the liquids are immiscible. Emulsion stabilizers modify the surface tension of the droplets which makes coalescing difficult, if not impossible.

EMULSION SEPARATION—Chemical methods of emulsion separation are regularly employed to remove the oil phase from spent emulsion cutting oils, prior to disposal. Typical treatment is by dosing with a solute of a divalent or trivalent metal. Thermal, electrical and physical methods are also used. *See coalescence.*

ENCAPSULATED—Process in which a material is coated or covered with a plastic film or sheath.

END CAPS—Components adhered to ends of an element with adhesive or by other means to contain medium in the form designed for the element.

END LOAD RATING—Maximum specified axial force which can be applied to the end of a filter element without causing permanent deformation or seal failure.

END POINT—Final objective or, in petroleum distillation, temperature at which distillation ceases. Used to describe terminal pressure at which point further use of elements is not recommended. Term may also be used in filtration to describe point at which a marked color change is observed, indicating that no more reagent is to be added.

END SEAL—Bond between the end cap and the filter medium. In cartridges of pleated paper construction this is frequently an epoxide, polyurethane or nitrile-phenolic adhesive. Also refers to the sealing device which seals the end cap of a cartridge to its housing.

ENTRAINED WATER—Discrete water droplets carried by a continuous liquid or gas phase when water is immiscible with the liquid. May be separated from the continuous phase by coalescing and gravity separation. Usually picked up in a system by condensation or a water washing used in process.

ENTRAINMENT—Mist, fog, or droplets of a liquid which is usually considered to be a contaminate when used in the filtration industry.

EQUALIZING LINE—A connection to equalize the vacuum or pressure at two separate points.

EQUILIBRIUM LOADING—Maximum loading for a given temperature, pressure, and concentration. Also used to describe an equality of distribution on the surface of filter medium.

EUTECTIC—Characteristic of a mixture having the lowest possible melting point of two or more constituents which melt completely at a definite temperature to form a single liquid.

EXCELSIOR—Wood type frequently used as coalescing medium for light products and bulk filter. Selected Aspen type excelsior with selected strand thickness and average length is packed into a cylinder, generally for end-to-end flow.

EXCEL-SO—Trade name of the original products sold by Warner Lewis Company, generally describing excelsior packed separators.

EXTENDED AREA—Family of pleated cellulose filter cartridges marketed by Facet. By pleating, the available surface area is increased substantially to provide for greater flow, increased efficiency, and solids retention capacity. Closely controlled manufacturing processes provide for specified basic weight, pore size, and wet strength. Use of different specifications provide for varying efficiencies to provide for a wide variety of applications.

F

FEDERAL STOCK NUMBER—Identification number assigned by the U.S. Government to code the specific descriptions of items purchased for their stock; number is preceded by letters FSN.

FEED—Material to be filtered. Also referred to as concentrate, influent, intake, liquor, mud, prefilter, pulp, slime or sludge.

FELT—Fabric built up of the interlocking of fibers by a combination of mechanical work, chemical action, moisture and heat. Frequently used as filter medium, some types of which have been adapted to high temperature applications for air or gas.

FIBER—Fundamental unit comprising a textile raw material such as cotton, wool, etc.

FIBER MIGRATION—Carry-over of fibers from the media used in coalescer, separator, or filter cartridges into the effluent. More definitive than media migration since fiber migration is qualitative.

FIBERGLASS—Trade name for a variety of products made of, or with, glass fibers.

FIBERGLASS—Term used to describe a variety of products made of, or with, glass fibers, *See glass fiber*.

FILM STRENGTH—Property of a lubricant which permits it to resist being ruptured or broken when under pressure between two metal surfaces.

FILTER—Term generally applied to a device used to remove solid contaminate from a liquid or gas. A filter, as referred to in the industry today, is limited to a device which removes solid contaminants only. If a device is used to remove solid and liquid contaminants, it is referred to in general terms as a separator, filter separator, or entrainment separator. The term filter is sometimes erroneously used to describe the medium used inside the housing or filter case, but the correct use should be filter element, cartridge, etc.

FILTER AID—Substance of low specific gravity which remains in suspension when mixed with the liquid to be filtered. It should be porous and must be chemically inert to the liquid being filtered. Increases filtering efficiency and maintains cake porosity.

FILTER COALESCER—Single stage, horizontal housing for coalescing and separating one immiscible fluid from another and the removal of solids. Generally recommended for use where continuous phase has a light gravity. Available with various efficiencies.

FILTER EFFECT—Gradual increase of filter resistance.

FILTER MEDIUM—The porous material mounted on a plate or frame which separates the solids from the liquids in filtering. Also referred to as filter cloth, filter plate or septum.

FILTER MONITOR—Water absorbent filter element which will continuously remove dirt and water from aviation fuel.

FILTER PAPER—A permeable web of randomly oriented fibers, generally cellulose (i.e., wood pulp, cotton) or glass fiber is formed from water draining from a carefully prepared suspension of these fibers fed to a continuously traveling, endless belt of wire mesh—a paper making machine. The preparation and type of fiber controls the permeability within any one thickness and weight per unit area of grade. Various grades are available with these variations and also with resin addition to give strength to the paper when wet. A further variation arises with a crepe finish whereby the effective area of paper for a given weight is considerably increased. A wide range of filter papers is available commercially for the removal of particles from liquids and gases.

FILTER PLATE—The porous material mounted on a plate or frame which separates the solids from the liquids in filtering. Also referred to as filter cloth, filter medium or septum.

FILTER SEPARATOR—Housing which removes solids and entrained liquid from another liquid or gas. Uses some combination of a baffle and/or coalescer, filter, or separator element. May be single-stage, two-stage, or single or two-stage with prefilter section for gross solids removal. Common application is the removal of water from gas or another immiscible liquid. General reference to term implies the equipment is capable of both filtration and separation to specific degrees of efficiencies.

FILTER SYSTEM—The combination of a filter and associated hardware required for the filtration process.

FILTERABILITY—Ease or difficulty of filtering.

FILTERS, BULK TYPE—Similar to depth type filters; however, the density is not graded and therefore the reproducibility of the filtration varies.

FILTERS, DEPTH TYPE—*See depth type filtration.*

FILTERS, EXTENDED AREA—*See extended area.*

FILTERS, INERT TYPE—Designed to remove insoluble contaminants; all filters except the absorbent and adsorbent types can be generally considered inert.

FILTERS, SURFACE TYPE—Usually constructed of pleated, impregnated paper and/or a combination of paper and other media, such as glass fibers. Opposite of depth type. *See extended area.*

FILTRATE—Liquid which has passed through the filter; fluid that has been separated from the solids in the slurry being filtered. Also referred to as discharge liquor, effluent, mother liquor, solute, or strong liquor.

FILTRATION—Process of removing solid particles from liquid or gas by forcing them through a porous medium.

FILTRATION BETA RATIO—The ratio of number of particles greater than a given size (n) in the influent fluid to the number of particles greater than size (n) in effluent fluid.

FILTRATION RATE—The volume of liquid that passes through a given area of filter in a specific time. Usually expressed as gallons per square foot per minute (or hour).

FINES—Portion of a powder like material composed of particles smaller than a specified size.

FIRE POINT—Lowest temperature at which a liquid evolves vapors fast enough to support continuous combustion; usually close to the flash point.

FLASH DISTILLATION—Operation wherein the liquid is vaporized immediately on entrance to the housing.

FLASH POINT—Lowest temperature at which a combustible liquid will give off a flammable vapor that will burn momentarily.

FLOAT CONTROL—Float operated pilot valve which controls other valves or the opening of an orifice; generally used for the elimination of the discontinuous phase; operates on the interface of two immiscible liquids. In the case of air or gas would operate on the surface of a liquid.

FLOATING SCRAPER—Balanced scraper which, with minimum pressure, follows the contour of a drum.

FLOCCULATION—Growing together of minute particles to form larger ones, which are called flocs and are easier to filter. Also referred to as coagulation.

FLOW—Viscous flow (also known as streamline or laminar) is characterized by the viscosity of the fluid controlling the relationship between pressure and its velocity; with turbulent flow the relationship is controlled by inertial factors. For viscous flow in ducts Reynolds number is less than 2,000 and for turbulent flow greater than 4,000. *See laminar flow.*

FLOW RATE—Rate at which product is passed through a housing or system; generally expressed as gallons per minute, barrels per hour, barrels per day, actual or standard cubic feet per minute, hour, day, etc. *Same as rate of flow.*

FLOW RESISTANCE—Resistance offered by filter medium to fluid flow; the pressure difference required to give unit flow of a fluid of unit viscosity through a unit cube of filter medium. *See also resistance ventilation filter.*

FLUID—Term used in filtration and separation to include liquids, air or gas as a general term.

FOG—Condensed water, hydrocarbon, or other liquids which are visible to the naked eye.

FOUR-STAGE—Design for entrainment separators for use on air or gas, marketed by Facet, which contain a prefilter section ahead of the coalescer and separator cartridges to remove gross solids. Baffle before prefilter cartridges removes coarse solids and free liquid by impingement. Impingement baffle and prefilter section permit extended use of Facet two-stage efficiency on compressed air or gas.

FRACTIONATION TOWER—Tower wherein rising vapors meet descending liquid. The lower boiling liquids tend to pass on to the condenser, and the higher boiling phases remain as liquids.

FRAZIER PERMEOMETER—Porosity testing device. The normal measurement is the air flow in CFM passed through one square foot of fabric at 1/2" water pressure. Fabrics with rating of 1 to 10 CFM are considered very tight, whereas cloths that test at 450 to 500 CFM are extremely porous. The test is used on woven and non-woven materials.

FREE BOARD—Clear space between top of liquid and rim of housing.

FREEZING POINT—For a pure substance the freezing point or melting point is : the temperature at which the liquid and solid are in equilibrium with one another; i.e., at a higher temperature the solid will melt and at a lower temperature the liquid will solidify. Varies with the composition of the liquid.

FRIABLE—Easily crushed or crumbled.

FRICTION—Resistance created by the surface of one object moving over the surface of another due to the interlocking of minute projections from the surfaces; this is called solid friction. If a lubricant is introduced between the two moving surfaces fluid friction replaces solid friction.

FUEL-GARD®—Trade name for a small, compact two-stage filter separator marketed by Facet for use on liquid/liquid separation. Permits the use of highly efficient medium developed for larger industrial applications on low flow rates.

FUEL MONITOR—Housing which monitors the cleanliness of product streams and shuts off all flow when water or solids contamination reaches predetermined concentration; moisture-sensitive elements trap contaminants and increase differential pressure to activate shut-off diaphragm.

FUEL WETTABLE—Capable of accepting liquid fuels. Opposite of nonwetable.

FULL FLOW—Product flow through the housing at the rate for which the housing is designed to operate. Also refers to all product passing through medium. Opposite of a bypass filter which is designed to filter only a portion of the stream at a higher efficiency on a continuous basis.

FULLER'S EARTH—Medium used in some elements, usually a blend of attapulgis and montmorillonite clay. A finely divided hydrous aluminum silicate. *See attapulgis.*

FUSE—*See filter monitor.*

G

GAS—State of matter in which molecules move freely causing matter to expand indefinitely, occupying the total volume available. Definition sometimes includes a reference to critical temperature, i.e., temperature above which liquefaction does not occur by pressure.

GAS SCRUBBER—Housing designed to knock out liquid and solid contaminants by impingement on a series of baffles or demister pads. Accomplished by drastic reduction of velocity as the gas enters the scrubber. Entrainment separation would expand the general use of the term to include mechanical cartridge type separators.

GASEOUS STREAM—Stream containing gas, either pure or mixed with a liquid.

GASKET—Material inserted between contact surfaces of a joint to ensure a fluid-tight seal. Although invariably softer than surfaces with which it is in contact it should not form a permanent bond. Constructional material is dependent on the temperature, pressure and chemical nature of the confined fluid.

GELATINOUS—Used to describe suspended solids that are slimy and deformable, causing rapid filter plugging.

GLASS FIBER—Proper reference to a fibrous material made from glass that is commonly used as a filter and separator medium. May be used in blanket or tube form and, due to the random dispersal of the fibers, makes good filter medium.

Are hydrophilic (water wettable) and perform the function of coalescing immiscible liquids for separation. May be used effectively on compressed air, gas, or liquids which are acidic but only slightly caustic. Also referred to as fiberglass or Fiberglas.

GLYCOL—General term for a family of alcohols; clear, colorless, and soluble to varying degrees in water, alcohol, ether, benzene, etc. Has a wide range of usage such as coolants, antifreeze and processes. Refer to specific type for further details.

GPD—Gallons per day.

GPH—Gallons per hour.

GPM—Gallons per minute.

GRAVITY—Relationship between the weight of a material and the weight of an equal volume of water. In the United States this relationship is expressed in terms of API gravity, Baumé gravity or specific gravity.

GRAVITY FILTER—Filter in which the driving force for filtration is provided solely by the head of liquor above the filter medium (i.e., not employing pressure or vacuum to give a high differential pressure). Gravity filters often handle compressible materials or materials in the form of flakes which would pack down and become impervious under high differential pressure.

GRAVITY SEPARATION—Separation of immiscible phases resulting from a difference in specific gravity by coalescing.

GREASE FILTER—Assembly consisting of either a coalescing section or an adsorptive section, or both. The former usually formed from knitted wire an/or glass fiber and the latter employs activated carbon.

GROOVED COUPLING—Clamp-like device with tongue-like edges which fit into grooves; forms a seal when secured. Commonly called by trade name Victaulic.

GROSS SOLIDS—Describes what may be considered an abnormally heavy solid load.

GROSS WATER—Describes what may be considered an abnormally heavy water load.

GSFM—Abbreviation for gallons per square foot per minute. Also GSFH for hour.

GURLEY—Term derived from name of manufacturer of permeometers, densitometers, and other instruments which use air to measure porosity, density and stiffness of paper. It is also possible for Gurley equipment to be used on porous or permeable material other than paper. Gurley instruments are used by TAPPI, the association of paper manufacturers. Porosity ratings are given in the number of seconds taken for 300 cc of air to pass through one square inch of material. Frazier and Gurley numbers are not convertible—no specific Frazier number equals a certain Gurley number. Frazier numbers are possibly more significant in that they reflect porosity specifications.

H

HAZE—Fine suspension of smoke or dust having some effect on the visual range. An opalescent or a very fine suspension in a liquid, especially in a beverage, e.g., wine, is referred to as a haze.

HEAD GASKET—Gasket seal at the main closure of a pressure housing. Usually the seal used between two flanges. Generally, either a flat gasket or o-ring.

HEAD LIFT—Device for raising head of a vertical pressure housing to permit access to interior of housing.

HEAT OF ADSORPTION—Heat released when a substance is adsorbed; equivalent to the energy which the adsorbate must give up in going from its normal energy state to the lower energy state it has when adsorbed. The heat depends on the adsorbate and adsorbent.

HEAT OF VAPORIZATION—Heat which must be put into a liquid to vaporize it at its boiling point.

HEEL—(1) The liquid left in a filter shell at the end of a cycle; (2) The precoat left on R.V.P.F. at end of its cycle.

HOLDING CAPACITY—Refers to the amount of solids, particulate or foreign material one or more elements is capable of retaining up to the terminal or maximum differential pressure. Also can refer to volumetric holding capacity of either a solid or a liquid.

HOMOGENEITY—Uniformity of particle size and distribution of a solid in the product.

HOOK—Device to aid in the mounting of elements held in position by the extension spring.

HYDROCARBON—Any one of a large number of compounds composed primarily of elements carbon and hydrogen. As they increase in molecular weight and boiling point, they may be respectively gases, liquids or solids.

HYDROPHILIC—Water accepting or water wetting. Having an affinity for water. Capable of uniting with, or dissolving in, water. Effective coalescing requires medium to have hydrophilic characteristics causing free or entrained water to commingle into droplets which, when mated with other droplets, form into drops which separate by gravity. Opposite of hydrophobic.

HYDROPHOBIC—Non-water wetting. Having an antagonism for water. Not capable of uniting or mixing with water. Hydrophobic features are induced in the process of cellulose manufacture. Opposite of hydrophilic.

HYDROSTATIC TEST—Test conducted with either air, water or other fluids at a given value over design pressure, to prove the structural integrity of a pressure housing.

I

ID—Inside diameter

IFT—Interfacial tension

IMHOFF TANK—Tank for settling sewage and digesting sludge, having upper sedimentation chamber with sloping floor leading to slots through which solids settle to digestion chamber.

IMMISCIBLE—incapable of being mixed; insoluble; opposite of miscible.

IMPINGEMENT—Process of removing liquid or solid contaminate from a stream of compressed air or gas by causing the flow to impinge on a baffle plate at a high velocity. Contaminate falls off by gravity into a large quiescent sump area to prevent the contaminants from being picked up a second time by the velocity of the stream. May also be used on liquid streams to separate solid contaminants.

IN SITU—In its original place.

INERT—Inactive chemically or physically.

INFLUENT—Stream of fluid at the inlet of a filter or filter separator. Same as affluent. Opposite of effluent.

INHIBITOR—Compounds or materials that have the effect of slowing down or stopping an undesired chemical change such as corrosion, oxidation, or polymerization. Addition of certain types of inhibitors change the interfacial tension of a petroleum product, which may reduce the coalescing efficiency of some medium. Reduced interfacial tension between two liquids causes a tighter emulsion more difficult to break up by coalescing.

INITIAL PRESSURE DROP—Loss in differential pressure between two points upon the start of flow through a housing using new elements.

IN-LINE—Applied to mixing and conditioning, in-line means the mixing of liquids with liquids or solids with liquids, or suspensions of solids in liquids with liquids, within a pipework system using metering units and automated control, which eliminates the requirement for separate storage tanks and mixing compartments.

IN-LINE FILTER—Filter or strainer arranged as a continuous flow unit in a pipeline or similar location.

INORGANIC—Not formed from living substance; substances which do not contain carbon as a major constituent.

INSIDE-OUT—Flow of product from inside to outside of element.

INSOLUBLE—Incapable of being dissolved in a fluid; opposite of soluble.

INTAKE—Material to be filtered. Also referred to as concentrate, feed, influent, liquor, mud, prefilter, pulp, slimes, or sludge.

INTERCHANGEABLE—One particular element which may be used in place of another particular element. Dimensions of both must be equal. Element being substituted frequently has more desirable characteristics than Element which it replaces. Refers primarily to dimensional interchangeability and must be for the same general applications.

INTERFACE—Surface over which continuous phase and discontinuous phase are in contact.

INTERFACIAL TENSION—Measure of miscibility or solubility of the continuous and discontinuous phases. Increases as miscibility or solubility decreases. *See inhibitors for effect on coalescing.*

INTERLOCK—Facet patented device that is a fail-safe device to prevent unmonitored fuel from bypassing the elements.

INTERPLEAT—Pleating of two or more filter media into an element, such as glass fibers and cellulose.

INTERSTICES—Spaces or openings in a medium. Also referred to as pores or voids. Usually refers to those voids contained in adsorptive media such as carbon, Fuller's Earth, etc. Available area for adsorption on or within a particle then must take into account not only the surface area but also that area within the particle due to the interstices or voids.

INTERSTITIAL—Pertaining to the openings in a medium.

ION—Electrically charged atom or group of atoms, formed by the gain or loss of electrons.

ION EXCHANGE—Reversible chemical reaction, usually between a solid and a liquid, in which ions may be interchanged.

I.P.—The Institute of Petroleum.

ISOKINETIC SAMPLING—Fluid flowing in a duct is sampled isokinetically when taken through an upstream facing sharp-edged probe so that the velocity into the probe is identical with the undisturbed free stream velocity at that point. Isokinetic conditions are vital for accurately sampling solid or liquid particles above a 5 micron diameter from gas streams but may be less important for liquid streams. Sampling non-isokinetically may produce errors in the weight concentration and size distribution of collected particles, depending on the density, shape and size of the particles and on the density, viscosity and velocity of the flowing fluid.

ISOTHERM—A constant temperature curve.

ISOTROPIC—Having same properties in all directions.

J

JET FUEL—Petroleum product used as fuel for jet engines.

K

KARL FISHER—Analytical method of determining amount of water present in a sample by titration.

KEROSENE—Petroleum liquid used as fuel, or for heating purposes.

KIESELGUHR—Finely divided siliceous material similar to diatomaceous earth, but usually with more impurities.

KNIFE EDGE PLEAT—Sharply defined creases at the outer cage of a pleated element.

KNIFE EDGE SEAL—Narrow, pointed ridge on the sealing surface of an end cap, center seal, or cartridge adaptor which provides a seal by biting into the cartridge gaskets.

L

L-TYPE FILTER—Cartridge filter in which the inlet and outlet port axis are at right angles and the filter elements axis is parallel to either port axis.

LACQUER—Natural or synthetic resin which is dissolved in a suitable solvent such as hydrocarbon oil rich in aromatics. When applied, the oil solvent evaporates, leaving behind a lacquer film.

LAMINAR FLOW—Term synonymous with streamline flow and viscous flow. A flow regime in which the flow characteristics are governed mainly by the viscosity of the fluid.

LEAF—Any flat filter element that has or supports the filter septum.

LIFE EXPECTANCY—Amount of use which may be expected from an element before it must be replaced; will vary according to element's characteristics, operating conditions, and condition of influent.

LINE SIZE—Size of line used to carry the product in a system, such as a six-inch line.

LIQUID—Product stream in liquid filtration and liquid filtration separation. Also may be the material to be removed by a liquid or gas entrainment separator.

LIQUID LEVEL CONTROL—Generally a float-operated control operating off the interface of two liquids for the purpose of evacuating one of the liquids from the housing after separation. In air or gas, it would operate off the surface of the liquid.

LIQUID LEVEL GAUGE—Gauge by which the interface of two immiscible liquids can be viewed, generally in an accumulator sump. May also be called a level gauge or interface gauge.

LIQUOR—Material to be filtered. Also referred to as concentrate, feed, influent, intake, mud, prefillt, pulp, slimes, or sludge.

LITER—1.057 quarts. Used as a volumetric standard to analyze liquids for water or solids content.

LOCK UP—Device that will lock either a column, elements or the body of a housing in place.

LOW INTERFACIAL TENSION—Where the interfacial tension of one liquid over another liquid would be less than 25 dynes/cm at 70°F. *See inhibitor* for effect on coalescing.

LOX CLEANING—Process of cleaning for liquid oxygen service. Generally known as a process of degreasing or making a component completely free of any hydrocarbons and/or foreign materials.

LUBRICATION—Substituting fluid friction for solid friction by inserting oil between two moving parts.

LVM—Low volatile material. *See attapulugus*.

M

MAGNETITE—Iron ore fully oxidized (Fe_3O_4) and naturally magnetic.

MAIN CLOSURE—Closure through which the housing is serviced when there is more than one opening into a housing.

MALE MOUNTING CAP—Device which allows elements to be mounted through an opening in a tube sheet. Normally removed with the cartridge. Used primarily in conversion kits.

MANIFOLD—A pipe or assembly into which the filter elements are connected to form one common discharge for the filtered product.

MARTIN'S DIAMETER—Statistical diameter used in particle size analysis; the mean length of line, parallel to the microscope traverse, dividing each particle into two equal areas.

MASS—Matter contained by a body, regardless of its location.

MASS DISTRIBUTION—Relative frequency distribution by mass within a particle size distribution. Sometimes presented as cumulative percentage undersize. *See average particle size*.

MASS TRANSFER—Movement of matter.

MASS TRANSFER RATE—Measurement of the movement of matter as a function of atoms, etc.

MATTER—Material substance of which an element, elements, or mass is composed. In this use does not refer to cartridge elements.

MAXIMUM ALLOWABLE PRESSURE DROP—Maximum pressure differential of a housing under specified product and flow condition.

MAXIMUM DIFFERENTIAL PRESSURE—Highest pressure differential which an element is required to withstand without structural failure or collapse.

MAXIMUM OPERATING PRESSURE—Maximum pressure allowed in the system.

MEAN EFFICIENCY RATING—A measurement of the average efficiency of a filter medium using the Multi-Pass Test where the average filtration (BETA) ratio = 2.0.

MEDIA—The material that performs the actual separation of solids from liquids. Sometimes erroneously used to mean septum.

MEDIA MIGRATION—Carry-over of fibers from filter and/or separator elements, or other filter material into the effluent. Less definitive than fiber migration and is quantitative.

MEDIUM—Principal component of an element. Material of controlled pore size or mass through which a product is passed to remove foreign particles held in suspension or to repel droplets of coalesced water; or a material without controlled pore size such as glass fiber mats which contribute to filtration, coalescence, or separation of two immiscible liquids.

MEMBRANE—Medium through which the liquid streams are to be passed or exchanged. Normally associated with ion exchange media such as dialysis, osmosis, diffusion, etc., although filter paper itself could be classed as a membrane.

MEMBRANE FILTER—Thin permeable film of inert polymeric material cast in such a way from a mixture of solvents so that the size, number and shape (tortuosity) of the pores is controlled. Widely used in bacterial filtration—solution sterilizing—in the medical field. In multiple units they are used industrially in beverage filtration and preparation of very pure water, etc. Can be in cylindrical cartridge form. Fine grades used in ultrafiltration, reverse osmosis and dialysis.

MESH (WIRE CLOTH)—Number of openings, or fractions of openings, in a lineal inch of wire cloth. Where the fractional part of an inch is specified, for example 1/2 mesh or 1/2" mesh, the term is understood to mean the measurement from the center of one wire to the center of the adjacent wire. Term should not be confused with clear openings or space.

METER PROVING TANK—Tank for calibrating capacity to provide volumetric proof of the delivery of liquids by positive displacement meters. Also referred to as calibrating tank.

MICROMETER—One millionth part of a meter. A standard SI unit.

MICRON—Short unit of length in the metric system. One millionth of a meter, 10^{-4} centimeter, 10^{-3} millimeter, or 0.000039 of one inch. Used as a criterion to evaluate the performance or efficiency of filter medium or to describe the condition of either the influent or effluent. Usually stated in terms of being either absolute or nominal. Nominal micron rating is generally taken to mean that 98% of all particles over a given micron value have been removed by specific medium. Absolute micron rating is generally taken to mean that all particles over a given micron value have been removed. Naked eye can see a particle 40 microns or larger.

MICROORGANISMS—Living bodies that can be seen only through a microscope.

MICROSCOPE COUNT—Use of a microscope for the estimation of mean particle size within a selected size range, by the use of a calibrated scale, graticule, or other aid. To avoid serious error some 500 to 600 counts, or observations, should be made.

MIGRATION—Contaminant released downstream of a filter. Built-in dirt migration—migration composed of foreign materials introduced during handling, storage and manufacture; Contaminant migration—migration due to unloading. Media migration—migration composed of the materials making up the filter media.

MILLILITER—One thousandth of a liter, equal to approximately one cubic centimeter.

MISCIBLE—Capable of being dissolved, soluble. Opposite of immiscible.

MIST—Visible water or hydrocarbon vapor; floating or failing in fine drops.

MIXING—Process of intermingling fibers from different bales or lots to produce a uniform mixture of all. Usually implies the use of only one kind of fiber, while the term blending is usually used for combinations of different fibers, colors, etc.

MMSCFD—Million standard cubic feet per day.

MMSCFH—Million standard cubic feet per hour.

MMSCFM—Million standard cubic feet per minute.

MOLE—Unit quantity in chemistry. Amount of a substance in grams (gram mole) or pounds (pound mole) which corresponds to the sum of the atomic weights of all the atoms appearing in the molecule. Sometimes referred to as a mol.

MOLECULAR SIEVE—Zeolite, natural or synthetic, or similar materials whose atoms are arranged in a crystal lattice in such a way that there are a large number of small cavities interconnected by smaller openings or pores of precisely uniform size. Used as drying agents for some liquids or gases as well as for other absorptive applications. May be regenerated for extended use under specified conditions.

MOLECULAR WEIGHT—Sum of the atomic weights of all the atoms in a molecule. Sometimes referred to as mole weight or mol weight.

MONITOR—*See filter monitor.*

MONO FILAMENT—Single, large continuous filament of a synthetic fiber.

MONTEJUS—Closed pressure tank partially filled with a fluid mixture which is forced out by gas pressure on its surface.

MONTMORILLONITE—Soft mineral commonly found in bentonite; becomes mud like when wet without expanding.

MOTHER LIQUOR—Liquid which has passed through the filter. Also referred to as discharge liquor effluent, filtrate, solute, or strong liquor.

MOTIVATING FORCE—That which causes the coalescing, filtering or separating action to take place.

MS—Military Standard. Prefix to government-assigned numbers indicating standardized items to military specifications.

MSCFD—Thousand standard cubic feet per day.

MSCFH—Thousand standard cubic feet per hour.

MSCFM—Thousand standard cubic feet per minute.

MUD—Material to be filtered. Also referred to as concentrate, feed, influent, intake, liquor, prefilt, pulp, slimes, or sludge.

MUD SUMP—Area of a horizontal housing, located upstream of the media, for the collection of solids falling out by gravity prior to going through the coalescing media, where gross solids are present in the stream.

MULLEN BURST TEST—Measurement of the force needed to burst a given area of paper or cloth, under fluid flow conditions, and usually expressed as the pressure in inches of water that will burst a 2" diameter test specimen.

MULTI-FILAMENT—A number of continuous fiber strands that are twisted together to form a yarn; used in weaving filter cloths.

MULTI-PASS—This test system is designed to be representative of a typical hydraulic and lubricating circuit. Fresh contaminant is introduced in slurry form into the test reservoir, mixed with the fluid in the reservoir, and pumped through the test filter, contaminant not captured by filter is returned to the reservoir for another pass through the filter.

MULTIPLE CARTRIDGES—Two or more cartridges fastened together end to end, to make up one element.

N

NEGATIVE PRESSURE—Vacuum or suction.

NOMINAL—Arbitrary term used to describe or define a degree of filtration. The filtration industry uses various methods of determining nominal ratings which are not necessarily interchangeable. Generally nominal references 98% removal of solids above a specified micron rating on a single pass basis. *See absolute.*

NOMINAL RATING—An arbitrary micrometer value indicated by filter manufacturer. Due to lack of reproducibility, this rating is deprecated.

NONAQUEOUS—Not water borne, water related, water resembling, nor containing water.

NONPOLAR—Compound or element whose electron capacity is satisfied. A neutral condition that will remain unreactive. Not polar. *See polar.*

NONTOXIC—Having a non-poisonous effect.

NONWOVEN—A filter cloth or paper that is formed of synthetic fibers that are randomly oriented in the media. Usually held together with a binder.

NORMAL PILING—Arrangement structure of filter cake as formed.

NOZZLES—Connections at the inlet and outlet of a housing through which product flows; or connections in a housing which permit connecting of accessories, etc. Term nozzle is not considered as descriptive.

NPT—National pipe thread standard.

NTP—Normal conditions of temperature and pressure. Refers to a gas measured at a pressure one (1) atmosphere absolute (760 mm of Hg) and a temperature of 0°C; some sources use a different reference temperature to define NTP.

O

OCCLUDED—Taken in and retained, absorbed.

OD—Outside diameter.

ON-STREAM—Describes when a filter system is producing a filtered product.

OPEN AREA—Pore area of filter medium, often expressed as a percentage of the total area.

OPERATING PRESSURE—Normal pressure at which a system operates.

OPERATING PRESSURE, CRITICAL—Pressure above the normal or design limits which may cause damage or rupture.

OPERATING PRESSURE, MAXIMUM—Maximum pressure allowed in the system.

ORGANIC—Describes the vast number of chemical substances containing carbon, hydrogen and oxygen.

ORGANIC SOLVENTS—Substances in which an organic material will dissolve.

ORIFICE PLATE—Plate with a central circular orifice which is clamped in a pipe or duct. Dependent on the type of plate, pressure tapings are provided as an integral part of the plate or on each side of it in the duct. The rate flow of fluid in the pipe or duct may be derived from measurement of the pressure difference across the plate.

OSMOSIS—Diffusion of a solvent through a semi-permeable membrane from a dilute solution into a more concentrated solution, thus tending to equalize the concentration of each side of the membrane.

OUT OF BALANCE PRESSURE—Pressure difference on either side of a filter press plate which may be induced by blockage of the feed ports and/or inconsistent physical conditions within adjacent filter chamber.

OUTER SHELL—Outer covering of an element, usually perforated or screen.

OUTER WRAP—Outside covering of an element.

OUTLET (FILTRATE OUTLET)—Ports integrally formed in a filter plate through which filtrate can escape from the filter chambers.

OUTSIDE-IN—Flow of product from outside to inside of element.

OXIDE—Combination of oxygen with another element.

OXIDATION—Chemical combination of any substance in which the oxidation state (positive valence) of an element is increased.

OZONE—Bluish gas which becomes indigo blue when compressed; highly explosive under pressure and for this reason is not used in industry in this form but as ozonized air created by electric discharge. Once thought to be beneficial to health, ozone is now considered to be harmful and its appearance in electrostatic precipitators associated with air is therefore undesirable. Efficient bactericide in the treatment of water, in which application it does not give rise to undesirable tastes and odors. Main disadvantage is the high cost in the treatment of large bulk supplies.

P

PACKED BED—Discrete materials such as sand, gravel, anthracite, fabricated rings or saddles, assembled in a confined space as a filtration medium for liquids or gases.

PAPER—Medium used in many elements. A very general term applied to resin impregnated cellulose. Many types of paper or cellulose, made to specification, are used as a filter medium.

PARTICLE—Single piece of solid material which is small in relation to its environment. Normally characterized by its size and shape.

PARTICLE COUNT—Practice of counting particles of solid matter in groups based on relative size. Frequently used in engineering a filter to a specific task or to evaluate the performance of a filter under specific operating conditions. When used as data to engineer a filter, proper consideration can be given the type of medium to be used, expectant life of the medium, and the true cost of operation.

PARTICLE SIZE DISTRIBUTION—Tabulation resulting from a particle count of solids grouped by specified micron sizes to determine the condition of either the influent or effluent stream. Usually expressed in percentage of total solids to the specific group. Example: 31% in the 6 to 10 micron group. *See particle count.*

PARTICULATE—Relating to minute, separate particles.

PELLET STRENGTH—Ability of a pellet to withstand service conditions without breaking or dusting.

PERFORATED—Material in which holes have been punched, such as the material used to make the center tube of a cartridge.

PERLITES—Material similar to volcanic glass with concentric shell structure.

PERMEABILITY—Ability of a cake or medium to pass liquids; or the rate of flow of fluid under a differential pressure through a material. Air permeability measurement provides a convenient comparison for various media and indicates the construction requirements for specific particle size retention. As a rule of thumb, lower permeability values indicate finer particle retentivity.

PERMEABLE—Material that has openings through which liquid will pass in filtering. Also referred to as porous or pervious.

PERVIOUS—*See permeable.*

pH RANGE—Arbitrary scale of numbers from 0 to 14 indicating acidity or alkalinity of a solution. A neutral solution has a pH of 7; below 7 represents acidity, and above 7 represents alkalinity.

PHASE—May be continuous, as the basic product flowing through a housing; or discontinuous, as the material to be removed from the basic product. Both are distinct and separate.

PHENOLIC RESINS—Synthetic thermosetting resins obtained by the condensation of phenol or substituted phenols with aldehydes. Used as a binder in cellulose and glass fibers to form filter media.

PIGMENT—Inorganic or organic, natural and synthetic chemical substances used to color paints, inks. etc.

PLASTISOL—Suspension of a thermosetting plastic which can be molded into any desired shape. Used as a combination end cap and gasket on element.

PLATE—Any flat surfaced filter element. Usually found in horizontal plate filters.

PLEAT, PINCHED—Pleat in a pleated filter element, closed off by excessive differential pressure or crowding, thus reducing the effective area of the filter element.

PLEAT, SPACERS—Used to prevent the collapse of pleats in a pleated paper cartridge, under the action of differential pressure. Examples are individual spacers of expanded metal or plastic and continuous spacers of plastics or woven materials, usually wire-cloth.

PLEATED—Physical form of cartridge made into a convoluted form to resemble the folds in an accordion.

PLEATING—In filters with paper medium or other sheet material, pleating means the folding processes which provide a large surface area within a given volume of filter.

PLUGGING—Filtered out particles filling the openings in a medium to the extent of shutting off the flow of product; loading up of the medium so as to reduce capacity. Also referred to as blinding or blocking.

POLAR—Compound or element capable of receiving or giving electrons. See *non-polar*.

POLYELECTROLYTE—Synthetic, water-soluble, linear polymers characterized by the presence of ionizing groups distributed along with molecular length. Used to promote flocculation.

POLYMERIZATION—Union of monomers or molecules to form a polymer consisting of giant molecules. Bonding of two or more monomers to produce a polymer. Any chemical reaction that produces such a bonding.

POLYURETHANES—Synthetic plastics formed by action of di-isocyanates on dihydric alcohols, polyesters or polyethers.

PORES—Openings in a medium. Also referred to as interstices. Size and shape of openings in cellulose are closely controlled in manufacture.

PORE SIZE DISTRIBUTION—Exclusive to permeable medium; describes the number of pores in various groups of sizes in a way similar to that discussed under particle size distribution. Data are valuable in assessing filtration performance from various standpoints.

POROSITY—Ratio of void volume to total cake volume. Also filter medium which may have larger pores than any other media.

POROUS—Material that has openings through which liquid will pass in filtering. Also referred to as permeable or pervious.

POTABLE—Drinkable (water).

POUR POINT—Lowest temperature at which a liquid will pour or flow when chilled without disturbance under specified conditions.

PPM—Parts per million. A unit of concentration; e.g., 3 ppm would be 3 pounds of solids in 1,000,000 pounds of water.

PRECOATING—Operation of depositing an inert material (filter aid) prior to beginning filtration.

PREFILT—Material to be filtered. Also referred to as concentrate, feed, influent, intake, liquor, mud, pulp, slimes or sludge.

PREFILTER—Filter for removing gross contaminate before the product stream enters a filter separator. Used to remove gross solids.

PREFILTER COALESCER—Two-stage, horizontal housing for efficient solids and water removal at high flow rates. Used on light gravity streams.

PREFILTER COALESCER SEPARATOR—Three-stage housing for use where stream carries an unusually high amount of solids; prefilter elements in first stage remove bulk of solids and permit coalescer and separator elements in next two stages to function more effectively for phase separation.

PRESSURE ABSOLUTE—Gauge pressure plus 14.7 psi.

PRESSURE, ATMOSPHERIC—Force exerted by the atmosphere at sea level; equivalent to 14.7 psi.

PRESSURE, EXPRESSED IN ATMOSPHERES—Total gauge pressure divided by 14.7 and expressed in atmospheres.

PRESSURE, PARTIAL—In a mixture of gases, each gas exerts a pressure equal to the total pressure multiplied by the mole fraction (or volume fraction) of the individual gas. The sum of the partial pressures equals the total pressure.

PRESSURE, PROOF—A test pressure above normal operating pressure to assure that part will withstand the norm without damage or leakage.

PRESSURE DIFFERENTIAL—Difference in pressure between two points.

PRESSURE DROP—Difference in pressure between two points, generally at the inlet and outlet of a filter or a filter separator. Measured in pounds per square inch gauge, or inches of mercury.

PRESSURE DROP, CLEAN—Differential pressure (drop) across a housing measured in pounds per square inch at rated flow on new elements with clean product.

PRESSURE DROP, MAXIMUM ALLOWABLE—Maximum pressure differential of a housing under specified product and flow conditions.

PRESSURE RELIEF—Valve which permits enough liquid or gas to escape from the housing to prevent extreme pressure buildup within a housing.

PRETREATMENT—Changing the properties of a liquid-solid mixture by physical or chemical means to improve its filterability. Chemical means include coagulation, flocculation and conditioning; physical means include size classification, preaeration, mechanical agitation, freezing and thawing, heating, ultrasonic and mechanical vibrations, electronic and magnetic treatment and ionizing radiation. Filter aids are also used for pretreatment.

PRIME—Used in the phrase “prime contractor” to designate a company which has been awarded a contract by the government agency; this company in turn may obtain material required by the contract from a subcontractor. Also the first coat of paint. Or the feeding of a pump at start-up.

PRODUCT—Continuous phase, either liquid, air or gas, which is being processed through filtration or filtration separation equipment.

PROVER TANK—Housing for proving the volumetric accuracy of positive displacement meters. Also called meter calibrating tank or meter proving tank.

PSI—Pounds per square inch.

PSIA—Pounds per square inch absolute.

PSID—Pounds per square inch differential.

PSIG—Pounds per square inch gauge.

PULP—Material to be filtered. Also referred to as concentrate, feed, influent, intake, liquor, mud, prefilter, slimes, or sludge. Also a material prepared by chemical or mechanical means chiefly from wood but also from rags and other materials, and used in making paper and cellulose products.

PULSATING BLOWBACK—Intermittent, on-off blowing, with or without cake discharge.

PURIFICATION—Removal of water of hydrocarbon in vapor form from an air or gas stream. Differs from entrainment removal in that the dew point of a gas stream will be lowered by vapor removal. May be the same as dehydration, classification, or clarification.

Q

QUIESCENT—State of rest of a body. In entrainment separation, the body would be a liquid. Also used to describe a sump containing evacuated liquids or solids.

R

RATE OF FLOW—See *flow rate*.

RATE OF FLOW CONTROL—Valve operated by differential pressure across an orifice for control of the rate at which a product flows through a housing.

RATED FLOW—Normal operating flow rate at which a product is passed through a housing; flow rate which a housing and medium are designed to accommodate.

RAW SLUDGE—Untreated sewage sludge.

RECYCLE—Return of filtered liquid for another filtering; a continuous flow of liquid through an open or closed system.

RED MUD—Filter cake in sodium aluminate filtration.

REDISTILL—Re-treat a distillate.

REENTRAINMENT—Process of rendering particles airborne again after they have been deposited from an airstream Example: particles captured in a filter may be reentrained if the velocity through the filter is increased slightly or if the filter is subjected to increased vibration.

REGENERATED—Cleaned of impurities and made reusable.

REGENERATED CELLULOSE—Those rayons in which the cellulose raw material is changed physically but not chemically. Viscose, cuprammonium and nitrocellulose rayons are of this type.

REJECTS—Undesired materials from ore disintegration.

RELATIVE HUMIDITY—Percentage relation that the actual amount of water vapor present in the given volume of air at a definite temperature bears to the maximum amount of water vapor that would be present if the air were saturated with water vapor at that temperature.

REPACK—Cylindrical element used in a single-stage filter separator for removal of one liquid and coarse solids from another liquid. May be used as a single element, a combination of waters, or a cluster type. Medium may be excelsior, glass fibers, or steel wool: or a combination of glass fibers and metal mesh.

REPAIR KIT—Composite of frequently replaced parts for an accessory item to permit the replacement of all high mortality parts.

REPELLENCY—Quality of repelling water, or being hydrophobic; opposite of water wettable.

REPLACEABLE—Element which is to be discarded after use and replaced with an identical element. Same as disposable. Opposite of reusable.

RESIDUE—Solids deposited upon the filter medium during filtration in sufficient thickness to be removed in sheets or sizable pieces. Sometimes referred to as cake or discharged solids.

RESIN IMPREGNATED—Treatment of fiber used in filter elements. Impregnation is carefully controlled in the manufacture of cellulose and provides a binder for the fibers which must be cured to specification during cartridge manufacture to preserve all the properties of the original specification for the cellulose.

RESIN IMPREGNATION—Filter papers used to construct pleated paper cartridges in order to give high mechanical strength. Typically 30% by weight of phenol formaldehyde, polyurethane or epoxide resins are added.

RESIN-WOOL—Filter material for the removal of particles from a gas stream. Usually made by carding degreased wool with a rosin-modified phenolformaldehyde resin. Used largely in industrial respirators. Also “wool resin filter”.

RESISTANCE—*Ventilation filter*. Pressure drop across a filter at a stated flow and under given conditions; generally expressed in millimeters water gauge, or in SI units as N/m^2 or Pascals. *See also flow resistance*.

RETAINER—Any device which holds a component in place.

RETENTION—Ability of filter medium to retain particles of a given size.

RETROFIT—Term used for the conversion of a filter or filter separator.

RETROFITTING—Modifying equipment to make changes of added features that have been an improvement to product.

REUSABLE—Element which may be cleaned and used again. Opposite of disposable or replaceable.

REVERSE OSMOSIS—Membrane separation process whereby a solvent is recovered from a solution. Permeability of the membrane is naturally very low since solutes are to be retained, and the normal osmotic pressure effect has to be overcome because the pressure required to cause the solvent to flow is high. To help the permeability, membranes are thin and it is necessary to support them well. They can be cast on porous tubes or as hollow fibers, and these forms are convenient for giving large areas as well as strong configurations. There is a constant flow across the membrane to prevent buildup of solid particles. The purified liquid is known as permeate and is almost always the desired product although proposals for using the concentrate, e.g., in fruit juices, have been investigated. *See osmosis*.

REYNOLDS NUMBER—Any of several dimensionless quantities, of form LV_p/N in theory of fluid motion.

RFSO—Raised face slip-on. Describes flange facing.

RFWN—Raised face weld neck. Describes flange facing.

RTJ—Ring type joint. Describes a flange facing. May be either slip-on, weld neck, or long weld neck.

RUNS—Cycles or batches.

S

SAE NUMBER—Classification of lubricating oils for crankcases and transmissions in terms of viscosity as standardized by the Society of Automotive Engineers.

SAND FILTER—Filter composed of layers of sand, graded in particle size so that the coarser particles face the unfiltered flow. Commonly employed in filtration of water supplies. Filters of this type (perhaps incorporating crushed coke and grit) have occasionally been used for removal of particles from gases. *See deep bed.*

SAYBOLT SECONDS UNIVERSAL (SSU)—Units of viscosity as measured by observing the time in seconds required for 60 ml. of a fluid to drain through a tubular orifice 0.483 inches long by 0.0695 inches in diameter at stated conditions of temperature and pressure.

SCAVENGER—A filter or element in the bottom of a filter that recovers the liquid heel that remains in a filter tank at the end of a cycle.

SCFD—Standard cubic feet per day.

SCFH—Standard cubic feet per hour.

SCFM—Standard cubic feet per minute.

SCREEN—Covering for element for physical protection; also used as a basic material for a separator element or the basket in a basket strainer. May have special coating such as Teflon®*.

SCREW BASE—Element base which is threaded to mounting by screwing the cartridge onto the cartridge adaptor.

SEAL—Any device which serves the purpose of sealing. Examples: center seal, gaskets, O-Rings, and mounting caps. May also include two precision machined surfaces that seal, referred to as a metal to metal seal.

SEAL NUT—Gasketed nut which holds element cap in place.

SEDIMENTATION—Action of the settling of the suspended solids.

SELECTOR VALVE—Component of a pressure gauge which permits independent pressure readings at two or three points.

SELF-CLEANING—Filtering device designed to clean itself by the use of a blowdown or backwash action. Medium is commonly a screen mounted on a cylindrical drum or device that removes bulk solids from large flow rates. Baffle in first stage aids in the separation of solids by impingement. Blowdown may be continual or intermittent and operated either manually or automatically by instruments.

SEPARATION—Action of separating solids or liquids from fluids. May be accomplished by impingement, filtration, or by coalescing. Term "separation" is used by some to refer to separation of liquids; also used to describe the action in the second stage of two-stage separation.

* Teflon is a registered trademark of E.I. DuPont de Nemours Co., (Inc.)

SEPTUM—Any permeable material that supports the filter media.

SERIES AGB—Facet's designation for a series of air/gas filters and entrainment separators designed in one- to four-stages for use in removing solids and liquids from air or gases.

SERIES B—Facet's designation for basket strainers.

SERIES CKF—Facet's designation for filter conversion kits.

SERIES CKS—Facet's designation for separator conversion kits.

SERIES CY—Facet's designation for cyclone type filters.

SERIES F—Facet's designation for fuller's earth filters and elements for adsorption and ion exchange applications; not for products containing polar additives and not for large amounts of water.

SERIES FC—Facet's designation for single-stage liquid filter coalescer.

SERIES FCS—Facet's designation for two-stage, horizontal filter separators, for removal of Solids and liquid from another immiscible liquid.

SERIES FG—Facet's designation for Fuel-Gard® products qualified to the I.P. monitor specification.

SERIES GNG—Facet's designation for products using absorptive type elements for military and commercial applications.

SERIES HP—Facet's designation for single-stage liquid filter separator using one or more repacks as medium, primarily for separation of water from light liquid streams.

SERIES M—Facet's designation for series of liquid filters for removal of insoluble contaminants, all using uniform sized "M" Series surface and depth type filter cartridges.

SERIES PFC—Facet's designation for two-stage liquid prefilter coalescer.

SERIES PFCS—Facet's designation for three-stage liquid prefilter coalescer separator.

SERIES R—Facet designation for filters using nominal 10" Duro-Gard cartridges in larger welded housings.

SERIES VCS—Facet's designation for two-stage vertical coalescer separator for removal of solids and liquid from another immiscible liquid.

SERIES VFCS—Facet's designation for two-stage vertical filter coalescer separator for removal of solids and liquid from another immiscible liquid.

SERVICE LIFE—Length of time an element operates before reaching the maximum allowable pressure drop.

SERVICED—Housing which has had old elements removed and replacement elements installed; servicing may also include installation of new head gasket, repair of accessories, cleaning, etc.

SHELL—Outer wall of a housing. Also referred to as a body or housing.

SILICA GEL—Regenerated adsorbent, consisting of amorphous silica. Used as a drying or dehumidifying agent for gases, liquids, or oils. Also used in certain types of packaging where moisture may be a problem.

SILTING INDEX—Measurement of the tendency of a fluid to cause silting in close tolerance devices as a result of fine particles and gelatinous materials being suspended in the fluid; measured by a silting index apparatus.

SINGLE-PASS—This test system is designed to be representative of a typical filter circuit. Fresh contaminate is introduced in slurry form into the test reservoir, mixed with the fluid in the reservoir, and pumped through the test filter. Contaminant not captured by filter is removed by a clean-up filter before fluid is returned to reservoir.

SINGLE-STAGE FILTER SEPARATORS—Liquid or air/gas filter separators containing only one type or kind of replaceable element, as opposed to two-stage, three-stage, or four-stage filter separators.

SIZE DISTRIBUTION—Proportion of particles of each size (by mass, number or volume) in a powder or suspension. See also *particle size distribution, size grading, number distribution, mass distribution and volume distribution*.

SKID-MOUNTED—One or more housings with pump and motor, all mounted on a portable platform.

SLAG—Waste from blast furnaces or from burning bituminous coal.

SLIMES—Slurry of fine solids; material to be filtered. Also referred to as concentrate, feed influent, intake, liquor, mud, prefillt, pulp, or sludge.

SLUDGE—Residues and deposits occasionally formed by oils after extended use; material to be filtered. Also referred to as concentrate, feed, influent, intake, liquor, mud, prefillt, pulp, or slimes.

SLUG VALVE—Pilot operated valve system which shuts off the flow of liquid when flow through the filter separator contains a "slug" of liquid such as water. Also called a discharge valve.

SLURRY—Thin, watery suspension; a material to be filtered.

SMOG—Term applied to a fog accompanied by pollution from industrial sources. Also applied to the haze of fine particles and gases over cities.

SMOKE—A disperse system of particles generally less than 5 micron in size. Smokes are of low vapor pressure and are formed by, for example, volatilization and condensation, oxidation, photochemical action or electric and mechanical pulverization.

SOFT IRON FILLED—Gasket with small, soft particles of iron compressed into the basic material.

SOLIDS—Mass or matter contained in a stream, considered undesirable and should be removed; that part of the discontinuous phase removed from liquid or gas through filtration.

SOLUBLE—Capable of being dissolved in a fluid. Opposite of insoluble.

SOLUTE—Liquid which has passed through the filter. Also referred to as discharge liquor, effluent, filtrate, mother liquor, or strong liquor.

SOLUTION—Single-phase combination of liquid and non-liquid substances, or two or more liquids.

SOLVENT—Substance, usually a liquid, in which another substance becomes dissolved; solvent will generally comprise the greater part of the solution.

SONOCO—Trade name for Kraft impregnated paperboard center tube.

SP. G.—Specifies gravity. The weight of any substance relative to the weight of water (water Sp. G. = 1.0).

SPACE—Area available to install a filter, filter separator, or entrainment separator.

SPACE SAVERS—Small compact Facet two-stage liquid filter separators or liquid filters which may be either horizontal or vertical and which occupy small floor space.

SPECIFIC GRAVITY—Ratio of Weight of any volume of a substance to the weight of an equal volume of another substance. Water for solids and liquids, and air or hydrogen for gases.

SPECTROPHOTOMETER—Laboratory instrument which measures the wave length and intensity of a light emitted by most chemical elements. When a sample is atomized and burned, the presence of most elements may be determined by their spectra (wave length) emission down to the parts per million range.

SPIN-ON-FILTER—Cartridge filter in which the filter body and the filter element have been constructed as an integral disposable item. Filter change is quick by spinning off the used unit from a fixed filter head and quickly spinning on a replacement unit.

SPINNING—Method of forming pressure housing heads.

SPORE FORMING BACTERIA—Bacteria which forms a resting cell, difficult to destroy.

SQUATTY—One type of open meter proving tank or a filter, both being designed in a low silhouette.

SS—Abbreviation for stainless steel without reference to type or material specification.

STACK—One or more cartridges mounted on a single column.

STATIC GENERATION—Result of friction between two non-conductors such as filter or filter separator elements and hydrocarbons; retained in the liquid dielectric.

STEEL JACKETED ASBESTOS—Gasket material; gasket with a steel jacket on the sealing surfaces of the basic material.

STOCK—Paper pulp feed; designation of a particular oil in refinery; bright stock.

STOKES' DIAMETER—Diameter of a sphere having the same density and the same free falling speed as the particle when moving in a homogeneous fluid, of the same density and viscosity, under conditions of laminar flow.

STOKES' LAW—A physical law which approximates the velocity of a particle falling under the action of gravity through a fluid. The particle will accelerate until the frictional drag of the fluid just balances the gravitational acceleration, after which it will continue to fall at a constant velocity known as the terminal or free-settling velocity.

STOOL—Device on the cartridge mounting plate used to mount an element. Also called a cartridge adaptor.

STRATIFICATION—Condition in which the larger particles settle out below the finer ones. Also referred to as a classification.

STREAM—Term sometimes used and synonymous with the words product, liquid, etc., in speaking of any matter processed by filtration or filtration separation equipment.

STRONG LIQUOR—Liquid which has passed through the filter. Also referred to as discharge liquor, effluent, filtrate, mother liquor, or solute.

SUBSTRATE—Substance on which an enzyme or ferment acts; a basic material used in making filter medium, usually in a deposit type process.

SUMP—Collecting area of a housing, located downstream from the coalescer elements, in which coalesced droplets of the dispersed phase are deposited; also called water leg. May also be used to collect solids in applications where gross solids are present in a stream; also called mud sump.

SUPERNATANT—Liquid above settled solids.

SURFACE—That part of the medium which is perpendicular to the direction of flow. Also surface medium which provides filtration, as opposed to media which may be considered depth media.

SURFACE ENERGY—Molecular reaction; the breaking away of ion particles from a mass.

SURFACE FILTER—Filter material that retains particles wholly on its surface.

SURFACE TENSION—That property of liquids which tends to contract the exposed surface to the smallest possible area; i.e., cohesion between like molecules.

SURFACE TENSITY—State or quality of the exposed surface of liquids.

SURFACTANTS—Coined expression for surface active agents which are sometimes called emulsifiers or wetting agents. First appeared in hydrocarbons with the advent of the catalytic cracking process in refining. Caused by the forming of sodium sulfonate and sodium naphthanate molecules. Affects liquid/liquid separation by reducing interfacial tension and forming into a slime which blinds off the fibers used in coalescing media.

SURGE—Peak system pressure measured as a function of restricting or blocking fluid flow.

SUSPENDED SOLIDS—Solids that do not dissolve in liquid; those that remain suspended and can be removed by filtration.

SUSPENSION—Any liquid containing undissolved solids.

SWING BOLT—Type of housing head closure which reduces service time. Opposite of thru-bolt flange where studs and nuts are used, such as with ASA type flanges.

T

TEFLON®—Registered trade name of E.I. DuPont de Nemours Co., (Inc.) for a material having non-stick characteristics. Facet's screen separator cartridges are made of Teflon coated mesh and are hydrophobic (repel water). Sometimes a Teflon material is used for gaskets.

TEMPERATURE, ABSOLUTE—Temperature measured from absolute zero which is minus 273°C, or minus 460°F; e.g., 70°F is 460 plus 70 or 530°R. (R stands for degrees Rankin), and 70°C is 273 plus 70 or 343° Kelvin.

TENSIOMETER—Device used to read the surface tension of a liquid, or to read the interfacial tension between two immiscible liquids.

TERMINAL PRESSURE—Pressure drop across the unit at the time system is shut down, or when the maximum allowable pressure drop is reached.

TERMINAL VELOCITY—Steady velocity achieved by a falling particle when gravitational forces are balanced by viscous forces. *See Stokes' Law.*

- THERMAL RELIEF**—Valve which is preset to effect opening when pressure becomes excessive due to increased atmospheric temperature.
- THERMOSWITCH**—Control which is preset to start and stop immersion heater operation at certain temperatures.
- THREE-STAGE FILTER SEPARATORS**—Liquid prefilter coalescer separators containing three kinds or types of replaceable elements. Air/gas filter separators containing two kinds of replaceable elements in addition to a first-stage baffle. As opposed to single-stage, two-stage, or four-stage filter separators.
- THRU-BOLT**—Type of housing closure using studs and nuts, such as in ASA type flanges.
- TITRATION**—Method of analyzing a solution by adding another solution until a given reaction is produced.
- TORTUOUS PATH**—Crooked, twisting, or winding path which tends to trap or stop solid particulate matter.
- TOXIC**—Having a poisonous effect.
- TRAMP OIL**—Free oil contained in emulsion type machine tool coolants. May be from machine leakage and from breakdown of the emulsifying agents in the cutting oil. Impairs the efficient operation of some types of cutting oil filter and is often removed by rotating steel drum of belt skimmers.
- TRANSMISSION**—Percentage of contaminant which passes through filter or filter medium. Penetration and transmittance have the same meaning.
- TRUE DENSITY**—Mass of a particle divided by its volume, pores, etc., being excluded from the volume calculation. *See porosity.*
- TUBE**—Either center tube or cartridge mounting tube. Sometimes used to describe a wound cartridge or glass fibers formed into a cylinder with an open center.
- TUBE SHEET**—A cartridge mounting plate.
- TURBIDITY**—Any insoluble particle that imparts opacity to a liquid. **TURBULENT FLOW**—Flow regime in which the flow characteristics are governed mainly by the inertia of the fluid. Turbulent flow in ducts is associated with high Reynolds Number (Re). It also gives rise to high drag forces.
- TWO-STAGE FILTER SEPARATOR**—Liquid filter separators and prefilter coalescers containing two kinds or types of replaceable elements. Air/gas filter separators containing one kind or type of replaceable element in addition to a first-stage baffle. As opposed to single-stage, three-stage, or four-stage filter separators. Two-stage filter separators are considered the most efficient device to separate immiscible liquids.
- U**
- ULTRAFILTRATION**—Separation of colloidal solids from liquids through semi-permeable medium.
- UNIFORMITY COEFFICIENT**—Specification factor applied to the sizing of the sand used in water filtration plants. Ratio of the mesh size of the sieve which permits 60% to pass through to the 10% “through Size” in a test sieving of a sand. Common size used for these filters is 0.4 to 0.6 mm, and for such a range the “uniformity coefficient” is usually specified to be not larger than 1.7.

UNIFORMITY OF FEED—Uniformity of the mixture of the solids in the feed liquid.

UNLOADING—Release downstream of trapped contaminate. Due to change in flow rate, mechanical shock, vibration, excessive pressure build-up or medium failure.

UPSTREAM—Portion of the product stream which has not yet entered the system.

V

VACUUM—A void; a perfectly empty space. Space at the upper end of a barometric tube created by the fall of the mercury. The term vacuum is also applied to pressures lower than atmospheric created by the partial removal of atmospheric air. A very wide range of filters operate by subjecting the underside of the filter cloth to vacuum so that atmospheric pressure above the filter cloth creates an appreciable differential pressure.

VAPOR—A solid or a liquid in a gaseous form under normal conditions of pressure and temperature.

VAPOR—General term used to describe a gaseous substance below its critical temperature. *See critical state and critical temperature.*

VEGETABLE FIBER—Paper-like gasket material.

VELOCITY—Time rate of motion in a given direction and sense.

VELOCITY HEAD—Velocity pressure or kinetic pressure. Is half the product of the fluid density and the square of the velocity in fluid flow. Difference between total and static pressure in incompressible flow.

VIBRA-PACKED—Mechanical means used by Facet to fill clay treater bags and canister type cartridges to maximum capacity with Attapulugus clay.

VISCOSITY—Degree of fluidity; property of fluids' molecular structure by virtue of which they resist flow. Resistance to flow exhibited by a liquid resulting from the combined effects of cohesion and adhesion. Units of measurement are poise and stoke. A liquid has a viscosity of one poise if a force of one dyne per square centimeter causes two parallel liquid surfaces one square centimeter in area and one centimeter apart to move past one another at a rate of one centimeter per second. There are a great many crude and empirical methods for measuring viscosity which generally involve measurement of the time of flow or movement of a ball, ring, or other object in a specially shaped or sized apparatus.

VISCOSITY INDEX—Numerical value assigned to a lubricating oil which indicates to what degree the oil changes in viscosity with change in temperature. Higher (VI) viscosity index oils show the least amount of change.

VITON A—Trade name for material used in gaskets and O-rings.

VOID CHANNELS—Open passages of the medium through which the liquid travels.

VOID RESTRICTION—Obstructions in the void openings which interfere with flow.

VOIDS—Openings in the medium. Also referred to as interstices or pores.

VOLUMETRIC FLOW RATE—Fluid flow expressed as a volume flowing per unit of time (cc.³/sec., ft.³/min., etc.).

W

WAFER—Type of repack consisting of four or more cylindrical packs.

WASTE—Material removed, rejected, or otherwise lost in various manufacturing processes.

WATER LEG—Area of housing for collection of water. *See sump.*

WATER WETTABLE—Capable of accepting water, or being hydrophilic; opposite of repellency or hydrophobic.

WEIGHT OF SOLIDS—Measure of solid particulate matter contained in a fluid sample. May be reported in various units such as milligrams per liter, weight percent, pounds per barrel, etc.

WET STRENGTH—Strength of the medium when saturated with water. Can also refer to the property obtained when an additive is imparted to a filter paper to give it additional strength when wet.

WETTED—Having accepted water or other liquid.

Y

YOKE—End cap used to hold a cartridge in place.

Z

ZEOLITE, ARTIFICIAL—Desiccant made in various-sized pellets.

MULTIPLY	BY	TO OBTAIN
Acres	160	Square rods
	4840	Square yards
	43.560	Square feet
Acres Inches	27,154	Gallons
Acres Inch/Hour	452	GPM
Atmospheres (Std.)		
760 MM of Mercury at 32°F	14.696	Pounds/square inch
	76.0	Cms. of mercury
	29.92	Inches of mercury
	33.90	Feet of water
	1.0333	Kgs./square cm.
	14.70	Lbs./square inch
	1.058	Tons/square foot
Barrels-Oil	42	Gallons-Oil
Barrels (Beer)	31.5	Gallons
(Wine)	31.0	Gallons
BTU (British Therm. Units)	0.2520	Kilogram-calories
	777.5	Foot-pounds
	3.927×10^{-4}	Horsepower-hours
	107.5	Kilogram-meters
	2.928×10^{-4}	Kilowatt-hours
BTU/Minute	12.96	Foot-pounds/second
	0.02356	Horsepower
	0.01757	Kilowatts
	17.57	Watts
Centares (Centiares)	1	Square Meters
Centigrams	0.01	Grams
Centiliters	0.01	Liters
Centimeters	0.3937	Inches
	0.03280	Feet
	0.01	Meters
	10	Millimeters
Centimeters of Mercury	0.01316	Atmospheres
	0.4461	Feet of water
	136.0	Kgs./square meter
	27.85	Lbs./square foot
	0.1934	Lbs./square inch
Centimeters/Second	1.969	Feet/minute
	0.03281	Feet/second
	0.036	Kilometers/hour
	0.6	Meters/minute
	0.02237	Miles/hour
	3.728×10^{-4}	Miles/minute
Centimeters/Sec./Sec.	0.03281	Feet/second/second
Cubic Centimeters	3.531×10^{-5}	Cubic feet
	6.102×10^{-2}	Cubic inches

MULTIPLY	BY	TO OBTAIN
Cubic Centimeters cont.	10^{-6}	Cubic meters
	1.308×10^{-6}	Cubic yards
	2.642×10^{-4}	Gallons
	10^{-3}	Liters
	2.113×10^{-3}	Pints (liquid)
	1.057×10^{-3}	Quarts (liquid)
Cubic Feet	2.832×10^4	Cubic centimeters
	1728	Cubic inches
	0.02832	Cubic meters
	0.03704	Cubic yards
	7.48052	U.S. Gallons
	6.23	Imperial Gallons
	28.32	Liters
	59.84	Pints (liquid)
	29.92	Quarts (liquid)
Cubic Feet/Minute	472.0	Cubic cms./second
	0.1247	Gallons/second
	0.4720	Liters/second
	62.43	Lbs. of water/minute
Cubic Feet/Second	0.646317	Million gallons/day
	448.831	Gallons/minute
Cubic Foot Water	62.4	Pounds
	998.8	Ounces
	28.315	Kilograms
Cubic Inches	16.39	Cubic centimeters
	5.787×10^{-4}	Cubic feet
	1.639×10^{-5}	Cubic meters
	2.143×10^{-5}	Cubic yards
	4.329×10^{-3}	Gallons
	1.639×10^{-2}	Liters
	0.03463	Pints (liquid)
	0.01732	Quarts (liquid)
Cubic Meters	10^6	Cubic centimeters
	35.31	Cubic feet
	61,023	Cubic inches
	1.308	Cubic yards
	264.2	U.S. Gallons
	10^3	Liters
	220	Imperial Gallons
	2113	Pints (liquid)
	1057	Quarts (liquid)
Cubic Yards	7.646×10^5	Cubic centimeters
	27	Cubic feet
	46,656	Cubic inches
	0.7646	Cubic meters
	202.0	Gallons
	764.6	Liters
	1616	Pints (liquid)
	807.9	Quarts (liquid)

MULTIPLY	BY	TO OBTAIN
Cubic Yards/Minute	0.45	Cubic feet/second
	3.367	Gallons/second
	12.74	Liters/second
Decigrams	0.1	Grams
Deciliters	0.1	Liters
Decimeters	0.1	Meters
Degrees (Angle)	60	Minutes
	0.01745	Radians
	3600	Seconds
Degrees/Second	0.01745	Radians/second
	0.1667	Revolutions/minute
	0.002778	Revolutions/second
Dekagrams	10	Grams
Dekaliters	10	Liters
Dekameters	10	Meters
Drams	27.34375	Grains
	0.0625	Ounces
	1.771845	Grams
Fathoms	6	Feet
Feet	30.48	Centimeters
	12	Inches
	0.3048	Meters
	3	Yards
Feet of Water	0.02950	Atmospheres
	0.8826	Inches of mercury
	0.03048	Kgs./sq. centimeter
	62.43	Pounds/square feet
	0.4335	Pounds/square inch
Feet/Minute	0.5080	Centimeters/second
	0.01667	Feet/second
	0.01829	Kilometers/hour
	0.3048	Meters/minute
	0.01136	Miles/hour
Feet/Second/Second	30.48	Centimeters/sec./sec.
	0.3048	Meters/sec./sec.
Foot-Pounds	1.286×10^{-3}	BTUs
	5.050×10^{-7}	Horsepower-hours
	3.241×10^{-4}	Kilograms-calories
	0.1383	Kilogram-meters
	3.766×10^{-7}	Kilowatt-hours
Foot-Pounds/Minute	1.286×10^{-3}	BTU/min.
	0.01667	Foot-pounds/sec.
	3.030×10^{-5}	Horsepower
	3.241×10^{-4}	Kg.-calories/minute
	2.260×10^{-5}	Kilowatts

MULTIPLY	BY	TO OBTAIN
Foot-Pounds/Second	7.717×10^{-2}	BTU/minute
	1.818×10^{-3}	Horsepower
	1.945×10^{-2}	Kg.-calories/minute
	1.356×10^{-3}	Kilowatts
Gallons, U.S.	3785	Cubic centimeters
	0.1337	Cubic feet
	231	Cubic inches
	3.785×10^{-3}	Cubic meters
	4.951×10^{-3}	Cubic yards
	128	Fluid ounces
	3.785	Liters
	8	Pints (liquid)
	4	Quarts (liquid)
Gallons, Imperial	0.83267	Imperial gallons
	1.20095	U.S. Gallons
	277.3	Cubic inches
	0.16	Cubic feet
	4.546	Liters
Gallons Water (U.S.)	0.00454	Cubic meters
	8.3453	Pounds of water
Gallons Water (Imperial)	3.785	Kilograms
	10.02	Pounds
Gallons/Minute	4.54	Kilograms
	2.228×10^{-3}	Cubic feet/second
	0.06308	Liters/second
Gallons Water/Minute	8.0208	Cubic feet/hour
	6.0086	Tons water/24 hours
Grains (Troy)	1	Grains (avoirdupois)
	0.06480	Grams
	0.04167	Pennyweights(troy)
	2.0833×10^{-3}	Ounces (troy)
Grains/U.S. Gallons	17.118	Parts/million
	142.86	Lbs./million gallons
Grains/Imperial Gallons	14.286	Parts/million
Grams	980.7	Dynes
	15.43	Grains
	.001	Kilograms
	1000	Milligrams
	0.03527	Ounces
	0.03215	Ounces (troy)
	2.205×10^{-3}	Pounds
Grams/Centimeters	5.600×10^{-3}	Pounds/inch
Grams/Cubic Centimeters	62.43	Pounds/cubic foot
	0.03613	Pounds/cubic inch
Grams/Liters	58.417	Grains/gallon
	8.345	Lbs./1000 gallons
	0.062427	Pounds/cubic foot
	1000	Parts/million

MULTIPLY	BY	TO OBTAIN
Hectograms	100	Grams
Hectoliters	100	Liters
Hectometers	100	Meters
Hectowatts	100	Watts
Horsepower	42.44	BTU/min.
	33,000	Foot-lbs./minute
	550	Foot-lbs./second
	1.014	Horsepower(metric)
	10.70	Kg.-calories/minute
	0.7457	Kilowatts
	745.7	Watts
Horsepower (Boiler)	33,479	BTU/hour
	9.803	Kilowatts
Horsepower-Hours	2547	BTU
	1.98×10^6	Foot-pounds
	641.7	Kilogram-calories
	2.737×10^5	Kilogram-meters
	0.7457	Kilowatt-hours
Inches	2.540	Centimeters
	25.4	Millimeters
	.0254	Meters
	.0833	Foot
Inches of Mercury	0.03342	Atmospheres
	1.133	Feet of water
	0.03453	Kgs./square cm.
	70.73	Lbs./square feet
	0.4912	Lbs./square inch
Inches of Water	0.002458	Atmospheres
	0.07355	Inches of mercury
	0.002540	Kgs./square cm.
	0.5781	Ounces/square inch
	5.202	Lbs./square foot
	0.03613	Lbs./square inch
Kilograms	980,665	Dynes
	2.205	Pounds
	1.102×10^{-3}	Tons (short)
	10^3	Grams
Kilograms/Meters	0.6720	Pounds/foot
Kilograms/Sq. Centimeters	0.9678	Atmospheres
	32.81	Feet of water
	28.96	Inches of mercury
	2048	Lbs./square foot
	14.22	Lbs./square inch
Kilograms/Sq. Millimeters	10^6	Kgs./square meter
Kiloliters	10^3	Liters
Kilometers	10^5	Centimeters

MULTIPLY	BY	TO OBTAIN
Kilometers cont.	3281	Feet
	10^3	Meters
	0.6214	Miles
	1094	Yards
Kilometers/Hour	27.78	Cms./second
	54.68	Feet/minute
	0.9113	Feet/second
	0.5396	Knots
	16.67	Meters/minute
	0.6214	Miles/hour
Kilometers/Hour/Second	27.78	Cms./sec./sec.
	0.9113	Feet/sec./sec.
	0.2778	Meters/sec./sec.
Kilopascals	20.885434	Lbs./square foot
	.145038	Lbs./square inch
	.296134	Ins. of mercury @ 60°F
	4.018647	Ins. of water @ 60°F
Kilowatts	56.92	BTU/minute
	4.425×10^4	Foot-lbs./minute
	737.6	Foot-lbs./second
	1.341	Horsepower
	14.34	Kg.-calories/minute
	10^3	Watts
Kilowatts-Hour	3415	BTU
	2.655×10^6	Foot-pounds
	1.341	Horsepower-hour
	860.5	Kilogram-calories
	3.671×10^5	Kilogram-meters
Liters	10^3	Cubic centimeters
	0.03531	Cubic feet
	61.02	Cubic inches
	10^{-2}	Cubic meters
	1.308×10^{-3}	Cubic yards
	0.2642	Gallons
	2.113	Pints (liquid)
	1.057	Quarts (liquid)
Liters/Minute	5.886×10^{-4}	Cubic/feet/second
	4.403×10^{-3}	Gallons/second
Lumber Width (Inch) x Thickness (Inch)		
12	Length (feet)	Board feet
Meters	100	Centimeters
	3.281	Feet
	39.37	Inches
	10^{-3}	Kilometers
	10^3	Millimeters
	1.094	Yards
Meters/Minute	1.667	Centimeters/second

MULTIPLY	BY	TO OBTAIN
Meters/Minute cont.	3.281	Feet/minute
	0.05468	Feet/second
	0.06	Kilometers/hour
	0.03728	Miles/hour
Meters/Second	196.8	Feet/minute
	3.281	Feet/second
	3.6	Kilometers/hour
	0.06	Kilometers/minute
	2.237	Miles/hour
	0.03728	Miles/minute
Metric Tons	2204.6	Pounds
	1.1023	Short tons
Microns	10^{-6}	Meters
Miles	1.609×10^5	Centimeters
	5280	Feet
	1.609	Kilometers
	1760	Yards
Miles/Hour	44.70	Centimeters/second
	88	Feet/minute
	1.467	Feet/second
	1.609	Kilometers/hour
	0.8684	Knots
	26.82	Meters/minute
Miles/Minute	2682	Centimeters/second
	88	Feet/second
	1.609	Kilometers/minute
	60	Miles/hour
Milliers	10^3	Kilograms
Milligrams	10^{-3}	Grams
Milliliters	10^{-3}	Liters
Millimeters	0.1	Centimeters
	0.03937	Inches
Milligrams/Liter	1	Parts/million
Million Gallons/Day	1.54723	Cubic feet/second
Minutes (Angle)	2.909×10^{-4}	Radians
Ounces	16	Drams
	137.5	Grains
	0.0625	Pounds
	28.349527	Grams
	0.9115	Ounces (troy)
	2.790×10^{-5}	Tons (long)
	2.835×10^{-5}	Tons (metric)
Ounces, Troy	480	Grains
	20	Pennyweights (troy)
	0.08333	Pounds (troy)
	31.103481	Grams

MULTIPLY	BY	TO OBTAIN
Ounces, Troy cont.	1.09714	Ounces, (avoirdupois)
Ounces (Fluid)	1.805	Cubic inches
	0.02957	Liters
Ounces/Square Inch	0.0625	Pounds/square inch
Parts/Million	0.0584	Grains/U.S. gallon
	0.07016	Grains/Imp. gallon
	8.345	Pounds/million gallon
Pennyweights (Troy)	24	Grains
	1.55517	Grams
	0.05	Ounces (troy)
	4.1667×10^{-3}	Pounds (troy)
Pints	0.4732	Liter
Pounds (Avoirdupois)	16	Ounces
	256	Drams
	7000	Grains
	0.0005	Tons (short)
	453.5924	Grams
	1.21528	Pounds (troy)
	14.5833	Ounces (troy)
	0.454	Kilograms
Pounds (Troy)	5760	Grains
	240	Pennyweights (troy)
	12	Ounces (troy)
	373.24177	Grams
	0.822857	Pounds (avoir.)
	13.1657	Ounces (avoir.)
	3.6735×10^{-4}	Tons (long)
	4.1143×10^{-4}	Tons (short)
	3.7324×10^{-4}	Tons (metric)
Pounds of Water	0.01602	Cubic feet
	27.68	Cubic inches
	0.1198	Gallons
	0.10	Imperial gallons
Pounds of Water/Minute	2.670×10^{-4}	Cubic feet/second
Pounds/Cubic Foot	0.01602	Grams/cubic cm.
	16.02	Kgs./cubic meter
	5.787×10^{-4}	Lbs./cubic inch
Pounds/Cubic Inch	27.68	Grams/cubic cm.
	2.768×10^4	Kgs./cubic meter
	1728	Lbs./cubic foot
Pounds/Foot	1.488	Kgs./meter
	178.6	Grams/centimeter
Pounds/Square Foot	6.945×10^{-3}	Pounds/square inch
	.014139	Ins.of mercury @ 32°F
	0.01602	Ft.of water @ 39.1°F
	.04788	Kilopascals
	4.883×10^{-4}	Kgs./sq. centimeter

MULTIPLY	BY	TO OBTAIN
Pounds/Square Inch	0.06804	Atmospheres
	144	Pounds/square foot
	2.036	Ins. of mercury @ 62°F
	2.307	Feet of water @ 62°F
	6.894757	Kilopascals
	0.07031	Kgs./sq. centimeter
Quarts (Dry)	67.20	Cubic inches
Quarts (Liquid)	57.75	Cubic inches
Qunital	101.28 (Argentina)	Pounds
	129.54 (Brazil)	Pounds
	101.43 (Castile, Peru)	Pounds
	101.41 (Chile)	Pounds
	101.47 (Mexico)	Pounds
	220.46 (Metric)	Pounds
<hr/>		
	1	
Sq. Ft./ Gal./Min.	8.0208	Overflow rate (ft./hr.)
Temperature		
°C + 273	1	Absolute °C
°C + 17.78	1.8	°F
°F + 460	1	Absolute °F
°F - 32	$\frac{5}{9}$	°C
Tons (Long)	1016	Kilograms
	2240	Pounds
	1.12	Tons (short)
Tons (Metric)	10^3	Kilograms
	2205	Pounds
Tons (Short)	2000	Pounds
	32000	Ounces
	907.18486	Kilograms
	2430.56	Pounds (troy)
	0.89287	Tons (long)
	29166.66	Ounces (troy)
	0.90718	Tons (metric)
Tons of Water/24 Hours	83.333	Pounds water/hour
	0.16643	Gallons/minute
	1.3349	Cubic feet/hour
Watts	0.05692	BTU/minute
	44.26	Foot-pounds/minute
	.7376	Foot-pounds/second
	1.341×10^{-3}	Horsepower
	0.01434	Kg.-calories//minute
	10^{-3}	Kilowatts
Watt-Hours	3.415	BTU
	2655	Foot pounds
	1.341×10^{-3}	Horsepower/hours
	0.8605	Kilogram-calories
	367.1	Kilogram-meters
	10^{-3}	Kilowatt-hours

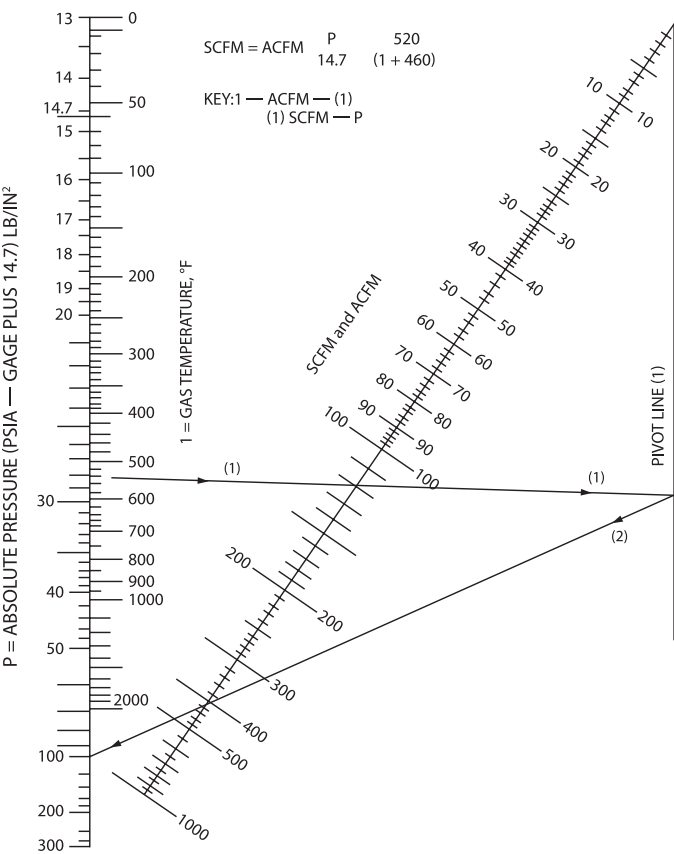
NOTE: The numbers in boldface refer to the temperature in degrees, either Centigrade or Fahrenheit, which it is desired to convert into the other scale. If converting from Fahrenheit to

Centigrade			Centigrade		
Fahrenheit			Fahrenheit		
—73.3	—100	—148.0	2.8	37	98.6
—67.8	—90	—130.0	3.3	38	100.4
—62.2	—80	—112.0	3.9	39	102.2
—59.4	—75	—103.0	4.4	40	104.0
—56.7	—70	—94.4	5.0	41	105.8
—53.9	—65	—85.0	5.6	42	107.6
—51.1	—60	—76.0	6.1	43	109.4
—48.3	—55	—67.0	6.7	44	111.2
—45.6	—50	—58.0	7.2	45	113.0
—42.8	—45	—49.0	7.8	46	114.8
—40.0	—40	—40.0	8.3	47	116.6
—37.2	—35	—31.0	8.9	48	118.4
—34.4	—30	—22.0	9.4	49	120.2
—31.7	—25	—13.0	10.0	50	122.0
—28.9	—20	—4.0	10.6	51	123.8
—26.1	—15	5.0	11.1	52	125.6
—23.3	—10	14.0	11.7	53	127.4
—20.6	—5	23.0	12.2	54	129.2
—17.8	0	32.0	12.8	55	131.0
—17.2	1	33.8	13.3	56	132.8
—16.7	2	35.6	13.9	57	134.6
—16.1	3	37.4	14.4	58	136.4
—15.6	4	39.2	15.0	59	138.2
—15.0	5	41.0	15.6	60	140.0
—14.4	6	42.8	16.1	61	141.8
—13.9	7	44.6	16.7	62	143.6
—13.3	8	46.4	17.2	63	145.4
—12.8	9	48.2	17.8	64	147.2
—12.2	10	50.0	18.3	65	149.0
—11.7	11	51.8	18.9	66	150.8
—11.1	12	53.6	19.4	67	152.6
—10.6	13	55.4	20.0	68	154.4
—10.0	14	57.2	20.6	69	156.2
—9.4	15	59.0	21.1	70	158.0
—8.9	16	60.8	21.7	71	159.8
—8.3	17	62.6	22.2	72	161.6
—7.8	18	64.4	22.8	73	163.4
—7.2	19	66.2	23.3	74	165.2
—6.7	20	68.0	23.9	75	167.0
—6.1	21	69.8	24.4	76	168.8
—5.6	22	71.6	25.0	77	170.6
—5.0	23	73.4	25.6	78	172.4
—4.4	24	75.2	26.1	79	174.2
—3.9	25	77.0	26.7	80	176.0
—3.3	26	78.8	27.2	81	177.8
—2.8	27	80.6	27.8	82	179.6
—2.2	28	82.4	28.3	83	181.4
—1.7	29	84.2	28.9	84	183.2
—1.1	30	86.0	29.4	85	185.0
—0.6	31	87.8	30.0	86	186.8
0.0	32	89.6	30.6	87	188.6
0.6	33	91.4	31.1	88	190.4
1.1	34	93.2	31.7	89	192.2
1.7	35	95.0	32.2	90	194.0
2.2	36	96.8	32.8	91	195.8

Centigrade degrees, the equivalent temperature will be found in the left column while if converting from degrees Centigrade to degrees Fahrenheit, the answer will be found in the column on the right.

Centigrade			Centigrade		
Fahrenheit			Fahrenheit		
33.3	92	197.6	293	560	1040
33.9	93	199.4	299	570	1058
34.4	94	201.2	304	580	1076
35.0	95	203.0	310	590	1094
35.6	96	204.8	316	600	1112
36.1	97	206.6	321	610	1130
36.7	98	208.4	327	620	1148
37.2	99	210.2	332	630	1166
37.8	100	212.0	338	640	1184
43	110	230	343	650	1202
49	120	248	349	660	1220
54	130	266	354	670	1238
60	140	284	360	680	1256
66	150	302	366	690	1274
71	160	320	371	700	1292
77	170	338	377	710	1310
82	180	356	382	720	1328
88	190	374	388	730	1346
93	200	392	393	740	1364
99	210	410	399	750	1382
100	212	414	404	760	1400
104	220	428	410	770	1418
110	230	446	416	780	1436
116	240	464	421	790	1454
121	250	482	427	800	1472
127	260	500	432	810	1490
132	270	518	438	820	1508
138	280	536	443	830	1526
143	290	554	449	840	1544
149	300	572	454	850	1562
154	310	590	460	860	1580
160	320	608	466	870	1598
166	330	626	471	880	1616
171	340	644	477	890	1634
177	350	622	482	900	1652
182	360	680	488	910	1670
188	370	698	493	920	1688
193	380	716	499	930	1706
199	390	734	504	940	1724
204	400	752	510	950	1742
210	410	770	516	960	1760
216	420	788	521	970	1778
221	430	806	527	980	1796
227	440	824	532	990	1814
232	450	842	538	1000	1832
238	460	860	566	1050	1922
243	470	878	593	1100	2012
249	480	896	621	1150	2102
254	490	914	649	1200	2192
260	500	932	677	1250	2282
266	510	950	704	1300	2372
271	520	968	732	1350	2462
277	530	986	760	1400	2552
282	540	1004	788	1450	2642
288	550	1022	816	1500	2732

Conversions — Standard CFM to Actual CFM



EXAMPLE:

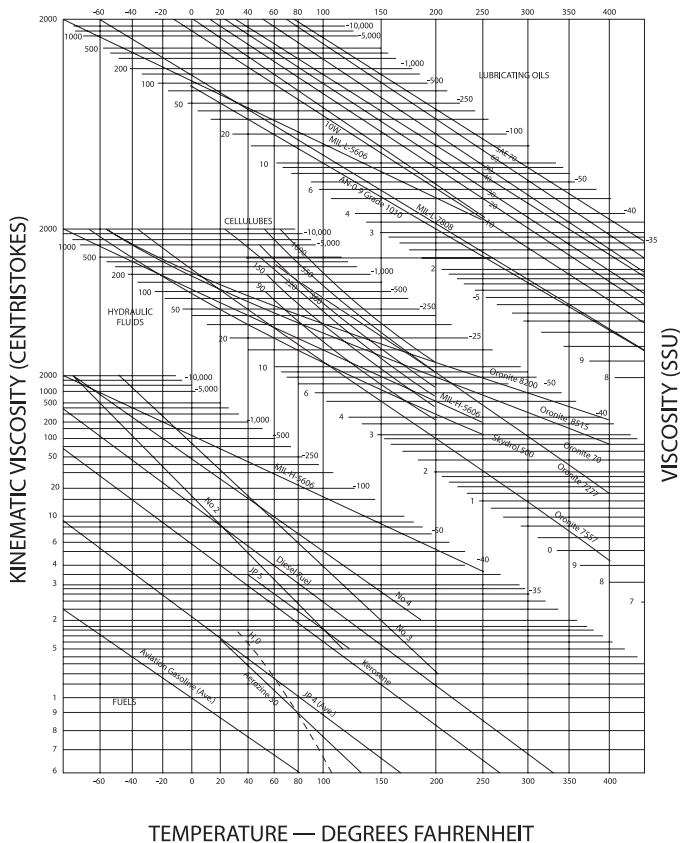
A dryer can handle 120 ACFM gas at 540°F and 1000 psia. What is its SCFM capacity?

SOLUTION:

Align $t = 540^{\circ}\text{F}$ with ACFM = 120 and mark (1); align (1) with $P = 1000 - (10) \cdot 100$ and read SCFM = $(10) \cdot 425 = 4250$

NOTE:

If P scale is multiplied by 10, 100, etc., multiply SCFM scale by same number. Also, SCFM and ACFM scales can be simultaneously multiplied by the same factor.

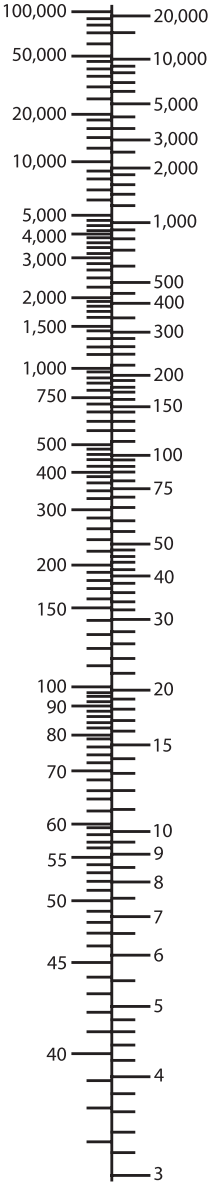


Conversion of Centistokes
to
Saybolt Universal Seconds

$$\text{centistokes} = \frac{\text{centipoise}}{\text{specific gravity}}$$

Viscosity, Saybolt Universal Seconds

Kinematic Viscosity, Centistokes



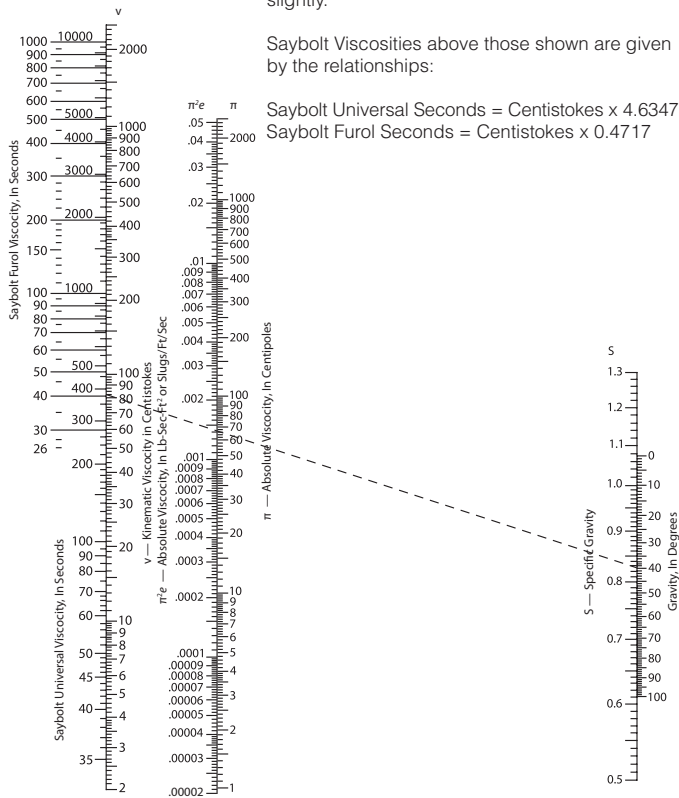
$$\mu = \nu \rho' = \nu S$$

The empirical relation between Saybolt Universal Viscosity and Saybolt Furol Viscosity at 100°F and 122°F, respectively, and Kinematic Viscosity is taken from A.S.T.M. D2161-63T. At other temperatures, the Saybolt Viscosities vary only slightly.

Saybolt Viscosities above those shown are given by the relationships:

$$\text{Saybolt Universal Seconds} = \text{Centistokes} \times 4.6347$$

$$\text{Saybolt Furol Seconds} = \text{Centistokes} \times 0.4717$$



Example 1

To determine the absolute viscosity of an oil which has a kinematic viscosity of 82 centistokes and a specific gravity of 0.83, connect 82 on the kinematic viscosity scale with 0.83 on the specific gravity scale; read 67 centipoise at the intersection on the absolute viscosity scale.

Example 2

To determine the absolute viscosity of an oil having a specific gravity of 0.83 and a Saybolt Furol viscosity of 40 seconds, connect 0.83 on the specific gravity scale with 40 seconds on the Saybolt Furol scale; read 67 centipoise at the intersection on the absolute viscosity scale.

Viscosity and Gravity of Common Liquids

LIQUID	SPECIFIC GRAVITY	VISCOSITY SSU	
		40°F	60°F
TRANSMISSION OILS—AUTO TRANSMISSION GEAR LUBRICANTS			
SAE 90	.880 - .935	14,000	5,500
SAE140	.880 - .935	35,000	12,000
SAE 250	.880 - .935	160,000	50,000

OTHER OILS

Castor Oil	.960	36,000	9,000
Chinawood	.943	4,000	1,800
Cocconut	.925	1,500	500
Cod	.928	1,800	600
Corn	.924	1,600	700
Cotton Seed	.880 - .925	1,500	600
Cylinder	.820 - .950	60,000	14,000
Navy No. 1 Fuel Oil	.989	4,000	1,100
Navy No. 2 Fuel Oil	1.000	—	24,000
Gas	.887	180	90
Insulating	—	350	150
Lard	.912 - .925	1,100	600
Linseed	.925 - .939	1,500	500
Raw Menhadden	.933	1,500	500
Neats Foot	.917	—	1,000
Olive	.912 - .918	1,500	550
Palm	.924	1,700	700
Peanut	.920	1,200	500
Quenching	—	2,400	900
Rape Seed	.919	2,400	900
Rosin	.980	28,000	7,800
Rosin (Wood)	1.090	Extremely Viscous	
Sesame	.923	1,100	500
Soya Bean	.927 - .980	1,200	475
Sperm	.883	360	250
Turbine (Light)	.910	500	350
Turbine (Heavy)	.910	3,000	1,400
Whale	.925	900	450

MISCELLANEOUS LIQUIDS

Water	1.00	31.5	31.5
Gasoline	.68 - .74	30	30
Jet Fuel	.74 - .85	35	35
Kerosene	.78 - .82	42	38
Turpentine	.86 - .87	34	33
Varnish Spar	.90	3,500	1,600

CRANKCASE OILS—AUTOMOBILE LUBRICATING OILS

SAE 10	.88 - .935	1,500-2,400	600-900
SAE 20	.88 - .935	2,400-9,000	900-3,000
SAE 30	.88 - .935	9,000-14,000	3,000-4,400
SAE 40	.88 - .935	14,000-19,000	4,400-6,000
SAE 50	.88 - .935	19,000-45,000	6,000-10,000
SAE 60	.88 - .935	45,000-60,000	10,000-17,000
SAE 70	.88 - .935	60,000-120,000	17,000-45,000

VISCOSITY SSU

80°F	100°F	120°F	140°F	160°F
2,200	1,100	650	380	240
5,000	2,200	1,200	650	400
18,000	7,000	3,300	1,700	1,000

3,000	1,400	900	400	300
1,000	580	400	300	200
250	140	100	70	60
300	175	110	80	70
400	250	175	100	80
300	176	125	80	70
6,000	2,700	1,400	1,000	400
600	380	200	170	90
8,700	3,500	1,500	900	480
60	50	45	—	—
90	65	50	45	40
380	287	180	140	90
250	143	110	85	70
250	140	110	80	70
430	230	160	100	80
320	200	150	100	80
380	221	160	120	90
300	195	150	100	80
450	250	180	130	90
450	250	180	130	90
3,200	1,500	900	500	300
Extremely Viscous		Extremely Viscous		
290	184	130	90	60
270	165	120	80	70
170	110	90	70	60
230	150	—	—	—
700	330	200	150	100
275	170	140	100	80

31.5	31.5	31.5	31.5	31.5
30	30	30	30	30
35	35	35	35	35
34	33	31	30	30
32.8	32.6	32.4	32	32
1,000	650	530	250	230

300-400	170-220	110-130	75-90	60-65
400-1,100	220-550	130-280	90-170	65-110
1,100-1,800	550-800	280-400	170-240	110-150
1,800-2,400	800-1,100	400-550	240-320	150-200
2,400-4,000	1,100-1,800	550-850	320-480	200-280
4,000-6,000	1,800-2,500	850-1,200	480-580	280-380
6,000-10,000	2,500-4,000	1,200-1,800	580-900	380-500

Viscosity and Gravity of Common Liquids

LIQUID	SPECIFIC GRAVITY	VISCOSITY SSU	
		40°F	60°F
FUEL OIL AND DIESEL OIL			
No. 1 Fuel Oil	.82 - .95	40	38
No. 2 Fuel Oil	.82 - .95	70	50
No. 3 Fuel Oil	.82 - .95	90	68
No. 5A Fuel Oil	.82 - .95	1,000	400
No. 5B Fuel Oil	.82 - .95	1,300	600
No. 6 Fuel Oil	.82 - .95	—	70,000
No. 2D Diesel Fuel Oil	.82 - .95	100	68
No. 3D Diesel Fuel Oil	.82 - .95	200	120
No. 4D Diesel Fuel Oil	.82 - .95	1,600	600
No. 5D Diesel Fuel Oil	.82 - .95	15,000	5,000

LIQUID	SPECIFIC GRAVITY	VISCOSITY SSU
		70°F

SUGAR, SYRUPS, MOLASSES, ETC.

Corn Syrups	1.40 - 1.47	—
Glucose	1.35 - 1.44	—
Honey (Raw)	—	—
Molasses	1.40 - 1.49	—
Corn Starch 22 Baumé	1.18	150
Corn Starch 24 Baumé	1.20	600
Corn Starch 25 Baumé	1.21	1,400
Ink—Printers	1.00 - 1.38	—
Ink—Newspaper	—	—
Tallow	.918	56 SSU @ 212°F

TARS

Coke Oven—Tar	1.12+	3,000-8,000
Gas House—Tar	1.16 - 1.3	15,000-300,000

CRUDE OILS

Texas, Oklahoma	.810 - .916	100-700
Wyoming, Montana	.860 - .880	100-1,100
California	.780 - .920	100-4,500
Pennsylvania	.800 - .850	100-200

GLYCOL

Propylene	1.038	240.6
Triethylene	1.125	185.7
Diethylene	1.120	149.7
Ethylene	1.125	88.4
Glycerine (100%)	1.260	2,900
Phenol (Carbolic Acid)	.95 - 1.00	60
Silicate of Soda	—	—
Sulfuric Acid (100%)	1.830	75

VISCOSITY SSU

80°F	100°F	120°F	140°F	160°F
35	33	31	30	30
45	40	—	—	—
53	45	40	—	—
200	100	75	60	40
490	400	330	290	240
20,000	5,600	1,900	900	500
53	45	40	36	35
80	60	50	44	40
280	140	90	68	54
2,000	900	400	260	160

VISCOSITY SSU

100°F	130°F
5,000-500,000	1,500-60,000
35,000-100,000	10,000-13,000
340	—
1,300-250,000	700-75,000
130	—
440	—
800	—
2,500-10,000	1,100-3,000
5,500-8,000	2,400
56 SSU @ 212°F	
650-1,400	—
2,000-20,000	—
34-210	—
46-320	—
34-700	—
38-86	—
—	—
—	—
—	—
—	—
813	—
—	—
365-640	—
—	—

API and Baumé Gravities and Weight Factors

API Gravity	Baumé Gravity	Specific Gravity	Lbs. Per U.S. Gal.	U.S. Gals. Per Lb.
0	10.247	1.0760	8.962	0.1116
1	9.223	1.0679	8.895	0.1124
2	8.198	1.0599	8.828	0.1133
3	7.173	1.0520	8.762	0.1141
4	6.148	1.0443	8.698	0.1150
5	5.124	1.0366	8.634	0.1158
6	4.099	1.0291	8.571	0.1167
7	3.074	1.0217	8.509	0.1175
8	2.049	1.0143	8.448	0.1184
9	1.025	1.0071	8.388	0.1192
10	10.00	1.0000	8.328	0.1201
11	10.99	0.9930	8.270	0.1209
12	11.98	0.9861	8.212	0.1218
13	12.97	0.9792	8.155	0.1226
14	13.96	0.9725	8.099	0.1235
15	14.95	0.9659	8.044	0.1243
16	15.94	0.9593	7.989	0.1252
17	16.93	0.9529	7.935	0.1260
18	17.92	0.9465	7.882	0.1269
19	18.90	0.9402	7.830	0.1277
20	19.89	0.9340	7.778	0.1286
21	20.88	0.9279	7.727	0.1294
22	21.87	0.9218	7.676	0.1303
23	22.86	0.9159	7.627	0.1311
24	23.85	0.9100	7.578	0.1320
25	24.84	0.9042	7.529	0.1328
26	25.83	0.8984	7.481	0.1337
27	26.82	0.8927	7.434	0.1345
28	27.81	0.8871	7.387	0.1354
29	28.80	0.8816	7.341	0.1362
30	29.79	0.8762	7.296	0.1371
31	30.78	0.8708	7.251	0.1379
32	31.77	0.8654	7.206	0.1388
33	32.76	0.8602	7.163	0.1396
34	33.75	0.8550	7.119	0.1405
35	34.73	0.8498	7.076	0.1413
36	35.72	0.8448	7.034	0.1422
37	36.71	0.8398	6.993	0.1430
38	37.70	0.8348	6.951	0.1439
39	38.69	0.8299	6.910	0.1447
40	39.68	0.8251	6.870	0.1456
41	40.67	0.8203	6.830	0.1464
42	41.66	0.8155	6.790	0.1473
43	42.65	0.8109	6.752	0.1481
44	43.64	0.8063	6.713	0.1490
45	44.63	0.8017	6.675	0.1498
46	45.62	0.7972	6.637	0.1507
47	50.61	0.7927	6.600	0.1515
48	50.60	0.7883	6.563	0.1524
49	50.59	0.7839	6.526	0.1532
50	50.58	0.7796	6.490	0.1541

API Gravity	Baumé Gravity	Specific Gravity	Lbs. Per U.S. Gal.	U.S. Gals. Per Lb.
51	50.57	0.7753	6.455	0.1549
52	51.55	0.7711	6.420	0.1558
53	52.54	0.7669	6.385	0.1566
54	53.53	0.7628	6.350	0.1575
55	54.52	0.7587	6.316	0.1583
56	55.51	0.7547	6.283	0.1592
57	56.50	0.7507	6.249	0.1600
58	57.49	0.7467	6.216	0.1609
59	58.48	0.7428	6.184	0.1617
60	59.47	0.7389	6.151	0.1626
61	60.46	0.7351	6.119	0.1634
62	61.45	0.7313	6.087	0.1643
63	62.44	0.7275	6.056	0.1651
64	63.43	0.7238	6.025	0.1660
65	64.42	0.7201	5.994	0.1668
66	65.41	0.7165	5.964	0.1677
67	66.40	0.7128	5.934	0.1685
68	67.39	0.7093	5.904	0.1694
69	68.37	0.7057	5.874	0.1702
70	69.36	0.7022	5.845	0.1711
71	70.35	0.6988	5.817	0.1719
72	71.34	0.6953	5.788	0.1728
73	72.33	0.6919	5.759	0.1736
74	73.32	0.6886	5.731	0.1745
75	74.31	0.6852	5.703	0.1753
76	75.30	0.6819	5.676	0.1762
77	76.29	0.6787	5.649	0.1770
78	77.28	0.6754	5.622	0.1779
79	78.27	0.6722	5.595	0.1787
80	79.26	0.6690	5.568	0.1796
81	80.25	0.6659	5.542	0.1804
82	81.24	0.6628	5.516	0.1813
83	82.23	0.6597	5.491	0.1821
84	83.22	0.6566	5.465	0.1830
85	84.20	0.6536	5.440	0.1838
86	85.19	0.6506	5.415	0.1847
87	86.18	0.6476	5.390	0.1855
88	87.17	0.6446	5.365	0.1864
89	88.16	0.6417	5.341	0.1872
90	89.15	0.6388	5.316	0.1881
91	90.14	0.6360	5.293	0.1889
92	91.13	0.6331	5.269	0.1898
93	92.12	0.6303	5.246	0.1906
94	93.11	0.6275	5.222	0.1915
95	94.10	0.6247	5.199	0.1924
96	95.09	0.6220	5.176	0.1932
97	96.08	0.6193	5.154	0.1940
98	97.07	0.6166	5.131	0.1949
99	98.06	0.6139	5.109	0.1957
100	99.05	0.6112	5.086	0.1966

NOTES—

The relation of Degrees Baumé or API to Specific Gravity is expressed by the following formulas:

For liquids lighter than water:

$$\text{Degrees Baumé} = \frac{140}{G} - 130, \qquad G = \frac{140}{130 + \text{Degrees Baumé}}$$

$$\text{Degrees API} = \frac{141.5}{G} - 131.5 \qquad G = \frac{141.5}{131.5 + \text{Degrees API}}$$

For liquids heavier than water:

$$\text{Degrees Baumé} = 145 - \frac{145}{G} \qquad G = \frac{145}{145 - \text{Degrees Baumé}}$$

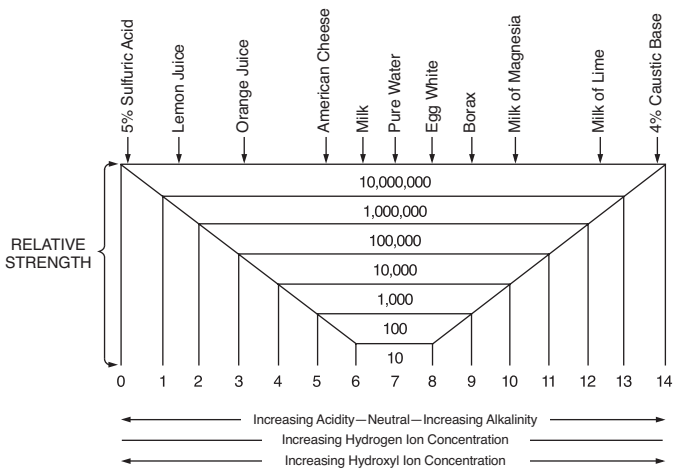
G = Specific Gravity = ratio of the weight of a given volume of oil at 60° Fahrenheit to the weight of the same volume of water at 60° Fahrenheit.

The above tables are based on the weight of 1 gallon (U.S.) of oil with a volume of 231 cubic inches at 60° Fahrenheit in air at 760 mm pressure and 50% humidity. Assumed weight of 1 gallon of water at 60° Fahrenheit in air is 8.32828 pounds.

$$D = \frac{md_1 + nd_2}{m + n}$$

- D = Density or Specific Gravity of mixture
- m = Proportion of oil of d₁ density
- n = Proportion of oil of d₂ density
- d₁ = Specific gravity of m oil
- d₂ = Specific Gravity of n oil

To determine the resulting gravity by mixing oils of different gravities:



The pH Scale

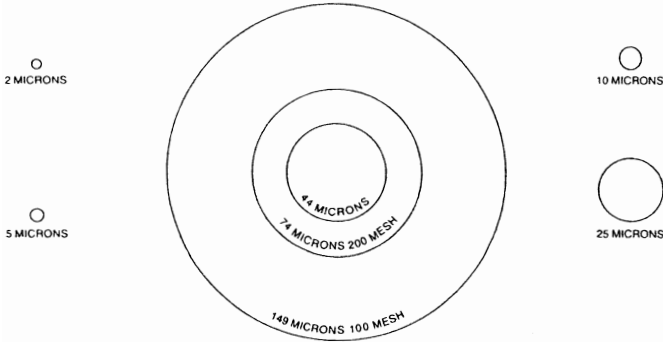
In its simplest definition, pH can be defined as a measure of the acidity or alkalinity of a substance. For instance, lemon juice is acid and lye is alkaline. The pH scale is used to express the degree.

There are many hundreds of acids and alkalis of varying strength. Despite their widely diverse properties, acids owe their acidity to the single property of actively producing dissociated, or free, hydrogen ions (H^+) in solution; while alkalis owe their alkalinity to the property of actively producing dissociated hydroxyl ions (OH^-) in solution. However, all acid substances have some hydroxyl ions, just as all alkaline substances have some hydrogen ions, and the product of the two ions in solution is always a constant. Therefore, it is possible to express the concentration of one ion relative to the other, rather than have a separate scale for each.

Hydrogen ion concentration is used to express both acidity and alkalinity, since an electrode that will sense hydrogen ion concentration is much more stable than one which will sense hydroxyl ion concentration. Because numerical values for the hydrogen ion concentration often are extremely small fractions (for example, $1/10,000,000$), the pH scale is used instead. This scale is defined as the negative logarithm (or the log of the reciprocal) of the hydrogen ion concentration. The arbitrary term, pH, is simply a logarithmic index employing small numbers to express hydrogen ion concentration.

The pH scale ranges from 0 to 14, with 7 (the pH of pure water) the neutral point at which hydrogen ions and hydroxyl ions exist at about the same concentration. Numbers greater than 7 indicate the degree of alkalinity, and numbers less than 7 indicate the degree of acidity. The relationship between the two ions and acidity and alkalinity is shown above. Note that the relative strength of acids and alkalis changes tenfold for each unit change in pH. Thus, compared with a solution of pH5, a solution of pH4 is ten times as acid, a solution of pH3 is a hundred times as acid, and a solution of pH2 is one thousand times as acid.

MAGNIFICATION: 500 TIMES



LINEAR EQUIVALENTS

1 inch	25.4 Millimeters	25,400 Microns
1 millimeter0394 Inches	1,000 Microns
1 Micron	$\frac{1}{25,400}$ of an inch ..	.001 Millimeters
1 Micron	3.94×10^{-5}000039 Inches

RELATIVE SIZES

Lower Limit of Visibility (Naked Eye)	40 Microns
White Blood Cells	25 Microns
Red Blood Cells	8 Microns
Bacteria (Cocci)	2 Microns

STANDARD SCREEN SIZES

Meshes per Linear Inch	ASTM-E-11-61 U. S. Sieve No.	Opening in Inches	Opening in Micron
20.16	20	0.0331	841
27.62	30	0.0234	595
38.02	40	0.0165	420
52.36	50	0.0117	297
72.45	70	0.0083	210
85.47	80	0.0070	177
101.1	100	0.0059	149
142.86	140	0.0041	105
200.00	200	0.0029	74
270.26	270	0.0021	53
323.00	325	0.0017	44