TITLE

Abrasion: The mechanical wearing away of one material by another material moving over it.

Absolute Pressure: A pressure scale with the zero point at a perfect vacuum. The sum of atmospheric and gauge pressure.

Absolute: A measure having as its zero point or base the complete absence of the entity being measured.

Absorbent Filters: A filter medium that entraps contaminants and holds it by mechanical means.

Accumulator: A container in which fluid is stored under pressure and includes some type of limit in loading mechanism for maintaining pressure.

Actuator: A device that converts fluid energy into mechanical motion.

Additive: A chemical compound or compounds added to a fluid to change or improve its properties or performance.

The adherence of surfaces due to weldment/fusion of asperity contact points/ junctions or by *Adhesion:* The molecular attraction exerted between the surfaces of two bodies in contact.

Adhesive Lock: increased surface contact area due to polishing.

Adiabatic: Compression or expansion of a gas without the transfer of heat to or from the fluid or surroundings. See isentropic.

Adsorbent Filters: A filter medium primarily intended to hold soluble and insoluble contaminants on its surface by molecular adhesion.

Aeration: Air in hydraulic fluid.

Aging: A gradual and continuous alteration in the parameters of a component or system.

Air Cleaner Fine Test Dust (ACFTD): A naturally occurring material representative of contaminant associated with ingression-type systems. It is produced from natural Arizona road dust and it is processed, packaged, and distributed worldwide. Used for particle counter calibration, filter tests, and component contaminant sensitivity testing.

Air, Standard: Air at state conditions of 68° F, a pressure of 14.7 psi absolute, and a relative humidity of 35 percent.

Airdraulic: A component combining both an air and oil system; e.g., an intensifier using air as the driving medium and oil as the amplified pressure medium.

Algorithm: A law, rule or procedure for solving a recurring mathematical problem.

Amplifier: A device that increases the volume over that of the source flow rate at the expense of pressure—also called a booster. An intensifier boosts pressure at cost of flow rate while an amplifier boosts volume at cost of pressure.

Amplitude Ratio: The ratio of the control parameter amplitude to the input parameter amplitude at a particular frequency.

Analogue: A term pertaining to a general class of devices, components or circuits whose output varies as a continuous function of its input over some specific range. For example, a pressure may be represented by a voltage that is its analogue.

Annulus: The net area created between two mating rings. For example, the difference between a cylinder bore area and the piston rod area.

Atmosphere, Standard: The pressure exerted by the atmosphere at sea level at 15° C and is equal to 14.7 psi, 1.034 kgf/cm^2 or 1.014 bar.

Atmospheric Pressure: The actual pressure exerted on all objects by the atmosphere because of the weight of the surrounding air. Varies with elevation, temperature and climatic conditions.

Attenuation: Production of an output signal of smaller magnitude than its corresponding input, sometimes termed a “gain” of less than 1.0 or an “amplitude ratio” of less than 1.0.

Automatic: A sequence of operations that can take place without operator control.

Back Pressure: A pressure existing on the discharge or backside of a load. It adds to the pressure required to move the load.

Backup Ring: Used to bridge a clearance and minimize extrusion of a seal when cylinder barrel circumferentially expands or when differential pressure across seal is high. It must not collapse or cold flow and IS sometimes known as an “anti-extrusion ring.”

Baffle: A device, usually a plate, installed in a reservoir to eliminate the line of sight between the pump inlet and the return line.

Bar: An international measure of pressure equal to 14.5 psi or 1.02 kgf/sqcm.

Barrel Bellowing: Expansion of the cylinder barrel during pressurization.

Base Oil: A base stock fluid without additives.

Bernoulli’s Law: States that if no work is done on or by a flowing frictionless fluid, its energy due to pressure and velocity remains constant at all points along the streamline. That is, an increase of velocity is always accompanied by a decrease in pressure.

Beta Ratio: An international standard method of expressing the filtration ratio or particle capture characteristics of a hydraulic filter. It is the ratio of the number of particles greater than a given size in the influent fluid to the number of particles greater than the same size in the effluent fluid.

Bleed: A small controlled flow of fluid from a pressurized system.

Blind End: A cylinder end closure which completely covers the bore area, called the cap.

Block Diagram: A diagram representing the flow of information and the functions performed by each component in a system.

Bode Plot: A chart showing how an output signal differs from its input signal in magnitude and timing as a function of frequency.

Booster: A device that increases the volume over that of the system flow rate at the expense of pressure, also called an amplifier. It is the adverse of an intensifier that amplifies pressure at the expense of flow rate.

Boundary Lubrication: A lubrication regime in which mating surfaces are in rubbing contact and where the lubricating film between the surfaces has a thickness approximately equal to the surface roughness of the contacting surfaces.

Braid Neutral Angle: The angle 54°44' is called the neutral angle of hose braid because it is the angle at which there is no movement of the hose, under internal pressure, either in hose length or diameter, assuming no elongation of the reinforcement. At the neutral angle, the braid offers maximum resistance to both hoop and longitudinal stresses and will therefore be in a state of equilibrium when the hose is subject to internal pressure.

Breather: A device which allows air to move in and out of a container to compensate for fluctuating levels of liquid to maintain atmospheric pressure.

Bulk Modulus, Effective: The bulk modulus of the system that includes the elasticity of the container, the amount of gas present in the liquid, and the compressibility of the liquid itself.

Bulk Modulus: A measure of resistance to compressibility of a fluid and is the reciprocal of compressibility.

By-pass: A secondary passage for fluid flow that changes the operation of a component or circuit.

Cap, Cylinder: A cylinder end closure that completely covers the bore area (opposite the rod end).

Capability: A measure of operational or system effectiveness

Capillary: A tube that exhibits a length to diameter ratio ³ 400. In most cases the tube has an internal diameter in the range of a few thousandths of an inch, which causes the characteristic elevation or depression of liquids.

Cartridge Valve: A valve that can be removed and replaced easily without being fully dismantled. They are completely bodiless and capable of satisfying directional, flow, and pressure functions.

Cartridge: A component that can be removed and replaced easily without being fully dismantled—e.g., a replaceable element for a filter, pump or valve.

Cavitation: A localized vaporous/gaseous condition within a liquid stream that occurs where the pressure is reduced below atmospheric and the vapour pressure of the liquid. In pumps it occurs when the suction line is restricted and the resulting vacuum causes the fluid to boil and the surface of the fluid wetted component to flake and pit.

Centipoise: A unit of absolute viscosity. cp

Centistoke: A unit of kinematic viscosity. cSt

Charge Pressure: The pressure at which replenishing fluid is forced into the hydraulic system (above atmospheric pressure).

Chatter: Instability of a hydraulic component. Usually associated with servovalve/actuator combinations, check valves, and relief valves. This instability manifests itself as a clattering sound or in the case of spring biased valves as a loud howl.

Check Valve: A valve that normally allows flow in one direction only.

Chemical Stability: The resistance possessed by a fluid to chemical decomposition; e.g., oxidation, and hydrolysis.

Choke: A restriction that is relatively long with respect to its cross-section dimension.

Circuit Relief: See System Protector.

Circuit: An arrangement of components and interconnecting lines that form the complete path of flow in a hydraulic system.

Cleanliness Code: The ISO/SAE Solid Contaminant Code is the only international standard for defining the contamination level of a hydraulic fluid.

Clearance Flow: Fluid flow through the space between two mating parts. Such space is needed to achieve easy relative motion and to compensate for differing thermal expansions.

Closed Centre: A description given to a directional valve in which all ports are blocked when it is in the neutral or null position.

Closed Circuit: A conduit arrangement in which the pump delivery, after passing through the hydraulic actuator, bypasses the reservoir and returns directly to the pump inlet. Closed circuit configuration is commonly used in hydrostatic transmission drive systems. A variable displacement pump and not a valve control the movement of the actuator in this type circuit.

Closed Loop: A group of control elements linked together such that the output is continually monitored and compared with the input. Should the output differ from the input, the resulting error signal will cause corrective action in the system.

Closure: A cap, a plug, or cover for a fluid passage.

Coefficient of Friction: The quotient of the applied force parallel to a sliding surface required to move an object and its load normal to the sliding surface.

Coefficient, Dry Friction: A coefficient due to the contact between the moving surfaces associated with a motor shaft.

Coefficient, Laminar Flow: Relates the flow/pres-sure characteristics of a restrictor at low Reynolds number.

Coefficient, Minor Losses: Relates minor pressure loss with flow velocity and density. The coefficient varies depending on the flow conditions and conduit geometric configuration.

Coefficient, Orifice Flow Discharge: The ratio of the mass flow rate at the discharge end of an orifice to mass flow rate through an ideal orifice which expands an identical working fluid from the same initial conditions to the same exit pressure.

Coefficient, Slip Flow: A coefficient proportional to a design characteristic dimension and the cube of the clearance between the internal sealing surfaces.

Coefficient, Valve Pressure-Flow: A coefficient that expresses the ratio of the flow of the valve at maximum opening to the square root of the corresponding maximum pressure.

Coefficient, Viscous Drag: A coefficient proportional to a characteristic dimension of a bearing divided by the associated clearance.

Compliance, Hydraulic: The change in liquid volume under a unit pressure change.

Component: A single hydraulic unit (e.g., a pump, valve, actuator, conduit and fluid) used to perform specific functions.

Compounded Oil: A petroleum oil to which has been added animal or vegetable oil, or other substances.

Compressibility Factor Z: The product of the pressure and volume of a gas divided by the product of temperature of the gas and the gas constant. This factor can be inserted in the ideal gas law to take into account the departure of true gases from ideal gas behaviour.

Compressibility: The change in volume of a fluid when pressure is applied. Usually expressed in terms of bulk modulus, which is the reciprocal of compressibility.

Compression Set: The inability of a seal to return to its original cross-sectional size and shape after compression. Usually expressed as a percent of original deflection and affects the original mechanical squeeze. It is considered the most important physical characteristic of an O-ring seal.

Compressor: A device that converts mechanical force and motion into pneumatic power.

Conduit: The fluid carrying link between system components.

Connector: A device for joining a conduit to a component port or to one or more additional conduits.

Contaminant Lock: A contaminant-induced lockup due to silt lock seizure, coincidence jam and/or formation of an obliterant choke.

Contaminant: Detrimental matter or energy in a fluid—e.g., particulates, moisture, thermal energy, etc.

Contamination Control: An engineering technology involved in planning, organizing, and implementing all the activities needed to identify (recognize and describe) contaminant, analyse (characterize and quantify) contaminant, exclude (restrict, isolate, and reject) contaminant, reduce (capture, retain, and remove) contaminant, establish the tolerance of components for contaminant, and ascertain the necessary contaminant balance (between the level of contamination in the fluid and the level of contaminant tolerance of the components to yield a given contaminant service life).

Control, Servo: A control actuated by a feedback system that compares the output with the reference signal and makes corrections to reduce the difference.

Control: A method applied to regulate the functions of a component, system or machine.

Controller: A component that serves as both a distributor and a regulator. A servovalve is a closed-loop controller; whereas, a proportional control valve is usually used as an open-loop controller.

Cooler: A heat exchanger used to remove excessive heat from hydraulic fluid.

Corner Frequency (On a Bode Plot): The frequency at which the amplitude ratio begins to decrease. It is a measure of the speed of response of the system to an incoming signal—the higher the corner frequency, the faster the response.

Corrosion: The destruction of a metal by chemical or electrochemical reaction with its environment.

Coulomb Friction: Friction occurring between sliding surfaces. It is greater just before motion begins than after surfaces are in steady relative motion. The magnitude of Coulomb friction is proportional to the force pressing the surfaces together and is independent of the area of contact and speed (after motion begins).

Counterbalance Valve: A valve that maintains resistance to flow in one direction but permits free flow in the other. It prevents a load from overriding an actuator and falling or dropping.

Coupling: A straight connector for fluid conduits.

Cracking Pressure: The pressure at which a valve begins to pass fluid.

Creep: The tendency for a material to continue plastic deformation with no increase in load.

Critical Volume Reservoir: A minimal size reservoir having an off-line or on-line configuration. It relies on external fluid conditioning equipment—e.g., filtration, heat exchanger, degasser, etc.

Crookedness Angle: The angular deflection of the cylinder rod caused by the moment at the sliding connection due to the elasticity of the bearings and seals.

Cubical Expansion: The increase in volume of a substance that accompanies a change in temperature or pressure.

Cushion: A device built inside the ends of a hydraulic cylinder to control the flow of fluid to the outlet port, thereby slowing the motion of the piston rod and decelerating the load.

Cycle: The composition of a predetermined sequence of operations or events of a machine or system, starting and ending at some defined point.

Cylinder Boot: An accordion shaped boot is installed to protect the piston rod and prevent the ingestion of contaminant across the rod seals.

Cylinder, Cap end: The cylinder end closure that completely covers the bore area. Also called the “Blind End” or “Back End.”

Cylinder, Double acting: A cylinder in which fluid force can be applied to the movable element in either direction.

Cylinder, Double rod: A cylinder with a single piston and a piston rod extending from each end.

Cylinder, Head end: The cylinder end closure that covers the differential area between the bore area and the piston rod area. Also referred to as the “rod end.”

Cylinder, Tandem: Two or more cylinders having interconnected piston assemblies.

Cylinder: An actuator that converts pressure energy into linear mechanical force and motion proportional to the effective cross-sectional area of the piston.

Damper: A device used to restrict the amplitude of a shock wave or the movement of a mechanical part as a function of velocity.

Damping Coefficient: The proportional quantity that relates the resisting force to its velocity in any type of motion.

Damping Length: The horizontal distance between the centres of the incoming and outgoing flows in a spool valve. It is used in the transient flow force analysis. Take positive sign if the fluid flows outward at the metering orifice and negative sign otherwise.

Damping Ratio: The ratio of the actual damping in the system to that damping which would produce critical damping.

Dead Band: The region or band of no response and where an error signal will not cause a corresponding actuation of the controlled variable.

Deceleration: The negative rate of change of velocity per unit time.

Decompression: The release of fluid under pressure.

Degree: The exponent of the highest order derivative, after the equation has been cleared of fractions and radicals in the dependent variable and its derivatives.

Dehydration: The removal of water and moisture from the hydraulic fluid.

Delivery: The volume of fluid discharged per unit time by a pump or other component in a system.

Density: The mass per unit volume of any substance.

Dependability: The ability of a component or system to remain functional during a definite period of time under specific operational conditions.

Dependent Variable: A variable quantity of a system whose value depends upon some other variable quantity or quantities.

Depth Filters: A filter medium that primarily retains contaminant within its tortuous passages.

Detent: A device that locks a valve spool in selected positions. Also see “hydraulic detent.”

Detergent: In lubrication, it is an additive or a compounded lubricant having the property of keeping insoluble matter in suspension so that is not deposited where it can do harm. It can also redisperse deposits already formed.

Diagram, Cutaway: A drawing showing the principle internal parts of components, controls and actuating mechanisms, interconnecting passages and functions of individual components.

Diagram, Pictorial: A drawing showing each component in its actual shape according to the manufacturer’s installation.

Diagram, Schematic or Graphical: A drawing showing each piece of apparatus including all interconnecting lines by means of approved (ANSI, ISO) standard symbols.

Differential Area: The net difference between two areas.

Differential Equation: An equation that involves one or more derivatives. They are classified as Ordinary Differential Equations and Partial Differential Equations.

Differential pressure: The net effect of two different pressures acting on separate areas or at different points in a system or component.

Digital: A term pertaining to the general class of devices, components, or circuits whose output varies in discrete steps (i.e., pulses or “on-off” characteristics).

Directional Valve: A valve that directs or prevents the flow of fluid to specific sections of a circuit.

Dispersancy: The ability of a fluid to disperse materials in the form of minute particles throughout the base fluid.

Dispersant: In lubrication, it is synonymous and used interchangeably with detergent.

Displacement: The volume of fluid that can pass through a pump, motor or cylinder in a given time or during a single actuation event; e.g., revolution or stroke.

Dissipative Load: A load that must be overcome to achieve motion—stiction or static friction, coulomb friction, viscous friction, and windage.

Dither: A relatively high frequency, low amplitude periodic signal or oscillatory motion sometimes superimposed on the servovalve input to improve system resolution. The dither (either mechanically or hydraulically) is applied to offset friction (static friction or silt lock), promote rapid and accurate response, and/or improve system resolution.

Double-acting: Describes a component such as a cylinder that operates in two directions or where an actuating force can be applied in either direction.

Drain: A passage that returns fluid from a component to a lower pressure region such as a reservoir and should normally enter the reservoir below the fluid level.

Drift: The change of a parameter with time under steady state operating conditions.

Drip: Leakage defined as a recurring falling droplet

Droplet: Leakage defined as a non-falling fluid particle.

Durability: the capability of a system to endure for a long time without yielding or suffering significant deterioration.

Duty Cycle: A reflection of the work cycle on the individual components of the system.

Dwell: The portion of a stroke or cycle in which the feed or pressure stroke is stopped in one part of the system.

Effective Length of Rod: The distance between the load application point and the cylinder resistance point.

Efficiency, Hydraulic: This efficiency is defined as the actual head produced by a centrifugal pump to its ideal head.

Efficiency, Mechanical: The ratio of the overall efficiency to the volumetric efficiency.

Efficiency, Overall or Operating: The ratio of horsepower out to the horsepower in or the product of the volumetric efficiency and the mechanical efficiency.

Efficiency, Volumetric: The ratio of the actual output at a given pressure to the theoretical output determined by the geometrical displacement.

Efficiency: The ratio of output to input power of a single unit or a whole system—usually expressed as a percent.

Effluent: The fluid leaving a filter or other device.

Elastance Loads: A load analogous to that produced by a spring—when stretched, it tries to contract, and vice versa as given by Hooke's law.

Elastomer: An elastic, rubber-like material (such as rubber or plastic) having elastic properties. At room temperature, it can be stretched to twice its original length and will snap back to its original length upon release. Used for seals, hoses and special enclosures.

Electro-hydraulic: A component that converts an electric signal into a hydraulic signal.

Emulsion, Water-Oil: A stabilized mixture of two immiscible components, water and oil, and may contain additives. There are two types: oil-in-water and water-in-oil.

EnBloc Manifold: It is a manifold machined from a solid block of metal and often contains a large number of control elements interconnected by drilled passages.

Enclosure: A housing for a hydraulic apparatus.

Energy: The ability or capacity to do work.

Equation of State: A mathematical expression defining the physical state of a substance (gas, liquid, or solid) by relating volume to pressure and to absolute temperature for a given mass of the substance.

Equivalent Length: An expression for pressure loss of fittings and conduit interruptions in terms of equivalent length of a straight conduit of specified diameter.

Erosion: The wearing away of a wetted surface due to high velocity flow.

Exclusion Device: A sealing device designed to exclude environmental contaminants from the internal parts of a hydraulic cylinder.

Failure Rate: The number of failures of an item per unit measure of life (cycles, time, miles, events, etc., as applicable for the item).

Failure: The inability of a component or system to perform adequately in the desired manner.

Feathering: A slowly changing rate of valve spool position between fully open and fully closed in which the fluid is throttled. Term sometimes used synonymously with "throttling."

Feedback Loop: A control loop in which the measured variable is fed back and compared with the desired value, and the difference is used as the input to the controller.

Feedback: A signal that represents the output action of a hydraulic component or function. Also a device that monitors the action of a hydraulic component or function.

Feed: The portion of the work cycle in which work is performed on the work piece.

Ferrography: A laboratory technique for examining and assessing wear particles entrained in a fluid using a magnetic field.

Filter: A device containing a porous media through which hydraulic fluid is passed to continuously remove suspended insoluble contaminants.

Fire Point: The temperature at which a liquid will burn continuously when ignited by a small flame under carefully specified conditions.

Flange Connection: A block of metal in which tubing or a conduit is terminated and bolted to the equipment or to a companion flange to form a union connection.

Flash Point: The temperature at which a liquid gives off sufficient flammable vapours to ignite when approached by a small flame under carefully specified conditions.

Flooded Suction: Refers to a pump suction port that is pressurised by a natural gravitational or elevated head of fluid (reservoir oil level is above the pump inlet port) or flooded by a charging or booster pump.

Flow Control: A device that regulates the rate of fluid flow.

Flow Fatigue: The ability of a component to resist structural failure due to flexing caused by a differential pressure created by a variable flow rate.

Flow Forces: The forces arising from high fluid velocity, particularly at spool lands, which manifest themselves in undesirable induced forces.

Flow Gain: The slope of the control flow vs. input signal curve in any specific operating region, under specific conditions.

Flow Lock: the impediment of the actuating member of a valve caused by induced axial thrust due to the change in fluid momentum.

Flow Metering Characteristics: A family of output flow versus input signal curves.

Flow Rate: The volume, mass, or weight of fluid passing through a flow passage per unit time.

Flow, Compressibility: A flow resulting from a change in pressure.

Flow, Couette: Flow that occurs as a result of relative velocity between fluid and mechanical element.

Flow, Deformation: A flow due to the distortion of the enclosure material.

Flow, Displacement: A flow due to the variation of the piston displacement.

Flow, Interstitial: This flow occurs due to the differential pressure across a seal contact area and within the interstices that are bounded by the asperities of the topography and the fluid film.

Flow, Laminar: A condition of a moving fluid stream exhibiting streamlines in which the Reynolds number is less than 2000.

Flow, Poiseulle: Flow that occurs as a result of a pressure gradient.

Flow, Pulsation Frequency FPF: This is the number of flow ripples that occur during a unit time period.

Flow, Pulsation Magnitude Ratio FPMR: This ratio is the difference between the maximum flow and the minimum flow to the mean flow, expressed as a percent.

Flow, Steady State: A flow situation in which conditions such as pressure, temperature, and velocity at any point in the fluid do not change with time.

Flow, Transition: The flow pattern that occurs between laminar and turbulent flow regimes.

Flow, Turbulent: A condition of a moving fluid exhibiting random flow vectors and a Reynolds number greater than 4000.

Flow, Unsteady: A flow condition in which quantities such as pressure, velocity and temperature change with time at some fixed point in the fluid.

Flow: the movement of a volume of fluid in a hydraulic passage produced by a pressure differential.

Fluid Conditioner: A device that is used to control the physical characteristics of a fluid.

Fluid Oxidation: A chemical breakdown of a fluid, causing the formation of oxidation products, which in turn cause emulsification, foaming, and the deposition of varnishes and sludge.

Fluid Power: Power transmitted and controlled through use of a pressurized fluid (liquid or gas).

Fluid Velocity: the linear speed at which fluid is flowing past a specific point in a hydraulic circuit.

Fluid, Fire-resistant: A fluid not easily ignited.

Fluid, Flash point: The temperature at which a fluid first gives off sufficient flammable vapour to ignite when approached by a small flame or spark.

Fluid, Hydraulic: A liquid that is specially compounded for use as a power-transmitting medium in a hydraulic system.

Fluid, Nonflammable: A fluid that cannot be ignited.

Fluid, Pour Point: The lowest temperature of a fluid at which it will flow or can be poured.

Fluid, Stability: Resistance of a fluid to permanent change in properties—chemical, thermal, mechanical and contamination.

Fluid, Viscosity: A measure of the internal friction or the resistance of fluid to flow.

Fluid: A substance (either liquid or gas) that yields to any pressure tending to alter its shape. The state of matter that is not solid and is able to flow and change shape.

Fluidity: The inverse of viscosity and expresses the flow properties of a fluid.

FMECA: “Failure Mode, Effects and Criticality Analysis” (detailed in SAE ARP 926) is a procedure designed to document all conceivable potential failures of a system or component, the effect of each failure on system operation, and identify those that are critical to operational success and personnel safety.

Foam: An intimate mixture of air and liquid occupying much more volume than the liquid alone. It is generally caused by the release of air in solution caused by reducing the pressure and is most prevalent in the reservoir.

Force: The total tendency to assist or oppose the movement of an object—it is a push or pull measured in units of weight. In hydraulics, force is expressed by the product of pressure and the area of the surface on which the pressure acts.

Four-way Valve: A valve having four distinct and separate flow paths.

Frequency Response: The performance of a system at various frequencies of sinusoidal input signal. The ratio of output to input magnitude is plotted against the input frequency. In a servovalve, frequency response is normally measured with constant input current amplitude and zero load pressure drop, expressed as amplitude ratio, and phase angle.

Fretting: Surface destruction caused by vibration existing between two surfaces in intimate contact with each and having an oscillatory relative motion of small amplitude.

Friction Losses: The pressure energy losses due to friction stem from Darcy's formula and the modified Moody diagram for friction factor.

Friction: The resistance to motion of an object under the action of an external force. Fluid friction is the internal friction of a liquid and better known as viscosity.

Full Flow: A condition where all the fluid must pass through the component or medium.

Function: A characteristic behaviour given by an expression such that for each value of x within a range there is an associated value, or several values, of the variable y. Therefore y is a function of x.

Fuzzy Logic: The logic of approximating reasoning using possibility functions.

Gain Margin: The amount of control loop gain in decibels that can be increased before the system reaches instability.

Gain: The ratio of output magnitude to input magnitude.

Galling: An adhesion condition that arises from a combination of materials that possess either poor bearing characteristics or are operated with improper or no lubrication. This wear mechanism results in the transfer of material from one member to the other member in such a manner as to cause extremely high force to move the members relative to each other. Galling can result in both members virtually locked together.

Gasket: A device that is used between two relatively static surfaces to prevent leakage and is made of several deformable materials.

Gauge Pressure: Pressure of a system over and above atmospheric pressure. The difference between absolute pressure and atmospheric pressure. It is the pressure used to calculate the forces exerted in a hydraulic system.

Generated Contaminant: It is contaminant produced due to the deterioration of surfaces, various tribological wear mechanisms, incompatible materials, etc. A product of system activity and inactivity

Gland: The cavity of a stuffing box.

Gum: A rubber-like, sticky deposit, black or dark brown in colour, which results from oxidation of lubricating oil.

Head, Pressure: The vertical distance between a point in a system and the surface of the fluid referenced to the atmosphere.

Head-Cylinder: The cylinder end closure that covers the differential area between the bore area and the piston rod area.

Head: The height of a column or body of fluid above a given point expressed in linear units. Pressure is equal to the height times the density of the fluid.

Heat Exchanger: A device that transfers heat through a conducting wall from one fluid to another.

Heat: The form of energy that has the capacity to create warmth or to increase the temperature of a substance. Any energy that is wasted or used to overcome friction is converted to heat. It is measured in calories or British Thermal Units (BTU's). One BTU is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Horsepower: A standard unit of power or work. One Hp is equal to 550 ft lb. of energy or work done per second, 33,000 ft lb. of work per minute, 0.746 KW, or 42.4 BTU per minute.

Hose: A flexible conduit for conveying fluid between components that may have relative motion. Consists of synthetic elastomer IC tubes reinforced with woven wire or fabric braid or spiral wrapped wire to provide strength and fitted with various types of connectors.

Humidity: The amount of water vapour in the air at a given temperature.

Hunting: A low frequency instability in which the output of a unit or system moves back and forth without command input. The action of an improperly damped or unstable system in which the actuator moves alternately to both sides of a required position before coming to rest, if at all. Sometimes caused by looseness in the input system.

Hydraulic Balance: A condition of equal opposed hydraulic forces acting on an element in a hydraulic component. That is, a condition in which opposing hydraulic forces are equal.

Hydraulic Detent: A valve configuration that applies the open actuator port pressure against an axial control surface of the spool to hold the valve spool position until a greater axial force is applied to shift the valve in the opposite direction.

Hydraulic Fuse: A hydraulic fuse is designed to provide excess flow protection. It automatically shuts off any line in which failure (component rupture or fracture) has occurred and where hydraulic fluid spews out of a system. It is analogous to an electrical safety device called a "fuse" in which a strip of metal melts and interrupts the circuit when the current exceeds a particular amperage. These devices consist of various types of excess-flow valves. Such devices are used to block flow and not to relieve pressure as performed by a hydraulic system protector.

Hydraulic Horsepower: Horsepower computed from the product of flow rate and pressure differential in terms of work performed by the fluid.

Hydraulic Lock: A situation in which a quantity of trapped fluid prevents movement of a piston or other part.

Hydraulic Motor: A rotary actuator that converts pressure energy into rotary energy.

Hydraulic Null: The hydraulic neutral or no flow zone of, for example, a four-way servovalve.

Hydraulics: An engineering science pertaining to the conversion and transmission of energy associated with the pressure and flow of liquid to provide force and motion.

Hydrodynamic Lubrication: A condition in which the shape and relative motion of the sliding surfaces cause the formation of a fluid film having sufficient pressure to separate the two surfaces.

Hydrodynamics: The engineering science dealing with the motion of a fluid and the interactions with its boundaries. For example a jet pump.

Hydrokinetics: The engineering science pertaining to the forces produced by a liquid as a result of its motion. For example a centrifugal pump.

Hydrolytic Stability: The resistance to permanent changes in properties caused by chemical reaction with water.

Hydrostatic Transmission: A drive system which transmits power from a rotary input to a remote rotary output by means of fluid under pressure.

Hydrostatics: The engineering science that deals with the properties of liquids at rest; that is, with liquid pressure (in a closed system).

Hygroscopic: A substance that has a strong affinity for water.

Hysteresis: The difference in output value for the same input when this condition is approached from opposite directions. That is, it is the failure to follow the same path in the forward direction as in the backward direction.

Inertial Load: The reaction force resulting from the acceleration of a mass and is equal to the product of the mass and the acceleration, and always acts in a direction opposite to that of the actuator motion.

Influent: The fluid flowing into a valve, filter or other devices.

Ingested Contaminant: Environmental contaminant that ingresses due to the action of the system (across reservoir breathers, pulled in by the drag action of rod and wiper seals, etc.)

Inhibitor: Any substance that slows, prevents, or modifies chemical reactions such as corrosion or oxidation.

Input: An incoming signal (pressure, flow, etc.) to a control system or device that initiates a hydraulic process.

Instability: A time dependent increase in output without a corresponding increase in the input. Many special definitions of stability have been introduced for non-linear systems.

Intensifier: A device that amplifies or increases the pressure over that of the source pressure and applies it to a particular section of a system at the cost of reduced flow rate. Also see booster and amplifier.

Isentropic: A reversible adiabatic process.

Isobaric: Refers to constant pressure conditions.

Isochoric: Refers to a change that takes place at constant volume.

ISO: International Organization for Standardization.

Isothermal: Compression or expansion occurring at a constant temperature, as opposed to the adiabatic process.

Jack: A single-acting cylinder that can be pressure actuated in only one direction.

Kinetic Energy: The energy that a substance or body possesses by virtue of its mass (weight) and velocity.

Lag: The quantity that an output is behind the input, normally measured in degrees.

Lapping-in: Polishing a surface such as a valve seat to obtain a smooth mating surface.

Lap: The relative axial position relationship between the fixed and movable flow metering edges with the spool at null. Lap is measured as the total separation at zero flow of straight line extensions of the nearly straight portions of the normal flow curve, drawn separately for each polarity, expressed as per cent of rated input parameter.

Latent Heat: The heat required to cause a material to undergo a change of phase.

Lead: The quantity that the output is ahead of the input, usually measured in degrees.

Leakage, Centre Position: This refers to the amount of leakage associated with spool lap conditions for a given clearance.

Leak: That amount of fluid emitting from a component sufficient to cause rejection and which performs no useful work.

Level or Sight Gauge: A device for indicating the amount of fluid contained in a reservoir.

Leverage: A gain in output force over input force by sacrificing the distance moved. Mechanical advantage or force multiplication.

Life, Operating: The useful life of a device or system expressed in terms of cycles of operation, hours or similar units.

Lift: The height a body or column of fluid is raised; e.g., from the reservoir fluid level to the pump inlet. Lift is sometimes used to express a negative pressure or vacuum. The opposite of head.

Line: A tube, pipe or hose that acts as a conductor of hydraulic fluid. Conduits are expressed as a pressure line, suction line, bypass line, drain line, etc.

Linear Actuator: A device that converts pressure energy into linear motion with a limited stroke; i.e., a hydraulic cylinder or ram.

Linear Equation (Function): An equation of the first degree (which always maps as a straight line).

Linear: A straight-line relationship between two variables.

Linearity: A measure of deviation from proportional relationship in the ratio of valve output to input. The degree to which the normal flow curve conforms to the normal flow gain line with other operational variables held constant. When output varies in direct proportion to the input, the valve is considered linear.

Load Pressure: The pressure generated by an externally applied force.

Load Sensing System: A closed-circuit system with load/pressure feedback. It combines the advantages of an open-centre system and constant pressure closed-centre systems while avoiding their major disadvantages.

Logic: The interrelation or sequence of events or facts required to achieve a predictable and specific outcome.

Longevity: Long duration of useful life or that part of a component's, equipment's or system's service life that lies between the phases of early failure and wear-out failure.

Lubricity: The ability of a lubricant to minimize friction between mating surfaces under boundary lubrication conditions and moderate loading. Oiliness.

Magnetic Lock: A motion impediment produced by an unshielded magnetic field attracting and accumulating ferromagnetic particles that induce surface lockup.

Maintenance: The art of ensuring that the performance of a component, equipment or system is kept within a set of predetermined limits. All actions necessary for retaining an item in, or restoring it to, a serviceable condition and includes servicing, repair, modification, overhaul, inspection, and condition verification.

Manifold: A fluid conduit that has multiple inlets and multiple connection ports and possibly various interconnections.

Manual Control: A control method that requires the physical effort of the operator; e.g., a lever or foot pedal control for a valve.

Manual Override: A means of manually operating an automatic control.

Mechanical Control: Any control actuated by linkages, gears, screws, cams or other mechanical elements.

Mechanical Lock: An asperity induced lockup or seizure of two mating surfaces in relative motion.

Meter-in: To regulate the flow of fluid entering an actuator or system.

Meter-out: To regulate the flow of fluid exiting an actuator or system.

Meter: To regulate the rate of flow of fluid in a circuit.

Metre: A metric unit of length equal to 39.37 inches.

Micron (or Micrometer): One thousandth part of one mm, 0.0000394-in., or one-millionth of a meter. A common unit used when specifying filters, sieves and screens.

Minor Losses: These losses occur when flow is suddenly expanded or contracted.

Modulus, Rubber (or Elastomer): The stress level at a predetermined elongation, usually reported at 100%. It is a good indicator of compound toughness and at a given hardness, high modulus generally means good anti-extrusion and dynamic characteristics

Motor, Fixed-displacement: A rotary motor in which the displacement per revolution is not adjustable.

Motor, Fluid: A rotary-motor device for converting fluid energy into rotary motion, a rotary actuator.

Motor, Limited Rotary: A rotary motor having limited angular motion or oscillation.

Motor, Rotary: A motor capable of continuous rotary motion and producing an output torque proportional to the displacement per revolution and the pressure drop between intake and discharge ports.

Motor, Variable-displacement: A rotary motor in which the displacement per revolution is adjustable.

Motor: A device for converting electrical or fluid energy into rotary mechanical motion.

Motoring: A condition caused by servo valve static friction that requires an undesirable force application to stop the motion.

Natural Frequency: The frequency of the cycling motion of an undamped second-order component. For a transient-response curve, the frequency of cycling which the deviation would have if the response were undamped. Also the frequency at which an object would vibrate at zero damping. On a Bode Plot of a second-order system, it is the frequency where the extension of the final slope of the response curve intersects the 0-db line of the amplitude ratio.

Net Positive Suction Head Available NPSHA: The NPSH available at pump suction port.

Net Positive Suction Head NPSH: The minimum suction head required for a pump to operate and this value depends on liquid characteristics, total liquid head, pump speed and capacity, and impeller design.

Net Positive Suction Head Required NPSHR: The NPSH required at pump suction port. If NPSHA is less than NPSHR, cavitation occurs.

Neutralization Number: A measure of the acidity of a fluid. It is defined as the milligrams of potassium hydroxide required to neutralize the acidity in one gram of fluid.

Newt: A unit of kinematic viscosity in the British system of units. One Newt is one square inch per second.

Newtonian Fluid: A liquid in which viscosity is independent of the shear rate of the fluid.

Nipple: A short length of tubing or pipe used for joining conduit elements.

Nominal Rating: An arbitrary value assigned to a filter by the manufacturer and generally lacks reproducibility.

Nomograph: A chart on which a straight line can be drawn so as to intersect three scales in values that satisfy an equation or a given set of conditions.

Non-linear Differential Equation: A differential equation that contains at least one non-linear term such as: $x^2, |x|, x \cdot x^2, x \cdot \dot{x}$

No linearity: An input-output relationship that cannot be represented by a single straight line, e.g. hysteresis, dead band, coulomb friction, sharp edged orifice, etc.

Non-return Valve: A valve that normally allows flow in one direction only.

Normally Open: A valve or other device that allows fluid flow when there is no input signal. An input action must be applied to close the valve.

Nozzle: A device used to shape a stream of fluid emerging from a line. It is used to convert pressure energy into velocity energy.

Null: The condition where the valve supplies zero control flow at zero load pressure drop.

Obliteration: A process producing an obstructed flow path choked off by obliterants (polar materials such as water, long chain polymers and silica) that are attracted to the walls of the flow passage.

Oiliness: that property of a lubricant that produces low friction under conditions of boundary lubrication.

Oil-in-Water: A dispersion of oil in a continuous phase of water.

Omega Rating: A standard method of expressing the tolerance or sensitivity of a hydraulic component to contaminants in the hydraulic fluid. The OMEGA value corresponds to the Beta-Ten value of the filtration system needed to protect the pump for 1000 hours of service at rated conditions.

Open Centre: A condition where pump delivery recirculates freely to the reservoir in the centre or neutral position of the valve.

Open Loop Circuit: A hydraulic circuit in which there is no automatic feedback to the control input signal.

Operating Conditions: Operating conditions such as temperature and pressure numerical values relating to any given specific application of a unit. These may change during the course of operations.

Operator: Notation used to simplify the writing of differential equations such as the Laplace operator.

Optimal Control System: A system where the control process is manipulated according to a “performance index” defined by the user.

Order: The highest order derivative that occurs in the equation.

Orifice: A flow restriction whose length is relatively short as compared to its diameter or its cross-sectional dimension.

O-Ring: A type of seal consisting of an elastomer in the shape of a toroid or donut. It is normally mounted in a groove in a manner that the effectiveness of sealing increases with pressure.

Oscillatory: A reciprocating type rotary motion also called limited rotation.

Overshoot: The exceeding or surpassing of a target value as operating conditions change.

Oxidation Stability: Ability of substance to withstand chemical reaction with oxygen/air and subsequent degradation. A factor of prime importance in high temperature operation.

Oxidation: A chemical process in which oxygen joins with metal atoms to form oxidation products (e.g., oxide coating), which can cause changes in fluid properties.

Pascal’s Law: A law of physics expressing conservation of momentum. It states that a pressure (force) applied to a confined fluid is transmitted equally in all directions through the fluid.

Passage: A machined or cored fluid connection or path within a hydraulic component that acts as a conductor of the fluid.

Passivator: A type of additive preventing corrosion and the catalytic effect of metals on oxidation.

Phase Lag-Time Lag: The angle by which the cycling output lags behind a sinusoidal input. Sometimes it is simply called “phase.”

Phase Margin: The additional phase angle in degrees required to lag the input to cause 180° phase lag in output.

Physical Stability: The resistance possessed by a fluid to physical changes promoted by state conditions (pressure and temperature), contamination, and mechanical shear.

Pilot Control: A method of operating valves and other devices by means of a small independent pressure signal.

Pilot Pressure: A pressure used to actuate or control hydraulic components

Pilot Valve: A small valve used to control the operation of larger valves.

Piston Motor/Pump: A rotary actuator or pump that employs pistons to transmit hydraulic or shaft power.

Piston: A cylindrical member forming the internal element of a cylinder assembly and transmits or receives motion by means of a connecting rod. It is the component within a cylinder on which fluid acts to convert pressure energy into linear motion.

Plunger Pump: This pump operates practically the same as a piston pump. The primary difference is that the plunger moves through a stationary packed seal; whereas a piston pump seal is carried on the piston itself (e.g., piston rings). Plunger pumps are by necessity, single acting. Both piston and plunger pumps are self-priming.

Pneumatics: The engineering discipline dealing with gas (usually air) flow, pressure, and power transmission.

Poiseuille Law: States that the quantity of fluid that flows through a small tube in a given time is proportional to the pressure difference and to the fourth power of the internal diameter of the tube, and varies inversely with its length.

Polymer: A substance of high molecular weight that is formed by joining together a number of smaller units into a large macromolecule.

Polytropic Process: An expansion or compression of a gas in which the quantity PV^n is held constant, where P and V are the pressure and volume of the gas, and *n* is a constant.

Poppet Valve: A valve that prevents flow when the valve element (poppet) closes against a conical shaped seat and opens when the element is lifted from the seat.

Poppet: A valve element that prevents flow when it closes against a conical shaped seat

Port: An opening at a surface of a component; e.g., the internal or external terminus of a passage in a component.

Positive Displacement: A characteristic of a particular pump or motor that has the inlet positively sealed from the outlet so that fluid cannot recirculate in the component.

Positive Position Stop: A structural member that rigidly limits the working motion at a desired position.

Power Pack: A unit that usually includes a fluid reservoir, prime mover, a pump, and essential control valves.

Power: The time rate of doing work or the work done per unit time. Measured in horsepower or watts.

ppm: The parts per million concentration; e.g., mg/kg or ml/m^3.

Pre-charge: The residual pressure in a hydraulic accumulator before the introduction of oil.

Precursor: Something that precedes and indicates the approach of another. A condition from which another condition is formed. A forerunner or warning of events that will occur.

Prefill Valve: An unusually large capacity two-way or pilot-check valve that is located between an overhead reservoir and the top of the working cylinder or ram of a hydraulic press. This valve allows a press ram to drop due to gravity without cavitation and draw in oil to fill the press ram.

Pressure Drop: The difference in pressure between any two points in a circuit. It represents the loss of energy of a pressure oil flow through a hydraulic element as a result of friction and conversion into heat.

Pressure Fuse: See Hydraulic Fuse.

Pressure Gain: The rate of change of load pressure drop with an increase in input signal at zero control flow (control ports blocked). It is usually specified as the average slope of the curve of load pressure drop vs. input signal between ± 40% of maximum load pressure drop.

Pressure Line: The conduit that transmits fluid under pressure.

Pressure Override: The difference between the cracking pressure of a valve and the pressure reached when the valve is passing full flow.

Pressure Plate: A side plate in a gear or vane pump or motor cartridge to minimize the clearance and slippage.

Pressure Reducing Valve: A pressure control valve whose primary function is to limit the outlet pressure.

Pressure Switch: An electric switch operated by fluid pressure and responsive to a rise or drop in pressure.

Pressure, Absolute: The sum of atmospheric and gauge pressure.

Pressure, Atmospheric: The pressure at any point in the atmosphere due solely to the weight of the atmospheric gases above the point. Used synonymously with barometric pressure.

Pressure, Back: The pressure encountered on the return side of a system; e.g., reservoir pressure.

Pressure, Barometric: see Atmospheric Pressure.

Pressure, Burst: The pressure that causes component rupture.

Pressure, Charge: The pressure at which replenishing fluid is forced into a fluid power system.

Pressure, Compensated: Describes a pump or control valve whose output is automatically regulated in response to variations in system pressure.

Pressure, Operating: The pressure at which the system is operated.

Pressure, Peak: The highest pressure noted in a hydraulic system.

Pressure, Precharge: The pressure of compressed gas in an accumulator prior to the admission of liquid.

Pressure, Proof: The non-destructive test pressure in excess of the maximum rated operating pressure.

Pressure, Rated: The maximum qualified operating pressure that is recommended for a component or system by the manufacturer.

Pressure, Relief Valve: A pressure control valve which by-passes pump delivery and thus limits circuit or system pressure to a predetermined maximum value.

Pressure, Snubber: A pressure snubber protects sensitive components against pulsating or surge pressures. Damping is accomplished by porous metal devices or a small restricting orifice upstream of the gauge. These snubbers are sometimes called a “gauge savers.”

Pressure, Static: The pressure existing in a fluid at rest.

Pressure, Suction: The pressure at the suction port of the pump.

Pressure, Surge: The pressure existing due to surge conditions.

Pressure, Vapour: The pressure, at a given fluid temperature, in which the liquid and gaseous phases are in equilibrium.

Pressure, Working: The pressure that overcomes the resistance of the working device—load and line loses.

Pressure: A measure of potential energy expressed in force per unit of area. The force exerted per unit area on a body.

Priority Valve: Used when one particular circuit must always have priority over all other circuits for flow, irrespective of other demands.

Probability: A mathematical estimate of the possible realization of a random event or random quantity.

Proportional Control Valve: A control valve whose output is directly proportional to the input signal.

Proportional Control: A control action producing a controller output proportional to the size of the deviation.

Proportional: A relationship of one variable to another for which there is a constant ratio.

Pump, Booster: A pump used to boost the fluid entering the suction port of a hydraulic pump.

Pump: A device which converts mechanical torque and motion into hydraulic power (flow and pressure)—also known as a “hydraulic generator” and used to transport energy-laden fluid to the actuators.

Quick Disconnect: A coupling usually containing at least one check valve that can be rapidly disconnected with minimal leakage.

Rabbet Mount: A mounting configuration that utilizes matching male and female forms (usually coaxial circular) between the cylinder and its mating mounting element.

Ram: A single-acting cylinder in which the movable element has approximately the same cross-sectional area as the cylinder bore. Hence, a ram has a single diameter type plunger as opposed to a piston and rod. The plunger in a ram-type cylinder is also called a ram.

Ramp Input Function: an inclined slope, a constantly increasing function, a linear intensification of magnitude.

Ratchetting: A stick-slip action (intermittent motion) of the control system.

Rated: Refers to the manufacturer’s designation of the normal operating condition—the maximum, allowable, continuous, etc.

Ratio of Specific Heats: The ratio of the amount of heat required to raise a mass of material 1 degree in temperature to the amount of heat required to raise an equal mass of a reference substance 1 degree in temperature.

Reciprocation: A back-and-forth straight-line motion or oscillation.

Redundancy: The existence of more than one means for accomplishing a given function.

Regeneration: The recovery of energy that would ordinarily be lost.

Regenerative Control System: A system where part or all of the output is fed back to help drive the function or is stored for driving the output converter.

Regulation: The control of fluid energy with simultaneous feedback of fluctuations for comparison of input/actual values related to system or component.

Reliability: The capability of a system to perform its intended design function for an acceptable period of time under a given set of operating conditions.

Repeatability: Quantitative expression of the random error associated with a single tester in a given laboratory.

Replenish: To add fluid to maintain the volume of a hydraulic system: make-up or top-out fluid.

Reproducibility: Quantitative expression of the random error, associated with testers working in different laboratories, each obtaining single results on identical test material, using same method. That is, the precision with which the measurement of a given quantity can be duplicated in separate facilities.

Reservoir, Atmospheric: A reservoir that exposes the fluid media to atmospheric pressure—contains a vented opening.

Reservoir, Pressurised: A reservoir that is sealed to the atmosphere and maintains a pressure in the reservoir above atmospheric.

Reservoir: A vessel that contains the transient fluid of a system—an active interface for fluid entering and leaving the system

Resilience: The ability of a seal or elastomeric material to return to its original shape after deformation.

Response Time: The time required for the system output to reach and stay within a specified percentage of its theoretical final value due to a step input – usually equal to five time constants.

Restriction: A reduced cross-sectional area in a line or passage that produces a pressure drop.

Restrictor, Choke: A restrictor whose length is relatively large compared to its cross-sectional area.

Restrictor, Orifice: A restrictor, the length of which is relatively small with respect to its cross-sectional area

Restrictor: A device having a reduced fixed or variable area that creates a deliberate pressure drop and resistance to the normal flow of fluid. Variable types are noncompensated, pressure-compensated, or pressure- and temperature-compensated.

Return Line: A conduit used to carry the full pump flow being exhausted from actuators or bypass valves at low pressure back to the reservoir.

Reynolds Number: The dimensionless ratio of dynamic force due to mass flow to the shear stress due to viscosity.

Rigidity: The elasticity of a fluid column.

Ripple: A periodic variation of a parameter above or below its mean operating value.

Rise Time: The elapse of time from the application of a step function input signal for the output to rise from 10% to 90% of the required steady state value.

Rod Scraper: A scraper to remove contaminant build-up and ice from a cylinder rod.

Rotary Actuator: A device for converting hydraulic energy into rotary motion—a hydraulic motor.

SAE Numbers: Numbers applied to crank case, transmission, and read axle lubricants to indicate their viscosity range.

Safety Valve: A highly reliable relief valve not susceptible to silt lock seizure or corrosion. Usually a poppet-type two-way valve intended to release fluid to a secondary area when pressures approach the maximum set value. It serves the same function as a hydraulic fuse—that is, to relieve the over-pressurisation of a system.

Safety: The conservation of human life and its effectiveness, and the prevention of damage to items, consistent with operational requirements.

Saturation: A magnitude limiting condition of the system.

Scoring: Abrasive damage to slide and sleeve type valves, piston rods, seal glands, seals, piston heads or barrel bore. Scratches in the direction of motion of mechanical parts caused by abrasive contaminants in the fluid.

Scuffing: A wear mechanism involving microwelding of asperities on contacting surfaces under conditions of highloading and high relative velocities. This microwelding is normally followed by rupture of the welds, roughening and increasing friction.

Seal Compatibility: The ability of a fluid and an elastomeric material to coexist in intimate contact without the elastomer displaying signs of substantial swelling, hardening or deterioration of mechanical properties.

Seal, Clearance: a seal which limits the leakage between a rotating or reciprocating shaft and a stationary housing by means of a controlled annular clearance between the two.

Seal, Dynamic: A seal used between parts having relative motion.

Seal, Gasket: A static seal.

Seal, Labyrinth (10): A clearance-type seal in which the fluid being sealed must traverse a tortuous path in order to escape.

Seal, Mechanical: A seal obtained by mechanical force.

Seal, Pressure: A seal obtained by means of fluid pressure.

Seal, Reciprocating: A sealing interface that exhibits relative movement of the sealing surfaces by alternately moving forward and backward as in a hydraulic cylinder.

Seal, Rotary: A sealing interface in which relative movement of the sealing surfaces are moving away from each other by rotary action. Normally, it is the shaft that rotates and the casing remains stationary.

Seal, Static: A seal used between parts having no relative motion.

Seal, Windback: A helically grooved liner, installed either on a stationary member or on a rotating shaft, which operates through a clearance and tends to lower leakage by means of a pumping action resulting from the transfer of momentum to the fluid.

Seal, Wiper: A seal that operates by a wiping action to remove material from the sealing surfaces.

Seal: A device that prevents or controls the escape of a fluid or the entry of a foreign material.

Seep: Leakage described as recurring fluid not forming a droplet.

Sensitivity, Contaminant: see Omega Rating.

Sensitivity, Control: The ratio of controller output response to a specified change in a measured variable; that is, it is the measure of the response of a control unit to a change in the incoming signal. Mathematically, it is the ratio of the response or change induced in the output to a change in the input.

Sensor: A device that detects a condition in a system and produces an associated signal.

Sequence Valve: A pressure-operated valve that automatically diverts flow to a secondary actuator while holding pressure on the primary actuator. Allows one function to take place, one after the other in strict sequence.

Sequence: The order in which various operations in a hydraulic system takes place.

Service Compliance: Used to express how well the "service integrity" of system satisfies the service requirements—includes not only the power to perform but also to endure.

Service Integrity: A quality of a system that possesses the necessary durability and performance to satisfy its intended purpose.

Servomechanism (Servo): A closed-loop system containing a controller, a feedback element or elements and a servoamplifier. There are three types of hydraulic servomechanisms: the displacement-control system and the valve-control system.

Servovalve Null Bias: The input current required to bring the servovalve to null, excluding the effects of valve hysteresis, expressed as percent of rated current.

Servovalve Null Shift: A change in null bias in a servovalve, expressed as percent of rated current. Null shift may occur with changes in supply pressure, the return pressure, and/or the load pressure drop.

Servovalve Threshold: The increment of input current required to produce a change in servovalve output, expressed as percent of rated current. Threshold is normally specified as the current increment required to revert from a condition of increasing output to a condition of decreasing output.

Servovalve, Flow Saturation Region: The region where flow gain decreases with increasing input current, in a servovalve.

Servovalve, Null Region: The region in a servovalve about null wherein effects of lap in the output stage predominate.

Servovalve: A valve that automatically modulates its output as a function of the input command.

Shear Force: The force that resists the parallel motion of two adjacent planes.

Shock Wave: A pressure wave front that moves at a supersonic velocity.

Signal: A command or indication of a desired position or velocity; that is, information that is transmitted from one point in a system to another.

Slenderness Ratio: A term that describes the geometry of a column undergoing compression and is defined as the effective length of the rod divided by the radius of gyration.

Slip: Internal leakage of liquid under pressure in a component such as in a pump or actuator.

Sludge: An insoluble material formed as a result either of deterioration reactions in an oil or by contamination of an oil.

Sound Pressure Level (SPL): is the ratio of the sound pressure generated by a noise source with respect to a reference sound pressure expressed in decibel scale.

Specific Gravity: The ratio of the density of a given volume of fluid to the density of an equal volume of water at reference conditions.

Specific Heat: The amount of heat required to raise the temperature of a unit mass of a substance one degree under specified conditions.

Specific Weight: The weight per unit volume of a substance.

Spool Valve, Critical-lapped: A valve in which the spool land width is identical to the port width. This is also called a zero lapped.

Spool Valve, Matched: A four-way valve in which all orifice areas are equal in either direction of spool travel.

Spool Valve, Overlapped: A valve in which the spool lands are wider than the ports, thus producing a dead zone or band at neutral.

Spool Valve, Symmetrical: see Matched Spool Valve.

Spool Valve, Underlapped: A valve in which the spool lands are narrower than the ports.

Spool: Any cylindrical shaped part of a hydraulic component that controls the flow passing through the component in accordance with its movement.

Spring Rate: The ratio of the force applied on a spring to the deflection of the spring from its equilibrium position as predicted by Hooke's law.

Stability: The resistance of a substance to permanent changes in its physical or chemical properties under normal storage and use conditions.

Starting Torque: The pressure required to bring an energy converter from its inoperative condition into motion.

Static Error: The error of a servomechanism with a fixed applied signal, usually due to friction or load effects.

Static Pressure: Pressure in a fluid at rest.

Stationarity Time: Also known as "standing time"—it is the time for which a valve spool remains stationary.

Step Input Function: An instantaneous increase in an input variable.

Stick-Slip: A jerky relative motion between sliding contacts under boundary lubrication conditions. This situation prevails when the static coefficient of friction is higher than the kinetic value. Normally, the addition of a friction modifier can eliminate the problem by ensuring that the kinetic coefficient is greater than the static friction coefficient. See ratchetting.

Stiction: It is the force required to initiate movement. The static friction that tends to prevent relative motion between two movable parts.

Strainer: A coarse filter often used in pump suction lines—normally contains wire-cloth media.

Stroke: The linear movement of a valve spool, cylinder rod, or pump/motor displacement element that establishes the limits of motion.

Subplate: A manifold base on which surface-mounted valves are attached and through which fluid connections are made.

Suction Head: The vertical distance between the fluid level in the reservoir and the pump inlet along with any reservoir pressure usually specified by the pump manufacturer according to the pump design.

Suction Line: The conduit between the reservoir and the pump.

Sump: A basin or container for collecting leakage fluid for recycling or disposal.

Surface Tension: The tendency of liquid molecules to pull together at any surface to form the smallest possible area. The tension that a given liquid is capable of developing before it ruptures is called its “surface tension.” It is expressed in dynes per centimetre or ergs per square centimetre.

Surge: A momentary uncontrolled rapid rise in pressure or flow usually resulting from opening or closing of a valve or a change in loading conditions.

Swashplate: An inclined disk or plate in an axial piston pump or motor that causes the pistons to reciprocate as the cylinder barrel rotates. The swashplate angle can be adjusted to vary the displacement of the pistons.

Swell: The increased volume of a seal or elastomer caused by immersion in or contact with a fluid.

System Effectiveness: The probability or chance that a system can successfully meet an operational demand within a given time when operated under specified conditions.

System Pressure: Nominal pressure usually measured at the inlet to the first valve or at the pump outlet.

System Protector: A safety device that provides pressure protection when an overload pressure condition occurs—a safety valve function. One such device is equipped with a frangible disk that ruptures at a preset value of pressure. Unlike relief valves, they do not automatically reset themselves—they require a fractured part to be replaced (e.g., a disc or a nail). See also “Hydraulic Fuse” for excess flow protection.

System: A collection of parts or components arranged in some order according to a rational set of principles or natural laws and used for the independent execution of some task.

Tank: A storage vessel used to contain and supply make-up fluid to a hydraulic system. It is a passive container for hydraulic fluid.

Telltale: An outward sign of a condition—a precursor.

Thermal Stability: A measure of the chemical stability of a fluid subjected to high temperatures and includes resistance to molecular scission or cracking. For hydraulic fluids, this property is principally a criterion for the stability of additives.

Thin-film Lubrication: A condition in which the film thickness of the lubricant is such that the friction between the surfaces is determined by the properties of the surfaces as well as the viscosity of the lubricant.

Throttle: A restriction to the normal flow of fluid.

Throttling Process: An adiabatic, irreversible process in which a fluid flows from a region of constant high pressure through a restriction to a region of constant lower pressure such that no heat can flow into or out of the system.

Throttling: The regulation of flow through a restriction or valve where the velocity must increase.

Time Constant: The elapsed time from the application of a step function input signal until the output signal reaches 63.2% of the required steady state value.

Torque Converter: A rotary fluid coupling that is capable of multiplying torque.

Torque Motor: An electromagnetic device that provides actuation of a spring-restrained armature, either rotary or translatory.

Torque: A rotary thrust or force. A measure of rotary force or turning effort that is usually expressed in pound force feet (lbf ft) or Newton meters (Nm) where 0.74 Nm = 1.0 lbf ft.

Tractive Effort: The force delivered to the contact point with the ground and includes all mechanical losses.

Transducer: A component used to convert one form of energy into another, e.g., pressure into electrical voltage.

Transfer Function: An expression stating the relation between an input signal and a corresponding output signal, the relation involving both the magnitude and the timing of the signal.

Tribology: The science and technology of friction, lubrication and wear. Officially known as the study of interacting surfaces in relative motion and all related engineering problems including the subjects and practices of friction, lubrication, and wear.

Trunnion: A pair of short journals supported in bearings projecting coaxially from opposite sides of a component required to pivot about their axis.

Turbulence: A condition where fluid moves in random paths rather than in parallel layers.

Two-way Valve: A control valve with only two flow paths.

Ullage: The volume of fluid that a vessel lacks from being full.

Ultrasonic: A vibration with a frequency higher than that normally audible to the human ear.

Unloading Valve: A valve that bypasses flow to the reservoir when a set pressure is maintained on its pilot port.

Unload: To release flow to the reservoir.

Vacuum Pressure: A deficiency of fluid or flow resulting from too low temperature, incorrect fluid viscosity or too high suction velocity. Leads to suction difficulties and pump damage.

Vacuum: The absence of pressure—that is, a pressure less than atmospheric. A perfect vacuum is the total absence of pressure. A partial vacuum is some condition less than atmospheric pressure.

Valve Actuator: The valve parts through which force is applied to move or position flow-directing elements.

Valve Mounting, Base: A mounting plate for a valve that has top and side ports.

Valve Mounting, Line: Valve is mounted directly to system lines.

Valve Mounting, Manifold: Valve is mounted to a plate that provides multiple connection ports for two or more valves.

Valve Mounting, Sub-Plate: Valve is mounted to a plate that provides straight-through top and bottom ports.

Valve, Detent Position: *A predetermined position maintained by a holding force acting on the* flow-directing elements of a directional control valve.

Valve, Open Centre: A directional control valve in which all ports are connected to the tank line when the valve is in the neutral position.

Valve, Prefill: see Prefill Valve

Valve, Priority: A valve that directs flow to one operating circuit at a fixed rate and directs excess flow to another operating circuit.

Valve, Proportioning: This valve is a fixed differential pressure-reducing valve and has a fixed spring and a fixed differential area. It is used in brake systems to limit the magnitude of the pressure to the rear brakes.

Valve, Reducing: This valve can produce a constant reduced pressure to a circuit downstream of the valve irrespective of input pressure.

Valve, Spring-Cantered: A valve that is normally held in the centre position by a spring until it is moved from this position by some external force.

Valve, Spring-offset: A valve that is normally held in one of its end positions by a spring until it is moved from this position by some external force.

Valve, Three-Position: A directional control valve that has three possible choices of flow direction.

Valve: A device that controls fluid flow direction, flow rate, or pressure.

Varnish: In lubrication, it is a deposit resulting from the oxidation and polymerisation of the fluid.

Velocity Fuse: See “Hydraulic Fuse.”

Velocity: Linear or rotary speed expressed as a unit of length or angular displacement per given time.

Vena Contracta: The region of smallest cross section in a fluid stream. As fluid emerges from an orifice, it tends to contract in cross section reaching a minimum and then expanding back to fill the conduit.

Vent: The release of pressure to actuate a balanced spool; or a small valve to allow the removal of air. Usually connected to the atmosphere.

Venturi: A local contraction in a conduit that is shaped so that the loss of pressure due to friction is reduced to a minimum.

Virtual Laboratory: A virtual location in which systems can be represented and a human operator can conduct simulation tests with visual and audible animation generated by a computer program as though the test is physically being carried out in an actual laboratory.

Viscosity Index: A measure of the viscosity-temperature characteristics of a fluid compared to two arbitrary reference fluids.

Viscosity, Absolute or Dynamic: The resistance of a fluid to relative motion of its molecules. Common units are Poise (metric), pounds per foot-second (lb/ft-sec) and Reyn in the British system of units expressed in pound seconds per square foot.

Viscosity, Kinematic: The ratio of absolute viscosity to the density of the fluid and can be derived from Saybolt Universal Seconds. It is measured in stokes in the metric system where one stoke is one centimetre squared per second.

Viscosity: A measure of the internal friction or resistance of a fluid to flow, which is determined by measuring the liquid shear strength under specific conditions.

Viscous Lock: A viscosity induced drag on adjacent surfaces and ultimate lockup.

Volatility: Readiness of a liquid to evaporate

Volume: The size of a space or chamber in cubic units.

Water Hammer: The vibration of a conduit in a fluid system due to rapid changes in liquid velocity due to valve closure.

Wear Ring: An element used to prevent cylinder seals from being crushed and metal-to-metal contact from occurring by maintaining seal concentricity when side loads exist.

Wearout: The process of attrition that results in an increase of the failure rate with increasing age (cycles, time, miles, events, etc., as applicable for the item).

Weepage: A minute amount of liquid leakage by a seal. It has rather arbitrary limits, but is commonly considered to be a leakage rate of less than one drop of liquid per minute.

Weep: Leakage defined as any non-recurring fluid

Wire Drawing: The erosion of a valve seat under high velocity flow conditions whereby vaporous cavitation of entrained water creates thin wirelike gullies.

Wobble Plate: A rotating canted plate in an axial type piston pump which pushes the pistons into their bores as it “wobbles.”

Work Cycle: A series of load applications carried out over a prescribed distance or period of time that recurs regularly.

Work: The exertion of a force over a finite distance. A measure of the energy consumed in units of force multiplied by distance.

X, Port: This refers to a pilot signal port.

Y, Port: Refers to a pilot signal port.

Yield Strength: The stress at which a material exhibits a specified deviation from proportionality of stress and strain.

Young’s Modulus: The ratio of a simple tension stress applied to a material to the resulting strain parallel to the tension.

Z Factor: This factor is defined by the relation Z = PV/NRT and is based on the assumption that at the same reduced pressure and temperature all gases have the same compressibility factor.

Zero-lapped: A critical-centre condition where the spool land width is identical to the port width.

Source: Anonymous (2000), *BarDyne Inc. – Providing Innovative Solutions*, BarDyne Web Site: www.bardyne.com/glossary.htm.