A.

Abnormal Pressure - Reservoir pore fluid pressure that is not similar to normal saltwater gradient pressure. The term is usually associated with higher than normal pressure, increased complexity for the well designer and an increased risk of well control problems. Abnormal pressure gradients exceed a 10-ppg equivalent fluid density (0.52 psi per foot). Gradients below normal are called subnormal.

Absolute Pressure - pressure measured with respect to zero pressure; the sum of atmospheric pressure and gauge pressure.

Absolute Temperature - temperature measured with respect to absolute zero, in degrees Rankine or degrees Kelvin.

Absolute Viscosity - dynamic relationship between a force and the fluid motion.

Absolute Zero Temperature - temperature that prevents molecular motion.

Acceleration - rate of change in velocity.

Active data - continually updated data, based on latest operational data.

Actuators - part of a control system, which regulates speed, power, valve position, etc. to match a set point.

Adiabatic – process that is at constant temperature without loss or gain of heat.

Adiabatic Efficiency - ratio of theoretical temperature increase to actual temperature increase; a measure of the work done by a compressor that is not lost as heat.

Adapter Spool - connects blowout preventers of different sizes or pressure ratings to the casing head.

Adequately Ventilated Area – is an area having a natural or artificial ventilation system to prevent the accumulation of gases to an explosive level. API Recommends 12 air volume changes per hour or 1.5 CFM per square foot of floor area whichever is greater.

Adjustable Choke - A choke with a conical needle and seat vary the rate of flow. See also chokes

Aeration – injecting gases in varying amounts into a fluid..

Aftercooler - Heat exchanger used post compression to reduce gas temperatures.

Air Cutting - inadvertently incorporating and dispersing air (mechanically) into a drilling fluid system.

Anchor - Device used to secure items of equipment, important in the context of UBD where vibration is a factor or concern.

Affinity Laws - equations that correlate the relationship of head, speed, impeller diameter, flow, and efficiency for turbo machinery.

Ambient Temperature - temperature of the surroundings.

American Standard Code for Information Interchange. (ASCII) – A different byte represents each number, letter, symbol and punctuation mark. Replaced by Unicode.

ASME – American Society of Mechanical Engineers.

ANSI – American National Standards Institute.

Aniline Point – The aromatics content of a hydrocarbon mixture.

Annulus Friction Pressure (AFP) – Difference between bottomhole pressure and choke pressure due to friction; a function of flow rate, hole geometry, surface roughness, fluid properties.

API – American Petroleum Institute. .

API Gravity - arbitrary measurement of density adopted in 1921 by the American Petroleum Institute and the Bureau of Standards.

Apparent Power - combination of real and reactive power.

Apparent Viscosity - Slope of the shear stress versus velocity gradient for a fluid. For Newtonian fluids, the apparent viscosity equals the absolute viscosity.

Aromatics – Ring group chemical structure. Most common are benzene, toluene, and xylene.

B.

Back Pressure Valve - A flow control valve to provide backflow control when running or pulling a string.

Backup – Redundant equipment available to complete an operation in the event the primary equipment fails.

Balance - steady state of flow line or vessel has three critical characteristics: a) a single flow rate from node to node; (b) an even pack throughout the system; and (c) approximately equal volumes entering and leaving the line or vessel.

Ball Check Valve - A valve permitting flow in one direction only by lifting a spring-loaded ball off its seat. Valve opens when pressure differential acts in the desired flow direction. The valve seals by forcing the ball tightly against the seat when a pressure differential acts opposite the desired flow direction.

Ball Valve - ball-shaped valve with conduit port and 90 degree rotation. Normally full port with minor pressure loss.

Barrel - unit for volume of oil, the standard barrel contains 42 gallons.

Base Load - minimum load.

Battery - Equipment used to process or store crude oil from one or more wells.

Bernoulli's Equation - relates to the total energy at two points in an incompressible liquid flowing at a steady rate.

Bernoulli's Principle - liquid pressure is inversely proportional to the square of liquid velocity.

Best Efficiency Point (BEP) - point on the speed-efficiency curve where the pump or compressor is operating at its highest efficiency.

Bleed Off Line – Component of pressure containment system on a snubbing stack to drain cavity and reduce trapped wellbore pressure.

Block Valve - valve that is either open or closed; used to isolated equipment or pipeline sections.

Blooie Line – Large diameter flow line for air or gas drilling that diverts the flow of air or gas from the rig into a pit area.

Blow Down - To vent off gas in a well.

Blowout - A condition when hydrocarbon containment of a wellbore is lost. Oil and gas 'blow wild' at the surface.

Blowout Preventers (BOPS) - High-pressure wellhead valves designed to shut off the uncontrolled flow of hydrocarbons.

Booster Pumps - mechanical devices used to raise the head of liquid to meet minimum head requirements of the main line pumps downstream.

Borehole Pressure - Total pressure exerted in the wellbore by a column of fluid and /or backpressure imposed at the surface.

Brake Horsepower (BHP) - effective (useful) horsepower developed by an engine brake.

Branch - See lateral.

BTU - British Thermal Unit; the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit. Equivalent to 252 calories or 778.2 foot-pounds.

Bubble Flow - A multiphase fluid-flow regime. The gas phase exists as bubbles distributed through the liquid phase. Where the bubbles coalesce and form a less uniform distribution of the gas phase, slippage will occur between the phases.

Bull Heading - The practice of pumping into a closed – in well without returns, or forcing fluid down a well under pressure.

Butterfly Valve - relatively flat, rotating disc mounted on a bearing that allows it to rotate its axis.

Bypass Valve - ON/OFF valve that allows fluid to bypass a station when open, and forces fluid to enter a station when closed; operates together with the station inlet valve.

C.

Can-type Vertical Pumps - pump where liquid enters through the inlet valve and flows to the can bottom increasing the pump suction head.

Capacity - volume of fluid per unit time that the pump or compressor can move.

Capacity Control - use of varying operating speeds to control the volume of fluid moved under certain given conditions.

Carbon Doxide/Monoxide – Naturally occurring substances resulting from combustion of hydrocarbons. Are also found as components in hydrocarbon reservoirs.

Cascade Shutdown - gradual shutdown of the units in a station where the units are shutdown one by one in specified intervals.

Case Remote Warning (CRW) - high case pressure warning alarm level.

Casing Burst Pressure - The amount of pressure that, when applied to casing causes the casing to fail. Especially important in terms of gas kicks due to the increased pressure exerted by the gas as it comes towards the surface and expands.

Casing Pressure – is the pressure between the casing and drill pipe or casing and tubing in a well.

Cathodic Protection - type of protection that prevents external corrosion; it consists of setting up a current around the line or vessel to reverse the flow of electrons and thus inhibit corrosion.

Cavitation – is when the fluid pressure in the line or vessel drops below the vapor pressure of the liquid being transported resulting in the rapid formation and collapse of vapor bubbles in a flowing liquid.

Cavitation Index - ratio of pressure drop across the valve divided by the difference between the inlet pressure and the vapor pressure of the liquid. Valve selection to ensure operation above the cavitation point is the primary use.

Cellar - A pit beneath the rig floor to provide additional height between the rig floor and the wellhead and to allow the installation of the bops / rotating head / rotating diverter, rat hole mouse hole etc.

Centrifugal Compressor - uses a rotating impeller to increase the pressure of a gas.

Centrifugal Pump - rotating machine device that uses centrifugal force to convert mechanical energy into pressure or head.

Centrifugal/Gear Pump - pump used to draw the crude oil at a constant pressure and flow rate.

Centripetal Force - pulls or pushes an object towards the center of a circular path.

Certified – components manufactured and maintained under a quality control program to ensure conformance with design specifications.

Check Valve - a valve that allows flow in one direction only.

Choke - A device with a fixed (positive) or variable (adjustable) orifice installed in a line to restrict the flow and control the rate of production from the well.

Choked Flow 1) operating condition that occurs when pressure at the vena contracta drops below the liquid vapor pressure and the liquid starts to vaporize and form bubbles; 2) operating condition that occurs when the fluid velocity reaches its sonic velocity in the equipment and no additional flow can be handled.

Choke Manifold - Used to control flowing pressure from underbalance well. May be used on connections or trips to either keep production from displacing the drilling fluid (HP gas wells), or to artificially charge the annulus to avoid loading to reservoir pressure equilibrium (prolific oil wells).

Christmas Tree - The collection of fittings and valves, on the top of the casing, controlling the hydrocarbon production rate.

Clearance - percentage of the swept volume of gas through a reciprocating compressor that remains within the cylinder (see also: sweep).

Closed Returns System – Flow path from the drill string non-return valves (floats) to the rotating control device and flow choke that can hold pressure.

Coating - material applied to the pipe to help prevent corrosion or erosion.

Coefficient of Thermal Expansion - incremental increase in the volume of a unit of fluid for a rise in temperature.

Column Separation - condition that occurs in areas of low pressure, where a large number of bubbles coalesce and form a vapor cavity.

Comm.-out - communication outage; loss of communications from one or more stations requiring operation of those stations without analytical data.

Compressibility - change in volume and density of a fluid with respect to changes in pressure and temperature.

Compression Ratio - ratio of absolute discharge and absolute suction pressures

Continuity Equation – equation to balance mass in a closed system. Prevents mathematical destruction or creation of mass in the system.

Condensate - Light hydrocarbon liquid obtained by condensation of hydrocarbon vapors. Consists of varying proportions of butane, propane, pentane, and heavier fractions with little or no ethane or methane.

Connection Gas - The small amount of gas that enters a well after stopping the mud pumps for a connection.

Constant Bottom Hole Pressure (CBHP) – Methodology within MPD, Proactive Category; whereby bottomhole pressure is kept constant during connections to compensate the loss of AFP when mud pumps are off.

Typical methods include:

1. By keeping continuous circulation during connections.
2. By trapping annular pressure prior to shutting down mud pumps.
3. By diverting mud pump flow across the wellhead.

Constant Choke Pressure Method - The adjustment of choke size to maintain constant casing pressure. Used in well killing operations where the influx is composed of water, does not work with gas due to expansion of the gas as it rises up the wellbore.

Control - imposition of operational limits to the separation system.

Control Panel, - Master or Primary - A manifold system of valves which is usually situated at the power source, which may be operated manually or by remote control, to direct pressurized fluids to well closing devices.

Control Panel – Remote or Secondary - A system of controls usually convenient to the driller, used to actuate controls at the Master or Primary panel.

Control System - system where a comparison between a measured control variable a set point prompts an action to achieve the set point.

Control Valve - valve position determined by a control system based on a set point.

Cooling - process to lower the temperature of the fluid.

Critical Flow - fluid flow that is unstable, alternating between laminar and turbulent flow; Critical flow occurs at Reynolds numbers between 2000 and 4000.

Critical Point - location on a line or vessel that determines the rate at which the fluid in the line or vessel can flow.

Critical Pressure Differential - difference between the pressure at the valve inlet and at the vena contracta that would cause cavitation.

Critical Velocity - speed to maintain turbulent flow and prevent transition to laminar flow.

Critical Zone - see: critical flow.

Cup Tester or Cup Packer - Device lowered into the well on a drill stem to pressure test casing and blowout preventers. The sealing component is cup – shaped, hence the name.

Cyclic Surging - small surges of pressure that oscillate within the line or vessel; cyclic surges are associated with line or vessel equipment, such as reciprocating pumps/compressors and pressure reducing valves.

D.

Darcy Equation - mathematical relationship used to determine a simple system curve.

Dead Band - how far a device can move within its mechanical linkage before it triggers a reaction.

Degasser - Equipment that removes undesirable gases from a liquid, especially gases entrained in drilling or completion fluids. Relies on pressure reduction or inertia to accomplish separation of liquid and gas phases.

Degree-day - measure of the extent to which the mean daily temperature varies from an assumed base, usually 65° F; one degree day is counted for each degree of variation.

Degree of Tolerance - value assigned by an operator for a change in system conditions (magnitude) over a given time (interval) for the present state of the system (steady state or transition).

Dehydration – removal of water vapor from gas.

Dehydrator - vessel used to remove water vapor from gas.

Densitometer - instrument that measures its fluid density.

Density - mass of a substance per unit of volume.

Design Capacity - maximum average capacity of the line or vessel calculated assuming ideal operating conditions.

Design Pressure - Maximum pressure ratings for a pipe or vessel based on its specified minimum yield strength (SMYS), diameter and wall thickness, operation zone, and weld joint type.

Determined Viscosity - actual measurement of viscosity taken with a viscometer.

Differential Head -increase in head between the suction and discharge nozzles of pumps or compressors (see also: head).

Differential Pressure - The difference in pressure between the hydrostatic head of the drilling fluid in the fluid column, and the pressure exerted by or from the formation at any given depth in the hole. May be positive, zero, or negative with respect to the hydrostatic head.

Discharge Control - control based on the limits of the station discharge pressure.

Discharge Nozzle - port through which fluid leaves the pump or compressor.

Discharge Pressure - fluid pressure as it leaves a pump, compressor, or valve.

Discharge Pressure Allowable - pressure allowable that specifies the pressure that triggers the simultaneous shutdown of all the units.

Discharge Set Point - the set limit for discharge pressure allowed to exit the station.

Discharge Valve - OPEN/CLOSED valve, such as a gate valve or a ball valve, that allows or disallows fluid from leaving a pump or compressor.

Displacement (compressor) - volume displaced by each stroke of a piston in a reciprocating compressor cylinder.

Displacement (pipe) - physical volume of a pipe section, usually in cubic feet.

Displacement Meter - a type of meter that measures flow based on the physical displacement of fluid.

Diverter - Typically a device attached to the wellhead or marine riser to close the vertical access and direct any flow from the well away from the rig. The line running from the diverter may be referred to as the "Blooie line"

Downhole Pumping MPD – A pump of some design is used downhole to apply upward lift to annulus returns; to offset annulus friction pressure when circulating, to return riserless drilled mud and cuttings to the rig, or mid riser to reduce the hydrostatic head of mud and cuttings in ultra-deep water.

Down Surge - line or vessel pressure surge, which is negative because its magnitude is below the normal operating pressure of the line or vessel.

Drafting - process of delivering more gas than is presently entering the system.

Drag - another term for frictional loss often associated with the AGA flow equation.

Drag Reducing Agents (DRAs) - long-chain organic molecules in a hydrocarbon or water base injected into line or vessels to reduce frictional losses.

Draining - decrease in volume of fluid in the line or vessel due to lack of pressure.

Drill Stem Safety Valve - An essentially full – opening valve used to close off the drill pipe and prevent flow up the drill string. Kept on the drill floor, and has threaded connections matching the drill pipe in use.

Drill Stem Test - A procedure to determine the productive capacity, pressure, permeability or extent (or a combination of these) of a hydrocarbon reservoir. While several different proprietary hardware sets are available to accomplish this, the common idea is to isolate the zone of interest with temporary packers. Next, one or more valves are opened to produce the reservoir fluids through the drillpipe and allow the well to flow for a time. Finally, the operator kills the well, closes the valves, removes the packers and trips the tools out of the hole. The test may be short (one hour or less) or long (several days or weeks) depending on the requirements and goals. Also there might be more than one flow and pressure buildup periods.

Drilling Spool - BOP stack connection, with flanged ends, used as a spacer between bop equipment, may or may not have side outlets for connection to auxiliary lines

Drooping Characteristic Curve - head developed at shut-off is lower than that on another part of the curve for pumps.

Dry Gas - Natural gas composed mainly of methane with only minor amounts of ethane, propane, butane, and minimum heavier hydrocarbons in the gasoline range.

Dual Gradient (DG) – Two or more pressure gradients within selected well sections to manage the well pressure profile.

Dynamic Fluid Flow - see transient flow.

Dynamic Head - kinetic energy of a fluid due to its velocity.

E.

Effective Horsepower - power reading based on the pump or compressor usage.

Effectiveness - measured in terms of line or vessel balance. With stable flow rate, volume in equals volume out, and an even pack exists throughout.

Efficiency - 1) ratio of the friction for a fluid moving through an ideal pipe to the friction for a fluid moving through an actual pipe 2) measure of how well a pump or compressor converts shaft horsepower into pressure and flow. More specifically, efficiency is the ratio of the hydraulic horsepower delivered at the discharge to the actual horsepower supplied to the shaft.

Elevation Head - potential energy per unit weight of a fluid because of its elevation above a reference level.

Elevation Pressure - pressure due to weight of a fluid over a change in elevation.

Elevation Profile - elevation of the flow path above a datum.

Elastomer Seals – all rubber components containing any wellbore pressure in the BOP, wellhead, casing, or separation system.

Emergency Shutdown Valves. (ESD) - Typically remotely actuated valves, preferably gate, butterfly or plug, mounted to outlet on flow cross. Valve is functioned in cases of unplanned release of well returns due to breach in flow back system. Actuated by air, hydraulics, or electrical signal over hydraulics. .

Energy - ability to do work.

Energy Consumption - quantity of energy consumed and measured in hours, such as horsepower-hours and kilowatt-hours.

Entrained Gas - Formation gas entering the drilling fluid in the annulus, causing gas cut mud.

Equal Percentage Valve - valve where the percentage change in fraction corresponds to the increased flow percentage, used normally as control valves Best results occur in the 30-70% open range.

Equalize - static (no flow) condition that occurs when pressures become constant.

Equalization Line or Loop – line providing the means to equalize pressure across a valve, BOP element or other pressure containing device.

Equivalent Mud Weight (EMW) – The pressure at any given depth expressed in terms of mud density at that given true vertical depth.

Error Signal - a signal generated by the controller equal to the difference between the set point and the sensor provided information.

Established Reserves - Portion of the discovered resource base (under anticipated economic conditions) estimated to be recoverable.

Euler's Equation - determines theoretical pump head available from a pump.

Expected Capacity - expected volume the line or vessel flows during a period.

F.

FMEA - Failure modes and effects analysis. A technique for determining the ways in which equipment can fail and the consequences of the failure on reliability and safety.

Feed – in - Fluid flow from formation into well bore.

Feedback Control System - type of control system, also called a closed loop or bump-less system, where the control system receives or uses the information collected to control the process.

Final Control Element - part of a control system that actually affects what is happening in the control system.

Flash Point or Flashpoint - temperature that a liquid releases sufficient vapor to form a mixture with air igniteable by a flame.

Flashing - when a pressure drop causes the fluid to become gas-liquid mixture that continues to flow within a line or vessel.

Flat Characteristic Curve - head developed at shut-off is only slightly greater than that at the design capacity.

Flare Line - Leads from pressure vessel, and is sized according to the pressure rating of the vessel. Contains a backpressure valve that maintains desired pressure on the pressure vessel. Manifolding before the flare line allows gas to feed a pipeline compressor.

Flare Stack - completes the gas separation process and may be 10 to 100 feet high depending on production rates and gas composition. Careful decisions on height and placement of the flare stack are very important for personnel / equipment safety. May have auto ignition facility.

Flow - volume of fluid moving in a given direction per unit of time.

Flow Back System - typically consists of flow cross, flow diverter, emergency shut down valve (ESD), flow line, choke manifold, sample catcher, phase separation vessels, shipping pumps, flare line, flare stack.

Flow Cross - first item of ancillary equipment coupled with the rig's primary well control equipment. A flanged spool with one or two flanged outlets and is typically located between the rig's upper spherical preventer and the flow diverter

Flow Characteristic - describes how the valve operates when opened to different percentages.

Flow Chart - 1) diagram that shows logic, choices, and results of each step of a program with symbols and standard English 2) chart showing flow delivery into or out of a line or vessel.

Flow Computers, Totalizers and Indicators - Computers and totalizers integrate the functions of flow and temperature measurement, computation, alarms, data acquisition, input and output standardization, and closed loop control. They require external sensor input to function.

Flow Control - operational limit based on the line or vessel flow rate through a station.

Flow Controllers - A controller is a device that operates automatically to regulate a controlled variable. Flow controllers regulate flow direction and velocity.

Flow Diverter - installed at the top of the BOP above the flow cross. Function is to divert returned fluids away from the drill floor. There are two types of flow diverter -

(A) Passive - creates a friction fit seal between the rubber element and the drill string. Tension in the rubber element and well pressure maintains the seal.

(B) Active. Active diversion relies on external hydraulic pressure to create a seal between the element and the drill string. A Hydraulic regulator is required to maintain the seal in the face of changes as different components pass through the element. This method requires an oil regulator, accumulator, charging pump and hydraulic controls.

Flow Drilling – An underbalance technique where liquid hydrocarbons are returned to surface and separated by a skimmer system

Flow Indicators Sight - Sight flow indicators provide a quick, reliable and economical way to verify the flow of fluids through industrial process lines.

Flow line - Conduit for well returns routed from the wellhead to the choke manifold and from the wellhead to processing equipment. Considerations of design include size, connections, geometry, and pressure rating and anticipated flow conditions.

Flow Meters and Sensors - Flow meters and flow sensors are devices used for measuring the flow or quantity of a moving fluid or gas.

Flow Meter Gas Volumetric - Gas volumetric flow meters measure the flow or quantity of a moving gas in terms of volume per unit time (ACFM).

Flow Meter (Gas & Liquid Mass) - Gas and liquid mass flow meters measure the flow or quantity of a moving fluid or gas in terms of mass per unit time (lbs per hour).

Flow Meter (Gas & Liquid Velocity) - measure the flow or quantity of a moving fluid or gas in terms of velocity (e.g. feet per second).

Flow Meter Liquid Volumetric - measure the flow or quantity of a moving fluid in terms of volume per unit time (gpm).

Flow Sensors Air Velocity - These flow sensors measure air velocity or volume flow using insertion probes or capture hoods.

Flow Straightener – line or vessel flow straightener that lessens any whorls or eddies in the flow that might decrease the accuracy of the meter measurement.

Flow Switches Gas & Liquid Mass - A device with a switch output based on the measured flow of a moving fluid or gas in terms of mass per unit time (e.g. kilograms per hour).

Flow Switches Gas & Liquid Velocity - A device with a switch output based on the measured flow of a moving fluid or gas in terms of velocity (e.g. feet per second).

Flow Switches - Gas Volumetric - A device with a switch output based on the measured flow of a moving gas in terms of volume per unit time (for example, cubic feet per minute).

Flow Switches - Liquid Volumetric - A device with a switch output based on the measured flow of a moving liquid in terms of volume per unit time (for example, gallons per hour).

Fluid Flow - State in fluid dynamics of fluid in motion determined by fluid type, properties, geometry and velocity.

Foam - A two-phase system where the dispersed portion is air. Applied to UBD in water sensitive formations. Recyclable foams are available.

Formation Pressure - The pressure at the bottom of a well when shut-in at the wellhead.

Formation Water - Salt water underlying gas and oil in the formation.

Fracturing - A method of breaking down a formation by pumping fluid at very high pressures.

Friction – resistive force of particles sliding over one another damping out motion.

Friction Factor - determined experimentally or empirically by correlating the Reynolds number and the pipe relative roughness to the fluid friction in a flowing pipe; used by some flow equations to calculate pipe pressure loss.

Friction Head Loss - resulting loss of head pressure due to friction in a fluid flowing in a pipe; the head is converted to thermal energy.

Frictional Pressure Loss - difference between the upstream discharge pressure and downstream suction pressure due to friction; the amount of energy lost between nodes depends on flow rate, pipe size, and fluid characteristics.

Fundamental Flow Equation - gas flow equation using a calculated friction factor.

G.

Gage Joint - the heaviest wall casing in the well usually located just beneath the preventers or tree.

Gas - state of matter that has no definite shape or volume.

Gas Buster - Slang for mud / gas separator.

Gas Cut - gas entrained in a drilling fluid.

Gas Horsepower - total horsepower available to a compressor before derating for mechanical and thermal inefficiencies.

Gas-Lift Mandrel - A gas-lift system assembled with the production tubing string to provide a means of deploying gas-lift valves. The position or depth of the gas lift valves is crucial to the efficient operation of the entire system. Consequently, proper assembly of the gas lift mandrels within the completion tubulars is essential. A port in the gas-lift mandrel provides communication between the lift-gas supply in the tubing annulus and the production-tubing conduit.

Gas/Oil Ratio - The volume of gas at atmospheric pressure produced per unit of oil produced.

Gate Valve - valve that closes by lowering a flat plate or gate to block the flow through the valve.

Gauge Pressure - pressure relative to atmospheric pressure.

Globe Valve - valve that opens or closes when a plug attached to the stem moves linearly in the spherical valve body.

Glycol - dihydric alcohol where different carbon atoms bond to the two-hydroxyl groups. The general formula for a glycol is $(CH_2)_n(OH)_2$.

Graph - visual method of showing the relationship between two or more characteristics.

Graphical User Interface (GUI) - Computer program user interface using graphics to control the software.

Gravitational Energy - potential energy caused by changes in elevation.

Gravitometer - device to measures the specific gravity of a fluid.

H.

Hard Shut In - to close in a well with the bop having the choke or choke line valve closed.

HAZID – Hazard Identification Study. .

HAZOP – Hazard Operability Study. .

Head - potential energy exerted by a column of liquid that has the ability to do work; expressed as the vertical height of the column.

Head Pressure - pressure exerted on a unit area by a column of liquid.

Head-Capacity Curve - graphical representation of the relationship between the head and the flow rate for a centrifugal pump or compressor.

Header - 1) collection of valves or short pipes connecting all the flow line in a given area; 2) modeling term for a short pipe which is treated as a steady state device in transient programs.

Heat Exchanger - vessel that permits heat exchange between hot and cold fluids.

Heater - device that increases the temperature of the fluid flowing through the heater.

Heater-treater - vessels that use heat to separate water from emulsion.

High Recovery Pressure Control Valve - valve that recovers a significant percentage of the pressure differential from inlet to the vena contracta.

High Signal Converter - relay that compares two error signals, selects the highest one, and sends this to the final control element.

High Vapor Pressure (HVP) - liquid hydrocarbons with vapor pressure above 50 psi (340 kPa) absolute at 100ºF (38°C).

Horsepower - unit of work that represents the amount of work required to raise a one-pound weight 33,000 feet in one minute.

Hot work – Work done when hydrocarbons are present or probable. See API RP 500

HSE MPD – The adoption of MPD tools or processes for health, safety, or environmental considerations.

Hunting - constant movement of a control system around the set point.

Hydrocarbon - chemical compound composed solely of carbon and hydrogen.

Hydrostatic Pressure – See Hydrostatic head.

Hydrates - solids (ice) that form when water vapor in gas cools; can be a high temperature based on the amount of CO2 and H2S.

Hydraulic Gradient (grade line) - graphical representation of the change in pressure or head with respect to distance along the line or vessel.

Hydraulic Head - pressure exerted by the weight of a column of liquid.

Hydraulic Horsepower - actual energy imparted to fluid flowing through a pump or compressor.

Hydraulic Profile - hydraulic gradient.

Hydraulics - set of laws governing the behavior of fluids at rest and in motion.

Hydrocarbon - Chemical compound composed solely of carbon and hydrogen. A catchall term used mainly for oil, gas, and condensate.

I.

Inside BOP - installed in a drill string to prevent a blowout inside the string. Inside BOPs are essentially a check valve preventing flow up the drill string while allowing flow down the drill string. Also called Internal Blowout Preventer, and IBOP.

ID - inside diameter of a pipe. Calculated by the difference between the nominal (outside) pipe diameter and twice the wall thickness (w.t.).

Impeller - rotating part of a centrifugal compressor/pump that imparts kinetic energy to a fluid.

Incompressible Fluids – fluids having very little change in volume as pressure is significantly increased or decreased.

Indirect Heater - vessel that heats a fluid without using a direct flame.

Induction Motor - motor that uses current induced into the rotor by electromagnetic fields in the stator.

Inertia - force that keeps a stationary body from moving and a moving body from changing speed or direction.

Injection - process of accepting commodity into the system.

Instantaneous Measurement - value of the measurement at a specific instant in time.

Instrument - device that reads and records specific information about line or vessel condition and operation, including pressure or temperature sensors, meters or detection devices.

Intake Nozzle - suction nozzle.

Interlocks - software or hardware that allows or prevents motors from starting, or valves from opening or closing.

J.

Jetting the Well in - circulating a lower – density fluid to allow the well to go underbalance, either to drill in underbalance mode or to induce production from the formation.

K.

Kelly Cock - valve installed between the swivel and the Kelly to prevent high-pressure backflow. Closing the valve keeps pressure off the swivel and rotary hose.

Kelly Valve Lower - an essentially full opening valve below the Kelly, with an OD same as the drill pipe.

Kelvin - metric absolute temperature unit (degrees Celsius + 273.16).

Kick - Unplanned, unexpected influx of liquid or gas from the formation into the wellbore, where the pressure of fluid in the wellbore is insufficient to control the inflow. If not corrected can result in a blowout. .

Kill - Action taken to kill well and prevent or correct blowout. Includes circulation of heavy weight fluid downhole, circulating kick out, and closing of blowout preventers.

Kill Line - High-pressure line between the mud pump and the blowout preventer to facilitate the pumping of fluid into the hole to overcome well pressure with the preventers closed.

Kill Rate - A predetermined fluid circulation rate expressed in volume per unit of time that is used under kick conditions, often a selected fraction of the circulating rate time unit used while drilling under normal conditions.

Kill Rate Circulating Pressure - Pump pressure required to circulate kill rate volume under well kick conditions.

Kinematic Viscometer - a device that measures efflux times in determining kinematic viscosity.

Kinematic Viscosity - the ratio of a fluid's absolute (dynamic) viscosity to its density.

Kinetic Energy - energy an object has because of its motion.

L.

Laminar Flow - fluid flow where fluid layers at the center of the line or vessel move faster than the layers next to the pipe wall.

Law of Conservation of Energy – prohibits creation or destruction of energy. Work changes energy from one form to another (heat to mechanical).

Leak Detection - examining and reporting any anomalies in the line or vessel hydraulics.

Line Fill - sequence of commodities in the line.

Line Looping - see: loop and looping.

Line Pack or linepack - 1) volume of fluid in the pipe at flowing pressure and temperature; 2) increased volume of a fluid within a given pipe due to increased pressure.

Line Section - segment of line or vessel between two terminals.

Linear Valve Flow Characteristic -proportional increased flow by equal opening increments of the valve.

Line Break Detector - automatic valve operator that activates if the rate of pressure drop exceeds a pre-set amount, thereby limiting fluid loss to the section in which the line break occurs.

Line Pack - increase in volume of fluid in the line or vessel caused by an increase in pressure

Liquid - one of the three states of matter; has a definite volume, but no definite shape.

Liquid Leak Detectors - Liquid leak detectors sense when a liquid is leaking from a pipe, tank, or other receptacle area.

Liquefied Natural Gas (LNG) - Oilfield or naturally occurring gas, chiefly methane, liquefied for transportation.

Liquefied Petroleum Gas (LPG) - fluid consisting mainly of ethane, propane and butane that are gases at atmospheric pressure but under high pressure are liquids.

Load Factor - ratio of the average demand to the peak demand.

Load Profile - manner that the fluid flow varies over a given period.

Load Shifting - moving an entire load from a peak time to an off-peak time.

Look-ahead Model - projects flow transients into the future, based on current operating conditions and any specified schedule of events; if any constraint violations occur, alarms activate to initiate preventative actions.

Loop - sections of pipe that parallel the existing line to increase the capacity and efficiency of a line.

Loop Swing - putting a line or vessel loop into or out of service.

Loop-Fill - volume of commodity that fills the out-of-service loop section.

Looping - installation of sections of pipe that run parallel to the existing line and increase the capacity of the line.

Lower Kelly Cock - Also called drill-stem safety valve, see drill-stem safety valve. .

Low Vapor Pressure (LVP) - hydrocarbons with vapor pressure lower than 50 psi (340 kPa) absolute at 100ºF (38°C).

Low head – a drilling procedure using underbalance techniques to maintain a reduced hydrostatic head on the formation.

M.

Managed Pressure Drilling (MPD) – an adaptive drilling process used to precisely control the annular pressure profile throughout the wellbore. The objectives are to ascertain the downhole pressure environment limits and to manage the annular hydraulic pressure profile accordingly. It is the intention of MPD to avoid continuous influx of formation fluids to the surface. Any influx incidental to the operation will be safely contained using an appropriate process.

- MPD process employs a collection of tools and techniques which may mitigate the risks and costs associated with drilling wells that have narrow downhole environmental limits, by proactively managing the annular hydraulic pressure profile.
- MPD may include control of back pressure, fluid density, fluid rheology, annular fluid level, circulating friction, and hole geometry, or combinations thereof.
- MPD may allow faster corrective action to deal with observed pressure variations. The ability to dynamically control annular pressures facilitates drilling of what might otherwise be economically unattainable prospects.

Manifold - a system of pipe and valves that serves to convert separate flows into one flow, to divide one flow into separate parts, or to re route a flow to any one of several possible destinations.

Master Choke Line Valve - the valve on a choke and flow line that is nearest to the preventer assembly, used to stop flow through flow line and choke.

Man Machine Interface (MMI) - interface between an operator and a computer.

Mass - amount of matter that an object contains.

Maximum Operating Pressure (MOP) - maximum pressure permitted for normal line or vessel operation; MOP is related to pipe strength and the pipe's ability to withstand internal pressure. MOP results from the lowest of three factors: design pressure, hydrostatic test pressure, or flange rating.

MAOP - Maximum Allowable Operating Pressure.

MAWP – Maximum Allowable Working Pressure. See MAOP

Mean Effective Pressure - theoretical constant pressure applied during each power stroke to produce the brake horsepower of an engine.

Mean Pressure - average pressure in a flowing line or vessel.

Mean Temperature - average temperature in a flowing line or vessel.

Mechanical Efficiency - efficiency of the mechanical linkage between an engine and the pump or compressor it is driving.

Mechanical Energy - ability to apply a force to an object causing it to move.

Mechanical Losses - friction losses in bearings and stuffing boxes and other rotational contact points.

Mechanical Vapor Plug - used to provide a gas vapor seal when required during pipe replacement and repair.

Mechanical Work - force acting on an object through a distance.

Membrane Nitrogen – Reduced Oxygen content air produced by passing compressed air over a membrane to reduce the oxygen content to 2-5% on average.

Meter - device that measurers the amount of fluid entering and leaving a line or vessel system.

Meter Banks - single meters arranged in parallel configurations.

Meter Factor - used to adjust meter readings to show the actual volume measured by the meter.

Meter Multiplier - used when actual voltages or currents are too large for the meter and would be out of range.

Meter Prover - device to test ("prove") meter accuracy and determine the meter factor.

Meter Run - one leg of a meter bank, consisting of a strainer, a meter, and the associated valves.

Meter Stack - device equipped with a set-stop counter that shuts down the unit when reaching the maximum allowable volume.

Metering - measuring the volume of fluid as it moves past a particular point on the line or vessel.

Metering Manifold - array of pipes and valves allowing an operator to redirect the fluid to other pipes or processes.

Mist Drilling - A method of dispersing water, oil or both in air, nitrogen, gas or a combination of the three and used as the drilling fluid.

Momentum - attribute of an object's velocity multiplied by its mass.

Moody Diagram - graph that shows relative roughness, and Reynolds number as a way to determine the friction factor (f) used in the Darcy equation.

Motor - converts electrical energy to mechanical energy in the form of a rotating shaft.

Mud Cap – A variable length fluid column maintained above a formation that is taking the circulating fluid and drilled cuttings.

Mud Flow Indicator - Device that continually monitors and records the mudflow from the annulus and out of the mud return line.

Mud Gas Separator - device that separates free gas from mud also known as a Gas Buster.

Mud Return Line - A trough or pipe, usually pipe, running from the surface connection at the wellbore to the header boxes for the shale shakers at the start of the solids control system.

Multi-stage Pump - pump that has two or more impellers mounted on the same shaft and an equal number of liquid pressurization stages.

N.

Natural Gas - Typical composition is (approximate percentages) 80% methane, 7% Ethane, 6% Propane, 2.5% Butane, 1.5% Isobutane, and 3% Pentane. Used in UB Drilling where it is available from local pipelines or other sources at reasonable cost. Has advantage of eliminating downhole corrosion and combustion problems, but surface handling presents safety issues during connections and tripping.

Natural Gas Liquids (NGL) - petroleum fluid primarily composed of ethane, propane, and butane. NGL is a gas at atmospheric pressure but transported as a liquid by maintaining it under high pressure.

Near Balance – A drilling procedure using underbalance techniques to keep the bottom hole pressure near the pore pressure. This technique is often used in very sour wells.

Needle Valve - A globe valve incorporating a needlepoint disc that allows extremely fine flow control.

Net Positive Suction Head (NPSH) - head above the vapor pressure of the liquid existing at the pump suction nozzle.

Net Positive Suction Head Available (NPSHA) - actual NPSH available at the pump suction for the particular operating conditions; NPSHA is the difference between NPSHR and NPSH.

Net Positive Suction Head Required (NPSHR) - minimum NPSH required by the pump to prevent cavitation.

Net Pumping Requirement - total volume of commodity that the line or vessel must pump every day of the month through each section of pipe in order to meet the Notice of Shipment.

Net Standard Volume - volume of a fluid at standard pressure and temperature after the deduction of S&W.

Network – system model of pipes and equipment.

Nitrogen, (NO_2) cryogenic - inert gas, satisfies the operational requirements of underbalance drilling in terms of safety and operational flexibility. Can be expensive in underbalance operations due to transportation, storage and volume requirements.

Node - connection point between different devices in a pipeline model.

Non-Recoverable Energy - head between the total energy head line and the total head line; energy that is no longer useful for moving oil down the line or vessel because it has been converted to heat and absorbed by the ground surrounding the line or vessel.

NRV – A non-return valve. A float or other check valve in the system. See Inside BOP

NPSHR Capacity Curve - shows the relationship between NPSHR and capacity.

O.

OD - outside diameter of a pipe.

Off-line Model - may be steady state or transient, but does not have access to SCADA data. Typically requires manual Inputs.

Oil and Gas Separator - Equipment used to separate liquid phase of well production from the gas components. Separators may be vertical or horizontal, and are cylindrical or spherical in shape. Separation occurs essentially by gravity with the heavier liquids falling to the bottom and the lighter phases (gas) rising to the top.

Online Model - uses real-time telemetry (SCADA) to retrieve current operating data.

Operator - the Company having legal authority to drill wells and undertake the production of hydrocarbons. The Operator is often part of a consortium and acts on behalf of this consortium.

Operating Capacity - average sustainable flow rate over specified periods taking into account routine and unexpected maintenance and operating problems.

Operating Limits - Set of limits for a section of line or vessel established to prevent over-pressuring.

Operating Point - point of intersection between a pump head-capacity curve and a system curve. This value is the maximum flow rate that a given pump can maintain in the line or vessel.

Optimization - selection of the most desirable combination of factors to meet a specified objective.

Optimizer - software that uses mathematical techniques to meet objective functions.

P.

Pack Off or Stripper Preventer - Preventer having an element or packing material that relies on pressure from the wellbore for closure. Used primarily to strip pipe through the hole or allow pipe movement with pressure on the annulus.

Pack Off or Stripper - Device with elastomer packing element that depends on pressure below the packing to create a seal in the annulus. Used primarily to run or pull pipe at low or moderate pressure. .

Panhandle Formula - empirical equation used for calculating flow in gas pipelines; two versions are Panhandle "A" (partially turbulent) and "B", sometimes-called Modified, (fully turbulent).

Parallel Operation - configuration where pump or compressor capacities are additive while the head remains constant.

Parasite (string, casing) - Annulus or ID used to inject fluid at some depth below surface. The use is very similar to a gas lift mandrel.

Partial Pressure - pressure a fluid would exert if it alone were present in the container.

Pascal's Laws - pressure acts uniformly in all directions on a small volume of liquid; in a liquid confined by solid boundaries, pressure acts perpendicular to the boundary.

Peak Shaving - 1) technique used to shift a portion of an electrical load at a peak time of day to a non-peak time; 2) technique used to meet peek demands using alternate gas supplies such as storage, LNG or propane air.

Piezometric Pressure - pipe pressure plus elevation pressure.

Pig (pigged) - device, which may contain instruments, propelled by fluid down the line to clean pipe walls, gather information about the pipe, or separate different batches of fluid.

Pig Time - time required for a "pig" to traverse a section of line or vessel.

Pipe Leg - modeling term.

Pipe light – a condition when the force acting on the drillstring from the wellbore pressure exceeds the weight of the drillstring.

Pipe Prover - common device used in the proving of a meter.

Pipe Work (surface pipe connections) - May be threaded, unions, clamps, or flanged. Flanged connections are preferable (not mandatory) especially in the higher pressure applications, unions and clamps are acceptable in low to medium pressure, functions, threaded connections are appropriate in low pressure operations only and care must be taken to avoid galling / thread damage.

Piping and Instrumentation Diagram (P&ID) - diagram showing the sequence of piping and instruments on a section of the line or vessel but not drawn to scale.

Pit Level Indicator - Device that constantly monitors the level of drilling fluid in the pits during operations incorporates float devices with sensors that report levels to a recording and alarm device (the pit volume recorder) placed near the driller's position on the rig floor, the alarm is set to sound if the pit level goes too high or too low.

PLC - Programmable Logic Controller.

Plug Valve - wedge shaped, reduced part valve with 90-degree rotation; causes high-pressure drop.

Pocket (unloader) - reduces the flow through a reciprocating compressor by increasing the volumetric capacity of the compressor cylinder.

Pore Pressure - Pressure exerted by fluids in a formation pore space.

Positive Choke - choke requiring orifice size change to change the rate of flow.

Potential Energy - energy of position (usually the energy input to the system such as at pumps.

Potential or Head Energy - energy that can be converted to velocity or flow; this pressure is created through changes in elevation or by pump units that are equivalent to positive changes in elevation.

Pour Point - lowest temperature at which a liquid will pour, or flow.

Power (p) - rate of doing work.

Power Factor - ratio of real power (measured in Hp (kW)) and apparent power (measured in kVAr).

Predictive Model - performs "what if" analyses by calculating the effects of transients introduced by scheduled or unscheduled line or vessel events, such as pump or compressor outages, valve closures, or supply variations. The operator typically enters these events into a "scenario".

Pressure - amount of force (F) exerted on a unit area (A) of a surface.

Pressure Base - assumed atmospheric pressure used in calculations requiring "absolute" pressure. (DATUM)

Pressure Control - operational limit based on either the line or vessel suction pressure or the discharge pressure at a station.

Pressure Control Valve (PCV) - valve that regulates pressures at stations, restricting flow by use of a ball or plug positioned by an actuator.

Pressure Deployment – process of deploying or recovering drill string or coiled tubing components from a live or pressurized well.

Pressure Loss - rate of decrease in pressure along the flowing line or vessel (P f) due to friction of the fluid against the pipe wall.

Pressure Relief Valve (PRV) - a valve that opens automatically to relieve the line pressure that is above the safe operating limit.

Pressure Transient -pressure waves, traveling through the pipes at the wave speed of the fluid and caused by changes in the operation of the system.

Pressure Transmitters - instruments to measure and report pressure.

Pressurizable Mud Returns – See Closed Returns System.

Pressurized Mud Cap Drilling (PMCD) – Variation of MPD, drilling with no returns to surface where an annulus fluid column, assisted by surface pressure, is maintained above a formation that is capable of accepting fluid and cuttings. A sacrificial fluid with cuttings is accepted by the loss circulation zone. Useful for cases of severe loss circulation that preclude the use of conventional wellbore construction techniques.

Pressurized Surge Tank - also called an accumulator; prevents the transfer of pressure waves to other parts of the line or vessel system.

Primary Location Instruments - location where the instruments normally used to monitor flow conditions are located.

Proactive MPD – Using MPD methods and/or equipment to actively control the pressure profile throughout the exposed wellbore.

Process Disturbances - things that change the steady state of a control system profile.

1) Horizontal line that indicates changes in ground elevation along the line or vessel route.
2) Modeling term used to define changes with respect to time.

Productivity Index – The continuous production capacity of a well. PI is a measure of rate (MSCFD) divided by the pressure drop to generate the flow rate (PSI). Index is MSCFD/PSI or Barrels per day per PSI.

PHA – Process Hazard Assessment. An organized and systematic methodology to identify the potential hazards associated with a particular operation, piece of equipment, or total system. Processes commonly used are:

i) What if
ii) Checklist
iii) HAZOP
iv) FMEA
v) FTA

Proportional Integral Derivative (PID) - controller that uses all terms in determining the movement to meet the set point.

Pressure Gradient - Change of pressure with depth, usually expressed as pounds per square inch per foot.

A scale of pressure differences in which there is a uniform difference in pressure from point to point. .

Pressure Vessel –Phase Separation - *First Option.* Single four – phase separation vessel using velocity drop in the first compartment to create gas and solids phase separation. Liquids cascade to the back compartments where with sufficient residence time the interface forms. Requires sufficient time for the interface between liquids to take place which means the vessel has to be correspondingly large to accomplish the process.

Second Option. A series of vessels designed to separate the phases sequentially. Order of phase separation may vary from system to system. Different systems available are: Gas to be separated first as it is compressible and of lower density than solids or liquids. Remove solids first as they will erode pipe work and components in the system. Separation of gas, solids, and liquids occurs in individual hydro-cyclones connected in series, parallel, or a combination of both. In all separators, the design should make it impossible for gas to travel down the liquid leg and liquid to travel down the gas leg.

Pump Capacity - flow rate of a pump at a particular head as read off the pump head-capacity curve.

Pump Curve - graph that shows the relationship between flow, head, horsepower, efficiency, and NPSHR of a pump.

Pump Differential - total pressure output of a pump minus its suction pressure.

Pump Differential Head - difference in total head between the suction and discharge of the pump.

Pump Head - amount of the increase in total head across the pump. Also referred to as pump differential head.

Pump Head-capacity Curve - graphical representation of pressure produced by the pump vs. flow rate.

Pump Horsepower Capacity Curve - graphical representation of required power versus flow.

Pump Run Out - flow rate that produces little to no head.

Pump Station - one of the installations built at intervals along a liquid line or vessel to route and increase the flow; contains pumps and other equipment.

Pump Unit Lockout - removal from service of a shutdown pump unit.

Pump Unit Shutdown - temporary loss of a pump unit, indicates exceeded one or more of the pump's operating parameters.

Purge - procedure that removes all air from a line or vessel to prevent fire or corrosion. The length of time required to purge a line is dependent on the size and length of the line, size of the blow off valve, and the purging method selected.

PVR (Plant Volume Reduction) - the volume of gas removed from a line or vessel at a hydrocarbon processing plant.

Q.

Quick Opening Valve Flow Characteristic - produces a very rapid increase in flow between the closed position and the partially open position.

R.

Ramping - 1) gradual startup or shutdown of a pump unit. 2) Modeling term meaning to change variables with time.

Rankine (degrees temperature) - English measurement of absolute temperature (+459.69 offset).

Rate of Rise - surge control in which a pressure sensor initiates a device control that is proportional to the rate of pressure increase caused by the surge.

Reactive MPD – Using MPD methods and/or equipment as a contingency to mitigate drilling problems as they arise.

Real-time Model - uses SCADA data to run in lock step with the actual line or vessel. The goal is for calculated flows and pressures to track telemetered points, with consistent and reasonable accuracy, so that confidence can be gained in the model's ability to predict future operating conditions, as well as estimate conditions at non-telemetered locations.

Reciprocating Compressor - 1) a piston-type positive displacement compressor which increases the pressure of a definite volume of gas by reducing the cylinder volume, resulting in a pulsating delivery of gas; 2) any compressor which employs a piston working inside a cylinder to compress a gas; usually has "pockets" that allow for limited pressure and flow control.

Recoverable Energy - head below the total headline; energy which is still useful for moving oil down the line or vessel.

Recycle Line - gas line that allows re-circulation of discharge gas into the suction side of a centrifugal compressor; this permits a centrifugal compressor to be placed on-line or off-line in parallel with other units without creating a surge condition.

Reference Level - zero elevation/head on a total energy diagram. For line or vessel applications, the reference level is usually sea level.

Regulator - control valve used to regulate pressure or flow.

Reid Vapor Pressure – a test method to determine the vapor pressure of volatile petroleum liquids at 100° F with an initial boiling point above 32° F. (ASTM D 323)

Relative Roughness - ratio of the absolute roughness of the inside pipe wall to the internal diameter of the pipe; Absolute roughness is the average height of imperfections in the pipe wall surface.

Relief Valve - valve specifically designed to protect a line or vessel from exceeding MAOP by relieving to atmosphere or a tank.

Remote Choke Panel - A set of controls, usually placed on the rig floor, used to control the amount of fluid circulated out through the choke manifold.

Remote Station - Auxiliary controls for operating a blowout preventer.

Remote Control – line or vessel control achieved at a remote control center using a SCADA system.

Remote Terminal Unit (RTU) - computer located at a remote location that gathers the information provided by all the PLCs at the location, and transmits that information back to the host computer.

Report by Exception - RTU sends information to the Host when data has changed by a specified amount.

Reservoir – An economic hydrocarbon-bearing zone.

Return System - Handles returns from the well – injected fluids, (gas and liquid) cuttings, hydrocarbons, formation water etc. Consists of flow diverter, flow cross, emergency shut down valve, choke manifold, pressure vessel and solids control equipment, from where the liquid phase used for drilling is passed on to the drilling fluid tank, and then to the rig pumps for re injection to the well.

Reverse Circulation - circulation of drilling fluid down the annulus and up through the drill string.

Reynolds Number - mathematical relationship that describes the interdependence between the pipe diameter, fluid viscosity, and flow velocity; a dimensionless number used to describe the type of flow exhibited by a fluid flowing through a pipe.

Riser - vertical pipe intended to move fluid to either a higher or a lower elevation, such as from the ocean floor to a platform.

Rising Characteristic Curve - preferred curve shape for pump H-Q curves; this curve has a steady increase of H with decreasing Q.

Rotary Motion Valve - valve whose closure member rotates opening or closing rotating equipment, centrifugal pumps, or compressors.

Rotating Diverter - Generic term, - sometimes used to mean rotating head, or rotating blowout preventer.

Rotating Blowout Preventer (rotating annular preventer designed to rotate with pipe and seal on both pipe and kelly while allowing upward and downward movement of the pipe – also known as RBOP) Design specific to underbalance drilling. Models available for both top drive and Kelly drive applications.

Rotating Head, Low-pressure diverter designed to rotate with drill pipe and used mainly in air drilling.

Roughness - measure of the surface condition of the internal wall of pipe; Roughness can change with the age of the pipe and the type of service it has provided.

RTU - remote transmission (terminal) unit used in telemetry (SCADA) systems to transmit operating information to a master terminal unit (MTU) usually located in a control center.

Rupture disc - device that relieves pressure when an absolute pressure value is high enough to rupture the disc material, thus allowing fluid to flow into some type of a vessel.

S.

Safety Valves (pop offs) – valves most commonly used for temperature or pressure relief. Ensure venting from these valves terminate in a safe area.

Sample Catcher - Designed to take a portion of the flow from the wellbore, direct it through a chamber to remove drilled solids but reject liquids and gas.

Scraper - pigging device for cleaning paraffin or other substances from the inside surface of a pipeline. See pig.

Scraper Pig - pig equipped with brushes or urethane blades used to clean line or vessels; see also: pig.

Seat, Casing – designed to ensure that damage or breakage does not result from a hard shut in.

Sediment and Water (S&W) - dissolved impurities such as salt, water, asphalt and other substances in crude

oil, which come out of suspension and sink to the bottom of a container as the oil cools and settles. .

Sensor - instrument used to measure operating information such as pressure, flow or temperature.

Separator - horizontal, vertical, or spherical vessel used to remove liquid from gas, and gas from liquid. .

Series Configuration - a configuration of pumps or compressors linked together so that the discharge of one pump or compressor enters the inlet of another. Heads are additive at the same flow series/parallel operation flow is divided between the series pumps/compressors and the parallel pumps/compressors according to the capacity of each of the units.

Set Point - preset value that is the desired value of a variable, such as suction or discharge pressure.

Shipping Pumps - Typically centrifugal in design, used to transport drilling fluids to the suction tank and produced fluids to the storage facility. Mostly activated manually, but some float activated pumps are in use.

Sight Windows - Sight windows are an effective and economical way of viewing tank, pressure vessel and piping systems interiors. Also referred to as a sight glass.

SICP - Shut in casing pressure.

Shutdown Valves, Emergency - used to shut down flow line from rotating head in emergency situations, preferably butterfly or similar quick - closing design See ESD

Shut-off Head - head delivered by the pump at zero flow.

Single Stage Pump - one impeller and single stage of pressurization.

Slack Pipeline - maintaining column separation at a location with an extreme drop in elevation so that the pressure does not exceed the maximum operating pressure (MOP).

Slug Flow - A multiphase fluid-flow regime where the gas and liquid phase are discrete over portions of the flow. Generally occurs in combination with bubble flow. Flow will vary from high liquid to high gas cuts. Also called Line Jacking

SMYS (Specified Minimum Yield Strength) - the design value of the strength of the steel used in the pipe or vessel.

Snubbing – conducting tripping operations when the force acting on the drill string or coiled tubing from the wellbore pressure equals or exceeds the drill string or coiled tubing weight.

Soft Shutdown - using the VFD to slow the motor before stopping.

Soft Shut In - To shut in a well by closing the blowout preventer with the choke and choke line valve open, then closing the choke while monitoring the casing pressure gage for maximum allowable casing pressure.

Soft Start - with VFD, logic circuit increases AC power gradually until the motor has reached full speed.

Solubility - capacity of a substance to be dissolved.

Sonic Flow Meter - device for measuring fluid flow by timing sound waves across a cross-section of pipe.

Sonic Wave Speed - speed at which a transient wave travels through a line or vessel. It depends on fluid properties, and the elastic modulus of the pipe.

Sour – Hydrocarbon fluids containing sulfur. Generally taken as greater than or equal to 10-ppm, the 8 hour occupational exposure limit.

Sour Fluids (handling) - in underbalance drilling operations, where sour fluids are expected a closed system is utilized to meet recognized industry standards for handling such fluids

Sour Water (handling) - water contaminated with hydrogen sulfide (H_2S). Run through a degasser (poor boy, vane type etc) and pass to a tank before disposal.

Source - flow into a system.

Spacer Spool - used in underbalance operations to adjust height of stack and components on assembly, and to raise or lower height of flow line.

Specific gravity - 1) measure which compares the density of any liquid with the density of water at the reference temperature; 2) weight of a given volume of gas compared under standard conditions to an equal volume of dry air.

Specific Heat - heat required to raise a unit mass of a substance one degree.

Specific Heat Ratio - Ratio of specific heats at constant pressure and constant volume.

Specific Speed - design index that gives a general indication of the overall performance and geometry of the pump and impeller.

Specific Weight – substance weight divided by its volume.

Spitzglas Formula - equation used for calculating flow in small diameter, low-pressure distribution lines.

Square Law - relationship between velocity and the pressure drop in the pipe, where for over a limited range of flows, pressure drop is proportional to the square of the velocity for flow rate (also called capacity).

Squeeze Job - Remedial operation to pump cement slurry down a well into open perforations, formation cavities etc, to create a blockage. .

Standard Temperature - temperature used to correct volumes to a standard volume.

Static - usually refers to a pipe segment with no flow.

Static Gradient - representation of the height of liquid column or static head above the elevation at any point on the line or vessel.

Static Head - elevation of a column of liquid above a given reference point.

Static Head Pressure - pressure exerted upon a unit area by a column of liquid.

Static Hydraulics - refers to the properties of liquids when liquids are at rest and examines how pressure and changes in elevation affect fluid behavior in the line or vessel.

Static Pressure - pressure when the system is shutdown.

Static Resistance - sum of the elevation head and static head that must overcome before any liquid begins to flow.

Static Fluid Level - the level to which fluid rises in a well when shut in.

Station Bypass - diverting a full or reduced flow in the line or vessel around a shut down station.

Station Differential - pressure difference between the station suction pressure and the station discharge pressure.

Station Suction Valve - ON/OFF valve that allows fluid to enter a station when open, and forces fluid to bypass a station when closed. Operates together with the bypass valve.

Steady State - For steady state to occur the flow into a pipe must equal the flow through the pipe that must equal the flow out of the pipe. Steady state also has no change in flow or pressure with respect to time.

Steady State Analysis - method of flow analysis of a line or vessel system that assumes constant flowing conditions.

Steady State Energy Equation - modification of Bernoulli's equation that accounts for friction and work added by pumps. It compares the energy in a fluid at two different points and accounts for the addition or removal of energy between the same two points. .

Steady State Model - performs offline simulation that does not allow for changing line or vessel conditions over time. Stead-state models are the historical norm for facilities planning and quick evaluation of operational situations. It remains an essential step in the transient modeling process.

Steep Characteristic Curve - rising pump H-Q curve, with a large increase in head between the head developed at design capacity and at shut-off storage field.

Studded Block – A solid block of metal bored and studded to accept flanges. Used for erosion points or high stress connections.

Stress Corrosion Cracking – Cracking induced by a combination of stress and corrosion.

Stripper Head - Blowout prevention device consisting of a gland and packing arrangement bolted to a wellhead. Used to seal annular space between tubing and casing.

Stripper Rubbers - Internal component of rotating head used to strip pipe in and out of hole, available for drill pipe and casing sizes, and may be polyurethane composition where required to suit application / conditions e.g., high temperature service, or in certain drilling fluid applications where standard elastomers are inappropriate. .

Stripper Well - A well having minimal hydrocarbon production.

Stripping - Adding or removing drill pipe into a live or pressurized well after exceeding pipe light depth.

Stripping In - The process of lowering the drill stem into a well when the well is live.

Stripping Out - The process of raising the drill string out of the wellbore when the well is live.

Storm Choke - A choke that is pre–set to close automatically if flow exceeds its pre–set rating.

Suction Control - control based on the limits of the station suction pressure.

Suction Pressure - pressure at the suction flange of a pump or compressor.

Suction Set Point - required suction pressure necessary for the station.

Suction Valve - ON/OFF valve, such as a gate valve or a ball valve. If the valve is open, fluid can flow into the pump or compressor. If the valve is closed, no fluid can flow into the pump or compressor.

Supervisory Control and Data Acquisition (SCADA) - computer and communications system that gathers and analyzes operating data and sends reports to the control center. In addition, the SCADA system carries out commands issued by the operator at the control center.

Supply - flow into a system.

SCSSV - Surface controlled sub surface safety valve.

SSV - Surface safety valve.

Surge - 1) pressure change produced by conditions such as pump or compressor startup or shutdown, valve openings or closures, and line leaks 2) pulsating flow in centrifugal compressors caused by operating under low flow conditions.

Surge Pressure - rapid change in line or vessel pressure.

Sustainable Capacity - average sustainable flow rate over long periods taking into account routine maintenance and operating problems.

Sweep - a procedure that accelerates gas velocity, or increases gas turbulence, through a specific section of line or vessel, for removing accumulated liquids.

System Curve - line graph that shows how variables like viscosity, density, and flow rate combine with fixed conditions such as length of pipe, inside diameter of pipe, internal roughness of pipe, and changes in elevation influence throughput.

T.

Tension Tool - a retrievable or drillable packer where sufficient pipe weight is not available to set the tool in compression.

Thermal Energy - ability to do work via temperature.

Thermal Expansion – as temperature increases, fluid volume increases thus decreasing the specific gravity.

Throughput - actual flow rate of fluid to flow through the system.

Tie Downs - Used to secure lines and system components on land and offshore drilling rigs, particularly important in underbalance drilling operations, where vibration is encountered. Specialist tie down equipment is available. Also, anchoring device for the deadline of a hoist block arrangement.

Tight System - minimized phase separation at a location with an extreme change in elevation by maintaining sufficient pressure upstream and down-stream of the drop in elevation.

Time Step - each calculation out in time for a transient model.

Torque - force that produces rotation of an object around a point. Also called a couple.

Total Energy Diagram - graphical representation that shows the elevation profile of a line or vessel, with the total head for each batch drawn as a horizontal line above the elevation profile.

Total Energy Head - total head at the beginning of a line or vessel segment.

Total Energy Head Line - horizontal line on the total energy diagram that indicates the amount of total head that is in the liquid at the start of a line or vessel segment.

Total Head - the sum of static head, elevation head and dynamic head. Total head is the total useful energy the liquid has at any point.

Total Line Pressure - gravitational pressure plus pump pressure.

Total Static Head Gradient - sum of the static head and the elevation at any given point in the line or vessel.

Traceability – The ability for parts to traced to their origin. The origin refers to material and place of manufacture.

Transducer - see sensor.

Transient - unsteady (changing) flow or pressure condition that changes with time. A transient can also refer to a transition between two steady state conditions.

Transient Flow - unsteady (changing) flow or pressure condition that changes with time. A transient can also refer to a transition between two steady state conditions.

Transient Analysis - method of flow analysis of a line or vessel system that takes into consideration changing flowing or pressure conditions over time usually using a computer program.

Transient Model - on- or off-line simulation that considers dynamic fluid flow characteristics over a specified time span. Also called unsteady state model.

Transit Time - time it takes the carrier to transport a batch from the supply point to the delivery point.

Transition Flow - multiphase-fluid flow regime characterized by a chaotic mixture of liquid and gas, with neither phase appearing to be continuous. Also known as churn flow, transition flow is an intermediate flow condition between slug flow and mist flow.

Transition Region – flow regime where the fluid flow is turbulent but not fully developed turbulence.

Trip Gas - Accumulation of gas in wellbore while a tripping.

Trip Margin - An incremental increase in drilling fluid density to provide an element of overbalance and compensate for the effects of swabbing.

Tuning - tweaking physical system characteristics until predicted flow and pressure values match actual data.

Turbine Meter - a meter using a multi-bladed rotor to which the fluid imparts a rotational velocity that is proportional to the mean velocity of the stream; counting rotor revolutions derives volume.

Turbulent Flow - occurs when fluid particles in the line or vessel flow in random directions and forward at the same velocity.

U.

UBD Zone - section of well, in the context of Underbalanced Operations, where performing UBD.

Ultimate Potential - An estimate of recoverable reserves produced by the time all exploration and development activity is completed.

Underbalance – A condition where the pressure exerted in the wellbore is less than the pore pressure in any part of the exposed formations.

Underbalanced – Conducted in a state of underbalance.

Underbalanced Drilling (UBD) – A drilling activity employing appropriate equipment and controls where the pressure exerted in the wellbore is intentionally less than the pore pressure in any part of the exposed formations with the intention of bringing formation fluids to the surface.

Underbalanced Operation (UBO) – A well construction or maintenance activity employing appropriate equipment and controls where the pressure exerted in the wellbore is intentionally less than the pore pressure in any part of the exposed formations with the intention of bringing formation fluids to the surface.

Unloader -See: pocket unloader.

Upsurge – positive pressure surge. Upsurge pressure is above the normal operating pressure.

V.

Valve - device used to stop or control the rate of flow in a line or vessel or to serve as an automatic or semiautomatic safety device. Common valves include the butterfly, gate, plug, globe, needle, check, and pressure relief.

Valve Actuators - General - devices that, in response to a signal, automatically move the valve to the desired position using an outside power source.

Valve Actuators Manual - by definition, require no outside power source.

Motor Actuators Electric/Electronic - Valve actuators using a motor to drive a combination of gears that generates the desired torque or thrust level.

Valve Actuators Pneumatic - Pneumatic valve actuators that convert air pressure into motion.

Valve Actuators Hydraulic/Electro-hydraulic - Hydraulic and electro-hydraulic valve actuators convert fluid pressure into motion.

Valve Flow Coefficient - specifies the friction coefficient for a valve.

Valve Positioners - Valve positioners compare the control signal to the actuator's position and move the actuator accordingly.

Valve Position Indicators - are devices that show the position of the closure element.

Vaporization - a change of state from liquid to gas.

Vapor Pressure – For a given temperature, the pressure that maintains a liquid and its vapor in equilibrium.

Variable Frequency Drive (VFD) – electric motor that adjusts its speed by adjusting the frequency of AC power.

Variable Speed Drive – A system using a VFD. Pumps that use VFD have the same system curve but the changed rotational speed creates a new pump curve and operating point.

Velocity – speed.

Velocity Transients - Pressure waves occurring when there is a change in flow rate caused by a change in fluid energy in the line or vessel. Also known as pressure transients.

Vena Contracta - point of lowest pressure is just downstream of the actual orifice at a distance of about half the diameter of the orifice downstream.

Venting (gases) - The release of unburned gas through a vent or flare stack. Also called cold venting

Vertical Centrifugal Pump - pump's rotating unit is mounted in a vertical position.

Vertical Inline Pumps - single-stage vertical pumps with top-mounted motors. Suction and discharge nozzles arranged so the pump cases can be conveniently fitted into and supported by the piping.

Vibration – three-dimensional motion a machine exhibits from its static state.

Viscometer - instrument that measures the viscosity of a fluid.

Viscosity - measure of a fluid's tendency to resist flow.

Volatility - measure of how easily a liquid will vaporize.

Volume – the space occupied by an object.

W.

w.t. - Abbreviation for pipe wall thickness.

Wafer Check Valve - variety of check valve that has a two-piece disk, hinged down the diameter of the pipe. Flow pushes the valve into the open position. When there is no flow, a spring pushes the disk shut to prevent back flow.

Water Hammer - pressure wave created by the rapid closing of a valve on a flowing line or vessel.

Weight - measure of gravitational force on an object.

Weight Cut - drilling fluid density reduction by entrained fluids.

Wet Gas - gas containing water or condensate vapor.

Weymouth Formula - equation used to calculate flow in line or vessels.

Work - force applied through a distance.

Workover - Remedial work done to the equipment within a well, the well pipe work, or relating to attempts to increase the rate of flow.

X.

Y.

Yielding - The permanent deformation of the steel walls of a line or vessel caused when the MOP is exceeded.

Z.

Z factor – The factor used to compensate for change in density of gas with temperature and pressure not accounted for in the ideal gas law (PV=nRT).

Zoning - All equipment should meet API RP 500 for zoning purposes.