DEFINITIONS

PCP Surface Drive
The surface drive is a machine, which transfers rotational power from the prime mover to the rod string to a surface foundation, and manages stored energy during shutdown events.

Rod String
The rod string is a rod or series of rods capable of transferring torsion from the surface drive to the pump. The rod string typically handles axial load from the pump to the drive.

PCP
A Progressing Cavity Pump is comprised of a stator and rotor. The geometry of the assembly is such that it constitutes two or more series of spiral, separate cavities. When the rotor rotates inside the stator, the cavities move spirally from one end of the stator to the other, creating a positive displacement pumping action.

Friction Brake
A friction braking system provides torque by applying a normal force to a sliding surface creating drag.

Hydraulic Brake
A hydraulic braking system provides torque by pumping liquid through an orifice resulting in a pressure drop.

Electric Motor Brake
Electric motor brakes control the power to and from the electric prime mover during backspin to create a braking effect on the system.

Auxiliary Equipment
Auxiliary equipment is any component that is changed by the end user. Examples are sheaves, belts, motor guards, motor controllers, torque limiting devices and speed limiting devices.

Thrust Bearing
Device typically contained in the surface drive to hold axial load from the rod string while allowing it to rotate.

Torque Limiting Device
A torque limiting device prevents the system from applying torsion greater than a prescribed value to the rod string. Slow reaction time and dependence on ambient temperature makes “heaters” in the electric power supply system unacceptable as torque limiting devices. Acceptable devices will apply torque to greater than 110% of the torque limiter set during a stuck pump event.

Energy Capacity
The energy capacity of a surface drive is a measure of the total work the brake can do over the expected duration of a shutdown event. For example, a braking system that manages stored energy by absorption and not dissipation has a finite energy capacity defined by the thermodynamic characteristics and maximum allowable operating temperature. A brake that dissipates energy as fast as it is generated by the shutdown process has an infinite energy capacity.

Strain Energy
Strain energy is the work potentially done by the elastic torsional deformation of the rod string. Strain energy is typically of a smaller magnitude than the fluid energy, but can be released more quickly; thereby, placing different requirements on the braking system.

Fluid Energy
Fluid energy is work potentially done by gravity acting on the fluid in the production system.

Applied Torque
Applied torque is that applied to the top of the rod string by the surface drive.

Safe Operating Torque
Safe operating torque is that applied torque, which will never result in an unsafe operating condition. This value will be very low with specific applications permitting the assignment of a less conservative operating torque.

Backspin
Backspin is the process by which the surface drive turns in the direction opposite to normal operation. Backspin is driven by the strain energy of the rod string and the differential fluid pressure across the pump.

Stuck Pump Case
The stuck pump case describes one possible extreme event of the conditions at shutdown. PCP rotors sometimes become "stuck" in the stator and locked together. The top of the rod string continues to turn while the bottom stops, causing the rod string to further wind up as a torsional spring causing increased torque. When drive torque is removed, backspin occurs.

Fluid Dump Case
The fluid dump case describes most normal shutdowns where power to the surface drive is removed; thereby, allowing backspin. The differential fluid pressure across the pump causes the rotor and rod string to rotate in the direction opposite to normal pumping, allowing fluid to flow from the production tubing back through the pump. Backspin continues until torque resulting from differential pressure across the pump equal friction torque in the system.

Fluid Head
Fluid head is pressure resulting from gravity acting on a column of fluid. Fluid head is used to describe the pressure differential between two fluid columns contributing to the total differential pressure across the pump, which in turn produces torque.

Dynamic Fluid Level
Dynamic fluid level is the distance from the wellhead to the top of the liquid column in the annular space between the tubing and casing during normal operation.

Residual Fluid Head
Residual fluid head is the condition caused by friction in the PCP equaling torque generated by fluid pressure over the effective area of the pump. The result is the non-obvious presence of energy in the system, which may be released unexpectedly.

Tubing Head Pressure/Casing Head Pressure
Tubing head pressure/casing head pressure is measured at the wellhead and contributes to the total differential pressure across the PCP.

Flow Losses
Flow losses refer to internal friction of moving fluids resulting in pressure loss.

Mass Moment of Inertia
Mass moment of inertia is a measure of rotating equipment response to applied torque.

Dissipation Rate
Dissipation rate refers to the power transferred by the braking system to its surroundings in the form of heat.

Fluid Depression Test (Foam Depression Test)
A fluid depression test is one of the most popular tests for determining the producing bottomhole pressure and annular fluid gradient(s) in a pumping well. In typical pumping installations it is desirable to have the pump intake landed below the perforated (or producing) interval, to assist with downhole gas separation and minimize the amount of gas produced through the pump. Determination of the gradient(s) and resulting producing pressure can assist with more accurate determination of the Inflow Performance Relationship (IPR). To conduct a fluid depression test, the annulus of the well is closed, (while the well continues to pump) which typically results in an increase in casing pressure. This increase in pressure causes the fluid level to be "depressed". A series of fluid levels with corresponding pressures are used to determine the gradient(s) and resulting bottomhole pressure.