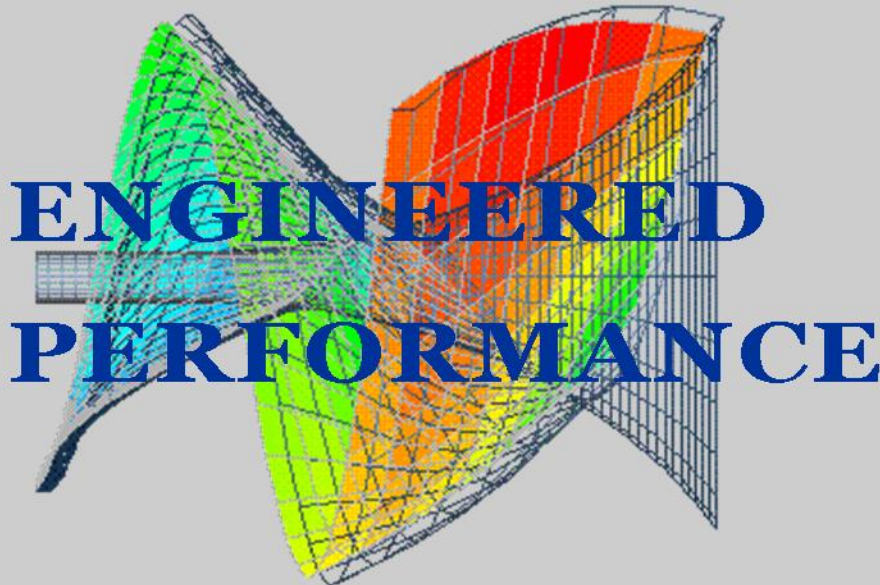


# intMPE



International Mineral Processing Equipment



**Industrial Series**

**API-610 & ANSI B73.1M**



*intMPE*

International Mineral Processing Equipment  
A Division of Canamera Enterprises Inc.



## Glossary of Pump Terms: **A**

**Adapter:**

Connects and aligns the power end of an ANSI pump to the wet end.

**A.N.S.I. Standard:**

American National Standards Institute. A set of specifications (envelope dimensions) for centrifugal pumps manufactured in the United States

**Absolute pressure:**

Atmospheric pressure added to gauge pressure.

**Affinity laws:**

They predict how capacity, head and horsepower are affected by changes in the centrifugal pump impeller diameter or shaft speed.

**Air ingestion:**

Air is coming into the stuffing box because of a negative suction pressure.

**Alignment:**

The centerline of the pump is perfectly aligned with the centerline of the driver (usually an electric motor).

**Ambient heat/pressure:**

The heat or pressure in the area where the equipment is located.

**Annealing:**

To soften the metal by heating it to a predetermined temperature somewhere below its melting point.

**Atmospheric pressure:**

At sea level, atmospheric pressure is 14.7 psi.

## Glossary of Pump Terms: **B**

**Back plate:**

Used in some centrifugal pumps to position the stuffing box and provide an impeller wear surface.

**Back pull out pump:**

A design that allows the wet end of the pump to be left on the piping when the power end and adapter are removed. A.N.S.I. pumps are designed this way.

**Back to back double seal:**

The rotating seal faces are facing in opposite directions. The worst possible configuration. In the past this term was used to describe a higher barrier fluid pressure between dual mechanical seals.

**Balanced seal:**

A design in which the seal face closing area is reduced to lower the closing force, and reduce the heat generation between the faces.

**Balance Ratio:**

A 70/30-balance ratio means that 70% of the seal face closing area is seeing the stuffing box pressure and 30% is not seeing the pressure.

**Ball bearing:**

Consists of an inner race, an outer race, and a series of balls between them. Often called a precision or anti friction bearing.

**Bar:**

Metric term for one atmosphere of pressure.

**Barrier fluid:**

The high-pressure fluid that is circulated between two mechanical seals. The fluid should enter the bottom and leave the top to prevent air pockets.

**Base plate:**

The pump and motor mount on this unit. The pump and motor feet closest to the coupling should be doweled to the base plate.

**Bearing:**

Supports the rotating shaft and allows it to turn with a minimum amount of friction. Could be either sleeve or anti-friction type

**Bellows:**

Can be manufactured from metal or non-metallic materials to eliminate flexing, rolling or sliding elastomers in mechanical seal designs.

**Bernoulli's Law:**

A moving stream of liquid or gas exerts less sideways pressure than if it were at rest. The result is that things seem to be drawn into the stream, but the higher pressure from outside is really pushing them in.

**B.E.P.:**

The best efficiency point. It is the point where the power coming out of the pump (water horsepower) is the closest to the power coming into the pump (brake horsepower) from the driver. This is also the point where there is no radial deflection of the shaft cause by unequal hydraulic forces acting on the impeller.

**B.H.P.:**

Brake horsepower. The actual amount of horsepower being consumed by the pump as measured on a pony brake or dynamometer.

**Brinnell hardness:**

A method of measuring the hardness of metal parts and hard seal faces. Above 350 the standard machining operations of turning, boring, drilling, and tapping become uneconomical.

**Buffer fluid:**

The low pressure fluid that is circulated between dual mechanical seals.

**Buna N:**

Some times called *Nitrile*. A common elastomer used in the sealing of oil or water. Sensitive to Ozone attack and therefore has a short shelf life.

**Bushing:**

A close fitting support device used to restrict flow between two liquids, thermally isolate a hot liquid, support the rotating shaft, break down pressure etc. Commonly made of carbon or Teflon.

**Bypass line:**

Used to either re-circulate fluid from the pump discharge to the stuffing box, the stuffing box to the pump suction, or the pump discharge to a lower pressure point in the system.

## Glossary of Pump Terms: C

**C frame adapter:**

Used to connect and align the pump to the motor with registered fits. (imperial dimensions. Called the D frame adapter in the metric system)

**Canned pump:**

A non-seal pump with the shaft, bearings and rotor contained in a can to prevent product leakage. Limited to pumping clean lubricating liquids.

**Capacity:**

Fluid flow measured in gpm, liters/min, M3/hr. etc.

**Carbide:**

The compound formed when carbon combines with an element. The carbides of metal are very hard and are often used as a mechanical seal face.

**Carbon bushing:**

Used as a restrictive bushing in flushing applications, a thermal barrier in high temperature applications, a disaster bushing in an A.P.I. gland and to support a deflecting shaft in many mechanical seal applications.

**Carbon/ graphite:**

A common mechanical seal face material chemically inert to most fluids with the exception of oxidizers, bleaches, halogens and a few other fluids.

**Cartridge seal:**

A self-contained assembly containing the seal, gland, sleeve, and both stationary and rotating seal faces. Usually needs no installation measurement. Must be used if impeller adjustments are made. Cartridge seals are the standard for A.P.I. seal applications.

**Cavitate:**

Cavities or bubbles form in the fluid low-pressure area and collapse in a higher-pressure area of the pump, causing noise, damage and a loss of capacity.

**Center line design:**

The pump is suspended on feet attached to the sides of the volute instead of the bottom. Used in higher temperature (> 100°C) pumping applications.

**Centipoise:**

The metric system unit of viscosity.

**Centistoke:**

The kinematic unit of viscosity. Viscosity in centipoises divided by the liquid density at the same temperature gives kinematic viscosity in centistokes.

**Centrifugal pump:**

Moves liquid with centrifugal force. Available in circular and volute configurations.

**Centrifugal separator:**

Sometimes called a cyclone separator. Uses centrifugal force to throw solids out of the fluid. Does not work very well in slurry seal applications.

**Ceramic:**

A hard, chemically inert seal face material that includes products referred to as silicon carbide.

**Change of state:**

When a liquid flashes into a vapor, solidifies, crystallizes, cokes etc.

**Chloride stress corrosion:**

Occurs in the 300 series of stainless steel. Caused by a combination of tensile stress, chlorides and heat. No one knows the threshold values.

**Chrome carbide:**

Forms when chrome forms with carbon in the heat affected zone during the welding of stainless steel. The use of low chloride stress corrosion carbon stainless steel is recommended in these applications.

**Chrome Oxide:**

The passivated layer that forms on the 300 series of stainless steel.

**Circular casing:**

Used with centrifugal pumps that circulate fluid rather than build head or pressure.

**Close coupled:**

The pump impeller is mounted directly on the motor shaft. There is no separate bearing case.

**Coated Face:**

A hard coating is plated or welded to a softer base material. Presents problems with different thermal expansion rates, the hard coating can "heat check" or crack. Not recommended as a seal face material.

**Compression set:**

The elastomer changes shape when it has been exposed to too much heat. Round O-rings come out square.

**Concentric dual seal:**

One seal is located inside the other, with a common hard face shared by both of them. Because of its large radial space requirement the seal is usually limited to mixer type applications.

**Concentricity:**

When the parts share the same centerline they are concentric to each other.

**Condensate:**

Condensed steam.

**Convection:**

A natural circulation of fluid. The hot fluid (lighter) rises and the cool fluid (heavier) sinks.

**Convection tank:**

Used to contain fluid between two mechanical seals. An enclosed heater or cooler can be used to control the barrier or buffer fluid temperature. Pressure or level gages can indicate which seal has failed.

**Cooling jacket:**

Surrounds the stuffing box of the pump to control the temperature of the fluid in the stuffing box. Usually molded into the back plate.

**Corrosion resistant:**

Corrodes at a rate of less than 0.002 inches (0.05 mm) per year.

**Coupling:**

Used to connect the pump to the driver. It transmits torque and compensates for axial growth, but not for radial misalignment.

**Critical speed:**

Any object made of an elastic material has a natural period of vibration. When a pump rotor or shaft rotates at any speed corresponding to its natural frequency, minor unbalances will be magnified. These speeds are called the critical speeds.

**Cryogenic:**

Very cold temperatures.

**Cutwater:**

Directs the pumped liquid to the discharge piping.

**Glossary of Pump Terms: D****D frame adapter:**

Used to connect and align the pump and motor (manufactured in metric dimensions). The Imperial version is called a "C" frame adapter.

**D.I.N. standard:**

The German standard for industrial products.

**Deflection:**

Movement or displacement of the shaft in a radial direction.

**Density:**

Measured in gm/cm<sup>2</sup> or lb./in<sup>2</sup> A measure of the weight of the fluid. A better term than specific gravity.

**Dilatant:**

A liquid that thickens (increases its viscosity) with agitation.

**Differential Pressure:**

The difference between the outlet pressure and the inlet pressure. Differential Pressure is sometimes called the Pump Total Differential Pressure.

**Discharge Head:**

The outlet pressure of a pump operation.

**Discharge recirculation:**

Connecting a line from the discharge side of the pump to the stuffing box. Should be used with a close fitting bushing in the end of the stuffing box to increase the stuffing box pressure. A common application when pumping a fluid close to its vapor point.

**Double balanced seal:**

Hydraulically balanced in both directions. A desirable feature, but seldom provided by seal manufacturers.

**Double seal:**

An out dated term describing two seals in a pump. The latest terminology is "dual seals". In the past the term was used to describe a higher-pressure barrier fluid between dual seals.

**Double suction pump:**

The rotor is suspended between two bearings with the fluid entering on either side of the impeller. Used at higher capacities.

**Double volute:**

A centrifugal pump design that incorporates two cut waters to prevent shaft deflection when the pump is operating off of the B.E.P. Lowers the efficiency of the pump and therefore seldom used on smaller size impellers.

**Dry running:**

Running without fluid at the seal face.

**Dual Seal:**

Two seals running in various configurations: back to back, tandem, face to face, or concentric.

**Ductility:**

The property of a metal that allows a great deal of mechanical deformation without cracking.

**Dynamic elastomer:**

The rubber part that has to move or flex to compensate for seal face wear or shaft movement.

**Dynamic head (system head):**

The pump head created by friction in the piping system.

## Glossary of Pump Terms: E

**Efficiency:**

Power out of the equipment divided by power in.

**Elastic range:**

The stressed part retains its memory and returns to its original shape.

**Elastomer:**

A rubber like material that, when compressed and then released will return to 90% of its original shape in less than five seconds.

**Electrolysis:**

A process involving chemical change caused by the passage of an electric current through a liquid.

**Endurance limit:**

Beyond this point the metal will fatigue without increasing the stress.

**E.P.R.**

Ethylene propylene rubber. The most common elastomer used in the sealing of water based and higher pH materials. Cannot be used in petroleum products.

**Extrusion:**

Permanent displacement of a portion of the O-ring into a gap, under the action of fluid pressure.

**Eye of the impeller:**

The center of the impeller, where the fluid enters.

## Glossary of Pump Terms: F

**Face combination:**

The materials chosen for the lapped seal faces. Usually a grade of carbon graphite running on a hard face material.

**Face to face seals:**

Two seals running against a common seal face. The barrier fluid pressure is always lower than stuffing box pressure.

**Face flatness:**

Measured by an optical flat and a monochromatic light. The measurement is read in helium light bands (.0000116 inches or 0,3 microns).

**Face lubrication:**

The fluid or vapor that sometimes exists between lapped mechanical seal faces.

**Face pressure:**

The sum of all the loads on the seal face including the spring load, hydraulic load and shaft axial thrust, divided by the area of the seal face. This face load is reduced by friction between the sliding elastomer and the shaft or sleeve.

**Filled carbon:**

Contains organic or inorganic materials that might be sensitive to temperature, or be attacked by the fluid you are sealing. Usually a low cost carbon.

**Filter:**

A device used to remove solid particles from liquid. It removes smaller particles than a strainer.

**Finite element analysis:**

A computer generated method of predicting seal face distortion.

**Flashing:**

A rapid change in liquid state from a liquid to a gas.

**Flatness:**

Measured by Helium light bands (0.0000116" or 0,3 microns) as opposed to surface finish that is measured by R.M.S. or C.L.A.

**Flexibility factor:**

Same as L3/D4 used to predict shaft-bending problems.

**Flexible member:**

The portion of the seal containing the springs or bellows.

**Flexible shaft:**

A shaft with an operating speed higher than its first critical speed.

**Flooded suction:**

When the liquid source is higher than the pump, and the liquid flows to the pump by gravity. Preferable for centrifugal pump installations.

**Fluid:**

The material assumes the shape of its container. It could be either a liquid or a gas.

**Fluorocarbon:**

Generic term for the elastomer called Viton? Viton is a Dupont Dow elastomer product.

**Flush:**

Putting an outside liquid into the stuffing box of the pump at a pressure higher than stuffing box pressure. All of this liquid mixes with and dilutes the pumped fluid.

**Foot Valve:**

A type of check valve with a built-in strainer. Used at the point of the liquid intake to retain liquid in the system, preventing the loss of prime when the liquid source is lower than the pump.

**Force:**

Created whenever pressure works on an area. The units are pounds. ( $F = P \times A$ )

**F.P.M. (fpm.):**

Feet per minute. When used in the context of seals it is measured at the center of the seal face.

**Francis vane impeller:**

The most popular impeller shape with a specific speed between 1500 and 4000.

**Free length:**

The uncompressed axial length of a seal.

**Fret or fretting:**

Damage or grooving caused by the removal of the protective oxide that is formed on most corrosion resistant metals. It happens when a softer material (rubber) rubs against a hard shaft or sleeve. A common problem with low cost OEM mechanical seals and bearing grease or lip seals.

**Friction Head:**

The pressure expressed in lbs./sq. in. or feet of liquid needed to overcome the resistance to the flow in the pipe and fittings.

## Glossary of Pump Terms: G

### **Galvanic series:**

Lists of metals with those on the top of the list being attacked by those lower down in the list. The further apart on the list, the faster the attack.

### **Gasket:**

Used between two static surfaces to provide a seal. Made from a variety of deformable materials.

### **Gland:**

The part that holds one half of the mechanical seal and attaches to the stuffing box.

### **Grease seal:**

A spring-loaded elastomer seal commonly used to seal bearings. Sometimes called a "lip seal". Not a good choice for sealing the bearing casing of a pump. A labyrinth or face seal would be a better choice.

## Glossary of Pump Terms: H

### **Halogen:**

Elements that attack carbon. Fluorine, bromine, chlorine, astatine and iodine.

### **Hard face:**

A seal face either rotating or stationary. The most common materials are silicon carbide, ceramic, tungsten carbide, Stellite, Ni-resist. The hard face must be the wider seal face.

### **Harmonic vibration:**

Vibrating in harmony with something near by. This can be a big problem for bearings in stationary or non-running equipment.

### **Hastelloy "C":**

A nickel rich, corrosion resistant metal used for mechanical seal springs and metal bellows because it is not sensitive to chloride stress corrosion.

### **Head:**

The equivalent height of the liquid. 20°C. Water is used, as the standard where 10 meters (33.9 ft.) of water equals one atmosphere (14.7 psi. or 1 bar). The term head is used instead of pressure in the centrifugal pump business.

### **Horse power:**

33,000 foot pounds per minute. Common methods of measuring work.

### **Hydraulic balance:**

A method of reducing mechanical seal face loading by reducing the seal face closing area.

### **Hydraulic force:**

Occurs any time pressure acts on a seal face area. Force times distance divided by time is a measurement of work done.

### **Hydrocarbon:**

A petroleum product consisting of hydrogen and carbon.

### **Hydrodynamic seal:**

Special geometric features on the seal face that provide lift by taking advantage of the rotation of one seal face upon the other.

### **Hysteresis:**

The delay or lag that causes seal faces to open.

**Hydrostatic seal:**

Maintains a controlled gap between the seal faces by balancing the open and closing forces. There is a small amount of leakage across the faces when the shaft is rotating. Used in some compressor applications, but not very practical for the chemicals found in the process industry.

**Glossary of Pump Terms: I****I.D.:**

Inside diameter.

**I.S.O.:**

International standards organization. Sets pump and seal standards for the metric community.

**Impeller:**

Attaches to the end of the shaft to impart energy to the fluid being pumped. Available in open, semi- open and closed designs.

**Impeller eye:**

The center of the impeller or the point where fluid enters the impeller.

**Impeller shroud:**

The plates located on one or both sides of the impeller vanes. Prevents solids from penetrating behind the vanes.

**Impeller vane:**

Located between the eye and the discharge side of the impeller. Directs the flow of the liquid to the outside diameter of the impeller.

**Inducer:**

A small axial flow vane that attaches to the impeller of a centrifugal pump to increase the N.P.S.H. available.

**Induction motor:**

The most common type used in industry. Has a slippage of 2 to 5 percent compared to synchronous motors.

**Inline pump:**

Mounted in the piping. No base plate or alignment required.

**Internal recirculation:**

A loss of efficiency caused by liquid flowing through wear rings or the impeller to volute clearances.

**Glossary of Pump Terms: J****Jacket:**

Usually refers to the heating/cooling jacket surrounding the stuffing box on some pumps.

**Joule:**

A metric unit for the measurement of heat. Defined, as the energy required to move one Newton over one meter.

## Glossary of Pump Terms: **K**

### **Kalrez®:**

An "elastomer like" material manufactured by E.I. Dupont that is used to seal most solvents and other aggressive fluids. It is available in several different grades.

### **Kilowatt:**

One thousand watts. The normal unit for work in the metric system.

### **Kinetic Energy:**

Created by a centrifugal pump when the velocity of the fluid is accelerated to the outer rim of the impeller. The amount of kinetic energy given to the fluid corresponds to the velocity at the impeller vane tip. The faster the impeller revolves, or the bigger the impeller, the greater the energy given to the fluid. This kinetic energy is then harnessed and slowed by the resistance created by the pump volute (casing).

### **KPa:**

A metric unit for pressure. 100 kPa = one atmosphere.

## Glossary of Pump Terms: **L**

### **Labyrinth seal:**

A non-contacting seal utilizing a tortured path for the escape of the fluid. Utilizes a series of pressure drops to reduce the leakage.

### **Lantern Ring:**

A device used to supply lubricant to packing. Usually located in the middle of the packing ring set.

### **Linear pressure drop:**

A straight-line pressure drop across the lapped seal faces. Seldom happens.

### **Line bearings:**

Position the rotor or shaft radially. Normally of the sleeve type.

### **Lip Seal:**

See grease seal.

### **Lubricant:**

Any fluid that will maintain a film thickness of one micron or more at its operating temperature and load.

## Glossary of Pump Terms: **M**

### **Magnetic drive:**

A type of seal less pump that is most often limited to pumping clean lubricating liquids. Similar in concept to a canned pump.

### **Magnetic seal:**

Uses magnetic materials rather than springs to keep the lapped seal faces together. Limited to non-corrosive fluids because of the magnets.

### **Magnetite:**

Iron oxide ( Fe<sub>3</sub>O<sub>4</sub>). Protective coating that forms on iron pipe to prevent further rapid corrosion. Usually black or maroon in color. Can be very destructive to mechanical seal components until the oxide stabilizes. We often find these iron pipes in new hot water systems

### **Mating ring:**

Another name for the hard face in a mechanical seal. It can be either rotating or stationary.

**Mechanical seal:**

A positive sealing device used to seal all fluids (liquids and gases). The primary seal is a set of lapped seal faces that are installed perpendicular to the shaft.

**Metal bellows:**

Used in mechanical seal designs to eliminate the need for a dynamic elastomer.

**Metal fatigue:**

A breakage of the metal caused by the bending and flexing of a metal part beyond its endurance limit.

**Minimum flow:**

A condition that can cause excessive heat inside the pump volute. A temperature rise of 10°C (18°F) across the operating pump is considered excessive. Normally caused by throttling a pump discharge valve.

**Moment of inertia:**

Referring to rotation about an axis. In the pump business it refers to a formula that describes the shape of the shaft. A solid shaft would have a different moment of inertia than a hollow shaft.

## Glossary of Pump Terms: N

**Negative pressure:**

Less than atmospheric pressure.

**N.P.S.H.A.:**

The net positive suction head available to prevent cavitation of the pump. It is defined as atmospheric pressure gage pressure static pressure - vapor pressure - friction loss in the suction piping.

**N.P.S.H.R.:**

Net positive suction head required to stop a pump from cavitating. The pump manufacturer gives this number to you. Since testing with cold fresh water generated the number, it can be lowered in some cases if you are pumping hot water or some hydrocarbons.

**Newton:**

A metric unit of force. Kilogram x gravity.

**Newtonian fluid:**

A fluid that does not change viscosity as it is agitated.

**Non lubricant:**

The fluid that will not maintain a film thickness of at least one micron at its operating temperature and load. A concern with mechanical sealing.

## Glossary of Pump Terms: O

**O.D.:**

Outside diameter.

**Operating length:**

Measured after the seal has been compressed the proper amount. The measurement is usually made from the face of the stuffing box.

**O-ring groove:**

The space into which an O-ring is inserted. Dynamic O-ring grooves use a different dimension than static O-ring grooves.

**Over hung impeller:**

Not supported with bearings on either side of the impeller.

**Oxidizer:**

Combines with carbon to form carbon monoxide or carbon dioxide. The oxidizers attack all forms of carbon including the seal face and any black O-rings in the system.

**Ozone:**

Created by oxygen atoms combining with oxygen molecules in a high-energy atmosphere. Will prematurely age Buna rubber. Ozone forms in the shop as a result of the sparking of electric motor brushes.

**Glossary of Pump Terms: P****Packing:**

The soft rings that mechanical seal replace to stop leakage. Packing must leak because it works on the theory of a series of pressure drops to reduce the stuffing box pressure to the point where the leakage is acceptable. A minimum of five rings of packing is required to do this.

**Parallel operation:**

The pumps are discharging to a common header. It is important that the impeller speed and outside diameters are the same or one of the pumps will throttle the other.

**Pascal:**

A metric unit for pressure. 100 kPa = one atmosphere.

**pH:**

A measure of the acidity or the alkalinity of a fluid. The scale ranges from 0 (acid) to 14 (alkali) with 7 considered neutral.

**Pipe friction loss:**

The positive head loss due to friction resistance between the pipe walls and the moving liquid.

**Pipe strain:**

The strain on the pump volute caused by the piping. It will cause excessive mechanical seal movement and can cause contact between rotating and stationary pump and seal components.

**Pitting:**

Surface voids caused by corrosion, erosion or cavitation.

**Power end:**

The end of the pump that attaches to the power source and does not get wet from the pumpage. The bearings are in this part.

**Power factor:**

A measure of how the voltage leads or lags the amperage.

**Precision bearing:**

Ball or roller bearing as opposed to a sleeve or babbitt bearing.

**Pressure drop:**

Referring to the loss of pressure from the outside to the inside of the mechanical seal faces or across the individual rings of packing.

**Pressure gradient:**

The pressure drop between the seal faces. Usually illustrated by a wedge.

**Pressure head:**

The pump head exerted by atmospheric pressure or any additional pressure that might be in the vessel.

**Prime:**

A charge of liquid required beginning the pumping action of centrifugal pumps when the liquid source is lower than the pump.

**Pump out vane:**

Located behind the impeller shroud in some impeller designs to lower stuffing box pressure. Should not be used in hot well condensate pumps or any pump running with a negative stuffing box pressure.

**Pumping ring:**

Used with a convection system to get circulation between two mechanical seals. Absolutely necessary if oil is used as a barrier fluid because of oil's poor specific heat.

**Pusher seal:**

A design that has a spring loaded dynamic elastomer or rubber like part. A very poor design that should be avoided.

**Glossary of Pump Terms: Q****Quench:**

The introduction of a fluid outside the seal to cool the product, or dilute any leakage across the seal faces.

**Quill shaft:**

A hollow shaft with another shaft inside it.

**Glossary of Pump Terms: R****Radial:**

90 degrees to the centerline of the shaft.

**Radial bearing:**

In an end suction centrifugal pump it is the bearing located closest to the stuffing box. This bearing handles most of the radial loads put on the impeller.

**Rankin scale:**

Used to measure low temperatures in the Fahrenheit scale. Similar to Kelvin which is used to measure low temperatures in the Centigrade system.

**Repeller:**

A second impeller used to lower the stuffing box pressure.

**Rigid shaft:**

Shafts with a rotating speed lower than its first critical speed.

**RMS:**

Root mean square. A measure of surface finish or smoothness. Metric uses C.L.A. or centerline average for the same purpose.

**Rockwell "C":**

The scale most often used to measure hardness of the hard seal face.

**Rotating seal:**

When the spring loaded or moveable portion of the seal rotates with the shaft.

**Run out:**

Twice the distance that the center of the shaft is displaced from the axis of rotation.

## **Glossary of Pump Terms: S**

### **Seal faces:**

The lapped faces that provide the primary seal in a mechanical seal.

### **Seal life:**

Seals should run leak free until the sacrificial face (usually carbon/ graphite) is worn away. More than 85% of the mechanical seals in use today fail prematurely.

### **Seal only pump:**

The pump does not have a conventional stuffing box so it could not be supplied with soft packing.

### **Self align:**

A method of keeping both mechanical seal faces square to the rotating shaft.

### **Series operation:**

The pumps are connected with the discharge of the first pump discharging to the suction of the other. The speed and impeller widths must be the same or the difference in capacities could cause cavitation or over heating problems.

### **Shaft packing:**

The soft packing supplied by pump manufacturers. Mechanical seals are replacing most of these leaking packing.

### **Shelf life:**

Usually refers to the seal elastomer. Buna "N" is the biggest problem because of Ozone attack.

### **Shut off head:**

The maximum head that the pump can generate with a given impeller outside diameter and horsepower driver.

### **Sintered material:**

Formed from a powder as opposed to being melted and poured into a mold.

### **Sleeve bearing:**

A non-precision bearing. Usually manufactured from carbon, Teflon, brass etc. Allows too much axial and radial movement for most mechanical seal applications.

### **Slip stick:**

An alternating slipping and sticking of the seal faces caused by a poor lubricant between the faces. Will cause vibration problems at the seal face unless the vibration is dampened.

### **Slurry:**

Solids in liquid. It is impossible to define when the quantity and size of the particles becomes too much for the mechanical seal.

### **Soluble:**

When one liquid dissolves or mixes with another liquid.

### **Specific Gravity:**

A measure of the weight of a liquid. Fresh water at 4°C (39°F) is given a value of one. If the liquid you are questioning will float on water the specific gravity is less than one. If it sinks, it is higher than one. Density is a better term.

### **Specific heat:**

Refers to the amount of calories or BTUs required to raise a quantity of a liquid one-degree.

### **Specific speed:**

A formula that describes the shape of a pump impeller. The higher the specific speed the less N.P.S.H. required.

**Stainless steel:**

Alloy steels containing a high percentage of chromium.

**Static head:**

The maximum height the liquid is being pumped as long as you take into consideration the siphon affect in some piping systems.

**Stationary seal:**

The spring loaded or moveable portion of the seal does not rotate with the shaft. Must be used when the seal surface speed exceeds 5000 fpm. or 25 meters per second.

**Strainer:**

A device installed in the inlet of the pump to prevent foreign particles from damaging the internal parts of the pump.

**Stuffing box:**

The portion of the pump that held the packing and now holds the mechanical seal.

**Stuffing box pressure:**

Between suction and discharge pressure but closer to suction pressure.

**Submersible pump:**

A pump that operates only when totally submersed in the fluid which is being pumped, with waterproof electrical connections, using a motor that is cooled by the liquid.

**Suction head:**

Exists when the liquid source is above the centerline of the pump.

**Suction lift:**

Exists when the liquid source is below the centerline of the pump.

**Suction recirculation:**

Piping from the bottom of the stuffing box back to the suction side of the pump. Used to lower pressure and circulate liquid in the stuffing box.

**Suction specific speed:**

A formula that will predict one of the types of cavitation. Pumps should be purchased with a number below 8500 (10,000 metric)

**Surface speed:**

A measure of the feet per minute the seal face or some other component is moving.

**Synchronous motor:**

Runs with out slippage. Used in elevators and compressors frequently, but seldom used in pumping. Pumps mostly use induction or "squirrel cage" motors.

**System curve:**

A description of what the pump is required to perform. The pump will pump where the system curve intersects the pump curve.

**System head:**

The head caused by friction in the piping valves and fittings.

**Glossary of Pump Terms: T****Tandem seals:**

The seals are facing in the same direction with a low-pressure barrier fluid circulating between them.

**T.D.H.:**

Total discharge head. A combination of the suction head and the head being produced by the pump.

**Tensile strength:**

The strength measured when the part is being pulled axially.

**Thermal conductivity:**

A measure of the material's ability to conduct heat. This is a very important factor in the selection of mechanical seal faces.

**Thixotropic fluid:**

The viscosity of the fluid decreases with agitation. Non drip paint is an example of such a fluid.

**Thrust bearing:**

Locates the rotor or shaft axially. Normally located close to the coupling.

**Total head:**

The amount of head produced by the pump. Discharge head minus suction head. If suction head is a negative number it is added to the discharge head.

**Thrust:**

In a centrifugal pump it refers to the axial movement of the shaft. The thrust can be towards the wet or power end of the pump and at start up it thrusts in both directions.

**Thrust bearing:**

Designed to take the axial thrust in pump applications. It is usually located next to the coupling and is often supplied in a "double row" configuration.

**Tungsten carbide:**

A common hard face seal material available in several grades depending upon hardness and corrosion resistance. Cobalt and nickel are the two most common types.

**Turbulence:**

Disturbed fluid. Can cause cavitation problems in a centrifugal pump. Often caused by an elbow located too close to the pump suction inlet.

**Two way balance:**

A method of balancing a mechanical seal in two directions. A very important consideration in dual seal applications.

## Glossary of Pump Terms: U

**Unbalanced seal:**

Not hydraulically balanced to generate low heat at the seal faces. Typical of original equipment designs.

**Unfilled carbon:**

Containing carbon/ graphite and nothing else. Filled carbons contain inorganics that will be sensitive to some chemicals and temperature extremes. Unfilled carbons are the preferred seal faces.

## Glossary of Pump Terms: V

**Variable speed motor:**

Used to control flow in a system by varying the frequency of the motor. Recommended for circulating systems and any other system where the main head is friction losses in the piping system.

**Vacuum:**

Any pressure less than atmospheric. Can present a problem for the elastomer in many seal applications.

**Vane passing syndrome:**

A type of cavitation caused by the impeller/ cutwater clearance being too small.

**Vapor pressure:**

Below this pressure, the liquid at this temperature will vaporize.

**Vaporize:**

The fluid passes from a liquid to a gaseous state. If this happens at the seal faces the seal faces will be blown open.

**Velocity:**

A measurement of the speed of the liquid in the system. Measured in feet or meters per second. The pump is a constant velocity device.

**Velocity head:**

Part of the total head calculation. Derived from the formula  $h = V^2/2g$

**Vent:**

To remove air or gas from the system. It is important to vent the stuffing box in vertical pumps to prevent the seal faces from running dry.

**Vibration Damping:**

Important in metal bellows seal designs. The elastomer acts as a vibration damper in the other seals. The vibration can chip carbon faces, destroy anti-rotation drive lugs, and open the lapped seal faces.

**Viscosity:**

Resistance to pouring. Higher viscosity can restrict seal movement. Centrifugal pumps can handle a maximum viscosity similar to 30-weight oil at room temperature. Above this viscosity a positive displacement pump should be used.

**Viton®:**

An E.I. Dupont Dow manufactured elastomer widely used in the sealing industry. The generic name is fluorocarbon. Water and steam attack many of these compounds.

**Volute casing:**

Derives its name from a spiral shaped casing surrounding the pump impeller. It converts velocity energy to pressure energy.

**Vortex Pump:**

A type of pump used for excessive solids. The impeller is recessed into the volute. A very low efficiency design, but practical in many applications.

**Vortexing liquid:**

Creating a "whirlpool affect" that can draw air into the suction of the pump.

**Glossary of Pump Terms: W****Water hammer:**

Occurs in a closed piping system as a result of the pressure being rapidly increased when the liquid velocity is suddenly increased. This damaging effect is usually the result of sudden starting, stopping, change in pump speed, or the sudden opening or closing of a valve. Water hammer can usually be controlled by regulating the valve closure time, surge chambers, relief valves or other means.

**Water Horse Power (W.H.P.):**

The calculated horse power coming out of the pump using the formula  $WHP = \text{head} \times \text{gpm}/3960$

**Watt:**

A measure of power. 746 watts equals one horsepower.

**Wear ring:**

Used with closed impeller pumps to restrict leakage from the high-pressure side of the pump to the low-pressure side. Should be replaced when the recommended clearance is doubled.

**Welded metal bellows:**

A seal design used to eliminate the use of elastomers. Excellent for cryogenic and hot applications. Not as effective for hot petroleum applications because of "coking" problems

**Wet end:**

The part of the pump that gets wet from the pumping fluid. Includes the volute, stuffing box, impeller wear rings, and shaft or sleeve

**Glossary of Pump Terms: Y****Yield point:**

Where the metal passes from the elastic to the plastic range