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PUMPING TERMINOLOGY

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PUMPING TERMINOLOGY

A

ACCELERATOR - A pump inserted in a closed system to increase the rate of flow.

AFFINITY LAWS - The laws governing the performance of rotodynamic pumps of the same design but of different sizes. They enable the performance of full-size pumps to be accurately forecast from tests on models. They are

q/nd^3 Q/ND^3

and h/n^2d^2 H/N^2D^2

where h and H are the heads
n and N the speeds
q and Q the quantities
and d and D the rotator diameters of the two pumps in the same system of units.

AIR CHAMBERS OR VESSEL - A vertical chamber with the upper end closed and lower end connected to the discharge branch of a pump. Whilst it contains air it tends to dump out pressure surges and pump pulsations.

ARCHIMEDEAN SCREW - An inclined helical screw rotating in a trough or the raising liquid from one level to another. One of the oldest types of pump and still used for land drainage.

B

BALANCE DISC - A disc fitted to one end of the shaft of a single or multi-stage centrifugal pump which is acted on by pressure to counteract the axial forces in the impellers.

BALANCE PIPE - The pipe taking the liquid leaking past the balance disc to the pump inlet.

BALANCE SUCTION - An arrangement whereby the axial forces on the impeller of a centrifugal pump are balance by making it symmetrical and having two suction branches.

BARREL - The cylindrical tube which envelops the ram of a plunger pump.

BERNOULLI'S EQUATION - States that-

$V^2/2g = P/p = Z$ = constant

where V = liquid velocity
p = density P = Pressure Z = height above datum

BELL MOUTH - An enlarged end to a suction pipe which ensure that the entering liquid accelerates gradually to the pipe velocity, so reducing friction losses.

BUCKET - The pumping element or piston packing of some types of plunger pumps, especially those intended for large volumes at low heads.

C

CAVITATION - The information of bubbles of air, steam or vapor due to the pressure falling too low. espectially at the inlet of the pump. The pressure at which cavitation occurs depends on the liquid and its temperature. If not checked it can cause severe shock and erosion or even break down. It can be prevented or cured reducing the suction lift.

CHARACTERISTIC CURVES - Performance curves of rotodynamic pumps on which effective head, discharge and efficiency are plotted for a number of speeds. They are issued by pump makers and are useful when choosing a pump for a particular application.

CLOSED VALUE OR SHUT-OFF PRESSURE - The pressure or head produced by a centrifugal pump at zero delivery when the power consumption is at a minimum. This does not apply to positive displacement or screw propeller pumps.

COUPLING,HYDRAULIC OR FLUID - A coupling for interposing between a prime mover and pump, consisting of an impeller driven by a prime-mover and a rotating casting party filled with oil, which drives the pump. A fluid coupling allow an electric motor to be started up under no load, damps out speed fluctuatuations and if of the scoop type, enables the pump speed to be varied to meet the requirements.

D

DESIGN POINT - The condition for which a pump is expressly designed and usually those at which it will be most efficient.

DISPLACEMENT - The quantity of liquid pumped for each revolution of a positive displacement pump.

DOUBLE ACTING - A reciprocatin pump with which delivers liquid on both directions of its stroke.

DUPLEX - A reciprocating pump with two pistons and cylinders in line on the same axis.

E

EFFICIENCY - The ratio of the effective work done by a pump to the power supplied to it. It does not include losses in the lines. For large pumps the efficiency may reach 88% falling for smaller sizes and viscous liquids.

EFFICIENCY, VOLUMETRIC - The ratio of the quantity actually delivered to theoretical displacement of a pump. A volumetric efficiency of 95% is common in a positive displacement pump, losses being due to imperfect suction, leakage and to the compressibility of the liquid.

EJECTOR - A device in which steam or water is forced through a jet and in so doing caused a suction which draws in liquid, mixes with it and then forces it forward. Although less efficient than conventional pumps, the absence of moving parts makes ejectors attractive for some applications.

EROSION - The warring away of parts by liquids, especially when carrying grit, etc.., flowing over them, or by cavitations. Erosion of impeller blades is often the limiting factor in the design of very high speed pumps.

F

FILTER - A device for removing solids from liquids. There are several type in general use including wire mesh, formed wire, felt, formed specially treated paper, sintered metal.
The filter element is usually fitted in a container with inlet and outlet ports and with provision by-passing filter when blocked. Paper elements are often of the throw-away type.

FLOW, LAMINAR OR STREAMLINE - The flow of fluid below certain velocity, known as the critical, is said to be laminar because the original stratification of the fluid is not disturbed.

FLOW, TURBULENT - Flow becomes turbulent above a certain velocity which is usually less than that prevailing in hydraulic pipes. There is some increase in fluid friction when flow changes from laminar to turbulent.

G

GASKET - Usually understood to mean a sheet of material, often with several holes, which is placed between two relatively fixed metal joint faces to prevent leakage.

GLAND - A device for sealing a cylindrical part where it passes through the wall of a pressure vessel. Glands can be arranged to seal a fixed part or a moving part such as piston or rotating shaft. Typical examples of the letter are stuffing boxes & face seals.

H

HEAD - The vertical distance between a pump and its suction or discharge points; the pressure equivalent to the height of a column of liquid.

HEAD, DELIVERY - The pressure at the pump outlet measured in feet of water.

HEAD, SUCTION - The head at the pump inlet measured in feet of water. If the suction pipe is below the pump the head may be negative.

HEAD, MANOMETRIC - A head as indicated by a pressure gauge, usually expressed in terms of the height of a liquid column, e.g. feet of water.

I

IMPELLER - A steam operated jet instrument which uses the latent heat oft the steam to produce kinetic energy. The steam jet produces a vacuum which draws in water with which it mixes and the energy in the steam is then able to produce a pressure higher than the original steam pressure. It is chiefly used for filling low pressure boilers, using steam from the boiler itself.

L

LEAK-OFF - When a high pressure turbine pump operates under closed valve conditions, the heat produced by churning is considerable. A leak off value is opened thermostatically under these conditions to ensure sufficient circulation through the pump.

LIQUID - Anything which can be pumped.

LIQUID-VOLATILE - A liquid which vaporized at a relatively low temperature and which may, therefore, cause trouble through cavitations unless care is taken.

P

PACKING - Any soft material used for preventing leakage between the metal parts of a pump.

PACKING LESS - A term usually applied to electrically driven pumps where the pump and motor rotor are in one casing.

PRESSURE - The force exerted by a fluid when compressed or by a columns of liquid. It is measured as weight per unit area, e.g. pounds per sq. in (psi) or by feet of columns of liquid it will support e.g. feet of water equals 0.433 psi.

PRESSURE, ABSOLUTE - Pressure measured from an absolute vacuumed as datum, Atmospheric pressure is 14.7 psi absolute when the barometer is 30 in. mercury. Phenomena such as cavitation and vapor pressure depend on the absolute pressure of the liquid.

PRESSURE, GUAGE - The pressure as shown by an ordinary pressure gauge which uses the prevailing atmospheric pressure as a datum.

PRESSURE,VAPOUR - The pressure exerted by a liquid in a partially filled closed vessel which contains nothing but the liquid and its vapour. Vapour pressure varies with temperature and for water is :-

- 0.25 psi absolute at 60 F
- 0.97 psi absolute at 100 F
- 3.7 psi absolute at 150 F

PRIMING - Filling a pump with liquid when it unable to produce a sufficient vacuum to draw in liquid when dry.

PRIMING METHODS - These include the water ring pump and the ejector either of which produce a sufficient vacuum to draw up water from depths up to 25 ft. If a foot value is fitted to the suction pipe, priming can be carried out by admitting water through the delivery pipe or a special connection on the pump casing.

PROPELLer - A screw - impeller which moves the liquid axially.

PTFE (Polytetrafluoroethylene) - A plastic which has remarkable qualities of chemical resistance and freedom from friction. It is used for impregnating asbestos gland pickings materials where its properties have proved very beneficial. Also known by its trade names of Flu on & Teflon.

PTECE (Polytrifluorochloroethylene) - A plastic similar to PTFE with superior mechanical but inferior chemical qualities.

PUMP AIR OPERATED - A liquid pump in which the motive power is provide by compressed air. It is usually in the form of two cylinders in line, one for air and one for liquid, together with value gear to give a reciprocating motion.

PUMP AXIAL FLOW - The pumping element is of screw propeller type and is usually housed in a cylindrical casing.

PUMP, BILGE - A pump specially constructed for dealing with the dirty sea water in ship' holds etc.

PUMP, BOILER FEED - Any pump intended for supplying a boiler with water, usually hot and including duplex, ram and multi-stage centrifugal types.

PUMP BOOSTER - A pump inserted in a pipe-line to increase the velocity of liquid flowing through it. Usually of the centrifugal or axial type.

PUMP BORE HOLE - Usually refers to a vertical pump immersed below the bore hole low water level. The pump is either driven from the surface by long shaft running inside the rising main or is made in a unit a submersible electric motor.

PUMP, CENTRIFUGAL - Kinetic energy is imparted to the liquid by a rotating impeller and this is transformed to pressure in a specially shaped casing or volute, which gradually increases in area and reduces the velocity.

PUMP, CHAIN - Covers several different types of apparatus where an endless chain runs over pulleys and carries cups or is fitted with discs which run inside a vertical tube.

PUMP, DIAPHRAGM - A flexing diaphragm operated either mechanically or fluctuating air or liquid pressure. The diaphragm serves instead of a piston but as there are no sliding parts, it is very suitable for contaminated liquids, chemicals, etc.

PUMP, GEAR - This pump has two or more meshing gears, one of them being driven and others idlers. Liquid is entrained in the tooth spaces and carried round in them from the inlet to outlet port.

PUMP, GLANDLESS - Usually an electric driven pump where the motor is immersed in the liquid being pumped and the stator winding is arranged round the outside of the pressure-tight casing.

PUMP, GRAVEL - A modification of a centrifugal pump, designed to pass water-borne gravel and similar abrasive substances.

PUMP, LIQUID METAL - An axial flow pump where the liquid metal is rotary motion by induced current from an enveloping stator winding on the squirrel cage motor principle and is propelled forward by guide vanes. The metals usually pumped are mercury and sodium/potassium mixture.

PUMP, METERING - The liquid is delivered in an accurately measured amount, usually adjustable.

PUMP, MIXED FLOW - A pump where the characteristics and centrifugal pump are combined. The impeller is shaped so that the first part of the flow is axial and the remainder radial or at an angle. For a given size a mixed flow pump can be run faster that a centrifugal pump.

PUMP, MUD - A special multi-throw ram pump for the mud used when drilling oil wells.

PUMP, MULTI-STAGE - A centrifugal pump where a number of impellers are mounted on one shift, passages taking the liquid from periphery of one stage to the inlet eye of the next. By this means very high pressure can be attained.

PUMP, POSITIVE DISPLACEMENT - A ram, piston diaphragm, gear or similar pump, where the liquid is trapped by the pump parts so that the rate of discharge varies only with the speed and is almost unaffected by pressure.

PUMP, POWDER - One capable of propelling air-borne powder.

PUMP, PROPELLER - Another name for an axial flow pump.

PUMP, RAM - Any pump which uses a reciprocating piston or ram, but usually taken to mean a slow speed high pressure pump of this type.

PUMP, ROTODYNAMIC - The opposite of a positive displacement pump; The liquid is acted on by rotation blades and the rate of discharge is dependent to a large extend on the pressure.

PUMP, SCREW - The pumping element is a comparatively long screw which meshes with two or three similar screws, but of opposite hand, to provide the liquid moves axially. Liquids with high viscosity such as fuel oil can be pumped.

PUMP, SEMI-ROTARY - A hand operated pump with a vane which moves backward and forwards in a shaped casing.

PUMP, STEAM - Usually refers to a duplex pump with liquid and steam cylinders in line and with a common piston rod.

PUMP, SUBMERSIBLE - An electrically driven pump capable of running when fully submerged in water. This type normally made for installing at bottom of boreholes.

PUMP, TURBINE - A centrifugal pump where vanes take the place of the volute. In practice, vanes are only used in multi-stage pumps.

PUMP, UNSHAKEABLE - One from of sewage pump.

PUMP, VERTICAL - A rotodynamic pump where the main shaft is vertical, or a ram pump with vertical cylinders.

PUMP, WATER RING - A rotor fitted with radial vanes revolves in an eccentric casing which is partly filled with water. When the pump is in operation the water forms an annular ring which is capable of an appreciable centrifugal pump shafts for priming the main pump.

R

RAM - The reciprocating element of a single acting pump which operates through a pressure-tight gland and there is a clearance between ram and cylinder.

RAM, HYDRAULIC - A device for lifting water from a river or other continuous supply where the kinetic energy is used to pressurize a proportion of the water flowing through it.

REYNOLDS NUMBERS - A dimensionless number used in consideration of fluid flow and given by the formula

Velocity x pipe diameter

Reynolds number = ----------
Kinematics viscosity

Where the Reynolds number is below 2000 laminar flow is certain to exist; at higher values it may be either laminar or turbulent but the higher the number the less likely it is to be laminar.

S

SEAL - Any device for preventing the passage of pressure between two parts, whether fixed or moving.

SEAL, FACE - A shift seal which has two faces, one fixed and other stationary, held in contact by a spring and by the pressure. Any wear is taken up automatically This type of seal is preferred where no leakage can be tolerated and where a seal that requires no adjustment is necessary.

SHADUF - A contrivance for raising water by a bucket on a counterpoised pivoted rod.

SIPHON - A pipe or passage in the form of an inverted "U".

SIPHON, DISCHARGE - A siphon fitted to the delivery end of a low lift pump and terminating below the water level of the outflow channel to prevent back flow when the pump is stopped without the use of value or loss of efficiency. It effectively prevents back flow when the pump is stopped without the use of values-a vacuum breaker admitting air to empty the siphon.

SPECIFIC SPEED - All geometrically similar rotodynamic pumps have the same specific speed which is given in British units by-

Ns = NQ/H
Ns = specific speed.
N = RPM.
Q = Output in gallons per minute at maximum efficiency.
H = total gauge head in feet at maximum efficiency.

If the speed of a pump is fixed by the prime mover and the other factors are also known, then the most suitable type of pump can be determined by calculating the specific speed.

STUFFING BOX - A gland on a pump shaft or ram containing a soft packing which can be compressed by a sleeve and screw.

SUCTION - In pump it is usually refers to any phenomenon which tends to draw liquid into the pump.

SUCTION LIFT - The height of a pump above the surface of the liquid which it is pumping (or the equivalent). The maximum suction lift is theoretically equal to the barometric pressure less the pipe friction. In practice it ranges from about 25 feet for a positive displacement or centrifugal pump to five feet or less for an axial flow pump.

SURGE - If moving column of liquid has its velocity reduced, the accompanying loss of energy usually reappears as an increase of pressure which may be sufficient to cause damage to piping and pump. Surges can be caused by shutting a value, stopping a pump or by breaking of the column of liquid.

SURGE CHAMBER - An open topped vertical pipe of comparatively large diameter tce-ed into the delivery line close to pump and higher than the maximum delivery head Pressure surges can to a certain extend, be dissipated in the chamber.

V

VACUUM - Usually understood to mean any pressure less than atmospheric and measured either in inches of mercury or feet of water.

VACUUM BREAKER - A device fitted to the top of a siphon tube which automatically admits air when the main flow stops, so preventing liquid from flowing backwards.

VACUUM GUAGE - A "pressure" guage of the Bourdon or diaphragm type of measuring sub-atmospheric pressures or vacua.

VANE - An element of a pump intended to separate one part from another or to guide the flow of liquid.

VALVE, AUTOMATIC - Usually one which is operated by a change in the velocity or the direction of flow of the liquid.

VALVE, FOOT - A return value fixed to the end of pump suction pipe to prevent the pipe and pump emptying when the pump stops.

VALVE, REFLUX - A non return or one-way valve.

VISCOSITY - When a liquid flows, a shed force which resists the motion is developed between the particles of the liquid. The magnitude of the force depends on the characteristics of the liquid and the velocity. The absolute dynamic viscosity of the liquid is given in poises, and is defined as the tangential force on unit area of either of two parallel plans at unit velocity in its own plane relative to the other. If the force is one dyne when the area is 1 sq. cm. per sec.., the viscosity is one poise.

For practical purposes it is usual to consider the kinematics viscosity where-

$$\text{absolute dynamic viscosity} = \frac{\text{Absolute kinetic viscosity}}{\text{Density}}$$

This is usually measured in centistokes.
Practical viscosity measurement are made by measuring the-time taken for the liquid to flow through an orifice under specific conditions. These are given as Redwood (English) and Saybolt (American) seconds and are the viscosity figures usually quoted in practice when specific an oil. As viscosity varies appreciably with temperature, the temperature must always be stated.

VOLUTE - The portion of the casing of centrifugal or similar rotodynamic pump which joins the impeller chamber to the delivery pipe. It gradually increases in area and so reduces the liquid velocity to that in the delivery pipe, the effect being to convert most of the kinetic energy imparted by the impeller to pressure.