

# **TWINKLE CO**

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**WEB TOPICS #4**

## **GLOSSARY**

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Like most other trade or profession, dredging has developed a number of unique words and phrases to describe various dredge phenomena. Where a descriptive term pertaining to dredges is lacking we have taken the liberty of supplying one.

### **Cavitation**

The formation of vapor bubbles in the eye of the pump impeller and the collapse of those bubbles as they travel to an area of higher pressure. Occurs whenever the pump discharges more water and solids than it can take in at its inlet.

### **Chain Ladder**

Full length chain ladder digging device with a tattered reputation. Old technology. See Linear Cutter.

### **Chain Ladder Dredge**

A dredge which has a chain ladder digging device fitted to the suction inlet. Ancient history. The forerunner of the modern Linear Cutter dredge.

### **Clear water vacuum**

The vacuum reading obtained when pumping clear water at the target velocity.

### **Cobbled**

As in a "cobbled rotary cutter". A condition in which a rotary cutter is surrounded by oversize material that will not pass through the cutter openings. A cobbled cutter is ineffective at loosening new material and results in low production.

### **Critical Velocity**

The flow rate at which solids begin to drop out of the mixture and form a bed on the bottom of the pipeline. The critical flow rate varies with the density of the slurry, the diameter of the pipe, the shape of the particles (Spherical particles settle faster than irregularly-shaped particles) and the gradation of the solids particles.

### **Cutter Basket**

The hemispherical shaped, rotating, working end of a rotary cutter. Ideally, the cutter basket loosens solids and reduces friable material to a size that will pass through the dredge system. Where oversized rock is present the cutter basket should loosen the solids and screen out pump-plugging oversize particles to prevent them from entering the suction pipe.

**Cutter Basket with Gridded Backring**

One of the worst ideas to come down the pike for keeping oversize out of a dredge system. This design creates a plethora of pinch points that cause the rotary cutter to function as a rock crusher. Broken cutter shafts are a frequent accompaniment to the operation of this dog.

**Cutter Clearance**

The distance from the bottom of the cutter basket to the surface of the water when the ladder is raised as high as possible. Cutter clearance is required for normal maintenance. This is an optional feature not available on all new dredges.

**Cutterhead**

Obsolete term. See Rotary Cutter.

**Cutterhead dredge**

See rotary cutter dredge.

**Datalogger**

An electronic device that records information for retrieval and analysis at a later.

**Density By Volume (DBV)**

A way of measuring the amount of solids in a mixture or slurry. It is the ratio of the space occupied by solids to the space occupied by the water. DBV is approximately one half of the Density by Weight when the solids are sand and gravel. Density by Volume is not used to explain hydraulic dredging operation.

**Density By Weight (DBW)**

The amount of solids in a mixture of slurry expressed as a ratio of the weight of the solids to the weight of the water. Anyone who claims to be continuously pumping *sand and gravel* at a density in excess of 50% by weight has been smoking his socks. The slurry density in a plugged pipeline is 50% solids by weight.

**Differential Pressure**

The difference in pressure between two separate areas. The vacuum gauge measures the differential between atmospheric pressure and the lower pressure inside the suction pipe. A ladderpump dredge requires a differential pressure gauge (LADDERVAC) to measure the difference in pressure between the inside and outside of the suction pipe near the pump inlet.

**Digging depth**

Vertical distance below the surface of the water from which the dredge is raising solids.

**Discharge head**

The discharge pressure expressed as feet of water, equivalent of the pressure measured at the base of a column of water. A pressure of 1 pound per square inch (psi) equals a head of 2.31 feet of water. A discharge pressure of 50 psi would be equal to a discharge head of  $50 \times 2.31$  or approximately 116 feet of head.

**Discharge pressure**

Is indicated in terms of pounds per square inch (psi) on a gauge connected to a tap on the discharge pipe near the dredge pump discharge port. It is an indication of the resistance to flow of the water and solids through the discharge pipe to the discharge point.

**Discharge-side Limitation**

This occurs when a dredge pump is operating at maximum speed and production has to be controlled at a rate less than desired to prevent pipeline plugging.

**Dredge System**

Everything under the control of the dredge operator. The primary elements are the cutter, suction pipe, dredge pump and the discharge pipe. Secondary elements are flotation, power units, winches and instruments.

**Dredgeucation**

The never-ending process of learning the art and science of dredging. With Twinkle Co products and information, this does not have to be the school of hard knocks.

**Dutchman**

A downward bend in the end of ladder structure. Effective means to increase the productive capacity of rotary cutter dredges when the ladder is too long for the digging depth.

**Effective vacuum**

The difference between the operating vacuum and the clear water vacuum when pumping at the target velocity.

**Feet of Head**

Refers to the head (pressure) that a pump develops in its suction and discharge ports expressed in terms of the equivalent height in feet of a column of water.

Suction port pressure is feet of suction head:

(vacuum—1 inch Hg = 1.1 feet of head). 30 inches Hg = 33 feet of head.

Discharge pressure is feet of discharge head:

(psi—1 psi = 2.31 feet of head). 100 psi = 231 feet of head.

**Fillet de Loop**

A 360-degree loop in the discharge pipe observed on some dredges. An archaic, energy-wasting, high-wear contraption used to obtain dredge operating data best done by modern electronic means.

**Friction**

Resistance to flow in a pipe. Increases with velocity. Friction in small pipes is greater than in larger pipes.

**Friction Loss**

A term used to indicate the pressure required to overcome the resistance to flow due to friction. Usually expressed as feet of head.

**Gauge, Analog**

A needle moves across a dial to indicate a value. One glance tells an observer if and how much the reading varies from the desired value as well as the rate of change. No thinking required! Superior to a digital gauge.

**Gauge, Analog, Mechanical, Liquid-Filled**

This is the one you are looking for. Big is better. For vacuum, 6" diameter is about right.

**Gauge, Compound**

Indicates both positive and negative (vacuum) pressure. This gauge is useless as an operating instrument on a dredge because the vacuum scale is too small.

**Gauge, Digital**

A gauge that displays numbers, usually a blinding blur of numbers. DO NOT use for velocity or vacuum or hydraulic pressure displays on a dredge. An observer must think each time a comparison is made between the displayed value and the desired value. A gauge that requires thinking is bad!

**Hell Hole**

The machinery room on many small dredges. A dark, cramped, greasy, gritty, grimy, enclosed space containing the dredge pump, pump drive, main engine, accessory engine, hydraulics, service water pump, scuttle pipe and all the heat and noise these components generate.

**Hullpump Dredge**

A dredge that has the dredge pump located with its suction inlet at or just above water level.

**Hydraulic Pressure**

Indicated in terms of pounds per square inch (psi) on a gauge connected to the hydraulic circuit piping. It is a measure of the amount of force being applied by the digger or pull on a winch cable.

**Ladder**

A structural framework that extends out horizontally from hinge pins fixed on the front of the dredge hull. The suction pipe is mounted on the ladder and a digging device is mounted on the suction inlet end. The ladder can pivot downward a maximum of 90 degrees.

**Ladderpump Dredge**

A dredge that has the dredge pump mounted on the ladder so that it can operate submerged.

**LADDERVAC**

An electronic “vacuum” gauge system for ladderpump dredges. A Twinkle Co product introduced in 1985 that remains the industry standard.

**LCAP**

Linear Cutter Automation Package. A Twinkle Co control system that semi-automates the hoist winch and cutter operation on dredges fitted with a Linear Cutter.

**Linear Cutter**

Absolutely the most productive digging device that can be fitted to the suction inlet of a sand and gravel mining dredge.

**Linear Cutter Dredge**

A dredge which has a Linear Cutter digging device fitted to the suction inlet. Capable of awesome rates of continuous production.

**Mixture**

The flow of water and solids moving through a dredge system.

**Net Positive Suction Head Required, NPSHR**

The vacuum that a pump develops to cause a liquid to flow into its inlet port. The NPSHR increases as the rate of flow increases. When sufficient flow is not available, the dredge pump cavitates. The NPSHR information should be part of the pump curve.

**Operating Vacuum**

The vacuum gauge reading observed when pumping a mixture of water and solids.

**Plain Suction Dredge**

A dredge which does not have a digging device fitted to the suction inlet. A member of the eunuch class of dredges.

**Priming a Pump**

Removing the air from a centrifugal pump case.

**Pump Well**

The open topped hull compartment on a hullpump dredge that contains only the dredge pump and suction pipe. Will not cause the dredge to sink in the event that it fills with slurry. Found only on well designed hullpump dredges. Not the same as a Sink Hole.

**Refurbish**

The application of a new coat of paint.

**Rock, Oversize**

A rock that will not pass through a dredge system without plugging. The size is determined by the passage through the dredge pump impeller. Should be prevented from entering the dredge system by the cutter.

**Roots**

The nemesis of the rotary cutter dredge. Prevent this problem by removing roots by other means, preventing growth in the years prior to mining or equip the dredge with a Linear Cutter.

**Rotary Cutter**

Formerly called a cutterhead. Consists of a cutter basket mounted on a driveshaft and gearbox to turn the shaft. The cutterbasket covers the end of the suction pipe and rotates to loosen solids and (hopefully) screens out oversize.

**Rotary Cutter Dredge**

A dredge which has a rotary cutter digging device fitted to the suction inlet.

**Scuttle Pipe**

A pipe, usually the service water pump suction, that enters the hull below the water line.

**Service Water Pressure**

Indicated in terms of pounds per square inch (psi) on a gauge connected to the service water pump piping.

**Settling Rate**

The rate at which particles of solids fall through water, usually expressed in terms of feet per minute. Sand, gravel and silt was, at one time, solid rock. This material all has the same specific gravity. The settling rate of a particle is dependent on its shape and size.

**Sink Hole**

The open-topped hull containing the dredge pump, drive gear, main engine and accessory engine which when filled with water or slurry causes the dredge to sink. Not the same as a Pump Well.

**Sliding Bed**

A phenomena that occurs in horizontal pipelines when solids settle out of the flow of slurry and come to rest in shallow beds on the bottom of the pipe. These beds then move in rhythmic start and stop fashion which can be heard by nearby listeners. Caused by low velocity.

**Slurry**

The mixture of solids and water that flows through the dredge system. Also called a mixture.

**Specific Gravity**

The ratio of the weight of a volume of material compared to the same volume of water. A cubic foot of solid stone (becomes sand and gravel when broken into pieces) weighs about 160 pounds. A cubic foot of fresh water weighs 62.4 pounds.

The specific gravity of sand and gravel (and silt) is 160 divided by 62.4 or 2.67.

**Spuds**

Heavy-wall pipes that slide vertically in guides (spud wells) located at the rear corners of the dredge hull and fitted with the means to raise and lower them. In operation, the working spud is stabbed into the bottom and the rotary cutter is pulled in an arc about the spud by swing winch cables to accomplish the digging operation. The second spud, called the walking spud, is used to advance the dredge. Spuds are rarely found on productive sand & gravel dredges. There are various models of spud-equipped dredges including the traveling spud, the wagger and the swinging ladder dredge.

**Static Lift**

The vertical distance from the surface of the water to the point where the end of the discharge pipe is open to the atmosphere.

**Stationary Bed**

A phenomena that occurs in horizontal pipelines when the slurry velocity is so slow that solids settle out of the slurry and come to rest, forming a bed along a significant portion of the pipeline. This condition is the precursor to a plugged pipeline.

**Suction Head**

The vacuum gauge reading expressed as the height in feet of a column of water. Consists of the six variables known as the Suction Six. 34 feet of water head equals 30 inches of vacuum (Hg). One inch of vacuum equals 1.133 feet of suction head.

**Suction Inlet**

The open end of a pipe which connects to the suction inlet of a dredge pump. Productive suction inlets are fitted with a mechanical digging device.

**Suction-side Limitation**

This occurs when sustained maximum operating vacuum is not sufficient to satisfy production requirements.

**Suction-Six**

The six suction side variables which added together make up the vacuum reading or suction head. They are:

1. Entrance Loss.
2. Velocity Loss.
3. Density Loss.
4. Friction Loss.
5. Depth Loss.
6. Static Lift Loss.

Six variables a vary'n means that vacuum alone cannot be used as a reliable indicator by which to measure and control dredge production.

**Surface Feet Per Minute**

The speed of a point on a surface related to the impeller eye or outside diameter.

**Target Velocity**

The velocity to be maintained in the discharge line by the dredge operator. About 20 percent faster than the critical velocity.

**Titanic Syndrome**

Usually terminal, causes a dredge to sink when flotation bulkheads are not fully watertight and water can flow over the top of the bulkheads into the next compartment. Commonly found in rectangular flotation, this condition is often discovered by salvage divers.

**TorqueShaft**

A simple, rugged and reliable solid shaft used to drive an underwater dredge pump. Requires a stiff ladder frame.

**TorqueTube**

A complex, flexible tube and bearing arrangement used to drive an underwater dredge pump. Found primarily on dredges with flexible ladders.

**Total Dynamic Head (TDH)**

Pressure expressed as the height of a column of water measured in feet. TDH is the sum of the suction head and the discharge head. The TDH is the amount of work a dredge pump is doing to cause slurry to flow through a dredge system.

**Turbulent Flow**

Flow in a pipeline that is fast enough to keep the solids particles from settling out and coming to rest on the bottom of the pipe.

**Underwater Dredge Pump (Ladderpump)**

A dredge pump with a bearing and seal arrangement that allows for submerged operation. Without proper instruments and controls an underwater pump has the capacity to take in slurry that is too dense to pump to discharge.

**Vacuum**

Any pressure that is less than atmospheric pressure.

**Vacuum gauge**

Measures the difference in pressure between the inside of the suction pipe and the atmospheric pressure outside of the dredge pump suction inlet in terms of inches of mercury (In. Hg). An indispensable operating instrument.

**Vanging System**

A hydraulic system arrangement which controls the swing winches so that the brake on the outhaul drum is partially released to allow cable to be pulled off the drum as the inhaul drum takes in cable. Very useful on spud-equipped dredges.

**Velocity**

The speed at which water and solids move through a pipeline. Velocity is measured by a velocity meter.

**Velocity Meter**

Measures and indicates the speed at which the mixture flows through the dredge system in terms of feet per second (fps). An indispensable operating instrument-available in two styles-the inexpensive Doppler and the very accurate magnetic.

**Wench**

A girl or young woman. Not to be confused with a winch.

**Whistlepipe**

A capped, vertical pipe teed into the top of a booster pump inlet pipe. Check valves at the top of the whistlepipe permit air to enter the booster pump case and prevent cavitation whenever the inlet pressure becomes a vacuum.

**Winch**

A mechanical device featuring a powered drum about which wire rope is wound. Several winches are used to position a dredge in the water and raise and lower the ladder.

**Wobble Pin**

An unneeded, overly complex, likely-to-fail design feature.