Willard Says……

Spiffy stuff to know about hydraulic dredging.

The Discharge Pipeline—Instruments

To operate efficiently, the dredge operator must control the rate of flow and the density of the slurry flowing in the pipeline. Conveying solids by means of a pipeline is a continuous process as opposed to a batch process. Conveyors, whether pipelines or belts or chains have an inherent capacity that cannot be exceeded. Maximum capacity is achieved when the conveyor operates continuously with a full load. Periods of production at less than full capacity cannot be made up later with a surge of overloading because the system cannot function if overloaded.

The dredge operator must have two instruments—a velocity meter and a pressure gauge—to tell him how to achieve and maintain maximum production in the dredge discharge pipeline. Please note that it is **impossible** for an operator to achieve maximum production without these instruments.

A third instrument, the density meter, may be appropriate for certain applications.

Velocity Meters

Two types of velocity meter are available for use on dredges.

Doppler. This is most common type of velocity meter because it is relatively inexpensive and one size fits all size pipes. The sensing element—a transducer—clamps to the outside of the discharge pipe at a convenient location on the dredge. The accuracy of this type of velocity meter is adequate for most dredge applications. One transducer is all that is required. Paying more for multiple transducers and associated electronics is money wasted. Doppler-type velocity meters may not read clear water flows.

M**agnetic.** This type of velocity meter provides an extremely accurate indication of clear water or slurry IF calibrated properly. Depending on size they usually cost more than Doppler-type meters; approximately $1,000 per inch of pipe size. They install between flanged sections of discharge pipe and are subject to wearing out due to abrasion by the solids.

See Willardsays…*How to Use the Velocity Meter.*

As explained in the above paper, the operator should utilize the velocity meter to determine the target velocity for his dredge system. Having determined target velocity he should then devote his efforts to maintaining the target velocity and maximizing production by increasing vacuum and pump speed as much as possible.

Pressure Gauge

The primary use of the pressure gauge is to warn of the onset of cavitation. When a dredge system is operating at maximum capacity it is vital that a potential problem be detected and corrected before it has a substantial effect on production.

The first indication that cavitation is occurring is a slight dip in the discharge pressure. If dredge operation is otherwise normal and the discharge pressure drops five to ten percent it almost always signals that the pump is starving. It cannot take in enough liquid to maintain flow in the discharge pipeline. The response has to be an immediate reduction in the vacuum at the pump inlet.

The reduction of vacuum can be achieved by raising the suction to slightly reduce the rate at which solids are entering the dredge system or, better yet, employing Twinkle Co's CONVAC suction side stability system. This system automatically prevents the vacuum from increasing to the cavitation point so maximum production can continue without intervention by the operator. In other words, in most cases, the operator does not have to do anything.

Old-time dredgers placed great reliance on the discharge pressure gauge as a production meter. After some experimenting they limited vacuum (production) to some value that would prevent the pressure reading from exceeding some arbitrary value. They interpreted any increase in discharge pressure gauge above that value as a warning that the pipeline was about to plug. Such uses of the discharge pipe pressure gauge are counterproductive and serve no purpose in the pursuit of maximum production.

Density Meter

Two streams of information must be integrated to determine the rate at which solids are being produced and the total accumulated production over some period of time. One stream of information is the velocity, however, note that a magnetic velocity meter must be used for accuracy. The other information stream is the density of the slurry passing through dredge system. When the velocity and density are electronically integrated the rate of production can be determined.

A density meter sends a calibrated beam of nuclear particles through the discharge pipe and measures the degradation of the beam caused by the presence of solids flowing inside the pipe. Density meters utilize nuclear material to create the beam. Recently, density meters have become available that require only minimal regulatory oversight which are much less cumbersome than older meters.

Ordinarily, a sand and gravel dredge pumps into a process plant and the only meaningful production is that of revenue producing products. The operator of such a dredge should strive to maximize production. Knowing the rate of total solids production is not very useful because a significant portion of the production may go to waste or secondary products.

A density meter is useful when there is no other means to measure the rate of solids production or when payment is dependent on solids production.

Density meters are a challenge to calibrate. They are highly susceptible to "thumb on the scale" syndrome. In other words density meters readings can easily be "fiddled" up or down to suit the goals of the user.

Any hope of accurately measuring the rate of solids production in a discharge pipe requires the use of a magnetic velocity meter.

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Contact willard@willardsays.com.