Willard Says……

LADDERPUMP DRIVES

Installing the dredge pump on the ladder and running it underwater has become the accepted arrangement to achieve maximum production from medium to deep depths. A variety of means are being used to transmit power from a source on deck to the underwater pump. They are not all equal. Some drive means are virtually unworkable. I will help you recognize the drives that have proven to be duds.

Hydro$tatic Drives

This paper is not directed at hydrostatic-drive-equipped, puddle-jumper dredges that are primarily designed to move silt and muck from shallow depth ponds, boat harbors and the like. Many of these hydrostatic ladderpump drives are successful because the horsepower and speed requirements are comfortably within the envelope of hydrostatic drive technology.

This paper explores how to drive ladderpumps on eight to fourteen-inch sand and gravel pipeline dredges where the horsepower requirements are substantially greater. My use of the dollar sign in place of the "s" is symptomatic because these drives are not only expensive to buy; they cost a ton to keep fixing. This should remind you that this drive means is a dud.

Let us explore the derivation (roots) of the word "hydrostatic."

"**Hydro**" is thought to be an acronym for one of the following:

High **D**owntime **R**ebuild **O**ften
High**lY** **D**estructive **R**ebuild **O**ften
Halt-**Y**ell-**D**rain-**R**ebuild-**O**perate

"**Static**" is defined thusly: *Static, adj. a. having no motion; being at rest; quiescent. b. fixed; stationary.*

No matter how you define it, hydrostatic, high-horsepower ladderpump drives live up to their name.

I have designed and put several versions of hydro$tatic drives in operation. Only one of them is still in semi-satisfactory operation after twenty-three years. Bitter personal experience now causes me to view hydro$tatic ladderpump drive systems as recipes for disaster. This view has been and is still being bolstered by the failure of hydro$tatic ladderpump drives installed by others.

Hydro$tatic drives can make you proud of the way they work until they get a bellyache, which often occurs soon after initial startup. Then they recur not too long after the first "take it apart, buy new parts, clean the contaminated system, put in new oil and put it back together, ponder the cause" procedure. Then, too soon, it gets another bellyache and so it goes. Each bellyache can cost tens of thousands of dollars as well of days of downtime.

Hydro$tatic systems fail because they are being abused in some manner. Factors such as speed too fast, pressure too high, oil too hot, contaminated oil, hot motor running in cold water, pressure spikes, component misalignment and mismatched components have all been identified as life-shortening problems. Identifying the problem(s) is very difficult. So is the decision to spend the money required to effect the solution. The only certainty is that the uncertain nature of the failure means there is no warranty.

Hydro$tatic systems have a finite, not-overly-long life expectancy even when correctly designed and maintained. Ideally, with proper maintenance the system components can be rebuilt before catastrophic failure for a fraction of new price. Restoring a crashed system requires the installation of new components. Both scenarios come with the depressing realization that the system is no better than when new. In other words, future failures are assured.

The onset of a serious problem is usually signaled by symptoms such as something getting hot, metal particles in the oil, a noise or vibration, an unusual change in pressure or a drop off in performance. Ignoring or not observing such signals sets up the worst case scenario that plays out when the dredge pump abruptly stops.

Direct-drive hydro$tatic motor limitations.
Ideally, the hydro$tatic drive motor is direct-coupled to the ladderpump shaft to eliminate the need for a speed reduction gearbox. No standard hydro$tatic motor will deliver adequate horsepower to a dredge pump with an impeller much larger than 30 inches in diameter. A gearbox enables one or more hydraulic motors to run at design speed, develop ample horsepower and turn 36 or 40-inch pump impellers at 400 to 600 rpm. The wobble pin with this arrangement is the gearbox.

My high horsepower hydro$tatic pumpdrive designs caused numerous gearboxes and motors to perish prematurely. I have seen other dredge builder's gearboxes turn to trash with regularity. High-powered hydro$tatic pumpdrive gearboxes are bad news.

One dredge builder avoids the gearbox problem by using a 30-inch impeller ladderpump so they can direct-connect it to a hydro$tatic drive. This 30-inch impeller is a standard part for a standard 8-inch pump. The dredge has an identical belt-driven deck-mounted pump that functions as a booster for the ladderpump. The discharge pipeline is 12-inch. Yep, you read it right! Each 8-inch pump impeller, one after the other, has to replicate the performance of a 12-inch pump.

Unsurprisingly, the hydro$tatic drive on this dredge has failed several times. The drive is being abused because it must supply sufficient power and speed to make the boy-size impeller perform the task of a man-sized impeller. If this hydro$tatic drive were a truck stopped on the Interstate, the trooper would write a ticket for going 100 mph and being 20 tons overweight.

Flexible Lineshafts

One dredge manufacturer, frustrated by the repeated failures of their simple one-piece solid-shaft lineshafts, came up with an expensive and complex solution to their problem. Their desperation to devise a drive shaft that would have a decent life span is evident in the Byzantine collection of wobble pins (potential points of failure) that they now foist on their customers. They created a flexible lineshaft.

Their flexible ladderpump driveshaft links together an elaborate collection of tubular shafts, flexible couplings and short shafts supported on roller bearing housed in sealed, oil-filled housings. Viewing one of these things brings to mind that old saying about a chain being no stronger than its weakest link.

An inquiring mind might wonder why this dredge builder changed to a drive of this complexity when previously they had utilized the much simpler, less expensive, rigid, solid driveshaft supported in water-flushed marine bearings.

A knowledgeable observer might offer the opinion that flexible ladder frames require equally flexible drive shafts.

Rigid Lineshafts

The rigid lineshaft provides a simple, inexpensive, durable, low maintenance means to transmit power from a deck mounted power unit to an underwater pump. Done correctly, it is simply the best way.

I designed my first lineshaft drive in 1981. It was 80 feet long and connected a 600 hp electric motor to a 12" x 14" x 40" underwater dredge pump. It was made up of several sections of solid shafting bolted together with rigid couplings running in water-flushed marine bearings. I recently called the owner to see if they had had any problem with it. He responded, "No, should we?" He went on to say that they had replaced the eight marine bearings about 8 years ago because they thought they were worn. Two years ago they had to replace the galvanized piping that distributes water to each bearing because it was rusting out. Twenty-six years of trouble-free operation is what I call durable.

I have seen several lineshafts that were designed and installed by others that were downright troublesome. In each case the cause of the problem was obvious and I take pains to avoid them.

Conclusion

The best ladderpump drive is a well-designed, solid, rigid lineshaft supported by marine bearings mounted in a ladder frame that has structural integrity.

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