OIL-SAVING AND DREDGING – PURSUING MAXIMIZATION OF BENEFITS

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ABSTRACT

Dredging consumes a lot of oil and the dredging volume achieved is closely connected to crude oil consumption. Nowadays, in order to help construct an economic society, it is especially important to reduce the oil consumption per cubic meter of soil by using different ways and in a different manner. This paper looks at some of the efforts being made to reduce unnecessary consumption in order to maximize dredging benefits. This is especially important with the fierce competition being experienced in the present inland-river dredging markets.

One example of where savings are being attempted relates to the hydraulic system failures on cutter suction dredgers. The dredge cutter-head on a cutter suction dredger continuously cuts the dredged face which often contains foreign matter. This can often result in higher pressures with subsequent explosion of the hydraulic hose. The efflux of quantities of hydraulic oil when this occurs not only results in large economic losses but also causes environmental pollution. Problems with the cutter operation can also occur with a loss of hydraulic oil. However, equipment has been designed to solve this leakage problem of quantities of hydraulic oils. This involves a “non-touch” oil detecting element and an independently designed automatic oil return device. This paper describes such a devise which has been used in an actual production situation with good results.

Keywords: Oil return, hydraulic oil, oil-saving, dredging benefits

INTRODUCTION

The oil consumption while dredging is relatively high with the amount of dredging closely connected to the consumption of crude oil. This seems especially important today when economic principles are being advocated by society. The price of crude oil is continuously rising while the unit price of dredging earthwork does not appear to be changing. The market competition is, at the same time, becoming intense with a growing number of dredging participants. To gain benefits and achieve sustainable development for enterprises, all the personnel engaged in dredging have to meet new requirements. Every dredging person has to change this sense of concern into a momentum towards responsibility for society and enterprises. They need to be aiming for environmental protection, starting small, emphasizing the treatment of details in a scientific and practical way thereby achieving oil savings for the maximum benefit of dredging.

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This paper sums up experiences in oil saving and consumption reduction for dredgers in inland river basins during the process of dredging and provides mutual encouragement to people in the same trade.

OIL SAVING STRATEGIES

By making use of macro-guidance, supervision and inspection during the process of dredging, we can achieve an oil saving and a reduction in consumption. This is mainly embodied in the following aspects.

Improving the Quality of Overall Maintenance, Oil Saving and Consumption Reduction

It is universally acknowledged in many circles that high-quality maintenance brings about benefits and productivity. In specific work areas, the personnel taking charge of equipment management and maintenance have to comprehensively utilize all kinds of knowledge and skills. This includes selecting good maintenance solutions and removing bad ones in order to reduce the time the ship has to stop. They have to work on the premise of being fast and efficient while ensuring the quality of any maintenance work being done. A spectral distribution testing instrument is used to analyze and judge the predictive trouble in dredger equipment. It can analyze and predict the service life of equipment, gradually turning maintenance after trouble has occurred into adjustments to equipment before trouble occurs thereby putting an end to any sudden faults. This reduces expensive equipment maintenance and gives full recognition to the costs of equipment management. Any technical section must feel the pulse and fate of the equipment and make vigorous efforts to promote practical technologies suitable for on line production. Meanwhile, more talented personnel need to be cultivated for maintenance work so as to improve maintenance precision. Based on the specific situation of any enterprise, new technologies are introduced at the right time, the equipment structure is optimized, manufacturing cost is reduced and the combination of overall renewal & reconstruction and local optimization is achieved. The various areas where consumption occurs are controlled in a macro way in order to increase benefits. (refer to *the Application of Spectral Distribution in the Management of Dredgers)*

Utilizing Other Energy Use in a Reasonable Way - Oil Saving and Consumption Reduction

We should make good use of the characteristic field operations of dredgers, utilize natural resources, and reduce the internal consumption of energy. The following are examples:

- The power for dredger lighting and communication systems can be supplied by wind energy and solar energy systems.
- The runoff of rain from the roof of the operator’s cabin can be collected in the sump for use. Rainwater can provide distilled water for battery cells and cooling water for machinery.
- Used lubricating oil serves as anti-rust treatment for exposed steel rope and bolts.
- For the dredging of inland waters, vessels can be powered by electricity in order to reduce the consumption of diesel oil.

Strengthening the Engine Room's Internal Management -Oil Saving and Consumption Reduction

We should always pay attention to the management of oil and use oil the complies to the regulations of the National Petrochemical Corporation. As an example, Shandong Water (Lushui) Ship No. 8 has a TBD234V8 diesel engine built be the Luoyang Diesel Engine Factory. This machine is equipped with a BOSCH high-pressure German oil pump, type PEBP120/52S427, with an oil nozzle type DLLA 142S924 (FRANCE). After 6,200 hours of operation it became difficult for this machine to start up. On inspection the injection pressure was found to be 14.5Mpa at the normal start-up rotation speed while the oil pressure at fuel injector was 21Mpa, so the principal machine failed to start. According to the analysis undertaken, the reason for this was the piston's early aging as a result of using bad-quality fuel. Therefore, we have to strengthen the control of oil by using fuel complying with the required mark number. The preheating prior to use in the principal machine and for the auxiliary engine’s operation is necessary; usually 20 to 45min. By improving the calorific value, selecting the lubricant with a high mark number etc, we shorten the time taken for preheating and thereby reduce the oil consumption while the engine is idle. The control of a large electric machine in engine room is through a PLC frequency converter in order to reduce the startup current and eliminate startup impacts.

Water collected inside the vessel can be automatically controlled by using a water monitor in the ship’s hold. Negative pressure at the dredge pump mouth piece is used for sewage management in the engine room.

Attaching Importance to the Operating and Coordination of the Deck Department -Oil Saving and Consumption Reduction

Deck operations are considered the “front line” of dredging operations and the engine room the “back up” that guarantees smooth operations. The deck department is responsible for the actions of operating personnel and the master of the operating personnel for every detail of the dredging process that ensures the continuity of dredging operations.

Shandong Water (Lushui) Ship No. 1 and Shandong Water (Lushui) Ship No. 4 started construction work in the Wo River site of the Woyang, Anhui Province at the same time, with the same quality of soil to be removed and dredging row spacing pattern. After two months of work Ship No.1 completed the removal of 250,000 cubic meters of soil and consumed 100 tons of diesel oil. On average every cubic meter of soil consumed 0.4 k g . The dredging quantity for Ship No. 4 was 227,000 cubic meters of soil and it consumed 98 tons of diesel oil. On average every cubic meter of soil consumed 0.43 k g of diesel oil. Without consideration of any outside factors that influenced construction work, the competency level of the deck operating personnel played a key role. The following is another example of this. A Work pile (spud) is hoisted in advance so as to reduce an empty run. When the vessel is going forward and the pile is changing along with the hoisting the auxiliary pile**,** we observe the changes of pressure on the pressure gauge. When the pressure reading shows that the auxiliary pile has left the mud layer we can start the normal sideslip dredging work. In this way we can effectively reduce the time for changing piles, and reduce the time of useless work for the mud pump. We select a proper constrictor in accordance with operating conditions like row spacing and soil quality, balancing vacuum and pressure, giving full play to the best efficiency of the mud pump. On the premise that the pressure of mud pump output end does not decrease, we adjust the depth of digging and the

speed of side slipping, trying to improve the vacuum at the mud pump mouth piece thereby increasing mud content. We make preparations for anchoring well in advance, and reduce the time required for changing the anchoring place. When a discharge pipeline needs to change direction we install a three-way dredging pipe in position. We need to make preparations, reduce the time of useless running by the machines in engine room, and increase the service efficiency of the machines.

Learning Advanced Experience from Those of the Same Trade in Relation to Oil Saving and Consumption Reduction

We should actively take part in various meetings associated with the dredging industry, finding out about, introducing, and absorbing the new correct technologies. The application of various new technologies in dredgers is also an emphatic guarantee of achieving measures for oil saving. The following are examples of effective application and management experiences. Mud pumps have adopted high chromium wear resistant materials ensuring that the efficiency of the pump does not change over a relatively long periods of time. Mud pump water-seals adopt frequency conversion controls that not only save energy but also monitor the internal wear situation of the mud pump. We have new, low wear rate, side anchor pulleys that use hydraulic oil leakage control devices and dredger discharge pipeline rotating nozzles. Through local optimization and reconstruction measures we have improved the overall performance of dredgers, reduced consumption of oil and increased benefits for the operators.

Making Use of the Guidance, Monitoring and Encouragement of Management for Oil Saving and Consumption Reduction

There is a fundamental need for oil saving and consumption reduction to be part of any solution when optimizing construction especially by the project department prior to construction. We should avoid repeated or useless operations during construction and ensure the continuity of construction work. We should pay attention to the ideological education of employees, praising economic achievements, strengthening the sense of environmental protection undertaken by employees, and increasing the opportunities for initiatives by employees. Also stimulating appraisal systems and encouraging those dredger operators with conspicuous achievements. Through effective measures, we create a good atmosphere for oil-saving during dredging.

Adopting New Technology for Oil Saving and Consumption Reduction

One example illustrating this is the use of a hydraulic oil leakage self-returning device. This leakage device can effectively solve the problem of hydraulic oil losses due to a hydraulic hose bursting or for other similar reasons. Hydraulic oil leakage not only causes heavy economic loss but also does harm to the relationship with local people. It also causes environmental pollution. The device reduces hydraulic oil loss and saves money. After the treatment at a leakage point, we adjust and test components. There is no need to add any oil which reduces the amount of stopping for the vessel. This device directly installed on a pipeline has no negative influence on the hydraulic system of the ship. (Refer to *Hydraulic Oil Leakage Self-returning Device*).

We also install dredger a work pile (spud) hoisting protection devices. After the installation of this device, the friction on the work pile and shroud ring changes from an original sliding friction to rolling friction. The coefficient of friction drops to 0.05 and the resistance to hoisting decreases. The diameter of work pile and the internal diameter of the shroud ring stay basically unchanged for a relatively long time. This prolongs the service life of the work pile and shroud ring effectively reducing down time and increasing economic benefits. (Refer to *200m^3/h Dredger Work Pile Hoisting Protection Device*).

CONCLUSION

It is our objective to continuously pursue the treatment of every detail in relation to oil use reduction in a scientific way. We should also attach importance to the details of management, energy consumption reduction, optimizing the configuration of equipment and introducing better human-machine systems in order to improve a dredgers' ability to work in adverse circumstances and make them better controlled and highly efficient. Through effective management of every detail during the dredging process we can reduce the amount of idle work and make the fullest use of every drop of fuel thereby achieving the maximum benefit for dredging operations.