

Winch Solution for Diamond Dredging Vessel

INNOVATIVE CLUTCH SYSTEM
FOR HEAVY-DUTY ABANDONMENT
& RECOVERY WINCH



RELIABILITY



INNOVATION

INTRODUCTION

In the seemingly infinite expanse of the ocean, where the depths hold undiscovered secrets, a diamond dredging vessel stands at the forefront of innovation and mastery. This diamond dredging vessel, equipped with cutting-edge technology and impressive engineering solutions, has re-imagined what underwater exploration and resource extraction looks like. Through collective engineering excellence with fully customized solutions, the vessel has achieved unparalleled success in the diamond dredging industry.

THE VESSEL AND ITS COMPONENTS

At the heart of the vessel lies a sophisticated winch system meticulously designed to deploy and recover a remotely operated crawler vehicle. This crawler, which is a self-propelled track machine, is also equipped with a cutter suction head. As it searches the ocean floor, the suction pipe positioned behind the dredging head effectively removes the ocean floor sediment in its path. This sediment, complete with the all-important uncut diamonds, is then sucked up into the vessels processing plant via the interconnected umbilical system for subsequent harvesting.

THE WINCH SYSTEM

Aboard the vessel, the mining vessel deployment system, a bespoke version of an abandon and recovery winch, stands prominent. Utilizing a synthetic rope, this winch gently lowers the crawler vehicle to the ocean floor via a wave compensation system. This system guarantees the crawler's consistent lowering speed during the abandon and recovery phases whilst under wave motion.

The winch system was designed with redundancies to handle the full load with multiple drives, always ensuring reliability and safety. The umbilical winch supplies the crawler with power and interface electronics, enabling precise control of the vehicle on the ocean floor. The usage of power and control systems further exemplifies the vessel's overall commitment to advanced engineering and operational efficiency.

THE CLUTCH SYSTEM

Throughout the design phase, one of the most significant challenges to overcome is the safe recovery of the crawler from the ocean floor, especially if it becomes stuck in seabed sediment. The clutch system, designed by Wichita Clutch, addresses this challenge head on. The spring-applied hydraulic released clutches, featuring sintered metallic friction pads, provide the necessary torque limiting functionality of the winch during recovery of the crawler.

The winch system's design incorporates 12 identical clutches, each positioned to drive its respective pinion gear via 12 electric motor and reduction gearboxes. All 12 pinions in turn mesh with the main cable drum gear.

To safeguard against excessive and potentially damaging lifting forces during the vehicle recovery stage, the operator of the winch can choose to select clutch torque limiting (slipping point) values of 25, 50, 75, and 100% load capacity of the winch. Typically, a 25% value will be the starting point and under normal conditions would provide enough clutch torque capacity to successfully lift the crawler. However, if the crawler remains stuck in the sediment the clutches will slip at the predetermined slip torque value and in doing so limit the mechanical forces imparted to both the winch and crawler vehicle.

The operator can now decide to incrementally increase the slipping torque rating of the clutches, which effectively increases the lifting capacity of the winch and allows it to proceed in a cautious and controlled manner until a successful lift is realized.

HEAT AND ENERGY MANAGEMENT

Within the clutch design, managing heat and energy absorption is critical. The clutch unit, which is fully enclosed to protect against corrosion, utilizes sintered metallic friction pads and a high thermal mass of steel plates to accept the high energy inputs during the torque limiting slipping phases. To monitor the internal clutch temperature, an embedded thermocouple feeds back to the winch operator allowing for a pause in proceedings to allow cooldown of the clutches should the limits of safe operation be exceeded.

CORROSION RESISTANCE AND CUSTOMIZATION

The vessel's clutch system is a fully bespoke solution, tailored specifically for this diamond dredging opportunity. Protective measures include electroless nickel plating, nitrotech treatment, and stainless steel components to ensure high corrosion resistance.

This custom design highlights multiple collaborative efforts and the innovative spirit of the engineers behind this project.

The bespoke clutch system was designed specifically to provide high energy and variable torque capacity within a very compact size envelope.

DEPLOYMENT AND RECOVERY PROCESS

Most importantly, the safe deployment and recovery process of the crawler vehicle is a highly complex operation that requires precise control and coordination. During deployment, the crawler vehicle is lowered to the ocean floor using the on-board winch system paired with the accumulator system to compensate for wave motion. This pairing ensures the crawler's consistent depth and stability, allowing it to safely deploy in varying water conditions.

Recovery poses significant challenges, particularly when the crawler vehicle is stuck in sediment. The winch system brilliantly uses the wave form motion to assist in lifting the vehicle. The multiple clutch system's torque limiting capability ensures controlled and consistent lifting force, preventing system overload and potential damage to the crawler or winch system.

CONCLUSION

The diamond dredging vessel's journey is a true testament to the power of wisdom, creativity, and years of experience in expert design and engineering. Through meticulous efforts and a completely customized solution, the vessel can overcome the challenges brought on by diamond dredging head on. As it continues to explore the depths of the waters, the vessel stands as a prominent symbol of innovation, mastery, and the relentless pursuit of excellence.

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