

COMRA's Research on Lifting Motor Pump

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ABSTRACT

China has started the research on lifting technology in deep-sea mining since 1991. Some experimental researches have been done on hydraulic lift by slurry pump, air-lift, pump-lift with clear water, lift by jet pump, etc. After being compared with each other, hydraulic lifting method with slurry pump has been considered as the lifting method in Chinese deep-sea mining system research. During the 10th Five-Year plan period (2000-2005), the main research work on lifting technology by COMRA is to design and fabricate the lifting motor pump for nodules mining test in deep sea at the depth of 1000m. The author of this paper not only took part in all these studies on the lift technology from 1991 when COMRA was founded, but also was responsible for research on lifting pump. In this paper, a detailed description will be given of the lifting motor pump. It includes: (1) requirements for the lifting motor pump designed for test in the sea at the depth of 1000m, (2) design parameters for the pump, (3) the description of design and construction of the pump, (4) the test of the characteristics of the two-stage motor pump in the lab.

KEY WORDS: ocean resources; deep sea mining; lifting technology; lifting motor pump.

INTRODUCTION

China has started the research on lifting technology in deep-sea mining since 1991. Some experimental researches have been done on several lift methods. After being compared with each other, hydraulic lifting method with slurry pump has been considered as the lifting method in Chinese deep-sea mining research (Zou, 2006). In the hydraulic lift system, the lifting motor pump which transports slurry of nodule-water mixtures from the buffer at the bottom part of the pipe through the nearly vertical pipe string to ocean surface is the most important equipment (Chung, 1996). Two submersible motor pumps made by KSB company in Germany, whose head and rate of flow are 265m and 500m³, had delivered about 1000 tons manganese nodules out of a depth of 5000 meters at the beginning of 1978 (Kunts, 1979). Deep-submersible pumps, driven by submerged 1000-1700kW electric motors, were developed in Japan in 1980s (TRAM, 1991). The pumps are schedule to be installed at about 1000m below the free surface.

The mining chief designer group of COMRA made out the plan of nodules mining test at the depth of 1000m in 2001. Fig.1 illustrates the hydraulic lift system for the 1000m deep mining test. In the 10th Five-Year plan period, the main research work on lifting technology by COMRA was to design and fabricate the lifting pump for this test plan. Author and his research group undertook this research task.

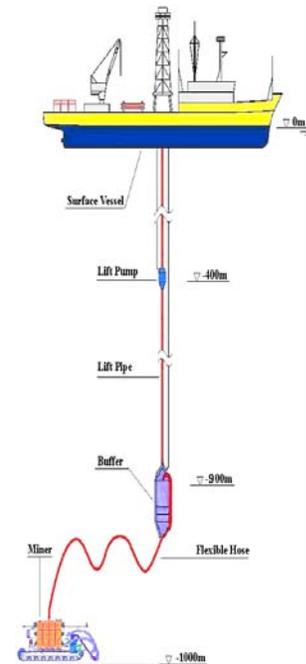


Fig.1 Hydraulic lift system

REQUIREMENTS FOR THE LIFTING MOTOR PUMP DESIGNED

Requirements for the Pump

The following requirements have to be taken into consideration in designing the pump for 1000m deep mining test:

(1) Base data for lifting motor pump design