低扬程泵装置效率与泵效率关系研究 Study on the Relationship between System and Pump Efficiencies of Low-head Pumping Systems

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关键词： 装置效率 泵效率 流道效率 关系

摘 要： 低扬程泵站的泵效率与装置效率之间关系主要取决于流道的损失，在对现有研究两者关系的主要方法进行总结的基础上，根据大量的试验数据对现有的泵效率与流道效率乘积为装置效率的基本假定进行验证，发现基本假定存在矛盾；进而采用CFD方法对采用不同比转数叶轮的不同装置型式进、出水流道水力损失进行预测，分析流道损失的变化规律，提出装置效率可以采用泵效率与流道效率的乘积表述，但前提条件是流道损失必须是有泵时的水力损失，在泵最优工况点附近流道无泵损失表述的装置效率与实测结果是近似相等，因此在装置水力优化设计中需要考虑叶轮在内的全装置水力优化。

The relationship between system efficiency and pump efficiency in low-head pumping stations depends on the hydraulic losses of its suction box and discharge passage. Based on the summary of the existing main methodologies for the relationship, the conventional basic hypothesis was verified and the antithesis discovered. The system efficiency was equal to the product of the passage efficiency and the pump efficiency; the passage losses occurred when there was no pump. Using CFD technology, the passage losses at different specific speeds modeled impellers with different types of suction boxes. Discharge passages were calculated and the relationship between the loss and flow rate in different systems was analyzed. When the passage loss was one with the pump, the product of the passage efficiency and the pump efficiency expressed the system efficiency. Near the optimal efficiency of the pump, the system efficiency expressed by the passage efficiency without the pump was nearly equal to the test results. The whole system, including the pump, must be considered for the optimal hydraulic design of the system.

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