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### 南水北调工程邳州站竖井贯流泵装置进出水流态分析

## Flow pattern analysis on inlet and outlet conduit of shaft tubular pump system of Pizhou pumping station in South-to-North Water Diversion Project

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英文关键词: [computational fluid dynamics](#) [pumps](#) [flow patterns](#) [inlet conduit](#) [outlet conduit](#) [hydraulic performance](#) [shaft tubular pump system](#)

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中文摘要:

为揭示竖井贯流泵装置内、外特性之间的联系, 完善其优化水力设计理论, 该文采用三维流动数值计算的方法, 对南水北调东线一期工程邳州站泵装置流道表面的流场和垂直于x、y、z三个方向剖面的流场进行了多视角的详尽剖析, 并分别采用透明流道模型试验和透明泵装置模型试验的方法检验了流态数值模拟结果。由数值计算和模型试验结果可得: 前置竖井贯流泵装置进水流道内的流态均匀平顺、层次分明; 出水流道内的水流在螺旋状运动中平缓扩散, 流道内无任何脱流或旋涡等不良流态; 其水力性能优异的主要原因在于其具有优异的内特性。邳州站前置竖井贯流泵装置主要工况点的泵装置效率超过83%、临界空化余量小于5 m, 水力性能优异。该文可为低扬程泵站的水力设计提供有益参考。

英文摘要:

In order to reveal the relationship between the internal characteristics and external characteristics of shaft tubular pump system and to perfect its theory of the optimum hydraulic design, flow patterns of the conduit surface and the sections perpendicular to x, y, z directions for shaft tubular pump system of Pizhou pumping station in Eastern Route of South-to-North Water Diversion Project were analyzed in detail from all angles of view by 3D turbulent numerical simulation. And the numerical simulation results of the flow pattern were verified by both transparent conduit model test and transparent pump system model test. The results of numerical computation and model test came to the conclusions as follows: 1) Flow pattern was uniform and smooth in the inlet conduit of the pump system, and the stream line layers were clear; 2) Flow in the outlet conduit diffused gently in the form of spiral motion, and there was no improper flow such as separation or vortex in the conduit; 3) The main reason of the excellent hydraulic performance of the pump system was due to the excellent internal characteristics. At the main operation points of the pump system, the pump system efficiency exceeded 83%, critical cavitation flow margin was lower than 5m and the hydraulic performance of the pump system was excellent. The research results provide a beneficial reference for the hydraulic design of pumping stations with low head.

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