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Technical guide for dealing with sand abrasive erosion in reaction hydraulic turbines

反击式水轮机泥沙磨损技术导则

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Standardization Administration of the PRC

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Foreword

This standard was drafted in accordance with GB/T 1.1-2009 given rules. The standard proposed by the People's Republic of China Ministry of Water Resources. This standard by the Ministry of Water Resources and Hydropower Planning and Design centralized. This standard is drafted by: China Institute of Water Resources and Hydropower. Participated in the drafting of this Standard. China Three Gorges Corporation, Harbin Institute of Electronics, Dongfang Electrical Machinery Co., Ltd., water north Survey Design and Research Co., Ltd. The main drafters of this standard. the land force, Wu Peihao, Yujiang Cheng, Wu Jian, Xu Hongquan, Dai Jiang, Masu Ping, Shi Qinghua, Liu Jie, Wuxi Dong, Gu four lines, Juan, sinus pine.

High sediment content in many of our rivers, sand abrasion turbine problem is very prominent. In order to effectively reduce sediment turbine Hazards, ensuring economic and safe operation of the station should be in the design and selection of hydropower turbines, design, manufacture, installation, operation, maintenance and repair Wear problems and other aspects to consider and take appropriate action, it is necessary to develop this standard. Study on the sediment carried turbine wear more than 50 years of history, especially in the past 30 years about the research, design, manufacture, operation Each party maintenance and other units, sediment wear mechanism turbines, two-phase flow theory, model selection, anti-wear measures, operation and maintenance, testing technology Surface, a lot of experimental research and practice, access to a wealth of research and practical experience, this standard has laid a good preparation Good foundation. Reaction turbine to sand abrasion Technical Guidelines

1 Scope

China's national technical guide for dealing with sediment abrasion in reaction hydraulic turbines. It gives the technical requirements and guidance for reducing the harm caused by sediment to a turbine, across the selection, design, manufacture, installation, operation, maintenance and repair of the machine. Many of China's rivers carry a great deal of sediment, and a hydroelectric turbine on such a river is a machine being sandblasted

continuously by its own working fluid. The particles are hard, they are travelling at the velocity of the flow, and they strike the runner blades, the guide vanes, the labyrinth seals and the draft tube liner. The result is that surfaces lose material, clearances open, the efficiency falls, cavitation starts where the profile has been eroded away, and the machine has to be repaired far more often than a turbine on clean water. On a heavily loaded river the runner may need repair every season, and the loss of generation during those outages exceeds the cost of the repair. Because the damage cannot be prevented, the guide treats it as something to be designed for and managed rather than avoided. It covers what to do at each stage: the assessment of the sediment in the river and its abrasiveness at the selection stage, the choice of turbine type and the specific speed that limits the velocities, the hydraulic design that avoids the flow patterns that concentrate wear, the materials and hard facings, the manufacturing quality where surface finish determines wear rate, the operating regime and the sediment-avoidance strategies available to the station, and the inspection, repair and overlay techniques by which an eroded runner is restored. Issued on 31 December 2012 and in force since 1 June 2013.

This standard specifies the reaction turbine selection, design, manufacture, installation, operation, maintenance and repair of technology involved in sand abrasion Claim. This standard applies to installations in reaction turbines Hydropower Station.

Note. For water containing corrosive substances or pH turbine protection and greater precautions and other water conditions need separate consideration.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version suitable for use herein Member. For undated references, the latest edition (including any amendments) applies to this document.

GB/T 2900.45 Electrotechnical terminology Hydropower Plant Equipment

GB/T 8564 Specification for installation of hydro-generating unit

GB/T 10969 turbines, storage pumps and pump turbine passage components conditions

GB/T 15468 Turbine basic technical requirements

GB/T 15469.1 turbines, storage pumps and pump - turbines cavitation pitting evaluation - Part 1. Evaluation in reaction turbines cavitation of SL142 muddy water turbine model acceptance test procedure (with provision in) DL/T 838-2003 Guide of maintenance for power plant equipment

IEC 60193 turbines, storage pumps, pump turbine model acceptance test procedure (Hydraulicturbines, storagepumps andpump-turbines-Modelacceptancetests)

3 Terms and Definitions

GB/T 2900.45, GB/T 15468 and GB/T 15469.1 defined and the following terms and definitions apply to this document.

3.1 Reaction turbine reactionhydraulicturbine By interacting with the runner blade flow will flow potential and kinetic energy is converted into mechanical energy output from the turbine. NOTE. The main types of reaction turbine Francis turbine, axial flow turbine, oblique flow turbine and tubular turbines and the like.

3.2 Cavitation cavitation Water partial pressure in the flow path down to the critical pressure (generally close to the vapor pressure), the water and air nuclear development to grow into bubbles, bubble Accumulation, flow, division and general collapse of the process.

3.3 Aspiration height staticsuctionhead Hs Cavitation plane turbine tail water level with a predetermined elevation difference.

Note. The height of aspiration units represented by m.