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NB/T 11557-2024

Guide for rehabilitation design of electromechanical equipment for hydropower projects

水电工程机电设备更新改造设计导则

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Foreword

This document was issued on 24 May 2024 by the National Energy Administration of the PRC and takes effect on 24 November 2024.

It is a NB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

It is classified under ICS 27.140, Chinese classification P 59.

This guide was prepared in accordance with the requirements of the Notice of the General Department of the National Energy Administration on issuing the 2021 plan for the formulation and revision of industry standards in the energy field and the plan for the translation of foreign language versions, document Guo Neng Zong Tong Ke Ji [2021] No. 92. The drafting group carried out extensive investigation and research, carefully summarised practical experience, and prepared this guide on the basis of wide consultation.

The main technical content of this guide is: general provisions; terms; basic regulations; the main work content; the rehabilitation design of hydraulic turbine generator units and their auxiliary equipment; the rehabilitation design of hydraulic machinery auxiliary equipment; the rehabilitation design of electrical equipment; the rehabilitation design of control, protection and communication system equipment; the rehabilitation design of heating, ventilation and air conditioning system equipment; the rehabilitation design of the hydraulic steel structures of the waterway and generation system; and the identification of risks in rehabilitation and the countermeasures against them.

This guide is administered by the National Energy Administration, was proposed by and is under the routine administration of the General Institute of Hydropower and Water Resources Planning and Design, and the Hydropower and Hydraulic Machinery Standardization Technical Committee of the Energy Industry (NEA/TC20) is responsible for the interpretation of the specific technical content.

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1 Scope

NB/T 11557-2024 is the Chinese guide to designing the rehabilitation of the electromechanical equipment in a hydropower station that is already built and running. It exists because China's hydropower fleet has aged into its refurbishment decades: the civil works of a dam last a century, but the turbines, generators, governors, switchgear and control systems inside it do not, and a plant commissioned in the 1980s or 1990s is now running equipment whose spares no longer exist and whose efficiency is well below what a modern runner would deliver on the same water. Refurbishing it is attractive because the expensive part - the dam, the reservoir, the waterway, the grid connection - is already paid for, so a new runner or a digital governor buys extra megawatt-hours from water that is already being spilled through the machine. The difficulty is that the work is done inside a live asset, and this guide is written around the constraints that follow. Its first rule is that rehabilitation must not change what the reservoir is: not its characteristic parameters, not the project grade or the grade of its structures, not the layout of the complex, not the flood control, water supply, irrigation or navigation functions, and not the ecological dispatching or the ecological flow release. It sets when rehabilitation is indicated - equipment past its service life should be rehabilitated, equipment short of it shall be when defects, failure rate or degraded performance make it unreliable or unsafe - and the five purposes it may serve: reliability, restored performance, improved performance, higher automation and intelligence, and extended life, with reliability assessed under the DL/T 793 series and expected life determined under GB/T 28545. The body then works through each equipment family in the same three steps - data collection, evaluation of the work scope, and the rehabilitation design scheme: the turbine generator units and their auxiliaries, including the hydraulic transient guarantee design that governs what the waterway can survive during load rejection; the hydraulic machinery auxiliaries; the electrical equipment; the control, protection and communication systems; the HVAC systems; and the hydraulic steel structures of the waterway. A final clause covers the identification of the risks a rehabilitation project carries and the countermeasures against them. It applies to units of 10 MW and above, and was issued on 24 May 2024 by the National Energy Administration, taking effect on 24 November 2024.

1.0.1 This guide is formulated in order to standardise the rehabilitation design of the electromechanical equipment of hydropower projects already built, drawing on the experience of electromechanical equipment rehabilitation design in China and abroad in

recent years.

1.0.2 This guide applies to the rehabilitation design of the electromechanical equipment of hydropower projects with a unit capacity of 10 MW and above.

1.0.3 The rehabilitation design of the electromechanical equipment of a hydropower project shall actively adopt new technologies, new processes, new equipment and new materials, shall satisfy the requirements of safety, energy saving and environmental protection, and shall be safe and reliable, technically advanced and economically reasonable.

1.0.4 In addition to complying with this guide, the rehabilitation design of the electromechanical equipment of a hydropower project shall also comply with the provisions of the relevant current national standards.

2 Terms

2.0.1 rehabilitation

The activity of replacing existing equipment or components with entirely new equipment or components, or of technically modifying existing equipment or components, because of ageing, damage, degraded performance or a change in the basic conditions on which the original design was based, so that the performance of the equipment reaches or exceeds that of the existing equipment, its safety and reliability are improved, and its service life is extended.

3 Basic regulations

3.0.1 The rehabilitation design of electromechanical equipment shall not change the characteristic parameters of the reservoir, the project grade or the grade of the structures of the project complex, or the layout of the complex; it shall not affect the other comprehensive functions such as flood control, water supply, irrigation and navigation; and it shall not change the ecological dispatching mode of the reservoir or the release of the ecological flow.

3.0.2 The rehabilitation of special equipment such as pressure vessels and lifting equipment shall comply with the current special equipment management regulations.

3.0.3 Apart from special equipment, electromechanical equipment that has reached its specified service life should be rehabilitated.

3.0.4 Electromechanical equipment that has not reached its specified service life shall be rehabilitated when it has many defects in use, a high failure rate or markedly degraded performance, when it fails to meet the equipment reliability requirements, or when it affects the safety of the equipment or the exercise of its normal function.

3.0.5 The reliability evaluation of the electromechanical equipment of a hydropower project