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NB/T 10392-2020

Guide for design of energy dissipation and erosion control for water release structures of hydropower projects

水电工程泄水建筑物消能防冲设计导则

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Foreword

This document was issued on 23 October 2020 by the National Energy Administration of the PRC and takes effect on 1 February 2021.

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 has been prepared in accordance with the requirements of the Notice of the National Energy Administration on Issuing the First Batch of Formulation (Revision) Plans for Energy Sector Industry Standards in 2009 (Guo Neng Ke Ji [2009] No. 163). The drafting group carried out extensive investigation and research, carefully summarized practical experience, and prepared this guide on the basis of wide solicitation of opinions.

The main technical contents of this guide are: basic requirements; type and arrangement of energy dissipation and erosion control; design for hydraulic jump energy dissipation and erosion control; design for ski-jump energy dissipation and erosion control; design for surface flow and roller bucket type flow energy dissipation and erosion control; design for inside-tunnel energy dissipation and erosion control; downstream protection design;

hydraulic model test and hydraulic numerical simulation; safety monitoring design; and operation and maintenance requirements.

This guide is under the administration of the National Energy Administration. It was proposed by, and is under the routine administration of, China Renewable Energy Engineering Institute. The Standardization Technical Committee of Hydropower Investigation and Design of the Energy Industry is responsible for the interpretation of its specific technical contents. Comments and suggestions arising in the course of implementation should be addressed to China Renewable Energy Engineering Institute (Address: No. 2 Liupukang Beixiaojie, Xicheng District, Beijing; Postcode: 100120).

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1 Scope

NB/T 10392-2020 is the Chinese design guide for energy dissipation and erosion control at the water release structures of hydropower projects. When a high dam discharges, the water arriving downstream carries enough energy to scour the riverbed and undermine the works, and the whole art is to spend that energy where it can do no harm. The guide covers the full family of dissipation arrangements: hydraulic jump stilling basins with their baffle blocks and end sills, ski-jump and flip bucket dissipation with the trajectory and plunge pool that follow, submerged jet and surface flow regimes, slotted and differential buckets, plunge pools with and without a lining, and the internal dissipation used inside outlet tunnels. For each it sets the hydraulic design method, the geometry, the flow conditions across the discharge range, and the criteria for judging that dissipation is adequate. Erosion control is treated alongside: the estimation of scour depth in rock and in alluvium, the protection of

the riverbed and the banks, the stability of the downstream channel, and the interaction between adjacent outlets discharging together. Cavitation and aeration, the abrasion caused by sediment, and the vibration induced in the structure are addressed as design constraints. Hydraulic model testing, prototype observation and the monitoring expected in service close the document. It applies to the design of spillways, outlets and discharge tunnels on hydropower projects in China.

1.0.1 This guide is formulated in order to unify the requirements for the arrangement of energy dissipation and erosion control works, the configuration design, the hydraulic design, the structural design and the operation management of water release structures of hydropower projects, so as to achieve operational safety, technical advancement and economic rationality.

1.0.2 This guide is applicable to the design of energy dissipation and erosion control for water release structures of hydropower projects.

1.0.3 For small hydropower projects, the design of energy dissipation and erosion control of water release structures may be carried out in a simplified way in accordance with this guide.

1.0.4 For hydropower projects in plain areas, the design of energy dissipation and erosion control of water release structures may be carried out in accordance with the relevant provisions of the current industry standard Design Code for Sluice SL 265.

1.0.5 In addition to complying with this guide, the design of energy dissipation and erosion control for water release structures of hydropower projects shall also comply with the provisions of the relevant current national standards of China.

2 Terms

2.0.1 water release structure. A hydraulic structure provided for discharging flood water or waterlogging water in excess of the storage or carrying capacity of a reservoir, river course, canal or waterlogged area, and for releasing the water stored in a reservoir or canal in order to facilitate safety protection or inspection and maintenance.

2.0.2 hydraulic structure of energy dissipation and erosion control. A hydraulic structure arranged along the water release structure or at its outlet so that the high-velocity discharge flow is well connected with the downstream river channel, forming local hydraulic energy dissipation flow patterns such as a jet nappe, a hydraulic jump, a roller, sharp contraction and expansion, or spiral flow, thereby dissipating the energy of the discharge flow; it is also a hydraulic structure that prevents harmful scouring and undermining of the downstream riverbed and bank slopes.

2.0.3 stilling basin. An energy dissipation facility located downstream of a dam body, a sluice or a water release structure, composed of side walls, a baseplate, an end sill, an