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NB

**ENERGY INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

NB/T 10857-2021

**Code for design of rational service life and durability for
hydropower projects**

水电工程合理使用年限及耐久性设计规范

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Table of Contents

1 General Provisions	1
2 Terms	2
3 Basic Requirements	5
3.1 General Requirements	5
3.2 Classification of Environmental Conditions	5
4 Rational Service Life and Design Service Life	9
4.1 Rational Service Life	9
4.2 Design Service Life	10
5 Durability Design Requirements	12
5.1 General Requirements	12
5.2 Detailing Requirements	12
5.3 Material Requirements	15
5.4 Design Requirements for Different Corrosive Environmental Conditions	18
6 Construction Requirements	25
7 Operation and Maintenance Requirements	27
Explanation of Wording in This Code	29
List of Quoted Standards	30
Addition: Explanation of Provisions	31

Foreword

This document was issued on 22 December 2021 by the National Energy Administration of the PRC and takes effect on 22 June 2022.

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 P59.

This code was formulated in accordance with the requirements of the Notice of the National Energy Administration on Issuing the 2015 Plan for the Formulation (Revision) of Energy Sector Industry Standards (Guo Neng Ke Ji [2015] No. 283). The drafting group carried out extensive investigation and research, carefully summarized practical experience, referred to relevant domestic standards and widely solicited opinions before formulating this code.

The main technical contents of this code are: general provisions, terms, basic requirements,

rational service life and design service life, durability design requirements, construction requirements, and operation and maintenance requirements.

This code is under the administration of the National Energy Administration; it was proposed by and its routine management is the responsibility of China Renewable Energy Engineering Institute, and the Energy Sector Standardization Technical Committee on Hydropower Survey and Design (NEA/TC 15) is responsible for the interpretation of its specific technical contents. Comments and suggestions arising during implementation should be sent to China Renewable Energy Engineering Institute (address: No. 2 Liupukang Beixiaojie, Xicheng District, Beijing; postcode: 100120).

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Announcement of the National Energy Administration

National Energy Administration Announcement No. 6 of 2021: in accordance with the Standardization Law of the People's Republic of China and the Measures for the Administration of Energy Standardization, the National Energy Administration approved 356 energy industry standards, including the Code for Design of Forced Permeability Enhancement Engineering in Underground Coal Mines (Annex 1), and 25 foreign-language editions of energy industry standards, including the Technical Code for Design and Calculation of Combustion System of Fossil-fired Power Plant (Annex 2), and hereby releases them.

Annex 1 (List of Industry Standards) lists this code as item 8: NB/T 10857-2021, Code for Design of Rational Service Life and Durability for Hydropower Projects, with no superseded standard and no adopted international standard; approval date 2021-12-22, implementation date 2022-06-22.

The code was prepared under the chief editorship of China Renewable Energy Engineering

Institute, approved by the National Energy Administration, published by China Water and Power Press (Beijing, 2022) and put into effect on 22 June 2022.

1 Scope

NB/T 10857-2021 is the Chinese code for setting the rational service life of hydropower structures and designing them for durability. A dam, a powerhouse and a tunnel are expected to last far longer than most civil works, but the environment they sit in attacks them continuously - water flowing at high velocity, freeze and thaw, sulphate and magnesium in groundwater, carbonation, abrasion by sediment. The code first fixes how long each structure must last, by project grade and by the importance of the component, and then what the design must do so that it does. It sets the general provisions and defined terms, then the basic requirements: the classes of service life with the tables assigning them to dams, spillways, intakes, powerhouses, tunnels and their components, and the classification of the exposure environment by the aggressiveness of water and soil, with tabulated limits for sulphate, magnesium, pH and other indicators. Durability design follows for concrete - minimum strength grade, maximum water-cement ratio, minimum cement content, cover to reinforcement, crack width limits, frost resistance and impermeability grades, and additional measures for severe environments - and for steel structures, metal gates and embedded parts with their corrosion protection. Requirements on construction quality, inspection, maintenance and the assessment of existing structures close the code.

1.0.1 This code is formulated to standardize the design of rational service life and durability of hydropower projects, to ensure the quality of engineering design, and to meet the requirements of safety and reliability, economic rationality and technical advancement.

1.0.2 This code is applicable to the determination of the rational service life and to the durability design of new hydropower projects.

1.0.3 The rational service life and durability requirements of reconstructed and extended hydropower projects shall be studied and demonstrated.

1.0.4 The design documents of each design stage of a hydropower project shall state the rational service life of the project and of its hydraulic structures.

1.0.5 When a hydropower project has reached its rational service life, or has been damaged by an accident or disaster, and is to remain in use, an assessment of its safety and service performance shall be carried out and its continued service life shall be determined.

1.0.6 In addition to this code, the design of rational service life and durability of hydropower projects shall also comply with the current relevant national standards.

2 Terms

2.0.1 hydropower project; hydropower engineering; hydroelectric project: a project whose main task is hydroelectric power generation, including pumped storage power stations, which may also serve flood control, irrigation, water supply, navigation and other tasks as required.

2.0.2 hydraulic structure: a structure that controls and regulates water flow, develops and utilizes water resources, prevents water hazards and achieves the objectives of the hydropower project. By period of use, hydraulic structures are divided into permanent hydraulic structures and temporary hydraulic structures; by their function in the hydropower project, they are divided into main structures and secondary structures.

2.0.3 structure and component: the continuous parts of a hydraulic structure that have a certain strength and stiffness and are organically combined together. The physically distinguishable parts of a structure are components.

2.0.4 rational service life: the minimum required number of years during which a hydropower project and its hydraulic structures, after completion and commissioning, can be used safely according to their design functions under normal operating conditions and specified maintenance conditions.

2.0.5 design service life: the period specified in the design during which a structure or component can be used for its intended purpose without major repair.

2.0.6 structure durability: the ability of a structure to maintain its serviceability and safety within the rational service life under the environmental actions determined in the design and the specified maintenance and use conditions.

2.0.7 maintenance: technical, management and other activities undertaken to maintain the functions required of a structure or its components within the design service life, including upkeep and restoration.

2.0.8 restoration: activities carried out by patching, replacement or strengthening to restore a damaged structure or its components so as to meet normal use. According to the scale and cost of the restoration and its effect on the normal use of the structure, restoration may be divided into major repair and minor repair. Restoration that requires the normal use of the structure to be stopped for a certain period, or requires large-area replacement of damaged material in structural components, or replacement of main structural components, is major repair.

2.0.9 chlorine ion diffusion coefficient: a parameter describing the diffusion of chloride ions in concrete pore water from a zone of high concentration to a zone of low concentration.

2.0.10 alkali content: the sum of the products of the mass of each raw material in a unit volume of concrete, such as cement, mineral admixture, chemical admixture, water and sand and stone aggregates, and its effective alkali content, expressed in kg per cubic metre. The effective alkali content is the content of alkali in the concrete raw materials that