ICS 27.140
CCS P 59

NB

ENERGY INDUSTRY STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

NB/T 10224-2019

Technical specification for electrical exploration of hydropower projects

水电工程电法勘探技术规程

Issued on: November 4, 2019 **Implemented on: May 1, 2020**

Issued by: National Energy Administration of the PRC

Table of Contents

Foreword

This document was issued on 4 November 2019 by the National Energy Administration of the PRC and takes effect on 1 May 2020.

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 specification has been prepared in accordance with the requirements of the Notice of the National Energy Administration on Issuing the Second Batch of the 2013 Plan for the Formulation and Revision of Sector Standards in the Energy Field (Guo Neng Ke Ji [2013] No. 526). The drafting group conducted extensive investigation and research, carefully summarized practical experience, and prepared this specification on the basis of soliciting opinions widely.

The main technical contents of this specification are: basic requirements; instruments and equipment; field work; data processing and interpretation; and compilation of results and reports.

This specification is administered by the National Energy Administration. It is proposed by, and placed under the day-to-day administration of, the China Renewable Energy Engineering Institute (General Institute of Hydropower and Water Resources Planning and Design). The Standardization Technical Committee for Hydropower Survey and Design of the Energy Industry is responsible for the interpretation of its specific technical contents.

Comments and suggestions arising during the implementation of this specification should be sent to the China Renewable Energy Engineering Institute (address: No. 2 Liupukang Beixiaojie, Xicheng District, Beijing; postcode 100120).

Chief editing organization of this specification: POWERCHINA Beijing Engineering Corporation Limited (China Power Construction Group Beijing Survey, Design and Research Institute Co., Ltd.).

Participating editing organizations of this specification: POWERCHINA Guiyang Engineering Corporation Limited; POWERCHINA Kunming Engineering Corporation

Limited.

Principal drafters of this specification: Zhao Dangjun, Chang Wei, Gong Hailing, Lou Jiading, He Shicong, Wang Shixue, Du Xingzhong, Xu Hui, Zhou Jian, Wang Naisheng, Lin Baiyu, Li Chuangui, Liu Shanjun, Chen Jianqiang, Song Kemin, Ai Baoli, Jin Yuan, Wang Hongjiang, Peng Xuzhou, Li Wei, Li Qiang, Li Jian.

Principal reviewers of this specification: Wang Huiming, Wang Bo, Sha Chun, Zhu Jianye, Fan Junxi, Li Guangchang, Zhao Anning, Tang Qixu, Huang Runtai, Xiao Changan, Deng Xigui, Xie Xiangwen, Li Wenzhong, Liu Kanghe, Wei Yanjun, Liu Guifu, Qian Wei, Piao Cen, Li Shisheng.

This standard was approved by Announcement No. 6 of 2019 of the National Energy Administration, dated 4 November 2019, which released 384 energy sector standards headed by the Technical Specification for Electrical Exploration of Hydropower Projects, and it takes effect on 1 May 2020. The printed edition is issued by China Water & Power Press, Beijing, 2020.

1 Scope

NB/T 10224-2019 governs electrical geophysical exploration on hydropower projects - the surveys that read the ground from the surface by passing current through it or measuring its natural and induced electrical response. On a dam site they answer questions that drilling alone would answer too slowly and too expensively: where the bedrock surface lies beneath overburden, where the weathered and fractured zones run, where a fault or a karst cavity crosses the alignment, where the water table sits and where seepage moves. The specification defines the terms and the full set of symbols, then the general requirements on survey design, the choice of method against the target and the site conditions, and the accuracy expected. It then covers the methods in turn: resistivity profiling and sounding with their electrode arrays, high density resistivity imaging, electrical resistivity tomography between boreholes, induced polarisation, self potential, transient and frequency domain electromagnetic methods, ground penetrating radar, and the cross-hole and surface-to-hole configurations. For each it gives the field layout, the equipment and its checks, the observation procedure, the quality control and the permitted error, and the data processing and inversion applied. Interpretation is treated on its own, with the correlation to boreholes and to geology that turns a resistivity section into a ground model. The compilation of results, the drawings and the report close the specification. It applies to hydropower investigation in China.

1.0.1 This specification is formulated in order to standardize the electrical exploration work of hydropower projects, so that the technology employed is advanced, the methods are reliable, the data are accurate, and the analysis and interpretation are reasonable.

1.0.2 This specification applies to electrical exploration work for hydropower projects.

1.0.3 In addition to complying with this specification, electrical exploration for hydropower projects shall also comply with the provisions of the relevant current national standards.

2.1 Terms

The following terms and their definitions apply to this specification.

2.1.1 Resistivity sounding method. An electrical exploration method in which the electrode spacing is progressively enlarged at a measuring point so that the depth of investigation increases step by step; the variation of resistivity in the vertical direction, from shallow to deep, is observed at the same measuring point, and the distribution of the underground media is detected on the basis of the resistivity differences between the strata.

2.1.2 Resistivity profiling method. An electrical exploration method in which the electrode spacing of the array is kept unchanged and the horizontal variation of the earth resistivity is observed along the survey line; on the basis of the resistivity contrast between the underground target body and the surrounding medium, the geological conditions within a given depth range are investigated.

2.1.3 Resistivity imaging method (high-density electrical method). An electrical exploration method that combines the resistivity sounding method with the resistivity profiling method, with a high density of observation points and a rich information yield, allowing the variation of the electrical properties in both the horizontal and the vertical direction to be investigated in relative detail.

2.1.4 Self-potential method. An electrical exploration method in which the natural potential produced by the electrochemical action of good underground conductors and by the filtration and diffusion of particles in groundwater is observed and analysed, in order to understand hydrogeological problems.

2.1.5 Mise-a-la-masse method. An electrical exploration method in which current is supplied artificially to the target body under investigation so as to raise the electric potential of the target body relative to the surrounding medium, thereby detecting the distribution of the target body.

2.1.6 Induced polarization method. An electrical exploration method in which the induced polarization effect of the earth is observed and analysed, and the distribution of the underground target body is detected on the basis of the difference in the artificially induced polarization effect between the target body and the surrounding medium.

2.1.7 Pseudo-random current field fitting method. A detection method in which a current field is used to simulate a seepage field and coding technology is adopted for excitation and reception, employed to ascertain the position of the inflow openings of leakage such as piping.

2.1.8 Apparent resistivity. The equivalent resistivity value calculated by means of the