

ICS 27.140
CCS P 59

NB

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

NB/T 10241-2019

Replacing DL/T 5415-2009

**Specification for engineering geological investigation of
underground structures for hydropower projects**

水电工程地下建筑物工程地质勘察规程

Issued on: November 4, 2019

Implemented on: May 1, 2020

Issued by: National Energy Administration of the PRC

Table of Contents

1 General Provisions	1
2 Terms	2
3 Basic Requirements	3
4 Engineering Geological Investigation Content for Underground Structures	4
4.1 Investigation of Basic Geological Conditions	4
4.2 Investigation of Engineering Geological Properties	7
5 Engineering Geological Investigation Methods for Underground Structures	10
5.1 Engineering Geological Investigation Methods for Tunnels	10
5.2 Engineering Geological Investigation Methods for Underground Powerhouse System	12
6 Engineering Geological Assessment of Surrounding Rock for Underground Structures	15
6.1 Location Selection for Underground Structures	15
6.2 Surrounding Rock Classification and Engineering Geological Assessment on Stability of Surrounding Rock	16
6.3 Prediction of Rock Burst	18
6.4 Prediction of Water Inrush and Mud Inrush	19
6.5 Prediction of Ground Temperature, Harmful Gases and Radioactivity	20
6.6 Prediction of External Water Pressure	21
6.7 Engineering Geological Assessment on Stability of Surrounding Rock for High Head Pressure Tunnels	21
6.8 Engineering Geological Assessment on Stability of Surrounding Rock for Air Cushion Surge Chambers	22
7 Engineering Geological Investigation During Underground Structure Construction	24
7.1 Investigation of Special Engineering Geological Problems	24
7.2 Geological Work During Construction	24
Appendix A Determination of Firmness Coefficient, Unit Elastic Resistance Coefficient and Strength-Stress Ratio of Surrounding Rock	27
Appendix B Types of Soluble Halite	29
Appendix C Determination of Physical and Mechanical Parameters of Surrounding Rock	30
Appendix D Instability Mechanism Types and Failure Modes of Surrounding Rock	31
Appendix E Allowable Relative Convergence Values for Tunnels or Caverns	32

Appendix F Maximum Allowable Concentration of Harmful Gases and Main Indexes of Air Composition for Underground Caverns	33
Appendix G Classification of Gas Tunnel	34
Explanation of Wording in This Specification	36
List of Quoted Standards	37
Addition: Explanation of Provisions	39

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.

It replaces DL/T 5415-2009, which is superseded.

This specification has been revised by the drafting group in accordance with the requirements of the Notice of the National Energy Administration on Issuing the 2015 Plan for the Formulation and Revision of Standards in the Energy Sector (Guo Neng Ke Ji [2015] No. 283), on the basis of extensive investigation and research, a careful summary of practical experience, and wide solicitation of comments.

The main technical contents of this specification are: basic requirements; the content of engineering geological investigation of underground structures; the methods of engineering geological investigation of underground structures; the engineering geological assessment of the surrounding rock of underground structures; and the geology of underground structures during construction.

The main technical contents revised in this specification are the following.

Content on environmental protection during investigation work has been added.

Content on ground temperature investigation and on the investigation of water inrush and mud inrush has been added.

Content on the prediction of mud inrush in fault fracture zones with a relatively high mud content has been added.

Content on the assessment of heat hazard due to ground temperature has been added.

Content on the engineering geological assessment of the stability of the surrounding rock of air cushion surge chambers has been added.

The content of the part dealing with the geology of underground structures during construction has been adjusted: the contents of geological work for surrounding rock treatment and of geological work for surrounding rock monitoring have been simplified and merged into geological work during construction.

The content of the part dealing with the classification of gas tunnels has been adjusted.

This specification is under the administration of the National Energy Administration. The Hydropower and Water Resources Planning and Design General Institute has put it forward and is responsible for its routine management, and the Standardization Technical Committee for Hydropower Investigation and Design of the Energy Sector is responsible for the interpretation of its specific technical content.

Should any comment or suggestion arise in the course of implementation, it is requested that it be sent to the Hydropower and Water Resources Planning and Design General Institute, at No. 2 Liupukang Beixiaojie, Xicheng District, Beijing, postcode 100120.

The chief editing organization of this specification is PowerChina Chengdu Engineering Corporation Limited, that is, the Chengdu Engineering Investigation, Design and Research Institute of the China Power Construction Group.

The chief drafters of this specification are: Li Wengang, Chen Weidong, Liao Mingliang, Yang Jianhong, Deng Zhongwen, Li Panfeng, Zhang Yunda, Sha Chun, Zhang Yong and Ju Lin.

The chief reviewers of this specification are: Yang Jian, Wan Zongli, Zhang Dongsheng, Guo Yihua, Mi Yingzhong, Gong Hailing, Shan Zhigang, Chen Liqiang, Lu Dongliang, Zeng Xiangxi, Zhang Guofu, Li Kaide, Gao Qiang, Wu Yongfeng, Dai Qixiang, Wang Huiming and Li Shisheng.

The foreword therefore identifies a single chief editing organization, ten chief drafters and seventeen chief reviewers, a composition typical of a hydropower sector specification revised from an earlier electric power standard.

Publication and Approval Data

NB/T 10241-2019 is an energy sector standard of the People's Republic of China (Zhonghua Renmin Gongheguo Nengyuan Hangye Biaoqun). It is registered under ICS 27.140 (hydraulic energy engineering) and under the Chinese Standard Classification Code P 59, and it carries the sector prefix NB together with the professional classification letter P shown on the cover.

The Chinese title printed on the cover is Shuidian Gongcheng Dixia Jianzhuwu Gongcheng Dizhi Kancha Guicheng. The official English title printed on the cover is Specification for Engineering Geological Investigation of Underground Structures for Hydropower Projects.

The standard was issued on 4 November 2019 and came into force on 1 May 2020, giving a transition period of just under six months between issue and implementation.

The standard replaces DL/T 5415-2009, the earlier electric power sector specification covering the same subject. With the publication of NB/T 10241-2019 the superseded document ceased to apply on the implementation date.

The issuing authority is the National Energy Administration (Guojia Nengyuanju), whose name appears at the foot of the cover page above the word Fabu (issued).

The title page states that the chief editing department is the China Renewable Energy Engineering Institute, also known as the Hydropower and Water Resources Planning and Design General Institute; the approving department is the National Energy Administration; and the date of entry into force is 1 May 2020. The printed edition is dated 2020 and was published in Beijing.

The standard was promulgated by Announcement No. 6 of 2019 of the National Energy Administration, dated 4 November 2019. That announcement approved 384 energy sector standards headed by the Technical Specification for Electrical Prospecting of Hydropower Projects (Attachment 1), 48 English versions of energy sector standards headed by the Technical Guide for Rock-Filled Concrete Dams (Attachment 2), first amendment sheets for 7 energy sector standards headed by the Technical Code for Environmental Impact Assessment of Wind Farm Projects (Attachment 3), and the abolition of 5 energy sector standards and standard projects headed by the Charging Standard for Investigation and Design of Wind Farm Projects (Attachment 4).

The four attachments to the announcement are: 1. Catalogue of Sector Standards; 2. Catalogue of English Versions of Sector Standards; 3. Notification Sheets of Amendments to Sector Standards; 4. Catalogue of Abolished Sector Standards and Standard Projects.

In the Catalogue of Sector Standards (Attachment 1) this document appears as serial number 18, with standard number NB/T 10241-2019, title Shuidian Gongcheng Dixia Jianzhuwu Gongcheng Dizhi Kancha Guicheng, superseded standard DL/T 5415-2009, approval date 2019-11-04 and implementation date 2020-05-01. No adopted international standard number is shown, so the document is a wholly domestic specification and not an adoption of an ISO or IEC text.

The front matter of the printed edition is paginated with Roman numerals I to VIII and carries, in order, the announcement of the National Energy Administration, the extract from the catalogue of sector standards, the Chinese foreword, the Chinese table of contents and the official English Contents. The body of the specification is paginated with Arabic numerals from page 1 to page 39 or beyond.

Structure of the Document