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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 50662-2011

**Code for design of hydraulic structures against ice and freezing
action**

水工建筑物抗冰冻设计规范

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Foreword

This code was compiled by China Water Northeastern Investigation, Design and Research Co., Ltd. together with the units concerned, in accordance with the requirements of the notice of the former Ministry of Construction on the 2007 plan for the preparation and revision of engineering construction standards and codes (first batch), document Jianbiao [2007] No. 125.

This code is divided into 13 chapters and 6 appendices. Its main contents are: general provisions; terms and symbols; basic information; ice and frost-heaving loads; general provisions for materials and structures; water retaining and releasing structures; water

intake and conveyance structures; canals and canal linings; structures of pump plants and hydropower stations; sluice and culvert structures; soil retaining structures (walls); bridges and flumes; and hydraulic metal structures.

This code is administered by the Ministry of Housing and Urban-Rural Development; day-to-day management is the responsibility of the Ministry of Water Resources, and the interpretation of its specific technical content is the responsibility of the General Institute of Water Resources and Hydropower Planning and Design of the Ministry of Water Resources.

The chief compiling organisation is China Water Northeastern Investigation, Design and Research Co., Ltd.; the participating organisations are the Xinjiang Uygur Autonomous Region Water Resources and Hydropower Survey and Design Institute of the Ministry of Water Resources, the Cold Region Engineering Technology Research Centre of the Ministry of Water Resources, Northwest A&F University, the State Key Laboratory of Frozen Soil Engineering of the Cold and Arid Regions Environmental and Engineering Research Institute of the Chinese Academy of Sciences, and the Heilongjiang Provincial Water Resources and Hydropower Survey and Design Institute.

The code was approved as a national standard, numbered GB/T 50662-2011, by Announcement No. 938 of the Ministry of Housing and Urban-Rural Development of 18 February 2011, and has been in force since 1 March 2012.

1 General provisions

China's national design code for hydraulic structures that have to survive ice, freeze-thaw and frost heave. North of the Yellow River the design winter is the governing case for a great deal of water infrastructure: a canal lining is lifted and cracked by the ground freezing beneath it, a sluice gate is jammed by an ice sheet that grows against it, a concrete face is spalled away over years of freezing and thawing, and an intake is blocked by frazil ice on the coldest nights of the year. The forces involved are large and unfamiliar - static ice pressure from a warming ice cover, impact from a moving one, and frost-heaving pressures normal and tangential to a buried surface - and they act on structures designed for hydraulic loads. This code sets out how to design against all of them, in thirteen chapters and six appendices: general provisions, terms and symbols, basic information, ice and frost-heaving loads, general provisions for materials and structures, and then chapter by chapter the water retaining and releasing structures, water intake and conveyance structures, canals and their linings, pump and hydropower station structures, sluice and culvert structures, retaining walls, bridges and flumes, and metal structures. It applies to the anti-ice and anti-freezing design of new or reconstructed hydraulic structures subject to ice, freeze-thaw and frost heave.

1.0.1 This code is formulated in order to unify the design standards and technical requirements for hydraulic structures against the action of ice, freeze-thaw and frost heave,

and to raise the standard of anti-ice and anti-freezing design of hydraulic structures.

1.0.2 This code applies to the anti-ice and anti-freezing design of new or reconstructed hydraulic structures subject to the action of ice, freeze-thaw and frost heave.

1.0.3 The anti-ice and anti-freezing design of hydraulic structures shall comply with the following provisions: 1 it shall suit local conditions and be safe, reliable, economically rational, practical and pleasing in appearance; 2 the basic information on the natural conditions at the site of the structure and on the conditions of construction and operation shall be fully mastered; 3 the anti-ice and anti-freezing design scheme shall be determined according to the factors of the ice and frost action, the degree of harm, the class of the structure and its type, and requirements on construction and operation shall be put forward; 4 special studies shall be carried out for works severely affected by ice and frost action; 5 advanced techniques against the action of ice and frost may be adopted for particular works.

1.0.4 In addition to complying with this code, the anti-ice and anti-freezing design of hydraulic structures shall also comply with the provisions of the relevant current national standards.

2.1 Terms

2.1.1 Frozen ground: soil or rock having a negative or zero temperature and containing ice.

2.1.2 Seasonally frozen ground: soil or rock of the surface layer of the earth's crust that freezes in the cold season and thaws completely in the warm season.

2.1.3 Depth of seasonal freezing: the maximum depth of freezing (the thickness of the frozen layer) counted from the ground surface over the whole winter.

2.1.4 Design freezing depth: the design value adopted for the depth of freezing at the point of calculation.

2.1.5 Design freezing depth of foundation: the design value adopted for the depth of freezing of the foundation soil counted from the bottom face of the structure, or of the soil behind a wall counted from the back of the wall.

2.1.6 Freezing index: the cumulative day-by-day value of the daily mean air temperatures below 0 degrees Celsius over the whole freezing period.

2.1.7 Amount of frost-heaving: the amount of expansive deformation of soil during the process of freezing.

2.1.8 Amount of frost-heaving of ground surface: the difference in level between the ground after frost expansion over the whole freezing period and the ground before freezing.

2.1.9 Frost-heaving force: the force produced when the frost heave of the soil is restrained.