

UDC

**SL**

**Professional Standard of the People's Republic of  
China**

P

SL 282-2003

---

**Design specification for concrete arch dams  
混凝土拱坝设计规范**

**Issued on March 9, 2003**

**Implemented on June 1, 2003**

---

**Issued by Ministry of Water Resources of the People's Republic of China**

**Water Conservancy Industry Standards of the People's  
Republic of China**

**Design specification for concrete arch dams**

**SL282—2003**

Chief editorial unit: Shanghai Investigation, Design & Research Institute

Changjiang Investigation, Planning, Design and Research Institute of  
Changjiang Water Conservancy Commission

Approved by: Ministry of Water Resources of the People's Republic of China

Implemented on: June 01, 2003

**Ministry of Water Resources of the People's Republic of China**  
**Notice on Approval of Release of SL282—2003 *Design***

***Specification for Concrete Arch Dams***

**SGK [2003] No. 94**

Units directly under the ministry, water resources (water affair) departments (bureaus) of provinces, autonomous regions and municipalities directly under the central government, water resources (water affair) bureaus of municipalities with independent planning status, and water resources bureau of Xinjiang Production and Construction Corps:

Through examination, *Design Specification for Concrete Arch Dams* is approved and issued as water conservancy industry standards. The Standard Number is SL282—2003, replacing the previous SD145—85.

This Standard will be implemented from June 1, 2003.

Texts of this Standard are published by China Water Power Press.

March 9, 2003

## Foreword

SD145—85 *Design Specification for Concrete Arch Dams* is revised according to the formulation and revise plan on technical standards issued in 1997 by Ministry of Water Resources, document SGJ (1997) No. 7 *Notice on Printing and Distributing Documents Related to Water Resources and Hydroelectricity Survey Design Technical Standards Working Conference* of Water Resources and Hydroelectricity Design Administration, and SL01-97 *Specification on Compiling Technical Standard of Water Resources and Hydroelectric Development*.

The theoretical principle of the revise of the specification is that currently, the water conservancy industry will make revisions in accordance with the safety factor method of constant values instead of the provisions in GB 50199—94 *Unified Design Standard for Reliability of Hydraulic Engineering Structures*. In document SGJJ (1999) No. 10 *Letter on Printing and Distributing Minutes of Water Resources and Hydroelectric Project Design Reliability Theory Application Seminar*, Water Resources and Hydroelectricity Design Administration of Ministry of Water Resources restated the above principle and put up the idea that conditional large-scale projects could be analyzed and studied in the design with reliability theory, and be studied when the specification is revised again after accumulating experiences through project design practices till the condition permits.

The major contents of chapters in the revised SL282—2003 *Design Specification for Concrete Arch Dams* are:

- The selection of arch dam shape, the method of flood discharge and the arrangement of arch dam;
- Hydraulic design for flood discharge, energy dissipation and scour prevention;
- Load and load combination upon arch dam;
- The contents, methods and control standards of the stress analysis on arch dam;
- The antiskid stability, deformation stability and safety indexes of arch dam abutment;
- The excavation, grouting, seepage-proofing, drainage, and the treatment of fault and rock mass with weak structure of the dam foundation;
- The design of dam crest's arrangement, parting, corridors, water-stop, drainage and

other structures;

——The concrete materials, temperature control standards, and temperature control measures of the dam body;

——Safety monitoring design principles, monitoring items and monitoring facility layout.

The major revised and supplementary contents for Specification SD145—85 are as follows:

——Add the chapter of main terms and symbols, and remove Annex V of the previous specification;

——Add the preferred flood discharge method of the dam body for the flood discharge arrangement of the arch dam, and emphasize the influence of the project's geological factors on the arrangement of arch dam;

——Add use variable thickness, variable curvature and other arch shapes in the selection of arch dam shape, add the description of the relations between reasonable design of arch crown beam section and the arrangement of dam crest surface holes;

——Remove the content of “Remark ⑤” in the body of the previous specification on the arrangement of arch dam flood discharge, list other remarks in the explanation of articles, and add adverse influence of the flood discharge atomization shall be paid attention to;

——Separately list flood standards and discharge capacity in the hydraulic design, add the arrangement with a combination of various drainage buildings in flood discharge, and add the requirements on the combined energy dissipation methods adopted to discharge holes of the dam body;

——Add the design requirements of the application of artificial cushion pool for the energy dissipation and impingement prevention, and emphasize that the energy dissipater is responsible for solving the revetment and impingement prevention problems of the eroded phase of the river channel downstream;

——Add two basic load combinations and two special load combinations which include the normal design temperature rise;

——Emphasize that the results calculated according to finite element method shall also be regarded as the main standards of measuring the strength safety of the arch dam, and add the control standards for stress calculated according to finite element method;

——Define that for the arch dam under normal working state, there is no risk of skidding along the foundation surface, which will be lessened in the requirements on the design of controlling working condition;

——Add principles of the dam foundation treatment in karst regions and the requirements on impervious curtain; Relax the requirement of foundation surface evacuation on weathered depth of bedrock; Add the content that in the treatment of fault fracture zone and the weak interlayer, the dam body is better to be studied together with the batholiths; Supplement high-pressure cement grouting, high-pressure spraying and rinsing grouting and other treatment measures for the fault fracture zone;

——Emphasize the requirements on the minimum elevation of dam crest; Relax the set spacing of cross joints and longitudinal joints; Put up the construction methods of arc cross joint keyway type and plastic tube drawing; Add the requirements on fire-fighting; Have supplemented the requirements on dam body and basic water-stop;

——Remove the general functional requirements on the dam body concrete, and define that the labeling and partitioning design of the concrete shall focus on the strength control indexes; New temperature control computing method is used; Add the basis of the formulation of temperature control standards and temperature control measures; Define determining factors of thickness of the concrete lift; Supplement specific measures of temperature control;

——Change the name of the previous chapter “Observation Design” to “Safety Monitoring Design”; Remove the Annex IV of the original specification; Amend the characteristics division of observation tasks; Clearly stipulate the project monitoring scope, and supplement the principles which shall be obeyed in the safety monitoring design; Adjust the content of specific monitoring project; Add the layout requirements of main monitoring facilities.

Compulsory articles in this Specification are 1.0.2, 4.1.2, 4.4.4, 6.2.1, 6.3.1, 6.3.2, 6.3.3, 7.2.6, 7.2.7, Clause 1 of 8.4.5, 8.4.6, 8.6.6, 9.1.1, 9.2.5, 9.3.9, 10.1.3, 10.2.5, Clause 1 of 11.1.1, Clause 1 of 11.1.5, 11.2.2, which are identified in boldface.

This Specification is explained by: China Renewable Energy Engineering Institute of

Ministry of Water Resources

This Specification is mainly compiled by:

Shanghai Investigation, Design & Research Institute

Changjiang Investigation, Planning, Design and Research Institute of Changjiang

Water Conservancy Commission

Main drafters of this Specification:

Zhong Yuanqing Zhang Liangqian Liu Shikang Liao Renqiang

Miao Qinsheng Bo Baozhong Cao Quxiu Zhang Zhiqi

Chen Zaimin Fan Wuyi Zhang Zhiyong Tang Shuming

Hu Zhongping Wan Xuejun

## Contents

|      |  |    |
|------|--|----|
| 1    | General Provisions.....  | 10 |
| 2    | Main Terms and Symbols.....  | 12 |
| 2.1  | Main Terms.....  | 12 |
| 2.2  | Basic Symbols.....   | 14 |
| 3    | Arch Dam Arrangement .....   | 17 |
| 3.1  | General Rules .....  | 17 |
| 3.2  | Arch Dam Shape Selection .....   | 18 |
| 3.3  | Dam Flood Discharge Arrangements .....                                 | 19 |
| 3.4  | Other Arrangement Requirements .....                                   | 20 |
| 4    | Hydraulic Design.....  | 22 |
| 4.1  | General Principles.....  | 22 |
| 4.2  | Hydraulic Design for Release Structures.....                           | 22 |
| 4.3  | Hydraulic Calculation for Energy Dissipation and Erosion Control ..... | 25 |
| 4.4  | Other Relevant Hydraulic Designs .....                                 | 30 |
| 5    | Load and Load combination.....   | 33 |
| 5.1  | Load .....   | 33 |
| 5.2  | Load Combination .....   | 36 |
| 6    | Stress Analysis of Arch Dam .....                                      | 40 |
| 6.1  | Analysis Content .....   | 40 |
| 6.2  | Method of Analysis .....   | 41 |
| 6.3  | Control Indexes and Other Stipulations .....                           | 41 |
| 7    | Stability Analysis of Arch Dam Abutment.....                           | 44 |
| 7.1  | General Principles.....  | 44 |
| 7.2  | Anti-sliding Stability .....   | 45 |
| 7.3  | Deformation Stability and Others.....                                  | 47 |
| 8    | Dam Foundation Treatments.....   | 49 |
| 8.1  | General Rules .....  | 49 |
| 8.2  | Excavation of Dam Foundation .....                                     | 49 |
| 8.3  | Consolidation Grouting.....  | 50 |
| 8.4  | Anti-seepage Curtain.....  | 51 |
| 8.5  | Dam Foundation Drainage.....   | 54 |
| 8.6  | Processing of Fault Fracture Zone and Weak Intercalated Layer .....    | 54 |
| 9    | Arch Dam Construction.....   | 57 |
| 9.1  | Dam Crest Arrangements.....  | 57 |
| 9.2  | Transverse Joints and Longitudinal Joints.....                         | 58 |
| 9.3  | Corridor and Traffic in the Dam .....                                  | 59 |
| 9.4  | Sealing Up and Drainage of Dam.....                                    | 61 |
| 10   | Dam Concrete and Temperature Control.....                              | 63 |
| 10.1 | Dam Concrete .....   | 63 |
| 10.2 | Temperature control .....  | 63 |
| 11   | Safety Monitoring Design .....   | 68 |
| 11.1 | General principles .....   | 68 |
| 11.2 | Arrangement of Monitoring Programs and Main Monitoring Facilities..... | 69 |



|         |  |     |
|---------|--|-----|
| Annex A | Computational Formulas of Hydraulic Design .....                                     | 76  |
| Annex B | Load calculation Formula .....   | 87  |
| Annex C | The Calculation of Dam Body Temperature and Temperature Stress in Construction ..... | 104 |
|         | Terms and wording description of this Specification .....                            | 122 |

## **1 General Provisions**

**1.0.1** To meet the needs of the construction and development of concrete arch dam and to specify the requirements on concrete arch dam design, hereby formulate this Specification by revising SD145-85 *Design Specification for Concrete Arch Dams* to ensure project designs are safe and applicable, economical and reasonable, advanced in technology, and guaranteed in quality.

**1.0.2** The classification of concrete arch dam shall comply with the provisions in SL252-2000 *Standard for Classification and Flood Control of Water Resources and Hydroelectric Project*.

**1.0.3** This Specification is applicable to the design of concrete arch dam of Classification 1, 2 and 3 in water resources and hydroelectric junction. For the design of concrete arch dam of Classification 4 and 5, this Specification can be a reference. For the dam over 200m high or the arch dam project under special situations, special study shall be done.

**1.0.4** According to the height, concrete arch dams can be divided into low dam, medium dam and high dam. Low dam is less than 30m, medium dam is between 30m and 70m, and high dam is over 70m.

**1.0.5** According to the thickness to height ration, concrete arch dams can be divided into thin arch dam, medium thick arch dam and thick arch dam (or called as gravity-arch dam). The thickness to height ration of thin arch dam is less than 0.2, that of medium thick arch dam is between 0.2 and 0.35, and that of thick arch dam is over 0.35.

**1.0.6** In the concrete arch dam design, the following problems shall be paid attention to:

**1** Fully grasp the basic data related to meteorology, hydrology, sediment, topography, geology, seism, building materials, ecology, environmental protection, industrial hygiene, river planning, construction and application conditions, etc. in the dam construction area, especially engineering geological and hydrogeological conditions of the abutment of the damsite.

**2** Carefully analyze the stability and stress of arch dam and properly choose arch dam shape.



北京文心雕语翻译有限公司  
Beijing Lancarver Translation Inc.

---

---

---

**完整版本请在线下单/Order Checks Online for Full Version**

**联系我们/or Contact :**

TEL: 400-678-1309

QQ: 19315219 | Skype: Lancarver

Email : [info@lancarver.com](mailto:info@lancarver.com)

<http://www.lancarver.com>

---

---

**线下付款方式 :**

**I. 对公账户 :**

**单位名称 :** 北京文心雕语翻译有限公司

**开户行 :** 中国工商银行北京清河镇支行

**账 号 :** 0200 1486 0900 0006 131

---

---

**II. 支付宝账户 : [info@lancarver.com](mailto:info@lancarver.com)**

**III. Paypal: [info@lancarver.com](mailto:info@lancarver.com)**

---

---

注: 付款成功后, 请预留电邮, 完整版本将在一个工作日内通过电子 PDF 或 Word 形式发送至您的预留邮箱, 如需索取发票, 下单成功后的三个工作日内安排开具并寄出, 预祝合作愉快!

**NOTE** All documents on the store are in electronic Adobe Acrobat PDF format, there is not sell or ship documents in hard copy. Mail the order and payment information to [info@lancarver.com](mailto:info@lancarver.com), you will shortly receive an e-mail confirming your order.

---

