

ICS 27.140
CCS K 55

DL

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

DL/T 2020-2019

**Code of operation and maintenance for Pelton turbine
(English Translation)**

Issued on: June 4, 2019

Implemented on: October 1, 2019

Issued by: National Energy Administration

Table of Contents

Foreword

1 Scope

2 Normative references

3 Terms and definitions

4 Bucket turbine operation

4.1 General provisions

4.2 Normal operation and requirements

4.3 Operation

4.4 Operation monitoring

4.5 Inspection

4.6 Abnormal operation and accident handling

5 Bucket turbine maintenance

5.1 General provisions

5.2 Overhaul of bucket runner

5.3 Spindle maintenance

5.4 Overhaul of water guide bearing

5.5 Nozzle maintenance

5.6 Maintenance of the deflector

5.7 Overhaul of water distribution ring

5.8 Maintenance of auxiliary equipment

5.9 Maintenance test

Appendix A (informative appendix) List of technical documents and information for bucket turbine operation

Appendix B (informative appendix) Main items and requirements of inspection

Appendix C (informative appendix) Bucket turbine maintenance items

Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009 "Guidelines for Standardization Part 1: Standard Structure and Compilation".

1 Scope

This standard specifies the general regulations, operation monitoring, operation, inspection, failure and treatment of bucket turbine operation management;

General provisions of maintenance management, runner maintenance, spindle maintenance, water guide bearing maintenance, nozzle maintenance, deflector maintenance, water distribution ring pipe maintenance, Related requirements for ancillary equipment maintenance, test, etc.

This standard is applicable to vertical shaft water bucket turbines with a single unit capacity of 10 MW and above, horizontal and vertical shaft water bucket types with a single unit capacity of less than 10 MW.

Water turbines can be implemented by reference.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version applies to this article Pieces. For undated references, the latest version (including all amendments) is applicable to this regulation.

GB/T 2900.45 Electrician Terminology Hydropower Station Hydraulic Machinery Equipment
GB/T 8564 Technical Specification for Installation of Hydraulic Turbine Generator Set
GB/T 9652.1 Technical conditions of hydraulic turbine control system
GB/T 10969 Technical requirements for flow parts of hydraulic turbines, storage pumps and water pump turbines
GB 11120 turbine oil
GB/T 11805 Automatic components (devices) of hydraulic turbine generator sets and basic technical conditions of their systems
GB/T 14478 Basic technical requirements for inlet valves of large and medium-sized turbines
GB/T 15468 Basic technical conditions for hydraulic turbines
GB 26164.1 Electrical Safety Work Regulations Part 1: Heat and Machinery
GB 26860 Electrical Safety Work Rules for Electrical Parts of Power Plants and Substations
GB/T 32584 Evaluation of Mechanical Vibration of Hydropower Plants and Energy Storage Pumping Stations
DL/T 563 Technical specification for hydraulic turbine electro-hydraulic regulating system and device
DL/T 792 Regulations for operation and maintenance of hydraulic turbine regulating system and equipment
DL/T 1066 Management Guidelines for Equipment Maintenance of Hydropower Station
NB/T 47013.1 Non-destructive testing of pressure equipment Part 1: General requirements
NB/T 47013.2 Non-destructive testing of pressure equipment-Part 2: Radiographic testing
NB/T 47013.3 Non-destructive testing of pressure equipment-Part 3: Ultrasonic testing
NB/T 47013.4 Non-destructive testing of pressure equipment-Part 4: Magnetic particle testing

3 Terms and definitions

The following terms and definitions defined in GB/T 2900.45 apply to this document.

Intake pipe/flow shunt tube at the end of the penstock (or the short pipe downstream of the water inlet ball valve) and the nozzle assembly volute pipeline.

Water retaining cone the cylindrical cylinder body of the main shaft of the hydraulic turbine is prevented from being impacted by the water flow, and it is also the air supplement channel for the casing of the hydraulic turbine.

Flow leveling rake

The grid-like metal material platform located under the runner is used to eliminate the energy of water leakage and is used for the maintenance and repair of runners, nozzles and other parts Replacement work platform.

Deflector working

The deflector is in the water-retracting state or the water-retaining plate is in the water-blocking state, so that the nozzle jet is deflected and does not act on the water bucket.

Deflector unworking

The deflector is in a non-folding or water-retaining state, so that the nozzle jet can directly act on the bucket.

Main nozzle

The bucket turbine is the first to be turned on when it is started or does not switch with load changes during normal operation of the unit, and always remains at a given load Optimal opening of nozzles.

Nozzle shift point

In order to ensure the operation of the multi-nozzle bucket turbine in the high-efficiency zone, the working nozzle will increase or decrease its opening at a certain load change point.

Switching on and off, this load change value point is called the nozzle switching point.

4.1 General rules

4.1.1

The technical conditions and requirements of bucket-type turbines should meet the requirements of relevant parts of GB/T 15468; turbine automation components and systems it should meet the requirements of GB/T 11805; the turbine regulating system should meet

the requirements of relevant parts of GB/T 9652.1, DL/T 563, and DL/T 792;

The inlet ball valve at the front end of the turbine shall meet the requirements of GB/T 14478.

4.1.2

Operators should receive technical training and master the relevant skills of bucket turbine operation.

4.1.3

There should be an operation management system for equipment patrol inspection, regular test and rotation, defect management, etc.

4.1.4

The operation safety management of the water turbine shall comply with the relevant safety work regulations of GB 26164.1 and GB 26860.

4.1.5

The power station shall compile on-site operation regulations according to its own characteristics and establish necessary operation records. According to the collected operation data, regular Analyze the running state of the turbine.

4.1.6

There should be corresponding technical data for turbine operation. See Appendix A for the list of technical files and data.

4.2.1 Basic requirements for normal operation

- a) Bucket-type turbines should be operated within the range allowed by the design.
- b) During the operation of the turbine, its protection, signal and automatic devices should be normally turned on. The setting values of each protection, signal and automatic device shall be in accordance with regulations Set procedures.

4.2.2 No-load operation

- a) The bucket-type turbine is not suitable to run for a long time at low speed during the process from starting to no-load. The governor should be put into operation in accordance with the prescribed procedure Insert the corresponding nozzle and adjust its opening to make the unit reach and stabilize at the rated speed along the starting curve.
 - b) For single-nozzle-started water turbines, when the no-load operation time is long after starting, the vibration, swing and water guide shaft of the turbine should be strengthened.
- Support temperature monitoring.