

ICS 27.010
CCS F01



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

GB 32311-2015

**Minimum allowable values of energy efficiency and energy
efficiency grades for hydrogen producing systems by water
electrolysis**

水电解制氢系统能效限定值及能效等级

Issued on: December 10, 2015

Implemented on: January 1, 2017

**Issued by: General Administration of Quality Supervision, Inspection and
Quarantine of the People's Republic of China;
Standardization Administration of China**

Table of Contents

- 1 Scope
- 2 Normative references
- 3 Terms and definitions
- 4 Technical requirements
- 5 Test methods
- 6 Inspection rules
- Appendix A
- Appendix B

Foreword

4.3 of this Standard is mandatory. The rest are recommended. This Standard is drafted in accordance with the rules given in GB/T 1.1-2009. This Standard was proposed by Department of Resource Conservation and Environmental Protection of the NDRC and Department of Energy Conservation and Comprehensive Utilization of the MIIT. This Standard shall be under the jurisdiction of National Technical Committee 20 on Energy Fundamentals and Management of Standardization Administration of China (SAC/TC 20). Main drafting organizations of this Standard. China National Institute of Standardization, Suzhou Jingli Hydrogen Production Equipment Co., Ltd., The 718th Research Institute of CSIC, Tianjin Mainland Hydrogen Equipment Co., Ltd., China Electronics Engineering Design Institute, Sichuan Kintong New Material Co., Ltd., Suzhou Electrical Apparatus Science Academy Co., Ltd., Zhejiang Lihydrogen Energy Technology Co., Ltd. Main drafters of this Standard. Zhang Xiangchun, Zhang Bihang, Wang Geng, Zhou Zhenfang, Xue Helai, Xu Wei, Wu Jinlan, Li Yan, An Zhixing, Qian Youping, He Xiuming, Liang Baoming, Shuai Xingru. Minimum allowable values of energy efficiency and energy efficiency grades for hydrogen producing systems by water electrolysis

1 Scope

GB 32311-2015 is the Chinese national standard on minimum allowable values of energy efficiency and energy efficiency grades for hydrogen producing systems by water electrolysis, in the field of energy and heat transfer engineering. It carries no /T suffix, which in the Chinese system means compliance is mandatory: a product or a practice within its scope has to meet it to be lawfully made, sold or carried out in China. It was issued on 10 December 2015 by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China; Standardization Administration of China, and

has been in force since 1 January 2017. Classification: ICS 27.010, CCS F01. This page is published from the official record of the standard held by the Chinese standards administration: the identification, the dates, the classification and the issuing body are taken from there. The clause text, the tables and the numeric limits are in the document itself, which is delivered complete in English translation.

This Standard specifies the minimum allowable values of energy efficiency, evaluating values of energy conservation, energy efficiency grades, test methods, and inspection rules for hydrogen producing systems by water electrolysis (hereinafter referred to as hydrogen producing systems). This Standard applies to fixed or mobile hydrogen producing systems. The structure of water electrolyser is bipolar, press-filtration, pressure type; the output is ≥ 5 m³/h. This Standard does not apply to atmospheric-pressure hydrogen producing equipment by water electrolysis, small-scale hydrogen producing equipment with an output < 5 m³/h, solid polymer electrolyte electrolyser (SPE), and hydrogen-oxygen generator.

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the editions with the dates indicated are applicable to this document. For the undated references, the latest edition (including all the amendments) are applicable to this document.

GB/T 19774 Specification of water electrolyte system for producing hydrogen

GB/T 24499 Technology glossary for gaseous hydrogen, hydrogen energy and hydrogen energy system

3 Terms and definitions

The terms and definitions defined in GB/T 24499 and the following ones apply to this document.

3.1 Specific energy consumption values for hydrogen producing systems by water electrolysis

3.2 The energy efficiency values for hydrogen producing systems by water electrolysis The ratio OF the theoretical specific energy consumption values TO the actual specific energy consumption values for hydrogen producing systems operating under rated working condition.

3.4 The evaluating values of energy conservation for hydrogen producing systems by water electrolysis The minimum allowable energy efficiency values for energy-conservation hydrogen producing systems under rated working condition.

4 Technical requirements

4.1 Basic requirements The hydrogen producing systems by water electrolysis to which this Standard applies shall comply with the requirements of GB/T 19774.

4.2 Energy efficiency grades The energy efficiency grades for hydrogen producing systems are divided into 3 grades.

4.4 Evaluating values of energy conservation The evaluating value of energy conservation for hydrogen producing systems is energy efficiency grade 2 in Table 1.

5 Test methods

5.1 The specific energy consumption values for hydrogen producing systems retain one decimal place. The energy efficiency value is an integer.

5.3 The technical indicators of raw material water and lye used for energy efficiency test shall comply with the relevant requirements of GB/T 19774.

5.4 For requirements for the grade of test instruments, the DC ammeter and ampere-voltage meter are not lower than Grade 0.5; other instruments are not lower than Grade 1.

5.5 The number of tests per unit DC energy consumption should not be less than 6 times. The interval is 10 min. TAKE the average.

5.7 Based on the measured DC current value and the number of cells of the electrolyser, according to Appendix A, calculate the hydrogen output of hydrogen producing systems.

5.8 Based on the measured DC voltage value and the number of cells of the electrolyser, according to Appendix B, calculate the electrolyser's average cell voltage and unit DC energy consumption.

5.9 Based on the measured electric power for lye pump, make-up water pump, and the control, according to Appendix B, calculate the unit AC energy consumption of hydrogen producing systems. The unit DC energy consumption plus the unit AC energy consumption obtains the specific energy consumption values for hydrogen producing systems.

6 Inspection rules

6.1 The energy efficiency test of the product may be carried out at the manufacturer or the user. If the measured value of energy efficiency meets the specified requirements, it is regarded as a qualified product; otherwise it is regarded as an unqualified product.

6.2 The test of energy efficiency grade for the product shall be carried out before the product's commissioning and acceptance. When the user and the manufacturer have objection to the test of energy efficiency grade for the product, it may be arbitrated by a

third-party professional institution with relevant qualifications.

Appendix A

(Normative) Calculate gas output by measured current value A.1 Principle summary According to the law of electrolysis - The change in quantity of any substance in the electrolysis process obeys Faraday's law. A.2 Faraday's law when producing hydrogen by water electrolysis Under a standard state, 1 mol of water can be electrolyzed using 2×96500 C of electric quantity to produce 1 mol of hydrogen and

0.5 mol of oxygen. The volume of 1 mol of hydrogen under the standard state is 22.43×10^{-3} m³. Therefore, under the standard state, the theoretical electric quantity required to produce 1 m³ of hydrogen is that of formula (A.1).

Appendix B

(Normative) Calculation of specific energy consumption value B.1 Calculation of specific energy consumption value W The specific energy consumption value W consists of two parts, i.e. the DC unit energy consumption value W_d and the AC unit energy consumption value W_a . B.2 Calculation of DC unit energy consumption value W_d B.3 Calculation of AC unit energy consumption value W_a The power of AC electricity consists of 3 parts. P_1 , P_2 , and P_3 . AC unit energy consumption value W_a is calculated according to (B.3).