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

NB/T 47066-2018

Thermal performance test method for condensing boiler

冷凝锅炉热工性能试验方法

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Foreword

This document was issued on 6 June 2018 by the National Energy Administration of the PRC and takes effect on 1 October 2018.

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 27.060.30, Chinese classification J 98.

This standard has been drafted in accordance with the rules given in GB/T 1.1-2009, Directives for standardization - Part 1: Structure and drafting of standards.

This standard was proposed by and is under the jurisdiction of the National Technical Committee on Boilers and Pressure Vessels of Standardization Administration of China (SAC/TC 262).

Drafting organizations of this standard: China Special Equipment Inspection and Research

Institute; Harbin Institute of Technology; Shenyang Special Equipment Inspection and Research Institute; Shandong Special Equipment Inspection and Research Institute; Jiangsu Special Equipment Safety Supervision and Inspection Institute; Ningbo Special Equipment Inspection and Research Institute; Shanghai Power Equipment Complete Design and Research Institute Co., Ltd.; Shanghai Industrial Boiler Research Institute Co., Ltd.; Jiangsu Shuangliang Boiler Co., Ltd.; Zhejiang Tefu Boiler Co., Ltd.; Xi'an Jinniu Co., Ltd.; Harbin Hongguang Boiler Group Co., Ltd.; China Energy Conservation Technology Investment Co., Ltd.

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This standard is issued for the first time.

This standard was approved by the National Energy Administration on 6 June 2018 under Announcement No. 8 of 2018, which released 87 industry standards, comprising 47 energy standards (NB) and 40 electric power standards (DL), and it entered into force on 1 October 2018.

1 Scope

NB/T 47066-2018 is the Chinese method for testing the thermal performance of condensing boilers. A condensing boiler is designed to cool the flue gas below the dew point of the water vapour in it, recovering the latent heat that an ordinary boiler sends up the stack - which is why its efficiency can be quoted above one hundred per cent on the lower heating value, and why measuring that efficiency honestly requires a defined method. The standard sets the scope, the normative references and the full set of terms and symbols with their units, then the general requirements: the condition of the boiler before test, the stabilisation period, the permitted variation of the operating parameters during the test, and the duration and number of runs. It specifies the measurements to be taken - fuel flow and its analysis, air and flue gas flow, temperatures at each point, oxygen and carbon dioxide in the flue gas, condensate flow and its temperature, water flow and the inlet and outlet temperatures, and the ambient conditions - with the instruments to be used and the accuracy required of each. The calculation of efficiency by the input-output method and by the heat loss method is given step by step, including the treatment of the latent heat recovered, followed by the uncertainty analysis, the correction to reference conditions, and the content of the test report. Note the printed English carries a typographic error, boiler for boiler, in clause 3.1.1.

1.1 This standard specifies the test requirements, the instruments, meters and test methods, the calculation of results, the corrections, the uncertainty analysis and the requirements for the test report for the thermal performance test of condensing boilers.

1.2 This standard is applicable to condensing boilers fired with natural gas. Other gas-fired boilers, and boilers in which condensation occurs, may be tested by reference to this standard.

The standard therefore covers the complete chain of a thermal performance test: what has to be established before the test, what has to be measured during the test, how the measured quantities are converted into efficiency figures, how those figures are corrected to the guarantee conditions, how the uncertainty of the result is evaluated, and what has to be recorded in the report.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including all amendments) applies.

GB/T 2624.2, Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice plates.

GB/T 2624.3, Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 3: Nozzles and Venturi nozzles.

GB/T 8174, Testing and evaluating method of the thermal insulation effect for equipment and pipes.

GB/T 10184, Performance test code for utility boilers.

GB/T 13610, Analysis of natural gas composition - Gas chromatography.

JJF 1059.1, Evaluation and expression of uncertainty in measurement.

3 Terms and definitions

3.1 Terms and definitions. The following terms and definitions apply to this document.

3.1.1 condensing boiler - a boiler in which the water vapour contained in the flue gas condenses continuously and thereby releases its latent heat of vaporization. (The English entry is printed on the page as condensing boiler, which is a typographical error in the original for condensing boiler.)

3.1.2 input energy - the whole of the chemical energy that can be obtained from the fuel.

3.1.3 output energy - that part of the heat which is absorbed by the working medium and which is not recovered within the boiler system.

3.1.4 reference temperature - the temperature taken as the starting point for calculating the sensible heat, and the losses of heat, of the material streams entering and leaving the boundary of the boiler system. Note: in this standard the reference temperature is taken as

25 degrees Celsius.

3.1.5 input-output method - the method of determining the thermal efficiency of a boiler by measuring the input heat and the output heat directly; it is also called the direct, or positive balance, method of measurement.

3.1.6 energy balance method - the method of determining the thermal efficiency of a boiler by examining in detail all the heat entering and leaving the boiler system; it is also called the indirect method of measurement, or the heat loss method.

3.1.7 measurement precision - the closeness of agreement between the indications, or the measured values, obtained by repeated measurement on the same or on similar objects under specified conditions; abbreviated as precision.

3.1.8 experimental standard deviation - the quantity characterizing the dispersion of the results of a set of n measurements of the same measurand.

3.1.9 measurement uncertainty - the parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand; abbreviated as uncertainty.

3.1.10 standard uncertainty - the uncertainty of measurement expressed as a standard deviation.

3.1.11 type A evaluation of measurement uncertainty - the evaluation of a component of measurement uncertainty by a statistical analysis of the measured quantity values obtained under specified measurement conditions; abbreviated as type A evaluation.

3.1.12 type B evaluation of measurement uncertainty - the evaluation of a component of measurement uncertainty by means other than a type A evaluation of measurement uncertainty; abbreviated as type B evaluation.

3.1.13 combined standard uncertainty - the standard measurement uncertainty of the output quantity obtained from the standard measurement uncertainties of the input quantities in a measurement model.

3.1.14 relative standard uncertainty - the standard uncertainty divided by the absolute value of the measured value.

3.1.15 expanded uncertainty - the product of the combined standard uncertainty and a numerical factor greater than one.

3.1.16 coverage interval - the interval containing a set of values of the measurand, determined on the basis of the information available, within which the value of the measurand lies with a stated probability.

3.1.17 coverage probability - the probability that the set of values of the measurand is contained within the stated coverage interval.