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Analysis of water used in boiler and cooling system -

General rule

锅炉用水和冷却水分析方法 通则

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Analysis of water used in boiler and cooling system - General rule

1 Scope

This document specifies the general requirements for water quality analysis methods of water used in boiler and cooling system, including general regulations, laboratory requirements, the expression method of solution concentration and the expression method of analysis results.

This document applies to the quality analysis of water used in boiler and cooling system.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the version corresponding to that date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB/T 601, Chemical reagent - Preparations of reference titration solutions

GB/T 602, Chemical reagent - Preparations of standard solutions for impurity

GB/T 603, Chemical reagent - Preparations of reagent solutions for use in test methods

GB 3100, The international system of units and its application

GB 3101, General principles concerning quantities, units and symbols

GB/T 3358.2, Statistics - Vocabulary and symbols - Part 2: Applied statistics

GB/T 6682-2008, Water for analytical laboratory use - Specification and test methods

GB/T 8170, Rules of rounding off for numerical values & expression and judgment of limiting values

GB/T 14666, Terms for analytical chemistry

GB/T 33087-2016, Ultra-pure water for instrumental analysis specification and test methods

3.6

reproducibility limit

R

Under reproducibility conditions, there is a 95% probability that the absolute difference between the two test results is less than or equal to this number.

[Source: GB/T 3358.2-2009, 3.3.14, modified]

4 General provisions

4.1 Measurement units and symbols

The units and symbols used in the analysis methods (referred to as "methods") for water used in boiler and cooling system shall comply with the provisions of GB 3100 and GB 3101.

4.2 Selection of test methods

Appropriate analytical methods shall be selected according to the content range and accuracy requirements of the substance to be tested in the water quality to be determined.

4.3 Reagents or materials

4.3.1 The purity of reagents used for analysis shall meet the requirements of water and steam quality analytical methods. The reagents used in the method, unless otherwise specified, shall be of analytical reagents and above.

4.3.2 The reference titration solution, impurity standard solution, preparation and product required in the method shall be prepared and stored in accordance with the provisions of GB/T 601, GB/T 602 and GB/T 603 unless other provisions are specified.

4.3.3 The water in the method refers to the test water used for preparing solutions, washing instruments, diluting water samples and doing blank tests. When no other requirements are specified, it refers to the grade-3 water that meets the requirements of GB/T 6682-2008.

4.3.4 According to different measurement ranges of the method, the trace component analysis shall use the grade-2 water or above according to the method requirements, and the micro and macro component analysis shall use the grade-2 or grade-3 water according to the method requirements. For trace instrumental analytical methods, use high-purity water in accordance with GB/T 33087-2016 if necessary.

4.3.5 When it's not indicated which solution is used, it refers to the aqueous solution.

4.4 Blank test

4.6.1 Before the water sample analysis, the characteristics such as color, odor, transparency, and the presence or absence of precipitation shall be observed and recorded.

4.6.2 Unstable items such as pH value, hydrazine content, chemical oxygen consumption, and nitrite content shall be measured as soon as possible after sampling, and other items shall be measured within 72 hours.

4.6.3 The turbid water sample shall be mixed evenly and divided into two water samples, where for the first one, take the upper clarified liquid to measure pH value, nitrite and other unstable items, and filter to measure chloride, nitrate and other items. For the second one, after mixing it evenly, immediately measure the chemical oxygen consumption, and measure items such as silica, iron, calcium and magnesium.

5 Laboratory requirements

5.1 Laboratory environment

The laboratory environment shall be clean and well ventilated; the temperature and humidity shall meet the test requirements; measures such as dustproof, shockproof, anti-electromagnetic and anti-pollution shall be taken when necessary.

5.2 Laboratory facilities

5.2.1 The laboratory shall be equipped with instruments and equipment that meet the testing requirements according to the measured water quality characteristics. Laboratories engaged in trace analysis shall be equipped with special utensils.

5.2.2 The laboratory instruments shall be regularly verified or calibrated and checked during the period according to the metrological requirements. The volume calibration of glassware shall be carried out in accordance with the glassware calibration procedure.

5.2.3 The laboratory shall be equipped with safety protective devices and facilities.

5.3 Laboratory management system

5.3.1 The laboratory shall establish a system that can ensure the normal working order of the laboratory and the reliability of analytical data, including sampling, sample circulation, operating procedures, verification and review of analytical data, instrument use system and storage system for original records, inspection reports and other data files.

5.3.2 When toxic and harmful chemical reagents (such as mercury, hydrofluoric acid, toxic organic reagents, etc.) are used in the laboratory, strict protective measures shall be taken in accordance with the Material Safety Data Sheet (MSDS) of the reagents.

5.3.3 The laboratory shall manage precursors and explosives in accordance with the requirements of the relevant departments.

5.3.4 The laboratory shall have measures and procedures for the safe handling and disposal of laboratory waste chemicals.

6 Expression method of solution concentration

6.1 Mass concentration of substances

It refers to the amount of solute-containing substances per liter of solution. The concentration of the standard titration solution and the reference solution shall be expressed as the mass concentration of the substance, expressed in moles per liter (mol/L), and indicated with the elementary unit.

6.2 Volume by volume concentration

If the solution is prepared by dilution with another specific solution, it shall be expressed as follows:

- "Diluted $V_1 \rightarrow V_2$ " means that a specific solution of volume V_1 is diluted to a final mixture of total volume V_2 ;
- " $V_1 + V_2$ " means that a specific solution of volume V_1 is added to a solvent of volume V_2 .

6.3 Mass concentration

The concentration expressed in terms of the mass of an element, ion, compound or functional group contained in a unit volume of solution, in grams per liter (g/L) or its submultiples.

7 Expression method of analysis results

7.1 Calculation of analysis result

According to the mass or volume of the sample to be tested, the data obtained from the measurement and the relevant measurement relationship in the analysis process, calculate the content of the tested component in the sample.

7.2 Rounding up of significant figures

When calculating the analysis results, the significant figures shall be rounded and calculated in accordance with the provisions of GB/T 8170.

7.3 Expression of precision

The expression of precision should be carried out in accordance with the provisions of Appendix B of GB/T 20001.4-2015. The repeatability determinations performed by the same laboratory shall be expressed as follows:

- Take the arithmetic mean of the parallel determination results as the determination result; the absolute difference between the parallel determination results shall not be larger than ...;
- Take the arithmetic mean of the parallel determination results as the determination result; the relative deviation of the parallel determination results shall not be greater than ...%;
- The absolute difference between two independent test results that are obtained by independently testing the same test object within a short period of time, in the same laboratory, by the same operator using the same equipment, according to the same test method, shall not be greater than ...% of the arithmetic mean of the two measured values.

7.4 Number of determinations

In general, the arithmetic mean of two parallel determinations shall be taken as the reported value of the analysis result:

- When the absolute error of the results of the two parallel determinations exceeds the allowable error, perform the third determination;
- When the absolute error between the third measured value and the first two measured values is less than the allowable error, take the arithmetic mean of the three measured values as the reported value of the analysis result;
- When the absolute error between the third measured value and any of the previous two measured values is less than the allowable error, take the arithmetic mean of the two values as the reported value of the analysis result, and discard the other determination data;
- When the absolute error between the three parallel determination exceeds the allowable error, discard all the data, and perform the determination again after finding the cause.

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