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NATIONAL ENVIRONMENTAL PROTECTION STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

HJ/T 101-2019

Replacing HJ/T 101-2003

Technical specifications and test procedures for water quality on-line automatic monitoring equipment of ammonia

氨氮水质在线自动监测仪技术要求及检测方法

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Table of Contents

Foreword	3
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 Technical specifications	9
5 Performance indexes and test methods	13
6 Operating manual	22

Technical specifications and test procedures for water quality on-line automatic monitoring equipment of ammonia

1 Scope

This Standard specifies the technical specifications, performance indexes and test methods for water quality on-line automatic monitoring equipment of ammonia.

This Standard applies to guiding production and design, guiding to application type-selection and implementing performance test.

The measuring range of water quality on-line automatic monitoring equipment of ammonia shall include 0.1 mg/L ~ 150 mg/L, which can satisfy the monitoring requirements for underground water, surface water, domestic wastewater and industrial wastewater.

2 Normative references

This Standard referenced the following documents or clauses therein. For undated references, the latest edition of the referenced documents (including all amendments) applies to this document.

GB/T 9969, *General principles for preparation of instructions for use of industrial products*

GB/T 13306, *Plate*

HJ 212, *Data transmission standard for online monitoring systems of pollutant*

HJ 535, *Water quality – Determination of ammonia nitrogen – Nessler reagent spectrophotometry*

HJ 536, *Water quality-Determination of ammonia nitrogen – Salicylic acid spectrophotometry*

expressed as relative standard deviation, provided that no unplanned artificial maintenance and correction is carried out for instruments.

3.7

low level drift in 24 h

The mean value of the deviation absolute value between measured value and initial value of instruments for the continuous measurement (0 ~ 20%) of upper limit of the test range of a low concentration reference solution at specified periods, provided that no unplanned artificial maintenance and correction is carried out for instruments.

3.8

high level drift in 24 h

The percentage of the mean value, in relation to the upper limit of the test range (80% ~ 100%), of the deviation absolute value between measured value and initial value of instruments for the continuous measurement (0 ~ 20%) of upper limit of the test range of a high concentration reference solution at specified periods, provided that no unplanned artificial maintenance and correction is carried out for instruments.

3.9

memory effect

The degree of interference of the residues in the tubes of instruments on the next result of measurement after the measurement of some reference solution or sample using instruments.

3.10

interference of voltage

The deviations of measured values, which are obtained in the measurement of the same reference solution using instruments under different supply voltages, from measured value under reference voltage (220 V).

3.11

interference of pH

The deviation of measured values, which are obtained from the measurement of a reference solution using instruments under different pH values, from measured value from the measurement of a neutral reference solution (pH = 7).

3.12

management, data and running log query and output, and so on; meanwhile, they have such functions as sample reservation triggering sampling. Control units are capable of providing corresponding communication protocols when performing the above-mentioned functions, and such communication protocols satisfy the requirements of HJ 212.

4.2 Environmental conditions for service

Environmental temperature: 5°C ~ 40°C;

Relative humidity: 65% ± 20%;

Supply voltage: alternating voltage 220 V ± 22V;

Supply frequency: 50 Hz ± 0.5 Hz;

Water sample temperature: 0°C ~ 50°C.

4.3 Appearance requirements

4.3.1 The marking of instruments shall be as specified in GB/T 13306. Plates shall be affixed to an appropriate, visible position. Plates shall include the following content:

- a) category of power supply;
- b) name and address of manufacturer;
- c) name and specifications of instruments;
- d) factory number;
- e) manufacturing date;
- f) test range and limit of quantitation;
- g) limit of quantitation;
- h) environmental conditions for service.

4.3.2 The monitor shall be free from stains and damages. All display interfaces shall be in Chinese and the characters uniform and clear; the screen shall be free from dark corners, black spots, rainbows, bubbles, flickers, etc.; it is capable of finishing all operations according to the instructions of the monitor.

4.3.3 The enclosure shall be made of corrosion resistant materials; the surface shall be free from crack, deformation, contamination, burr, etc.; the coating of the surface shall be uniform, without corrosion, rust, shedding or abrasion.

4.4.4.2 The output signals of test modules shall be stable.

4.4.4.3 Signal converters shall have the function to convert measured values into a corresponding quantity of electric signals (4 mA ~ 20 mA DC or RS232/RS485 interfaces).

4.4.4.4 The test period shall not be greater than 60 min.

4.4.5 Control units

4.4.5.1 They shall have the timed test function.

4.4.5.2 They shall have the manual and automatic cleaning function for the units including sample introduction/measurement, physical/chemical pretreatment and analysis and test.

4.4.5.3 They shall have the manual and automatic correction function; they are capable of setting automatic correction period.

4.4.5.4 They shall have the automatic reference sample inspection function.

4.4.5.5 If they have multiple measuring ranges, they shall have the automatic measuring range switching function; instruments display the final results of measurement.

4.4.5.6 They shall be capable of automatic acquisition, storage, processing, query, display, output, etc. of all data, instruments' parameters and running logs.

4.4.5.7 They shall store initial data and running logs for at least 12 months.

4.4.5.8 They shall have the function to add marks for different test data; the specific marks shall be as specified in HJ 212.

4.4.5.9 The unit of measured results of instruments shall be mg/L, which shall be rounded off to the second decimal place.

4.4.5.10 They shall have the digital quantity communication interfaces; output instructions, relevant data and running logs through the digital quantity communication interfaces; can receive the remote control instructions of the platform, at least including remote start, remote time setting function.

4.4.5.11 Data transmission shall be accompanied by communication protocols, as specified in HJ 212.

4.4.5.12 They shall realize the serial port output and internet access output of monitored data.

of ammonia standard stock solution.

5.3.3 Other reagents: to be provided by the manufacturer of instruments.

5.4 Test preparation and correction

5.4.1 Check all parts of instruments; adjust instruments to the normal working condition.

5.4.2 Check all reagents of instruments; ensure they are sufficient and that their quality is as specified.

5.4.3 After switching on, preheat in accordance with the preheating time specified in the operating manual provided by the manufacturer of instruments, making all parts function stably.

5.4.4 In accordance with the correction method specified in the operating manual provided by the manufacturer of instruments, use ammonia standard stock solution (5.3.2) to prepare standard solution of the concentration specified for instruments.

5.5 Test method for basic test range

5.5.1 Indication error

During the normal running period of instruments, test three standard solutions of ammonia concentrations about 2 mg/L, 5 mg/L and 8 mg/L; test each solution consecutively for n ($n = 6$) times; calculate the relative error of the mean value of the n ($n = 6$) measured values in relation to the concentration of standard solution. Calculate the indication error Re for each time.

$$Re = \frac{\bar{x} - \rho}{\rho} \times 100\% \quad (1)$$

where, Re – the indication error, in %;

$\bar{x}$ – the mean value of n measurements for each concentration, in mg/L;

ρ – the concentration of ammonia standard solution, in mg/L.

5.5.2 Limit of quantitation

During the normal operating period of instruments, test standard solution of ammonia concentration about 0.1 mg/L for n ($n = 7$) times; in accordance with Equation (1), calculate the indication error Re of n ($n = 7$) measured values; in accordance with Equation (2), calculate the standard deviation S of the n ($n = 7$) measured values; in accordance with Equation (3), calculate the limit of quantitation of instruments LOQ .

where, T – the memory effect, in mg/L;

X_i – the measured value of the i^{th} measurement, in mg/L.

5.5.7 Interference of voltage test

During the normal operating period of instruments, use standard solution of ammonia concentration about 8 mg/L to carry out measurement for 3 times under the initial voltage 220 V; adjust the voltage to 242 V and measure the same standard solution for 3 times; adjust the voltage once again to 198 V and measure the same standard solution for 3 times. Use the mean value of 3 measured values under 220 V; in accordance with Equation (8), calculate respectively the relative error ΔV of the mean value V_i of 3 measured values under 242 V and 198 V, in relation to V_s ; use the larger absolute value as the value of interference of voltage test.

$$\Delta V = \frac{V_i - V_s}{V_s} \times 100\% \quad (8)$$

where, ΔV – the interference of voltage, in %;

V_i – the mean value of 3 measured values under some voltage, in mg/L;

V_s – the mean value of 3 measurements under 220 V, mg/L.

5.5.8 Interference of pH test

During the normal operating period of instruments, use standard solution of ammonia concentration about 5 mg/L; adjust the pH value of standard solution to 4 and 9; use instruments to measure respectively the original standard solution, the standard solution of pH 4 and the standard solution of pH 9, for 3 times. Use the mean value of 3 measured values of the original standard solution as A_s ; in accordance with Equation (9), calculate interference of pH ΔA under different pH conditions; take the largest absolute value as the value of interference of pH test.

$$\Delta A = \frac{A_i - A_s}{A_s} \times 100\% \quad (9)$$

where, ΔA – the interference of pH, in %;

A_i – the mean value of 3 measured values under some pH condition;

A_s – the mean value of 3 measurements of the original standard solution.

5.5.9 Interference of environmental temperature test

where, $\overline{A}$ – the mean value of the relative error's absolute value of the water samples, in %;

$\overline{a}$ – the mean value of the absolute error's absolute value of the water samples, in mg/L;

X_i – the value of the water samples measured for the i^{th} time using water quality on-line automatic monitoring equipment of ammonia, in mg/L;

$\overline{B}$ – the mean value of the water samples using the manual method, in mg/L;

n – the number of measurements of the water samples using water quality on-line automatic monitoring equipment of ammonia;

i – the i^{th} time using water quality on-line automatic monitoring equipment of ammonia to measure the water sample.

5.5.11 Minimum period between maintenance periods

During the whole test period of instruments, the interval between any two maintenance operations of instruments (including dumping waste liquids, adding reagents, changing measuring ranges and other repairs and maintenance) shall be ≥ 168 h.

5.5.12 Data availability

During the whole test period of the basic test range, the data available is as follows:

- a) when instruments are used to carry out the test of the items specified in this Standard (excluding the interference of environmental temperature), the indicated values for the performance of measurements shall satisfy the requirements for all indexes of Table 1 in this Standard (excluding the data availability indexes);
- b) when instruments are used to carry out the test beyond the items specified in this Standard, instruments shall be used to measure the standard solution of some certain concentration. The measured values shall satisfy the requirement that the indication error is within the range of $\pm 10\%$.

Those, which fail to satisfy the above-mentioned clauses or lacks data, are invalid values. The percentage of the size of actual data available (excluding the interference of environmental temperature), in relation to the size of all data (excluding the interference of environmental temperature) which shall be obtained during the test period, is the data availability. For calculation method, see Equation (13).

$$D = \frac{D_e}{D_t} \times 100\% \quad (13)$$

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