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HY/T 271—2018

Methods for testing marine multi-parameter water-quality monitoring instruments

海洋多参数水质仪检测方法

(English Translation)

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Foreword

SAC/TC 283 is in charge of this English translation. In the case of any doubt about the contents of the English translation, the Chinese original shall be considered authoritative. This standard is drafted in accordance with the rules given in GB/T 1.1-2009.

This standard was proposed and drafted by the National Center of Ocean Standards and Metrology, Nankai University, and prepared by the Technical Committee SAC/TC 283 ocean.

Methods for testing marine multi-parameter water-quality monitoring instruments

1 Scope

This standard specifies the technical requirements of marine multi-parameter water-quality monitoring instruments (hereinafter referred to as “water-quality monitoring instrument”), and the test items, test equipment and test methods of water-quality monitoring instruments.

This standard is applicable to the testing of the water-quality monitoring instrument and its matching sensors.

2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this standard. For dated references, subsequent amendments or revisions of any of these publications do not apply to this standard. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. The latest edition of the normative document referred to applies to undated references.

GB 17378.4-2007 The specification for marine monitoring - Part 4: Seawater analysis

HY/T 096-2007 Test method of seawater dissolved oxygen analyzer

HY/T 098-2007 Test method of seawater pH analyzer

HY/T 100-2007 Test method of seawater turbidity analyzer

HY/T 126-2009 Multiparameter water quality monitor

HY/T 268-2018 Test method of ocean temperature measuring instrument

JJF 1571-2016 Calibration specification for seawater turbidity analyzers

JJG 763-2002 CTD measuring instrument

ASTM D1498 Standard test method for oxidation-reduction potential of water

UNESCO NO.39 Oceanographic science and technology literature of UNESCO: International oceanographic tables, Vol. 3

3 Terms and Definitions

For the purpose of this document, the terms and definitions given in HY/T 008 and the following apply.

3.1 Multi-parameter water-quality monitor

A device used for marine field measurement of multiple water-quality parameters such as

seawater temperature, conductivity, dissolved oxygen (DO), pH, turbidity and oxidation-reduction potential (ORP).

Note: Modify the HY/T 126-2009, Definition 3.1.

4 Technical Requirements

4.1 Appearance and power-on check

Appearance and power-on check requirements of the water-quality monitoring instrument are:

a) The shell of the water-quality monitoring instrument, the paint coat and cladding layer of the surface shall have no evidence of obvious abrasion, rust corrosion, and the nameplate shall be clear and indicate specification and model, factory number, manufacturer and other information.

b) The electrode leads connections of the water-quality monitor shall be reliable, and the fasteners and connectors shall not be loose.

c) The accessories of the water-quality monitoring instrument shall be complete, including optical disks and technical documents.

d) Sensors of the water-quality monitor shall be reliable, and shall work normally after being powered on.

4.2 Metrological performance

The metrological performance indexes of conductivity and turbidity are added according to Table 1 from HY/T 126-2009. The metrological performance indexes of water-quality monitoring instrument are found in Table 1.

Table 1 Metrological Performance of Water-quality Monitor

Parameter	Measurement range	Maximum permissible error		
		Level 1	Level 2	Level 3
Temperature	(0～35) ℃	± 0.05 ℃	± 0.1 ℃	± 0.2 ℃
Conductivity	(0～65) mS/cm	± 0.08 mS/cm	± 0.17 mS/cm	± 0.33 mS/cm
pH	2～12	± 0.1	± 0.2	± 0.3
DO	(0～15) mg/L	± 0.2 mg/L	± 0.3 mg/L	± 0.5 mg/L
Turbidity	(0～1000) NTU	± 5%	± 10%	± 15%
ORP	(-1000～1000) mV	± 20 mV	± 25 mV	± 30 mV
Note: Convert between conductivity and salinity according to the formula in Annex A.				

5 Test Items

The test items of the water-quality monitoring instrument are:

a) Appearance inspection.

b) Indication error.

6 Test Equipment

The standard equipment used to test the water-quality monitoring instrument is given in Tables 2–7.

Table 2 Standard equipment used to test water-quality monitoring instrument (temperature)

Test equipment standard substance	Measurement range	Uncertainty/accuracy class /maximum permissible error (MPE)
Precision thermodetector	(-5 - 40) °C	MPE: ± 0.01 °C
Thermostatic seawater tank	(-2 - 40) °C	Temperature field uniformity: ≤ 0.01 °C Temperature fluctuation: ≤ 0.01 °C

Table 3 Standard equipment used to test water-quality monitoring instrument (conductivity)

Test equipment/standard substance	Measurement range	Uncertainty/accuracy class /MPE
Precision thermodetector	(-5 - 40) °C	MPE: ± 0.01 °C
Thermostatic seawater tank	(-2 - 40) °C	Temperature field uniformity: ≤ 0.01 °C Temperature fluctuation: ≤ 0.01 °C
Laboratory salinometer	Salinity: 2 - 42	MPE: ± 0.005
Chinese series standard seawater	Salinity: 35	Expanded uncertainty, U = 0.003; coverage factor, k = 2

Table 4 Standard equipment used to test water-quality monitoring (pH)

Test equipment/standard substance	Measurement range	Uncertainty/accuracy class /MPE
Precision thermodetector	(-5 - 40) °C	MPE: ± 0.01 °C
Thermostatic seawater tank	(-2 - 40) °C	Temperature field uniformity: ≤ 0.01 °C Temperature fluctuation: ≤ 0.01 °C
Potassium acid phthalate	4.00 (25 °C)	Expanded uncertainty, U = 0.01; coverage factor, k = 3
Mixed phosphate	6.86 (25 °C)	Expanded uncertainty, U = 0.01; coverage factor, k = 3
Borax	9.18 (25 °C)	Expanded uncertainty, U = 0.01; coverage factor, k = 3
Note 1: Unless otherwise specified, the water used in this standard is deionized water or pure water of equivalent conductivity. Note 2: The pH standard buffer solution may be purchased directly or be prepared according to the requirements of certificate reference material.		

Table 5 Technical index of standard equipment used to test water-quality monitor (DO)

Test equipment/standard substance	Measurement range	Uncertainty/accuracy class /Maximum Permissible Error (MPE)
Precision thermodetector	(-5 - 40) °C	MPE: ± 0.01 °C
Thermostatic seawater tank	(-2 - 40) °C	Temperature field uniformity: ≤ 0.01 °C Temperature fluctuation: ≤ 0.01 °C
Electronic balance	(0 - 220) g	①
DO burette	(0 - 25) mL	MPE: ± 0.05 mL
Note: Unless otherwise specified, all reagents used in this standard are analytically reagent (AR), and deionized water or equivalent conductivity of pure water is used.		

Table 6 Technical index of standard equipment used to test water-quality monitor (turbidity)

Test equipment/standard substance	Measurement range	Uncertainty/accuracy class /maximum permissible error
Formazine turbidity solution	4000 NTU	Expanded uncertainty, U = 2%; coverage factor, k = 2
Electronic balance	(0－220) g	①
Pipette	10 mL, 50 mL and 100 mL	Grade A
Note 1: Unless otherwise specified, all chemical reagents used in this standard are AR, and deionized water or equivalent conductivity of pure water is used. Note 2: The turbidity standard solution may be purchased directly or prepared according to the methods in ISO7027.		

Table 7 Technical index of standard equipment used to test water-quality monitor (ORP)

Test equipment/standard substance	Measurement range	Uncertainty/accuracy class /maximum permissible error
Electronic balance	(0－220) g	①
Note: Unless otherwise specified, all chemical reagents used in this standard are AR, and deionized water or equivalent conductivity of pure water is used.		

7 Environmental Conditions

The requirements for test environmental conditions for the water-quality monitoring instrument are:

a) Ambient temperature: (20±5) ℃;

b) Relative humidity: 20－80%.

c) Supply voltage: AC 220±22 V.

d) There shall be no strong mechanical vibration or electromagnetic interference nearby.

e) There shall be no other light interference nearby during the turbidity test.

8 Test Methods

8.1 Appearance and power-on check

Visual inspection and tactile examination shall be used to inspect the appearance of the water-quality monitoring instrument according to 4.1.

8.2 Indication errors test

8.2.1 Temperature indication error

To test the temperature indication error of the water-quality monitoring instrument, the temperature test points shall be 35 ℃, 30 ℃, 20 ℃, 10 ℃ and 0 ℃, according to 7.2 in HY/T 268-2018.

8.2.2 Conductivity indication error

Carry out the test according to the following operation procedure:

a) The test points shall be set as 35 ℃, 30 ℃, 20 ℃, 10 ℃ and 0 ℃. The temperature reduction sequence to be followed is:

b) The conductivity cell shall be washed with seawater 3－5 times, and the water-quality monitoring instrument shall be immersed in the constant thermostatic seawater tank.

c) When testing the inductive and pump-free electrode seawater conductivity sensor at test points above 20 ℃, the water-quality monitoring instrument shall be shaken several times before reading, to eliminate bubbles adhering to the conductivity cell.

d) At every temperature test point, after the tank temperature becomes stable, start the water-quality monitoring instrument until the data become stable. At least 10 groups of conductivity and salinity data shall be read for the precision thermodetector and the water-quality monitor, and the average values shall be calculated as the measured conductivity value $\bar{C}_j$ and measured salinity value at such test points. The seawater samples shall be collected according to 5.3.3.2 in JJG 763-2002.

e) The seawater samples shall be measured according to the operation procedure of the laboratory salinometer. Each sample shall be measured twice, and the average values shall be calculated as their measured salinity values (i.e., standard salinity values of the water-quality monitoring instrument), then the standard conductivity value of C_{j0} shall be calculated at the corresponding temperature according to Annex A.

f) The indication error shall be calculated as per Formula (2):

$$\Delta C_j = \bar{C}_j - C_{j0} \cdots\cdots (2)$$

where:

$\triangle C_j$ — Indication error of the water-quality monitoring instrument on the j^{th} test point (mS/cm);

$\bar{C}_j$ -- Average value of the water-quality monitoring instrument on the j^{th} test point (mS/cm); and

C_{j0} -- Standard conductivity value on the j^{th} test point (mS/cm).

8.2.3 pH indication error

Carry out the test according to the following operation procedure:

a) At constant temperatures of 20 ± 5 ° C the water-quality monitoring instrument shall be cleaned with deionized water and dried with filter paper. The borax standard buffer solution and the water-quality monitoring instrument shall be put into a pH test bottle, and the underwater machine shall be run until the data become stable. At least 10 groups of data shall be read and the average value $\overline{pH}_j$ shall be calculated as the measurement result of such test points.Measure the standard buffer solution of the mixed phosphate and potassium acid phthalate successively according to the above requirements.

b) Alternating temperature environment. The borax standard buffer solution and water-quality monitoring instrument shall be put into a pH test bottle. This is put into the thermostatic seawater tank with the precision thermometer, and the water temperatures shall be adjusted to 30 ° C, 15 ° C and 5 ° C. The underwater machine shall be started, and at least of 10 groups data shall be read and the average value $\overline{pH}_j$ calculated as the measurement result of such test points.

c) At the same time, based on the accurate temperature values, determine the standard pH value according to (d) of 8.2.1 in HY/T 098-2007.

d) Calculate the indication error as per Formula (3):

$$\Delta \mathrm{pH}_j = \overline{\mathrm{pH}}_j - \mathrm{pH}_{j0} \cdots\cdots (3)$$

where:

$\Delta \mathrm{pH}_j$ -- Indication error of the water-quality monitoring instrument on the j^{th} test point;

$\overline{\mathrm{pH}}_j$ -- Average value of the water-quality monitoring instrument on the j^{th} test point; and

pH_{j0} -- pH standard value on the j^{th} test point.

8.2.4 DO indication error

Carry out the test according to the following operation procedure:

a) The water-quality monitoring instrument shall be immersed in the thermostatic seawater tank, and a thermal insulating layer shall cover the top of the thermostatic tank. The temperature of the thermostatic seawater tank shall be adjusted to 30 °C, 15 °C and 5 °C, and DO water shall be prepared according to (2) of 8.2.1 in HY/T 096-2007. The instrument shall be started after the water temperature is fully balanced. After the data become stable, at least 10 groups of data shall be read and the average value $\bar{A}_j$ shall be calculated as the measurement result of such test points. At the same time, at least three seawater samples shall be collected from the sampling pipe in numbered sampling bottles according to the sampling method in the DO—iodine method of 31 in GB 17378.4-2007. Before sampling, the sampling bottles shall be washed with the tank water three times. Finally, the samples shall be titrated according to the DO—iodine analysis method in GB 17378.4, which mean value $\bar{A}_0$ regarded as the standard DO value of the samples.

b) Calculate the DO indication error as per Formula (4):

$$\Delta A_j = \bar{A}_j - \bar{A}_0 \cdots\cdots (4)$$

where:

ΔA_j -- Indication error of the water-quality monitoring instrument on the j^{th} test point (mg/L);

$\bar{A}_j$ -- Average value of the water-quality monitoring instrument on the j^{th} test point (mg/L); and

$\bar{A}_0$ -- Standard DO value on the j^{th} test point (mg/L).

8.2.5 Turbidity indication error

Carry out the test according to the following operation procedure:

a) Within the general measurement range of turbidity, the test points shall be determined according to 8.2.2 in HY/T 100-2007.

c) The turbidity standard stock solution shall be prepared by using a formazine turbidity solution or according to Annex B. The series turbidity standard solution shall be diluted

accurately according to the formula in Annex B.

d) The water-quality monitoring instrument shall be put into a turbidity test barrel filled with turbidity standard solution, according to 6.2.1 in JJF1571-2016. Tests of turbidity values of the turbidity standard solution are run successively in the sequence small to large. The water-quality monitoring instrument shall be cleaned with zero turbidity water whenever the turbidity standard solution is replaced. The instrument is started; after the data become stable, at least 10 groups of data shall be read, and the average value $\bar{Z}_j$ calculated as the measurement result of such test points.

e) Calculate the indication error of the turbidity sensor as per Formula (5):

$$\Delta Z_j = \bar{Z}_j - Z_{j0} \cdots\cdots (5)$$

where:

$\triangle Z_j$ — Indication error of the water-quality monitoring instrument on the j^{th} test point (NTU);

$\bar{Z}_j$ -- Average value of the turbidity reading of the water-quality monitoring instrument on the j^{th} test point (NTU); and

Z_{j0} -- Standard turbidity value on the j^{th} test point (NTU).

8.2.6 ORP indication error

The test sequence of the ORP indication error is:

a) ORP standard solution shall be prepared according to 8.8 in ASTM D1498 or Annex C;

b) At constant temperatures of 25±3℃, clean the water-quality monitoring instrument with deionized water for 3 times, and dry with filter paper. Put a stirrer in a beaker, and put the ORP standard solution and the water-quality monitoring instrument in the beaker, the electrode shall be completely immersed in the solution. Start the electromagnetic stirrer and underwater machine, after the data become stable, at least 10 groups of data shall be read and the average value shall be calculated as the measurement result of such test points;$\overline{ORP_j}$

d) Calculate the ORP indication error as per Formula (6):

$$\Delta E_j = \bar{E}_j - E_{j0} \cdots\cdots (6)$$

where:

ΔE_j -- Indication error of the water-quality monitoring instrument, (mV);

$\bar{E}_j$ -- Average value of the water-quality monitoring instrument, (mV); and

E_{j0} -- ORP standard value, (mV).

9 Test Report

The test report shall be accurate and objective, and each test result shall include:

a) The title: “Test Report”.

b) Name and address of testing organization and location where test is carried out.

c) Unique identifier of the test report and of every page, to identify every page as part of the test report; and clear identification indicating the end of the test report.

d) Customer’s name and address.

e) Name, model/type, serial number and manufacturer of analyzer tested.

f) Technical documentation on which the report is based.

g) Name, position, signature or equivalent identification of authorizer of the test report.

h) Signatures or equivalent identifications of analyst and verifier.

i) Description and state of the tested instrument.

j) List of main measuring instruments used in the test, including model/type, uncertainty/accuracy/maximum permissible error and certificate number.

k) Test date, location and environmental conditions.

l) Test results.

See Annex D for the test record format.

See Annex E for the test report format.

Annex A
(Normative Annex)
Reduction Formula between Salinity and Conductivity

A.1 The standard conductivity value of the seawater samples is calculated as Formula (A.1):

$$C(S,t_s,p)=C(35,15,0)R_{ts}r_{ts} \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (A.1)$$

where:

$C(35,15,0)$ -- Constant, 42.914 mS/cm;

R_{ts}-- Conductivity ratio of the seawater samples under the standard temperature value of t_s, calculated according to A.2; and

r_{ts} -- Function of the standard seawater temperature, calculated according to A.3.

A.2 The conductivity ratio of R_{ts} of the seawater samples at the standard temperature value of t_s is calculated between the standard salinity value of S and the standard temperature value of t_s of the seawater samples, using the Newton iteration method or from Vol. 3 of the International Oceanographic Tables, as per the reduction formula (A.2) between salinity and conductivity ratio.

According to the practical salinity scale (PSS-78), determination of the practical salinity of seawater is based on the conductivity ratio of K_{15} of the KCl solution with a mass ratio of 32.4356×10^{-3}, at seawater conductivity of a standard atmospheric pressure and at the same temperature and pressure, at 15°C. When K_{15} is equal to 1, the practical salinity is equal to 35. The reduction formula between salinity and conductivity is:

$$S=a_0+a_1R_t^{1/2}+a_2R_t+a_3R_t^{3/2}+a_4R_t^2+a_5R_t^{5/2}$$
$$+\frac{t-15}{1+k(t-15)}(b_0+b_1R_t^{1/2}+b_2R_t+b_3R_t^{3/2}+b_4R_t^2+b_5R_t^{5/2}) \quad \cdots\cdots\cdots\cdots\cdots (A.2)$$

where:

Coefficient, k = 0.0162,

a_0 = 0.0080, a_1 = −0.1692, a_2 = 25.3851, a_3 = 14.0941, a_4 = −7.0261, a_5 = 2.7081,

b_0 = 0.0005, b_1 = −0.0056, b_2 = −0.0066, b_3 = −0.0375, b_4 = 0.0636 and b_5 = −0.0144;

S -- Standard salinity value (PSS-78) of the seawater samples.

t_s -- Temperature value of the seawater samples IPTS-68 under test; that is, bath temperature value (°C) of the salinometer, wherein t refers to the 1968 International Practical Temperature Scale (IPTS-68). Within the temperature range of −5 – 40°C, the conversion coefficient with the 1980 International Practical Temperature Scale (IPTS-90) is δt=1.00024.

A.3 r_{ts} is the function of the standard seawater temperature, calculated as per Formula (A.3):

$$r_{ts}=C_0+C_1t_s+C_2t_s^2+C_3t_s^3+C_4t_s^4 \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (A.3)$$

where:

C_0 = 0.6766097, C_1 = 2.00564 × 10^{-2}, C_2 = 1.104259 × 10^{-4}, C_3 = −6.9698 × 10^{-7} and C_4 = 1.0031 × 10^{-9}.

Annex B
(Normative Annex)
Preparation of Turbidity Standard Solution

B.1 Preparation of zero turbidity water

Pass the deionized water (or equivalent pure water) through a Millipore filter with a pore size of no larger than 0.2 μm. The filtrate obtained from two filtrations is zero turbidity water, used for preparation and dilution of the turbidity stock solution.

B.2 Preparation of 4,000 NTU turbidity standard stock solution

The preparation procedure is:

a) Preparation of #I solution: Weigh 100.0 g $C_6H_{12}N_4$(AR), accurate to 0.01 g, and dissolve in a small amount of zero turbidity water.

b) Preparation of #II solution: Weigh 10.0 g $N_2H_6SO_4$(GR), accurate to 0.001 g, and dissolve in a small amount of zero turbidity water.

c) Pour the #I and #II solutions into a 2,000 mL flask, dilute with zero turbidity water to 2,000 mL and mix evenly. Keep static at constant temperatures of 25 ± 3℃ for 24 h to obtain the 4,000 NTU standard stock solution.

Note 1: The 4,000 NTU stock solution may be stored in a dark environment at 25 ± 3℃ for 4 weeks.

Note 2: For the preparation method, see 6.2.2 from ISO 7027-1999 [1].

B.3 Preparation of turbidity standard solution

Prepare the turbidity standard solution. The preparation volume is 5,000 mL. The volume of the required stock solution is calculated as in Formula B.1:

$$C = \frac{C_0 \times V_1}{V_1 + V_2} \quad \text{(B.1)}$$

where:

C -- Concentration value of the test point, NTU;

C_0 -- Turbidity value of the turbidity standard stock solution, NTU;

V_1 -- Volume of the required turbidity standard stock solution, mL;

V_2 -- Volume of the zero-turbidity water, mL.

Annex C
(Normative Annex)
Preparation of ORP Standard Solution

C.1 Reagent material(s)

Unless otherwise specified, all reagents used in this standard shall be analytical reagent (Grade AR), and the water shall be deionized water or equivalent conductivity of pure water.

C.2 Ammonium ferrous sulfate–ammonium ferric sulfate standard solution

Dissolve 39.21 g of $Fe(NH_4)_2{\bullet}(SO_4)2{\bullet}6H_2O$, 48.22 g of $Fe(NH_4)(SO_4)_2{\bullet}12H_2O$ and 56.2 mL of concentrated sulfuric acid in deionized water. Dilute to 1,000 mL, and store in a glass or polyethylene bottle. The ORP of this solution is +476mV at 25°C. The reference electrode is Ag/AgCl electrode.

Annex D
(Informative Annex)
Format of Test Record Table

Information on the water-quality monitoring instrument and the test record formats for each element are given in Tables D.1–D.7.

Table D.1 Information on the Water-quality Monitoring instrument and Formats of Record Tables

Product name		Report no.	
Model/type		Serial no.	
Receiving date			
Description of samples			
Customer			
Customer Address			
Manufacturer			
Test basis			

Sensor information				
Name	Measurement range	Maximum permissible error	Resolution	Sensor no.

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Table D.2 Temperature Test Record Table

<table>
<tr><td colspan="5">Test equipment</td></tr>
<tr><td>Name</td><td>Measurement range</td><td>Uncertainty/accuracy class/maximum permissible error</td><td>Certificate no.</td><td>Valid until</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Location, date and environmental conditions</td></tr>
<tr><td>Location</td><td colspan="2"></td><td>Date</td><td>Y M D</td></tr>
<tr><td>Temperature</td><td colspan="2">℃</td><td>Relative humidity</td><td>%</td></tr>
<tr><td colspan="5">Indication error test results</td></tr>
<tr><td colspan="2">Temperature standard value, ℃</td><td colspan="2">Temperature indication of water-quality monitoring instrument, ℃</td><td>Indication error, ℃</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td></td></tr>
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<tr><td colspan="2"></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="5">Remarks</td></tr>
<tr><td colspan="5">Tested by Checked by

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</table>

Table D.3 Conductivity Test Record Table

Test equipment				
Name	Measurement range	Uncertainty/accuracy class/maximum permissible error	Certificate no.	Valid until
Location, date and environmental conditions				
Location		Date	Y M D	
Temperature	℃	Relative humidity	%	
Indication error test results				
Conductivity standard value mS/cm	Conductivity indication of water-quality monitoring instrument, mS/cm	Conductivity indication error of water-quality monitoring instrument, mS/cm	Salinity standard value	Salinity indication of water-quality monitoring instrument
Remarks				
Tested by			Checked by	

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Table D.4 pH Test Record Table

Test equipment				
Name	Measurement range	Uncertainty/accuracy class/maximum permissible error	Certificate no.	Valid until

Location, date and environmental conditions			
Location		Date	Y/M/D
Temperature	℃	Relative humidity	%

Indication error test results			
Sensor no.			
Temperature ℃	pH standard value	pH indication of water-quality monitoring instrument	pH indication error

Remarks
Tested by Checked by Page x of y

Table D.5 DO Test Record Table

Test equipment				
Name	Measurement range	Uncertainty/accuracy class/ maximum permissible error	Certificate no.	Valid until

Location, date and environmental conditions			
Location		Date	Y/M/D
Temperature	℃	Relative humidity	%

Titration results					
Temperature ,℃	Iodine flask no.	Iodine flask volume, mL	Volume of $Na_2S_2O_3$ consumed, mL	Titration value, mg/L	Average, mg/L

Indication error test results			
Temperature, ℃	DO standard value, mg/L	DO indication of water-quality monitoring instrument, mg/L	DO indication error, mg/L

Remarks
Tested by: Checked by:

Table D.6 Turbidity Test Record Table

Test equipment				
Name	Measurement range	Uncertainty/accuracy class/ maximum permissible error	Certificate no.	Valid until

Location, date and environmental conditions			
Location		Date	Y/M/D
Temperature	℃	Relative humidity	%

Indication error test results		
Turbidity standard value, NTU	Turbidity indication of water-quality monitoring instrument, NTU	Turbidity indication error, NTU

Remarks

Tested by Checked by

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Table D.7 ORP Test Record Table

Test equipment				
Name	Measurement range	Uncertainty/accuracy class/ maximum permissible error	Certificate no.	Valid until

Location, date and environmental conditions			
Location		Date	Y/M/D
Temperature	℃	Relative humidity	%

Indication error test results			
Temperature, ℃	ORP standard value, mV	ORP indication of water-quality monitoring instrument, mV	ORP indication error, mV

Remarks:

Tested by Checked by

Annex E
(Informative Annex)
Format of Test report

The format of test report is given in Tables E.1–E.2.

Table E.1 **Cover Format of Test Certificate**

Organization name	
Test Report Report No.:	
Customer:	
Customer Address:	
Instrument name:	
Model/specification:	
Serial Number:	
Manufacturer:	
Issue date:	
(Stamp for test)	Approved by (Signature)
Address: Postal code:	Fax: Tel:
EMAIL:	Website:

Table E.2 Back Format of Test Certificate

Main measuring instruments used in the test				
Name	Model/type	Uncertainty/accuracy class/ maximum permissible error	Certificate no.	Valid until
Test date, location and environmental conditions				
Date		Location		
Temperature		Relative humidity		
Test results				
Test item	Technical requirement	Test result	Conclusion	
Appearance inspection				
Indication error				

Note: Please bring copies of this certificate to the next test.

Tested by Checked by

Reference [1] International Standard ISO 7027-1999. Water Quality - Determination of Turbidity. International Organization for Standardization[S]. Genève, Switzerland. 6 pages.