

JIS

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 7984 : 2006

(JEMIMA/JSA)

**Continuous analyzer for hydrogen
chloride in flue gas**

ICS 71.040.40

Reference number : JIS B 7984 : 2006 (E)

PROTECTED BY COPYRIGHT

Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Electric Measuring Instruments Manufacturers' Association (JEMIMA)/ Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS B 7984:1997** is replaced with this Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Date of Establishment: 1997-07-20

Date of Revision: 2006-03-25

Date of Public Notice in Official Gazette: 2006-03-27

Investigated by: Japanese Industrial Standards Committee
Standards Board
Technical Committee on Testing and Measurement
Technology

JIS B 7984 : 2006, First English edition published in 2006-10

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

© JSA 2006

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

KK/HN

PROTECTED BY COPYRIGHT

Contents

	Page
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Type of analyzer and measurement range	2
5 Performance of analyzer	2
6 Construction	3
6.1 General construction	3
6.2 Constitution	3
6.3 Sampling part	4
6.4 Analyzer	4
6.5 Signal for indication and recording	6
7 Performance test	6
7.1 General	6
7.2 Conditions for test	6
7.3 Calibration of analyzer	7
8 Test report	10
9 Marking	10
10 Instruction manual	11
Annex 1 (informative) Comparison test (performance of measuring system)	12
Annex 2 (informative) Continuous analyzer for hydrogen chloride in flue gas by non-suction sampling technique	15
Annex 3 (informative) Fourier transform infrared spectrophotometer (FTIR)	18
Annex 4 (informative) Automatic measuring system of hydrogen chloride in flue gas by dilution sampling	20

Continuous analyzer for hydrogen chloride in flue gas

1 Scope This Japanese Industrial Standard specifies the automatic analyzer, specifically of ion-selective electrode, (hereafter referred to as “analyzer”) for measuring continuously the concentration of hydrogen chloride in flue gas.

NOTE : The comparison test required for maintaining a measuring system is described in Annex 1.

Information : As the analyzers of measurement principles other than those given in table 1, the non-suction sampling technique (pass monitor) is given in Annex 2, the Fourier transform infrared spectrophotometer (FTIR) in Annex 3, and the automatic measuring system of hydrogen chloride in flue gas by dilution sampling in Annex 4 for information.

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards indicated below (including amendments) shall be applied.

JIS B 7551 *Variable area flowmeters*

JIS C 1302 *Insulation resistance testers*

JIS K 0055 *General rules for calibration method of gas analyzer*

JIS K 0095 *Methods for sampling of flue gas*

JIS K 0107 *Methods for determination of hydrogen chloride in flue gas*

JIS K 0122 *General rules for ion selective electrode method*

JIS K 0211 *Technical terms for analytical chemistry (General part)*

JIS K 0212 *Technical terms for analytical chemistry (optical part)*

JIS K 0213 *Technical terms for analytical chemistry (Electrochemistry division)*

JIS K 0215 *Technical terms for analytical chemistry (analytical instrument part)*

JIS K 0557 *Water used for industrial water and wastewater analysis*

JIS K 8150 *Sodium chloride*

JIS K 8548 *Potassium nitrate*

JIS K 8809 *Potassium hydrogen phthalate*

JIS Z 8103 *Glossary of terms used in measurement*

3 Terms and definitions For the purpose of this Standard, the definitions in JIS K 0122, JIS K 0211, JIS K 0212, JIS K 0213, JIS K 0215, JIS Z 8103 and the following shall apply.

- a) **sample gas** flue gas which has been pretreated by passing through a filter or others, and is to be introduced into analyzer
- b) **equivalent liquid** a solution which has been prepared so that its indicated value of the concentration of hydrogen chloride is equivalent to that shown by sample gas
 - 1) **equivalent liquid for zero adjustment**
 - 2) **equivalent liquid for span adjustment**
 - 3) **equivalent liquid for midpoint test**
- c) **zero drift** fluctuation of the value indicating the minimum scale of analyzer for definite period
- d) **span drift** fluctuation of indicated value corresponding to the scale span of analyzer for definite period
- e) **established flow rate** flow rate of sample gas or absorption liquid which has been established for each analyzer
- f) **ppm** volume fraction expressed as parts per million with respect to concentration

4 Type of analyzer and measurement range The type and measurement range of the analyzer shall be as shown in table 1. The range shall be the suitable one chosen from table 1.

Table 1 Type and measurement range of analyzer

Type	Range ⁽¹⁾ ppm	Measurement target component	Condition for application
Ion-selective electrode	(0 to 50) to (0 to 1 000)	Hydrogen chloride	This is applicable when the influences made by other halogenide, cyanide, or sulfide can be disregarded.

Note ⁽¹⁾ Within this range, there are several separated ranges that are adequate for measurement purpose.

5 Performance of analyzer Analyzer shall conform to the requirements in table 2 when being tested according to the performance test in clause 7.

Table 2 Performance

Unit : %		
Item	Performance	Test method
Repeatability	± 3 of the maximum scale value	7.3.3 a)
Zero drift	± 2 of the maximum scale value	7.3.3 b)
Span drift	± 3 of the maximum scale value	7.3.3 c)
Indication error	± 4 of the maximum scale value	7.3.3 d)
Minimum detection limit	1 or less of the maximum scale value	7.3.3 e)
Response time (minutes)	5 or less	7.3.3 f)
Stability of sample-gas flow rate	± 5 of established flow rate	7.3.3 g)
Stability of absorption-liquid flow rate	± 5 of established flow rate	7.3.3 h)
Stability on voltage fluctuation	± 1 of the maximum scale value	7.3.3 i)
Withstand voltage	There shall be no unusualness	7.3.3 j)
Insulation resistance (M Ω)	5 or more	7.3.3 k)

6 Construction

6.1 General construction The construction of analyzer shall be in conformity with each of the following.

- It is right in shape, superior in its assembly and finish of each part, and soundly constructed.
- When it runs in ordinary condition, it shall not cause any danger, and shall work safely and smoothly.
- Each part shall be free from mechanical or electrical troubles, and be constructed to be free from dangers.
- It shall be constructed not to make troubles on the operation owing to dew condensation or others.
- The parts contacting with heat generating parts such as a light source or a heater shall be constructed not to make thermal deformation or functional deterioration.
- It shall allow easy maintenance or inspection, without causing any danger during the work.

6.2 Constitution The analyzer is composed of sampling part and analyzing device and other parts as shown in figure 1.

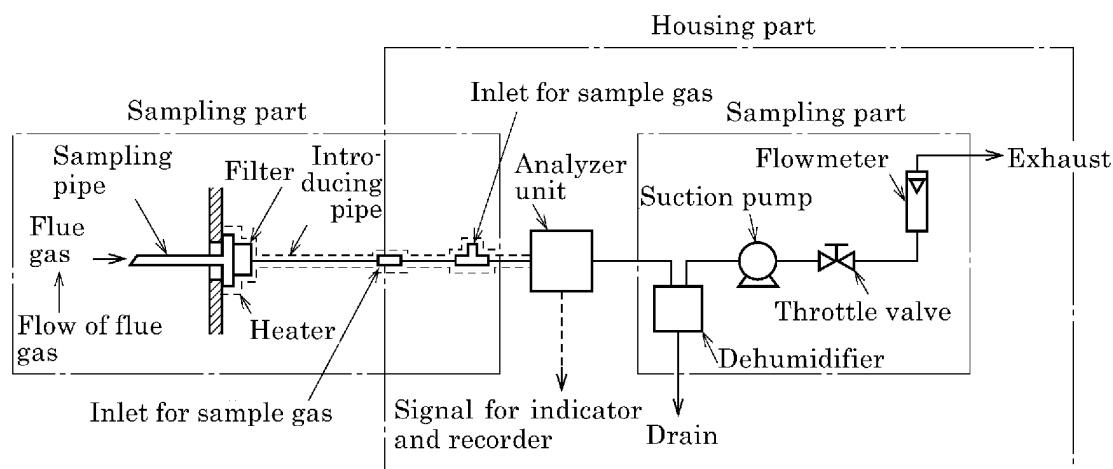


Figure 1 Example of constitution of analyzer

6.3 Sampling part Sampling part is for eliminating dusts in flue gas so that the loss of the object substance is minimized, and for providing continuously a necessary constant amount of sample gas into an analyzer. As specified in JIS K 0095, it shall be composed of a sampling tube, filter, introducing pipe, dehumidifier, suction pump, throttle valve, flowmeter, and so on.

- a) **Sampling pipe**, attached on the wall of a gas flue to take in sample gas, and made of titanium tube, ceramics tube, or quartz tube.
- b) **Filter**, for removing dusts in flue gas, heated to about 120 °C to prevent water from condensation. Its material is silica wool, tetrafluoroethylene resin, or porous ceramics.
- c) **Introducing pipe**, for introducing flue gas from filter to the sample introducing inlet and principally made of tetrafluoroethylene resin. Heat the tube from filter to analyzer to about 120 °C for keeping water from condensation.
- d) **Dehumidifier**, for removing the humidity in the gas exhausted from an analyzer. It employs the thermoelectric refrigeration or semipermeable membrane gaseous-phase dehumidifying by selective permeability of water vapor.
- e) **Suction pump**, for sucking sample and so on, which is usually a diaphragm pump. The system contacting with gas shall be made of anticorrosive material such as hard vinyl chloride, fluororubber, or tetrafluoroethylene resin.
- f) **Throttle valve**, a needle valve made of anticorrosive material.
- g) **Flowmeter**, generally a float-type variable area flowmeter (JIS B 7551).

6.4 Analyzer As shown in figure 2, it is composed of a gas absorption part, cell for measurement, pump for sending absorption liquid, tank of absorption liquid, controller for amplifying, and drain tank.

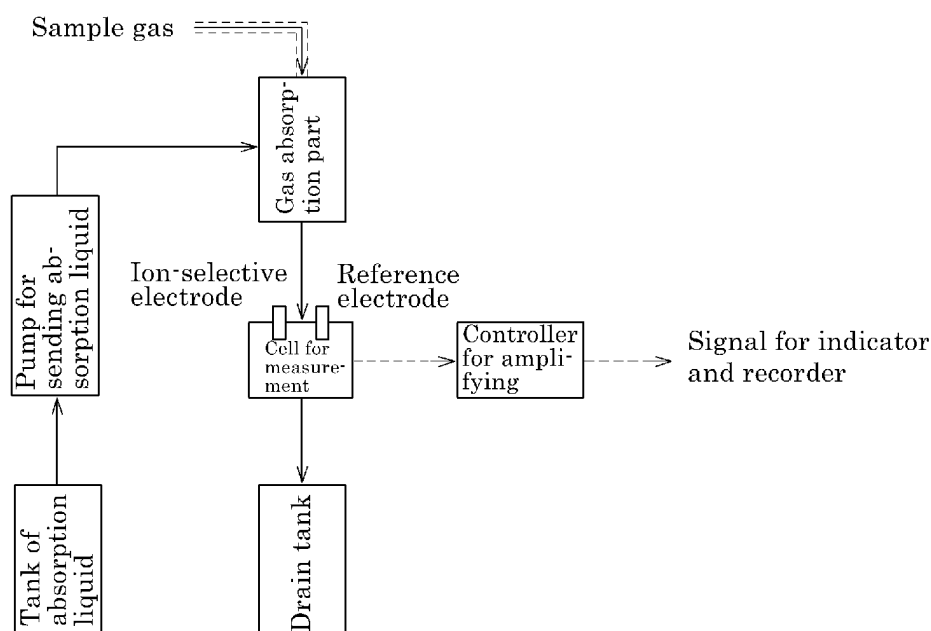


Figure 2 Example of constitution of analyzer

- a) **Gas absorption part** The gas absorption part is for introducing absorption liquid and sample gas at their respective specified flow rates and for catching the hydrogen chloride in sample gas into absorption liquid, and its material shall not be corroded by absorption liquid or not deteriorate it.
- b) **Measurement cell** This is the part where hydrogen chloride in sample gas is absorbed and chloride ion in absorption liquid is detected, and composed of an ion-selective electrode and reference electrode.
- c) **Controller for amplifying** This controller has the function to amplify and transduce the potential of ion-selective electrode into electric signal which is proportional to the concentration of hydrogen chloride, and transmit the signal to each constitutional element by which the following procedures are automatically carried out according to its program.
 - 1) Start and stop of measurement
 - 2) Operation and processing of signals
 - 3) Indication of concentration of hydrogen chloride, and outputting signal for indication and recording
 - 4) Alarming signal
 - 5) Others
- d) **Pump for sending absorption liquid** This pump can send the absorption liquid from the tank of absorption liquid to gas absorption part at specified flow rate, and the part contacting with liquid shall be of such materials as polypropylene that are

not corroded by absorption liquid and that do not deteriorate it.

- e) **Tank for absorption liquid** This tank is for storing absorption liquid, and its material shall not be corroded by absorption liquid and not deteriorate it.
- f) **Absorption liquid** Either of the following, when preparing the amount of 20 L, is to be used.
 - 1) Dissolve 200 g of potassium hydrogen phthalate (**JIS K 8809**) in about 10 L of water ⁽²⁾, add a ml of 0.1 mol/L ⁽³⁾ or 1 mol/L sodium chloride solution which can be achieved from the following formula, and add water to make total 20 L.

$$a = 0.4 \times R \times (1.1 - M)$$

where, a : added quantity of sodium chloride solution (ml)

R : the maximum value of range (ppm)

M : concentration of sodium chloride solution (0.1 mol/L or 1 mol/L)

- 2) Dissolve 200 g of potassium nitrate (**JIS K 8548**) in water ⁽²⁾ to make total 20 L.
- 3) Use 20 L of water ⁽²⁾ as it is.

Notes ⁽²⁾ Use Class A2 water specified in clause 3 of **JIS K 0557**.

⁽³⁾ Use this solution when the maximum scale value of range gives 100 ppm or less.

6.5 Signal for indication and recording The concentration of hydrogen chloride shall be indicated in a uniform scale and recorded. For the digital display system, a unit of measurement shall be printed.

7 Performance test

7.1 General In case of each item other than indicated error, withstand voltage and insulation resistance, the test result obtained at minimum range of the measuring instrument can be regarded as the performance of each range.

7.2 Conditions for test The conditions for test shall be as follows.

- a) **Ambient temperature** Optional temperature from 5 °C to 35 °C, and its fluctuation allowance is 5 °C max.
- b) **Humidity** Relative humidity 85 % or less
- c) **Atmospheric pressure** Pressure from 95 kPa to 106 kPa, and its fluctuation allowance is 5 kPa or less.
- d) **Voltage of power source** Rated voltage
- e) **Frequency of power source** Rated frequency
- f) **Time for warming up** Time specified in the instruction manual