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Methods for determination of phenols in flue gas

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Reference number : **JIS K 0086 : 1998 (E)**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

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Methods for determination of phenols in flue gas

1 Scope This Japanese Industrial Standard specifies the methods for determination of phenols in flue gas.

Remarks 1 In this standard, flue gas means ones which are generated by being accompanied with chemical reaction, etc. and exhausted out to flue, chimney or duct.

2 The normative references to this Standard are shown in Attached Table 1.

2 Common Items The common items concerned with chemical analysis, sampling method of flue gas, gas chromatography and molecular absorptuometric analysis shall be in accordance with **JIS K 0050**, **JIS K 0095**, **JIS K 0114** and **JIS K 0115** respectively.

3 Classification of analytical methods and their outline The method for determination and their outline shall be shown in Table 1.

Table 1 Classification of analytical methods and their outlines

Classification of analytical methods	Outlines of analytical methods			Application requirement
	Summary	Sampling	Range of determination vol ppm	
Gas chromatography	Absorb phenols in sample gas into absorption solution or collect in collecting bag, etc. Introduce it into gas chromatograph and determine phenols with chromatogram obtained.	Absorption bottle method Vacuum collection bottle method Collection bag method	1 to 2 000 (1)	
4-Aminoantiprine spectrophotometric method	After absorbing phenols in sample gas into absorption solution, add 4-aminoantipyrine solution and potassium ferricyanide solution. Measure the absorbance (510 nm) of colored antipyrine compound.	Absorption bottle method absorption solution:0.4% Sodium hydroxide solution amounts : 50 ml × 2	1 to 20 (1)	According to **5.2.1**
Ultraviolet absorptiometry	After absorbing phenols in sample gas into absorption solution, measure the absorbance (270 nm) of this solution.	Absorption bottle method absorption solution: water	1 to 50 (1)	According to **5.3.1**

Note (1) : It is the case of the sample solution in which 20 *l* of sample gas is collected and the absorption solution is diluted to 200 ml.

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4 Sampling method of gas Sampling method of gas shall be in accordance with methods of absorption bottle, vacuum collection bottle and collection bag. Sampling position of gas for analysis shall be selected the point where the typical gas is collected and after collected at least twice in the same position within adjacent time, these gases shall be analyzed respectively.

4.1 Method with absorption bottle This method shall be applied for 4-Aminoantipyrine absorptiometry, ultraviolet absorptiometry, and gas chromatography.

4.1.1 Reagents and preparation of reagent solution Reagents and preparation of reagent solution for 4-Aminoantipyrine absorptiometry, ultraviolet absorptiometry and gas chromatography shall be as follows:

(1) **Reagents**

(a) **Sodium hydroxide** Specified in **JIS K 8576.**

(b) **Water** A2 grade specified in **JIS K 0557.**

(c) **Water** A3 grade specified in **JIS K 0557.**

(2) **Preparation of reagent solution**

(a) **Absorption solution** Solution dissolved 4 g of Sodium hydroxide in water and make up to 1 *l*. In the ultraviolet absorptiometry, the following water shall be used for the absorption solution.

(1) Reagent

(a) Water (absorption solution): A3 grade specified in **JIS K 0557.**

4.1.2 Apparatus and device

(1) **Absorption bottle** Absorption bottle which has 50 ml to 250 ml in volumes as shown in Fig. 3 (a) and (d) (an example of absorption bottle) of **JIS K 0095** shall be used.

(2) **Gas sampling apparatus** The apparatus shall be constructed as shown in Fig.1 and provided with the following requirements.

(a) The sampling tube made of such material that it is not corroded by phenols and co-existences in flue gas. For an example, glass tube, quartz tube, stainless steel tube and fluoride resin tube shall be used.

(b) In order to prevent against mixing-in of dust in flue gas, appropriate filter medium such as silica wool, etc. shall be put into the end part of gas sampling tube.

(c) Fearing that moisture in sample gas might become condense, the part between the sampling tube and conducting tube shall be heated at approx. 120 ℃.

For connecting part between both tubes, glass grinding tube, silicon rubber tube shall be used.

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4.1.3 Sampling of sample gas

(1) **Procedure of gas sampling** The sampling of gas shall be carried out according to the following procedures. The symbols of the apparatus shown in the following sentences are in accordance with ones in Fig. 1.

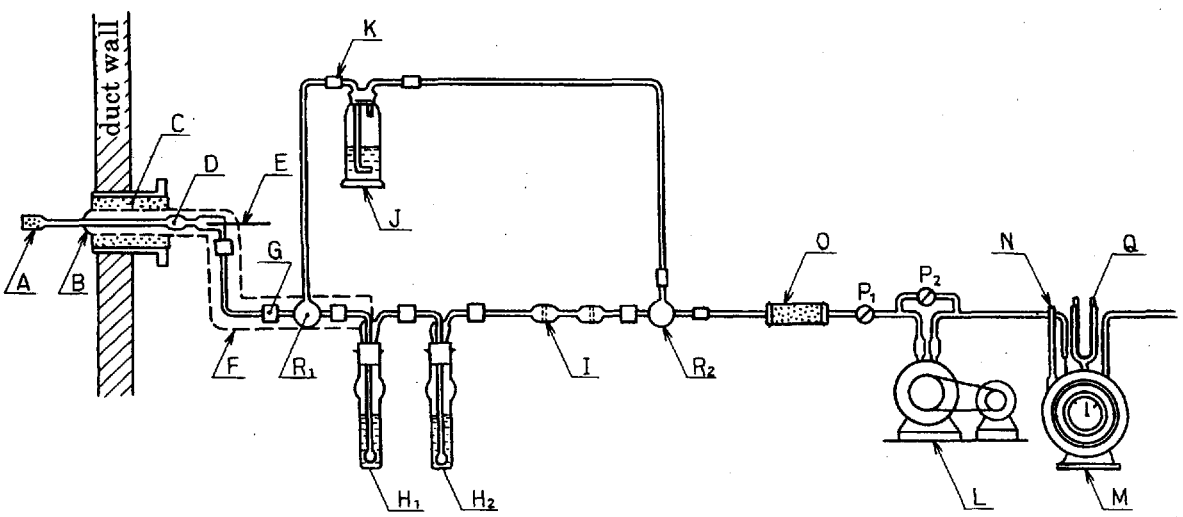
(a) Take 50 ml of the absorption solution into each absorption bottle (H_1, H_2).

(b) After turning the passage change cock (R_1, R_2) to the side of bypass, start the suction pump (L) and substitute air in the piping (between B and R_1) for sample gas.

(c) After stopping the suction pump (L), turn the passage change cock (R_1 and R_2) to the side of absorption bottles (H_1, H_2). Read off the indication of gas meter (M) to 0.01 *l* (liter) orders of magnitude.

(d) Start the suction pump (L) and pass the sample gas into absorption bottles (H_1, H_2). Adjust the flow rate to approx. 1 *l* /min with the flow-rate adjusting cock (P_1, P_2) and take approx. 20 *l* of the sample gas. Stop the suction pump (L), close the passage change cock (R_1, R_2) and read off the indication of gas meter (M) to 0.01 *l* orders of magnitude. At the same time, record the data of temperature, and gauge pressure of gas with the thermometer (N) and the manometer (Q) during sampling the gas. Atmospheric pressure shall be also measured.

(e) According to necessity, measure the moisture in the sample gas according to **6** in **JIS Z 8808**. (Measuring methods of moisture content in flue gas).



A : filter medium	H_1 : No.1 absorption bottle	N : temperature
B : sampling tube	H_2 : No.2 absorption bottle	O : drying agent
C : insulated material	I : glass filter	P_1 : flow-rate adjusting cock
D : fluorine-containing rubber tube	J : gas washing bottle	P_2 : flow-rate adjusting cock
E : thermometer	K : silicone tube	Q : manometer
F : heater	L : suction pump	R_1 : passage change cock
G : ball-and-socket joint coupling	M : gas meter	R_2 : passage change cock

Fig. 1 Sampling apparatus of gas from the duct (example)

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