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# Methods for determination of carbon monoxide in flue gas

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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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the original JIS is to be the final authority.



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# Methods for determination of carbon monoxide in flue gas

**1 Scope** This Japanese Industrial Standard specifies the methods for determination of carbon monoxide in flue gas exhausted to flue, chimney, duct, etc., (hereafter referred to as "duct" ) following combustion of fuel, metal refining, chemical reaction process, etc.

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

**2 Common items** The common items concerned with chemical analysis, calibration method of gas analyzer, sampling method of flue gas, gas chromatographic analysis shall be in accordance with **JIS K 0050**, **JIS K 0055**, **JIS K 0095** and **JIS K 0114** respectively.

Remarks : Unit ppm in this standard shall be volppm.

**3 Classification of analytical methods and their outline** The methods for determination and their outline shall be according to Table 1.

**Table 1 Classification of analytical methods and their outlines**

| Methods of determination | Outlines of analytical method | | | Applicable condition |
|---|---|---|---|---|
| | Summary | Sampling | Range of determination | |
| Gas chromatography | Obtain the concentration of carbon monoxide according to absolute working curve method by using a gas chromatograph provided with thermal conductivity detector (TCD) or methanation reaction apparatus and hydrogen flame ionization detector (FID). | The syringe method or collecting bag method | TCD: 0.1 % min. FID: 0 ppm to 2 000 ppm | — |
| Gas-detector tube method | Obtain the concentration of carbon monoxide by using a gas-detector tube type measuring device. | The collecting bag method or gas-detector tube method | 5 ppm to 100 ppm, 50 ppm to 1 000 ppm, 1 000 ppm min. | In accordance with **6.1** |
| Infrared absorption method | Obtain the concentration of carbon monoxide by using infrared gas analyzer. | The collecting bag method or continuous measurement | (0 ppm to 250 ppm) up to (0 % to 1 %) | — |
| Controlled potential electrolysis | Obtain the concentration of carbon monoxide by using a controlled potential electrolysis analyzer. | The collecting bag method or continuous measurement | (0 ppm to 20 ppm) up to (0 % to 3 %) | In accordance with **8.1** |

**4 Gas sampling method** Gas sampling method shall be as follows.

**4.1 Sampling position of gas** Sampling position of gas for analysis shall be selected the point where the typical gas is collected, for example the position where the flow rate

of gas does not remarkably change.

**4.2 Classification of gas sampling method** Gas sampling method shall be according to the syringe method and collecting bag method. However, gas sampler may be used for the gas detector tube method.

**4.3 Method with the syringe** This method shall be applied for the gas chromatograph method.

**4.3.1 Device and apparatus** Device and apparatus which is used with the syringe method shall be as follows.

(1) **Syringe** The syringe having a capacity of 100 ml specified in **JIS T 3201**. Volumetric error for the instrument shall be examined according to **9.3.1** in **JIS K 0050**.

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

(a) Use the gas sampling tube for example glass tube, stainless steel tube, quartz tube, or fluoride resin tube which are not corroded by coexisting component in flue gas.

(b) For prevention of the dust to mix with the sample gas, put filter medium into suitable portion of the gas sampling tube.

(c) Fearing that the moisture in sample gas might become condense, heat the sampling tube at approx. 120 ℃.

(d) For connection of tubes at heating part, use ground glass joint or silicone rubber tube.

**4.3.2 Operation of sampling** The sampling of gas with the syringe method shall be carried out according to the following procedure. The symbols of the apparatus shown in the following sentences are the same ones in Annex Fig. 1.

(1) Turn the three way stop cock (G) to the horizontal direction (⊕) and start the suction pump.

(2) Connect the syringe (H) removed injection needle with three way stop cock (G) by rubber tube.

(3) Open the three way stop cock (G) in all directions (⊕).

(4) Repeat suction and pushing-out of the syringe (H) several times to displace the inside of the syringe sufficiently with sample gas.

(5) Take the sample gas in the syringe (H).

(6) Close the three-way cock, and remove the syringe. Quickly attach the needle to the syringe and stick a rubber piece to the needle tip.