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Emission standard of volatile organic compounds for printing industry

印刷行业挥发性有机化合物排放标准

(Release version)

Issued on: October 22, 2010 **Implemented on: November 1, 2010**

Issued by: Guangdong Provincial Environmental Protection Office;

Quality and Technical Supervision Bureau of Guangdong Province.

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Foreword

This Standard specifies the volatile organic compounds (VOCs) content limits for different printing inks, basing on the printing plate and the printing material. It specifies the VOCs emission limits for the crafting process and the concentration limits and monitoring requirements for the fugitive emission reference points, proposes VOCs monitoring methods and production technology and management requirements of printing industry to control VOCs emissions.

Annex A and Annex D of this Standard are normative, Annex B and Annex C of this Standard are informative.

This Standard is drafted according to the rules of GB/T 1.1-2009.

From the date of implementation of the emission limits of each period in this Standard, they replace the corresponding content of “Emission limits of air pollutants” (DB44/27-2001) of the local standard of Guangdong Province.

The technical content of this Standard is mandatory.

This Standard is proposed by and under the jurisdiction of Guangdong Provincial Environmental Protection Office.

Drafting organizations of this Standard: Guangdong Provincial Academy of Environmental Science, South China University of Technology.

Main drafters of this Standard: Zhang Yongbo, Zhang Hui, Liu Yimin, Ye Daiqi, Wang Mingxu, Liao Chenghao, Liu Jianjun, Yang Lixian.

This Standard is approved by People’s Government of Guangdong Province on October 22, 2010.

This Standard was first issued on October 22, 2010.

Emission standard of volatile organic compounds for printing industry

1 Scope

This Standard specifies the content limits of volatile organic compounds (VOCs) in the ink (in the ready-to-use state) used in the printing process of printing enterprises in Guangdong Province; it also specifies the requirements for VOCs emission control.

This Standard applies to the VOCs emission control of existing printing enterprises, as well as the environmental impact assessment, design, completion acceptance of projects under construction, reconstruction and expansion, and the VOCs emission control of these pollution sources after completion.

This Standard applies to the printing by lithographic, letterpress, gravure, flexographic and screen (porous) printing methods, using newspapers, books, magazines, advertising, posters, packaging (paper, plastic), metal, glass, ceramics and other materials as substrates.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the dated edition cited applies. For undated references, the latest edition of the referenced document (including all amendments) applies.

GB/T 16157 Determination of particulates and sampling methods of gaseous pollutants emitted from exhaust gas of stationary source

GB 16297 Integrated emission standard for air pollutants

HJ/T 1 Fixing installation for gas measuring and sampling

HJ/T 55 Technical guidelines for fugitive emission monitoring of air pollutants

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions.

3.1

volatile organic compounds

At the standard atmospheric pressure of 101325 Pa, any organic compounds with boiling point of less than or equal to 250 °C, referred to as VOCs.

3.2

standard state

State where the temperature is 273.15 K and the pressure is 101325 Pa. The standard values specified in this Standard are based on dry air in the standard state.

[GB 16297-1996, definition 3.1]

3.3

printing

Process using printing plates or other methods to transfer the graphic information on the original material to the substrate, including 4 categories, i.e. publications printing, packaging and decoration printing, other printed matter printing and layout, plate making, post-printing.

3.4

printing ink

A dyed or viscous material for printing.

3.5

non-porous substrate

A substrate that prevent moisture from penetrating on the surface, including (but not limited to) sheets, polyethylene, polypropylene, cellophane, paper or cardboard added with non-porous materials, metallized polyester and nylon.

3.6

porous substrate

A substrate that does not prevent moisture from penetrating on the surface, including (but not limited to) paper, cardboard and any paper product added with porous materials.

3.7

flexographic ink

[GB 16297-1996, definition 3.3]

3.13

fugitive emission

Irregular emissions not going through exhaust pipes are deemed as fugitive emissions.

3.14

concentration limit at fugitive emission reference point

In the standard state, the limit that the average value of the concentration of air pollutants at reference points (determined according to HJ/T 55) in any 1 h shall not exceed.

3.15

emission pipe height

The height from the ground plane where the exhaust pipe (or its main building structure) is to the outlet of the exhaust pipe.

[GB 16297-1996, definition 3.10]

4 Technical contents

4.1 Definition of pollution sources and period division

4.1.1 The existing source refers to the pollution source that has been approved for production or environmental impact assessment before the date of implementation of this Standard (November 1, 2010). The new source refers to the pollution source under construction, reconstruction and expansion with the environmental impact assessment document has been approved from the date of implementation of this Standard (November 1, 2010).

4.1.2 The existing source and new source implement different emission limits in different periods. The existing source implements the limits of period I from the date of implementation of this Standard to December 31, 2012, and implement the limits of period II from January 1, 2013; the new source implements the limits of period II from the date of implementation of this Standard.

4.1.3 For emission limits, technical and management provisions without period division, implement form the date of implementation of this Standard.

Annex A

(normative)

Production processes and management requirements for VOCs emission control of printing industry

A.1 Inks, adhesives, organic solvents and other raw and auxiliary materials shall be stored in sealed containers. During the transfer of organic solvents and cleansing of ink rollers and other equipment, it shall reduce VOCs emissions as far as possible. Abandoned ink buckets, organic solvent containers or glue buckets shall be sealed before transferring to a special recycling facility.

A.2 Process lines that generate exhaust gas containing VOCs shall be placed in a closed working room as far as possible, and the exhaust gas shall be concentrated and imported to the VOCs control device for treatment; for production lines that cannot be set up in closed workplace, it shall set exhaust systems consisting of exhaust hoods and exhaust ducts as far as possible at the work section where emits VOCs.

A.3 For enterprises having VOCs treatment facilities, the VOCs treatment facilities shall reach the design and processing efficiency.

A.4 Closed exhaust system and pollution control equipment shall work synchronously with processing facilities. Exhaust gas collection devices and the treatment devices must be operated in accordance with the specification parameters.

A.5 Enterprise operators shall record monthly the name, manufacturer, brand, model, VOCs content, purchase amount, use amount and inventory and other information of the raw materials used that contain VOCs.

Annex B

(informative)

Extrapolation method for determining the maximum acceptable emission rate of exhaust pipes

If the exhaust pipe height is less than 15 m, calculate the maximum acceptable VOCs emission rate by extrapolation method, according to the following equation:

$$Q = Q_c(h/15)^2$$

where:

Q - the maximum acceptable VOCs emission rate, in kg/h;

Q_c - the maximum acceptable VOCs emission rate of a pollutant listed in Table 1, in kg/h;

h - the exhaust pipe height, in m.

Annex C

(informative)

Calculation methods for relevant parameters of equivalent exhaust pipes

C.1 When exhaust pipe 1 and exhaust pipe 2 emit the same pollutant and the distance between them is less than the sum of their height, the two exhaust pipes shall be represented by an equivalent exhaust pipe.

C.2 Calculation methods for relevant parameters of the equivalent exhaust pipe are as follows.

C.2.1 The VOCs emission rate of the equivalent exhaust pipe is calculated according to equation (C1):

$$Q = Q_1 + Q_2 \quad \text{..... (C1)}$$

where:

Q - the VOCs emission rate of the equivalent exhaust pipe, in kg/h;

Q_1, Q_2 - the VOCs emission rate of exhaust pipe 1 and exhaust pipe 2, in kg/h.

C.2.2 The height of the equivalent exhaust pipe is calculated according to equation (C2):

$$h = \sqrt{\frac{1}{2}(h_1^2 + h_2^2)} \quad \text{..... (C2)}$$

where:

h - the height of the equivalent exhaust pipe, in m;

h_1, h_2 - the height of exhaust pipe 1 and exhaust pipe 2, in m.

C.2.3 Position of equivalent exhaust pipe

The position of the equivalent exhaust pipe shall be located on the connection of exhaust pipe 1 and exhaust pipe 2. If exhaust pipe 1 is the origin, the distance between the equivalent exhaust pipe and the origin is calculated according to equation (C3)

$$x = a(Q - Q_1)/Q = aQ_2/Q \quad \text{..... (C3)}$$

where:

x - the distance between the equivalent exhaust pipe and exhaust pipe 1, in m;

Annex D

(normative)
VOCs monitoring methods

NOTE: This method does not address all possible safety issues and it is the user's responsibility to take appropriate safety precautions and to comply with national regulatory requirements.

D.1 Scope of application

This Annex specifies the monitoring methods for VOCs in organized emissions from enterprises. VOCs monitoring of fugitive monitoring points can also be performed in accordance with the relevant methods in this Annex.

D.2 General

D.2.1 Relevant standards and basis

References for sampling method:

1) US EPA Method TO-17.

2) GB/T 16157 Determination of particulates and sampling methods of gaseous pollutants emitted from exhaust gas of stationary source.

Reference for determination and analysis method of pollutants:

3) Annex E of GB 50325 Code for indoor environmental pollution control of civil building engineering (2006 revision): Determination of total volatile organic compounds (TVOC) in indoor air.

D.2.2 Method selection

D.2.2.1 The total VOCs concentration in this Standard refers to the arithmetic sum of all VOCs concentrations. It may choose one of the following methods to monitor:

1) use a monitoring method to determine all expected organic matters;

2) use a variety of specific monitoring methods to determine all the expected organic matters respectively.

D.2.2.2 The monitoring methods listed in Table D.1 or other methods approved by the Ministry of Environmental Protection shall apply to this Standard.

D.2.2.3 All methods shall comply with the basic requirements of Annex D.3.

D.3.2.3 If use a sampling method differ from the specified method, such as changing the adsorbent, it shall be demonstrated and meet the requirements of quality control/quality assurance.

D.3.2.4 Precautions

a) The temperature of partial exhaust gas is high and the effect of temperature on sampling and monitoring shall be taken into account.

b) The humidity of partial exhaust gas is high and the effect of humidity on sampling and monitoring shall be taken into account.

c) If use solid adsorption sampling method, the concentration and sampling volume of pollutants shall be estimated before sampling, which shall not exceed the penetration amount and volume of the adsorption tube (if the humidity of sample gas is more than 2 to 3%, the adsorption amount of the adsorption tube will be declined sharply).

D.3.3 Analysis

If use chromatographic method, in order to obtain better results, the following technical deviation may be chosen without limitation to the specific requirements of a method, but all deviations must meet the requirements of quality control/quality assurance.

a) Select a different solvent or dilution ratio;

b) Select a different chromatographic column;

c) Select different chromatographic conditions.

D.3.4 Quality assurance and control

D.3.4.1 Quality assurance and quality control measures shall be carried out as required by the method.

D.3.4.2 The actual operation that deviates from the requirements of the method must comply with the basic principle requirements of the method. If the method has not specific requirements, it shall be carried out with reference to the requirements of GB/T 16157-1996 and this Annex D.4.6.

D.4 VOCs monitoring method

D.4.1 Principle

Collect gas samples by adsorption tubes, and inject the adsorbed gas into gas chromatograph by thermal desorption method for qualitative and quantitative analysis.

D.4.4.1.2 The adsorption tube shall be purged with nitrogen and heated to no impurity peaks.

D.4.4.2 Sample collection

Sampling of fugitive emission reference points shall be in accordance with *Monitoring and Analysis Methods for Air and Exhaust Gas* (Fourth Edition); sampling of exhaust pipes shall be in accordance with GB/T 16157.

If the atmosphere contains more particulates, a filter head may be connected in front of the sampling tube.

Record the sampling time, sampling flow, temperature and atmospheric pressure.

D.4.4.3 Field blank sample collection

Transport the purified sampling tube to the sampling site; remove the Teflon cap and seal it immediately. It is not used for sample collection and stored with the sampling tube that has been used to collect sample. At each time of sample collection, at least one field blank sample shall be collected.

D.4.5 Analysis of adsorption tube samples

D.4.5.1 Selection of chromatographic columns

According to the expected organic matter (category, concentration), select a chromatographic column that provides well separation and fast peaks.

D.4.5.2 Establishment of chromatographic operating conditions

According to the standard and the test, determine the optimal conditions for the analysis, that is, the material that is expected to be analyzed has a good separation effect and the shortest analysis time.

D.4.5.3 Establishment of reference curve

Use appropriate gas reference or liquid reference for organic matter and select appropriate concentration. Each kind of organic matter has at least 5 different reference concentration points. Prepare each reference sample and inject them into the adsorption tube as a reference series. Analyze the reference series in adsorption tubes by thermal desorption gas chromatography. The reference curve is drawn with the content (μg) of each component as the abscissa and the peak area as the ordinate.

D.4.5.4 Determination

Analyze the sample and the field blank according to the same thermal desorption gas chromatography analysis method as that of the reference series, carry out qualitative

site. Use two sets of exactly the same sampling devices, one is labeled and another is not labeled. Place two sampling tubes in the flue or at fugitive monitoring points, sampling tubes shall be placed on the same cross section at a distance of 2.5 cm. Add all expected compounds (gaseous or liquid) to the adsorption tube of the labeled device before sampling. The collection amount of the labeled device shall be about 40 % to 60 % of that of the unlabeled device. Two sets of devices simultaneously collect gas in the pipe; use the same instrument and method to analyze the adsorption tubes collected from the two sets of devices. Calculate the average recovery rate (*R*) for each labeled substance according to equation (D3):

$$R = \frac{(t-u)\times V_s}{s}\times 100\ \% \qquad \text{..... (D3)}$$

where:

R - the recovery rate.

t - the measured concentration of labeled samples, in mg/m^3.

u - the measured concentration of unlabeled samples, in mg/m^3.

V_s - the sample volume of labeled samples, in L.

s - the quality of labeled substances, in μg.

The acceptable range of the recovery rate is 60 % < *R* < 120 %. If the *R* value fails to meet the requirements, this sampling technology does not apply.

D.4.6.2 Additional requirements for adsorption tube sampling method

D.4.6.2.1 The adsorption capacity of two adsorption tubes can be tested in series. If the determination results of the latter adsorption tube exceed 10 % of the total amount (the sum of the two tubes), it is considered to have penetrated.

D.4.6.2.2 The sampler or flowmeter shall be calibrated as specified. If the flow change is greater than 5 % but not more than 10 % after sampling, it shall be calibrated; if the flow change is greater than 10 %, it shall re-sample.

D.4.6.3 Performance indicators of methods

The precision of this method: the deviation of parallel sample is not greater than 10 %. The accuracy of this method: the error is not greater than ± 10 %.

D.4.6.4 Interference and elimination

D.4.6.4.1 Periodically analyze blank experiments of hydrocarbon-free air or nitrogen to ensure that the analytical system is not contaminated.

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