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**Standard for Fugitive Emission of Volatile Organic
Compounds**

挥发性有机物无组织排放控制标准

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Standard for Fugitive Emission of Volatile Organic Compounds

1 Scope

This Standard specifies the fugitive emission control requirements for VOCs-containing materials storage; the fugitive emission control requirements for VOCs-containing materials transferring and transportation; the VOCs fugitive emission control requirements in the technology process; the control requirements for equipment and pipeline components VOCs leakage; control requirements for open liquid surface VOCs fugitive emission; as well as the requirements for the exhaust gas collection and treatment system of VOCs fugitive emissions; and the requirements for pollution monitoring in and around the enterprise plant.

This Standard is applicable to the management of VOCs fugitive emission of existing enterprises or VOCs fugitive emission of production facilities; the environmental impact assessment, design of environmental protection facilities, environmental protection acceptance of completion, and review of pollution emission permits for the construction projects involving VOCs fugitive emission; as well as the management of VOCs fugitive emission after the project is put into production.

The industry pollutant emission standards issued by the state have stipulated the VOCs fugitive emission control; and they shall be implemented in accordance with the industry pollutant emission standards.

If, due to the safety factors or special process requirements, the requirements for the VOCs fugitive emission specified in this Standard cannot be met, other equivalent pollution control measures may be taken and report to the local ecological environment authority or be implemented in accordance with the relevant requirements of the pollutant emission permit.

2 Normative References

This Standard quoted the following documents or some clauses in them. For the undated documents, only the latest version is applicable to this Standard.

GB 16297 Comprehensive Emission Standard of Air Pollutants

GB/T 8017 Standard Test Method for Vapor Pressure of Petroleum Products (Reid

3 Terms and Definitions

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

3.1 Volatile organic compounds (VOCs)

Organic compounds that participate in atmospheric photochemical reactions, or organic compounds determined in accordance with relevant provisions.

When characterizing the overall emissions of VOCs, according to industry characteristics and environmental management requirements, total volatile organic compounds (expressed in TVOC) and non-methane hydrocarbons (expressed in NMHC) may be used as pollutant control items.

3.2 Total volatile organic compounds (TVOC)

Use the prescribed monitoring method to measure the individual VOCs in the exhaust gas; sum them together to obtain the total amount of VOCs; it shall be calculated by the mass concentration of the individual VOCs. In actual work, the individual VOCs that account for more than 90% of the total amount shall be measured and summed according to the expected analysis results.

3.3 Non-methane hydrocarbons (NMHC)

Use the prescribed monitoring method, the total amount of gaseous organic compounds other than methane that the hydrogen flame ionization detector responds are measured by the mass concentration of carbon.

3.4 Fugitive emission

Air pollutants are emitted randomly without passing through the exhaust tube, including the escape of open workplaces, and the emission through gaps, vents, open doors and windows, and similar openings (holes), etc.

3.5 Closed/close

The state or operating method of the pollutant that does not come into contact with the ambient air, or is isolated from the ambient air through sealing materials and sealing equipment.

3.6 Closed space

A closed area or closed building formed by a complete enclosure structure to block the pollutants, workplaces, etc. from the surrounding space. In this closed area or closed building, except for the entry and exit of personnel, vehicles, equipment, and materials, as well as exhaust pipes and vents established by law, doors, windows, and other

the primary seal, and the upper seal is called the secondary seal.

3.13 Vapor balancing system

A gas communication and balancing system installed between the loading facility and the storage tank or between the storage tanks.

3.14 Leakage detection value

Use the prescribed monitoring method, the net value of the VOCs concentration of the leak points of the equipment and pipeline components detected by the testing instrument after deducting the environmental background value, which is expressed in mole fraction of carbon.

3.15 Open recirculating cooling water system

A circulating cooling water system in which circulating cooling water directly contacts the atmosphere to dissipate heat.

3.16 Existing facility

Industrial enterprises or production facilities that have been completed and put into operation before the implementation of this Standard, or whose environmental impact assessment documents have been approved or filed.

3.17 New facility

Since the date of implementation of this standard, the environmental impact assessment documents have been approved or filed for new, rebuilt and expanded industrial construction projects.

3.18 Key regions

In accordance with the requirements of environmental protection work, regions that have serious air pollution, fragile ecological environment, or need for further environmental air quality improvement, and require strict control of air pollutant emission.

3.19 Stack height

The height from the ground where the exhaust tube (or its main building structure) is located to the exhaust tube outlet, in m.

3.20 Enterprise boundary

The legal boundary of an enterprise or production facility. If it is difficult to determine the legal boundary, it refers to the actual land occupation boundary of the enterprise or production facility.

used between the floating roof and the tank wall. For outer floating roof tanks, double seals shall be used between the floating roof and the tank wall; and the prime seal shall adopt high-efficiency sealing methods such as liquid-mounted seal and mechanical shoe seal, etc.

- b) Use fixed roof tanks, the emitted exhaust gas shall be collected, treated and meet the requirements of the relevant industry emission standards (the requirements of GB 16297 shall be met if there is no industry emission standard), or the treatment efficiency shall be no less than 80%.
- c) Adopt a gas balancing system.
- d) Adopt other equivalent measures.

5.2.2 Special control requirements for storage tanks

5.2.2.1 For the storage tanks that store the volatile organic liquid with true vapor pressure ≥ 76.6 kPa, low-pressure tanks, pressure tanks or other equivalent measures shall be adopted.

5.2.2.2 For the storage tanks that store the volatile organic liquids with true vapor pressure ≥ 27.6 kPa but < 76.6 kPa and tank volume ≥ 75 m³, as well as the storage tanks that store the volatile organic liquid with true vapor pressure ≥ 5.2 kPa but < 27.6 kPa and tank volume ≥ 150 m³, they shall meet one of the following requirements:

- a) Use floating roof tanks. For inner floating roof tanks, high-efficiency sealing methods such as liquid-mounted seal and mechanical shoe seal, etc. shall be used between the floating roof and the tank wall. For outer floating roof tanks, double seals shall be used between the floating roof and the tank wall; and the prime seal shall adopt high-efficiency sealing methods such as liquid-mounted seal and mechanical shoe seal, etc. shall be adopted.
- b) Use fixed roof tanks, the emitted exhaust gas shall be collected, treated, and meet the requirements of relevant industry emission standards (the requirements of GB 16297 shall be met if there is no industry emission standard), or the treatment efficiency shall be no less than 90%.
- c) Adopt a gas balancing system.
- d) Adopt other equivalent measures.

5.2.3 Requirements for operation and maintenance of the storage tank

5.2.3.1 Floating roof tank

- a) The body of the floating roof tank shall be kept intact without any holes or gaps. The edge seal of the floating roof shall not be damaged.

shall be used.

6.1.2 The powdery and granular VOCs materials shall be transported by pneumatic conveying equipment, tubular belt conveyors, screw conveyors, and other closed methods; or shall be transferred by sealed packaging bags, containers or tankers.

6.1.3 When loading volatile organic liquids, it shall meet the requirements of 6.2.

6.2 Loading of volatile organic liquids

6.2.1 Loading method

Volatile organic liquids shall be loaded at the bottom; if top immersion loading is used, the height from the discharge nozzle to the bottom of the groove (tank) shall be less than 200 mm.

6.2.2 Loading control requirements

If loading the materials with true vapor pressure ≥ 27.6 kPa and the annual loading capacity of a single loading facility ≥ 500 m³, the loading process shall meet one of the following requirements:

- a) The emitted exhaust gas shall be collected, treated and meet the requirements of relevant industry emission standards (if there is no industry emission standard, the requirements of GB 16297 shall be met), or the treatment efficiency shall be no less than 80%;
- b) The emitted exhaust gas is connected to the gas balancing system.

6.2.3 Special control requirements for loading

If loading the materials with true vapor pressure ≥ 27.6 kPa and the annual loading capacity of a single loading facility ≥ 500 m³, as well as loading the materials with true vapor pressure ≥ 5.2 kPa but < 27.6 kPa and the annual loading capacity of a single loading facility ≥ 2500 m³, the loading process shall meet one of the following requirements:

- a) The emitted exhaust gas shall be collected, treated and meet the requirements of relevant industry emission standards (if there is no industry emission standard, the requirements of GB 16297 shall be met), or the treatment efficiency should not be less than 90%;
- b) The emitted exhaust gas is connected to the gas balancing system.

7 VOCs Fugitive Emission Control Requirements in the

and treatment system. If airtight equipment is not used, it shall be operated in a closed space; or local gas collection shall be carried out; and the exhaust gas should be discharged to the VOCs exhaust gas collection and treatment system.

- c) The exhaust gas discharged from the operation of the units such as absorption, washing, distillation/rectification, extraction, and crystallization ones, and the non-condensable tail gas discharged from the operation of the condensation unit, as well as the desorption tail gas from the operation of the adsorption unit shall be discharged to the VOCs exhaust gas collection and treatment system.
- d) The mother liquor of VOCs after separation and refining shall be sealed to collect; and the exhaust gas generated in the mother liquor storage groove (tank) shall be discharged to the VOCs exhaust gas collection and treatment system.

7.1.4 Vacuum system

The vacuum system shall use a drying vacuum pump; and the vacuum exhaust gas shall be discharged to the VOCs exhaust gas collection and treatment system. If using the liquid ring (water ring) vacuum pumps, water (steam) jet vacuum pumps, etc., the circulating groove (tank) of the working medium shall be sealed; and the vacuum exhaust gas and circulating groove (tank) exhaust gas shall be discharged to the VOCs exhaust gas collection and treatment system.

7.1.5 Ingredient processing and packaging of VOCs-containing products

Ingredients processing processes, such as mixing, stirring, grinding, granulating, slicing, briquetting of VOCs material, as well as the packaging (filling, sub-packing) process of VOCs-containing products shall be operated in airtight equipment or in a closed space; and the exhaust gas shall be discharged to VOCs exhaust gas collection and treatment system. If it cannot be sealed, local gas collection measures shall be taken, and the exhaust gas shall be discharged to the VOCs exhaust gas collection and treatment system.

7.2 The use process of VOCs-containing products

7.2.1 For VOCs-containing products with a mass percentage of VOCs greater than or equal to 10%, the use process shall adopt airtight equipment or operate in a closed space; and the exhaust gas should be discharged to the VOCs exhaust gas collection and treatment system. If it cannot be closed, local gas collection measures shall be taken; the exhaust gas shall be discharged to the VOCs exhaust gas collection and treatment system. The use process of VOCs-containing products includes but is not limited to the following operations:

- a) Blending (mixing, stirring, etc.);
- b) Painting (spraying, dipping coating, flow coating, roll coating, spread coating,

8.3.1 The enterprise shall conduct VOCs leak detection on the sealing points of equipment and pipeline components at the following frequency:

- a) Visually observe the sealing points of the equipment and pipeline components weekly to check whether there is visible leakage at the sealing positions.
- b) Pumps, compressors, agitators (machines), valves, open valves or open pipelines, pressure relief equipment, and sampling connection systems shall be detected at least once every 6 months.
- c) Flanges and other connecting parts and other sealing equipment shall be detected at least once every 12 months.
- d) For directly-discharged pressure relief equipment, perform leak detection in a non-pressure relief state. After the pressure is released from the directly-discharged pressure relief equipment, the pressure relief equipment shall be conducted leak detection within 5 working days from the date of pressure relief.
- e) After the initial starting or maintenance of equipment and pipeline components, leak detection shall be carried out within 90 days.

8.3.2 Equipment and pipeline components that meet one of the following conditions can be exempted from leak detection:

- a) When the system is in negative pressure state under normal working state;
- b) When using the canned motor pumps, magnetic pumps, diaphragm pumps, bellows pumps, double-end-face mechanical seal pumps with the pressure of sealing isolation liquid higher than the pressure of the technology, or pumps with the same efficiency;
- c) When using shielded compressors, magnetic compressors, diaphragm compressors, double-end-face mechanical seal compressors with the pressure of sealing isolation liquid higher than the pressure of the technology, or compressors with equivalent performance;
- d) When using the shielded mixers, magnetic mixers, double-end-face mechanical seal mixers with the pressure of sealing isolation liquid higher than the pressure of the technology, or mixers with equivalent efficiency;
- e) When using the shield valves, diaphragm valves, bellows valves or valves with equivalent efficiency, and pressure relief valves with rupture discs upstream;
- f) When the equipment and pipeline components are equipped with seal failure detection and alarm systems;
- g) When the immersed (semi-immersed) pumps and other equipment and pipeline

- a) When using online sampling analysis system;
- b) When adopting a closed loop sampling connection system;
- c) When the sampling connection system is connected to the VOCs exhaust gas collection and treatment system;
- d) When using airtight containers to store and record the sample recovery volume.

9 Control Requirements for Open Liquid Surface VOCs Fugitive Emission

9.1 Control requirements for wastewater liquid-level

9.1.1 Wastewater gathering and transportation system

For VOCs-containing wastewater discharged from the technology process, the gathering and transportation system shall meet one of the following requirements:

- a) Use airtight pipelines for transportation, and take measures to isolate the inlet and outlet from ambient air;
- b) Use ditch transportation. If the detected concentration of VOCs at 100 mm above the open liquid level is $\geq 200 \mu\text{mol/mol}$, it shall be sealed and the inlet and outlet shall be isolated from the ambient air.

9.1.2 Wastewater storage and treatment facilities

If the detected concentration of VOCs at 100 mm above the open liquid level of the VOCs-containing wastewater storage and treatment facilities is $\geq 200 \mu\text{mol/mol}$, it shall one of the following requirements:

- a) Use floating top cover;
- b) Adopt a fixed top cover to collect exhaust gas to the VOCs exhaust gas collection and treatment system;
- c) Other equivalent measures.

9.2 Special control requirements for wastewater liquid-level

9.2.1 Wastewater gathering and transportation system

For VOCs-containing wastewater discharged from the technology process, the gathering and transportation system shall meet one of the following requirements:

10.2.1 Enterprises shall consider factors such as production technology, operation methods, exhaust gas properties, treatment methods and the like to classify and collect VOCs exhaust gas.

10.2.2 The setting of the exhaust hood (gas collection hood) of the exhaust gas collection system shall meet the requirements of GB/T 16758. If an external exhaust hood is used, the wind speed shall be measured and controlled according to the method specified in GB/T 16758, AQ/T 4274-2016; and the measurement point shall be selected at the position of VOCs fugitive emission farthest from the opening surface of the exhaust hood to control the wind speed to be no less than 0.3 m/s (If there are specific provisions in the relevant industry regulations, the relevant provisions shall be implemented).

10.2.3 The conveying pipeline of the exhaust gas collection system shall be sealed. The exhaust gas collection system shall be operated under negative pressure. If it is under positive pressure, the sealing points of the pipeline components shall be conducted leak detection; the leak detection value shall not exceed 500 $\mu\text{mol/mol}$, neither there shall be sensory detectable leakage. The requirements for the frequency of leak detection, repair and recording shall be implemented in accordance with Clause 8.

10.3 Requirements for VOCs emission control

10.3.1 The emission of pollutants from the VOCs exhaust gas collection and treatment system shall comply with the provisions of GB 16297 or relevant industry emission standards.

10.3.2 When the initial emission rate of NMHC in the collected exhaust gas is ≥ 3 kg/h, VOCs treatment facilities shall be equipped, and the treatment efficiency shall be no less than 80%. For key regions, when the initial emission rate of NMHC in the collected exhaust gas is ≥ 2 kg/h, VOCs treatment facilities shall be equipped, and the treatment efficiency shall be no less than 80%; except for the raw and auxiliary materials used in compliance with the national regulations on products with low VOCs content.

10.3.3 If the exhaust gas that enters the VOCs combustion (incineration, oxidation) device needs supplementary air for combustion and oxidation reaction; the measured atmospheric pollutant emission concentration in the exhaust cylinder shall be converted into the atmospheric pollutant emission concentration with reference oxygen content of 3% according to Formula (1). When using boilers, industrial furnaces, and solid waste incinerators to incinerate organic exhaust gas, the reference oxygen content of the flue gas shall be implemented in accordance with its emission standards.

$$\rho_{\text{ref.}} = \frac{21 - O_{\text{ref.}}}{21 - O_{\text{act.}}} \times \rho_{\text{act.}} \quad (1)$$

around the Enterprise Plant

11.1 The monitoring requirements of VOCs at the enterprise boundary and surrounding areas shall implement the provisions of GB 16297 or relevant industry emission standards.

11.2 The local ecological and environmental authorities may monitor the VOCs fugitive emission in the plant area according to local environmental protection needs, and the specific implementation methods are determined by each locality. Refer to Appendix A for the monitoring requirements for VOCs fugitive emission in the plant.

12 Pollutant Monitoring Requirements

12.1 The enterprise shall establish an enterprise monitoring system, formulate a monitoring plan, conduct self-monitoring of pollutant discharge status and its impact on the surrounding environmental quality in accordance with relevant laws, *Measures for the Administration of Environmental Surveillance*, HJ 819 and relevant provisions; keep original monitoring records; and announce the monitoring results.

12.2 The requirements for the installation of automatic pollutant discharge monitoring equipment for newly-built enterprises and existing enterprises shall be implemented in accordance with relevant laws, *Measures for Automatic Monitoring and Management of Pollution Sources*, and relevant provision.

12.3 For VOCs emission from storage tanks of volatile organic liquids, loading facilities of volatile organic liquids, and exhaust gas collection and treatment systems, its monitoring, sampling and measurement methods shall be implemented in accordance with the provisions of GB/T 16157, HJ/T 397, HJ 732 and HJ 38, HJ 1012, HJ 1013. For pollution sources whose emission intensity fluctuates periodically, for instance storage tank breathing exhaust gas, the pollutant emission monitoring period shall cover the period of high emission intensity.

12.4 For VOCs emission from the leakage of equipment and pipeline components and the emission the open liquid surface, its monitoring, sampling and measurement methods shall be implemented in accordance with the provisions of HJ 733, and use a hydrogen flame ionization detector (with methane or propane as calibration gas). For the total organic carbon (TOC) in circulating cooling water, the measurement method shall be implemented in accordance with HJ 501.

12.5 The monitoring of VOCs at the boundary of the enterprise and its surroundings shall be implemented in accordance with HJ/T 55.

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