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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 32251-2024

Replacing GB/T 32251-2015

Investment casting process - Pollutants control

熔模铸造工艺 污染物的控制

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Foreword Foreword

The document is drafted in accordance with the rules given in GB/T 1.1-2020, Directives for standardization-Part 1: Rules for the structure and drafting of standardizing documents.

It replaces GB/T 32251-2015, Investment casting process-Pollutants control. Apart from structural adjustments and editorial changes, the main technical changes are: the scope has been changed (Clause 1, against Clause 1 of the 2015 edition); requirements on the types of pollutant and their discharge limits have been added (Clause 4); pollutant monitoring requirements have been added (Clause 5); sampling and test methods for pollutant monitoring have been added (Clause 6); the mould material, the preparation, melting and recovery of the pattern material, the preparation of the core and the assembly and cleaning of the wax patterns have been deleted (3.1, 3.2, 3.3 and 3.4 of the 2015 edition); protective measures in the wax pattern preparation process have been added (7.1); the protective measures in the shell and core preparation process (7.2), in the melting and pouring process (7.3), in the cleaning and finishing process (7.4) and in the casting quality inspection process (7.5) have been changed against 3.5 to 3.8 of the 2015 edition; and the discharge of pollutants has been deleted (3.9 of the 2015 edition). In the printed list the item letters stand after their items rather than before them, so that the first change carries no letter and the last is followed by the letter k.

The document was proposed by and is under the jurisdiction of the National Technical Committee on Foundry of Standardization Administration of China (SAC/TC 54). It was first issued in 2015, and the present edition is the first revision.

1 Scope

The document lays down the types and discharge limits of the pollutants produced in investment casting, the monitoring requirements, the sampling and test methods for monitoring, and the protective measures.

It applies to the control of the pollutants produced in the investment casting process.

2 Normative references

The following documents are cited normatively in the text and their content constitutes indispensable provisions of the document. For dated references only the edition cited applies; for undated references the latest edition, including all amendments, applies.

The water quality methods cited are GB 7466 for total chromium, GB 7467 for hexavalent chromium by diphenylcarbazide spectrophotometry, GB 7475 for copper, zinc, lead and cadmium by atomic absorption spectrophotometry, GB/T 11893 for total phosphorus by ammonium molybdate spectrophotometry, GB/T 11901 for suspended matter by the gravimetric method, GB/T 11911 for iron and manganese by flame atomic absorption spectrophotometry, GB/T 11912 for nickel by flame atomic absorption spectrophotometry, HJ 485 for copper by sodium diethyldithiocarbamate spectrophotometry, HJ 535 for ammonia nitrogen by Nessler reagent spectrophotometry, HJ 537 for ammonia nitrogen by distillation and neutralization titration, HJ 601 for formaldehyde by acetylacetone spectrophotometry, HJ 636 for total nitrogen by alkaline potassium persulfate digestion and ultraviolet spectrophotometry, HJ 637 for petroleum oils and animal and vegetable oils by infrared spectrophotometry, and HJ 828 for chemical oxygen demand by the dichromate method.

The air and waste gas methods cited are GB/T 15432 for total suspended particulates in ambient air by the gravimetric method, GB/T 16157 for the determination of particulates and the sampling of gaseous pollutants in the exhaust of stationary sources, HJ 38 for total hydrocarbons, methane and non-methane hydrocarbons in the waste gas of stationary sources by gas chromatography, HJ 549 for hydrogen chloride in ambient air and waste gas by ion chromatography, HJ 604 for total hydrocarbons, methane and non-methane hydrocarbons in ambient air and waste gas by direct injection gas chromatography, HJ 629 for sulfur dioxide in the waste gas of stationary sources by non-dispersive infrared absorption, HJ 692 for nitrogen oxides in the waste gas of stationary sources by non-dispersive infrared absorption, HJ 693 for nitrogen oxides in the waste gas of stationary sources by the fixed potential electrolysis method, HJ 836 for low-concentration

particulates in the waste gas of stationary sources by the gravimetric method, HJ/T 55 for the technical guidelines on monitoring fugitive emission of air pollutants, and HJ/T 56 for sulfur dioxide in the exhaust of stationary sources by the iodometric method.

The remaining documents cited are GB/T 5611, Terminology of casting; GB 8978, Integrated wastewater discharge standard; GB 12348, Emission standard for industrial enterprises noise at boundary; GB 39726, Emission standard of air pollutants for foundry industry; GBZ/T 189.4, Measurement of physical agents in workplace-Part 4: Laser radiation; GBZ/T 189.8, Measurement of physical agents in workplace-Part 8: Noise; and HJ/T 92, Technical specifications for monitoring the total quantity of water pollutant discharge.

3 Terms and definitions

The terms and definitions given in GB/T 5611 apply to the document.

4 Types of pollutant and discharge limits

The types of pollutant produced in investment casting are given in Table 1, and the discharge limits for the solid, liquid, gaseous and other pollutants produced are to comply with Tables 2 to 5 respectively.

Table 1 lists the pollutants by process stage and classes each as a solid, liquid, gaseous or other pollutant. In wax pattern preparation: volatile organic compounds, particulates in the form of fume, non-methane hydrocarbons as a fugitive emission, waste gas from three-dimensional printing of wax patterns and malodour, expressed as a dimensionless quantity, all gaseous pollutants. In shell and core preparation: silica dust, zircon flour and the like as solid pollutants; volatile organic compounds, particulates in the form of fume and fugitive non-methane hydrocarbons as gaseous pollutants; hydrogen chloride as a liquid pollutant; and noise as another pollutant. In melting and pouring: particulates, sulfur dioxide and nitrogen oxides as gaseous pollutants; light pollution and noise as other pollutants. In casting cleaning and finishing: particulates in the form of fume as a gaseous pollutant; noise as another pollutant; and chemical cleaning liquid as a liquid pollutant. In casting quality inspection: fluorescent waste liquid and dye penetrant waste liquid as liquid pollutants, and ionizing radiation as another pollutant.

Table 2, discharge limits for the solid pollutants, gives limits in milligrams per cubic metre: particulates 30, and silica dust, zircon flour and the like 30.

Table 3, discharge limits for the liquid pollutants, applies to chemical cleaning liquid, fluorescent waste liquid and dye penetrant waste liquid. It gives a limit for direct discharge and a limit for indirect discharge, expressed in milligrams per litre except for the pH value, together with the monitoring position. Measured at the general wastewater outlet: pH value 6 to 9 for both direct and indirect discharge; suspended matter 30 and 70; chemical oxygen

demand 60 and 180; petroleum oils 3 and 10; total nitrogen 15 and 35; total phosphorus 0.5 and 2.0; ammonia nitrogen 5 and 15; total iron 2.0 and 10; and total copper 0.5 and 1.0. Measured at the wastewater outlet of the workshop or of the production facility, a single limit is printed for each of the last three items: hexavalent chromium 0.5, total chromium 1.5 and total nickel 1.0.

Table 4, discharge limits for the gaseous pollutants, gives a discharge concentration limit and an exposure limit, in milligrams per cubic metre. Volatile organic compounds: discharge limit 100, no exposure limit. Fugitive non-methane hydrocarbons: 30, no exposure limit. Waste gas from three-dimensional printing of wax patterns: 30, no exposure limit. Malodour, dimensionless: 2000, no exposure limit. Hydrogen chloride: no discharge limit, exposure limit 30. Sulfur dioxide: 200, no exposure limit. Nitrogen oxides: 200, no exposure limit.

Table 5, discharge limits for the other pollutants, has columns for the pollutant class, the wavelength in nanometres, the exposure time in seconds, the radiant exposure in joules per square centimetre, the irradiance in watts per square centimetre and the exposure limit. For ionizing radiation the exposure limit is 2.5 $\mu\text{Sv/h}$ and for noise 85 dB(A). The three lines for visible and infrared radiation over the wavelength range 400 nm to 1400 nm are divided into three bands of exposure time, and the corresponding radiant exposure and irradiance values are given as expressions in the correction factor CA and the exposure time; those expressions, and the relation between the wavelength and the correction factor given in the note to the table, are damaged in the extracted text and are not reproduced here.

5 Pollutant monitoring requirements

The requirements on the monitoring of fugitive pollutant emissions within the plant area of the enterprise and the requirements on the monitoring of pollutants at the boundary of the enterprise are to comply with GB 39726.

6 Sampling and test methods for pollutant monitoring

6.1.1 Sampling for the monitoring of particulates and gaseous pollutants follows GB/T 16157.

6.1.2 Volatile organic compounds are sampled by collecting the waste gas discharged from the stack of the stationary source directly with equipment such as a vacuum box or a suction pump and storing it for monitoring in a gas bag of a fluoropolymer film of good chemical inertness. For a source whose discharge intensity varies in cycles, the monitoring period is to cover the periods of high discharge intensity.

6.1.3 Sampling for the monitoring of gaseous pollutants at the boundary of the enterprise follows HJ/T 55. 6.1.4 Sampling for the monitoring of liquid pollutants follows GB 8978 and HJ/T 92.

6.2 Test methods. The pollutants are tested by the methods listed in Tables 6 and 7.