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Code for dust collection design of non-ferrous metals plant

有色金属冶炼厂收尘设计规范

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2.1 Terms

2.1.1 flue gas - the gas containing dust and other pollutants produced during a pyrometallurgical smelting process.

2.1.2 dust resistivity - the resistance value of dust of unit area at unit thickness.

2.1.3 dust collection - the process of separating the dust in flue gas from the gas.

2.1.4 dust concentration - the mass of dust contained in a unit volume of gas.

2.1.5 collection efficiency - the percentage of the mass of dust captured by the collector in unit time over the mass of dust entering the collector.

2.1.6 pneumatic conveying - a way of conveying material through a pipeline by means of a gas stream.

2.1.7 bag filter - a collector that captures the dust in a dust-laden gas by means of bag-shaped or cylinder-shaped filtering elements made of a filter medium.

2.1.8 electrostatic precipitator - a collector that separates dust from the gas by the attraction that a high-voltage electric field exerts on charged dust.

2.1.9 dry-type collection - a collection process that does not use liquid to capture the dust in a dust-laden gas.

2.1.10 wet separation - a collection process in which the washing action of a liquid separates the dust from the dust-laden gas.

2.1.11 precipitator gas velocity - the ratio of the volume of flue gas treated by an electrostatic precipitator in unit time to the flow area of the electric field.

2.1.12 dust drift velocity - the velocity at which charged dust moves towards the surface of the collecting plate under the force of the electric field.

2.1.13 filtration velocity - the apparent velocity of the dust-laden gas stream through the effective area of the filter material.

2.1.14 spray cooler - a device that sprays into the flue gas a liquid atomized by gas or mechanically and lowers the flue gas temperature by the latent heat of vaporization of that liquid.

2.1.15 back corona - the local discharge that takes place inside a layer of high-resistivity dust deposited on the surface of the collecting electrode.

2.1.16 corona block - the phenomenon in which, when the dust concentration in the electric field reaches a certain limiting value, the electrostatic shielding effect brings the corona current down to nearly zero.

2.1.17 dew point temperature - the temperature at which unsaturated air of a given moisture content, at a given atmospheric pressure, reaches saturation on cooling.

2.1.18 heat transfer coefficient - the heat flow through a unit area under a unit temperature difference between the hot and cold fluids on the two sides of a body, in the steady state.

2.2 Symbols

The clause gives the symbols and units used in the document. Flue gas quantity under operating conditions and under standard conditions, in cubic metres per hour and in normal cubic metres per hour; flue gas temperature and air temperature, in degrees Celsius; dust

concentration of the flue gas, in grams per normal cubic metre; quantity of dust captured, in kilograms per hour.

System pressure and system resistance, in pascals; air leakage rate, as a percentage; heat dissipated by the flue gas cooling facilities, in kilojoules per hour; area of the collector or of the cooler, in square metres; plate area of an electrostatic precipitator, in square metres; flue gas velocity, in metres per second or metres per minute; efficiency of the collection equipment selected, as a percentage.

Motor power, in kilowatts; motor speed, in revolutions per minute; inside diameter of a pipe or fitting, nominal diameter and outside diameter, in millimetres; water consumption per unit time, in tonnes per hour; drift velocity of the dust inside the electrostatic precipitator, in metres per second.

Mean temperature, flue gas dew point temperature and temperature difference between the flue gas and the cooling medium, in degrees Celsius; specific heat capacity of the flue gas, in kilojoules per normal cubic metre and degree Celsius; heat transfer coefficient, in watts per square metre and degree Celsius; flue gas density under operating conditions, in kilograms per cubic metre, and under standard conditions, in kilograms per normal cubic metre; mixing ratio, in kilograms of material per kilogram of gas.

3.1 Process flow - General requirements

3.1.1 Dry collection should be chosen for the collection flow. Where dry collection is not suitable, wet collection may be chosen. The waste water from wet collection is to be recirculated; when it has to be discharged, it is to be treated up to the discharge standard. Wet collection should not be chosen in the cold regions of the north.

3.1.2 A fan should be provided for the collection system, and it should be placed downstream of the collection equipment. When flue gas containing arsenic is treated, the arsenic collection equipment is to work under negative pressure, and the arsenic-bearing dust collected must not be conveyed by positive-pressure pneumatic conveying.

3.1.3 For the equipment and pipework of the collection system that need thermal insulation, the insulation design is to follow the relevant provisions of the current national standard GB 50264 on the design of thermal insulation for industrial equipment and pipework. Pipes carrying sulphur dioxide gas may be given an internal anti-corrosion lining.

3.1.4 This clause is one of the provisions declared mandatory in the ministerial announcement. When the flue gas entering an electrostatic precipitator contains carbon monoxide, a carbon monoxide detection device must be installed on the inlet duct of the precipitator. When the carbon monoxide content exceeds 2 %, the precipitator must give an alarm; when it exceeds 4 %, the precipitator must be interlocked so as to cut off the power supply.

3.1.5 Temperature and pressure detection devices and a dust detection device are to be provided at the inlet and outlet of the collection equipment. For flue gas sent to acid making, flue gas flow and sulphur dioxide detection devices should be placed at the fan outlet.

3.1.6 The operating temperature of a dry collection system should be kept at least 30 degrees Celsius above the flue gas dew point. When the collection system has to work below the dew point temperature, strict anti-corrosion measures are to be taken on the pipework and the equipment of the system.

3.1.7 The choice of the dust collection process flow is to be made on the basis of the specific smelting process requirements, the properties of the flue gas and of the dust, and the conditions of the project.

3.2 and 3.3 Tables for drying of materials and for copper smelting

3.2.1 requires the collection flow and the technical indices for the flue gas from the drying of the various non-ferrous metals to comply with Table 3.2.1. The table sets out four flow routes, each running from the drying kiln or drying machine through a collection train - bag filter, electrostatic precipitator, wet collector, or settling chamber followed by first-stage and second-stage cyclones and an electrostatic precipitator - to the fan and then to atmosphere or to desulphurization. For each route the table fixes a minimum total collection efficiency of the system and a maximum total air leakage rate of the system, both as percentages. The individual figures are not reproduced here.

3.3.1 requires the collection flow and the technical indices for the flue gas from copper smelting furnaces to comply with Table 3.3.1. The table is arranged in five columns: name of the smelting furnace, flow route, minimum total collection efficiency of the system, maximum total air leakage rate of the system, and operating temperature of the electrostatic precipitator. Four furnace types are listed: top-blown smelting furnace, slag-cleaning electric furnace, bottom-blown smelting furnace and flash smelting furnace. The individual figures are not reproduced here.

3.3.2 and 3.3.3 carry two further tables of the same shape, for the flue gas from copper converting and for the arsenic-bearing flue gas of copper smelting. Clauses 3.4 to 3.8, on nickel, lead, zinc, tin and aluminium smelting, are built in the same way, each with one or more tables that pair a flow route with a minimum total collection efficiency, a maximum total air leakage rate and an operating temperature limit for the collection equipment.

Note on the chapters of the document Chapters beyond the extracted contents page

The foreword states that the document is divided into 7 chapters and 3 appendices, and names the chapters as general provisions, terms and symbols, process flow, dust collection process design and selection of equipment, arrangement of equipment, dust conveying,