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Technical specification for the energy saving of hot-dip galvanizing production lines

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1 Scope

China's national technical specification for energy saving on hot-dip galvanizing lines. The line's energy goes almost entirely into two places, and the specification addresses both. The annealing furnace heats the strip to several hundred degrees to develop its mechanical properties and to reduce the surface oxide so the zinc will wet it, and everything about its efficiency turns on the recovery of heat from its exhaust and on the sealing that stops its controlled atmosphere escaping. The zinc pot holds molten metal at around 460 degrees C continuously, including through the weekends and stoppages when nothing is being produced, and the loss from its surface and its walls runs whether the line does or not. Between them they account for most of a galvanizing line's consumption, and the measures that help - regenerative burners, pot insulation and lid arrangements, strip cooling recovery - are what the specification sets out.

This document specifies the technical requirements and operation energy efficiency index evaluation of the hot-dip galvanizing thermal system for steel tubes. This document is applicable to the design, construction and operation energy efficiency evaluation of new construction, expansion and renovation projects of hot-dip galvanizing thermal systems for steel tubes.

2 Normative references

The provisions of the following documents constitute the essential clauses of this document through normative references in this text. Among them, for referenced documents with dates, only the versions corresponding to the dates are applicable to this document; for referenced documents without dates, the latest versions (including all amendments) are applicable to this document.

GB/T 2589 General rules for calculation of the comprehensive energy consumption

GB/T 8722 Test method for thermal conductivity of carbon materials

GB/T 10863 Thermal test method for gas pass heat recovery boiler

GB/T 13296 Seamless stainless steel tubes for boiler and heat exchanger

GB/T 16618 General principles for thermal insulation technique of industrial furnaces

GB 24500 Minimum allowable values of energy efficiency and energy efficiency grades of industrial boilers

GB/T 24593 Welded austenitic stainless steel tubes for boiler and heat exchanger

GB/T 27698.3 Test methods for the performance of heat exchangers and heat exchange elements - Part 3: Heat exchanger elements

GB/T 28056 General specification for gas pass heat recovery boiler

GB/T 28475.2 Microprocessor control equipment in industrial stove - Part 2: steam in the heat recovery steam generator to blow the inner wall of the steel tube and dry the galvanized steel tube. The excess steam heats the solvent and pickling medium (hydrochloric acid or sulfuric acid) in the heat exchanger, or heats the circulating water and then heats the solvent and pickling medium (hydrochloric acid or sulfuric acid) in the heat exchanger. If there is excess heat, it is transported to the office area and living area for use.

4.2 Galvanizing furnace body, combustion system and control system

4.2.1 Energy selection The heating energy of the galvanizing furnace shall be natural gas, liquefied petroleum gas, other clean energy or new energy. When natural gas is used for heating, the calorific value and pressure shall meet the following requirements:

a) The heat output is stable, and the fluctuation range allowed during production is within ±10%;

b) The pressure is stable, and the allowable fluctuation range of the workshop gas contact pressure is within ±5%.

4.2.2 Furnace type selection and main structure design

4.2.2.1 The furnace type can be a flat flame galvanizing furnace or a high-speed pulse galvanizing furnace.

4.2.2.2 The furnace body may adopt an I-shaped or U-shaped steel structure frame, and the furnace width should not exceed 1650 mm.

4.2.2.3 The zinc pot shall be equipped with a supporting device.

4.2.2.4 The galvanizing furnace shall be equipped with a zinc leakage pit of reasonable capacity.

4.2.3 Galvanizing furnace insulation

4.2.3.1 The side walls and furnace roof shall be made of ceramic fiber products, and the outer surface temperature of the furnace wall shall comply with the provisions of GB/T 16618.

4.2.3.2 On the premise of meeting the performance requirements such as temperature and load bearing, the furnace bottom masonry materials shall also be selected based on insulation effect, service life and economic rationality.

4.2.3.3 When refractory bricks and thermal insulation bricks are used to build the furnace bottom, the length and width of the refractory brick masonry are recommended to be integer multiples of 116 mm, and the masonry height is recommended to be an integer multiple of 68 mm.

4.2.3.4 When refractory castables are used to cast the furnace bottom as a whole, the temperature and load-bearing requirements shall be met.

4.2.4 Galvanizing furnace heat load

4.2.4.1 The zinc capacity of the zinc pot should be 15~20 times the designed production capacity per unit time.

4.2.4.2 The average heating intensity of the zinc pot wall shall not be less than 24 kW/(m2 - h).

4.2.4.3 The combustion device of appropriate specifications shall be selected according to the type and structural size of the galvanizing furnace, heating process, fuel type, heat load size and environmental protection requirements.

4.2.4.4 The heat supply of the galvanizing furnace shall be determined by heat balance calculation or selected according to empirical data.

4.2.4.5 The maximum heat load of the galvanizing furnace shall not exceed

1.3 times the rated heat load.

4.2.5 Energy saving of galvanizing furnace

4.2.5.1 The exhaust gas temperature of the galvanizing furnace should not exceed 600 °C, and the waste heat shall be recycled.

4.2.5.2 It is recommended to use a computer control system for the thermal system of the galvanizing furnace and effectively control the zinc liquid temperature according to the heating model.

4.2.6 Combustion system configuration of galvanizing furnace

4.2.6.1 The combustion system shall include low NOx burners, gas regulating valves, monitoring systems, induced draft fans and temperature sensors, and be equipped with automatic ignition and flame monitoring devices.

4.2.6.2 The burners of the flat flame galvanizing furnace shall be arranged reasonably according to the combustion chamber, the influence of temperature uniformity and the smoke exhaust method.

4.2.6.3 The center line of the burner of the high-speed pulse galvanizing furnace shall be arranged vertically on the center line of the fire channel.

4.2.6.4 The combustion system shall be equipped with a main shut-off valve with alarm

4.3.2 Waste heat system process design

4.3.2.1 When designing the process for collecting and utilizing the waste heat of the production line, energy-saving factors shall be considered, including fully collecting and utilizing the waste heat from production line combustion and workpiece cooling.

4.3.2.2 In the waste heat collection system, the waste heat collection equipment and automatic control system are used to automatically collect or utilize the waste heat from the production line online.

4.3.2.3 The waste heat utilization system uses the collected heat for drying, heating and steam production required by other processes, as well as office life, etc. until the heat energy is fully utilized.

4.3.3 Waste heat collection equipment

4.3.3.1 Waste heat collection equipment shall include heat recovery steam generator, pipelines, control system, accessories and instruments, etc.

4.3.3.2 The design and selection of flue-type heat recovery steam generators shall comply with the requirements of