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The Norm of Energy Consumption per Unit Product of Electrolytic Aluminum and Alumina

电解铝和氧化铝单位产品能源消耗限额

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Table of Contents

Foreword 3

1 Scope 4

2 Normative References 4

3 Terms and Definitions 4

4 Levels of the Norm of Energy Consumption 4

5 Technical Requirements 5

6 Statistical Scope and Calculation Method of Energy Consumption of Electrolytic Aluminum Products 6

7 Statistical Scope and Calculation Method of Energy Consumption of Alumina Products 11

Appendix A (informative) Standard Coal Conversion Coefficients of Various Types of Energy (reference values) 14

Appendix B (informative) Standard Coal Conversion Coefficients of Main Energy-consuming Working Media (calculated by energy equivalent value) (reference values) 15

The Norm of Energy Consumption per Unit Product of Electrolytic Aluminum and Alumina

1 Scope

This document specifies the levels, technical requirements, statistical scopes and calculation methods for the norm of energy consumption per unit product of electrolytic aluminum and alumina.

This document is applicable to the calculation and assessment of energy consumption per unit product of electrolytic aluminum and alumina production, as well as the energy consumption control of new construction, renovation and extension projects.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 1196 Unalloyed Aluminum Ingots for Remelting

GB/T 2589 General Rules for Calculation of the Comprehensive Energy Consumption

GB/T 12723 General Principles for Establishing Allowance of Energy Consumption per Unit Throughput

YS/T 803 Smelter Grade Alumina

3 Terms and Definitions

The terms and definitions defined in GB/T 2589 and GB/T 12723 are applicable to this document.

4 Levels of the Norm of Energy Consumption

4.1 The levels of the norm of energy consumption per unit product of electrolytic aluminum are shown in Table 1, in which, Level-1 represents the lowest energy consumption.

shall not be greater than Level-3 in Table 2; the access value of energy consumption per unit product of newly constructed, renovated and extended alumina enterprises shall not be greater than Level-2 in Table 2.

6 Statistical Scope and Calculation Method of Energy Consumption of Electrolytic Aluminum Products

6.1 Statistical Scope of Energy Consumption

6.1.1 The statistics of the AC power consumption of aluminum liquid include: the AC power consumed by the process of the electrolysis workshop belonging to the production system; the AC power consumed by the stop-slot conductive bus bar and the short-circuit junction in the electrolysis workshop, the AC power consumed during the roasting and start-up of the electrolytic cell, the AC power consumed by the external compensation bus and the AC power consumed by the corridor bus needs to be deducted in calculation.

6.1.2 The statistics of the comprehensive AC power consumption of aluminum liquid include: the AC power and line loss consumed by the electrolysis workshop belonging to the production system, the power supply workshop (rectification station), power workshop (air compressor station), and purification workshop (mainly in charge of flue gas purification, electrolytic desulfurization and material transportation) belonging to the auxiliary production system, and workshop and the management department for lighting, heating, cooling and bathing, etc. belonging to the affiliated production system; the AC power consumed by electrolytic desulfurization in the electrolytic series of flue gas purification needs to be deducted in calculation.

6.1.3 The statistics of the comprehensive AC power consumption of aluminum ingots include: the AC power and line loss consumed by the electrolysis workshop and casting workshop belonging to the production system, the power supply workshop, power workshop and purification workshop belonging to the auxiliary production system, and workshop and the management department for lighting, heating, cooling and bathing, etc. belonging to the affiliated production system; the AC power consumed by electrolytic desulfurization in the electrolytic series of flue gas purification needs to be deducted in calculation.

6.1.4 The statistics of the comprehensive unit consumption of aluminum ingots include: the AC power and various other energy sources consumed by the electrolysis workshop and casting workshop belonging to the production system, the power supply workshop, power workshop and purification workshop belonging to the auxiliary production system, and workshop and the management department for lighting, heating, cooling and bathing, etc. belonging to the affiliated production system.

6.1.5 The calculation of energy consumption indicators of electrolytic aluminum products only includes the output and energy consumption of aluminum ingots and electrolytic aluminum liquid for re-melting, and does not include the output and energy consumption of multi-variety

requirements of GB/T 1196 or the contract), expressed in (t).

6.2.1.2 The AC power consumed by the stop-slot conductive bus bar and the short-circuit junction shall be calculated in accordance with Formula (2):

$$Q_{tj} = Q_j \times \frac{N_t \times V_t}{V_x} \qquad \cdots\cdots (2)$$

Where,

Q_{tj}---the AC power consumed by the voltage drop of the stop-slot conductive bus bar and the short-circuit junction in the electrolytic series during the reporting period, expressed in (kW • h);

Q_j---the AC power consumed by the electrolytic series of process during the reporting period, expressed in (kW • h);

N_t---the number of stop-slot days during the reporting period, expressed in (d);

V_t---the measured value of the voltage drop of each stop-slot conductive bus bar and short-circuit junction, expressed in (V);

V_x---the cumulative DC voltage of the electrolytic series during the reporting period, expressed in (V • d).

6.2.1.3 The DC power consumption during the roasting and start-up of the electrolytic cell shall be calculated in accordance with Formula (3):

$$Q_{qj} = Q_j \times \frac{N_q \times V_q}{V_x} \qquad \cdots\cdots (3)$$

Where,

Q_{qj}---the AC power consumed during the roasting and start-up of the electrolytic cell during the reporting period, expressed in (kW • h);

Q_j---the AC power consumed by the electrolytic series of process during the reporting period, expressed in (kW • h);

N_q---the number of roasting start-up cells in the electrolytic series during the reporting period, expressed in set;

V_q---the voltage used for the roasting and start-up of the electrolytic cell (each cell does not exceed 30 V • d), expressed in (V • d/set);

V_x---the cumulative DC voltage of the electrolytic series during the reporting period, expressed in (V • d).

6.2.1.4 The DC power consumed by the external compensation bus shall be calculated in

$$E_d = \frac{\sum_{i=1}^{n}(e_i \times \rho_i)}{M_{ld}} \quad \cdots\cdots(8)$$

Where,

E_d---the comprehensive unit consumption of aluminum ingots during the reporting period, expressed in (kgce/t);

n---the number of energy types consumed by the product during the reporting period;

e_i---the physical quantity of the i^{th} type energy consumed by the electrolytic aluminum production system, as well as the auxiliary production system and the affiliated production system during the reporting period;

ρ_i---the standard coal conversion coefficient of the i^{th} type energy during the reporting period;

M_{ld}---the output of qualified aluminum ingots delivered to the warehouse during the reporting period, including the output of commercial aluminum ingots and the amount for self-use, expressed in (t).

7 Statistical Scope and Calculation Method of Energy Consumption of Alumina Products

7.1 Statistical Scope of Energy Consumption

7.1.1 The statistics of the energy consumption of the Bayer process include: the process energy consumption of alumina products by batching workshop, dissolution workshop, sedimentation workshop, decomposition workshop, roasting workshop and evaporation workshop, which belong to the production system, as well as laboratory and water supply workshops, which belong to the auxiliary production system; the energy consumption of the condensed return water with oil in the evaporation and dissolution process needs to be deducted in calculation.

7.1.2 In addition to the workshops included in 7.1.1 described above, the statistics of the comprehensive energy consumption of the Bayer process also include the comprehensive energy consumption of alumina products by gasification furnace, machine maintenance, warehouse and transportation workshops, which belong to the auxiliary production system, as well as the production command system (factory department) and the departments and organizations serving production in the factory area, which belong to the affiliated production system.

7.1.3 The statistics of the energy consumption of other processes include: the process energy consumption of alumina products by batching workshop, clinker sintering workshop, dissolution workshop, sedimentation workshop, decomposition workshop, roasting workshop and evaporation workshop, which belong to the production system, as well as other process

energy consumption of alumina products by laboratory and water supply workshops, which belong to the auxiliary production system.

7.1.4 The statistics of the comprehensive energy consumption of other processes include: the comprehensive energy consumption of other processes of alumina products by batching workshop, clinker sintering workshop, dissolution workshop, sedimentation workshop, decomposition workshop, roasting workshop and evaporation workshop, which belong to the production system, laboratory, water supply, thermal power, gasification furnace, machine maintenance, warehouse and transportation workshops, which belong to the auxiliary production system, as well as the production command system (factory department) and the departments and organizations serving production in the factory area, which belong to the affiliated production system.

7.1.5 The energy consumed by the waste heat utilization device is included in the energy consumption. The self-use part of recovered energy is included in the self-use process; the recovered energy for external use or other non-production purposes shall be deducted.

7.1.6 The lower heating value of energy and the energy consumption of energy-consuming working media shall be converted into standard coal in accordance with the actual measured value or the data provided by the supplier. If the actual measured value cannot be obtained, the standard coal conversion coefficient can refer to the data published by the National Bureau of Statistics or the data provided in Appendix A and Appendix B. For self-produced secondary energy, its standard coal conversion coefficient shall be calculated and determined in accordance with the actual input and output.

7.2 Calculation Methods

7.2.1 Physical unit consumption

The physical unit consumption includes the consumption during the production of alumina, such as: burnt coal, raw coal, steam, carbon coke, electricity, roasting fuel, pipeline dissolution fuel (natural coal, gas and coal, etc.), new water, circulating water and compressed air, etc.

7.2.2 Water return per unit of steam condensation

The water return per unit of steam condensation, which includes condensed return water during the evaporation and dissolution process, shall be calculated in accordance with Formula (9):

$$D_q = \frac{e_q}{M_{sa}} \qquad \cdots\cdots (9)$$

Where,

D_q---the water return per unit of steam condensation during the reporting period, expressed in (t/t);

e_q---the return water of steam condensation in the production of alumina during the reporting

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