GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 13.230

CCS C 67

GB 19081-2025

Replacing GB 19081-2008

Safety Specification for Dust Explosion Prevention in Feed Processing System

饲料加工系统粉尘防爆安全规范

Issued on: January 24, 2025 **Implemented on: February 1, 2026**

Issued by: State Administration for Market Regulation;

Standardization Administration of the People's Republic of China.

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Safety Specification for Dust Explosion Prevention in Feed Processing System

1 Scope

This document specifies the zoning and scope of dust explosion hazardous area, overall requirements, building (structure) requirements, process system and equipment requirements, electrical requirements, dust removal and pneumatic conveying system requirements, explosion control measures, and operation safety management requirements for the feed processing system. It also describes the corresponding verification methods.

This document applies to the design, operation and safety management of the feed processing system involving combustible dust explosion hazards.

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 12158 General Guideline for Preventing Electrostatic Accidents

GB 15577 Safety Regulations for Dust Explosion Preventing and Protection

GB/T 15604 Terminology for Dust Explosion Prevention

GB/T 15605 Guide for Pressure Venting of Dust Explosions

GB/T 26888 Grain and Oil Machinery - Magnetic Separator

GB/T 37241 Guide on Inerting for the Prevention of Explosions

GB 50016 Code of Design on Building Fire Protection and Prevention

GB 50057 Design Code for Protection of Structures against Lightning

GB 50058 Code for Design of Electrical Installations in Explosive Atmospheres

GB 55037 General Specification for Building Fire Protection

3 Terms and Definitions

The terms and definitions defined in GB/T 15604 and the following terms and definitions are

clouds may occur in the air.

[source: GB/T 3836.35-2021, 3.25.2]

3.9 Zone 22

During normal operation, a location where an explosive dust atmosphere in the form of dust clouds is unlikely to occur in the air, or if it does occur, but it will only occur for a short period of time.

NOTE: the possibility of explosive dust clouds arising from the dust layer also needs to be considered.

[source: GB/T 3836.35-2021, 3.25.3]

4 Zoning and Scope of Feed Dust Explosion Hazardous Area

4.1 Based on the frequency and duration of the explosive dust atmosphere of feed dust, the dust explosion hazardous area of the feed processing system shall be divided into Zone 20, Zone 21 and Zone 22.

4.2 Based on conditions such as the process, feed characteristics, location of feed dust release sources, amount and possibility of dust release, explosion conditions, ventilation and dust removal, and site structure and layout, the zoning and scope of feed dust explosion hazardous area shall be determined. Examples of the zoning are provided in Appendix A.

4.3 Whenever changes occur in the process, feeds, equipment, site structure and layout, or work organization mode, the scope and class of dust explosion hazardous area shall be re-assessed, re-defined and re-zoned.

4.4 Throughout the entire operation, the zoning and instruction files shall be documented, and regular dynamic assessments of the process hazards and zoning shall be conducted.

4.5 When the zoning and scope of the feed dust explosion hazardous area change, timely technical and management measures shall be implemented to ensure that the equipment and facilities within the changed area meet the requirements for dust explosion protection.

5 General Requirements

5.1 The design of the feed processing system shall adhere to the principle of holistic protection. Design documents shall clearly describe the zoning of feed dust explosion hazardous area in the design, and the dust explosion prevention measures implemented in terms of building structure, process selection, equipment model selection and layout, dust control, electrical engineering and management, etc.

5.2 Process pipeline and dust removal ductwork shall not pass through non-hazardous areas or

6 Building (structure) Requirements

6.1 General Requirements

6.1.1 Fire protection design for buildings shall comply with the provisions of GB 50016 and GB 55037.

6.1.2 The location of the distribution room shall ensure that the system power supply can be quickly shut off in the event of a dust explosion and meet the requirements for firefighting and evacuation lighting.

6.1.3 Where there are dust release sources within 10 meters around the control room or distribution room, dust-proof measures shall be implemented on doors, windows and openings, and ventilation devices shall be equipped with dust filters.

6.1.4 For silo clusters consisting of multiple silos, each silo shall be independently sealed, with no connecting holes. Each silo shall be equipped with a manhole or cleanout opening, and dust shall be prevented from escaping from the silo.

6.1.5 Wall and floor openings within the feed dust explosion hazardous area shall be sealed after equipment installation is completed.

6.1.6 Explosion venting doors shall open outward.

6.2 Floors

6.2.1 The floors of warehouses and feed processing workshops shall be flat, smooth, and easy to clean.

6.2.2 When insulating materials are used as the entire surface layer of the floor, anti-static measures shall be implemented.

6.3 Walls

6.3.1 The fire resistance rating of the walls of the feed processing system shall comply with the provisions of GB 50016.

6.3.2 The interior surfaces of the building and the surface of its components shall be smooth, flat, and easy to clean.

7 Process System and Equipment Requirements

7.1 General Requirements

7.1.1 Explosion-proof measures shall be implemented for machinery and equipment used in the feed dust explosion hazardous area.

7.1.2 Non-metallic materials and wear-resistant liners used inside silos, equipment, and pipelines that come into contact with feed materials and dust shall be anti-static materials and grounded in accordance with the requirements of GB 12158.

7.1.3 The interior walls of the equipment shall be flat and smooth, and the internal structural components shall be impervious to dust accumulation and easy to clean.

7.1.4 The equipment enclosure shall be made of non-combustible materials.

7.1.5 The machine enclosure, outer cover, machine body, observation windows (doors), overhaul windows (doors), chutes, and pipelines shall be tightly and firmly connected.

7.1.6 Effective dust control measures shall be implemented for open chutes (troughs) and equipment.

7.1.7 The conveyor belts of conveying equipment shall be equipped with tensioning devices.

7.1.8 The moving components of the equipment shall smoothly operate, without scraping, colliding, jamming or rubbing.

7.1.9 The equipment's bearings and slideways shall be kept clear of the feeding flow and prevent dust accumulation.

7.2 Bucket Elevators

7.2.1 Bucket elevators with a risk of dust explosion shall adopt one or more explosion control measures, such as explosion venting, explosion suppression, inerting and explosion isolation, etc. Explosion isolation measures shall not be used alone.

7.2.2 When explosion venting measures are used, explosion vents shall be installed at the elevator head and base (or lower portion of the machine body). The effective pressure relief area at the elevator head shall be no less than 0.05 m^2/m^3 of the elevator head volume. The explosion vents shall not be located in basements.

7.2.3 When explosion vents are installed in vertical sections of the machine enclosure, they shall be set in accordance with the height of the machine body and comply with the provisions of GB/T 15605.

7.2.4 Bucket elevators shall be equipped with anti-slip and anti-skid safety protection devices. In the event of a malfunction, they shall be able to provide an immediate alarm and interlock shutdown.

7.2.5 An inspection opening shall be provided at the elevator head, and a feed removal opening shall be provided at the elevator base.

7.2.6 The cylinder enclosure, elevator head and elevator base shall be reliably grounded.

7.2.7 Bearings of rotating parts shall be located externally of the elevator body.

7.2.8 Continuous bearing temperature monitoring devices shall be provided at the head and tail of the bearings.

7.2.9 The bucket and bucket belt shall be firmly connected.

7.2.10 The bucket shall be made of non-metallic flame-retardant materials.

7.2.11 The rubber coating on the drive wheel and the bucket belt shall use flame-retardant and anti-static materials.

7.3 Chutes

7.3.1 Connections of the chutes, pipe fittings and buffer buckets shall be fabricated, and all joints shall be sealed.

7.3.2 The chutes for conveying feeds shall be equipped with buffer devices at bends and when the vertical drop exceeds 6 m.

7.4 Screw Conveyors and Scraper Conveyors

7.4.1 The spiral shall not scrape, collide or jam. If the discharge port becomes blocked, the conveyor shall automatically shut down and issue an alarm.

7.4.2 The scraper chain of the scraper conveyors shall correctly engage when entering the head pulley, and shall not jam or jump.

7.4.3 The scraper conveyors shall be equipped with chain break or tail pulley stall protection devices.

7.4.4 The scraper conveyors shall be equipped with anti-blocking monitoring devices that shall be able to immediately issue an alarm and interlock shutdown in the event of a malfunction.

7.4.5 If the scraper conveyors use wear-resistant, anti-static ultra-high molecular weight plastic guide plates, the guide plate interfaces shall be aligned and shall not scrape, collide or jam.

7.5 Bin Dischargers

7.5.1 The connection between the feed inlet of the bin dischargers and the silo shall be properly sealed. The connecting flanges shall be lined with non-metallic sealing gaskets and securely bolted. The plugboard gate shall be conveniently opened. The discharge port connection of the bin dischargers and hose connections shall be sealed.

7.5.2 A start-up interlocking protection system shall be provided to ensure that the bin dischargers (bin clearers) cannot operate unless the downstream conveying equipment is activated and the center blanking gate is opened.

7.5.3 When electrical equipment is installed in the bin dischargers (bin clearers), it shall satisfy the requirements of the explosion hazardous area in which it is located.

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