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Safety code for painting - Safety for electrostatic spray painting process

涂装作业安全规程

静电喷漆工艺安全

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Safety code for painting - Safety for electrostatic spray painting process

1 Scope

This standard specifies the safety requirements for electrostatic spray painting process and equipment, paint storage and transportation, operation and maintenance, etc.

This standard is applicable to the design, manufacture, use, supervision and management of electrostatic spray painting process and equipment using combustible or combustible paint. The electrostatic spraying process using other flammable and explosive materials or water-based paint can be implemented with reference to this standard.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard; however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB 3836.15-2000 Electrical apparatus for explosive gas atmospheres - Part 15: Electrical installations in hazardous areas (other than mines) (eqv IEC 60079-14:1996)

GB 4385 Technical requirements for antistatic footwear and conductive footwear (GB 4385-1995 neq ISO 8782-1: 1989)

GB 6514-1995 Safety code for painting - Safety, ventilation and air clean-up for painting process

GB 7691-2003 Safety code for painting - Safety management general rule

GB 8978 Integrated wastewater discharge standard

GB 12158 General guideline for preventing electrostatic accidents

GB/T 14441-1993 Safety code for painting - Terminology

GB 50058 Electrical installations design code for explosive atmospheres and fire hazard

GBJ 140 Code for design of extinguisher distribution in buildings

3 Terms and definitions

The terms specified in GB/T 14441-1993 as well as the following terms and definitions apply to this standard.

3.1

Electrostatic spray painting

Under the action of a high-voltage electric field, the spray painting method where the sprayed solvent-based paint drops are charged with a negative charge by the principle of corona discharge, then further atomized, adsorbed on the positively charged grounded substrate, finally discharged and attached to the substrate.

3.2

Working area for electrostatic spray painting

Painted area where electrostatic spray painting is performed.

3.3

Electrostatic atomizing head

Pneumatic, electric, hydraulic, ultrasonic or other forms of equipment with high-voltage electrostatic protection measures which, at the aid of centrifugal force or compressed air and electrostatic repulsion, electrostatically charge and fully atomize the paint, such as: electrostatic spray gun, spinning cup, throwing plate, fog bin, etc.

3.4

Booth for electrostatic spray painting

A completely enclosed or semi-enclosed room or enclosure structure with good mechanical ventilation and lighting equipment, specially used for electrostatic spray painting. The indoor airflow organization can prevent paint mist and solvent vapor from escaping outward and make it concentrated and safely introduced into the exhaust system.

- d) There shall be explosion-proof seal when the tow line is lead into the junction box, accessory box or enclosure;
- e) It shall comply with the national provisions on electrical equipment in explosive hazardous areas.

4.5 Electrostatic painting equipment

Electrostatic painting equipment shall comply with the requirements specified in 9.3 of GB 3836.15-2000 and GB 50058; it shall only be installed and used in electrostatic painting areas when it meets the requirements of chapter 6 and chapter 7 of this standard.

4.6 Fire protection

4.6.1 The fire protection requirements of the electrostatic spray painting area shall be implemented in accordance with the provisions of clause 5.4 and chapter 8 of GB 6514-1995.

4.6.2 The electrostatic spray booth shall be equipped with a combustible gas concentration and fire alarm device (explosion-proof detector), which shall be interlocked with automatic feeding stop, power cut off device, automatic fire extinguishing device, etc.

4.6.3 Automatic fire control valves shall be installed in the ventilation ducts which connect the electrostatic spray booth; the effective working conditions of the valves shall be maintained.

4.6.4 The building where the electrostatic painting area is located shall be equipped with fire extinguishing equipment according to the requirements specified in GBJ 140.

4.6.5 Automatic electrostatic painting equipment using combustible or combustible paint shall be protected by a flame detection device. When a fire occurs, the flame detection device can react to the flame within 0.5 s and complete the following tasks:

- a) Turn on the local alarm near the electrostatic painting area and the alarm system that may be installed on the electrostatic spray painting equipment;
- b) Close the feeding system;
- c) Terminate all spraying operations;
- d) Stop all conveying equipment entering and leaving the electrostatic spray painting area;
- e) Cut off the power supply of the high voltage devices in the electrostatic

5.5 The wastewater produced in the electrostatic spray painting process shall be purified and treated to meet the requirements of GB 8978.

6 Automatic electrostatic painting equipment

6.1 Approved equipment

The electrostatic atomizing head is an electrostatic painting equipment fixed by mechanical clamping. Both the equipment and the equipment for eliminating static electricity shall comply with the requirements of chapter 6 of GB 7691-2003, meanwhile it shall have the in-factory acceptance certificate.

6.2 Electrical and control equipment

6.2.1 The electrostatic spray painting area allows the installation of high-voltage grids, electrodes, electrostatic atomizing heads and connecting cables.

6.2.2 Transformers, high-voltage power supplies, control devices and other electrical components (such as plugs, etc.) shall be installed outside the electrostatic spray painting area.

6.2.3 Electrical equipment and ignition sources shall comply with the provisions of 5.4 of GB 6514-1995.

6.3 High-voltage electrostatic generator

The requirements of the high-voltage electrostatic generator shall be implemented in accordance with the provisions of 8.3 of GB 6514-1995.

6.4 Electrode and electrostatic atomizing head

6.4.1 Electrodes and electrostatic atomizing heads or the electrodes and electrostatic atomizing heads on the robot shall be firmly installed on the base, support or moving device, meanwhile it shall have reliable ground insulation, its grounding resistance shall be greater than $1 \times 10^{10} \Omega$.

6.4.2 When the fixed element is a thin metal wire, the metal wire shall be tightened at any time; it shall not use knotted, twisted or even hardened metal wire.

6.5 High-voltage cable

6.5.1 High-voltage cables shall be protected by armored cables or pipes to prevent mechanical damage or exposure to corrosive media.

6.5.2 High-voltage cables shall comply with the requirements of 8.4.5 in GB 6514-1995.

equipment in the electrostatic spray painting area and the conductive parts outside the device shall be reliably grounded. This requirement also applies to paint containers, washing metal containers, safety fences and other conductive objects or equipment in electrostatic spray painting areas. An eye-catching grounding mark shall be installed on the equipment.

6.10 Isolation

There shall be separate or combined safety protection facilities around the electrostatic painting equipment, such as isolated chambers, fences and barriers.

6.11 Insulator

All insulators shall be kept clean and dry.

7 Manual electrostatic painting equipment

7.1 Approved equipment

The electrostatic atomizing head is a hand-held or hand-controlled electrostatic painting equipment. Hand-held or hand-controlled electrostatic painting equipment and static elimination equipment shall comply with the requirements of Chapter 6 of GB 7691-2003, meanwhile it shall have an in-factory acceptance certificate.

7.2 High-voltage circuit

The high-voltage circuit shall be designed as a safety type. The electrostatically charged exposed components of the spray gun shall only be energized through the operating switch, meanwhile the operating switch shall also be interlocked with the spray paint supply.

7.3 Electrical and control equipment

Except for the spray gun and its connection with the power supply, the requirements of other electrical and control equipment shall meet the requirements of 6.2.

7.4 Grounding

- a) Metal wires shall be used to ground the handle of the spray gun. The operator shall hold the grounding handle firmly in the normal operating position, its contact resistance shall be less than $1 \times 10^6 \Omega$;
- b) Persons who are not wearing conductive shoes shall not enter the area being painted; it is strictly forbidden to touch people who are working;

procedures for electrostatic painting.

9.2 Personal protective measures to be taken by operators

- a) Operators shall wear conductive shoes, which shall meet the requirements of GB 4385; the dirt on the shoes shall be removed in time when wearing them;
- b) In case of manual electrostatic spray painting, the gloves worn must have holes or do not wear gloves, so that the hands can directly touch the metal part of the spray gun handle and ensure that the operator is grounded;
- c) Operators shall wear anti-static clothing; they shall not wear underwear made of materials that are prone to generate and accumulate static charges such as silk and synthetic fibers;
- d) Clothes, hats or similar shall be worn and removed in the electrostatic painting area;
- e) Operators shall not wear isolated metal objects.

9.3 Operation precautions for operators

- a) When spraying paint, the spray gun shall not be pointed at people; hands shall not be placed on the nozzle;
- b) Check whether the paint leaks before painting. If there is paint leak, it shall not carry out spraying;
- c) If the operator feels an electric shock during the painting operation, the painting operation shall be stopped immediately;
- d) If it is necessary to suspend the operation during the painting operation, the electrostatic power switch shall be turned off, the spray gun's pressure shall be relieved, the electrode shall not be grounded;
- e) During the painting operation, insulating objects shall not be used to touch the workpiece, electrode or electrostatic atomizing head.

9.4 Daily maintenance of electrostatic atomizing head

- a) The enterprise shall specify the resistance of the electrostatic atomizing head, the power supply resistance and the detection period of the resistance of the electrostatic atomizing head's resistance bar according to the actual use;
- b) Perform inspections as required, to confirm whether the resistance is intact and the seals are leaking. If problems are found, they shall be dealt

- a) The waste and slag generated when cleaning the electrostatic spray booth and spray equipment shall be properly handled. Generally, it should uniformly establish the treatment of waste and waste residues by region and industry; waste and waste residues can be classified and incinerated;
- b) Cotton yarn, rags, etc. stained with paint or solvents shall not be littered, which shall be placed in a metal box (bucket) with a lid and "marked", cleared on duty and handled properly;
- c) Clearing and handling conditions shall be recorded.

9.10 Supplement of paint

9.10.1 Before adding paint to the paint container placed on the insulating support, the following shall be done:

- a) Turn off the high-voltage electrostatic generator;
- b) Discharge with a discharge rod;
- c) Ground the paint container.

After the above requirements are met, the paint in the grounded container can be added to the grounded paint container.

9.10.2 When the paint container is in a grounded state, the paint container shall be reliably grounded before refilling the paint.

9.11 Repair

Maintenance operations shall follow the following provisions:

- a) Before maintenance, the electrostatic painting operation shall be stopped, the mechanical ventilation device shall continue to operate, so that the concentration of flammable and explosive gas is lower than the concentration specified by the national explosion-proof standard, then the combustibles can be evacuated from the scene;
- b) When the maintenance operation involves open fire operation, the hot fire safety system shall be implemented and the safety operation procedures shall be followed;
- c) The concentration of hazardous substances in the maintenance work site shall meet the requirements of 5.2.1 in GB 6514-1995;
- d) The electrostatic measuring instruments used in production and maintenance can refer to Table A.1 in Appendix A. The Table shows the commonly used electrostatic measuring instruments for different

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