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Code for Design of Electronic Industry Clean Room

电子工业洁净厂房设计规范

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OF PEOPLE'S REPUBLIC OF CHINA

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Chief Development Department: Ministry of Industry and Information Technology of the People's Republic of China

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Contents

1 General Provisions

1.0.1 This code was compiled to make the design of clean room design in electronic industry be advanced in technology, economic, suitable, safe, reliable, resource saving, energy consumption less, quality guaranteed and in accordance with the requirements of labor health and environmental protection.

1.0.2 This code is applicable for the clean room design in construction, extension and innovation electronic industry.

1.0.3 Electronic industry clean room design shall be in accordance with the production process for electronic products requiring clean environment and shall obligate conditions for the product production development or production process improvement in the future according to specific circumstances.

1.0.4 The electronic industry clean room design shall create necessary conditions for the construction and installation, debugging detection, safe operation, operation and maintenance.

1.0.5 In addition to this code, electronic industry clean room design still shall comply with those specified in the current relevant standards of the state.

2.0.23 Minienvironment

It refers to the isolated space which separates the product production process from the operating staff and pollutants strictly.

2.0.24 Fan filter unit (FFU)

It refers to the device which is combined by the HEPA or ULPA and fans, constituting air cleaning at the end air cleaning which may be self powered.

2.0.25 Cleanliness recovery characteristic

It refers to the time required for the cleaning air conditioning system from initial operation to specify indoor cleanliness grade after the clean room is contaminated.

2.0.26 Technical mezzanine

It refers to the mezzanine separated with horizontal members, which is used for accessory equipment, public power facilities and pipeline installations.

2.0.27 Technical tunnel

It refers to the corridor separated with vertical members, which is used for accessory equipment, public power facilities and pipeline installations.

2.0.28 Technical shaft

It refers to the shaft-type corridor separated with vertical members, which is used for accessory equipment, public power facilities and pipeline installations.

2.0.29 Fire-firing access

It refers to the exclusive entrance for the fire fighters to enter the building to extinguish a fire, which is closed at original times and opened by the fire fighter s when applied.

2.0.30 Pure water

It refers to the water with little impurity content and the electrolyte impurity content (usually represented with resistivity) and non-electrolyte impurity (such as fine particles, organic materials, bacteria and dissolved gas and so on) content requires little water.

2.0.31 Bulk gas

It refers to the extensively used hydrogen gas, oxygen, nitrogen, argon gas, helium gas and other gases.

2.0.32 Special gas

It refers to the silicohydrides, phosphine, diborane, arsine, silicon tetrachloride, chlorine and other gases used during production process of electronic products. These gases are inflammable, toxic, corrosive or suffocating.

2.0.33 Chemical

It refers to the acid, alkali, organic solvent and oxide compound used during production process of electronic products.

4 Overall Design

4.1 Site Selection and General Layout

4.1.1 The clean room site shall be selected through technical economical comparison according to the following requirements:

1 It shall be located in the zones with lower concentration of dust-contained and harmful gas or chemical pollutant in the air and with preferable natural environment;

2 It shall be far away from the railroad, dock, airfield, main traffic lines as well as the workshop radiating abundant dust and harmful gas or chemical pollutants, storage bunker, yard and other zones with severe air pollution, vibration or noise interference strong-current magnetic field. When it fails to stand off severe air pollution source, it shall be located at the lower wind side in the minimum frequency all year around;

3 It shall be located at the section with clean environment, less pollutants, or without or with little pedestrian flow or logistics.

4.1.2 The distance (adjacent edges)from the fresh air inlet of cleaning air conditioning system in clean room to the main road of urban traffic should be greater than 50m. When urban green belt is set between clean room and traffic main road, it may be properly reduced according to actual conditions, however shall not be less than 25m.

4.1.3 The clean room site with mini-vibration control requirements shall be selected by measuring the existent influence of vibration source and analogy vibration source and comparatively analyzing the permissible vibration values.

4.1.4 The general layout of plant area shall be arranged according to the functional zones, such as cleaning production, non- cleaning production, auxiliary production, public dynamical system and office and living.

The clean room should be laid out according to the requirements of production process characteristics of electronic products and all functional zones and the combined type large size integral factory building.

4.1.5 The material with favorable performance and fewer fumes shall be adopted around the clean room and the road surface.

4.1.6 It shall be landscaped around the clean room, however, the plants which may trigger influence on the production environment and product quality should not be planted.

4.1.7 Circuit fire lane should be installed in clean room, if there is any difficulty, fire lanes may be set at the long length side of factory building. The fire lane installation shall meet the relevant requirements of the current national standard “Code of Design on Building Fire Protection and Prevention” GB 50016.

4.2 Clean Room Type

4.2.1 The clean room, according to the production process characteristics of electronic products, air

5 Process Design

5.1 General Requirements

5.1.1 The process design, process layout of clean room shall obligate necessary conditions for the alteration and enlargement of production of electronic products development and product production process.

5.1.2 The clean room process design shall determine all the production conditions and under the premise of meeting the production requirements of electronic products, good safety performance, less construction investment, less energy expenditure and less operating cost as well as high production efficiency shall be provided.

5.1.3 The clean room process design shall be installed with pedestrian flow path, material transportation and warehouse facilities according to the product production process and air cleanliness class requirements.

5.2 Process Layout

5.2.1 The process layout of clean room shall be determined according to the requirements of product production process line, air pattern of clean room, installation and maintenance of process equipments and material transportations.

When the production process equipment, operation procedures, personnel flowing path and material transportation layout is carried out in unidirectional flow clean room, measures to avoid interference in airflow and cross contamination shall be taken.

5.2.2 The process layout shall avoid mixture and crossing between pedestrian flow and material circulation and should be installed with corresponding cleaning facilities at the respective entrances.

5.2.3 Under the premise of meeting the requirements of production process, mini-vibration control and noise control, the clean room (zone) with strict air cleanliness should be laid out near the air conditioner room and the procedures or workroom with same air cleanliness class should be laid out in concentration.

5.2.4 It is required to make the procedure (equipment) with strict air cleanliness in the clean room (zone) shall be far away from the entrance and exit and any site which may interfere the air flow and should be laid out at the upper wind side; the process equipments which may generate pollutants easily shall be laid out at the return air port or the lower wind side.

5.2.5 When process layout is carried out, the transport channel, installation port or manhole shall be installed according to the transportation, installation, maintenance requirements for large scale production process equipments.

5.2.6 When the clean rooms (zones) of different air cleanliness class are frequently connected in clean room, measure to prevent pollution shall be taken.

5.3 Cleaning Human Body

5.3.1 The rooms for cleaning human body and facilities shall be installed according to the scale and

people. When the working personnel in the clean room (zone) are more than 5, the unidirection by-pass door shall be installed at one side of airshower;

4 The entrance and exit of airshower shall not be opened at the same time and shall be adopted with interlock control measures;

5 The clean room (zone) with vertical unidirectional flow in 5 class or higher in air cleanliness class should be installed with clean room (zone).

5.3.6 The air cleanliness class of room for cleaning human body and for living should be cleaned from the outside to the inside and pure air filtered in high efficiency shall be blown indoors.

The air cleanliness class in the dressing room of clean working garment should be lower than that of the adjacent clean room (zone); when no washing chamber of clean working garment is provided, the air cleanliness class for washing chamber should be class 8.

5.4 Material Cleaning

5.4.1 The exit and entrance of equipment and material in the clean room (zone) shall be independently installed and the rooms for cleaning and corresponding facilities for material cleaning shall be installed according to the characteristics, properties, shapes and others of equipment and material.

5.4.2 Air lock or passbox shall be installed between room for cleaning material and clean room (zone).

5.5 Equipments and Working Instruments

5.5.1 The clean room (zone) shall adopt the production facilities and auxiliary operating equipments with dust and pollutant prevention and shall be in accordance with the following requirements:

1 The surface shall be smooth and clean, easy to clean without dust deposition and chemical substances;

2 The drive components of equipments shall be provided with favorable sealing property and shall be able to prevent lubricant, coolant and other leakages;

3 For the equipments with larger amount of fume and heat quantity during production or discharging toxic and combustible gas, measures to prevent spreading shall be taken.

4 The metal enclosure of equipment shall be installed with grounding facilities.

5.5.2 When the equipments are installed at clean rooms (zones) in different air cleanliness class, sealing and isolation measures should be taken.

5.5.3 The equipments in clean room (zone) should be selected with low noise products. When the chosen equipments exceed the permissible value of noise in the clean room, isolation measures shall be taken.

5.5.4 Facilities to carry out purifying treatment over the used working instruments during production process of electronic products shall be arranged in clean room (zone).

5.5.5 The storage and transmission of all sorts of components and parts during the production process of electronic products in the clean room (zone) should be adopted exclusive vessels. And the

6 Clean Architectural Design

6.1 General Requirements

6.1.1 The architectural plane and spatial layout of clean room shall be determined according to the electronic product development and production process alteration and production scale enlargement requirements.

6.1.2 The major structure of clean room should be adopted with large-space and wide span column grid and shall not be adopted with supporting system of inner wall.

6.1.3 The vertical plane design of clean room shall be simple, tidy, bright and comfortable and shall adapt the layout requirements of clean room (zone). The material lectotype of enclosing construction of clean room shall meet the requirements of thermal insulation, fire prevention, moisture protection, less fume and easy cleaning.

6.1.4 The major structure durability of clean room shall be coordinated with the production line equipments, production environment and controlling devices of electronic products and shall be provided with fire prevention, temperature deformation control and uneven settlement performance. The deformation joints of factory building shall not cross the clean zone.

6.1.5 The architectural plane, spatial layout and structure of the clean room installed with upper and lower technical mezzanines shall meet the requirements of product production process, automation transportation and installation and maintenance of public power facilities.

6.1.6 For the clean room installed with technical mezzanine and technical tunnel, the architectural design of technical mezzanine and technical tunnel shall meet the requirements of all sorts of air pipes and power pipes installation and maintenance. When the vertical pipeline crossing the story is required to be laid in hidden form, technical shaft should be installed. And the form, dimension and structure for technical shafts shall meet the requirements of installation, overhaul and fire protection of air pipe and pipeline.

6.1.7 For the integrated factory building acted as both production area and clean room (zone), the plan layout and structure treatment of factory building should avoid the adverse impact on clean production environment triggered by the pedestrian flow, material circulation transportation and fire prevention.

6.1.8 The passage width in the clean room shall meet the requirements of personnel operation, material transportation, equipment installation and overhaul.

6.2 Fire Prevention and Evacuation

6.2.1 The fire resistance grade of clean room shall not be less than grade II.

6.2.2 The fire hazard in production workshop of clean room shall be in accordance with the relevant requirements of the current national standard “Code of Design on Building Fire Protection and Prevention” GB 50016. See Appendix B of this code for the examples of fire hazard classification.

6.2.3 The fire compartment division in clean room shall meet the relevant requirements of the current national standard “Code of Design on Building Fire Protection and Prevention” GB 50016.

6.2.9 The room with explosion hazard included in the clean room shall be close to the building external wall and shall not be adjacent to the evacuation safety exit (between staircases). The explosion prevention measure and explosion relief areas in the room with explosion hazard shall meet the relevant requirements of the current national standard "Code of Design on Building Fire Protection and Prevention" GB 50016.

6.3 Interior Decoration

6.3.1 The building and building enclosure and interior decoration of clean room shall be adopted with material with favorable air-tightness and little deformation when temperature and humidity are changed. The decoration materials and sealing materials of clean room neither shall nor release the materials which may influence the electronic product quality. The burning behavior of decoration materials shall meet the relevant requirements of the current national standard "Code for Fire Prevention in Design of Interior Decoration of Buildings" GB 50222. The fume density grade of decoration materials shall not be greater than 50 and the fume density grade of materials shall meet the relevant requirements of the current national standard "Test Method for Density of Smoke from the Burning or Decomposition of Building Materials" GB/T 8627.

6.3.2 The decoration of inner wall and ceiling of clean room shall be in accordance with the following requirements:

1 It shall meet the requirements of use functions and the surface shall be smooth, slick without dust, glare and convenient for cleaning and shall reduce the roughness;

2 When skirting is adopted, the skirting should not protrude the wall surface.

6.3.3 The floor design of clean room shall meet the following requirements:

1 It shall meet the requirements of production process and equipment installation of electronic products;

2 It shall be smooth, wear-proof, easy to clean, difficult to accumulate static electricity, without glare, crack and shall be clash resistant.

3 The ground should be reinforced and shall be made into moisture protection structure.

6.3.4 The wall and ceiling of technical mezzanine in clean room shall meet the use function requirements and the surface shall be smooth and slick. The technical layer or technical mezzanine located under ground shall be taken with waterproof or moisture protection and rot resistance measures.

6.3.5 When external windows are installed in clean room, double layer fixed windows shall be adopted and shall be provided with favorable air-tightness; moisture condensation measures shall be taken.

6.3.6 The design of door and windows, walls, ceiling, ground and floor in clean room (zone) shall be in accordance with the following requirements:

1 The use function requirements shall be met and the structure and construction gap shall be sealed;

7 Air Cleaning and Ventilation Design of Air Conditioner

7.1 General Requirements

7.1.1 The air cleanliness class in clean room (zone) shall be determined according to the production process characteristics of electronic products and the clean room types.

7.1.2 The air pattern shall be selected according to the various requirements of air cleanliness class and electronic product process characteristics in each clean room (zone).

7.1.3 If any of the following conditions is met, the cleaning air conditioning system should be separately installed:

1 The operation shifts or service times are different;

2 The substance emitted during production process has impact on other procedures, cross contamination of equipments, product quality or operating staff health and safety;

3 The requirements of temperature and humidity control are greatly different;

4 The process equipment heating in clean room (zone) is greatly different;

5 Cleaning air conditioning system and general air conditioning system,

6 Cleaning air conditioning system for oversized air flow in system.

7.1.4 The temperature, relative humidity in clean room (zone) shall in accordance with those specified in Article 3.2.3 of this code.

7.1.5 The air cleanliness class in clean room (zone) shall be in accordance with the relevant requirements of the current national standard “Code for Design of Clean Room” GB 50073.

7.1.6 A certain static pressure difference shall be kept between the clean room (zone) and the surrounding space and the static pressure difference shall meet the following requirements:

1 The static pressure difference between each clean room (zone) and the surrounding space shall be determine according to the production process requirements;

2 The static pressure difference between clean rooms (zones) in different classes shall be larger than or equal to 5Pa;

3 The static pressure difference between the clean room (zone) and the non- clean room (zone) shall be larger than 5Pa;

4 The static pressure difference between the clean room (zone) and the outdoor shall be larger than 10Pa.

7.1.7 The pressure difference air flow required to maintain the static pressure difference in clean room (zone) should be adopted with slit method or ventilation rate method.

7.1.8 The open and close, interlock and control requirements of supply air, return air and exhaust air system shall meet the relevant requirements of the current national standard “Code for Design of Clean Room” GB 50073.

7.1.9 The non-continuous operating clean room may be installed with supply air on duty according

in other buildings.

7.3.4 The fresh air when a few cleaning air conditioning systems are applied at the same time or the fresh air of cleaning air conditioning system in large scale electronic industry clean rooms shall be centralized processed.

7.3.5 Rational utilization of return air shall be adopted in the cleaning air conditioning system design; however, the return air shall not be adopted in the following conditions:

1 When the hazardous substances emitted to the workshop during the production process exceeds the requirements;

2 When local processing could not meet the hygienic requirements;

3 When it may trigger hazard to other procedures or the cross contamination is inevitable.

7.3.6 When the cleaning air conditioning system is required to install electrical heating, electric heater which may not generate fume shall be adopted and shall be installed at the upper wind side of high efficiency filter; besides, the safety precautions shall be adopted.

7.3.7 The electric humidifier of cleaning air conditioning system shall be adopted with safety precautions.

7.3.8 The fresh air system shall be adopted with frost prevention measures in the areas with possible freezing conditions according to the meteorological conditions.

7.4 Air Cleaning Facilities

7.4.1 The selection and layout of air filter shall be in accordance with the following requirements:

1 The air filters shall be selected according to the air cleanliness class;

2 The treatment air flow of air filter shall be less than or equal to the rated air flow;

3 The medium high efficiency (high and medium high efficiency) particulate air filter should be installed on the positive pressure section of air conditioning cabinet.

4 The high efficiency (sub-high efficiency) particulate air filter should be installed at the end of cleaning air conditioning system and the (ULPA) ultra low penetration air filter shall be installed at the end of cleaning air conditioning system;

5 The resistance and efficiency of high efficiency (sub-high efficiency and ultra-low penetration) particulate air filter installed at the end of the same cleaning air conditioning system shall be similar;

6 The ratio of applied air flow to the rated air flow of high efficiency (sub-high efficiency and ultra-low penetration) particulate air filter installed at the end of the same cleaning air conditioning system shall be similar;

7 Chemical filters or other removal devices shall be installed in the cleaning air conditioning system according to environment conditions in the clean room (zone) with control requirements of chemical pollutants;

8 High efficiency (sub-high efficiency and ultra-low penetration) particulate air filter shall be adopted with incombustible or nonflammable material.

1 It shall be provided with favorable air-tightness and the air leakage rate shall not be larger than 1%;

2 The overall structure shall be provided with adequate strength and rigidity; the internal surface shall be smooth, slick and the external surface shall not be moisture condensate;

3 It shall be arranged in order and convenient for operation and maintenance; when a few air handling units are providing service to the same clean room (zone), air handling units with same specification should be adopted;

4 The air supply fan should be adopted with frequency control measures. The air supply fan may be selected according to the total air flow and total resistance values of cleaning air conditioning system. When the total resistance of system is calculated, the resistance of medium efficiency (high-medium efficiency), high efficiency (sub-high efficiency, ultra-low penetration) air filter should be adopted with 1.5~2.0 times of the initial resistance values.

5 Drainage facilities shall be installed.

7.5 Space Heating and Ventilating

7.5.1 The clean room (zone) with air cleanliness class higher than class8 shall not be adopted with radiators to heat.

7.5.2 The process equipments and accessory equipments generating dust and harmful gas in the clean room shall be arranged with partial air exhaust device and the exhaust hood should be adopted with closed type. The independent installation requirements for partial exhaust air system shall meet the relevant requirements of the current national standard “Code for Design of Clean Room” GB 50073.

7.5.3 The exhaust system design in clean room (zone) shall be in accordance with the following requirements:

1 Outdoor downdraught shall be prevented;

2 The partial exhaust system containing combustible and explosive materials shall be adopted with corresponding fire prevention and explosion prevention measures according to its physicochemical properties;

3 For the harmful gas discharged from partial exhaust system, when the hazardous substance concentration exceeds the discharge standard, efficient processing measures shall be adopted. The exhaust pipe height and drainage rate shall be in accordance with the relevant current national discharge standard;

4 The exhaust system containing vapor or condensed materials shall be installed with slope and discharge port;

5 When extremely toxic substance is contained in the air exhaust medium, standby exhaust fan and treatment facilities shall be installed and emergency power shall be arranged;

6 When the combustible and explosive hazardous substances are contained in the air exhaust medium or higher reliability requirements of process shall be provided, standby exhaust fan and emergency power shall be arranged;

8 Water Supply and Drainage Design

8.1 General Requirements

8.1.1 The main pipe of water supply and drainage in clean building shall be arranged in the technical mezzanine or technical tunnel and shall be arranged in the circulating technical mezzanine. When conditions are suitable, it may be buried. The interior pipeline in clean room (zone) should be concealed installed and the pipeline irrelevant to this room shall not pass.

8.1.2 The water pipeline passing through the clean room shall determine the thermal insulation and moisture condensation proof measures according to the water temperature in the pipeline and the room temperature and humidity. When thermal insulation and moisture condensation proof measures are taken, the external surface shall be slick and smooth.

8.1.3 When the water supply and drainage pipelines cross the wall, floor slab and ceiling of clean room (zone), sleeves shall be installed and the sealing measures shall be taken between the pipeline and the sleeve.

8.2 Water Supply

8.2.1 The water supply system in the clean building shall be determined according to the requirements of water quality, water temperature, water pressure and water quantity in the aspect of various uses (including cooling water of process) and shall be respectively installed with independent water supply systems according to the production, living and fire fighting uses.

8.2.2 When hazardous chemicals storage and distribution rooms are installed, emergency shower and eye bath shall be installed according to the requirements of physicochemical performances and personal safely and the feed water piping shall be laid out in circuit form.

8.2.3 The tubes and pipes as well as the accessories of feed water piping shall be selected in accordance with the following requirements:

1 The tubes and pipes as well as the accessories of water supply system shall be selected according to the requirements of production process and system operating parameters;

2 The buried pipeline shall be corrosion resistant and shall be provided with capacity for bearing according ground load;

3 The water supply and return water pipeline of re-circulated cooling water for production facilities shall be adopted with stainless steel tubes, steel plastic pipe and so on according to the production process and water quality requirements and should not be adopted with welded steel tubes;

4 The valves and accessories shall be adopted with materials same with the tubes and pipes.

8.3 Drainage

8.3.1 The drainage systems for production and living shall be respectively installed. The drainage system for production shall be determined according to the characteristics prerogative of waste water property, concentration of pollutant and water quantity drained by the production

9 Pure Water Supply

9.1 General Requirements

9.1.1 The pure water system for electronic product production use shall be selected according to the requirements of water quality in terms of raw water quality and product production process and shall be determined by combining the system scale, provision of equipment and other conditions through the technical economical comparison.

9.1.2 The transmission main pipe of pure water shall be laid out in the technical mezzanine or technical tunnel; the pure water branch pipe should be concealed and installed in the clean room (zone).

9.1.3 Sleeves shall be installed on pure water pipeline passing through the wall, floor slab and ceiling of clean room (zone) and sealing measures shall be taken between the sleeve and pipeline.

9.1.4 The heat insulating material of pure water pipeline in the clean room (zone) shall not generate pollutants and the external surface shall be smooth, slick and easy to clean.

9.2 Pure Water System

9.2.1 The equipments for the pure water system shall not only meet the requirements of water quantity and water quality as required but also shall meet the requirements of flexible operation, safety and reliability, convenient operation and management and low operating cost.

9.2.2 The manufacturing, storage and delivering device of pure water shall meet the requirements of electronic product production process and shall also meet the following requirements:

1 The pure water manufacturing, terminal handling equipment lectotype and selection of manufacturing materials shall meet the requirements of feeding water quality and the terminal water quality;

2 The pure water reservoir, the lectotype of delivery equipments and the selection of manufacturing materials shall make sure that the water quality pollution is less, the air-tightness is favorable without out-gassing phenomenon;

3 The preparation, storage and conveyer equipment of pure water shall effectively prevent the water quality reducing.

9.2.3 Cycle water supply manners shall be adopted for the pure water system and should be adopted with single pipe type water supply system or twin pipe type water supply system installed with independent return water pipe and shall meet the following requirements:

1 Cycle return water quantity shall be larger than 30% of the designed water supply quantity;

2 The main pipe flow rate shall be larger than or equal to 1.5m/s;

3 The length of non circulation branch pipe shall not be greater than six times of the pipe diameter;

4 Cleaning port shall be arranged on the main pipe;

10 Gas Supply

10.1 General Requirements

10.1.1 Different types of special gases, bulk gases, dry and compressed air shall be applied according to the production requirements in the clean building and the gas quality shall be in accordance with the production process requirements.

10.1.2 The gas supply manner and air supply system for bulk gas shall be determined through technical economical comparison according to the gas dosage, gas quality, and the air supply conditions in the local and other factors.

10.1.3 The preparation, storage and distribution system of bulk gas and special gas in the clean building shall be in accordance with those specified in this code and shall also meet the relevant requirements of the current national standard "Code of Design on Building Fire Protection and Prevention" GB 50016 and "Code of Design on Hydrogen Plant" GB 50177 as well as the "Norm of Oxygen Plant Design GB 50030".

10.1.4 The main pipe of gas pipeline in the clean building shall be laid out in the technical mezzanine or technical tunnel. When it is sharing one frame with the water and electricity pipeline, the gas pipeline heavier than air should be installed below the water and electricity pipeline and the gas pipeline lighter than the air should be installed above the water and electricity pipeline.

10.1.5 The combustible gas pipeline and toxic gas pipeline in the clean room (zone) shall be laid in exposed manner and the pipeline sections crossing the wall or floor slab of clean room (zone) shall be arranged with sleeves; no weld seam shall be existent for the pipeline in the sleeve and sealing measures shall be taken between sleeve and pipeline.

10.1.6 The combustible gas pipeline and toxic gas pipeline shall not cross the room not applying these gases; when it must cross, sleeve or duplex tube shall be installed.

10.1.7 The high pure gas pipeline design shall meet the following requirements:

1 The pipe diameter shall be determined according to the permissible gas flow rate, pressure or production process equipment and the external diameter of pipe should not be less than 6mm; the wall thickness should not be less than 1mm.

2 Dead space, like "diverticula" which is difficult to blowdown shall not be present.

3 Blowing down port and sampling nozzle shall be installed in the pipeline system.

10.1.8 Combustible gas pipeline system in the clean building shall be arranged with the following safety devices:

1 Valve box shall be installed when the valves are installed on the combustible gas pipeline and the valve box shall be arranged with gas leakage warning and accident air exhaust devices; the warning device shall be interlocked with the corresponding accident exhaust fan;

2 The branch pipe and exhaust pipe connected to the equipment for gas use should be installed with fire retardant facilities;

3 The exhaust pipe led outdoor shall be arranged with lightning protection facilities;

10.2.6 The following technical safety measures shall be taken on the oxygen pipe line in the clean building:

1 Strict degreasing treatment shall be carried out for the pipeline, valves and accessories;

2 Grounding facilities to guide the static shall be arranged;

3 Automatic cut out valves shall be installed on the inlet pipeline of oxygen.

10.2.7 The gas container warehouse of all bulk gases shall be installed outside the clean building; when the daily air flow is not greater than 1 bottle, the gas container may be installed in the clean room (zone), however measures to dust deposition and to clean shall be taken.

10.2.8 The gas pipeline and valve shall be selected according to the product production process requirements and should meet the following requirements:

1 When the gas purity is greater than or equal to 99.999999%, low carbon stainless steel tubes with internal wall electro-polished shall be adopted and the membrane valve shall be adopted by valves;

2 When the gas purity is greater than or equal to 99.999% and the dew point is lower than －76℃, low carbon stainless steel tubes with internal wall electro-polished or stainless steel tubes with internal wall electro-polished should be adopted and the membrane valves or bellows valves should be adopted on the valve;

3 When the gas purity is greater than or equal to 99.99 % and the dew point is less than －60℃, stainless steel tubes with internal wall polished should be adopted; except the combustible gas pipeline, which shall be adopted with bellows valve, the other gas pipeline should be adopted with ball valves;

4 The materials of gas pipeline valve and accessories should be uniform with that of its connected pipeline.

10.2.9 The gas pipeline connection shall meet the following requirements:

1 The pipe connection shall be welded;

2 The stainless steel tubes shall be adopted with argon arc welding and should be adopted with argonaut welding or plasma fusion and butt welding;

3 The connection between the pipeline and the equipment or valve ring shall be adopted with joint of face seal or double sleeve chucks and the sealing materials of joints or double cutting sleeves should be adopted with metal pad or polytetrafluoroethylene pad;

4 The pipeline and equipment connection shall meet the requirements of equipment connection. When hose connection is adopted, the metal hose should be applied.

10.3 Dry and Compressed Air System

10.3.1 The dry and compressed air system in clean building shall be determined according to the product production process requirements, air supply and air supply quality and other factors and shall meet the following requirements:

1 The air supply scale shall be determined according to the required air supply for product

11 Chemical Supply

11.1 General Requirements

11.1.1 The storage and delivery means of chemicals in clean building shall be determined according to the product production process ands the quality, quantity and physicochemical characteristics of chemicals.

11.1.2 The chemicals applied in the clean building shall be classified and stored according to their respective physicochemical characteristics of chemicals and shall be in accordance with the relevant requirements of the current national standard “Classification and Labels of Dangerous Chemical Substances” GB 13690 .

11.1.3 The production facilities and spaces for applied hazardous chemicals in the clean room (zone) shall be taken with corresponding safety precautions.

11.2 Chemical Storage and Transmission

11.2.1 The chemical storage room (zone) in the clean building shall be installed according to the following requirements:

1 The storage volume of chemicals in the storage room (zone) shall not be greater than the consumption of this chemical in 24 hours;

2 The chemical shall be classified and stored according to the physicochemical properties of chemicals and when it is not permissible for the storage in the same warehouse due to the physicochemical properties, solid wall separation shall be adopted;

3 The hazardous chemicals shall be stored in independent storage room or distribution room for storage and the barrier with fire endurance greater than 1.5h shall be adopted between the storage room and the adjacent room

4 The hazardous chemicals storage and distribution room should be laid out near the external wall;

5 The storage and distribution rooms for different chemicals shall be arranged with mechanical air exhaust. And the mechanical air exhaust shall adopt the emergency power;

6 The storage and distribution rooms for explosive chemicals shall be adopted with electrostatic prevention flooring which will not generate sparks;

7 The pipelines delivering combustible and explosive chemicals shall be arranged with grounding facilities to guide the static;

8 When it shall be connected to the main pipeline delivering combustible and explosive chemical for the user, automatic and hand off valves shall be installed.

11.2.2 When vessels shall be adopted to deliver hazardous chemicals in the clean building, it shall meet the following requirements:

1 It is strictly prohibited to store and distribute hazardous chemicals at the exit and

12 Electrical Designs

12.1 Power Distribution

12.1.1 The electrical load grade and power supply requirements for clean building shall be determined according to the production process of the electronic products and the relevant requirements of the current national standard "Code for Design of Electric Power Supply Systems" GB 50052.

12.1.2 The low voltage distribution grade for clean building shall be in accordance with the power utilization for the production process equipments. The live conductor system type should be adopted with single phase two wire system, three-phase three-wire system and three-phase four-wire system. The system earth types should be adopted with TN-S or TN-C-S systems.

12.1.3 The main process equipments for electronic product production use shall be power supplied by the exclusive transformer or exclusive low voltage supply line. The production facilities and power equipments having special requirements on the power continuity should be installed with uninterrupted power supply or standby power generation system and so on. Independent overhaul power should be installed in the clean room (zone).

12.1.4 The cleaning air conditioning system of clean building (including refrigerating machine) shall be power supplied by private line of substation.

12.1.5 The power inlet wire (excluding fire fighting power inlet wire) in the clean building shall be arranged with hand off device and the hand off device should be installed outside clean room (zone) for the convenient of operation and management.

12.1.6 The distribution equipments in the clean room (zone) shall be adopted with small scale and concealed installed equipments which are not easy to accumulate dust and convenient for wiping and should not be installed with ground distribution equipments. The distribution equipments should be installed at the lower technical mezzanine and water retaining facilities shall be installed at the top.

12.1.7 The electric pipeline in the clean building should be laid in the technical mezzanine or technical tunnel and should be adopted with low fume and halogen-freehalogen cable; the threading conduit pipe shall be adopted with non combustible material. The electric pipeline in the clean production area shall be laid out in concealed form and the pipe orifice of electric pipeline and the electrical equipments installed on the wall and the seam section of wall shall be adopted with sealing measures.

12.1.8 The electrical designs of combustible gas or liquid storage and distribution rooms in the clean building shall be determined according to the characteristics of combustible gas or liquid and shall be in accordance with the relevant requirements of the current national standard "Electrical Installations Design Code for Explosive Atmospheres and Fire Hazard" GB 50058.

12.2 Illumination

12.2.1 The general lighting luminance value of the main building for productive purpose in the clean room (zone) should be 300~500 lx; and the luminance values in the auxiliary working room, room for cleaning body and materials, air lock and corridor should be 200~300 lx.

grade shall meet the relevant requirements of the current national standard "Code for Design of Automatic Fire Alarm System" GB 50116. When the fire compartment area exceeds the allowable value of maximum building area as specified in the current national standard "Code of Design on Building Fire Protection and Prevention" GB 50016, the protection grade shall be grade I.

12.3.3 The fire control room in the clean building shall not be located in the clean room (zone). The switchboard of special telephone installation shall meet the relevant requirements of the current national standard "Code for Design of Automatic Fire Alarm System" GB 50116 and special fire fighting telephone shall be installed at the following places:

1 At the entrance of the clean room (zone);

2 At the emergency treatment center;

3 Master control room;

4 Management room for special gases.

12.3.4 The fire detector installation in the clean building shall meet the following provisions:

1 The production area, technical mezzanine, machine room and station room shall be installed with fire detector and intelligent detectors shall be installed in the clean production area and technical mezzanine;

2 When the fire compartment area of clean building exceeds those specified in the current national standard "Code of Design on Building Fire Protection and Prevention" GB 50016 or the top mount point detector fails to meet the design requirements in the current code, in the cleaning air conditioning system before fresh air is mixed with return air flow in the clean room (zone) shall be installed with early stage smog warning detectors with sensitivity level higher than 0.01%obs/m;

3 The silicohydrides storage and distribution room (zone) shall be arranged with infrared ray-ultraviolet flame detector;

4 Manual alarm button and sound and light alarm device shall be arranged in the clean production area, walkway and technical mezzanine (excluding non-circulating technical mezzanine) .

12.3.5 Automatic fire alarm and fire fighting gang control shall be arranged in the clean building. The control and display of control equipment shall meet the relevant requirements of the current national standard "Code for Design of Automatic Fire Alarm System" GB 50116, the fire alarm in the clean room (zone) shall be checked and when the fire is confirmed, manual controls shall be carried out for the following items in the fire control room:

1 Electric fire proof damper at the associated part shall be shut down and the corresponding supply fan, exhaust fan and fresh air fan of the cleaning air conditioning system shall be shutdown and feedback signals shall be received;

2 Smoke exhaust fan shall be initiated and the feedback signals shall be received;

3 Shut off the non-fire fighting power of relevant parts by hand in the fire control room or low voltage power distribution room.

12.3.6 Gas leakage warning devices shall be arranged at the following places in the clean building:

1 The storage and distribution room (zone) for combustible, explosive and toxic gases;

adopted with conducting electrostatic. The surface resistance and resistance to ground of conducting electrostatic ground, wall surface and cylindrical surface shall be 2.5×10^{4}~$1\times10^{6}\Omega$ and the tribo-electrification voltage shall not be greater than 100V; the halflife of static shall not be greater than 0.1s;

2 The ground, wall surface cylindrical surface, ceiling, door and flexible curtain of grade II anti-static working area shall be adopted with electrostatic dissipative type. The surface resistance and resistance to ground of the electrostatic dissipative ground, wall surface, cylindrical surface, ceiling and door shall be 1×10^{6}~$1\times10^{9}\Omega$ and the tribo electrification voltage shall not be greater than 200V; the static halflife shall not be greater than 1 s and the tribo electrification voltage of flexible curtain, however, shall not be greater than 3.0V;

3 The ground, wall surface and cylindrical surface of the grade III anti-static working area should be adopted with electrostatic dissipative materials or low electrification material according to the production process requirements and the ceiling and door should be adopted with low electrification materials. The ground, wall surface and cylindrical surface adopting electrostatic dissipative materials shall meet the requirements in 2 of this article; the tribo electrification voltage of the ground, wall surface and cylindrical surface adopting low electrification materials shall not be greater than 1000V.

13.2.3 The door and window design in ESD controlled environment of clean building shall be in accordance with the following requirements:

1 The electrostatic dissipative materials shall be adopted to manufacture door and window and dissipative materials shall be adopted to veneer;

2 The metal door and window surface shall be brushed with electrostatic dissipative coats and shall be grounded;

3 When large area glass is installed on the indoor partition and observation window, the glass surface shall be pasted with electrostatic dissipative transparent film or sprayed with electrostatic dissipative coats.

13.2.4 The renovation of ESD controlled environment of clean building shall be in accordance with the following requirements:

1 The renovation materials shall be provided with electrostatic dissipative performance on the surface and shall not adopt the high molecule insulating decoration materials without surface modification;

2 The veneer of renovations shall be smooth and slick.

13.2.5 The air supply outlet and air pipe of cleaning air conditioning system for ESD controlled environment of clean building shall be made of conductor materials and shall be grounded;

13.2.6 When the cleaning air conditioning system of the clean building ESD controlled environment and part of the isolative materials are adopted with attached piping, metal mesh shall be installed on the surface and shall be grounded; when the conductive rubber hose is adopted, metallic conductor shall be installed tightly connected to the hose and reliable connection and grounding shall be carried out with ground lead.

13.2.7 In the ESD controlled environment, the clean building shall be installed with static eraser and anti-static safe operation platform according to the production process requirements.

14 Noise Control

14.1 General Requirements

14.1.1 The noise control in the clean building shall meet the requirements of electronic product production and shall provide the working personnel with a comfort and safe environment.

14.1.2 The noise control design of clean building shall meet the relevant requirements of the current national standard "Specifications for the Design of Noise Control System in Industrial Enterprises" GBJ 87.

14.1.3 The noise grade (as-built) for the noise control design in clean room (zone) shall meet those specified in Article 3.2.5 of this code.

14.1.4 The spectrum limit of noise in the clean room (zone) shall be adopted with the octave band sound pressure grade and each band pressure grade shall meet the relevant requirements of the current national standard "Code for Design of Clean Room" GB 50073.

14.2 Noise Control Design

14.2.1 When the plan and spatial layout for clean building is carried out, it shall be laid out according to the noise control requirements and should arrange the sounding equipments in concentration.

14.2.2 The equipments in the clean room (zone) shall be adopted with low noise products. For the radiated noise value exceeding that of the specified equipments, sound insulation facilities to reduce the sound source noise shall be installed according to the characteristics, physical dimension and other factors of the equipments. The enclosing construction of clean room shall be provided with favorable sound insulation performance.

14.2.3 The main noise source of clean buildings, such as cleaning air conditioning system, public power equipment and transmission pipeline shall be taken with noise control measures of sound insulation, noise elimination and vibration isolation. The following measures should be taken for the air conditioning room, power station room and so on:

1 The enclosing construction should be adopted with sound absorption and sound insulation treatment;

2 For the equipments, of which the radiated noise value exceeds the specified one, sound insulation screen, acoustic shield or suspension sound absorber and so on shall be installed;

3 The enclosing construction of control room in the machine room and station room should be adopted with materials of high sound insulation performance.

14.2.4 The exhaust air systems (excluding accident exhaust air system) in the clean room (zone) shall be arranged with silencer or other noise reduction facilities.

particles such as ethanel/glycol etc. formed by chemical process to observe or make image under high-intensity light source.

5 Air flow visual inspection shall be carried out by adopting image processing techniques, this method is generally combined with tracer methods to obtain flow characteristic after material handling of the particle image on the camera or the film.

6 Measuring points position and instrument etc. of air flow visual inspection shall be determined according to actual conditions of clean room (zone) through negotiation.

D.3.6 Testing of Temperature and relative humidity shall meet the following requirements:

1 Testing of temperature and relative humidity shall be tested in homogeneous condition of flow distribution in clean room (zone), and shall be arranged to carry out after the qualification of the test operation of purification of air conditioning system. Testing of temperature and relative humidity shall be tested after the operation of purification of air conditioning system and it shall be tested after at least 1.0h steady operation of purification of air conditioning system.

2 Relative humidity testing shall divide clean working area into equal-area grid, the maximum area of each grid shall be 100m^2, each grid shall have one observation point, but each room shall not be less than 2observation points.

3 Detector used for testing shall be set up within the operating height of clean room (zone), and it shall be a distance of less than 300mm away from the suspended ceiling, wall and ground. Possible existential thermogenic affect shall be measured in clean room (zone).

4 Testing time shall be at least 1.0h, and reading and records shall be carried out every 6mm (30s).

D.3.7 Noise detection shall be in accordance with the following requirements:

1 Sound level meter with frequency octave analysis shall be adopted in the noise detection of clean room (zone).

2 The noise monitoring point of clean room (zone) shall be determined according to the requirements of production process of electronic product.

D.3.8 Illumination test shall meet the following requirements:

1 The luminance detection in the clean room (zone) should be adopted with portable automatic recording illuminometer.

2 The luminance detection shall be carried out after the indoor temperature is becomes stable and the light source output is stable. The luminance detection in the clean room (zone) shall not include the local illumination and standby illumination of production facilities.

3 The check point of luminance shall be installed at the working height and it shall be 0.85m higher than the ground and one checking point shall be installed every 25m^2.

D.3.9 The mini-vibration detection shall meet the following requirements:

1 The detection of the places with mini-vibration control requirements in the clean room (zone) shall be adopted with the mini-vibration test analysis system with permissible vibration value requirements of precision equipment and instruments to check in stage.

2 The mini-vibration check point shall be laid out according to the precision equipment and

For the leak detection over the opened door of clean room, the suspended particle concentration in the clean room shall be checked at the 0.3~3.0m section from the door.

Record and report the tested reading and position, of which the particle concentration is greater than 10^{-3} times of the same particle diameter.

D.4 Accreditation

D.4.1 Before the accreditation of the performance test for clean building, an agreement shall be signed between the owner and accreditation organization; in the agreement, the test items, test point position and quantity, measurement requirements and limit and so on shall be specified, such as the sampling point number for the particle concentration in the air suspension, the least number of air samplings, sampling time, measurement times for each sampling point, measuring interval, particle diameter of the counted particles and the particle population limit and so on.

D.4.2 When the test is carried out According to the agreement and the requirements in Article D.2 of this Appendix and the method in Article D.3, if the test results are within the specified limit, it shows that the clean room (zone) meet the specifications. If the test results exceed the specified limits, it shows that the clean room (zone) fails to meet the requirements and shall be modified; after the improvement, it shall be re-accreditated.

D.4.3 It shall be recorded for each performance test or re-accreditation test and a general report about the performance shall be submitted. The test report shall include the following content:

1 The name and address of test organization;

2 Test date and tester signature;

3 The series number of execution standard and the publication date of this standard;

4 The address, test items, specific series number of the test point and coordinate drawing of the tested clean room (zone);

5 The air cleanliness class of the tested clean room (zone), the tested particle diameter, the state of the tested clean room (zone), air pattern and static pressure difference, and the particle concentration shall be indicated in the coordinate drawing of all the sampling points;

6 The series number and calibration certificate of the instrument for measurement use; and the test method and specification as well as the special circumstances in the test.

7 The test results include all the record data, analyzing and conclusion of the test items;

8 Explanation of the abnormal test value and the data processing;

9 The test date of the previous test;

10 The test file for the facilities may be regarded as the reference for the next test.

D.4.4 The test organization shall submit the testing certificate and re-inspection certificate of the clean room.

D.5 Records

D.5.1 Records retention shall meet the requirements of quality control procedures.

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