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Code for Design of Clean Room

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Code for Design of Clean Room

1 General

1.0.1 This code is formulated with view to making the design of clean room to be technologically advanced, economic, reliable, safe and qualified as well as comply with requirements of energy conservation, labor sanitation and environmental protection.

1.0.2 This code is applicable to the design of new-built, extended and rebuilt clean room.

1.0.3 Design of clean room shall the basis of construction installation, maintenance, examination, test and safe operation.

1.0.4 In addition to this code, the design of clean room shall also comply with requirements of relevant current standards.

2 Terms

2.0.1 Clean room

The room where the suspended particle concentration in the air is controlled; its construction and application shall be able to reduce the entering, production and retention of particles in the room. Other relevant parameters in the room like temperature, humidity and pressure shall be controlled according to requirements.

2.0.2 Clean zone

Restricted zone where the airborne particle concentration in the air is controlled; its construction and application shall be able to reduce the entering, production and retention of particles in the space. Other relevant parameters in the space like temperature, humidity and pressure shall be controlled according to requirements. Clean zone may be open or closed type.

2.0.3 Mobile clean booth

Small clean room which may be moved as a whole and may be divided into two types respectively provided with hoarding made of rigid and flexible materials.

2.0.4 Room for cleaning human body

The room for cleaning human body according to certain procedure before entering into clean zone.

2.0.5 Room for cleaning material

The room for cleaning material according to certain procedure before entering into clean zone.

2.0.6 Particle size

The diameter of the globoid which is shown on the adopted particle size tester and equivalent to the response of the tested particle.

2.0.7 Airborne particle

Solid or liquid airborne particles (with dimension of 0.1~5 μ m) in the air used for classification of air cleanliness which are not used to represent the physical property, chemical property, radioactivity and life feature of airborne particles.

2.0.8 Ultrafine particle

Particles with equivalent diameter less than 0.1 μ m.

2.0.9 Microparticle

Particles with equivalent diameter greater than 5 μ m.

2.0.10 Particle size distribution

A function of particle size on its frequency distribution and cumulative distribution.

2.0.11 Particle concentration

The number of airborne particles in the air per unit volume.

2.0.12 Cleanliness

The cleanliness is divided by the number of particles (with particle diameter greater than or equal to a certain value) in the air per unit volume.

2.0.13 Air flow pattern

The rational design for flow pattern and distribution of interior air.

2.0.14 Unidirectional airflow

The steady and parallel controlled air flow sweeping across the whole section.

2.0.15 Vertical unidirectional airflow

The unidirectional airflow perpendicular to horizontal plane.

2.0.16 Horizontal unidirectional airflow

The unidirectional airflow parallel to horizontal plane.

2.0.17 Non-unidirectional airflow

A distribution pattern of airflow introduced into the clean room (zone) and mixed with the original air in such room or zone.

2.0.18 Mixed airflow

The airflow composed of unidirectional airflow and non-unidirectional airflow.

2.0.19 Clean working area

The area 0.8~1.5m (except for special process requirements) high from the ground in clean room.

2.0.20 Air shower

The booth blowing down and removing adhesive particles on the surface of human body entering clean room by high-speed clean airflow.

2.0.21 Air lock

A buffering room arranged at access of clean room for obstructing polluted airflow from outdoors or adjacent room and controlling pressure difference.

2.0.22 Pass box

An opening arranged on the partition of the clean room for transmitting materials and tools; it is equipped with casements on each side which may not be opened simultaneously.

2.0.23 Clean bench

A bench keeping the required cleanliness in the operation space.

2.0.24 Clean working garment

Clean garments with lower particle production to minimize particles produced by workers.

2.0.25 As-built

A state where the production equipment, personnel and material are unavailable while the facility is built and the utility reserve is connected and operated.

2.0.26 At-rest

by production process and equipment manufacturing department. If these departments fail to provide permissible vibration value, it shall be referred to “Code for Vibration Isolation Design” (GB 50463).

4.5.3 The passive vibration isolation design for precise equipment and instruments shall be provided with the following conditions:

- 1 Vibration data of the comprehensive effect of surrounding vibration sources on them.
- 2 Type, specification and dimension chart of equipment and instruments.
- 3 Mass, mass center position and mass moment of inertia of equipment and instruments
- 4 The outer dimension chart of base and accessory device of equipment and instruments, the position of pipe the of pit, channel and holes as well as position of anchor bolt and embedded part.
- 5 Leveling requirements of equipment and instruments.
- 6 Permissible vibration value of equipment and instruments.
- 7 Technical parameter, external dimension and installation condition of selected or designed vibration isolator or isolation device.

4.5.4 The passive vibration isolation design of precise equipment and instruments shall meet the following requirements:

- 1 The vibration isolation base shall be provided with sufficient rigidity.
- 2 Tilt correction measures shall be taken for the vibration isolation base.
- 3 The damping ratio of vibration isolation system in each direction shall not be less than 0.15.
- 4 The vibration insulation measures shall not affect the air flow pattern in the clean room.

4.5.5 Air spring vibration isolation device equipped with automatic tilt correction should be adopted for the passive vibration insulation measures of precise equipment and instruments. The air source supply for air spring shall be cleaned.

5 Architecture

5.1 General Requirement

5.1.1 The construction plan and space layout of the clean room should be properly flexible. The large space and large span column grid should be adopted for the major structure.

5.1.2 The type selection for materials of the enclosing structure of clean room shall meet the requirements of thermal insulation, fire protection, moisture protection and dust control.

5.1.3 The endurance of the major structure of clean room shall be in accordance with the interior equipment and decoration, and shall be provided with performance like fire protection and control of temperature, deformation and uneven settlement. The deformation joint should not get across the clean zone.

5.1.4 During the conceal of supply and return air pipe and other pipe, technical interlayer, technical tunnel or trench shall be arranged; where the vertical pipe crossing floor is concealed technical shaft should be arranged, of which the form, dimension and structure shall meet the installation, overhaul and fire protection requirements of air duct and pipe.

5.1.5 As for the plane layout and structure treatment of comprehensive plant used for general production and clean production, the unfavorable effect on clean production brought

6.4.4 Frequency-conversion measures shall be taken for the fan of cleaning air-conditioning system.

6.4.5 Anti-freezing protection measures shall be taken for the fresh air system in severe cold and cold area.

6.5 Heating, Ventilation and Smoke Control

6.5.1 The radiator shall not be adopted for the heating of clean room with classification of air cleanliness higher than Grade 8.

6.5.2 For process equipment generating dust and harmful gas in clean room, local exhaust device shall be set.

6.5.3 Under the following conditions, local exhaust system shall be set separately:

- 1 After being mixed, the medium of air exhaust may generate or intensify its corrosion, toxicity, the risk to burn/explode and cause cross contamination.
- 2 The medium of air exhaust containing toxic gas.
- 3 The medium of air exhaust containing inflammable and explosive gas.

6.5.4 The design of air exhaust system in clean room shall meet the following requirements:

- 1 The outdoor air flow shall be prevented from backflow.
- 2 For local exhaust system containing inflammable and explosive substances, corresponding measures against fire and explosion shall be taken according to their physicochemical property.
- 3 Where the concentration and emission rate of harmful substances in air exhaust medium exceed the values specified in national or local laws, innocent treatment shall be carried out.
- 4 For air exhaust system containing vapor and concrete substances, the gradient and outlet shall be set.

6.5.5 For production auxiliary rooms for shoe changing, outerwear storing, washing, toileting and showering, ventilation measures shall be taken, and the static pressure value of the room shall be less than that of clean zone.

6.5.6 Accident air exhaust system shall be set according to the requirements of production process. The system shall be equipped with automatic and manual control switches and the manual switch shall be set in and out of clean room for easy operating.

6.5.7 The installation for smoke exhaust facility of clean room shall meet the following requirements:

- 1 The mechanical smoke exhaust facility shall be set in the evacuation corridor of clean room.
- 2 The smoke exhaust facility set in clean room shall meet relevant requirements of the current national standard "Code of Design on Building Fire Protection and Prevention" (GB 50016).

6.6 Air Pipe and Accessories

6.6.1 The fresh air pipe section of cleaning air-conditioning system shall be equipped with electric closed valve and control valve; the air supply and return pipe section shall be equipped with control valve; the air exhaust system in clean room shall be equipped with control valve, check valve or electric closed valve.

6.6.2 Under either of the following conditions, the air pipe of air exhaust system and cleaning air-conditioning system shall be equipped with fire valves:

- 1 The air pipe passes through the partition of fire compartment and both sides for fire

rating and volume of building.

7.4.2 The arrangement of fire water supply and fixed fire-fighting equipment of clean room shall meet the relevant requirements current national standard "Code of Design on Building Fire Protection and Prevention" (GB 50016) .

7.4.3 The interior fire hydrant shall be set in the production layer and passable technical interlayer in clean room. The water consumption of hydrant shall not be less than 10L/s and at least 2 hydraulic giants shall be used. The length of hydraulic giant's full water spout shall not be less than 10m and the water output of each giant shall be calculated no less than 5L/s.

7.4.4 In clean room, each place shall be equipped with extinguisher, whose design shall meet relevant requirements on the current national standard "Code for Design of Extinguisher Distribution in Buildings" (GB 50140).

7.4.5 For the room with valuable equipment and instrument, the arrangement of fixed fire-extinguishing facility shall meet the relevant requirements of the current national standard "Code of Design on Building Fire Protection and Prevention" (GB 50016) and the following requirements:

- 1 For the arrangement of automatic sprinkler system, pre-action type shall be adopted.
- 2 For the arrangement of gas fire-extinguishing system, alkyl halide 1211 and extinguishant causing asphyxia of personnel and secondary damage to protected objects shall not be adopted.

8 Industrial Pipe

8.1 General Requirement

8.1.1 The laying of industrial pipe in clean room (zone) shall meet the following requirements:

- 1 The industrial pipe in clean room (zone) shall not pass through irrelevant room.
- 2 Main pipe shall be laid in technical interlayer or tunnel.
- 3 The pipe for inflammable, explosive and toxic substance shall adopt exposed laying.
- 4 Where the pipes for inflammable, explosive and toxic substance are laid in technical interlayer or tunnel, reliable measures for concentration inspection and alarming as well as ventilation shall be adopted.

8.1.2 The design of industrial pipe in clean room (zone) shall meet relevant requirements of the current national standard "Design Code for Industrial Metallic Piping" (GB 50316).

8.1.3 The design of industrial pipe shall meet the following requirements:

- 1 The flow speed of material in pipe and pipe diameter shall be reasonably determined according to the physicochemical property of transmission medium.
- 2 The pipe system shall be as short as possible where production process is satisfied.
- 3 The blind pipe and dead corner which are not easy to blow and parts which are not easy to clean shall be avoided.
- 4 The necessary blowdown opening, cleaning opening and sampling opening shall be equipped for pipe system.

8.1.4 The industrial pipe section crossing the wall and floor of clean room shall be free form welding seam. Reliable sealing measure shall be taken between pipe and wall or floor.

8.1.5 Bleeder shall be set on the end or top of combustible gas pipe and oxygen pipe. The

the concentration of particles greater than 5 μ m. It may also be regarded as the supplemental instruction of the air cleanliness classification of airborne particles.

M descriptor is expressed by "M (a, b); c", where "a" is the maximum permissible concentration of the microparticle (p/m³); "b" is the equivalent diameter that has the same measuring methods as those of the microparticles (μ m); "c" is the specified measuring method.

For example, the microscope is adopted to inspect the particles collected by the multilevel impact sampler. The concentration of airborne particles whose particle size scope measured to be 10~20 μ m is 1000/m³. M descriptor expresses "M (1000; 10~20 μ m). The multilevel impact sampler determines the particle size by microscope and count."

A.4 Monitoring

A.4.1 The concentration of airborne particles and other parameters are monitored according to the requirements of the agreement of the parties.

A.4.2 The agreement of the parties shall define the minimum sampling points of airborne particles concentration, the minimum air sampling quantity each time, the sampling time, the measuring frequency of each sampling point, the measuring time intervals, the particle size of counted particles and the limit number of particles.

A.4.3 Where the monitoring results are beyond the time limit, the facilities are verified to be unqualified and shall be corrected. The certification and inspection shall be conducted again after correction. Where monitoring results are within the specified limit, the monitoring may be continued.

A.5 Certification

A.5.1 According to the requirements of the agreement of both parties and Section A.2, the test is conducted based on the methods in Section A.3. Where the test results are within the limit, this clean room is identified to be in accordance with the specified requirements. Where the test results are beyond the specified limit, this clean room is determined to be unqualified and shall be corrected. The certification shall be conducted after correction.

A.5.2 The assessment of the recording data shall meet the following requirements:

1 During the classification of air cleanliness test, where the quantity of measuring points is between 1~10, the average medium value, standard deviation, standard error and 95% confidence upper limit led out by the average particle concentration of all the sampling points shall be calculated.

2 Where the quantity of sampling points is over 10, the arithmetic average shall be calculated. And the classification of air cleanliness shall be assessed according to the arithmetic average.

A.5.3 Each performance test or the re-certification test shall be recorded. The general report of whether the performance is qualified shall be submitted. The test report shall cover the following items:

- 1 the name and address of the test organization;
- 2 the test date and tester's signature;
- 3 the number of the executive standard and the standard publication date;
- 4 the address, the specific number of the sampling point and the coordinate graph of the tested clean room or clean zone;
- 5 the classification of the classification of air cleanliness of the tested clean room and clean zone, the tested particle size, the situation of the tested clean room, air flow pattern and

List of Quoted Standards

- GB 50016 Code of Design on Building Fire Protection and Prevention
- GB 50052 Code for Design of Electric Power Supply Systems
- GB 50057 Design Code for Protection of Structures against Lightning
- GB 50058 Electrical Installations Design Code for Explosive Atmospheres and Fire Hazard
- GB 50116 Code for Design of Automatic Fire Alarm System
- GB 50140 Code for Design of Extinguisher Distribution in Buildings
- GB 50210 Code for Construction Quality Acceptance of Building Decoration
- GB 50222 Code for Fire Prevention in Design of Interior Decoration of Buildings
- GB 50316 Design Code for Industrial Metallic Piping
- GB 50243 Code of Acceptance for Construction Quality of Ventilation and Air Conditioning Works
- GB 50463 Code for Design of Vibration Isolation
- GB/T 8627 Test Method for Density of Smoke from the Burning or Decomposition of Building Materials

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