

## Foreword

According to the requirements of Document JIANBIAO[2010] No.43 issued by the Ministry of Housing and Urban-Rural Development(MOHURD) of the People's Republic of China—"Notice on Printing and Distributing 'the Development and Revision Plan of National Engineering Construction Standards in 2010'", this code is completed by Electronic Engineering Standard Quota Station of China Electronics Standardization Institute and China Electronics Engineering Design Institute (CEEDI) together with relevant units.

During the process of compiling this code, the compiling group has conducted extensive investigation and research and seriously summarized practical experience, referred to relevant domestic and foreign standards and regulations, repeatedly modified the code on the basis of extensive consultation, and finally finalized the code after review.

This code consists of 14 chapters and 2 appendixes, covering: general provisions; terms; basic requirements; process; general layout; architecture; structure; dynamic; heating, ventilation and air purification; water supply and drainage; electric; chemicals; space management; energy conservation, etc.

The provisions printed in bold type are mandatory ones and must be implemented strictly.

The Ministry of Housing and Urban-Rural Development of the People's Republic of China is in charge of administration of this code and explanation of its mandatory provisions. The Ministry of Industry and Information Technology is responsible for its routine management, and the China Electronics Engineering Design Institute is in charge of the explanation of technical specifications. All relevant organizations are kindly invited to summarize and accumulate actual experiences when implementing this code. Relevant comments and recommendations, whenever necessary, should be submitted to China Electronics Engineering Design Institute (Address: No. 160, West Fourth Ring North Road, Haidian District, Beijing, Postcode: 100142).

Chief Development Organizations, Co-Development Organizations, Chief Drafters, Chief Reviewers, Chief Translators and Chief Translation Reviewers of this code are as follows:

### **Chief Development Organizations:**

Electronic Engineering Standard Quota Station of China Electronics Standardization Institute

China Electronics Engineering Design Institute

### **Co-Development Organizations :**

A + E Design Co., Ltd.

China Printed Circuit Association

The IT Electronics Eleventh Design & Research Institute Scientific and Technological Engineering Corporation Limited

Shennan Circuits Co., Ltd.

Enda Circuit (Shenzhen) Co., Ltd.

Huizhou Xiong Yue Bao Huan Technology Co., Ltd.

**Chief Drafters:**

WANG Li YIN Ming CHEN Rongxian XU Yiqing CAO Huiyou  
WANG Zhijun MAO Wenxiong HAN Yebin LIU Zhiyuan LUO Rong  
YANG Zhouli CHEN Cha WANG Wenzhong LI Xueyang CHEN Li  
CHEN Jifeng LIAO Xuejiang ZHANG Jin ZHAO Yongsheng  
WANG Longji HAN Yiwei DU Baoqiang MAO Airui

**Chief Reviewers:**

HAN Fangjun GONG Yonglin LI Jinsheng CHAO Yang WANG Zhaotian  
REN Zhaocheng ZHU Litong ZHANG Zhenjun DAI Ruizhi

**Chief Translators:**

WANG Li YIN Ming WANG Bin

**Chief Translation Reviewers:**

ZHAO Qingyu LIU Yu CHEN Xiaoran



## Contents

1	General provisions	( 1 )
2	Terms	( 2 )
3	Basic requirements	( 3 )
4	Process	( 4 )
4.1	General requirements	( 4 )
4.2	Basic process and cooperation in production	( 4 )
4.3	Equipment allocation	( 5 )
4.4	Process regionalization and equipment layout	( 5 )
4.5	Air cleanliness requirements of workshop	( 6 )
5	General layout	( 7 )
5.1	General requirements	( 7 )
5.2	Master layout	( 7 )
5.3	Vertical design	( 8 )
5.4	Traffic organization	( 8 )
5.5	Greening design	( 9 )
6	Architecture	( 10 )
6.1	General requirements	( 10 )
6.2	Fire protection design	( 10 )
6.3	Anticorrosion design	( 11 )
7	Structure	( 13 )
7.1	General requirements	( 13 )
7.2	Structure design	( 13 )
8	Dynamic	( 14 )
8.1	Cold and heat sources	( 14 )
8.2	Gas supply	( 15 )
9	Heating, ventilation and air purification	( 16 )
9.1	General requirements	( 16 )
9.2	Ventilation and exhaust gas management	( 16 )
9.3	Air conditioning and purification	( 17 )
9.4	Anti-smoke exhaust	( 19 )
10	Water supply and drainage	( 20 )
10.1	General requirements	( 20 )
10.2	General water supply and drainage	( 20 )
10.3	Purified water	( 21 )
10.4	Industrial recycling cooling water	( 22 )
10.5	Wastewater treatment	( 22 )
10.6	Fire water supply and deployment of fire extinguisher	( 23 )
11	Electric	( 24 )
11.1	General requirements	( 24 )

11.2	Power supply system	( 24 )
11.3	Electric lighting	( 24 )
11.4	Lightning protection and grounding	( 25 )
11.5	Communication and control	( 25 )
11.6	Electro-static prevention	( 26 )
12	Chemicals	( 27 )
12.1	General requirements	( 27 )
12.2	Storage of chemicals	( 27 )
12.3	Pipeline transportation of chemicals	( 28 )
12.4	Collection and recycling of chemical waste	( 29 )
13	Space management	( 30 )
14	Energy conservation	( 31 )
14.1	General requirements	( 31 )
14.2	Energy conservation of cold-heat system	( 31 )
14.3	Energy conservation of equipment	( 31 )
14.4	Energy saving in electric	( 32 )
14.5	Other energy saving measures	( 32 )
Appendix A	Typical production process of PCB	( 33 )
Appendix B	Cleanliness level recommended list of production process of PCB	( 34 )
	Explanation of wording in this code	( 35 )
	List of quoted standards	( 36 )

## 1 General provisions

**1.0.1** This code is prepared with a view to implement relevant national laws, regulations and provisions in the design of printed circuit board plant with advanced technology, cost-effectiveness, safety, reliability, energy conservation and environmental protection.

**1.0.2** This code is applicable for the design of new construction, expansion and retrofit of printed circuit board plant.

**1.0.3** In addition to the requirements in this code, the design of printed circuit board plant shall comply with those stipulated in the current relevant standards of the nation.

住房和城乡建设部信息中心  
浏览专用

## 2 Terms

### 2.0.1 printed circuit board (PCB)

On an insulated substrate, a printed circuit or finished printed circuit board was made of printed components, printed circuits, or a combination of the two to follow a predefined design.

### 2.0.2 laminating

The process in which two or more layers of prepreg and copper clad laminate (CCL) materials are heated and pressed together to form a PCB.

### 2.0.3 etching

The process of chemically or electrochemically removing useless conductive materials to form a printed pattern.

### 2.0.4 chelate compound

An indispensable metal-containing compound in a ring structure.

### 2.0.5 chemical storage room (area)

A room or an area in the workshop where chemicals are temporarily stored.

### 2.0.6 chemical station

A room or an area that modulates and stores finished chemical products.

### 2.0.7 chemicals store

A warehouse for the storage of finished chemical products in the plant.

### 2.0.8 thermal oil

Materials that transfer heat by heating oil.

### 2.0.9 brown oxidation

Oxidation treatment that increases the bonding force between the copper surface and the pre-soaked material after lamination. Similar processes include black oxidation and red oxidation.

### 3 Basic requirements

**3.0.1** The design of PCB plant shall be in accordance with the following requirements:

**1** It shall rationally use resources and protect the environment , prevent the harm and contamination caused by waste gas, waste water, solid waste, noise and vibration generated in production activities to the environment.

**2** It shall actively adopt new processes, technologies, equipment and materials.

**3** It shall ensure the implementation of technical measures for fire control , environmental protection, energy conservation and occupational hazard prevention, and shall meet the relevant provisions of the current national standards GB 50523 *Code for Design of Occupational Safety and Hygiene in Electronics Industry*, GB 50710 *Code for Design of Energy Conservation of Electronic Industry*, GB 50814 *Code for Design of Environmental Protection of Electronic Engineering*.

**4** It should meet the requirements of green industrial building design.

**3.0.2** Anti-freezing measures shall be taken for pipelines and equipment in severely cold regions and cold regions where there is a risk of freezing; anti-aging and anti-explosion measures shall be taken in hot regions.

**3.0.3** PCB plant with corrosive medium effect and relatively high environmental humidity shall be designed in accordance with the relevant provisions of the current national standard GB/T 50046 *Standard for Anticorrosion Design of Industrial Constructions*.



## 4 Process

### 4.1 General requirements

**4.1.1** The process design of the PCB plant shall be in accordance with the following requirements:

- 1 Labor intensity shall be reduced and occupational safety shall be guaranteed.
- 2 The production efficiency and product quality shall be ensured.
- 3 The project, operation and maintenance costs shall be reduced.
- 4 The design shall have appropriate flexibility and adaptability.

**4.1.2** PCB production process shall not be lower than the level 2 requirements of the current environmental protection standard HJ 450 *Cleaner Production Standard—Printed Circuit Board Manufacturing*. The production process and the equipment selection of the plant shall be determined by technical and economic comparison according to production methods, production scale, product varieties and construction conditions and other factors.

**4.1.3** The PCB production capacity shall be designed according to product type, current output and future development plan. The design capability of batch production line shall meet the requirements of economic scale. When the production capacity needs to be implemented in stages, the necessary dynamic services expansion shall be reserved in the process design, and the space for sustainable development should be considered in the layout.

**4.1.4** The production departments of the PCB plant should adopt the method of continuous operation, and the shift of other auxiliary production department may be determined according to the needs.

**4.1.5** Equipment or process that are not technically mature or have been expressly eliminated shall not be used.

**4.1.6** The process design of the PCB plant shall specify the following conditions according to the production process:

- 1 The spatial layout, logistics, pedestrian, load and other conditions of the building.
- 2 Consumption and quality requirements of industrial water, gas and chemicals.
- 3 Requirements for lighting, power supply, air conditioning, air cleaning, noise, and microvibration proof foundation.
- 4 Types, quantities and components of pollutants of waste water, gas and solid.

**4.1.7** The selection of corrosive medium for PCB production shall meet the production process requirements. The equipment area with corrosive medium shall be separated from the equipment area without corrosive medium.

**4.1.8** Safety protection and noise reduction measures should be taken in machining process.

### 4.2 Basic process and cooperation in production

**4.2.1** The process design of the PCB plant shall be based on the determined product type, structure and general production process, it may also be determined according to the contents and processes of each process listed in Appendix A of this code.

**4.2.2** In the production of PCB, the process design of each basic process shall be in accordance with

the following requirements:

- 1 Sorting, recycling and utilization of waste materials shall be carried out in processes such as cutting, drilling, punching and laminating.
- 2 Water-soluble anticorrosive agents shall be used in printing, photosensitive and other graphic forming processes, and waste materials shall be classified, recycled and utilized.
- 3 The cleaning agent on the board surface cleaning process shall not contain complex, and counter current rinsing should be used.
- 4 Etching liquids containing chromium and chelate compound should not be used in the etching process, and etching waste liquids shall be collected, stored and utilized centrally, and counter current rinsing should be used in the etching and cleaning process.
- 5 In addition to the gold plating process, non-cyanide plating baths shall be used in electroplating and electroless plating processes. Lead alloy coatings and electroplating solutions containing fluorine complexes shall not be used.

**4.2.3** The following production processes of PCB plant may be implemented by external collaboration:

- 1 The maintenance or calibration of processing and testing equipment that cannot be maintained or calibrated by user.
- 2 Off-site transportation of raw and auxiliary materials.
- 3 Off-site transportation of finished products.
- 4 Waste solid recycling and treatment.
- 5 Process more economical and reasonable on using external collaboration.

### **4.3 Equipment allocation**

**4.3.1** Automatic material transfer system should be adopted in the production line for mass production of PCB, and vertical transport equipment shall be adopted between production areas arranged in multiple layers.

**4.3.2** PCB production line should be equipped with maintenance equipment.

**4.3.3** Central dust removal system should be installed in the PCB workshop.

**4.3.4** The etching process should be configured with a closed automatic transmission etching device, etching machines should have automatic control, supply and recycling circulation system.

**4.3.5** Automatic control devices should be installed for equipment in electroplating and electroless plating processes.

**4.3.6** Copper recovery devices should be attached to the surface treatment equipment.

### **4.4 Process regionalization and equipment layout**

**4.4.1** PCB production areas shall be divided according to the product process flow, and the production equipment of the same production process should be centrally arranged according to the type of equipment.

**4.4.2** Vibration sensitive equipment shall be placed far away from sources of vibration.

**4.4.3** The main production area of the production line shall be set with equipment moving inlet or moving channel.

**4.4.4** The PCB plant shall be provided with raw and auxiliary materials and waste storage facilities. The warehouse shall be in accordance with the following requirements:

1 The main settings shall be set according to the physical and chemical properties of stored materials and the requirements of the storage environment.

2 The warehouse of raw and auxiliary materials should choose the storage mode suitable for first-in, first-out.

3 The transport channel shall be set up in the main raw and auxiliary materials and products warehouse.

4 The chemicals needed for daily production shall be stored in the chemical storage room (area) of the production line, and chemical intermediates or raw materials shall be stored in the chemical station or chemicals store respectively, and all above shall meet the safety requirements.

5 The storage site of solid waste and waste generated in production shall meet the relevant provisions of the current national standard GB 18599 *Standard for Pollution Control on the Non-hazardous Industrial Solid Waste Storage and Landfill*.

6 The hazardous waste storage sites shall meet the relevant provisions of the current national standard GB 18597 *Standard for Pollution Control on Hazardous Waste Storage*.

4.4.5 The entrance and exit of pedestrian flow and logistics shall be separated without affecting each other.

4.4.6 When setting the visiting channel, the solid wall shall be used to separate the channel from the main production area.

4.4.7 Chemical laboratory and physical laboratory should be set up in PCB plant, and the chemical laboratory should be located near the electroplating line.

#### **4.5 Air cleanliness requirements of workshop**

4.5.1 Clean spaces or clean room shall be set in graphics transfer, laminate and photographic plate making process; a clean space may be set in the local area with clean requirements. Air cleanliness classification for each process may be defined according to Appendix B of this code.

4.5.2 PCB production processes with cleanliness requirements should be set in adjacent areas.

4.5.3 The personnel and material cleaning zones shall be set up according to the plant cleaning requirements, and shall meet the relevant provisions of the current national standard GB 50472 *Code for Design of Electronic Industry Clean Room*.

## **5 General layout**

### **5.1 General requirements**

**5.1.1** The general planning of the PCB plant shall be based on the plant scale , production process , transportation, environmental protection, fire protection, safety and health and other requirements, and in combination with the natural conditions of the site and the surrounding environment of the site.

**5.1.2** The general planning shall be in accordance with the following requirements:

- 1** It shall meet the requirements of urban planning.
- 2** The phased construction projects shall be uniformly planned with area for development.
- 3** The building shall have good orientation, lighting and natural ventilation conditions according to the local meteorological conditions.
- 4** The logistics and pedestrian shall be reasonably organized. Logistics shall be convenient , pedestrian and vehicles shall be diverted.
- 5** Technical and economic factors such as land resource utilization , project investment , environmental protection and others shall be taken into consideration in a comprehensive way to achieve compact layout and reduce land use.
- 6** The layout of the building group shall be coordinated with the spatial landscape.

### **5.2 Master layout**

**5.2.1** The master layout of the PCB plant shall be in accordance with the following requirements:

- 1** Buildings, structures and other facilities should be combined, and adopted with multi-layer.
- 2** The functional division of the plant shall be clear, and the width of the roads shall meet the requirements of fire protection, transportation, and safety spacing, etc.
- 3** The shape of the building should be regular and the arrangement of various facilities shall be compact and reasonable.

**5.2.2** The distance between buildings shall meet the requirements of fire protection, transportation, safety, sanitation, etc. And shall comply with the requirements of pipelines layout, greening arrangement, construction, installation, maintenance and vertical design.

**5.2.3** The master layout shall make use of topography and engineering geological conditions and shall be arranged according to the following requirements:

- 1** Buildings, structures and related facilities shall be arranged according to the production process requirements.
- 2** The vertical design requirements for site drainage and road interface shall be met.
- 3** The vertical design shall be based on factors such as logistics loading and unloading , gravity flow of waste water, etc.
- 4** The extension and renovation projects shall prioritize the usage of existing facilities.

**5.2.4** The main building should be located more than 50m away from the urban traffic trunk road. This distance may be appropriately reduced when a green belt is installed in between, but shall not be less than 25m. The main building shall be set in the downwind side of the wind direction of the source of



harmful gas and dust with the minimum annual frequency.

**5.2.5** The utility building should be located close to the main workshop. The wastewater treatment station should be located at a lower side of the site, close to the waste water discharge outlet, and shall be located on the upwind side of the minimum annual frequency wind direction.

**5.2.6** The chemicals store shall be set up and managed separately. It shall be located at the edge of the plant area and be separated by fences or walls.

**5.2.7** The resource recycling station may be set up separately or combined with other auxiliary facilities.

**5.2.8** Dormitory, canteen and activity room should be separated from the production areas and arranged in groups.

**5.2.9** The fire separation distance between buildings shall comply with the relevant provisions of the current national standard GB 50016 *Code for Fire Protection Design of Buildings*.

**5.2.10** The fire lane settings shall meet the relevant provisions of the current national standards GB 50016 *Code for Fire Protection Design of Buildings* and GB 50472 *Code for Design of Electronic Industry Clean Room*.

### **5.3 Vertical design**

**5.3.1** The vertical design of PCB plant site shall meet the requirements of urban planning and flood prevention and drainage, and shall be coordinated with the drainage system of existing and planned roads outside the site as well as the elevation of the terrain around the plant. The minimum design elevation of the site shall be more than 0.2m higher than the minimum section elevation of the surrounding municipal roads.

**5.3.2** The site shall be equipped with facilities to drain rainwater from the ground and road to the municipal drainage system, and rainwater recycling system should be prioritized.

**5.3.3** The vertical design shall be carried out simultaneously with the master layout and the vertical layout shall be reasonably determined based on the actual terrain, production process and transportation mode.

**5.3.4** Horizontal slope or step type should be adopted in vertical design. The width of steps shall be determined according to factors such as terrain and geological conditions, building size, production technology, transportation mode, building density and pipeline laying when using a step type.

**5.3.5** The elevation of indoor floor shall not be less than 0.15m higher than that of outdoor floor.

**5.3.6** The elevation of the loading dock of the building shall match the model of the transport vehicle to meet the loading and unloading requirements.

**5.3.7** The elevation of entrances and exits of the plant should not be lower than the elevation of the road surface outside the plant.

### **5.4 Traffic organization**

**5.4.1** Circular road should be set up in the PCB plant area, and the width of the road shall meet the requirements of production and transportation.

**5.4.2** The entrances and exits of the plant should not be less than two, and there shall be a special entrance and exit for logistics. Separate exit should be set up in the living area.

**5.4.3** The entrances and exits of the logistics, office pedestrian and worker pedestrian should be



arranged separately.

**5.4.4** The cargo handling site should be set close to the cargo flow exit. The area of cargo loading and unloading shall meet the requirements of carriage return for transport vehicles. Waiting area for goods vehicles should be set up at the entrance and exit of cargo flow.

**5.4.5** The layout of car parking spaces shall meet the requirements of urban planning.

**5.4.6** The bearing capacity of the road surface in the plant shall meet the corresponding lorry load capacity, and cement concrete or asphalt pavement should be adopted.

## **5.5 Greening design**

**5.5.1** No topsoil shall be exposed in greening, and greening arrangement shall meet the requirements of production, transportation, safety, hygiene, fire prevention.

**5.5.2** The greening of the plant area shall make full use of the open space around the building (structure), both sides of the road, ground, area of the underground pipelines, marginal area.

**5.5.3** The plants selected for landscaping shall be suitable for the local growth environment, and shall not affect the production environment and product quality.

## 6 Architecture

### 6.1 General requirements

**6.1.1** The building functions of the PCB plant shall meet the production process requirements. The floor plan and spatial layout of the building shall be determined according to the requirements of product technical progress, production process transformation and expansion of production scale, and shall have appropriate flexibility.

**6.1.2** Pedestrian, logistics and auxiliary facilities inside the building shall be planned rationally.

**6.1.3** The column network and floor height should be determined by the production process requirements.

**6.1.4** The material selection of the building enclosure shall meet the requirements of heat preservation, heat insulation, fire prevention and moisture proof.

**6.1.5** The deformation joints in the building should not pass through the clean spaces.

**6.1.6** Technical interlayer or technical channel should be set up in the clean production area of the plant, and a maintenance access shall be set up in the technical interlayer or technical channel. The pipeline across the floor should be set in the shaft.

**6.1.7** The width of the passageway in the building shall meet the requirements of fire evacuation, personnel operation, material transportation, equipment installation, and maintenance. Anticollision components should be set on both sides and around the logistics passageway.

**6.1.8** The design of clean production areas in the plant shall meet the relevant provisions of the current national standards of GB 50016 *Code for Fire Protection Design of Buildings* and GB 50472 *Code for Design of Electronic Industry Clean Room*.

### 6.2 Fire protection design

**6.2.1** The fire-resistance class of PCB plant building shall not be lower than Class II.

**6.2.2** The classification of fire hazards in production of PCB plant buildings shall meet the relevant provisions of the current national standards GB 50016 *Code for Fire Protection Design of Buildings* and GB 50472 *Code for Design of Electronic Industry Clean Room*.

**6.2.3** The ceiling, wall panels, and their core materials in the clean spaces shall be non-combustible, and organic composite materials shall not be used. The fire resistance limit of the ceiling shall not be less than 0.40h, the fire resistance limit of wallboard shall not be less than 0.50h, and the fire resistance limit of the ceiling and wallboard of the egress path shall not be less than 1.00h.

**6.2.4** Non-combustible partition wall or ceiling shall be set between the clean production area and the general production area in one fire prevention zone, and its fire resistance limit shall not be less than 1.00h. The gaps around the pipe through the partition wall or ceiling shall be tightly filled with fireproof or refractory materials.

**6.2.5** The pipe shaft wall shall be non-combustible, its fire resistance limit shall not be less than 1.00h, and the fire resistance limit of the inspection door on the shaft wall shall not be less than 0.60h. Each floor slab within shaft shall be separated by non-combustible body which is equivalent to the fire

resistance limit of the floor in each floor, and the gaps around the pipeline through the horizontal fire prevention shall be tightly filled with fireproof or refractory materials.

**6.2.6** The safety exits shall be set dispersedly, and the evacuation route from production area to safety exit shall be convenient, with obvious evacuation signs. The safe evacuation distance shall be determined according to the layout of the process equipment, and shall comply with the relevant provisions of the current national standard GB 50016 *Code for Fire Protection Design of Buildings*.

**6.2.7** The chemical storage room (area) in the plant shall be set up in accordance with the following provisions:

1 The chemical storage room (area) shall be set in a separate room, and the room in which chemicals of Class A, B and C are stored shall adopt partition wall with fire resistance limit not less than 4.00h and non-combustible floor board with fire resistance limit not less than 1.50h, and this room shall be separated from other areas of the building, and shall be arranged against the external wall.

2 Chemical storage rooms (areas) shall be classified according to the physical and chemical properties of the chemicals, when the materials' properties are not allowed to be stored in the same room, solid walls shall be used to divide them and each area shall have its own entrance and exit.

3 The storing capacity of chemical storage rooms (areas) of Class A and B shall not exceed the required amount of 1d, and the volume of Class C liquid intermediate tank shall not exceed 1m<sup>3</sup>.

**6.2.8** The setting of thermal oil room shall meet the relevant regulations of the current national standard GB 50041 *Standard for Design of Boiler Plant*, and shall also be in accordance with the following requirements:

1 It may be built adjacent to the plant building. It shall be arranged against the external wall of the plant when it must be located within the plant.

2 The interior walls shall be separated from other areas by solid walls. The fireproof limit of envelope shall not be lower than the relevant requirements of the building with fire-resistance Class II.

3 The fire door of Class A and doorsill shall be used. The height of the doorsill shall meet the maximum leakage volume of the thermal oil.

### **6.3 Anticorrosion design**

**6.3.1** The anticorrosion design of the PCB plant shall be in accordance with the following requirements:

1 The corrosive grade of the gaseous and liquid medium on the building materials for the production workshop shall meet the relevant provisions of the current national standard GB/T 50046 *Standard for Anticorrosion Design of Industrial Constructions*.

2 Anticorrosive measures shall be taken on the surface of indoor walls, reinforced concrete members and steel components such as columns and girders in the room with corrosive gases and high relative humidity.

**6.3.2** The design of anticorrosion floors shall be in accordance with the following requirements:

1 Different corrosive media shall be protected respectively.

2 Anticorrosive materials shall be chosen according to the type, nature, concentration, temperature and quantity of corrosive media as well as the mechanical and thermal requirements.

3 Deformation joints should not be set up on the ground. When it must be set, the structure of the ground deformation joints shall be tight. The sealing material shall be elastic and corrosion-resistant.

The expansion pieces shall be made of plastic, rubber, corrosion-resistant metal and other materials.

**6.3.3** Anticorrosive skirting shall be provided at the intersection of anticorrosive ground, floor and wall, column.

**6.3.4** Corrosion-resistant bases shall be installed for steel structures supporting on the ground. The base of steel support should not be less than 300mm above the ground.

**6.3.5** A boundary line should be set between the anticorrosive ground and the non-anticorrosive ground, and the anticorrosive ground should be 20mm lower than the non-anticorrosion ground or set water blocking measures.

**6.3.6** The surface material of drainage ditch should be consistent with ground material, but asphalt mortar shall not be used. The isolation layer shall be set up in drainage ditch and water collecting well, and the isolation layer shall be connected with the ground isolation layer as a whole.

**6.3.7** Drainage ditch should be arranged along the equipment using corrosive medium, and should not pass through the pipe trench, trench, etc.



## 7 Structure

### 7.1 General requirements

**7.1.1** The structure of the PCB workshop shall be in accordance with the following requirements:

**1** The safety grade of the building structure, the service life of the structure design and the importance factor of the structure shall be in accordance with the relevant provisions of the current national standard GB 50068 *Unified Standard for Reliability Design of Building Structures*.

**2** Structural arrangement, selection and construction treatment shall be determined according to the production process, building function, construction technology, natural environment, geotechnical engineering conditions, material supply and reconstruction and expansion need.

**3** The building structure shall have sufficient strength, stiffness and ductility, and shall meet the requirements of stability and durability.

**4** New technologies, structures and materials used shall have complete technical documents.

**5** Basic design data such as geotechnical engineering, earthquake and meteorology shall be available before structural design.

**7.1.2** Frame structure, frame-shear wall structure should be adopted in PCB plant.

**7.1.3** When the length of the plant building exceeds the maximum spacing of the expansion joints specified in the current relevant standards of the nation, the effect of temperature change and concrete shrinkage on the structure shall be considered.

**7.1.4** The design of anticorrosion structure in the corrosive medium area of the PCB plant building shall meet the relevant provisions of the current national standard GB/T 50046 *Standard for Anticorrosion Design of Industrial Constructions*.

### 7.2 Structure design

**7.2.1** The strength grade of the concrete structure for PCB plant shall not be lower than C20.

**7.2.2** When the plant floor hangs equipment and pipelines, the load shall be determined according to the actual load, but should not be less than  $0.5\text{kN/m}^2$ .

**7.2.3** The calculation and verification of the plant floor load shall be in accordance with the following requirements:

**1** The ground load shall be determined according to the process requirements.

**2** The stacking load on the ground shall be determined according to the two distribution conditions of large-area dense stacking or local stacking.

**3** In the large-area dense stacking area with definite support point, when the central distance of the supporting surface is not more than 0.8m and the supporting area is not less than  $0.09\text{m}^2$ , the unit area load may be calculated according to the projected area.

**4** When the conditions of the supports do not meet the requirements of Item 3 of this article, the load calculation shall be based on the number, spacing and geometric shape of supporting surface, and shall according to relevant regulations of the current national standard GB 50037 *Code for Design of Building Ground*.

**7.2.4** Cast-in-place reinforced concrete beams and slabs should be used in the roof of PCB plant.



## 8 Dynamic

### 8.1 Cold and heat sources

**8.1.1** The cold and heat sources station of the PCB plant shall be set reasonably according to the general planning and process layout in accordance with local meteorological conditions, energy supply status, transmission energy consumption and other conditions. It should be set independently and centrally outside, or may be set in the production building.

**8.1.2** The cold and heat sources station shall be located far away from the process area with anti-vibration requirements.

**8.1.3** The performance parameters of the refrigeration and heating equipment shall meet the relevant regulations of the current national standard GB 50189 *Design Standard for Energy Efficiency of Public Buildings*.

**8.1.4** The scheme of cold and heat sources shall be determined according to the cooling and heating loads required by the production process, heating, air conditioning and other systems, the meteorological conditions, energy structure, price, environmental protection and other relevant factors in the region.

**8.1.5** The cold source design shall be in accordance with the following requirements:

1 It shall meet the regulation requirements of air conditioning load, process load change rule and partial load operation, and should not be less than two units. When only one unit is being used for the low cooling load, a model with excellent adjustment performance shall be selected.

2 When using the electric compression chiller, the refrigerant shall meet the requirements of environmental protection. When transitional refrigerant is used, its service life shall not exceed the national prohibition schedule.

**8.1.6** The heat source design shall be in accordance with the following requirements:

1 The heat energy obtained by installing the heat recovery systems of the air compressors, refrigerators, and process equipment should be preferential used for heat supply.

2 When using the urban central heat source, the design of heating pipe network and heat exchange station shall meet the relevant provisions of the current professional standard CJJ 34 *Design Code for City Heating Network*.

3 When using the boiler for heating, it shall comply with the relevant provisions of the current national standard GB 50041 *Standard for Design of Boiler Plant*.

**8.1.7** The system design of the thermal oil required for the laminator shall comply with the relevant provisions of Chapter 11 "Organic heat carrier boiler and system" of professional standard TSG G0001-2012 *Boiler Safety Technical Supervision Administration Regulation*.

**8.1.8** The design of cold and hot water system shall be in accordance with the following requirements:

1 The cold and hot water system should adopt the close type primary pump system. When the chilled water system is larger, the resistance is higher, and the load characteristics or the pressure loss of each loop are greatly different, a secondary pump system shall be used. The secondary pump system should adopt variable speed and variable flow regulation according to the flow demand.

2 High expansion tank should be adopted for the constant pressure and expansion of the cold and

hot water system.

**3** The design temperature difference between the water supply and return of chiller shall not be less than 5℃. The temperature difference between supply and return water may be increased when the technology and economy are more reasonable.

**4** The main technical properties of the cooling and heating preservation materials shall be determined according to the requirements of the current national standard GB/T 8175 *Guide for Design of Thermal Insulation of Equipments and Pipes*, and nonflammable or refractory cooling and heat preservation materials with small thermal conductivity, low water absorption, large wet resistance factor and low density shall be preferred.

**5** The cut-off valve, pressure gauge, thermometer and heat meter shall be set at the cold and hot water pipe entrance of the building.

**6** The energy saving design of cold and hot water system shall meet the relevant provisions of the current national standard GB 50710 *Code for Design of Energy Conservation of Electronic Industry*.

## **8.2 Gas supply**

**8.2.1** The gas station in the PCB plant shall be reasonably located according to the process requirements, transportation energy consumption, water and electricity supporting facilities, air environment, the effect of vibration and noise on the surrounding environment and other factors, which may be combined with the chiller station.

**8.2.2** When the production process of PCB has clear requirements, the quality of compressed air shall be designed according to the process conditions. Otherwise, the quality of compressed air should conform to the requirements in the Table 8.2.2.

**Table 8.2.2 Compressed air quality**

Name	Pressure	Pressure dew point	Oil content	Dust content
Compressed air	0.7MPa	3℃~5℃	< 0.1ppm	< 0.1μm

**8.2.3** The micro oil screw air compressor or centrifugal air compressor should be preferred.

**8.2.4** The form, number, pressure and the post treatment system of the air compressor shall be determined by technical and economic comparison according to the requirements of production process, the number of air compressors should be recommended to 2~5, the models should not exceed two, and the standby units shall be set.

**8.2.5** When freeze-drying post-treatment compressed air system is adopted, devices that can discharge oil and water stored in the pipeline should be set at the lower position of the pipe system.

**8.2.6** The cut-off valve, pressure gauge and flowmeter shall be set at the compressed air pipe system entrance of the building.

**8.2.7** The hot-dip galvanized carbon steel pipe or stainless-steel pipe should be adopted for compressed air pipe, and ball valves should be chosen.

**8.2.8** The design of compressed air system for PCB plant shall meet the relevant provisions of the current national standard GB 50029 *Code for Design of Compressed Air Station*.

## 9 Heating, ventilation and air purification

### 9.1 General requirements

**9.1.1** The design of the ventilation, air conditioning and air purification systems for PCB plant shall meet the production process requirements for the production environment.

**9.1.2** The radiator heating shall not be installed in a clean room (clean spaces) with air cleanliness class higher than Class 8. The heating system in other rooms shall be set in accordance with the relevant provisions of the current national standard GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*.

### 9.2 Ventilation and exhaust gas management

**9.2.1** The design of the ventilation system for PCB plant building shall meet the requirements of production process, labor hygiene and personnel safety.

**9.2.2** The ventilation design of chemicals store, chemical station and chemical storage room (area) shall be in accordance with the following requirements:

1 Mechanical ventilation system of whole room shall be set.

2 Emergency ventilation device shall be set up for the room which may release a large amount of harmful gas or explosive dangerous gas suddenly. The ventilation volume of the emergency ventilation shall meet the relevant provisions of the current national standard GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*.

3 Explosion-proof fans shall be used in the mechanical all-room ventilation and accident ventilation system of the room which may release a large amount of harmful gas or explosive dangerous gas suddenly, and the fans shall be interlocked with the gas concentration detection device.

**9.2.3** Full room ventilation systems shall be set in the rooms of electroplating, copper precipitation, brown oxidation, surface treatment, etching, cleaning, etc. The air supply in the room should be ventilated mechanically. The sum of air supply rate and task air supply rate in each room shall be less than the exhaust air rate, and the pressure in the room shall be kept negative.

**9.2.4** The exhaust gas generated in the following production processes of PCB plant shall be discharged after being treated:

1 Acidic exhaust gas discharged from processes such as electroplating, brown oxidation, surface treatment, acid etching, acid cleaning.

2 Alkaline exhaust gas discharged from processes such as copper precipitation, alkaline etching, alkaline cleaning.

3 Organic exhaust gas discharged from printing, drying, coating and other processes.

4 Dust-laden exhaust gas discharged from drilling, edge milling and other processes.

**9.2.5** For the exhaust of explosive hazard gas with dust produced by drilling, edge milling and other processes, the air rate shall be calculated as the dust concentration no more than 50% of the lower limit of explosion under normal and accident situations; the dust exhaust system shall set up a grounding device to eliminate static electricity.



**9.2.6** The fans that discharge acid, alkaline, organic and dust-laden exhaust gases should be set at the outlet of the treatment device, the fans should be equipped with variable frequency device; when two and more exhaust gas treatment devices are in parallel operation, an electric or pneumatic airtight valve should be set at the entrance of each device.

**9.2.7** Acid, alkaline, organic and dust-laden exhaust gases shall be discharged into the atmosphere through the exhaust cylinder after treatment, the discharge concentration and the height of the exhaust cylinder shall meet the relevant provisions of the current national standard *GB 16297 Integrated Emission Standard of Air Pollutants* and the relevant provisions of environmental impact assessment and the opinions on the approval of the environmental impact assessment.

**9.2.8** The duct materials of the exhaust air system of the plant shall be in accordance with the following requirements:

1 Non-combustible material shall be used for the duct material that discharge common exhaust gas, organic exhaust gas, and dust-laden exhaust gas.

2 The corrosion-resistant and flame-retardant materials shall be used for the duct that discharge acidic exhaust gas and alkaline exhaust gas.

### **9.3 Air conditioning and purification**

**9.3.1** The air cleanliness, temperature and humidity requirements of the PCB workshop shall meet the requirements of the production process.

**9.3.2** The air conditioning system should be set separately when the plant or area in the workshop meets one of the following conditions:

- 1 The rooms with big difference on temperature and humidity control requirements.
- 2 Clean air conditioning systems and general air conditioning systems.
- 3 Areas or rooms that are prone to cross-contamination.
- 4 Different rooms with wide different calorific value of process equipment.

**9.3.3** The clean room (clean spaces) in the plant shall maintain a certain pressure difference with the surrounding environment. The static pressure difference between the clean areas of different class shall not be less than 5Pa; the static pressure difference between the clean area and the non-clean area shall not be less than 5Pa; the static pressure difference between the clean room (clean spaces) and the outside shall not be less than 10Pa.

**9.3.4** The volume of make up air for the air conditioning system and clean room of the production areas shall be the bigger one between the following two items:

1 The sum of the make up air volume required to compensate for indoor exhaust air and maintain the indoor positive pressure.

2 The volume of make up air per person per hour in the clean room (clean spaces) is no less than 40m<sup>3</sup>; the volume of make up air in the non-clean room (non-clean spaces) per person per hour is no less than 30m<sup>3</sup>.

**9.3.5** The on-off interlock and control requirements of the air supply, return and exhaust systems of air conditioning shall meet the relevant provisions of the current national standard *GB 50472 Code for Design of Electronic Industry Clean Room*.

**9.3.6** The supply air volume (at-rest) and air flow pattern of the clean room meeting the air cleanliness class should be calculated according to Table 9.3.6.

**Table 9.3.6 Clean room supply air volume (at-rest) and air flow pattern**

Air cleanliness classification	Air flow pattern	Average wind speed (m/s)	Air change rate (h <sup>-1</sup> )
1-5	Unidirectional or mixed flow	0.20-0.45	—
6	Non-unidirectional flow	—	50-60
7	Non-unidirectional flow	—	15-25
8-9	Non-unidirectional flow	—	10-15

Notes:1 The air change rate is applicable to clean room with height less than 4.0m.

2 Lower limit value should be used when there are few people and few heat sources in the room.

**9.3.7** The noise level (as-built) of unidirectional flow and mixed flow clean room shall not be greater than 65dB(A), and the noise level (as-built) of non-unidirectional flow clean room shall not be greater than 60dB(A).

**9.3.8** The air supply method of the clean room may be classified as centralized air supply, fan filter unit air supply.

**9.3.9** Electroplating, copper precipitation, brown oxidation, surface treatment, etching, cleaning, baking board and other processes should be set up task air supply system. The task air supply system should be filtered, cooled, heated, and the air supply temperature should be maintained at 16℃-28℃.

**9.3.10** The selection and arrangement of air filters shall be in accordance with the following requirements:

- 1 Air filter shall be selected reasonably according to air cleanliness class for air purification treatment system.
- 2 The air handling volume of the air filter shall not be greater than rated air volume.
- 3 Medium and high efficiency air filters should be centrally arranged in the positive pressure section of the air conditioning system.
- 4 Sub-high efficiency and high-efficiency filters should be set at terminal units of the air conditioning system.

5 The resistance, efficiency and ratio of air volume to rated air volume of terminal air filters in the same purified air conditioning system shall be similar.

**9.3.11** The setting of fan filter unit shall be in accordance with the following requirements:

- 1 It shall be selected according to the air cleanliness class and supply air volume.
- 2 The supply air volume shall be adjustable.
- 3 It shall be convenient for installation, maintenance and filter replacement.

**9.3.12** The setting of dry coils shall be in accordance with the following requirements:

- 1 The face velocity should not exceed 2.5m/s.
- 2 Air side resistance shall not exceed 40Pa.
- 3 For dry coils arranged in the same clean room (clean spaces), the difference of air side resistance shall not be greater than 10% under working conditions.

4 The chilled water supply temperature shall be higher than the dew point temperature of the clean room (clean spaces).

- 5 Drainage system shall be set.



**9.3.13** The make up air suction pipe of the purification air conditioning system shall be equipped with airtight device and shall be interlocked with the fan.

**9.3.14** When electric heater is used in air conditioning system, the electric heater and the fan shall be interlocked and controlled, and the protection devices for windless and over temperature power off shall be set up. When electric humidifier is used, water-free and wind-free power-off protection devices shall be installed. In cold area, anti-freezing protection measures shall be installed for make up air system.

#### **9.4 Anti-smoke exhaust**

**9.4.1** The design of the smoke control and exhaust system for PCB plant shall meet the relevant provisions of the current national standard GB 50016 *Code for Fire Protection Design of Buildings*.

**9.4.2** The mechanical smoke exhaust system should be set separately from the ventilation and air conditioning systems. The air supply system of smoke exhaust should be combined with the ventilation and air conditioning system, and shall meet the requirements of smoke exhaust and air supply of smoke exhaust when combined.

住房和城乡建设部  
浏览专用

## 10 Water supply and drainage

### 10.1 General requirements

**10.1.1** The water supply system of PCB plant should be set up separately according to industrial, domestic and fire fighting.

**10.1.2** In PCB plant, the drainage system of rainwater and sewage shall be separate, domestic sewage and industrial waste water shall be separate.

**10.1.3** Independent piping system shall be used for PCB plant water reuse.

**10.1.4** **The drinking water pipes must not be connected to the non-domestic drinking water pipes, such as reclaimed water, recycled rainwater and production water.**

**10.1.5** Casings shall be set up when pipes pass through floors, steel roofs and clean room walls, and reliable sealing measures shall be taken between pipes and casings, effective sealing measures shall be taken at the parts where casings can not be installed.

**10.1.6** The pipe should not pass through the firewall. When necessary, non-combustible material casing pipe shall be used, and refractory materials shall be used for sealing between pipes and casings. When the pipe passing through the firewall is combustible material, fire prevention measures shall be taken on the pipes on both sides of the firewall.

**10.1.7** Waterproofing casing shall be set up when pipes passing through the following parts:

- 1 External walls of basements or underground structures.
- 2 The walls of reinforced concrete tank pool or pipe connection location of well.
- 3 Reinforced concrete roof.

**10.1.8** Pipes transporting corrosive media shall not be buried directly.

**10.1.9** In cold areas, anti-freeze measures shall be taken for the wastewater treatment system in accordance with the process requirements.

**10.1.10** When pressurized water supply is used in industrial and domestic water supply systems, variable frequency control should be adopted for pressurized pumps. The standby pump shall be set up for the frequency conversion water supply equipment, and the water supply capacity of the standby pump shall not be less than that of the largest one.

### 10.2 General water supply and drainage

**10.2.1** The calculation of the water consumption of the PCB plant shall be in accordance with the following requirements:

1 Production water consumption shall be determined based on the calculation of water used for process equipment.

2 The supplementary water flow rate of the system should be calculated according to the 1% to 2% of the circulating flow rate for the water cooling system of the open mechanical ventilation cooling tower.

3 The water consumption of the boiler shall be determined according to the process steam consumption and heating steam consumption.

4 The water consumption for living, greening, waterscape, road and others shall be in accordance with the relevant provisions of the current national standard GB 50015 *Standard for Design of Building Water Supply and Drainage*.

**10.2.2** The water quality of domestic drinking water, industrial boiler water and industrial circulating cooling water shall be in accordance with the relevant provisions of the current national standards GB 5749 *Standards for Drinking Water Quality*, GB/T 1576 *Water Quality for Industrial Boilers* and GB/T 50050 *Code for Design of Industrial Recirculating Cooling Water Treatment*.

**10.2.3** When the water quality, water pressure and water flow rate of the municipal water supply network meet the requirements, the urban water supply pipe network shall be used for direct water supply.

**10.2.4** The industrial waste water pipeline should be installed in the pipe trench or the lower technical interlayer. The pipe support and hanger shall adopt anticorrosion measures, and the pipe trench shall adopt anticorrosion and drainage measures.

**10.2.5** The material of the industrial waste water pipeline shall be selected according to the corrosive property of the waste water in the pipeline.

**10.2.6** Pipelines for transporting corrosive liquids should not be laid above pedestrian passage, protective measures shall be taken when they must be laid.

**10.2.7** Connected pipe drainage should be taken for the industrial drainage of process equipment in the clean spaces, and the ventilation system should be set up for the main drainage pipes.

**10.2.8** Water supply pipelines should be equipped with metering devices at the following locations:

- 1 The main water inlet pipe connected to the municipal water supply system.
- 2 The main water inlet pipe of production workshop or building.
- 3 The main water inlet pipes, supplementary pipes or main water points of each water supply system.

**10.2.9 Emergency showers or eye washers shall be installed in the following locations:**

**1 Storage, configuration, delivery and wastewater treatment dispensing area of hazardous chemicals in production areas such as copper precipitation, electroplating, inner layer pre-treatment, inner layer etching, brown oxidation or black oxidation, graphics transfer pre-treatment/developer, soldering pre-treatment/developer and surface treatment.**

**2 Hazardous waste liquid collection, storage and transshipment area.**

**3 Other places that may cause chemical burns to workers.**

**10.2.10** The water supply pressure of the emergency shower or eye washer shall meet the requirements of the corresponding products. The water supply pipe connected with it shall be separately connected to the main water supply pipe, and the strainer shall be installed on the pipe.

### **10.3 Purified water**

**10.3.1** The scale and quality of purified water preparation system shall be determined according to the production process requirements of the PCB plant.

**10.3.2** The location of the purified water station shall meet the overall layout requirements of the process and should be close to the water consumption point.

**10.3.3** Ultra pure water pipelines with high water quality requirements shall adopt a circulation water supply mode, and the circulation pipelines should be arranged with reversed return system. The amount

of additional recycled water shall not be less than 30%.

**10.3.4** The design of purified water station shall meet the relevant provisions of the current national standard GB 50685 *Code for Design of Pure Water System of Electronic Industry*.

#### **10.4 Industrial recycling cooling water**

**10.4.1** The industrial recycling cooling water system for the PCB process shall be in accordance with the following requirements:

1 The requirements of water temperature, water pressure and water quality shall be determined according to the production process conditions. For the equipment with different requirements of water temperature, water pressure and operation, the industrial recycling cooling water system should be set separately.

2 An indirect heat exchange open system should be adopted for the cooling water supply system of laminator.

3 Filters shall be set up and should be equipped with standby filters, the accuracy of filters shall be determined according to the requirements of the process equipment for water quality.

4 When the recycling water flow rate is greater than 100m<sup>3</sup>/h, the water quality stabilization treatment device shall be set up.

**10.4.2** The piping of the industrial recycling cooling water system shall be in accordance with the following requirements:

1 Over pressure relief valves, exhaust valves and sewage pipes shall be installed.

2 The layout of the pipelines shall meet the water's equal distribution requirements.

3 According to the water quality requirements of the production process, the material of the process cooling water pipe may be made of stainless steel, plastic or galvanized steel, and the pipe accessories and valves should be made of the same material as the pipe.

4 Insulating materials shall be used as the shield between the non-thermal insulation stainless-steel pipes and the carbon steel supports and hangers, the special heat preservation pipe clamps with thermal insulation block shall be used for the thermal insulation stainless-steel pipes.

5 The piping of the industrial recycling cooling water system shall be convenient for maintenance, overhaul and testing.

#### **10.5 Wastewater treatment**

**10.5.1** In addition to the relevant provisions of the current national standard GB 50814 *Code for Design of Environmental Protection of Electronic Engineering*, the classification, collection and treatment of waste water and liquid for PCB plant shall be in accordance with the following requirements:

1 Waste water containing Class 1 heavy metal pollutants shall be collected and treated separately.

2 Ionic copper and complex copper shall be discharged and treated separately.

3 The developing and demolding waste water containing high concentration of organic matter shall be discharged and pretreated separately.

4 Cyanide-containing waste water shall be discharged and pretreated separately.

5 Waste liquids with different natures shall be discharged and collected separately.

**10.5.2** The quantity and quality of waste water shall be determined according to the actual conditions of PCB production.



**10.5.3** Emergency waste water collection tank shall be set up for the industrial wastewater treatment system.

**10.5.4** Regulating tank should be set up for the industrial waste water system.

**10.5.5** The reuse rate of industrial water shall not be less than 45%, and shall meet the water reuse requirements of local environmental management departments.

**10.5.6** The quality of recycled water used in the production process shall meet the requirements of the PCB production process.

**10.5.7** The quality of recycled water used for toilet flushing, road cleaning, greening and vehicle washing shall meet the relevant provisions of the current national standard GB/T 18920 *The Reuse of Urban Recycling Water —Water Quality Standard for Urban Miscellaneous Use*.

**10.5.8** The quality of recycled water used for landscape shall meet the relevant provisions of the current national standard GB/T 18921 *The Reuse of Urban Recycling Water—Water Quality Standard for Scenic Environment Use*.

**10.5.9** Water quality analysis and monitoring devices shall be set up for the wastewater treatment system, and the metering device shall be installed at the main discharge outlet.

**10.5.10** Monitoring points for monitoring groundwater quality should be set up around wastewater treatment structures.

## **10.6 Fire water supply and deployment of fire extinguisher**

**10.6.1** The indoor and outdoor fire hydrant water supply system shall be installed in the PCB plant, and the design shall meet the relevant provisions of the current national standard GB 50016 *Code for Fire Protection Design of Buildings*.

**10.6.2** Fire extinguishers shall be equipped in the PCB plant, and the design shall meet the relevant provisions of the current national standard GB 50140 *Code for Design of Extinguisher Distribution in Buildings*.

**10.6.3** Dry powder fire extinguishers should not be used in the clean spaces of the plant.

**10.6.4** **Automatic sprinkler system shall be set up for the PCB plant buildings with site area more than 1 500m<sup>2</sup> or total floor area more than 3 000m<sup>2</sup>. Quick response sprinklers shall be used in the clean spaces.**

**10.6.5** The design of sprinkler system shall meet the relevant provisions of the current national standard GB 50084 *Code for Design of Sprinkler Systems*.

## 11 Electric

### 11.1 General requirements

**11.1.1** In addition to meet the requirements of the production process, the design of the power supply system for PCB plant shall meet the relevant provisions of the current national standard GB 50052 *Code for Design Electric Power Supply Systems*.

**11.1.2** The electrical design of the chemical storage rooms, combustible gas or liquid storage rooms shall be determined according to the characteristics of the gas or liquid, and shall meet the relevant provisions of the current national standard GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres*.

### 11.2 Power supply system

**11.2.1** The main process equipment for PCB production should be supplied by special transformers or special low voltage feeders.

**11.2.2** Standby power supply shall be provided for process equipment and instruments with special requirements for power supply continuity such as electroplating and lamination. And uninterruptible power supply (UPS) device should be set up for important process equipment such as lithography machine, etching, testing equipment, exposure machine, etc.

**11.2.3** The voltage level of the low-voltage distribution for PCB plant shall conform to the requirements of the production process, and 380V/220V voltage should be adopted. TN-S or TN-C-S system should be used for grounding system.

**11.2.4** Low-voltage reactive power compensation cabinet shall be set at the low voltage side of the transformer, and the reactive compensation cabinet should have the functions of automatic zero-crossing switching, phase-splitting compensation, and should be equipped with an adaptive reactor.

**11.2.5** Electroplating rectifier equipment and other process equipment with particularly serious harmonic should be equipped with corresponding harmonic treatment devices at the equipment or harmonic treatment facilities in low-voltage distribution cabinet.

**11.2.6** Natural ventilation is the main ventilation measure in the substation. When natural ventilation cannot meet the requirements of environmental temperature, mechanical ventilation or air conditioning system shall be installed.

### 11.3 Electric lighting

**11.3.1** Power distribution equipment which are difficult to accumulate dust and easy to clean should be selected in the clean spaces and clean room of PCB plant.

**11.3.2** Metal conduits should be used for electrical piping in technical interlayer. The electrical conduit in the clean spaces should be concealed, and the threading conduit shall be non-combustible.

**11.3.3** Reliable sealing measures shall be taken at the joints between the wall in clean spaces and the mouth of the electrical conduit or various electrical equipment installed on the wall.

**11.3.4** The illuminance value of the general lighting in the main production rooms of the PCB plant

should not be less than 300 lx. The illuminance value of the general lighting in auxiliary rooms shall meet the relevant provisions of the current national standard of GB 50034 *Standard for Lighting Design of Buildings*. Energy-saving light source should be selected for lighting fixtures.

**11.3.5** The setting of stand-by lighting shall be in accordance with the following requirements:

- 1 Stand-by lighting shall be set in the clean spaces.
- 2 Stand-by lighting should be part of the normal lighting and shall not be lower than 10% of the general illuminance value of the place.

**11.3.6 Emergency lighting for evacuation shall be set up in the plant. Evacuation indication signs shall be set at the safety exits, evacuation passageways or corners of the evacuation passageways.**

**11.3.7** Maintenance lighting should be set in technical inter layer of the plant.

**11.3.8** Clean lamps for general lighting in clean spaces should have characteristics of roof suction installation, dust-proof and easy cleaning. When using the embedded lamps, the installation gaps shall be sealed.

**11.3.9** Power distribution boxes should not be placed in the places with strong corrosion, such as electroplating and etching areas. If necessary, the distribution box's shell shall be made of corrosion resistant materials such as plastic, and sealing measures shall be taken; the lamps should be made of corrosion resistant materials; the cables and wires should be laid by non-metallic grooves and protective pipes.

**11.3.10** Yellow light sources or anti-ultraviolet white lamps should be used in places requiring sensitivity such as exposure, screen printing and film sticking.

#### **11.4 Lightning protection and grounding**

**11.4.1** The lightning protection design of the PCB plant shall meet the relevant provisions of the current national standards GB 50057 *Code for Design Protection of Structures against Lightning* and the GB 50343 *Technical Code for Protection of Building Electronic Information System against Lightning*.

**11.4.2** The lightning-proof grounding system, anti-static grounding system, electronic information system and special grounding system for process equipment with special requirements of the plant should adopt common grounding mode and make equipotential connection, the grounding resistance value shall not be greater than 1Ω.

#### **11.5 Communication and control**

**11.5.1** The installation of communication devices in a PCB plant shall be in accordance with the following requirements:

- 1 Voice communication devices that allows convenient contact with the outdoor shall be set in the clean room.
- 2 Data communication devices shall be set according to the needs of production management and production process.
- 3 The integrated wiring system should be used in the wiring of communication system, the equipment room and wiring room of the integrated wiring system shall not be located in the clean spaces.
- 4 The communication room shall not be located in the clean spaces.

**11.5.2** The plant may set up industrial TV system, entrance and exit control system according to the

requirements of production management and production process.

**11.5.3** The plant shall be set up with automatic fire alarm and fire protection linkage control systems, and shall meet the relevant provisions of the current national standards GB 50016 *Code for Fire Protection Design of Buildings* and GB 50116 *Code for Design of Automatic Fire Alarm System*.

**11.5.4** Fire-fighting duty room or control room shall be set up in the plant, and the location shall not be set in the clean spaces.

**11.5.5** Automatic control system should be set for the plant, and automatic monitoring shall be carried out for clean air conditioning, exhaust gas treatment, cooling, heating, purified water, wastewater treatment and other systems.

## **11.6 Electro-static prevention**

**11.6.1** Anti-static grounding facilities shall be set up in the clean area, chemical storage room (area) and other areas of the PCB plant, and anti-static grounding measures shall be taken for the pipelines prone to electrostatic effects.

**11.6.2** Metals in the clean room shall be reliably connected to the anti-static grounding system.

**11.6.3** Anti-static grounding measures shall be taken for equipment and pipelines that produce electrostatic hazards in the production process. The design of equipment and pipeline with explosion or fire hazard shall meet the relevant provisions of the current national standards GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres* and GB 50611 *Code for Design of Protection of Electrostatic Discharge in Electronic Engineering*.

**11.6.4** The anti-static grounding cable shall have sufficient mechanical strength, and the minimum cross section of the main line should not be less than  $95\text{mm}^2$ . The minimum cross section of the branch line shall be  $2.5\text{mm}^2$ .

**11.6.5** In addition to the provisions of this code, anti-static grounding shall also meet the relevant provisions of the current national standard GB 50611 *Code for Design of Protection of Electrostatic Discharge in Electronic Engineering*.



## 12 Chemicals

### 12.1 General requirements

**12.1.1** The storage and transportation mode of chemicals in PCB plant shall be determined according to the amount of chemicals needed in the production process and their physical and chemical characteristics.

**12.1.2** Grooves or anti-outflow measures shall be provided for chemical tankers' parking or unloading places, and enclosure facilities shall be set for chemical storage rooms (areas).

**12.1.3** The storage capacity of chemicals may be determined according to production scale, transportation distance and other relevant factors.

**12.1.4** The setting of chemicals store shall meet the relevant provisions of the current national standards GB 50016 *Code for Fire Protection Design of Buildings* and GB 50351 *Code for Design of Fire Dike in Storage Tank Farm*, and should comply with the relevant provisions of the current professional standard HG/T 20568 *Code for Design of Storageyard and Warehouse of Bulk Material of Chemical Industry*.

**12.1.5** The chemical station shall be set up in accordance with the relevant provisions of the current national standard GB 50016 *Code for Fire Protection Design of Buildings* as well as the safety, health and environmental protection requirements of chemical transportation, and monitoring facilities should be set up.

**12.1.6** The pipe material of the chemical supply system shall be determined according to the physical and chemical properties and quality requirements of the chemicals transported. The materials with stable chemical properties and good compatibility shall be selected.

### 12.2 Storage of chemicals

**12.2.1** The amount of chemicals in the chemicals store of PCB plant should not exceed chemical consumption for 7d. Finished chemicals purchased in independent packaging shall be stored separately in the chemicals store.

**12.2.2** Chemical stations shall be set up independently for large capacity storage tanks and related equipment, the designed volume of storage tanks in chemical stations should not exceed the volume occupied by chemical consumption for 7d.

**12.2.3** The chemicals needed for daily production should be stored in the chemical storage room (area) of the production line, and the storage capacity should not exceed chemical consumption for 1d.

**12.2.4** The chemicals stores should not be located in the densely populated areas of the plant.

**12.2.5** The setting of chemical stations shall be in accordance with the following requirements:

1 The location of chemical stations shall avoid the densely populated areas of the plant, and the corresponding safety measures shall be taken if it can not be avoided.

2 The relevant equipment in the chemical supply system such as chemical pressure pumps, storage tanks for raw liquid and delivery pumps before the daily storage tank should be set up in the chemical station.

3 The relevant equipment in the chemical collection system such as chemical waste liquid storage tanks, external transportation pressure pumps after the daily storage tank shall be set up in the chemical station.

**12.2.6** The setting of various chemical storage rooms(areas) within the plant shall be in accordance with the following requirements:

1 Chemicals shall be classified and stored in storage rooms or distribution rooms in accordance with the relevant provisions of the current national standard GB 13690 *General Rule for Classification and Hazard Communication of Chemicals*. When physical and chemical properties of the chemicals are not allowed to be stored in the same area or room, solid wall separation shall be used.

2 The storage rooms (areas) and distribution rooms of inflammable and explosive chemicals shall be arranged by the external wall.

3 The storage rooms (areas) and distribution rooms of hazardous chemicals shall not be located above, below or adjacent to the office areas and other crowded rooms and evacuation corridors.

4 The anti-static floor without sparks shall be used in the storage rooms(areas) and distribution rooms of inflammable and explosive chemicals; and the anticorrosion floor shall be used for corrosive chemicals.

**12.2.7** Overflow protection facilities shall be installed in storage rooms(areas) and distribution rooms of liquid hazardous chemicals and shall be in accordance with the following requirements:

1 When there is no water fire extinguishing system in the storage rooms(areas) and distribution rooms, the storage tank or tank group shall be equipped with protective embankment. The effective volume of the protective embankment shall be larger than the volume of the maximum storage tank. When the water fire extinguishing system is set up, the effective volume of the protective embankment shall be greater than the fire water volume of 20 minutes plus the volume of the maximum storage tank. The design height of the effective volume of the protective embankment shall be 0.2m higher than the calculated height, and the minimum height of the protective embankment shall not be less than 0.5m.

2 Protective barriers shall be set up between different chemical tanks or tank groups that can cause chemical reactions after mixing.

3 The liquid leakage alarm system shall be set up in storage rooms(areas) and distribution rooms.

### **12.3 Pipeline transportation of chemicals**

**12.3.1** Pipeline transportation of chemicals shall be in accordance with the following requirements:

1 The chemical stability of conveying system equipment and pipelines shall be compatible with the nature of the chemicals conveyed.

2 Liquid level monitoring, automatic closing devices and overflow response facilities shall be set up.

**12.3.2** The selection of pipelines conveying common chemicals and industrial plastic shall be in accordance with the following requirements:

1 Low-carbon stainless steel pipes should be used for conveying non-corrosive organic solvents.

2 Plastic pipes should be used for conveying acid, alkali and corrosive organic solvents, and leakage protection sleeves shall be installed.

3 The gaskets used in the pipeline system should be made of fluorine rubber, polytetrafluoroethylene or other materials compatible with the conveyed chemicals.

4 Valves and accessories should be made of the same material as the pipe.

## **12.4 Collection and recycling of chemical waste**

**12.4.1** Waste liquid collection system shall be set up in the storage room(area) and distribution room of chemicals, and shall be in accordance with the following requirements:

**1** The waste liquid classification and collection system shall be set according to the composition and nature of the chemicals discharged from the production, it's form should be determined according to the waste liquid volume.

**2** The waste collection system of chemicals with incompatible physical and chemical properties shall be set separately.

**12.4.2** Chemical waste liquid shall be recycled and reused according to the waste liquid volume and the requirements of energy conservation and environmental protection.

住房和城乡建设部信息公开  
浏览专用

## 13 Space management

**13.0.1** The design of space management for PCB plant shall reasonably determine the layout, direction and vertical elevation of various pipelines according to the function of the building, and the layout of the indoor pipelines shall not affect the usage of the interior space and its aesthetics.

**13.0.2** Pipelines layout shall be in accordance with the following requirements:

- 1 It should be close to the wall, column side, door corner, wall corner, etc.
- 2 It shall not interfere with production operation, transportation and building function, and shall be convenient for installation and maintenance.
- 3 Gravity pipeline shall be arranged prior to pressure pipeline.
- 4 The dust suction pipe shall reduce turning; if necessary, the bending angle should not be less than 45 degrees.
- 5 The installation of supports and hangers for pipelines shall meet the relevant provisions of the current national standard GB/T 17116.1 *Pipe Supports and Hangers—Part 1: Technical Specification*.
- 6 The design of the indoor pipeline shall not affect the structural safety.

**13.0.3** Integrated pipe racks should be adopted in public walkways, pipe galleries and sections with complex pipelines, and the layout shall be in accordance with the following requirements:

- 1 Large-diameter pipes shall be arranged close to the pillars of the integrated pipe rack.
- 2 Small-diameter pipes, gas pipes and utility pipes should be arranged in the middle of the integrated pipe rack.
- 3 Process pipes should be arranged on the side of the equipment connected with the integrated pipe rack.
- 4 The high temperature pipelines with square compensator shall be located near the columns, and the square compensator should be set centrally.
- 5 For multi-layer pipe racks, gas pipelines, heat pipes, electric power pipelines should be arranged on the upper layer; the general process pipes, the low temperature pipes should be arranged on the middle layer; and the corrosive medium pipelines should be arranged on the lower layer.

- 6 Integrated pipe racks should reserve extra pipeline space for production development.

**13.0.4** The coating color and marking of pipelines shall meet the relevant provisions of the current national standard GB 7231 *Basic Identification Colors and Code Indications and Safety Sign for Industrial Pipelines*.



## **14 Energy conservation**

### **14.1 General requirements**

**14.1.1** The energy conservation design of the PCB plant enclosure structure shall meet the relevant provisions of the current national standard GB 50710 *Code for Design of Energy Conservation of Electronic Industry*.

**14.1.2** The energy conservation design of airconditioning system shall be in accordance with the following requirements:

1 Waste heat from process production shall be rationally utilized.

2 Monitoring and control shall be carried out according to production characteristics and actual system installation. The monitoring and control contents shall include parameter detection, parameter and equipment status display, automatic regulation and control, automatic conversion of working conditions, energy metering, function interlocking control, central monitoring and management, etc.

3 The thermal insulation layer of air duct shall be made of non-combustible or flame retardant materials, and its minimum thermal resistance shall meet the current national standard GB 50189 *Design Standard for Energy Efficiency of Public Buildings*. The air barrier layer and protective layer should be installed outside the thermal insulation layer.

4 The calculation of the thermal insulation thickness of hot water pipes and cold water pipes shall meet the relevant provisions of the current national standard GB/T 8175 *Guide for Design of Thermal Insulation of Equipments and Pipes*.

**14.1.3** Energy management system should be installed for the plant.

### **14.2 Energy conservation of cold-heat system**

**14.2.1** Solar energy, geothermal energy, shallow ground energy and other renewable energies should be used in PCB plant under natural conditions and reasonable technical and economic conditions.

**14.2.2** Under the condition of both cooling and heating are required at the same time, the heat recovery chillers should be select according to load requirements, the heat should be recovered by controlling the temperature of recovered hot water and adjusting the amount of hot water circulating.

**14.2.3** The compressed heat of the air compressor should be recovered, and the air compressor shall be cooled reliably.

**14.2.4** The heat generated by cooling of the laminator thermal oil should be recovered, and indirect heat exchange should be adopted.

### **14.3 Energy conservation of equipment**

**14.3.1** Power equipment with high efficiency and low energy consumption shall be used in PCB plant, and obsolete products shall not be used.

**14.3.2** Variable frequency speed control system should be adopted for pumps and fans.

**14.3.3** Variable frequency chiller should be the first choice.

**14.3.4** The energy efficiency ratio of chillers shall not be lower than the relevant provisions of the

current national standard GB 50189 *Design Standard for Energy Efficiency of Public Buildings*, and the chiller with higher energy efficiency ratio shall be the first choice.

**14.3.5** Fuel and gas fired boilers should select the fully automatic boilers with proportional adjusting burners.

**14.3.6** The number and capacity of the heat source equipment shall be reasonably selected according to the annual heat load condition, and the equipment shall be ensured to operate safely and efficiently under high and low heat load conditions.

**14.3.7** The drift water rate of open mechanical ventilation cooling tower shall be less than 0.01% of the total water quantity entering the tower.

**14.3.8** The number and capacity of transformers shall be determined according to the characteristics and changes of the electric load of process equipment, auxiliary facilities and public power facilities, and shall be in accordance with the following requirements:

- 1 Energy-saving transformer with low loss and noise shall be selected.
- 2 The number and capacity of transformers shall be reserved.
- 3 Low voltage connection shall be set up between multiple transformers.

#### **14.4 Energy saving in electric**

**14.4.1** Electric devices with power no less than 50kW in PCB plant should be separately equipped with ammeter, active energy meter and other metering devices.

**14.4.2** Electrical system design shall adopt electrical products with high efficiency, low energy consumption and advanced performance, and obsolete products shall not be used.

**14.4.3** The selection of lighting ballast shall meet the relevant provisions of the current national standard GB 50034 *Standard for Lighting Design of Buildings*.

**14.4.4** The gas discharge lamps with inductive ballasts should be equipped with capacitance compensation in the circuit or lamps, and the power factor shall not be less than 0.9.

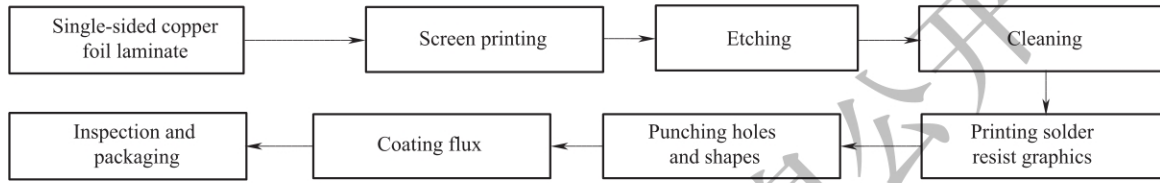
**14.4.5** Photoelectric and time control should be adopted for road lighting in plant area, and energy-saving lamps should be used.

#### **14.5 Other energy saving measures**

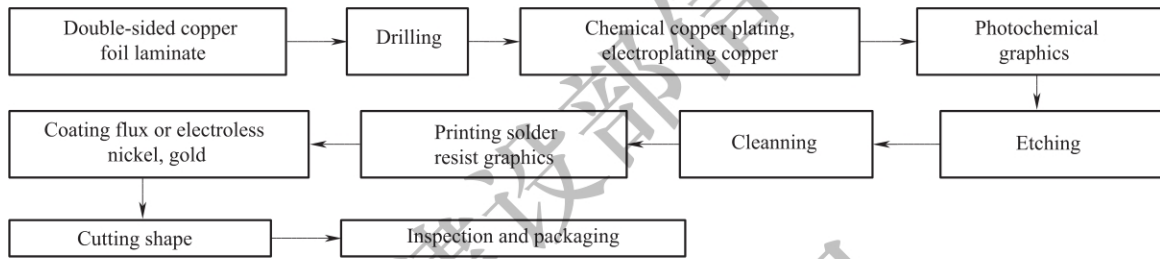
**14.5.1** Air conditioning condensate, steam condensate, roof rainwater, reverse osmosis concentrated water of purified water system and standard water after wastewater treatment in the PCB plant should be recycled.

**14.5.2** The purified water system should preferentially use recovered heat as it's heat source.

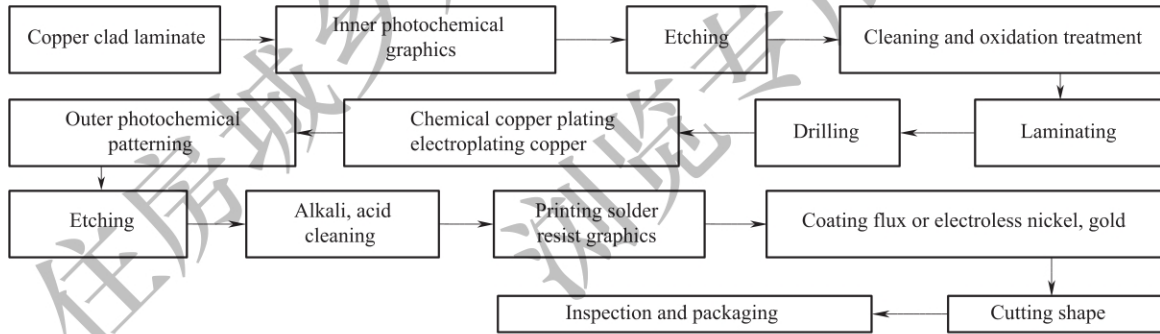
## Appendix A Typical production process of PCB



(a) Single panel typical production process



(b) Dual-panel typical production process



(c) Multilayer boards typical production process

Figure A Typical production process of PCB

## Appendix B Cleanliness level recommended list of production process of PCB

**Table B Recommended cleanliness class for PCB production process**

Process	Air cleanliness class (N)	Maximum concentration limit of particles greater than or equal to the marked particle size (particles/m <sup>3</sup> )					
		0.1μm	0.2μm	0.3μm	0.5μm	1μm	5μm
Laminate	ISO Class 6	1 000 000	237 000	102 000	35 200	8 320	293
Graphics transfer (exposure)	ISO Class 7	—			352 000	83 200	2 930
Photographic plate	ISO Class 7	—			352 000	83 200	2 930
Printing solder resist graphics transfer (exposure)	ISO Class 8	—			3 520 000	832 000	29 300



## Explanation of wording in this code

**1** Words used for different degrees of strictness are explained as follows in order to mark the differences in implementing the requirements of this code.

**1)** Words denoting a very strict or mandatory requirement:

"Must" is used for affirmation, "must not" for negation.

**2)** Words denoting a strict requirement under normal conditions:

"Shall" is used for affirmation, "shall not" for negation.

**3)** Words denoting a permission of a slight choice or an indication of the most suitable choice when conditions permit:

"Should" is used for affirmation, "should not" for negation.

**4)** "May" is used to express the option available, sometimes with the conditional permit.

**2** "Shall comply with..." or "shall meet the requirements of..." is used in this code to indicate that it is necessary to comply with the requirements stipulated in other relative standards and codes.

## List of quoted standards

- GB 50015 *Standard for Design of Building Water Supply and Drainage*
- GB 50016 *Code for Fire Protection Design of Buildings*
- GB 50019 *Design Code for Heating Ventilation and Air Conditioning of Industrial Buildings*
- GB 50029 *Code for Design of Compressed Air Station*
- GB 50034 *Standard for Lighting Design of Buildings*
- GB 50037 *Code for Design of Building Ground*
- GB 50041 *Standard for Design of Boiler Plant*
- GB/T 50046 *Standard for Anticorrosion Design of Industrial Constructions*
- GB/T 50050 *Code for Design of Industrial Recirculating Cooling Water Treatment*
- GB 50052 *Code for Design Electric Power Supply Systems*
- GB 50057 *Code for Design Protection of Structures against Lightning*
- GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres*
- GB 50068 *Unified Standard for Reliability Design of Building Structures*
- GB 50084 *Code for Design of Sprinkler Systems*
- GB 50116 *Code for Design of Automatic Fire Alarm System*
- GB 50140 *Code for Design of Extinguisher Distribution in Buildings*
- GB 50189 *Design Standard for Energy Efficiency of Public Buildings*
- GB 50343 *Technical Code for Protection of Building Electronic Information System against Lightning*
- GB 50351 *Code for Design of Fire Dike in Storage Tank Farm*
- GB 50472 *Code for Design of Electronic Industry Clean Room*
- GB 50523 *Code for Design of Occupational Safety and Hygiene in Electronics Industry*
- GB 50611 *Code for Design of Protection of Electrostatic Discharge in Electronic Engineering*
- GB 50685 *Code for Design of Pure Water System of Electronic Industry*
- GB 50710 *Code for Design of Energy Conservation of Electronic Industry*
- GB 50814 *Code for Design of Environmental Protection of Electronic Engineering*
- GB/T 1576 *Water Quality for Industrial Boilers*
- GB 5749 *Standards for Drinking Water Quality*
- GB 7231 *Basic Identification Colors and Code Indications and Safety Sign for Industrial Pipelines*
- GB/T 8175 *Guide for Design of Thermal Insulation of Equipments and Pipes*
- GB 13690 *General Rule for Classification and Hazard Communication of Chemicals*
- GB 16297 *Integrated Emission Standard of Air Pollutants*
- GB/T 17116.1 *Pipe Supports and Hangers—Part 1: Technical Specification*
- GB 18597 *Standard for Pollution Control on Hazardous Waste Storage*
- GB 18599 *Standard for Pollution Control on the Non-hazardous Industrial Solid Waste Storage and Landfill*
- GB/T 18920 *The Reuse of Urban Recycling Water—Water Quality Standard for Urban*

*Miscellaneous Use*

GB/T 18921 *The Reuse of Urban Recycling Water—Water Quality Standard for Scenic Environment Use*

CJJ 34 *Design Code for City Heating Network*

HG/T 20568 *Code for Design of Storageyard and Warehouse of Bulk Material of Chemical Industry*

HJ 450 *Cleaner Production Standards—Printed Circuit Board Manufacturing*

TSG G0001 *Boiler Safety Technical Supervision Administration Regulation*

住房和城乡建设部信息公开  
浏览专用