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## Guidelines for Site Selection, Design, Construction, and Operation Management of Emergency Infectious Diseases Hospitals

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# Contents

# Foreword

These Guidelines were proposed by the Standardization Committee under the Urban Planning Society of China (UPSC).

These Guidelines are put under centralized management by the Standardization Committee under the UPSC.

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# Guidelines for Site Selection, Design, Construction, and Operation Management of Emergency Infectious Diseases Hospitals

## 1. General Provisions

### 1.1 Background

These Guidelines were developed to quickly respond to major public health emergencies, deliver a good performance in emergency management of epidemic prevention and control, provide guidance on the site selection, design, construction, and operation management for new, renovated and extended emergency medical facilities in severely-hit areas, and ensure the efficiency and safety for the construction and operation of those emergency medical facilities.

### 1.2 Scope of Application

These Guidelines are applicable to the site selection, design, construction, and operation management of new, renovated, and functionally transformed emergency medical facilities for respiratory infectious diseases, including new emergency infectious diseases hospitals, public facilities renovated as temporary venues for treating infectious diseases, ordinary diagnosis and treatment areas of general

hospitals renovated or extended as improvised places for diagnosis and treatment of infectious diseases, and makeshift hospitals for centralized treatment of patients.

### 1.3 Basic Principles

1.3.1 Putting safety first and foremost, with efficiency taken into account

The "Safety First" principle must be followed throughout all stages of a project, including site selection, general layout planning, architectural design, structural design, design of municipal and supporting electrical and mechanical (E&M) facilities, construction and operation management, so as to ensure the safety concerning medical staff and patients, the internal & external environment of emergency hospitals as well as their overall operation. Efficiency should be strengthened without ignoring safety requirements. Efforts should be made to speed up construction and enhance capabilities in coordination with an array of new technologies including IT application, smart application, modularization, and prefabricated structures, to ensure the quality and operational stability of the buildings.

1.3.2 Overall Planning for Both Medical Treatment and Prevention

A concept highlighting both clinical care and disease prevention/control shall be established for building new emergency hospitals or renovating and expanding

existing ones. This concept must meet the requirements of the municipal (or county-level) territory planning (comprehensive urban planning) and special health planning programs, with overall consideration given to the urban transportation system and supporting infrastructure.

1.3.3 Controlling Sources of Infection and Cutting off the Chain of Infection

In accordance with the prevention and control requirements of early detection, early reporting, early quarantine and early treatment, and the medical requirements of centralizing patients, experts, resources and treatment, emergency hospitals should have proper planning, architectural design, and operation management that highlight controlling sources of infection and cutting off the chain of infection.

1.3.4 Adapting to Both Times of Peace and Crisis Based on Environmental Protection

A system operation mechanism adapted to both times of peace and crisis should be established. In times of peace, it is necessary to reserve the sites for building emergency hospitals following the strategic reservation rules for urban planning and develop plans for flexible extension and transformation of medical facilities. In times of crisis, priority should be given to the control of contamination of emergency medical facilities, as well as the environmental health and safety inside and outside the hospital, so as to prevent external interference and contamination to

medical areas within the hospital. Meanwhile, the efforts to manage and prevent sources of contamination within the hospital should be redoubled to avoid secondary contamination.

## 2. Terminology

### 2.1 Emergency Infectious Diseases Hospitals

The temporary specialized hospital that admits patients with confirmed infectious diseases under emergency circumstances.

### 2.2 Living Area

The living area of medical staff, and temporary dwelling for quarantine for medical staff on duty before they leave the emergency hospital. It is classified as the hygienic area regarding the health and safety level.

### 2.3 Screening Area

The area where patients are pre-examined and screened.

### 2.4 Reception Area

The division set up in the outpatient department for receiving and registering

patients, including those transferred from other medical institutions.

**2.5 Restricted Area**

The area for medical staff to have a rest temporarily, for emergency command, and for material supply; it is classified as the hygienic area regarding the health and safety level.

**2.6 Isolation Area**

The area where the medical staff directly or indirectly diagnose and treat patients, and where patients stay for the isolation purpose; it is classified into the semi-contaminated area and the contaminated area regarding the health and safety level.

**2.7 Three Areas and Dual Passages**

The medical area of an emergency hospital should be classified into "three areas and dual passages" by health and safety levels for strict separation of medical staff and patients. "Three areas" refer to the hygienic area, the contaminated area, and the semi-contaminated area; "dual passages" refer to the medical staff passage and the patient passage.

**2.8 Hygienic Area**

The area within the ward and treatment area for diagnosis and treatment of infectious diseases, which is less likely to be contaminated by patients' blood, body fluids, and pathogenic microorganisms, and denies the access of patients with infectious diseases. It covers the living area for medical staff, duty room, and material logistics area.

**2.9 Contaminated area**

The area within the ward and treatment area for diagnosis and treatment of infectious diseases, including the place for temporary storage and processing of items contaminated by patients' blood, body fluids, secretions, and excretions, as well as the bed area, medical staff working area, and treatment area within the emergency hospital.

**2.10 Semi-contaminated Area**

The area between the hygienic area and contaminated area within the ward and treatment area for diagnosis and treatment of infectious diseases, facing the risk of being contaminated by patients' blood, body fluids, and pathogenic microorganisms.

**2.11 Bio-safety Protection Area**

The area that has a requirement on the tightness of building envelope and airflow direction as it is exposed to higher biological risks.

**2.12 Sanitary Passage**

The passage connecting areas of different health and safety levels, which allows medical staff to change their shoes and clothes, take a shower, and wash hands for disinfection.

**2.13 Negative Pressure Ward**

The ward partitioned in planar space and equipped with the air-conditioning system to control the airflow direction and ensure that the indoor static air pressure is lower than the static air pressure of surrounding areas, with effective health and safety measures taken against infection.

**2.14 Negative Pressure Operating Room**

The operating room partitioned in planar space and equipped with the air-conditioning system to control the airflow direction and ensure that the indoor static air pressure is lower than the static air pressure of surrounding areas, with effective

health and safety measures taken against infection.

### 2.15 Buffer Room

A partitioned chamber that serves as a safety barrier, with doors on both sides to allow organized airflow. It is arranged between adjacent spaces of different health and safety levels, such as the contaminated area, semi-contaminated area, and hygienic area.

### 2.16 Ward for Suspected Patients

The ward that hospitalizes patients with symptoms for further observation and diagnosis.

### 2.17 Makeshift Hospital

Large existing public buildings with high ceilings, such as gymnasiums, exhibition halls, and warehouses, are temporarily requisitioned and transformed into places for centralized treatment of patients with mild symptoms.

## 3. Planning for Site Selection and Layout

### 3.1 Principles of Site Selection

3.1.1 Site selection is mainly discussed for new emergency infectious diseases hospitals, including the permanent and temporary emergency infectious diseases hospitals. Site selection and layout of makeshift (cabin) hospitals will be illustrated separately.

3.1.2 The site selection of a new emergency infectious disease hospital should be based on the approved municipal (or county-level) territory planning (city comprehensive planning) with multiple factors considered, including the surrounding environment, external traffic, service radius, construction duration and investment cost etc. The site selection of a new emergency infectious disease hospital should give priority to the use of the reserve land for urban development or integrate with civil air defense base and central shelter.

3.1.3 The site should be far away from densely populated and heavy traffic areas with residential buildings, schools, large public buildings and ecologically sensitive urban areas.

3.1.4 The site should be located in the downwind prevailing in the urban area throughout the year and downstream of the water source conservation area. The selected section should be regular, complete, flat, with high elevation and stable geological condition.

3.1.5 The site shall be easily accessible (close to areas accessible to public transport and other major means of transport) while away from busy roads, with consideration for sufficient above-ground parking space.

3.1.6 The hospital shall be close to and accessible to the existing municipal utilities. In order to facilitate sewage discharge, the site should be close to the existing sewage network system with sewage discharge outlet. Meanwhile, the resources available around the hospital should be considered to provide living and logistical support for the hospital.

3.1.7 The site shall be kept away from areas where natural disasters including floods possibly happen, production and processing yards exposed to contamination and other risks, and areas for production or storage of combustibles and explosives.

3.1.8 The site shall reserve sufficient areas for future renovation and extension.

**3.2 Planning Layout**

3.2.1 The number of new emergency infectious diseases hospitals shall be reasonably determined according to the size of city. In principle, each city shall establish a high-standard infectious diseases hospital. For megacities and super-cities, it is suggested to build one in every district of a city depending on the urban spatial layout.

3.2.2 The construction scale of emergency infectious disease hospitals can be divided into three types: below 250 beds, 250-399 beds, 400 beds and above. The specific construction scale of the hospital shall hinge on the local municipal (county-level) territory planning (city comprehensive planning), economic level, population size, health resources and other factors.

3.2.3 The emergency infectious diseases hospitals shall have warning signs erected on its periphery and be separated from surrounding buildings with 20 meter or wider green belts. If it is not feasible to provide such a green belt, a safe isolation distance shall not be less than 30 meter. During renovation and extension, the irrelevant facilities within 20 meter around the infectious diseases building shall be removed, and any buildings nearby with an interval shorter than the safe isolation distance shall be properly isolated, or suspended and labeled as the "isolation area" at a noticeable position.

3.2.4 Emergency infectious diseases hospitals shall be laid out in a manner to allow for strict division of restricted areas and isolation areas, and physical partitions with barrier gates shall be set up between these areas. The restricted areas are mainly planned for living quarters and logistic support rooms, and the isolation area mainly for reception rooms, medical test and imaging rooms, inpatient rooms, air suction, medical waste incinerators, temporary morgues, and sewage treatment plants.

3.2.5 Two entrances & exits, as a minimum, shall be set up, and the main entrance & exit shall be kept away from the trunk road. In case of large hospitals, additional entrances & exits can be provided for reception, inpatient visit, living and logistic support, and sewage treatment, respectively. The ambulance cleaning/disinfection ground and facilities shall be available near the entrance & exit of the hospital for ambulances.

3.2.6 Sufficient parking spaces for motor vehicles and non-motor vehicles shall be provided inside the hospital. According to particular functional requirements, these parking spaces shall be divided into different zones close to the reception area, inpatient department, and living and logistics area, to provide parking convenience for staff, patients, and visitors. A temporary parking place shall be set up near the entrance of the emergency area. Vehicle cleaning/disinfection ground and facilities shall be available in the isolation area of the hospital.

Hospitals in remote regions shall coordinate the vehicles for patients seeking for medical needs or referral. If the medical process requires shuttle buses, the parking space for shuttle buses shall be available.

3.2.7 A reasonable, science-based approach should be adopted for traffic organization inside the hospital to facilitate smooth flows of pedestrians, vehicles, and materials to ensure absolute separation between hygienic and contaminated

flows. The roads and squares inside the hospital shall be properly arranged for both the traffic and firefighting needs, to enable separation of pedestrians from vehicles, and entrances from exits.

3.2.8 The layout of the main medical buildings shall be designed to ensure safe, convenient, reasonable, and efficient functional connections between main departments (such as reception, medical test and imaging, and inpatient). In general, the layout that leaves room for future extension and development is advisable. The intervals between buildings inside the hospital shall meet the requirements for infection control and sanitary isolation. The isolation area and restricted area should be more than 30 meter apart from each other, and the buildings within the isolation area should be more than 20 meter apart.

3.2.9 The restricted area shall sit upwind of the isolation area. The incinerators, temporary morgues, and sewage treatment plants shall be arranged downwind of the main buildings in the hospital, away from the major activity areas where large crowds gather, and located at a safe distance from other buildings in the hospital, so as to minimize their impact on the hospital itself and surrounding areas.

3.2.10 The sewage treatment plant shall be arranged at the low-lying ground in the hospital, to facilitate the discharge of satisfactorily treated sewage into the municipal sewage network.

### 3.3 Site Design

3.3.1 Surface drainage and laying of underground pipelines shall be organized reasonably based on the natural terrain features, planar functional layout, and technical conditions for construction of the site. The connection between inside and outside the site should be handled appropriately, and the elevation of the site and the buildings/structures should be reasonably designed.

3.3.2 The vertical design shall provide smooth access to major outdoor medical spaces, main roads and fields.

3.3.3 For the areas (including those occupied by buildings) prone to cause sewage and waste pollution, measures such as laying waterproof materials and impermeable membranes shall be taken for the ground, to prevent sewage and waste leakage.

### 3.4 Site Selection, Layout, and Design of Makeshift Hospital

3.4.1 Makeshift hospitals have the characteristics of large space, high capacity, and temporary use. Alternative existing buildings should be single-storey or multi-storey buildings in good structural condition, and large-space buildings such as gymnasiums, schools and old factories are preferred. Makeshift hospitals shall be kept away from crowded downtown areas, such as densely populated residential

areas, kindergartens, primary schools, middle schools, colleges and universities, and have noticeable warning signs or isolation belts set on the periphery of facilities. The design and renovation of makeshift hospitals should follow the principle of "safety first", to ensure the safety concerning medical staff and patients, building structure, operation of facilities and equipment, firefighting work and environment. These hospitals are for temporary and short-term use (usually no more than 12 months).

3.4.2 The existing building shall have a parking and turn-around area set near its entrance to allow quick arrival and departure of ambulances, providing convenience for access with a complete set of accessibility facilities offered. In addition, the spaces for temporary parking and supplies turnover shall be reserved, with a full range of security facilities set around. The cleaning/disinfection ground and facilities shall be available near the main entrance & exit.

3.4.3 The site should provide wide open spaces to accommodate tents and relevant medical equipment for the diagnosis, treatment, inspection, and monitoring of patients.

3.4.4 The municipal utilities (water supply and drainage, power supply and distribution, communication) around existing buildings should be able to meet, or otherwise upon conversion, the functional requirements of the makeshift hospital.

3.4.5 Renovation of the makeshift hospital covers the following particulars: outdoor municipal utilities, sewage treatment facilities, indoor partitions of buildings, indoor facilities and equipment, access roads, personnel and materials access, environmental protection and improvement of adjacent areas, epidemic prevention, biosafety, safety protection, etc.

## 4. Medical Process Design

### 4.1 General Provisions

4.1.1 The temporary emergency infectious diseases hospital shall be capable of providing a full range of functional and auxiliary facilities for medical service that allow hospitalization of confirmed patients. The hospital shall include the reception department, inpatient department, medical test and imaging area, and logistic support area.

4.1.2 Design parameters of the medical process shall depend on the scale of the temporary hospital for infectious respiratory diseases upon research, or, if no relevant data are available for reference, conform to the following requirements:

(1) Number of beds in a nursing unit: 50 or fewer;

(2) Number of operating rooms: total number of beds × 2%;

(3) Number of beds in a respiratory intensive care unit (RICU): total number of beds × 4%.

4.1.3 The temporary emergency hospital for infectious diseases shall, according to the infectious diseases treating process and the specific safety & health level, provide a reasonable layout for the areas shared by patients and medical staff following the principle of "three areas and dual passages" and have sanitary passages or buffer rooms set between adjacent areas. Different areas shall be easily accessible and have hygienic items completely separated from contaminated items.

4.1.4 The routes for patients and medical staff to enter the contaminated area shall be separately arranged, with their entrances opposite to or perpendicular to each other if possible.

4.1.5 Medical staff and workers must go through the sanitary passages before they can return to the hygienic area from the semi-contaminated area or contaminated area.

4.1.6 The routes for delivery of hygienic supplies and medical waste shall be separated, without any crossing.

**4.2 Medical Process Flow**

4.2.1 The consultation and treatment process are shown as figure 1:

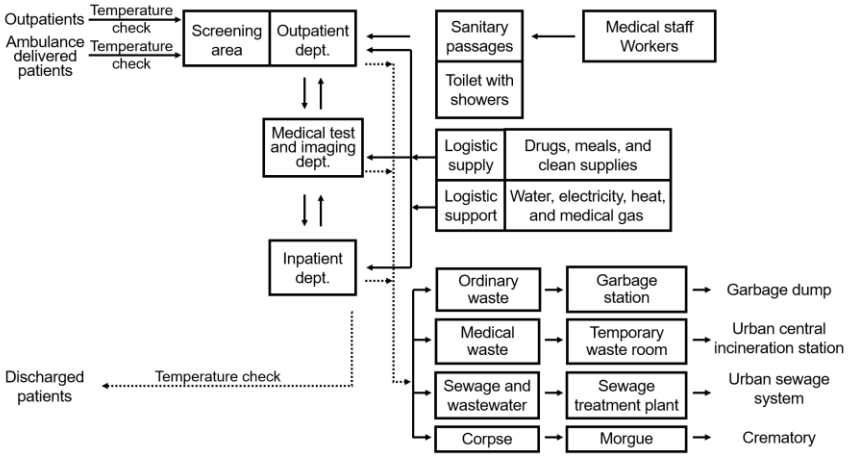


Figure 1. Consultation and Treatment

4.2.2 Medical staff of the emergency infectious diseases hospital should follow the process below as figure 2 and figure 3 when entering and leaving their working areas.

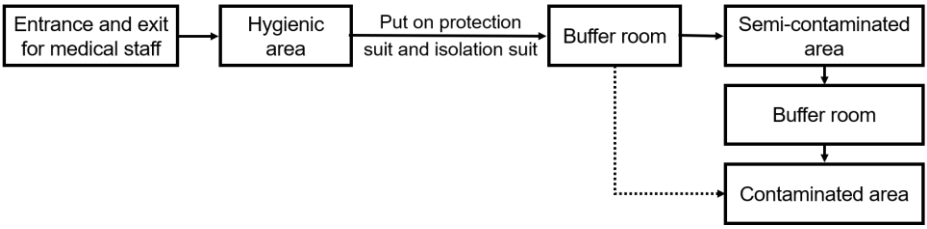


Figure 2. Movement from the Hygienic Area to Semi-contaminated Area or Contaminated Area

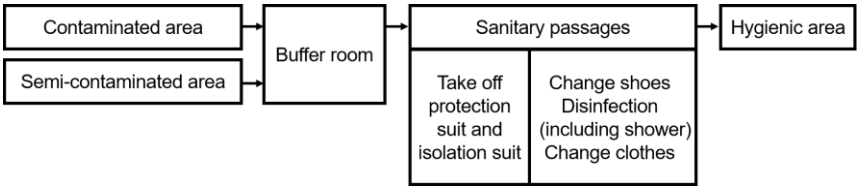


Figure 3. Movement from Semi-contaminated Area or Contaminated Area back to Hygienic Area

4.2.3 The following process as figure 4 should be adopted for delivering supplies to the nursing unit of the ward and treatment area of the emergency infectious diseases hospital:


Figure 4. Delivery to the Nursing Unit of the Ward and Treatment Area

4.2.4 The disposal of used items shall meet the following requirements:

(1) Disposable medical supplies must not be reused but disposed of as medical waste;

(2) Reusable instruments and supplies shall be recycled in a closed manner, and counted, sorted, cleaned, disinfected, dried, inspected, and packaged in the decontamination area. Disinfected reusable instruments shall be sent to the sterile storage room and later to the use area as required.

# 5. Architectural Design

## 5.1 General Provisions

5.1.1 Intended Objects

This chapter mainly discusses the architectural design of new temporary infectious diseases hospitals, renovated and extended existing hospitals, and makeshift hospitals.

5.1.2 Separation of Patients from Medical Staff

(1) The entrances and exits for patients and medical staff shall be separated. The sanitary passage shall be set at the place where the medical staff access the reception area. The points for patients' admission to and discharge from the hospital should be separated if possible. A cleaning room should be set at the hospital discharge point for spraying sanitization.

(2) The infectious disease ward and treatment area shall be divided into different zones according to the types of infectious diseases treated and the severity of patients. Patients with different infectious diseases should be assigned to different zones.

(3) Medical rooms shall be properly located by the "three areas" principle, with buffer rooms provided between different areas.

(4) When leaving the contaminated area, rooms shall be available for medical staff

to take off their protection suits and isolation suits. Patients and medical staff should enter the contaminated area and hygienic area from entrances in different directions (including staircase and elevators). If the entrance and exit have to be set at the same side, they shall have a horizontal distance not less than 30 meter.

(5) Eye-catching signs should be erected at transition area between the three areas.

(6) All external windows in the contaminated area and internal windows must not be opened, except for the delivery window.

(7) Buffer rooms shall have non-manual wash basins, with doors not being opened simultaneously. The internal corridor can have observation windows and disinfected delivery windows set on the wall to deliver food and drugs to patients.

5.1.3 Architectural Design

(1) Single-story buildings (a maximum of three stories) are advisable in the hospital. Elevators should be provided for two-story or higher medical rooms. For elevators carrying patients and medical waste, special ones fit for sickbeds shall be used. When land is available, barrier-free and anti-skidding slope passage can be considered. Ramps can be used for vertical transport and connection. Such ramps shall be of accessible, anti-skid design.

(2) Indoor walkways for passing sickbeds should have a minimum clear width of 2.40 meter. The clear width of the examination room and ward should be at least

2.8 meter. The clear width of the medical test and imaging room should be at least 3.00 meter, with the requirements of relevant medical equipment taken into account.

(3) The access to the tubular well, inspection port, and ceiling manhole shall not be set in the contaminated area of an emergency infectious diseases hospital.

(4) The acceptable noise level of wards and the weighted sound reduction index for airborne sound insulation of partition walls and slabs shall meet the requirements of relevant standards.

(5) A robot logistics system can be provided if possible. Sufficient space should be reserved for related E&M facilities, even if they are not to be installed in the near future.

5.1.4 Accessibility Design

(1) The main entrances & exits and internal medical passages shall have accessible passages directly leading to all medical rooms. Inside the existing building, a ramp slope should be built to connect two passages with a height difference. The ramp slope should have a gradient meeting the requirements for accessible passages and a sufficient width that allows a mobile sickbed and an accompanying person to access simultaneously.

(2) At least one accessible toilet shall be available at the public area on each floor. The toilet in the ward shall have grab bars intended for the disabled.

(3) Accessible facilities shall bear accessibility signs in line with prevailing national standards. Braille maps, voice guidance and prompt systems for visually impaired persons, and sign language interpreting services and text guidance systems for hearing impaired persons should be available at the main entrances & exits of the hospital.

(4) Patients' changing rooms shall have a wheelchair turning space with a diameter of not less than 1.50 meter and provide some lockers no higher than 1.40 meter.

(5) Physiotherapy rehabilitation and patient exercise rooms shall have wall-mounted handrails according to the treatment requirements.

5.1.5 Interior Decoration

(1) Environment-friendly materials shall be selected for interior decoration to ensure indoor air quality compliant with prevailing national standards.

(2) For rooms requiring high cleanliness, such as operating rooms, sterile rooms, and laminar flow wards, the interior decoration materials shall be easy to clean and resistant to disinfectant scrubbing. Operating rooms shall use conductive or Electro-Static discharge (ESD) floor. Radiology rooms and Electroencephalogram (EEG) rooms shall use damp-proof, insulated ESD floor.

(3) Formulation rooms, drug storage rooms, central pharmacy, and pharmacy storage of the pharmacy department shall take measures against moisture, insects,

and rats.

(4) Floor and wall finishes of temporary morgues, pathological autopsy rooms, and places for temporary storage of medical waste shall be resistant to washing and disinfection, and both the floor and dado shall be protected against insects, rats, birds, and other animals.

(5) A surface easy to wash and resistant to corrosion and combustion should be applied to special tables, including test tables and fume hoods in the biochemical lab and central lab, operating tables in the blood matching room and washing room of the blood bank, and staining tables of the pathology department. Washing sinks and drainage pipes at these places should be made of corrosion-resistant materials.

(6) Interior floor and wall finishes shall be smooth and resistant to corrosion and scrubbing. Internal and external corners should be made into fillet angles with an arc radius greater than 30 millimeter.

(7) When it is necessary to drill holes into walls, prefabricated wallboards, or containers for installing conduits, these holes should be positioned in advance and later blocked after conduits are installed. Such holes should be properly sealed, fireproof, waterproof, protected, and soundproof.

(8) Roofing of temporary buildings shall be effectively sealed to avoid rainwater leaking. Light steel slope roofing, waterproof rolls, or other waterproofing measures

should be provided on the container roof. The gap between containers should be filled and sealed by rubber strips or other compatible products 5–10 millimeter wider than the gap.

5.1.6 Signage System

(1) The hospital shall have a signage system to provide guidance and management functions. A signage guidance system with two tiers of signs (within the hospital area and within the buildings) shall be provided.

(2) Guide signs in the hospital must clearly indicate locations of the isolation area, living area for medical staff, and support area, as well as the entrances and exits for patients and medical staff, entrances of clean materials, and exits of medical waste. The patient route must not be overlapped with other flows of people.

(3) Guide signs within a building must clearly indicate the room's name and the boundary between the hygienic area, semi-contaminated area, and contaminated area. The rules for putting on and taking off protection articles shall be described in detail.

**5.2 New Temporary Emergency Hospital for Infectious Diseases**

5.2.1 It is recommended to adopt the design with standardized modular and prefabricated units for new temporary emergency hospitals and use the Building

Information Modeling BIM technology for technical synergy across all disciplines and processes to achieve standardization and integration in design for prefabrication. A management mode for general contracting project is suggested to pace up the construction.

5.2.2 Reception Department

(1) It shall be close to the main entrances and exits of the hospital.

(2) The reception area shall include the consulting room, X-ray room, treatment (preparation) room, tentative waste storage room, sanitary ware room, medical staff's duty room, changing room, doctors' office, and doctors' restroom.

(3) While the consulting room and X-ray room are open to both the medical staff’s passage and the patient’s passage, the other medical rooms are open only to medical staff’s passage.

5.2.3 Medical Test and Imaging Department

(1) The medical test and imaging department includes the imaging section, function examination rooms, blood bank, central supply room, pharmacy department, clinical lab, operating section, and other technical support systems.

(2) The imaging section should be located at a proper place convenient for inpatients to access. This section shall include examination rooms, X-ray rooms, CT rooms, control rooms, waiting rooms, film registration and storage rooms, film reading

rooms, duty rooms, lounges, doctors' offices, technician's offices, and other functional rooms and restrooms.

(3) These function examination rooms shall include examination rooms, medical staff offices, lounges, duty rooms, and restrooms.

(4) The blood bank should be located in a separate area, close to the clinical lab and the operating section. It shall include rooms for blood storage, blood matching, and blood pickup, cleaning rooms, sterilization rooms, changing rooms and restrooms for staff. Moreover, blood test and verification compartments shall be available, and blood storage and matching shall be done in separate compartments.

(5) The central supply section (disinfection and sterilization) should be located in a separate area, close to the operating section and with a direct passage leading to the latter. It shall include rooms for sample collection, sorting and cleaning, preparation of auxiliary materials, packaging, sterilization, quality inspection and storage, and instrument storage and distribution. It shall be divided into the clean area, hygienic area, and contaminated area, in a layout adaptive to the one-way production and processing flow.

(6) The pharmacy section should be located in a separate area with easy access to the inpatient department. The central pharmacy storage and pharmacies shall be set

in the hygienic area, while the pharmacies of the nursing unit can be set in the semi-contaminated area.

(7) The clinical lab shall be located in a separate area with easy access to the inpatient department. It shall include rooms for sample collection, negative pressure inspection, tentative waste storage and packaging, high-pressure disinfection, and repackaging and separation by technology, as well as offices, duty rooms, lounges, restrooms, consumable rooms, and water purifying rooms. Emergency spray faucets and self-closed floor drains shall be arranged at appropriate positions in the working areas of the clinical lab. The high-level animal biosafety labs such as ABSL-3 and ABSL-4 for test and research of infectious diseases shall be properly designed according to the relevant provisions of the prevailing standard

(8) The operating section shall be located in a separate area, close to the inpatient department and allowing easy access to the central supply room and the blood bank. This section shall include contaminated operating rooms (negative pressure operating rooms), bed changing rooms, surgical hand-scrubbing sinks, anesthetic preparation rooms, postoperative revival rooms, sterilized dressing rooms, medical apparatus and instrument storage, tentative waste storage, and specimen delivery rooms.

5.2.4 Inpatient Department

(1) The inpatient department should be located in a separate area. The standard nursing units for inpatients should be tailored for mild, moderate, and critical cases. Its location shall allow easy access to the RICU, operating section, medical imaging section, clinical lab, pharmacy, and dietary kitchen.

(2) The arrangement of wards shall meet the following requirements: In the ward and treatment area for suspected patients regarding each type of disease, one ward shall only hospitalize one patient; and in the ward and treatment area for confirmed patients, two patients share one ward with such medical facilities as the suction apparatus, oxygen ports, electrical sockets, and call buttons. Each ward shall have a restroom equipped with the closet pan, shower, and washbasin, and the integrated shower room is preferred. Beds shall be placed parallel to the wall surface with a lighting window, and each ward should house at most 3 beds. The clear distance between two parallel beds shall be at least 1.10 meter, and that between the wall and the bed next to it shall be at least 0.80 meter. The net width of the passage between a bed (end) and the wall it faces shall not be less than 1.10 meter if beds are placed in a single row, and that of the passage between two beds (end-to-end) shall not be less than 1.40 meter in case of double-row beds. The net width of the ward door shall be at least 1.10 meter. The door leaf shall have an observation window, and its lock switch shall be set on the side reachable by the medical staff.

(3) The working area in each ward and treatment area shall have the nurse station, treatment room, doctors' office, nurses' office, medical staff lounge, medical staff restroom, washroom, supplies warehouse, pantry and boiler room, waste room, mobile instrument room, specimen room, and patient reception room.

(4) The lounge, restroom, and washroom for medical staff shall be located in the hygienic area. The waste room shall have a door directly leading outside. The mobile instrument room, pantry and boiler room, specimen room, and waste room shall be located at the end of each ward and treatment area, with their doors open towards the patient corridor. Each ward and treatment area shall reserve a passage for cart delivery of supplies.

(5) Patient waste and other contaminated garbage should be collected through the waste channel of each ward in the ward and treatment area, delivered in hermetic conditions to the waste room, and later transferred to the incinerator or medical waste disposal center for incineration.

5.2.5 RICU

(1) RICU should be located in a separate area, and preferably close to the operating section to allow easy access.

(2) RICU rooms shall include the nurse station, treatment room, instrument room, waste room, and equipment room. The medical staff working area shall include the

doctors' office, director's office, conference room, consultation room, consumable warehouse, pharmacy, duty room, lounge, and restroom. The medical staff working area shall be located at the hygienic area.

(3) Each RICU should house at most 20 beds. The layout of single-bed compartment is preferred.

(4) The waste room of RICU shall have a door directly leading outside.

(5) An RICU shall be arranged into negative pressure single-bed compartments.

(6) RICU shall reserve a passage for cart delivery of supplies.

5.2.6 Support System

(1) The nutrition and dietary section shall not set a canteen for patients with infectious diseases, and the kitchen shall be properly designed to meet the relevant requirements of standards.

(2) The temporary morgue should be located at a separate doorway, with a convenient access to the corpse delivery passage.

(3) The temporary storage room of medical waste shall be located downwind in the hospital and enclosed to allow separation from other areas.

**5.3 Renovation and Extension of Existing Hospitals**

5.3.1 For the renovation and extension under emergency circumstances, a general

hospital can be divided into the emergency treatment area and general medical area depending on the scale required, which are temporarily partitioned for separate management. The flow routes of persons, materials, and medical waste for the two areas must be separated.

(1) The emergency area shall be close to the main entrances & exits of the hospital or provided with independent entrances & exits, and the area and flow routes shall be separated from the general medical area.

(2) Separate medical test and imaging facilities (X-ray, ECG, B-mode ultrasound, and lab test) shall be provided for patients with respiratory infectious diseases and ordinary patients. It should be located at a proper place convenient for outpatients and inpatients to access.

(3) Patient waste and other contaminated garbage should be collected through the waste channel of each ward in the ward and treatment area, delivered in hermetic conditions to the waste room for disposal by professional companies. The temporary storage room of medical waste shall be located downwind in the hospital and enclosed to allow separation from other areas.

(4) The temporary apartments for medical staff working in the infectious disease ward and treatment area should be arranged in a separate area within the same building.

5.3.2 A triage and a reception room should be set at the entrance of the outpatient area to provide a space for clear screening of patients. If the clinic space is insufficient, temporary facilities can be added outdoors to allow for an extensive space, to avoid cross-infection among patients within the overcrowded clinic space.

5.3.3 Multidisciplinary consultation rooms and telemedicine rooms should be added. If conditions permit, a negative pressure operating room shall be added. The medical test and imaging rooms (CT rooms and operating rooms), if having been reserved in the original infectious diseases building, shall be immediately enabled when a public health emergency occurs.

5.3.4 The infectious disease ward and treatment area shall provide a certain number of negative pressure isolation wards and isolated negative pressure compartments for ICU.

5.3.5 Portable prefabricated buildings of steel structure, which are assembled into modular units depending on the construction location and scale, are advisable to facilitate rapid construction.

5.3.6 Green, lightweight building materials easy to remove and recycle shall be used for renovation and extension of the hospital.

**5.4 Makeshift Hospital**

5.4.1 The makeshift hospital for treating infectious diseases shall observe the basic principles of controlling sources of infection, cutting off the chain of transmission, and isolating susceptible people, and follow the treatment process of the infectious diseases hospital.

5.4.2 Buildings to be transformed into the makeshift hospital should be single-story or multi-story frame structures or large-span structures easy for internal dismantling and modification. Such buildings should meet prevailing specifications and requirements in terms of the architectural structure, fire-resistance rating, fire compartment, safe evacuation, firefighting facilities, and fire lanes. Building structures should be evaluated by practical methods.

The plane layout, structure, floor height, municipal utilities, and indoor facilities of existing buildings shall essentially meet, or otherwise upon renovation, the functional requirements of the makeshift hospital.

5.4.3 Any uninterrupted facilities in the original building, such as trenches, deformation joints, or upper inspection galleries, shall be properly blocked where they cross the two areas (hygienic area and contaminated area).

5.4.4 For large buildings, such as exhibition centers, gymnasiums, and warehouses, the partition walls for separating nursing units should be made of 2.44 × 1.22 standard paint-free eco-boards. The partition height and length should be designed

based on the modulus of such boards to reduce the effort in secondary processing of materials.

5.4.5 The makeshift hospital transformed from existing buildings shall meet the requirements of health and disease control departments at all levels and comply with the prevailing national standards. The width of emergency staircases and emergency exits in the makeshift hospital shall be properly designed based on the number of persons that the hospital can hold currently.

5.4.6 The renovated building can only serve as the makeshift hospital till the end of the requisition.

5.4.7 Design of Ward and Treatment Area

(1) In the patient treatment area, a nurse station and two emergency relief beds shall be provided for every 90 beds. The nurse station should be properly located so that nurses can watch all beds of this area and reach patients through the shortest route.

(2) Some other rooms including central nurse stations, emergency rooms, treatment rooms, pantries, infusion preparation rooms (pharmacies), mobile equipment rooms, linen stores, boiler rooms, filth cleaning rooms, and temporary storage rooms for domestic waste (the last two should be close to the exterior wall and the sewage outlet) should be provided near the ward and treatment area. The hygienic working area for medical staff can provide goods receiving areas, teleconference rooms, drug

storage rooms, sterile supplies storage rooms, pantries, lounges, duty rooms, and offices.

(3) Each ward area shall provide noticeable signs or isolation belts. Beds shall be grouped for different zones and genders.

(4) Each zone should hold no more than 42 beds and provide 2 emergency exits, each with a 30 meter or smaller distance from any point within the zone. A passageway for fire escape shall be provided between two zones. For large space with a high elevation, the passageway should be at least 4 meter wide.

(5) Evacuation signs shall be attached to the flooring of intra-zone passageways and passageways for fire escape.

(6) Partition materials shall be flame retardant or incombustible, with a scrub-resistant surface and a height not less than 1.8 meter.

(7) Beds shall be kept at a proper interval for convenient nursing and treatment.

(8) The clear distance between two parallel beds should be at least 1.2 meter, and nightstands should be available. The clear width of the passage between two beds (end-to-end) should not be less than 1.4 meter if beds are placed in double rows, and that of the passage between a bed (end) and the wall if faces should not be less than 1.1 meter in case of single-row beds.

(9) A public area should be available for patient entertainment, including an audio-

visual area, a learning area, and a communication area.

(10) The exit for patients to be transferred to another hospital and for recovered patients shall be equipped with a disinfection and packing area.

5.4.8 Sanitary Room

(1) Toilets for patients and medical staff should be separated.

(2) It's recommended that patients use temporary toilets. An exclusive passage should be set between temporary toilets and ward areas. Foam-framed mobile toilets are preferred.

(3) One cubicle is offered for every 20 persons (men's room) or 10 persons (women's room). More cubicles may be added to cater for patients' needs.

(4) In the washroom, every five cubicles should be provided with a washbasin. Shower stalls, preferably with 24 hour hot water supply, should be provided for patients.

(5) Chairs should be offered for the weak. The sanitary area should be fenced for easy management. Canopies shall be erected over the paths leading to outdoor toilets and shower stalls, with smoking areas available.

(6) The toilet shall be located downwind of the building and kept away from food and beverage areas and water supply points. Domestic sewage from temporary toilets and wastewater from shower areas must be disinfected. Direct discharge of

any untreated or disqualified domestic and medical sewage and waste from the ward and treatment areas is prohibited.

(7) The existing toilets and shower areas of the building are only allowed for healthy medical staff and logistics workers.

5.4.9 Logistic support rooms should include supplies warehouses, administrative offices, and canteens. Logistic support rooms should be located, if possible, in a separate area and connected with other functional rooms through corridors. These rooms should be located upwind of the base in the perennial prevailing wind direction. If a separate area is not available, those rooms may be built in an annex, but in total physical isolation from other functional rooms and with access directly leading outside.

## 6. Water Supply & Drainage System

### 6.1 General Provisions

(1) The water supply & drainage, firefighting, and sewage treatment works within the hospital are subject to unified planning and design.

(2) The water supply & drainage and firefighting design shall comply with the prevailing national codes and standards.

(3) Durable facilities and equipment shall be used for the water supply & drainage and sewage treatment works, in order to reduce the risk of contact infection during maintenance.

(4) The quality of treated sewage from the hospital shall conform to the relevant provisions. Discharge of medical sewage that has not been disinfected or still fails to reach the standard after treatment is prohibited.

**6.2 New Temporary Emergency Infectious Diseases Hospital**

6.2.1 Water Supply System

(1) The domestic water supply system shall use a combination of break tanks and water pumps, with sterilizing equipment provided. Water supply pipes shall be connected to the sanitary appliances and equipment with an air break or backflow preventer provided in between.

(2) Mains and branches for indoor/outdoor water supply pipes and hot water pipes shall be provided with service valves. Valves and other accessories should be set in the hygienic area for staff.

(3) In the area for severe cases, a disinfectant dosing port and a disinfectant dosage metering device shall be provided at the inlet of water mains.

(4) Washing and disinfection facilities shall be available at the parking lot.

6.2.2 Supply of Hot Water and Drinking Water

(1) The domestic hot water system shall take the same backflow prevention measures as the water supply system. In addition, anti-bacteria measures shall be taken. The unit-type electric water heater, if used, should provide water of a constant temperature that is easy to adjust.

(2) Each nursing unit shall provide a separate drinking water supply point. A centralized boiled water supply, electric water boiler, or water dispenser is recommended. Drinking water pipelines should avoid contaminated area. When conditions are limited, protective measures should be taken.

6.2.3 Drainage System

(1) For the infectious diseases hospital, rainwater shall be diverted from sewage. It is not recommended to drain surface rainwater through surface runoff or open ditches.

(2) The indoor and outdoor sewage/wastewater from the infectious disease ward and treatment area shall be collected and discharged separately from that of the non-infectious disease area. Sewage/wastewater from the infectious disease ward shall be separately discharged to the pre-disinfection facilities, and then to the sewage treatment plant of the hospital.

(3) The sewage/wastewater drainage vent pipes in the infectious disease ward and treatment area shall also be designed for separate collection and discharge. The sewage/wastewater drainage vent pipes on the roof shall be well ventilated all round. In the infectious disease ward and treatment area, the exhaust gas from the vent pipes should be collected for centralized treatment. The vent pipes of the drainage system shall not be connected with the exhaust ducts of the heating ventilation air conditioning (HVAC) system.

(4) The outpatient and emergency fever clinics for patients with respiratory diseases shall provide separate restrooms, with their drainage and vent pipes disconnected with pipes from other areas. Their drainage pipes shall lead out separately. The bacteria and virus lab shall provide exclusive washing facilities. Its wastewater shall be sterilized, and then discharged into the outdoor pipe network and later to the sewage treatment plant of the hospital.

(5) The water supply & drainage pipes must not go through the sterile room. When they have to do so, leak-proof measures shall be taken. Drainage pipes used to collect viruses of severe infectious diseases shall be sealed with non-shrinking, non-combustible, and dust-free materials in the places through which they pass.

(6) Floor drains should be of non-water seal type with strainer and trap, and the trap should have a water seal of 50 to 75 millimeter.

(7) Outdoor drainage manholes in the infectious disease ward and treatment area shall be provided with sealed covers and vent pipes with a diameter larger than DN100.

(8) Condensed water from air conditioners in the infectious disease ward and treatment area shall be centrally collected and discharged into the sewage drainage system of the hospital in an indirect manner, and later to the sewage treatment plant for unified treatment.

(9) Washing and disinfection wastewater shall be discharged into the sewage system, and water seals shall be available under the drains.

6.2.4 Sewage Treatment

(1) Sewage and wastewater from the infectious disease ward and treatment area shall be sealed before pre-disinfection; Sewage must be pre-disinfected and discharged into the septic tank, then into the sewage treatment plant of the hospital, and finally subject to the secondary biochemical treatment before discharge. Sewage treated by chlorine-containing disinfectants shall be dechlorinated before being discharged into the surface water.

(2) Anti-corrosion and anti-leakage measures shall be taken for sewage treatment structures of the hospital. The structures should be sealed or covered. Tail gas shall be collected and disinfected before emission.

(3) Sludge generated during sewage treatment should be discharged into the sludge tank, where sludge is disinfected and dehydrated, and then removed by qualified hazardous waste treatment companies.

## 6.3 Temporary Hospitals Transformed from Existing Hospitals, and Makeshift Hospitals

6.3.1 Water Supply and Drinking Water

(1) Domestic water supply mode: If there is a low risk of backflow pollution and satisfying water supply pressure, the water can be supplied at the pressure of the municipal pipe network, with a decompression type backflow preventer provided to prevent backflow pollution. In case of high risk, a combination of break tanks and water pumps shall be used for water supply, with sterilizing equipment provided.

(2) The water supply pipes in the hygienic area and the contaminated area shall be separated, and the service valve on the water mains for the contaminated area shall be located in the hygienic area and easily accessible to maintainers.

(3) Drinking water: Each ward and treatment area shall be provided with a separate drinking water supply point, supplying sufficient room-temperature drinking water or boiled water.

6.3.2 Hot Water

(1) A centralized domestic hot water supply system is recommended for the shower area. When the electric water heater is used, it must be equipped with a device to ensure safe use.

(2) The outlet water temperature of the water heater for the centralized hot water supply system shall be 60–65°C. When the outlet water temperature fails to meet such requirements, the system shall be equipped with disinfection facilities, and the temperature of the water preparation point shall not be lower than 45°C.

6.3.3 Drainage

(1) Rainwater should be diverted from sewage outdoors, while the indoor sewage and wastewater from the ward and treatment area and other areas shall be collected and discharged separately.

(2) Every water appliance in the drainage system shall carry a self-contained water seal or external water seal, and the depth of such water seal must not be less than 50 millimeter .

(3) For temporary restrooms and shower areas built outdoors for patients, drainage pipes without inspection wells shall be connected, with a vent pipe set every 50 meter.

(4) Condensed water from air conditioners of the hospital shall be centrally collected by areas, discharged indirectly, and treated together with sewage and wastewater from respective areas.

(5) Washing and disinfection facilities shall be available at the parking lot for ambulances. Washing and disinfection wastewater shall be discharged into the sewage system, and the outlet shall be water-sealed.

6.3.4 Sanitary Appliances

(1) Sanitary appliances shall incorporate contactless or non-manual switches and take measures against sewage splashing.

(2) Plugs must not be used for washbasins and sewage sinks.

6.3.5 Sewage and Waste Treatment

(1) Sewage from the ward and treatment area must be disinfected. Wastewater treatment should meet the water quality requirements of the relevant provisions before discharge.

(2) The feces, vomit, sewage, and wastewater from the ward and treatment area must be sterilized before disposal. Solid infectious waste and waste chemical liquids must not be discarded or dumped into sewers. Wastewater, waste, and medical sewage from the ward and treatment area that are not disinfected or are still disqualified after treatment must not be directly discharged.

# 7 HVAC System

## 7.1 General Provisions

(1) The design parameters including temperature and humidity of the Heating Ventilating and Air Conditioning (HVAC) system for each room shall meet the requirements of the corresponding codes.

(2) The HVAC mode is subject to the weather conditions and actual conditions of the project site.

(3) The HVAC system shall be designed according to the hospital's characteristics concerning construction and operation.

(4) The mechanical ventilation system shall be available in the ward and treatment area, medical staff area, and medical test and imaging area. The mechanical air supply and exhaust system shall be provided in the hygienic area, semi-contaminated area, and contaminated area, respectively.

(5) The pressure gradient in areas with different contamination levels shall be properly set based on the principle of directional air distribution, to ensure that air flows in such a direction: the hygienic area → the semi-contaminated area → the contaminated area.

(6) If the all-air HVAC system is used, the DC-type air conditioning system should be provided in the negative pressure isolation wards, negative pressure ICUs,

negative pressure operating rooms, and negative pressure labs.

(7) The supply and exhaust fans of the HVAC system shall be set in the hygienic area or outdoors.

(8) The exhaust fan shall be set at a proper place so that negative pressure can be maintained within the exhaust duct in the building. An electric shutdown valve interlinked with the exhaust fan shall be provided at the suction inlet of the exhaust fan.

(9) The air shall be subject to two-level filtration, i.e., primary-efficiency filter and medium-efficiency filter, if supplied to the hygienic area, or to three-level filtration, i.e., primary-efficiency filter, medium-efficiency filter, and sub-high-efficiency filter, if supplied to the contaminated area and semi-contaminated area. Exhaust air from the contaminated area and the semi-contaminated area shall go through the high-efficiency filter before discharge.

(10) Primary-efficiency filters should be G2 or higher rated, medium-efficiency filters at least F7, sub-high-efficiency filters at least F9, and high-efficiency filters at least H13.

(11) The high-efficiency filter for the exhaust air of the negative pressure (isolation) ward shall be installed at the exhaust vent of the room.

(12) The air supply system and exhaust system should be subject to interlocking

control, and their start-stop sequence should depend on the indoor static pressure.

(13) A proper distance shall be kept between the outdoor exhaust vent and intake vent, at least 20 meter horizontally or at least 6 meter vertically.

(14) Strict sealing and waterproofing measures shall be taken where pipes penetrate outer walls and roofs of the negative pressure ward and treatment area.

(15) Condensed water of air conditioners shall not be discharged outdoors separately but collected in a centralized manner in each area and discharged together with sewage and wastewater of the same area.

(16) An online monitoring device capable of displaying the temperature, humidity, PM2.5, and CO2 concentration should be provided in each room of the negative pressure ward and treatment area, to facilitate the management and operation and maintenance of the HVAC system.

(17) A two-liquid manometer shall be provided for adjacent areas with a pressure difference.

(18) Equipment and materials should be selected with the consideration of easy installation and commissioning.

(19) The high-efficiency air filter for exhaust air should be disinfected by professionals before replacement, and replaced filters should be disposed of with medical waste.

(20) The smoke control system shall comply with relevant provisions.

**7.2 New Temporary Infectious Diseases Hospital**

(1) The decentralized air-conditioning system should be used for different areas.

(2) The air supply and exhaust systems of the negative pressure (isolation) ward should be arranged in a centralized manner, and each system should not serve more than 6 wards.

(3) The fresh air volume of the negative pressure wards and negative pressure isolation wards should not be smaller than 6 AC/H and 12 AC/H respectively.

(4) The air cleaning system with direct expansion air conditioning unit (DX A/C) shall be used in high-precision medical rooms, such as operating rooms, ICUs, and labs; while split air conditioners or VRF air conditioning system should be used for other areas.

(5) In the area where split-type air conditioners are used, the direct-expansion fresh air processing unit capable of temperature regulation is recommended. If it is only used in winter without other heat sources, electric heaters can serve as the air heating device.

(6) The high-efficiency filter for exhaust in the negative pressure (isolation) ward shall be installed at the exhaust outlet of the room. Enough space shall be reserved

for installation and replacement.

(7) The air supply and exhaust volume of ventilation systems in negative pressure (isolation) wards and other areas shall be able to maintain the pressure gradient in each area. It is recommended to install constant air volume devices on branch pipes of air supply and exhaust systems.

(8) Differential pressure detection and alarm devices are recommended for filters of air supply and exhaust systems in negative pressure (isolation) wards and other areas.

(9) In air supply and exhaust systems, the air supply and exhaust branch pipes for each ward should be equipped with an electric shutdown valve that allows independent shutdown, as well as switches easily accessible to medical staff and maintainers. If a manual shutdown valve is used, it shall be installed at a place easily accessible to maintainers.

(10) The design of the air exhaust of the ward restroom shall be integrated into that of exhaust for the ward, instead of the use of the shared shaft.

(11) The differential pressure (negative pressure) of adjacent and connected rooms with different contamination levels shall be at least 5 Pa. The hygienic area shall maintain a positive pressure.

(12) The air supply and exhaust vents of the negative pressure (isolation) ward shall

conform to the principle of directional air distribution. That is, the air supply vent should be set on the upper side of the room near the upper part of the medical staff's entrance, while the air exhaust vent should be set in the lower part of the ward near the head of the bed.

(13) It is recommended that air is supplied from the upper side while it is exhausted through the lower side for negative pressure ICUs, negative pressure operating rooms, and negative pressure labs.

(14) The biosafety cabinet shall use an independent air exhaust system, with no air supply vent set over the cabinet.

**7.3 Renovation and Extension of Existing Hospitals**

(1) Operators shall preferentially consider the existing cold and heat source conditions in the hospital and check whether the capacity of the existing cold and heat source is sufficient.

(2) Operators shall preferentially utilize the exiting AC terminal devices and check whether the capacity and air pressure of the existing AC terminals meet the need of the hospital.

(3) The AC terminal in each room shall be able to operate independently. An AC terminal, if found to afford multiple rooms, shall be stopped immediately, and the

air supply outlets and return air vents of these rooms must be closed, where the split-type air conditioner or VRF air conditioner shall be set instead.

(4) The HVAC system shall also meet the following requirements:

The fresh air volume of the outpatient area and medical test and imaging rooms should be at least 6 AC/H. The negative pressure ward should have a fresh air volume not smaller than 3 AC/H and a total clean air volume not smaller than 6 AC/H. The fresh air volume of the air supply system for the negative pressure isolation ward should not be smaller than 6 AC/H, and the total clean air volume shall not be smaller than 12 AC/H.

Each room should have an independent AC terminal, with a filter set at the return air vent of the terminal. In this case, the low-resistance sub-high-efficiency air filter is recommended.

(5) When the fresh air volume in the renovated buffer room cannot reach 6 AC/H, it is recommended to use the fan filter units (FFU) with the high-efficiency filter for air supply.

(6) The observation ward in the outpatient area shall maintain a negative pressure ≥-5 Pa comparing to the adjacent room.

(7) During renovation of the HVAC system, the civil and E&M conditions required for new equipment shall be re-examined.

(8) The smoke control system of existing buildings shall be fully utilized.

### 7.4 Makeshift Hospital

(1) The AC and ventilation system should be transformed to cut off the pollution sources, avoid cross-infection, and minimize the impact on the surrounding environment.

(2) The preferred indoor temperature is 14–28°C, and other temporary auxiliary facilities can be used to control the indoor temperature accordingly.

(3) Positive pressure control should be available at the medical staff's entrance, and negative pressure control at the medical staff's exit, patients' entrance and exit, and logistics channel.

(4) The indoor air distribution shall be reasonably designed, and medical air purifiers can be provided in some areas if needed.

(5) The air exhaust vent shall be arranged at the downwind side of the dominant wind direction during the epidemic. The fresh air vent and air exhaust vent should be kept at a proper distance to avoid mutual impact.

(6) The ward and treatment area with the all-air system should be transformed to work in full-fresh-air mode. When the return air mode is adopted, reliable high-efficiency filtering measures for return air must be provided. The high-efficiency

filter shall be of H13 or higher grade.

(7) The contaminated area with the cold/hot end + fresh air system should transform the fresh air system into the air exhaust system, to supplement natural air through the external window and maintain a negative pressure in the room. The air exhaust system should be able to operate without interruption.

## 8 Heavy Current System

### 8.1 General Provisions

(1) In addition to the Guidelines, the electrical design of the new or renovated temporary infectious diseases hospital and makeshift hospital shall comply with prevailing national codes, standards, and local policies.

(2) If the project is implemented in an emergency, the electrical system should be simplified and optimized as much as possible to shorten the construction duration, without degrading electrical safety and basic functional requirement.

(3) Uninterruptible power supply (UPS) shall be available for medical venues and facilities that require power recovery within 0.5 second after an outage.

(4) The lighting system for emergency evacuation shall meet the requirements of corresponding codes and standards.

(5) UV disinfection lamps shall be provided, or their power sockets should be

reserved in clean corridors, filth cleaning rooms, restrooms, waiting rooms, consulting rooms, treatment rooms, wards, operating rooms, and other places requiring sterilization. The UV disinfection lamp shall have an exclusive switch with obvious on-off indication, which shall not be placed side by side with ordinary lamp switches and should bear a special mark. The switch should be installed 1.8 meters above the floor. When set at places where people may stay at ordinary times, the UV disinfection lamp providing indirect illumination or with an adjustable illumination angle is recommended.

(6) Night lighting should be available in the ward and along the inter-ward aisle, preferably subject to centralized control from the nurse station. Lamp switches in the ward should be of senior-friendly wide-panel push-button switches, mounted at a height of 1.2 meters above the floor. The working status indicator shall be provided above the doors of the radiation room, operating room, and emergency room. The operating room, emergency room, and ICU shall be equipped with safety lighting, whose illumination value is 100% of general lighting.

(7) Power sockets should be reserved for facilities in the isolation ward, including delivery windows, sensor doors, automatic toilet flush kits, sensor faucets, and electric sealing valves.

(8) Packaged products of a specific type should be selected for the linkage control

of ventilation and AC equipment. Such products should be centrally controlled from the nurse station (duty room).

**8.2 New Temporary Infectious Diseases Hospital**

8.2.1 Two independent mains supplies (dual power supply) 100% standby for each other shall be used.

8.2.2 An emergency diesel generator set shall be available, capable of automatic start and output within 15 seconds when the mains supply fails. The generator set and mains supply shall be equipped with a reliable lock-out device, and they must not be connected to the grid. A fuel storage room shall be available or a self-contained daily tank with a fuel filler reserved be provided for the generator unit. Winter anti-freezing measures shall be available in cold areas.

8.2.3 LV Distribution System

(1) The primary load should be powered by a dual power supply, with automatic terminal switching; the secondary load also powered by a dual power supply, preferably with automatic terminal switching; and the tertiary load powered by a single power.

(2) Radiological equipment shall be powered by an exclusive line and meet the requirements for internal resistance of the power source. A medical IT system shall

be provided for power distribution of operating rooms, emergency rooms, ICUs, and other Class-II medical facilities. Insulation monitors that meet relevant monitoring requirements shall also be provided.

(3) The distribution room and electrical shaft shall be arranged in the hygienic area. The distribution box and control box should be provided at the hygienic area, rather than the contaminated area.

8.2.4 Cable Model Selection and Cabling

(1) Low smoke, halogen-free, and flame retardant type wires and cables shall be used for ordinary loads, while fireproof type or low smoke, halogen-free, and flame retardant type wires and cables for fire loads.

(2) For LV cables directly buried outdoors or laid along cable trenches, armored power cables shall be selected.

(3) Trunking and conduit are recommended for open laying. When cables go through the interface between the hygienic area, semi-contaminated area, and contaminated area, gaps of the partition wall, mouth of trunking and conduit, etc. shall be reliably sealed with incombustible materials to prevent cross infection.

8.2.5 Lightning, Grounding, and Safety Protection

(1) The new temporary infectious diseases hospital should follow the prevailing relevant standards for the design of lightning protection and grounding.

(2) The LV incoming power cables laid to the house shall be subject to multiple grounding, and the TN-S system should be used within the building.

(3) The building shares the same grounding system for lightning protection, protective grounding, functional grounding, and shield grounding. The grounding resistance shall not exceed 1 ohm and the minimum grounding resistance shall be set as required for medical equipment.

(4) A building shall be provided with main equipotential bonding. ICUs, operating rooms, emergency rooms, treatment rooms, shower stalls, and restrooms with showers shall be provided with auxiliary (local) equipotential bonding.

(5) Grounding devices must not destroy the impermeable membrane, and if there is any local damage, reliable sealing and waterproofing shall be conducted.

**8.3 Renovation and Extension of Existing Hospitals**

8.3.1 Power Supply and Distribution System and LV Distribution System

(1) The renovated hospital shall provide the power supply with the highest load level and capacity, and new distribution lines shall protect the sensitivity and avoid voltage loss.

(2) Backup emergency power supply: A diesel generator unit shall be made available as the emergency power supply, with measures to guarantee the diesel

supply, to afford loads of the renovated hospital in such places as the operating room, emergency room, emergency treatment and observation room, delivery room, infant room, ICU, ward for respiratory infectious diseases, negative pressure ventilation equipment, and hemodialysis room; and for such equipment as the medical incubator, thermostat (refrigerator), important pathological analysis and inspection device, vacuum suction apparatus, compressor, and oxygen generator. Winter anti-freezing measures shall be available in cold areas.

(3) The distribution box and control box in the renovated area should be set outside the contaminated area and placed in an exclusive room if conditions permit.

(4) When cables go through the interface between the hygienic area, semi-contaminated area, and contaminated area, gaps of the partition wall, mouth of trunking and conduit, etc. shall be reliably sealed with incombustible materials to prevent cross-infection.

8.3.2 Lighting System

(1) Clean dust-proof lighting fixtures with enclosed covers that are easy to clean shall be provided at the medical facilities. The lights should be mounted to the ceiling, with their installation gaps sealed tightly.

(2) Additional lighting, socket power cables, and light current cables laid on the ground shall be encased with metal pipes (troughs), which should keep away from

the passages of people and supplies, and if it fails to do so, necessary measures shall be taken.

8.3.3 Lightning, Grounding, and Safety Protection

(1) Lightning protection and grounding: The new (expanded) part of the hospital should follow the prevailing national standards for the design of lightning protection and grounding, while for the renovated part, the original lightning protection, grounding, and equipotential connection system of the building needs to be repaired and functional, meeting the lightning protection and grounding requirements after renovation.

(2) New LV incoming power cables laid to the house shall be subject to multiple grounding, and the TN-S system should be used within the building. The building shares the same grounding system for lightning protection, protective grounding, functional grounding, and shield grounding. The grounding resistance shall not exceed 1 ohm and the minimum grounding resistance shall be set as required for medical equipment.

(3) ICU, operating room, emergency room, treatment room, bathroom, and restroom with showers shall incorporate auxiliary (partial) equipotential bonding.

## 8.4 Makeshift Hospital

8.4.1 Power Supply and Distribution System and LV Distribution System

(1) The power supply conditions shall meet the requirements of the highest load level.

(2) Backup emergency power supply: A diesel generator unit shall be made available as the emergency power supply, with measures to guarantee the diesel supply, when the mains cannot afford the highest load level or the hospital has the operating room, emergency room, ICUs, ward for respiratory infectious diseases, negative pressure ventilation equipment, vacuum suction apparatus, compressor, and oxygen generator. Winter anti-freezing measures shall be available in cold areas.

(3) After the renovation, the power supply system in the renovated venue shall have a sufficient capacity to afford loads of the temporary hospital. If it fails to meet the power supply requirements, an outdoor box-type substation should be provided, and new distribution lines shall protect the sensitivity and avoid voltage loss.

(4) The distribution box and control box should be set outside the contaminated area and placed in an exclusive room if conditions are favorable.

8.4.2 Lighting System

(1) The standby power supply for fire emergency lamps and evacuation indicators shall have a continuous power-on time of not less than 1 hour. In the staircase, front chamber, shared front chamber, refuge aisle, and refuge room, the minimum

horizontal illumination of the evacuation lighting above the floor shall not be less than 10 LX.

(2) Each bed shall be provided with two or three 220 V, 10 A, single-phase sockets. When an electric blanket is used for heating, a separate power circuit should be provided for centralized and time-sharing control, so as to reduce the fire hazard.

(3) When conditions permit, some lamps can be mounted on the wall of the large bay, or some pole lamps can be placed on the ground. These additional lamps should carry opaque covers or give out light indirectly, so as to reduce the glare effect of lighting fixtures on the ceiling of the original building.

(4) A 30-mA residual current action protector shall be adopted for the lighting and socket circuit added during the renovation.

(5) Additional lighting, socket power cables, and light current cables laid on the ground shall be encased with metal pipes (troughs), which should keep away from the passages of people and supplies, and if it fails to do so, necessary measures shall be taken.

8.4.3 Lightning, Grounding, and Safety Protection

(1) Lightning protection and grounding: implement and repair the original lightning protection, grounding, and equipotential bonding system of the building. The temporary hospital after renovation should be fortified as per the Class-II lightning

protection level for its structure and with Grade-C configuration for its electronic information system.

(2) New LV incoming power cables laid to the house shall be subject to multiple grounding, and the TN-S system should be used within the building.

(3) When the integrated grounding system is adopted, the grounding resistance should not be greater than 1 ohm.

(4) Medical equipment rooms, shower stalls, and restrooms with showers shall incorporate auxiliary (local) equipotential bonding.

# 9 Light Current System

## 9.1 General Provisions

(1) The overall architecture of the intelligent system shall be properly designed to cater for the needs of the temporary infectious diseases hospital and meet the comprehensive planning requirements of the same.

(2) For the design of the intelligent system, the rapidity and convenience of procurement, construction, installation, commissioning, and maintenance shall be considered.

(3) The configuration of the intelligent system shall comply with the relevant provisions of prevailing national standards.

(4) In medical decontamination areas (care units, operating rooms), system points should be designed in close collaboration with the process design to meet the process requirements.

(5) The negative pressure isolation ward shall have a device to monitor the air pressure difference between the ward and the buffer room, and the monitor shall be installed at the doorway of the buffer room, capable of giving out an audible and visual alarm when the pressure difference turns abnormal.

(6) The mouth of the trunking and conduit for the intelligent system shall be reliably sealed, and the through-wall gap shall be tightly sealed.

(7) The automatic fire alarm system shall be properly designed as per the relevant provisions of prevailing national standards.

**9.2 New Temporary Infectious Diseases Hospital**

9.2.1 Information Application System

(1) The information application system of the temporary infectious diseases hospital shall include the medical service information system and nurse call system. Moreover, the queuing system, ward visiting system, telemedicine system, video conference system, and video demonstration system are also recommended.

(2) Level 2 or higher information security is favorable for the information security

management system.

(3) Terminal equipment of each information application system shall be easy to clean and disinfect.

(4) The medical service information system should consist of the Hospital Management System (HMS), Picture Archiving and Communication System (PACS), Hospital Information System (HIS), Radiology Information System (RIS), Laboratory Information System (LIS), and Clinical Information System (CIS).

(5) The queuing system should be available in the outpatient waiting area, clinical labs, and radiology department.

(6) The ward visiting system should be available for ICUs and negative pressure isolation wards and be established in line with the nurse call system.

9.2.2 Information Facility System

(1) The information facility system shall include the information access system, telephone switching system, information network system, indoor mobile signal coverage system, generic cabling system, cable TV system, and public address system.

(2) The intranet (application network for medical services), extranet (network with access to the Internet services), and exclusive network for equipment shall be available in the temporary hospital as required.

(3) The hospital intranet shall reserve interfaces for communicating with the center for disease control, emergency command center, and government administration.

(4) The hospital shall have full coverage of WLAN.

(5) The indoor mobile signal coverage system shall be designed and installed by relevant operators and contractors, to realize full coverage of 4G (or 5G) signals provided by at least three operators.

(6) The cable TV system should be deployed in IPTV model.

(7) The public address system should share speakers with the fire emergency broadcasting system to broadcast services and background music at ordinary times, and switch to the emergency broadcasting system in case of fire.

(8) The wireless intercom system shall cover all the areas within the boundary line.

9.2.3 Public Safety System

(1) A network video surveillance system shall be available, providing 1080P or higher cameras and 90-day or longer storage of images, and reserving a communication interface with the public security organ.

(2) The access control system shall be properly set based on the medical process. This system shall be designed for contactless recognition and allow interlocking control of doors A and B.

(3) A possible fire occurrence shall be controlled by the automatic fire alarm system

with linkage control measures. In such a circumstance, all doors with interlocking functions and doors on the evacuation route shall be kept open.

(4) A one-key alarm system should be available at the nurse station, doctors' offices, and monitoring room, and there shall be audible and visible alarm signal in the monitoring room.

(5) In the isolation zone, the vehicle entrance should be provided with a barrier gate capable of automatic license plate recognition, and the pedestrian entrance with a gate capable of identity recognition.

(6) Intrusion alarm devices are recommended for pharmacies and important equipment rooms (network equipment room, substation, etc.), and an electronic patrol system is advisable to guard main passages and key areas in the hospital.

9.2.4 Equipment Room

(1) Equipment rooms of the intelligent system should include the information access room, intelligent general control room, information network room, and intelligent equipment room (light current room). Equipment rooms shall be arranged in the hygienic area.

(2) The equipment room of the intelligent system shall have a sufficient area to cater for the layout of equipment cabinets (racks). The information network room shall have a complete set of devices and systems, including the power distribution and

lighting, lightning protection and grounding, UPS, precision air conditioner, gas fire extinguishing, security protection, environmental monitoring, and ESD flooring.

(3) The container-type data room or micro-module equipment room is preferred to serve as the information network room.

**9.3 Renovation and Extension of Existing Hospitals**

(1) The negative pressure isolation ward shall have a device to monitor the air pressure difference between the ward and the buffer room, and the monitor should be installed at the doorway of the buffer room, capable of giving out an audible and visual alarm when the pressure difference turns abnormal.

(2) The access control system shall be properly set based on the medical process. This system shall be designed for contactless recognition and allow interlocking control of doors A and B.

(3) A possible fire occurrence shall be controlled by the automatic fire alarm system with linkage control measures. In such a circumstance, all doors with interlocking functions and doors on the evacuation route should be kept open.

(4) The ward visiting system should be available for ICUs and negative pressure isolation wards and be established in line with the nurse call system.

**9.4 Makeshift Hospital**

(1) Metal pipes (troughs) shall be used for new light current lines on the ground. The laying of pipes (troughs) should keep away from the passages of people and supplies. And if it fails to do so, necessary measures shall be taken.

(2) The medical service information system, telemedicine system, and video conference system shall be provided.

(3) The wireless network access conditions shall be available to ensure the full coverage of the 4G or 5G network. Where conditions permit, wireless AP shall be added to achieve full Wi-Fi coverage.

(4) It's feasible to utilize the public address system at the original venue and connect its front end to the nurse station, or set a temporary broadcasting system that works in distributed wireless networking mode.

(5) The one-key alarm button should be set at the nurse station (duty room) and connected to the security system of the makeshift hospital.

(6) The video surveillance system should cover the patient rest area and nurse station.

(7) When cable wiring is unavailable for the light current and intelligent system, the wireless scheme can work to replace it.

(8) The renovated information management system shall share the information as required by the superior administration.

## 10 Operation Management

### 10.1 Water Supply & Drainage System

10.1.1 Daily Management and Operation and Maintenance (O&M)

(1) It is necessary to establish a complete file management system and prepare equipment operation manuals for the water supply and drainage system.

(2) Water supply

The administrative department shall develop guidelines for safety precautions, strengthen the safety management over important parts of secondary water supply facilities (pump room, pools, tanks, etc.), and check electrical equipment.

O&M staff shall carry out disinfection before getting close to the important parts of secondary water supply facilities for daily maintenance, to avoid pollution to domestic water.

(3) Drainage

The administrative department shall develop guidelines for safety precautions and strengthen safety management over important facilities (sewage pump, pit, and sewage treatment plant).

O&M staff shall take proper preventive and protective measures and disinfect their working areas according to the requirements for the contaminated area.

(4) Hot water

O&M staff shall regularly inspect water supply facilities of the hot water supply system and keep them clean.

(5) Medical water for specific purpose

The quality of medical water for specific purpose shall be carefully monitored, and its water quality shall meet the prevailing national standards.

Filtration consumables shall be replaced regularly as required in the process flow.

(6) Direct drinking water

It is essential to enhance the management of terminals of drinking water and monitor the water quality of direct drinking water. All water quality standards of direct drinking water shall meet the requirements of prevailing national standards.

10.1.2 Emergency Treatment During the Epidemic Period

Before or at the early stage of the epidemic, all water supply and drainage systems shall be thoroughly inspected, cleaned, and maintained, with consumables replaced and reserve of common spare parts supplemented, so as to save or minimize the maintenance during the epidemic period and reduce the risk of maintenance staff getting infected. Also, saving protective equipment is a measure to improve the

efficiency in operating emergency medical facilities.

During the epidemic period, O&M staff should report their epidemiological status and receive body temperature measurement. Those who have a fever or have been to major epidemic regions recently must not be allowed to work on the O&M of the water supply and drainage system in the hospital.

(1) It is essential to enhance the online management and monitoring of water quality monitoring equipment for domestic water supply.

(2) The discharge outlet of sewage treatment facilities and the sewage outlet of infectious diseases hospitals should receive the water quality monitoring and evaluation in strict accordance with provisions of relevant standards.

(3) The maintenance and management of the fire water system shall comply with the prevailing national standard.

**10.2 AC Ventilation System**

(1) In summer and winter, windows shall be kept closed in the office. Where the AC system is working, it is suggested that the air conditioning temperature should be≥26℃ in summer and≤18℃ in winter.

(2) The operation manager of the AC ventilation and medical gas system shall, according to the needs of the hospital and the routine inspection requirements

specially provided by the manufacturer, formulate the timing, routing, and objectives for inspection of central AC equipment, and assign staff for patrol and inspection. When faults and hidden dangers are found, they shall be handled in time and relevant records shall be filled in truthfully.

In addition to routine inspection, the manager shall follow the manufacturer's technical specifications to develop the maintenance plan for the AC ventilation and medical gas system, and provide spare parts as required.

(3) The AC ventilation and medical gas system shall receive at least one hygienic inspection every year. System operation indicators, such as fresh air volume, carbon dioxide concentration, biological pollutants, inhalable particles, and dust accumulation, shall conform to provisions of corresponding standards.

(4) The AC ventilation and medical gas system shall be cleaned according to the requirements of corresponding standards. The scope and method of such cleaning shall meet the requirements of relevant specifications.

(5) The cooling tower, cooling water pipeline, and chilled water (including the heating hot water and AC condensate) pipeline should be regularly cleaned and disinfected, to meet the requirements of relevant specifications.

(6) Within 7 days upon cleaning and disinfection of the AC ventilation and medical gas system in the hospital, the air handling equipment such as air disinfection device,

filter, heat exchanger's coil, and condensate tray as well as the interior surface of equipment box shall receive another hygienic inspection. The test results shall meet the requirements of relevant specifications in terms of the cleaning and disinfection effects.

(7) The inspection cycle, evaluation indicators, and management requirements of air filters should follow the requirements of Table 1.

Table 1: Inspection Cycle, Evaluation Indicators, and Management Requirements of Air Filters

| Types of Filters | Inspection Cycle | Evaluation Indicator | Management Requirements |
|---|---|---|---|
| Filter at fresh air inlet | 7 days (shorter in areas prone to sandstorm) | Mesh blocked＞50% | Cleaning and disinfection |
| Reusable primary filter | 20 days | Mesh blocked > 50% | Cleaning and disinfection |
| Disposable primary - efficiency filter | ＜2 months | The resistance is 50 Pa higher than the rated initial resistance | Replacement |
| Medium-efficiency filter | ＜4 months | The resistance is 60 Pa higher than the rated initial resistance | Replacement |

(8) Monitoring of fan fault and pressure difference alarm for air filters of the air supply and exhaust system shall be strengthened. Clogged air filters shall be

replaced in time to ensure the normal operation of the fan.

(9) The patrol inspection over the gas pressure alarm device shall be reinforced to ensure reliable gas supply to the ward and treatment area.

(10) The removed high-efficiency exhaust filters and medical waste from the medical vacuum system should be centrally treated following the requirements of relevant specifications.

(11) The AC ventilation system, when polluted by biological pollutants, shall be disinfected. Disinfection shall comply with relevant specifications.

(12) The rooms with AC terminals shall be sampled more than once a day, to ensure that the temperature, humidity, and carbon dioxide concentration in such rooms comply with the provisions of relevant specifications. The number of AC rooms sampled shall account for more than 1% of the total AC rooms.

(13) Any end equipment, if suspended for more than 3 months, shall be repaired, maintained, and thoroughly checked in accordance with the manufacturer's technical specifications, and further cleaned, disinfected, or replaced based on the inspection results.

(14) In every quarter, the infection management department of the hospital shall monitor the number of air bacterial colonies in the protective isolation ward and treatment areas (non-hygienic operating section, delivery room, catheter room,

hemopathy area, and burn area) and in key departments (ICU, newborn room). The ratio of the rooms checked every time to the total rooms in the key departments shall be greater than 10%.

(15) If it is suspected that the sharp increase of infectious cases or suspected cases is related to the hospital environment, medical staff shall perform the target microorganism detection and specify the frequency of sample monitoring and the ratio of sampled rooms based on the specific epidemic situation of the hospital, with the monitoring method and result judgment compliant with the provisions of prevailing national standards.

(16) If it is found that a certain area within the hospital building has the virus from infectious or suspected patients, toxic and harmful gases, and dust that may spread through the AC ventilation system, operators shall immediately close all air vents or stop the central AC terminal equipment in this area.

(17) The hospital shall, based on the actual situation, develop emergency plans for preventing airborne infectious diseases and for ensuring the safety of the AC ventilation and medical gas system. Such emergency plans shall be drilled at least once a year, and the drilling process shall be recorded in detail. If any problems are found, they shall be solved in time, and the emergency drill shall be performed again for this purpose.

(18) After an emergency event occurs, follow-up appraisal shall be carried out, and appropriate measures should be taken immediately to prevent its recurrence. Upon emergency treatment, relevant indicators shall be tested again, and equipment must not be put into use until the indicators meet the relevant regulations.

**10.3 Laboratory**

10.3.1 It is necessary to regularly inspect the testing items, instruments and equipment, water supply and drainage, pure water, sewage treatment, ventilation and air conditioning, electricity, decontamination, firefighting, and gas in the laboratory area based on the laboratory management system, and solve all problems in time.

10.3.2 Protective Measures

Standard preventive measures: refer to the measures taken to protect all patients and medical staff against infection. Specific measures include hand hygiene, articles selected considering the expected exposure risks (protection suit, mask, gloves, goggles, face shield, and safe injector), safe injection, passive and active immunization, and environmental cleanness.

Personal protective equipment (PPE) is used for medical staff working in laboratories: as the barrier to protect medical staff against infectious factors. PPE

includes the masks, gloves, goggles, face shield, waterproof apron, isolation suit, protection suit, and personal protective devices etc.

10.3.3 Barrier isolation and space isolation measures are taken in the lab area to avoid cross-infection. Barrier isolation: refers to the isolation measure that erects physical barriers (such as walls, partitions, curtains, and films) between the susceptible persons and exposure sources. Spatial isolation: refers to the measure that separates the susceptible persons from the exposure sources with distance and space, such as isolating rooms.

10.3.4 A detailed disinfection process for the lab area shall be developed. It is necessary to perform partial disinfection once an hour and comprehensive disinfection once a day, conduct the assessment, and record the disinfection time, involved persons, and their contact in detail. Disinfection operators must receive training and have the knowledge of disinfection. Operators should adopt standard preventive procedures and wear PPE.

10.3.5 The laboratory management and O&M organization shall provide professional technicians for the maintenance work, have sufficient maintenance tools and testing instruments, and store the maintenance materials and supplies for common use.

**10. 4 Elevator Operation Management**

10.4.1 The E&M equipment in the equipment room shall be inspected every day. The elevator shall be maintained at least once every half month according to the requirements of relevant regulations.

10.4.2 Important mechanical components and electrical devices are scrutinized quarterly to adjust and repair the following items: traction machine oiling, replacement of door guide shoes and car guide shoe liner, and replacement of damaged or ablated safety switches and relays.

10.4.3 Various safety protection devices and electric control parts should be scrutinized, and vulnerable parts should be replaced every month.

10.4.4 Elevators for long-term suspension or subject to fire, earthquake, flooding, etc. shall have the conditions recorded in detail and must not be put into use until being qualified for supervisory inspection.

10.4.5 Medical staff shall wear clean clothes when taking the special elevator for them, and wear the protection suit, gloves, shoe covers, masks, hats, and goggles (if necessary) when taking the patient elevator. When delivering domestic garbage, medical waste, and oxygen cylinders through a service lift, staff must wear the protection suit, gloves, shielding shoes, masks, hats, and goggles (if necessary).

10.4.6 A detailed disinfection process for elevators shall be developed. Operators

shall perform partial disinfection (e.g. for the button panel of the elevator) once an hour and comprehensive disinfection (covering the frequently contacted buttons, handrails, car walls, etc. ) once a day, record the disinfection time, involved persons, and their contact in detail, and copy out the record and put it beside the product certificate in the car while keeping another paper version of this record. During special periods, partial disinfection and comprehensive disinfection can be alternately performed.

10.4.7 Sensitive components within the elevator car, such as the floor display panel, shall be covered with disposable plastic wrap, to prevent the disinfectant from entering the circuit substrate through buttons and resulting in an elevator failure.

10.4.8 Disinfection must be carried out by trained personnel with the knowledge of disinfection. Staff must wear the isolation suit, protection suit, work shoes, masks, hats, gloves, and goggles.

10.4.9 Upon the completion of comprehensive disinfection, operators shall open the elevator door and turn on the exhaust fan for 30-minute ventilation before the elevator is resumed for normal operation. The ventilator within the elevator car shall always be turned on.

**10. 5 Medical Gas Operation Management**

10.5.1 A 24-hour duty system shall be incorporated. Attendants must receive training on fire safety, infection control, safety technology, and operation and maintenance, possess safety awareness and emergency handling ability, and pass the exams before they can take their jobs.

10.5.2 A detailed inspection system shall be developed in accordance with the medical gas specifications and in line with its own situation. The equipment room for medical gas shall be inspected at least every two hours.

10.5.3 Before entering the isolation area (e.g. for delivery of oxygen bottles and terminal maintenance), staff must wear PPE.

10.5.4 A detailed disinfection system shall be developed, covering the disinfection process for gas bottles, tools, warehouses, and other equipment.

10.5.5 The surface of gas bottles shall be cleaned and disinfected at least twice a day. Gas bottles and valves should be disinfected with wet wipes containing 70% alcohol or 70% alcohol disinfectant, instead of 100% alcohol or detergents that may produce chlorine, ammonia, or sulfur dioxide. During the disinfection of oxygen cylinders, it is prohibited to wipe the bottles with a rag containing grease.

10.5.6 Tools shall be classified, and maintenance tools for oxygen devices shall be marked for exclusive use and must not be mixed with other tools. After the daily grease removal work is done, tools shall also be disinfected. Tools should be stored

in a special warehouse. After use, especially after accessing the isolation area, tools shall be disinfected immediately by wiping with a disinfectant towel and then with UV disinfection. Warehouses for gas bottles, carts, tools, and accessories should be regularly cleaned and disinfected with UV or air disinfecting machine. The ultraviolet intensity shall be greater than 90 microwatts per square centimeter. UV disinfection shall be performed 1–2 times a day and lasts at least 1 hour per time, and the air disinfecting machine shall be used 4 times a day and lasts 2 hours per time.

10.5.7 Other equipment, such as the buoy oxygen inhaler, negative pressure meter, and pressure reducer shall be wiped with 75% alcohol or 500mg/L available chlorine disinfectant, then cleaned with clear water and dried for future use. They shall be wiped with disinfectants once a week.

**10. 6 Disinfection Measures**

After the emergency situation is over, the emergency hospital (temporary infectious diseases hospital) shall receive terminal disinfection covering the entire hospital, to ensure environmental safety.

10.6.1 Disinfection Rules

(1) Planning: prepare required disinfectants, instruments, and protective articles in

advance.

(2) Implementation by category zonal disinfection measures are taken according to the varying pollution situations and pollution objects in different areas: preventive disinfection and hygiene management measures for the hygienic area, and terminal disinfection for the contaminated area and potentially contaminated area.

(3) Staff training: staff involved in disinfection shall receive training in advance to know the scope of disinfection, application of protective measures, and precautions for the use of disinfection equipment and disinfectants.

10.6.2 Scope and Objects of Disinfection

(1) Scope: wards, restrooms, contaminated passages, examination rooms, temporary storage rooms for medical waste, elevator cars, potentially contaminated areas, and other areas that may have been contaminated.

(2) Objects: medical equipment, surface of common objects, indoor air, floor, walls, AC system, medical fabrics, patients' secretions, blood, and vomit, toilet bowl, fecal sewage, etc. in the contaminated area.

10.6.3 Disinfection Methods

(1) Disinfection of medical items

Disposable medical items are disposed of as medical waste. Non-disposable medical items shall be soaked with 1000 mg/L chlorine-based disinfectant for at

least 30 minutes, and then disposed of by conventional methods. Expensive medical equipment, such as ECMO, breathing machine, and monitor, shall be handled in strict accordance with their manuals, and other medical equipment, such as sphygmomanometer, oximeter, and defibrillator, can be wiped, soaked, or sprayed with 75% alcohol, 1000 mg/L chlorine-based disinfectant containing available chlorine, or 500 mg/L chlorine dioxide disinfectant based on their corrosion resistance. The disinfectants should be kept for 30 minutes and then wiped clean with clear water.

(2) Disinfection of object surface

Small surfaces or personal electronic products can be disinfected with 75% alcohol. Bedsteads, nightstands, furniture, call devices, sickbed handles, door handles, power switches, faucets, washbasins, toilet bowls, etc. should be wiped and sprayed with 1000 mg/L chlorine-based disinfectant with available chlorine or 500 mg/L chlorine dioxide disinfectant. Assembled items, such as nightstands, shall have their drawers and doors opened, and with both interior and exterior properly sprayed or wiped.

(3) Indoor air disinfection

Rooms (without persons) can be disinfected with 0.2% peracetic acid, 3% hydrogen peroxide, or 500 mg/L chlorine dioxide at the dosage of 10–20 ml/$m^3$ for 1-hour

ultra-low volume spray disinfection. If conditions permit, a disinfection robot can be used for air disinfection.

(4) Disinfection of ground and wall surface

If the surface has any contaminants visible to the naked eyes, they shall be removed before disinfection. When there are no pollutants visible to the naked eyes, the surface can be wiped or sprayed with 1000 mg/L chlorine-based disinfectant with available chlorine or 500 mg/L chlorine dioxide disinfectant. The ground shall be sprayed once from outside to inside, with a spraying amount of 100–300 ml/$m^2$, and after indoor disinfection, sprayed again from inside to outside. Disinfection shall last at least 30 minutes.

(5) Disinfection of air conditioning (AC) system

The AC system, if having its air supply vent and return air vent effectively blocked before the emergency hospital is put into operation, only needs to be cleaned and disinfected by the normal procedure, without special disinfection.

The AC system that may have been contaminated, may have its air supply vent and return air vent blocked with plastic film for more than 30 days if it can be suspended. The AC system to be reused after the suspension shall have its indoor components (grille and frame batten of the air supply vent and return air vent) cleaned and filter screen replaced. The AC system that may have been contaminated, if it is required

to be put into use as soon as possible, shall be cleaned and disinfected by a qualified central air-conditioning cleaning company entrusted, and must not be put into use until meeting relevant indicators.

(6) Disinfection of medical fabrics

Disposable medical fabrics are incinerated as medical waste. Non-disposable fabrics can be disinfected by circulating steam or boiling for 30 minutes, or soaked in 500 mg/L chlorine-based disinfectants containing available chlorine for 30 minutes, or soaked in clothing disinfectant before normal cleaning, or packed in a water-soluble bag and directly put into the washing machine for 30-minute washing and disinfection while keeping the content of available chlorine at 500 mg/L.

(7) Disinfection for patients' secretions

Few contaminants can be carefully wiped out with disposable absorbent materials (gauze, rags, etc.) dipped with 5000–10000 mg/L chlorine-based disinfectant with available chlorine (or wet /dry wipes capable of reaching high-level disinfection). Massive contaminants shall be completely covered with disinfectant powder or bleaching powder with absorbent ingredients, or completely covered with disposable absorbent materials and watered with 5000–10000 mg/L chlorine-based disinfectant with available chlorine on these materials for over 30-minute reaction (or covered with dry wipes capable of reaching high-level disinfection) before they

are wiped carefully.

Patients' secretions and vomit shall be collected in special containers and soaked with 20,000 mg/L chlorine-based disinfectants containing available chlorine at the ratio of 1:2 (secretions/vomit to disinfectant).

Staff should avoid contact with contaminants during the cleaning process, and removed contaminants shall be disposed of as medical waste. After contaminants are removed, the surface of the contaminated environmental objects shall be disinfected. Containers holding contaminants can be soaked in 5000 mg/L chlorine-based disinfectants containing available chlorine for 30 minutes, and then cleaned.

(8) Disinfection of fecal sewage

If an independent septic tank is available, fecal sewage needs to be disinfected before entering the municipal drainage pipe network. The septic tank is regularly provided with the chlorine-based disinfectant, and the total residual chlorine shall reach 6.5mg/L–10 mg/L after 1.5-hour disinfection. After disinfection, the sewage shall conform to relevant requirements.

If the independent septic tank is unavailable, excrement shall be collected with special containers and disinfected before discharge. Excrement shall be soaked with 20000 mg/L chlorine-based disinfectant containing available chlorine at the ratio of 1:2 (excrement to disinfectant) for 2 hours, while massive diluted excrement (if any)

shall be fully mixed with dry bleaching powder containing 70%–80% available chlorine at the ratio of 20:1 (excrement to disinfectant) for 2-hour disinfection.

(9) Disinfection process

Disinfection in the contaminated area shall follow the order from mild contamination to severe contamination. Objects to be disinfected shall be handled according to the degree of infection risk (from high to low). It is recommended to preferentially disinfect indoor air, before the object surface and contaminants. During disinfection, staff can spray and retreat, or spray and advance laterally, and watch their steps.

(10) Air disinfection process

After the emergency requisition is over, if the hospital needs to be put into service again in a short time, operators can open windows or start the mechanical forced air exhaust for 1 hour, and later wrap or cover valuable medical equipment, close doors/windows and turn off the exhaust system before carrying out air disinfection with an ultra-low volume of chemical disinfectant.

Close doors/windows and turn off the exhaust system, turn on the ultraviolet lamp and/or dynamic air disinfecting machine with circulating wind for 1-hour air disinfection, then wrap/cover valuable medical equipment and launch air disinfection with an ultra-low volume of chemical disinfectant.

(11) Disinfection of object surface

Clean up articles, pack up beddings and medical fabrics, and remove medical waste. Remove contaminants visible to the naked eye.

Spray to disinfect the walls and floor from outdoor to indoor following the sequence from top to bottom and from left to right, and pay attention to the covered parts of furniture and avoid any omissions. After 30-minute disinfection on the object surface, open the doors and windows for ventilation and wipe the object surface with clear water as required to remove the residual disinfectant.

10.6.4 Personal Protection

When preparing and using chemical disinfectants, onsite disinfection staff shall take personal protection measures, master the applicable scenarios and usage of protective equipment, and be able to put on and take off protective articles correctly and deftly.

Staff assisting in preparing disinfectants in the hygienic area shall take Class-I protection measures and wear the disposable working cap/round cap, disposable isolation suit/white gown, surgical mask, goggles, latex/nitrile gloves, elbow-length rubber gloves, and waterproof boots/rubber boots.

Disinfection staff entering the isolation ward and treatment area shall take Class-II protection measures and wear the disposable working cap/round cap, medical

protective mask, disposable isolation suit, medical protection suit, goggles, face shield, latex/nitrile gloves, rubber gloves, and waterproof boots/rubber boots.

## 11 Explanation of Wording in the Standard

11.1 The words with different semantic emphases are described below to make a difference for implementing provisions of these Guidelines.

11.1.1 Wording for extreme strictness, indicating that it must be done in this way:

"Must" is employed for positive wording, while “must not” is employed for negative wording.

11.1.2 Wording for strictness, indicating that it shall be done in this way under normal conditions:

"Shall" is employed for positive wording, while "shall not" is employed for negative wording.

11.1.3 Wording for limited options, indicating that it shall be first done in this way if conditions permit:

"Should" is employed for positive wording, while "should not" is employed for negative wording.

11.1.4 Wording for options, indicating that it may be done in this way under certain conditions: "May" is employed.

11.2 The wording indicating that it shall be implemented as per relevant standards comes in this way: "shall conform to the provisions of …" or "shall be implemented as per…".