

WATER SUPPLIES DEPARTMENT
STANDARD SPECIFICATION EM-02-10
CHLORINE ROOM VENTILATION

This specification shall be read in conjunction with the following WSD Standard Specifications :

- (a) EM-02-01 - Chlorine Plant – General and Design;
- (b) EM-02-04 - Chlorine Gas Detection System;
- (c) EM-02-08 - Chlorine Plant Process Control Panel; and
- (d) EM-02-12 - Chlorine Scrubber System.

1. **VENTILATION CAPACITY**

For all types of chlorine rooms, for both equipment and store, the air change rate shall be not less than 18m³/hr per square metre of floor area.

2. **VENTILATION ARRANGEMENT**

2.1. **General**

The ventilation system shall have naturally aspirated intake and forced exhaust. All the air intakes and the exhausts shall be located at the highest possible level or at roof. Exhaust air shall be collected inside the room at low level and ducted to the exhaust opening for discharge. The air intakes, exhausts and ducts shall be so arranged that no stagnant air pockets shall be created inside the room and no exhaust air shall be drawn into the intake.

The capacity, construction and layout of the ventilation system shall meet the requirements and approval of the Fire Services Department (FSD).

2.2. **Ventilation Fans and Ancillary Equipment**

Ventilation fans and ancillary equipment shall be suitable for 380V 3-phase or 220V single phase 50 Hz supply.

Equipment such as fan motor enclosures, fan blades, fan housings, louvres and ventilation ducts which are susceptible to be attacked by the chemical fume in the plant room shall be protected with suitable chemical resistant coating.

2.3. Ventilation Ducts

Ductwork provided shall comply with the latest edition of the Specification for Sheet Metal Ductwork issued by the Heating and Ventilating Contractors' Association (HVCA) (DW/144), and shall be constructed from stainless steel sheet, grade 316 or above.

Minimum sheet thicknesses of stainless steel ductwork shall conform to relevant tables in DW/144. The ducts shall be supplied and installed true in section and free of twist and distortion.

The ducts shall be so constructed that pressure losses due to eddies or vortices are minimised and no noise or vibration is created or transmitted. Face panels shall be stiffened and creased to prevent "drumming".

All ductwork shall be secured by hangers, brackets or other appropriate means of support. Flexible joints shall be provided at fan inlet and outlet connections. All ducting, accessories such as hangers, brackets, bolts & nuts shall be made from stainless steel, grade 316 or above.

Access doors shall be provided for the maintenance and inspection of equipment (e.g. thermostats, fire dampers, and fire and smoke dampers) installed in the ductwork. Access platforms shall be provided for such equipment items when they are located at high level.

Fiberglass ducting is acceptable, but it shall comply with BS 476 : Part 6 or equivalent with fire propagation index meeting latest FSD requirements and be approved by FSD.

A safety interlock shall be provided between the chlorine ventilation system and the chlorine scrubber system, where provided, to make sure that all ventilation louvres in the room will be properly closed in the presence of chlorine leak at or above 3 ppm.

For all exhaust air ducts, indicative type of non-return dampers shall be used in the chlorine plant area. The ventilation air ducts and dampers connecting to the chlorine scrubber system shall also meet the detailed requirements of WSD Standard Specification EM-02-12.

The nominal air speed inside the duct shall not exceed 10 m/s. Multiple duty and standby ventilation fans may share one duct provided that the specified air speed and the sound level are not exceeded when the designed maximum number of fans is running and that no short circuit paths are created when not all fans are running.

2.4. Inlets and Outlets

Stainless steel fixed louvres with removable wire mesh screens shall be provided for the air inlets and outlets. The nominal air speed through the intake louvres shall not exceed 2.5 m/s.

2.5. Louvre Shutters

In addition to the fixed louvres, automatic louvre shutters shall be provided to prevent chlorine gas from escaping into the atmosphere in the event of a leak. The inlet shutters shall be electrically operated and interlocked with the respective fan starters. The outlet shutters shall be operated by the air flow either mechanically or by gravity means.

2.6. Fire Dampers

Fire dampers shall be provided in air ducts at the following locations for fire compartmentation:

- (a) where a duct passes through a floor slab or a fire resisting wall which is expressly built for the purpose of preventing the spread of fire;
- (b) other locations as required by the Building (Ventilating Systems) Regulations, Hong Kong; and

Unless a damper is deemed to be unsuitable, un-insulated stainless steel folded fire damper having unbroken joints and comprising of stainless steel constant tension closure springs and stainless steel peripheral gasket shall be provided and installed in the line of the cavity barrier, fire wall or compartment wall/floor through which the ductwork passes.

The Contractor, who shall be a registered fire service contractor, shall certify the completed works including ductwork are installed in compliance with the damper manufacturer's recommendations and FSD requirements.

2.7. Motorised Fire and Smoke Dampers

Motorised fire and smoke dampers shall be provided and installed in the protected areas, where specified by Buildings Department, to meet the FSD requirements. The motorised fire and smoke damper shall be corrosion resistant with 2 hours of Fire Resistant Period. The dampers, which are actuated by smoke detectors located in the protected area and adjoining compartment, shall be manufactured and constructed to BS 476 or equivalent.

In addition to the externally replaceable failsafe electric sensor, the damper shall be normally held by electromagnet with power consumption not more than 3W and released to the closed, or fail safe position on loss of power supply.

3. VENTILATION EQUIPMENT

3.1 Design

Fans shall be driven by squirrel cage induction motors to IEC 60034 with IP55 enclosure and class B insulation. All equipment used in chlorine rooms shall be of industrial safety type approved by FSD.

3.2. Fan Capacity

The fan capacity shall be determined with the following consideration :

- (a) The required ventilation rate in the room
- (b) Pressure drops associated with ducts and louvres
- (c) Back pressure at the exhaust not less than 5mm w.g.
- (d) Fan speed not exceeding 1500 r.p.m.

3.3. Noise Level

The sound pressure level caused by the ventilation system, at any frequency, measured at 1 metre shall not exceed 75 dBA.

4. **VENTILATION MONITORING AND CONTROL**

4.1. Chlorine Plant Ventilation Control Panel

- (a) The Chlorine Plant Ventilation Control Panel (CPVCP) shall interface with the Distribution Control System (DCS) and Emergency Control Panel at the Main Control Room. The panel shall be programmable logic controller (PLC) based with power supply equipment, touch screen panels and accessories to relay all the analogue, control, alarm and status signals from the chlorine gas detection, ventilation and chlorine scrubber (where provided) systems. It shall be compatible in appearance and size to the Chlorine Plant Process Control Panel (CPPCP) as stipulated in WSD Standard Specification EM-02-08, both of which shall be housed in the Chlorine Control Room.
- (b) The panel shall be designed for monitoring of the concerned systems and initiation of the chlorine emergency operation. The independent manual operation of each field equipment such as ventilation fan, damper, motorised louvre and pump shall be performed at the respective local control panels if provided.
- (c) When protection is set at "In" position, upon receiving a high chlorine leak alarm transmitted by chlorine detectors, or initiated manually by pressing a manual call point, emergency push buttons installed at the Chlorine Control Room and Main Control Room, the following control functions shall be activated automatically.
 - (i) To sound the "High Chlorine Leak " alarm.
 - (ii) To shut down the ventilation fans.

- (iii) To close the dampers of the ventilation ducts.
 - (iv) To close all air inlet louvers.
 - (v) To operate the chlorine scrubbing system if provided via the scrubber local control panel.
 - (vi) To shut off the chlorine supply from the chlorine containers via the CPPCP.
 - (vii) To trip the power supply for the evaporator heating (if applicable) via the CPPCP.
 - (viii) To transmit an alarm signal to FSD via the Automatic Fire Alarm Panel.
- (d) When protection is set at "Out" position, upon receiving a high chlorine leak alarm transmitted by chlorine detectors, or initiated manually by pressing a manual call point, emergency push buttons installed at the Chlorine Control Room and Main Control Room, only the control functions at items (i) to (v) of sub-Clause (c) above shall be operated without interrupting the chlorine process plant at items (vi) and (vii) above.
- (e) The transmission of the high chlorine leak alarm, chlorine leak evacuation alarm, evacuation system test alarm and all control signals shall be via hardwire connection. The control circuits shall be implemented in relay logic.
- (f) The PLC equipment and its power supply equipment shall be in compliance with Part 2 of WSD Standard Specification EM-02-08.
- (g) Two 19-inch touch screens shall be provided, one for the chlorine gas detection system and another for the ventilation and scrubber systems. Mimic diagrams, one for overview of the whole system and one for each of the sub-systems, shall be provided for monitoring of the chlorine system as follows :

Each Chlorine Gas Detection Zone

- "High Chlorine Leak" alarm
- Chlorine leak detection protection "Out" alarm
- Chlorine Leak Alarm Test "On / Off" indication
- "Chlorine Call Point Pressed" alarm
- "Chlorine Emergency Push Button Operated" alarm
- "Wind speed" indication
- "Wind direction" indication

Each Chlorine Leak Detector

- "Power Supply On" indication
- "Detector Faulty" alarm
- "High Chlorine Leak" alarm (normally set at 3p.p.m.)
- "Low Chlorine Leak" alarm (normally set at 1p.p.m.)
- "Gas Concentration" display

Each Ventilation Zone

- "Duty Ventilation Fan" indication
- "On / Off" status of ventilation fan
- "Open / Close" status of motorised louvers and dampers
- "Tripped" alarm of ventilation fans
- "Control Not Available" alarm

Each Chlorine Scrubber System

- "Discharge Stack Chlorine Concentration" (0-20 p.p.m.) indication
- "Sodium Hydroxide Solution Temperature" (0-60°C) and "pH" (1-14) indications
- "Solution Tank Level" indication
- "Duty Pump" and "Duty Fan" indications
- "On / Off" status for each of the mixer, pumps and fans
- "Open / Close" status for each of dampers
- "Tripped" alarm for each of the mixers, pumps and fans
- "Fault" alarm for each of dampers
- "Scrubber System Failed" alarm
- "Sodium Hydroxide Solution Temperature High" alarm
- "Sodium Hydroxide Solution Level High" alarm
- "Sodium Hydroxide Solution Level Low" alarm
- "Sodium Hydroxide Solution No-Flow" alarm
- "No Air Flow" alarm
- "Power Supply Failed" alarm
- "Scrubber System Not on Auto" alarm
- "Scrubber System Running" indication
- "Scrubber Discharge Chlorine Concentration High" alarm
- "Chlorine Leak in Scrubber Room" alarm
- "Control Not Available" alarm

(h) The panel shall conform to WSD Standard Specification E-11-03 with enclosure of IP 54 to IEC 60529 and equipped and complete with the following additional monitoring and control equipment :

(i)

- "Chlorine Leak Alarm Test" alarm indication
- "Chlorine Leak Evacuation" alarm indication
- "Chlorine Room Door Opened" indication (for each door)
- "Communication Link to DCS Healthy" indication
- "AC Power Supply On" indication
- "DC Power Supply On" indication

(ii) Chlorine Room Ventilation System Monitoring (each ventilation zone)

- "Control Not Available" indication

(iii) Chlorine Scrubber System Monitoring (each system)

- "Scrubber System Failed" indication
- "Scrubber System Running" indication

- "Scrubber Discharge Chlorine Concentration High" indication
- "Chlorine Leak in Scrubber Room" indication
- "Control Not Available" indication

(iv) Other Controls

- A selector switch for "DC/Auto/AC" power supply selection
- "Test Lamp" push button and relay indications
- A selector switch for chlorine leak protection "In/Out" selection (one for each chlorine zone)
- A stay-put type push button for initiation of "Chlorine Leak " alarm (one for each zone)
- A stay-put type push button for initiation of "Evacuation " alarm
- Two push buttons for muting and resetting of "Chlorine Leak" alarm

- (i) Panel heater, fuses, relays, timers, stabilised power supply units, terminal blocks and other wiring accessories required shall be provided.

4.2. Ventilation Local Control Panel

A Ventilation Local Control Panel (VLCP) shall be provided for each chlorine room. The panel shall be wall mounted near the entrance. The panel shall conform to WSD Standard Specification E-11-03 with enclosure of IP 65 to IEC 60529.

When the control mode selector switch is set at the "Manual" position, "Control Not Available" alarm shall be initiated at the CPVCP. The independent manual control of each ventilation fan, motorised air inlet louvre and damper shall be available by overriding the chlorine leak interlocks in the control circuits.

When the control mode selector switch is set at the "Auto" position, the ventilation system shall be controlled by the CPVCP.

The following equipment shall be provided in this panel :

- Motorised louvre controllers
- 2-position key operated "Manual/ Auto" selector switch
- "Start" and "Stop" illuminated pushbuttons for each fan
- "Open" and "Close" illuminated pushbuttons for each inlet motorised louver
- "Open / Close" illuminated pushbuttons for each motorised damper
- "Tripped" indication lamp for each fan
- Repeat contacts for remote "Fan Tripped" and "Control Not Available" alarm initiation at the CPVCP

If there is only one ventilation zone at the chlorine plant, the function of VLCP can be integrated with the CPVCP.