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22 VENTILATION SYSTEMS

22.1 GENERAL

22.1.1 Scope

1 This part specifies the particular requirement for the ventilation systems for sewerage and sewage treatment installations. This section is to be read in conjunction with Section 22. Where there is conflict then the requirements of this Section shall prevail.

2 Related Sections and Parts are as follows:

Section 1	General
Section 8	Drainage Works
Section 10	Instrumentation, Control and Automation
Section 13	Building Electrical Works
Section 21	Electrical Works
Section 22	Air Conditioning, Refrigeration and Ventilation

22.1.2 Noise Level

1 The noise level due to ventilation and air conditioning equipment shall be no greater than sound power level 65dB(A) at one metre.

2 The Contractor shall include for sound absorbers and anti-vibration mountings as necessary.

22.1.3 Inlets and Outlets

1 All inlets and outlets through the roof shall be fitted with approved GRP or Aluminium cowls and bird screens. All inlets and outlets through walls shall be fitted with demountable aluminium louvers. All materials used for external fittings shall be highly resistant to ultra-violet light.

2 All louvers shall be of the sand trap type and shall be fitted with internal sand filters and mosquito screens.

22.1.4 References

BS 970-1 Specification for wrought steels for mechanical and allied engineering purposes - General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels; (ISO 683-1 Heat-treatable steels, alloy steels and free-cutting steels — Part 1: Non-alloy steels for quenching and tempering; ISO 683-2 Heat-treatable steels, alloy steels and free-cutting steels — Part 2: Alloy steels for quenching and tempering; ISO 683-3 Heat-treatable steels, alloy steels and free-cutting steels — Part 3: Case-hardening steels; ISO 683-4 Heat-treatable steels, alloy steels and free-cutting steels — Part 4: Free-cutting steels; ISO 683-5 Heat treatable steels, alloy steels and free-cutting steels — Part 5: Nitriding steels; EN 10250-4: Open die steel forgings for general engineering purposes - Stainless steels; EN 10095 Heat resisting steels and nickel alloys; BSI PD 970 Wrought steels for mechanical and allied engineering purposes. Requirements for carbon, carbon manganese and alloy hot worked or cold finished steels)

EN 10084 Case hardening steels - Technical delivery conditions; (ISO 683-3 Heat-treatable steels, alloy steels and free-cutting steels — Part 3: Case-hardening steels)

22.2 VENTILATION SYSTEMS

22.2.1 Ventilation Rates

1	The minimum number of air changes per hour shall be:	
	Toilets	12
	Stores	12
	Workshops	15
	Garages/Car park areas	12
	Messes (two speed)	6 – 20
	Motor Room	10 – 20
	Dry Well	20
	Covered areas containing untreated sewage	6 when covered rising to 20 prior to and during man entry

22.2.2 Wet Well Ventilation/Process Area Ventilation

- Ventilation equipment shall ensure that at all times the wet well area is not hazardous to operators, during operation or shut down of the pumping plant. It should be noted that the gases given off by sewage may include methane (marsh gas), carbon dioxide, nitrogen, oxygen, hydrogen, hydrogen sulphide, water vapour and other constituents. In naturally ventilated wet wells/process area levels of hydrogen sulphide of up to 100 ppm are common and concentrations in excess of 400 ppm have been measured. Methane concentrations above the lower explosive limit are possible. This should be borne in mind when designing the ventilation system and odour control systems.
- The system shall be capable of treating the specified H₂S concentration such that the operating mean H₂S level in the well does not exceed 3 ppm. Removable cell type deodorisers shall not require filter replacement in a period less than 6 months. Bulk carbon deodorisers shall not require carbon regeneration in a period less than 2 years. Pelletised activated caustic or water regenerable carbon shall be used for the bulk type deodorizer units.
- Where H₂S levels are likely to exceed 20 ppm, a chemical scrubber of other suitable pre-filter shall be provided before a carbon filter.
- The system shall operate on the principle of forced draught ducted outlet/natural ducted inlets and account shall be taken of the fact that the gases to be handled have differing specific gravities. The high and low level ducted inlets and outlets should span the width of the wet well so that there is a constant sweep of clean air across the wet well.
- A complete fan/motor assembly shall be provided as a spare. This shall include the fan housing on the bulk carbon deodorisers.
- On bulk carbon deodoriser systems a flow switch shall be fitted into the extract ductwork to actuate an alarm on the annunciator in the event of failure of the extract system.
- In the event of failure of the wet well ventilation red rotating beacon, high intensity, alarm lights shall be illuminated adjacent to each wet well access door.
- The extract shall be through a Deodoriser unit as specified elsewhere to remove obnoxious smells.

- 9 Warning labels worded as follows in English and Arabic shall be fitted at each alarm light location.

WARNING
DO NOT ENTER WHEN RED LIGHT IS ON
NO NAKED LIGHTS AT ANY TIME

- 10 Two identical systems shall be provided, each capable of providing 60% of the overall design requirement for ventilation.
- 11 The treated air shall be discharged into the atmosphere via a stack which shall extend above the height of the building.

22.2.3 Dry Well Ventilation

- 1 The system shall operate on the principle of forced draught outlet/ natural ventilation inlet via the stairways and other apertures.
- 2 Fans shall be of the double motor type having a standby motor which comes into operation should the duty motor fail. Alternatively two complete fans and motors shall be provided and installed to act as duty and standby.
- 3 Two identical systems shall be provided, each capable of providing 60% of the overall design requirement for ventilation.

22.2.4 Motor Room Ventilation

- 1 The system shall operate on the principle of forced draught outlet/ natural ventilation inlet via inlet louvers. All inlet louvers shall be fitted with 2" thick metallic washable filters. Access shall be provided for cleaning/changing filters.
- 2 Fans shall be of the double motor type having a standby motor which comes into operation should the duty motor fail. Alternatively two complete fans and motors shall be provided and installed to act as duty and standby.
- 3 Two identical systems shall be provided, each capable of providing 60% of the overall design requirement for ventilation.

22.2.5 Fans

- 1 Fans shall be of the axial flow or centrifugal types suitable for handling air of high humidity and having concentrations of hydrogen sulphide.
- 2 They shall be of non ferrous construction or be protected with suitable epoxy resin coatings.
- 3 Odour Control fans shall be constructed entirely from stainless steel Grade 316 S31 to BS 970-1 (partially replaced by EN 10084) or fibreglass reinforced plastic of vinyl ester resin.
- 4 For deodorizer fan units, bearings shall be of the roller or ball type and shall be mounted using adaptor sleeves and plumber blocks with provision for lubrication. Sealed bearings shall be used for small fan units in dry well/motor room ventilation system.

22.2.6 Fan Motors

- 1 Fan motors shall be suitable for continuous operation in hot, humid atmospheres at an ambient temperature of up to 55°C at 100% humidity.
- 2 The degree of protection shall be IP55 and for the wet well a classification of Ex N IIA T3 or better is required.

- 3 All motors shall comply with the section of this Specification headed "Motors" insofar as it applies.

22.2.7 Ducting

- 1 Ventilation ducting shall be of GRP, Reinforced uPVC or Stainless Steel to BS 970, Grade 316 S31. Material thickness, stiffening and joint arrangements shall not be of a standard lower than those set out in the Chartered Institution of Building Services (C.I.B.S), Guide (Section B3) 1983 Edition.
- 2 Ducting shall be complete with all necessary supports. Galvanised or stainless steel nuts and bolts shall be used for all ducting joints and all supports and brackets shall be galvanised. All supports, ducting, brackets and fixings in wet wells shall be stainless steel as specified elsewhere.
- 3 Ducting shall be sized so that the air velocity within the ducts shall not exceed 5.5 metres per second.
- 4 Flexible connections and anti-vibration mountings shall be provided as necessary between the ductwork and fans and provision shall be made for thermal expansion.
- 5 Where ducts pass through the roof or floor slab the gap shall be sealed with polystyrene or similar approved material. Wood is not acceptable.

END OF PART