WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION EM-01-02

CENTRALISED DUST EXTRACTION AND FILTRATION SYSTEM FOR LIME STORES

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1. GENERAL

A centralised dust extraction and filtration system shall be provided for extraction and filtration of lime powder and debris that are deposited on the floor, and on the surface of plant and platform inside a lime store. This Specification does not cover the extraction and filtration requirements for individual plant and equipment.

2. DESIGN

2.1 General

The centralised dust extraction and filtration system supplied shall comprise electrically driven vacuum air extraction unit, dust filtration unit, fixed pipework, flexible hoses, switchgear, control cubicle, accessories etc. Access and facilities shall be provided for the inspection and maintenance of the equipment including the unloading and cleaning of the extracted powder and debris inside the system.

The whole dust extraction and filtration system shall be suitable for lime and capable of withstanding the highest vacuum pressure created even when there is a complete blockage of the system. Unless otherwise specified in the Particular Specification, the system shall be designed to allow simultaneous operation of at least any two connection points of the system for dust extraction and filtration, and shall comply with the following requirements under the maximum rating condition:

Minimum air flow rate and vacuum pressure created:	5 m^3/min at 20 kPa
Minimum air flow velocity inside pipework and flexible hose:	18 m/s
Maximum sound pressure level at any point 1 m away from the noise source:	85 dB(A)

2.2 Vacuum Air Extraction Unit

The air extraction fan of the vacuum air extraction unit shall be a standard product of proven performance supplied from a manufacturer. The unit shall be made of

steel and suitably reinforced to form a robust structure. All metal surfaces for the unit construction shall be coated with chemical and corrosion resistant material, which shall be submitted for approval/acceptance prior to application.

The air extraction fan shall be sized to cope with the pressure drop across all filters, fixed pipework, flexible hoses and accessories under the maximum rating condition of the system. A vacuum pressure gauge shall be provided at the inlet of air extractor for indication of vacuum pressure created. Protective devices shall be provided to switch off the plant and protect the air extraction unit when there is a complete blockage in the vacuum pipework for a long period of time, with alarm indication at the local and remote control panels as appropriate.

2.3 Dust Filtration Unit

The dust filtration unit shall consist of a two-stage filtration with an overall efficiency of 99% or above. Each stage shall be provided with a dust collection bin for the collection of expelled dust and debris during the filtration process. The bin shall be connected to the housing of the filtration unit tightly and equipped with quick release device and casters for easy removal.

First-stage Filtration:

The first-stage filtration shall be in the form of a cyclone separator for separating large particles. The Contractor shall design and select the size of particles to be removed and advise about the removal efficiency of the cyclone separator under normal operating condition. The expelled particles from the cyclone separator shall be collected by the dust collection bin.

Second-stage Filtration:

The second-stage filtration shall be in the form of a filter unit for filtering out fine particles. The filter element shall be made of suitable chemical resistant material and certified to IEC 60335-2-69 Class L or better. It shall be cleaned by water, reverse air jet or compressed air when necessary.

In addition, a self-cleaning device shall be provided for the filter media, the operation of which shall be initiated automatically after each vacuum cleaning operation. The device shall be operated by electrical means, but other means of operation such as by compressed air shall be acceptable if all the associated equipment are provided by the Contractor at no extra cost.

The filtration unit shall be capable of satisfactory operation continuously for extracting and filtering no less than 10 kg of lime powder after each self-cleaning process. The Contractor shall make allowance for the lower efficiency of the filter media after being used.

2.4 System Exhaust

Requirements on the air discharge outlet on downstream of the filtration unit shall be specified in the Particular Specification. If the exhaust outlet is inside the chemical store, it shall be positioned at low level so as to minimize dispersion of the residual particles. Where necessary, silencers shall be provided at the exhaust outlet for noise suppression to the requirement as stipulated in Section 2.1 above.

2.5 Water Scrubber

Where specified in the Particular Specification, water scrubber shall be provided for further treatment of air before discharging.

2.6 Fixed Extraction Pipework

The fixed extraction pipework of the system shall be made of grade 304 stainless steel piping with adequate strength and rating for withstanding the highest vacuum pressure so generated. If other materials are used, the Contractor shall submit details of the materials to the Engineer for approval or *Project Manager* for acceptance prior to fabrication. The pipework shall be installed at high level as far as possible with the hose connection points provided at low level for further connection to flexible hoses for dust extraction when required.

The number of hose connection points shall be specified in the Particular Specification with their locations indicated in the general layout drawing of the lime store. The Contractor shall submit the layout arrangement of the extraction and filtration system together with the pipework and the hose connection points for approval prior to the commencement of installation works on site. The pipework shall include the provision of removable fittings at strategic turning points and positions to facilitate inspection and cleaning. Grade 304 stainless steel pipe supports shall be provided at intervals of 2.5m or shorter. Each hose connection point shall be equipped with a quick connector complete with auto-closing flap and coarse screen for connecting the flexible hose for dust extraction.

Individual IP65 start/stop control station shall be provided adjacent to each hose connection point to facilitate the operation of dust extraction and filtration system.

2.7 Flexible Hoses

Unless otherwise specified, three sets of flexible hoses (with one set as spare provision) shall be provided for the dust extraction and filtration system. Each set of flexible hoses shall comprise all necessary tools, fittings and accessories including wands, nozzle tubes, dusters, floor sweepers etc. that are required for satisfactory operation and effective performance of extracting lime powder and dust on the floor inside the lime store. The flexible hose and its accessories when

connected to any connection point shall be capable of serving the whole floor area of the lime store.

Unless otherwise specified, a light weight stainless steel box with casters shall be provided for housing and storage of the flexible hoses and all its accessories.

2.8 Electrical Equipment

Electrical equipment shall be powered by a 220V single-phase or 380V three-phase 50 Hz a.c. supply. Motors shall be of the squirrel cage induction type with IP55 enclosures in accordance with IEC 60034-5. The motor power rating shall be not less than 110% of the driven load overall operating conditions. The design of the control panel shall comply with the relevant requirements of WSD Standard Specification E-11-03.

3. INFORMATION FOR EQUIPMENT APPROVAL

3.1 Descriptive Literature and Performance Data

Descriptive literature and performance data related to the centralised dust extraction and filtration system shall be submitted for assessment.

Type test certificates of the filters based on the relevant standards of manufacture and performance shall be submitted for assessment.

3.2 Design Calculations

The Contractor shall submit design calculations for sizing the air extraction unit, filters and pipework, together with the characteristic curves showing the relationship among air flow, vacuum pressure creation and power consumption for approval.

4. TESTING AND COMMISSIONING

4.1 Works Test

The vacuum air extraction unit shall be tested at manufacturer’s works. Curves relating to air flow, vacuum pressure creation and power consumption shall be obtained in the tests. Test reports shall be submitted for approval/acceptance prior to delivery of the plant and equipment.

4.2 Site Test and Commissioning

The Contractor shall carry out site tests on the dust extraction and filtration system after installation to demonstrate compliance with the requirements of the Specification.

The Contractor shall submit detailed test procedures for approval/acceptance prior to testing. The tests shall include, but not limited to, the following when operating under the maximum rating condition:

a) All the specified control functions;
b) The sustainment of the highest vacuum pressure created with the inlets of the vacuum pipework completely blocked;
c) Removal efficiency of the dust filtration unit;
d) Effectiveness of self-cleaning device for filters;
e) Sound pressure level measured at 1 m away from the noise source.

- End of Specification -