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Indian Standard "पुनर्दंड १९९६"

REQUIREMENTS FOR "RE-AFFIRMED 1996"
RAPID SAND GRAVITY
FILTRATION EQUIPMENT

PART 2 UNDERDRAINAGE SYSTEM

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Indian Standard

REQUIREMENTS FOR RAPID SAND GRAVITY FILTRATION EQUIPMENT

PART 2 UNDERDRAINAGE SYSTEM

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Indian Standard

REQUIREMENTS FOR RAPID SAND GRAVITY FILTRATION EQUIPMENT

PART 2 UNDERDRAINAGE SYSTEM

0. F O R E W O R D

0.1 This Indian Standard (Part 2) was adopted by the Indian Standards Institution on 31 August 1984, after the draft finalized by the Public Health Engineering Equipment Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Underdrainage systems in a rapid sand gravity filter perform two main functions:

- a) To collect filtered water uniformly through out the filter bed area and carry it to outlet chambers.
- b) To distribute compressed air, where provided and wash water during washing operation in such a fashion that entire portion of the bed perform the same amount of work.

0.2.1 Since the rate of wash water is many times that of filtration, the design of underdrains is governed by upflow requirements.

0.3 Part 1 of this Standard covers requirements for filter sand and gravel and this part covers requirements for underdrainage system.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part 2) lays down the requirements of pipe grid types and false bottom floor types underdrainage system of filtration equipment for water treatment plants.

2. PIPE GRID TYPES

2.0 There are two types of underdrainage system:

- a) Pipe grid without nozzles, and
- b) Pipe grid with nozzles.

2.1 Without Nozzle Type

2.1.1 This comprises a main called manifold or header and perforated laterals.

2.1.2 *Material of Construction* — Material of construction for pipe grid without nozzles underdrainage system is given in Table 1.

2.1.3 Construction

2.1.3.1 The manifold is in the form of pipe or RCC duct below the floor of filter. Top of this duct should be covered by *in-situ* RCC slab of minimum grade M-20 leaving one or two convenient gaps to remove shuttering. These gaps are covered with precast slabs. The size of precast slab should not exceed 0.6 m² in area. Precast slabs reinforcements are jointed with floor reinforcement and concrete is poured for floor, covering precast slab joints also.

NOTE — No reinforcement/MS bars should be left exposed since these are likely to be corroded.

2.1.3.2 Perforations should be drilled into the laterals in a single row of orifices directed vertically downward or in two rows as pair of orifices directed downward at a suitable angle on either side of the vertical diameter and spacing of orifices/perforations will be governed by the hydraulic design.

2.2 With Nozzles Type

2.2.1 This comprises a main called manifold or header and laterals with nozzles.

2.2.2 *Material of Construction* — Material of construction of pipe grid with nozzle underdrainage system is given in Table 2.

TABLE 1 MATERIAL OF CONSTRUCTION OF UNDERDRAINAGE SYSTEM (PIPE GRID WITHOUT NOZZLE)

(Clause 2.1.2)

SL No.	COMPONENTS	MATERIALS	REF TO IS
1	Manifold	AC pressure pipe	IS : 1592-1980*
		Unplasticized PVC pipes	IS : 4985-1981†
		HDPE pipes	IS : 4984-1978‡
		RCC	Grade M-20 of IS : 456-1978§
2	Laterals	AC pressure pipe	IS : 1592-1980*
		Cast iron pipe	IS : 1536-1976
		Unplasticized PVC pipes	IS : 4985-1981†
		HDPE pipes	IS : 4984-1978‡
3	'O' Rings	Rubber	IS : 5382-1969¶
4	Saddle	Cast iron	IS : 210-1978**
		RCC	(Grade FG 15) M-20 of IS : 456-1978§
5	Tee	RCC	M-20 of IS : 456-1978§
		Unplasticized PVC	—
		HDPE	—
6	Clamp	Stainless steel	Grade 04Cr18Ni11 of IS : 1570 (Part 5)-1972††
		Stainless steel	-do-

*Specification for asbestos cement pressure pipes (*second revision*).†Specification for unplasticized PVC pipes for potable water supplies (*first revision*).‡Specification for high density polyethylene pipes for potable water supplies, sewage and industrial effluents (*second revision*).§Code of practice for plain and reinforced concrete (*third revision*).||Specification for centrifugally cast (spun iron pressure pipes for water, gas and sewage) (*second revision*).

¶Specification for rubber sealing rings for gas mains, water mains and sewers.

**Specification for grey iron castings (*third revision*).††Schedule for wrought steels for general engineering purposes: Part 5 Stainless and heat-resisting steels (*first revision*).

2.2.3 Construction

2.2.3.1 The filter floor should consist of a series of lateral pipes each connecting to a central channel or manifold and fitted with nozzles. The pipes should have holes on the top to receive bosses, or 'nozzle plates' in which the nozzles are screwed. The portions of the pipes bridging the channel, formed in the floor of the filter tank should have slots on the undersides. All the pipes should be grouted to the floor and embedded

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in concrete with suitable reinforcement, after which the hole should be screeded to a smooth surface flush with the upper faces of the nozzle plates. The nozzles should then be screwed into the position.

TABLE 2 MATERIAL OF CONSTRUCTION OF UNDERDRAINAGE SYSTEM (PIPE GRID WITH NOZZLE)

(Clause 2.2.2)

Sl. No.	COMPONENTS	MATERIALS	REF TO IS
1	Manifold	RCC	Grade M-20 of IS : 456-1978*
		Unplasticized PVC pipes	IS : 4985-1981†
		AC pressure pipe	IS : 1592-1980‡
		HDPE pipes	IS : 4984-1978§
2	Laterals	Glazed stoneware pipes	IS : 651-1980
		Unplasticized PVC pipes	IS : 4985-1981†
		HDPE pipes	IS : 4984-1978§
3	Nozzles	Unplasticized PVC	
		Cast iron	
		HDPE	
		Brass	
4	Reinforcing rods/ hook bolts	Mild steel	IS : 432 (Part 1) - 1982¶
5	Binding wire	Mild steel	IS : 280-1978**
6	Asbestos strips	Asbestos	

*Code of practice for plain and reinforced concrete (*third revision*).

†Specification for unplasticized PVC pipes for potable water supplies (*first revision*).

‡Specification for asbestos cement pressure pipes (*second revision*).

§Specification for high density polyethylene pipes for potable water supplies, sewage and industrial effluents (*second revision*).

||Specification for salt-glazed stoneware pipes and fittings (*fourth revision*).

¶Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part 1 Mild steel and medium tensile steel bars (*third revision*).

**Specification for mild steel wire for general engineering purpose (*third revision*).

2.2.3.2 The compressed air for the aircour where provided should be brought through header pipes, located at angles to the floor laterals. The headers are tapped and fitted with small bore tubes connecting into the laterals through additional bosses similar to those for the nozzles.

2.2.3.3 The pipe for the filtered water outlet and upwash inlet should be connected into the manifold at the front end of the filter.

3. FALSE BOTTOM FLOOR TYPE

3.1 Filter floors which replace pipe side, serve two functions: (a) support the filter bed, and (b) create a waterway beneath the filter for collecting filtered water and for distributing the wash water.

3.2 The floor, depending upon its thickness, should be perforated by short tubes or orifices of such dimension as to introduce the controlling loss of head and provide even distribution of wash water. The openings should be relatively small and closely spaced.

3.3 Construction

3.3.1 This should consist of either precast slab or *cast-in-situ* slabs to which the nozzles is fitted. An internal threaded bush should be grouted in concrete and nozzles screwed into it. Nozzles should be unplasticized PVC/HDPE/stainless steel/brass.

3.3.2 Precast slabs should rest on either RCC stub columns or series of beams or dwarf walls. For holding precast slabs against uplift while back washing, bolts, nuts and washers of stainless steel should be used. To provide uniform bearing pressure on the underside of precast slabs, stainless or brass strips should be used on the edges resting on beams or dwarf walls. Precast slab edges are filled with bituminous compound for sealing, for which edges should be provided with grooves.

3.3.3 For *cast-in-situ* slab, nozzle bushes should be held in suitable fixtures while concreting for uniform pitching and levelling of bushes.

3.3.4 For uniform distribution along the length of filter, a header channel, normally below the waste water gullet inside the filter should be provided. This header channel is provided with necessary openings at top and bottom on two side vertical walls for uniform distribution of back wash water and air.

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