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Indian Standard

REQUIREMENTS FOR
SLUDGE DEWATERING EQUIPMENT

**PART I SLUDGE DRYING BEDS — SAND, GRAVEL
AND UNDERDRAINS**

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Indian Standard

REQUIREMENTS FOR SLUDGE DEWATERING EQUIPMENT

PART I SLUDGE DRYING BEDS — SAND, GRAVEL AND UNDERDRAINS

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 24 December 1981, after the draft finalized by the Public Health Engineering Equipment Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 A series of Indian Standards are being formulated to cover different types of equipment used for dewatering of treated waste water, such as vacuum filtration equipment, pressure filtration equipment and centrifugal equipment.

0.3 Sand and gravel are often employed as dewatering media in sludge drying beds, either open to sunlight or covered. This standard provides the necessary guidelines for selecting the appropriate type of sand, gravel and underdrains for the bed. Other media that may be used are not covered under this standard. Typical details of cross-section of sludge drying beds are shown in Fig. 1.

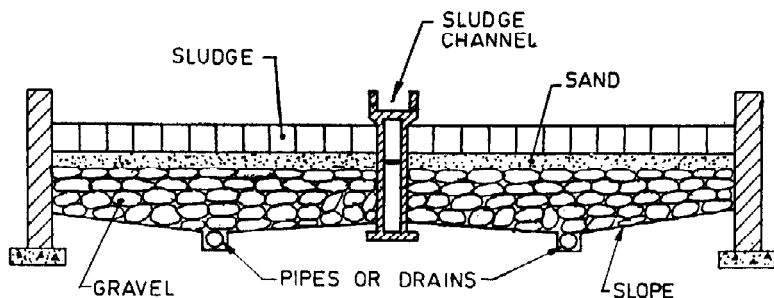


FIG. 1 TYPICAL DETAILS OF SLUDGE DRYING BED

0.4 In the formulation of this standard, due weightage has been given to international coordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in India.

0.5 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.

1. SCOPE

1.1 This standard (Part I) lays down the requirement for sand, gravel and underdrains used in sludge drying beds.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Effective Size (ES) — Particle diameter corresponding to 10 percent fine on the grain size curve determined according to IS : 2720 (Part IV)-1975†.

2.2 Uniformity Coefficient — The ratio $\frac{D_{60}}{D_{10}}$, where D_{60} is the particle diameter corresponding to 60 percent fines on the grain size curve and D_{10} is the particle diameter corresponding to 10 percent fines on the grain size curve.

3. SAND OR STONE DUST

3.1 Quality Requirement

3.1.1 Sand used for drying beds shall consist of hard, durable grains of silica and shall have a specific gravity of not less than 2.5. The minimum silica content in sand as determined by the method given in 7 of IS : 2000-1962‡ shall be 90 percent.

3.1.2 Any sample of sand shall not contain more than 10 percent by volume of impurities, such as clay, loam, silt, etc, in one hour of settlement after shaking in water in accordance with the procedure described in Appendix A of IS : 8419 (Part I)-1977§.

3.1.3 The sand shall not contain more than 10 percent of acid soluble matter as determined by the solubility test described in Appendix B of IS : 8419 (Part I)-1977§.

*Rules for rounding off numerical values (revised).

†Methods of test for soils : Part IV Grain size analysis (first revision).

‡Methods of chemical analysis of bauxite.

§Requirements for filtration equipment : Part I Filtration media — sand and gravel.

3.2 Grain Shape and Size Variation

3.2.1 The shape of sand grains is important from the hydraulic and suspended solids removal performance point of view. The nearer the sand grains approach a sphere (rounded) the better is the performance.

3.2.2 Size variation shall meet the requirement of effective size and uniformity coefficient. The value of ES in the range 0.5 — 0.75 mm and the uniformity coefficient not greater than 4.0 are recommended.

3.3 Depth of Sand — The minimum depth of sand shall be 150 mm.

4. GRAVEL

4.1 Quality Requirements

4.1.1 Gravel used in drying beds shall consist of hard, preferably rounded stones with an average specific gravity of not less than 2.5 and shall be free from clay, sand, loam and organic impurities of any kind.

4.1.2 The gravel shall not contain more than 2 percent by volume of thin, flat or elongated pieces (in which the larger dimension exceeds three times the smallest dimension) determined by hand packing.

4.1.3 Gravel shall be free from excessive amounts of limestone or shells and acid solubility determined in accordance with the procedure given in Appendix B of IS : 8419 (Part I)-1977* shall not exceed the following limits :

- | | |
|---------------------------------|----------------|
| a) For sizes smaller than 10 mm | 5% solubility |
| b) For sizes of 10 mm or larger | 10% solubility |

4.2 Grain Size and Shape

4.2.1 Gravel grains shall have a shape as near to sphere as possible.

4.2.2 The size variation of gravel used in the bed shall not be less than 25 mm and not more than 50 mm.

4.3 Depth of Gravel — The minimum depth of gravel which is placed above the top of the underdrains shall be 150 mm. At least 80 mm of the top layer shall consist of gravel of 3 to 6 mm size.

*Requirements for filtration equipment : Part I Filtration media — sand and gravel,

5. UNDERDRAINS

5.1 Underdrains consist of open jointed laterals and main, non-pressure drains laid on the floor of the drying beds. The laterals are placed at a spacing of 3 to 6 m.

5.2 The underdrains shall be made from asbestos cement pipes (*see* IS : 6908-1975*), concrete pipes (*see* IS : 4350-1967†), vitrified clay pipes or tiles. The underdrains can also be made by using burnt clay bricks with brick on-edge position.

5.3 The minimum diameter of pipes shall not be less than 100 mm.

6. SIDE WALLS

6.1 Side walls should be of pucca brick or stone masonry extended 40-45 cm above and at least 15 cm below the surface. Outer walls should be kerbed to prevent washing of sand on beds.

7. BED DIMENSIONS

7.1 Bed widths are commonly 6 to 8 m. Bed lengths are commonly 30 to 45 m, preferably 30 m, for single point wet sludge discharge and there is no limit for dimensions for multiple discharge points. A minimum of two beds are necessary for sludge removal.

*Specification for asbestos cement pipes and fittings for sewerage and drainage.

†Specification for concrete porous pipes for under drainage.

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