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SPECIFICATION FOR SEWAGE SCREENS

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Indian Standard

SPECIFICATION FOR SEWAGE SCREENS

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SPECIFICATION FOR SEWAGE SCREENS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 27 October 1971, after the draft finalized by the Public Health Engineering Equipment Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Unsatisfactory or insanitary disposal of sewage and industrial wastes leads to nuisance and public health hazards. Treatment of sewage before its ultimate disposal, therefore, assumes much importance. The equipment used in the treatment of sewage should be designed and constructed to suit the purpose. Standards are being formulated for different types of equipment used in sewage treatment.

0.3 Sewage admitted to sewage treatment plant and pumping stations should be effectively screened to protect the machinery in the plant and to avoid difficulties and unsightly conditions in subsequent stages of treatment. Screens are also necessary to intercept unsightly and repulsive floating matter where raw sewage is discharged into a water course without treatment. Screens, mechanically or manually cleaned are normally used for this purpose and this standard covers their requirements.

0.4 There is no standard design criteria for screens in the country and guidance on this aspect is basically necessary for suiting the equipment to the scheme of sewage treatment as a whole. Certain recommendations have, therefore, been given in **0.4.1** to **0.4.3** for general guidance and to indicate the basis of the specification themselves. These design criteria will be reviewed when more data becomes available for the Sectional Committee's consideration.

0.4.1 Wherever the average quantity of sewage exceeds 400 m^3/h mechanical screens are recommended. All mechanically cleaned medium screens should be preceded by a coarse screen which is manually screened.

0.4.2 Channels in which screening devices are to be installed should be designed to provide a velocity of not less than 0·3 m/s at average design flow.

0.4.3 The effective area of opening of the screen (which is the vertical projected area of the screen openings from the invert of the channel to the

flowline) should be such as to produce a velocity through the screen opening not exceeding 0·9 m/s at maximum expected flow.

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 covers the materials, dimensions and methods of construction of screens used in treatment plants for domestic as well as municipal sewages, the latter often containing a variety of industrial wastes.

1.2 This standard shall also be applicable to wholly industrial wastes where screens are intended to be used.

1.3 The standard does not cover fine screens and communitors since these are not yet in common use at present in India.

2. TERMINOLOGY

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

2.1 Screens — A screening device comprising of flats of rectangular or trapezoidal section placed vertically, inclined or curved and spaced at close and equal intervals across a channel through which sewage flows. It is used for removal of certain materials such as pieces of wood, floating debris, leaves, frigs, rags, etc, found in sewage. Depending on the clear spacing between flats, the screens shall be classified as under:

a) Coarse screens	Above 50 mm
b) Medium screens	20 to 50 mm
c) Fine screens	Less than 20 mm

3. MATERIALS

3.1 The materials to be used for different component parts are given in Table 1.

4. LOCATION

4.1 Screening devices generally precede grit chamber. Screens shall preferably be installed in open channels; where screens are required to be located in deep pits or inside buildings the precautions given in **4.1.1** and **4.1.2** shall be taken.

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

TABLE 1 MATERIALS FOR DIFFERENT PARTS OF SEWAGE SCREENS

(*Clause* 3.1)

Sl No.	Component Parts	Recommended Materials	Ref to Indian Standard
i)	Civil works	a) Concrete b) Brick masonry c) Stone masonry	IS : 456-1964[1] IS : 2212-1962[2] IS : 1597 (Part I)-1967[3] IS : 1597 (Part II)-1967[4]
ii)	Gates	a) Cast iron b) Steel	IS : 3042-1965[5] IS : 226-1969[6]
iii)	Floats	Plastic (polyethylene, PVC, glass reinforced polyester)	
iv)	Rake arm and Frame, Raking mechanism	a) Fabricated structural steel b) Cast iron	IS : 226-1969[6] IS : 210-1962[7]
v)	Teeth	Cast steel	IS : 1030-1962[8]
vi)	Shaft	Cold finished steel	IS : 1570-1961[9]
vii)	Motors, starters, time switches, electrode switches	—	IS : 325-1961[10] IS : 996-1964[11] IS : 1766-1961[12] IS : 1822-1967[13]
viii)	Flats, channels	Structural steel	IS : 226-1969[6]
ix)	Bearings	Bronze	Grade 5 of IS : 318-1962[14]
x)	Steel ropes, cables, chains and gear	Steel	IS : 2266-1963[15]
xi)	Sheet housing	Mild steel	IS : 1730-1961[16]
xii)	Reduction gear	Steel	IS : 1570-1961[9] and IS : 1871-1965[17]

[1]Code of practice for plain and reinforced concrete for general buildings construction (*second revision*).
[2]Code of practice for brickwork.
[3]Code of practice for construction of stone masonry: Part I Rubble stone masonry.
[4]Specification for construction of stone masonry: Part II Ashlar masonry.
[5]Specification for single faced sluice gates (200 to 1 200 size).
[6]Specification for structural steel (standard quality) (*fourth revision*).
[7]Specification for grey iron castings (*revised*).
[8]Specification for steel castings for general engineering purposes (*revised*).
[9]Specification for schedules for wrought steel for general engineering purposes.
[10]Specification for three-phase induction motors (*second revision*).
[11]Specification for single-phase small ac and universal electric motors (*revised*).
[12]Specification for time switches.
[13]Specification for ac motor starters for voltage not exceeding 1 000 volts (*first revision*).
[14]Specification for leaded tin bronze ingots and castings (*revised*).
[15]Specification for steel wire ropes for general engineering purposes.
[16]Specification for dimensions for steel plate, sheet and strip and structural and general engineering purposes.
[17]Commentary on Indian Standard wrought steels for general engineering purposes.

4.1.1 Screening devices located in deep pits shall be provided with stairway access, adequate lighting, ventilation and convenient and adequate means for removing screenings. While coarse screens may need to be provided in this manner before pumps, installation of medium screens in deep pits shall be avoided due to operational and maintenance difficulties.

4.1.2 Screening devices installed in a building where other equipment or offices are located shall be separated from the rest of the building by partitions and provided with adequate means of ventilation.

5. CONSTRUCTION

5.1 General Requirements for Coarse and Medium Screens

5.1.1 The top of the screen shall be at least 300 mm above the highest flow level.

5.1.2 In manually cleaned screens, the top of the screen channel shall be provided with a perforated platform from which the operator may conveniently rake the screenings from the screen. Suitable draining facilities shall be provided in the platform. A hand rake shall be provided.

5.1.3 The screen shall be embedded in such a manner that the frame, if any, shall offer no obstruction to the flow of sewage.

5.1.4 The flat shall not be less than 10 mm in thickness and not less than 50 mm deep. The flats shall not have any joints. The spacing between the flats shall be uniform and preferably so maintained by adequate number of spacers, which shall be so located as not to interfere with the raking operation.

5.1.5 For facility of manual cleaning of the screen inclination shall be between 45° and 60° to the horizontal.

5.1.5.1 Screens installed in deep pits may also consist of flats fixed to a suitable steel frame. Frame shall be placed freely in cast iron guide provided in the sides and bottom of the channel so as to provide no obstruction to flow of sewage and shall enable easy lifting, whenever required. For this purpose such screens are installed vertically.

5.1.5.2 The cleaning may be done by providing two coarse screens, one behind the other with independent arrangement for hauling the screen with the screenings to the surface for cleaning purposes. Such screens need to be provided with a flat plate of 300 mm width slightly inclined towards the screen at the bottom to catch the screenings during lifting operation. In case of large plants the screen channel may be suitably divided to have a maximum screen width of 1·5 m.

5.1.6 Where necessary, provision should be made for adequate ventilation and lighting. The lamps should be of low-voltage and/or of flame

proof type. Ventilation should be of the forced type which may be provided by blowers located at ground level with suitable flexible ducting to displace out air from the pit swiftly.

5.1.7 The screen channel invert downstream of mechanically operated screen shall drop not less than 75 mm below the invert level of screen channel; in the case of manually operated screen, the drop shall be not less than 150 mm.

5.1.8 The channel preceding and following the screens shall be filletted.

5.1.9 A minimum free-board of 300 mm shall be provided; this may be suitably raised where required by turbulent conditions in the channel.

5.1.10 The design of approach channel for screens shall provide for gates to shut off flow or divert the flow to other units or bye-pass it (*see* **5.2.2**).

5.1.11 Provision of a canopy over screen platform is advisable to facilitate operation under all weather conditions.

5.1.12 Necessary approach road shall be provided to the screen and from the screen to the point of disposal.

5.1.13 All the corners shall be rounded and the edges shall be chamfered near the screen to facilitate the cleaning of the channel near the screen.

5.2 Mechanically Cleaned Units

5.2.1 Mechanically cleaned screen shall consist of a screen provided with a mechanical raking device for cleaning operation.

5.2.2 Whenever a mechanically cleaned screen is used, an auxiliary unit either mechanically operated or manually operated shall be provided as a standby with suitable arrangements for diversion of flow.

5.2.3 The inclination of the screen shall be between 60° and 90° with the horizontal in case of straight flats.

5.2.4 The part of the screen above the platform may be kept open to facilitate inspection.

5.2.5 The screen shall be provided with a raking mechanism for removing the screenings from the screen. The raking mechanism may be (a) revolving type (for curved screen), or (b) reciprocating type (for straight screens which move up and down, or (c) endless revolving type. In each case rake arm teeth shall be so formed as to mesh with the screen, throughout the period of removal of screenings. The rake speed shall not be more than 3 m/min. Typical illustration of screens are given in Fig. 1, 2 and 3.

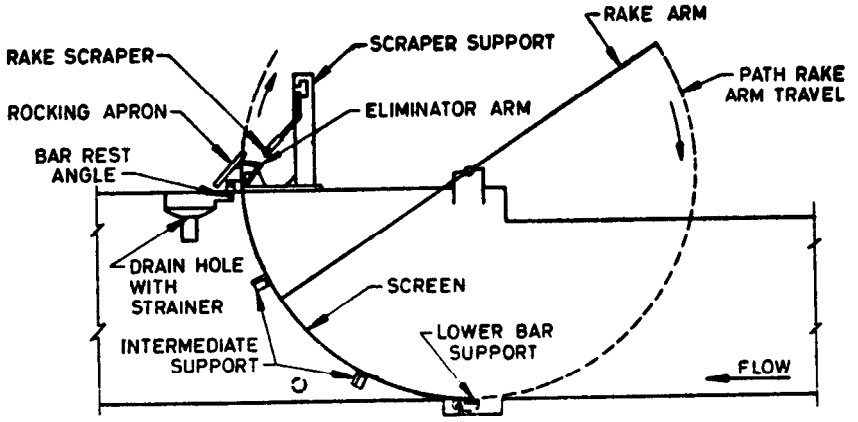
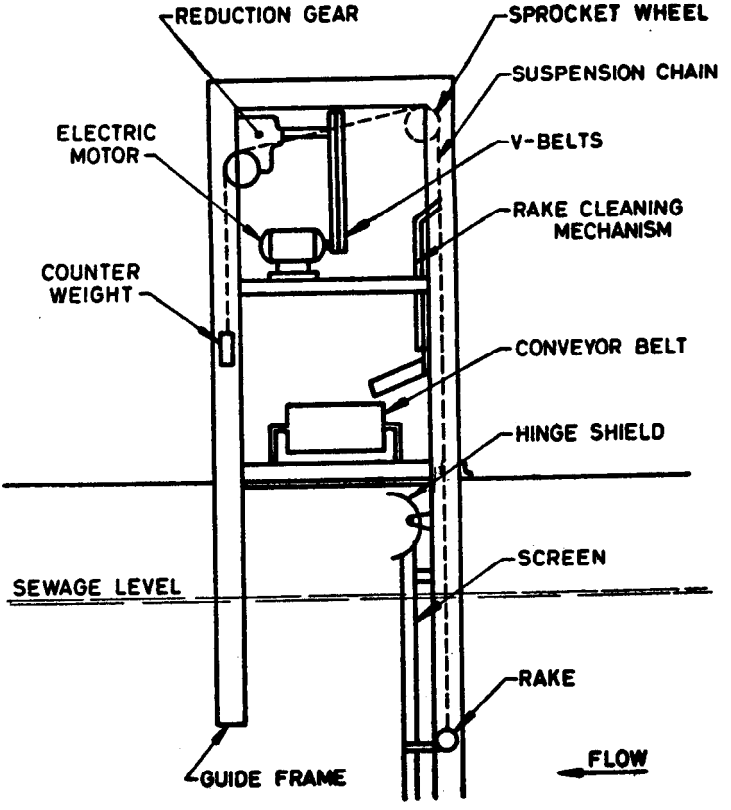
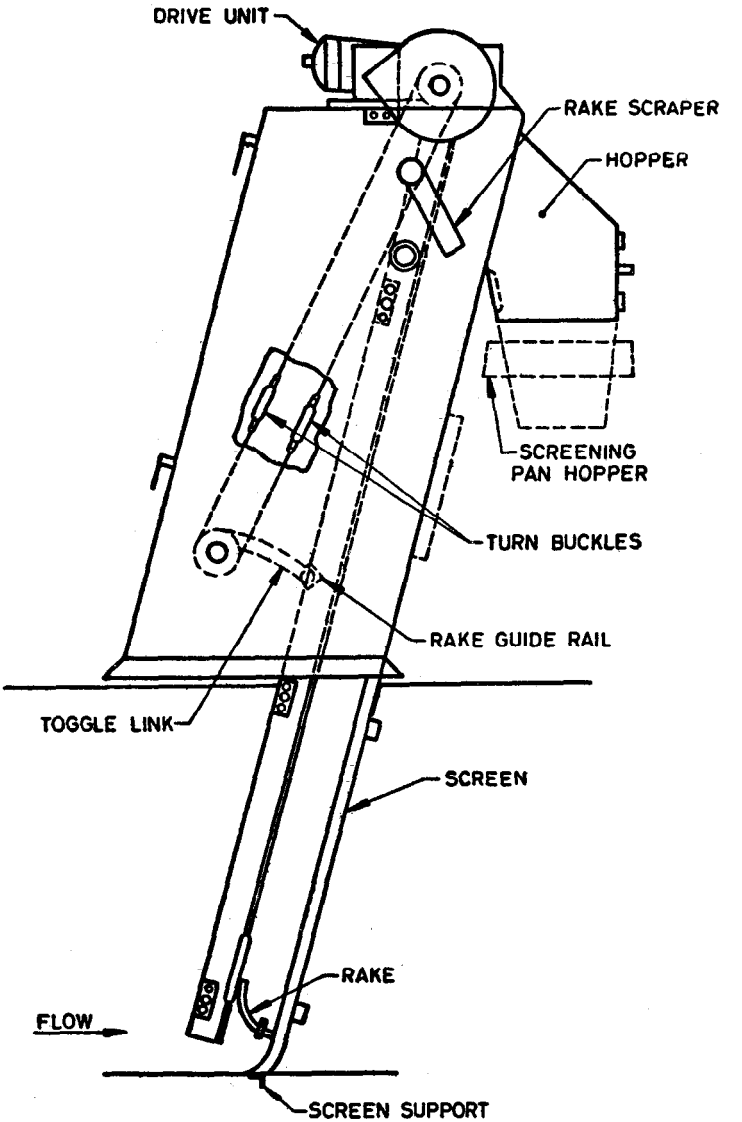


FIG. 1 CURVED SCREEN WITH REVOLVING RAKE



2A Vertical Screen with Reciprocating Rake

FIG. 2 SCREEN WITH RECIPROCATING RAKE — *Contd*



2B Inclined Screen with Reciprocating Screen

FIG. 2 SCREEN WITH RECIPROCATING RAKE

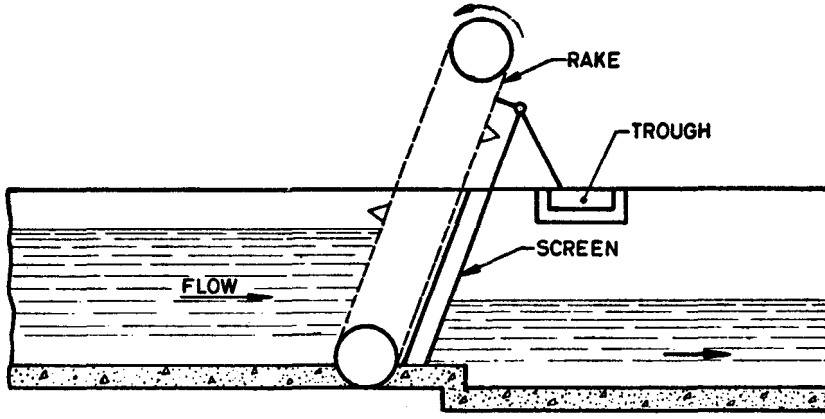


FIG. 3 SCREEN WITH ENDLESS REVOLVING RAKE

5.2.6 In raking mechanisms of the revolving or reciprocating type, the size of the shaft shall be adequate but not less than 60 mm in diameter. Lower shaft sprockets shall be provided with bushings for underwater service in gritty conditions. Upper shaft sprockets shall be split facilitating replacement. The chain or cable used shall be of material having tensile strength of not less than 2 000 kgf/cm^2.

5.2.7 The entire raking mechanism shall be designed to be rigid to prevent deflection and to ensure that the rack will mesh with screen at all times. A raking comb may be provided in sections to facilitate replacement.

5.2.8 The motor shall comply with the requirements specified in IS : 325-1961* or IS : 996-1964† and shall be totally enclosed fan cooled type and suitable for outdoor mounting. The motor shall be not less than 0·5 kW in capacity. The drive unit shall consist of reduction gear preferably oil immersed type with anti-friction bearings. Each motor shall be provided with magnetic starter and no-volt and overload protection devices. The drive itself, either chain or belt type, shall be enclosed in sheet metal guard of thickness not less than 2 mm. For motors installed in the open, additional cover in the form of louvered box may be provided over the motors. A push button type control shall be provided near the motor. An additional control at a central point may be provided in the case of large plants, where desired.

5.2.9 The rake cleaning arrangement shall be such as to ensure that the screenings lifted up by mechanism are not allowed to drop back in the sewage downstream of the screen; this may be accomplished by providing

*Specification for three-phase induction motors (*second revision*).

†Specification for single-phase small ac and universal electric motors (*revised*).

a dead-plate or any other suitable device. Where a dead plate is provided it shall be of mild steel not less than 5 mm thickness and running for the full width of the screen for retaining the screenings discharged by the rake at the discharge end. Where necessary, the removal of the screenings to a distant receptable may be made by providing a suitable belt conveyor at a required height for facilitating its loading directly into a trolley or trailer.

5.2.10 The raking mechanism shall be operated by either a time switch or an automatic float control or electrode type switch. The provision of time switch is, however, preferred because of its greater reliability. In the case of time switch the setting shall be variable to enable the operator to set the frequency as dictated by the plant operation. In the case of float controlled switch, the control shall be such that the operator may vary the head differential. The float shall preferably be rod operated. An additional electrode switch may be provided to operate the mechanism continuously at a pre-determined high level in the channel while giving a visible and audible alarm.

5.2.11 The raking mechanism shall also be provided with an auxiliary switch for operating the rake at will.

5.2.12 In addition to the overload protection devices provided to electric motors, the raking mechanism may also be provided with a mechanical type overload device which shall automatically disengage the rake, if the unit is overloaded due to an unusual obstruction or jamming of rake or some other cause.

5.2.13 To facilitate cleaning of raking equipment, conveyor belt, etc, it is recommended that a pressure pump (to give a minimum of 2 kgf/cm^2) may be provided at a suitable location.

6. PAINTING

6.1 Red oxide (zinc chromate) shall be used as a primer for painting. One coat of primer and at least 3 coats of bitumastic or other approved anti-corrosion paint shall be applied after erection [*see* IS : 1477 (Part I)-1959* and IS : 1477 (Part II)-1963†].

7. DISPOSAL OF SCREENINGS

7.1 To facilitate collection and disposal of screenings, rubber tyred tipper of capacity not less than 140 litres may be provided; trailers may be used in the case of large plants and for small plants wheel barrows which could be properly cleaned may be used. The disposal of screenings may be either done by sanitary land fill or incineration.

*Code of practice for finishing of iron and steel ferrous metal in buildings, painting and allied finishes: Part I Operations and workmanship.

†Code of practice for finishing of ferrous metals in buildings, painting and allied finishes: Part II Schedules and equipment.

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5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001	20 10 83
E-52, Chitaranjan Marg, C- Scheme, JAIPUR 302001	37 29 25
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