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IS : 9872 - 1981

Indian Standard
SPECIFICATION FOR
PRECAST CONCRETE SEPTIC TANKS

(First Reprint JULY 1990)

UDC 628.352:666.982

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

Indian Standard

SPECIFICATION FOR PRECAST CONCRETE SEPTIC TANKS

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Indian Standard

SPECIFICATION FOR PRECAST CONCRETE SEPTIC TANKS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 June 1981, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Many small towns and innumerable villages suffer from the absence of hygienic means for the disposal of sewage. Concrete septic tanks offer a very economical and convenient solution to this problem, both for private residences and for small communities. Apart from the simplicity of construction of concrete septic tanks, one of their greatest advantages is that maintenance is very simple and does not require sustained attention. The sludge is required to be removed at intervals of about 6 months to one year.

0.3 A concrete septic tank built of precast units makes possible the installation of a complete home sanitation system in a short time. Use of this tank eliminates mixing concrete at the job and requires no special equipment for handling units. Mass production of precast concrete tanks at central plants simplifies inspection, lowers cost and improves quality.

0.3.1 Construction of septic tanks with precast concrete units is an advantage where a larger number of tanks have to be built in out of the way places, because precasting of elements makes possible the speedy erection of a number of tanks and reduces, to a great extent, the employment of skilled labour at site.

0.4 This standard covers the requirements of precast concrete septic tanks of small capacities. For recommendations on capacities, size, etc, reference has been made to IS : 2470 (Part I)-1968* and IS : 2470 (Part II)-1971† in this standard. Typical construction details of a rectangular septic tanks are also given in this standard.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated,

*Code of practice for design and construction of septic tanks: Part I Small installations (*first revision*).

†Code of practice for design and construction of septic tanks: Part II Large installations (*first revision*).

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 requirements for the manufacture and installation of small precast concrete septic tanks.

1.2 For recommendations on capacities, sizes, design, layout, construction and maintenance of septic tanks, methods of treatment and disposal of tank effluent of domestic sewage of houses, flats and such other residential buildings, where the number of users does not exceed 50 persons, reference may be made to IS : 2470 (Part I)-1968†. For housing colonies, hostels, and boarding schools where the number of users range from 50 to 300, reference may be made to IS : 2470 (Part II)-1971‡.

2. MATERIALS

2.1 The cement used shall be any of the following types, with the prior approval of the engineer-in-charge :

- a) Ordinary Portland cement conforming to IS : 269-1976§,
- b) Portland slag cement conforming to IS : 455-1976||,
- c) Portland pozzolana cement conforming to IS : 1489-1976¶,
- d) Rapid-hardening Portland cement conforming to IS : 8041-1978**,
- e) High strength ordinary Portland cement conforming to IS : 8112-1976††, and
- f) Hydrophobic cement conforming to IS : 8043-1978‡‡.

*Rules for rounding off numerical values (revised).

†Code of practice for design and construction of septic tanks : Part I Small installations (first revision).

‡Code of practice for design and construction of septic tanks: Part II Large installations (first revision).

§Specification for ordinary and low heat Portland cement (third revision).

||Specification for Portland slag cement (third revision).

¶Specification for Portland pozzolana cement (second revision).

**Specification for rapid-hardening Portland cement.

††Specification for high strength ordinary Portland cement.

‡‡Specification for hydrophobic Portland cement (first revision).

2.2 Aggregates — Aggregates shall comply with the requirements of IS : 383-1970* and IS : 456-1978† as applicable. The nominal maximum size of coarse aggregate shall not exceed 12.5 mm.

2.3 Water — The water used shall conform to the requirements specified in IS : 456-1978†.

2.4 Pozzolanas — Pozzolanic materials conforming to relevant Indian Standards may be used for part replacement of unblended cements or as an admixture.

2.5 Admixtures — Where admixtures are employed, they shall be used in such proportions as to have no harmful effects on the setting, hardening, and durability of the concrete. The admixtures, when used, shall conform to IS : 2645-1975‡ or IS : 9103-1979§.

2.6 Reinforcement — Steel wire or rod for reinforcement shall conform to IS : 432 (Part I)-1966||, IS : 432 (Part II)-1966¶, IS : 1139-1966**, IS : 1566-1967††, or IS : 1786-1979‡‡ as agreed to between the purchaser and the manufacturer.

2.7 Concrete — The concrete shall not be weaker than M 20 grade. The production and control of concrete shall be in accordance with IS : 456-1978†. The minimum cement content in concrete shall be 400 kg/m³ and maximum water/cement ratio shall be 0.4.

3. CONSTRUCTION

3.1 The construction details given in 3.2 to 3.2.7 apply to rectangular septic tanks.

3.2 Rectangular Septic Tanks — Details of a typical rectangular precast concrete septic tank shall be as shown in Fig. 1.

*Specification for coarse and fine aggregates from natural sources for concrete (*second revision*).

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

‡Specification for integral cement waterproofing compounds (*first revision*).

§Specification for admixtures for concrete.

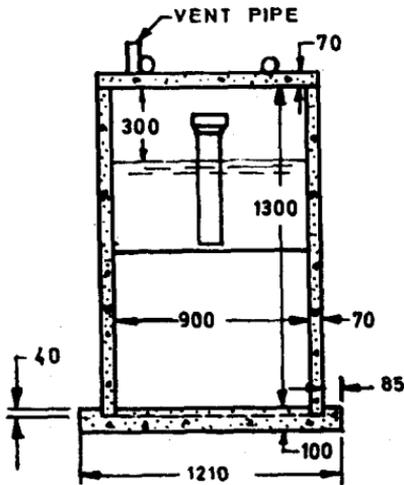
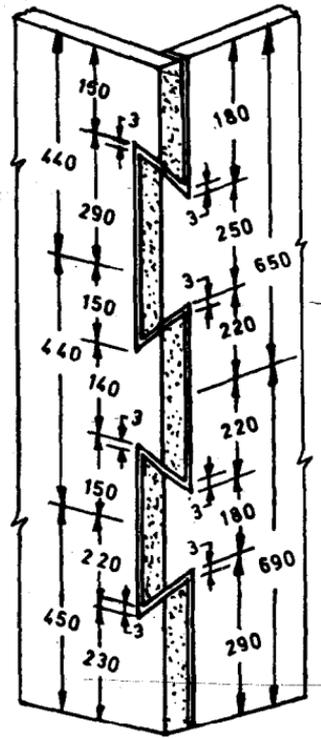
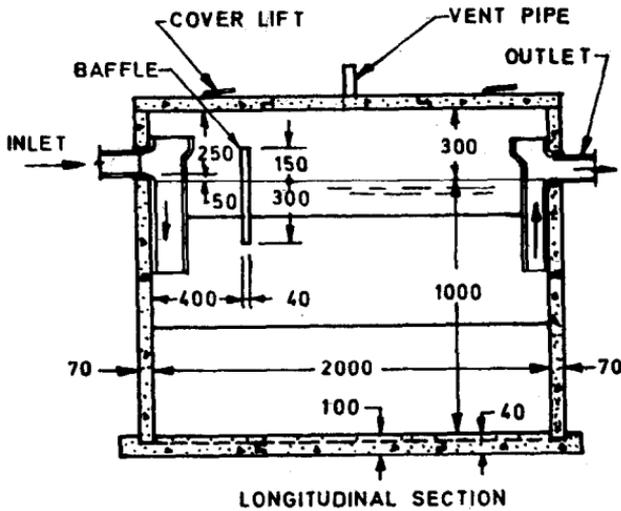
||Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part I Mild steel and medium tensile steel bars (*second revision*).

¶Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part II Hard-drawn steel wire (*second revision*).

**Specification for hot-rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcement (*revised*).

††Specification for hard drawn steel wire fabric for concrete reinforcement (*first revision*).

‡‡Specification for cold-worked steel high strength deformed bars for concrete reinforcement (*second revision*).



All dimensions in millimetres.

FIG. 1 TYPICAL DETAILS OF A PRECAST CONCRETE SEPTIC TANK (1 800 LITRES CAPACITY)

NOTE — Figure 1 gives details of a septic tank of 1 800 litres capacity. The capacity of the tank may be increased by corresponding changes in the dimensions of the precast units recommended below:

<i>Precast Unit</i>	<i>Increase in Dimensions* Over Those Indicated in Fig. 1, cm</i>	<i>Modified Capacity, litres</i>
Side slab	30	2 070
End slab	30	2 400
Both side and end slabs	30	2 760

3.2.1 General — Plain concrete base slabs of 10 cm thickness shall be provided with 40 mm deep grooves in them. The two top slabs of the long walls shall also have grooves in them to insert the 40 mm thick precast concrete baffle. The top of the tank shall consist of precast concrete cover slabs as they permit opening up of the tank for cleaning, inspection, repairs, etc. The connection of precast units shall be effected as shown in Fig. 1.

3.2.2 Forms — The forms for the wall, floor, baffle and cover slabs shall conform to the required shapes and sizes. By adhering meticulously to the details given in the form drawings, the concrete slabs produced will fit properly and can be erected rapidly. Wooden forms, when properly made, are satisfactory. Since the forms have to be re-used many times, a wood that will not warp easily shall be used and it shall be well-seasoned and free from knots. A thin metal tubing for inserts in the holes of the divider strips shall be used to make removal easier and also to prolong the usefulness of the form.

3.2.2.1 The built-up sections shall be glued with a water-proof glue and nailed. All new forms shall be soaked with light oil before initial use, then thoroughly cleaned, and re-oiled each time they are filled. They shall be kept on a flat surface, preferably under clamps or weights, and in the shade when not in use.

3.2.2.2 The forms shall be bolted tightly to the platform to assure production of slabs of uniform thickness. Forms shall be discarded when the concrete slabs made in them do not fit properly. After forms are assembled and before each use, each piece shall be checked to make sure that it is straight before setting it on the casting platform.

3.2.2.3 When a large number of tanks are produced, steel forms made from angles and solid bars may be more economical. The same-casting platform shall be used for either wooden or steel forms, so that a change from wood to steel can be made at any time.

*The dimensions of the bottom and top slabs also should be increased suitably.

3.2.3 Reinforcement — The reinforcements in the wall slabs shall consist of at least 6 mm dia bars at 10 cm centres bothways placed in the centre of slabs. The baffle and floor slabs shall be provided with a minimum reinforcement of 0.15 percent of gross sectional area. The cover slabs shall be reinforced with 5 bars of 8 mm dia for tanks up to 90 cm width, and 4 bars of 10 mm dia for those 110 cm wide, located 20 mm from the bottom of slabs. Two short pieces of mild steel bars shall be bent to make handles for cover slabs.

NOTE — The reinforcement recommended refers to mild steel reinforcement.

3.2.4 Casting — The casting bed shall be cleaned and oiled to prevent sticking of the slabs. The concrete shall be so spaded and tamped in the forms that all corners and shaped joints will be completely filled to produce smooth surfaces free from honeycomb or rough spots. Reinforcement placed after the form is screeded half-full of concrete, shall remain in that position as the form is filled. The surface shall be screeded, floated, and smooth-troweled flush with the top of the form. After hardening for 24 hours, in warm weather under wet covering, the outer forms shall be removed and the slab slid off the platform by using tapered wooden pegs or suitable steel bolts as handles inserted in the holes provided in slab ends at the time of casting. When picked up by these pegs or bolts, the slab shall swing down in position for its erection in the tank and it shall then be stacked on edge for further wet curing.

3.2.5 Curing and Maturing — The period of curing shall not be less than 7 days. From the date of casting, the precast units shall be matured for the following periods before testing or despatch, including the period of curing, so that they will attain sufficient strength to resist damage to them when first handled:

Cement used

Portland slag cement	} 28 days
Ordinary Portland cement	
Portland pozzolana cement	

Rapid-hardening Portland cement 14 days

3.2.6 Assembling the Tank — The digging for the septic tank shall first be carried out and then the bottom covered with fine dry earth or dry sand, tamped and finally, screeded to a level surface. Care shall be taken to compact the foundation base adequately to avoid unequal settlement.

3.2.6.1 The following procedure is recommended for assembling the tank units:

- a) Wet all concrete surfaces thoroughly to ensure bond for the grout.

- b) Lower bottom slabs by rope slings attached to handling pins in holes at slab ends. The centre slab is first placed in proper position, then end slabs are set carefully fitting grooves in which cement grout has been spread against the tongues of the centre slab.
- c) Check slabs to see that they are square and level, then fill all grooves in surface of bottom slabs with cement grout.
- d) Set bottom side slabs in centre of 40 mm receiving grooves of the bottom slab. Remove excess grout. Hook two space-spreaders over the top edges of these slabs near the ends to hold them in position while being levelled.
- e) Lower and hook bottom end slabs over the dovetailed end joints.
- f) Check the first section erected for square and matching corners.
- g) Pour cement grout (Portland cement and water mixed to proper consistency) in the upper grooved edges of all slabs.
- h) Lower and fit in place middle side slabs.
- j) Fit, in the same manner, the top end slabs and finally top side slabs, and baffle, after filling each horizontal joint with cement grout.

3.2.6.2 Immediately after the tank is assembled, earth backfill shall be tamped in place around the tank while grout in joints is still plastic. A fillet of mortar, mixed with one part Portland cement and two parts clean sand, is next placed from the top to bottom in the inside corner of the tank to seal the dovetailed joints. This triangular fillet shall be at least 5 cm thick at its centre and may be a run of stiff mortar placed with a trowel and shaping block, or placed behind a 2.5 × 10 cm strip used across the corner as a form.

3.2.6.3 Excess grout shall be scraped from all joints inside the tank leaving smooth, well compacted surfaces. A fillet of mortar 5 cm thick as placed in vertical corners shall then be well compacted and shaped at the joint between the precast bottom and walls of the tank. When this water seal has hardened, the tank shall be filled with water to a depth of at least 15 cm for this joint to cure under water.

3.2.6.4 The top surfaces of the tank shall be cleaned and wetted, and a 1 : 2 cement mortar applied and levelled. Strips of paper shall be laid over this fresh, soft mortar to prevent cover slabs from bonding to it when placed in position without sacrificing a close fit. Lap joints of the cover slabs need not be grouted. The top of the tank may either be flush with or approximately 30 cm below the ground surface. The vent pipe shall extend above the ground level.

3.2.6.5 Cast *in situ* concrete may be used for the tank floor if the top of the digging cannot be readily levelled for precast slabs. In this case, bricks are set on edge at corners and the side and end slabs erected on them.

Next concrete of grade M 15 and of mushy consistency is placed, so that the bottoms of side and end slabs are embedded at least 40 mm in the concrete. A minimum reinforcement of 0.15 percent of sectional area shall be provided for the cast *in situ* floor slabs.

3.2.7 Tank Connections — Ordinarily, T-pipes (see Fig. 1 Longitudinal Section) for inlet and outlet in the tank may prove satisfactory. However, slots for baffle are easily provided in the required position by embedding tapered strips in the side slabs when casting. Y or L pipe may be used in the top end slabs as may be required locally.

4. FINISH

4.1 Each unit shall have a dense surface showing no coarse aggregate and shall have no crevices likely to assist in the disintegration of concrete or rusting of reinforcement. Each unit and its edges shall be so finished that when assembled, the septic tank is watertight.

5. SAMPLING AND CRITERIA FOR CONFORMITY

5.1 Scale of Sampling

5.1.1 Lot — In any batch, all units of the same type and same dimensions shall be grouped together to constitute a lot.

5.1.1.1 Sub-lot — If the number of units in a lot exceeds 500, the lot shall be divided into a suitable number of sub-lots such that the number of units in any sub-lot shall not exceed 500. The acceptance or otherwise of a sub-lot shall be determined on the basis of a sample selected from it.

5.1.1.2 The number of units to be selected from a lot or a sub-lot shall depend upon its size and shall be in accordance with Table 1.

5.1.1.3 The sample shall be selected at random. In order to ensure randomness, all units in the lot or the sub-lot may be arranged in a serial order and starting from any unit, every r th unit may be included in the sample, r being the integral part of N/n , where N is the size of the lot or sub-lot and n , the sample size.

5.2 Number of Tests

5.2.1 All the units selected as per 5.1.1.2 shall be checked for dimensions and finish.

5.3 Criteria for Conformity

5.3.1 A lot or sub-lot shall be considered as conforming to this specification if the conditions under 5.3.2 are satisfied.

5.3.2 The number of units which do not satisfy the requirements of dimensions and finish shall not exceed the corresponding number given in Table 1. If the number of such units exceed the corresponding number, all units in the lot or sub-lot shall be tested for these requirements and those not satisfying the requirements shall be rejected.

TABLE 1 SAMPLE SIZE AND CRITERIA FOR CONFORMITY

(Clauses 5.1.1.2 and 5.3.2)

SIZE OF LOT OR SUB-LOT, <i>N</i>	REQUIREMENTS OF DIMENSIONS AND FINISH	
	Sample Size <i>n</i>	Permissible No. of Defectives
(1)	(2)	(3)
Up to 100	10	1
101 ,, 200	15	1
201 ,, 300	20	2
301 ,, 500	30	3

6. MARKING

6.1 The septic tank units shall be clearly and indelibly marked with the following particulars:

- a) Manufacturers' name and/or trade-mark, if any;
- b) Month and year of manufacture; and
- c) Capacity.

6.2 Each unit may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the rules and regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors may be obtained from the Indian Standards Institution.

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