Indian Standard

SPECIFICATION FOR PRECAST CONCRETE MANHOLE COVERS AND FRAMES

PART 1 COVERS

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Indian Standard

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PART 1 COVERS

0. FOREWORD

0.1 This Indian Standard (Part 1) was adopted by the Bureau of Indian Standards on 23 December 1988, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The cost of cast iron is increasing day by day and cast iron manhole covers are prone to pilferage and misuse since they possess a high resale value. This may result in financial loss due to the need for replacement of stolen covers, accidents due to the open manholes, and other environmental problems. Precast concrete manhole covers and frames are found to satisfy the general requirements specified in IS : 1726 (Part 1)-1974*. They have also been found to be economical substitute to cast iron manhole covers and frames and, as such, use of such covers and frames is increasing day by day.

0.3 This standard has been prepared with a view to introducing and guiding the manufacture of precast reinforced cement concrete manhole covers and frames. This standard (Part 1) covers the requirements of precast concrete manhole covers using reinforced cement concrete. Part 2 of this standard will cover precast concrete manhole frames.

0.3.1 The manufacturing process of precast concrete manhole covers and frames is simple and requires only ordinary locally available machinery, such as concrete mixers, vibrators, steel moulds, hydraulic jacks, etc. These products can be produced in existing factories producing precast concrete products.

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.

*Specification for cast iron manhole covers and frames: Part 1 General requirements (*first revision*).

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

1. SCOPE

1.1 This standard (Part 1) covers the requirements for precast reinforced cement concrete manhole covers intended for use in sewerage and water works.

2. TYPES

2.1 Heavy duty, denoted by the letters 'HD', for use in heavy vehicular traffic conditions.

2.2 Medium duty, denoted by the letters 'MD', for use under light traffic conditions, such as, footpaths and cycle tracks.

2.3 Light duty, denoted by the letters 'LD', for use in domestic premises or other places where they are not subjected to wheeled traffic loads.

3. MATERIAL

3.1 Cement — Cement complying with any of the following Indian Standards may be used at the discretion of the manufacturer:

IS : 269-1976	Specification for ordinary and low heat Portland cement (*third revision*)
IS : 455-1976	Specification for Portland slag cement (*third revision*)
IS : 1489-1976	Specification for Portland pozzolana cement (*second revision*)
IS : 6909-1973	Specification for super-sulphated cement
IS : 8041-1978	Specification for rapid hardening Portland cement (*first revision*)
IS : 8043-1978	Specification for hydrophobic Portland cement (*first revision*)
IS : 8112-1976	Specification for 43 grade ordinary Portland cement

3.2 Aggregates — The aggregates used shall be clean and free from deleterious matter and shall conform to the requirements of IS : 383-1970*. The aggregates shall be well graded and the nominal maximum size of coarse aggregate shall not exceed 20 mm.

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

3.3 Water — The water used shall be free from matter harmful to concrete or reinforcement, or matter likely to cause efflorescence in the units and shall conform to the requirements of IS : 456-1978*.

3.4 Concrete — The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing, etc (*see* IS : 456-1978*). The maximum cement content in the concrete shall be 360 kg/m^3 with a maximum water cement ratio of 0·45. Concrete weaker than grade M 30 shall not be used. Compaction of concrete shall be done by machine vibration.

3.5 Reinforcement — The reinforcement steel shall conform to IS : 226-1975† or IS : 432 (Part 1)-1982‡ or IS : 432 (Part 2)-1982§ or IS : 1566-1982‖ or IS : 1786-1985¶, as appropriate.

3.5.1 Reinforcement shall be clean and free from loose mill scale, loose rust, mud, oil, grease or any other coating which may reduce or destroy the bond between the concrete and steel. A slight film of rust may not be regarded as harmful but steel shall not be visibly pitted by rust.

3.6 Additives or Admixtures — Additives or admixtures may be added either as additives to the cement during manufacture, or as admixtures to the concrete mix. Additives or admixtures used in the manufacture of covers may be:

a) accelerating, water-reducing and air-entraining admixtures conforming to IS : 9103-1979**;

b) colouring pigments,

c) fly ash conforming to IS : 3812-1981††, and

d) Waterproofing agents conforming to IS : 2645-1975‡‡.

Where no Indian Standards apply, the additives or admixtures shall be shown by test or experience to be not detrimental to the durability of the concrete.

4. SHAPES AND DIMENSIONS

4.1 Shapes — The shapes of precast concrete manhole covers shall be square, rectangular or circular similar to the shapes of cast iron manhole covers given in IS : 1726*.

4.2 Dimensions and Tolerances — Length, breadth and diameter of precast concrete manhole covers shall be such that the maximum clearance at top between the frame and the cover shall be 5 mm. The minimum thickness of heavy duty, medium duty and light duty precast concrete manhole covers shall be 70, 50 and 35 mm, respectively. Placing of precast concrete manhole cover in a cast iron frame is shown in Fig. 1 for guidance. For facility of removing from the frame, suitable downward taper not more than 5° may be provided to the periphery of the cover.

5. DESIGN

5.1 The design of the reinforced concrete manhole cover shall be done according to IS : 456-1978†.

6. MANUFACTURE

6.1 Mixing — Concrete shall be mixed in a mechanical mixer. Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency.

6.2 Placing and Compaction — The reinforcement and lifting device (*see* Fig. 2 for guidance) shall be placed in proper position in a steel mould properly greased and concrete shall be filled up to a height above the mould appropriate to the machine used, vibrated and struck off level with a trowel.

6.2.1 After demoulding, the covers shall be protected until they are sufficiently hardened to permit handling without damage.

6.3 Curing

6.3.1 The hardened concrete manhole covers shall be placed in a curing water tank or taken to the curing yard (*see* Note) where these shall be kept continuously moist for at least 28 days. Covers may be water cured by immersing in water, covering with water saturated material or by a system of perforated pipes, mechanical sprinklers or by any other approved method

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

†Specification for structural steel (standard quality) (*fifth 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 (*second revision*).

§Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement : Part 2 Hard-drawn steel wire (*third revision*).

‖Specification for hard-drawn steel wire fabric for concrete reinforcement (*second revision*).

¶Specification for high strength deformed steel bars and wires for concrete reinforcement (*third revision*).

**Specification for admixtures for concrete.

††Specification for fly ash for use as pozzolana and admixtures (*first revision*).

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

*Specification for cast iron manhole covers.

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

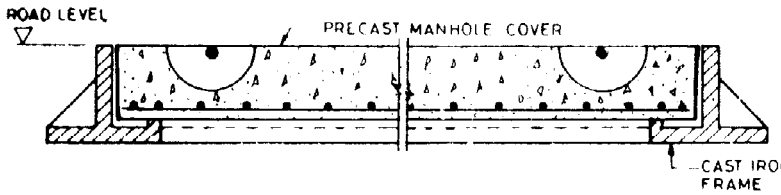

FIG. 1 PRECAST CONCRETE MANHOLE COVER WITH CAST IRON FRAME

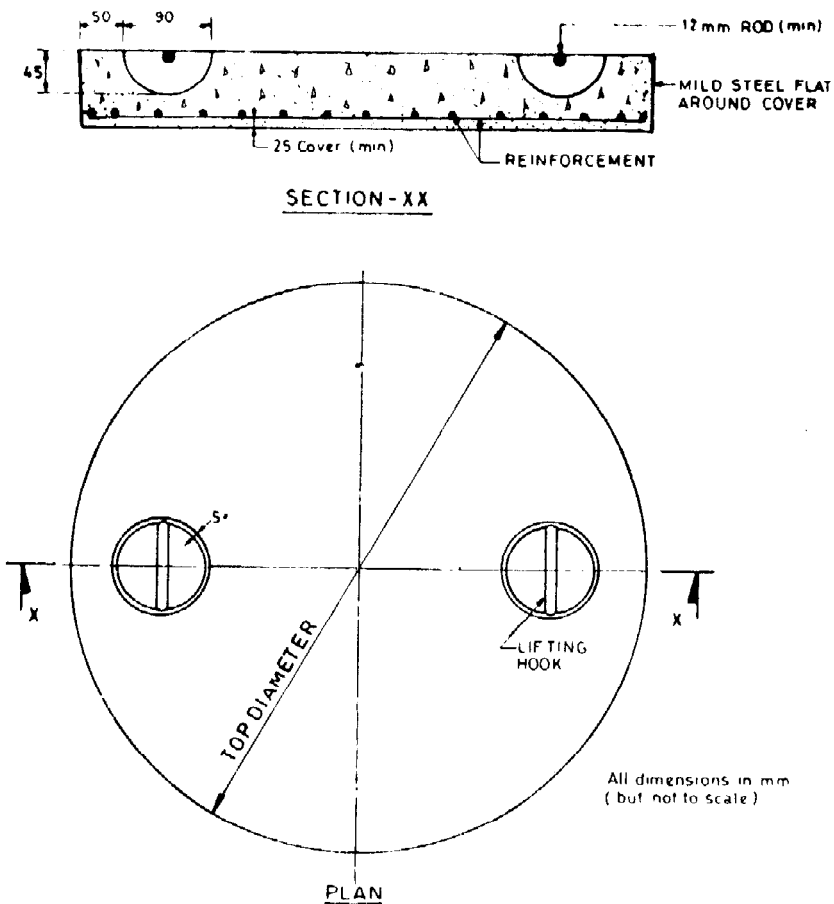

FIG. 2 TYPICAL ILLUSTRATION OF A CIRCULAR PRECAST CONCRETE MANHOLE COVER

that will keep the covers moist during the specified curing period.

NOTE — The curing yard is a paved yard subdivided by shallow drains in 4 to 5 m square platforms which are provided with water fountains in the centre. The manhole covers are stacked on platforms around the fountains which work continuously. The fountains are connected to an elevated water storage tank.

6.3.2 Steam curing of the manhole covers may be adopted instead of the method specified in **6.3.1** provided the requirements of pressure or non-pressure steam curing are fulfilled and the manhole covers meet the requirements specified in the standard.

6.4 Finishing and Coating — To prevent any possible damage from corrosion of steel, the underside of the covers shall be treated with anticorrosive paint. The top surface of the covers shall be given a chequered finish.

In order to protect the edges of the covers from possible damage at the time of lifting and handling, it is necessary that the manhole covers shall be cast with a protective mild steel sheet of minimum 2 mm thickness around the periphery of the covers.

7. PHYSICAL REQUIREMENTS

7.1 General — All units shall be sound and free

from cracks and other defects which interfere with the proper placing of the unit or impair the strength or performance of the units. Minor chipping resulting from the customary methods of handling during delivery shall not be deemed grounds for rejection.

7.2 Dimensions — The overall dimensions of the units when measured as given in Appendix A shall be in accordance with **4**.

7.3 Load Test — The breaking load of individual units when tested in accordance with the method described in Appendix B, shall be not less than the values specified in Table 1.

8. TESTS

8.1 Tests shall be conducted on samples of covers selected according to the sampling procedure given in **9** to ensure conformity with the physical requirements laid down in **7**.

9. SAMPLING AND INSPECTION

9.1 Scale of Sampling

9.1.1 *Lot* — In any consignment, 500 precast concrete manhole covers or a part thereof of the same dimensions and belonging to the same batch of manufacture, shall be grouped together to constitute a lot.

9.1.2 For ascertaining the conformity of the materials in the lot to the requirements of this specification, samples shall be tested from each lot separately.

9.1.3 The number of covers to be selected from the lot shall depend on the size of the lot and shall be according to Table 2.

9.2 Sampling Covers in Motion — Whenever practicable, samples of covers shall be taken when the units are being moved as in the case of loading, unloading, etc. The batch from where the samples are to be drawn shall be divided into a number of convenient portions such that when one sample is drawn from each of these portions, the minimum number of units specified under **9.1.3** is provided.

9.3 Sampling Covers from a Stack — The number of covers required for the test shall be taken at random from across the top of the stacks, the sides accessible and from the interior of the stacks by opening trenches from the top.

9.4 Number of Tests

9.4.1 All the covers selected according to **9.1.3** hall be checked for dimensions (*see* **7.2**) and inspected for visual defects (*see* **7.1**).

9.4.2 The number of covers to be subject to load test shall be according to column 4 of Table 2.

10. CRITERIA FOR CONFORMITY

10.1 The lot shall be considered as conforming to the requirements of the specification if the conditions mentioned in **10.2** and **10.3** are satisfied.

10.2 The number of covers with dimensions outside the tolerance limit and/or with visual defects among those inspected shall be less than or equal to the corresponding acceptance number given in column 3 of Table 2.

10.3 For load test no value shall be less than the load specified in Table 1.

11. MANUFACTURER'S CERTIFICATE

11.1 The manufacturer shall satisfy himself that the manhole covers conform to the requirements of this specification and, if requested, shall supply a certificate to this effect to the purchaser or his representative.

12. MARKING

12.1 The following information shall be clearly and permanently cast on top of each manhole cover:

a) Manufacturer's name or trade-mark;

b) Grade denoted by the abbreviation given in **2**;

c) The words 'SWD' or 'SEWER' to denote 'Storm water drain' and 'sewer' respectively, if required by the purchaser;

d) An identification mark as required by the purchaser; and

e) Date of manufacture.

12.1.1 Each manhole cover conforming to this standard may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The Standard 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 BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

TABLE 1 TEST LOAD AND DIAMETER OF BLOCK

(*Clauses* 7.3 *and* 10.3)

GRADE OF COVER	TYPE	LOAD IN TONNES	DIAMETER OF BLOCK IN mm
(1)	(2)	(3)	(4)
HD	Circular	35	300
MD	Circular or rectangular	5	300
LD	Rectangular or square	1	300

TABLE 2 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES

(*Clauses* 9.1.3, 9.4.2 *and* 10.2)

No. OF COVERS IN THE LOT	DIMENSIONAL REQUIREMENTS		NUMBER OF SAMPLES FOR LOAD TEST
	Sample Size	Acceptance Number	
(1)	(2)	(3)	(4)
Up to 100	10	1	2
101 to 200	15	1	3
201 to 300	20	2	4
301 to 500	30	3	5

NOTE — If the number of covers in the lot is 20 or less, the number of samples for load test shall be decided by mutual agreement between the purchaser and the manufacturer.

APPENDIX A

(*Clause* 7.2)

MEASUREMENT OF DIMENSIONS

A-1. PROCEDURE

A-1.1 Individual measurements of the dimensions of each unit shall be made with a steel scale graduated in 1 mm divisions and shall be read to the nearest division of scale and the average recorded.

A-1.2 Length or diameter shall be measured on the longitudinal centre line of each face, width of square or rectangular manhole covers across the top and bottom bearing surfaces at midlength, and thickness on both faces at midlength.

A-2. REPORT

A-2.1 The report shall show the average length, width, or diameter and thickness of each specimen.

APPENDIX B

(*Clause* 7.3)

METHOD FOR LOAD TEST

B-1. PROCEDURE

B-1.1 A suitable testing arrangement is shown in Fig. 3. The cover shall be supported in a frame which may be standard cover frame or a specially made testing appliance simulating normal conditions of use. The specified load as given in Table 1 shall be applied without shock through the medium of a bearing block faced with hard rubber or other resilient material. The bearing block shall be of the size specified in Table 1 and shall bear centrally on

the cover. The block shall be sufficiently rigid to ensure that the load on the cover is uniformly distributed over the full area of the block. The specified load shall be applied for a minimum period of 30 s and then increased gradually till the cover breaks.

B-2. REPORT

B-2.1 The maximum load which the manhole cover withstands without fracture for a minimum period of 30 s shall be reported as the breaking load.

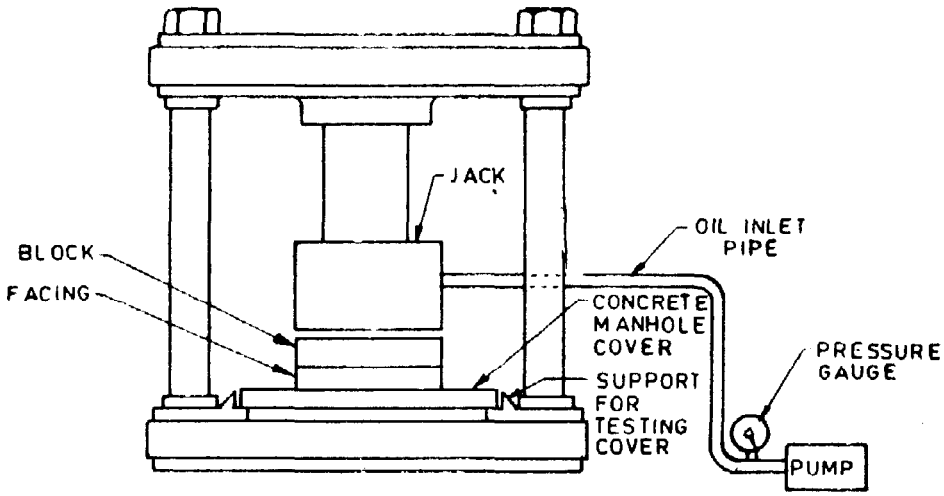

FIG. 3 ARRANGEMENT FOR TESTING MANHOLE COVERS

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AMENDMENT NO. 1 NOVEMBER 1990
TO
IS 12592 (Part 1):1988 SPECIFICATION FOR PRECAST CONCRETE MANHOLE COVERS AND FRAMES

PART 1 COVERS

(Page 2, clause 3.4, line 5) - Substitute 'minimum' for 'maximum'.

(CED 2)

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AMENDMENT NO. 2 AUGUST 1991
TO
IS 12592 (Part 1) : 1988 SPECIFICATION FOR PRECAST CONCRETE MANHOLE COVERS AND FRAMES
PART 1 COVERS

(*Page* 2, *clause* **3.5.1**) — Insert the following new clause after **3.5.1** and renumber the existing **3.6** as **3.7** :

'**3.6 Steel Fibres** — The diameter/equivalent diameter of steel fibres shall not be greater than 0.75 mm. The aspect ratio of the fibres (ratio of length of the fibre to its diameter/equivalent diameter) shall be in the range of 50 to 80. The minimum volume of fibres, where used, shall be 0.5 percent of the volume of concrete.'

(*Page* 3, *clause* **6.4**) — Insert the following at the end:

'Exposed surface of mild steel sheet shall be given suitable treatment with anticorrosive paint or coating. The lifting device shall be protected from corrosion by hot dip galvanizing or epoxy coating or any other suitable means approved by the purchaser.'

(CED 2)

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AMENDMENT NO. 3 MAY 1995
TO
IS 12592 (Part 1) : 1988 SPECIFICATION FOR PRECAST CONCRETE MANHOLE COVERS AND FRAMES

PART 1 COVERS

(*Page* 1, *clauses* 2 *to* 2.3) — Substitute the following for the existing clauses:

'2 GRADES AND TYPES

2.1 Manhole cover shall be of the following four grades and types:

Grades	*Grade Designation*	*Type/Shape of Cover Frame*
Light Duty	LD - 2.5	Rectangular, square and circular
Medium Duty	MD - 10	Rectangular and circular
Heavy Duty	HD - 20	Circular, lamphole, square and rectangular (scrapper manhole)
Extra Duty	EHD - 35	Circular, square and rectangular (scrapper manhole)'

(*Page* 2, *clause* 4.1) — Substitute the following for the existing clause:

'4.1 **Shapes** — The shapes of precast concrete manhole covers shall be of any shape as mentioned in 2.1.'

(*Page* 2, *clause* 4.2, *first sentence*) — Substitute the following for the existing sentence:

"Length, breadth and diameter of precast concrete manhole covers shall be such that the maximum clearance (along the periphery) at top between the cover and the frame of corresponding grade and shape [*see* IS 12592 (Part 2) : 1991**] shall be 5 mm."

(*Page* 2, *foot-note*) — Add the following foot-note at the end:

'**Precast concrete manhole covers and frames — Specification: Part 2 Frames.'

(*Page* 5, *Table* 1) — Substitute the following for the existing table:

TABLE 1 TEST LOAD AND DIAMETER OF BLOCK

(*Clauses* 7.3 *and* 10.3)

GRADE OF COVER	TYPE	LOAD IN TONNES	DIAMETER OF BLOCK mm
LD – 2.5	Rectangular, square and circular	2.5	300
MD – 10	Rectangular and circular	10	300
HD – 20	Circular, lamphole, square and rectangular (scrapper manhole)	20	300
EHD – 35	Circular, square and rectangular (scrapper manhole)	35	300

(CED 53)

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