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Indian Standard SPECIFICATION FOR OUTDOOR STEEL BINS FOR FOODGRAIN STORAGE

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INDIAN STANDARDS INSTITUTION
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NEW DELHI 110002

Indian Standard

SPECIFICATION FOR OUTDOOR STEEL BINS FOR FOODGRAIN STORAGE

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Indian Standard

SPECIFICATION FOR OUTDOOR STEEL BINS FOR FOODGRAIN STORAGE

0. FOREWORD

- 0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 May 1979, after the draft finalized by the Storage Structures and Storage Management Sectional Committee had been approved by the Agricultural and Food Products Division Council.
- **0.2** Bins made of steel are gaining popularity for storage of foodgrains. Outdoor bins up to capacity 7 m³ are generally preferred by farmers for such storage. With a view to helping the manufacturers to fabricate bins of required quality and performance and helping farmers in getting proper type of bins, this standard has been formulated.
- **0.3** It is recommended that the flat-bottom bins should be suitably mounted on prefabricated steel elevated base. The hopper-bottom bins should be mounted on brick masonry columns as given in Appendix A.
- 0.4 The requirements contained in this standard are based on the survey carried out and designs developed by the Indian Grain Storage Institute, Hapur. Other types of bins will be taken up as and when developed by other organizations.
- 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 prescribes requirements for materials, dimensions, capacities and method of construction of circular galvanized plain steel outdoor bins for bulk storage of grains at farm level. This standard includes flat- and hopper-bottom bins.

^{*}Rules for rounding off numerical values (revised).

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2. TERMINOLOGY

- 2.1 Grains All cereals, pulses, milled products, oilseeds and the grains intended to be used as seed (see IS: 2813-1970*).
- 2.2 Grain Storage Bin A structure designed for holding grain in bulk.
- 2.3 Flat-Bottom Bin A bin with a horizontal steel bottom from which all the quality of grain does not flow out by gravity.
- **2.4 Hopper-Bottom Bin** A bin with a sloping or conical bottom which is self-emptying.

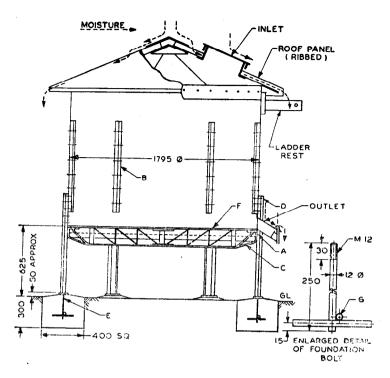
3. DESCRIPTION

- 3.1 The outdoor flat-bottom steel bin (see Fig. 1) consists of a cylindrical body and conical roof having the same diameter with variable heights so as to provide five different capacities. The conical roof with a slope of 25° should be made by joining 12 roof panels and roof stiffeners. The bin should have an inlet either at the centre or at the side of the roof to facilitate filling of the bin and the inclined outlets be provided at the bottom of the bin at the floor level. In a small-capacity bin only one outlet should be provided while for large capacity structures two outlets diagonally located may be provided. The flat-bottom bins should be mounted on prefabricated steel elevated base is given in Appendix A.
- 3.2 The outdoor hopper-bottom bin (see Fig. 2) consists of a cylindrical body conical roof and self-emptying type hopper having the hopper angle either of 35° or 45° as required for different foodgrains. The hopper part of the bin carries one single outlet at the bottom which facilitates the emptying of the structure completely. The hopper bottom of the bin has an advantage over the flat-bottom bin as the former allows complete discharge of the grain while certain quantity of the grain is left over in the case of flat-bottom bin. The remaining grain from the flat-bottom bin is ultimately required to be reclaimed manually. The spout of the bin would be nearly 750 mm about the ground level to facilitate filling of the bags conveniently. The details of the construction of the foundation are given in Appendix A.

4. CAPACITIES AND DIMENSIONS

4.1 The capacities and dimensions of the flat-bottom and hopper-bottom bins shall be as given in Tables 1 and 2 respectively.

^{*}Terminology for foodgrains (first revision).



- A Bolts M6 ϕ × 25 mm (electrogalvanized, 36 required) (Hex headed) Bolts M 6 ϕ × 20 mm (electrogalvanized, 34 required)
- B Wall stiffener
- C Support truss ring
- D Support leg .
- E Foundation bolt
- F Bottom plate
- $G-12 \phi \times 150$ weld at 90°

All dimensions in millimetres.

Fig. 1 Flat-Bottom Steel Bin

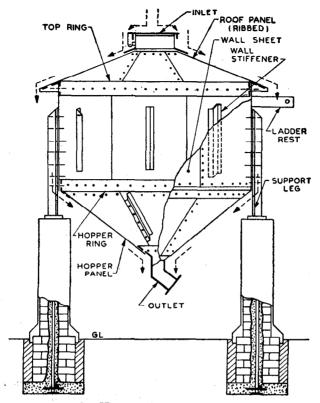


Fig. 2 Hopper-Bottom Steel Bin

TABLE 1 CAPACITY AND DIMENSIONS OF OUTDOOR FLAT-BOTTOM BINS

(Clause 4.1)

Sı No.	CAPACITY m ⁸	App	ROXIMATE T	ONNAGE	Bin Diameter	TOTAL HEIGHT OF BIN ABOVE	
		Paddy	Maize	mm	GROUND LEVEL		
						mm	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
i)	2.8	2.1	1.6	2.0	1 795	2 020	
ii)	3.5	2.6	1.9	2.5	1 795	2 270	
iii)	4·1	3.1	2.3	2.9	1 795	2 520	
iv)	5.4	4.0	3.0	3.8	1 795	3 020	
v)	6.7	5.0	3.7	4.8	1 795	3 520	

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TABLE 2 CAPACITY AND DIMENSIONS OF OUTDOOR HOPPER:

(Clause 4.1)

SL No.		MCITY m ³	M	ROXI- ATE BAT		NNAGE LDDY 45°		45°	BIN DIA- METER (mm)	TOTAL F OF BIN A GROUND	ABOVE LEVEL
	33	7.	35°	45°	33	33	, of at	1.77	()	35°	45°
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i) ii) iii) iv) v)	3·4 4·0 4·6 5·9 7·2	3.6 4.2 4.8 6.1 7.4	2·6 3·0 3·5 4·5 5·4	2·7 3·2 3 6 4·6 5·5	1.9 2.2 2.5 3.3 4.0	2·0 2·3 2·7 3·4 4·0	2.4 2.9 3.2 4.1 5.1	2·4 3·0 3·4 4·4 5·2	1 795 1 795 1 795 1 795 1 795	2 900 3 150 3 400 3 900 4 400	3 170 3 420 3 670 4 170 4 670

5. MATERIALS OF CONSTRUCTION

5.1 The bins shall be constructed from the following materials:

- a) Bin Wall, Roof, Roof Stiffener— The bin wall, roof, roof stiffeners shall be fabricated by using 1.00 mm thick galvanized plain sheets (see IS: 277-1977*). Hopper panels and hopper stiffeners required in the case of hopper-bottom outdoor bin, shall be fabricated by using 1.00 mm thick galvanized plate sheet (see IS: 277-1977*).
- b) Top, Intermediate and Bottom Rings The top intermediate and bottom rings shall be fabricated by using 50 × 4 mm, 75 × 4 mm and 100 × 6 mm mild steel flat (see IS: 1731-1971†) and 3 mm thick sheet (see IS: 277-1977*).
- c) Inlet and Outlet The inlet shall be fabricated by using mild steel flat, mild steel round and 3 mm thick sheet. The outlet is fabricated by using different sizes of mild steel flat (see IS: 1731-1971†) and 3 mm thick sheet (see IS: 277-1977*).
- d) Wall Stiffeners These shall be provided in both types of structures and fabricated by using 1.25 mm thick galvanized plain sheet (see IS: 277-1977*).
- e) Bolts, Nuts and Washers The galvanized bolts and nuts of different sizes shall be used for joining the wall sheets, roof panels and other components of the bin. In order to make the joints completely waterproof, two types of washers shall be used. The flat plain metal washer shall be provided inside while the fibre washers shall be provided outside.

^{*}Specification for galvanized steel sheets (plain and corrugated) (third revision).
†Dimensions for steel flats for structural and general engineering purposes (second revision).

6. FITTINGS AND ACCESSORIES

- **6.1 Outlet** A rectangular outlet of 250×200 mm sloping downward at an angle of 30° shall be provided at the bottom of the wall of the flatbottom bin. An outlet of 200 mm diameter shall be provided at the bottom of the hopper in case of hopper-bottom bin. The outlets shall be provided with locking and sealing arrangement.
- 6.2 Ladder Rest The ladder rest fabricated by using different structural steel shall be provided at the top of the bin wall as shown in Fig. 2.
- **6.3 Sealing** In order to make the wall and roof panel joints completely air- and water-tight, the necessary grooving should be provided in the wall and roof-panels and these grooves should be filled up with cotton cord coated with white stiff paint (Safaida).
- **6.4 Painting** All the mild steel components should be cleaned of oil and welding slag and painted by applying the single coat of red oxide metal primer and single finishing coat of enamel paint.

7. ASSEMBLY

7.1 The details of assembly and location of bins are given in Appendix A for guidance.

8. CRITERIA FOR DESIGN

8.1 The bins should be designed with due consideration to grain pressure, wind loads and other safety factors.

9. PERFORMANCE

9.1 For satisfactory performance of the bins, moisture content of the grain at the time of storage for different foodgrains should be within the safe limits [see IS: 6151 (Part II)-1971*].

10. PACKING AND MARKING

- 10.1 Packing The storage bins shall be supplied in prefabricated parts. The suppliers of the bins shall furnish details of erection and assembly of the bins and a copy of the guidelines for construction brick masonry columns for hopper-bottom bin and concrete foundation for flatbottom bins and list of materials supplied. Fitting tools and 5 percent of the fastenings shall be supplied to the buyer.
- 10.2 Marking A metal plate giving the name of the supplier, the date of fabrication and the batch and serial number shall be attached to each bin.

^{*}Storage management code: Part II General care in handling and storage of agricultural produce and inputs.

10.2.1 Each bin 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 liceace for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A

(Clauses 0.3, 3.1, 3.2 and 7.1)

DETAILS OF CONSTRUCTION OF STEEL ELEVATED BASE, BRICK MASONRY COLUMN AND ASSEMBLY OF FLAT-AND HOPPER-BOTTOM BINS

A-1. PREFABRICATED STEEL ELEVATED BASE

- A-1.1 Prefabricated Steel Elevated Base Alternatively when the bin is to be mounted on a prefabricated steel elevated base, it should be fabricated by using different sizes of structural steel as shown in Fig. 1.
- A-1.1.1 The details of columns, trusses and bottom plates sheet be as follows:
 - a) Columns The columns should be made from 3 mm thick mild steel plate and should be of 900 mm in length and 40 mm in width.
 - b) Trusses The trusses should be made of 50 × 4 mm mild steel flats and mild steel rod of 12 mm diameter.
 - c) Bottom plate The bottom plate shall be of 1.0 mm thick galvanized plain sheet.

A-2. BRICK MASONRY COLUMN

A-2.1 The details of construction of brick masonry column for hopperbottom bin are shown in Fig. 3. The number of columns required for bins of different capacities are given as below:

Capacity of Bins	Number of Columns per Bin
3. 4 to 4. 2	3
4.6 to 4.8	4
5.9 to 7.4	6

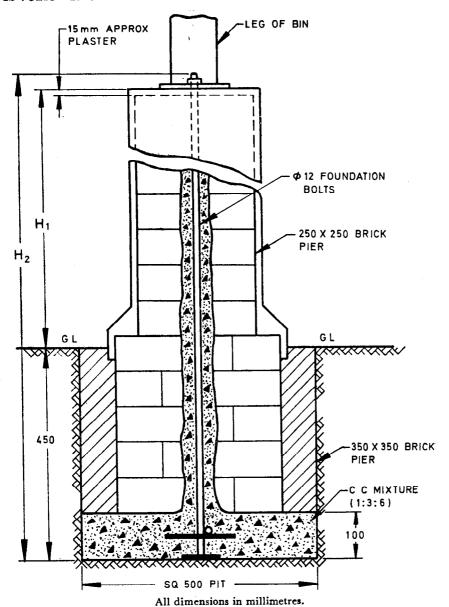


Fig. 3 Brick Masonry Column for Outdoor Hopper-Bottom Steel Bins

A-3. LOCATION AND ASSEMBLY

- **A-3.1** The site for the bins should be so selected that the ground is free from floods and proper drainage arrangements are made to prevent water logging near the bins.
- A-3.2 Wall Assembly The wall panels should be joined one by one to the bottom ring by using specific sizes of galvanized bolts, nuts and washers (plain and fibre). The wall panels should also be joined together by bolts, nuts and washers. The cotton cord of 6 mm diameter coated with white stiff paint should be provided in the groove of each panel joint to make the joint air- and water-tight. The wall stiffeners should be provided at respective positions of the wall panels. The top and intermediate rings should be provided to the bin at their respective positions.
- A-3.3 Roof Assembly The roof panels and roof stiffeners should be joined together with bolts, nuts and washers to form the conical roof. The inlet with a minimum diameter of 450 mm should be provided during its assembly either at the centre or at the side of the roof with locking and sealing arrangement. The cotton cord of 6 mm diameter coated with white stiff paint should be provided in the groove of each panel joint. The assembled roof should be mounted on the top of the bin and joined with bolts and nuts against the top ring.
- A-3.4 Hopper Assembly In case of outdoor hopper-bottom bin the hopper panels and hopper stiffeners should be joined together by using bolts, nuts and washers with the bottom ring so as to form a conical hopper. The spout with its flange should be provided at the bottom of the hopper at the desired position and joined by bolts, nuts and washers. The hopper angle shall be 35° and 45° to facilitate the emptying of the bin for different commodities, such as wheat, maize and paddy conveniently.
- A-3.5 Legs In case of elevated base, six prefabricated steel legs should be joined to the bin at its respective position to keep the floor elevated above the ground level. The entire structure should then be mounted over the foundation bolts embedded in cement concrete foundation as shown in Fig. 1. Similarly, in case of hopper-bottom bin the required number of prefabricated steel legs should be joined to the bin wall at their respective positions. The legs should have proper welded plates with holes corresponding to the foundation bolts already embedded in the foundation columns to receive the legs and shall be properly bolted and secured with necessary washers.

INDIAN STANDARDS

ON

STORAGE STRUCTURES AND STORAGE MANAGEMENT

IS:

- 607-1971 Code of practice for construction of bagged storage structures (second revision)
- 631-1977 Aluminium foodgrain storage bins (first revision)
- 3453-1966 Gode of practice for construction of hexagonal type concrete-cum-masonry bins bulk storage of foodgrains
- 3503 (Part I)-1969 General requirements for silos for grain storage: Part I Constructional requirements
- 3503 (Part II)-1969 General requirements for silos for grain storage: Part II Grain handling equipment and accessories
- 5606-1970 Steel bins for grain storage
- 5826-1970 Constructional requirements for flat storage structures for grain (capacity above 200 tonnes)
- 6151 (Part I)-1971 Storage management code: Part I Terminology
- 6151 (Part II)-1971 Storage management code: Part II General care in handling and storage of agricultural produce and inputs
- 6151 (Part III)-1976 Storage management code: Part III Specific care in handling and storage of agriculture produce and inputs
- 6201-1971 Constructional requirements for flat storage structures for grains (100 to 200 tonnes capacity)
- 6883-1972 Method for determination of angle of repose of grains
- 7147 (Part I)-1973 Steel bins for domestic storage: Part I GHARELU KOTHI
- 7247 Code of practice for fumigation of agricultural produce:
 - 7247 (Part I)-1973 Methyl bromide
 - 7247 (Part II)-1973 Ethylene dibromide
 - 7247 (Part III)-1973 Aluminium phosphate
 - 7247 (Part IV)-1975 Ethylene dichloride and carbon tetrachloride mixture
- 7715-1975 Methods for testing suitability of bins for safe storage of foodgrains
- 7716-1975 Method for testing efficacy of fumigation for disinfestation of grains in domestic bins
- 8455-1977 Code of practice for construction of polyethylene embedded bins for bulk storage of foodgrains