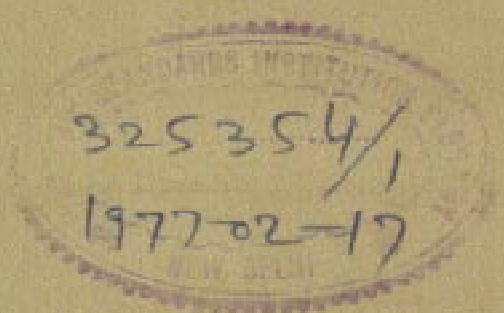
(Reaffirmed 1999)

Indian Standard

DIMENSIONS AND MATERIALS OF CEMENT ROTARY KILNS, COMPONENTS AND AUXILIARIES (DRY PROCESS WITH SUSPENSION PREHEATER)

UDC 666·94·041·57 : 389·63 : 620·2



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

Price Rs 5·00

November 1976

Indian Standard

DIMENSIONS AND MATERIALS OF CEMENT ROTARY KILNS, COMPONENTS AND AUXILIARIES (DRY PROCESS WITH SUSPENSION PREHEATER)

Cement and Concrete Sectional Committee, BDC 2

Chairman	*Representing*
DR H. C. VISVESVARAYA	Cement Research Institute of India, New Delhi
Members	
DR A. S. BHADURI	National Test House, Calcutta
SHRI E. K. RAMACHANDRAN (*Alternate*)	
DEPUTY CHIEF ENGINEER (BUILDINGS)	Public Works Department, Government of Tamil Nadu
DEPUTY CHIEF ENGINEER (IRRIGATION & DESIGNS) (*Alternate*)	
DIRECTOR	Central Road Research Institute (CSIR), New Delhi
DR R. K. GHOSH (*Alternate*)	
DIRECTOR (CSMRS)	Central Water Commission, New Delhi
DEPUTY DIRECTOR (CSMRS) (*Alternate*)	
ENGINEER-IN-CHIEF	Central Public Works Department, New Delhi
SUPERINTENDING ENGINEER, 2ND CIRCLE (*Alternate*)	
SHRI K. H. GANGWAL	Hyderabad Asbestos Cement Products Ltd, Hyderabad
SHRI K. C. GHOSAL	Alokudyog Services Ltd, New Delhi
DR R. K. GHOSH	Indian Roads Congress, New Delhi
BRIG HARISH CHANDRA	Engineer-in-Chief's Branch, Army Headquarters
SHRI G. R. MIRCHANDANI (*Alternate*)	
DR R. R. HATTIANGADI	Associated Cement Companies Ltd, Bombay
SHRI P. J. JAGUS (*Alternate*)	
DR IQBAL ALI	Engineering Research Laboratories, Hyderabad
JOINT DIRECTOR, STANDARDS (B & S), RDSO	Railway Board (Ministry of Railways)
DEPUTY DIRECTOR, STANDARDS (B & S), RDSO (*Alternate*)	
SHRI S. B. JOSHI	S. B. Joshi & Co Ltd, Bombay
SHRI M. T. KANSE	Directorate General of Supplies & Disposals, New Delhi

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
SHRI S. L. KATHURIA	Roads Wing (Ministry of Shipping & Transport)
SHRI S. R. KULKARNI	M. N. Dastur & Co (Pvt) Ltd, Calcutta
SHRI M. A. MEHTA	Concrete Association of India, Bombay
DR MOHAN RAI	Central Building Research Institute (CSIR), Roorkee
DR S. S. REHSI (*Alternate*)	
SHRI ERACH A. NADIRSHAH	Institution of Engineers (India), Calcutta
SHRI K. K. NAMBIAR	In personal capacity (*'Ramanalaya' 11 First Crescent Park Road, Gandhinagar, Adyar, Madras*)
PROF G. S. RAMASWAMY	Structural Engineering Research Centre (CSIR), Roorkee
DR N. S. BHAL (*Alternate*)	
DR A. V. R. RAO	National Buildings Organization, New Delhi
SHRI K. S. SRINIVASAN (*Alternate*)	
SHRI G. S. M. RAO	Geological Survey of India, Nagpur
SHRI T. N. S. RAO	Gammon India Ltd, Bombay
SHRI S. R. PINHEIRO (*Alternate*)	
SECRETARY	Central Board of Irrigation & Power, New Delhi
DEPUTY SECRETARY (I) (*Alternate*)	
SHRI R. P. SHARMA	Irrigation & Power Research Institute, Amritsar
RESEARCH OFFICER (LR) (*Alternate*)	
SHRI G. B. SINGH	Hindustan Housing Factory Ltd, New Delhi
SHRI C. L. KASLIWAL (*Alternate*)	
SHRI J. S. SINGHOTA	Beas Designs Organization, Nangal Township
SHRI T. C. GARG (*Alternate*)	
SHRI R. K. SINHA	Indian Bureau of Mines, Nagpur
SHRI K. A. SUBRAMANIAM	India Cements Ltd, Madras
SHRI P. S. RAMACHANDRAN (*Alternate*)	
SHRI L. SWAROOP	Dalmia Cement (Bharat) Ltd, New Delhi
SHRI A. V. RAMANA (*Alternate*)	
SHRI D. AJITHA SIMHA, Director (Civ Engg)	Director General, ISI (*Ex-officio Member*)

Secretary

SHRI Y. R. TANEJA
Deputy Director (Civ Engg), ISI

Cement Plant and Machinery Subcommittee, BDC 2 : 11

Convener	
DR H. C. VISVESVARAYA	Cement Research Institute of India, New Delhi
Members	
SHRI B. C. BANERJEE	Cement Corporation of India Ltd, New Delhi
SHRI K. P. BANERJEE	Larsen & Toubro Ltd, Bombay
SHRI HARISH N. MALANI (*Alternate*)	
SHRI N. N. BHARGAVA	McNally Bharat Engineering Co Ltd, Kumardhubi
SHRI B. P. SINGH (*Alternate*)	
SHRI P. R. DASGUPTA	Ministry of Industry & Civil Supplies, New Delhi
SHRI H. H. GHUDE	Walchand Industries Ltd, Walchandnagar
SHRI A. K. BANERJEE (*Alternate*)	

(*Continued on page* 9)

Indian Standard

DIMENSIONS AND MATERIALS OF CEMENT ROTARY KILNS, COMPONENTS AND AUXILIARIES (DRY PROCESS WITH SUSPENSION PREHEATER)

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 22 June 1976, after the draft finalized by the Cement and Concrete Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The Indian cement industry has about 130 kilns in operation with widely differing capacities, dimensions and other details. A closer examination of these indicates that a rational and mature unification effort in the field of design of cement plant and machinery will bring in considerable benefits to the industry.

0.3 Standardization based on scientific principles and rational and logical considerations will lead to simplification and reduction of unwanted varieties, enable reduction in time and delivery, make it possible to place advance orders, facilitate interchangeability, optimize operational parameters, and finally reduce the total cost of cement plant and machinery taken as a whole for the industry. A balanced approach to achieve this goal will naturally have to take into consideration all the relative parameters so as to assist the planned expansion of the cement industry in the country and the projected export potential of the cement machinery manufacturing industry.

0.4 The cement kilns are presently designated in the country in terms of clinker that can be produced per day by a kiln; and the term standardization has been associated with such daily capacity. Designation of kiln by capacity in terms of tonnes per day has added to varieties in sizes with no special advantage. On the other hand, the output for any given size of kiln varies within certain narrow limits depending upon the raw materials and the fuel used, assuming that other operational parameters are substantially the same or optimum. Thus it is to the advantage of all that the sizes of the kilns are standardized on the basis of their dimensions within certain narrow ranges. Consequently, in this Indian Standard an attempt has been made to unify rotary kilns for cement essentially on the basis of dimensional requirements to achieve quickly the benefits of standardization.

0.5 The dimensions of six sizes of kilns covered in this standard are based on the data received from various cement machinery manufacturers in the country as well as the data worked out by Cement Research Institute of India, New Delhi. Though the kilns are designated on the basis of internal shell diameter and length it may be noted that other dimensions of kilns, such as the thickness of shell and kiln auxiliaries can be used with any of the kiln sizes designated, depending on the design parameters for the kiln.

0.6 Although, the major recommendations in the standard relate to dimensions of rotary kilns, recommendations have also been included for those materials which along with the dimensions recommended have a bearing on the performance of the kilns.

0.7 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.8 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 lays down the essential dimensions and materials for six sizes of cement rotary kilns and their components and auxiliaries.

2. KILN SIZE

2.1 The kiln size shall be represented by the inside shell diameter and the nominal length. The principal dimensions of different sizes of kilns shall be as given in Table 1.

TABLE 1 KILN DIMENSIONS

Size	Inside Diameter	Permissible Range in Inside Diameter	Nominal Length	No. of Supports
	m	m	m	
(1)	(2)	(3)	(4)	(5)
A	2·9	2·9 to 3·0	44	3
B	3·6	3·6 " 3·7	54	3
C	4·0	4·0 " 4·1	63	3
D	4·3	4·3 " 4·4	65	3
E	4·5	4·5 " 4·6	77	3
F	5·0	5·0 " 5·1	85	4

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

3. THICKNESS OF SHELL

3.1 The thickness of steel plate for shell for different zones of kiln shall be as given in Table 2.

TABLE 2 THICKNESS OF STEEL PLATE FOR KILN SHELL

Sl No.	Kiln Zone	Standard Thickness of Steel Plate to be Used, mm						
i)	For calcining, burning and cooling zones	18	20	22	25	28	32	40
ii)	Under tyres	45	50	63	75	80	85	90
iii)	Under girth gear	28	32	36	40	50	56	63

3.2 For calcining, burning and cooling zones, higher thickness may be adopted, at sections adjacent to the tyres.

4. THICKNESS OF REFRACTORY LINING

4.1 The thickness of refractory lining shall in no case be less than 150 mm.

5. DIMENSIONS OF KILN, COMPONENTS AND AUXILIARIES

5.1 Kiln Tyres — The tyres shall be in 12 sizes and their various dimensions shall be as given in Table 3.

TABLE 3 DIMENSIONS OF TYRES

Sl No.	Dimension	Preferred Sizes, mm						Optional Sizes, mm					
		T_1	T_2	T_3	T_4	T_5*	T_6*	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}
i)	Outside diameter	3 610	4 520	5 050	5 430	5 685	6 160	3 550	4 400	4 850	5 220	5 530	6 000
ii)	Inside diameter	3 110	3 900	4 300	4 600	4 830	5 360	3 110	3 900	4 300	4 600	4 830	5 360
iii)	Width	350	450	700	1 000	1 300	1 400	550	650	750	850	1 000	1 000
		600	700	900	1 200	1 600	1 600	750	850	1 000	1 100	1 200	1 200
		800	900										

*Should be preferably of hollow cross-section to limit the weight.

5.2 Support Rollers — The support rollers shall be in 9 sizes and their dimensions shall be as given in Table 4.

TABLE 4 DIMENSIONS OF SUPPORT ROLLERS

(*Clause* 5.2)

Sl No.	Dimension	Size, mm								
		R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9
i)	Outside diameter	1 100	1 200	1 500	1 700	1 800	2 100	2 300	2 500	3 000
ii)	Width	Shall be 100 mm wider than the respective tyre width								

5.3 Girth Gears and Pinions — The girth gears and pinions shall be in 6 sizes and their dimensions shall be as given in Table 5.

TABLE 5 DIMENSIONS OF GIRTH GEARS AND PINIONS

Sl No.	Dimension	Size, mm					
		G_1	G_2	G_3	G_4	G_5	G_6
i)	Outside diameter of girth gear	4 610	5 185	5 752	6 200	7 476	6 900
ii)	Face width of girth gear	450	520	520	600	750	600
iii)	Module	24	27	30	32	42	36
iv)	Face width of pinion	500	570	570	650	800	2 × 650 (twin drive)

5.4 Drive Motors and Gear Boxes — The drive motors and gear boxes shall be in 7 sizes as given in Table 6.

TABLE 6 SIZES OF KILN DRIVE MOTORS AND GEAR BOXES

Sl No.	Item	Size						
		M_1	M_2	M_3	M_4	M_5	M_6	M_7
i)	Drive, power in kW	50	75	110	150	185	220	275
ii)	Motor (continuously variable), speed range in rev/min	250 to 1 000	250 to 1 000	250 to 1 000	250 to 1 000	250 to 1 000	250 to 1 000	250 to 1 000
iii)	Gear box, power to be transmitted in kW	50	75	110	150	185	220	275

6. MATERIALS

6.1 Shell Material and Brick Quality — The material of the kiln shell and the quality of refractory shall be as given in Table 7.

TABLE 7 MATERIAL FOR KILN SHELL

Sl No.	Shell Material	Requirement
(1)	(2)	(3)
i)	Steel	a) For components and parts where the thickness does not exceed 20 mm, steel plates shall conform to IS : 226-1975*
		b) For components and parts where the thickness exceeds 20 mm, but does not exceed 50 mm, steel plates shall conform to IS : 2062-1969†
		c) For components and parts where the thickness exceeds 50 mm, steel plates shall conform to boiler quality Grade 2 A of IS : 2002-1962‡
ii)	Bricks	a) In preheater zone, the bricks shall conform to IS : 6-1967§
		b) In calcining zone, the bricks shall conform to IS : 8-1967‖ and IS : 6-1967§ near the inlet end
		c) In burning zone, the bricks shall conform to IS : 1749-1972¶ for magnesite bricks or as detailed in Note 2 for high alumina bricks of alumina content of 65 percent and above
		d) For insulation, the bricks shall conform to IS : 2042-1972**. Type 1 can be used at 1 500°C, Type 2 at 1 250°C and Type 3 at 850°C

NOTE 1 — Irrespective of the type of steel used, non-destructive testing shall be done to rule out the possibility of defects due to laminations and other imperfections.

NOTE 2 — High alumina refractories, castables and ramming masses can be used effectively especially in the higher temperature zones. Since there are no Indian Standards for these at present their specifications may be agreed upon between the purchaser and the manufacturer.

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

†Specification for structural steel (fusion welding quality) (*first revision*).

‡Specification for steel plates for boilers.

§Specification for moderate heat duty fireclay refractories, group A (*third revision*).

‖Specification for high heat duty fireclay refractories (*third revision*).

¶Specification for magnesite refractories (*first revision*).

**Specification for insulating bricks (*first revision*).

6.2 Material of Construction for Components and Auxiliaries — The material for the construction of tyres, support rollers, girth gear and pinion shall be as given in Table 8.

TABLE 8 CONSTRUCTION MATERIAL FOR COMPONENTS AND AUXILIARIES

Sl No.	Components/Auxiliaries	Material* Conforming to
(1)	(2)	(3)
i)	Tyres	Grade 1 of IS : 2644-1969† Grade 2 of IS : 2708-1973‡
ii)	Support rollers	Grade 1 of IS : 2644-1969† Grade 1 of IS : 4896-1968§
iii)	Girth gear	Grade 1 of IS : 4896-1968§
iv)	Pinion	Grade 1 of IS : 4896-1968§ Class 4 of IS : 2004-1970‖ 40 Cr 1 M'o' 28 IS : 157-1961¶

*Specification for higher grades may be used if required.
†Specification for high tensile steel castings (*first revision*).
‡Specification for 1·5 percent manganese steel castings (*first revision*).
§Specification for one percent chromium steel castings for resistance to abrasion.
‖Carbon steel forgings for general engineering purposes (*first revision*).
¶Schedules for wrought steels for general engineering purposes.

(*Continued from page* 2)

Members	*Representing*
SHRI A. B. MALLIK	Directorate General of Technical Development, New Delhi
SHRI R. C. MOHANTY	Bharat Heavy Electricals Ltd, Bhopal
SHRI A. L. PASTALA	Associated Cement Companies Ltd, Bombay
SHRI I. C. AHUJA (*Alternate*)	
SHRI M. J. SANE	Holtec Engineers Pvt Ltd, Delhi
SHRI S. SEN	ACC-Vickers-Babcock Ltd, Bombay
SHRI S. P. DEOLALKAR (*Alternate*)	
SHRI K. K. SOMANI	Shree Digvijay Cement Co Ltd, Bombay
SHRI S. B. SOOD	The Indian Sugar and General Engineering Corporation, Yamunanagar
SHRI L. SWAROOP	Dalmia Cement (Bharat) Ltd, New Delhi
SHRI A. V. RAMANA (*Alternate*)	
SHRI K. V. A. THAMPURAN	The K. C. P. Ltd, Madras