

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 1285 (2002): Wrought Aluminium and Aluminium Alloys - Extruded Round Tube and Hollow Sections for General Engineering Purposes [MTD 7: Light Metals and their Alloys]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



भारतीय मानक

सामान्य इंजीनियरिंग अनुप्रयोगों हेतु पिटवां ऐल्युमीनियम एवं
ऐल्युमीनियम मिश्र धातुओं से बनी एक्सट्रूडेड गोल नलियाँ
एवं खोखले सेक्शन — विशिष्टि
(तीसरा पुनरीक्षण)

Indian Standard

WROUGHT ALUMINIUM AND ALUMINIUM
ALLOYS — EXTRUDED ROUND TUBE AND HOLLOW
SECTIONS FOR GENERAL ENGINEERING
PURPOSES — SPECIFICATION

(Third Revision)

ICS 77.150.10

© BIS 2002

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

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Light Metals and Their Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1956 and subsequently revised in 1968 and 1975. While reviewing this standard in the light of experience gained during these years, the Sectional Committee decided to revise the standard.

In this revision, the following modifications have been made:

- a) Extruded round tubes have been further divided into extruded structural tubes and extruded seamless tubes.
- b) One new aluminium alloy 31000 which is having application for general engineering purposes have been included.
- c) Temper condition 'O' has been incorporated for Aluminium grade 19000, 19500 and Aluminium alloys 24345, 52000, 53000 and 54300.

The characteristics and typical uses of alloys are given in Annex A.

The comparison of new IS tempers with old tempers is given in Annex B.

The composition of the Committee responsible for formulation of this standard is given in Annex C.

For the purpose of deciding whether 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 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

WROUGHT ALUMINIUM AND ALUMINIUM ALLOYS — EXTRUDED ROUND TUBE AND HOLLOW SECTIONS FOR GENERAL ENGINEERING PURPOSES — SPECIFICATION

(Third Revision)

1 SCOPE

This standard covers the requirements for wrought aluminium and aluminium alloy extruded round tubes and hollow sections for general engineering purposes.

2 REFERENCES

The following standards contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
504 : 1963	Method of chemical analysis of aluminium and its alloys (<i>revised</i>)
1608 : 1995	Mechanical testing of metals — Tensile testing (<i>second revision</i>)
2673 : 2002	Dimensions for wrought aluminium and aluminium alloys extruded round tube (<i>second revision</i>)
5047	Glossary of terms relating to aluminium and aluminium alloys
Part 1 : 1986	Unwrought and wrought metals (<i>second revision</i>)
Part 2 : 1979	Plant and operations, thermal treatment, control and testing, finishing
5052 : 1993	Aluminium and its alloys-temper designations (<i>first revision</i>)
6051 : 1970	Code for designation of aluminium and its alloys
6477 : 1983	Dimensions for wrought aluminium and aluminium alloys extruded hollow sections (<i>first revision</i>)
10259 : 1982	General conditions for delivery and inspection of aluminium and aluminium alloy products

3 TERMINOLOGY

3.1 For the purpose of this standard, the following definitions in addition to those given in IS 5047 (Parts 1 and 2) shall apply.

3.2 Extruded Round Tube

A circular hollow extrusion of uniform wall thickness not subjected to cold working.

3.3 Extruded Structural Tube

An extruded round tube brought to final dimensions by extruding through a bridge type die, port hole die or by similar method at the option of the producer.

3.4 Extruded Seamless Tubes

An extruded round tube brought to final dimensions by extrusion of hollow billet.

3.5 Hollow Section

An extruded shape other than round tube, the cross-section of which completely encloses a void or voids.

3.6 Heat Treatment Batch

A quantity of material of one alloy, of the same dimensions and produced in the same way and complying one of the following conditions shall make a heat treatment batch:

- a) The material solution treated in one furnace load,
- b) The material charged consecutively in a continuous solution heat treatment furnace during an 8 h period,
- c) The press heat-treated extrusions of one extrusion charge, or
- d) Such material solution heat-treated by one of the above methods and subsequently precipitation treated in one furnace load.

However, a furnace load may comprise of more than one heat treatment batch.

4 SUPPLY OF MATERIAL

General requirements for the supply of material shall conform to IS 10259.

5 FREEDOM FROM DEFECTS

5.1 The extruded round tube and hollow sections shall be sound and reasonably free from harmful defects.

5.2 Slight discolouration due to heat treatment, minor polishing marks and spiral marks due to roll straightening shall not be a cause for rejection.

6 CONDITIONS OF SUPPLY

The material shall be supplied in the condition as specified by the purchaser. While specifying the condition, the temper designations as laid down in IS 5052 shall be followed.

7 DIMENSIONS AND TOLERANCES

Dimensions and tolerances of the material shall be as laid down in the Indian Standards indicated below:

- a) Extruded round tube IS 2673, and
- b) Extruded hollow sections IS 6477.

8 CHEMICAL COMPOSITION

The material, when analyzed as per IS 504 or any other established instrumental/chemical method, shall

conform to the requirements as given in Table 1. In case of dispute, the procedure given in IS 504 shall be the referee method. However, when the method is not given in IS 504, the referee method shall be as agreed to between the purchaser and the manufacturer.

9 MECHANICAL PROPERTIES

The material when tested in accordance with IS 1608, shall have the mechanical properties as given in Table 2.

10 SELECTION OF TEST SAMPLES

10.1 Extruded round tube and hollow sections of the same dimensions, produced in the same way and of the same alloy, shall be grouped into lots as given in Table 3.

10.2 Aluminium and Non-Heat Treatable Aluminium Alloy

10.2.1 One test sample shall be cut from an extruded round tube or hollow section selection from each lot.

10.2.2 Before the test samples are cut off, they shall be marked to identify them with the lot they represent.

10.2.3 The sample shall be taken from the material as supplied and shall not be annealed or mechanically worked (except for straightening and machining to the shape of the test piece) before they are tested.

Table 1 Chemical Composition of Wrought Aluminium and Aluminium Alloy Extruded Round Tube and Hollow Sections for General Engineering Purposes

(Clause 8)

(Composition Limits are in Percent <i>Max</i> Unless Shown Otherwise)												
Designation	Aluminium	Copper	Magne- sium	Silicon	Iron	Manga- nese	Zinc	Tita- nium*	Chromium	Others		Remarks
										Each (11)	Total (12)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1900	99.0, <i>Min</i>	0.1	0.2	0.5	0.7	0.1	0.1	—	—	0.05	—	Ti+V=0.07
19500	99.5, <i>Min</i>	0.05	0.05	0.3	0.4	0.05	0.10	—	—	0.03	—	Ti+V=0.07
24345	Remainder	3.8-5.0	0.2-0.8	0.5-1.2	0.7	0.3-1.2	0.2	0.3	0.3	0.03	—	Ti+Cr=0.3
31000	Remainder	0.1	0.1	0.6	0.7	0.8-1.5	0.2	0.2	—	0.05	0.15	—
52000	Remainder	0.1	1.7-2.6	0.6	0.7	0.5	0.2	0.2	0.25	0.05	0.15	Cr+Mn=0.
53000	Remainder	0.1	2.8-4.0	0.6	0.7	0.5	0.2	0.2	0.25	0.05	0.15	Cr+Mn=0.
54300	Remainder	0.1	4.0-4.9	0.4	0.7	0.5-1.0	0.2	0.2	0.25	0.05	0.15	—
62400	Remainder	0.1	0.4-0.6	0.5-0.9	0.7	0.1	0.1	0.1	0.1	0.05	0.15	—
63400	Remainder	0.1	0.4-0.9	0.3-0.7	0.6	0.3	0.2	0.2	0.1	0.05	0.15	—
64423	Remainder	0.5-1.0	0.5-1.3	0.7-1.3	0.8	1.0	0.2	—	—	0.05	0.15	—
64430	Remainder	0.1	0.4-1.2	0.6-1.3	0.6	0.4-1.0	0.1	0.2	0.25	0.05	0.15	—
65028	Remainder	0.15-0.	0.7-1.2	0.4-0.8	0.7	0.2	0.2	0.2	0.15-0.35	0.05	0.15	—
65032	Remainder	0.15-0.	0.7-1.2	0.4-0.8	0.7	0.2-0.8	0.2	0.2	0.2	0.05	0.15	—
74530	Remainder	0.2	1.0-1.5	0.4	0.7	0.2-0.7	4.0-5.0	0.2	0.2	0.05	0.15	—

* 'Ti' also includes other grain refining elements, if any.

T.I. = Total Impurities.

NOTE — It is the responsibility of the supplier to ensure that any element not specifically limited is not present in an amount, such as is generally accepted as having an adverse effect on the product. If the purchaser's requirements necessitate limits for any element not specified these should be agreed to between the supplier and the purchaser.

**Table 2 Mechanical Properties of Wrought Aluminium and Aluminium Alloy
Drawn Tubes for General Engineering Purposes
(Clause 9)**

Designation	Condition		Thickness		0.2 Percent Proof Stress, MPa, <i>Min</i>	Tensile Strength		Elongation in Gauge Length of 50 mm, Percent, <i>Min</i>
	New	Old	Over, mm	Up to and Including, mm		MPa, <i>Min</i>	MPa, <i>Max</i>	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
19000	F	M	—	—	—	65	—	18
	O	O	—	—	—	—	110	25
19500	F	M	—	—	—	65	—	23
	O	O	—	—	—	—	100	25
24345	O	O	—	—	120	—	240	12
	T ₄	W	—	—	225	375	—	10
	T ₆	WP	—	—	275	430	—	6
31000	F	M	—	—	—	95	—	16
	O	O	—	—	—	—	130	20
52000	F	M	—	—	—	170	—	14
	O	O	—	—	60	160	225	16
53000	F	M	—	—	100	215	—	12
	O	O	—	—	75	200	265	14
54300	F	M	—	—	130	275	—	11
	O	O	—	—	100	260	350	12
62400	T ₆	WP	—	—	200	255	—	15
63400	F	M	—	—	—	110	—	13
	T ₄	W	—	—	80	140	—	14
	T ₃	P	—	3.0	140	170	—	7
			3.0	12.5	110	150	—	7
	T ₆	WP	—	—	150	185	—	7
64423	F	M	—	—	—	120	—	11
	T ₄	W	—	—	155	265	—	14
	T ₆	WP	—	—	265	330	—	9
64430	F	M	—	—	—	110	—	14
	T ₄	W	—	—	120	185	—	14
	T ₆	WP	—	6.0	255	295	—	7
65028		O	6.0	—	270	310	—	7
	F	M	—	—	—	110	—	12
65032	T ₄	W	—	—	115	185	—	14
	T ₆	WP	—	—	235	290	—	7
74530	T ₄ *	W*	—	6.0	220	255	—	9
			6.0	25.0	230	275	—	9
			—	6.0	245	285	—	7
	T ₆	WP	—	25.0	265	310	—	7

(* Naturally aged for 30 days)

NOTE — 1 MPa = 1 N/mm² = 0.102 kgf/mm².

Properties in F/M conditions are given for information only.

10.3 Heat Treatable Aluminium Alloys

10.3.1 One test sample shall be cut from an extruded round tube or hollow section selected from each heat treatment batch.

10.3.2 Before any of the test samples are cut off, they shall be marked to identify them with the heat treatment batch.

10.3.3 The test samples after heat treatment shall not be mechanically worked (except for straightening and machining to the shape of the test piece) before they are tested.

10.3.4 For material supplied in the F condition, the test samples shall be heat treated and tested in the

F or T₄ or T₆ condition as specified by the purchaser.

10.3.5 For material supplied in the T₄ condition, the test samples shall be tested in the condition as supplied unless the purchaser has specified that he requires the test samples in the T₆ condition.

11 RETEST

11.1 Should any of test pieces first selected fail to pass the mechanical tests, two further samples from the same lot/heat treatment batch shall be selected for testing, one of which shall be from the tube or length from which the original test sample was taken, unless the tube or length has been withdrawn by the supplier.

Table 3
(Clause 10.1)

Diameter or Equivalent Cross-section		Mass for	
Over, mm	Up to and Including, mm	Aluminium and its Non-Heat-Treatable Alloys, kg	Heat Treatable Aluminium Alloys, kg
(1)	(2)	(3)	(4)
—	10	500	1 000
10	20	1 000	2 000
20	50	1 500	2 000
50	—	2 000	2 000

11.1.1 For heat-treatable alloys, the supplier shall have the right, if he so desired, to reheat-treat the material before two further samples are selected.

11.1.2 Should the test pieces from both these additional samples pass, the lot prescribed represented by the test samples shall be deemed to comply with the requirements of mechanical properties. Should the test

pieces from either of these additional samples fail, the lot represented by the test samples shall be deemed not to comply with this standard.

12 MARKING

12.1 Extruded round tube and hollow sections shall be suitably marked for identification, with the following details:

- Lot or heat-treatment batch number,
- Alloy designation and condition, and
- Indication of the source of manufacture.

12.1.1 The material may also be marked with the Standard Mark.

12.1.2 The use of Standard Mark is governed by the provision of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made there under. The details of the conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Foreword)

CHARACTERISTICS AND TYPICAL USES OF ALLOYS

Designation	Characteristics	Available Forms	Typical Uses
(1)	(2)	(3)	(4)
19000	Commercially pure aluminium, very ductile in annealed or extruded condition, excellent resistant to corrosion	Sheet, plate, extruded tube, wire, forgings	Panelling and moulding, equipment for food, chemical and brewing industries, architectural and builders hardwares, fasteners, welding wires and electrical guide tubes
19500	High purity aluminium, more resistant to corrosion than other grades	Sheet, plate, extrusion, tube, wire, rolled rod and forgings	Food, chemical, brewing and processing equipment, marine fittings, pressed and anodized utility items, heat exchanger tubes, condenser tubes, gas and oil transmission pipeline.
24345	Strong alloy that is aged naturally at room temperature after solution treatment and has fair ductility in this condition	Sheet, plate, extrusion tube, wire and forgings	Stressed parts in aircrafts and other structures where high strength is of primary consideration, hydraulic tubes air-conditioning ducting fan blades and vehicle panelling

<i>Designation</i>	<i>Characteristics</i>	<i>Available Forms</i>	<i>Typical Uses</i>
(1)	(2)	(3)	(4)
31000	Stronger and harder than 19000 and has good workability, weldability and corrosion resistance	Extrusion rods and tubes, sheet, plate, wire and forgings	General purpose alloy for moderate strength applications for chemical equipment, irrigation tubing, heat exchangers furniture, condenser, air-conditioning, ducting, pressure cookers utensils, detonator caps, pressure vessels, fan blades and vehicle panelling
52000	Ductile in soft condition, but work hardens rapidly becoming extremely tough. Has high resistance to corrosion in marine atmosphere	Sheet, plate, extrusion tube, wire and forgings	Paneling and structures, hydraulic tube appliances, refrigeration tubing condenser and heat exchanger tubes, gas and oil transmission pipelines
53000	Ductile in the soft condition, but work-hardens rapidly, becoming extremely tough. High resistance to corrosive attack especially in marine atmosphere	Sheet, extrusion, tube, wire and rolled rods	Ship building rivets; pressure vessels and other processing tanks; cryogenics and welded structures
54300	Similar to 53000	Sheet, plate, extrusion and forgings	Welded structures, cryogenic applications, structural marine applications, rail and road tank cars, rivets and missile components
62400	Medium strength alloy. Gives good surface finish and has excellent bending characteristics	Tube	Further where appearance and bending characteristics are important, such as furniture applications
63400	Suitable for intricate extruded sections of medium strength, forms well in W condition, highly resistant to corrosion	Extrusion, wire, tube rolled rod and forgings	Architectural uses and other similar applications where surface finish is important and medium strength would suffice. Electrical conduits, tubes for wave guides, gas and oil transmission pipelines
64423	Stronger than 64430 and has superior machinability	Extrusions	Applications requiring good strength and machinability, such as textile machinery components

Annex A (Concluded)

<i>Designation</i>	<i>Characteristics</i>	<i>Available Forms</i>	<i>Typical Uses</i>
(1)	(2)	(3)	(4)
64430	A medium-strength alloy with good mechanical properties, corrosion resistance and weldability	Sheet, plate, extrusion, tube, wire and forgings	Structural applications of all kinds, such as road and rail transport vehicles, bridges, cranes, roof trusses, rivets, etc. Cargo containers, milk containers, deep drawn containers and flooring
65032	Medium strength alloy with good mechanical properties and corrosion resistance	Extrusion, wire, tube, forgings, sheet, plate	Similar to 64430
74530	Medium strength self-ageing weldable alloy. It does not require heat treatment after hot working or welding. Excellent welding characteristics and good formability. Good corrosion resistance when compared with other high strength aluminium zinc alloys	Sheet, plate, extrusion and forgings	Stressed structural applications requiring welding, such as bridges, chequered plates, dump-truck bodies, pressure vessels and rail coaches.

ANNEX B**(Foreword)****COMPARISON OF NEW IS TEMPERS WITH THE OLD TEMPERS**

<i>Old IS Temper</i>	<i>New IS Temper</i>	<i>Old IS Temper</i>	<i>New IS Temper</i>
—	M	WD	T ₃
M	F	W	T ₄
O	O	P	T ₅
H	H	WP	T ₆
H ₁	H × 2	WS	T ₇
H ₂	H × 4	WDP	T ₈
H ₃	H × 6	WPD	T ₉
H ₄	H × 8	—	T ₁₀
—	T ₁	PD	—
—	T ₂	WR	—

ANNEX C

(Foreword)

COMMITTEE COMPOSITION

Light Metals and Their Alloys Sectional Committee, MTD 7

<i>Organization</i>	<i>Representative(s)</i>
In Personal Capacity (Flat No. 102, Rohtas Court, 15 Gokhale Marg, Lucknow-226001)	SHRI V. K. AGRAWAL (<i>Chairman</i>)
Aeronautical Development Establishment, Bangalore	SHRI N. C. SUD
Aluminium Association of India, Bangalore	SHRIMATI CHHAYA RAJPUT (<i>Alternate</i>)
Bharat Aluminium Co Ltd, Korba/New Delhi	PROF K. S. S. MURTHY
Bharat Forge Ltd, Pune	SHRI K. S. NAGESH (<i>Alternate</i>)
Bharat Heavy Electricals Ltd, Bhopal/Hyderabad	SHRI D. K. BISWAS
CEMILAC, Ministry of Defence, Bangalore	SHRI S. M. CHOBAY (<i>Alternate I</i>)
Central Electricity, Authority, New Delhi	SHRI V. K. VASUDEVA (<i>Alternate II</i>)
Central Electrochemical Research Institute, Karaikudi	SHRI N. R. HABBU
Central Power Research Institute, Bangalore	SHRI A. R. CHAUTHAI (<i>Alternate</i>)
Civil Aviation Department, Bangalore/New Delhi	SHRI R. K. SETH
Directorate General Supplies & Disposal (Inspection Wing), New Delhi/Bhilai	SHRI C. KANNAN (<i>Alternate</i>)
Defence Research & Development Laboratory, Hyderabad	DR P. RAGHOTHAMA RAO
Development Commissioner (SSI), New Delhi	SHRI KARNAIL SINGH
Electrical Manufacturing Co Ltd, Kolkata	SHRI NARENDER SINGH (<i>Alternate</i>)
Galada Continuous Castings Ltd, Hyderabad	SHRI A. SELVAKESAVAN
Heat Treaters and Engineers, Mumbai	DR V. ANANTH (<i>Alternate</i>)
Hindalco Industries Ltd, Renukoot	DR SEETHARAMU
Hindustan Aeronautics Ltd, Bangalore	SHRI B. H. NARAYANA (<i>Alternate</i>)
ISRO (VSSC), Thiruvananthapuram	SHRI R. C. GUPTA
India Foils Ltd, Kolkata	SHRI M. M. WALECHA (<i>Alternate</i>)
India Pistons Ltd, Chennai	SHRI B. B. RAJ
Indian Aluminium Co Ltd, Talaja/Kolkata	SHRI S. K. PANDEY (<i>Alternate</i>)
Indira Gandhi Centre for Atomic Research, Kalpakkam	DR S. SUNDARAJAN
Institute of Indian Foundrymen, New Delhi	SHRI G. RAJA SINGH (<i>Alternate</i>)
J.L.N. Aluminium R&D and Design Centre, Nagpur	DIRECTOR (MET)
Jindal Aluminium Ltd, Bangalore	SHRI G. K. GHOSH
Ministry of Defence (DGAQA), Hyderabad	SHRI D. C. GALADA
Ministry of Defence (DGQA), Ichapur	SHRI SANDEEP PARIKH
Ministry of Defence (DMRL), Hyderabad	SHRI J. P. SINGH
Ministry of Defence (OFB), Ambemath	SHRI ABHAY AGARWAL (<i>Alternate</i>)
National Aerospace Laboratory, Bangalore	DR P. K. SENGUPTA
	SHRI D. DUTTA (<i>Alternate</i>)
	DR P. K. BALASUBRAMANIAM
	REPRESENTATIVE
	SHRI N. GOWRISHANKAR
	SHRI S. SUNDARAJAN (<i>Alternate</i>)
	SHRI S. V. DESAI
	SHRI S. GUPTA (<i>Alternate</i>)
	SHRI K. V. KASIVISWANATHAN
	SHRI UDAYAN SEN
	DR V. V. KUTUMBARAO
	SHRI K. R. RAGHUNATH
	SHRI S. C. AGRAWAL (<i>Alternate</i>)
	SHRI K. N. SINHA
	SHRI V. K. SACHDEVA (<i>Alternate</i>)
	SHRI A. BHATTACHARYA
	SHRI P. K. L. R. NIMONKAR (<i>Alternate</i>)
	DR AMOL A. GOKHALE
	SHRI VIJAY SINGH (<i>Alternate</i>)
	DR S. K. PANDEY
	SHRI P. R. JADAV (<i>Alternate</i>)
	DR R. V. KRISHNAN

(Continued on page 8)

(Continued from page 7)

<i>Organization</i>	<i>Representative(s)</i>
National Aluminium Co Ltd, Bhubaneswar	SHRI M. M. SETH SHRI S. P. MOHAPATARA (<i>Alternate</i>)
National Metallurgical Laboratory, Jamshedpur	SHRI KISHORI LAL
National Thermal Power Corporation, NOIDA	REPRESENTATIVE
Research, Designs and Standards Organization, Lucknow	DIRECTOR (M&C-I) DIRECTOR (Carriage)/I&L (<i>Alternate I</i>) ARO (Met-V) (<i>Alternate II</i>)
Rural Electrification Corporation, New Delhi	REPRESENTATIVE
BIS Directorate General	SHRI JAGMOHAN SINGH, Director & Head (MTD) [Representing Director General (<i>Ex-officio</i>)]
<i>Member-Secretary</i> SHRI DEEPAK JAIN Joint Director (MTD), BIS	

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. MTD 7 (4284).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	{ 323 76 17 323 38 41
Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700 054	{ 337 84 99, 337 85 61 337 86 26, 337 91 20
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022	{ 60 38 43 60 20 25
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600 113	{ 254 12 16, 254 14 42 254 25 19, 254 13 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400 093	{ 832 92 95, 832 78 58 832 78 91, 832 78 92
Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM	