भारतीय मानक
Indian Standard

IS 14234 (Part 2) : 2017

स्पार्क प्रज्वलन वायु — शितित इंजिन के लिए स्नेहक — विशिष्टि

भाग 2 चार स्ट्रोक स्पार्क प्रज्वलन वायु – शितित स्कूटर, मोपेड़ और मोटर साइकल के इंजिन के लिए

Lubricants for Spark-Ignition Air-Cooled Gasoline Engines — Specification

Part 2 Four-Stroke Spark-Ignition Air-Cooled Engines for Scooters, Mopeds and Motorcycles

ICS 75.100

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FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards after the draft finalized by the Lubricants and their Related Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This Indian Standards was originally published in 1996 basically for two stoke engines. The design of the two-stroke cycle gasoline engine offers unique operational and economic advantages for a wide range of different power applications. The two-stroke air-cooled engine applications are widely seen in (a) Mopeds, (b) Motorcyles, (c) Scooters, (d) Chain saws, (e) Lawn movers, and (f) Portable small generators etc. Proper lubrication of two-stroke engines is of primary importance for their satisfactory operation.

The Committee responsible for the preparation of the standard decided to revise it to include the performance parameters, keeping in view the current and future engine/vehicle population in the market place. The Standards has been revised in two parts as follows:

Part 1 covering the requirements of lubricants for two-stroke spark-ignition engines [which has since been published as IS 14234 : 2002 Lubricants for spark ignition air-cooled gasoline engines Part 1 two stroke spark ignition air-cooled gasoline engines (first revision)] and

Part 2 covering the requirements of lubricants for four-stroke spark-ignition engines.

This standard (Part 2) covers the requirements for lubricants primarily intended for use in automotive, four-stroke spark-ignition air-cooled gasoline engines for mopeds, scooters, motorcycles, etc Proper lubrication of four-stroke engines is of primary importance for their satisfactory operation. Generally the following parameters constitute the basis for acceptability of lubricant for four-stroke engines:

(a) Density
(b) Kinematic viscosity
(c) Low temperature cranking viscosity
(d) Low temperature pumping viscosity
(e) High temperature high shear viscosity
(f) Foaming tendency
(g) Shear stability
(h) Frictional characteristics

Because of many variations in design and the broad range of power application, varying degrees of stresses are placed on the lubricants. The choice of a suitable lubricant is an especially difficult task in the absence of any guide.

In preparation of this standard considerable assistance has been derived from the requirements given in documents provided by various technical societies such as ASTM/API/SAE/CEC and JASO. In the present version, the performance level for four-stroke engine oil for Motor Cycles and Scooters have been categorized in reference to 2006 and 2011 equivalent JASO performance level.

a) Products certified for JASO T 903 : 2006 specification before Sep 30, 2011 would be valid till April 30, 2016. These products would be designated as F-SL-11-A/B/C/D
b) Products certified for JASO T 903 : 2011 would stand valid from October 2011 itself. Although mandatory after April 30, 2016 any certification after Sep 30, 2011 would, necessarily, required to be certified as category JASO T 903 : 2011. These products would be designated as F-SL-16-A/B/C/D.

In the present version, in view of above points a and b of the foreword the performance levels for four-stroke engine oil have been covered as under:

(*Continued on third cover*)

Indian Standard

LUBRICANTS FOR SPARK-IGNITION — AIR-COOLED GASOLINE ENGINES

PART 2 FOUR-STROKE SPARK-IGNITION AIR-COOLED ENGINES FOR SCOOTERS, MOPEDS AND MOTORCYCLES

1 SCOPE

1.1 This standard covers lubricants primarily intended for use in automotive, four-stroke, spark ignition, air cooled, air-cooled, gasoline engines such as those fitted to scooters, mopeds, motor cycles etc.

1.2 This standard prescribes the requirements for the four grades (*see* 3) of lubricants as applicable to spark ignited four-stroke gasoline engines.

1.3 Lubricants conforming to the requirements of this standard may also be prescribed/recommended by engine manufacturers for use in other types of four-stroke gasoline engines.

2 REFERENCES

The following standards contain provisions, which through reference in this text constitute provisions 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:

IS No./International Standard	*Title*
1447 (Part 1) : 2000	Petroleum and its products — Methods of sampling Part 1 manual sampling (*first revision*)
1448	Methods of test for petroleum and its products
[P: 1/Sec 1] : 2002	Determination of Acid Number of Petroleum Products by Potentiometric Titration
[P 4] : 1984	Ash, sulphated ash and water soluble ash (*second revision*)
[P 16] : 1990	Density of crude petroleum and liquid petroleum products by hydrometer method (*third revision*)
[P 21] : 2012	Determination of Flash Point — Pensky-Martens Closed Cup Method
[P 25] : 1976	Determination of kinematic and dynamic viscosity (*first revision*)
[P 33] : 1991	Sulphur by bomb method (*second revision*)
[P 54] : 1979	Determination of phosphorous in lubricating oil; Quinoline phosphomolybdate method (*first revision*)
[P 56] : 2004	Viscosity Index by Calculation
[P 67] : 1982	Foaming characteristics of lubricating oils (*first revision*)
[P 69] : 1969	Flash and fire point by Cleveland (open) cup
[P 77] : 1971	Metallic constituents of lubricating oils, chemical method
[P 83] : 1974	Determination sulphur by Wick bold oxy-hydrogen method
[P 108] : 1982	Apparent viscosity of engine oil at low temperature using cold-cranking simulator
[P 136] : 1991	Determination of loss of lubricating oils (Noak's Method)
13656 : 2002	Internal Combustion Engine Crankcase Oils (Diesel and Gasoline) (*First revision)*
ASTM D 4629-12	Standard Test Method for Trace Nitrogen in Liquid Petroleum Hydrocarbons by Syringe/Inlet Oxidative Combustion and Chemi-luminescence Detection
ASTM D4683-13	Standard Test Method for Measuring Viscosity of New and Used Engine Oils at High Shear Rate and High Temperature by Tapered Bearing Simulator Viscometer at 150 C
ASTMD 4684-12	Standard Test Method for Determination of Yield Stress and Apparent Viscosity of Engine Oils at Low Temperature

IS No./International Standard	*Title*
ASTMD 4951-09	Standard Test Method for Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectrometry
ASTM D 5291-10	Standard Test Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Petroleum Products and Lubricants
ASTM D 6278-12	Standard Test Method for Shear Stability of Polymer Containing Fluids Using a European Diesel Injector Apparatus
JASO T 903 : 2011	Motorcycles — Four-stroke cycle gasoline engine oils
JASO T904 : 2006	Motorcycles — Four-stroke cycle gasoline engine oils — Test procedure for friction property of clutch system
JASO T 904 : 2011	Motorcycles — Four-stroke cycle gasoline engine oils — Test procedure for friction property of clutch system

3 CLASSIFICATIONS

Lubricants qualifying against this standard shall be classified as four-stroke lubricants (4T) under one of the following types:

3.1 Products certified for JASO T 903 : 2006 specification before Sep 30, 2011 would be valid till April 30, 2016. These products would be designated as F-SL-11-A/B/C/D

i) F-SL-11-A: Lubricants have relatively higher friction coefficients and are intended for use in four-stroke spark ignited gasoline engines of motor cycles. Equivalent International Performance Level: JASO MA; JASO T903 : 2006.

ii) F-SL-11-B: Lubricants are subset of F-SL-11-A lubricants and are intended for use in four-stroke spark ignited gasoline engines of motor cycles. Equivalent International Performance Level: JASO MA2; JASO T903 : 2006.

iii) F-SL-11-C: Lubricants are subset of F-SL-11-A lubricants and are intended for use in four-stroke spark ignited gasoline engines of motor cycles. Equivalent International Performance Level: JASO MA1; JASO T903 : 2006.

iv) F-SL-11-D: Lubricants have relatively lower friction coefficients and are intended for use in four-stroke spark ignited gasoline engines of scooters. Equivalent International Performance Level: JASO MB; JASO T903-2006. These are classified as the lowest friction oils among the four stroke motorcycle oils.

3.2 Products certified for JASO T 903 : 2011 would stand valid from October 2011 itself. Although mandatory after April 30, 2016 any certification after Sep 30, 2011 would, necessarily, required to be certified as category JASO T 903 : 2011. These products would be designated as F-SL-16-A/B/C/D.

i) F-SL-16-A: Lubricants have relatively higher friction coefficients and are intended for use in four-stroke spark ignited gasoline engines of motor cycles. Equivalent International Performance Level: JASO MA T903 : 2011.

ii) F-SL-16-B: Lubricants are subset of F-SL16-A lubricants and are intended for use in four-stroke spark ignited gasoline engines of motor cycles. Equivalent International Performance Level JASO MA2 T903 : 2011.

iii) F-SL-16-C: Lubricants are subset of E-SL-16-A lubricants and are intended for use in four-stroke spark ignited gasoline engines of motor cycles. Equivalent International Performance Level: JASO MA1 T903 : 2011.

iv) F-SL-16-D: Lubricants have relatively lower friction coefficients and are intended for use in four-stroke spark ignited gasoline engines of scooters. Equivalent International Performance Level: JASO MB T903 : 2011 These are classified as the lowest friction oils among the four stroke motorcycle oils.

4 REQUIREMENTS

4.1 General

The lubricant shall be formulated using virgin or re-refined oil or synthetic base stock blended with suitable additive material.

4.2 Performance Level

The lubricant shall meet one of the performance levels of engine oil specifications as given in Table 1.

Table 1 Engine Oil Performance Levels

(*Clause* 4.2)

Sl No. (1)	Requirement (2)	Performance Level (3)
i)	F-SL-11-A/B/C/D(API)	SG, SH, SJ, SL, SM, SN[1)]
ii)	F-SL-16-A/B/C/D (API)	SG, SH, SJ, SL, SM, SN[1)]

[1)] IS 13656:2002 to be referred for engine test requirement that are currently covered in it.

4.3 Physico-Chemical Requirements

4.3.1 The lubricant shall be free from suspended matter, grit, water or any other impurities.

4.3.2 The lubricant shall comply with the physico-chemical requirements prescribed in Table 2.

Table 2 Physico-Chemical Requirements

(*Clause 4.3.2*)

Sl No.	Characteristic	Requirement	Method of Test/ Ref to IS 1448 [P:]/AST*M*
(1)	(2)	(3)	(4)
i)	Density at 15°C, *g/ml*	To be reported	IS 1448 [P : 16]
ii)	Flash point °C	To be reported	IS 1448 [P : 69 and P : 21]
iii)	Kinematic viscosity at 40°C *cSt*	To be reported	IS 1448 [P : 25]
iii)	Kinematic viscosity at 100°C *cSt*	As specified for a particular SAE Viscosity grade*	IS 1448 [P : 25]
iv)	Viscosity Index	To be reported	IS 1448 [P : 56]
v)	Low temperature cranking viscosity, cP, *Max.*	As specified for a particular SAE viscosity grade*	ASTM D 5293
vi)	Low temperature pumping viscosity, cP, *Max*.	As specified for a particular SAE viscosity grade*	ASTM D 4684
vii)	High Temperature High Shear viscosity, mPa, *Min.*	2.9	ASTM D 4683
viii)	Sulphated ash, percent by mass, *Max*	1.2	IS 1448 [P : 4]
ix)	Total Base Number mg KOH/g	To be reported	IS 1448 [P : 86]
x)	Total Acid Number mg KOH/g	To be reported	IS 1448 [P : 1]
xi)	Evaporative loss, percent by mass, *Max.*	20	IS 1448 [P : 136]
xii)	Foaming Tendency/Stability, ml, *Max*.	IS 1448	[P : 67]
	a) Sequence I	10 / 0	
	b) Sequence II	50 / 0	
	c) Sequence III	10 / 0	
xiii)	Shear stability Kinematic viscosity at 100°C after test (mm^2/s), *Min*		ASTMD 6278
	a) XW-30	9.0	
	b) XW-40	12.0	
	c) XW-50	15.0	
xiv)	Colour	To be reported	
xv)	Calcium	To be reported	IS 1448 [P:77]/ASTM D 4951
xvi)	Barium	do	do
xvii)	Boron	do	do
xvii)	Magnesium	do	do
xix)	Phosphorus	0.08 - 0.12	IS 1448 [P : 54]/ASTM D 4951
xx)	Sulphur	do	IS 1448 [P : 86]/ [P : 153]
xxi)	Nitrogen	do	ASTM D 4629 upto 1 000 pm ASTM D 5291 above 1 000 pm
xxii)	Zinc	do	IS 1448[P : 77]/ASTM D 4951
xxiii)	Other elements less than 100 ppm	do	do

* SAE J 300 December 1999

** Under preparation. Till such time, ASTM D-4629 may be followed

4.4 Performance Classification

4.4.1 A lubricant is classified into four types, F-SL-11-A, F-SL-11-B, F-SL-11-C and F-SL-11-D based on the frictional performance criteria specified in Table 3.

4.4.2 A lubricant is classified into four types, F-SL-16-A, F-SL-16-B, F-SL-16-C and F-SL-16-D based on the frictional performance criteria specified in Table 4.

5 STABILITY OF FINISHED LUBRICATING OILS

5.1 The finished blended lubricating oils shall have the additive elements uniformly distributed throughout the oil and shall show no evidence of instability at a temperature specified in the homogeneity test described in Annex A.

Table 3 Performance Classification

(*Clause* 4.4.1)

Sl No.	Test Method	Evaluation Item	Standard Index			
			F-SL-11-A	F-SL-11-B	F-SL-11-C	F-SL-11-D
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	JASO T 904 : 2006	DFI (Dynamic Friction Index)	≥ 1.45 and < 2.50	≥ 1.80 and < 2.50	≥ 1.45 and < 1.80	≥ 0.50 and < 1.45
ii)		SFI (Static Friction Index)	≥ 1.15 and < 2.50	≥ 1.70 and < 2.50	≥ 1.15 and < 1.70	≥ 0.50 and < 1.15
iii)		STI (Stop Time Index)	≥ 1.55 and < 2.50	≥ 1.90 and < 2.50	≥ 1.55 and < 1.90	≥ 0.50 and < 1.55

Table 4 Performance Classification

(*Clause* 4.4.2**)**

Sl No.	Test Method	Evaluation Item	Standard Index			
			F-SL-16-A	F-SL-16-B	F-SL-16-C	F-SL-1
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
i)	JASO T 904: 2011	DFI (Dynamic Friction Index)	≥ 1.30 and < 2.50	≥ 1.85 and < 2.50	≥ 1.30 and < 1.85	≥ 0.50 and < 1.30
ii)		SFI (Static Friction Index)	≥ 1.25 and < 2.50	≥ 1.70 and < 2.50	≥ 1.25 and < 1.70	≥ 0.50 and < 1.25
iii)		STI (Stop Time Index)	≥ 1.45 and < 2.50	≥ 1.85 and < 2.50	≥ 1.45 and < 1.85	≥ 0.50 and < 1.45

6 PRODUCT IDENTIFICATION

6.1 To ensure acceptance of only qualified products and for the purposes of product identification, tests may be carried out by the purchaser or his agency on the characteristics of the oil mentioned in Table 5 and the test results shall be compared with the corresponding figures given in the product identification report. Permissible tolerances of the results are indicated against each of the characteristics in Table 4.

Table 5 Requirements for Finished Product Identification and Permissible Variation for Product-Conformance

(Clause 6*)*

Sl No.	Characteristic	Requirement	Method of Test/Ref to IS 1448 [P :]/ASTM
(1)	(2)	(3)	(4)
i)	Density at 15°C, *g/ml*	To be reported	IS 1448 [P : 16]
ii)	Kinematic viscosity, percent	Should confirm to the control viscosity as given in product PI and within the viscosity range of the grade	IS 1448 [P : 25]
iii)	Low temperature cranking viscosity, cP, *Max.*	As specified for a particular SAE viscosity grade	IS 1448 [P : 108]
iv)	Low temperature pumping viscosity, cP, *Max*.	do	ASTM D 4684
v)	Sulphated ash, percent by mass, *Max*	As specified	IS 1448 [P : 4]
vi)	Evaporative loss, percent, *Max*.	do	IS 1448 [P : 136]
vii)	Foaming tendency/stability, ml, *Max.*	do	IS 1448 [P : 67]
viii)	Shear stability K. viscosity @ 100°C after test, *Min*.	do	ASTM D 6278
ix)	High Temperature High Shear ASTM D 4683 viscosity, cP, *Max.*	do	
x)	Calcium	–10 to +20 percent of the reported value	IS 1448 [P : 77]/ASTM D 4951
xi)	Barium	do	do
xii)	Magnesium	do	do
xiii)	Phosphorus	do	IS 1448 [P : 54]/ASTM D 4951
xiv)	Sulphur	do	IS 1448[P : 33]/ XRF
xv)	Nitrogen	do	IS 1448 [P :*]/ASTM D 4629 upto 1 000 pm IS 1448 [P :*]/ ASTM D 5291 above 1 000 pm
xvi)	Zinc	do	IS 1448 [P : 77]/ASTM D 4951

* Under preparation. Till such time, ASTM D 4629 may be followed.

7 PACKING AND MARKING

7.1 Packing

The material shall be packed in metal containers or in any other suitable containers as agreed to between the purchaser and the supplier.

7.2 Marking

7.2.1 The container shall be securely closed and marked with the following:

i) Indication of the source of manufacture;
ii) Name, type and grade of the material;
iii) Net mass of the material;
iv) Recognized trade-mark, if any, and
v) Identification in code or otherwise to enable the lot of consignment or manufacture to be traced back from records.

7.2.2 All markings including batch number of lot of manufacture shall be made on one flat end when the material is packed in barrels.

7.2.3 *BIS Certification Marking*

Each container may also be marked with the BIS Standard Mark.

7.2.3.1 The use of Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and regulations made there under. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufactures or producers may be obtained from the Bureau of Indian Standards.

8 SAMPLING

8.1 Representative samples of the material shall be drawn as prescribed in IS 1447.

8.2 Number of Tests

Tests for all the characteristics given in Table 2 shall be conducted on the composite sample.

8.3 Criteria for Conformity

The lot shall be declared as conforming to the requirements of the specification if all the test results on the composite sample satisfy the relevant requirements stipulated in the specification.

ANNEX A

(Clauses 5.1)

HOMOGENEITY AND MISCIBILITY TEST

A-1 GENERAL

This test determines whether oil is and will remain homogenous and is stable after being submitted to a prescribed cycle of temperature changes.

A-2 REFERENCE STANDARD TEST METHOD

This test method generally conforms to U.S. Federal Test Standard No. 791B Method 3470 dated January 15, 1969 excepting in one feature that the reference oils are those approved by the qualifying authority.

A-3 SAMPLE

A-3.1 Test Sample, approximately 300 ml.

A-3.2 Standard Reference Oils, as approved by the qualifying authority.

A-4 APPARATUS

A-4.1 Test Jar, A test jar of clear glass, cylindrical form, flat bottom, approximately 30 to 35 mm in inside diameter and 115 and 125 mm in height.

A-4.2 Thermometer, Minus 50°C to plus 50°C range

A-4.3 Cork, to fit the test jar, bored centrally to take the test thermometer.

A-4.4 Jacket — Glass or metal, water-tight, of cylindrical form, bottom, about 115 mm in depth, with inside diameter 9.5 to 12.5 mm greater than the outside diameter of the jar.

A-4.5 Disk — Cork or felt, 6 mm in thickness of the same diameter as the inside of the jacket.

A-4.6 Gasket — A ring gasket, about 5 mm in thickness, to fit snugly around the outside of the test jar and loosely inside the jacket to prevent the test jar from touching the jacket.

A-4.7 Bath — A cooling bath of a type for obtaining the required temperatures.

A-5 PROCEDURE

A-5.1 Shake oil sample well and pour into six sample jars upto 75 mm. Mix the oil thoroughly and heat to

46°C in a water bath. After the oil reaches room temperature, observe and record the colour and evidence of separation. Determine and record the colour and evidence of separation. Determine and record the pour point of each oil.

A-5.2 Maintain the temperature of the cooling bath at –1°C to 2°C. Support the jacket, containing the test jar, firmly in a vertical position in the cooling bath so that not more than 25 mm of the jacket projects out of the cooling medium.

A-5.3 Beginning at a temperature 12°C before the expected pour point, at each test thermometer reading that is a multiple of 3°C, remove the test jar from the jacket carefully and tilt it just enough to ascertain whether there is a movement of the oil in the test jar. The complete operation of removal and replacement shall require not more than 3s. If the oil has not ceased to flow when its temperature has reached 10°C, place the test jar in the jacket in a second bath maintained at a temperature of –18°C to –15°C. If the oil has not ceased to flow when its temperature has reached –7°C, place the test jar in the jacket in a third bath maintained at a temperature of –34.5°C. For determination of very low pour points additional baths should be maintained with successively lower temperature differentials of about 17°C. In each case transfer the jar when the temperature of the oil reaches a point of 28°C, above the temperature of the new bath. At no time place the cold test jar directly in the cooling medium. As soon as the oil in the test jar does not flow when jar is tilted, hold the test jar in a horizontal position for exactly 5s as noted by a stop watch or other accurate timing device, and observe carefully. If the oil shows any movement under these conditions, place the test jar immediately in the jacket and repeat a test for flow at the next temperature 3°C lower.

A-5.4 Continue the test in this manner until a point is reached at which the oil in the test jar shows no movement when the test jar is held in a horizontal position exactly for 5 s. Certain lubricating oils tend to move as a whole and should be closely observed. Record the reading of the test thermometer at this temperature, corrected for error, if necessary. Allow the samples to thaw and when the cloudiness has barely disappeared observe and record the colour and evidence of separation. When the samples reach room temperature, place them in an oil bath after removing the thermometer. Heat the bath at 230°C and immediately remove the sample jars. Cork the samples and store them at their respective pour points for 18 to 24h. Remove the jars and allow the sample to thaw. When cloudiness has barely disappeared, observe and record the colour and evidence of separation. Repeat the last operation when the samples reach room temperature.

A-6 METHOD OF REPORTING RESULTS

A-6.1 Report evidence of separation in the following four successive stages:

a) Initial sample;
b) Warmed to just above cloud point after having once reached pour point;
c) After a cycle of heating to 230°C cooling to pour point storing it for 24 h at this temperature and warming to just above pour point; and
d) Warmed to room temperature.

A-6.2 Evidence of separation is to be reported as:

a) Condition:
   1) Definite, and
   2) None or doubtful
b) Location:
   1) Near top
   2) Near bottom
   3) Filament, and
   4) Uniformly distributed
c) Particle size:
   1) Small, as in cloud or haze, and
   2) Specks or larger particles
d) Colour:
   1) White or very light
   2) Yellow, and
   3) Black

(*Continued from second cover*)

Category	Equivalent International Performance Level
F-SL-11-A	JASO MA-T-903-2006
F-SL-11-B	JASO MA2-T903-2006
F-SL-11-C	JASO MA1-T903-2006
F-SL-11- D	JASO MB-T903-2006
F –SL-16-A	JASO MA-T903-2011
F-SL-16- B	JASO MA2-T903-2011
F-SL-16- C	JASO MA1-T903-2011
F-SL-16- D	JASO MB-T903-2011

The performance levels prescribed in this specification are also in accordance with the test methods outlined in the API specifications.

In order to provide for certification of lubricants for four-stroke spark ignition engines by independent third party certifying agency, the procedure for qualification approval has been given in **6**. Bureau of Indian Standards may be contacted for further details of qualification approval and product conformity certification procedure. These procedures are in accordance with the ISO/IEC Guidelines 53. It is expected that having updated the standard in accordance with the international practice in vogue and the prevailing situation in the country, lubricant manufactures for four-stroke gasoline engines will opt for certification of their products conforming to this specification vide BIS Certification Marks Scheme which would help combat the menace of spurious or non-conforming products. BIS Certification Marks Scheme is operated under a well-defined Scheme of Testing and Inspection (STI) designed and supervised by the Bureau but operated by manufacturers.

For the purpose of decided 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 ‘Rules for rounding off numerical values (*revised*)’. The number of significant placed retained in the rounded off value should be the same as that of the specified value in this standard.

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.

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'.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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