भारतीय मानक
Indian Standard

IS 14681 : 2021

स्वचल वाहन — दुपहिया, तिपहिया एवं क्वाड्रिसाईकल वाहनों की ईंधन टंकिया

(पहला पुनरीक्षण)

Automotive Vehicles — Fuel Tanks for Two Wheelers, Three Wheelers and Quadricycles

(First Revision)

ICS 43.140

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

March 2021 **Price Group 5**

FOREWORD

This Indian Standard (First Revision) was adopted by Bureau of Indian Standards after the draft finalized by the Automotive Body, Chassis, Accessories, Springs and Suspension Systems Sectional Committee had been approved by the Transport Engineering Division Council.

This standard was first published in 1999. The revision of this standard has been taken up to align with other International Standards. The first revision of this standard has been aligned with the Global Technical Regulation GTR 17, formulated by UNECE, for which India has voted in favour of Further, the committee also proposed that the technical requirements of EU Regulation EU 44/2014 shall also be included appropriately in this standard.

In preparation of this standard considerable assistance has been derived from:

a) EU 44/2014 as amended by EU/2016/1824 & EU/2018/295.

b) Global technical regulation No. 17 'Global technical regulation on the measurement procedure for two- or three-wheeled motor vehicles equipped with a combustion engine with regard to the crankcase and evaporative emissions' An additional Hydraulic test for fuel tank is added to align with GTR 17. The technical specifications for type approval and some editorial corrections are also incorporated for better clarity in this standard.

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

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 '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

AUTOMOTIVE VEHICLES — FUEL TANKS FOR TWO WHEELERS, THREE WHEELERS AND QUADRICYCLES

(First Revision)

1 SCOPE

1.1 This standard specifies requirements of fuel tanks for following vehicle categories which are defined in IS 14272 : 2011.

1.2 L1, L2 and L5 category of vehicles.

1.3 L7 category of vehicles with fuel tank capacity up to 15 litres.

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:

IS No.	*Title*
14272 : 2011	Automotive vehicles — Types — Terminology
15547 : 2005	Automotive vehicles — Plastic fuel tank for four wheelers

3 DEFINITIONS

For the purpose of this standard, the following terms and definitions shall apply.

3.1 Tank — It is the tank(s) designed to contain the liquid fuel, as defined in **3.2** used primarily for the vehicle excluding its accessories (filler pipe if it is a separate element), gauge, connections to the engine or to compensate interior excess pressure, etc.

3.2 Liquid Fuel — It is a fuel which is liquid in normal ambient conditions.

3.3 Type of vehicle with regard to fuel storage' means a category of vehicles which do not differ in such essential respects as shape, size and material characteristics, and the method of mounting and location of the fuel tank on the vehicle.

4 TECHNICAL SPECIFICATIONS OF FUEL TANK

4.1 Technical specifications as relevant to fuel tank shall be declared by manufacturer and shall contain at least the details given in Annex A.

5 GENERAL REQUIREMENTS

Fuel tanks of vehicles fitted with one or more of these shall meet the following general requirements:

5.1 Fuel tank shall be made of materials, the thermal mechanical and chemical behaviour of which shall be suitable for its intended conditions of use.

5.2 Fuel tanks and attachment systems shall be so designed, manufactured and installed as to fulfil their function in all driving conditions.

5.3 Fuel tanks and the adjacent parts shall be so designed as not to generate any electrostatic charge which is likely to cause sparking between the tank and the chassis of the vehicle which is likely to ignite the fuel/air mixture.

5.4 Fuel tanks shall be made in such a way as to withstand corrosion.

5.5 Any excess pressure or any pressure exceeding the service pressure shall be automatically released by appropriate devices (orifices, safety valves, etc) the ventilation orifices shall be designed in such a way as to preclude any risk of ignition of air and fuel.

5.6 Fuel tanks shall be so designed that any fuel that may leak when they are being filled cannot fall on the vehicle's exhaust system, engine or other drivetrain parts or on the inside of any passenger or luggage compartment, but is channeled to the ground.

5.7 Fuel shall be unable to flow from the filler cap or any devices fitted in order to release excess pressure, even if the tank is fully inverted. Dripping is tolerated to a maximum of 30 g/min, to be verified by means of the test described in points **6.1.1** to **6.1.4**. If the leakage rate does not appear to be constant in nature, it shall be ensured that maximum leakage rate is determined within a one minute timeframe (that is, not averaged over a longer timeframe).

5.8 No tank shall be situated in, or form, a surface (e.g. floor, wall, roof or bulkhead) of the passenger compartment or other compartment integral with it, if the vehicle is fitted with bodywork.

5.8.1 For the purpose of **5.8**, a vehicle is deemed to have a passenger or other compartment integral with it if it is fitted with safety glazing, side doors, a rear door, side pillars and/or a roof creating an enclosed or partly enclosed compartment.

5.9 The fuel filler port shall not be situated in the passenger compartment, luggage compartment or engine compartment, if any.

5.9.1 Further to point **5.8.1** above, a vehicle is deemed to have an engine compartment or a luggage compartment if it is fitted with side panels in combination with a bonnet/hood lid and/or a boot/trunk lid creating an enclosed or partly enclosed compartment.

5.10 Fuel tanks shall pass the leak-tightness tests carried out with an internal pressure equal to twice the relative service pressure (design pressure) or an overpressure of 30 kPa, whichever is higher, as described in points **6.2** to **6.2.1**. Any orifices may be blocked for the purpose of this test. The fuel tank shall not crack or leak during the test, but may remain permanently deformed.

5.10.1 Fuel tanks made of materials other than metal are considered as meeting this requirement if they have passed the test described in **7.1** to **7.6**.

5.11 Fuel tanks made of materials other than metal shall be subject to the tests in accordance with points **7.1** to **6.6.1.1** in addition to those described in points **6.1** to **6.1.4**.

5.12 Vehicles fitted with one or more fuel tanks shall meet the following general requirements:

5.12.1 Fuel tanks shall be fitted and installed in such a way as to fulfil their function in all foreseeable operating conditions.

5.12.2 All parts and components of the vehicle's fuel supply system shall be adequately protected by parts of the frame or bodywork against contact with possible obstacles on the ground. Such protection shall not be required if the relevant parts or components located beneath the vehicle are further from the ground than the parts of the frame or bodywork which are located immediately ahead of them.

5.12.3 All parts and components of the vehicle's fuel supply system shall be designed, manufactured and installed in such a way as to withstand the effects of any internal and external corrosion to which it is exposed. No motion due to torsion, flexing and vibration of the vehicle structure, engine and transmission shall subject any part or component of the fuel supply system to abnormal friction or stress.

6 FUEL TANK TESTS

6.1 Overturn Test

6.1.1 The tank and all its accessories shall be mounted onto a test fixture in a manner corresponding to the mode of installation on the vehicle for which the tank is intended. This also applies to systems for the compensation of the interior excess pressure.

6.1.2 The test fixture shall rotate about an axis lying parallel to the longitudinal vehicle axis.

6.1.3 The test shall be carried out with the tank filled to 30 percent of its total rated capacity and also 90 percent of its total rated capacity with a non-flammable liquid having a density and a viscosity close to those of the fuel normally used, or with water.

6.1.4 The tank shall be turned from its installed position 90° to the left. The tank shall remain in this position for at least five minutes. The tank shall then be turned 90° further in the same direction. The tank shall be held in this position, in which it is completely inverted, for at least another five minutes. The tank shall be rotated back to its normal position.

Testing liquid that has not flowed back from the venting system into the tank may be drained and replenished if necessary.

The tank shall be turned from its installed position 90° to the right. The tank shall remain in this position for at least five minutes. The tank shall then be turned 90° further in the same direction. The tank shall be held in this position, in which it is completely inverted, for at least another five minutes. The tank shall be rotated back to its normal position.

The 90° rotations shall take place at one to three minute intervals.

6.1.5 Fuel tank leakage test is exempted for fuel tanks not having a vent hole, and venting is through a one way valve (for example, compliance to evaporative emission regulation).

6.2 Hydraulic Test

6.2.1 The fuel tank shall be subjected to a hydraulic internal pressure test which shall be carried out on an isolated unit complete with all its accessories. The fuel tank shall be completely filled with a non-flammable liquid having a density and a viscosity close to those of the fuel normally used, or with water. After all communication with the outside has been cut off, the pressure shall be gradually increased, through the pipe connection through which fuel is fed to the engine, to the internal pressure equal to twice the relative service pressure (design pressure) or an overpressure of 30 kPa, whichever is higher and this pressure shall be maintained for at least 60 seconds.

6.2.2 The fuel tank shall not crack or leak during the test, but may remain permanently deformed.

7 SPECIFIC REQUIREMENTS AND TESTS FOR FUEL TANKS MADE OF MATERIALS OTHER THAN METAL

7.1 Permeability Test

Permeability test to be carried out on completely new fuel tank.

7.1.1 *Test Method*

7.1.1.1 The fuel tank shall be tested at a temperature of 40 ± 2 °C. The test fuel to be used shall be either the reference fuel used during emission test or commercially available fuel on motor vehicles.

7.1.1.2 Prior to test, the tank shall be filled up to 50 percent of its rated capacity with test fuel and kept in the temperature condition of 40 ± 2 °C at least for 4 weeks or until there is a constant weight loss (pre-storage period).

7.1.1.3 The tank shall be emptied and then refilled to 50 percent of its rated capacity with test fuel after which it shall be closed and then stored under the stabilizing conditions at a temperature of 40 ± 2 °C. The fuel tank is then sealed. The pressure rise in the tank during the test may be compensated.

7.1.1.4 The weight loss due to diffusion shall be determined during the eight-week test. During that test a maximum quantity of 20 g may escape, on average, every 24 h. If the diffusion losses are greater, the fuel loss must also be determined at an ambient temperature of 23 ± 2 °C, all other conditions being maintained (pre-storage of 40 ± 2 °C). The loss determined under those conditions shall not exceed 10 g per 24 h. The permeability evaporation test results shall not be averaged between the different tested fuel tanks, but the worst-case diffusion loss rate observed of any one of those fuel tanks shall be taken and compared.

7.1.1.5 When the test is conducted with internal pressure compensation, which must be mentioned in the test report, the fuel loss resulting from the pressure compensation must be taken into account when the diffusion loss is established.

7.2 Shock Test

Shock test to be carried out on a fuel tank which has undergone the permeability test.

7.2.1 This test shall be applicable only if the fuel tank is fully exposed.

7.2.2 *Test Method*

7.2.2.1 The fuel tank shall be filled up to its nominal capacity with a mixture of 50 percent water and 50 percent ethylene glycol or with any other coolant which does not attack the fuel tank material, the freezing point of which is lower than −30 ± 2 °C.

7.2.2.2 The temperature of the substances contained in the fuel tank during the test shall be −20 ± 2 °C. The tank is cooled down to a corresponding ambient temperature. The fuel tank may also be filled with a suitably refrigerated liquid provided after ensuring that the fuel tank is left at the test temperature for at least one hour.

7.2.2.3 A pendulum shall be used for the test, its impact head shall take the form of an equilateral triangular pyramid having a radius of curvature of 3 mm at its peaks and edges with a mass of 15 kg ± 0.5 kg and the exerted the pendulum's energy may not be less than 30 J, for each impact on the fuel tank and as close as possible to that value.

More than one fuel tank may be used for the completion of all impacts, provided that all fuel tanks to be used have undergone the permeability test.

7.2.2.4 It is recommended that while designing the pendulum following aspects may be considered:

a) The center of percussion of pendulum shall be as close as possible to centre of gravity of pyramid,
b) The distance of centre of gravity of pyramid to its axis of rotation shall be 1 m,
c) Total mass of the pendulum referred to its centre of percussion shall be 15 kg, and
d) The tank shall be mounted on a fixture as it is mounted on the vehicle.

7.2.2.5 The points on the fuel tank to be tested shall be those considered at risk as a result of the fitting of the tank and its position on the vehicle. There must be no liquid leakage following a single impact at any of tested points.

7.3 Mechanical Strength Test

Mechanical strength test to be carried out on a fuel tank which has undergone the permeability test.

7.3.1 *Test Method*

7.3.2 The fuel tank shall be filled up to its rated capacity, the test liquid used being water at 53 ± 2 °C. The tank shall then be subjected to an internal pressure equal to twice the relative service pressure (design pressure) or an overpressure of 30 kPa, whichever is higher.

7.3.3 The tank shall remain closed for a period of 5 hours at an ambient temperature of 53 ± 2 °C.

7.3.4 The fuel tank shall not show signs of leakage and any temporary or permanent deformation which may arise shall not render it unusable. Account shall be

taken of specific fitting conditions if the deformation of the tank is to be assessed.

7.4 Fuel-resistance Test

Fuel resistance test to be carried out on samples of a completely new fuel tank and samples of a fuel tank which has undergone the permeability test.

7.4.1 *Test Method*

7.4.1.1 Six tensile-test pieces of approximately the same thickness shall be taken from the flat pieces or nearly flat faces of the completely new fuel tank. Their tensile strength and elastic limits shall be established at 23 ± 2 °C at an elongation rate of 50 mm/min. The obtained values shall be compared with the tensile strength and elasticity values obtained by similar tests using a fuel tank that has already been stored for the pre-storage period. The material shall be considered to be acceptable if there has been no difference in tensile strength of more than 25 percent.

7.5 Fire-resistance Test

Fire resistance test to be carried out on samples of a fuel tank which has undergone the permeability test

7.5.1 *Test Method*

7.5.1.1 The tank material shall be tested and comply as per Annex B.

7.6 High Temperature Test

High temperature test to be carried out on samples of a fuel tank which has undergone the permeability test.

7.6.1 *Test Method*

7.6.1.1 The fuel tank shall be fitted to a representative part of the vehicle and filled to 50 percent of its total rated capacity with water at 20 ± 2 °C. The test setup including the fuel tank shall then be placed in an ambient temperature of 70 ± 2 °C for 60 minutes, after which the fuel tank shall not display any permanent deformation or leaks and shall be in fully usable condition.

8 GUIDELINES FOR DECIDING TESTS FOR EXTENSION OF TYPE APPROVAL

8.1 The type approval granted to any vehicle model in accordance with this standard, shall be extended to its variants/new models in following cases:

a) In variant/new model, the material, the mounting arrangement, size and shape of fuel tank is same as type approved.

b) In variant/new model, the arrangement of fuel filling system is same as that of vehicle model already type approveds.

8.2 The extension of type approval to variants/new models as mentioned in **8.1** shall be granted irrespective of change in the model name.

8.3 If the type approval already granted to a vehicle model cannot be extended to variant/new model due to design change mentioned in 8.1(a) and 8.1(b) only the checks/tests relevant to that design change shall be carried out and extension shall be granted if these checks/tests are satisfactory.

Following guidelines may be followed:

a) *Design Change Checks/Tests to be Conducted*

1) Material of fuel tank in case of plastic (non-metallic fuel tank) All tests as per 7, as applicable;

2) Mounting arrangement of fuel tank Shock test as per **7.2**, if applicable;

3) Arrangement of fuel filling system Check as per **4.8**, **4.11**;

4) Fuel tank of a model type approved is relocated or used at a relocated position in other variants/new model. If tank is made of non-metallic material tests as per **7** as applicable. If tank is made of metal no tests are required; and

5) Design change size and shape of fuel tank tests as per **4.11**, **7.2** and **7.3** to be repeated.

ANNEX A

(*Clause* 4.1)

INFORMATION TO BE SUBMITTED BY MANUFACTURER

A-1 GENERAL

a) Name of manufacturer (trade name of manufacturer);
b) Address of manufacturer; and
c) Address(es) of assembly plant(s).

A-2 FUEL TANK(S)

a) Capacity of fuel tank; and
b) Materials used.

A-3 DRAWING OF THE TANK(S) WITH CONNECTIONS AND LINES OF THE BREATHING AND VENTING SYSTEM, LOCKS, FASTENING DEVICES

A-4 DRAWING CLEARLY SHOWING THE POSITION OF THE TANK(S) ON THE VEHICLE

ANNEX B

(*Clause* 7.5.1.1)

FIRE RESISTANCE TEST METHOD

B-1 TEST EQUIPMENT

B-1.1 Test Chamber

A totally enclosed laboratory fume test chamber with a heat resistant test-observation window. A mirror maybe used in certain test enclosures in order to provide a rear view of the sample The fume extractor fan shall be shut down during the test and restarted immediately after the test in order to remove combustion products.

Alternatively the test may be carried out inside a metal box placed beneath the fume test chamber with the extractor fan operating.

The top and bottom walls of the box shall incorporate ventilation holes enabling sufficient air for the combustion to pass through while not subjecting the burning sample to a drought.

B-1.2 Supporting Base

A laboratory supporting base including two grips which can be set in any position by means of swivel joints.

B-1.3 Burner

A gas-fired Bunsen (or Tirill) type with a 10-mm nozzle such that flame can come indirect contact with test piece. The nozzle shall not be fitted with any accessory.

B-1.4 Metal Mesh

A metal screen with a mesh size of 20 and overall dimensions of approximately 100 × 100 mm shall be provided.

B-1.5 Timer

A timer or similar device with divisions not greater than one second.

B-1.6 Water Bath

A water bath with suggested dimensions of approximately 150 × 75 × 30 mm shall be provided.

B-1.7 Graduated Scale

Graduation scale (in millimeters) shall be provided.

B-1.8 Sliding Caliper

A sliding caliper (with an accuracy of at least 0.05 mm) or equivalent measuring device shall be provided.

B-2 TEST SAMPLE

B-2.1 At least 10 test samples 125 ± 5 mm long × 12.5 ± 0.2 mm wide must be taken direct from a typical fuel tank which have undergone the permeability test.

B-2.2 However, if obtaining such test samples is prevented by the design characteristics (that is, shape) of the fuel tank, it is deemed acceptable for the purpose of this test to prepare one or more special tanks with similar characteristics but with more flat or nearly flat surfaces incorporated in the walls. The overall thickness of all samples shall be within ± 5 percent of the thickest sample.

B-2.3 Two lines, one at 25 mm and the other at 100 m from one end shall be marked on each sample.

B-2.4 The edges of the test samples shall be sharply defined. Edges obtained by sawing shall be fine-sanded down in order to obtain a smooth finish.

B-3 TEST METHOD

B-3.1 A sample is attached to one of the grips on the base by the end closest to the 100 mm mark, with its longitudinal axis horizontal and its transverse axis at 45° to the horizontal. Below the test sample, a clean woven metal screen is attached to the second grip and located 10 mm horizontally below the edge of the sample such that the sample protrudes approximately 13 mm beyond the end of the screen (*see* Fig. 1). A bath full of water shall be placed on the fume hood table in such a way as to receive any incandescent particles which may fall during the test.

B-3.2 The air supply to the burner shall be set in such a way as to obtain a blue flame with an approximate height of 25 mm.

B-3.3 The burner shall be placed so that its flame touches the outer edge of the test sample (*see* Fig. 1) at the same time the timer is started.

B-3.4 The flame is held in contact for 30 s. If the sample deforms, melts or shrinks away, the flame shall be repositioned in order to maintain contact with it. However, significant deformation of the sample during the test may invalidate the result.

The burner shall be withdrawn after 30 s or when the flame-front reaches the 25 mm mark, whichever occurs first. The burner shall be moved away at least 450 mm from the sample and the fume hood shall be closed.

B-3.5 When the flame front reaches the 25 mm mark, the indicated time in seconds shall be noted as time t1.

B-3.6 The timer is stopped when combustion (with or without flame) stops or reaches the mark 100 mm from the free end. The indicated time shall be noted as time t. When a sample is reignited by burning material deposited on the woven metal screen, the test result may be invalidated.

B-3.7 If the combustion does not reach the 100 mm mark, the unburnt length from the 100 mm mark along the lower edge of the sample is measured and rounded up or down to the nearest millimetre. The burnt length is thus equal to 100 mm minus the unburnt length expressed in mm.

B-3.8 If a sample has burnt up to or beyond the 100 mm mark, the combustion speed shall be calculated as follows: ((75)/(t-t1)) and expressed in mm/s.

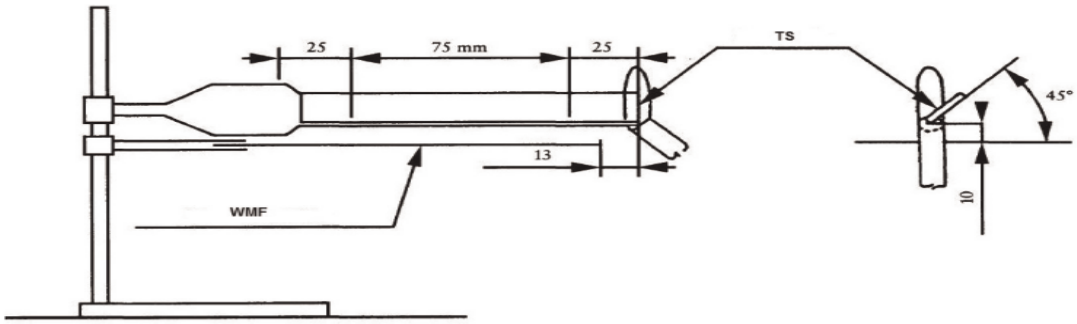
B-3.9 The test described in points **B-3.1** to **B-3.8** shall be repeated on different samples until three samples have burnt up to or beyond the 100 mm mark or ten samples have been tested.

B-3.10 If only one sample out of ten burns up to the 100 mm mark or beyond, the test described in points **B-3.1** to **B-3.8** shall be repeated on a maximum of ten new samples.

B-4 EXPRESSION OF RESULTS

B-4.1 The test report shall contain at least the following detailed information:

a) Number of samples tested, and concerning each of the individual samples;
b) Means of identification;



Comments:

(1) TS = test sample;

(2) WMF = woven metal fibre.

c) Method of preparation and storage;

d) Thickness measured in each third of the sample's length (mm with at least one decimal);

e) Combustion time (s);

f) Combustion length (mm);

g) Statement and reason where a sample does not burn up to the 100 mm mark (for example, because it drips, runs or breaks up into burnt particles); and

h) Statement when a sample is reignited by burning material deposited on the woven metal screen.

B-4.2 If at least two samples have burnt up to or beyond the 100 mm mark, the average speed of combustion (expressed in mm/s and as derived from the multiple results calculated in accordance with the formula in point **B-3.8** Shall be determined. The average speed of combustion is thus the average of the combustion speeds of all of the samples that have burnt up to or beyond the 100 mm mark. This value shall be compared against the requirement in points **B-5** to **B-5.1** and the calculations and verification referred to in point **B-4.3** shall not be carried out.

B-4.3 The average combustion time (ACT) and average combustion length (ACL) shall be calculated if no sample out of ten or no more than one out of 20 has burnt up to the 100 mm mark.

$$\text{ACT (s)} = \sum_{i=1}^{n} \cdot ((t_i - 30) / (n))$$

Where, n is the number of samples.

The result is rounded up or down to the nearest five-second increment. However, an ACT of 0 seconds shall not be used (that is, if the combustion lasts between less than 2 s and 7 s, the ACT is 5 s; if the combustion lasts between 8 and 12 s, the ACT is 10 s; if the combustion lasts between 13 and 17 seconds, the ACT is 15 s, etc.).

$$\text{ACL (mm)} = \sum_{i=1}^{n} \cdot ((100 - \text{unburnt length}_i) / (n))$$

Where, n is the number of samples.

The result is expressed in relation to the nearest 5 mm increment (that is, 'less than 5 mm' shall be stated if the combustion length is less than 2 mm and thus in no case can an ACL of 0 mm be given). Where a single sample out of 20 burns up to or beyond the 100 mm mark, the combustion length (that is, the value of (100 – unburnt length i) for that sample) shall be taken as 100 mm. The average speed of combustion is thus (ACL/ACT) (expressed in mm/s).

This value shall be compared against the requirement as laid down in points **B-5.1**.

B-5 REQUIREMENTS CONCERNING THE FIRE RESISTANCE OF FUEL TANK MATERIALS OTHER THAN METAL

B-5.1 The fuel tank material shall not burn at an average speed of combustion greater than 0,64 mm/s as determined in accordance with the test procedure laid down in points **B-1** to **B-4.3** of this Annex B.

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Automotive Body, Chassis, Accessories, Springs and Suspension Systems Sectional Committee, TED 06

Organization	*Representative(s)*
Automotive Research Association of India, Pune	Shri M. Sreenivasulu (***Chairman***) Shri A. Akbar Badusha (*Alternate* I) Shri B. S. Yamgar (*Alternate* II)
Asahi India Glass Ltd, Dist Rewari	Shri Deven Kumar Jally Shri Panneerselvam Arumugam (*Alternate*)
Ashok Leyland Ltd, Chennai	Shri Faustino V. Shri M. Ravi (*Alternate*)
Association of State Road Transport Undertakings, New Delhi	Shri R. Chandrababu Shri Ullas Babu (*Alternate*)
Automotive Component Manufacturers Association, New Delhi	Shri Uday Harite
Bajaj Auto Ltd, Pune	Shri R. Narasimhan Shri A. V. Kumbhar (*Alternate*)
Central Institute of Road Transport, Pune	Shri S. N. Dhole Shri Santosh Gutte (*Alternate* I) Shri D. H. Pendharkar (*Alternate* II)
Central Farm Machinery Training & Testing Institute (CFMTTI), P O Budni (M P)	Shri J. J. R. Narware Shri C. V. Chimote (*Alternate*)
Controllerate of Quality Assurance (BEML), Bengaluru	Controller CQA Shri M. K. Keshava Prasad (*Alternate*)
Force Motors Ltd, Pune	Shri P. R. Shivaraman Shri L. B. Patil (*Alternate*)
Gabriel India Ltd, Pune	Shri Harikrishna
Hero Motocorp	Nomination Awaited
Honda Cars (R&D) India	Shri Feroz Khan Shri S. Muthu Kumar (*Alternate*)
Honda Motorcycle & Scooter India Pvt Ltd	Nomination Awaited
ICAT, Manesar	Shri Ashish Kumar Shri Vijayanta Ahuja (*Alternate*)
Jamna Auto Industries Ltd, New Delhi	Shri Sunil Laroiya Shri Anuj Sharma (*Alternate*)
Maharashtra State Road Transport Corporation, Mumbai	Shri Vasant Baburao Gaidhani Chief Engineer (*Alternate*)
Mahindra & Mahindra Ltd, Nashik	Shri Pradeep Bansode Shri T. Viswanathan (*Alternate*)
Maruti Suzuki India Ltd, Gurugram	Shri Jitendra Malhotra Shri Deepak Panda (*Alternate*)
Mahindra Trucks and Buses Limited, Pune	Shri K. Nagaraju Shri V. G. Kulkarni (*Alternate*)
Ministry of Heavy Industries & Public Enterprises, New Delhi	Shri B. N. Das Shri R. K. Jaiswal (*Alternate*)

Organization	*Representative(s)*
Ministry of Road Transport & Highways, New Delhi	Director Rt Shri Dharkat R. Luikang (*Alternate*)
MSME, Delhi	Shri K. L. Rao Shri K. K. Funda (*Alternate*)
Ordnance Factory Board, Vehicle Factory, Jabalpur	Shri P. K. Arora Shri A. K. Maurya (*Alternate*)
Ruby Bus Pvt Ltd, Mumbai	Shri Pankaj D. Kapashi Shri V. M. Bhise (*Alternate*)
Renault Nissan, Chennai	Shri K. Thangaraj
Society of Indian Automobile Manufactures (SIAM), New Delhi	Shri P. K. Banerjee Shri Amit Kumar (*Alternate*)
Tata Motors Ltd, Pune	Shri P. S. Gaurishankar Shri Sharad Gole (*Alternate*)
Tata Autocomp Systems Limited-Technical Center	Dr Milind Mhalgi
Toyota Kirloskar Motors Ltd, Bengaluru	Shri Revadi Channappa Shri Raju M. (*Alternate*)
Vehicles Research & Development Establishment, Ahmednagar	Shri S. Muthukrishnan Shri Sam Shaikh (*Alternate*)
Volvo India Pvt Ltd, Bengaluru	Shri Karthik Sarma Shri P. K. Hugar (*Alternate*)
BIS Directorate General	Shri R. R. Singh, Scientist 'E' and Head (TED) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Navindra Gautam
Scientist 'E' (TED), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 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'.

This Indian Standard has been developed from Doc No.: TED 06 (13298).

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 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	2323 7617, 2323 3841
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi, KOLKATA 700054	2337 8499, 2337 8561, 2337 8626, 2337 9120
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, CHANDIGARH 160019	265 0206, 265 0290
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	2254 1216, 2254 1442, 2254 2519, 2254 2315
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East), MUMBAI 400093	2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi