AMENDMENT NO. 1

TO

AIS-033/2001

Automotive Vehicles - Plastic Fuel Tanks for Four - Wheelers.

1. Page No. 1, cl.3.2

   Delete entire clause 3.2 and renumber subsequent clauses as 3.2, 3.3---- etc. wherever it appears.

2. Page No. 3, cl.4.1, Hydraulic Test

   Delete entire clause 4.1 and renumber subsequent clauses as 4.1, 4.2---- etc. wherever it appears.

3. Page No. 4, cl. 4.4.1
   Substitute following text for existing text in first sentence.

   " The tank must be tested for rigidity of shape."

PRINTED BY

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P. B. NO. 832. PUNE 411 004

ON BEHALF OF
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF SHIPPING, ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

October 2004

AIS - 033/2001

AUTOMOTIVE INDUSTRY STANDARD

Automotive Vehicles – Plastic Fuel Tank for Four Wheelers

PRINTED BY:

THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA
P. B. NO. 832. PUNE 411 004

ON BEHALF OF :
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES - TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF ROAD TRANSPORT & HIGHWAYS
GOVERNMENT OF INDIA

August 2001

Status chart of the Standard to be used by the purchaser for updating the record

Sr. No.	Corr-igenda.	Amend-ment	Revision	Date	Remark	Misc.

General remarks :

Introduction

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the Ministry of Surface Transport (MOST) has constituted a permanent Automotive Industry Standard Committee (AISC) vide order No. RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CTSC). After approval, the Automotive Research Association of India, (ARAI), Pune, being the secretariat of the AIS Committee, has published this standard. For better dissemination of this information ARAI may publish this document on their Web site.

The fuel tank is an important safety critical item, the Bureau of Indian Standards has already come out with the Indian Standard IS: 12056 – 1987 for the metallic fuel tanks and IS: 14681 – 1999 for fuel tanks for 2 and 3 wheelers. With the advancement of technology and availability of this standard substitute plastic material more and more vehicle manufacturers have started using plastic fuel tanks. And hence, there was a need for a standard specifying the performance requirements of the plastic fuel tanks.

Considerable assistance have been taken from ECE R-34 “Uniform Provisions concerning the Approval of Vehicle with regard to the Prevention of Fire risk” and EEC Directive 2000/8/EC on “the approximation of lass of the members states relating to the liquid fluid tanks and rear under run protection of motor vehicles and their trailers”.

As the requirements of the under run projection are covered under a separate Indian Standard, these are excluded. Also the frontal and rear impact crash tests are not included in this standards, as they will be covered under a different standard.

The Committee responsible for preparation of this standard is given in Annexure-II.

Automotive Vehicles - Plastic Fuel Tanks for Four Wheelers

1.0 SCOPE

1.1 This standard applies to four wheeled motor vehicles & their Trailers whose engine uses Liquid Fuel and the Fuel tank is made of Plastic Material.

2.0 DEFINATIONS

For the purpose of this standard;

2.1 "Vehicle Type with regard to fuel tanks" means vehicles which do not differ essentially in such respect as.

2.1.1 The structure, shape, dimensions and materials of the tank (s)

2.1.2 The position of the tanks in the vehicle (right / left / front / rear / center).

2.2 "Occupant compartment" means the space for occupant accommodation bounded by the roof, floor, side walls, doors, outside glazing, front bulkhead and rear bulkhead.

2.3 "Unladen mass" means the mass of the vehicle in running order.

2.4 "Tank" means the tank(s) designed to contain the liquid fuel, as defined in Cl. No. 2.6 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.)

2.5 "Capacity of the tank" means the tank capacity as specified by the manufacturer.

2.6 "Liquid fuel" means a fuel which is liquid in normal ambient conditions.

3.0 GENERAL SPECIFICATIONS

3.1 Tanks must be made so as to be corrosion-resistant.

3.2 Tanks must satisfy, when equipped with all accessories, which are normally attached to them, the leakage tests are carried out according to Cl. No. 4.1 at a relative internal pressure equal to double the working pressure, but in any event not less than gauge pressure of 0.3 bar.

3.3 Any excess pressure or any pressure exceeding the working pressure must be compensated automatically by suitable devices (vents, safety valves etc.)

3.4 The vents must be designed in such a way as to prevent any fire risk. In particular, any fuel which may leak when the tank(s) is (are) being filled must not be able to fall on the exhaust system. It shall be channelled to the ground .

3.5 The tank(s) must not be situated in, or form, a surface (floor, wall, bulkhead) of the occupant compartment or other compartment integral with it.

3.6 A partition must be provided to separate the occupant compartment from the tank(s). The partition may contain apertures (e.g. to accommodate cables) provided they are so arranged that fuel cannot flow freely from the tank(s) into the occupant compartment or other compartment integral with it during normal conditions of use)

3.7 Every tank must be securely fixed and so placed as to ensure that any fuel leaking from the tank or its accessories will escape to the ground and not into the occupant compartment during normal conditions of use.

3.8 The filler hole must not be situated in the occupant compartment, in the luggage compartment or in the engine compartment.

3.9 The fuel must not escape through the tank cap or through the devices provided to compensate excess pressure during the foreseeable course of operation of the vehicle .In the case of overturning of the vehicle, a drip may be tolerated provided that it does not exceed 30 g/min; this requirement must be verified during the test prescribed in Cl. No. 4.2.

3.9.1 The tank cap must be fixed to the fillerpipe; the seal must be retained securely in place, the cap must latch securely in place against the seal and filler pipe when closed.

3.10 Tanks must be installed in such a way as to be protected from the consequence of an impact to the front or the rear of the vehicle; there shall be no protruding parts, sharp edges, etc. near the tank.

3.11 The fuel tank and the filler neck shall be designed and installed in the vehicles in such a way as to avoid any accumulation of static electricity charges on their entire surface. If necessary, they shall be discharged into the metallic structure of the chassis or any major metallic mass by means of a good conductor.

3.12 The tank / vehicle manufacturer should submit the details and drawing specified in Annexure I.

4.0 TESTS

4.1 Hydraulic Test

4.1.1 The tank must be subjected to a hydraulic internal pressure test which must be carried out on an isolated unit complete with all its accessories. The tank must be completely filled with a non- flammable liquid (water, for example). After all communication with the outside has been cut off, the pressure must be gradually increased, through the pipe connection through which fuel is fed to the engine, to a relative internal pressure equal to double the working pressure used and in any case not less than an gauge pressure of 0.3 bar, which must be maintained for one minute. During this time the tank shell must not crack or leak; however, it may be permanently deformed.

4.2 Overturn test

4.2.1 The tank and all its accessories must be mounted on to 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 a system for the compensation of the interior excess pressure.

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

4.2.3 The test will be carried out with the tank filled to 90% of its capacity and also 30% of its capacity with a non-flammable liquid having a density and a viscosity close to those of the fuel normally used (water may be accepted)

4.2.4 The tank must be turned from its installed position 90° to the right. The tank must remain in this position, for atleast five minutes.

4.2.5 The tank must then be turned 90° further in the same direction. The tank must be held in this position, in which it is completely inverted, for at least another 5 minutes.

4.2.6 The tank must be rotated back to its normal position. Testing liquid which has not flowed back from the venting system into the tank must be drained and replenished if necessary.

4.2.7 The tank must be rotated 90° in the opposite direction and left for at least 5 minutes in this position.

4.2.8 The tank must be rotated 90° further in the same direction. This completely inverted position must be maintained for at least 5 minutes. Afterwards, the tank must be rotated back to its normal position.

4.3 Impact resistance

4.3.1 The tank must be filled to its capacity with a water-glycol mixture or with another liquid having a low freezing point which does not change the properties of the tank material, and must then be subjected to the following perforation test.

4.3.2 The test must be carried out immediately after the tank attains temperature of 233 K ± 2 k (-40°C ± 2°C).

4.3.4 A pendulum impact testing fixture must be used for the test. The impact body must be of steel and have the shape of a pyramid with equilateral-triangle faces and a square base, the summit and the edges being rounded to a radius of 3 mm. The centre of percussion of the pendulum must coincide with the centre of gravity of the pyramid; its distance from the axis of rotation of the pendulum must be 1 m. The total mass of the pendulum must be 15kg. The energy of the pendulum at the moment of impact must be not less than 30 Nm and as close to that value as possible.

4.3.5 The tests must be made on the points of the tank which are regarded as vulnerable to frontal or rear collisions. The points regarded as vulnerable are those which are most exposed or weakest having regard to the shape of the tank or the way in which it is installed on the vehicle. The points selected by the laboratories must be indicated in the test report.

4.3.6 During the test, the tank must be held in position by the fittings on the side or sides opposite the side of impact. No leak must result from the test.

4.3.7 At the choice of the manufacturer, all the impact tests may be carried out on one tank or each may be carried out on a different tank.

4.4 Mechanical strength

4.4.1 The tank must be tested under the conditions prescribed in Cl. No. 4.1 for leaks and for rigidity of shape. The tank and all its accessories must be mounted onto a test fixture in a manner corresponding to the mode of Installation on the vehicle for which the tank is intended. Water at 326 k (53° C) must be used as the testing fluid and must fill the tank to its capacity. The tank must be subject to a relative internal pressure equal to double the working pressure and in any case to not less than 0.3 bar at a temperature of 326 K ± 2 K (53°C ± 2°C) for a period of five hours. During the test the tank and its accessories must not crack or leak; however, it may be permanently deformed.

4.5 Fuel permeability

4.5.1 The fuel used for the permeability test must be either the reference fuel or commercially premium-grade fuel. If the tank is only designed for installation on vehicles with a compression ignition engine, the tank shall be filled with diesel fuel.

4.5.2 Prior to the test, the tank must be filled to 50 per cent of its capacity with testing fuel and stored, without being sealed, at an ambient temperature of 313 K ± 2 K (40°C ± 2°C). until the weight loss per unit time becomes constant, but for not more than 4 weeks.

4.5.3 The tank must then be emptied and refilled to 50 percent of its capacity with test fuel, after which it must be hermetically sealed and stored at a temperature of 313 K ± 2K (40°C ± 2°C). under a test pressure of 0.3 bar . The pressure must be adjusted when the contents of the tank have reached the testing temperature. During the ensuing test period of eight weeks, the loss of weight due to diffusion during the test period shall be determined. The maximum permissible average loss of fuel is 20 g per 24 hours of testing time.

4.5.4 If the loss due to diffusion exceeds the value indicated in Cl. No. 4.5.3, the test described must be carried out again, on the same tank, to determine the loss by diffusion at 23° ± 2°C, but under the same conditions otherwise. The loss so measured shall not exceed 10g per 24 hours.

4.6 Resistance to fuel

4.6.1 After the test referred to in Cl. No. 4.5 above, the tank must still meet the requirements set out in Cl. No. 4.3 and 4.4

4.7 Resistance to fire

The tank must be subjected to the following tests:

4.7.1 For two minutes the tank, fixed as on the vehicle, must be exposed to flame. There must be no leakage of liquid fuel from the tank.

4.7.2 Three tests must be made on different tank filled with fuel as follows :

4.7.3 If the tank is designed for installation on vehicles equipped with either a positive ignition engine or a compression ignition engine, three tests must be carried out with tanks filled with premium-grade gasoline;

4.7.4 If the tank is only designed for installation on vehicles equipped with a compression ignition engine, three tests must be carried out with tanks filled with diesel fuel.

4.7.5 For each test the tank must be installed in a testing fixture simulating actual installation conditions as far as possible. The method whereby the tank is fixed in the fixture must correspond to the relevant specifications for the vehicle. Vehicle parts which protect the tank and its accessories against exposure to flame or which affect the course of the fire in any way, as well as specified components installed on the tank and plugs, must be taken into consideration. All openings must be closed during the test, but venting systems must remain operative. Immediately prior to the test the tank must be filled with specified fuel to 50 percent of its capacity.

4.7.6 The flame to which the tank is exposed must be obtained by burning commercial fuel for positive ignition engines (hereafter called " fuel") in a pan. The quantity of fuel poured into the pan shall be sufficient to permit the flame, under the burning conditions, to burn for the whole test procedure.

4.7.7 The pan dimensions must be chosen so as to ensure that the sides of the fuel tank are exposed to the flame. The pan must therefore exceed the horizontal projection of the tank by at least 20 cm , but not more then 50 cm. The side walls of the pan must not project more than 8 cm above the level of the fuel at start of the test.

4.7.8 The pan filled with fuel must be placed under the tank in such a way that the distance between the level of the fuel in the pan and the tank bottom corresponds to the design height of the tank above the road surface at the unladen mass (see Cl. No. 2.3) . Either the pan, or the testing fixture, or both, must be freely movable.

4.7.9 During phase C of the test, the pan must be covered by a screen placed 2 cm ± 1 cm above the fuel level. The screen must be made of a refractory material, as prescribed in Appendix 2. There must be no gap between the bricks and they must be supported over the fuel pan in such a manner that the holes in the bricks are not obstructed. The length and width of the frame must be 2 cm-4 cm smaller than the interior dimensions of the pan so that a gap of 1cm – 2cm exists between the frame and the walls of the pan to allow ventilation.

4.7.10 When the test is carried out on the open air, sufficient wind protection must be provided and the wind velocity at fuel pan level must not exceed 2,5 km/h. Before the test the screen must be heated to 308K ± 5K (35° ±5°C). The fire bricks may be wetted in order to guarantee the same test conditions for each successive test.

4.7.11 The test must comprise four phases (see Appendix 1)

4.7.12 Phase A : Pre-heating (figure 1)
The fuel in the pan must be ignited at a distance of at least 3 m from the tank being tested. After 60 seconds pre-heating, the pan must be placed under the tank.

4.7.13 Phase B: Direct exposure to flame (figure 2)
For 60 Seconds the tank must be exposed to flame from the freely burning fuel.

4.7.14 Phase C : Indirect exposure to flame (figure3)
As soon as phase B has been completed, the screen must be placed between the burning pan and the tank. The tank must be exposed to this reduced flame for a further 60 seconds.

4.7.15 Phase D : End of test (figure 4) :
The burning pan covered with the screen must be moved back to its original position (Phase A). If, at the end of the test, the tank is burning, the fire must be extinguished forthwith.

4.7.16 The results of the test shall be considered satisfactory if no liquid fuel is leaking from the tank.

4.8 Resistance to high temperature

4.8.1 The fixture used for the test must match the manner of installation of the tank on the vehicle, including the way in which the tank vent works.

4.8.2 The tank filled to 50 percent of its capacity with water at 293 K (20 °C), must be subjected for one hour to an ambient temperature of 368 K ± 2 K (95°C ± 2°C).

4.8.3 The results of the test shall be considered satisfactory if, after the test, the tank is not leaking or seriously deformed.

5.0 NUMBER OF SAMPLES

5.1 Total 8 nos. of samples are required for carrying out the above tests.

6.0 CONFORMITY OF PRODUCTION PROCEDURE

6.1 The conformity of production will be carried out as per the procedure led down by ministry of Road Transport and Highways.

APPENDIX 1

TEST OF RESISTANCE TO FIRE

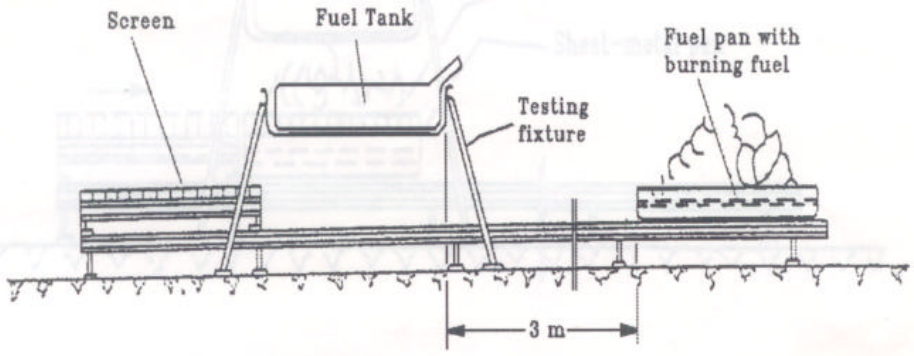


Figure 1

Phase A: Pre-heating

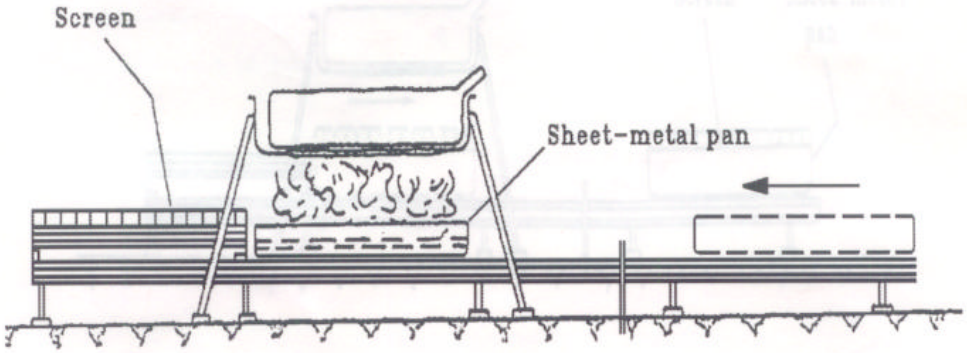


Figure 2

Phase B: Direct Exposure to Flame

APPENDIX 1

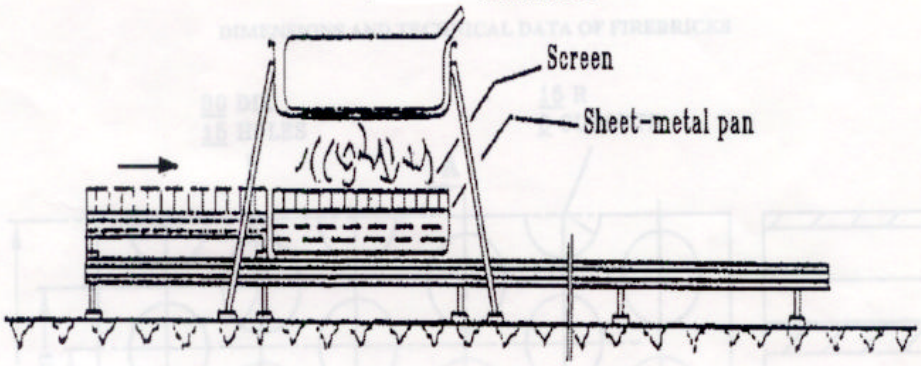


Figure 3

Phase C: Indirect Exposure to the Flame

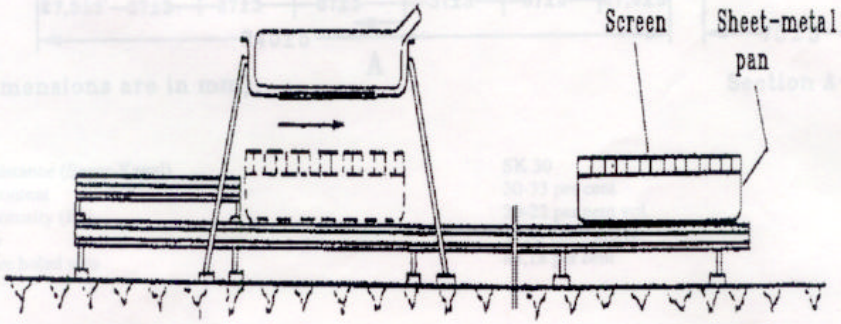
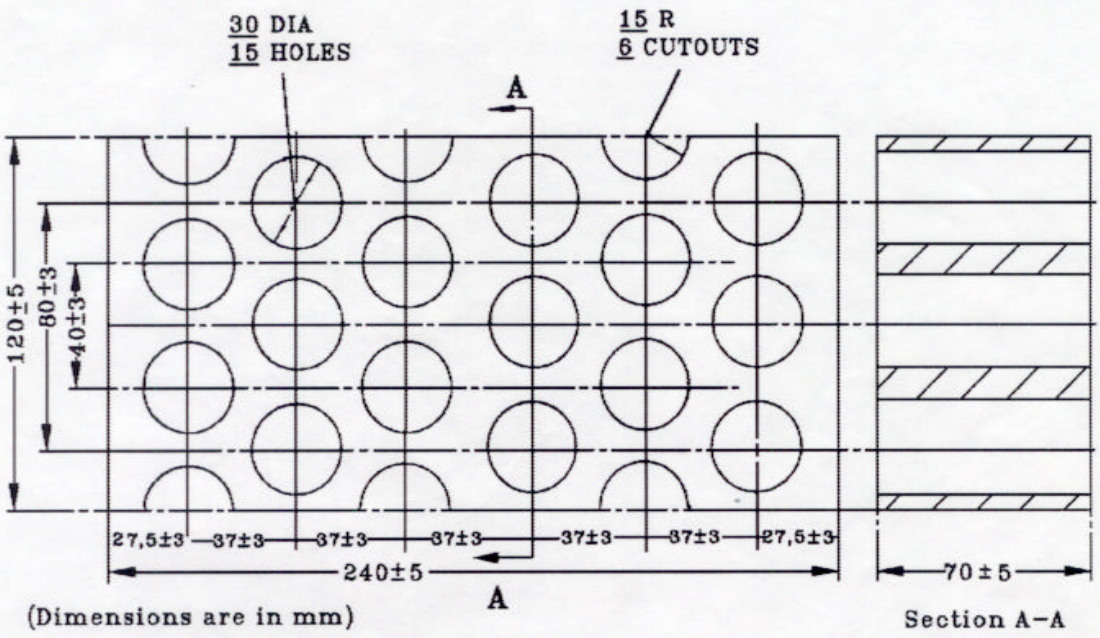


Figure 4

Phase D: End of Test

APPENDIX - 2

DIMENSIONS AND TECHNICAL DATA OF FIREBRICKS



(Dimensions are in mm)

Section A–A

Fire resistance (Seger-Kegel)	SK 30
Al_2O_3 content	30-33 per cent
Open porosity (Po)	20-22 per cent vol.
Density	1900-2000 km/m^3
Effective holed area	44,18 per cent

Annexure-I

Technical specification to be submitted by tank / vehicle manufacturer

1. Type of vehicle
2. Type of Fuel
3. Name of the vehicle manufacturer
4. Address of the vehicle manufacturer
5. Vehicle model / variants
6. Category of vehicle
7. Manufacturer of Fuel Tank
8. Sketch showing mounting and location of Fuel Tank.
9. Drawing and technical specification of the Fuel Tank with all connections and all lines of breathing and vending system and fastening devices.
10. Material of the tank, Trade name with Mark
11. Type of Engine
12. No. and Capacity of Fuel Tank

ANNEXURE-II
(see Introduction)

COMMITTEE COMPOSITION
Automotive Industry Standards Committee

Chairman	
Shri. B. Bhanot	Director, The Automotive Research Association of India, Pune.
Members	**Representing**
Shri. Alok Rawat	Ministry of Road Transport & Transport, New Delhi.
Shri. V.C. Mathur	Department of Heavy Industry, Ministry of Industries & Public Enterprises, New Delhi.
Shri. G. S. Kashyab Shri. M.K. Bhat (Alternate)	Office of the Development Commissioner Small Scale Industries, Ministry of Industry, New Delhi.
Shri. A. R. Gulati	Bureau of Indian Standards.
Shri. R. C. Sethi Shri. N. Karuppaiah (Alternate)	Vehicle Research & Development Establishment, Ahmednagar.
Shri. D. G. Shirke Shri. P. C. Barjatia (Alternate)	Central Institute of Road Transport, Pune.
Shri. R. M. Srivastava	Society of Indian Automobile Manufacturers.
Shri. T. M. Balaraman	Society of Indian Automobile Manufacturers.
Shri. I. V. Rao	Society of Indian Automobile Manufacturers.
Shri. Z. A. Mujawar (Alternate)	Society of Indian Automobile Manufacturers.
Shri. Vivek Adyanthaya (Alternate)	Society of Indian Automobile Manufacturers.
Shri. U. K. Kini (Alternate)	Society of Indian Automobile Manufacturers.
Shri. T. C. Gopalan	Tractor Manufacturers Association, New Delhi.
Shri. Vishnu Mathur	Automotive Components Manufacturers Association.
Shri. K. N. D. Nambudiripad	Automotive Components Manufacturers Association.

Member Secretary
Mrs. Rashmi Urdhwareshe
Sr. Assistant Director,
The Automotive Research Association of India, Pune.