

**AUTOMOTIVE INDUSTRY STANDARD**

**Requirements for the Protection of  
Fuel System in the Event of  
Rear Impact of a Motor Vehicle**

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ON BEHALF OF  
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER  
CENTRAL MOTOR VEHICLE RULES – TECHNICAL STANDING COMMITTEE

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

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

| Sr. No.                  | Corrigenda. | Amendment | Revision | Date | Remark | Misc. |
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| <b>General remarks :</b> |             |           |          |      |        |       |

## INTRODUCTION

- 0.0 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 erstwhile 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, will publish this standard.
- 1.0 The purpose of this standard is to bring about an improvement in the construction of the rear of vehicles and, in particular, those areas which influence the protection of the fuel systems (fuel tanks etc.) in the event of rear impact of a vehicle.
- 2.0 For improving the crashworthiness of a vehicle in the event of rear impact, the seating system should comply to the provisions of seats and seat anchorages standard IS 15546. AIS-101 and IS 15546 together would improve crashworthiness in rear impacts.
- 3.0 While preparing this AIS considerable assistance is derived from following international standards:

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| ECE R32 (Suppl. 1 to 00 series of amendments (11.06.2007)) | Uniform provisions concerning the approval of vehicles with regard to the behaviour of the structure of the impacted vehicle in a rear end collision |
| ECE R34 (Suppl. 2 to 02 series of amendments (11.06.2007)) | Uniform provisions concerning the approval of vehicles with regard to the prevention of fire risks   |

- 4.0 The AISC panel and Automotive Industry Standards Committee (AISC) responsible for preparation of this standard are given in Annex B and Annex C respectively.

**Requirements for the Protection of Fuel System in the Event of  
Rear Impact of a Motor Vehicle**

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## Requirements for the Protection of Fuel System in the Event of Rear Impact of a Motor Vehicle

### 1.0 SCOPE

- 1.1 This standard applies to the vehicles of categories M1 as defined in AIS-053 with regards to the protection of fuel system in the event of rear impact.
- 1.2 At the request of the manufacturer, vehicles other than those mentioned in paragraph 1.1 may be approved under this standard.

### 2.0 REFERENCES

- 2.1 AIS-053 Automotive Vehicles - Types - Terminology

### 3.0 DEFINITIONS

- 3.1 **"Approval of a vehicle"** means the approval of a vehicle type with regard to:
  - 3.1.1 the protection of the fuel system in the event of rear impact.
- 3.2 **"Vehicle type"** means a category of power-driven vehicles which do not differ in such essential respects as:
  - 3.2.1 the length and width of the vehicle in so far as they have an effect on the results of the impact test prescribed in this standard;
  - 3.2.2 the structure, dimensions, lines and materials of the part of the vehicle rearward of the fuel tank (s);
  - 3.2.3 the position of the fuel tank(s) in the vehicle in so far as it has a negative effect on the requirements of this standard,
  - 3.2.4 the structure, shape, dimensions and materials (plastic / metal) of the fuel tank(s);
  - 3.2.5 the siting of the engine (front, rear, centre);
  - 3.2.6 characteristics and siting of fuel feed system (pump, filters, etc.)
  - 3.2.7 characteristics and siting of electrical installation
- 3.3 **"Unladen kerb weight"** means the weight of the vehicle in running order, unoccupied and unladen but complete with fuel, coolant, lubricant, tools and a spare wheel (if provided as standard equipment by the vehicle manufacturer);

#### **4.0 APPLICATION FOR APPROVAL**

- 4.1 The application for approval of a vehicle type with regard to the protection of the fuel system in the event of rear impact shall be submitted by the vehicle manufacturer or by his duly accredited representative.
- 4.2 It shall be accompanied by the under mentioned documents in triplicate, and by the following particulars:
  - 4.2.1 a detailed description of the vehicle type with respect to its structure, dimensions, lines and constituent materials;
  - 4.2.2 drawings of the vehicle showing the vehicle type in front, side and rear elevation and design details of the rear part of the structure; and
  - 4.2.3 particulars of the vehicle's unladen kerb weight.
- 4.3 A vehicle representative of the type to be approved shall be submitted to the testing agency responsible for conducting the approval tests.
  - 4.3.1 A vehicle not comprising all the components proper to the type may be accepted for test provided that it can be shown that the absence of the components omitted has no detrimental effect on the results of the test, so far as the requirements of this standard are concerned.
  - 4.3.2 The testing agency responsible for conducting the tests may allow the same vehicle as is used for tests prescribed by other standards (including tests capable of affecting its structure) to be used also for the tests prescribed by this standard; and the vehicle may be weighted to an extent not exceeding 10 per cent of its unladen kerb weight with additional weights rigidly secured to the structure in such a way as not to affect the behaviour of the structure of the passenger compartment during the test.
- 4.4 It shall be the responsibility of the vehicle manufacturer for approval to show that acceptance of the variants referred to in paragraph 4.3.1. is compatible with compliance with the requirements of this standard.

#### **5.0 REQUIREMENTS**

When the vehicle has undergone the test referred to in paragraph 6 below

- 5.1 no more than a slight leakage of liquid in the fuel installation shall occur on collision;
- 5.2 if there is continuous leakage in the fuel installation after the collision, the rate-of leakage shall not exceed 30 g/min; if the liquid from the fuel installation mixes with liquids from the other systems, and if the several liquids cannot be easily separated and identified, the continuous leakage shall be evaluated from all the fluids collected;
- 5.3 no fire maintained by the fuel shall occur.

- 5.4 During and after the impacts described in paragraph 6 the battery shall be kept in position by its securing device.
- 5.5 After the test, no rigid component in the passenger compartment shall constitute a risk of serious injury to the vehicle's occupants.
- 5.6 In addition, the side doors of the vehicle shall not open under the effect of the rear impact.
- 5.7 Except in the case of a vehicle not having a roof of rigid construction, the opening of a number of doors sufficient to enable all the occupants to emerge shall, after the impact, continue to be possible without the use of tools.

## **6.0 TESTS**

- 6.1 The vehicle's compliance with the requirements of paragraph 5 above shall be checked by the method set out in Annex A to this standard.

## **7.0 MODIFICATIONS OF THE VEHICLE TYPE**

- 7.1 Every modification of the vehicle type shall be notified to the testing agency which approved the vehicle type. The testing agency may then either:
  - 7.1.1 consider that the modifications made are unlikely to have appreciable adverse effects, and that in any case the vehicle still meets the requirements; or
  - 7.1.2 require a further test report.
- 7.2 Without prejudice to the provisions of paragraph 7.1. above, a variant of the vehicle whose unladen mass is lower or does not exceed by more than 25% from that of the approval-tested vehicle shall not be regarded as a modification of the vehicle type.

## **8.0 CRITERIA FOR EXTENSION OF TYPE APPROVALS**

- 8.1 Criteria for extension of approval shall be as mutually agreed between the testing agency and vehicle manufacturer.

**ANNEX A**

(See 6.1)

**PROCEDURE FOR REAR-END COLLISION TEST****A.1 Purpose and scope**

A.1.1 The purpose of the test is to simulate the conditions of rear-end collision by another vehicle in motion.

**A.2 Installations, procedures and instruments****A.2.1 Testing ground**

The test area shall be large enough to accommodate the impactor (striker) propulsion system and to permit after-collision displacement of the impacted vehicle and installation of the test equipment. The part in which vehicle collision and displacement occur shall be horizontal, flat and smooth and have a coefficient of friction of not less than 0.5.

**A.2.2 Impactor (striker)**

A.2.2.1 The impactor shall be of steel and of rigid construction.

A.2.2.2 The impacting surface shall be flat, not less than 2,500 mm wide, and 800 mm high, and its edges shall be rounded to a radius of curvature of between 40 and 50 mm. It shall be covered with layer of plywood 20±2 mm thick.

A.2.2.3 At the moment of collision the following requirements shall be met:

A.2.2.3.1 the impacting surface shall be vertical and perpendicular to the median longitudinal plane of the impacted vehicle;

A.2.2.3.2 the direction of movement of the impactor shall be substantially horizontal and parallel to the median longitudinal plane of the impacted vehicle;

A.2.2.3.3 the maximum lateral deviation tolerated between the median vertical line of the surface of the impactor and the median longitudinal plane of the impacted vehicle shall be 300 mm. In addition, the impacting surface shall extend over the entire width of the impacted vehicle;

A.2.2.3.4 the ground clearance of the lower edge of the impacting surface shall be  $175 \pm 25$  mm.

**A.2.3 Propulsion of the impactor**

A.2.3.1 The impactor may either be secured to a carriage (moving barrier) or form part of a pendulum



#### A.2.4 **Special provisions applicable where a moving barrier is used**

- A.2.4.1 If the impactor is secured to a carriage (moving barrier) by a restraining element, the latter shall be rigid and be incapable of being deformed by the collision; the carriage shall at the moment of collision be capable of moving freely and no longer be subject to the action of the propelling device.
- A.2.4.2 The velocity of collision shall be between 35 and 38 km/h.
- A.2.4.3 The aggregate weight (mass) of carriage and impactor shall be  $1,100 \pm 20$  kg

#### A.2.5 **Special provisions applicable where a pendulum is used**

- A.2.5.1 The distance between the centre of the impacting face and the axis of rotation of the pendulum shall be not less than 5 m.
- A.2.5.2 The impactor shall be freely suspended by rigid arms rigidly secured to it. The pendulum so constituted shall be substantially incapable of being deformed by the collision.
- A.2.5.3 Arresting gear shall be incorporated in the pendulum to prevent any secondary collision by the impactor on the test vehicle.
- A.2.5.4 At the moment of collision the velocity of the centre of percussion of the pendulum should be between 35 and 38 km/h.
- A.2.5.5 The reduced mass " $m_r$ " at the centre of percussion of the pendulum is defined as a function of the total mass " $m$ ", of the distance " $a$ "\* between the centre of percussion and the axis of rotation, and of the distance " $l$ " between the centre of gravity and the axis of rotation, by the following equation:

$$m_r = m (l/a)$$

- A.2.5.6 The reduced mass  $m_r$  shall be  $1,100 \pm 20$  kg.

#### A.2.6 **General provisions relating to the mass and velocity of the impactor**

- A.2.6.1 If the test has been conducted at a collision velocity higher than those prescribed in paragraphs A.2.4.2 and A2.5.4 and/or with a mass greater than those prescribed in paragraphs A2.4.3 and A2.5.6, and the vehicle has met the requirements prescribed, the test shall be considered satisfactory.

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\* It is recalled that the distance "a" is equal to the length of the synchronous pendulum of the pendulum under consideration

**A.3 State of vehicle under test**

- A.3.1 The vehicle under test shall either be fitted with all the normal components and equipment included in its unladen kerb weight or be in such condition as to fulfill this requirement so far as the components and equipment affecting fire risks are concerned.
- A.3.2 The fuel tank shall be filled to at least 90 per cent of its capacity either with fuel or with a non-inflammable liquid having a density and a viscosity close to those of the fuel normally used. All other systems (brake-fluid header tanks, radiator, etc.) may be empty.
- A.3.3 At the choice of the vehicle manufacturer, a gear may be engaged and the brakes may be applied.
- A.3.4 The doors should be latched but not locked.

**A.4 Measuring instruments**

- A.4.1 The instruments used to record the speed referred to in paragraphs A.2.4.2 and A.2.5.4 above shall be accurate to within one per cent.

**A.5 Equivalent test methods**

- A.5.1 Equivalent test methods are permitted provided that the conditions referred to in this standard can be observed either entirely by means of the substitute test or by calculation from the results of the substitute test.
- A.5.2 If a method other than that described in paragraph A.2 above is used, its equivalence shall be demonstrated.

**ANNEX B**  
(See Introduction)

**COMPOSITION OF AISC PANEL ON REQUIREMENTS FOR THE  
PROTECTION OF FUEL SYSTEM IN THE EVENT OF REAR IMPACT  
OF A MOTOR VEHICLE**

|                         |  |
|-------------------------|--|
| <b>Convener</b>         |  |
| Mr. S. Ravishankar      | Tata Motors Ltd.   |
| <b>Member Secretary</b> |  |
| Mr. A. V. Mannikar      | The Automotive Research Association of India   |
| <b>Members</b>          | <b>Representing</b>  |
| Mr. A. S. Bhale         | The Automotive Research Association of India   |
| Mr. Amit Karwal         | ICAT, Manesar  |
| Mr V. M. Manel          | Society of Indian Automobile Manufacturers (SIAM)<br>(Bajaj Auto Ltd)                    |
| Mr. S. S. Kshirsagar    | Society of Indian Automobile Manufacturers (SIAM)<br>(Bajaj Auto Ltd)                    |
| Mr Saleem Mohammad      | Society of Indian Automobile Manufacturers (SIAM)<br>(General Motors India Private Ltd.) |
| Mr Jitendra Malhotra    | Society of Indian Automobile Manufacturers (SIAM)<br>(Maruti Suzuki India Ltd.)          |
| Mr. Pankaj Karn         | Society of Indian Automotive Manufacturers (SIAM)  |
| Mr. C. Anilkumar        | Society of Indian Automobile Manufacturers (SIAM)<br>(Tata Motors Ltd.)                  |
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| Mr. V. S. Gogate        | Society of Indian Automobile Manufacturers (SIAM)<br>(Tata Motors Ltd.)                  |
| Mr. S. Sakthivelan      | Society of Indian Automobile Manufacturers (SIAM)<br>(Toyota Kirloskar Motors Ltd.)      |
| Mr. Balamuralikrishna   | Society of Indian Automobile Manufacturers (SIAM)<br>(Toyota Kirloskar Motors Ltd.)      |
| Mr. Sumit Sharma        | Society of Indian Automobile Manufacturers (SIAM)<br>(Volkswagen India Private Ltd.)     |

**ANNEX C**  
(See Introduction)

**COMMITTEE COMPOSITION \***  
**Automotive Industry Standards Committee**

|   |  |
|---|--|
| <b>Chairman</b>                             |  |
| Shri Shrikant R. Marathe                    | Director<br>The Automotive Research Association of India, Pune   |
| <b>Members</b>                              | <b>Representing</b>  |
| Representative from                         | Ministry of Road Transport & Highways<br>(Dept. of Road Transport & Highways), New Delhi                     |
| Representative from                         | Ministry of Heavy Industries & Public Enterprises<br>(Department of Heavy Industry), New Delhi               |
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| Shri T. V. Singh                            | Bureau of Indian Standards, New Delhi  |
| Director<br>Shri D. P. Saste<br>(Alternate) | Central Institute of Road Transport, Pune  |
| Director                                    | International Centre for Automotive Testing, Manesar   |
| Director                                    | Indian Institute of Petroleum, Dehra Dun   |
| Director                                    | Vehicles Research & Development Establishment,<br>Ahmednagar   |
| Representatives from                        | Society of Indian Automobile Manufacturers   |
| Shri T.C. Gopalan                           | Tractor Manufacturers Association  |
| Shri K.N.D.<br>Nambudiripad                 | Automotive Components Manufacturers Association of<br>India, New Delhi                                       |

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

\* At the time of approval of this Automotive Industry Standard (AIS)