

AUTOMOTIVE INDUSTRY STANDARD

Approval of

**I. Front Underrun Protective Devices
(FUPDs)**

**II. Vehicles with regard to the
installation of an FUPD of
an Approved Type**

**III. Vehicles with regard to their
Front Underrun Protection (FUP)**

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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

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Status chart of the Standard to be used by the purchaser
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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 Standards 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 purpose of this standard is to offer effective protection against front underrunning of vehicles of category M_1 or N_1 in the event of front collision with vehicles of categories N_2 and N_3

While preparing this AIS considerable assistance is derived from ECE R 93 (Date of entry into force: 27th Feb. 1994) Uniform provisions concerning the Approval of :

- I. Front Underrun Protective Devices (FUPDs)
- II. Vehicles with regard to the installation of an FUPD of an Approved Type
- III. Vehicles with regard to their Front Underrun Protection (FUP)

The Automotive Industry Standards Committee responsible for preparation of this standard is given in Annexure: 2

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Approval of:

- I. Front Underrun Protective Devices (FUPDs)**
- II. Vehicles with regard to the installation of an FUPD of an Approved Type**
- III. Vehicles with regard to their Front Underrun Protection (FUP)**

1.0 SCOPE

- 1.1. This standard applies to:
 - 1.1.1. PART I: the FUPDs which are intended to be fitted to vehicles of categories N₂ and N₃; ⁽¹⁾
 - 1.1.2. PART II: the installation on vehicles of categories N₂ and N₃; ⁽¹⁾ of FUPDs which have been type approved to part I of this standard;
 - 1.1.3. PART III: vehicles of categories N₂ and N₃ with regard to its front underrun protection (FUP), equipped with an FUPD which has not been separately approved according to part I of this standard or so designed and/or equipped that their component parts can be regarded as fulfilling the function of the FUPD.
- 1.2. Vehicles of categories N₂ with a maximum mass not exceeding 7.5 tonnes shall comply only with the ground clearance requirement of 450 mm set out in this standard.
- 1.3. The requirements of this standard do not apply to:
 - 1.3.1. off-road vehicles of categories N₂G and N₃G; ⁽¹⁾
 - 1.3.2. vehicles such that their use is incompatible with the provisions of front underrun protection.

1.4 PURPOSE

The purpose of this standard is to offer effective protection for vehicles of category M₁ or N₁ ⁽¹⁾ against underrunning of vehicles mentioned in clause 1.0 of this standard in the event of a frontal collision.

2.0 REFERENCES

AIS-053 Automotive Vehicles – Types – Terminology
 AIS-037 Procedure for Type Approval and Establishing Conformity of Production for Safety Critical Components

(1) Refer AIS-053 for category of vehicle.

3.0 DEFINITIONS

- 3.1. For the purpose of this standard:
- 3.1.1. **"Maximum weight"** of the vehicle means the weight stated by the vehicle manufacturer to be the maximum technically permissible.
- 3.1.2. **"Unladen vehicle"** means the vehicle in running order unoccupied and unladen but complete with , coolant, lubricant, tools and a spare wheel (if provided as standard equipment by the vehicle manufacturer) and 90 percent fuel.
- 3.1.3. **"Approval of an FUPD"** means the approval of such a type of FUPD with respect to the requirements laid down in clause 7 below;
- 3.1.4. **"Type of FUPD"** means FUPD which do not differ with respect to the essential characteristics such as shape, dimensions, attachment, materials and the markings cited in clause 4.2. below;
- 3.1.5. **"Front underrun protection (FUP)"** means the presence at the front of the vehicle of either:
- 3.1.5.1. A special device (FUPD); or
- 3.1.5.2. Body work, chassis parts or other components, such that by virtue of their shape and characteristics, these elements can be regarded as fulfilling the function of the FUPD;
- 3.1.6. **"Approval of a vehicle"** means the approval of a vehicle type:
for part II of this standard with regard to the installation of an FUPD of an approved type according to part I of this standard, or

for part III of this standard with regard to its FUP;
- 3.1.7. **"Vehicle type"** means vehicles which do not essentially differ in such aspects as:
- The width of the foremost axle measured at the outermost part of the tyres excluding the bulging of the tyres close to the ground.
- The structure, the dimensions, the shape and materials of the front part of the vehicle in so far as they have a bearing on the requirements of the relevant part of this standard.
- The approved FUPDs fitted to the vehicle, where the application is pursuant to satisfying part II of this standard.
- The maximum weight of the vehicle type.

4.0 TECHNICAL INFORMATION TO BE SUBMITTED BY THE COMPONENT / VEHICLE MANUFACTURER

- 4.1. The application for approval to a part of this standard shall be submitted by the manufacturer of the type (vehicle/FUPD) or his duly accredited representative.
- 4.2. For each type the application shall be accompanied by:
 - 4.2.1. Documentation and latest version authenticated drawings in triplicate giving a description of the technical characteristics of the type (vehicle/FUPD): its dimensions, lines and constituent materials, in so far as required for the purpose of this standard.
 - 4.2.2. In case of FUPD sample of the type: the sample shall be clearly and indelibly marked on all its main components, relevant to the front underrun, with the applicant's trade name or mark and the type designation;
 - 4.2.3. A representative of the type of device or vehicle to be approved shall be submitted for each test to the Test Agency responsible for conducting the approval tests;
 - 4.2.4. For applications pursuant to parts II or III of this standard a vehicle not comprising all the components proper to the type may be accepted for test provided that they do not adversely affect the front underrun protection.
 - 4.2.5. Identification of the positions of the points P_1 , P_2 and P_3 as defined in Annexure:1. For applications pursuant to satisfying part I of this standard these shall take into account the requirements of part II.
- 4.3. Applications pursuant to satisfying part II of this standard shall be accompanied by:
 - 4.3.1. A list of the FUPDs intended to be fitted to the vehicle type;
- 4.4. Applications pursuant to satisfying parts II and III of this standard shall be accompanied by information on the vehicle type as defined in clause 3.1.7.
- 4.5. Administrative clause for CoP to follow clause 12.0

PART I
APPROVAL OF FRONT UNDERRUN PROTECTIVE DEVICES (FUPDs)

5.0 APPROVAL OF FUPD

- 5.1. The FUPD submitted for approval pursuant to this standard shall meet the requirements of clause 6 below.

6.0 REQUIREMENTS FOR FUPDs

- 6.1. The FUPD shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle and also satisfy certain dimensional requirements. These shall be demonstrated in accordance with the test procedure and conditions specified in Annexure : 1 to this standard.
- 6.2. The section height of the FUPD cross-member shall not be less than 100 mm for category N₂ vehicles and 120 mm for vehicles of category N₃. The lateral extremities of the cross-member shall not bend to the front or have a sharp outer edge; this condition is fulfilled when the lateral extremities of the cross-member are rounded on the outside and have a radius of curvature of not less than 2.5 mm.
- 6.3. The device may be so designed that its position at the front of the vehicle can be varied. In this event, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded. It shall be possible for the operator to vary the position of the device by applying a force not exceeding 40 daN;
- 6.4. The outermost surfaces of every front guard installation shall be essentially smooth or horizontally corrugated save that domed heads of bolts or rivets may protrude beyond the surface to a distance not exceeding 10 mm.

PART II**APPROVAL OF A VEHICLE WITH REGARD TO
THE INSTALLATION OF AN FUPD OF AN APPROVED TYPE****7.0 APPROVAL OF AN INSTALLATION OF AN APPROVED FUPD**

- 7.1. If the vehicle submitted for approval pursuant to this part of the standard is provided with an approved FUPD and meets the requirements of clause 8 below, approval of that vehicle type shall be granted.

8.0 REQUIREMENTS FOR INSTALLATION OF AN APPROVED FUPD

- 8.1. The maximum weight of a vehicle type for which approval is requested shall not exceed the value indicated on the type approval communication form of each approved FUPD intended to be installed on that vehicle.
- 8.2. The vehicle with the FUPD installed shall satisfy certain dimensional requirements specified in Annexure : 1 taking into account the test conditions and information submitted as per clause 4.0
- 8.3. The FUPD shall be so fitted to the vehicle that the horizontal distance measured in the rearward direction from the foremost part of the vehicle to the front of the FUPD does not exceed 400 mm diminished by the recorded deformation measured at any of the points where the test forces have been applied during the type approval of the FUPD in conformity with the provisions of part I of this standard (see figures 1 and 2).
- 8.4. In measuring these distances, any part of the vehicle which is more than 2 m above the ground shall be excluded.
- 8.5. The maximum ground clearance with respect to the underside of the FUPD shall be no more than 450 mm, as specified in clause 2.2 of Annexure :1, between the two points P₁ in the installed condition. Outboard of each point P₁ this height may be greater than 450 mm providing the underside is not above a plane passing through the underside of the FUPD directly below the point P₁ and forming a slope at 15° above the horizontal (see figure 3).
- 8.6. The height above the ground of the points of application of the test forces applied to the FUPD according to part I of this standard shall not exceed 495 mm as specified in clause 2.2 of Annexure: 1.
- 8.7. The maximum ground clearance with respect to the underside of the FUPD between the two points P₁ shall be no more than 500 mm taking into account their movement during the application of the test load, according to part I.
- 8.8. The width of the FUPD shall at no point exceed the width of the mudguards covering the wheels of the foremost axle nor shall it be more than 100 mm shorter on either side than the foremost axle measured at the outermost points of the tyres, excluding the bulging of the tyres close to the ground (see figure 1), or 200 mm shorter on either side, measured from the outermost points of the access steps to the driver's cabin.

PART III**APPROVAL OF A VEHICLE WITH REGARD TO ITS
FRONT UNDERRUN PROTECTION (FUP)****9.0 APPROVAL OF A VEHICLE WITH FUP**

- 9.1. If the vehicle submitted for approval pursuant to this standard is provided with FUP that meets the requirements of clause 10 below, approval of that vehicle type shall be granted.

10. REQUIREMENTS FOR A VEHICLE WITH FUP

- 10.1. Any vehicle in one of the categories N₂ or N₃ will be deemed to satisfy the condition set out in clause 10.2 provided that the vehicle is equipped with an FUPD which has not been separately approved to part I of this standard or is so designed and/or equipped at the front that, by virtue of their shape and characteristics, its component parts can be regarded as replacing the front underrun protective device. Components whose combined function satisfies the following requirements are considered to form a front underrun protective device.
- 10.2. The FUP shall offer adequate resistance to forces applied parallel to the longitudinal axis of the vehicle. The FUP shall also satisfy certain dimensional requirements. These shall be demonstrated in accordance with the test procedure and conditions specified in Annexure : 1 to this standard.
- 10.3. For application pursuant to part III, the section height of the FUPD cross-member (not separately approved to part I) shall not be less than 100 mm for category N₂ vehicles and 120 mm for vehicles of category N₃.
- 10.4. The device may be so designed that its position at the front of the vehicle can be varied. In this event, there shall be a guaranteed method of securing it in the service position so that any unintentional change of position is precluded. It shall be possible for the operator to vary the position of the device as specified by the manufacturer by applying a force not exceeding 40 daN;
- 10.5. The FUP shall have sufficient strength that the horizontal distance measured in the rearward direction between the foremost part of the vehicle after the application of the test forces (specified in this annexure) and the test ram contact surface on the vehicle does not exceed 400 mm.
- 10.6. In measuring these distances, any part of the vehicle which is more than 2 m above the ground shall be excluded.

- 10.7 The maximum ground clearance with respect to the underside of the FUP shall be no more than 450 mm, as specified in clause 2 of Annexure: 1, between the two points P_1 . Outboard of each point P_1 this height may be greater than 450 mm providing the underside is not above a plane passing through the underside of the FUP directly below the point P_1 and forming a slope at 15° above the horizontal (see figure 3).
- 10.8 The maximum ground clearance with respect to the underside of the FUP between the two points P_1 shall be no more than 500 mm taking into account their movement during the application of the test load.
- 10.9 The width of the FUP shall at no point exceed the width of the mudguards covering the wheels of the foremost axle nor shall it be more than 100 mm shorter on either side than the foremost axle measured at the outermost points of the tyres, excluding the bulging of the tyres close to the ground (see figure 1), or 200 mm shorter on either side, measured from the outermost points of the access steps to the driver's cabin.

11.0 MODIFICATION AND EXTENSION OF APPROVAL

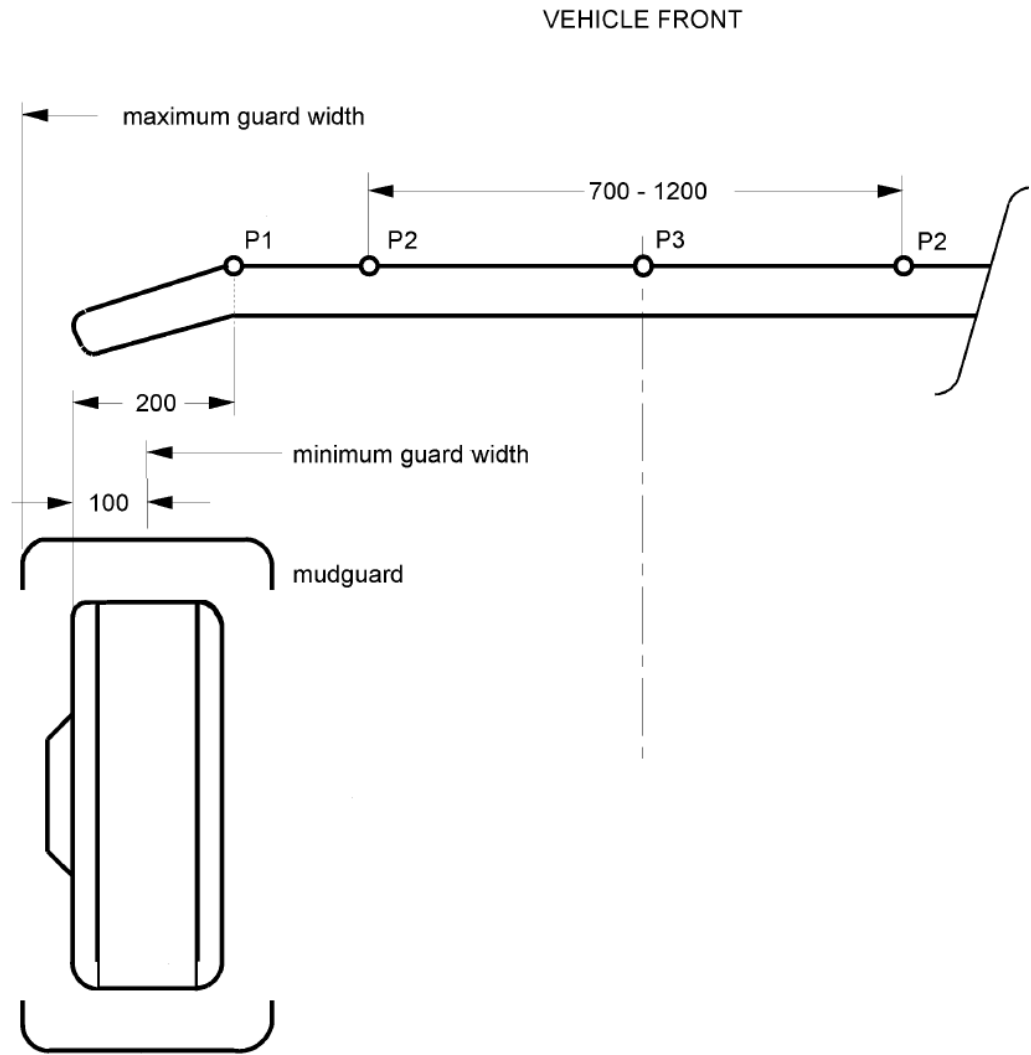
- 11.1 Every modification of a type of FUPD or vehicle shall be notified to the Test Agency, which approved the type. The Test Agency may then either:
- 11.1.1 Consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the FUPD or vehicle still complies with the requirements; or
- 11.1.2 Require a further test report from the Test Agency responsible for conducting the tests.
- 11.2 Confirmation or refusal of approval, specifying the alterations shall be communicated to the parties.

12.0 CONFORMITY OF PRODUCTION

- 12.1 FUPDs and vehicles approved to this standard shall be so manufactured as to conform to the type approval by meeting the requirements set forth in this standard.
- 12.2 In order to verify that the requirements of clause 12.1. above are met, suitable controls of the production shall be carried out.
- 12.3 The holder of the approval shall in particular:
- 12.3.1 Ensure existence of procedures for the effective control of the quality of the vehicle or the device:
- 12.3.2 Have access to the testing equipment necessary for checking the conformity to each approved type;
- 12.3.3 Record data of test results and annexed documents, which shall remain available for a period to be determined in accordance with the Test Agency.

- 12.3.4 Analyse the results of each type of test, in order to verify and ensure the stability of the vehicle or the device characteristics making allowance for variations of an industrial production;
- 12.3.5 Ensure that for each type of vehicle or device sufficient checks and tests are carried out regarding the dimensions, materials and performance of the components, which fulfil the function of the FUP and of those for the installation on the vehicle;
- 12.3.6 Ensure that any set of samples or test pieces giving evidence of non-conformity with the type of test considered shall give rise to another sampling and another test. All the necessary steps shall be taken to re-establish the conformity of the corresponding production.
- 12.4 The Test Agency which has granted type-approval may at any time verify the conformity control methods applicable to each production unit.
 - 12.4.1 In every inspection, the test books and production survey records shall be presented to the visiting inspector.
 - 12.4.2 The inspector may take samples at random which will be tested in the manufacturer's laboratory. The minimum number of samples may be determined according to the results of the manufacturer's own verification.
 - 12.4.3 When the quality level appears unsatisfactory or when it seems necessary to verify the validity of the tests carried out in application of clause 12.4.2. above the inspector may select samples to be sent to the Test Agency which has conducted the type approval tests.
 - 12.4.4 The Test Agency may carry out any test prescribed in this standard.
 - 12.4.5 The normal frequency of inspections authorized by the Test Agency shall be one per two years. In the case when negative results are recorded during one of these visits, the Test Agency shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.
- 12.5 Conformity of production procedure for FUPD as a component shall be as per AIS-037 and that for vehicles shall be applicable as and when formulated.

FIGURE 1
(See clause 8.3 and 10.9)



Note: The shape of FUPD is only an example.

FIGURE 2
(See clause 8.3)

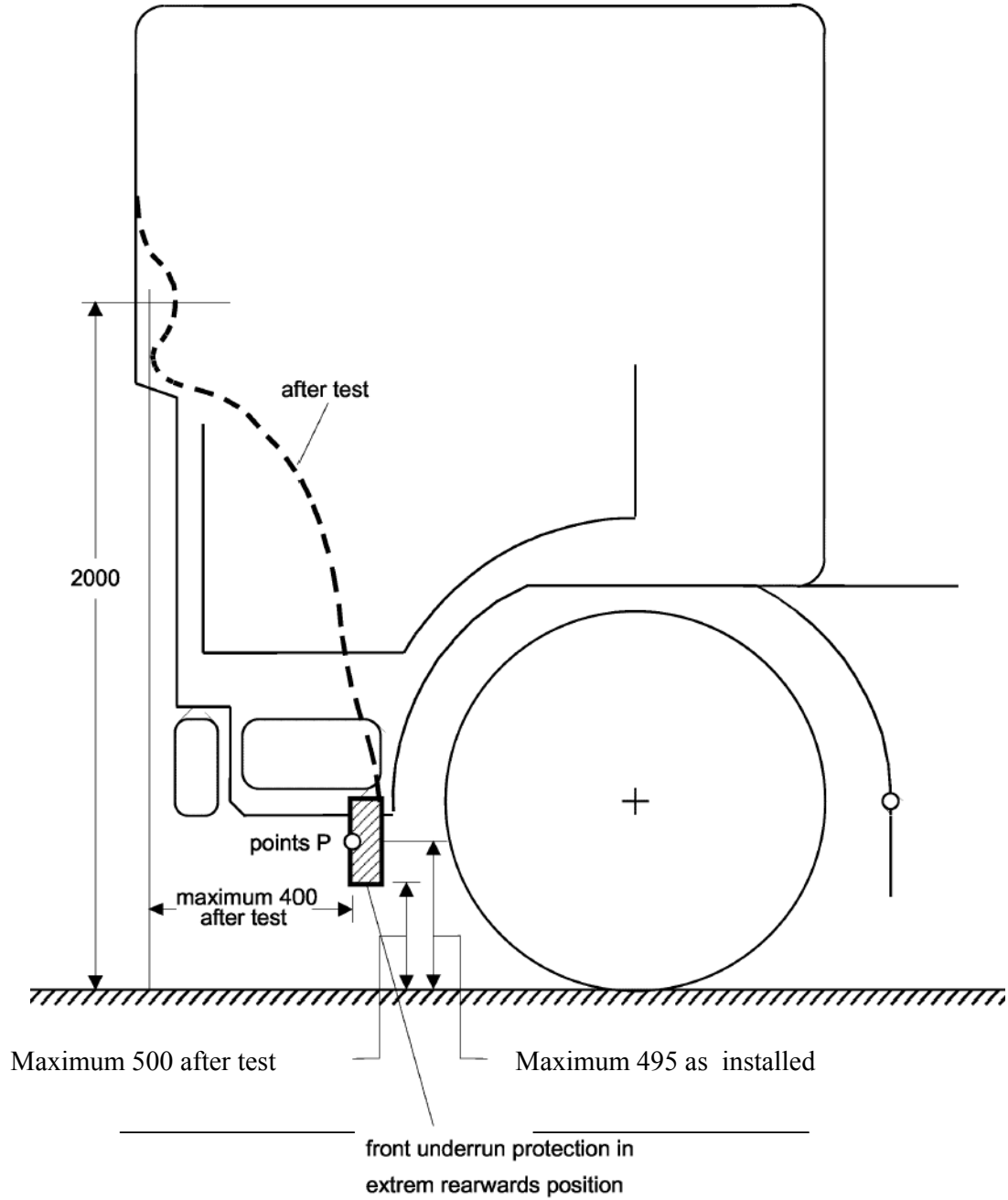
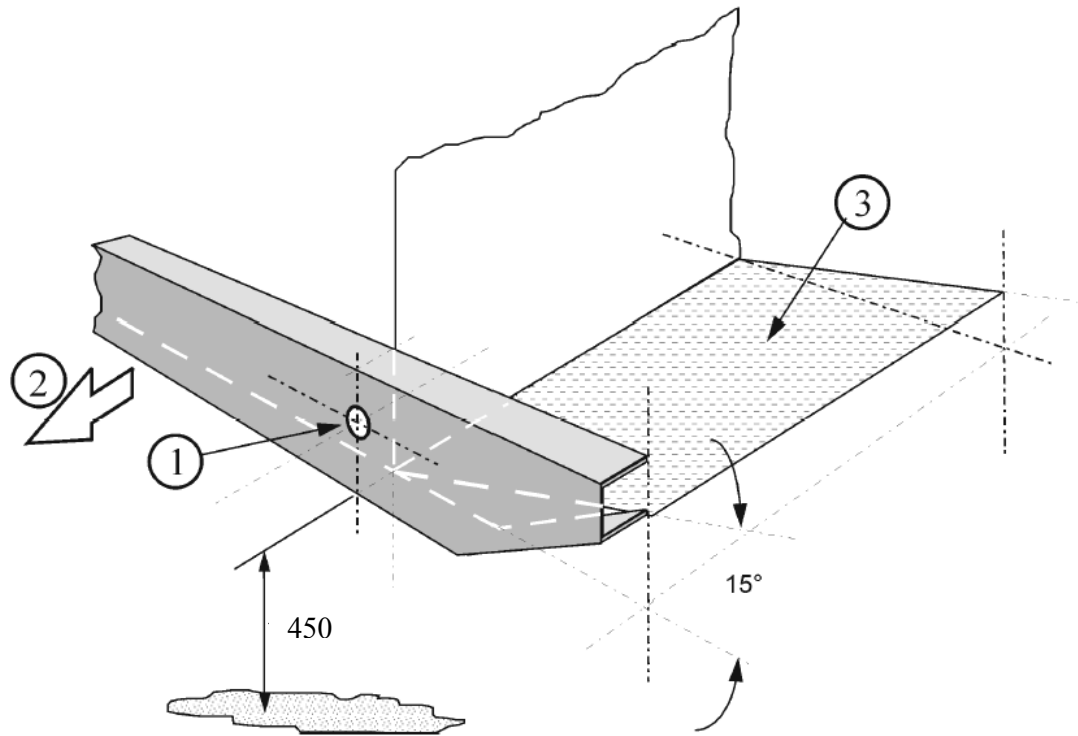


FIGURE 3
(See clause 8.5 and 10.7)



- ① POINT P1
- ② FRONT OF THE TRUCK
- ③ SURFACE DEFINING UPPER LIMIT OF THE ENDS SLOPED LOWER EDGE.

ANNEXURE : 1**TEST CONDITIONS AND PROCEDURES****1. TEST CONDITIONS FOR FUPDs**

- 1.1. At the request of the manufacturer the test may be conducted either:
 - 1.1.1. On a vehicle of the type for which FUPD is intended; in that case the conditions set out in clause 2.2 of this annexure shall be observed; or
 - 1.1.2. On a part of the chassis of the vehicle type for which the FUPD is intended; this part shall be representative of the vehicle type(s) in question; or
 - 1.1.3. On a rigid test bench.
- 1.2. In the case of clauses 1.1.2 and 1.1.3 above the parts used to connect the FUPD to part of the vehicle chassis or to the rigid test bench shall be equivalent to those which are used to secure the FUPD when it is installed on the vehicle.
- 1.3. At the request of the manufacturer and with the consent of the Test Agency the test procedure described in clause 3 below may be simulated by calculation or another such method provided that its equivalence is demonstrated.

2. TEST CONDITIONS FOR VEHICLES

- 2.1. The vehicle may, if necessary to achieve the test forces required in clause 3.1 below, be restrained by any method, this method to be specified by the vehicle manufacturer.
- 2.2. Dimensions shall be taken as if the vehicle were in the following condition:
 - 2.2.1. The vehicle was unladen.
 - 2.2.2. The vehicle was at rest on a level, flat, rigid and smooth surface.
 - 2.2.3. The front wheels were in the straight-ahead position.
 - 2.2.4. The tyres were inflated to the pressure recommended by the vehicle manufacturer.
 - 2.2.5. Vehicles equipped with hydropneumatic, hydraulic or pneumatic suspension or a device for automatic levelling according to load were in their normal running condition specified by the manufacturer.

- 2.3 Vehicles of categories N₂ with a maximum mass not exceeding 7.5 tonnes shall comply only with the ground clearance requirement of 450 mm set out in this standard.

3.0 TEST PROCEDURE

- 3.1. Points P₁ are located up to 200 mm from the longitudinal planes tangential to the outermost points of the tyres on the front axle, excluding the bulging of the tyres close to the ground; points P₂ are symmetrical to the median longitudinal plane of the vehicle at a distance from each other of 700 to 1,200 mm inclusive. The exact positions shall be specified by the manufacturer.
- 3.2. The height above the ground of points P₁ and P₂ shall be defined by the vehicle manufacturer within the lines that bound the front face of the device. The height shall not, however, exceed 495 mm when the vehicle is unladen. P₃ is in the vertical longitudinal median plane of the vehicle (see figure 1 of the standard).
- 3.3. The test forces set out below shall be applied to each of the test points in separate tests on the same vehicle or device or, if requested by the manufacturer/agent, in advance, on different vehicles or device samples.
- 3.3.1. If the structure and components of the vehicle relevant to the front underrun protection are located substantially symmetrical to its longitudinal median plane the tests at points P₁ and P₂ shall be carried out only on one side otherwise the forces mentioned in clause 3.3.3 and 3.3.4 shall be applied successively to points P₁ and P₂ on both sides.
- 3.3.2. When tested the forces shall be applied as rapidly as possible and the device or vehicle shall withstand the forces in the following clauses for at least 0.2 seconds.
- 3.3.3. A horizontal force equal to 50% of the maximum weight of the vehicle or intended vehicle type(s) but not exceeding 80×10^3 N shall be applied to points P₁;
- 3.3.4. A horizontal force equal to 100% of the maximum weight of the vehicle or intended vehicle type(s) but not exceeding 160×10^3 N shall be applied to points P₂.
- 3.3.5. If the device is discontinuous and is reduced in cross-section area between the two points P₂, then the tests shall continue with the application of a horizontal force applied to the point P₃ the same as that to the points P₁;
- 3.4. The maximum horizontal and vertical displacements of each test point during the application of the above forces shall be recorded and the highest recorded on the communication document.

- 3.5. Whenever a practical test is performed to verify compliance with the above-mentioned requirements, the following conditions shall be fulfilled:
 - 3.5.1. For application pursuant to part III, an FUPD (not separately approved to part I) shall be connected to the chassis side members of the vehicle or to whatever replaces them or a structure with demonstrated equivalent performance capabilities.
 - 3.5.2. The specified forces shall be applied by rams which are suitably articulated (e.g. by means of universal joints) and shall be parallel to the median longitudinal plane of the vehicle via a surface not more than 250 mm in height (the exact height and width shall be indicated by the manufacturer) and not more than 400 mm wide, with a radius of curvature of 5 ± 1 mm at the vertical edges; the centre of the surface is placed successively at points P₁, P₂ and P₃.

ANNEXURE : 2
(See Introduction)
COMMITTEE COMPOSITION *
Automotive Industry Standards Committee

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Member Secretary
Mrs. Rashmi Urdhwareshe
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* At the time of approval of this Automotive Industry Standard (AIS)