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(उपभोक्ता मामले, एवं सार्वजनिक वितरण मंत्रालय, भारत सरकार)
BUREAU OF INDIAN STANDARDS
(Ministry of Consumer Affairs, Food & Public Distribution, Govt. of India)

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व्यापक परिचालन में मसौदा DRAFT UNDER WIDE CIRCULATION

प्रलेख प्रेषण सूचना/DOCUMENT DESPATCH ADVICE

टीईडी 28/ टी-21 TED 28/T-21 15-06-2018

कुशल परिवहन प्रणाली विभागीय समिति, टी.ई.डी 28

Intelligent Transport System Sectional Committee, TED 28

क) परिवहन इंजीनियरिंग विभाग परिषद ।पंइविप। के सभी सदस्यों को

1) All Members of Transport Engineering Division Council TEDC

ख) कुशल परिवहन प्रणाली विभागीय समिति, टी.ई.डी 28 के सभी सदस्यों को

2) All members of Intelligent Transport System Sectional Committee, TED 28

ग) अन्य सभी रुचि रखने वाले निकाय

3) All others Interested

महोदय/महोदया, Dear Sir/Madam,

निम्नलिखित प्रलेख संलग्न है:
Please find enclosed the following draft Standard:

प्रलेख संख्या /Document No.	विषय/ Title
TED 28 (12783) W	कुशल परिवहन पद्धति (आईटीएस) : रिवर्स पार्किंग सहायता पद्धति (आरपीएएस) [आई सी एस नं 35.240.60; 43.040.15] Intelligent Transportation System (ITS): Reverse Parking Assist System (RPAS) [ICS 35.240.60; 43.040.15]

क्रप्या उपरोक्त मानक का अवलोकन कर अपनी सम्मतियाँ यह बताते हुये भेजें, कि यदि अंततः यह मानक राष्ट्रीय मानक के रूप में स्वीकृत हो जाए, तो इस पर अमल करने में आपके व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं।

Kindly examine this draft standard and forward your views stating any difficulty which you are likely to experience in your business or profession, if this is finally adopted as National Standard.

सम्मति की अंतिम तिथि/ Last Date for comments: 14-08-2018

सम्मति यदि कोई हो तो पीछे दिये गए प्रारूप में लिख कर ऊपरलिखित पते पर अधोहस्ताक्षरी को भेजे । यदि कोई सम्मति प्राप्त नहीं होती है अथवा सम्मति में केवल भाषा संबधी त्रुटि हुई तो उपरोक्त प्रलेख को यथावत अंतिम रूप दे दिया जाएगा। यदिसम्मति तकनीकी प्रकृति की हुई तो विषय समिति के अध्यक्ष के परामर्श से अथवा उनकी इच्छा पर आगे की कार्यवाही के लिए विषय समिति को भेजे जाने के बाद प्रलेख को अंतिम रूप दे दिया जाएगा।

Comments, if any, may please be made in the format given overleaf and mailed to the undersigned at the above address.

In case no comments are received, we would presume your approval of the document. However, in case we receive any comments on the document, the same shall be put up to the Sectional Committee for necessary action

धन्यवाद, Thanking You,

भवदीय, Yours faithfully,

(आर आर सिंह) (R. R. Singh)

वैज्ञानिक 'ई' एवं प्रमुख (परिवहन) Scientist 'E' & Head (TED)

संलग्न: ऊपरलिखित/ Encl: As above

Intelligent Transport Systems Sectional Committee, TED 28

FOREWORD

This Draft Indian Standard shall be considered for adoption by the Bureau of Indian Standards on the recommendation of the Intelligent Transport Systems Sectional Committee and after approval of the Transport Engineering Division Council.

This standard is a technical document which covers the basic architecture and the test requirements of the Reverse Parking Assist System (RPAS) with integrated camera, sensor, display, HMI, etc. The configuration of devices for RPAS with integrated camera, sensor and display is covered in ANNEX A of this standard. Any further configuration or applications of the RPAS used in the transportation domain can be added as an ANNEX to this standard.

In the formulation of this standard, considerable assistance has been derived from the following publications:

AIS 004 (Part 3)	Automotive Vehicles — Requirements for Electromagnetic Compatibility
AIS 028	Code of Practice for use of CNG fuel in internal combustion engine vehicle

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.

Draft *Indian Standard*

Intelligent Transportation System (ITS): Reverse Parking Assist System (RPAS)

1. SCOPE

The purpose of this standard is to define the basic architecture and performance requirements of the Reverse Parking Assist System (RPAS) which uses object-detection devices (sensors) or camera based displays in order to provide the driver with information about obstacles in specified zone while reversing the vehicle. The test objects in this standard are defined based on systems using ultrasonic sensors and electromagnetic sensors which reflect the most commonly used technology. For other sensing technologies possibly coming up in the future, these test objects shall be checked and changed if required.

- ANNEX A: Reverse Parking Assist System (RPAS) with integrated camera, sensor, display, HMI, etc

2. REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS/International Standard	Title
2465: 1984	Specifications for cable for motor vehicles
4905: 1968	Methods for random sampling
9000 (Part 2/Sec 4): 2004	Basic environmental testing procedures for electronic and Electrical Items: Part 2 Cold test Section 4 Cold Test for Heat Dissipating items with Gradual Change of Temperature
9000 (Part 5/Sec 2): 1981	Basic environmental testing procedures for electronic and Electrical Items: Part 5 Damp heat (cyclic) test
9000 (Part 3/Sec 5): 1977	Basic environmental testing procedures for electronic and electrical items: Part 3 Dry heat test
9000 (Part 7): 2006	Basic Environmental testing procedures for electronic and electrical items : Part 7 Impact Test
9000 (Part 8): 1981	Basic Environmental testing procedures for electronic and electrical items : Part 8 Vibration (Sinusoidal) Test
10250:1982	Specification for severities for environmental test for automotive Electrical equipment
ISO 7637-2: 2004	Road vehicles —Electrical disturbances from conduction and Coupling —Part 2: Electrical transient conduction along supply Lines only
ISO 16750-2: 2010	Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 2: Electrical loads
ISO 16750-4: 2010	Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 4: Climatic loads

ISO 10605: 2008	Road vehicles —Test methods for electrical disturbances from Electrostatic discharge
IS/IEC 60529: 2001	Degrees of protection provided by enclosures (IP CODE)

3. ABBREVIATIONS

Abbreviation	*Description*
BIS	Bureau of Indian Standards
DUT	Device Under Test
HMI	Human Machine Interface
RPAS	Reverse Parking Assist System
e.g.	for example
etc.	et cetera (and the rest)

4. TERMS, DEFINITIONS AND NOMENCLATURE

4.1 Ratings - The voltage and current range at which the RPAS is designed to operate satisfactorily.

4.2 Type Tests - Tests carried out to prove conformity of RPAS with respect to the requirements of this standard. These are intended to prove the general quality, design and performance of a given type of RPAS.

4.3 Acceptance Tests - Tests required to be carried out on samples taken from a lot for the purpose of acceptance of the lot.

4.4 Lot - Fifty numbers of RPAS of the same type, design, rating, manufactured in the same premises, using the same process and materials, offered for inspection at a time shall constitute a lot.

4.5 Functional Status Classification - Operational status of a device during and after exposure to an electromagnetic environment.

4.6 Device - Device is a component implementing one or more RPAS functions mentioned in this standard.

4.7 RPAS - System that is designed to alert the driver about obstacles on the rear side of vehicles while parking in reverse.

4.8 Audible information and warning - Acoustical signal that is used to present information about relevant obstacles, to the driver e.g. Pulses, Speech, etc.

4.9 Visual information and warning - Optical signal which is used to present information about relevant obstacles to the driver e.g. Telltale, Display, etc.

4.10 Monitoring range - It is the space at the rear side of the vehicle, which is divided into two parts:

(i) Monitoring Range Rear-1 (R1): Detection distance (M1): 0.6 m
(ii) Monitoring Range Rear-2 (R2): Detection distance (M1): 1.0 m (M1 category vehicles) and 2.0 m (M2, M3, N category vehicles)

4.11 Reversing detection system - System that gives an indication to the driver, when the reverse gear is selected, whether there are objects in the rear monitoring range.

4.12 Sensor - Component that detects objects in the monitoring range

4.13 System activation - Action of transitioning the system operation from a non-active mode to an active one in which the system is monitoring the rear monitoring ranges, evaluating the objects detected and generating appropriate feedback to assist the driver.

4.14 Test object - Object with a specific material, geometry and surface for testing the monitoring range.

Horizontal Test Object (H): Metal Tube, Diameter 75 mm and Length 1000 mm
Vertical Test Object (V): Metal Tube, Diameter 75 mm and Length 300 mm

Tube material (if required) may be changed as discussed between test agency and manufacturer

4.15 Rear view camera - Video camera which can continuously monitor the zone just behind the vehicle when activated.

4.16 Frame height - Height of the upper flank of the chassis frame at rear end of vehicle from the ground.

4.17 HMI/Driver Consol - Human machine interface which allows user to select various options in software or modes of software.

5 CLASSIFICATION OF FUNCTIONAL STATUS

Following classifications are for the total device/system functional status:

5.1 Class A – All functions of a device/system perform as designed during and after exposure to disturbance.

5.2 Class B – All functions of a device/system perform as designed during exposure. However, one or more of them can go beyond specified tolerance. All functions return automatically to within normal limits after exposure is removed. Memory functions shall remain class A.

5.3 Class C – One or more functions of a device/system do not perform as designed during exposure but return automatically to normal operation after exposure is removed.

5.4 Class D – One or more functions of a device/system do not perform as designed during exposure and do not return to normal operation until exposure is removed and the device/system is reset by simple "operator/use" action.

5.5 Class E – One or more functions of a device/system do not perform as designed during and after exposure and cannot be returned to proper operation without repairing or replacing the device/system.

NOTE: The word "function" in this context refers only to the function performed by the electronic system.

6 MARKING

6.1 The RPAS shall have the following information marked indelibly and legibly at an easily accessible location:

a) Name and/or trade-mark of the manufacturer;
b) Rated Voltage;
c) Size;
d) Type of RPAS;
e) Model number (if any);
f) Unique identification number;
g) Month and year of manufacture; and
h) Country of manufacture (if required).

7 BIS CERTIFICATION MARKING

The product may also be marked with Standard Mark.

7.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards* Act, 2016 and the Rules and Regulations made there under. The details of conditions under which the license for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A
(*Scope*)
REVERSE PARKING ASSIST SYSTEM (RPAS) WITH INTEGRATED CAMERA, SENSOR, DISPLAY, HMI, ETC

A-1 ANNEX A primarily covers the functional requirements, test and protocol requirements of "Reverse Parking Assist System (RPAS) with integrated camera, sensor, display, HMI, etc."

A-2 Functional and Performance Requirements

A-2.1 System activation and deactivation

A-2.1.1 The system is activated / deactivated automatically according to the driving situation
Activation criteria: Reverse gear selected.
Deactivation criteria: Gear other than reverse is selected.

A-2.1.2 It shall not be possible to disable the RPAS by simply switching it off. The system however shall remain in active state. On vehicles with automatic transmission the system may be deactivated if the P (parking) gear position is selected. It may be allowed to deactivate the system while the parking brake is engaged.

A-2.2 Audible/Visual information and warning

The RPAS shall give an acoustic signal to warn the driver on the obstacles detected in the monitoring range.

The audible warning signal shall consist of following:

a) Continuous sequence of individual tones when there are objects in the main warning zone
b) Continuous tone when there are objects in the collision zone

The system may have optical warning as supplementary warning to warn the driver. In case of camera based systems, obstacle within monitoring range shall be visible to driver.

The visual indicators in this case shall indicate messages related to one or more of the following:

a) Objects being in the main warning range or collision range
b) System activation
c) System readiness
d) Faults

In case of faults:

a) The faults in the system shall be indicated by a continuous tone and this tone shall differ markedly from the normal warning tones in its frequencies.
b) The warning tone shall have minimum duration of 3 s after selection of reverse gear. After sounding for the required period, the warning shall automatically switch off.
c) It shall only sound when the reverse gear is engaged and sound every time this gear is selected as long as the fault remains.

d) The warning signal shall not be cancelled unless the fault is rectified.

A-2.3 Duration of Signal

In general, signalling an obstacle shall be maintained as long as the obstacle is detected and shall cease when the obstacle is no longer detected or the system is deactivated.
In absence of obstacles, in order to reduce annoyance of the driver, the system may automatically switch off the audible signal temporarily after a certain time (duration can be defined by manufacturer).

A-2.4 Monitoring Range-Horizontal Coverage

The horizontal areas of relevance are the two-dimensional projections of the monitoring ranges on to the driveway. The minimum detection distances as measured from the vehicle boundary are defined in **4.10**.

The first 0.2 m starting from the vehicle boundary (*see* Fig. 1) shall not be tested, because state-of-the-art sensing technology cannot guarantee detection in this close proximity.

In order to perform the operational test the relevant monitoring range shall be scanned horizontally with test object H as specified in **4.14**. Each detected grid position is represented by a covered square with edge lengths of dx and dy (dx = 0.1 m, dy = 0.1 m for testing the horizontal coverage) and its centre at the position of the longitudinal axis of the standard obstacle. The grid is explained in Fig. 2.
The monitoring range is divided into two ranges, 'A1' that extends from the vehicle boundary up to 0.6 m and 'A2' which covers the range beyond 0.6 m till 1.0 m for M1 category vehicles and till 2.0 m for M2, M3, N category vehicles. 'A' is the distance starting from the vehicle boundary. The width of the rectangle, wr, is equal to the vehicle width, measured along the rear axle. The dimensions shall be rounded up to the nearest 0.1 m. The grid is arranged symmetrically to the vehicle centre line. (*See* Fig. 1).

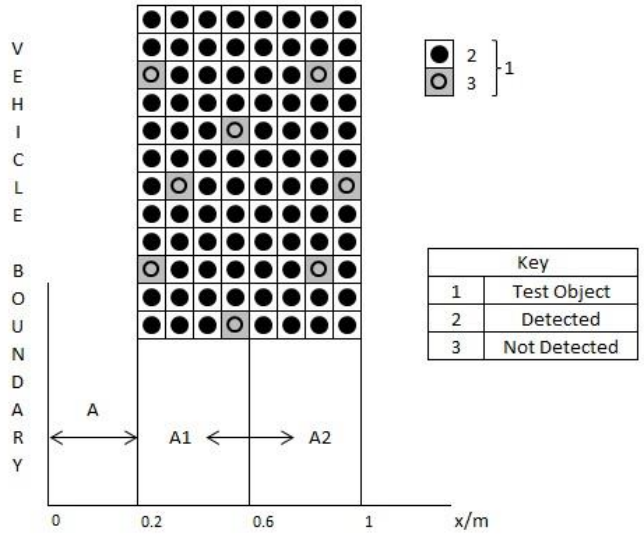

FIG. 1: DETERMINATION OF THE REAR HORIZONTAL COVERAGE RATIO IN THE SUB-AREAS A1 AND A2 (FOR M1 CATEGORY VEHICLES)

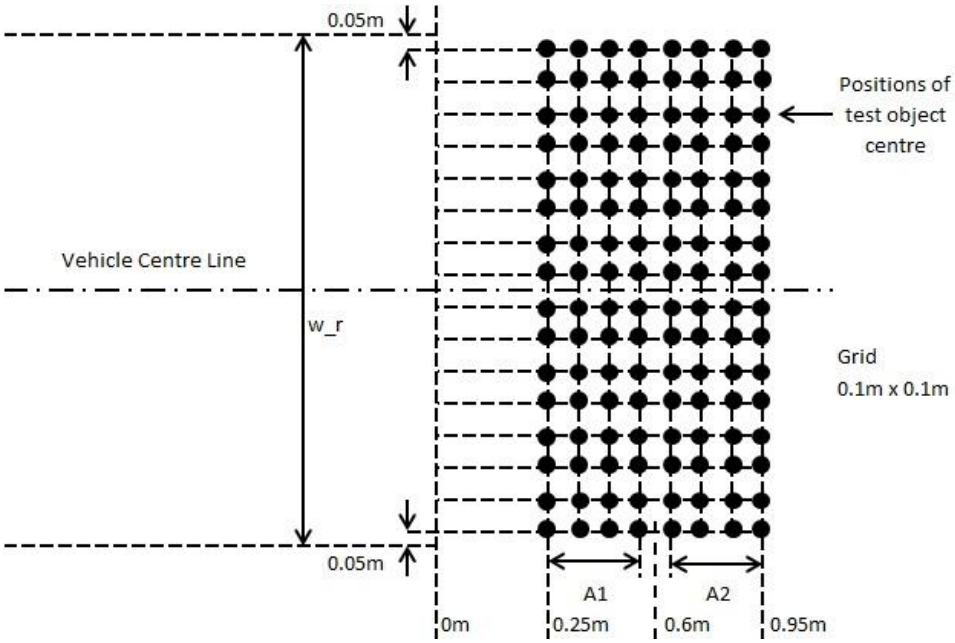

FIG. 2: GRID POSITIONS FOR TESTING THE HORIZONTAL COVERAGE OF THE REAR MONITORING RANGE (FOR M1 CATEGORY VEHICLES)

The coverage ratio is defined as the ratio of the covered area over the total area of relevance. Example: For a total area of relevance of 90 cells with a covered area of 78 cells, the average coverage ratio is 87%. The result shall be rounded off to nearest full number.

Sensor based system:
The minimum required coverage ratios for the rear horizontal areas of relevance are as follows:
(a) 87 % in Area A1 (Zone R1)
(b) 87 % in Area A2 (Zone R2)

Camera based system:
The display visible to driver from normal driving position shall show at least 87% test objects (by number) when tested as shown in Fig. 2
Alternately, the display visible to the driver from normal driving position shall show full vision on ground as per Fig. 2, where dimension 'A' is 0.2 m. (Refer Fig.1 for 'A')

A-2.5 Monitoring Range-Vertical Coverage
Position the test object V so that the axis of the tube is static and parallel to the ground and its longitudinal centre is at the grid measuring points shown in Fig. 3.

The detection of test object V shall be checked at all indicated positions of the test planes at 300 mm, 800 mm and 1100 mm, as applicable (height should not exceed vehicle frame height)

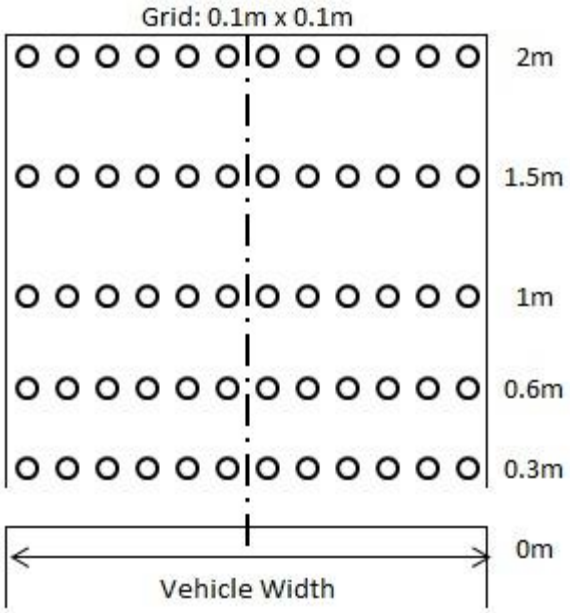

FIG. 3: GRID POSITIONS FOR TESTING THE VERTICAL COVERAGE OF THE REAR MONITORING RANGE (FOR M2, M3 AND N CATEGORY VEHICLES)

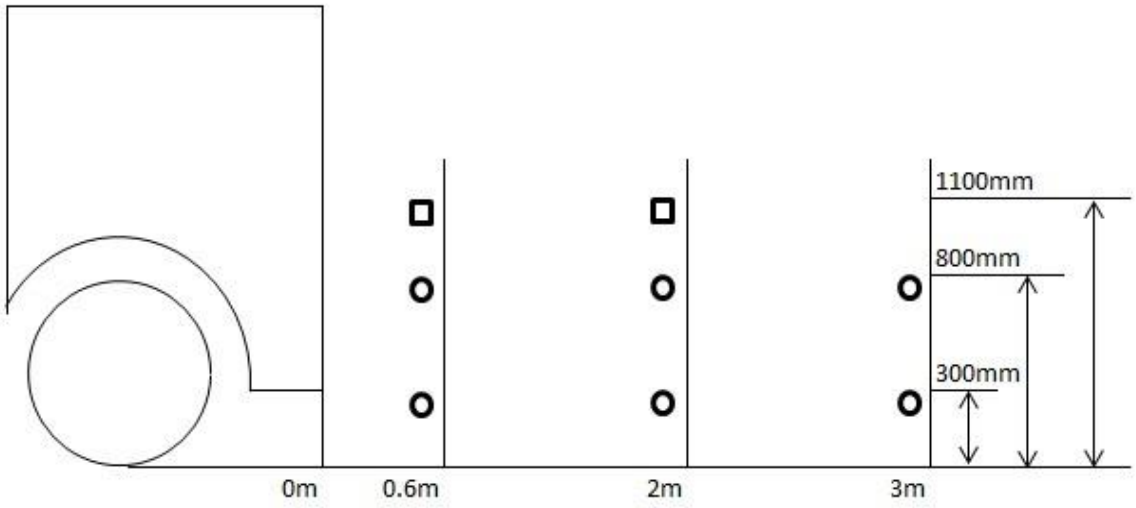

FIG. 4: GRID POSITIONS FOR TESTING THE VERTICAL COVERAGE OF THE REAR MONITORING RANGE (FOR M2, M3 AND N CATEGORY VEHICLES – SIDE VIEW)

Sensor based system:

The minimum required coverage ratios for the rear horizontal areas of relevance are as follows:

(a) 87 % in Area A1 (Zone R1)

(b) 87 % in Area A2 (Zone R2)

Camera based system:

The display visible to driver from normal driving position shall show at least 87% test objects (by number) when tested as shown in Fig. 2

Alternately, the display visible to the driver from normal driving position shall show full vision on ground as per Fig. 2, where dimension ‘A’ is 0.2 m. (Refer Fig.1 for ‘A’)

A-2.6 Test Setup and Ambient Conditions

The system can use either senor or camera based solutions or any other system for compliance to requirements.

In case vehicles are provided with alert as well as display, manufacturers may choose to meet either of the requirements specified for sensor based system or camera based system as per their discretion. Perform the operational test on a vehicle or test structure that allows the installation conditions of the selected vehicle model or selected vehicle range to be reproduced. In case a vehicle is used to perform the test, it shall have kerb weight. A tolerance of +/- 5% shall be allowed on kerb weight. If the ride height is adjustable, it shall be set to normal driving condition on paved roads.

Sensor surfaces shall be visibly clean and free of contamination.

During testing, the wind speed shall not exceed 5.4 m/s (wind force 3). Temperature shall be within 15 ºC to 40 ºC under non-precipitating conditions (not raining, sleeting, snowing, etc.). The test location shall be on a flat, dry, asphalt or concrete surface. The tests shall not be affected by reflections, neither of sonic nor of electromagnetic waves from walls in the environment, auxiliary test equipment or other objects.

A-3 Type Tests

A-3.1 Environmental Tests

A-3.1.1 *Dry Heat / High Temperature Test*

The high temperature test is used to evaluate effects of high temperature conditions on safety, integrity, and performance of the device. The test shall be carried out in accordance with IS 9000 (Part 3/Sec 5) the device shall be subjected to temperature of 70 ± 2°C for 16 h in high temperature. Test with device in working condition. The recovery period shall be 2 h.

Acceptance Criteria: Device during and after the high temperature test the device shall meet functional Class A.

A-3.1.2 *Cold Test*

The test shall be carried out in accordance with IS 9000 (Part 2/Sec 4). The device under test shall be subjected to temperature of –10 ± 2°C for 2 h with device in working condition. The recovery period shall be 2 h.

Acceptance Criteria: Device during and after the cold test, the device shall meet functional Class A.

A-3.1.3 *Damp Heat Test*

The device under test shall be tested according to IS 9000 (Part 5/Sec 2). The test is carried out at +25° to +55° C, Humidity 95%. Six cycles (each test cycle of 24 h) shall be run with device in off condition. Functional test shall be carried out with power in ‘On condition’ at start of 2nd, 4th and 6th cycle.

Acceptance Criteria: Device during and after the test the device shall meet functional Class A.

A-3.1.4 *Temperature Shock*
Temperature shock test is carried out to determine if the device can withstand sudden changes in the temperature of the surrounding atmosphere without experiencing physical damage or deterioration in performance. Exposure time at temperature extremes -10 ºC and 70 ºC would be 3h/cycle and number of cycles would be two.
Acceptance Criteria: Device after the test the device shall meet functional Class A.

A-3.1.5 *Salt Spray Test*
The salt spray test is conducted to check corrosion resistance of device. The device shall be tested according to **4.8** of IS 10250 for 96 h.
Acceptance Criteria: The device shall meet functional Class A.

A-3.1.6 *High Voltage Test*
The test is conducted to ensure service life requirements and functionality. The device under test shall be operated for 60 min at 18 V for 12 V systems and 36 V for 24 V systems. This test is as per ISO 16750-2.
Acceptance Criteria: Device during and after the test the device shall meet functional Class A.

A-3.2 Durability and Performance Tests

A-3.2.1 *Shock Test*
This test is performed to provide a degree of confidence that the device can physically and functionally withstand the relatively infrequent, non-repetitive shocks encountered in transportation environments.
This test provides an assessment of the effect of the shocks on the performance of the device. The test shall be performed as per IS 9000 (Part 7). Severity Level = 15 g,
Impact duration = 11 ms, Impact Type = Half sine, Total number of impact = 9 (3 on each axis)
Acceptance Criteria: Device after the shock test shall meet functional Class A.

A-3.2.2 *Vibration Test*
This test is performed to check that the device can physically and functionally withstand the vibration exposures in the life cycle typically encountered in a vehicular environment. The test shall be performed as per IS 9000 (Part 8). The test specimen mounted on a suitable support shall be rigidly fixed on a suitable vibrating machine constructed to produce simple harmonic function (total amplitude of 1.5 mm) and shall be subjected to vibration through a frequency range of 10-55-10 Hz in a sweep period of 1 min with continuously varying frequencies. The vibration shall be applied for not less than 1 h in the directions of each of the 3 major axes of the light.
Acceptance Criteria: During and after the test the device shall meet functional Class A.

A-3.2.3 *Ingress Protection (IP)*
The device must be able to work in dusty environment that are typically encountered by the vehicles where these would be installed. IP rating (IS/IEC 60529) is used for specifying the environmental protection characteristics of the device.

The device shall be tested for dust and water ingress as per following requirement:

IP	Dust	Water	
	6	5	7
	Dust Tight	For Internal Parts e.g. Display, Controller	For Exterior Parts e.g. Sensors, Camera

Acceptance Criteria: The device shall meet functional Class A and no ingress shall be observed.

A-3.2.4 *EMI /EMC Test*

The Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) tests are performed to assess whether the device performs its intended functions in the electromagnetic environment to which it would be exposed. Further, the device shall not generate electromagnetic disturbances that may influence other equipment in the vicinity.

Acceptance Criteria: The device shall meet the EMI/EMC requirements as per AIS 004 (Part 3).

A-3.2.5 *ESD Test*

The controller in LDBS shall be subjected to tests as per ISO 10605. The minimum and maximum test signal severity levels shall be as mentioned below:

Sl No.	Type of Tests	Test Levels	
		Minimum	Maximum
1) Powered Condition	Direct contact discharge	± 6 kV	± 8 kV
	Direct air discharge	± 6 kV	± 8 kV
2) Unpowered condition	Direct contact discharge	± 8 kV	± 15 kV
	Direct air discharge	± 8 kV	± 15 kV

Acceptance Criteria: Device shall meet the functional status of Class C during and after the discharge.

A-3.2.6 *Load Dump Test Pulse 5a*

As per standard ISO 7637-2: 2004

For 12 V System: A Voltage spike of 65 V, 4 Ω, 200 ms

For 24 V System: A Voltage spike of 123V, 8 Ω, 200ms

Acceptance Criteria: Device shall meet functional class A as per ISO 7637-2: 2004. After test, the device shall meet functional Class A

A-3.2.7 *Reverse Polarity Protection without Fuse*

The device to be tested shall be connected to a reversed voltage of 14 V for 12 V systems and 27 V for 24 V systems for 2 min after connecting the system to the suitable circuit.

Acceptance Criteria: After test; the device shall meet functional Class A

A-3.2.8 *Performance Parametric Test (Nine points, tri temperature/tri voltage)*

During testing, device shall be kept inside test chamber in power ON condition.

(System shall be stabilized for minimum 5 min at each condition. At each test point the system will be powered on and shut down 5 times with a duration of 1 min ON and 1 min OFF time)

Following are the various voltages and temperatures:

24V System	12V System
18V, -25°C	9V, -25°C
18V, +80°C	9V, +80°C
18V, Room Temperature	9V, Room Temperature
27V, -25°C	13.5V, -25°C
27V, +80°C	13.5V, +80°C
27V, Room Temperature	13.5 V, Room Temperature
32V, -25°C	16V, -25°C
32V, +80°C	16V, +80°C
32V, Room Temperature	16V, Room Temperature

Acceptance Criteria: The device shall meet functional Class A

A-3.2.9 *Insulation Resistance Test*
Test shall be conducted as per ISO 16750- 2 : 2010 after damp heat test mentioned in point 3 of the **6.4**. System/components shall remain 0.5 h at RT after the damp heat test.
Test shall be conducted with a voltage of 500 V d.c.
Acceptance Criteria: Insulation Resistance shall be > 1 MΩ. No arcing or puncturing of insulation allowed shall meet functional Class A

A-3.2.10 *Wiring Harness – Flammability Test*
Flammability Test: The wiring harness used in the device shall be tested for flammability as per IS 2465.

A-3.2.11 *Wiring Harness – Electrical Properties*
As per AIS 028 or ISO 6722

A-3.2.12 *Free Fall*
IS 9000 (Part 7/Sec 4) Free fall from 500 mm.
Acceptance Criteria: After test the device shall meet functional Class A

A-4 Criteria for approval
Minimum six samples shall be submitted for testing together with the relevant data. The testing authority shall issue a type approval certificate if the device is found to comply with the requirements of the Type tests.
The samples shall be tested as per the test sequence in Table 1:

Table 1 Sample-Wise Test Sequence

Sl No.	Tests	Sample Set No.					
		S1	S2	S3	S4	S5	S6
1.	EMI-EMC	X					
2.	ESD		X				
3.	Load Dump Test, Pulse 5a		X				
4.	Over Voltage Protection Test						X

5.	Performance Parametric Test (tri temperature/tri voltage)						X
6.	High Voltage Test						X
7.	Insulation resistance Test						X
8.	Reverse Polarity Protection without Fuse						X
9.	Ingress Protection			X			
10.	High Temperature Test				X		
11.	Temperature Shock Test					X	
12.	Cold Test					X	
13.	Damp Heat Test				X		
14.	Shock Test		X				
15.	Vibration Test		X				
16.	Salt Spray Test			X			
17.	Test for Wiring Harness	X					
18.	Free Fall Test				X		

The sequence of tests on Sample sets S1 to S6 shall be as mentioned in Table 1 and is subject to agreement between manufacturer and the test agency.

In case of failure in one or more type tests, the testing authority may call for fresh samples not exceeding twice the number of original samples and subject them to test(s) in which failure occurred. If, in repeated test(s) no failure occurs, the test may be considered to have been satisfactory.

A-5 Acceptance Tests

Following shall constitute acceptance tests:

1) High Voltage Test
2) Reverse Polarity Protection without fuse
3) Performance Parametric Test
4) Insulation Resistance Test
5) Load Dump Test (Pulse 5a)
6) ESD Test

FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS

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Sl. No.	Clause/ Sub-clause/ Para/Table/Fig. No. commented	Type of Comments (General/Editorial / Technical)	Justification	Proposed change