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**Intelligent transportation system - Extended-range
backing aid systems - Performance requirements and
test procedures**

智能运输系统 扩展型倒车辅助系统 性能要求与检测方法

[ISO 22840:2010, Intelligent transport system - Devices to aid reverse
manoeuvres - Extended-range backing aid systems (ERBA), NEQ]

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Intelligent transportation system - Extended-range backing aid systems - Performance requirements and test procedures

1 Scope

This standard specifies the function and performance requirements, as well as the test requirements, of the extended-range backing aid system.

This standard applies to light vehicles, mainly including passenger cars, small passenger cars and ordinary trucks in commercial vehicles, excluding motorcycles. Refer to the classification of vehicles in GB/T 3730.1.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 21436-2008 Parking distance monitoring & warning device for motor vehicle

ISO 15006 Road vehicles - Ergonomic aspects of transport information and control systems - Specifications for in-vehicle auditory presentation

ISO 15008 Road vehicles - Ergonomic aspects of transport information and control systems - Specifications and test procedures for in-vehicle visual presentation

ISO 16750 Road vehicles - Environmental conditions and testing for electrical and electronic equipment

3 Terms and definitions

The following terms and definitions apply to this document.

3.1

- b) Automatic execution;
- c) A warning signal is generated when the fault is diagnosed.

5.1.4 Driver interface and information strategy

5.1.4.1 Information prompt method

Audible method is the information prompt method that the system shall have; other methods, such as visual method, can be used as a supplement.

5.1.4.2 Audible information

The system's audible information prompt shall meet the following conditions:

- a) The audible information prompt shall meet the requirements of ISO 15006.
- b) The audible information prompt shall also meet the basic requirements as follows:
 - 1) The distance indication warning can be expressed, either audibly or visually. Corresponding to the distance, the distance indication warning must be coded into at least two segments; each segment is expressed as a different repetition frequency. The basic criterion is that the high repetition frequency or continuous corresponds to a relatively short distance. Synthetic or recorded voices can also be used as audible reminders. The system shall keep warning, when the obstacle is continuously detected; stop warning, when the obstacle is no longer detected. The audible information can be paused, after a period of time, but the system shall remain active. As long as the distance between the vehicle and the obstacle decreases, the audible information shall automatically start again. If the distance to the obstacle increases, the audible signal will remain in the off state.
 - 2) Presence warnings can be expressed audibly, visually, or a combination of both. They shall be coded in a certain way, to make it clearly inform the driver, that there are obstacles in the zone of regard. The presence warning can be combined with the distance indication warning; the synthesized or pre-recorded voice can also be used. The system shall keep warning, when the obstacle is continuously detected; stop warning, when the obstacle is not detected. The audible information lasts for at least 1s; it can be paused, BUT the system shall remain active. As long as the distance between the vehicle and the obstacle decreases, the audible signal shall automatically start again. If the distance to the obstacle increases, the audible signal will remain in the off state.

- 3) Dynamic warnings shall be presented, either by auditory means or supplemented with visual means. The dynamic warning shall be coded in a certain way, so that the driver immediately notices the warning. Dynamic warning shall be distinguished from distance indication warning and presence warning. Meanwhile, it shall prompt the driver to take immediate action. It may use synthesized or pre-recorded speech, as a dynamic warning.
- 4) The system's enable/disable status prompts and fault/interference prompts can be expressed, either in audible or visual means; however, they shall be clearly distinguished from other signals. It may use synthesized or pre-recorded speech, as a warning method. The status prompt can be paused, after a period of time, BUT it shall remain active.
- 5) The driver can be allowed to manually suppress the audible warning temporarily. The audible warning shall be in the inhibited state, until the driver changes its state to start. When the system is activated next time, the audible warning shall be automatically restored.
- 6) This standard does not specify the state switching, between the audible alarm types (distance indication warning, presence warning, dynamic warning). The general principle of state switching is to keep the audible state smooth and intuitive. It shall reduce the frequent switching, between alarm types; this is especially important for dynamic warnings.
- 7) If the system does not issue a presence warning, within 5 m of the entire zone of regard, OR the warning duration is less than 3 s, it shall provide a special diagnostic mode. When in the diagnostic mode, the system shall issue a presence warning, within 5 m of the entire zone of regard. The warning response time shall last, at least 3 seconds, without interruption. The diagnostic mode is only used, by technical service personnel, for standard compliance testing. This standard does not restrict how to enter or exit the diagnostic mode.

5.1.4.3 Visual information

The system's visual information prompt shall meet the requirements as follows:

- a) The visual information prompt shall meet the requirements of ISO 15008.
- b) The visual information prompt shall also meet the basic requirements as follows:
 - 1) The visual information is coded into at least two levels AND expressed in different colors. For example, red or amber means collision is imminent; yellow means attention. If different or more warning levels are used, they shall not conflict with the above basic guidelines.

- 2) Auditory-based readiness for service indication system: If the system's readiness for service indication is based on auditory perception, its activation delay refers to the time, FROM the end of the signal of the readiness for service indication, TO the moment when the system detects an obstacle and issues a warning. The obstacle is placed in a specified location, behind the vehicle, in advance. The average start delay shall not exceed 500 ms. There can be a period of silence, BETWEEN the readiness for service tone AND the system warning tone, in order to distinguish; however, the activation delay shall meet the above requirements.
- 3) Visual and auditory-based readiness for service indication system: If the system's readiness for service indication is based on both sight and hearing, the activation delay requirements are the same as the above-mentioned audible activation delay requirements.
- 4) Other readiness for service indication system: If the navigation display screen and other vehicle display systems are used, to display the information of the extended-range backing aid system, if the information of this system appears on the display screen, it is regarded as the readiness of system service.

5.2.3.2 Warning delay

When the system is active, the warning delay is the time period, FROM the appearance of an obstacle in the zone of regard, TO the system prompting or warning. The average warning delay shall not exceed 150 ms. The maximum value shall not exceed 250 ms.

The detection delay is verified by the corresponding test procedures. The measurement accuracy of the test is at least not less than 1/10 of the delay time. The final result is the arithmetic average of more than 10 measurements.

5.2.4 Requirements of presence warning

5.2.4.1 Horizontal zone of regard

The horizontal zone of regard is the projection of the zone of regard on the pavement (as shown in Figure 1). This zone consists of the following areas:

- a) B_{near} : It is laterally centered on the longitudinal centerline of the vehicle, covering 80% of the width of the bumper; it is longitudinally extended from 1 m behind the bumper, to at least 4 m behind the bumper.
- b) B_{far} : The lateral range is the same as B_{near} ; it is longitudinally extended from B_{near} to at least 5 m behind the bumper.

waves or electromagnetic waves), which is caused by their reflections.

6.3 Detection of system's delay time

6.3.1 For the detection of the system's delay time (see Table 1), the detection method and test equipment shall be able to measure the system's delay time, at an accuracy of 0.01 s.

6.3.2 Before performing this test, after the ignition voltage is turned on, the vehicle's electrical system and electronic control unit shall be given no less than 1.5 s of preparation time. Refer to Appendix A, for the detection method of system's delay time.

6.4 Test requirements of presence warnings

6.4.1 Basic requirements

For determining whether the system under test meets the functional requirements of this standard, the following general requirements shall be met. The manufacturer shall establish a more detailed detection method, on its basis.

6.4.2 Test conditions and environmental requirements

The test shall be carried out, on an actual vehicle, which has a tolerance of $\pm 5\%$ of the curb weight, OR on a simulated device, which has the same test conditions as the actual vehicle. The test environment shall be a running environment on a paved road.

6.4.3 Horizontal zone of regard

6.4.3.1 The test requirements for the horizontal zone of regard are as follows:

- a) Construct a grid, in the horizontal area, as shown in Figure 1;
- b) If the detection capability of the system under test is affected by the steering angle of the vehicle, the steering angle shall be set to zero;
- c) If the system is in the diagnostic mode to detect obstacles in the 5 m zone of regard OR continuously issue a warning for at least 3 s, the system shall be placed in the diagnostic mode;
- d) Place the test object on the ground vertically; place it in the center of the grid, in the horizontal zone of regard;
- e) Start the system to be tested; record the test results of test objects. The test objects shall be recorded continuously by the system for at least 3 s;
- f) Repeat the above operation for all the grids, in the zone of regard.

6.4.3.2 During the test, the tester can decide to keep the system under test always on, OR turn off and turn on the system again. The test results of each grid shall be completely independent of the test results of other grids.

6.4.4 Vertical zone of regard

6.4.4.1 The test requirements for the vertical zone of regard are as follows:

- a) Construct a grid in the vertical area, as shown in Figure 2;
- b) If the detection capability of the system under test is affected by the steering angle of the vehicle, the steering angle shall be set to zero;
- c) If the system's ability to detect obstacles, in the 5 m zone of regard, OR continuous issuing of warning for at least 3 s, can only be achieved, when the system is in the diagnostic mode, THEN, the system shall be set in the diagnostic mode;
- d) Place the test object horizontally on the ground AND in the center of the grid, parallel to the vehicle;
- e) Start the system to be tested AND record the test results of test objects. The test objects shall be recorded continuously, by the system, for at least 3 s;
- f) Repeat the above operation for all the grids.

6.4.4.2 During the test, the tester can decide to keep the system under test always on, OR turn on and off the system again. The test results of each grid shall be completely independent of the test results of other grids.

6.4.4.3 The vertical area test shall be carried out, after the performance of the horizontal zone of regard is determined.

6.5 Test requirements of dynamic warning

6.5.1 Basic requirements

The following general requirements are to determine whether the system under test meets the requirements for the functions, which are specified in this standard. The manufacturer shall establish a more detailed inspection method, on its basis.

6.5.2 Test conditions and environmental requirements

The test shall be carried out on an actual vehicle, which has a tolerance of $\pm 5\%$ of the curb weight OR on a simulated device, which has the same test conditions as the actual vehicle. The test environment shall be a running

Appendix B

(Informative)

Test example of extended-range backing aid system

B.1 Object under test

B.1.1 Audible information and warnings

Examples of audible information and warning devices are piezoelectric buzzers and electromagnetic sensors. Usually, audible warnings are coded, according to frequency, repetition rate, location (sound source).

B.1.2 Visual information and warnings

Examples of visual information and warning devices are indicator lights and LED display devices. Visual warnings are usually coded, based on color, repetition rate, symbols, indicators, or text.

B.1.3 Tactile information and warnings

Examples of tactile information and warning devices are vibrating seats and pulse brake pedals. Generally, tactile signals are encoded, according to intensity, vibration frequency, size, or touch location (for example, the driver's hands or feet).

B.1.4 Warning level

Examples of warning levels are volume change (from low to high) and vibration intensity (from weak to strong). Generally, warning levels are coded, according to frequency, intensity, volume, repetition rate, color.

B.1.5 Approaching speed

Examples of approaching speeds include:

- a) The approaching speed of a vehicle, which moves at a speed of 2 m/s, to a stationary obstacle, is 2 m/s;
- b) The approaching speed of a vehicle, which moves at a speed of 1 m/s, to a moving obstacle, which moves toward the vehicle at a speed of 2 m/s, is 3 m/s;
- c) The approaching speed of a vehicle, which moves at a speed of 2 m/s, to a moving obstacle, which moves in the opposite direction of the vehicle at a speed of 1 m/s, is 1 m/s.

B.1.6 Dynamic warning

The warning is delivered in a way, that the driver immediately pays attention to the warning. This type of warning is based on the approach speed, between the subject vehicle and the obstacle. This requirement does not attempt to establish a dynamic warning event standard, nor does it attempt to establish a dynamic warning activation threshold, which is the manufacturer's prerogative, to bring about vehicle customization and product differentiation.

B.2 Example of test procedure

B.2.1 Horizontal zone of regard for presence warning

B.2.1.1 The test steps for the horizontal zone of regard, for the presence warnings, are as follows:

- a) Use a rectangular grid (3 m × 6 m), which is about 3 m wide and 6 m long, composed of squares at a side length of 10 cm, to mark on the ground (if a portable substrate is used, it may also use tablecloths, canvas, etc.) (as shown in Figure 1);
- b) Adjust the grid (or the subject vehicle), so that the rectangle is perpendicular to the bumper of the vehicle. The distance from the first column of the grid to the rear edge of the bumper is 1 m;
- c) Place the test object, perpendicular to the ground AND in the center of the grid, parallel to the subject vehicle;
- d) If the detection capability of the system under test is affected by the steering angle of the subject vehicle, set the steering angle to zero;
- e) Place the test object, perpendicular to the ground, in the center of the grid of the horizontal zone of regard;
- f) Care shall be taken in the design of all test object's tooling fixtures, to ensure that only test objects can be detected, during the test;
- g) Start the system to be tested; record the detection results of test objects; the test objects are recorded continuously by the system, for at least 3 s;
- h) Repeat the above operation for all the grids, in the zone of regard.

B.2.1.2 During the test, the tester can decide to keep the test system always on, OR turn off and on the system again. The test results of each grid are completely independent of the test results of other grids.

B.2.2 Vertical zone of regard for presence warning

tester determined that, during the entire test, the test objects only move in their own independent areas (for example, B_{side}); they will not enter other areas (for example, B_{rear}).

- f) According to Table 4, the test objects are tested, according to the position in each area, in turn. During the test, the test objects only move in their respective areas AND will not enter other areas.
- g) Care shall be taken in the design of all test object's tooling fixtures, to ensure that only test objects can be detected during the test.
- h) Start the system to be tested; record the detection results of test objects. The test objects are recorded continuously, by the system, for at least 3 s.
- i) Repeat the above operation for all the grids, in the zone of regard.
- j) Use the appropriate test process, to measure and record the detection delay of the system under test. Refer to Appendix B for the examples of specific test process.

B.2.3.2 During the test, the tester can decide to keep the test system always on, OR turn off and on the system again. The test results of each grid are completely independent of the test results of other grids.

B.2.4 Vertical zone of regard of dynamic warning

B.2.4.1 The test steps for the vertical zone of regard of dynamic warning are as follows:

- a) Construct an appropriate mechanical device, so that the test object is located in a horizontal plane, which is parallel to the rear bumper of the vehicle, so that the test object can be moved from one grid into another, as shown in Figure 2.
- b) The test object is placed parallel to the test ground.
- c) If the detection capability of the system, to be tested, is affected by the steering angle of the subject vehicle, set the steering angle to zero.
- d) Place test objects in each area, as shown in Figure 4, for testing. During the whole test period, the test objects only move in each independent row area AND will not enter other rows.
- e) According to Table 5, the test objects are tested, according to the position in each area. During the test, the test objects only move in their respective areas AND will not enter other areas.
- f) Place the test object parallel to the ground, in the center of the grid, parallel

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