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Vehicle detector systems



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Vehicle detector systems

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Preface

This Standard was prepared by Standards Australia Committee LG-006, Road Traffic Signals, to supersede AS 2703—2008, *Vehicle loop detector sensors*.

The objective of this document is to specify requirements for the design, manufacture and performance of vehicle detector systems. These detectors may also be designed to operate with trams/light rail. The type of detectors covered in this document are independent, rack-mounted and integrated vehicle detectors.

The major changes in this edition are as follows:

- (a) A shift in focus from just loop detectors to cover other technologies.
- (b) Restructure of the document for consistency with other Standards.
- (c) Introduction of a sensor interface module in controllers for other technologies.

The terms “normative” and “informative” have been used in this document to define the application of the appendices to which they apply. A “normative” appendix is an integral part of a document, whereas an “informative” appendix is only for information and guidance.

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NOTES

Australian Standard®

Vehicle detector systems

Section 1 Scope and general

1.1 Scope

This document specifies requirements for the design, manufacture and performance of vehicle detector systems. These detectors may also be designed to operate with trams or light rail. The type of detectors covered in this document are independent, rack-mounted and integrated vehicle detectors.

NOTE See [Appendix D](#) for the information which should be supplied with an enquiry or order for vehicle detector systems to this document.

This document applies particularly to the electronic equipment used in traffic control and counting systems for the detection of vehicles.

Detector systems included in this document are inductive loop, radar, microwave, video, infrared and LiDAR (light detection and ranging). Other systems are not precluded provided they meet the performance requirements identified in this document.

1.2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS 4086.1, *Secondary batteries for use with stand-alone power systems, Part 1: General requirements*

AS 60068.2.6, *Environmental testing, Part 2.6: Tests— Test Fc: Vibration (sinusoidal)*

AS 60529, *Degrees of protection provided by enclosures (IP Code)*

AS/NZS 1170.2, *Structural design actions, Part 2: Wind actions*

AS/NZS 1768, *Lightning protection*

AS/NZS 2276.2, *Cables for traffic signal installations, Part 2: Feeder cable for vehicle detectors*

AS/NZS 2276.3, *Cables for traffic signal installations, Part 2: Loop cable for vehicle detectors*

AS/NZS 3000, *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

AS/NZS 3100, *Approval and test specification — General requirements for electrical equipment*

AS/NZS 5033, *Installation and safety requirements for photovoltaic (PV) arrays*

AS/NZS 5139, *Electrical installations — Safety of battery systems for use with power conversion equipment*

AS/NZS 61000.6.1, *Electromagnetic compatibility (EMC), Part 6.1: Generic standards—Immunity for residential, commercial and light-industrial environments*

AS/NZS 61000.6.3, *Electromagnetic compatibility (EMC), Part 6.3: Generic standards—Emission standard for equipment in residential environments*

AS/NZS 61558, *Safety of power transformers, power supply units and similar (all parts)*

US DEPARTMENT OF DEFENSE. MIL-HDBK-217B, Reliability, stress and failure rate data for electronic/equipment

1.3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

1.3.1

actuation

variation in the value of an input to a sensor unit which is normally caused by the movement or presence of a vehicle

Note 1 to entry: For example, in the case of a detector loop the movement or presence of a vehicle over the detector loop may cause a variation in the value of inductance detected across the input terminals of the sensor unit.

1.3.2

detection unit

device intended to detect vehicles using technologies other than an inductive loop detector

1.3.3

detection zone

field of influence within which a vehicle will produce an actuation

1.3.4

feeder cable

cable(s) which interconnect the sensor unit and its associated loop(s)

1.3.5

independent detector

one or more sensor units contained within an independent enclosure and incorporating a power supply for the functioning of its sensing circuit(s)

1.3.5.1

inductive loop detector

system that uses a sensor unit to generate a magnetic field to detect vehicles

1.3.6

initial inductance

inductance value corresponding to a loop which has no vehicle in its detection zone

1.3.7

integrated loop detector

traffic signal controller specific vehicle detector unit that operates as one of the controller's integral functional units

1.3.8

interaction

<crosstalk> voltage induced into the input (loop) circuit of one sensor unit as a result of the operation of other sensor units connected to loops in the vicinity

Note 1 to entry: This voltage results from the mutual inductance between (loop) inductors connected to different sensor units

1.3.9

limited presence detector

detector which produces an output for a limited period while a vehicle is present within the detection zone

1.3.10

loop

one or more turns of insulated conductor installed below the road surface and acts as a transducer

1.3.11**output**

electrical state at the output terminals of the sensor unit that indicates the detection of a vehicle

Note 1 to entry: See [Clause 6.8.12](#) for further information.

1.3.12**paralysis time**

the time after a sensor unit output ceases while an actuation is still present before a further actuation can generate another output

Note 1 to entry: See [Clause A.5](#) for more information.

1.3.13**passage detector**

detector which produces a short (pulse) output per vehicle of relatively constant duration independent of the speed, mass or type of vehicle within the detection zone

1.3.14**presence detector**

detector which produces a continuous output while a vehicle is present within the detection zone

Note 1 to entry: This definition does not imply unlimited presence capability.

1.3.15**presence time**

the duration of an output for a sustained actuation

Note 1 to entry: See [Clause A.4](#) for further information.

1.3.16**Q-factor**

ratio of inductive reactance to series resistance in an electrical circuit at a nominated frequency

1.3.17**rack-mounted detector**

one or more sensor units comprising printed circuit cards designed for mounting with other similar sensor units in a common mounting rack

1.3.18**recovery time**

minimum time between the end of one actuation and the start of the next actuation which ensures an interruption in output

Note 1 to entry: See [Clause A.3](#) for further information.

1.3.19**response time****turn-on-time**

time delay between the instant when an inductance change capable of causing an output occurs at the sensor terminals and the instant when an output actually occurs

Note 1 to entry: See [Clause A.2](#) for more information.

1.3.20**sensitivity**

minimum change in input signal which will cause the sensor to produce an output

1.3.21**sensor unit**

part of a detector which converts an input signal into an output

Note to entry: The output may be an electrical output, a mechanical contact closure etc.

1.3.22**tram****light rail**

railborne electric public passenger vehicle which can be on its own private right of way or share public roads with other vehicles

1.3.23**turn-off time**

<presence detectors and limited presence detectors> time delay between the instant when an inductance change which has caused an output ceases at the sensor input terminals and the actual termination of the associated output

Note 1 to entry: See [Clause A2](#).

1.3.24**turn-on time**

see response time ([1.3.20](#))

1.3.25**vehicle loop detector**

assembly of equipment used for the detection of vehicles passing or standing over a (wire) loop buried below the road pavement surface

Note 1 to entry: In addition to the wire loop, the assembly comprises a sensor unit, a power supply and associated interconnecting cables.

1.3.26**voltage**

for classification of voltage levels, refer to AS/NZS 3000

1.3.27**white noise**

random noise having constant power per constant bandwidth

Section 2 Mechanical and physical requirements

2.1 Construction

All components of the detector system shall be constructed to withstand the conditions of installation and operation which may be expected in normal use. The materials shall be either inherently corrosion-resistant or adequately treated to prevent corrosion. The protective enclosure of independent detectors shall be free from sharp corners and projections.

2.2 Marking

each individual module of the detector system shall be legibly and durably marked with the following information:

- (a) The name, trade name or mark of the manufacturer or responsible supplier.
- (b) Product model number.
- (c) Date of manufacture.
- (d) Marking as required in accordance with AS/NZS 3100.
- (e) Unique serial number.
- (f) Relevant regulatory compliance marking (RCM).

NOTE Refer to ACMA for requirements that may apply regarding marking.

Section 3 Electrical requirements

3.1 Conforming to wiring standards

The equipment and installation shall conform to all applicable requirements of AS/NZS 3000 and AS/NZS 3100.

3.2 Operating voltage

3.2.1 General

The equipment shall be capable of operating satisfactorily from a low voltage (LV) or extra low voltage (ELV) electricity supply as specified by the purchaser.

3.2.2 Low voltage operation

For LV operation, the equipment shall be capable of operating on voltages within the range of 216 V to 253 V a.c. r.m.s. and a frequency range of 48 Hz to 52 Hz. The equipment shall be protected from damage if subjected to voltages and frequency outside these ranges.

3.2.3 Extra low voltage operation

For ELV operation, the equipment shall be capable of operating on the ELV voltage specified by the purchaser. The equipment shall be protected from damage if subjected to voltages outside the specified range.

3.3 Battery backup

Where specified by the purchaser, a battery backup system shall be provided with each detector. The backup battery shall conform to AS 4086.1. The installation of the battery in the detector system shall conform to AS/NZS 5139.

Batteries used in the backup system shall be of a deep discharge, low-maintenance, leak-free type and be automatically charged from an internal system provided within the detector system. The battery life shall be a minimum of 5 years under designed operational conditions.

3.4 Lightning protection

The equipment shall provide surge protection to withstand the surges specified in AS/NZS 1768, Category B, with medium exposure peak amplitudes.

Lightning protection in accordance with AS/NZS 1768 shall be provided to stand-alone installations. Records of the lightning protection circuit and arrangement, and measured earth resistance shall be provided to the purchaser.

3.5 Solar power

Where specified by the purchaser, the equipment shall be designed to operate on solar power.

System sizing of the photovoltaic modules and batteries shall be in accordance with AS/NZS 5033.

3.6 Electromagnetic compatibility (EMC)

3.6.1 Immunity

All equipment covered by this Standard shall conform to AS/NZS 61000.6.1.

3.6.2 Electromagnetic emissions

All equipment covered by this Standard shall conform to AS/NZS 61000.6.3 and any other relevant statutory requirements.

3.6.3 Wireless equipment

Any equipment that use wireless communications shall conform to any relevant ACMA requirements.

3.7 Reliability

The detector system and its associated power supply, including components used, shall be designed such that the calculable (95 % confidence level) mean-time-between-failures is not less than 40 000 h (refer to MIL-HDBK-217B). If an electromechanical relay is used as the output device, it shall be rated for 10^7 actuations at the rated output conditions stipulated in [Clause 6.7.12.2](#) for loop detectors and [Clause 8.3.7.2](#) for other detector systems. For the purpose of this clause, failure is defined as the absence of an output when an actuation is present, or presence of an output in the absence of an actuation.

Section 4 Documentation requirements

Detector systems shall be supplied with an installation, operations and maintenance manual. The manual shall provide, as a minimum, clear instructions on the following:

- (a) Overview of the system design.
- (b) Hardware description.
- (c) Installation and configuration requirements.
- (d) Occupational Health and Safety (OH&S) instructions and information.
- (e) A layout of detector subsystems, installation details and interconnection diagrams.
- (f) Troubleshooting instructions.
- (g) A proposed maintenance plan for routine maintenance tasks on the detector and associated system.
- (h) A recommended list of spare parts for maintenance.
- (i) A statement confirming the warranty provisions associated with the detector and associated equipment.
- (j) Software overview and description including communications interface.
- (k) All operations-related information including start-up and shutdown, display programming, configuration of settings, local and remote controls, user-responses to system alarms and faults, and all other operational details.
- (l) Wiring and cabling layouts, circuit and schematic diagrams, including interconnection of all subsystems.

Section 5 Environmental requirements

5.1 Temperature and humidity

The detector and associated equipment shall be designed to operate under any combination of the following conditions:

- (a) Ambient air temperatures within the range -15°C to 55°C .
- (b) 95 % humidity.

The above shall be tested in accordance with IEC 60068-2-30.

5.2 Enclosure protection

The following levels of enclosure protection in accordance with AS 60529 shall be provided for stand-alone detectors:

- (a) IP65 for a unit which is mounted externally to an enclosure.
- (b) IP45 for the complete roadside cabinet or control housing where provided.

5.3 Wind loading

The facilities provided for supporting and stabilizing the detector shall ensure that, when installed as in normal operation, the detector will maintain its intended orientation and position when subjected to the wind-loading conditions applicable to the region in which the detector is intended to be used in accordance with AS/NZS 1170.2.

5.4 Vibration

The entire equipment shall be subjected to vibration tests specified in this clause. The test procedures shall be in accordance with AS 60068.2.6 for sinusoidal vibration. For tests specified in this clause, the amplitude shall be 0.75 mm up to the crossover frequency (approximately 8.2 Hz), where the acceleration is 0.2 g, and for higher frequencies the acceleration shall be maintained constant at 0.2 g.

The tests shall be performed for three mutually perpendicular axes with the equipment in the normal (upright) orientation.

For each axis of the tests, an investigative sweep cycle shall be performed on the test specimen over the frequency range 5–55 Hz with an amplitude of up to 0.75 mm to identify critical frequencies at which —

- (a) equipment malfunction, deterioration of performance or both due to vibration are exhibited; and/or
- (b) mechanical resonances and other response effects, such as chatter, occur.

The frequencies and the applied amplitudes at which these effects occur shall be noted, together with the behaviour of the test specimen at each critical frequency.

The equipment shall be tested for 10 min at each of the critical frequencies identified, with vibration amplitude of 0.75 mm below the crossover frequency, and 0.2 g acceleration above the crossover frequency.

For each axis of the tests, the entire equipment shall be tested with an endurance of 20 sweep cycles over the frequency range 5–55 Hz with initial amplitude of 0.75 mm. The sweep rate shall be 1 octave per minute.

The equipment shall be fully operational without malfunction during the tests.