

Draft Proposal for Regulation No. 46 Annex 12, Appendix 3 on special requirements to be applied to the safety aspects of camera monitor systems for indirect vision

Annex 12, Appendix 3

Special requirements to be applied to the safety aspects of camera monitor systems for indirect vision

1. General

The purpose of this Annex is to specify the requirements for documentation and verification for Camera-Monitor-Systems (CMS) for indirect vision to replace mandatory rear-view mirrors for road vehicles (e.g. Classes I to IV as defined in this regulation).

"The System", referred to herein, is the one for which type approval is being sought.

This annex does not specify the performance criteria for "The System" but covers the methodology applied to the design process and the information which must be disclosed to the Technical Service, for type approval purposes.

This information shall show that "The System" respects, under normal and fault conditions, all the appropriate performance requirements specified elsewhere in this Regulation.

2. Definitions

2.1 Camera Monitor System (CMS)

A CMS is used in road vehicles to present the required outside information of a specific field of view to the driver. It replaces a conventional legally prescribed mirror system on the vehicle by means of electronic image capture and display systems. It consists of a camera that is usually installed at the bodywork of a vehicle and a monitor that is usually placed inside the vehicle.

2.2 Camera

A camera is a device to capture color images of a specific field of view. It mainly consists of two relevant items: imager and lens.

2.3 Monitor

A monitor is a device for displaying images. It either consists of a matrix of active areas that radiate light of different wavelengths or is a (usually diffuse) reflector that is illuminated in different wavelengths and in a matrix of specific points by a projector.

2.4 Control unit

A control unit is a component which controls communication and co-ordination between electronic components e.g. a camera and a monitor.

2.5 Safety concept

A safety concept is a description of the measures designed into the system, for example within the electronic units, so as to address system integrity and thereby ensure safe operation even in the event of a system or electrical failure.

2.6 "Boundary of functional operation"

"Boundary of functional operation" defines the boundaries of the external physical limits within which the system is able to maintain functionality

3. Documentation

3.2 The manufacturer shall provide the following documentation package:

- A description of the camera monitor system which gives an explanation of the main function of the system, incl. drawings, pictures, block diagrams, etc.
- A description of the location of the camera and the monitor in the vehicle (system overview).
- Name of manufacturer of camera, monitor and electronic control units.
- Type of camera and monitor. Each unit shall be clearly and unambiguously identifiable (e.g. by marking for hardware and marking or software output for software content) to provide corresponding hardware and documentation association.
- The warning strategy and the safety concept, as laid down by the manufacturer, shall be explained also covering the list of failures of paragraph 4.

3.3 For periodic technical inspections, the documentation shall describe how the current operational status of "The System" can be checked.

3.4 The limits for the boundary of functional operation (e.g. environmental parameters) shall be stated where appropriate to the system performance.

3.5 Safety concept of the manufacturer

The manufacturer shall provide a statement which affirms that the strategy chosen allows a safe operation of "The system" and to achieve "The System" objectives.

In case of a failure, the driver shall be informed for example by warning signal or message display. When the system is activated, the warning shall be present as long as the fault condition persists.

The documentation shall be supported, by an analysis which shows, in overall terms, how the system will behave on the occurrence of any one of those specified faults according to paragraph 4.

This may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety considerations.

[Alternative to the two statements above:

The manufacturer has to provide a management summary with description of the process to reach the functional safety requirements.]

- 3.6 The chosen analytical approach(es) shall be established and maintained by the manufacturer and shall be made open for inspection by the technical service at the time of the type approval.

4. List of failures

4.1 Camera

- Failure of the camera.
- Electronic noise, reduced detail resolution.
- Defocus of the optics, reduced detail resolution.

4.2 Monitor

- Failure of monitor display, no image content is displayed.
- Freeze of displayed monitor content, image content is not refreshed.
- Enlarged image formation time, changing image content is blurred.

4.3 Control unit

- Failure of the control unit.
- Failure in the communication between camera and control unit.
- Failure in the communication between control unit and monitor.

5. Verification

- 5.1 Verification of the performance of the camera monitor system under non-fault and fault conditions shall be conducted against the manufacturer's specification.
- 5.2 For verification the safety concept of "The System" shall, at the discretion of the type approval authority, be checked under the influence of failures.
The verification results shall correspond with the documented summary of the chosen analytical approach to a level of overall effect such that the safety concept and execution are confirmed as being adequate.