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## Overview

This standard is about identifying and rectifying faults occurring in Advanced Driver Assistance Systems (ADAS) by carrying out diagnostic activities and then removing, replacing and recalibrating sensors. ADAS includes systems for driver safety, pedestrian safety, motion/stability control and collision avoidance systems.

## Performance criteria

- You must be able to:*
- P1 use appropriate personal and vehicle protective equipment when carrying out testing, diagnosis and rectification activities
  - P2 support the identification of **Advanced Driver Assistance System** faults, by reviewing vehicle:
    - P2.1 technical data
    - P2.2 diagnostic test procedures
  - P3 confirm and record presence and type of ADAS systems and sensors
  - P4 follow up-to-date and relevant industry codes of practice at all times
  - P5 prepare and check the required **testing and diagnostic equipment** following manufacturer's instructions prior to use
  - P6 use all **tools and equipment** required for your diagnostic and rectification activities, correctly and safely throughout
  - P7 use **testing techniques** which are relevant to the symptoms presented and ADAS system type
  - P8 collect diagnostic information in a logical and systematic way to enable an accurate diagnosis of Advanced Driver Assistance System faults
  - P9 identify and record any system deviation from acceptable limits
  - P10 make cost effective, accurate recommendations for rectification based on your analysis of the diagnostic information gained
  - P11 carry out all diagnostic and rectification activities following:
    - P11.1 manufacturer's instructions
    - P11.2 recognised researched replacement methods
    - P11.3 health, safety and environmental requirements
  - P12 work in a way that minimises the risk of:
    - P12.1 damage to other vehicle systems
    - P12.2 damage to other components and units
    - P12.3 contact with leakages
    - P12.4 contact with hazardous substances
  - P13 ensure the **calibration environment** is as identified by the manufacturer's instructions
  - P14 ensure all replacement components and parts in the proximity of **sensors** conform to the vehicle manufacturer's specification and any legal requirements
  - P15 **recalibrate** Advanced Driver Assistance System **sensors** correctly to ensure that they operate to meet vehicle system requirements and function to the vehicle manufacturer's specified tolerances
  - P16 record the recalibration has been successfully completed and meets vehicle manufacturer's specified tolerances

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P17 ensure your records are accurate, complete and passed to the relevant person(s) within the agreed timescale and in the format required

P18 complete all diagnostic and rectification activities within the agreed timescale

P19 report any anticipated delays in completion to the relevant person(s) promptly

## Knowledge and understanding

*You need to know and understand:*

K1 the current health and safety legislation and workplace procedures relevant to workshop practices and personal and vehicle protection when diagnosing, removing, replacing and recalibrating Advanced Driver Assistance System components

K2 legal requirements relating to the **Advanced Driver Assistance Systems** and components

K3 your workplace procedures for:

K3.1 recording fault location and correction activities

K3.2 reporting the results of tests

K3.3 completing and storing documentation relating to ADAS verifiable calibration

K3.4 the referral of problems

K3.5 reporting delays to the completion of work

K3.6 the **calibration environment** as identified by the manufacturer's instructions

K4 the importance of working to recognised diagnostic procedures and processes and obtaining the correct information for diagnostic activities to proceed

K5 types of ADAS diagnostic equipment

K6 the importance of documenting diagnostic and rectification information

K7 the importance of working to agreed timescales and keeping others informed of progress

K8 the importance of customer interaction relating to which systems can/can't be calibrated

K9 the relationship between time, costs and productivity

K10 the importance of reporting anticipated delays to the relevant person(s) promptly

K11 types of ADAS **sensors** and their function

K12 identifying the types of **vehicle calibration**

K13 features of **ADAS system operation**

K14 electrical and electronic principles, including Ohms Law, voltage, power, current (AC/DC) resistance, magnetism, electromagnetism and electromagnetic induction, digital and fibre optics principles, radio waves, time of flight and doppler shifts, electrical symbols, units and terms, electrical safety procedures

K15 how electrical and electronic units and components are constructed, dismantled and reassembled

- K16 how electrical and electronic units and components operate, including electrical component function, electrical inputs, outputs, voltage/current variation and patterns
- K17 the interaction between electrical, electronic and mechanical components within the systems defined
- K18 how electrical systems interlink and interact, including multiplexing
- K19 how to prepare and check the accuracy of **diagnostic testing** equipment
- K20 how to use electrical and electronic testing equipment to correctly and safely diagnose ADAS faults
- K21 the types and causes of Advanced Driver Assistance System failures
- K22 the circumstances which will necessitate replacement and recalibration of Advanced Driver Assistance System components and other possible courses of action
- K23 how to find, interpret and use sources of information on Advanced Driver Assistance System operating specifications, diagnostic test procedures, removal, replacement and recalibration procedures and legal requirements
- K24 how to carry out systematic **diagnostic testing** of Advanced Driver Assistance System components using electrical and electronic **testing techniques**
- K25 how to select the most appropriate **diagnostic testing** method for the symptoms presented
- K26 how to interpret test results and vehicle data in order to identify the location and cause of Advanced Driver Assistance System faults
- K27 how to remove, replace and **recalibrate** Advanced Driver Assistance System components and vehicle components in the proximity of **sensors**
- K28 how to make cost effective recommendations for rectification
- K29 the need to continually keep up to date with emerging ADAS system technology
- K30 the legal requirements of dynamic calibration activity on the road
- K31 the risk and potential legal implications of returning an uncalibrated vehicle to the customer
- K32 the value of providing the customer with evidence of successful calibration
- K33 the industry agreed autonomous vehicle capability levels

## Scope/range

### 1. Faults occurring in the following **Advanced Driver Assistance Systems**:

- a. Driver safety
- b. Pedestrian Safety
- c. Motion/stability control
- d. Collision Avoidance Systems

### 2. **Testing and diagnostic equipment** includes:

- a. volt meters,
- b. ammeters,
- c. ohmmeters
- d. multimeters
- e. battery testing equipment
- f. dedicated and computer based diagnostic equipment
- g. fault code readers
- h. oscilloscopes
- i. ADAS recalibration equipment

### 3. **Tools and equipment** include:

- a. hand tools
- b. special purpose tools
- c. general workshop equipment

### 4. **Diagnostic testing** is defined as:

- a. verify the fault
- b. collect further information
- c. evaluate the evidence
- d. carry out further tests in a logical sequence
- e. rectify the problem
- f. check all systems

### 5. **Testing techniques** include:

- a. voltage, resistance and current measuring
- b. frequency measuring
- c. visual
- d. dedicated and computer-based testing
- e. oscilloscope waveforms

**6. Calibration environment** includes:

- a. targets
- b. lighting
- c. radar boards
- d. static, dynamic and combinations of static and dynamic

**7. Sensors** include:

- a. optical
- b. radar
- c. lidar
- d. ultra-sonic
- e. sound
- f. GPS

**8. Recalibrate** to include:

- a. static
- b. dynamic
- c. hybrid systems

**9. ADAS system operation** to include:

- a. steering
- b. braking
- c. lane departure
- d. driver assistance
- e. parking

## Glossary

*This section contains examples and explanations of some of the terms used but does not form part of the standard.*

**Rectification activities** are defined as:

A suitable replacement and recalibration of a component(s) that rectifies the fault(s) identified from the diagnostic activities carried out

**Driver safety:**

For example, night vision, glare-free high beam and pixel light, automatic parking, blind spot monitor, driver drowsiness detector, driver monitoring system, traffic sign recognition.

**Pedestrian safety:**

For example, pedestrian detection and warning systems.

**Motion/stability control:**

For example, lane change assistance, hill descent control

**Collision avoidance system:**

For example, forward collision warning, surround view sound, night vision, lane departure warning, AEB (Autonomous emergency braking), adaptive cruise control and stability control.

**Agreed timescales:**

Examples include manufacturers' recommended work times, job times set by the company or a job time agreed with the customer.

**Vehicles:**

These can be any of the following – light vehicles, commercial vehicles, heavy vehicles,  
Additionally, these vehicles may be SI, CI, Hybrid, Electric or Alternative fuel vehicles.



<b>Developed by</b>	IMI
<b>Version Number</b>	1
<b>Date Approved</b>	March 2020
<b>Indicative Review Date</b>	March 2024
<b>Validity</b>	Current
<b>Status</b>	Original
<b>Originating Organisation</b>	IMI Ltd
<b>Original URN</b>	LV19
<b>Relevant Occupations</b>	Mechanical, Electrical and Trim Technician (Automotive); Tyre exhaust and windscreen fitters ; Heavy Vehicle Diagnostic Technician (Automotive); Light Vehicle Diagnostic Technician (Automotive); Light Vehicle Master Technician (Automotive)
<b>Suite</b>	Maintenance and Repair - Light Vehicle; Automotive Glazing
<b>Keywords</b>	ADAS; sensor; calibrate; re-calibrate; diagnostic