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Road Vehicles — Extended vehicle (ExVe) methodology —

Part 1: General information

Véhicules routiers — Méthodologie du véhicule étendu (ExVe) —

Partie 1: Information générale

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Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
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A list of all parts in the ISO 20077 series can be found on the ISO website.

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Introduction

This document is the first part of a series of ISO Standards dedicated to the extended vehicle.

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Road Vehicles — Extended vehicle (ExVe) methodology —

Part 1: General information

1 Scope

This document defines the concepts and the terms related to extended vehicles.

It presents general information regarding these vehicles, specifies the dedicated terminology and describes the interrelation with other standards related to extended vehicles.

It concerns:

— road vehicles with four or more wheels designed and constructed primarily for the carriage of persons that are defined as Category 1 vehicles in the United Nations Special Resolution No.1 *in TRANS*/WP.29/1045, as last amended on 19 June 2012;

— road vehicles with four or more wheels designed and constructed primarily for the carriage of goods that are defined as Category 2 vehicles in the United Nations Special Resolution No.1 *in TRANS*/WP.29/1045, as last amended on 19 June 2012,

where these road vehicles are still in accordance with the specifications of the vehicle manufacturer.

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While this document mentions already standardized interfaces and devices (e.g. external test equipment) connected to these interfaces, the specification of these interfaces and devices is not within the scope of this document.

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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. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20077-2:—[1)], *Road vehicles – Extended vehicle (ExVe) methodology – Part 2: Methodology for designing the extended vehicle*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

NOTE Illustration through a practical case of the interrelation between the diagnostics and prognostics concepts defined respectively in 3.2 to 3.4 and 3.13 may be found in Annex A.

3.1
diagnosis
result of a *diagnostic process* (3.2) carried out on a vehicle

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3.2
diagnostics
diagnostic process
process including the detection process of possible vehicle *malfunctions* (3.10), the identification of the likely root cause of these malfunctions and the appraisal of its relevance for the operation of the vehicle

3.3
diagnostics step 1
detection process of possible vehicle *malfunctions* (3.10)

Note 1 to entry: The detection process of possible vehicle malfunctions (diagnostics step 1) may lead to the conclusion of an absence of malfunction.

3.4
diagnostics step 2
identification of the likely root cause of *malfunctions* (3.10)

Note 1 to entry: Root cause analysis (diagnostics step 2) is only performed in presence of a malfunction. Root cause analysis is performed if diagnostics step 1 has been performed.

3.5
extended vehicle
entity, still in accordance with the specifications of the *vehicle manufacturer* (3.20), that extends beyond the physical boundaries of the road vehicle and consists of the road vehicle, *off-board systems* (3.11), external interfaces and the data communication between the road vehicle and the off-board systems

Note 1 to entry: Road vehicles without off-board systems and road vehicles equipped with telematics units are extended vehicles.

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3.6
ExVe manufacturer
vehicle manufacturer (3.20) responsible for the *extended vehicle* (3.5)

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3.7
function
task, action or activity that should be achieved to satisfy a functional requirement

EXAMPLE “KEY ON-ENGINE OFF”.

Note 1 to entry: The same function may be used in several different *use cases* (3.17).

3.8
functionality
set of *functions* (3.7) that ensures the overall capability of the system to satisfy a *functional requirement* (3.9)

EXAMPLE The set of functions necessary for “establishing the communication with an *extended vehicle* (3.5)”.

Note 1 to entry: In the set of functions necessary for “establishing the communication with an extended vehicle”, one can find such functions as “KEY ON-ENGINE OFF”, etc.

Note 2 to entry: The same functionality may be used in several different *use cases* (3.17).

3.9
functional requirement
<extended vehicles> statement issued by the *vehicle manufacturer* (3.20) that identifies what a product or process must accomplish to produce required behaviour and/or results

Note 1 to entry: The functional requirement is issued by the body in charge of the design of the product or process.

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[SOURCE: ISO/IEC/IEEE 24765:2010, 3.1229, definition 1, modified — source entry has been modified to introduce that, in the case of extended vehicles, the statement is issued by the vehicle manufacturer and Note 1 has been added to source entry.]

3.10
malfunction
state of a system or a component that deviates from the specifications of the *vehicle manufacturer* (3.20)

Note 1 to entry: A malfunction may be the object of an alert on board the vehicle and possibly lead to a DTC, but a malfunction does not necessarily preclude a DTC.

Note 2 to entry: A slight deterioration of a system, such as the normal wear of that system, is not a malfunction as long as it does not impair the performance of that system against the design specifications of the vehicle manufacturer.

3.11
off-board system
<road vehicles> software and hardware components off-board a road vehicle that have been specified, designed, developed and/or manufactured to address the requested *functionalities* (3.8)

3.12
prognosis
prediction which is the result of a *prognostic process* (3.13)

3.13
prognostics
prognostic process
<automotive> process of forecasting the possible occurrence of vehicle *malfunctions* (3.10) and appraising the likely remaining operation time of the vehicle until these malfunctions occur

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Note 1 to entry: A prognostic process cannot be performed without having performed the detection process of possible malfunctions of the same functionally related system [*diagnostics step 1* (3.3)].

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Note 2 to entry: A *diagnostic process* (3.2) may be performed without performing a prognostic process (for example, in the case of the presence of a malfunction, when *diagnostics step 2* (3.4) is performed).

3.14
remote, adjective
performed on a vehicle from a distance where the operator responsible for the concerned operation is not co-located with the vehicle and where the vehicle is connected via an external network

EXAMPLE Remote diagnostics, remote access.

Note 1 to entry: The "operator responsible for the concerned operation" is a specific actor in terms of *use case* (3.17).

3.15
remote diagnostician
remote diagnostics operator
physical person that performs a remote diagnostic process

3.16
remote diagnostic support
information provided to a *remote diagnostician* (3.15) to assist in the performance of the remote diagnostic process of a vehicle

Note 1 to entry: Typical examples of remote diagnostics support are:

— information for performing a remote diagnostic process on a vehicle (for example, instructions, training material, etc.),

— information specified for remote diagnostics *use cases* (3.17), and

— information used by the after-sales remote diagnostics tool equipment systems.

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Note 2 to entry: Diagnostic support that is provided for performing conventional diagnostics is the foundation for remote diagnostic support (the access to that information in the case of conventional diagnostics is standardized in ISO 18541-1).

3.17
use case
sequence of interactions between one or several actors and the concerned system, which has a defined goal and provides a measurable result

EXAMPLE Read all active DTCs

Note 1 to entry: "Read all active DTCs" may be comprised of the following interactions: initialization of the communication, identification of the vehicle, sending the request to get DTC information ("read DTC"), receiving DTC information, terminating of the communication.

Note 2 to entry: Actors may be both human and machines.

Note 3 to entry: In the case of an *extended vehicle* (3.5), the concerned system is the extended vehicle itself.

Note 4 to entry: In order to be able to perform the design of an extended vehicle, it is necessary that the use cases are completed by the appropriate use case scenarios and use case functional requirements.

3.18
use case cluster
<road vehicles> grouping of *use cases* (3.17) that together have the same goal measurable result

EXAMPLE Remote diagnostics, fleet management.

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Note 1 to entry: Use case clusters may be themselves regrouped into areas, the typology of which may generate different types of technical solutions, although some solutions may be common to several areas.

Note 2 to entry: Extended vehicles have been developed to be used in all the use case clusters areas where vehicle connectivity is expected, for example, cooperative ITS, fleet management, remote diagnostic, car sharing, etc.

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3.19
use case scenario
set of circumstances under which the sequence of interaction describing a *use case* (3.17) takes place

EXAMPLE Vehicle is in a workshop, vehicle is in a manufacturing process, vehicle is immobilized, etc.

Note 1 to entry: The same use case may take place under different scenarios, but the sequence of interaction may also be affected by the circumstances. In that case, one would have more than one use case.

Note 2 to entry: In the case of an operation performed on an immobilized vehicle, the presence or absence of a technician may be part of the use case scenario.

3.20
vehicle manufacturer
person or body who is responsible to the approval authority for all aspects of the type approval or authorization process and for ensuring conformity of production of a vehicle

Note 1 to entry: It is not essential that the person or body be directly involved in all stages of the construction of the vehicle, system, component or separate technical unit which is the subject of the approval process.

Note 2 to entry: Adapted from Directive 2007/46/EC.

[SOURCE: ISO 18541-1:2014, 3.1.46]

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3.21
web service
software system, with an interface described in a machine-processable format and designed to support interoperable machine-to-machine interaction over a network

[SOURCE: WORLD WIDE WEB Consortium Glossary - W3C Working Group Note 11 - February 2004, modified — source entry has been modified not to restrict the concept to one protocol or one type of messages and to partly include Note 1 to source entry and Note 2 to source entry has been disregarded.]

4 Abbreviated terms

DTC	Diagnostic trouble code
ExVe	Extended Vehicle
FMS	Fleet Management System
IT	Information Technology
ITS	Intelligent Transport Systems
OBD	On-board Diagnostics
PTI	Periodical Technical Inspection
RDS	Remote Diagnostic Support
rFMS	remote Fleet Management System
RMI	Repair and Maintenance Information
RSI	Road Side Inspection
VCI	Vehicle Communication Interface
VM	Vehicle Manufacturer
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
W3C	World Wide Web Consortium
WS	Web Service

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5 The extended vehicle

5.1 Background

The technology improvements, especially IT improvements, have permitted vehicle manufacturers to address the constant evolution of the needs of its customers by providing solutions that are not solely on-board the conventional vehicle (whether car, truck or bus) but that also involve off-board components and systems.

Typically, these improvements have been based on new ways of communicating with the vehicle where information can be accessed wirelessly.

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The removal of the constraints linked with a physical connection has enabled the possibility of new services based on:

— an access to vehicle functionalities in a way that was previously impossible or very hard;

— multiple access to the vehicle instead of e.g. a single OBD connector; and

— a time-critical access to vehicle operation data.

This evolution adds the additional risks related to remote access (hacking, intrusion, information misuse, etc.) to the already existing typical automotive risks. Accordingly, it is the responsibility of the vehicle manufacturer to take additional specific security measures when designing an extended vehicle.

Figure 1 and Figure 2 illustrate this evolution by presenting typical examples of the 2010s extended vehicles, respectively, the use of an "intelligent" key and the use of a VM server for reprogramming a vehicle ECU.

EXAMPLE 1

The use of an "intelligent key".

In Figure 1, the VM has provided the owner of a vehicle an off-board device that is an intelligent key. This key communicates with the conventional vehicle and enables the opening of the doors and the "activate in-vehicle network" process. For the owner as well as for the manufacturer, this device is part of the vehicle.

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EXAMPLE 2

The use of a VM server for reprogramming a vehicle ECU.

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In Figure 2, the VM has developed, e.g. in order to comply with the EU legislation on RMI, a reprogramming system that permits reprogramming a vehicle ECU through the OBD connector of the vehicle using a standardized VCI (for example, according to SAE J2534 or ISO 22900). To reprogram, the repairer has first to connect the VCI to a manufacturer end-point, where he will get the information that is necessary to perform the operation. For the owner of the vehicle, the VCI is not part of his vehicle.

The extended vehicle concept is expected to satisfy emerging new services, for example, remote services.

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