
**Road vehicles — Implementation
of World-Wide Harmonized On-
Board Diagnostics (WWH-OBD)
communication requirements —**

**Part 6:
External test equipment**

*Véhicules routiers — Mise en application des exigences de
communication pour le diagnostic embarqué harmonisé à l'échelle
mondiale (WWH-OBD) —*

Partie 6: Équipement d'essai externe

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This second edition cancels and replaces the first edition (ISO 27145-6:2015), which has been technically revised.

The main changes are as follows:

- clarification about cable length;
- rewording for a better clarification of requirements.

A list of all parts in the ISO 27145 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Overview

This document includes the communication between the vehicle's on-board diagnostics (OBD) systems and external test equipment within the scope of the World-Wide Harmonized On-Board Diagnostics Global Technical Regulations (WWH-OBD GTR).

This document has been established in order to apply the unified diagnostic services (specified in ISO 14229-1) to WWH-OBD systems.

This document includes the communication between the vehicle's WWH-OBD systems and external (off-board) “generic” test equipment within the scope of the country-specific regulatory requirements.

To achieve this, it is based on the Open Systems Interconnection (OSI) Basic Reference Model specified in ISO/IEC 7498-1 and ISO/IEC 10731, which structures communication systems into seven layers. When mapped on this model, the services specified by this document are broken into:

- diagnostic services (layer 7), specified in ISO 27145-3 with reference to ISO 14229-1,
- presentation layer (layer 6), specified in ISO 27145-2 with reference to SAE J1930-DA, SAE J1939-DA, SAE J1939-73:2022, Appendix A (FMIs), SAE J1979-DA, and SAE J2012-DA,
- session layer services (layer 5), specified in ISO 14229-2,
- transport layer services (layer 4), specified in ISO 27145-4 with reference to ISO 13400-2, ISO 15765-2, and ISO 15765-4,
- network layer services (layer 3), specified in ISO 27145-4 with reference to ISO 13400-2, ISO 15765-2, and ISO 15765-4,
- data link layer (layer 2), specified in ISO 27145-4 with reference to ISO 11898-1, ISO 11898-2, ISO 13400-3, ISO 15765-4, and IEEE 802.3, and
- physical layer (layer 1), specified in ISO 27145-4 with reference to ISO 11898-1, ISO 11898-2, ISO 13400-3, ISO 15765-4, and IEEE 802.3,

in accordance with [Table 1](#).

Table 1 — WWH-OBD specification reference applicable to the OSI layer

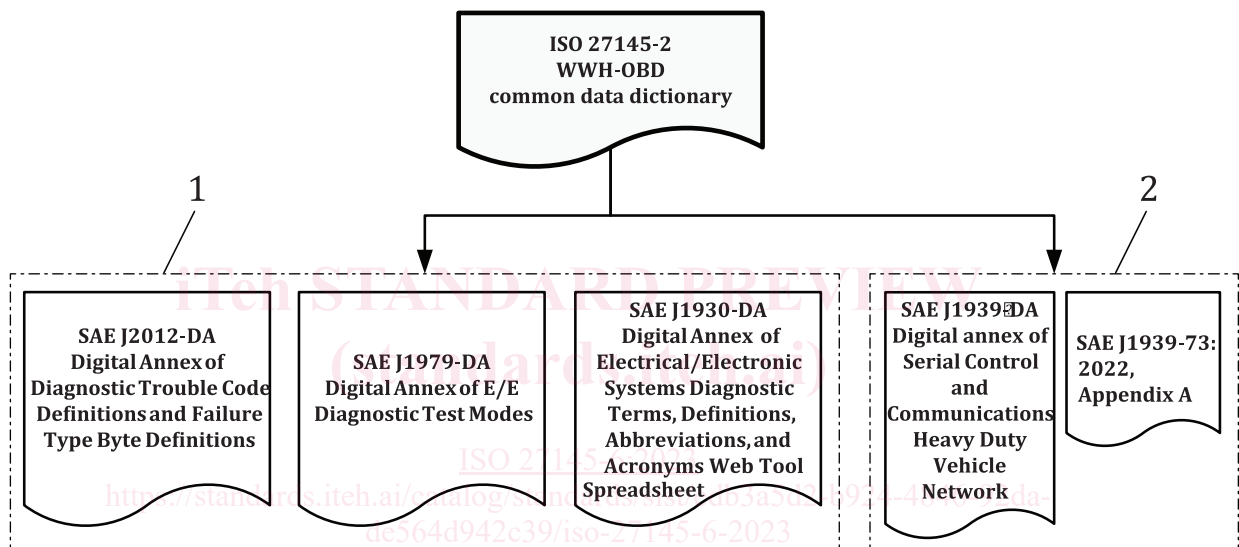
Applicability	OSI seven layer	WWH-OBD document reference			
Seven layers according to ISO/IEC 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO 14229-1, ISO 27145-3			this document
	Presentation (layer 6)	ISO 27145-2, SAE J1930-DA, SAE J1939-DA, SAE J1939-73:2022, Appendix A (FMIs), SAE J1979-DA, SAE J2012-DA			
	Session (layer 5)	ISO 14229-2			—
	Transport (layer 4)	ISO 15765-2 DoCAN,	ISO 27145-4	ISO 13400-2 DoIP TCP and IP	
	Network (layer 3)	ISO 15765-4 DoCAN			
	Data link (layer 2)	ISO 11898-1 CAN DLL,		ISO 13400-3 DoIP,	
	Physical (layer 1)	ISO 11898-2 CAN HS,		IEEE 802.3	
	ISO 15765-4 DoCAN				

SAE document reference concept

This document references several SAE documents which contain all terms, data and diagnostic trouble code (DTC) definitions.

ISO 27145-2 defines a common data dictionary for this document, according to the definitions in the following documents (Figure 1):

- SAE J1930-DA: this digital annex contains all standardized naming objects, terms, and abbreviated terms;
- SAE J1939-DA and SAE J1939-73: the digital annex indexes names for suspect parameter numbers (SPNs) that provide an alternative presentation format for SAE J2012-DA DTCs. SPNs are combined with failure mode indicators (FMIs) to form the full alternative presentation. These FMIs are described in SAE J1939-73:2022, Appendix A;
- SAE J1979-DA: this digital annex contains all standardized data items such as data identifiers (DIDs), test identifiers (TIDs), monitor identifiers (MIDs) and infotype identifiers (ITIDs);
- SAE J2012-DA: this digital annex contains all standardized data items such as DTC definitions and FTB (failure type byte) definitions.



Key

- 1 SAE digital annexes: data definitions
- 2 SAE J1939 series of documents: DTC definitions

Figure 1 — SAE digital annex document reference

Road vehicles — Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements —

Part 6: External test equipment

1 Scope

This document defines the requirements for the external test equipment as:

- a means of establishing communications between a WWH-OBD-equipped vehicle and external test equipment;
- a set of diagnostic services, including addressing methods, to be provided by the external test equipment in order to exercise the services defined in ISO 27145-3.

This document describes the minimum capabilities or functions in the external test equipment. Additional functionalities, for example, non WWH-OBD protocols or retrieval of repair and maintenance information, can be integrated into the external test equipment according to the test equipment manufacturer needs. The external test equipment designer ensures that no such capability or function can adversely affect either a WWH-OBD-equipped vehicle connected to the equipment, or the equipment itself.

When the external test equipment implements functionality, which is not covered by ISO 27145-3, this functionality is not linked to the timing requirements defined in this document.

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 13400-3, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 3: Wired vehicle interface based on IEEE 802.3*

ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Application layer*

ISO 14229-2, *Road vehicles — Unified diagnostic services (UDS) — Part 2: Session layer services*

ISO 15031-3, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 3: Diagnostic connector and related electrical circuits: Specification and use*

ISO 15765-4, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 4: Requirements for emissions-related systems*

ISO 27145-1, *Road vehicles — Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements — Part 1: General information and use case definition*

ISO 27145-2, *Road vehicles — Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements — Part 2: Common data dictionary*

ISO 27145-3, *Road vehicles — Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements — Part 3: Common message dictionary*

ISO 27145-4, *Road vehicles — Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements — Part 4: Connection between vehicle and test equipment*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 27145-1, ISO 27145-2 and ISO 14229-1 apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.2 Abbreviated terms

CALID	calibration identification
CAN	Controller Area Network
d.c.	direct current
DoCAN	Diagnostics over CAN
DoIP	Diagnostics over IP
DTC	Diagnostic Trouble Code
EMC	electromagnetic compatibility
ESD	electrostatic discharge
ETEREC	external test equipment recommendation
ETEREQ	external test equipment requirement
FMI	Failure Mode Identifier
GTR	Global Technical Regulations
HMI	Human-Machine Interface
IP	Internet Protocol
IUPR	In Use (Monitor) Performance Ratio
MVCI	Modular Vehicle Communication Interface
MI	Malfunction Indication
MIL	Malfunction Indication Lamp
NRC	Negative Response Code
ODX	Open Diagnostic data eXchange
VIN	vehicle identification number

4 Conventions

This document is based on the conventions discussed in the OSI service conventions (ISO/IEC 10731) as they apply to diagnostic services.

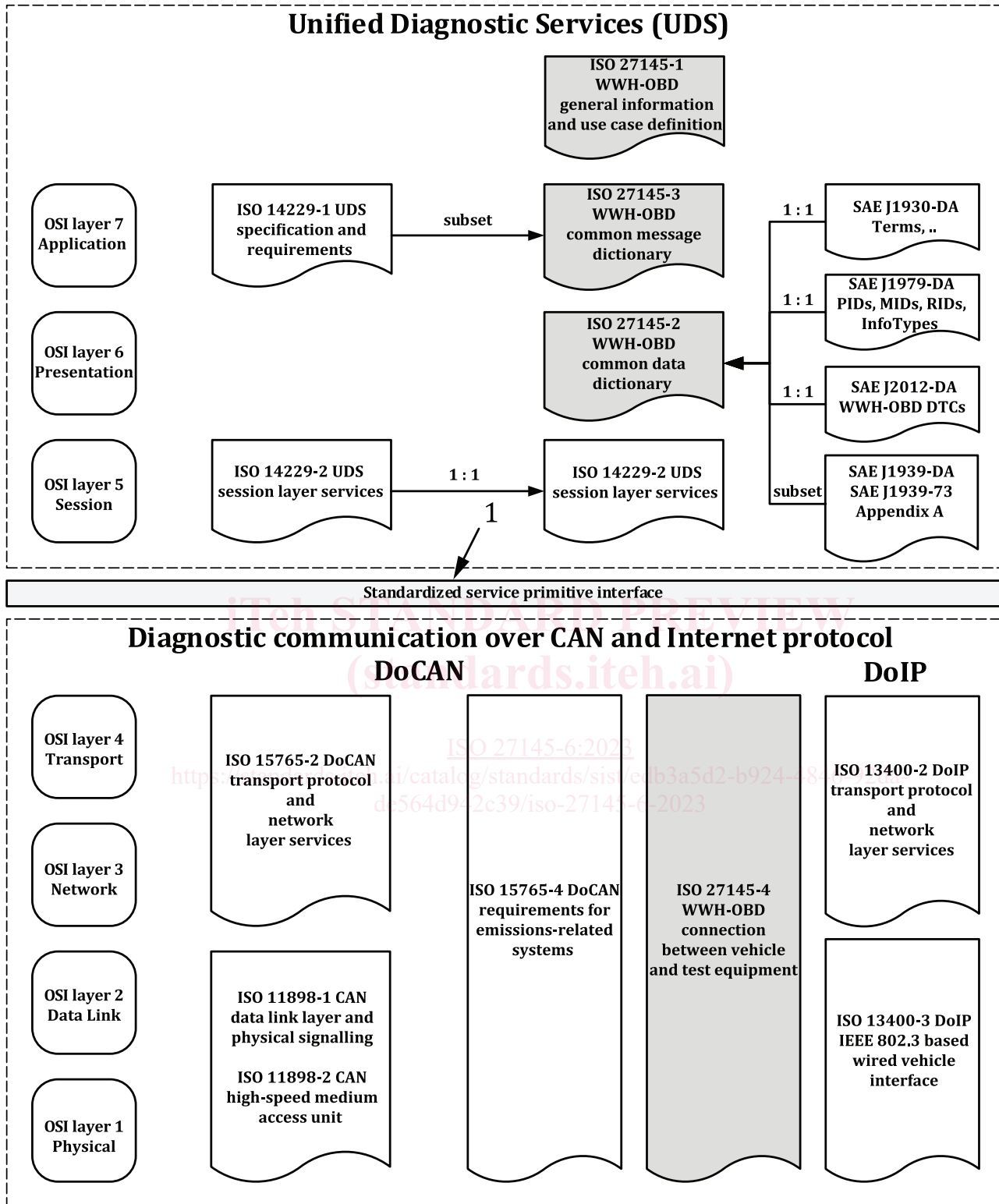
5 Document overview

[Figure 2](#) shows the reference documents for this document.

This document specifies the following references:

- a) ISO 27145-1 specifies the general structure of this document and the use cases applicable to WWH-OBD GTR;
- b) ISO 27145-2 specifies the common data dictionary with references to the following:
 - 1) SAE J1930-DA defines the terms, definitions, abbreviated terms, etc.;
 - 2) SAE J1939-DA contains all SPNs (parameters), PGNs (messages), and other SAE J1939 data previously published in the SAE J1939 top level document;

NOTE The SAE J1939 series of documents presents the definition of emissions-related SPNs and FMIs for use as DTCs.
 - 3) SAE J1939-73:2022, Appendix A specifies the FMIs;
 - 4) SAE 1979-DA specifies all data items;
 - 5) SAE J2012-DA specifies the DTC definitions and failure type byte definitions;
- c) This document specifies the diagnostic services defined in ISO 14229-1 that are applicable to WWH-OBD GTR;
- d) ISO 14229-2 specifies the standardized service primitive interface to separate application and session layers from protocol transport and network layers;
- e) ISO 27145-4 specifies the initialization procedure and includes references to:
 - 1) ISO 15765-4 DoCAN;
 - 2) the ISO 13400 series DoIP.



Key

1 The standardized service primitive interface is specified in ISO 14229-2.

Figure 2 — Reference documents for implementation of WWH-OBDonCAN and WWH-OBDonIP according to the OSI model

6 Requirements overview and principles

6.1 Basic principles for the graphical notation

The flow graphs show the behaviour of the external test equipment. Hierarchical references, e.g. are shown using round edged transparent rectangles. [Figure 3](#) shows the notation semantics.

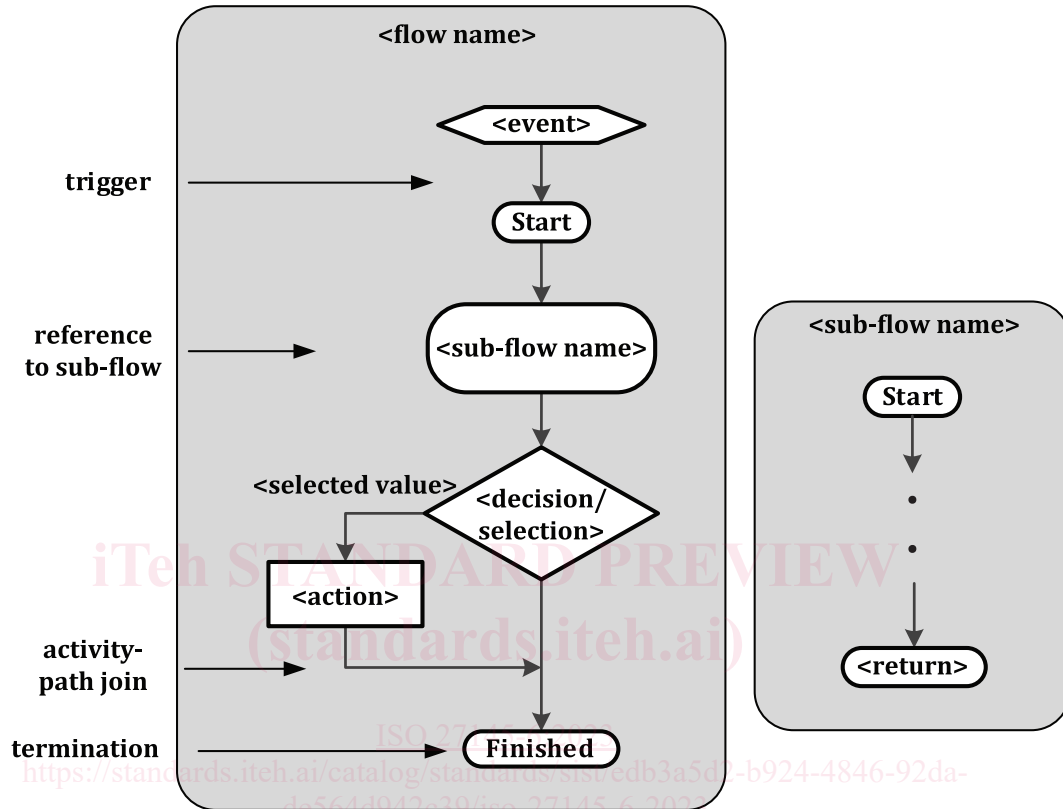


Figure 3 — Flow graph notation semantics used in this document

6.2 Requirements clustering

6.2.1 Overview

Each requirement in this document is assigned to one requirements cluster. The clusters cover technical areas where the assigned requirements apply for.

[Table 2](#) lists the technical requirements clusters. The table provides an overview of all requirements clusters and the associated technical requirements. This list is a summary of the requirements included in this document.

Each technical requirement is identified by the mnemonic “ETEREQ-” and an alpha-numeric number. In addition, the alpha-numeric number includes the requirement cluster classifier according to [Table 2](#).

Recommendations intended to guide the implementation are identified by the mnemonic “ETEREC-”.

6.2.2 Main requirements clusters

[Table 2](#) provides an overview of the main clusters of external test equipment requirements. A requirement cluster has at least one requirement and optional recommendations.