INTERNATIONAL STANDARD

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

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

Partie 4: Connexion entre véhicule et équipement d'essai

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 27145-4 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This first edition of ISO 27145-4 cancels and replaces ISO/PAS 27145-4:2006, which has been technically revised.

ISO 27145 consists of the following parts, under the general title *Road vehicles — Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements*:

— *Part 1: General information and use case definition*

— *Part 2: Common data dictionary*

— *Part 3: Common message dictionary*

— *Part 4: Connection between vehicle and test equipment*

The following parts are under preparation:

— *Part 6: External test equipment*

0 Introduction

0.1 Overview

The ISO 27145 series 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).

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

The ISO 27145 series 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 ISO 27145 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 Companion Spreadsheet (SPNs), SAE J1939-73:2010, 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 this part of ISO 27145 with reference to ISO 13400-2, ISO 15765-2 and ISO 15765-4,

— network layer services (layer 3), specified in this part of ISO 27145 with reference to ISO 15765-4, ISO 15765-2 and ISO 13400-2,

— data link layer (layer 2), specified in this part of ISO 27145 with reference to ISO 11898-1, ISO 11898-2, ISO 15765-4, ISO 13400-3 and IEEE 802.3, and

— physical layer (layer 1), specified in this part of ISO 27145 with reference to ISO 11898-1, ISO 11898-2, ISO 15765-4, ISO 13400-3 and IEEE 802.3,

in accordance with Table 1.

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

Applicability	OSI 7 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		
	Presentation (layer 6)	ISO 27145-2, SAE J1930-DA, SAE J1939 Companion Spreadsheet (SPNs), SAE J1939-73:2010, Appendix A (FMIs), SAE J1979-DA, SAE J2012-DA		
	Session (layer 5)	ISO 14229-2		
	Transport (layer 4)	ISO 15765-2 DoCAN, ISO 15765-4 DoCAN,	ISO 27145-4	ISO 13400-2 DoIP TCP & IP
	Network (layer 3)			
	Data link (layer 2)	ISO 11898-1 CAN DLL, ISO 11898-2 CAN HS, ISO 15765-4 DoCAN		ISO 13400-3 DoIP, IEEE 802.3
	Physical (layer 1)			

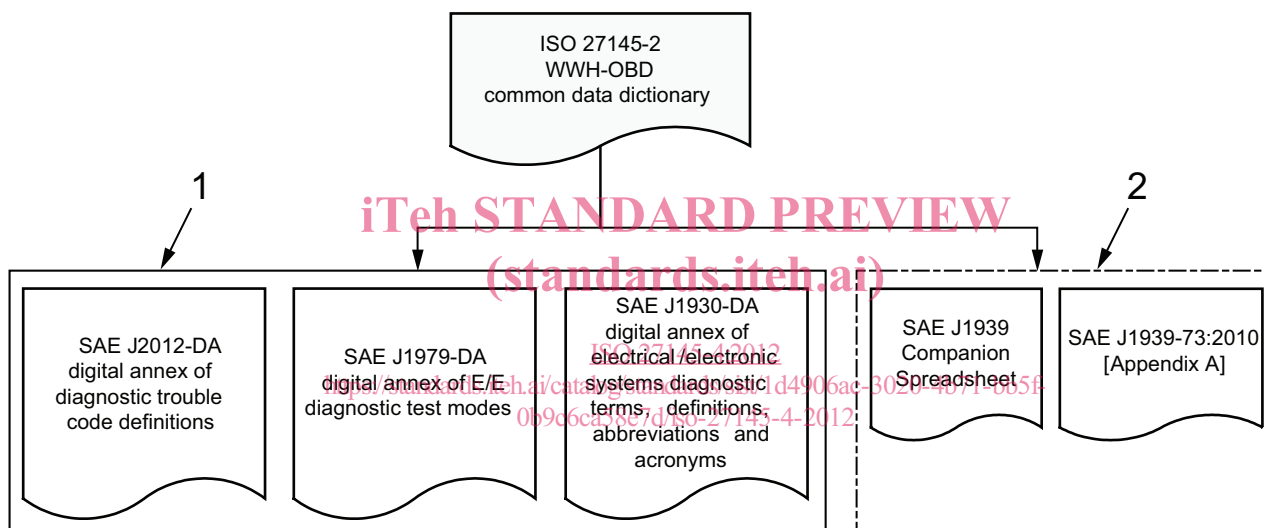## 0.2 SAE document reference concept

ISO 27145 makes reference to several SAE documents which contain the terms, data and diagnostic trouble code (DTC) definitions.

ISO 27145-2 defines a common data dictionary for the ISO 27145 series, according to the definitions in the following documents (see Figure 1).

— SAE J1930-DA: this digital annex contains all standardized naming objects, terms and abbreviated terms.

— SAE J1939 Companion Spreadsheet and SAE J1939-73: SAE J1939 Companion Spreadsheet 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. FMIs are described in SAE J1939-73:2010, Appendix A.

NOTE   The SAE J1939 Companion Spreadsheet is a document which supplements the SAE J1939 family of standards and contains SPNs and parameter group numbers (PGNs).

— 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

0.3   SAE digital annex revision procedure

New regulatory requirements drive new in-vehicle technology to lower emissions, improve safety, etc. It is important to standardize new technology-related OBD monitor data and DTCs in order to support the external (off-board) "generic" test equipment. All relevant information is proposed by the automotive industry, represented by members of the appropriate SAE task force.

ISO 27145-2 references a "Change request form" for use with new data items to be defined by the SAE task force for standardization. It is intended that the standardized data items be defined in SAE J1930-DA, SAE J1979-DA, SAE J2012-DA and SAE J1939. It is intended that the documents be published on the SAE store website once the information has been balloted and approved.

The revision request forms and instructions for updating the registers to ISO 27145 can be obtained on the following data registration websites:

— For SAE J1930-DA: http://www.sae.org/servlets/works/committeeHome.do?comtID=TEVDS7

The column entitled "Resources" shows a document with the title: J1930-DA_Revision_Request_Form. doc. Double click on the name to download the document with the filename: "SAE_J1930-DA_Revision_ Request_Form.doc".

— For SAE J1939: http://www.sae.org/

Search "J1939 Request", select "J1939 Request Processing Group", select "J1939 Request Processing Form and Guidelines".

— For SAE J1979-DA: http://www.sae.org/servlets/works/committeeHome.do?comtID=TEVDS14

The column entitled "Resources" shows a document with the title: J1979-DA_Revision_Request_Form. doc. Double click on the name to download the document with the filename: "SAE_J1979-DA_Revision_ Request_Form.doc".

— For SAE J2012-DA: http://www.sae.org/servlets/works/committeeHome.do?comtID=TEVDS9

The column entitled "Resources" shows a document with the title: J2012-DA_Revision_Request_Form. doc. Double click on the name to download the document with the filename: "SAE_J2012-DA_Revision_ Request_Form.doc".

It is intended that the revision request form be filled out with the request.

It is intended that e-mails with completed revision request forms as attachments be sent to:

E-mail: saej1930@sae.org

E-mail: saej1979@sae.org

E-mail: saej2012@sae.org

E-mail: saej1939@sae.org

ISO 27145-4:2012
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0b9c6ca58e7d/iso-27145-4-2012

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

Part 4:
Connection between vehicle and test equipment

1   Scope

This part of ISO 27145 defines the requirements to successfully establish, maintain and terminate communication with a vehicle that implements the requirements of the WWH-OBD GTR (Global technical regulation No. 5; see Reference [16]). This requires plug and play communication capabilities for the vehicle as well as for any test equipment that intends to establish communication with a vehicle. This part of ISO 27145 details all the OSI layer requirements to achieve this goal.

This part of ISO 27145 is intended to become the single communication standard for access to information relating to vehicle on-board diagnostics (VOBD). To allow for a smooth migration from the existing communication standards to this future world-wide standardized communication standard, the communication concept as specified in this part of ISO 27145 is based on two different data links:

— Diagnostic communication over Controller Area Network (DoCAN), ISO 15765-4;

— Diagnostic communication over Internet Protocol (DoIP), ISO 13400 (all parts).

NOTE   It is intended that this part of ISO 27145 will be extended as necessary upon introduction of additional communication media.

IMPORTANT — Use cases deriving from country-specific implementation of GTR No. 5 into local legislation are not included in this part of ISO 27145.

2   Normative references

The following referenced documents are indispensable for the application 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 13400-2:2012, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 2: Transport protocol and network layer services*

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: Specification and requirements*

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

ISO 15765-2, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 2: Transport protocol and network layer services*

ISO 15765-4:2011, *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*

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.

3.2 Abbreviated terms

CAN	controller area network
DHCP	dynamic host configuration protocol
DID	data identifier
DoCAN	diagnostic communication over CAN
DoIP	diagnostic communication over internet protocol
DTC	diagnostic trouble code
ECU	electronic control unit
FMI	failure mode indicator
FTB	failure type byte
GTR	global technical recommendation
IP	internet protocol
N_PDU	network layer protocol data unit
NRC	negative response code
OBD	on-board diagnostics
OSI	open systems interconnection
SA	source address
SPN	suspect parameter number
T_PDU	transport/network layer protocol data unit
TA	target address
TCP	transmission control protocol
WWH-OBD	world-wide harmonized on-board diagnostics
VOBD	vehicle on-board diagnostics

4 Conventions

The ISO 27145 series 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 the ISO 27145 series.

The ISO 27145 series specifies or includes the following references:

a) ISO 27145-1 specifies the general structure of the ISO 27145 series and the WWH-OBD GTR applicable use cases.

b) ISO 27145-2 specifies the common data dictionary with references to:

   1) SAE J1930-DA, which defines the terms, definitions, abbreviated terms, etc.;

   2) SAE J1939 Companion Spreadsheet, which specifies the SPNs;

   3) SAE J1939-73:2010, Appendix A, which specifies the FMIs;

   4) SAE J1979-DA, which specifies all data items;

   5) SAE J2012-DA, which specifies the DTC definitions and FTB definitions.

NOTE   The SAE J1939 series of documents is concerned with the definition of emissions-related SPNs and FMIs for use as DTCs.

c) ISO 27145-3 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) This part of ISO 27145 specifies the initialization procedure and includes references to:

   1) ISO 15765-4 DoCAN;

   2) ISO 13400 (all parts) DoIP.