INTERNATIONAL STANDARD

ISO 15031-4

Second edition
2014-02-15

Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics —

Part 4: External test equipment

Véhicules routiers — Communications entre un véhicule et un équipement externe pour le diagnostic relatif aux émissions —

Partie 4: Équipement d'essai externe

Reference number
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Contents

Page

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 documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electric and electronic equipment*.

This second edition cancels and replaces the first edition (ISO 15031-4:2005), which has been technically revised.

ISO 15031 consists of the following parts, under the general title *Road vehicles — Communication between vehicle and external test equipment for emissions-related diagnostics*:

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

— *Part 2: Guidance on terms, definitions, abbreviations and acronyms*

— *Part 3: Diagnostic connector and related electrical circuits, specification and use*

— *Part 4: External test equipment*

— *Part 5: Emissions-related diagnostic services*

— *Part 6: Diagnostic trouble code definitions*

— *Part 7: Data link security*

Introduction

0.1 Overview

This International Standard consists of a number of parts which, taken together, provide a coherent self-consistent set of specifications to facilitate emissions-related diagnostics. ISO 15031-1 provides an introduction to the series of International Standards. ISO 15031-2 to ISO 15031-7 are based on Society of Automative Engineers (SAE) recommended practices. This part of ISO 15031 is based on SAE J1978.

This International Standard includes the communication between the vehicle's On-Board Diagnostics (OBD) systems and test equipment implemented across vehicles within the scope of the legislated emissions-related OBD.

To achieve this, it is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with 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 International Standard are broken into the following:

— Diagnostic services (layer 7), specified in:

  — ISO 15031-5 (emissions-related OBD);

— Presentation layer (layer 6), specified in:

  — ISO 15031-2, SAE J1930-DA;[4]

  — ISO 15031-5, SAE J1979-DA;[8]

  — ISO 15031-6, SAE J2012-DA (OBD);[10]

— Session layer services (layer 5), specified in:

  — ISO 14229-2 supports ISO 15765-4 DoCAN and ISO 14230-4 DoK-Line protocols;

  — ISO 14229-2 is not applicable to the SAE J1850 and ISO 9141-2 protocols;

— Transport layer services (layer 4), specified in:

  — DoCAN: ISO 15765-2 Transport protocol and network layer services;

  — SAE J1850: ISO 15031-5 Emissions-related diagnostic services;

  — ISO 9141-2: ISO 15031-5 Emissions-related diagnostic services;

  — DoK-Line: ISO 14230-4, ISO 15031-5 Emissions-related diagnostic services;

— Network layer services (layer 3), specified in:

  — DoCAN: ISO 15765-2 Transport protocol and network layer services;

  — SAE J1850: ISO 15031-5 Emissions-related diagnostic services;

  — ISO 9141-2: ISO 15031-5 Emissions-related diagnostic services;

  — DoK-Line: ISO 14230-4, ISO 15031-5 Emissions-related diagnostic services;

— Data link layer (layer 2), specified in:

  — DoCAN: ISO 15765-4;

  — CAN: ISO 11898-1, ISO 11898-2;

  — SAE J1850;

— ISO 9141-2;

— DoK-Line: ISO 14230-2;

— Physical layer (layer 1), specified in:

— DoCAN: ISO 15765-4;

— CAN: ISO 11898-1, ISO 11898-2;

— SAE J1850;

— ISO 9141-2;

— DoK-Line: ISO 14230-1;

in accordance with Table 1.

Table 1 — Legislated emissions-related OBD diagnostic specifications applicable to the OSI layers

<table>
<tr><th>Applicability</th><th>OSI seven layers</th><th colspan="6">Emissions-related OBD communication requirements</th></tr>
<tr><td rowspan="8">Seven layers according to ISO/IEC 7498-1 and ISO/IEC 10731</td><td>Application (layer 7)</td><td colspan="6">ISO 15031-5</td></tr>
<tr><td rowspan="2">Presentation (layer 6)</td><td colspan="6">ISO 15031-2, SAE J1930-DA
ISO 15031-5, SAE J1979-DA</td></tr>
<tr><td colspan="6">ISO 15031-6, SAE J2012-DA (OBD)</td></tr>
<tr><td>Session (layer 5)</td><td colspan="2">ISO 14229-2</td><td colspan="2">Not applicable</td><td colspan="2">ISO 14229-2</td></tr>
<tr><td>Transport (layer 4)</td><td rowspan="2">ISO 15765-2</td><td rowspan="3">ISO 15765-4</td><td rowspan="3" colspan="3">ISO 15031-5</td><td rowspan="4">ISO 14230-4</td></tr>
<tr><td>Network (layer 3)</td></tr>
<tr><td>Data link (layer 2)</td><td rowspan="2">ISO 11898-1,
ISO 11898-2</td><td rowspan="2">SAE J1850</td><td rowspan="2">ISO 9141-2</td><td>ISO 14230-2</td></tr>
<tr><td>Physical (layer 1)</td><td>ISO 14230-1</td></tr>
</table>

0.2 SAE document reference concept

This International Standard references several SAE documents which contain all terms, data, and DTC definitions.

See Figure 1 with the following definition of content in ISO 15031-2, ISO 15031-5, and ISO 15031-6:

— SAE J1930: 15031-2 is concerned with a procedure for naming objects and systems and with the set of words from which names are built. It references SAE J1930-DA which contains all standardized naming objects, terms, and abbreviations.

— SAE J1979: 15031-5 is concerned with the definition of emissions-related diagnostic services (diagnostic test modes). It references SAE J1979-DA which contains all standardized data items like PIDs, TIDs, OBDMIDs, and ITIDs.

— SAE J2012: 15031-6 is concerned with the procedure for defining emissions-related diagnostic trouble codes. It references SAE J2012-DA which contains all standardized data items like DTCs and FTBs.

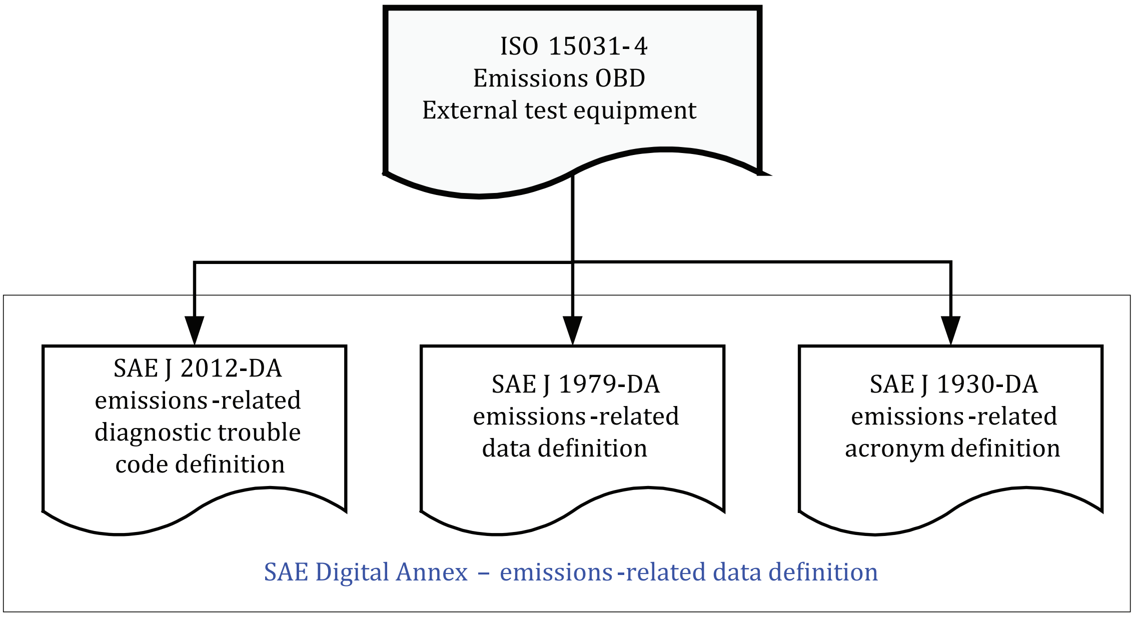

Figure 1 — SAE Digital Annex document reference

OBD regulations require passenger cars and light, medium, and heavy duty trucks to support a minimum set of diagnostic information to external (off-board) “generic” test equipment.

0.3 SAE Digital Annex revision procedure

New emissions-related regulatory requirements drive new in-vehicle technology to lower emissions. New technology related OBD monitor data and diagnostic trouble codes need to be standardized 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 15031-2, ISO 15031–5, and ISO 15031–6 reference a “Change Request Form” to be used for new data items to be defined by the SAE task force for standardization. The standardized data items will be defined in the SAE J1930-DA,[4] SAE J1979-DA,[8] and SAE J2012-DA.[10] Once the information has been balloted and approved, the documents will be published on the SAE Store website.

The revision request forms and instructions for updating the Registers to ISO 15031-2, ISO 15031-5, and ISO 15031-6 can be obtained from the Registration Authority’s website.

— For ISO 15031-2: http://www.sae.org/servlets/works/committeeHome.do?comtID=TEVDS7

  The column titled “Resources” shows a document with the title: J1930-DA_Revision_Request_Form.doc. Double click on the name and you will be asked to download the document with the filename “SAE_J1930-DA_Revision_Request_Form.doc”

— For ISO 15031-5: http://www.sae.org/servlets/works/committeeHome.do?comtID=TEVDS14

  The column titled “Resources” shows a document with the title: J1979-DA_Revision_Request_Form.doc. Double click on the name and you will be asked to download the document with the filename “SAE_J1979-DA_Revision_Request_Form.doc”

— For ISO 15031-6: http://www.sae.org/servlets/works/committeeHome.do?comtID=TEVDS9

  The column titled “Resources” shows a document with the title: J2012-DA_Revision_Request_Form.doc. Double click on the name and you will be asked to download the document with the filename “SAE_J2012-DA_Revision_Request_Form.doc”

Fill out the revision request form with your request.

Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics —

Part 4: External test equipment

1 Scope

This part of ISO 15031 specifies a set of standard diagnostic services to be provided by vehicles (OBD services). This part of ISO 15031 specifies a complementary set of facilities, to be provided by external test equipment, which will include scan tool facilities. These facilities provide complete, efficient, and safe access to all of the public OBD (on-board diagnosis) services on any vehicle, which is compliant with this part of ISO 15031.

This part of ISO 15031 specifies

— a means of establishing communications between an OBD-equipped vehicle and external test equipment, and

— a set of diagnostic services to be provided by the external test equipment in order to exercise the services defined in ISO 15031-5.

This part of ISO 15031 does not preclude the inclusion of additional capabilities or functions in external test equipment. However, it is the responsibility of the external test equipment designer to ensure that no such capability or function can adversely affect either an OBD-equipped vehicle, which may be connected to the external test equipment or the external test equipment itself.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7637-2:2011, *Road vehicles — Electrical disturbances from conduction and coupling — Part 2: Electrical transient conduction along supply lines only*

ISO 9141-2:1994, *Road vehicles — Diagnostic systems — Part 2: CARB requirements for interchange of digital information*

ISO 14230-2:2013, *Road vehicles — Diagnostic communication over K-Line (DoK-Line) — Part 2: Data link layer*

ISO 14230-4:2000, *Road vehicles — Diagnostic systems — Keyword Protocol 2000 — Part 4: Requirements for emission-related systems*

ISO 15031-2, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 2: Guidance on terms, definitions, abbreviations and acronyms*

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 15031-5, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 5: Emissions-related diagnostic services*

ISO 15031-6, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 6: Diagnostic trouble code definitions*

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

ISO 16750-2, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 2: Electrical loads*

SAE J1699-2, *Test Cases for OBD-II Scan Tools and I/M Test Equipment*

SAE J1850:*MAY2001, Class B Data Communications Network Interface*

3 Terms, definitions, symbols, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15031 (all parts) apply.

3.2 Abbreviated terms

Addr	address
DoCAN	diagnostic communication over Controller Area Networks
DoK-Line	diagnostic communication over K-Line
DTC	diagnostic trouble code
ECU	electronic control unit
IPT	in-use performance tracking
ITID	infotype identifier
MIL	malfunction indicator lamp
NRC	negative response code
OBDMID	on-board monitor identifier
OBD	on-board diagnostics
PID	parameter identifier
PWM	pulse width modulated
RPM	rounds per minute
TID	test identifier
VPM	variable pulse width

3.3 Symbols

%	percentage
A	ampere
°C	degree Celsius
Kbps	kilobits per second
km/h	kilometre per hour
kPa	kilopascal
mA	milliampere
ms	milliseconds
min^{-1}	1/minute
V	voltage

4 Conventions

This International Standard is based on the conventions discussed in the OSI Service Conventions (ISO/IEC 10731:1994) as they apply for diagnostic services.

5 Document overview

Figure 2 depicts the emissions-related OBD on ISO 15765-4, SAE J1850, ISO 9141-2, and ISO 14230-4 document references according to the OSI model.

The protocol initialization identifies whether ISO 15765-4 DoCAN, SAE J1850, ISO 14230-4 DoK-Line, or ISO 9141-2 is the data link layer supported by the vehicle. This International Standard references the standards as an applicable data link for emissions-related OBD.

ISO 15031-5 specifies the applicable emissions-related diagnostic services. This part of ISO 15031 specifies the data record structures and references SAE J1930-DA,[4] SAE J1979-DA,[8] and SAE J2012-DA.[10]

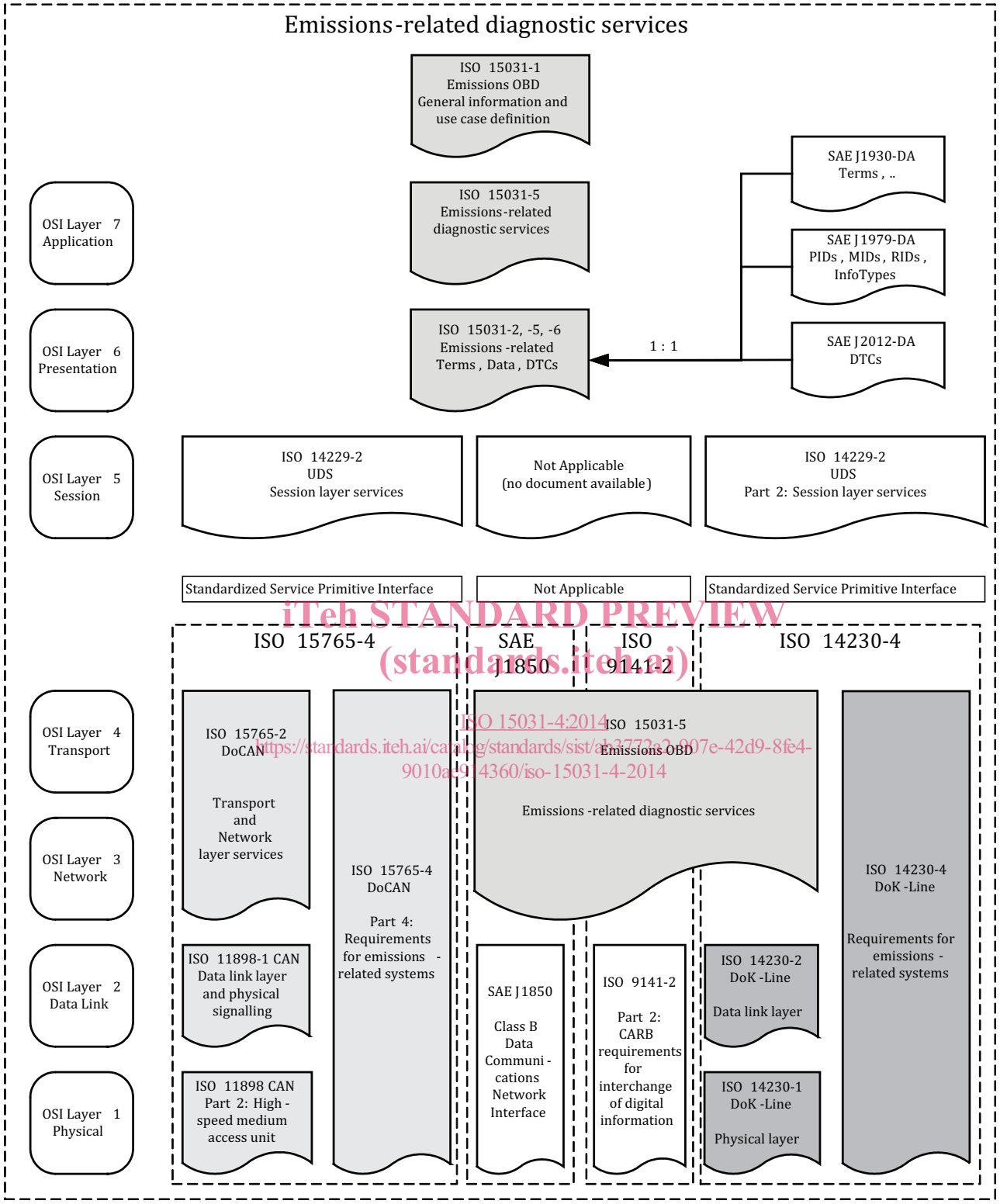

Figure 2 — Emissions-related OBD on ISO 15765-4, SAE J1850, ISO 9141-2, and ISO 14230-4 document references according to the OSI model

6 Required functions of the external test equipment

The following are the basic functions that the external test equipment is required to support or provide:

— automatic hands-off determination of the communication interface used to provide OBD services on the vehicle;

— obtaining and displaying the status and results of vehicle on-board diagnostic evaluations;

— obtaining and displaying OBD emissions-related diagnostic trouble codes (DTCs);

— obtaining and displaying OBD emissions-related current data;

— obtaining and displaying OBD emissions-related freeze frame data;

— clearing the storage of OBD emissions-related DTCs, freeze frame data storage, and diagnostic tests status;

— obtaining and displaying OBD emissions-related test parameters and results as described in ISO 15031-5;

— user manual and/or help facility.

7 Communication protocols

The following communication protocols shall be supported:

a) ISO 9141-2: The following specifications clarify and, if in conflict with ISO 9141-2, override any related specifications in ISO 9141-2:

   1) maximum sink current to be supported by the external test equipment is 100 mA;

   2) range for all tests performed relative to ISO 7637-2 is −1,0 V to +40,0 V;

   3) minimum bus idle period before the external test equipment shall transmit an address and shall be 300 ms;

b) SAE J1850 41,6 kbps pulse width modulated (PWM);

c) SAE J1850 10,4 kbps variable pulse width (VPW);

d) ISO 14230-4;

e) ISO 15765-4.

A fully compliant external test equipment shall support all communication protocols as specified in Clause 7.

Only one protocol is allowed to be used in any one vehicle to access all legislated emissions-related functions. The external test equipment is not required to support simultaneous use of different protocols.

8 Connections to the vehicle

To connect the external test equipment to the vehicle, the ISO 15031-3/SAE J1962 connector shall be used.