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

Part 5: Emissions-related diagnostic services

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

Partie 5: Services de diagnostic relatif aux émissions

Reference number
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ISO copyright office
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
www.iso.org

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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 documents 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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication.*

This third edition cancels and replaces the second edition (ISO 15031-5:2011), which has been technically revised.

ISO 15031 consists of the following parts, under the general title *Road vehicles — Communication between vehicle and external 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*

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Introduction

Overview

ISO 15031 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 through ISO 15031-7 are based on SAE recommended practices. This part of ISO 15031 is based on SAE J1979.

This International Standard includes the communication between the vehicle's On-Board Diagnostic (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 layers in accordance with Table 1.

— Diagnostic services (layer 7), specified in the following:
  — this part of ISO 15031;
  — ISO 27145-3 (WWH-OBD).
— Presentation layer (layer 6), specified in the following:
  — ISO 15031-2, SAE J1930-DA;
  — this part of ISO 15031, SAE J1979-DA;
  — ISO 15031-6, SAE J2012-DA;
  — ISO 27145-2, SAE J2012-DA.
— Session layer services (layer 5), specified in the following:
  — 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 the following:
  — ISO 15765-2;
  — SAE J1850 defined in this part of ISO 15031;
  — ISO 9141-2 defined in this part of ISO 15031;
  — ISO 14230-4, defined in this part of ISO 15031.
— Network layer services (layer 3), specified in the following:
  — ISO 15765-2;
  — SAE J1850 defined in this part of ISO 15031;
  — ISO 9141-2 defined in this part of ISO 15031;
  — ISO 14230-4 defined in this part of ISO 15031.
— Data link layer (layer 2), specified in the following:
  — ISO 15765-4, ISO 11898-1, and ISO 11898-2;

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- SAE J1850;
- ISO 9141-2;
- ISO 14230-2.

— Physical layer (layer 1), specified in the following:

- ISO 15765-4, ISO 11898-1, and ISO 11898-2;
- SAE J1850;
- ISO 9141-2;
- ISO 14230-1.

Table 1 — Legislated emissions-related OBD/WWH[a]-OBD diagnostic specifications applicable to the OSI layers

<table>
<tr><th>Applicability</th><th>OSI 7 layers</th><th colspan="6">Emissions-related OBD communication requirements</th><th colspan="3">Emissions-related WWH-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/SAE J1979</td><td colspan="3">ISO 27145-3</td></tr>
<tr><td rowspan="2">Presentation (layer 6)</td><td colspan="6">ISO 15031-2, ISO 15031-5, ISO 15031-6</td><td colspan="3">ISO 27145-2</td></tr>
<tr><td colspan="6">SAE J1930-DA, SAE J1979-DA, SAE J2012-DA</td><td colspan="3">SAE J1930-DA, SAE J1979-DA, SAE J2012-DA</td></tr>
<tr><td>Session (layer 5)</td><td colspan="2">Not applicable</td><td colspan="4">ISO 14229-2</td></tr>
<tr><td>Transport (layer 4)</td><td colspan="2" rowspan="2">ISO 15031-5</td><td rowspan="2">ISO 14230-4</td><td rowspan="2">ISO 15765-2</td><td rowspan="3">ISO 15765-4</td><td rowspan="2">ISO 15765-2</td><td rowspan="3">ISO 15765-4</td><td rowspan="2">ISO 13400-2</td></tr>
<tr><td>Network (layer 3)</td></tr>
<tr><td>Data link (layer 2)</td><td rowspan="2">SAE J1850</td><td rowspan="2">ISO 9141-2</td><td>ISO 14230-2</td><td rowspan="2">ISO 11898-1, ISO 11898-2</td><td rowspan="2">ISO 11898-1, ISO 11898-2</td><td rowspan="2">ISO 13400-3</td></tr>
<tr><td>Physical (layer 1)</td><td>ISO 14230-1</td></tr>
<tr><td colspan="10">[a] World-Wide Harmonized.</td></tr>
</table>

SAE document reference concept

ISO 15031 references several SAE documents which contain all terms, data, and DTC (diagnostic trouble code) definitions. This is illustrated in Figure 1.

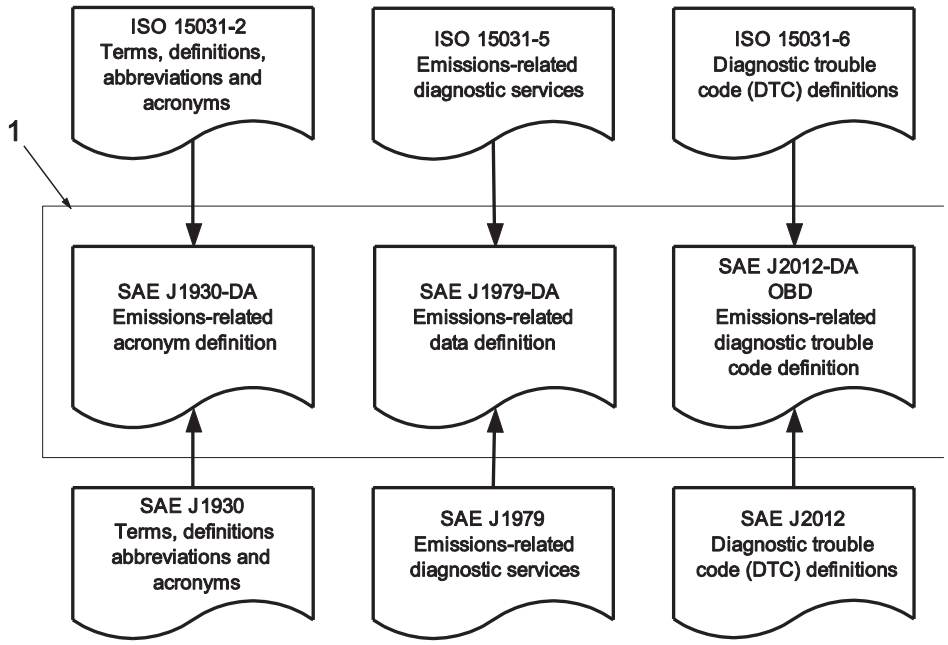
Additional information on the content of the referenced documents is given below:

— SAE J1930: the document 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: the document is concerned with the definition of emissions-related diagnostic services (diagnostic test modes). It references SAE J1979-DA which contains all standardized data items such as PIDs, Test IDs, Monitor IDs, and INFOTYPE IDs.

— SAE J2012: the document is concerned with the procedure for defining emissions-related DTCs. It references SAE J2012-DA which contains all standardized data items such as DTCs and FTBs (failure type bytes).

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Key

1 SAE Digital Annexes

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.

SAE J1979-DA (OBD) Digital Annex

This part of ISO 15031 references SAE J1979-DA. SAE J1979-DA is concerned with the definition of the following:

— Parameter Identifiers (PIDs);

— Test IDentifiers (TIDs);

— OBD Monitor Identifiers (OBDMIDs);

— Unit and Scaling Identifiers (UASIDs);

— INFOTYPEs (INFOTYPEs).

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 DTCs 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.

The revision request form and instructions for updating the registers to this part of ISO 15031 can be obtained on the Registration Authority's website at:

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 file name:

SAE_J1979-DA_Revision_Request_Form.doc

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Fill out the revision request form with your request.

Please send an e-mail with the completed revision request form as an attachment to:

SAE Headquarters
755 West Big Beaver Road
Suite 1600
Troy, MI 48084-4093, USA
Fax: +1 (248) 273-2494
Email: saej1979@sae.org

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

Part 5: Emissions-related diagnostic services

1 Scope

This part of ISO 15031 is intended to satisfy the data reporting requirements of On-Board Diagnostic (OBD) regulations in the United States and Europe and any other region that may adopt similar requirements in the future. This part of ISO 15031 specifies

a) message formats for request and response messages,

b) timing requirements between request messages from external test equipment and response messages from vehicles and between those messages and subsequent request messages,

c) behaviour of both the vehicle and external test equipment if data are not available, and

d) a set of diagnostic services, with corresponding content of request and response messages, to satisfy OBD regulations.

This part of ISO 15031 includes capabilities required to satisfy OBD requirements for multiple regions, model years, engine types, and vehicle types. Those regulations are not yet final for some regions and are expected to change in the future. This part of ISO 15031 makes no attempt to interpret the regulations and does not include applicability of the included diagnostic services and data parameters for various vehicle applications. The user of this part of ISO 15031 is responsible for verifying the applicability of each clause of this part of ISO 15031 for a specific vehicle, engine, model year, and region.

This part of ISO 15031 specifies diagnostic services and functionally addressed request/response messages required to be supported by motor vehicles and external test equipment for diagnostic purposes which pertain to motor vehicle emission-related data. Any external test equipment meeting the requirements of ISO 15031-4 use these messages to retrieve emissions-related information from the vehicle.

Each clause in this part of ISO 15031 which specifies additional details to existing clauses of ISO 9141-2, ISO 14230-4, SAE J1850, and ISO 15765-4 supersede those specifications.

This part of ISO 15031 references SAE J1979-DA (Digital Annex), which includes all definitions of PIDs, OBDMIDs, TIDs, and INFOTYPEs.

This part of ISO 15031 provides the mechanism to satisfy the requirements included in the country-specific regulations and not all capabilities included in this part of ISO 15031 are required by the country-specific regulations. This part of ISO 15031 is not considered a final authority for interpretation of the regulations. Therefore, readers should determine the applicability of capabilities defined in this part of ISO 15031 for their own specific needs.

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.

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

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

ISO 14230-2, *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 15765-2, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 2: Transport protocol and network layer services*

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

SAE J1930-DA, *Digital Annex of Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms*

SAE J1979-DA, *Digital Annex of E/E Diagnostic Test Modes*

SAE J2012-DA, *Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14229-2, ISO 14230-2, ISO 15031-2, and ISO 15765-2 and the following apply.

3.1.1
absolute throttle position sensor
value intended to represent the throttle opening

Note 1 to entry: For systems where the output is proportional to the input voltage, this value is the percent of maximum input signal. For systems where the output is inversely proportional to the input voltage, this value is 100 % minus the percent of maximum input signal. Throttle position at idle usually indicates greater than 0 % and throttle position at wide open throttle usually indicates less than 100 %.

3.1.2
bank
specific group of cylinders sharing a common control sensor

Note 1 to entry: Bank 1 always contains cylinder number 1 and bank 2 the opposite bank.

Note 2 to entry: If there is only one bank, the DTCs for bank #1 DTCs are used and the word bank may be omitted. With a single “bank” system utilizing multiple sensors, bank #1 DTCs are used in identifying the sensors as #1, #2, and #3 in order as they move further away from the cylinder.

3.1.3
base fuel schedule
fuel calibration schedule programmed into the powertrain control module or PROM when manufactured or when updated by an off-board source, prior to any learned on-board correction

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