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

Part 6: Diagnostic trouble code definitions

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

Partie 6: Définition des codes d'anomalie de diagnostic

Reference number
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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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 15031-6:2010), 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 J2012 (Diagnostic Trouble Code Definitions).

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 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:
  — ISO 15031-5 (emissions-related OBD);
  — ISO 27145-3 (WWH-OBD).
— Presentation layer (layer 6), specified in the following:
  — ISO 15031-2, SAE J1930-DA;
  — ISO 15031-5, SAE J1979-DA;
  — ISO 15031-6, SAE J2012-DA (OBD);
  — ISO 27145-2, SAE J2012-DA (WWH-OBD).
— 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 Transport protocol and network layer services;
  — SAE J1850 defined in ISO 15031-5 Emissions-related diagnostic services;
  — ISO 9141-2 defined in ISO 15031-5 Emissions-related diagnostic services;
  — ISO 14230-4 defined in ISO 15031-5 Emissions-related diagnostic services.
— Network layer services (layer 3), specified in the following:
  — ISO 15765-2 Transport protocol and network layer services;
  — SAE J1850 defined in ISO 15031-5 Emissions-related diagnostic services;
  — ISO 9141-2 defined in ISO 15031-5 Emissions-related diagnostic services;
  — ISO 14230-4 defined in ISO 15031-5 Emissions-related diagnostic services.
— Data link layer (layer 2), specified in the following:
  — ISO 15765-4, ISO 11898-1, 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, ISO 11898–2;
- SAE J1850;
- ISO 9141-2;
- ISO 14230-1.

Table 1 — Legislated emissions-related OBD/WWH-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 layer according to ISO/IEC 7498-1 and ISO/IEC 10731</td><td>Application (layer 7)</td><td colspan="6">ISO 15031-5</td><td colspan="3">ISO 27145-3</td></tr>
<tr><td rowspan="2">Presentation (layer 6)</td><td colspan="6">ISO 15031-2, -5, -6
SAE J1930-DA/SAE J1979-DA</td><td colspan="3">ISO 27145-2
SAE J1930-DA/SAE J1979-DA</td></tr>
<tr><td colspan="6">SAE J2012-DA (OBD)</td><td colspan="3">SAE J2012-DA (WWH-OBD)</td></tr>
<tr><td>Session (layer 5)</td><td colspan="2">Not applicable</td><td colspan="7">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 27145-4</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>
</table>

SAE document reference concept

ISO 15031 references several SAE documents which contain all terms, data, and DTC definitions.

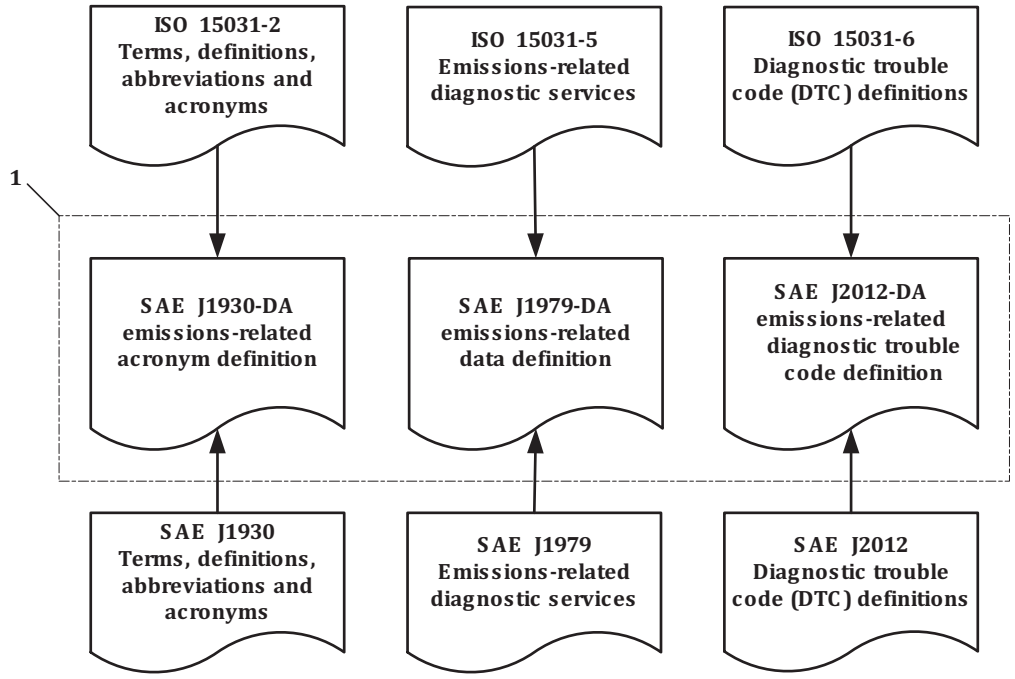
See Figure 1 with the following definition of content in this International Standard.

— 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 like PIDs, test IDs, monitor IDs, and InfoType IDs.

— SAE J2012: the document 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.

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Key

1 SAE Digital Annexes

Figure 1 — SAE Digital Annex document reference

On-Board Diagnostic (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. 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.

SAE J2012-DA (OBD) Digital Annex

This part of ISO 15031 references SAE J2012-DA. SAE J2012-DA is concerned with the definition of DTCs (diagnostic trouble codes) and FTB (failure type byte) information.

SAE J2012-DA (OBD) includes several appendices for

— diagnostic trouble code naming guidelines,

— powertrain system diagnostic trouble codes,

— network communication system, body systems, chassis systems, and

— DTC failure category and subtype definition.

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.

Revision request forms 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=TEVDS9

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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.

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

SAE Headquarters
755 West Big Beaver Road
Suite 1600
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Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics —

Part 6: Diagnostic trouble code definitions

1 Scope

This part of ISO 15031 provides uniformity for standardized diagnostic trouble codes (DTC) that electrical/electronic On-Board Diagnostic (OBD) systems of motor vehicles are required to report when malfunctions are detected. It further provides guidance for uniform messages (text descriptor) associated with these codes.

This part of ISO 15031 specifies the rules and guidelines for the definition of the following:

a) the diagnostic trouble code format, which consists of the following:

   1) addressing format;

   2) structure;

   3) messages;

b) a description of the standardized set of diagnostic trouble codes and descriptions contained in SAE J2012-DA. The two most significant bytes of a DTC may be decoded according to two different lists in two formats: DTC Format Identifier 00_{16} and 04_{16};

c) a description of the standardized set of diagnostic trouble codes subtypes known as failure types contained in SAE J2012-DA (applies only when 3-byte DTCs are used).

This part of ISO 15031 specifies all general rules and guidelines to define new diagnostic trouble codes. This part of ISO 15031 references SAE J2012-DA (Digital Annex), which includes all standardized DTCs (number and text descriptor) as well as all diagnostic trouble codes subtypes known as failure types.

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/IEC 10731:1994, *Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definition of OSI services*

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

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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 15031-2 apply.

3.2 Abbreviated terms

B1S1	Bank 1 Sensor 1
B1S2	Bank 1 Sensor 2
B1S3	Bank 1 Sensor 3
B2S1	Bank 2 Sensor 1
B2S2	Bank 2 Sensor 2
B2S3	Bank 2 Sensor 3
BARO	barometric atmospheric pressure
CVN	calibration verification number
DTC	diagnostic trouble code
ECM	engine control module
ISR	interrupt service routine
LSB	least significant bit
MAF	mass air flow
MAP	manifold absolute pressure
MIL	malfunction indicator light
MSB	most significant bit
OBD	On-Board Diagnostics
OSI	Open Systems Interconnection
PCM	powertrain control module
SI	international system of units
TCM	transmission control module

4 Conventions

ISO 15031 is based on the conventions discussed in the OSI Service Conventions (ISO/IEC 10731) as they apply for diagnostic services.

5 Document overview

Figure 2 illustrates the document references.

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