INTERNATIONAL STANDARD

ISO 15031-6

Second edition
2010-08-15

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
ISO 15031-6:2010(E)

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Published in Switzerland

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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 15031-6 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second edition cancels and replaces the first edition (ISO 15031-6:2005), which has been 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*

Introduction

0.1 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. Parts 2 through 7 are based on SAE recommended practices. This part of ISO 15031 is based on SAE J2012.

ISO 15031-1 provides an introduction to the series of International Standards.

This document set 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 ISO 15031 are broken into the following layers in accordance with Table 1:

— diagnostic services (layer 7), specified in
  — ISO 15031-5 (emissions-related OBD);
  — ISO 27145-3 (WWH-OBD);
— presentation layer (layer 6), specified in
  — ISO 15031-2, SAE J1930-DA;
  — ISO 15031-5, SAE J1979-DA;
  — this part of ISO 15031, SAE J2012-DA (OBD);
  — ISO 27145-2, SAE J2012-DA (WWH-OBD);
— session layer services (layer 5), specified in
  — ISO 14229-2 support ISO 15765-4 DoCAN and ISO 14230-4 DoK-Line protocols;
  — ISO 14229-2 are not applicable to the SAE J1850 and ISO 9141-2 protocols;
— transport layer services (layer 4), specified in
  — ISO 15765-2;
  — SAE J1850 defined in ISO 15031-5;
  — ISO 9141-2 defined in ISO 15031-5;
  — ISO 14230-4 defined in ISO 15031-5;

— network layer services (layer 3), specified in

  — ISO 15765-2;

  — SAE J1850 defined in ISO 15031-5;

  — ISO 9141-2 defined in ISO 15031-5;

  — ISO 14230-4 defined in ISO 15031-5;

— data link layer (layer 2), specified in

  — ISO 15765-4, ISO 11898-1 and ISO 11898-2;

  — SAE J1850;

  — ISO 9141-2;

  — ISO 14230-2;

— physical layer (layer 1), specified in

  — 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[1)]-OBD diagnostic specifications applicable to the OSI layers

<table>
<tr><th>Applicability</th><th>OSI 7 layers</th><th colspan="3">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="3">ISO 15031-5</td><td colspan="3">ISO 27145-3</td></tr>
<tr><td rowspan="2">Presentation (layer 6)</td><td colspan="3">ISO 15031-2, ISO 15031-5, ISO 15031-6</td><td colspan="3">ISO 27145-2</td></tr>
<tr><td colspan="3">SAE J1930-DA/SAE J1979-DA/
SAE J2012-DA (OBD)</td><td colspan="3">SAE J2012-DA (WWH-OBD)</td></tr>
<tr><td>Session (layer 5)</td><td colspan="2">ISO 14229-2</td><td colspan="2">Not Applicable</td><td>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 colspan="3" rowspan="2">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>

1) World-Wide Harmonized

0.2 SAE document reference concept

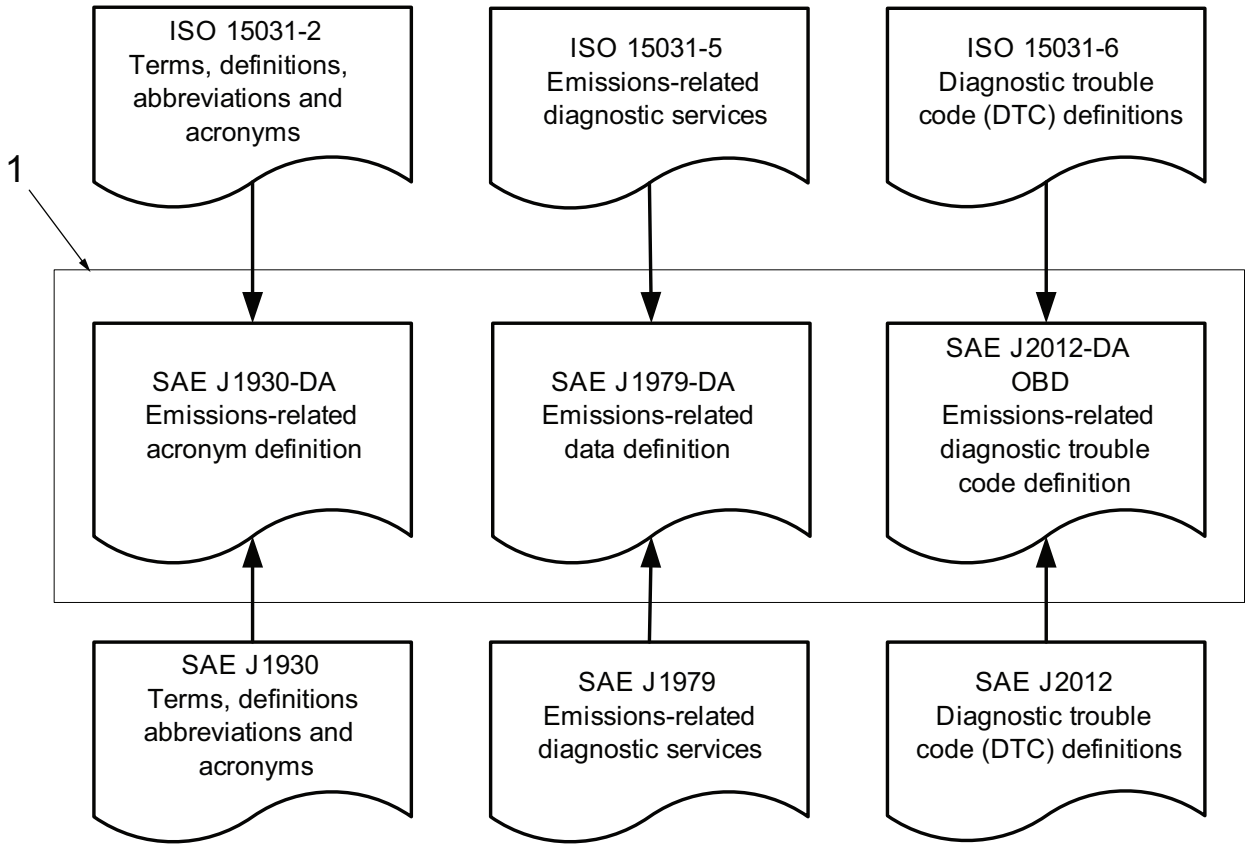
ISO 15031 references several SAE documents which contain all terms, data and DTC (diagnostic trouble code) definitions.

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 like 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 like DTCs and FTBs (failure type bytes).



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.

0.3 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 and FTB information.

SAE J2012-DA (OBD) includes several appendices for:

— DTC naming guidelines;

— powertrain system DTCs;

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

— DTC failure category and subtype definition.

0.4 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.

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

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 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
mailto: saej2012@sae.org

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 also 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:

a) the DTC format, which consists of:

   1) addressing format;

   2) structure;

   3) messages;

b) a standardized set of DTC and descriptions;

c) a standardized set of DTC subtypes known as failure types.

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

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 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*

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 10731:1994) as they apply for diagnostic services.

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. ISO 15031 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, SAE J1979-DA and SAE J2012-DA which include all emissions-related OBD data definitions.

5 Document overview

Figure 2 illustrates the document references.

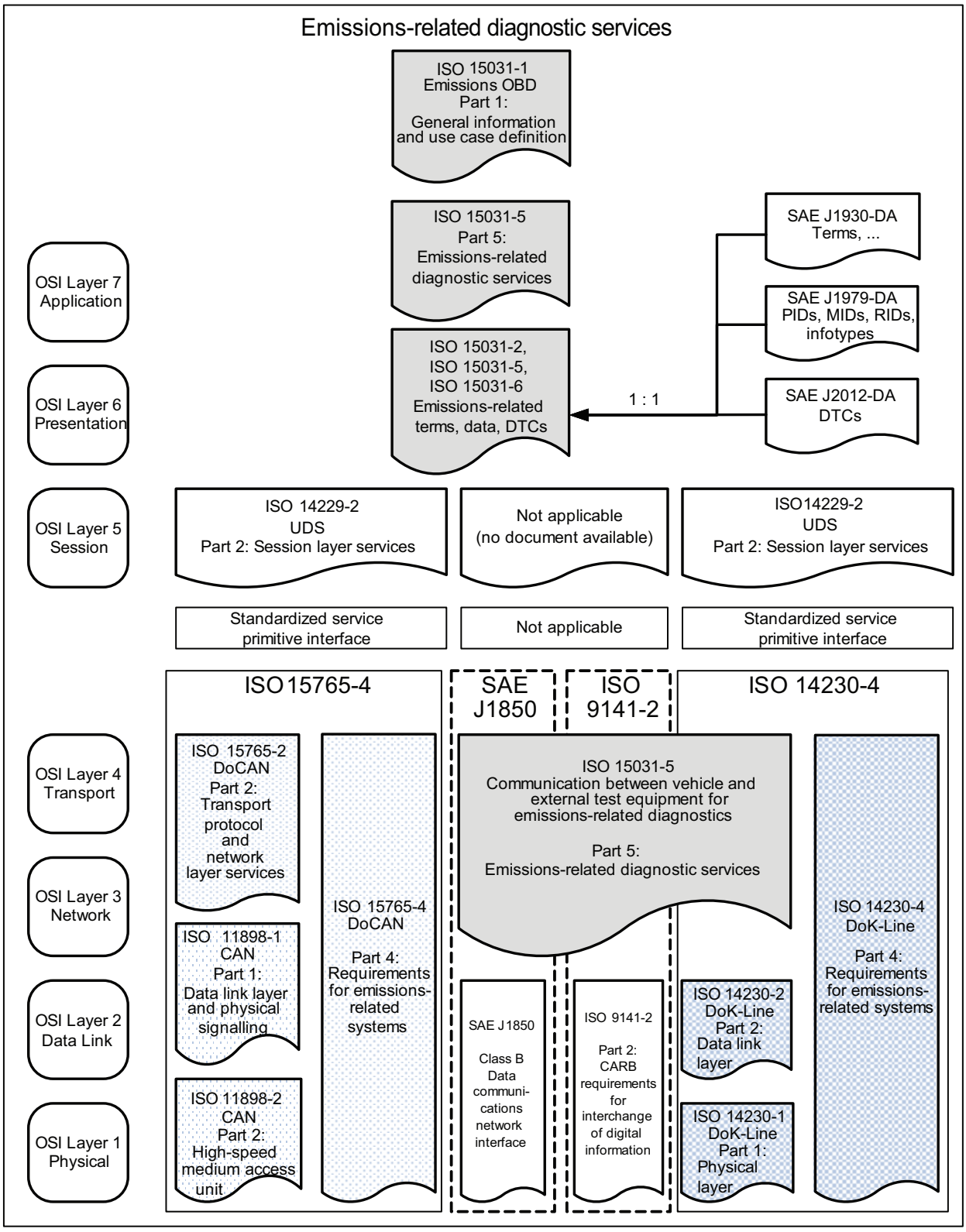


Figure 2 — Emissions-related OBD on ISO 15765-4, SAE J1850, ISO 9141-2, ISO 14230-4 document reference according to OSI model

6 General specification

6.1 General code information

Table 2 specifies systems, code categories, hexadecimal values and particular sections of electrical/electronic systems diagnostic.

Table 2 — General code specifications

System	Code categories	Hex value	Appendix
Body	B0*xxx* – B3*xxx*	8*xxx* - B*xxx*	B
Chassis	C0*xxx* – C3*xxx*	4*xxx* - 7*xxx*	C
Powertrain	P0*xxx* – P3*xxx*	0*xxx* - 3*xxx*	P
Generic/network	U0*xxx* – U3*xxx*	C*xxx* - F*xxx*	U

The recommended DTCs consist of a three digit numeric code preceded by an alphanumeric designator. The alphanumeric designators are “B0”, “B1”, “B2”, “B3”, “C0”, “C1”, “C2”, “C3”, “P0”, “P1”, “P2”, “P3”, “U0”, “U1”, “U2”, “U3”, corresponding to four sets of body, four sets of chassis, four sets of powertrain and four sets of network trouble codes. The code structure itself is partially open-ended. A portion of the available numeric sequences (portions of “B0”, “C0”, “P0”, “P2”, “P3”, “U0” and “U3”) is reserved for uniform codes assigned by this or future updates. Detailed specifications of the DTC format structure are specified in Clause 7. Most circuit, component, or system DTCs that do not support a subfault strategy are specified by four basic categories:

— circuit/open,

— range/performance,

— circuit low,

— circuit high.

“Circuit low” is measured with the external circuit, component, or system connected. The signal type (voltage, frequency, etc.) shall be included in the message after “circuit low” or “circuit high”.

“Circuit high” is measured with the external circuit, component, or system connected. The signal type (voltage, frequency, etc.) may be included in the message after “circuit low” or “circuit high”.

6.2 Sensor location definition

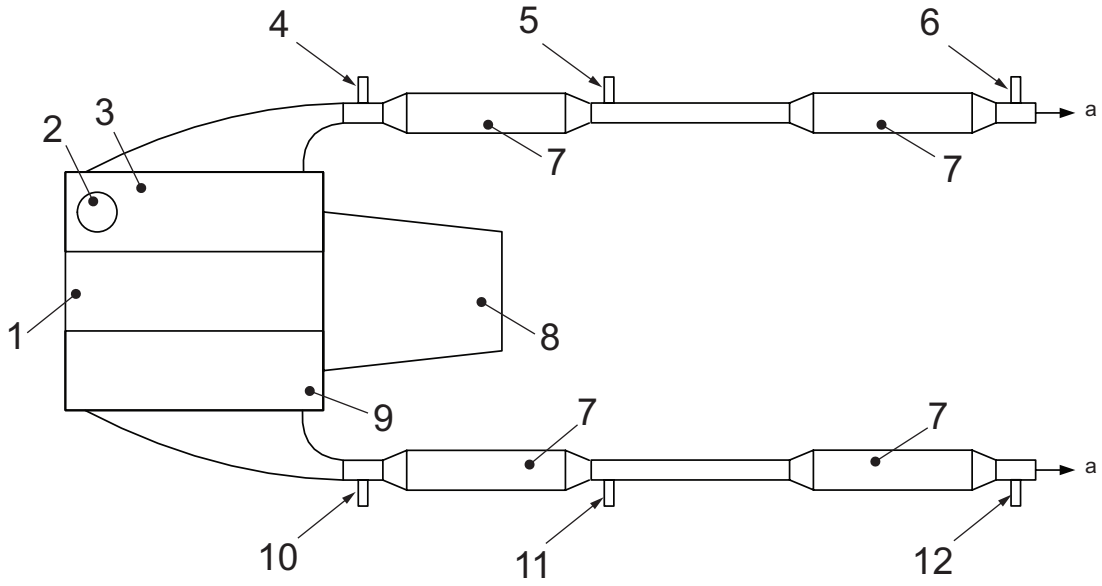
6.2.1 General

This subclause defines the location of sensor(s) in relation to the engine airflow, starting from the fresh air intake through to the vehicle tail pipe or fuel flow from the fuel tank to the engine, numbered 1, 2, 3, etc.

If there is only one bank, use bank #1 DTCs and the word “bank” may be omitted. With a single “bank” system using multiple sensors, use bank #1.

NOTE See Figure 3 through Figure 7.

6.2.2 Definition of V6/V8/V12 cylinder engine with two exhaust banks and four catalysts



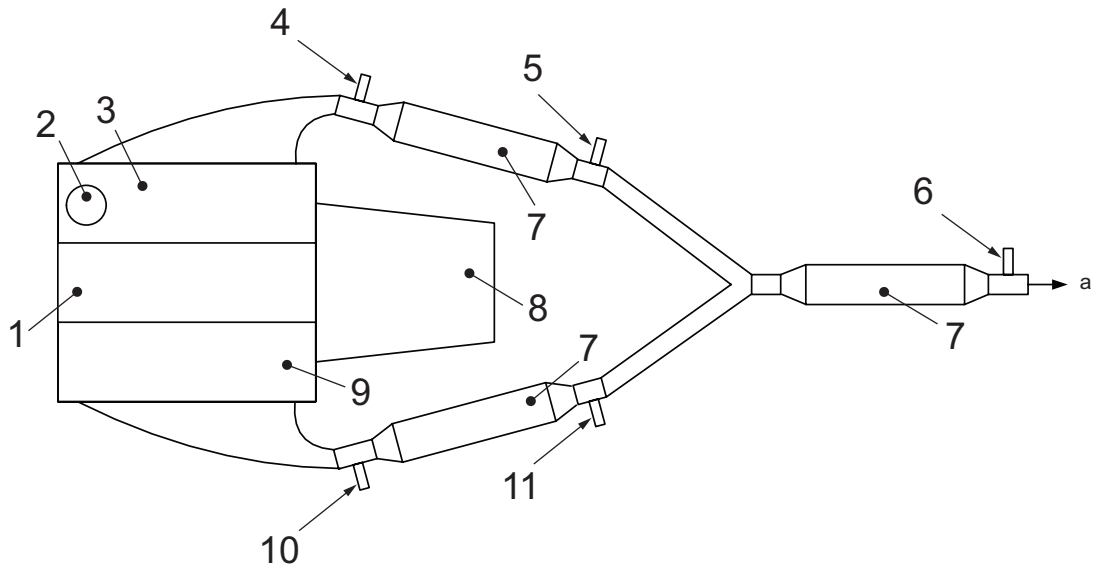
Key

1	V6/V8/V12 cylinder engine	7	catalyst
2	cylinder 1	8	transmission
3	cylinder bank 1 exhaust bank 1	9	cylinder bank 2 exhaust bank 2
4	B1S1 – Bank 1 Sensor 1 wide range	10	B2S1 – Bank 2 Sensor 1 wide range
5	B1S2 – Bank 1 Sensor 2 heated	11	B2S2 – Bank 2 Sensor 2 heated
6	B1S3 – Bank 1 Sensor 3 heated	12	B2S3 – Bank 2 Sensor 3 heated

[a] To tail pipe.

Figure 3 — V6/V8/V12 cylinder engine with two exhaust banks and four catalysts

6.2.3 Definition of V6/V8/V12 cylinder engine with two exhaust banks and three catalysts



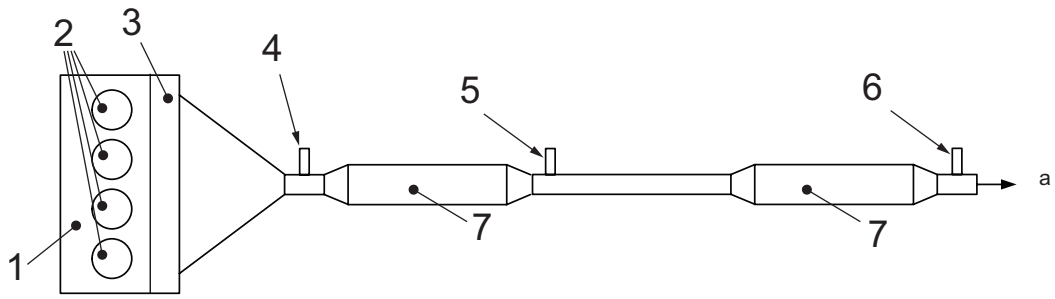
Key

1 V6/V8/V12 cylinder engine
2 cylinder 1
3 cylinder bank 1 exhaust bank 1
4 B1S1 – Bank 1 Sensor 1 wide range
5 B1S2 – Bank 1 Sensor 2 heated
6 B1S3 – Bank 1 Sensor 3 heated
7 catalyst
8 transmission
9 cylinder bank 2 exhaust bank 2
10 B2S1 – Bank 2 Sensor 1 wide range
11 B2S2 – Bank 2 Sensor 2 heated

[a] To tail pipe.

Figure 4 — V6/V8/V12 cylinder engine with two exhaust banks and three catalysts

6.2.4 Definition of L4/L5/L6 cylinder engine with one exhaust bank and two catalysts



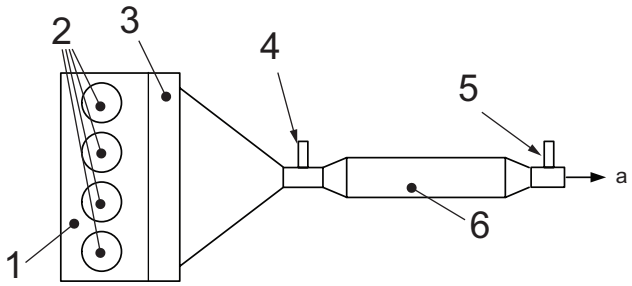
Key

1 L4 cylinder engine
2 cylinders 1 to 4 (from top to bottom)
3 exhaust bank 1
4 B1S1 – Bank 1 Sensor 1 wide range
5 B1S2 – Bank 1 Sensor 2 heated
6 B1S3 – Bank 1 Sensor 3 heated
7 catalyst

[a] To tail pipe.

Figure 5 — L4/L5/L6 cylinder engine with one exhaust bank and two catalysts

6.2.5 Definition of L4/L5/L6 cylinder engine with one exhaust bank and one catalyst



Key

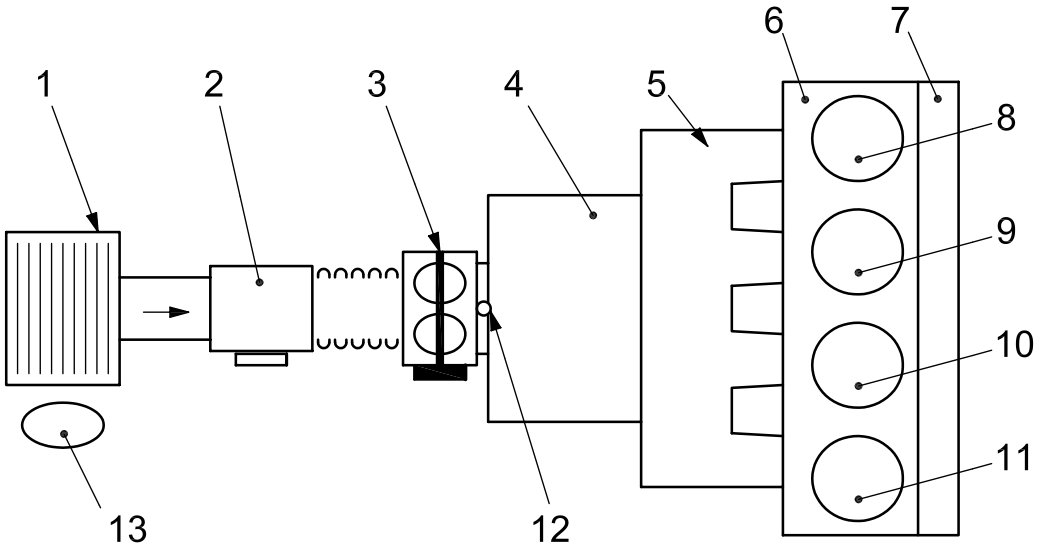
1	L4 cylinder engine	4	B1S1 – Bank 1 Sensor 1 wide range
2	cylinders 1 to 4 (from top to bottom)	5	B1S2 – Bank 1 Sensor 2 heated
3	exhaust bank 1	6	catalyst

[a] To tail pipe.

Figure 6 — L4/L5/L6 cylinder engine with one exhaust bank and one catalyst

6.2.6 Definition of turbocharger/supercharger pressure sensor location draw-through system

The intake air system pressure sensor location for boosted applications in relation to the engine airflow includes the fresh air inlet, boost device and engine manifold.



Key

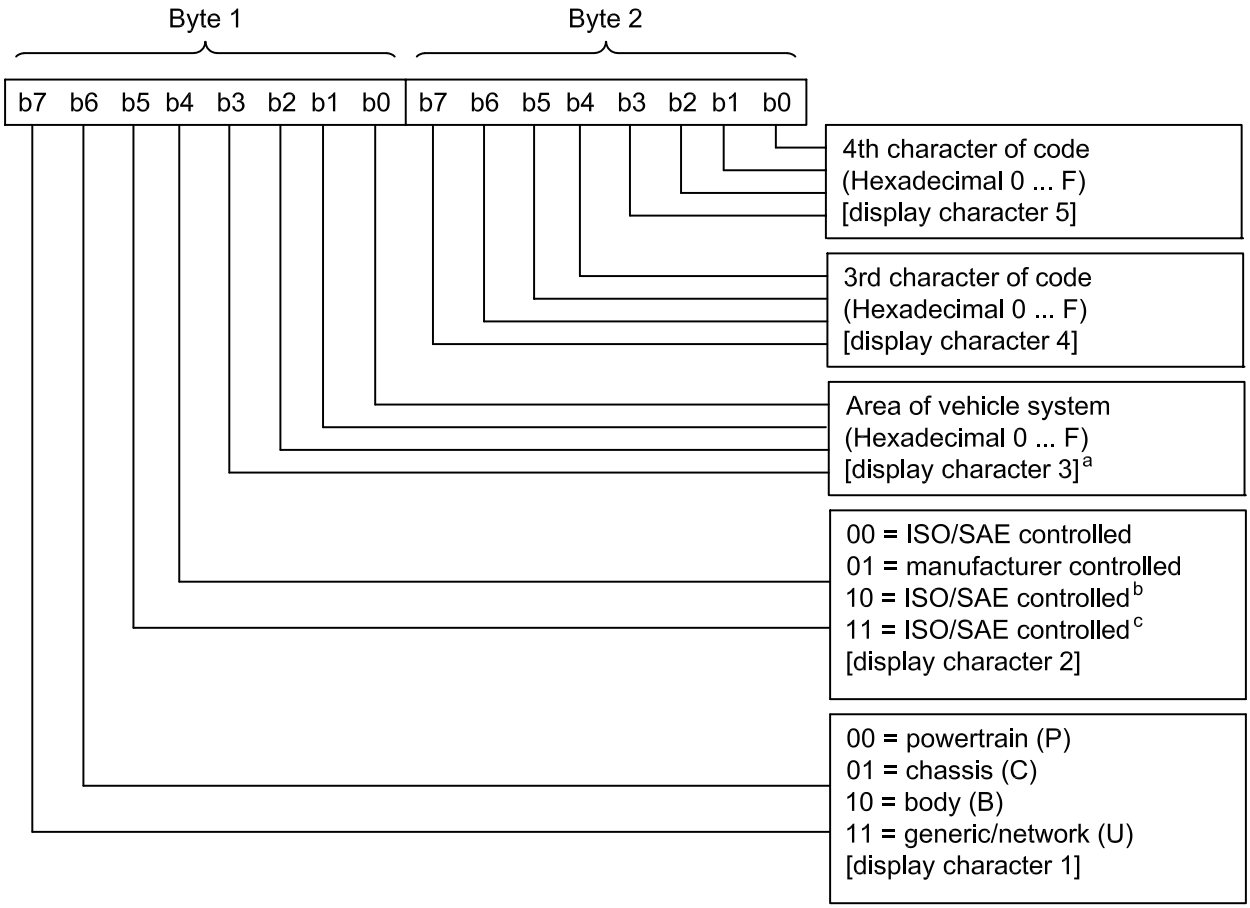
1	air cleaner	8	cylinder 1
2	MAF	9	cylinder 2
3	throttle body	10	cylinder 3
4	turbocharger/supercharger	11	cylinder 4
5	MAP (manifold pressure closest to the intake valves)	12	inlet (pressure after the throttle body, but before the pressurizing device)
6	L4 cylinder engine		
7	exhaust bank 1	13	BARO (atmospheric pressure)

Figure 7 — Turbocharger/supercharger pressure sensor location draw-through system

7 Format structure

7.1 Description

Figure 8 illustrates the diagnostic trouble code which consists of an alphanumeric designator, B0 – B3 for body, C0 – C3 for chassis, P0 – P3 for powertrain, and U0 – U3 for network communication, followed by three characters. The assignment of the proper alpha designator should be determined by the area most appropriate for that function. In most cases, the alpha designator will be implied, since diagnostic information will be requested from a particular controller. However, this does not imply that all codes supported by a particular controller shall have the same alphanumeric designator.



a "Display character 3" is used to identify a specific vehicle area. Within any area, display characters 4 and 5 allow up to 256 code definitions.

b For powertrain: these bits are ISO/SAE controlled, for all others they are manufacturer controlled.

c For powertrain: 11 = manufacturer controlled for P3000 to P33FF; 11 = ISO/SAE reserved for P3400 to P3FFF.

Figure 8 — Structure of DTCs

EXAMPLE 1 The 2-byte DTC as a data bus value 0×9234 would be displayed to technicians as the manufacturer controlled body code B1234; see Table 3.

Table 3 — Example of 2-byte diagnostic trouble code structure

DTC high byte									DTC low byte							
0×9				0×2					0×3				0×4			
1	0	0	1	0	0	1	0		0	0	1	1	0	1	0	0
B		1		2					3				4			

EXAMPLE 2 The 3-byte DTC as a data bus value 0×923400 would be displayed to technicians as the manufacturer controlled body code B1234-00; see Table 4 for DTC low byte (failure type byte) definitions. The low byte shall be displayed in hexadecimal format e.g. 0×1A shall be displayed as 1A.

Table 4 — Example of 3-byte diagnostic trouble code structure

DTC high byte									DTC middle byte									DTC low byte								
0×9				0×2					0×3				0×4					0×0				0×0				
1	0	0	1	0	0	1	0		0	0	1	1	0	1	0	0		0	0	0	0	0	0	0	0	
B		1		2					3				4					0				0				

Codes have been specified to indicate a suspected trouble or problem area and are intended to be used as a directive to the proper service procedure. To minimize service confusion, fault codes should not be used to indicate the absence of problems or the status of parts of the system (e.g. powertrain system OK, or MIL activated), but should be confined to indicate areas in need of service attention.

Ranges have been expanded beyond 100 numbers by using the hexadecimal base 16 number system.

7.2 ISO/SAE controlled codes (core DTCs)

ISO/SAE controlled DTCs are those codes where industry uniformity has been achieved. These codes were felt to be common enough across most manufacturers' applications that a common number and fault message could be assigned. All unspecified numbers in each grouping are ISO/SAE reserved for future growth. Although service procedures may differ widely amongst manufacturers, the fault being indicated is common enough to be assigned a particular fault code. Codes in this area are not to be used by manufacturers until they have been approved by ISO/SAE.

7.3 Manufacturer controlled codes (non-uniform DTCs)

Areas within each alpha designator have been made available for manufacturer-controlled DTCs. These are fault codes that will not generally be used by a majority of the manufacturers due to basic system differences, implementation differences, or diagnostic strategy differences. Each vehicle manufacturer or supplier who designs and specifies diagnostic algorithms, software, and DTCs is strongly encouraged to remain consistent across their product line when assigning codes in the manufacturer controlled area. It is recommended that powertrain codes use the same groupings as in the ISO/SAE controlled area, i.e. 100 s and 200 s for fuel and air metering, 300 s for ignition system or misfire, etc.

While each manufacturer has the ability to define the controlled DTCs to meet their specific controller algorithms, all DTC words shall meet the requirements of ISO 15031-2 for information that should be made public.

7.4 Body system groupings — DTC numbers and descriptions are given in SAE J2012-DA

Table 5 defines the DTC range controlled by ISO/SAE and the manufacturer and the DTC range reserved by this part of ISO 15031.

Table 5 — Body system groupings

DTC range	Description
B0000 – B0FFF	ISO/SAE controlled
B1000 – B1FFF	Manufacturer controlled
B2000 – B2FFF	Manufacturer controlled
B3000 – B3FFF	Reserved by ISO 15031-6/SAE J2012

7.5 Chassis system groupings — DTC numbers and descriptions are given in SAE J2012-DA

Table 6 defines the DTC range controlled by ISO/SAE and the manufacturer and the DTC range reserved by this part of ISO 15031.

Table 6 — Chassis system groupings

DTC range	Description
C0000 – C0FFF	ISO/SAE controlled
C1000 – C1FFF	Manufacturer controlled
C2000 – C2FFF	Manufacturer controlled
C3000 – C3FFF	Reserved by ISO 15031-6/SAE J2012

7.6 Powertrain system groupings — DTC numbers and descriptions are given in SAE J2012-DA

Table 7 defines the DTC range controlled by ISO/SAE and the manufacturer and the DTC range reserved by this part of ISO 15031.

Table 7 — Powertrain system groupings

DTC range	Description
P0000 – P0FFF	ISO/SAE controlled
P1000 – P1FFF	Manufacturer controlled
P2000 – P2FFF	ISO/SAE controlled
P3000 – P33FF	Manufacturer controlled
P3400 – P3FFF	ISO/SAE controlled

7.7 Generic/Network groupings — DTC numbers and descriptions are given in SAE J2012-DA

Table 8 defines the DTC range controlled by ISO/SAE and the manufacturer and the DTC range reserved by this part of ISO 15031.

Table 8 — Generic/Network groupings

DTC range	Description
U0000 – U0FFF	ISO/SAE controlled
U1000 – U1FFF	Manufacturer controlled
U2000 – U2FFF	Manufacturer controlled
U3000 – U3FFF	ISO/SAE controlled

8 Diagnostic trouble code descriptions

8.1 Diagnostic trouble code application

Recent developments have expanded the scope of this documentation to include additional DTCs and descriptions for network systems, body systems, and chassis systems.

Two different DTC application methods are required depending on the system.

a) Powertrain DTCs require the assignment of a unique DTC number and description for each failure mode (e.g. circuit low, circuit high, rationality, etc.).

b) Body and chassis systems descriptions are more general and require the assignment of a single DTC number and description for each component, not failure mode.

Unique body and chassis failure mode identification is still possible, but is dependent upon using diagnostic protocols that support a subfault failure strategy. One example is ISO 14229-1, which uses a “failure type byte” associated with each DTC to describe the failure mode (e.g. circuit low, circuit high, rationality, etc.). However, any protocol supporting a subfault strategy will work with these DTCs. Manufacturers must select the appropriate failure mode to apply to the base DTC description.

It is recommended that standardized powertrain DTCs be used for faults detected by chassis or body systems, where applicable, e.g. a chassis ECU may store a P0502-00 vehicle speed sensor “A” circuit low DTC instead of defining a new DTC for that specific fault.

8.2 Powertrain systems

The powertrain systems category covers functions that include engine, transmission and associated drivetrain accessories. For powertrain systems, each specified fault code has been assigned a description to indicate the circuit, component or system area that was determined to be at fault. The descriptions are organized such that different descriptions related to a particular sensor or system are grouped together. In cases where there are various fault descriptions for different types of faults, the group also has a “generic” description as the first code/message of the group. A manufacturer has a choice when implementing diagnostics, based on the specific strategy and complexity of the diagnostic.

Where more specific fault descriptions for a circuit, component or system exist, the manufacturer should choose the code most applicable to their diagnosable fault. The descriptions are intended to be somewhat general to allow manufacturers to use them as often as possible yet still not conflict with their specific repair procedures. The terms “low” and “high”, when used in a description, especially those related to input signals, refer to the voltage, frequency, etc., at the pin of the controller. The specific level of “low” and “high” shall be specified by each manufacturer to best meet their needs.

For example, in diagnosing a 5 V reference throttle position sensor (TP sensor), if the input signal at the powertrain control module (PCM) is stuck at near 0 V, a manufacturer has the flexibility to select from either of two codes – P0120 (throttle/pedal position sensor/switch A circuit) or P0122 (throttle/pedal position sensor/switch A circuit low), depending on the manufacturer's diagnostic procedures. If the input signal at the PCM is stuck at near 5 V, a manufacturer has the flexibility to select from either of two codes – P0120 (throttle/pedal position sensor/switch A circuit) or P0123 (throttle/pedal position sensor/switch A circuit high), depending on the manufacturer's diagnostic procedures. If the input signal at the PCM is stuck at 1,5 V at idle instead of the expected 1,0 V, the manufacturer has the flexibility to select from either of two codes – P0120 (throttle/pedal position sensor/switch A circuit) or P0121 (throttle/pedal position sensor/switch A circuit range/performance), depending on the manufacturer's diagnostic procedures. The root cause of the higher than expected TP sensor voltage may be either a faulty TP sensor, corrosion in the TP sensor connections or an improperly adjusted throttle plate. Identification of the root cause is done using the diagnostic procedures and is not implied by the DTC message, thus allowing the manufacturer the flexibility in assigning DTCs.

8.3 Body systems

The body systems category covers functions that are, generally, inside of the passenger compartment. These functions provide the vehicle occupants with assistance, comfort, convenience, and safety. Each specified trouble code has been assigned a description to indicate the component or system area that was determined to be at fault. Unlike powertrain systems, the body system trouble code descriptions are intended to be general. Powertrain DTCs typically include separate DTCs for each failure mode (e.g. circuit low, circuit high, rationality, etc.) within each DTC description. Body system DTCs are designed to only support the base component in the description, which makes these DTCs dependent upon diagnostic protocols that support a subfault failure strategy. Manufacturers must select the appropriate failure mode (e.g. circuit short to ground, circuit short to battery, signal plausibility failure, etc.) to apply to the general DTC description. The supported body subsection included in this group is “restraints”.

8.4 Chassis systems

The chassis systems category covers functions that are, generally, outside of the passenger compartment. These functions typically include mechanical systems such as brakes, steering and suspension. Each specified trouble code has been assigned a description to indicate the component or system area that was determined to be at fault. Unlike powertrain systems, the chassis system trouble code descriptions are intended to be general. Powertrain DTCs typically include separate DTCs for each failure mode (e.g. circuit low, circuit high, rationality, etc.) within each DTC description. Chassis system DTCs are designed to only support the base component in the description, which makes these DTCs dependent upon diagnostic protocols that support a subfault failure strategy. Manufacturers must select the appropriate failure mode (e.g. circuit short to ground, circuit short to battery, signal plausibility failure, etc.) to apply to the general DTC description. The supported chassis subsections included in this group are “brakes” and “traction control”.

8.5 Network and vehicle integration systems

The network communication and vehicle integration systems category covers functions that are shared among computers or systems on the vehicle. Each specified trouble code has been assigned a description to indicate the component or system area that was determined to be at fault. The descriptions of data links are intended to be general in order to allow manufacturers to use them for different communication protocols. The descriptions of control modules are intended to be general in order to allow manufacturers to reuse the DTC for new control modules as technologies evolve. Also, the descriptions may be supplemented with additional subfault information such as the “failure type byte” data defined in SAE J2012-DA. The subclauses included in this group are “network electrical”, “network communication”, “network software”, “network data”, and “control module/power distribution”.

Bibliography

[1] ISO/IEC 7498-1:1994, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

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

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

[4] ISO 11898-1, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

[5] ISO 11898-2, *Road vehicles — Controller area network (CAN) — Part 2: High-speed medium access unit*

[6] ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*

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

[8] ISO 14230-1, *Road vehicles — Diagnostic systems — Keyword Protocol 2000 — Part 1: Physical layer*

[9] ISO 14230-2, *Road vehicles — Diagnostic systems — Keyword Protocol 2000 — Part 2: Data link layer*

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

[11] ISO 15031-1, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 1: General information and use case definition*

[12] ISO 15765-2, *Road vehicles — Diagnostics on Controller Area Networks (CAN) — Part 2: Network layer services*

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

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

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

[16] SAE J1930, *Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms*

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

[18] SAE J1979, *E/E Diagnostic Test Modes*

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

[20] SAE J2012, *Diagnostic Trouble Code Definitions*

[21] SAE J2012-DA, *Digital Annex of Diagnostic Trouble Code Definitions*

[22] SAE J1850, Class B Data Communications Network Interface

ICS 13.040.50; 43.040.10

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