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Road vehicles — Implementation of Word-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements — Part 6: External test equipment

Véhicules routier — Mise en œuvre des exigences de communication du diagnostic embarqué mondial harmonisé (WWH-OBD) — Partie 6: Equipement d'essai externe

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html~~the following URL:~~.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This second edition cancels and replaces the first edition (ISO 27145-6:2015), which has been technically revised.

The main changes ~~compared to the previous edition~~ are as follows:

— clarification about cable length;

— rewording for a better clarification of requirements.

A list of all parts in the ISO 27145 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

Introduction

Overview

This document 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).

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

This document 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 this document 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-DA, SAE J1939-73:2022, 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 ISO 27145-4 with reference to ISO 13400-2, ISO 15765-2, and ISO 15765-4,

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

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

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

in accordance with Table 1.

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

Applicability	OSI seven layer	WWH-OBD document reference		
Seven ~~layer~~layers according to ISO/IEC 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO 14229-1, ISO 27145-3		~~ISO 27145-6~~ this document
	Presentation (layer 6)	ISO 27145-2, SAE J1930-DA, SAE J1939-DA, SAE J1939-73:2022, 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 and 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)			

SAE document reference concept

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

ISO 27145-2 defines a common data dictionary for this document, according to the definitions in the following documents (Figure 1):

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

— SAE J1939-DA and SAE J1939-73: the digital annex 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. These FMIs are described in SAE J1939-73:2022, Appendix A;

— 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.
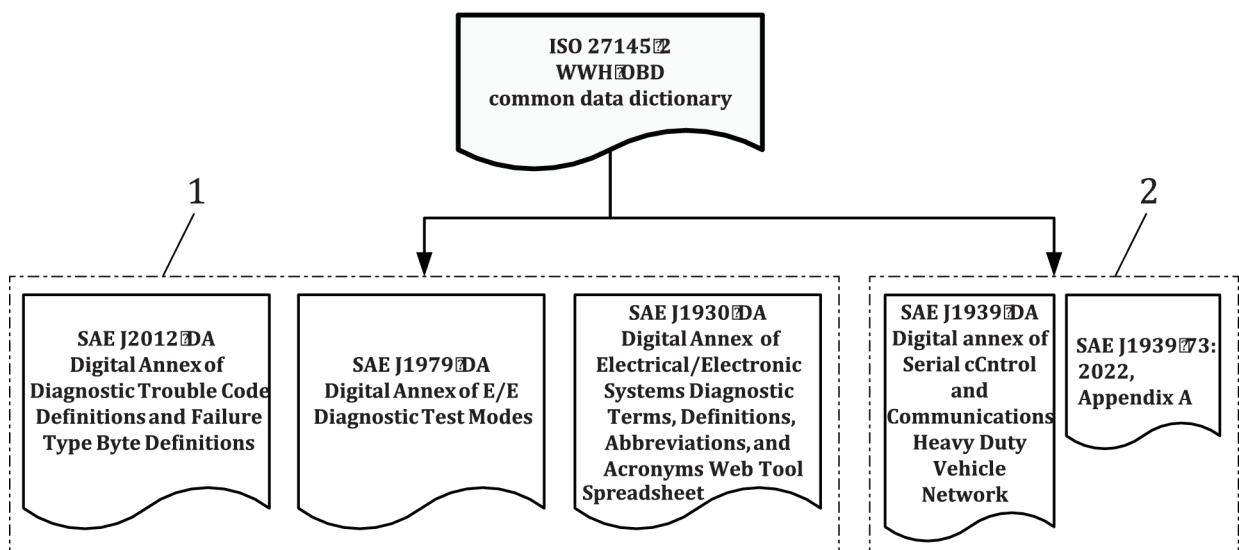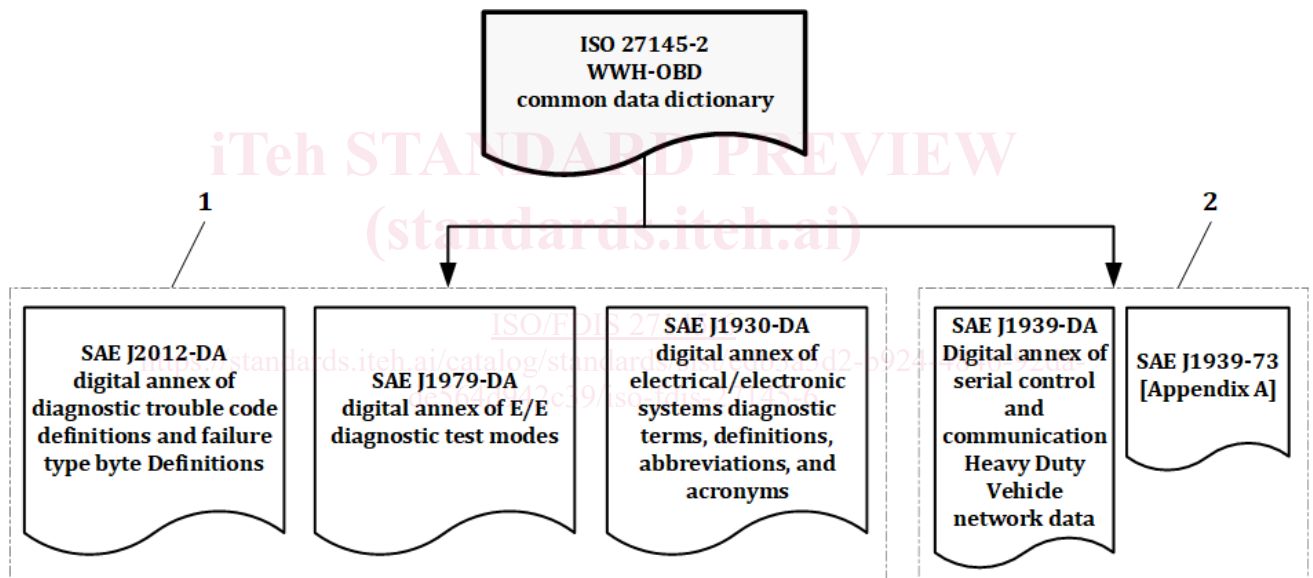
Key

1   SAE digital annexes: data definitions

2   SAE J1939 series of documents: DTC definitions

Figure 1 — SAE digital annex document reference

Road vehicles — Implementation of Word-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements — Part 6: External test equipment

1 Scope

This document defines the requirements for the external test equipment as:

— a means of establishing communications between a WWH-OBD-equipped vehicle and external test equipment;

— a set of diagnostic services, including addressing methods, to be provided by the external test equipment in order to exercise the services defined in ISO 27145-3.

This document describes the minimum capabilities or functions in the external test equipment. Additional ~~functionality~~functionalities, for example, non WWH-OBD protocols or retrieval of repair and maintenance information, can be integrated into the external test equipment according to the test equipment manufacturer needs. The external test equipment designer ensures that no such capability or function can adversely affect either a WWH-OBD-equipped vehicle connected to the equipment, or the equipment itself.

When the external test equipment implements functionality, which is not covered by ISO 27145-3, this functionality is not linked to the timing requirements defined in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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--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: Application layer*

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

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 15765-4, *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*

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*

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, ISO 14229-1, and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.2 Abbreviated terms

CALID	calibration identification
CAN	Controller Area Network
d.c.	direct current
DoCAN	Diagnostics over CAN
DoIP	Diagnostics over IP
DTC	Diagnostic Trouble Code
EMC	electromagnetic compatibility
ESD	electrostatic discharge
ETEREC	external test equipment recommendation
ETEREQ	external test equipment requirement
FMI	Failure Mode Identifier
GTR	Global Technical Regulations
HMI	Human-Machine Interface
IP	Internet Protocol
IUPR	In Use (Monitor) Performance Ratio
MVCI	Modular Vehicle Communication Interface
MI	Malfunction Indication
MIL	Malfunction Indication Lamp
NRC	Negative Response Code
ODX	Open Diagnostic data eXchange
VIN	vehicle identification number

4   Conventions

This document is based on the conventions discussed in the OSI service conventions (ISO/IEC 10731) as they apply to diagnostic services.

5   Document overview

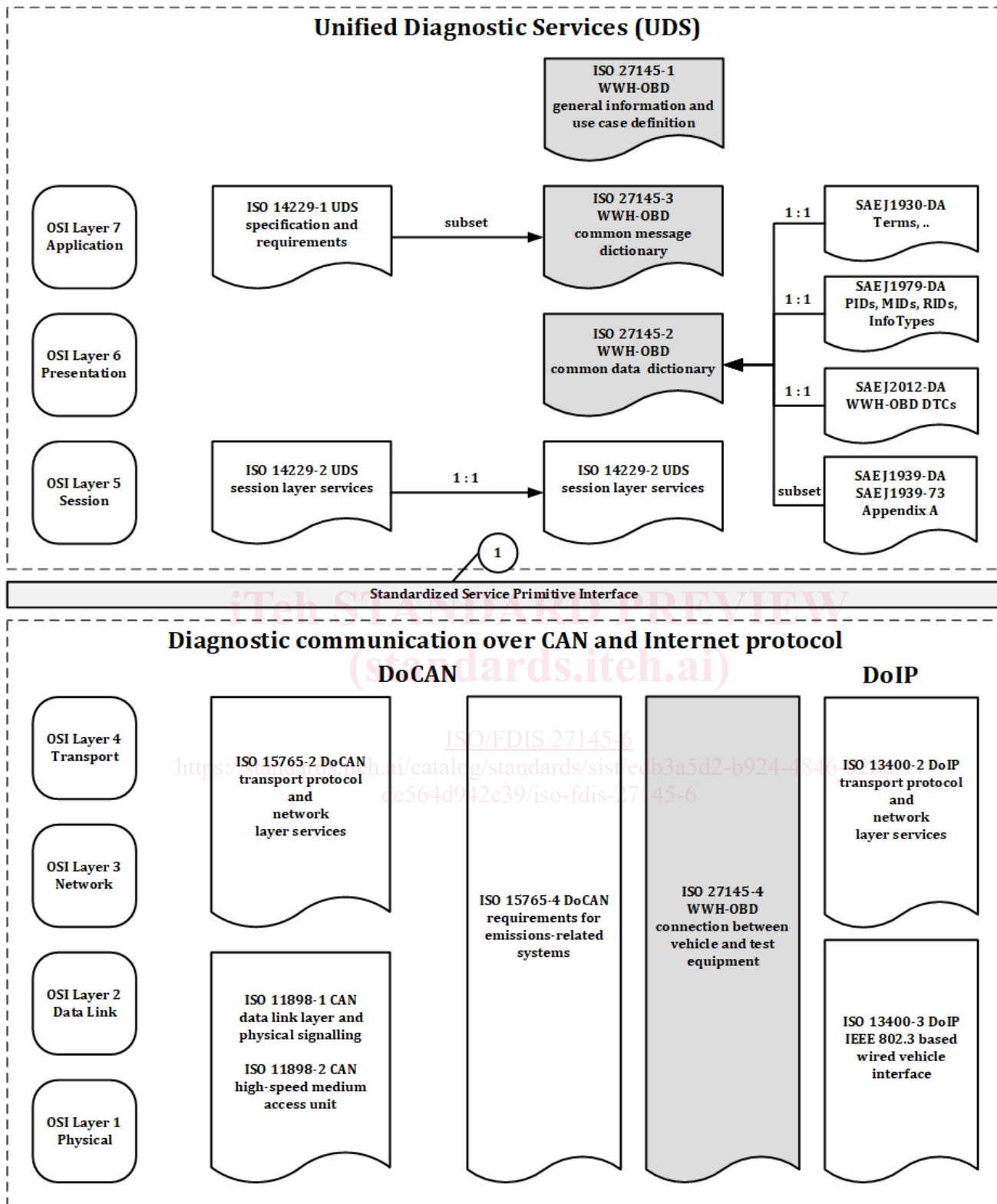Figure 2 shows the reference documents for this document.

This document specifies the following references:

a)   ISO 27145-1 specifies the general structure of this document and the use cases applicable to WWH-OBD GTR;

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

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

2)   SAE J1939-DA contains all SPNs (parameters), PGNs (messages), and other SAE J1939 data previously published in the SAE J1939 top level document;

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

3)   SAE J1939-73:2022, Appendix A specifies the FMIs;

4)   SAE 1979-DA specifies all data items;

5)   SAE J2012-DA specifies the DTC definitions and failure type byte definitions;

c)   This document 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)   ISO 27145-4 specifies the initialization procedure and includes references to:

1)   ISO 15765-4 DoCAN;

2)   the ISO 13400 series DoIP.

Unified Diagnostic Services (UDS)

		ISO 27145-1 WWH-OBD general information and use case definition		

OSI Layer 7
Application

ISO 14229-1 UDS
specification and
requirements

subset →

ISO 27145-3
WWH-OBD
common message
dictionary

1 : 1

SAE J1930-DA
Terms, ..

1 : 1

SAE J1979-DA
PIDs, MIDs, RIDs,
InfoTypes

OSI Layer 6
Presentation

ISO 27145-2
WWH-OBD
common data dictionary

1 : 1

SAE J2012-DA
WWH-OBD DTCs

OSI Layer 5
Session

ISO 14229-2 UDS
session layer services

1 : 1 →

ISO 14229-2 UDS
session layer services

subset

SAE J1939-DA
SAE J1939-73
Appendix A

1

Standardized Service Primitive Interface

Diagnostic communication over CAN and Internet protocol

DoCAN   **DoIP**

OSI Layer 4
Transport

ISO 15765-2 DoCAN
transport protocol
and
network
layer services

ISO 13400-2 DoIP
transport protocol
and
network
layer services

OSI Layer 3
Network

ISO 15765-4 DoCAN
requirements for
emissions-related
systems

ISO 27145-4
WWH-OBD
connection between
vehicle and test
equipment

OSI Layer 2
Data Link

ISO 11898-1 CAN
data link layer and
physical signalling

ISO 11898-2 CAN
high-speed medium
access unit

ISO 13400-3 DoIP
IEEE 802.3 based
wired vehicle
interface

**OSI Layer 1**
Physical

Key
1   The standardized service primitive interface is specified in ISO 14229-2.

**Figure 2 — Reference documents for implementation of WWH-OBDonCAN
and WWH-OBDonIP according to the OSI model**

6 Requirements overview and principles

6.1 Basic principles for the graphical notation

The flow graphs show the behaviour of the external test equipment. Hierarchical references, e.g. are shown using round edged transparent rectangles. Figure 3 shows the notation semantics.
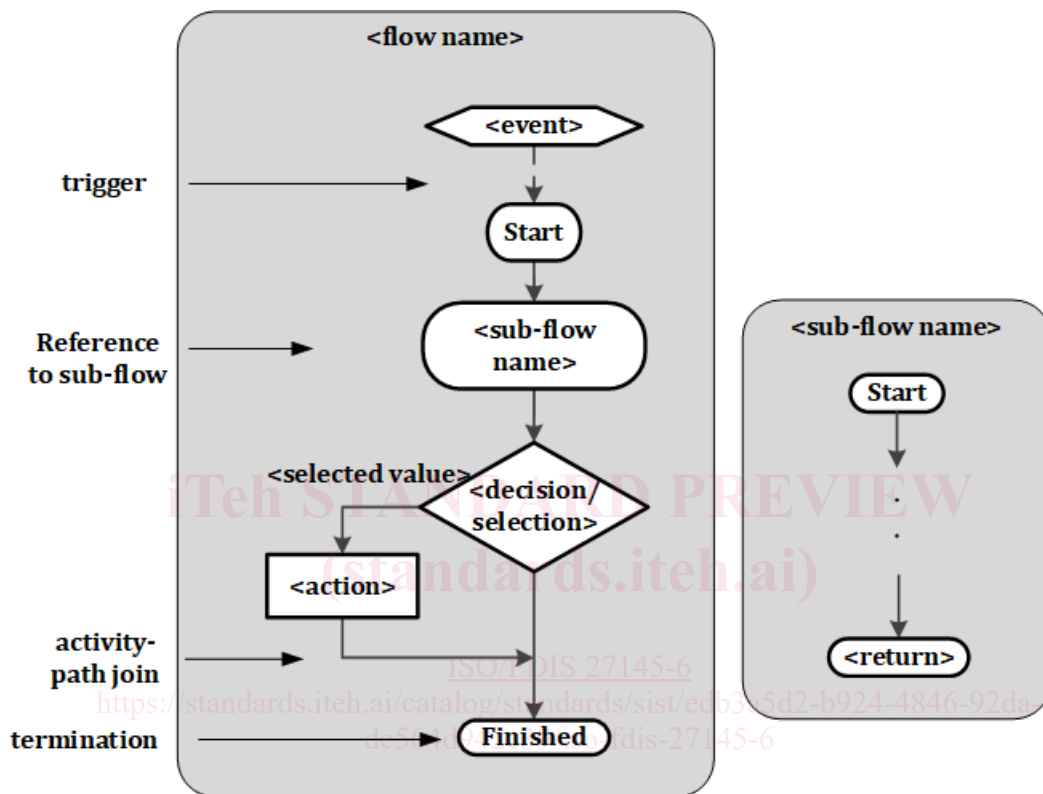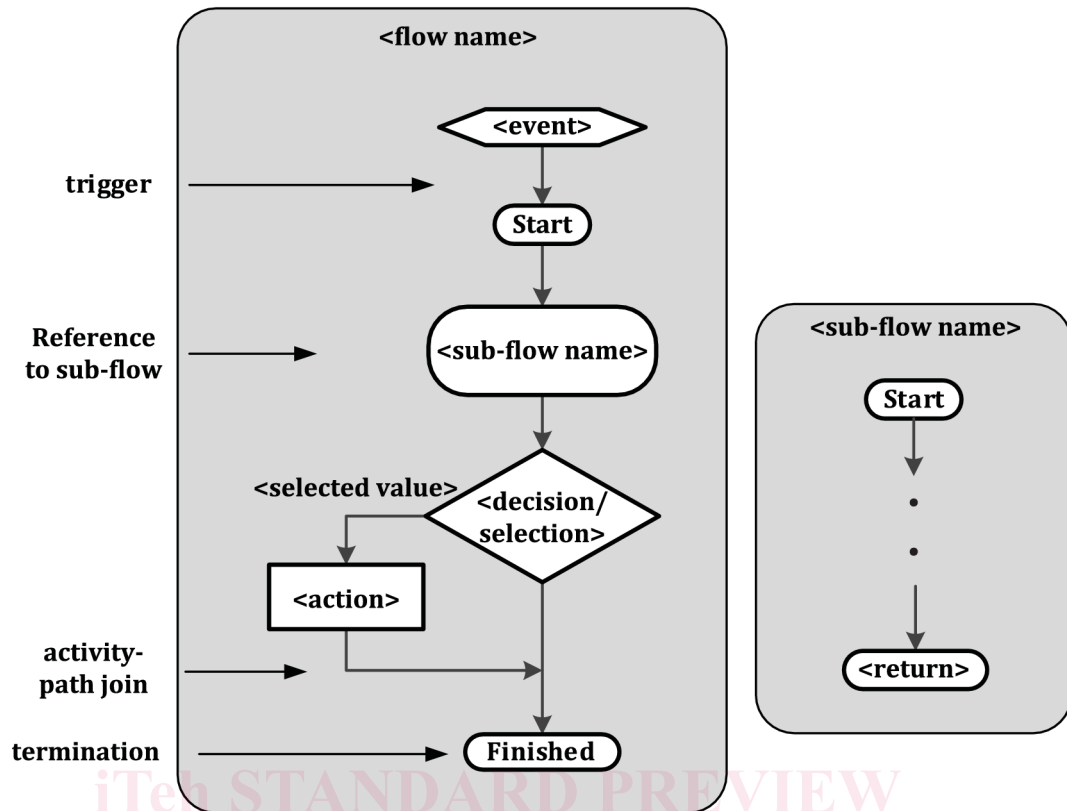
Figure 3 — Flow graph notation semantics used in this document

6.2 Requirements clustering

6.2.1 Overview

Each requirement in this document is assigned to one requirements cluster. The clusters cover technical areas where the assigned requirements apply for.

Table 2 lists the technical requirements clusters. The table provides an overview of all requirements clusters and the associated technical requirements. This list is a summary of the requirements included in this document.

Each technical requirement is identified by the mnemonic "ETEREQ-" and an alpha-numeric number. In addition, the alpha-numeric number includes the requirement cluster classifier according to Table 2.

Recommendations intended to guide the implementation are identified by the mnemonic "ETEREC-".

6.2.2 Main requirements clusters

Table 2 provides an overview of the main clusters of external test equipment requirements. A requirement cluster has at least one requirement and optional recommendations.

Table 2 — Main requirements clusters

#	Main title of cluster	Classifier	Brief description	Related requirements and recommendations