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Road vehicles — End-of-life activation of on-board pyrotechnic devices —

Part 3: Tool requirements

Véhicules routiers — Activation de fin de vie des dispositifs pyrotechniques embarqués —
Partie 3: Exigences de l'outil

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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 26021-3 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 26021 consists of the following parts, under the general title *Road vehicles — End-of-life activation of on-board pyrotechnic devices*:

- *Part 1: General information and use case definitions*

- *Part 2: Communication requirements*
- *Part 3: Tool requirements*
- *Part 4: Additional communication line with bidirectional communication*
- *Part 5: Additional communication line with pulse width modulated signal*

Introduction

Worldwide, nearly all new vehicles are equipped with one or more safety systems. This can include advanced protection systems based on pyrotechnic actuators. All components which contain pyrotechnic substances can be handled in the same way.

Recycling these vehicles demands a new process to ensure that the deactivation of airbags is safe and cost-efficient. Due to the harmonization of the on-board diagnostic (OBD) interface, there is a possibility of using it for on-board deployment, which is based on the same tools and processes.

Representatives of the global automobile industry agreed that automobile manufacturers

— do not support reuse as an appropriate treatment method for pyrotechnic devices,

— believe treatment of pyrotechnic devices is required before shredding, and

— support in-vehicle deployment as the preferred method.

Based on this agreement, the four big associations of automobile manufacturers (ACEA, Alliance, JAMA and KAMA) started to develop a method for the “in-vehicle deployment of pyrotechnic components in cars with the pyrotechnic device deployment tool (PDT)”. The objective is that in the future a dismantler will use only one tool without any accessories to deploy all pyrotechnic devices inside an end-of-life vehicle (ELV) by using an existing interface to the car.

It is necessary to test and to validate the development of the disposal functionality inside the pyrotechnical control unit (PCU).

Road vehicles — End-of-life activation of on-board pyrotechnic devices —

Part 3: Tool requirements

1 Scope

This part of ISO 26021 specifies the technical requirements to realize tool requirements for end-of-life activation of on-board pyrotechnic devices. It defines a test tool for ISO 26021 disposal functionality as well as the requirement for the final pyrotechnical device deployment tool (PDT). The focus is the definition of the human interface and the interfaces to the vehicle. It also defines general requirements for tests to validate the disposal functionality of the PCU. It specifies two tool use cases.

— Tool use case 1 – deployment test tool (DTT):
  — a development tool used to test and validate the PCU;
  — the target users of this tool are the engineers of the PCU suppliers and the OEMs;
  — the use case defines the human interface, the interfaces to the vehicle (CAN & ACL) and concrete test sequences.
— Tool use case 2 – pyrotechnic device deployment tool (PDT):
  — the final tool that is used to dispose of pyrotechnical devices in vehicles;
  — the target users of this tool are dismantlers;
  — the use case defines the human interface, the interfaces to the vehicle (CAN & ACL), the environmental conditions and the deployment sequences.

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

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 15031-4, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 4: External test equipment*

ISO 26021-1, *Road vehicles — End-of-life activation of on-board pyrotechnic devices — Part 1: General information and use case definitions*

ISO 26021-2:2008, *Road vehicles — End-of-life activation of on-board pyrotechnic devices — Part 2: Communication requirements*

ISO 26021-4:2008, *Road vehicles — End-of-life activation of on-board pyrotechnic devices — Part 4: Additional communication line with bidirectional communication*

ISO 26021-5:2008, *Road vehicles — End-of-life activation of on-board pyrotechnic devices — Part 5: Additional communication line with pulse width modulated signal*

3 Terms and definitions

For the purposes of this document, the definitions given in ISO 14229-1 and the following apply.

3.1
key
data value sent from the external test equipment to the on-board controller in response to the seed for gaining access to the locked services

3.2
pyrotechnic device deployment tool
tool to be plugged into the diagnostic connector in order to communicate via the in-vehicle network with all control units which are able to activate pyrotechnic devices, implementing the communication sequence as defined in ISO 26021-1, ISO 26021-2, ISO 26021-4 and ISO 26021-5, to trigger the PCUs to perform the required deployment sequence

3.3
pyrotechnic control unit
electronic control unit on the vehicle network, which controls the activation of pyrotechnic devices

3.4
safing unit
part of the PCU, for example an electromechanical switch or separate processor, that allows the deployment microprocessor (µP) to deploy the pyrotechnic devices via the driver stage

3.5
safing
mechanism of which the primary purpose is to prevent an unintended functioning of the PCU processor prior to detection of a crash situation

3.6
ScrappingProgramModule
program module responsible for firing the selected pyrotechnic device loops one by one

3.7
ScrappingProgramModuleLoader
program module loader responsible for converting the scrapping program module to an executable format

3.8
seed
data value sent from the on-board controller to the external test equipment, which is processed by the security algorithm, to produce the key

4 Symbols and abbreviated terms

ACL	additional communication line
AB	airbag
CAN	controller area network
DTT	deployment test tool
DTT-LB	deployment test tool load box
ELV	end-of-life vehicle
GND	ground
ID	identification
IDIS	international dismantling information system[1)]
I/O	input/output
LSB	least significant bit
MSB	most significant bit
OBD	on-board diagnostic
OEM	original equipment manufacturer
PC	personal computer
PCU	pyrotechnic control unit
PDT	pyrotechnic device deployment tool
PWM	pulse width modulated
RAM	random access memory
SRS	supplementary restraint system
TTL	transistor–transistor logic
µP	microprocessor
U_{BATT}	battery voltage

5 Conventions

ISO 26021 is based on the conventions discussed in the OSI. Service Conventions (ISO/IEC 10731:1994) as they apply for diagnostic services.

1) To create IDIS, most of the OEMs worldwide provide all legally necessary information to the dismantlers (for further information, see Reference [5]).

6 General requirements and assumptions

CAN communication: see ISO 26021-2 for detailed information.

ACL line with PWM: see ISO 26021-5 for detailed information.

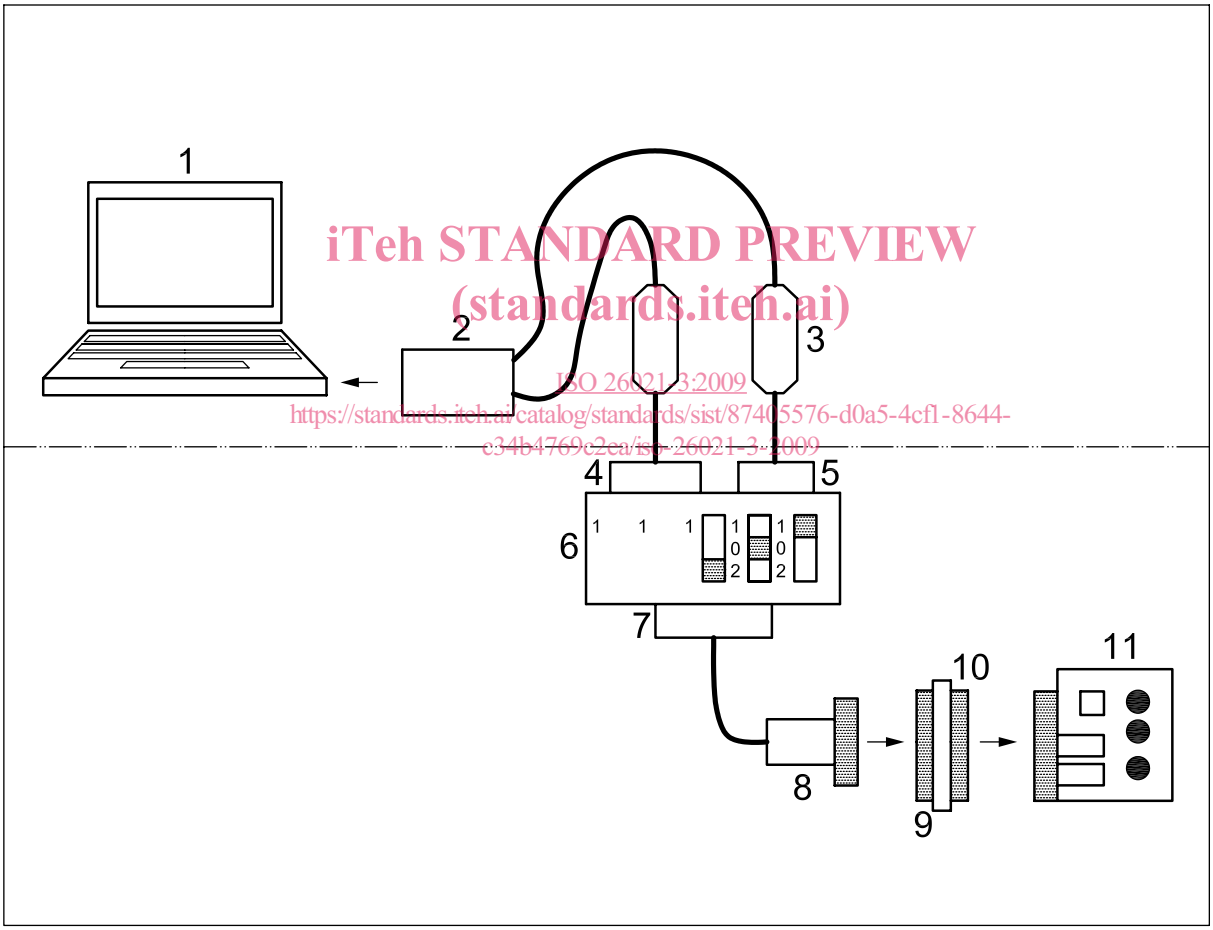
ACL line with bidirectional communication: see ISO 26021-4 for detailed information.

The PCU is not powered by the DTT. A standard diagnostic connector (male) in accordance with ISO 15031-3 is used to connect the DTT/PDT.

7 Description of tool use case 1 – deployment test tool (DTT)

7.1 General

Figure 1 shows an example of a possible setup.



Key

1 standard PC
2 CAN interface
3 I/O interface
4 input for CAN interface
5 input for IO interface
6 deployment test tool load box
7 diag out
8 ISO 15031-3 type B male connector
9 ISO 15031-3 female connector
10 OEM-specific interface
11 PCU with OEM-specific connector

NOTE The OEM-specific interface is used to connect the female ISO 15031-3 connector with the OEM-specific PCU connector.

Figure 1 — Deployment test tool system overview

7.2 Hardware requirements for deployment test tool (DTT)

7.2.1 Simulation of CAN messages

To simulate all required CAN messages in accordance with ISO 26021-2 a CAN interface is required.

7.2.2 Simulation of ACL with PWM

The DTT shall be able to generate a PWM signal in accordance with ISO 26021-5 and to modify the timing in accordance with Table 1.

Table 1 — ACL timing requirements

	Range	Accuracy
Period	1 Hz to 20 Hz (0,2 Hz step size)	± 1,5 %
Duty Cycle	1 % to 99 % (1 % step size)	± 1,5 %

The voltage level of the ACL signal is adjusted in the external load box defined in Table 2.

Table 2 — ACL voltage requirements

	Range	Accuracy
Low	0 V to 4 V (0,1 V step size)	± 2 %
High	4 V to 18 V (0,1 V step size)	± 2 %

7.2.3 Simulation of ACL with bidirectional communication

The DTT shall be able to generate a bidirectional signal in accordance with ISO 26021-4

7.2.4 Simulation of errors with deployment test tool load box

The DTT-LB is used to simulate the hardware errors defined in Table 3.

An example of the load box is given in Figure 2.

Table 3 — Loadbox error conditions

CAN high	CAN low	ACL
Open	Open	Open
Short to Pin 4 (GND)	Short to Pin 4 (GND)	Short to Pin 4 (GND)
Short to Pin 16 (U_{Batt})	Short to Pin 16 (U_{Batt})	Short to Pin 16 (U_{Batt})
Short to Pin 14 (CAN-L)	Short to Pin 6 (CAN-H)	Short to Pin 6 (CAN-H)
Short to Pin 15 (ACL)	Short to Pin 15 (ACL)	Short to Pin 14 (CAN-L)

All pins listed in Table 3 shall be accessible in order to apply any resistance or voltage and shall be protected against shortages with a maximum current of 1 A.