Device Testing & the Future of Alcohol Interlocks

Dr. Stefan Morley – CENELEC BTTF 116-2

The appetizer*

- New EU regulations to streamline the implementation of alcohol interlocks in cooperation with automotive manufacturers represent an important step forward.
- Activities undertaken to lay the groundwork for this objective and lessons learned will be shared along with proposed implementation strategies.
- Critical practices with respect to device testing by jurisdictions will also be discussed

*as the the conference agenda

Agenda

1. some background on European standardization and legislation
2. new aspects and preconditions
3. new legislation in Europe
4. (technical) details of the requirements
5. best practices / lessons learned during implementation
6. device testing
7. next activities – some future

1

Some background on European standardization and legislation

CENELEC BTTF 116-2

The Group that works on Alcohol Interlock Standards in Europe

The Task Force of the Technical Board 116-2 of CENELEC, the European Committee for Electrotechnical Standardisation, developed the series of European alcohol interlock standards EN 50436.

The initiative for the connectivity improvement is aligned with the needs of the European commission.

BTTF 116-2 Members and Participants

Members from National Standardisation Committees & additional experts

Road Safety Authorities and Organisations
Alcohol Interlock Manufacturers
Testing Laboratories
Automotive Industry
Automobile Manufacturers' Associations (ACEA, JAMA)

Automotive Stakeholders

acea
DRIVING MOBILITY FOR EUROPE

The European Automobile Manufacturers' Association, or ACEA, unites Europe's 14 major car, truck, van and bus makers.

ACEA also has close relations with the 30 national automobile associations in Europe that represent vehicle manufacturers and / or importers in their respective countries.

BMW GROUP
DAF
DAIMLER TRUCK
Ford
HONDA The Power of Dreams
HYUNDAI
IVECO • GROUP
JAGUAR
LAND ROVER
Renault Group
TOYOTA
VOLKSWAGEN AKTIENGESELLSCHAFT
VOLVO

Interlock Standardization in Europe - The EN 50436 Series of Standards

Alcohol interlocks - Test methods and performance requirements

-1 Instruments for drink-driving-offender programs

Essential performance requirements based on the experience and necessities of drink driving offender programmes in different countries over several decades

will merge in 2023 edition

-2 Instruments having a mouthpiece and measuring breath alcohol for general preventive use

General preventive use concerns a much larger number of drivers and vehicles and applies to both professional and private drivers of motor vehicles

-3 Guidance for authorities, decision makers, purchasers and users

This guidance contains numerous recommendations for those interested in the use of alcohol interlocks. However, it is not mandatory and it does not contain any requirements.

-4 Connection and digital interface between the alcohol interlock and the vehicle

Specification of the interface between an alcohol interlock and a vehicle. It details the modes of electrical connections, the assignment of electrical connection lines plus the information to be exchanged for LIN and CAN bus systems.

-6 Data security

Definition of requirements for the security of event records which are stored in the data memory of the alcohol interlock, and which may be downloaded, processed and transferred to supervising persons or organizations.

-7 Installation document

Definition of the standardized installation document to give the necessary details for those who install the devices. It is mainly directed at vehicle manufacturers and supports interlock manufacturers and workshops.

Example Belgium (EU member state)

In Belgium the EN 50436 series of standards is cited and referred to in the Royal Decree:

Arrêté royal relatif aux spécifications techniques des éthylotests antidémarrage visés à l'article 61sexies de la loi du 16 mars 1968 relative à la police de la circulation routière, de 26 novembre 2010

It states that only those devices can apply for type approval which comply with EN 50436-1 or EN 50436-2

There also is the Royal Decree concerning the installation of the alcohol interlock and the support program of 26. November 2010.

Example Norway (not member of EU, but with CENELEC)

EN 50436 is stated as fulfilment for alcohol interlocks where legislation is provided. And where alcohol interlocks are used where legislation is not (still) provided, the users simply request certification when alcohol interlocks are ordered.

In short: certification in compliance with EN 50436 is legally stated in the laws, and the sublaws (forskrift) regulating the use of alcohol interlocks.

Forskrift om alkolås, alkolåsverksteder mv. Fastsatt av Vegdirektoratet 30. mai 2018 med hjemmel i lov 18. juni 1965 nr. 4 om vegtrafikk (vegtrafikkloven) § 18, § 19 a, § 19 b og § 19 c, jf. delegeringsvedtak 4. mai 2018 nr. 704. Sist endret FOR-2022-12-20-2377 fra 01.01.2023

Furthermore: Requests for certification in compliance with EN 50436, is mentioned in every delivery contract for alcohol interlocks.

Ans also: requests EN 50436 certification are usually included in agreements between unions and employers where alcohol interlocks are used, either as company policy, or because the buyers of transport services demands it. Like Norwegian Municipalities demands it installed in vehicles transporting school children to and from their school every day.

2

New aspects and preconditions

asymmetric partnership

additional requirements

opposition

cost efficiency

never change a running system

it worked for many years

risk of satellisation

over-regulation

complex stakeholder management

If things are so well in place, why is there a need for a standardized connection?

Why can't we simply carry on as before

- standardization is unnecessary regulation
- to complex compared to the number of installations
- better go for peer-to-peer relationship
- why not use OBD?

Electronic Features in Vehicles

Complexity

1930

- electr. injection
- electr. ignition
- check control
- speed control
- central locking

1970

- electr. gear box control
- electr. air cond. control
- ABS
- telephone
- seat heating
- automatic mirror dimmer

1980

- navigation syst.
- CD changer
- active cruise control
- airbags
- electronic stability control
- adaptive gear box control
- RDS/TMC
- electronic damper control
- **BUS systems**

1990

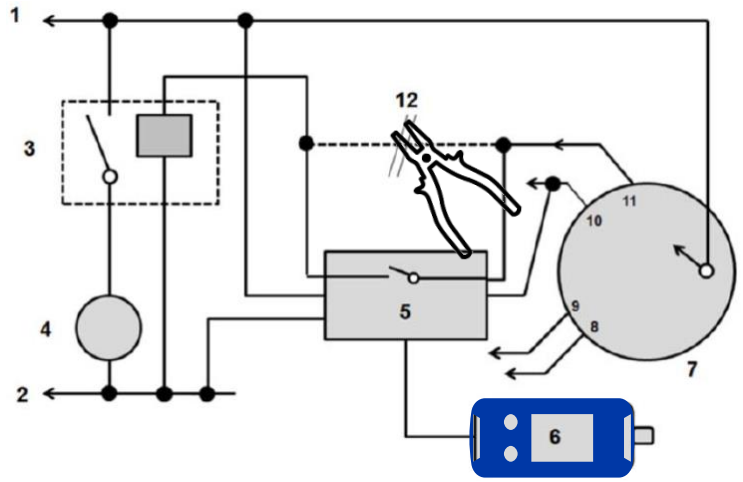
- adaptive cruise control
- curve light control
- internet
- telematics
- brake by wire
- steer by wire
- personalisation
- software updates
- infotainment
- keyless entry
- keyless go
- start w/o starter

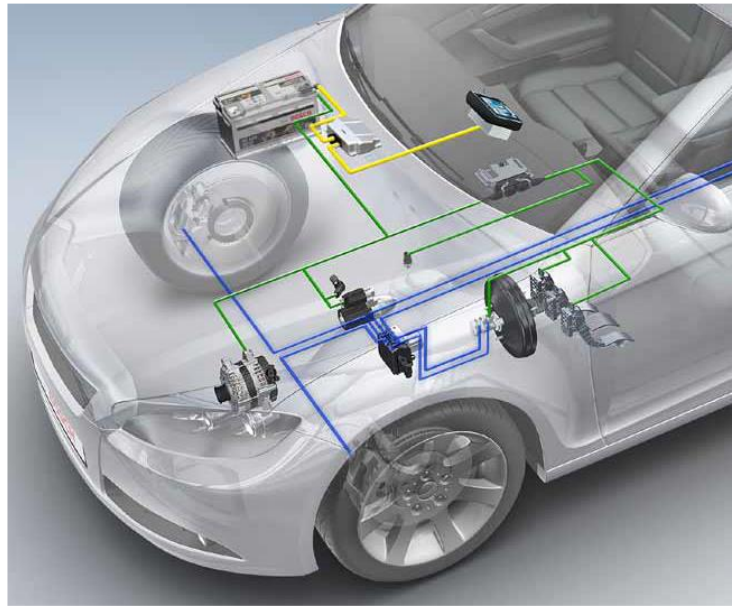
2000

2010+

- hybrid cars
- electric cars
- electric commercial vehicles
- ……..

Influence on Alcohol interlocks





There is a need to transform the way alcohol interlocks are installed.

This also mandates a different way of interfacing and communicating between vehicle and alcohol interlock in future.

3

New legislation in Europe

Steps to legislation

March 2015

March 2015 EU commission report by TRL “Benefit and Feasibility of a Range of New Technologies and Unregulated Measures in the fields of Vehicle Occupant Safety and Protection of Vulnerable Road Users “

Alcohol interlock devices to prevent drink driving

Legislate to ensure that it remains possible to connect an alcohol interlock to the vehicle in the future (not for fitment of the interlock), e.g. via a standard interface

May 2018

proposal 2018/0145 (COD) Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL states that alcohol interlock facilitaion shall be required / 'alcohol interlock installation facilitation' means a standardised interface facilitating the fitment of aftermarket alcohol interlock devices in motor vehicles;

Nov. 2019

Regulation 2019/2144 signed by president of European Parliament and President of Council

April 2021

COMMISSION DELEGATED REGULATION (EU) 2021/1243
lays down detailed rules concerning the alcohol interlock installation facilitation in motor vehicles

July 2022*
July 2024**

alcohol interlock installation facilitation

required for new types* and sold new vehicles**

Regulation (EU) 2019/2144 on type-approval requirements for motor vehicles

Article 6

Advanced vehicle systems for all motor vehicle categories

1. Motor vehicles shall be equipped with the following advanced vehicle systems:

(a) intelligent speed assistance;

(b) alcohol interlock installation facilitation;

(c) driver drowsiness and attention warning;

(d) advanced driver distraction warning;

‘alcohol interlock installation facilitation’ means a standardised interface that facilitates the fitting of aftermarket alcohol interlock devices in motor vehicles;

Standards support the transformation

Parallel and geared to legislation

March-Sept. 2007
published as draft

prEN 50436-4 *Connectors for the electrical connection between the alcohol interlock and the vehicle*
project afterwards stopped due as no consensus coul be reached

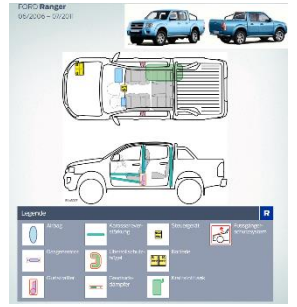
10/2014

Relaunch, again attempt to define a connector
Formation of an adhoc working group within BTTF 116-2

9/2016
final vote,
to be referenced in
EU legislation

EN 50436-7:2016

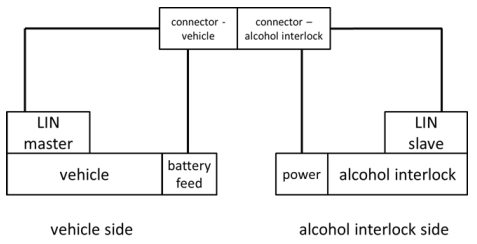
similar to rescue card

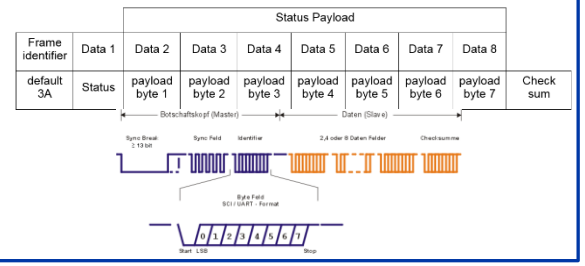


2019
first edition

EN 50436-4:2019

Connection and digital interface between the alcohol interlock and the vehicle





Delegated Regulation (EU) 2021/1243

Finally, the Delegated Regulation sets the framework for the practical implementation of installation facilitation, based on three pillars

Scope

Installation of alcohol interlocks **complying with EN 50436-1 or -2** shall be facilitated. Type tested devices are the target.

Method

The installation document after EN 50436-7 is the standardised generic interface.

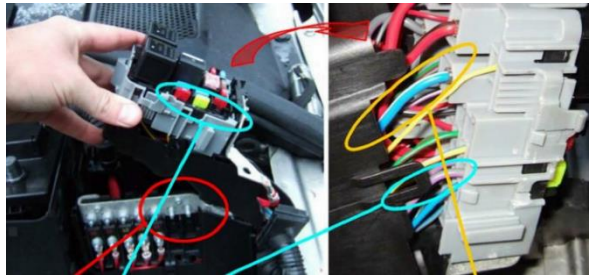
Access

Vehicle manufacturers shall provide access to alcohol interlock installation documents.

4

(Technical) details of the requirements

EN 50436-7:2016



Interaction

technical requirements reflect requirements given in other parts of
EN 50436 series of standards or standards refenced there

Figure D.1 — Location of ground installation point

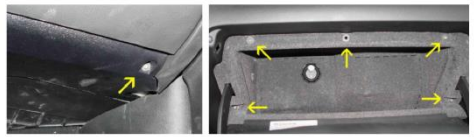


Figure D.2 — Taking apart to reach an installation point by minimizing damages

Content

- EN 50436-7 defines the content and layout of a document, that is needed to properly install an alcohol interlock into a vehicle.
- idea follows the safety card concept
- directs at future technologies

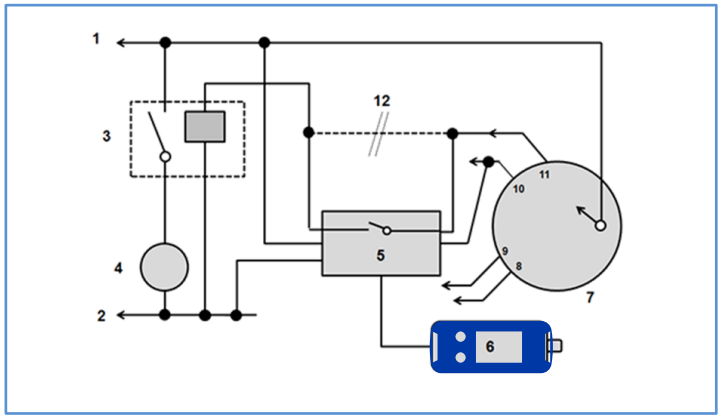
Function	*Cable or pin*	*Position of connection*
Battery feed (terminal +30), uninterrupted [a] For nominal 12 V or nominal 24 V the alcohol interlock requires and accepts 9 V-36 V when the vehicle is off or in stand-by. The interlock in its standby mode does not require a current of more than 5 mA. For short period of time, the current may be higher up to 1 A with transient bursts up to 3 A. For nominal 12 V or nominal 24 V the alcohol interlock requires and accepts 9 V-36 V when the vehicle is in use. The alcohol interlock does not require a current of more than 7 A, when the vehicle is in use.	Red cable Pin 5 2,5 mm²	Connector X2 in central fuse box in engine compartment
Ground (terminal -30)	Screw terminal at driver's door at A-pillar 2,5 mm²	The rear one of three terminals
Start enabler [b] 0 V to 36 V on the cable to be interrupted. Shall prohibit vehicle from starting / moving if circuit is open.	Blue-white cable Pin 6 2,5 mm²	Connector C5 in central electronic module
Input / Output Shall prohibit vehicle from starting / moving after signal from alcohol interlock, is GROUND or HIGH or shall allow vehicle to start / move after signal from alcohol interlock, is HIGH or GROUND.	Blue-white cable Pin 6 2,5 mm² Signal HIGH: start / move prohibited	Connector C5 in central electronic module
Data bus connection [c] Connection to an internal data bus of the vehicle for information exchange between the vehicle and the alcohol interlock. Details of the data bus connection shall be given in the assembly instructions (see 6.7)	LIN GROUND: Green cable Pin 5 2,5 mm² LIN HIGH: Yellow cable Pin 6 2,5 mm² *or alternatively* Connector according to prEN 50436-4 (Accessory part number 123456)	Connector C6 in central electronic module *or alternatively* Connector behind glove compartment

Requirement

- the numbers mandated in Annex C reflect the minimum requirements for alcohol interlocks after EN 50436-1.
- in order to fulfil EN 50436-7 the documentation as such needs to comply and the described functionality must to be available.

EN 50436-7
is the generic interface that shall facilitate alcohol interlock installation

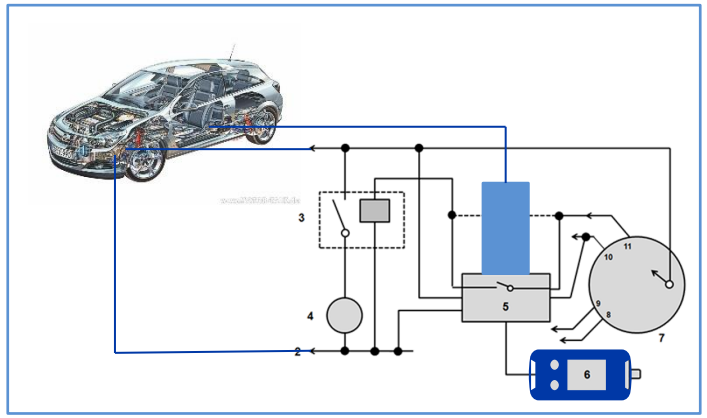
EN 50436-7 opens three options (interfaces) to support alcohol interlock installations



Classical Installation

Table C.1 3a - Start enabler

0 V to 36 V on the cable to be interrupted. Shall prohibit vehicle from starting / moving if circuit is open.



Pseudo–digital installation

Table C.1 3b - Input / Output

Shall prohibit vehicle from starting / moving after signal from alcohol interlock, is GROUND or HIGH

or

shall allow vehicle to start / move after signal from alcohol interlock, is HIGH or GROUND.

Digital installation

Table C.1 3c - Data bus connection

Connection to an internal data bus of the vehicle for information exchange between the vehicle and the alcohol interlock.

Details of the data bus connection shall be given in the assembly instructions.

How to get access to the manuals?

The fact that an installation document exists is not sufficient.

Access is needed!

Today
anyone who need access to diagnose and repair instructions of vehicle manufacturers must register with each manufacturer individually. The access to safety and security related documentation even needs an extended registration.

In future
these individual accesses shall become obsolete due to a single authorization for a workshop.

From August 2023
on access will be provided by the type approval regulation of the EU 2018/858 and in detail by the SERMI scheme described therein (Sermi = Security-Related Vehicle Repair and Maintenance Information).

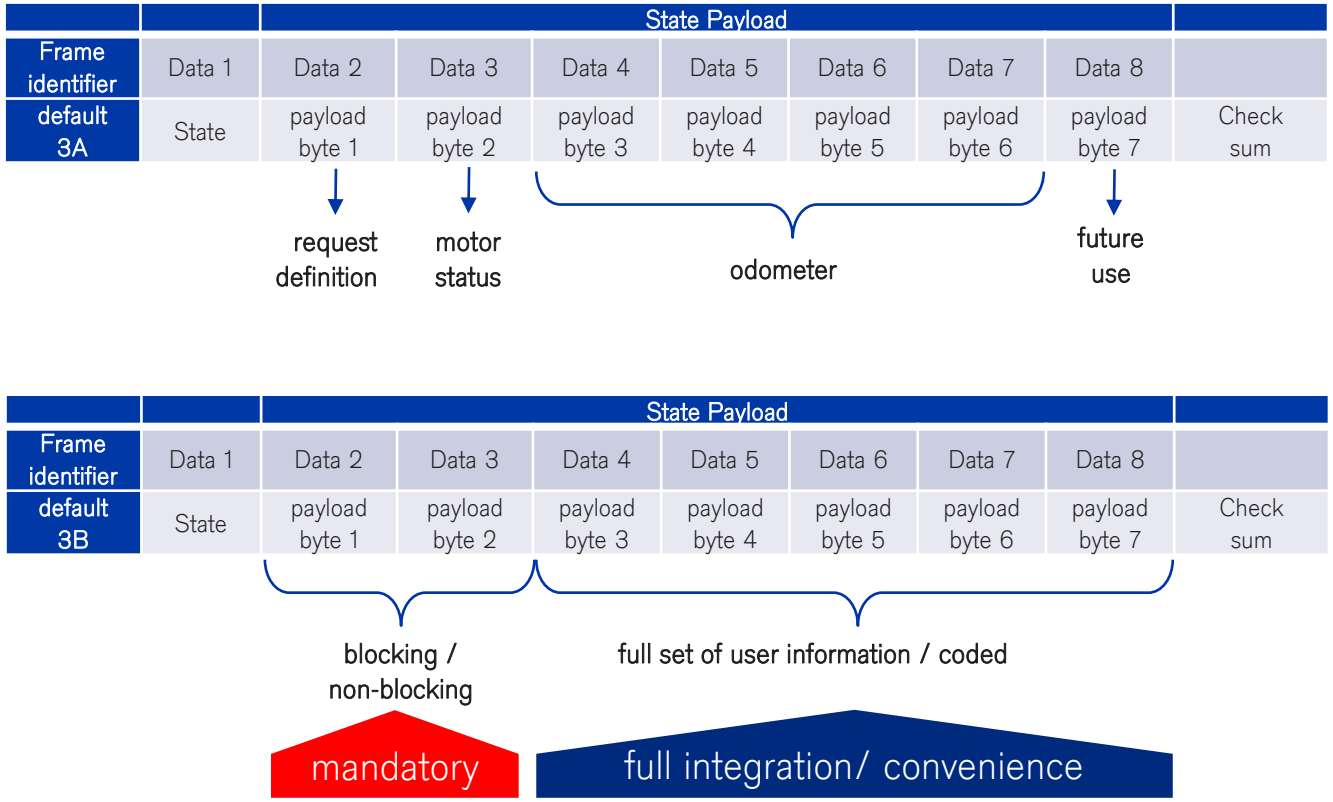
Philosophy behind the digital interface (EN 50436-4:2022)

- the alcohol interlock and interlock use communication state machines (no proprietary technical states on either side)
- minimum data from vehicle, but full coverage of anti-circumvention requirements
- minimum mandatory information from alcohol interlock, but option to include full information for user convenience

vehicle to alcohol interlock

No personal data transmitted !

alcohol interlock to vehicle



5

Best practice / lessons learned during implementation

Best practice / Implementation strategy

difficult starting position with seemingly contradictory missions

The mission of a vehicle is to enable movement as much as possible and the mission of an alcohol interlock is to restrict movement if not safe.

continuous dialogue and support, moderated by standardizatio ncommittee

interlock stakeholders

efficient installation, no re-engineering, power

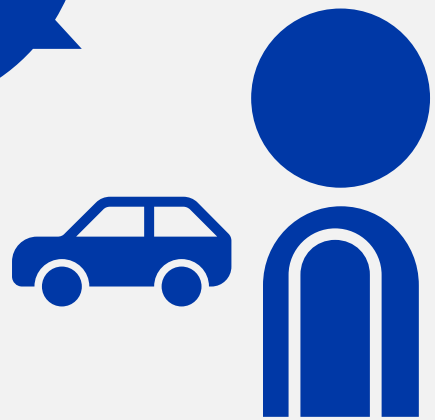
explain application in detail

CENELEC acea

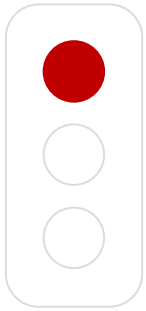
explain processes, provide options

vehicle manufacturers

no breakdowns, security, tamper proof, cost sensitivity ...

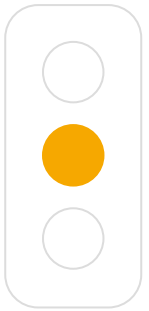


From no-go to feasibility (examples)



Initial idea of a simple OBD type connector

- to much effort due to low number and OEM supplier relationships
- not cost effective
- second step before the first
- can only be implemented with strong legal pressure

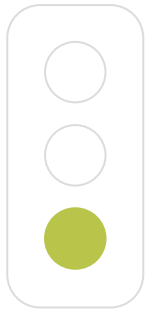


“there is always a cable to cut”

- “good point, tell us where”

the alcohol interlock is just one more immobilizer

- supports security and is not a bypass



universal but adaptive multi level approach

- applicable for small series vehicles and high-volume manufacturing
- retrofit and original equipment
- scalable invasiveness of digital data-bus option

Communication

CENELEC

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numerous questions
naturally came up in the beginning of the legislation, as vehicle manufacturers were not really prepared

Share knowledge

Best practice summary

initially queries were canalized through ACEA

feedbacks were distributed

peer-to-peer trainings (convenor – questioner)

documentation of frequently asked questions will be made available in Q2 / 2023

It is important to explain the alcohol interlock application in detail!

Global opportunity

Is this a strictly European thing?

Can anyone use this?

Any aspirations for spreading outside Europe?

automotive industry acts globally → world-wide technology availability is possible and cost-effective

standards are open → freedom to use and mandate

BTTF 116-2 can not actively drive → inquiries from classic ignition interlock regions and new adaptors (outside Europe)

6

device testing

Testing – general basic testing of devices

Europe – one series of standards

Testing the calibration curve, stability, environmental should only be done once (unless device changes appear)

Variations can only be made to parameters like

- timers
- degree of documentation
- reporting

can be mandated by national legislation

One approval for all member states, all get the same high grade of measurement.

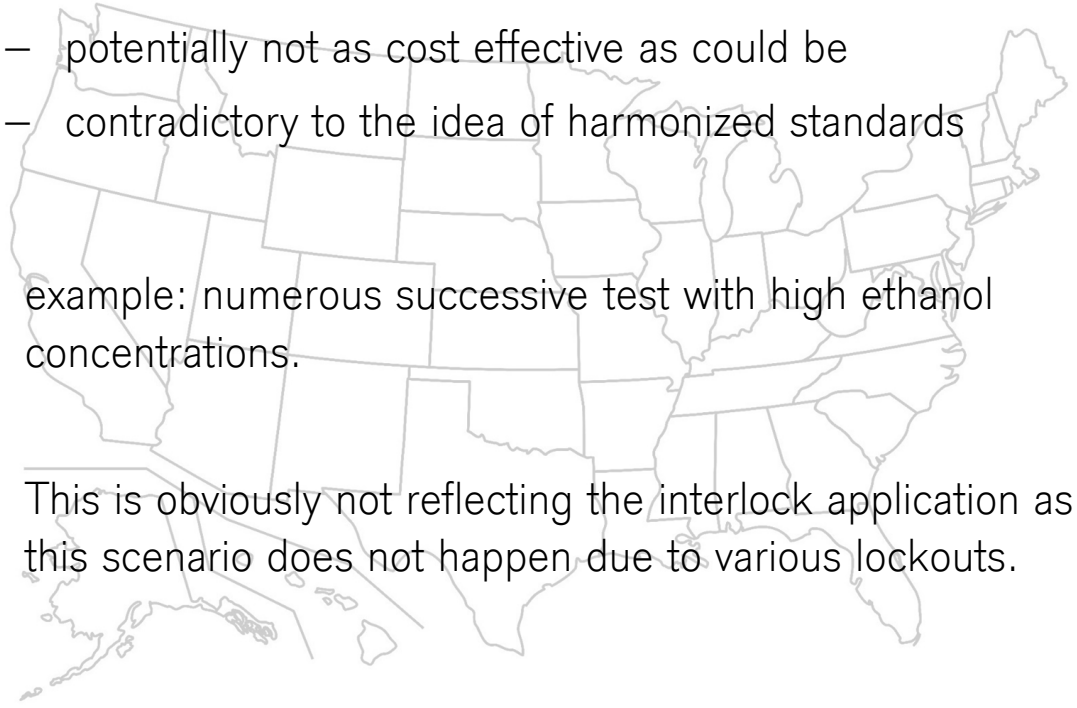
Cost efficient for customers, as customers will at the end bear them

USA – in principle one standard NHTSA

additional rules and requirements in virtually every state

despite advantages for local requirements

- potentially not as cost effective as could be
- contradictory to the idea of harmonized standards



example: numerous successive test with high ethanol concentrations.

This is obviously not reflecting the interlock application as this scenario does not happen due to various lockouts.

Testing of the interface between alcohol interlock and vehicle

Approvals

Currently conformance testing of installation manuals (EN 50436-7) is not required.

This means currently no formal testing of formal conformance or with respect to content.

Manufacturer's declaration

must be provided by OEM in which it certifies that it provides access to the installation document in compliance with of Commission Delegated Regulation (EU) 2021/1243 and the website address(es).

However, many OEMs are performing at least independent reviews of their documentation, also various inquires for initial opinion were received by the CENELEC committee.

Terms

The principle of self-declaration still must bring the proof that it works for alcohol-interlock workshops.

Disregard may result in a formal approval requirement.

Testing of the digital interface between alcohol interlock and vehicle

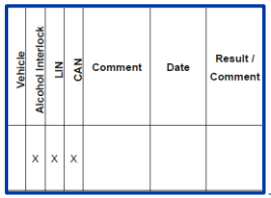
Digital connections need to be tested and approved for both sides **vehicle and alcohol interlock!**

LOCAL INTERCONNECT NETWORK

- LIN OSI Layer 1 - Physical Layer;
- LIN OSI Layer 2 - Data Link Layer, incl. NCNM (Node Configuration / Network Management);
- LIN EMC Test.

CAN SAE J1939

CAN J1939 conformance testing should be performed following a test specification document after SAE J1939-82



Full (informative) **test plan** is part of EN 50436-4:2022
Individual tests are marked to state relevance for vehicle or alcohol interlock as well as for LIN or CAN

- **the logical data bus connection should be type tested according to the standard,**
- **all sections with general or data bus relating requirements, either LIN or CAN.**

effort beyond classical device testing

7

next activities – some future

work in progress / in completion

EN 50436-1:2023

merging of parts 1 and 2

– part was kind of subset of part 1 defining exemptions and eased requirements
– effectively no instrument approval only after EN50436-2
– EN 50436-2 was integrated into
– EN50436-1 and all essential requirements
– Final vote passed
– will be published in 2023

EN 50436-7:2023

incorporation of state-of-the-art requirements

– details of data-bus updated
– installation details of retrofitted devices defined more clearly
– currently submitted to the Enquiry.
– final vote and publishing expected in 2023

non-contact measurement

EN 50436-5 candidate ?

Instruments measuring breath alcohol for general preventive use, not having a mouthpiece and compensating by carbon dioxide

– started in 2015

– no draft published; project stopped;

– carbon dioxide content in the exhaled breath air varies to much to ensure the accuracy and tamper proof necessary for the application in an alcohol interlock;

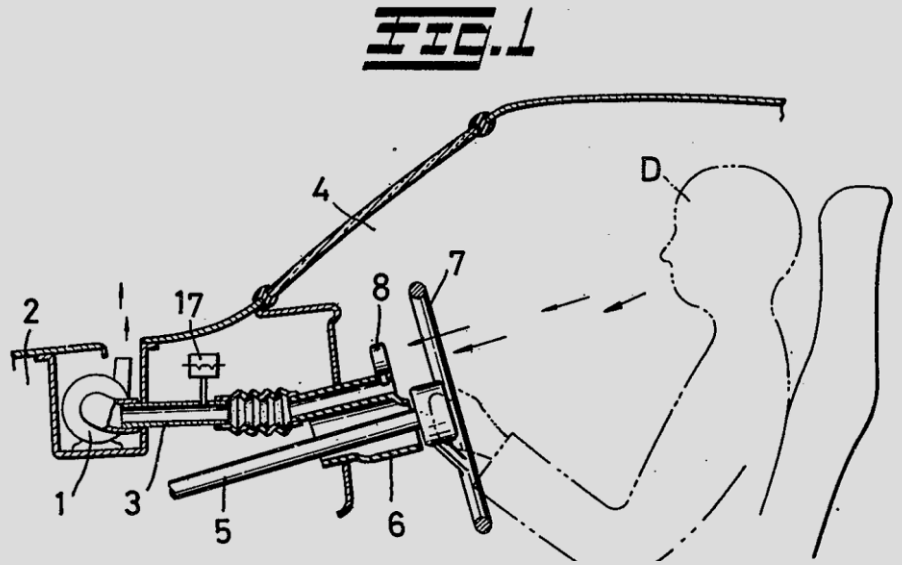
many attempts have been made in the past 50 years, yet not successful!

currently no priority for this topic

1,401,318
1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.



Patent GB 1 401 318

APPARATUS FOR PREVENTING DRUNKEN DRIVING OF A MOTOR VEHICLE

filed 24. Oct. 1972 by

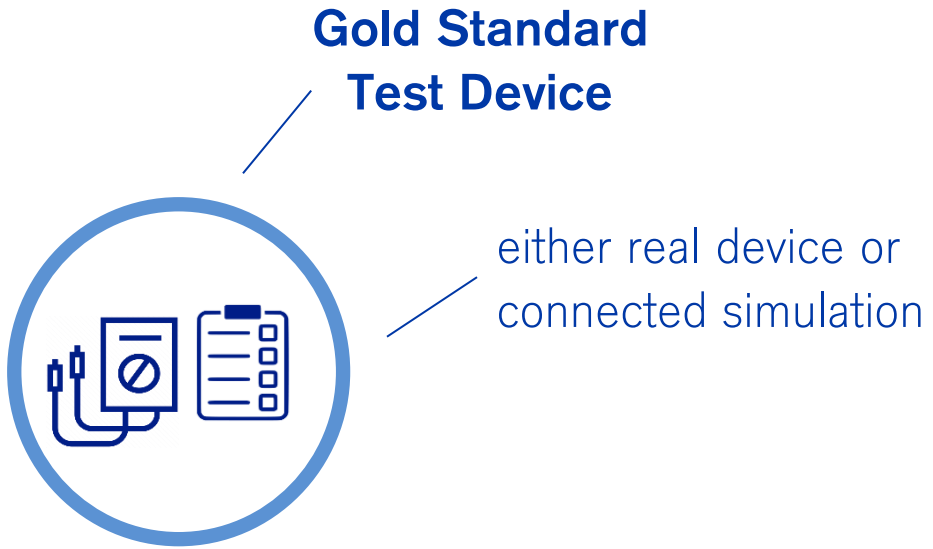
HONDA Giken Kogyo Kabushiki Kaischa

test device for the data bus interface

Current state

- written set of test proposed tests and test procedures;
- test houses prepare own tests and test equipment;
- customers depend on expertise and experience of test houses in vehicular and interlock applications;
- testing and validation on peer-to-peer base between interlock and vehicle manufacturers, which blurs the system border between vehicle and device;

Near future need



Best practice examples

- The USB Implementers Forum, Inc. (USB-IF) uses a tree of known, good, USB devices to verify interoperability and functionality of a USB device. This tree is referred to as the Gold-tree.
- The Bluetooth Special Interest Group (SIG) provides a list of test systems that have met the requirements of the Test System Activation Process and are named within the approved Test Case Reference List (TCRL), as is required for their use by Bluetooth SIG members in qualification

8

finally

Conclusion

- Alcohol interlock installation facilitation is legally mandated in Europe
- Cornerstones are EN 50436 -7 and -4 (in Europe)
- Automotive industry has started implementation
- Global buy in is seamlessly possible
- Standardization will be kept busy

The alcohol interlock application is technically well prepared for the future.

Many Thanks

Dr. Stefan Morley | Convenor BTTF 116-2 “Alcohol Interlocks”

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Time for questions