clean energy partnership

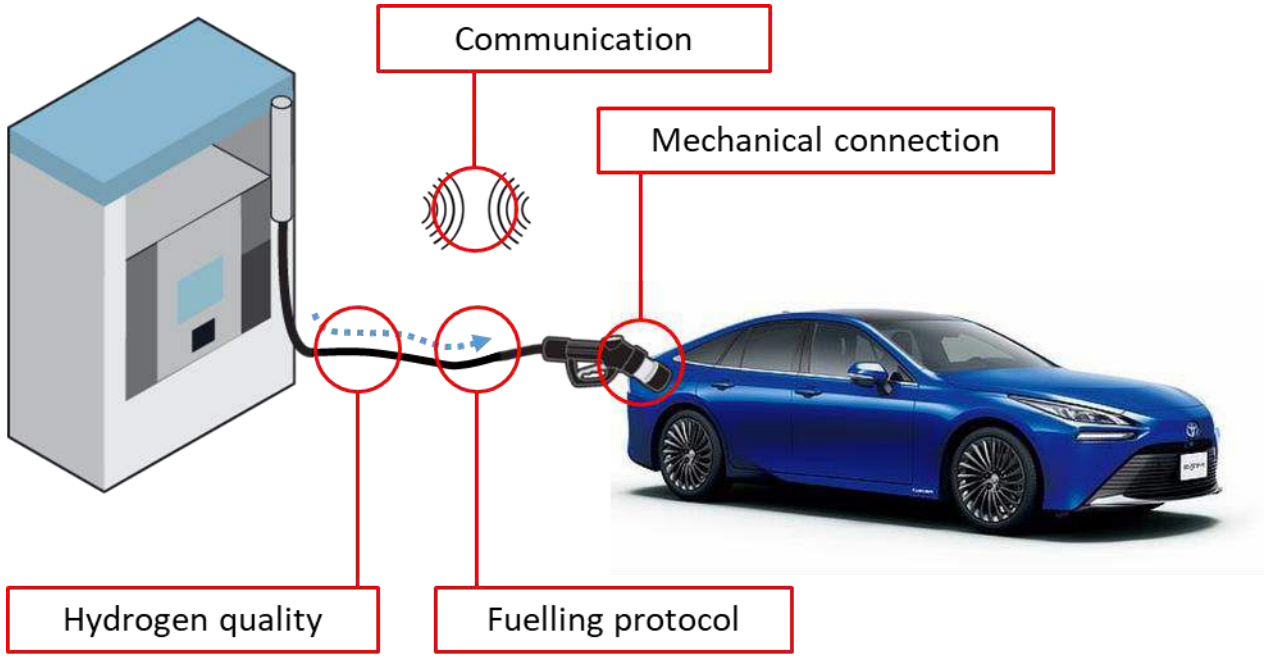
HRS Operational Acceptance Test according to EN 17127

Vincent Mattelaer
Senior Engineer
Toyota Motor Europe

Hydrogen. What else?

Regulations in Europe

concerning inter-operability between station and vehicle



AFID and AFIR

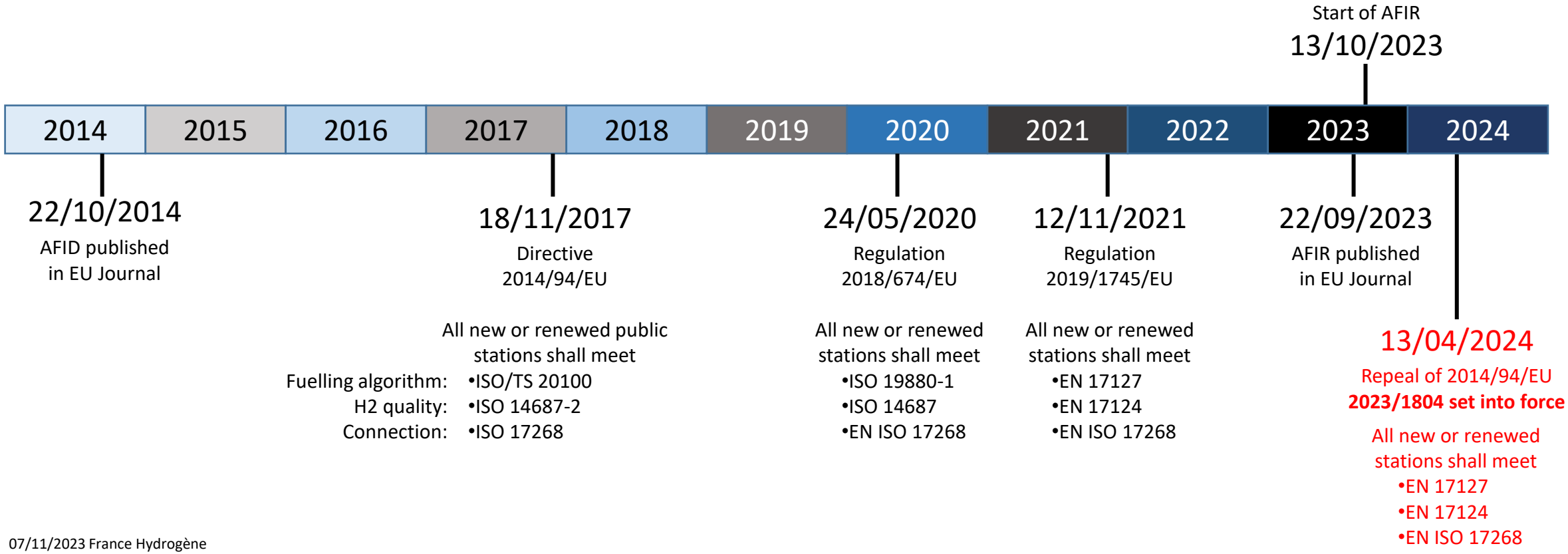
Alternative **F**uel **I**nfrastructure **D**irective [AFID 2014/94/EU]

l'arrêté JORF No. 0287

https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000036171677&dateTexte=20191206

Alternative **F**uel **I**nfrastructure **R**egulation [AFIR (EU) 2023/1804]

https://eur-lex.europa.eu/eli/reg/2023/1804/oj



AFIR (EU) 2023/1804

REGULATIONS

REGULATION (EU) 2023/1804 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 13 September 2023
on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU

Article 21

Common technical specifications

1. The technical specifications set out in Annex II shall apply.

ANNEX II

Technical specifications

3. Technical specifications for hydrogen supply for road transport vehicles

3.1. Outdoor hydrogen refuelling points dispensing gaseous hydrogen used as fuel on board motor vehicles shall comply at least with the interoperability requirements described in standard EN 17127:2020.

3.2. The quality characteristics of hydrogen dispensed by hydrogen refuelling points for motor vehicles shall comply with the requirements described in standard EN 17124:2022. The methods to ensure that the hydrogen quality is met are also described in the standard.

3.3. The fuelling algorithm shall comply with the requirements of standard EN 17127:2020.

3.4. Once the process of certification of standard EN ISO 17268:2020 is concluded, connectors for motor vehicles for the refuelling of gaseous hydrogen shall comply at least with that standard.

AFIR (EU) 2023/1804

Article 2

Definitions

(45) 'publicly accessible alternative fuels infrastructure' means an alternative fuels infrastructure which is located at a site or premises that are open to the general public, irrespective of whether the alternative fuels infrastructure is located on public or private property, whether limitations or conditions apply in terms of access to the site or premise and irrespective of the applicable use conditions of the alternative fuels infrastructure;

(11) Publicly accessible recharging or refuelling points include, for example, privately owned recharging or refuelling points accessible to the public that are located on public or private property, such as public parking areas or parking areas of supermarkets. A recharging or refuelling point located on private property that is accessible to the public should be considered to be publicly accessible also in cases where access is restricted to a certain general group of users, for example to clients. Recharging or refuelling points for car-sharing schemes should only be considered to be publicly accessible if they explicitly allow access for third party users. Recharging or refuelling points located on private property to which access is restricted to a limited and determinate group of persons, such as parking places in an office building to which only employees or authorised persons have access, should not be considered to be publicly accessible recharging or refuelling points.

EN 17127:2020

6 Inspection and validation of hydrogen refuelling points

6.1 Inspection prior putting into service and periodical inspection

Before being opened to the public, the following aspects of the hydrogen refuelling point shall be confirmed:

a) that the dispensing system, including the vehicle fuelling protocol, fulfils the requirements of 5.3.1;

b) that the vehicle fuelling protocol fulfils the process limit requirements of 5.3.2;

c) that, where applicable, the vehicle to refuelling point communications protocol fulfils the requirements of 5.3.3;

Same requirements as in SAE J2601.
(Max. 85°C, max. 60 g/s, T_{fuel} ≥ -40°C, <200g pulse etc..)

d) that minimum Site Acceptance Test (SAT) refuelling validation test has been performed according to Table 1.

SAT

Where appropriate, testing to cover points a, b and c above can be performed as Factory Acceptance Tests (FAT) and accepted without the need for replication when the station is installed on-site, unless the tests are included in Table 1 below. If specific tests at FAT are not possible, these tests shall be performed as Site Acceptance Testing (SAT).

FAT

Tests performed within the FAT testing may be covered in a type approval process.

The necessary documentation for SAT and FAT shall be prepared before testing.

Regular inspections relating to interoperability shall be carried out.

Appropriate inspections shall be performed after modification or maintenance that can affect the interoperability of the hydrogen refuelling point as defined within this document.

NOTE Refer to ISO 19880-1:2020 Annex C for an example of a test procedure to verify SAE J2601.

ISO 19880-1 Table C2

Table C.2 — Recommended FAT and SAT matrix for the validation of a dispensing system using the SAE J2601:2016 protocol

Category	Test no.	Function	Preparation	Test info	Acceptable criteria	Safety (S)/Performance (P)	FAT	SAT[a]
Pre tests	1	Correct communications protocol	Tests according to SAE J2799	Check functionality of all IrDa signals according to SAE J2799	Able to send and receive all IrDa commands, as defined in SAE J2799	S	YES	YES
	2	Correct table implementation	Confirmation report of software implementation	Confirmation in writing using "independent verification"	Table-based protocol: Correct values for all implemented tables (including communications, non-communications and optional cold dispenser) MC formula protocol: Correct values for all imple-	S	YES	NO
SAT fuelling tests	36	Non com fuelling validation	Two different starting conditions[d]	Two tests	Fuelling did not exceed any process limits, fuelled at the correct APRR and terminated the fuelling at the non-comm pressure target ±2 MPa	S	NO	YES
	37	Com fuelling validation	Two different starting conditions[d]	Two tests, one of which is below 2 MPa start[e]	Fuelling did not exceed any process limits, fuelled at the correct APRR and terminated the fuelling with an ending SOC in the HSTA of between 95 % to 100 %.	S	NO	YES

EN 17127:2020

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EN 17127:2020

EN 17127: Outdoor hydrogen refuelling points dispensing gaseous hydrogen and incorporating filling protocols

TABLE 1: Minimum Site Acceptance Testing to ensure interoperability

Copy/paste text from EN 17127:2020 | Extra information

Test Name	Prep to be performed	Test info	Acceptable Test	ISO test number
Ambient, fuelling pressure and temperature sensor accuracy table	-	Verification of ambient and fuelling temperature sensor and fuelling readings, review of calibration	Sensors show value reasonable to state of the refuelling point; calibration certificates OK	3 (ISO 19880-1)
Fault: CHSS starting pressure	CHSS with starting pressure greater than the appropriate vehicle NWP to be refuelled (attempted)	Connect the CHSS to the HRS and initiate the refuelling. HRS shall recognize full CHSS and not start main part of refuelling	Main refuelling is not allowed to start.	8 (ISO 19880-1)
Communication break	Simulated communications and then a break in communication signal	Confirm that the refuelling switches to non-communication fuelling	Dispensing system switches to non-com refuelling or stops refuelling.	16 (ISO 19880-1)

EN 17127:2020

EN 17127: Outdoor hydrogen refuelling points dispensing gaseous hydrogen and incorporating filling protocols

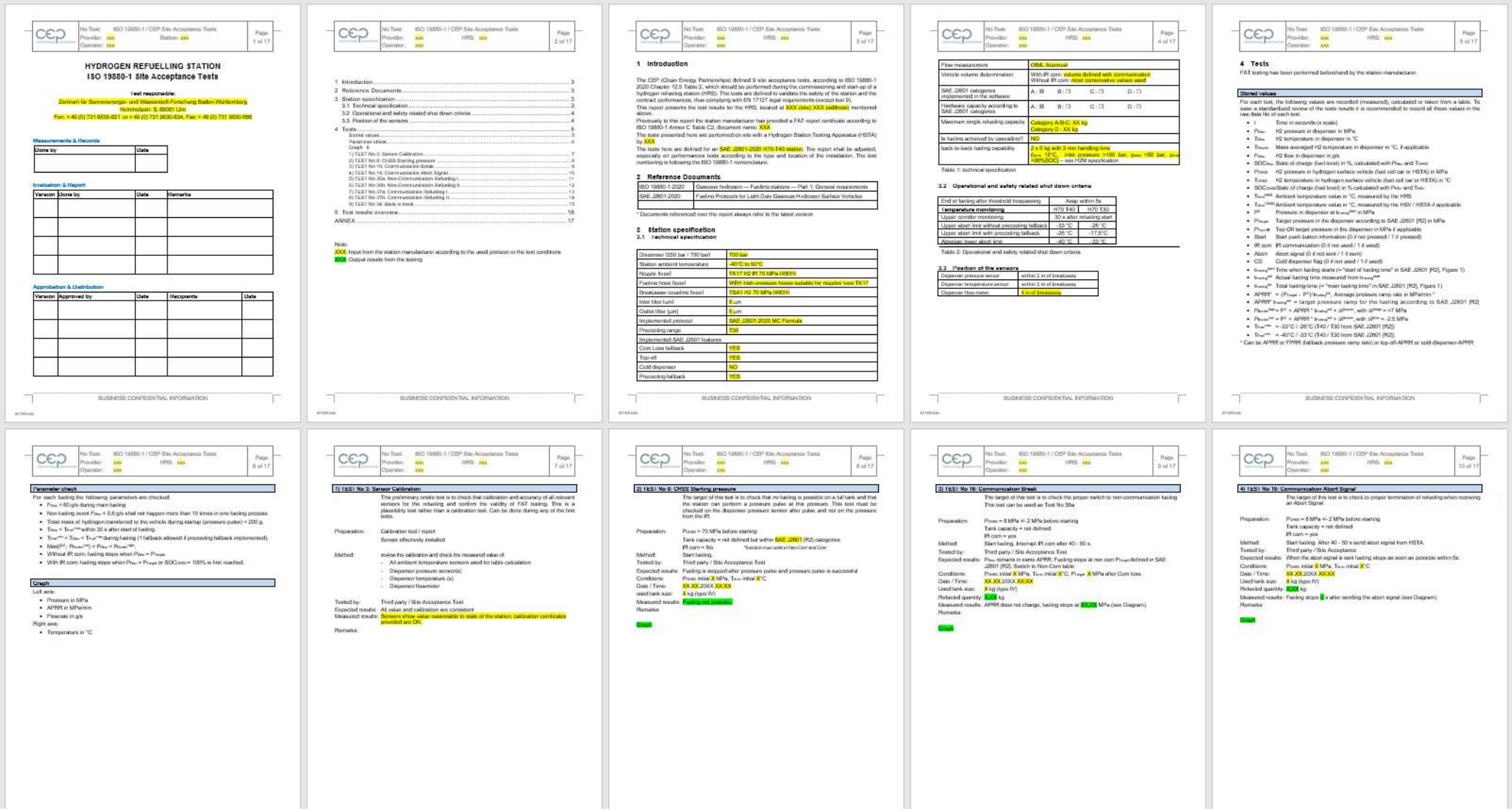
TABLE 1: Minimum Site Acceptance Testing to ensure interoperability

Copy/paste text from EN 17127:2020 | Extra information

Test Name	Prep to be performed	Test info	Acceptable Test	ISO test number
Fault: Communication Abort Signal	Simulated communications Abort Signal, e.g. by manipulation of the signal loop	To be monitored even with non-communications refuelling (if applicable)	Refuelling Stop within 5 seconds of Abort Signal being sent	18 (ISO 19880-1)
Non-comm refuelling validation for each pressure level (H70 and H35)	2 different starting conditions	Two tests per hydrogen service level where applicable	P_{target} ±2 MPa without exceeding the fuelling protocol process limits	36 (ISO 19880-1)
Communication refuelling validation	2 different starting conditions, one of which is below 2 MPa starting pressure	Two tests per hydrogen service level where applicable	SOC or P_{target} without exceeding the fuelling protocol process limits and with no abort signal received.	37 (ISO 19880-1)

CEP template

The CEP has made a template available for easy use. You only need to fill in the yellow and green marks and add graphs.



HYDROGEN REFUELLING STATION
ISO 19880-1 Site Acceptance Tests

1 Introduction

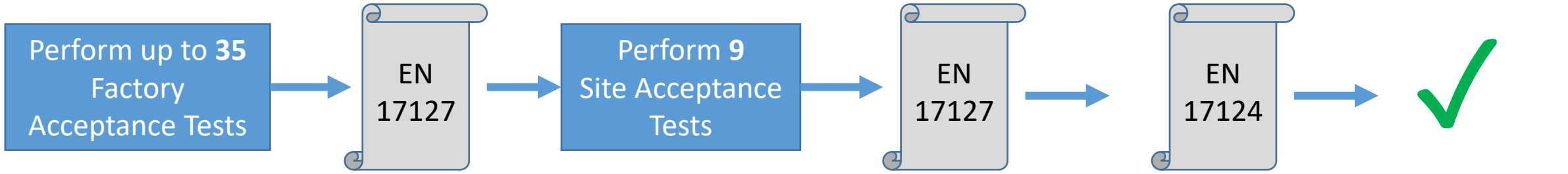
2 Reference Documents

3 Station specification

4 Tests

Proposed validation steps

- Process description



FAT confirmation report from refuelling station provider

SAT confirmation report from 3rd party (recommended) or refuelling station provider

H2 quality certificate

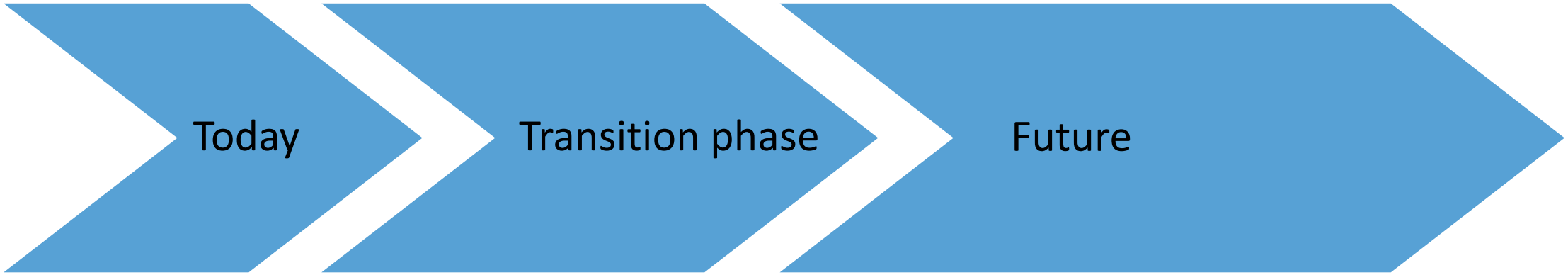
Station approved after OEM or 3rd party review

- *At station provider factory (or on site)*
- *Single testing for multiple stations possible*

- *At station final installation site*
- *For every single station*

HRS approval process today & future

Transition to future HRS approval process will be done in two steps



HRS approval process today

Procedure	Description	Responsibility
1. Declaration	The HRS supplier declares the SAE conformity of the system.	HRS-Operator
2. Testing	The HRS supplier is testing his HRS by himself, or a qualified independent 3rd party is doing the tests on behalf of the HRS operator/supplier in accordance with EN 17127 table 1. The results are documented in detail in an acceptance report.	HRS-Supplier / 3rd Party
3. Reporting	The acceptance report and declaration of conformity are submitted to the OEMs, who check the conformity of the test results. Deviations to the standards are being discussed with the HRS supplier bi-laterally.	HRS-Supplier / 3rd Party
4. Control	CEP evaluates acceptance report.	OEMs
5. Approval	Explicit approval of the acceptance reports by the OEMs.	OEMs

(1) Declaration

HRS declares SAE conformity to centralized organization.
(e.g. France hydrogène)

(2) Testing

HRS is tested by 3rd party (or notified body)
or they perform self-testing.

(3) Reporting

Conformity is checked and acceptance report created by 3rd party (or notified body) or themselves.

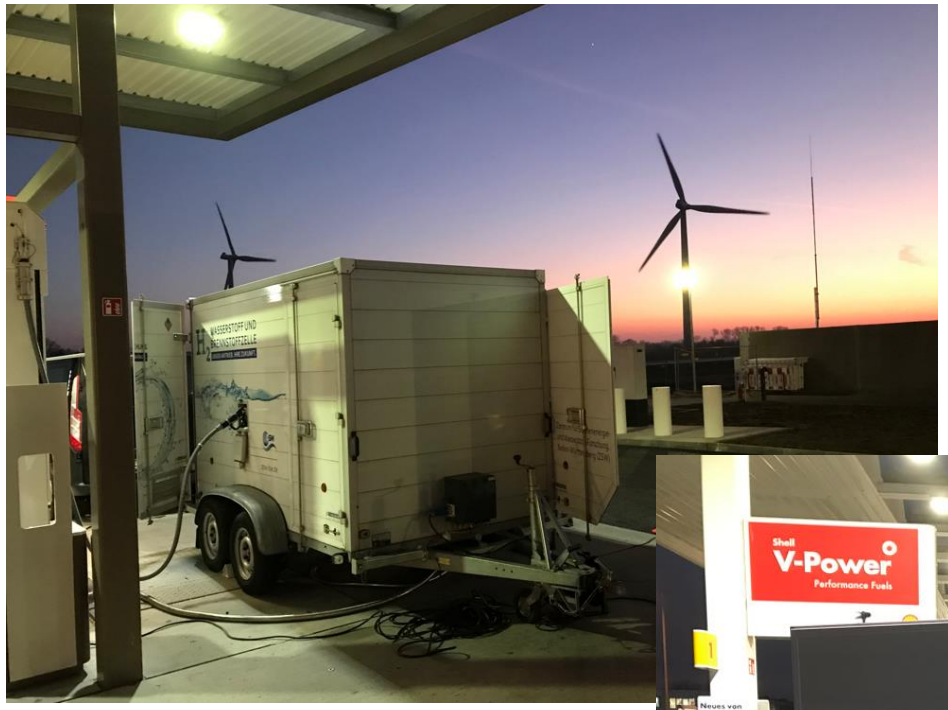
(4) Control

CEP evaluates acceptance report.
(In the future this should be done by independent 3rd party or notified body)

(5) Approval

When HRS is approved, Customers can pay and fuel at the HRS.
HRS will turn green on H2.live app.

ZSW Trailer Pictures



THANK YOU

Any questions?

Q&A

Q: Who do we need to contact if we want to have our FAT, SAT and H2 quality report approved?
A: You can contact our administrator carsten.zeidler@spilett.com

Q: Can you provide us with some contacts for performing a H2 quality sampling and analysis.
A: See below some example laboratories that are able to sample and analyse all the EN 17124 contaminants.

SGS

Arnaud BOILLE
Oil, Gas & Chemical France
Business Developer Hydrogène
arnaud.boille@sgs.com
SGS France
29 Avenue Aristide Briand
94111 Arcueil, France
+33 (0)6 08 58 13 68

CEMIAG/Air Liquide

Nathalie Chramosta
Directeur Laboratoire CEMIAG

nathalie.chramosta@airliquide.com
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NPL

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ZBT

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Department Fuel Processing
c.spitta@zbt-duisburg.de
ZBT GmbH, Carl-Benz-Str. 201
D-47057 Duisburg / Germany

+49 203 7598-4277

Q&A

Q: Can you provide us with the contacts of the notified bodies that are already allowed to perform the FAT/SAT report evaluation on behalf of the CEP?

A: See contact details below

- TÜV Süd
  Raphael Mayer
  Phone: +49 89 5791 2346
  Mobile: +49 151 51701950
  Email: raphael.mayer@tuvsud.com

- TÜV Rheinland
  Torsten Arndt
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  Mobile: +49 172 326 3396
  Mail: torsten.arndt@de.tuv.com

- DEKRA
  Raphael Blanc
  Tel: +49.69.420830
  Mobil: +49.170.7953369
  Raphael.Blanc@dekra.com