CEN-CENELEC GUIDE 38

Guide for multifuel stations

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CEN and CENELEC decided to adopt this new CEN-CENELEC Guide 38 through CEN Resolution BT N 12651 and CENELEC Decision BT169/DG12327/DV.

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European foreword

CEN and CENELEC develop European Standards (EN) and other publications, including Technical Specifications (TS), Technical Reports (TR) and Workshop Agreements (CWA). The European Standardization System has made a significant contribution to the creation of a common European market, embedded in a global economy, and in disseminating the knowledge incorporated in these publications through its network of CEN and CENELEC (national) Members.

To accelerate the development of alternative fuels, CEN and CENELEC developed this Guide 38 to facilitate the integration of alternative fuels at existing fuelling stations and to give guidance to design, authorize and operate new multi fuel stations with different fuels in support of the Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure. Other EU legislations considered as relevant are listed in the Bibliography: ATEX, PED, MID (other EU Directives or Regulations might apply).

Introduction

The transport sector contributes to the Greenhouse Gas emissions, and it will also contribute to the Energy Transition. In addition to improved efficiency and reduction in fuel consumption, the European Commission is targeting the development of alternative fuels.

The Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure was published to facilitate the development of alternative fuels and achieve interoperability throughout Europe. This Directive was requesting technical specifications for recharging points, hydrogen refuelling points for motor vehicles and natural gas refuelling points. These standards have been published by the relevant CEN and CENELEC Technical Committees (CEN/TC 301, CLC/TC 69X, eMCG, CEN/TC 268, CEN/TC 326 and CEN/TC 408).

To facilitate the integration of alternative fuels in existing stations, CEN and CENELEC organized a workshop in February 2019 with the relevant CEN and CENELEC Technical Committees (the TCs already involved in Directive 2014/94/EU plus CEN/TC 286 and CEN/TC 393) and with the relevant European Associations (Fuels Europe, Europe's Independent Fuel Suppliers, Liquid Gas Europe, NGVA Europe). The existing standards and regulations for each fuel were presented. Four topics were identified as requiring guidance to facilitate the coexistence of different fuels:

— Emergency Shut Down procedure

— Common language – aligned terms

— Common approach of risk assessment

— Covered requirements in standards

The Working Group "Multifuel stations" was launched by the CEN-CLC Sector Forum Gas Infrastructure (SFG-I) to draft CEN-CLC Guide 38. This Guide was submitted to the relevant CEN and CENELEC Technical Committees (CEN-CLC/JTC 6, CEN/TC 301, CLC/TC 69X, eMCG, CEN/TC 268, CEN/TC 286, CEN/TC 326, CEN/TC 393 and CEN/TC 408) and it was approved by the CEN and CENELEC BTs.

The intention of this document is to enable the relevant TCs to cover interaction with other fuels when they revise their standards and improve alignment with other standards. It does not intend to cover all the requirements to be applied in a multifuel station.

At a later stage, further items were identified that will require common agreement: labelling, ignition sources, fire extinguishers, emergency response, time for emergency shutdown.

1 Scope

This document provides guidance on multifuel stations. It was prepared to facilitate the integration of alternative fuels in existing fuelling stations and to facilitate the design, authorization and operation of multifuel stations.

This document compares the terms and definitions used in a selection of standards applicable to each fuel: electricity, hydrogen, compressed and liquefied natural gas, LPG, diesel and petrol.

It compares the requirements addressed in these standards for each fuel.

It describes the internal and external separation distances applied for different fuels.

It gives guidance on the design and operation of Emergency Shut Down systems and on combined activities.

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.

EN 13617-1:2012, *Petrol filling stations - Part 1: Safety requirements for construction and performance of metering pumps, dispensers and remote pumping units*

EN 14678-1:2013, *LPG equipment and accessories - Construction and performance of LPG equipment for automotive filling stations - Part 1: Dispensers*

EN 14678-2:2007+A1:2012, *LPG equipment and accessories - Construction and performance of LPG equipment for automotive filling stations - Part 2; Components other than dispensers, and installation requirements*

EN 14678-3:2013, *LPG equipment and accessories - Construction and performance of LPG equipment for automotive filling stations - Part 3: Refuelling installations at private and industrial premises*

EN ISO 16923:2018, *Natural gas fuelling stations — CNG stations for fuelling vehicles*

EN ISO 16924:2018, *Natural gas fuelling stations — LNG stations for fuelling vehicles*

ISO 19880-1:2020, *Gaseous hydrogen — Fuelling stations — Part 1: General requirements*

IEC 61851-1:2019, *Electric vehicle conductive charging system - Part 1 : general requirements*

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

The relevant CEN and CENELEC Technical Committees are encouraged to use these terms and definitions in their standards.

The terms and definitions used for the different fuels in the standards listed in Clause 2 are compared in Annex A.

3.1
emergency shutdown system
ESD
system composed of sensors, logic solvers, and final control elements for the purpose of taking the process, or specific equipment in the process, to a safe state when predetermined conditions are violated

Note 1 to entry: The system is designed to isolate, de-energize, shutdown, or depressurize where appropriate, equipment in a unit. Depressurization can be used for cryogenic liquids or parts of hydrogen systems.

3.2
fail-safe
capable to go to a predetermined safe state in the event of a specific malfunction

3.3
fuelling island
installation where single or multiple fuel dispensers, or refuelling points, for refuelling of road vehicles are located

Note 1 to entry: Typically part of a facility containing multiple fuelling islands, with measures installed on each island to protect the refuelling equipment from being impacted by vehicles (e.g. raised kerb and/or impact protection barriers).

3.4
multi-fuel station
facility for the refuelling of road vehicles providing a selection of fuel types, and including facilities for the supply of fuel to the facility, fuel storage and the fuel delivery equipment

Note 1 to entry: Multi-fuel stations may also include a charging, or recharging, infrastructure for battery electric vehicles.

Note 2 to entry: Often referred to as fuelling station, refuelling station, filling station or service station.

3.5
process shutdown
system composed of sensors, logic solvers, and final control elements for the purpose of taking the part of the process, or specific equipment in the process, to a safe state when predetermined conditions are violated

3.6
separation distance
distance to acceptable risk level or minimum risk-informed distance between a hazard source and a target (human, equipment or environment), which will mitigate the effect of a likely foreseeable incident and prevent a minor incident from escalating into a larger incident

Note 1 to entry: The term "separation distance" may also be referred to as "safe distance", "safety distance" or "setback distance".

[SOURCE: ISO 19880-1:2020, 3.70]

4 Safety of a multi energy station

4.1 General

At a fuelling station, different (alternative) fuels including electric charging can be offered. For each fuel, separate standards are available. However, there is no description of how the different fuels should interact in case of an emergency. The goal of this guidance is to describe the measures that can prevent a minor incident with one of the fuels at a multifuel station from escalating into a larger incident.

The regulations and standards for traditional fuels like petrol and diesel have existed for many years. Today, alternative fuels such as LPG, CNG, LNG and hydrogen and electric charging are being introduced. Several other fuels are under development, but as previously mentioned the focus of this document is on commercially available alternative fuels. The safety procedures in case of an emergency are written down separately in the standard for each individual fuel. This guidance will describe the interaction between the fuels and technical installations at a multifuel station.

There are three main focus areas in the case of multifuel stations:

1) internal and external separation distances;
2) combined activities;
3) ESD action.

4.2 Internal separation distances

4.2.1 General

As mentioned, the standards for the individual fuels already exist (see Clause 2). Some standards require separation distances, some give concepts to define these distances and for others the distances are defined by national regulations and/or standards. The same internal distances as mentioned in the separate fuel station standards are applicable for the technical installations of the other fuels at the multi fuel station. National standards/codes of practice might give stronger requirements than those given as examples below. When designing a multifuel station, as an alternative, a quantitative risk assessment can be used to redefine the separation distances to achieve the same level of safety.

4.2.2 Prescriptive separation distances

4.2.2.1 Separation distances for Compressed Natural Gas

The distances mentioned in EN ISO 16923:2018 can be found in Table 1.

Table 1 — Separation distances for Compressed Natural Gas

Total site storage below 10 000 l		
Hazard source	**Dispenser**	**Storage cylinders and compressor**
Buildings openings	>3 m	>3 m
Building walls (non-combustible)	≥0m	>1 m
Facility perimeter	>5 m	>5 m (>10 m for storage > 10 000 l)

If a 2 h fire wall is located between CNG equipment and the property line, the separation distance may be reduced to 1 m. The fire wall shall have a minimum height equal to 0,5 m greater than the maximum height of the equipment and shall limit the hazardous zone from crossing the property line.

4.2.2.2 Separation distances for Liquefied Natural Gas

The distances mentioned in EN ISO 16924:2018 can be found in Table 2.

Table 2 — Separation distances for Liquefied Natural Gas

Description	Distance (m)
LNG storage towards vehicle fuelling	4
LNG storage towards onsite storage of other fuels	5
LNG storage (< 120 m^3) towards site boundary	3
LNG storage (120 m3 to 300 m^3) towards site boundary	6
LNG storage (> 300 m^3) towards site boundary	10
On-site buildings to unloading point < 10 People	10 m for ground mounted pump
On-site buildings to unloading point < 10 People	20 m for trailer mounted pump
On-site buildings to unloading point 10 to 100 People	30 m
On-site buildings to unloading point > 100 People	50 m
Off-site buildings to unloading point < 10 People	10 m for ground mounted pump
Off-site buildings to unloading point < 10 People	20 m for trailer mounted pump
Off-site buildings to unloading point 10 to 100 People	30 m
Off-site buildings to unloading point > 100 People	50 m
LNG unloading point towards tank and buildings	6
LNG unloading point towards site boundary	3

4.2.2.3 Separation distances for hydrogen

The distances are not determined by ISO 19880-1:2020: no distances are mentioned in the standard.

4.2.2.4 Separation distances for LPG

The distances are not determined by EN 14678: no distances are mentioned in the standard.

4.2.2.5 Separation distances for Petrol

The distances are not determined by EN 13617-1:2012: no distances are mentioned in the standard.

4.2.2.6 Separation distance for high power charging

Besides the traditional electrical installation standards in Europe no specific standard is currently available to determine separation distances for high power charging stations. The distance of electrical equipment for gaseous fuels is determined by the ATEX zones and by the hazardous area classification of gaseous fuels (IEC 60079-10). In case the EV charging is located at a remote area of the fuelling station such that it does not have any impact on the technical installation of the other fuels, it is not necessary to combine the ESD functions.

4.2.3 Concepts for separation distances

The following concept was proposed for hydrogen refuelling stations by ISO 19880-1:2020: examples of separation distances are determined by the heat flux. The heat flux is given in Table 3.

Table 3 — Heat flux related and related harm

Description	Heat flux (kW/m^2)
prevent domino effects	8
prevent effects on windows of buildings	5
prevent consequences (“irreversible effects threshold for…how long exposure” from API 521)	3
prevent consequences (in API 521 KHK committee document)	1,26

4.3 Combined activities

Unloading of fuel at a fuelling station is a high risk activity. Unloading two different fuels, such as petrol and LNG, at the same time will increase the risk level. It should be prevented to unload two fuels at the same time at a multi fuel station except if the trailer is used as a storage at the station and appropriate mitigation measures are taken.

In some cases, it can be done by combining the unloading points so that it is impossible to unload two tanker trailers at the same time. Clear working instructions should be in place.

4.4 Process Shutdown and ESD functionality

4.4.1 General philosophy

Different aspects must be taken into consideration when ESD functionality is described. The basic idea of the ESD system is that in case of any emergency the complete installation should shut down in fail safe mode to minimize the consequences of an emergency and to prevent escalation of the incident. A total shut down of the whole fuelling station is called an ESD 3.

There are different ways of activating an ESD 3:

— manually by pressing an ESD button;

— automatically when a gas, flame or temperature detector is activated.

The general idea is that if a person presses the ESD button, the complete station should be shut down. The reason that a person is pressing the ESD button is that the person noticed a dangerous situation. Therefore, it is proposed to install one clearly marked central ESD button at a highly visible and easily accessible location, for example at the shop or at each dispenser island. This central ESD button connects all the ESD systems of the different fuels and charging systems. When that central ESD button is pressed, all dispensing of fuels should shut down automatically including dispensers and EV chargers and all technical installations should go into fail safe mode.

There should be no difference between an attended or unattended fuelling station. In case of an attended fuelling station, an additional ESD button can be placed in the shop.

To prevent escalation of an incident caused by fire at a multi fuel dispenser island, there should be flame detectors or high temperature (> 70 ˚C) detectors installed per dispenser island which activates the ESD 3 system.

The reference documents can be found in the Bibliography ([1], [2], [3] and [4]).

4.4.2 ESD 3

All fuels dispensing and charging systems are disconnected when activated, all technical installations go into fail safe mode.

It is activated by:

— a central ESD button and ESD buttons placed at the technical installation or other easily accessible and highly visible location such as the shop;

— low /high temperature detection.

The ESD system should trigger a visual and audible alarm that is unique and immediately recognizable by personnel on site.

Reset is only possible by trained technicians after inspection on site.

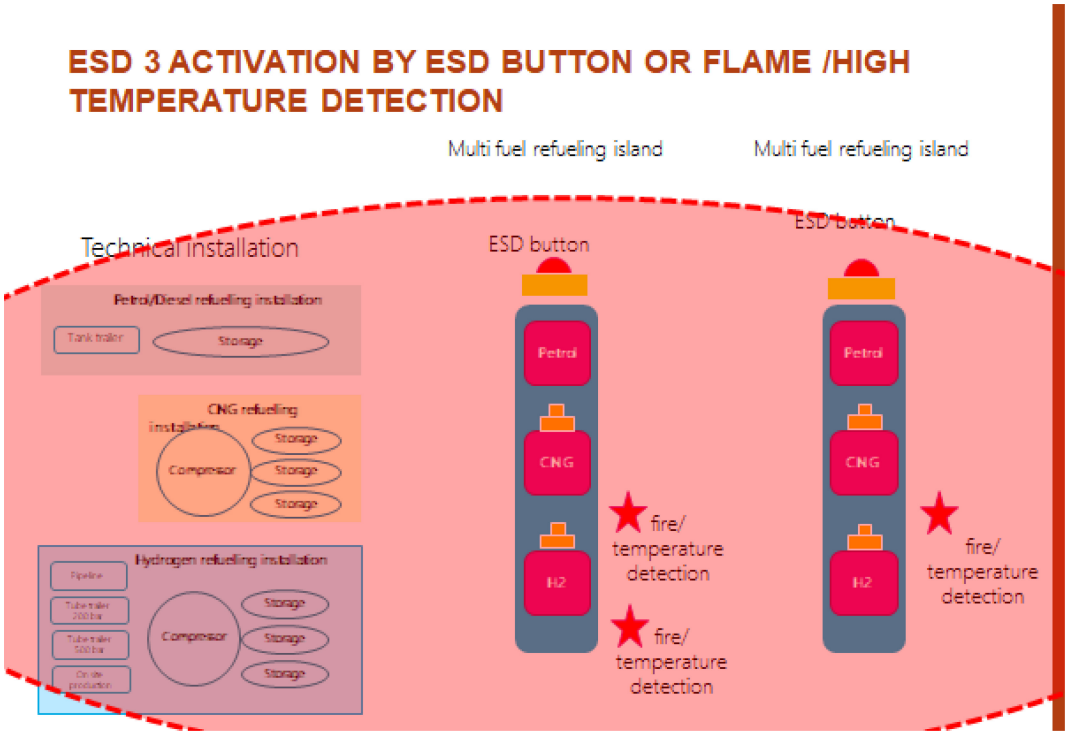

Figure 1 — ESD 3 activation by ESD button or flame/high temperature detection

In Figures 1 to 4, a few examples of technical installations are given. It is meant to show all technical installation on a multi energy station such as the technical installations for petrol, diesel, LPG, CNG, LNG, Hydrogen and High power charging.

In case of an incident at separate dispenser locations which cannot have an effect on each other or cannot have an effect on the technical installations, the ESD system doesn't need to be coupled and can work independently of each other. This is often the case with EV charging. If the high-power charging unit can have an effect (fire) on for example the storage of a CNG system, then the ESD systems should be coupled.

4.4.3 Process shut down or stop button

In the current situation, all alternative fuels like CNG, LNG, Hydrogen and EV have their own ESD button at each dispenser. It often happens that untrained users are wrongly using the ESD button when they are experiencing a (non-hazardous) problem. This causes a lot of unnecessary ESD actions. For operational purposes, the dispensers of the alternative fuels can be equipped with a stop button instead of an ESD button. The stop button will cause a process shut down of fuelling (or charging) of the specific fuel dispenser at the dispenser island when pressed. This can be the case when the user makes an operational error and wants to stop the fuelling (charging) process.

Stop button:

- Activated by stop button on dispenser
- Should isolate the single dispenser and should automatically be disconnected from the fuel supply
- Remote reset possible
- If dead man button is not pressed at the right time during LNG unloading
- If dead man button is not pressed at the right time during LNG dispensing to customer

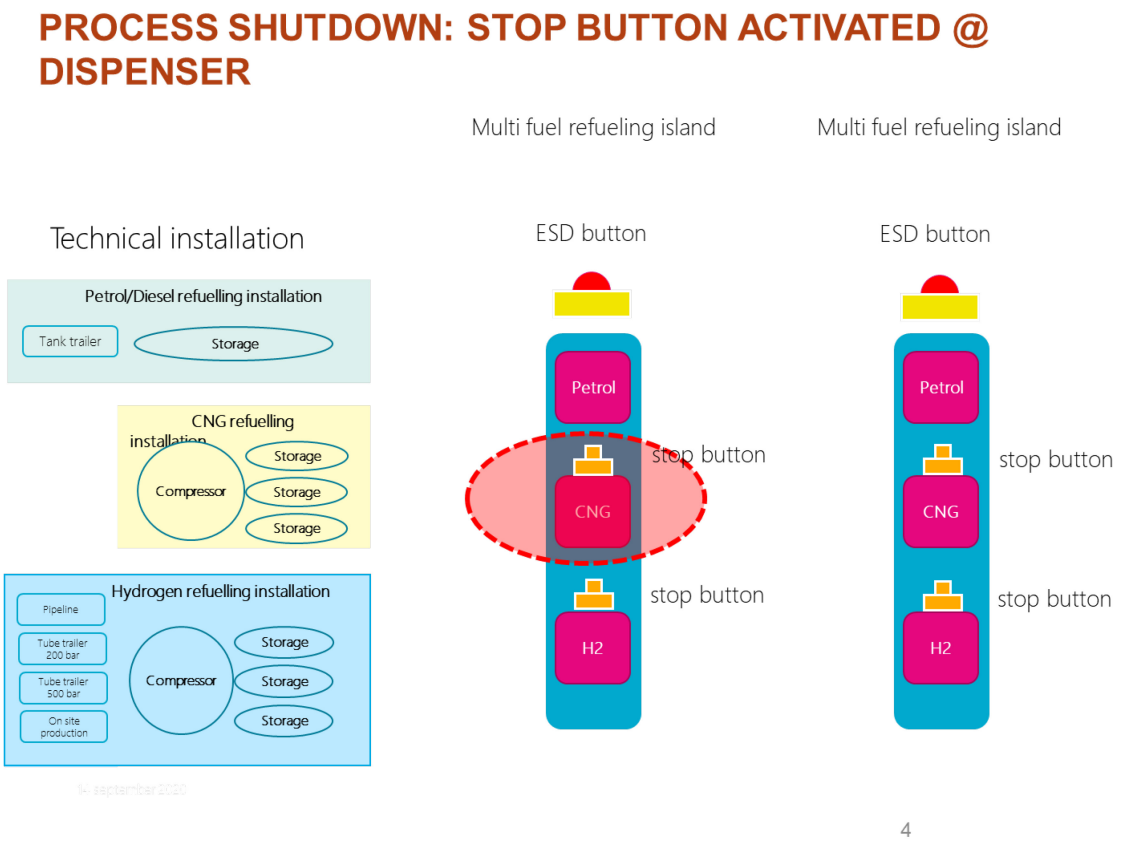

Figure 2 — Process shutdown: stop button activated at dispenser

4.4.4 ESD 2

All technical systems of alternative fuels are equipped with safeguards which will cause a process shut down when activated. There are two situations which can cause a process shutdown: a) safeguard activated in technical installation and b) safeguard activated at the dispenser island.

ESD 2 action

a) In the case of a process alarm in the installation such as a high temperature in the technical installation, it is not necessary to shut down the whole fuelling station, but only the specific fuel system.

- Activated by safeguard in technical installation
- Complete process shut down
- Whole single fuel system should be shut down and will go into fail safe mode, if safeguard is activated in the technical installation
- The ESD system should trigger an automated alarm to the (remote)control room
- Reset only after visual inspection at site

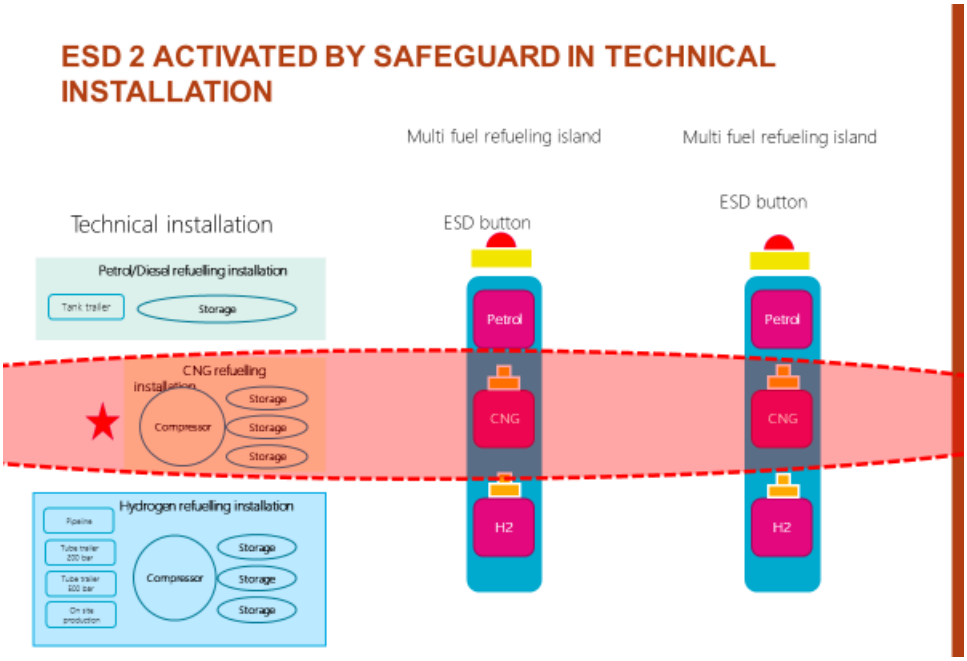

Figure 3 — ESD 2 activated by safeguard in technical installation

b) In the case of the activation of a safeguard at the dispenser island caused by for example gas detection, the other fuels at the dispenser island should be shut down as well.

ESD2:

- Activated by safeguard at dispenser island
- Complete process shut down
- Whole single fuel system will be shut down and go into fail safe mode, if safeguard is activated at the dispenser island installation
- Isolate the other fuels at the same dispenser island.
- The ESD system should trigger a visual and audible alarm that is unique and immediately recognizable by personnel on site
- Reset only after visual inspection at site

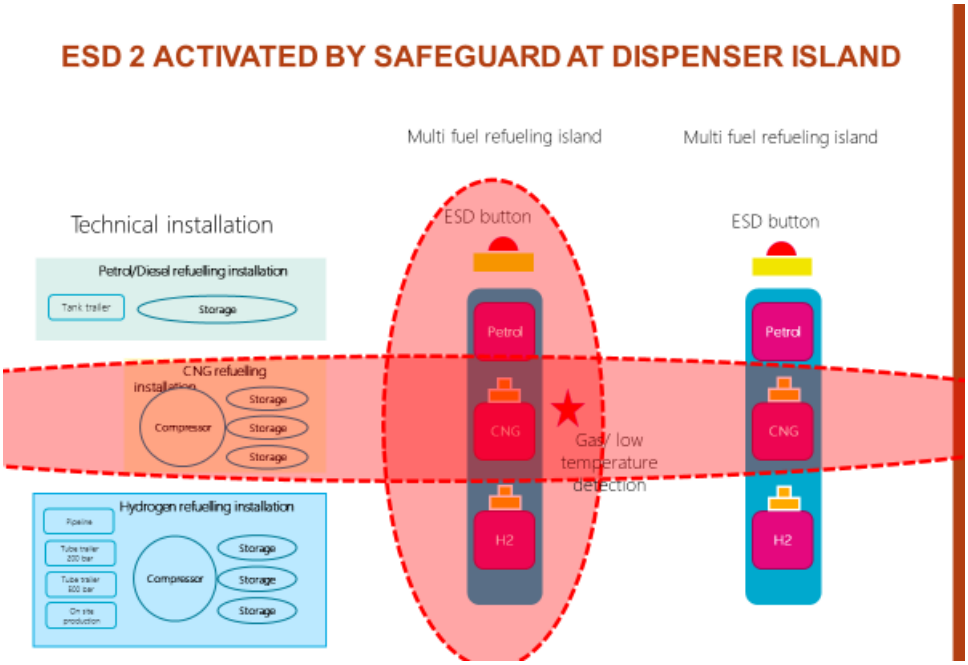

Figure 4 — ESD 2 activated by safeguard at dispenser island

4.4.5 Functionality of an ESD system

Below gives a description of which systems should be shut down according to the current European Standards. The actions of the ESD system during normal operation differs from fuel to fuel:

- Petrol/Diesel: not very specific, reference is made to EN ISO 13849-1. A safety-related stop function (e.g. initiated by a safeguard) should, as soon as necessary after actuation, put the machine in a safe state. Such a stop should have priority over a stop for operational reasons. When a group of machines are working together in a coordinated manner, provision should be made for signalling the supervisory control and/or the other machines that such a stop condition exists.

- LPG: when an ESD push button is activated, the electric system of the LPG part of the station's facilities, excluding the emergency lighting if present, should be switched off, and all actuators should close the valves within 15 s; ESD system should completely isolate the delivery and dispensing pipe-work from the storage pressure vessel.

- CNG: a) The compressor and dispensers should be shut down, and the outlets of any buffer storage should be isolated by the operation of fail-safe automatic valves. The isolation should be made as close to the storage as possible. b) The power supply should be isolated with the exception of power for safety control and mechanical ventilation systems. c) The gas supply should be shut off at the fuelling station gas supply inlet, compressor inlet, buffer storage outlet and dispenser.

- H2: the standard is not very specific: it should, while the process steps are similar to CNG, shut down the gas supply (by e.g. tank trailer) or stop the local H2 production (electrolyser or steam reformer), stop the compressor, close the output of the H2 storage and close the supply at the dispenser.

- LNG: The ESD system should switch the plant valves and other equipment into a safe state, as a minimum, closing the LNG storage tank liquid outlet valves; shut down the LNG pump of the fuelling station; closing the inlet/outlet valve of each dispenser.

- HPC: An HPC system is also equipped with ESD system, which is connected to shut off the power in case of an incident. ESD buttons are placed both on the dispenser and on the technical installation.

Other emergency shutdown functions may include:

— venting of any remaining gas in the dispensing system to an appropriate location;

— removal of power to electrical components in the vicinity of the dispenser that are not suitable for classified areas.

Annex A
(informative)

List of terms and definitions used in fuel station standards

The terms and definitions used in the 8 standards listed in Clause 2 have been compared:

— 346 terms have been recorded with 383 definitions. 316 terms are used by only one fuel.

— 2 terms are used by four different fuels: "dispenser" and "hazardous area".

— 3 terms are used by three different fuels: "breakaway coupling/device", "fuelling/filling station" and "maximum allowable (working) pressure".

— 25 terms are used by two different fuels.

These can be found in Table A.1.

Table A.1 — Terms and definitions used in fuel station standards

Term	**Natural gas** **EN ISO 16923:2018 (56 def)** *Natural gas fuelling stations — CNG stations for fuelling vehicles* **EN ISO 16924:2018 (77 def)** *Natural gas fuelling stations — LNG stations for fuelling vehicles*	**LPG** **EN 14678-1:2013 (17 def)** *Petrol filling stations - Part 1: Safety requirements for construction and performance of metering pumps, dispensers and remote pumping units* **EN 14678-2:2007+A1:2012 (20 def),** *Part 2; Components other than dispensers, and installation requirements* **EN 14678-3:2013 (19 def)** *Part 3: Refuelling installations at private and industrial premises*	**Hydrogen** **ISO 19880-1:2020 (81 def)** *Gaseous hydrogen — Fuelling stations — Part 1: General requirements*	**Diesel – Gasoline** **EN 13617-1:2012 (42 def)** *Petrol filling stations - Part 1: Safety requirements for construction and performance of metering pumps, dispensers and remote pumping units*	**Electricity** **IEC 61851-1:2019 (71 def)** *Electric vehicle conductive charging system - Part 1 : general requirements*
acceptance criteria			acceptable level of risk or harm, locally defined as: — a tolerable risk value; or — a specified harm level; or — requirements in a prescriptive document		
accessories		devices connected to the system whose main function is not for the storage or conveyance of LPG	device with an operational function		

adaptor					portable accessory constructed as an integral unit incorporating both a plug portion and one socket-outlet portion
air and/or vapour separator				device used for continuously separating and removing air or gases contained in the liquid	
approved	having approval for the intended usage from an authority having jurisdiction or having the manufacturer's declaration for intended use				
assembly	sub-system of fuelling stations comprising several components				
auto-extinguishing	feature of a material that ceases combustion upon removal of flame or ignition source				

basic process control system BPCS			system which responds to input signals from the process, its associated equipment, other programmable systems and/or an operator and generates output signals causing the process and its associated equipment to operate in the desired manner but which does not perform any safety-instrumented functions with a claimed SIL ≥ 1		
biomethane	methane rich gas derived from biogas or from gasification of biomass by upgrading with the properties similar to natural gas				
bleed			intentional expiration of a fluid from a fluid system		
boil-off gas	gas produced from evaporation of LNG in the LNG storage tank and other parts of the fuelling station including the gas returned from the vehicle tank				

bonding	equipotential zone where potentially live exposed metallic parts are electrically connected with at least one point connected to ground/earth				
break point		weakened section in a pipe or fitting intended to break when excessive force is applied			
breakaway coupling/device	coupling which separates at a predetermined section when required and each separated section contains a self-closing shut-off valve which seals automatically	coupling which separates at a predetermined section when required and each separated section contains a self-closing shut-off valve, which seals automatically	device on the fuelling hose that disconnects the hose from the dispenser when a tension limit is exceeded and blocks the flow of hydrogen from the dispenser, e.g. if the vehicle moves away with the fuelling hose connected to the vehicle		
buffer storage vessels	one or more suitable pressure vessels designed for the purpose of storing compressed natural gas		pressure vessels designed for the purpose of storing compressed hydrogen, which can be located between a hydrogen generator and a compressor for an even flow of gas to the compressor or between the compressor and dispensing system for accumulation of pressurized gas supply for vehicle fuelling		

building	structures, usually enclosed by walls and a roof, constructed to provide support or shelter for an intended occupancy		structure, usually enclosed by walls and a roof, constructed to provide support or shelter for intended occupancy		
bund	elevated boundary of the containment, like wall, dike or embankment				
burst pressure	pressure that causes failure and consequential fluid loss through the component envelope				
cable assembly					assembly consisting of flexible cable or cord fitted with a plug and/or a vehicle connector, that is used to establish the connection between the EV and the supply network or an EV charging station
cable management system					one or more devices that is intended to protect a cable assembly from mechanical damage and/or to facilitate its handling

canopy	roof, overhead shelter, or hood, that affords a degree of weather protection		roof, overhead shelter, or hood which affords a degree of weather protection		
catastrophic failure				irreversible damage resulting in an unsafe condition	
charging					all functions necessary to condition voltage and/or current provided by the AC or DC supply network to assure the supply of electric energy to the RESS
charging mode					method for connection of an EV to the supply network to supply energy to the vehicle
check valve				normally closed valve which is opened by flow of liquid in normal working conditions	
cladding				external panels that serve no structural, load bearing, purpose but which contribute to the physical protection of the contents of the housing	

cold end	cryogenic part of a reciprocating LNG pump				
contents gauge		device to indicate the liquid level or contents in a pressure vessel			
column extension				fabrication extending upwards from a metering pump / dispenser hydraulic housing	
compressed hydrogen storage system *CHSS*			hydrogen storage on-board vehicle, as defined in the GTR#13		
component pressure rating			maximum pressure at which it is permissible to operate a component as specified by the manufacturer at a specified temperature		
compressed natural gas *CNG*	natural gas which has been compressed and stored for use as a vehicle fuel				
compressor	machine that increases the pressure of gas				
conductive part					part which can carry electric current

exposed conductive part					conductive part of electrical equipment, which can be touched and which is not normally live, but which can become live when basic insulation fails
conduit	casing, tubing or liner, either metallic or non-metallic				
connecting point					point where one electric vehicle is connected to the fixed instal
connector			matching parts (such as male and female parts) that can be put together to form a "connection" which permits the transfer of fluids, electric power, or control signals		
containment	area, surrounded by a bund, to contain spilled LNG within that area				
control system			system which responds to input signals from the process and/or from an operator and generates output signals causing the process to operate in the desired manner		

control pilot conductor					insulated conductor incorporated in a cable assembly, which, together with the protective conductor, is part of the control pilot circuit
control pilot circuit					circuit designed for the transmission of signals or communication between the EV and the EV supply equipment
control pilot function					function used to monitor and control the interaction between the EV and the EV supply equipment
control pilot function controller CPFC					device in the EV supply equipment and the EV responsible for the control pilot function and the generation of the PWM signal
cord extension set					assembly consisting of a flexible cable or cord fitted with plug and a portable socket-outlet or connector which can match each other

cryogenic	intended for service over the temperature of −153 °C and −196 °C, the lower point being the normal boiling point of nitrogen				
cryogenic pump	pump that delivers LNG at a higher pressure				
cross ventilation				ventilation which facilitates airflow from one side of a housing or enclosure to the opposite side, usually horizontally	
cylinder	pressure vessel used for the storage of compressed natural gas				
cylinder working pressure	settled pressure of a fully filled cylinder at a uniform temperature of 15 °C				
dead man's push button		manually operated non latching device which immediately stops the flow when released			
delivery hose assembly				flexible delivery system to which the nozzle is connected	
detachable joint / demountable joint	mechanical joint that can be readily disassembled			joint which is designed to be assembled and disassembled	

direct contact					electrical contact of persons or animals with live parts
dispenser	equipment through which the fuel is supplied to the vehicle	delivery and measuring unit for LPG in the liquid phase	equipment in the dispensing system, including the dispenser cabinet(s) and support structure, that is physically located in the fuelling area	measuring and delivery system similar to that of a metering pump but without an integral pumping system	
dispenser cabinet			protective housing that encloses process piping and can also enclose measurement, control and ancillary dispenser equipment		
dispenser fuel pressure			pressure of the hydrogen gas supplied to the vehicle by the station		
dispenser fuel temperature			temperature of the hydrogen gas supplied to the vehicle by the station		
dispensing system			system downstream of the hydrogen supply system comprising all equipment necessary to carry out the vehicle fuelling operation, through which the compressed hydrogen is supplied to the vehicle		
dry air	air with a maximum dew point of −40 °C				

dryer	equipment which decreases the water vapour content (moisture) of natural gas				
earthing terminal / grounding terminal (US, CA)					terminal provided on equipment or on a device and intended for the electric connection with the earthing arrangement
electric vehicle EV					(electric road vehicle) any vehicle propelled by an electric motor drawing current from an RESS, intended primarily for use on public roads
plug in hybrid electric road vehicle PHEV					electrical vehicle that can charge the rechargeable electrical energy storage device from an external electric source and also derives part of its energy from another on-board source

EV supply equipment					equipment or a combination of equipment, providing dedicated functions to supply electric energy from a fixed electrical installation or supply network to an EV for the purpose of charging
EV charging system					complete system including the EV supply equipment and the EV functions that are required to supply electric energy to an EV for the purpose of charging
EV charging station					stationary part of EV supply equipment connected to the supply network
EV socket-outlet					specific socket-outlet intended to be used as part of EV supply equipment and defined in the IEC 62196 series
EV plug					specific plug intended to be used as part of EV supply equipment and defined in the IEC 62196 series

enclosure	structure, not being a building or canopy, that encloses a component of the fuelling station		structure, protective housing, container, machine cabinet, etc. which encloses or partially encloses equipment of a station that may have access for maintenance but is not intended to be occupied		
equipment for locations with restricted access					equipment accessible to all persons who are authorized to have access to the location (e.g. equipment located in private housing, private parking areas or similar places)
equipment for locations with non-restricted access					equipment accessible for all persons, e.g. access available in a public area
portable equipment					cord and plug connected equipment, cable assembly, adaptors or other accessories that are capable to be carried by one person and designed and intended to be carried within the EV

mobile equipment					electric equipment which is moved while in operation or which can easily be moved from one place to another while connected to the supply
stationary equipment					equipment or electric equipment not provided with a carrying handle and having such a mass that it cannot easily be moved
excess flow protection system		system, including software and hardware arrangements, designed to assess flow rate and close valves to stop the fluid flow when the flow rate exceeds a predetermined value			
excess flow valve		valve designed to close automatically, with a small residual flow, when the fluid flow passing through it exceeds a predetermined value, and to re-open when the pressure differential across the valve has been restored below a certain value			

explosion			ignition and rapid combustion that causes an over-pressure		
explosive gas atmosphere	mixture of substances with air, under atmospheric conditions, in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture		mixture with air, under atmospheric conditions, of flammable substances in the form of gas or vapour, which, after ignition, permits self-sustaining flame propagation		
external pump		pump which is installed on the LPG delivery pipe-work			
factory acceptance testing FAT			tests performed in the factory on fuelling station equipment or systems to verify functionality and/or integrity prior to shipment to the site, (or an appropriate alternative type acceptance methodology)		
fail-safe	design feature that ensures that safe conditions are maintained in the event of a malfunction of a control device or an interruption of a supply source				

fallback			back-up control strategy, for example in the fuelling protocol when the anticipated precooling of hydrogen to within a specified range of temperatures is not achieved, however fuelling is able to continue, typically at a different fuelling rate		
fault protection					protection against shock under single-fault conditions
fast fill	fuelling operation which has a designed flow rate greater than 100 m^3(N)/h per nozzle				
field piping	piping installed for interconnection between equipment at the site				
filling	process of transferring LNG into the LNG storage tank				
filling nozzle		mechanical system, fitted to the hose of the dispensing system, consisting of a filling nozzle body, operating mechanism, including sealing elements and a service gasket if required			

fire			non-premixed combustion process of a solid, liquid pool, or a jet plume of flammable substance		
fire resistant	property that prevents or retards the passage of excessive heat, hot gases or flames under specified conditions				
fire wall	wall, or separating partition erected to reduce the effects of radiated heat				
fitting			part or design feature on a component used to join (i.e. connect) any pressure retaining components in the system		
flash gas	gas generated from liquid when delivered to the tank to lower pressure than is its boiling pressure at its temperature				
flow rate				volume flow delivered under normal working conditions	
forecourt			surfaced area where vehicle dispensing operations are conducted including the fuelling pad and any area underneath a canopy		

fuelling	transfer of fuel from dispenser to the vehicle				
fuelling assembly			part of the dispenser providing the interface between the hydrogen fuelling station and the vehicle - an assembly consisting of a hose breakaway device, a hose(s), a nozzle and connections between these components		
fuelling hose			flexible conduit used for dispensing gaseous hydrogen to vehicles through a fuelling nozzle		
fuelling nozzle	device which permits quick connection and disconnection of the fuelling hose to/from the refuelling receptacle				
fuelling pad			area with special construction requirements adjacent to the hydrogen dispensers, where customers park their vehicles during fuelling		
fuelling pressure	pressure at which the fuel is delivered to the vehicle				

fuelling station / filling station	facility at which vehicles fuels are dispensed		facility for the dispensing of compressed hydrogen vehicle fuel, often referred to as a hydrogen refuelling station (HRS) or hydrogen filling station, including the supply of hydrogen, and hydrogen compression, storage, and dispensing systems	establishment providing for the delivery of liquid fuels into the tanks of motor vehicles, boats and light aircraft and into portable containers	
CNG fuelling station	facility at which compressed natural gas is dispensed to vehicles				
LCNG fuelling station	facility at which CNG derived from LNG is dispensed to vehicles				
LNG fuelling station	facility at which LNG is dispensed to vehicles				
mobile LNG fuelling station	LNG fuelling station (and/or LCNG fuelling station) having an LNG storage tank capacity of more than 1 000 litres that can be transported with LNG onboard				

movable LNG fuelling station	LNG fuelling station (and/or LCNG fuelling station) having an LNG storage tank capacity of more than 1 000 litres and consisting of one or more units intended for easy installation and possible relocation				
fuelling station operator			person or organization responsible for the safe operation, maintenance and housekeeping of the fuelling station		
ground mounted					equipment with a part intended to be embedded or attached to the ground
grounding	electrical connection of potentially live exposed metallic parts to earth				
guard			part of a machine specially used to provide protection by means of a physical barrier		
harm			physical injury or damage to the health of people, or damage to property or the environment		

harmonized standard			European standard developed by a recognized European Standards Organization (CEN, CENELEC, or ETSI), in line with a European Directive		
hazard			potential source of harm		
hazard distance			distance from the hazard to a determined physical effect value that can lead to a range of harm to people, equipment or environment		
hazardous area	area in which an explosive gas atmosphere is present, or can be expected to be present, in quantities such as to require special precautions for the construction, installation and use of apparatus to prevent ignition	area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment	area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment	area in which an explosive gas atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment	
hose	pipeline of flexible material with end fittings attached				

vent hose	pipeline of flexible material through which natural gas is vented from the fuelling connection at a vehicle				
hose assembly	hose or hoses with ancillary components, such as bend restrictors, breakaways and nozzles, attached		assembly which includes the hose and end connections, including any necessary fittings, bend restrictors, and appropriate markings		
hose cassette				separate assembly primarily for the storage of delivery hose assembly(s) or vapour recovery delivery hose assembly(s)	
high hose inlet joint				delivery hose assembly connection at a location on equipment that will be at a height greater than 2 m above ground level when the equipment is installed	
de-mountable joint				joint which is designed to be assembled and disassembled	
housing			guard or enclosure for operating parts, control mechanisms, or other components, that need not be accessible during normal operation		

hydraulic housing of a metering pump/dispenser				structure, which may include cladding, to provide physical and ingress protection of the liquid and/or vapour equipment	
hydrogen purifier			equipment to remove undesired constituents from the hydrogen		
hydrogen service level *HSL*			pressure level in MPa used to characterize the hydrogen service of the dispensing system based on the NWP of the vehicle		
hydrostatic relief valve		self-closing valve which automatically, without the assistance of any energy other than that of the fluid concerned, discharges fluid at a predetermined pressure			
in-cable control box *ICCB*					device incorporated in the Mode 2 cable assembly, which performs control functions and safety functions
incident			any unplanned event that resulted in injury or ill health of people, or damage or loss to property, plant, materials or the environment or a loss of business opportunity		

indoor use					intended for operation under normal ambient conditions in a building
installer		person or organization who, by qualification, training, experience and resources assumes technical responsibility for the installation of an LPG filling station			
insulation					all the materials and parts used to insulate conductive elements of a device, or a set of properties which characterize the ability of insulation to provide its function
basic insulation					insulation of hazardous-live-parts which provides basic protection
double insulation					insulation comprising both basic insulation and supplementary insulation

reinforced insulation					insulation of hazardous-live-parts which provides a degree of protection against electric shock equivalent to double insulation
supplementary insulation					independent insulation applied in addition to basic insulation for fault protection
integrated			being part of an existing, or new build, conventional fuelling station for the dispensing of compressed hydrogen		
interlock					device or combination of devices that prevents the power contacts of a socket-outlet/vehicle connector from becoming live before it is in proper engagement with a plug/vehicle inlet, and which either prevents the plug/vehicle connector from being withdrawn while its power contacts are live or makes the

					power contacts dead before separation
intrinsically safe circuit	circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under specified test conditions				
latching device					part of the interlock mechanism provided to hold a plug in the socket-outlet or vehicle connector in the vehicle inlet to prevent its intentional or unintentional withdrawal
leakage current					electric current in an unwanted conductive path under normal operating conditions
liquefied natural gas *LNG*	natural gas that has been liquefied, after processing, for storage or transportation purposes				
LNG offloading area	area where the LNG tanker connects to the LNG fuelling station for offloading LNG into the LNG storage tank				

LNG pump	cryogenic pump for transferring LNG				
LNG storage tank	cryogenic vessel used for the purpose of storing LNG				
LNG tanker	vehicle that delivers LNG for offloading to the LNG storage tank at the LNG fuelling station				
LNG transfer point	connection point between the hose of the LNG tanker and the fixed pipeline to the LNG storage tank				
liquefied petroleum gas		low pressure gas composed of one or more light hydrocarbons which are assigned to UN 1011, UN 1075, UN 1965, UN 1969 or UN 1978 only and which consists mainly of propane, propene, butane, butane isomers, butene with traces of other hydrocarbon gases Note 1 to entry: For the specification of automotive LPG see EN 589.			
LPG system		installation of piping and components in contact with LPG			

live part					conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor
hazardous-live-part					live part which, under certain conditions, can give a harmful electric shock
locking mechanism					means intended to reduce the likelihood of tampering with, or an unauthorized removal, of the accessories
lower explosion limit *LEL*	volume concentration of flammable gas or vapour in air, below which the mixture is not flammable				
lower flammable limit *LFL*	volume concentration of flammable gas or vapour in air, below which the mixture is not flammable		concentration of flammable gas, vapour or mist in air below which an explosive gas atmosphere will not be formed		

maximum allowable (working) pressure MA(W)P	maximum pressure to which a component or system is designed to be subjected and which is the basis for determining the strength of the component or system	maximum pressure for which the equipment is designed	maximum pressure permissible in a system at the temperature specified for the pressure		
maximum developed pressure maximum accumulated pressure			highest pressure expected during fault management by the dispensing system		
maximum fuelling pressure MFP	maximum pressure to which the vehicle tank can be filled		maximum pressure expected during a normal (fault-free) vehicle fuelling		
maximum (allowable) operating pressure M(A)OP	maximum pressure that the component or system is subjected to during normal operation		highest pressure that is expected for a component or system during normal operation including anticipated transients		
metering pump				measuring system containing its own pumping system to draw and deliver liquid fuel from a supply tank or tanks into the tanks of motor vehicles, boats and light aircraft and into portable containers	

metering pump/dispensers hydraulic housing				structure, which may include cladding, to provide physical and ingress protection of the liquid and/or vapour equipment	
metering unit				device for continuously measuring the amount of liquid fuels delivered	
mitigation			combination of the measures incorporated at the design stage and the measures required to be implemented by the station operator, dispenser operator, or others involved with the operation and maintenance of the fuelling station to reduce the probability or severity of an incident		

mobile storage	multi-cylinder or tank fixture mounted on a vehicle or trailer and used for the transportation of natural gas to CNG fuelling stations / LNG storage tank assembly, having a gross volume of more than 1 000 litres, mounted on a vehicle and used at the LNG fuelling station as a temporary LNG storage tank		multiple-element gas container or liquid hydrogen tank fixture mounted on a vehicle or trailer and used for the transportation of hydrogen to hydrogen fuelling stations		
mounded vessel		pressure vessel above or partially underground of which the part above the ground is completely covered			
multi-fuel dispenser / multi product metering pump/dispenser	dispenser delivering CNG and other fuels (liquid or gaseous)			unit designed to deliver liquid fuels where the customer can choose from more than one product, which may include systems where the fuel delivered is a mix of more than one base fuel	
multi-fuel station	fuelling station that can fuel natural gas as well as other fuels, for example diesel, petrol, LPG				

multiple-element gas container MEGC			multimodal assembly of cylinders, tubes or bundles of cylinders which are interconnected by a manifold and assembled within a framework, including service equipment and structural equipment necessary for the transport of gases		
natural gas	complex gaseous mixture of hydrocarbons, primarily methane, but generally includes ethane, propane and higher hydrocarbons, and some non-combustible gases such as nitrogen and carbon dioxide				
net positive suction head NPSH	inlet total head increased by the head (in flowing liquid) corresponding to the atmospheric pressure at the test location and decreased by the sum of the head corresponding to the vapour pressure of the pump liquid at the inlet temperature and the inlet impeller				

	height				
nominal working pressure NWP			pressure of a vehicle CHSS at 100 % SOC at a gas temperature of 15 ºC		
non-combustible	not capable of undergoing combustion under specified conditions				
non-hazardous area	area in which an explosive gas is not expected to be present in quantities such as to require special precautions for the construction, installation and use of apparatus			area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment	
non-public fuelling station			fuelling station that does not sell or dispense gaseous hydrogen to the general public		
non-return valve		valve designed to close automatically to restrict reverse flow			
normal operation	situation when the equipment is operating within its design parameters			situation when the equipment, protective systems, and components perform their intended function within their design parameters	

nozzle / automatic delivery nozzle / vapour recovery nozzle			device connected to a fuel dispensing system, which permits the quick connect and disconnect of fuel supply to the vehicle storage system	delivery nozzle that additionally includes a path through which vapour can be recovered nozzle	
nozzle boot		partially enclosed housing where the filling nozzle is located when not in use		location, normally a partially enclosed housing, where the nozzle or vapour recovery nozzle is stored when not in use	
nozzle sensor				device detecting the nozzle position in the nozzle boot	
odorant	intensely smelling organic chemical or combination of chemicals added to natural gas at low concentration and capable of imparting a characteristic and distinctive (usually disagreeable) warning odour so gas leaks can be detected at concentrations below their lower flammability limit				
odorization	process of introducing odorant(s) into natural gas				

odorizer	equipment used to introduce odorant into natural gas				
offloading	process of transferring LNG from the LNG tanker				
outdoor use					capable of operating under specific range of outdoor conditions
outdoors			location outside of any building or structure, or location under a roof, weather shelter, or canopy provided this area is not enclosed on more than two sides		
overground vessel		pressure vessel above the surrounding ground level and not covered			
overpressure	condition under which the pressure exceeds the maximum allowable working pressure				
permanently connected EV supply equipment					EV supply equipment that can only be connected to, or disconnected from, the AC or DC supply network by the use of a tool
plinth			raised area on the forecourt, supporting and protecting the dispensers and associated equipment		

plug					accessory having contacts designed to engage with the contacts of a socket-outlet, also incorporating means for the electrical connection and mechanical retention of flexible cables or cords
potential ignition source				equipment related ignition source which has the capability to ignite an explosive atmosphere (i.e. to become effective)	
positive isolation			complete separation of one part of the plant or equipment from other parts of the system		
power failure	reduction in power such that any electrical component or sub system (such as flow control) are operating outside manufacturers specification				
powering up sequence				internal sequence of events that follows the application of electrical power to the equipment	

pre-cooling			process of cooling hydrogen fuel temperature prior to dispensing		
preset delivery				delivery where the maximum volume (cost) for that delivery is fixed, either directly at the metering pump/dispenser or remote from the metering pump/dispenser, before the delivery commences	
preset delivery slowdown				last part of a preset delivery where the flow rate is limited by the metering pump/dispenser to allow accurate completion of the delivery	
pressure class			non-dimensional rating of components designed to dispense hydrogen to road vehicles at the required pressure and temperature		

pressure relief valve		self-closing valve which automatically, without the assistance of any energy other than that of the vapour concerned, discharges vapour at a predetermined pressure, and operates with a pop action	safety device that releases gases or liquids above a specified pressure value in cases of emergency or abnormal conditions		
pressure vessel		assembly of the pressure-retaining envelope (including the openings and their closures) and non-pressure retaining parts attached directly to it			
probability			expression of the chance (likelihood) that a considered event will take place to property, system, business or to the environment		
protective conductor					conductor provided for purposes of safety, for example protection against electric shock
protective earthing / protective grounding (US, CA)					earthing a point or points in a system or in an installation or in equipment for purposes of electrical safety
protective earthing					protective conductor provided for

conductor / protective grounding conductor (US, CA) / equipment grounding conductor (US, CA)					protective earthing
proved isolation			valved isolation where the effectiveness of valves closure can be confirmed via vent or bleed points		
proximity function					electrical or mechanical means to indicate the insertion state of the vehicle connector in the vehicle inlet to the EV and/or to indicate the insertion state of the plug in the socket-outlet of the EV charging station
public fuelling station			fuelling station that sells gaseous hydrogen to the general public		
pump unit	unit that transfers LNG and that consists of one or more pumps, including all associated piping and equipment				
qualified personnel /	person having the ability, appropriate		personnel with knowledge or abilities,		

competent person	training, knowledge and experience, to supervise or carry out the work being undertaken in a safe and proper manner		gained through training and/or experience as measured against established requirements, standards or tests, that enable the individual to perform a required function		
rechargeable energy storage system RESS					system that stores energy for delivery of electric energy and which is rechargeable
refuelling connector	joined assembly of LNG fuelling nozzle and LNG refuelling receptacle				
(refuelling) receptacle	device connected to a vehicle or storage system which receives the CNG/LNG refuelling nozzle and permits safe transfer of fuel		device connected to a vehicle storage system which receives the nozzle		

remote pumping unit				suction pump assembly mounted remotely from a dispenser	
residual current device *RCD*					mechanical switching device designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions
retaining means					device (e.g. mechanical or electromechanical) that holds a plug or vehicle connector in position when it is in proper engagement, and prevents its unintentional withdrawal
retraction system				system to assist the stowage of delivery hose assembly or vapour recovery delivery hose assembly	

risk			combination of the probability of occurrence of harm and the severity of that harm; encompassing both the uncertainty about and severity of the harm		
risk assessment			determination of quantitative or qualitative value of risk related to a specific situation and a recognized threat (also called hazard)		
risk level			assessed magnitude of the risk		
routine test				test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria	
safeguarding			instruments or final elements related to safety-instrumented system, SIS, or pressure relief device, PRD		
safe-break				device to minimize fuel spillage and to stop fuel flow achieved by separation between nozzle and metering pump or dispenser within a defined range of forces	

safety			freedom from unacceptable risk		
safety distance *separation distance* *safe distance* *setback distance*	minimum separation between a hazard source and an object, which is required to mitigate the effect of a likely foreseeable incident and prevent a minor incident escalating into a larger incident		distance to acceptable risk level or minimum risk-informed distance between a hazard source and a target (human, equipment or environment), which will mitigate the effect of a likely foreseeable incident and prevent a minor incident escalating into a larger incident		
satellite delivery system				remote delivery system connected to a metering pump/dispenser	
external separation distance	separation distance between a hazard source and an object situated outside the boundaries of the fuelling station				
internal separation distance	separation distance between a hazard source and an object situated within the boundaries of the fuelling station				

safety function			function to be implemented by a safety-instrumented system, which is intended to achieve or maintain a safe state for the process, with respect to a specific hazardous situation		
safety-instrumented system *SIS*			instrumented system used to implement one or more safety-instrumented functions		
safety integrity level *SIL*			discrete level (one out of a possible four), corresponding to a range of safety integrity values, where safety integrity level 4 has the highest level of safety integrity and safety integrity level 1 has the lowest		
safety-related system			designated system that both implements the required safety functions necessary to achieve or maintain a safe state for the EUC and is intended to achieve, on its own or with other E/E/PE safety-related systems, other technology safety-related systems or external risk reduction facilities, the necessary safety integrity		

			for the required safety functions		
saturation pressure	pressure at which the liquid boils				
service duct	enclosed conduit through which gas piping, utility piping, electrical cabling, etc. is routed				
settled pressure	gas pressure when a given settled temperature is reached and there is no gas flow				
settled temperature	uniform gas temperature in the cylinder after the dissipation of any heat caused by fuelling				
shear valve		normally open valve activated by impact which closes both sides of the break point to prevent flow and remains closed after activation		component whose function is to prevent continuous liquid flow or vapour release in the event of impact or fire	
shut-off valve		valve to provide a leak-tight seal which is operated either manually, remotely or is self-closing			
sight glass		device to allow checking that all, or part, of the measuring system is completely filled with liquid		device to allow checking that all, or part, of the measuring system is completely filled with liquid	

site acceptance testing *SAT*			tests performed after installation of the fuelling station at the site to verify functionality and/or integrity		
skid			process system contained within a frame that allows the process system to be easily transported and installed for operation		
screen		perforated cladding fabrication which may be provided to enhance the visual appearance of a pump or dispenser or to provide another related function		perforated cladding fabrication which may be provided to enhance the visual appearance of a pump or dispenser or to provide another related function	
slow fill	fuelling operation which has a designed flow rate equal or less than 100 m^3(N)/h per nozzle				
socket-outlet					accessory having socket-contacts designed to engage with the contacts of a plug and having terminals for the connection of cables or cords

standard plug and socket-outlet					plug and socket-outlet which meets the requirements of any IEC and/or any national standard that provides interchangeability by standard sheets, excluding the specific EV accessories as defined in the IEC 62196 series
stand-alone			independent for the dispensing of compressed hydrogen only		
standard temperature and pressure		15,6 °C (288,7 K), 1,013 bar absolute (0,1013 MPa absolute)			
standards development organization SDO			industry- or sector-based standards organizations that develop and publish industry specific standards		
state of charge SOC			density (or mass) ratio of hydrogen in the compressed hydrogen storage system (CHSS) between the actual CHSS condition and the capacity at NWP when the system is equilibrated at 15 °C		
submersible pump		pump which is completely or partially immersed in the liquid LPG			

supply network					any source of electric energy (eg. mains or electric grid, distributed energy resources (DER), battery bank, PV installation, generator, etc.)
switching device					device designed to make or break the current in one or more electric circuits
mechanical switching device					switching device designed to close and open one or more electric circuits by means of separable contacts
target pressure			dispenser fuel pressure that the hydrogen fuelling protocol targets for the end of fuelling		
test pressure pt	pressure at which the installation or part of the installation is tested				

thermal relief valve	relief valve that is installed to relieve excess pressure caused by vaporization of cryogenic liquid trapped in an isolated section of a pipeline or other small components of the LNG fuelling station				
touch current					electric current passing through a human body or through an animal body when it touches one or more accessible parts of an electrical installation or electrical equipment
trim heater	heat exchanger that heats the gas from the vaporizer to a temperature acceptable for the downstream equipment				
try cock	valve connected to a pipe, the inlet of which is at the position of the maximum fill level of the tank				

type of protection				specific measures applied to equipment to avoid ignition of a surrounding explosive atmosphere	
unattended filling station		self-service filling station that is not supervised by on-site personnel			
underground vessel		vessel below the surrounding ground level and completely covered			
user					party who will specify, purchase, use and/or operate the EV supply equipment, or someone acting on their behalf
vaporizer / ambient vaporizer	vaporizer heat exchanger that vaporizes LNG and delivers it in the gaseous phase / heat exchanger that vaporizes LNG with the heat of ambient air	device, other than a tank, that receives hydrogen in a liquid form and adds sufficient heat to convert the liquid to a gaseous state			
vapour barrier				sealing system to limit hazardous areas	
vapour pipe				tubing of the vapour recovery system, excluding the vapour recovery delivery hose assembly and vapour recovery nozzle	

vapour pump				pump positioned in the vapour recovery system to supply vacuum for vapour suctioning	
vapour recovery system				system in and attached to the metering pump/dispenser to feed back the vapours displaced from the fuel tank and led back into the vapour return lines to the storage tank	
vapour trap		unventilated part of a structure where vapours can accumulate creating an area of greater hazard than its immediate surroundings		unventilated part of a structure where vapours can accumulate creating an area of greater hazard than its immediate surroundings	
vault	room or space, typically situated underground				
vehicle adaptor					portable accessories constructed as an integral unit incorporating both vehicle inlet portion and vehicle connector portion
vehicle coupler electric vehicle coupler					means of enabling the connection at will of a flexible cable to an electric vehicle

vehicle connector electric vehicle connector					part of a vehicle coupler integral with, or intended to be attached to the cable assembly
vehicle inlet electric vehicle inlet					part of a vehicle coupler incorporated in, or fixed to, the electric vehicle
vehicle tank	cryogenic tank mounted on a vehicle for the storage of LNG as a fuel for that vehicle				
ventilation	movement of air and its replacement with fresh air due to the effects of wind, temperature gradients, or artificial means (for example fans or extractors)				
venting	controlled release of natural gas to the atmosphere				
vent stack	pipe that allows gas to be vented at a safe elevation and location				
warm end drive	non-cryogenic part of a reciprocating LNG pump, comprising the pump drive part				

water bath vaporizer	heat exchanger that vaporizes LNG using the heat from water that is warmed by the ambient air or an external source of energy including water from natural sources (e.g. river, sea)				
zone	hazardous area classified based upon the frequency of the occurrence and duration of an explosive gas atmosphere				

Annex B
(informative)

Requirements addressed in fuel station standards

The requirements addressed in the 8 standards listed in Clause 2 can be found in Table B.1 along with the corresponding chapter where the requirements are addressed.

Table B.1 — Requirements addressed in fuel station standards

Fuel station standard	EN ISO 16923: 2018	EN ISO 16924: 2018	ISO 19880-1: 2020	EN 13617-1: 2012	EN 14678-1: 2013	EN 14678-2: 2007+A1:2012	EN 14678-3: 2013	IEC 61851-1: 2019
Scope	1	1	1	1	1	1	1	1
Normative references	2	2	2	2	2	2	2	2
Terms and definitions	3	3	3	3	3	3	3	3
Symbols and abbreviated terms	4	4	4	N/R				
Risk management	5	5	5	4				
General design requirements	6	6	5	5				
Site layout	6.2	6.2	5,4	N/A				
Pressure safety relief valves and venting	6.3		5.4, 7.8	N/A				
Safety distances		6.2.1	5.4					
Fuel supply to the fuelling station	7	7	6	N/A				
Compressors	9	9	7.5	N/A				
Instrumentation and control	9.2	8.3	11	N/A				
Hazardous area classification	9.6	8.4	7.4, 10.2					
Dispensers	11	9	8	EN 13617-1:2012	EN 14678-1:2013	4.8		
Breakaway devices	11.2	9.2	8.3.4	EN 13617-2			4.12	
Fuelling hose assemblies	11.3	9.3	8.3.4	5.3.4.3				
Fuelling hoses	11.4	9.4	8.3.4					

Fuel station standard	EN ISO 16923: 2018	EN ISO 16924: 2018	ISO 19880-1: 2020	EN 13617-1: 2012	EN 14678-1: 2013	EN 14678-2: 2007+A1:2012	EN 14678-3: 2013	IEC 61851-1: 2019
Enclosure	11.5	9.5	5.3.3, 7.11, 8.3.3	5.3.6				
Fuelling controls and instrumentation	11.6	9.6	8.1, 8.2	5.3.1.2				
Electrical systems and interconnections	11.7	9.7	10	5.3.2				
Quality		10.1	9					
Pipework	13	11	7.2			4.9	4.8	
General	13.1	11.1	7.2.1					
Buried piping	13.2	11.2	(7.2.1)	N/A				
	EN ISO 16923:2018	EN ISO 16924:2018	ISO 19880-1:2020	EN 13617-1:2012	EN 14678-1:2013	EN 14678-2:2007+A1:2012	EN 14678-3:2013	IEC 61851-1:2019
Electrical	14	12	10	5.3.2	4.2	4.11	4.12	
Labelling	14.1	12.1	13.2, 13.3, 13.4	7,4				
Contact with live parts	14.2	12.2	10	5.3.2.5				
Cables	14.3	12.3	10	5.3.2.4				
Performance after power fail and restoration	14.4	12.4	11,1	5.3.1.2				
Electrical bonding and grounding	14.5	12.5	10.1.3, 10.2.3	6.2.1				
Instrumentation and control system	15	13	12	N/A				
Gas detection	15.1	13.1	11.2.3	N/A				

Fuel station standard	EN ISO 16923: 2018	EN ISO 16924: 2018	ISO 19880-1: 2020	EN 13617-1: 2012	EN 14678-1: 2013	EN 14678-2: 2007+A1:2012	EN 14678-3: 2013	IEC 61851-1: 2019
Emergency shutdown devices	15.2	13.2	11.2.2	N/A				
Emergency shutdown	16	14	11.2	N/A		4.11.2		15
Emergency shutdown procedure	16.1	14.1	11,2	N/A				
Restoration after emergency shutdown	16.2	14.2	11,2	N/A				
Testing and commissioning	18	16	12	6.2	5	6 7	5 6	
Operation	19	17	13	N/A				
Fuelling procedures	19.1	17.1	8	N/A				
Safety signs	19.2	17.2	13,2	7.2				
Training	19.3	17.3	13.7	N/A				
Emergency response plan	19.4	17.4	13.8	N/A				
Operations manual	19.5	17.5	14,8	7,3				
Inspection and maintenance	20	18	15	N/A				
Inspection and maintenance program	20.1	18.1	15.1	N/A				
Documentation	11.8	19	14	7.3	7			16

Bibliography

[1] IEC 61508, *Functional safety of electrical/electronic/programmable electronic safety related systems*

[2] IEC 61511, *Functional safety – Safety instrumented systems for the process industry sector*

[3] EN 13850, *Design principles for emergency stop systems*

[4] EN 17127:2018, *Outdoor hydrogen refuelling points dispensing gaseous hydrogen and incorporating filling protocols*

[5] ANSI/ISA S84.01, *Application of Safety Instrumented Systems for the Process Industries*

[6] Directive 2014/32/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments

[7] Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres

[8] Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment

[9] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure