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Guide for multifuel stations

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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.

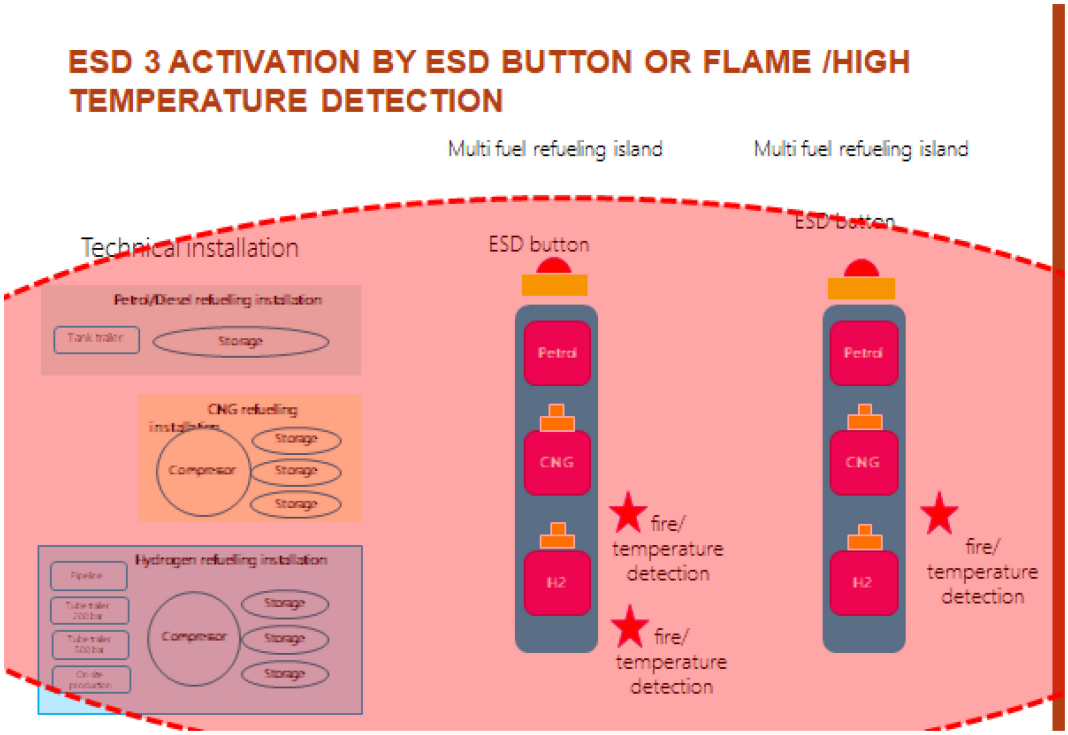

Figure 1 — ESD 3 activation by ESD button or flame/high temperature detection

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

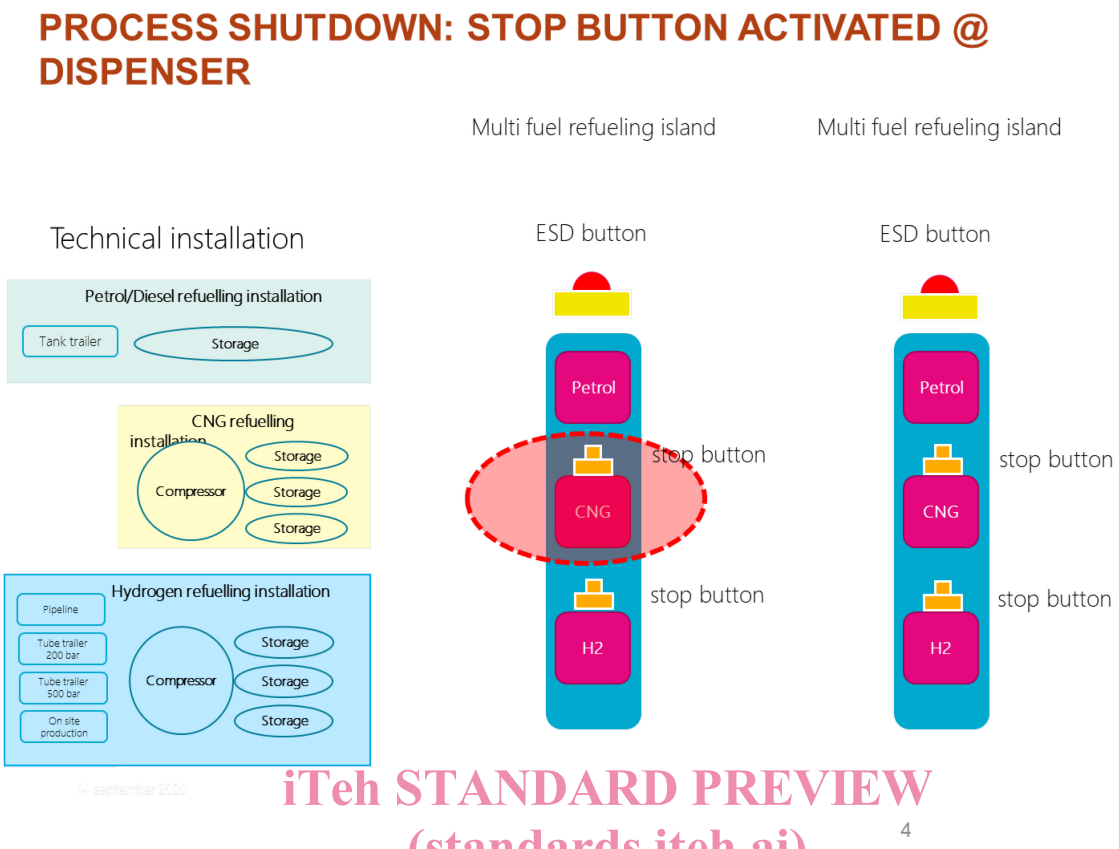

Figure 2 — Process shutdown: stop button activated at dispenser

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