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اللائحة الفنية المطبقة في اوروبا الخاصة بالدليل الخاص بالمخططات والتنفيذ والتركيب والفحص والاقلاع والتشغيل لمحطات وقود الغاز الطبيعي المضغوط

Guideline for Planning, Construction, Installation, Testing, Start-up and Operation of Natural Gas Fueling Stations

دولة الامارات العربية المتحدة

UNITED ARAB EMIRATES

IEC:

تقديم

هيئة الامارات للمواصفات والمقاييس هى الهيئة المسئولة عن انشطة التقييس بالدولة ومن مهامها إعداد المواصفات القياسية و اللوائح الفنية الاماراتية بواسطة لجان فنية متخصصة تضم خبراء ومختصين من الجهات المعنية في الدولة وقد قامت اللجنة الفنية الفرعية لمواصفات استخدام الغاز الطبيعي كوقود للمركبات وبعد الدراسة باقتراح التبني بالمصادقة للائحة المطبقة في الأوروبية:

TUV 510 اللائحة الفنية الخاصة بالدليل الخاص بالمخططات والتنفيذ والتركيب والفحص والاقلاع والتشغيل لمحطات وقود الغاز الطبيعي المضغوط

وأقرتها اللجنة الفنية للمواصفات لقطاع المنتجات الميكانيكية وهي موزعة لإبداء الرأي والملاحظات حولها قبل اعتمادها كلائحة فنية اماراتية

Foreword

Emirates Authority for Standardization & Metrology (ESMA) has a national responsibility for standardization activities in UAE. One of ESMA main functions is to issue Emirates Standards /Technical regulations through specialized technical committees.

ESMA sub committee for; Standardization the project of using CNG as fuel for vehicles had recommended the adoption of the Regulation used in European region:

TUV 510 " Guideline for Planning, Construction, Installation, Testing, Start-up and Operation of Natural Gas Fueling Stations"

The ESMA/TC for Standardization of Mechanical Products, had approved it.

This Regulation distributing for notes and recommendations.

VdTUV 510-PRESSURE GASES

Guideline for planning, construction, installation, testing, start-up and operation of Natural Gas fueling stations

This guideline serves as a working document for legally licensed technical experts. It contains all relevant provisions and instructions and is supplemented by interpretations and operating experiences summarized by the working party “pressure gases”.

Foreword

This guideline comprises the state of the art / best practice as a compendium of several technical standards. It is valid for planning, construction, installation, testing, start-up and operation of CNG fueling stations.

This code shows the applicable technological rules resulting in CNG fueling stations that can be operated safely.

It addresses the manufacturers and the operators as well as the legally licensed technical experts.

TABLE OF CONTENTS

1 Scope

1.1 Classification of Scope

This guideline applies to the planning, construction, equipment, installation, inspection, commissioning and use of NGV fueling stations and their components, using Natural Gas (CNG = Compressed Natural Gas) from the pipework of public gas supply to compress it and dispense it into gas cylinders as a fuel for the propulsion and operation of a vehicle.
The scope comprises the whole installation, from the main shut-off device of the NGV fueling station (appendix 1) to the fueling nozzle inclusive of the operating sites.

1.2 Purpose

This guideline presents the state of the art and serves to unify the inspection by the legally licensed technical experts. Its aim is to specify the requirements for NGV fueling stations and to ensure the safe operation of the fueling station as well as the proper fueling of vehicles' gas cylinders. This reduces the risk of accidents and repercussions on the public gas supply.

1.3 Gas composition

This guideline applies to gases according to DVGW-worksheet G 260/ ISO 13686. Care should be taken that condensation while compressing does not occur.

2 Terms and definitions

2.1 NGV Fueling Stations

NGV Fueling stations are installations to dispense Natural Gas into gas cylinders of vehicles after VdTUV-bulletin 757, whose storage vessels are fixed to the vehicle while operating.

One distinguishes between NGV fueling stations with or without gas storage.

NGV fueling stations comprise the operating sites and the technical equipment necessary for its operation, such as:

- pipeworks, compressor, cylinder
- measurement-, open loop control- and closed loop control units (MSR-units)
- dispensing units (e.g. dispenser, fueling hose, receptacle)
- safety devices
- mountings, fittings

2.2 Natural Gas fueling devices

Natural Gas fueling devices shall meet the following criteria:

- no gas storage
- Motor-/Compressor units are arranged in a hermetically sealed blow down tank

2.3 Compressor

The compressor compresses the Natural Gas taken from the public gas supply to the allowed operating pressure of the NGV fueling station.

2.4 Cylinder

Cylinders are gas storage vessels which contain the Natural Gas compressed by the compressor. Blow down tank, interceptor, gas dryer, filter, pulsation damper etc. might also be cylinders.

2.5 Dispensing units

Dispensing units are the parts of the NGV fueling station through which the compressed Natural Gas is supplied to the vehicles. They include the dispenser, gas meter (if necessary), fueling hose, fueling nozzle.

Dispensers are stationary dispensing units covered by a protective housing which does not have to be opened for operating the pump.

Quick couplers are fueling nozzles which make a connection between the receptacle of the vehicle and the NGV fueling station by simply attaching them.

2.6 MSR-units

2.6.1 MSR installations

Measurement-, open loop control- and closed loop control units (MSR) installations are MSR-units which control the intended use of the installation in its acceptance region. They are used for the automation processes measuring, operating, controlling, signaling, registering, etc.

2.6.2 MSR safety guards

MSR safety guards are MSR-units which prevent an illegal unsafe state to be reached.

2.7 Mechanically working safety devices

Mechanically working safety devices prevent the allowed operating pressure to be exceeded or an emission of gas in case of a deviation of the intended use. It runs without external energy (e.g. a spring-loaded safety relief valve, breakaway system)

2.8 Hazardous area

A hazardous area is the area in close vicinity to a NGV fueling station and its components where as a result of a leakage e.g. at ports, fittings, joints, or under normal operating conditions like connecting and disconnecting of pipes, the occurrence of Natural Gas or a gas/air-mixture cannot be ruled out. The hazardous areas of NGV fueling stations are explosive areas.

2.9 Explosive Areas

In explosive areas the atmosphere might become explosive due to local or operational conditions.

Explosive atmosphere is a mixture of air and inflammable gases under atmospheric conditions in which the combustion process after ignition spreads to the whole unburnt mixture.

One distinguishes between zone 1 and zone 2.
Zone 1 comprises areas in which an explosive gas atmosphere occurs occasionally.

Zone 2 includes areas in which an explosive gas atmosphere is not likely to occur, and if it does occur, it is likely to do so only infrequently and will exist for a short period only.

2.10 Effective range

The effective range is the area which can be reached horizontally with the fueling nozzle under normal operating conditions on working height plus 1 m.

2.11 Safety distance

The safety distance is the distance between an installation and an object outside of the installation that should be protected against Natural Gas emission in case of a deviation of the intended operation.

Beyond the safety distance hazards caused by the presence of an explosive atmosphere can be ruled out that is that the lower explosion level (LEL) will not be exceeded.

2.12 Protective distances

Protective distances between NGV fueling stations and adjacent installations, buildings or public traffic routes are distances whose aim is to protect the fueling station and the cylinder inside the vehicle from events causing damage, like

- temperature rise as a result of fire loads, or
- mechanical damages

2.13 Legally licensed technical expert

Legally licensed technical experts according to this guideline are

- Legally licensed technical experts of the accredited Technical Inspection Organizations

3 Layout of NGV fueling stations

The installation limit, the required technical facilities as well as a schematic representation of the NGV fueling stations are shown in annexes 1 and 2.

4 Requirements

4.1 General

Installation parts as well as the materials used shall guarantee that the NGV fueling stations and their components will be–in case of a professional set-up and under the usual conditions for operation and maintenance stated by the manufacturer–permanently safe and operable under the resulting strain and operating conditions.

NGV fueling stations shall be equipped with safety devices or MSR-safety guards which securely prevent an unallowed excess of the allowed working pressure in the installations and pipes.

Preventive measures have to be taken to guarantee the fire- and explosion protection. Equipment accessories, piping- and mounting-joints shall be designed and installed in such a way that they will be technically leak-proof, either through their construction or their monitoring and maintenance.

The safety devices and MSR-safety guards shall not be used for normal operational control. MSR-safety guards are used for emergency shut down. At faulty operation the relevant parts of the installation shall not be allowed to start up again autonomously (interlock circuit). The corresponding actuators shall be brought into a safe position when the MSR-safety guards respond.

MSR-safety guards shall fulfill at least class AK 3 according to DIN V 19250 and DIN V 1925. Higher classes are allowed and might be specified. Evidence of conformity by type verifications and tests. Wiring in accordance to VDE 0116 (i.e. no-load current principle).

All MSR-safety guards shall comply with the valid regulations (i.e. VDE).

If programmable logic controllers (PLC) are used for safety related processes, they shall comply with the requirements of DIN VDE 801. Otherwise the MSR-safety guards shall be wired by bypassing the PLC.

All safety related settings shall not be accessible for unauthorized persons. The settings shall be checkable.

4.2 Process-based requirements

The gas temperature at the outlet of the compressor unit after the cooler shall not lead to a function impairment or safety concerns.

If a function impairment is to be expected as a result of the moisture content of the gas, a gas drying unit shall be installed.

4.3 Protection against unallowed pressure drop below fixed value

If the minimal inlet pressure drops below the fixed value the compressor shall be switched off by a minimum pressure limiter.

4.4 Protection against illegal pressure increase above fixed value

A MSR-safety guard shall ensure that in the limits of inlet pressure–before the compressor– an excess of the allowed operating pressure is prevented.

The installation components next in line to the compressor shall be protected against an excess of the allowed operating pressure as a function of the physically possible final pressure of the compressor and the allowed operating pressure of the gas storage vessel and the proof pressure of the vehicle cylinders respectively. See table:

Compressor final pressure P_V [bar]	**Allowed operating pressure of vessel P_{Sp} [bar]**	**Class (AK) according DIN V 19250**	**Safety devices**	
			Vessel	**Dispensing unit**
$P_V \leq P_{Pruf}$	$P_{Sp} \leq P_{Pruf}$	AK1	-	-
$P_{Pruf} < P_V \leq P_{Berst}$	$P_{Sp} \leq P_{Pruf}$	AK4	MSR with AK4 or PRV, type-proof	-
$P_{Pruf} < P_V \leq P_{Berst}$	$P_{Pruf} < P_{Sp} \leq P_{Berst}$	AK4	MSR with AK4 or PRV type-proof	MSR with AK4 or PRV type-proof
$P_V > P_{Berst}$	$P_{Pruf} < P_{Sp} \leq P_{Berst}$	AK6	Acceptance by legally licensed technical expert	Acceptance by legally licensed technical expert

Erläuterungen:

P_{Pruf}	=	Test pressure of pressure vessels in vehicle according ECE R110
MSR	=	MSR-safety guard
BOV	=	Blow-off Valve
P_{Berst}	=	Min. burst pressure for full-composite vessels according ECE R110
P_{Sp}	=	max. allowable operating pressure of vessels at the fueling station
P_V	=	physikalisch möglicher Verdichterenddruck

The set pressures of the safety devices and/or MSR-safety guards shall be selected in such a way that the allowed operating pressure (p_{azul}) of the components next in line to the compressor does not exceed 1,1x p_{azul} in case of a deviation from the intended operation; the response tolerances of the safety devices used shall be considered.

4.5 Protection against illegal temperature excess

The allowed gas temperature behind the compressor shall be ensured using a temperature limiter that switches off the compressor.

4.6 Devices for a functional test

In general slotted lines/function lines for safety devices shall be designed that they cannot be locked. The functioning of the safety device shall be checkable. If shut-off devices in the active lines of the safety devices are required for this, adequately designed valves should be used, which will restore the function of the safety devices after the test. The functional test of the safety devices can also be carried out outside of the installation.

4.7 Requirements of technical equipment

4.7.1 General requirements

Technical equipment in NGV fueling station shall be protected against corrosion as well as resistant against the effects of gas attending matters. They have to be suitable for all operating conditions, also regarding the material used. Stress as the result of additional forces, e.g. temperature, strain due to erection and vibrations shall be taken into consideration.

The materials shall be suited for an operating temperature from -10°C to +50°C, provided that no other temperatures are calculated/expected.

4.7.2 Shut-off valve

DIN 3230 part 5 as well as–correspondingly–DIN 3394 part one apply. At pressures below 4 bar DIN 3537 part 1 applies. In the pressure range of PN 4 to PN 16 use DIN 3547 part 1; at pressures over 16 bar use DIN 3437, at pressures over 100 bar DIN 3437 correspondingly. For the valve bodies TRB 801, Nr. 45 applies. Automatically controlled shut-off valves with safety relevance shall be fail safe.

4.7.3 Piping

For pipings the DVGW-working sheet G 496 and TRR apply.

4.7.4 Filter, gas drier and separator

Before filters shut-off valves shall be provided which are not affected by gas attending matters. The manufacturers' procedure guidelines have to be observed.

Filters, gas dryers and separators have to meet the requirements of the TRB respectively.

In refueling installations filters and, if necessary, separators have to be provided if gas attending matters (e.g. dusts, fluids) that might disturb safe operation can be expected. Filter and separator shall be designed for the maximum gas flow and the gas attending matters to be expected, and equipped with storage tanks or collecting devices of sufficient size. Filter and separator can be combined in one apparatus.

Filters should in this case as well as under normal circumstances comply with DIN 33821.

The pollution of the filter insert in the main gas current has to be monitored. This may be done through organizational or technical measures, like differential pressure gauges indicating the maximum on the display. Filters and separators shall be designed in such a way that they can be opened and emptied safely. The provision of quick release fasteners (see TRB 402) is advisable in case of frequent opening and closing procedures.

For fluids (condensate) a manually or automatically operated discharge device with a storage tank (if applicable) shall be provided. The Regulations about inflammable fluids and the legal water rights shall be observed.

4.7.5 Compressor

The compressor shall be capable to compress gas according to section 1.3 of this guideline. It shall meet the requirements of 98/37/EG (machinery directive).

In addition the compressor shall be equipped with a pressure guard to protect it against unallowed pressure excess. The pressure guard shall be set in such a way that it will respond before the safety device (see table in section 4.4) and switches off the compressor.

Transfer of the compressor vibrations on other installation components shall be prevented by appropriate measures.

For compressors where by overheating of the bearings an ignition or release of inflammable gases is likely, the storage temperature should be monitored by means of a MSR-safety guard, unless an overheating is prevented reliably by a dry-running protection or an oil pressure monitoring. This MSR-safety guard switches off the compressor.

Around the compressor the zone classification according to EX-regulation, examples no. 1.3 apply.

Compressor shall be installed within the explosive areas of gas storages if they are designed for the use in the corresponding explosion zones.

4.7.6 Gas drying

The dew point of the gas shall be below -20°C under fueling conditions.

If so, devices for gas drying shall be provided. Gas drying devices shall ensure that hydration and malfunctions are safely prevented.

It shall be ensured that there is enough odorant in the gas after the drying.

Devices for drainage shall be provided in case of the accumulation auf condensate.

4.7.7 Gas pressure regulation and measuring

If upstream gas pressure regulation devices and/or measurement devices are necessary, they shall be installed in compliance with DVGW-working sheet G490/1, G491, G492/1 or G492/11 (depending on the allowed operating pressure).

4.7.8 Gas storage

Gas storage vessels and their equipment shall comply with the TRB.

With regards to the final test before start-up and the regular reinspection of the gas storage vessels and their equipment the requirements of the regulation 97/23/EC (pressure equipment directive) apply.

Every gas storage vessel shall be cut off individually from the gas supply. The shut-off devices should be easily accessible or remote-controlled.

If several storage vessels are interconnected to form a group, an individual shut-off device is not necessary. One shut-off device for the group is sufficient. The gas storage vessel shall be protected against overpressure with a safety relief venting device.

The gas storage vessel shall be suitably protected against overheating by solar radiation with i.e. a roofing or a paint.
With regards to cyclic loading refer to TRB 801 no. 15. In respect of the danger of stress crack corrosion refer to TRB 801, no. 34. Proof of stress crack corrosion resistance can be done with the test designated by ISO TC 58/SC 3 (“Sulphide stress cracking test” with NACE-dissolution). Refer to TRB 801 no. 25.

For the operation and the test certificates refer to the regulation 97/23/EC (pressure equipment directive).

4.7.9 Blow-off-, relief- and venting pipes

Blow-off-, relief- and venting pipes shall provide a safe discharge of gases, e.g. to the outside. They shall be designed for the expected inside pressure, but at least for PN 10.
The outlets of blow-off-, relief- and venting pipes shall be arranged in such a way that no inflammable gas mixture can reach accessible areas, adjacent rooms, inlet ports of air condition systems, the vicinity of ignition sources etc. A combination of blow-off-, relief- and venting pipes to form one unit is not allowed.

They shall be protected against plugging (e.g. caused by insect attacks). The DVGW-working sheet G496 and TRB 600 respectively apply. Around the pipe outlets zone classification according to ATEX-regulation 95 and 137 apply.

4.7.10 Blow down tank

An blow down tank should be provided if expansion gases have to be absorbed, e.g. from the upstream/high pressure part of the installation. At the same time such a tank can damp pulsations caused by the compressor.

The blow down tank has to be equipped with safety blow-down device which might not be locked. It shall be designed in a way that–caused by back-flowing gas–the maximum allowed pressure in the vessel will never be exceeded. It has to be ensured that the safety blow-down device will not be activated during the normal and intended use of the installation.

4.7.11 Dispensing unit

4.7.11.1 General

Immediately upstream of every dispensing unit a manually operated isolation device for maintenance purposes shall be installed.

In addition two redundant, remote-controlled isolation devices shall be provided before the fueling hose which close automatically when the allowed fueling overpressure of the vehicles’

cylinders is reached or an assigned MSR-safety guard responds. Upstream of these isolation devices a filter shall be installed. The redundancy of the remote-controlled isolation devices is not required if the isolation devices comply with the AK 3 in accordance with DIN V 19250, which has to be proved.

Dispensing units shall be erected in such a way that vehicles do not have to pass explosive areas of other installation components, e.g. gas storage. Dispensing units may be located next to dispensing units for mineral oil based fuel. Their effective ranges may overlap, see annex 3.

4.7.11.2 Safety installations
In every dispensing unit a temperature-compensated MSR installation shall be provided interrupting any additional gas supply to the fueling hose automatically when the allowed operating overpressure, based on +15°C inside the cylinder of the vehicle, is reached. This overpressure shall not exceed 250 bar.

Furthermore the cylinders of the vehicle shall be protected against an unallowed pressure increase above fixed value. See table in section 4.4.

Refer to section 4.7.9 if a BOV is used.

If BOVs are provided in the dispensing unit an MSR installation shall be build in for environmental and noise protection reasons. The MSR-installation interrupts the gas supply to the respective dispensing unit before the BOV responds. The dispensing unit shall not start up again automatically, but has to be restarted by qualified personnel.

The safety device shall ensure that an excess of 0,9 times the test pressure of the cylinder in the vehicle can be ruled out. MSR installations and safety guards can be combined in one apparatus, provided that the MSR safety guard meets the requirements of the respective class.

4.7.11.3 Requirements for the enclosure
Protective enclosures of dispensers shall meet the following requirements:
They shall resist the expected loads; they shall be sufficiently ageing-resistant and flameproof. Materials that may become electrostatically charged during normal operation shall not be used.

These requirements are fulfilled for protective steel enclosures if

1. the wall thickness of the covering panels
a) made of sheet steel is not < 1mm
b) from stainless sheet steel is < 0,5mm

2. viewing windows which are bigger than 0,12 m² or provided with indoor lighting, are made of multilayer safety glass of at least 4,5 mm thickness
3. viewing windows up to 0,12 m² without indoor lighting are made of multilayer safety glass of at least 4 mm thickness.

For protective enclosures made of plastic refer to the requirements of attachment 1 of the appendix for TRbF 40 part 1, except from no. 4, 7 and 8.

4.7.11.4 Venting of the enclosure
The enclosure of the dispenser shall be sufficiently vented naturally or artificially. In case of natural ventilation two opposite openings (at least 100 cm² in size) at displaced heights shall be provided. One opening shall be in the upper part of the enclosure, the other one in the lower part to ensure sufficient transverse ventilation. Venting safety devices shall be able to vent safely to the outside.

4.7.11.5 Explosive zones of the dispensing unit
For dispensers the inside of the protective enclosure is as rule zone 1, unless no other appropriate measures are demonstrated. The area up to a distance of 0,2 m around the protective enclosure down to the ground and 1 m above the protective enclosure is as a rule zone 2 (see appendix 3).

4.7.11.6 Fueling hose
Only fueling hoses which are resistant against Natural Gas attending matters and tested with at least 1,5 times the allowed operating pressure shall be installed. The length of the fueling hose should not be more than 5 m or less than 3 m. They shall be electrically conductive (see ZH 1/200).

4.7.11.7 Hose rupture protection
Upstream of each fueling hose a device shall be provided that interrupts any further gas supply in case of a sudden increase of the gas flow. This can also be done by the MSR installation (e.g. a flow guard). This MSR installation interrupts the gas supply to the fueling hose.

4.7.11.8 Breakaway system
In or before each fueling hose a breakaway device shall be installed that is activated if a certain level of vertical tension is reached, to prevent an emission of gas on both sides. This also applies to the gas back flow. The needed release force of the breakaway-device shall be much lower than the ultimate tensile strength of the fueling hose and the fixings on the dispenser and the vehicle.

4.7.11.9 Receptacles
The quick coupling which shall be attached to the receptacle of the vehicle shall be designed in such a way that the gas flow is only allowed if the connection is soundly leak-proof. The coupling shall be released from the vehicle only after the pressure relief. Expansion gases due to the pressure relief shall be safely disposed of. Not more than 10 liter of explosive gas/air-mixture shall develop during the release of the coupling.

Only fueling nozzles that fit into the vehicle receptacles should be used, i.e. NGV1 and NGV2.

Fueling nozzles shall be protected against unintended release, e.g. through operating of a blocking device. They shall be designed in such a way that even in case of an unintended release under pressure no persons may be harmed.

Fueling nozzles shall be type approved or shall be approved individually by a legally licensed technical expert.

4.7.12 Safety installations

Safety blow-down devices shall comply with DIN 3381 and AD-bulletin A2 respectively. The manufacturer has to provide evidence of the conformity to the standards by an official certification. The manufacturers' instructions shall be observed. The verification of suitability according to AD-bulletin A2 will be done by a TUV-component approval.

The functional test as well as the testing of the setting pressure of the safety installations shall be contrivable.

For examples of the position of the safety installations refer to annexes 1 and 2.

4.7.13 Equipment

The gas flow at the inlet of the NGV fueling station shall be blocked by a manually operated isolation device. It shall be arranged in consideration of the local circumstances as well as the specific circumstances of the installation, so that it can be safely operated in case of deviations from the intended operation. It shall be indicated with a signboard (see DIN 4065 and DIN 4069) and–where appropriate–protected against unauthorized access.

At the battery limit of the NGV fueling station a non-return valve and an automatically operated isolation device shall be installed. The isolation device will close as soon as the compressor is switched off or an attributive MSR safety guard responds.

4.8 Construction and erection requirements

4.8.1 Erection

The components of the NGV fueling station can be placed in rooms or cabinet casings, or erected as an outdoor installations. These components have to be protected against unauthorized access.

NGV fueling stations shall not be erected in thoroughfares, passageways, corridors open to the public, staircases and stairs of outdoor installations. They also shall not be erected in the vicinity of the aforementioned areas if traffic routes, escape routes or their accessibility would be affected.

The safety distance to installations, buildings and facilities outside of the NGV fueling station is as a rule at least 5 m. In individual cases this can be reduced, e.g. by constructional means.

Signs shall be erected adjacent to the dispensing unit indicating that smoking and naked lights are prohibited. A 6kg fire extinguisher approved for fire classes ABC shall be available.

The lot for the vehicle to be refueled shall be solid and even.

4.8.2 Explosion protection

For NGV fueling stations the zone classification and the corresponding safety measures according to ATEX-regulation 95 and 137 apply.

4.8.3 Traffic- and escape routes

Sufficient space as well as traffic- and escape routes for maintenance work and cleaning shall be provided.
If installation components are placed in separate rooms, containers or similar, the doors shall be securely lockable and only be accessible directly from the outside. The doors shall open to the outside and it shall be possible to wedge them while open. Sliding- and rolling doors shall have a hatch door. In accessible rooms the escape- and rescue routes shall be kept clear. It shall be possible to open the doors from the inside without additional means.

A swift vacation of the rooms shall be possible in case of an emergency. Every room with a floor area of more than 50 m² shall have at least two exits in opposite walls.

4.8.4 Erection in residential and commercial buildings

NGV-fueling stations and their components shall not be erected in residential buildings.

Rooms for NGV-fueling stations in commercial buildings should only be situated beside, above or under rooms where people are present if the partition walls to the adjacent rooms have no openings, are gas proof and constructed in accordance with fire rating F 90. Adjacent rooms shall not be used as living quarters or assembly space.

No other facilities or external objects which could pose a threat to the fueling station by mechanical exposure, fire or explosion shall be present in the installation space.

4.8.5 Mechanical protection

NGV fueling stations including their components shall be erected or protected in such a way that they cannot be knocked over or damaged by vehicles.

These provisions are fulfilled if the components are erected on a raised base, on a platform bounded by curbstones, or are protected by kerbstones, spur posts, or similar equipment with a height of at least 12 cm and a sufficient lateral protrusion.

4.8.6 Emergency shut down of the installation

The electric installations of the fueling station–except explosion proof emergency lights, ventilation and gas alarm unit–shall be switched off in case of an emergency (by emergency shut down button). The emergency shut down devices should be easily and quickly accessible and have to be located near the escape routes.

In case of a deviation of the intended operation the compressor shall be switched off by a central emergency shut down button, the connecting line of the compressor and the lines between gas storage and dispensing unit shall be isolated and the remote-operated valves shall be brought into a safe position.

The emergency shut down of the installation shall not be suspended by resetting the shutdown button; that is that the shut down shall be coupled with a locking mechanism.

In case of the compressor shut down, control box shut down and central emergency shut down, as shown in Appendix 4, they can be reset by handshaking the button at the system's control. The dispenser emergency shut down can be reset with a key-switch.

4.8.7 Walls and ducts, room interconnections

Any interconnection between the installation space of the components and other, non-explosion-proof rooms is forbidden. All partition walls as well as pipeworks, ducts and cable penetrations in buildings between areas where an accumulation of gases can be assumed and areas where this is not the case, are to be designed in such a way that a diversion of gases is impossible, e.g. by gas-proof walls and ducts. Walls and wall ducts for piping and cables shall comply with the fire grading of the room design.

4.8.8 Fueling in a shed

Notwithstanding ections 4.8.4 and 4.8.7, dispensing units can be erected in sheds if:

- only three main supply lines lead into the shed
- an additional automatically operated isolation device at the entry of the supply line to into the shed is provided
- a pressure relief device to the outside or to the blow down tank is provided for the dispensing unit

- a gas warning device is installed in the shed; the gas sensor shall be situated above the fueling area.

The venting devices at site shall be working as long as overpressure is present in the dispensing unit.

The isolation device at the gas supply inlet to the shed shall close if 20% LEL (lower explosion limit) are exceeded at the gas sensor.

The pressure relief device shall work for all gas bearing components between the mentioned isolation device and the coupling of the fueling hose, as soon as the emergency shut down is activated.

4.8.9 Ventilation of the installation space

Installation spaces for NGV-fueling stations and their components shall have sufficient ventilation (as a rule: transverse ventilation). In case of natural ventilation, the areation openings should be at the lowest point of the walls, the deareation openings at the highest point at the roof level. They shall lead directly to the outside. The effective surface of the aeration- and deareation openings shall be in each case 0,5% of the total floor space.. A technical ventilation should be designed for two air changes per hour, as to prevent the formation of a dangerous explosive atmosphere. The outlet air shall be safely disposed of.

Outside of all openings in the exterior walls the safety distance according to sections 2.11 and 4.8.1 apply.

Ignition sources inside the installation space are prohibited. Electrical facilities shall be suitable for the respective ex-zones.

As an alternative a technical venting device is required ensuring that no gas concentration of more than 20% LEL (lower explosion limit) can form inside the room. This technical venting device shall be automatically switched on by a gas warning device as soon as the gas warning device detects Natural Gas in the ambient air. In case of a failure of the technical venting device alarm shall be given.

Gas warning devices shall be set in such a way that they sound a pre-alarm at a concentration of 20% LEL and technical measures like e.g. the ventilation are activated or the whole installation is shut down. At 40% LEL the emergency shut down shall be activated. The requirements for stationary gas warning devices for explosion protection ZH 1/8, ZH 1/8.1, ZH 1/8.2 and ZH 1/8.3 shall be considered.

4.8.10 Heating of the installation space

Heating devices in installation spaces shall not be ignition sources.

4.8.11 Working areas

For work at NGV-fueling stations sufficient working space should be provided. The inside width of corridors shall be at least 0,8 m.

4.8.12 Corrosion protection

All technical installations of NGV fueling stations shall be protected against corrosive influences, e.g. by painting or casings. The painting for exposed lines shall be conducted according to DIN 55928. In aluminiferous painting an aluminum rate of up to 25% is allowed.

4.8.13 Noise attenuation

Design of NGV fueling stations shall consider state-of-the-art installations for the attenuation of noise shall, so that noise emissions remain within the scope of the emission levels of the applicable regulations.

4.8.14 Fire load

A fire load is an inflammable substance in the vicinity of the NGV fueling station representing a potential threat to the fueling station and the cylinder of the vehicle in case of a fire. Inflammable substances in closed containers are no fire loads. With regard to allowed material temperatures in case of fire loads refer to appendix 5 of TRB 610; here the required protection zones according to section 2.12 can be calculated.

4.8.15 Safety marking

See local standards

4.9 Electrotechnical requirements

4.9.1 Electrical installations

Installing electrical installations in areas of the NGV fueling station the valid DIN VDE guidelines shall be observed, especially 0100, 0165, 0185, 0800 as well as the regulations and guidelines of the Employer's liability Insurance Association and regulations like ATEX.

Electrical installations, switchboards and control boxes shall be protected by a door against unauthorized access.

4.9.2 Cables and lines

Cables and lines shall be laid in such a way that reciprocal effects are not possible. Signal cables should always have a well conducting screen that has to be attached to the potential equalization, if they are not shielded by steel pipes.

4.9.3 Lightning protection and potential equalization

An outer lightning protection after DIN VDE 0185 is recommended if the NGV fueling station is situated in a building on an open terrain and the floor area of the building exceeds 100m².

Measures for inner lightning protection are mandatory. This measure is fulfilled if a potential equalization is made and the electrical installation is erected according to DIN VDE 0165. The potential equalization shall be made in compliance with DIN VDE 0165 and DIN VDE 0185.

4.9.4 Bleeder of the flooring

Walkable spaces of floors in explosive rooms shall be fitted out with flooring that prevent unallowed sparking and electrostatic charging. The bleeder, including the flooring, shall not exceed 10^8 Ohm, metered according tov DIN 51953.

4.9.5 Safety measures against overvoltage in electronic installations

Inner lightning protection as described in section 4.9.3 is an essential requirement for the limiting of overvoltage on cables and electric equipment. If using electronic installations, these measures can be complemented through the use of an overvoltage protection device, to guarantee a sufficient protection of the installation.

5 Inspections

5.1 General

The compliance of the safety-, functional and constructional requirements for NGV fueling stations, their components, constructional elements and -assemblies as well as their equipment and erection shall be inspected and certified by a legally licensed technical expert before start up.

It is suggested that shipped ready-to-use components should be inspected and certified by a legally licensed technical expert in the manufacturers' plant.

Natural Gas fueling devices according to section 2.2 shall be subject to an expertise by a legally licensed technical expert according to section 2.13. For this the requirements of this guideline apply correspondingly.

5.2 Strength- and leak test

The strength and the tightness of all technical facilities and of the installation produced by the manufacturer of the installation shall be proven.

The leak test shall be conducted on site before start up, using air, inert gas or natural gas with the allowed operating pressure. The safe and reliable operation of the safety- and control devices installed in the final installation shall be certified, or inspected on site by a legally licensed technical expert.

5.3 Tests in the manufacturers plant

5.3.1 Pipe joints

Welded joints on pipelines > PN 1 shall be rated and certified while manufacture in compliance with DIN EN 25817 and TRR 100 respectively. Tests specified in compliance with TRR 100 remain unaffected.
For detachable joints the material requirements of TRR 100 apply.

5.3.2 Technical installations

The strength- and leak test for all technical installations > PN 1 produced by the manufacturer of the installation shall be conducted and certified in compliance with DIN 30690 part 1 and the DVGW-working sheet G 496 by a responsible legally licensed technical expert or a factory-authorized inspector named in the certificate in accordance with DVGW-working sheet G 493.

Tests required in the PED remain unaffected.

5.3.3 Certification of the inspections

For all technical installations of NGV fueling stations certificates of the required inspections shall be available.

The manufacturer shall prove by a legally licensed technical expert or a factory-authorized inspector (if responsible) that all certificates are on hand and that the inspections have been conducted accordingly. This requirement is met provided that DVGW-tested, type-tested or design-approved components are used.

5.4 Inspections by a legally licensed technical expert on site

5.4.1 Compliance with technical requirements

At the latest the legally licensed technical expert has to assure himself during the leak- and functional test of the assembled installation on site that the requirements of the guideline are met, their protection goals are fulfilled and all required inspection certificates are completely available. Contents of PED remains unaffected.

5.4.2 Change of the approved technical practice

The constructor is bound to inform the legally licensed technical expert about changes in time before the final inspection. Changes have to be at least equivalent in terms of safety. The legally licensed technical expert shall verify this.

5.4.3 Significant changes

Every change that affects the safety of the installation is significant. In case of significant changes the legally licensed technical expert shall assert the same security level. For this, the tests outlined in section 5 have to be conducted.

Significant changes in NGV fueling stations are for example:

- increase of the allowed operating pressure
- extension of the installation by the installation of further assemblies
- replacement, change or extension of existing components, as far as no equivalent components are concerned that comply with the approved technical practice or are type-approved components of the same pressure level
- alteration of the operating site.

5.4.4 Certification of the inspections

The inspections conducted on location have to be certified by the responsible legally licensed technical expert by an inspection certificate.

5.5 Inspection by the specialist for electrics

The electric facilities shall be inspected by a specialist for electrics before start up and in regular intervals of at least 3 years, provided that an affirmation of conformity is available which does not claim different. Otherwise the inspection will be conducted by a legally licensed technical expert.

5.6 Recurring inspections

Inspections on NGV fueling stations have to be carried out in regular intervals. Refer to the tables in appendix 5 for the correspondent requirements.

Fueling hose shall be tested for their safe condition (integrity and leak-proof) before start up and if required, either by the manufacturer or a trained employee of the fueling station operator. The test shall be conducted in compliance with TRG 402 Nr. 9.2 and within the periods of time stated there.

5.7 Inspection documentation

The certifications of the tests conducted by the manufacturer and the legally licensed technical expert as well as the certificates of the specialist for electrics have to be retained throughout the whole operating time of the NGV fueling station to allow inspection.

6 Start up

The start up shall take place under competent supervision and under observance of the general and specific safety engineering rules and regulations. The operating instructions of the manufacturer for the start up of the installed equipment and components shall be observed.

In installations which contain air or inert gas the means of ventilation have to be established before the operative gas is let in. Deareation in installation spaces is illegal. The installation shall be flushed with inert gas or natural gas to ensure that no unallowed portions of air remain.

It shall be ensured that the installation has been duly set under natural gas.

7 Operation and Maintenance

7.1 General

The operator of the NGV fueling station has to keep it in a proper condition, operate it skillful, carry out the necessary maintenance work immediately and implement the safety measures required.

NGV fueling stations shall only be operated by persons over 18 years of age with the necessary competence and knowledge of the operating rules and regulations.

7.2 Operating instructions, notes about danger prevention

Operating instructions and notes about danger prevention shall be available at the NGV fueling station.

7.3 Fueling instructions

The fueling procedure shall be laid down in a fueling instruction hung out visibly and in a durable form at the dispensing unit.

Only instructed individuals are allowed to refuel at a NGV fueling station. A person is instructed if it is able to refuel according to the fueling procedure.

Vehicles shall only be refueled when the engine and an external heating device with combustion chamber are switched off. The vehicle shall be secured against rolling off.

Smoking and handling of other ignition sources in explosive areas and effective ranges are prohibited. Refer to the required safety signs.

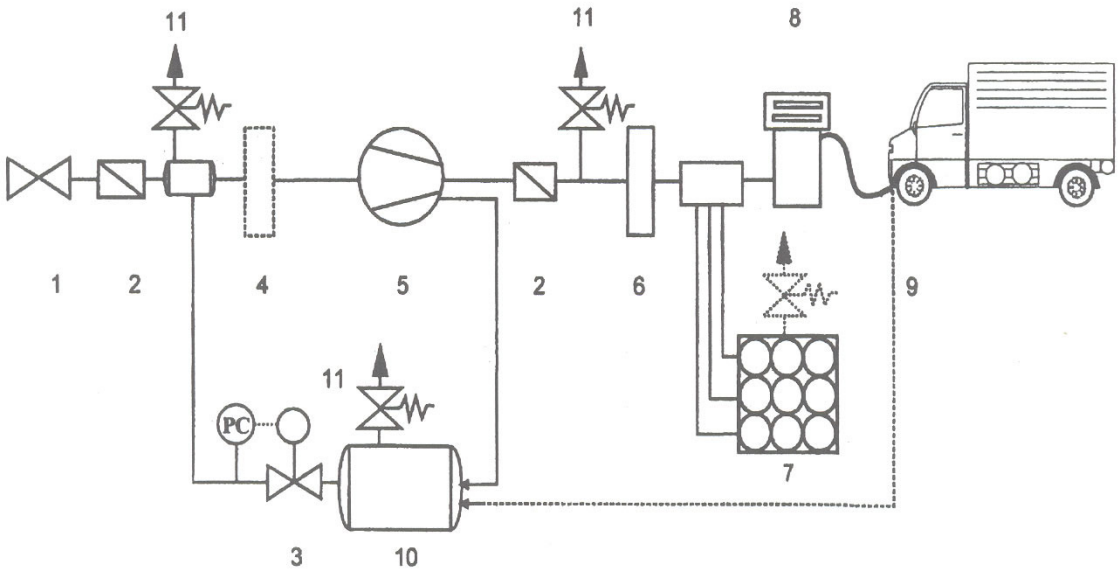
7.4 Operating and maintenance instructions

An operating instruction shall be provided for every installation.

The operating and maintenance instructions of the NGV fueling station shall be part of the operations manual. It is suggested to place a maintenance contract with competent companies.

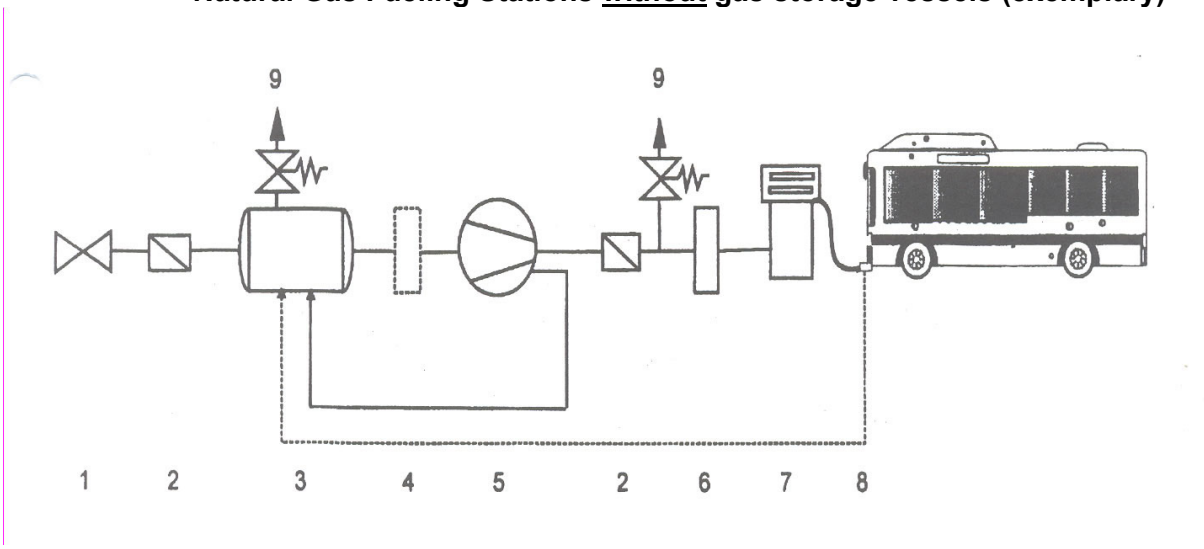
Fueling hose and fueling nozzle including their safety devices shall be inspected for visible defects in regular intervals by the operator, according to the operating instructions.

Appendix 1.1 Site limits and technical installations:
Natural Gas Fueling Stations <u>with</u> gas storage vessels (exemplary)



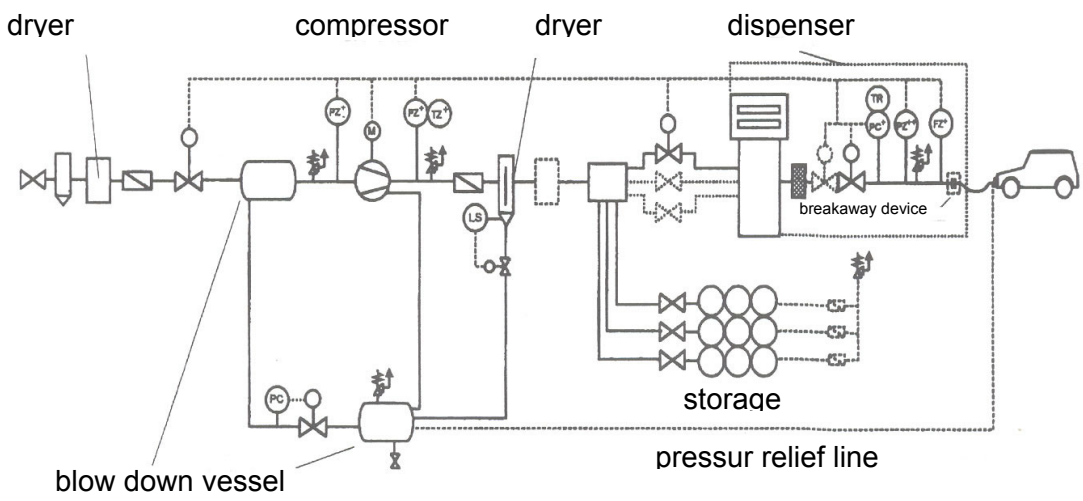
1 main isolation device
2 backflow safety device
3 pressure regulator
4 gas dryer before compressor (optional)
5 compressor
6 gas dryer after compressor (optional)
7 gas storage
8 dispenser
9 quick coupler
10 blow down vessel
11 blow off valve

Appendix 1.2 Site limits and technical installations:
Natural Gas Fueling Stations <u>without</u> gas storage vessels (exemplary)



1 main isolation device
2 backflow safety device
3 blow down vessel
4 gas dryer before compressor (optional)
5 compressor
6 gas dryer after compressor (optional)
7 dispenser
8 quick coupler
9 blow off valve

Appendix 2: Example for a fast fill fueling station



Appendix 3.1 Ex-Zones

A. compressor unit

a. installation inside a room
a.a. inside the room: Ex-zone 1
a.b. outside the room: see b.b.

b. installation with an enclosure
b.a. inside the enclosure: Ex-zone 1
b.b. outside the enclosure: Ex-zone 2, 20 cm in front of the opening, if inside the enclosure a gas warning device coupled with an emergency shut down is installed. Without gas warning device with emergency shut down: Ex-Zone 2; hazardous area 2 m.

c. installation open-air
Ex-zone 2; hazardous area 3 m

B. gas storage, gas dryer

a. installation inside a room
a.a. inside the room: Ex-zone 2
a.b. outside the room, around the venting openings: no Ex-zone, no hazardous area

b. installation within a screen
b.a. inside of the screen: Ex-zone 2
b.b. above the screen: Ex-zone 2
b.c. outside of the screen: no Ex-zone

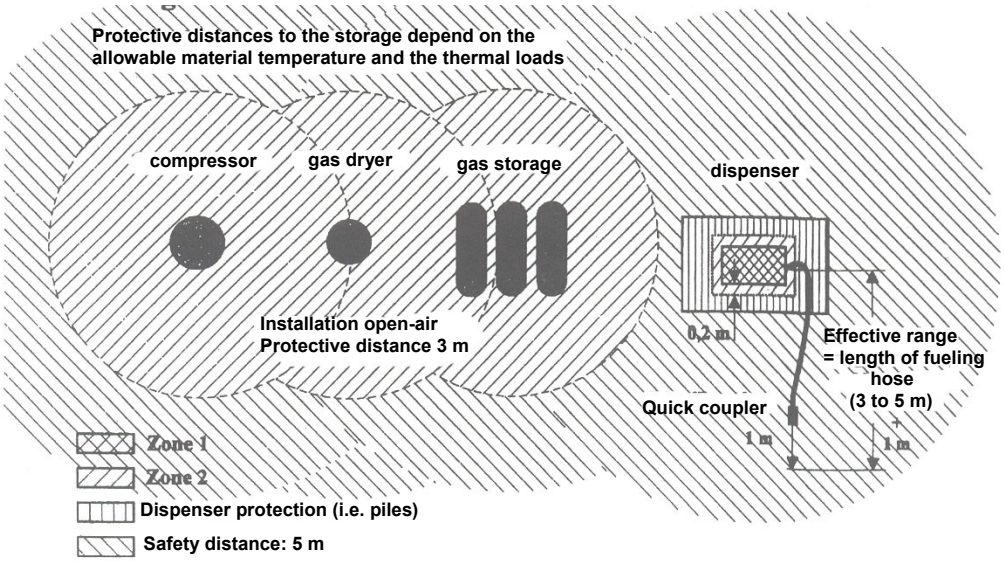
c. installation open-air
Ex-zone 2; hazardous area 3 m

C. dispenser unit

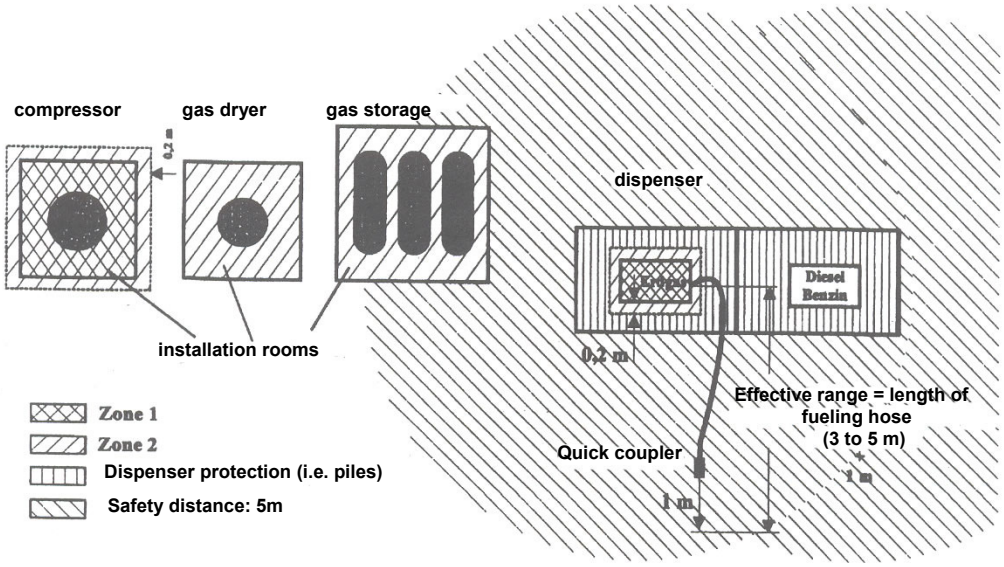
a. dispenser
a.a. inside the enclosure: Ex-zone 1
a.b. outside the enclosure: no Ex-zone 2, 20 cm

b. fueling nozzle
effective range 1 m

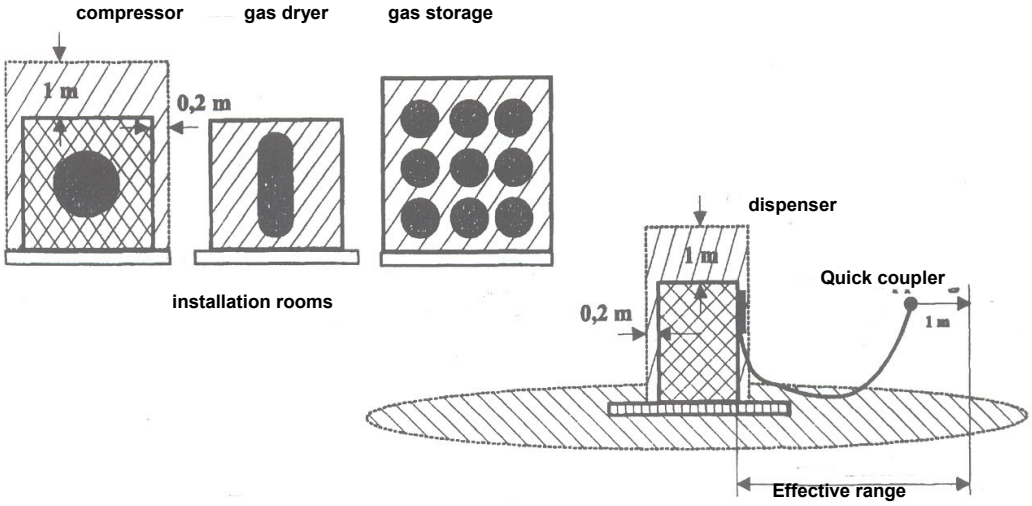
Appendix 3.2 Safety distances and protective distances (Ex-zones) of Natural Gas fueling stations, Installation open-air



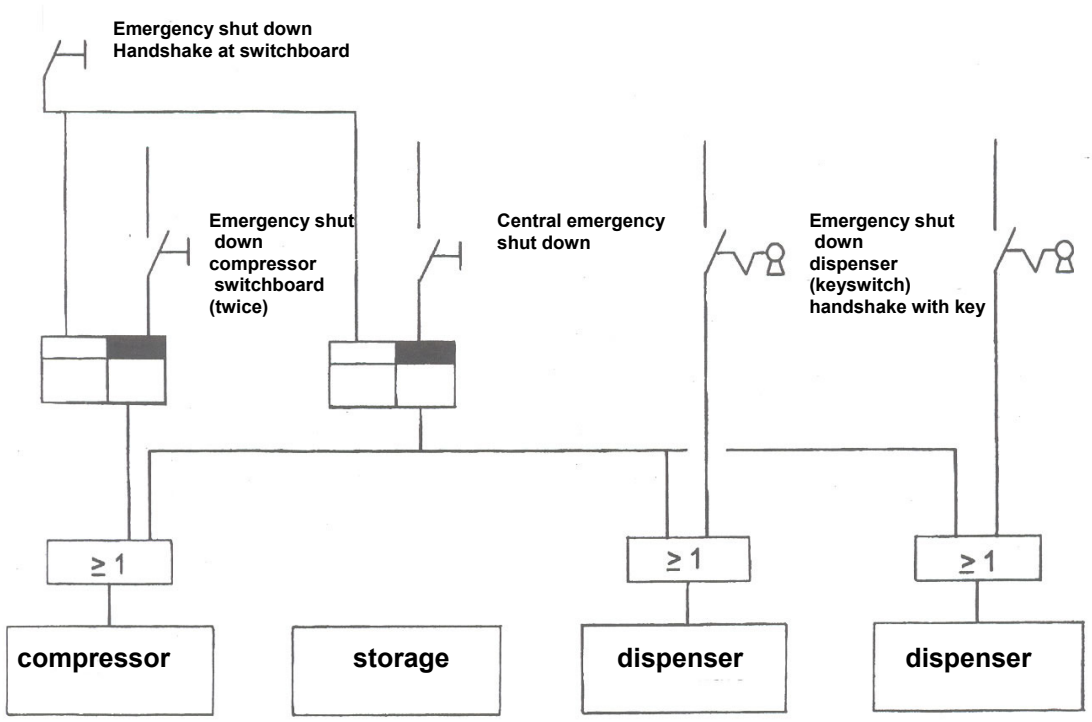
Appendix 3.3 Safety distances and protective distances (Ex-zones) of Natural Gas fueling stations, installation inside a room, dispensing units open-air, topview



Appendix 3.4 Safety distances and protective distances (Ex-zones) of Natural Gas fueling stations, installation inside a room, dispensing units open-air, side view



Appendix 4 Example for emergency shut down



Appendix 5 Inspections, inspection time limits and responsibilities

A. General
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B. Installations
B.1 Permission of the responsible authorities
NGV fueling stations that require a permission are NGV fueling stations that supply Natural Gas to cylinders in vehicles of others.
NGV fueling stations that supply Natural Gas to cylinders of vehicles of their operator do not require permission.

B.2 Inspections by the legally licensed technical expert
B.2.1 Inspections before start up
A NGV fueling station may only be started up after its erection or after significant changes, if the legally licensed technical expert has checked whether the erection or the changes have been done in compliance with the permission or the requirements of the PED, and a certificate has been issued.
For the inspection of the cylinders and their equipment components, refer to PED.
For the inspection of the piping and their equipment components, refer to PED. In case of piping up to diameter 25 the legally licensed technical expert has to prove the compliance to the requirements according to TRR 100.

B.2.2 Recurrent inspections
The NGV fueling station shall be recurrently inspected in compliance with PED and TRG 730, section 7.3.
For the recurring inspections of the cylinders and their equipment components refer to PED..
For the definition of the inspection-time limits the dynamic loads and stress crack corrosion according to TRB 801 shall be considered.
For the recurrent inspections of the piping and their equipment components refer to PED.

	NGV fueling station without storage	**Gas storage**	**electrical installations**
Recurrent inspection	4 years	10 years [1)]	3 years
inspector	Legally licensed technical expert	Legally licensed technical expert	Specialist for electrics
1) TRB 801 No. 15 and 25 have to be considered			