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Industrial Gas Installation - Guideline

Industrielle Gasinstallationen - Leitlinien

Installation gaz dans le domaine industriel - Lignes directrices

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Industrial Gas Installation - Guideline

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Foreword

This document (CEN/TR 16787:2014) has been prepared by CEN Sector Forum Gas.

Introduction

Gas industry leaders acknowledge the strategic role of European and National Standards in their efforts to ensure the safety of gas installations in industrial premises. This Technical Report has been prepared to explain to those involved with industrial premises some of the relevance of a range of Directives that affect their operations. In addition guidance is given on the terms and definitions widely in use throughout the European Union, together with some important information on how a consumer of gas can ensure safety in operating their site. Minimizing the adverse effects on the environment is also an important consideration.

European and National legislation and the related framework of standards are complex and changing at an ever increasing pace. For industrial plant engineers, finding the relevant standards can be a difficult task, demands specific knowledge, and can consume a considerable amount of time. A number of the principal standards are highlighted in this Technical Report, but EU Member States may have similar or equivalent standards covering the application. Additionally, member states may have slightly different legal systems and requirements that demand compliance.

Both designers and installers play an important role in applying the current standards for design, construction, testing, commissioning and operation of all industrial gas installations. Safety is therefore improved and the full energy efficiency potential of industrial thermal processes can be utilized.

It is recognized that the main reference is this Technical Report is to Natural Gas but many standards equally apply directly to LPG and LPG/Air mixtures. This Technical Report is also applicable to many bio-gases, and other flammable gases, and the user will need to ensure they are aware of any different requirements needed to ensure safety. For example some gases may be very hot or corrosive, some may be 'wet' and others may contain significant quantities of toxic gases such as carbon monoxide. Hydrogen rich gases may also require special attention to material selection.

Finally, due to the complexities and special needs of some types of process plant, it may be necessary to adopt higher standards of safety and to use risk assessments to ensure reliable judgements on plant safety.

In applying the recommendations contained within this Technical Report it is important that the relevant requirements of national guidance standards and legislation are considered.

In some cases where a lack of information is available in a member state, guidance from other member states or by other recognized national bodies such as ASME or API may be used.

The range of industrial thermal process and heating equipment providing energy solutions to customers for a diverse range of applications is significant.

1 Scope

This Technical Report applies to safety and operational topics for equipment and pipework systems installed within industrial premises which may be used for process and non-process applications such as Heating, Power Generation, Incineration, etc.

It is applicable to a range of combustible gases used within an industrial environment. The gas plant may include normal combustion with air and/or oxygen, catalytic oxidation or cracking (e.g. as in a refinery).

The user of gas equipment and pipework systems has a responsibility to ensure the safety of the design, of plant operation and plant maintenance.

For piped supplies of gas to a site this Technical Report applies to the system downstream of the 'point of delivery'. The term, 'point of delivery' refers to the isolation valve (or combination of regulator and isolation valve) located before or after the metering station, as will be defined by the particular EU member state national legislation.

The guidance in this Technical Report may also apply to gases generated for the sites own use, such as coke oven gas, site bio-gas plant, site LPG/air plant etc.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1775, *Gas supply — Gas pipework for buildings — Maximum operating pressure less than or equal to 5 bar - Functional recommendations*

EN 15001-1, *Gas Infrastructure — Gas installation pipework with an operating pressure greater than 0,5 bar for industrial installations and greater than 5 bar for industrial and non-industrial installations — Part 1: Detailed functional requirements for design, materials, construction, inspection and testing*

EN 15001-2, *Gas infrastructure — Gas installation pipework with an operating pressure greater than 0,5 bar for industrial installations and greater than 5 bar for industrial and non-industrial installations — Part 2: Detailed functional requirements for commissioning, operation and maintenance*

EN ISO 6976, *Natural gas — Calculation of calorific values, density, relative density and Wobbe index from composition (ISO 6976)*

3 Terms and definitions

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

NOTE These terms and definitions are given for information as they are widely used in the gas industry.

3.1 General terms

3.1.1
air gas ratio
ratio between the flow of combustion air and the flow of the fuel gas

Note 1 to entry: Sometimes fuel/air ratio is used. It can either be expressed in terms of volume or mass flows.

3.1.2
air factor
ratio between the actual flow of combustion air and the stoichiometric flow of combustion air

Note 1 to entry: It can be expressed in terms of volume or mass flows.

3.1.3
components
any item from which a gas supply system or installation is constructed

Note 1 to entry: A distinction is drawn between the following groups of components:

— ancillaries (for example; pressure regulators, valves, safety devices, expansion joints, and insulating joints);

— pipes, including bends made from pipe;

— instrumentation pipework;

— fittings (for example; reducers, tees, factory-made elbows, flanges, dome ends, welding stubs, and mechanical joints).

3.1.4
flexible appliance connector
fitting of flexible pipe to be fitted between the end of fixed pipework and the appliance inlet connection

3.1.5
gas appliances
appliances burning gaseous fuels used for cooking, heating, hot water production, refrigeration, lighting or washing and having, where applicable, a normal water temperature not exceeding 105 °C, except those specifically designed for use in industrial processes carried out on industrial premises

3.1.6
HAZOP
hazard and operability study (HAZOP) is a structured and systematic examination of a planned or existing process or operation in order to identify and evaluate problems that may represent risks to personnel or equipment, or prevent efficient operation

3.1.7
industrial appliances
appliances burning gaseous fuels installed in industrial premises and are subject to specific national health and safety regulations

3.1.8
pressure
gauge pressure of the fluid inside the system, measured in static conditions

3.1.9
design pressure
DP
pressure at which the design calculations are based

Note 1 to entry: This is equivalent to the maximum allowable pressure (PS) as given in the PED.

3.1.10
maximum allowable pressure
PS
maximum pressure for which pipework is designed in accordance with the strength requirements

3.1.11
maximum incidental pressure
MIP
maximum pressure at which a system can experience during a short time, limited by the safety devices

3.1.12
operating pressure
OP
pressure which occurs within a system under normal operating conditions

3.1.13
maximum operating pressure
MOP
maximum pressure at which a system can be operated continuously under normal operating conditions

Note 1 to entry: Normal operating conditions are: no fault in any device or stream.

3.1.14
tightness test pressure
TTP
pressure applied to a system during tightness testing

3.1.15
strength test pressure
STP
pressure applied to a system during strength testing

3.1.16
combined test pressure
CTP
pressure applied to a system during combined testing

3.1.17
risk assessment
identification, evaluation, and estimation of the levels of risks involved in a situation, their comparison against benchmarks or standards, and determination of an acceptable level of risk

Note 1 to entry: In this sense Risk is, ‘the likelihood and consequence of a hazard being realized’.

3.1.18
point of delivery
point of transfer of ownership of gas from the supplier to the customer

Note 1 to entry: This can be at a means of isolation or at the meter outlet connection.

Note 2 to entry: This can be isolation valve (or combination of regulator and isolation valve) located before or after the metering station, as defined by the particular EU member state.

3.1.19
user(s)
person (s) responsible for the safety of the gas installation and associated risks on a site

Note 1 to entry: Normally the user will be the site occupier or owner. It should be assumed that every user has a responsibility for work performed on their site, whether or not the work is performed directly for the user or not. This does not mean that they cannot take advice from an independent specialist.

3.1.20
pipework
assembly of pipes and fittings

3.1.21
installation pipework
pipework downstream of the point of delivery terminating at the appliance inlet connection

Note 1 to entry: This pipework is normally the property of the customer.

3.1.22
ventilated space
space where the air is continuously changed by natural or mechanical means

3.1.23
safety zone
area around the pipework from which persons who are not involved in the strength test are excluded during testing

3.1.24
equipotential bond
means of ensuring that metallic gas pipework and other metallic parts of the building are at the same electrical potential

Note 1 to entry: For safety reasons, this equipotential bonding is connected to earth.

3.1.25
duct
space specifically designed and constructed for the passage of building services

EXAMPLE Building services include gas pipework, water systems, power and telecommunication cables.

3.1.26
ventilation duct
duct forming part of the structure of the building and intended exclusively for ventilation purposes

3.1.27
means of isolation
device which is intended to interrupt the gas flow in pipework

EXAMPLE Manually operable valve.

3.2 Definitions relating to jointing methods

3.2.1
joint
means of connecting elements of a gas installation

3.2.2
flanged joint
joint in which gas tightness is achieved by compression of a gasket between the faces of two flanges

3.2.3
threaded joint
joint in which gas tightness is achieved by metal-to-metal contact within threads with the assistance of a sealant

3.2.4
mechanical joint
joint in which gas tightness is achieved by compression, with or without a seal and which can be disassembled and reassembled

Note 1 to entry: This definition includes twin ferrule type joints.

3.2.5
pressed joint
joint in which tightness is achieved by using a specific tool for either compressing a fitting to form the joint or expanding a pipe to enable forming the joint

3.2.6
brazed joint
joint formed by brazing

3.2.7
welded joint
joint formed by welding

3.2.8
electro fusion joint
joint formed between polyethylene components using fittings which have an integrated electric heating element

3.2.9
butt fusion joint
joint formed between polyethylene components where the two pipe ends are heated and brought together to be fused directly without the use of a separate fitting or filler material

3.2.10
compression joint
type of joint in which gas tightness is achieved by compression within a socket with or without a seal

3.3 Definitions relating to components

3.3.1
regulator
device which reduces the gas pressure to a set value and maintains it within prescribed limits

3.3.2
appliance connection
flexible pipe or length of rigid pipework connecting an appliance's means of isolation with the appliance inlet connection

3.3.3
insulating joint
fitting installed to insulate electrically one section of pipework from another

3.3.4
sleeve
protective pipe through which a gas pipe passes

3.3.5
vent pipe
pipework connected to a safety or control device to release gas at a safe location

3.3.6
creep relief valve
device designed to release a limited flow of gas in the event of an unacceptable pressure being detected within the system it protects

3.3.7
safety slam-shut device
device designed to quickly shut off the gas flow in the event of an unacceptable pressure being detected within the system it protects. This often referred to an over-pressure or under-pressure shut off device

3.3.8
instrumentation pipework
pipework required for the proper functioning of the ancillaries installed within the pressure regulating installation

EXAMPLE Sensing, measuring, auxiliary and sampling lines.

3.3.9
DN
alphanumeric designation of size for components of a pipework system, which is used for reference purposes

Note 1 to entry: It comprises the letters DN followed by a dimensionless whole number, which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections.

Note 2 to entry: The number following the letters DN does not represent a measurable value and should not be used for calculation purposes except where specified.

Note 3 to entry: Where DN designation is used, any relationship between DN and component dimensions are given, e.g. DN/OD or DN/ID.

3.4 Definitions relating to tests

3.4.1
strength test
specific procedure intended to verify that the pipework meets the requirements for mechanical strength

3.4.2
leak-tightness test
specific procedure intended to verify that the pipework meets the requirements for leak-tightness

3.4.3
combined test
specific procedure to verify that the pipework and/or installation meets the requirements for mechanical strength and leak-tightness

3.4.4
leak detection fluid
specially formulated fluid and foaming product that gives a clear indication that a leak exists when applied to an element of pipework

3.5 Definitions relating to assembly processes for metallic materials

3.5.1
welding
joining (union) of two or more parts by heat or pressure or a combination of both, (fusion, arc or oxy-acetylene) such that the materials form a continuity

Note 1 to entry: A filler metal having a melting point similar to that of the materials to be welded can be used.

3.5.2
brazing
operation in which metal parts are joined by means of capillary action of a filler metal in the liquid state with a melting temperature, higher than 450 °C, lower than that of the parts to be joined and wetting the parent metal(s), which does not participate in the making of the joint

Note 1 to entry: This is often referred to as hard soldering.

3.5.3
hot tapping
procedure involving the safe use of heat, e.g. welding or fusion, to affix an attachment to a section of pipework containing gas at pressure

3.6 Definitions relating to pressure regulating and metering

3.6.1
compressors
complete unit for raising the gas pressure within installation pipework above 0,5 bar to an OP greater than 5 bar

3.6.2
station
gas pressure regulating and/or metering system including (where applicable) the housing, the odourisation facilities and the fenced site

3.6.3
gas pressure regulating and metering system
system comprising all equipment, together with inlet and outlet pipework up to and including the isolating valves, which together performs the functions of pressure regulation, pressure safety and/or quantitative gas measurement, whether or not including pressure boosting and/or gas mixing facilities

3.6.4
monitor
second regulator used as a safety device in series with the active regulator which assumes control of the pressure at a higher set value in the event of the active regulator failing open

3.6.5
excess air ratio (λ)
ratio between the effectively introduced quantity of air and the theoretically required quantity of air

Note 1 to entry: The terms Lambda and air factor are also used to describe this ratio.

3.6.6
Wobbe index
Gross Wobbe index W_s; net Wobbe index W_i, ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions

Note 1 to entry: The Wobbe index is said to be gross or net according to whether the calorific value used is the gross or net calorific value.

3.6.7
gas family
group of gaseous fuels with similar burning behaviour, linked together by a range of Wobbe indices

3.6.8
gas group
group of gases with same specified range of Wobbe index

4 Safety management

4.1 General

To ensure the safety of an Industrial Installation, the equipment used shall be fit for purpose.

There is a legal requirement for equipment used in European installations to bear a CE mark as required by the various applicable Directives. A CE mark may not be required in all cases.

It is important to consider at the initial design stage of an installation, the maintenance requirements of equipment. If it is dangerous, or unacceptable to shut down parts of a plant to carry out maintenance at the required interval, redundant systems may need to be implemented.

To ensure the safety of the design and its operational suitability it is normal to carry out some form of risk assessment or HAZOP during the design and prior to commissioning. These should highlight any risk and operational issues and enable design modifications to be made at an early stage.

Maintenance procedures should be such that the release of a flammable or toxic gas during maintenance does not lead to a dangerous condition.

4.2 Maintaining records of completed gas work

In the context of Quality Management, it is important that the Technical File, Construction File, Explosion Protection Document and Conformity File are maintained and updated regularly to match with activities concerning the industrial gas installation. Here below there is an example scheme.