



BSI Standards Publication

Components for supply systems for consuming units with liquid fuels

National foreword

This British Standard is the UK implementation of EN 12514:2020, incorporating corrigendum February 2021. It supersedes BS EN 12514-1:2000 and BS EN 12514-2:2000, which are withdrawn.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by CEN corrigendum February 2021 is indicated in the text by AC AC.

The UK participation in its preparation was entrusted to Technical Committee RHE/13, Liquid fuel firing.

A list of organizations represented on this committee can be obtained on request to its committee manager.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

This publication has been prepared under a mandate given to the European Standards Organizations by the European Commission and the European Free Trade Association and is intended to support essential requirements of the EU legislation detailed in the European foreword. Annex ZA/ZZ describes how the publication relates to the legislation.

For the Great Britain market (England, Scotland and Wales), if the UK Government has designated this publication for conformity with UKCA marking legislation and has not amended the essential requirements of that legislation, Annex ZA/ZZ and any references to EU law in the publication should be read in accordance with the designation as applying to UK legislation in the same way as to EU law. Further information on designated standards can be found at www.bsigroup.com/standardsandregulation.

For the Northern Ireland market, UK law will continue to implement relevant EU law subject to periodic confirmation. References to EU legislation are therefore still valid.

More information on legislation can be found at www.gov.uk.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Components for supply systems for consuming units with liquid fuels

Composants destinés aux systèmes d'alimentation pour unités de consommation à combustible liquide

Komponenten für Versorgungsanlagen für Verbrauchsstellen mit flüssigen Brennstoffen

This European Standard was approved by CEN on 15 June 2020 and includes the Corrigendum issued by CEN on 17 February 2021.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European foreword

This document (EN 12514:2020+AC:2021) has been prepared by Technical Committee CEN/TC 47 “Atomizing oil burners and their components - Function - Safety - Testing”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2021, and conflicting national standards shall be withdrawn at the latest by April 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12514-1:2000 and EN 12514-2:2000.

This document includes the corrigendum EN 12514:2020/AC:2021 which corrects the wording related to Formula (6) in 5.5.1.2.1.4, 5.5.1.2.2.3, 5.5.1.3.3, 5.5.1.4.3, 5.12.2.1.3, 5.12.2.2.3 and 5.19.20.4.3.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags AC AC.

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association, and supports essential characteristics of EU Directives.

In comparison to EN 12514-1:2000 and EN 12514-2:2000, the following fundamental changes are given:

- standard new structured;
- new components for supply systems included;
- technical characteristics and requirements revised;
- updating of the terms and definitions;
- merging of components to type series;
- fuels categorized and new fuels added;
- nominal lifetime defined;
- essential characteristic for flood proof components included;
- selections of materials;
- marking, packing and instructions revised;
- inclusion of Annex ZA giving the correspondance to the Measuring Instruments Directive (MID) 2014/32/EU.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Pressure values given in this standard are given as gauge pressure (pressure exceeding atmospheric pressure) unless noted otherwise. Vacuum (negative pressure) is therefore designated by a negative value.

1 Scope

This document specifies the safety and performance essential characteristics and tests methods for the components for supply systems. Their intended use is the supply with liquid fuel for one or more consuming units from one or more tanks.

This document applies to components for pressurised, negative pressurised, (vacuum), non-pressurised, underground, above ground, inside and/or outside systems to supply liquid fuels.

The components for supply systems covered by this document are piping kits/systems with the following components:

- a) feed pump;
- b) control and safety device for feed pumps;
- c) service tank;
- d) service vessel;
- e) safety shut-off device;
- f) isolating valve;
- g) quick acting valve;
- h) switch-over valve;
- i) forced switch-over valve;
- j) check valve;
- k) pressure compensating device;
- l) discharge valve;
- m) pressure reducer;
- n) filter;
- o) meter;
- p) de-aerator;
- q) anti-siphon safety device;
- r) insulating device;
- s) pressure gauge;
- t) vapour/air separator;
- u) pressure control path;
- v) pressure retaining device;
- w) remote acting fire safety valve;
- x) pipe;
- y) pipeline connections;
- z) component within pipes;
- aa) combined component;
- bb) withdrawal device.

Not covered by this document are items belonging to the consuming unit (e.g.: heating/cooling appliances in buildings) and items used for the mounting and support of components.

Not covered by this document are items with the intended use of gas for building heating/cooling systems and any items of heating networks.

Not covered are items used for drainage (including highways) and disposal of other liquids and gaseous waste, supply of oil and other liquids, supply of gases, pressure and vacuum systems, communications, sanitary and cleaning fixtures and storage fixtures.

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 573-3:2019, Aluminium and aluminium alloys - Chemical composition and form of wrought products - Part 3: Chemical composition and form of products

EN 682:2002+A1:2005, *Elastomeric Seals - Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*

EN 754:2016 (All parts), *Aluminium and aluminium alloys - Cold drawn rod/bar and tube*

EN 755:2016 (All Parts), *Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles - Part 1: Technical conditions for inspection and delivery*

EN 806-4:2010, *Specifications for installations inside buildings conveying water for human consumption — Part 4: Installation*

EN 809:1998+A1:2009 + AC:2010, *Pumps and pump units for liquids - Common safety requirements*

EN 837-1:1996, *Pressure gauges - Part 1: Bourdon tube pressure gauges - Dimensions, metrology, requirements and testing*

EN 837-2:1997, *Pressure gauges - Part 2: Selection and installation recommendations for pressure gauges*

EN 837-3:1996, *Pressure gauges - Part 3: Diaphragm and capsule pressure gauges - Dimensions, metrology, requirements and testing*

EN 1057:2006+A1:2010, *Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications*

EN 1092 (All parts), *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated*

EN 1127-1:2019, *Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology*

EN 1254 (All parts except part 6), *Copper and copper alloys - Plumbing fittings*

EN 1267:2012, *Industrial valves - Test of flow resistance using water as test fluid*

EN 1363-1:2018, *Fire resistance tests - Part 1: General requirements*

EN 10151:2002, *Stainless steel strip for springs - Technical delivery conditions*

EN 10204:2004, *Metallic products - Types of inspection documents*

EN 10226-1:2004, *Pipe threads where pressure tight joints are made on the threads - Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation*

EN 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads - Part 2: Taper external threads and taper internal threads - Dimensions, tolerances and designation*

EN 10241:2000, *Steel threaded pipe*

EN 10242:1994, *Threaded pipe fittings in malleable cast iron*

EN 10270-3:2011, *Steel wire for mechanical springs - Part 3: Stainless spring steel wire*

EN 10284:2000, *Malleable cast iron fittings with compression ends for polyethylene (PE) piping systems*

EN 10305:2016 (All parts, except part 5), *Steel tubes for precision applications - Technical delivery conditions*

prEN 10344:2006, *Malleable cast iron fittings with compression ends for steel pipes*

prEN 10352:2010, *Stainless steel plumbing fittings - Fittings with press ends for metallic tubes*

prEN 10358:2012, *Unalloyed steel plumbing fittings - Fittings with press ends for unalloyed steel tubes*

EN 12170:2002, *Heating systems in buildings - Procedure for the preparation of documents for operation, maintenance and use - Heating systems requiring a trained operator*

EN 12171:2002, *Heating systems in buildings - Procedure for the preparation of documents for operation, maintenance and use - Heating systems not requiring a trained operator*

EN 12266-1:2012, *Industrial valves - Testing of metallic valves - Part 1: Pressure tests, test procedures and acceptance criteria - Mandatory requirements*

EN 12266-2:2012, *Industrial valves - Testing of metallic valves - Part 2: Tests, test procedures and acceptance criteria - Supplementary requirements*

EN 12449:2016, *Copper and copper alloys - Seamless, round tubes for general purposes*

EN 12627:2017, *Industrial valves - Butt welding ends for steel valves*

EN 13160-1:2003, *Leak detection systems — Part 1: General principles*

EN 13341:2018, *Static thermoplastic tanks for above ground storage of domestic heating oils, kerosene and diesel fuels — Blow moulded and rotationally moulded polyethylene tanks and rotationally moulded tanks made of anionically polymerized polyamide 6 — Requirements and test methods*

EN 13349:2002, *Copper and copper alloys - Pre-insulated copper tubes with solid covering*

EN 13480-1:2017, *Metallic industrial piping - Part 1: General*

EN 13480-3:2017, *Metallic industrial piping - Part 3: Design and calculation*

EN 13480-8:2017, *Metallic industrial piping - Part 8: Additional requirements for aluminium and aluminium alloy piping*

EN 13501-1:2018, *Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests*

EN 13616-2:2016, *Overfill prevention devices for static tanks for liquid fuels - Part 2: Overfill prevention devices without a closure device*

EN 13906-1:2013, *Cylindrical helical springs made from round wire and bar - Calculation and design - Part 1 : Compression springs*

EN 13906-2:2013, *Cylindrical helical springs made from round wire and bar - Calculation and design - Part 2: Extension springs*

EN 14125:2013, *Thermoplastic and flexible metal pipework for underground installation at petrol filling stations*

EN 14214:2012+A2:2019, *Automotive fuels — Fatty acid methyl esters (FAME) for diesel engines and heating applications — Requirements and test methods*

EN 14291:2004, *Foam producing solutions for leak detection on gas installations*

EN 14585-1:2006, *Corrugated metal hose assemblies for pressure applications - Part 1: Requirements*

EN 14879-4:2007, *Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media - Part 4: Linings on metallic components*

EN 14597:2012, *Temperature control devices and temperature limiters for heat generating systems*

EN 15014:2007, *Plastics piping systems - Buried and above ground systems for water and other fluids under pressure - Performance characteristics for pipes, fittings and their joints;*

EN 16668:2016+A1:2018, *Industrial valves - Requirements and testing for metallic valves as pressure accessories;*

EN 60529:2014, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:2014)*

EN 60534-2-3:2015, *Industrial-process control valves - Part 2-3: Flow capacity - Test procedures (IEC 60534-2-3:2015)*

EN 60730-1:2016, *Automatic electrical controls - Part 1: General requirements (IEC 60730-1)*

EN 61672-1:2013, *Electroacoustics - Sound level meters - Part 1: Specifications (IEC 61672-1:2013)*

EN 82079-1:2019, *Preparation of instructions for use - Structuring, content and presentation - Part 1: General principles and detailed requirements*

EN ISO 175:2010, *Plastics - Methods of test for the determination of the effects of immersion in liquid chemicals (ISO 175:2010)*

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 527-1:2012, *Plastics - Determination of tensile properties - Part 1: General principles (ISO 527-1:2012)*

EN ISO 9227:2017, *Corrosion tests in artificial atmospheres - Salt spray tests (ISO 9227:2017)*

EN ISO 1179 (all parts):2013, *Connections for general use and fluid power - Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing*

EN ISO 3183:2012+A1:2017, *Petroleum and natural gas industries - Steel pipe for pipeline transportation systems (ISO 3183:2012 + Amd 1:2017)*

EN ISO 8434 (All parts except part 5):2018 *Metallic tube connections for fluid power and general use (ISO 8434:2018)*

EN ISO 2719:2016, *Determination of flash point - Pensky-Martens closed cup method (ISO 2719:2016)*

EN ISO 6508-1:2015, *Metallic materials — Rockwell hardness test — Part 1: Test method (ISO 6508-1:2015)*

EN ISO 6806:2017, *Rubber hoses and hose assemblies for use in oil burners - Specification (ISO 6806:2017)*

EN ISO 9606-2:2004, *Qualification test of welders - Fusion welding - Part 2: Aluminium and aluminium alloys (ISO 9606-2:2004)*

EN ISO 9606-3:1999, *Approval testing of welders - Fusion welding - Part 3: Copper and copper alloys (ISO 9606-3:1999)*

EN ISO 9606-4:1999, *Approval testing of welders - Fusion welding - Part 4: Nickel and nickel alloys (ISO 9606-4:1999)*

EN ISO 9606-5:2000, *Approval testing of welders - Fusion welding - Part 5: Titanium and titanium alloys, zirconium and zirconium alloys (ISO 9606-5:2000)*

EN ISO 9974-1:2000, *Connections for general use and fluid power - Ports and studs ends with ISO 261 threads with elastomeric or metal-to-metal sealing - Part 1: Threaded ports (ISO 9974-1:1996)*

EN ISO 9974-3:2000, *Connections for general use and fluid power - Ports and studs ends with ISO 261 threads with elastomeric or metal-to-metal sealing - Part 3: Stud ends with metal-to-metal sealing (type B) (ISO 9974-3:1996)*

EN ISO 10380:2012, *Pipework - Corrugated metal hoses and hose assemblies (ISO 10380:2012)*

EN ISO 10497:2010, *Testing of valves - Fire type-testing requirements (ISO 10497:2010)*

EN ISO 11357-6:2018, *Plastics - Differential scanning calorimetry (DSC) - Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT) (ISO 11357-6:2018);*

EN ISO 11925-2:2011, *Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test (ISO 11925-2:2010)*

EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010);*

EN ISO 15609-1:2004, *Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15609-2:2001, *Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 2: Gas welding (ISO 15609-2:2001)*

EN ISO 15609-3:2004, *Specification and qualification of welding procedures for metallic materials - Welding procedures specification - Part 3: Electron beam welding (ISO 15609-3:2004)*

EN ISO 15609-4:2009, *Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 4: Laser beam welding (ISO 15609-4:2009)*

EN ISO 15609-5:2011, *Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 5: Resistance welding (ISO 15609-5:2011)*

EN ISO 15612:2018, *Specification and qualification of welding procedures for metallic materials - Qualification by adoption of a standard welding procedure (ISO 15612:2018)*

EN ISO 15614-7:2016, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 7: Overlay welding (ISO 15614-7:2016)*

EN ISO 15614-11:2002, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 11: Electron and laser beam welding (ISO 15614-11:2002)*

EN ISO 15874-2:2013+A1:2018, *Plastics piping systems for hot and cold water installations - Polypropylene (PP) - Part 2: Pipes (ISO 15874-2:2013 + Amd. 1:2018)*

EN ISO 15875-2:2003, *Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) - Part 2: Pipes (ISO 15875-2:2003)*

EN ISO 19879:2010, *Metallic tube connections for fluid power and general use - Test methods for hydraulic fluid power connections (ISO 19879:2010)*

EN ISO 21003-1:2008, *Multilayer piping systems for hot and cold water installations inside buildings - Part 1: General (ISO 21003-1:2008)*

EN ISO 23553-1:2014, *Safety and control devices for oil burners and oil-burning appliances - Particular requirements - Part 1: Automatic and semi-automatic valves (ISO 23553-1:2014)*

ISO 1817:2011, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 4548-1:1982, *Internal combustion engines; methods of test for full-flow lubricating oil filters; pressure drop/flow characteristics;*

ISO 6149 (All parts), *Connections for hydraulic fluid power and general use - Ports and stud ends with ISO 261 metric threads and O-ring sealing)*

ISO 6162 (All parts), *Hydraulic fluid power - Flange connectors with split or one-piece flange clamps and metric or inch screws*

ISO 6605:2003, *Hydraulic fluid power - Hoses and hose assemblies - Test methods*

ISO 7005:(All parts), *Specification for design and manufacture of carbon steel unfired pressure vessels for use in vapour compression refrigeration systems*

ISO 12151 (All parts), *Connections for hydraulic fluid power and general use - Hose fittings - Part 2: Hose fittings with ISO 8434-1 and ISO 8434-4 24° cone connector ends with O-rings (ISO 12151-2:2003)*

ISO 15901-1:2016, *Evaluation of pore size distribution and porosity of solid materials by mercury porosimetry and gas adsorption - Part 1: Mercury porosimetry*

ISO 16889:2008, *Hydraulic fluid power - Filters - Multi-pass method for evaluating filtration performance of a filter element*

ISO 19438:2003, *Diesel fuel and petrol filters for internal combustion engines. Filtration efficiency using particle counting and contaminant retention capacity*

ISO/TR 7620:2005, *Rubber materials — Chemical resistance*

CEN/TS 15223:2008, *Plastics piping systems - Validated design parameters of buried thermoplastics piping systems*

OIML R 117-1:2007, *Dynamic measuring systems for liquids other than water*

OFS E104:2015, *Filters, Strainers and Water Separation for use with Oil Supply Systems*

3 Terms, definitions, symbols and abbreviated terms

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

IEC Electropedia: available at <http://www.electropedia.org/>

ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE The English, French and German terms are listed in a vocabulary, see Annex G.

3.1 Terms and definitions

3.1.1 General

3.1.1.1

piping kit

construction product of at least two separate components

3.1.1.2

component

construction product of a supply system

Note 1 to entry: A component may consist of several parts.

3.1.1.3

electrical component

component driven by electrical power

3.1.1.4

component with shut-off function

component which shuts off the flow in pipelines

3.1.1.5

supply system

supply kit

installation for the processing and supply of liquid fuels from the tank to the consuming unit

Note 1 to entry: For examples of supply systems see Annex D.

3.1.1.6

consuming unit

unit in which liquid fuels are converted into thermal and/or mechanical energy

Note 1 to entry: Consuming units, for instance, are specified by the following standards: EN 1, EN 267, EN 303-2, EN 304, EN 13842, and EN 15035.

3.1.1.7

liquid fuel

fuel which is liquid at atmospheric pressure (see 4.16.1.1.)

3.1.1.8

tank

hollow body (container) for the storage of liquid fuels at atmospheric pressure including branches up to the first pipeline connection

[SOURCE: EN 13121-3:2008+A1:2010, 3.7, modified]

3.1.1.9

safety device

safety ancillary

component to prevent or indicate any dangerous operating status, overfill or leakage of liquid fuel within the meaning of this European standard

These safety devices are:

- control and safety device for feed pumps;
- pressure compensating device;
- anti-siphon safety device;
- remote acting fire safety valve;
- safety shut-off device.

3.1.1.10

vessel

closed hollow body (container) subject to applied pressure or vacuum, with or without hydrostatic head, including branches up to the first flanged connection

[SOURCE: EN 13121-3:2008+A1:2010, 3.4, modified]

3.1.1.11

piping

pipes and pipeline connections for the conveyance of fluids through pipelines

Note 1 to entry: For the purposes of this standard, the used fluid is liquid fuel, see 4.16.1.1.

3.1.1.12

type series

components with the same types of constructional and functional characteristics distinguished by different nominal sizes and/or different parts

Note 1 to entry: The assignment of nominal sizes to a type series is specified by the manufacturer. Within one type series, the maximum allowable pressures (PS) may vary with the nominal sizes. The components of one type series may have different pipeline connections or consist of different components.

Note 2 to entry: The term “type series” complies with for instance the term “basic type” in EN 736-1.

Note 3 to entry: For assessment see clause 6.

3.1.1.13

nominal lifetime

time during which the component is intended to operate under the condition it is operated according to the manufacturer's instructions for installation, operation and maintenance

Note 1 to entry: The components may have to be submitted to regular service and maintenance procedures carried out by authorized personnel according to the manufacturer's instructions.

3.1.1.14

pipeline

piping and components in a supply system

3.1.2 Components

3.1.2.1

feed pump

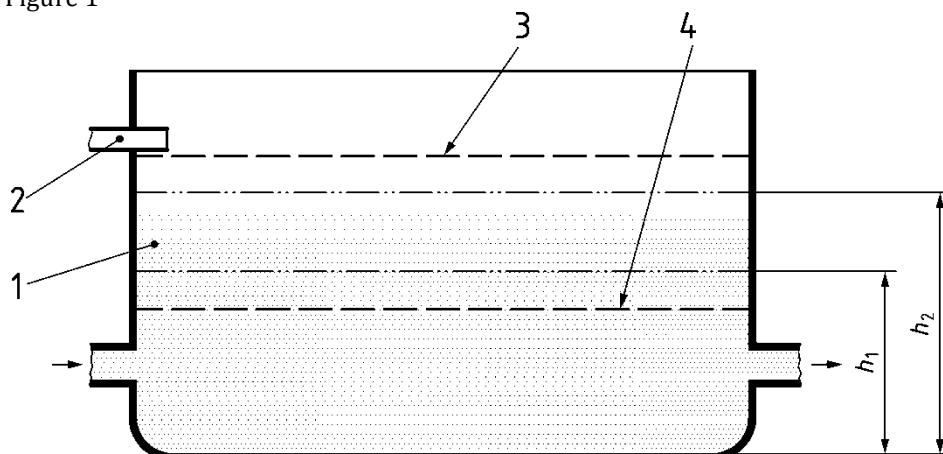
pump for feeding liquid fuels from the tank or vessel to other tanks, vessels or consuming units connected to the supply system, with control and/or safety device(s)

3.1.2.2

service tank

tank with control and/or safety device(s) as intermediate reservoir for liquid fuel

NOTE See Figure 1



Key

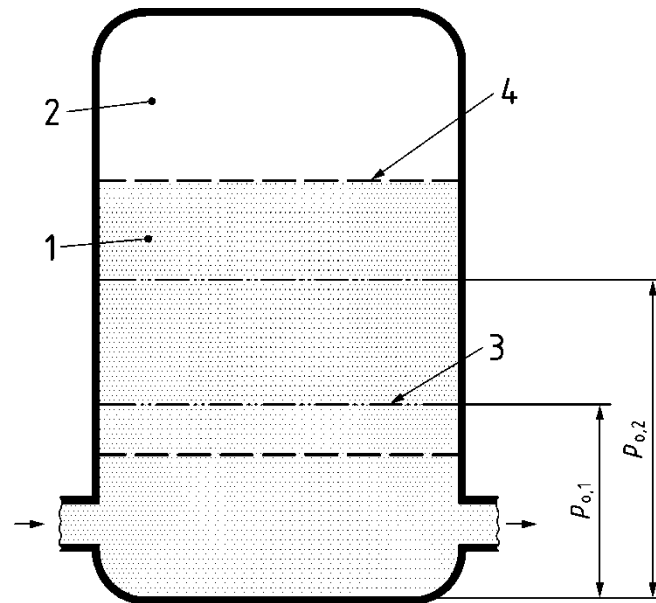
- | | |
|-------------------------|--|
| 1 liquid fuel | 4 low limit controller |
| 2 overflow pipeline | h_1 filling height (level) at opening of fuel supply |
| 3 high limit controller | h_2 filling height (level) at closing of fuel supply |

Figure 1 — Example of service tank

3.1.2.3**service vessel**

vessel within a supply system with or without control device and/or high and/or low limit controller as intermediate reservoir for liquid fuel

Note 1 to entry: See Figure 2

**Key**

- 1 liquid fuel
- 2 gas (e.g. nitrogen, air)
- 3 low limit controller
- 4 low limit controller or high limit controller
- $p_{o,1}$ operating pressure at opening of liquid fuel supply
- $p_{o,2}$ operating pressure at closing of liquid fuel supply

Figure 2 — Example of service vessel

3.1.2.4**isolating valve**

valve for shut-off and re-opening of flow in pipelines

Note 1 to entry: For basic types and examples, see EN 736-1.

Note 2 to entry: Designation of the valve parts according to EN 736-2.

3.1.2.5**quick-acting valve**

valve intended for opening or closing the flow in pipelines operated manually or automatically by short travel or a rotating movement of maximum 90°

Note 1 to entry: For basic types and examples, see EN 736-1.

Note 2 to entry: Designation of the valve parts according to EN 736-2.

Note 3 to entry: It only allows a completely opened or closed position, but no throttle position

3.1.2.6

safety shut-off device

safety shut-off valve

normally closed device, automatic or semi-automatic, that prevents the liquid fuel flow when de-energized

[SOURCE: EN ISO 23553-1:2014, 3.101.5, modified]

3.1.2.7

switch-over valve

valve in pipelines for the single shut-off or re-opening of several flow inlets to one flow outlet

Note 1 to entry: For basic types and examples, see EN 736-1.

Note 2 to entry: Designation of the valve parts according to EN 736-2.

3.1.2.8

forced switch-over valve

valve in pipelines with several feed inlets and associated return outlets and with one or more feed outlets and associated return inlets

Note 1 to entry: Designation of the valve parts according to EN 736-2.

3.1.2.9

check valve

valve which releases the flow in pipelines in the feed direction and shuts off automatically in the opposite direction

Note 1 to entry: For basic types and examples, see EN 736-1.

Note 2 to entry: Designation of the valve parts according to EN 736-2.

3.1.2.10

pressure compensating device

device for the limitation of pressure build-up in closed sections of pipelines due to temperature related volume changes of the liquid fuel

Note 1 to entry: Designation of the device parts according to EN 736-2.

3.1.2.11

discharge valve

valve for maintaining the upper pressure limit

Note 1 to entry: Designation of the valve according to EN 736-2.

3.1.2.12

pressure reducer

device for maintaining the outlet pressure constant irrespective of inlet pressure variations and/or changes of flow and/or temperature within specified limits

Note 1 to entry: A difference is made between the basic types of pre-set pressure reducers and adjustable pressure reducers.

Note 2 to entry: The nominal outlet pressure of a pre-set pressure reducer is set in adjustably by the manufacturer.

Note 3 to entry: The outlet pressure of an adjustable pressure reducer can be varied by the user between minimum and maximum nominal outlet pressure.

3.1.2.13**filter**

device which retains solid matter exceeding a specified particle size from the liquid fuel

3.1.2.14**meter**

device for the continuous measurement, recording and indication of the flow rate of liquid fuel in a closed, completely filled piping

Note 1 to entry: This term corresponds to the term “meter” according to Annex MI-005 in Directive 2014/32/EU.

Note 2 to entry: Meters may be component of measurement systems according to Annex MI-005 in Directive 2014/32/EU.

3.1.2.15**de-aerator**

device in pipelines for the automatic venting

3.1.2.16**anti-siphon safety device**

device in the pipeline which prevents siphoning of a tank or service tank

Note 1 to entry: Siphoning designates a condition when the maximum filling level in the tank or service tank lies above the lowest point of the suction pipeline, which could lead to leakage of liquid fuel due to the weight pressure of the liquid column.

Note 2 to entry: For basic types and examples, see EN 736-1.

Note 3 to entry: Designation of the valve parts according to EN 736-2.

3.1.2.17**pressure retaining device**

device for maintaining the pressure in a pressure pipeline approximately constant

Note 1 to entry: Designation of the valve parts according to EN 736-2.

3.1.2.18**insulation device**

device for the electrical separation between the tank and the pipeline to the consuming unit

Note 1 to entry: See also EN 13636

3.1.2.19**pressure gauge**

indicator of the applied (gauge) pressure with respect to the atmospheric pressure

[SOURCE: EN 472:1994, 2.3, modified]

Note 1 to entry: For basic types and examples, see EN 837-1 and EN 837-3.

3.1.2.20**vapour/air separator**

device used for continuously separating or removing of air or gases contained in the fuel

[SOURCE: EN 13617-1:2004+A1:2009, 3.1, modified]

3.1.2.21

pressure control path

device consisting of several components which controls the operating pressure in the pressure pipeline within limits specified for the consuming unit .

EXAMPLE See Figure D.4.

3.1.2.22

pipeline connection

fastener

device for connecting pipes and/or components

Note 1 to entry: Fasteners have not the task to transfer loads to a structure like e.g. walls.

3.1.2.23

combined component

component consisting of several components

3.1.2.24

remote acting fire safety valve

pneumatic or hydraulic device that automatically ceases the flow of liquid fuel to the consuming unit on sensing a higher than expected temperature at the installation point

3.1.2.25

withdrawal device

combined component for liquid fuel withdrawal of tank(s)

Note 1 to entry: Examples see Figure D.9.

3.1.3 Pipeline

3.1.3.1

suction pipeline

pipeline subject to vacuum under operating conditions

Note 1 to entry: The hydrostatic pressure in the pipeline is in this connection not considered.

3.1.3.2

pressure pipeline

pipeline subject to static and/or dynamic pressure under operating conditions

3.1.3.3

return pipeline

pressure pipeline for the return of excess liquid fuel

Note 1 to entry: See Figure D.7 and Figure D.8.

3.1.3.4

overflow pipeline

pipeline to return excess liquid fuel from the service tank

Note 1 to entry: See Figure 1.

3.1.3.5

pipe

hollow long product, open at both ends, of round or polygonal cross-section

[SOURCE: EN 10079:2007, 3.4.10.1, modified]

3.1.3.6**hose**

pipe which may vary its shape and position as intended

Note 1 to entry: On national level the term “flexible pipe” is in some instances also used for “hose”.

3.1.3.7**hose assembly**

hose with their hose connections

3.1.3.8**underground**

completely or partially covered with soil and additionally pipelines and/or installations in sections of construction works which are in contact to the ground

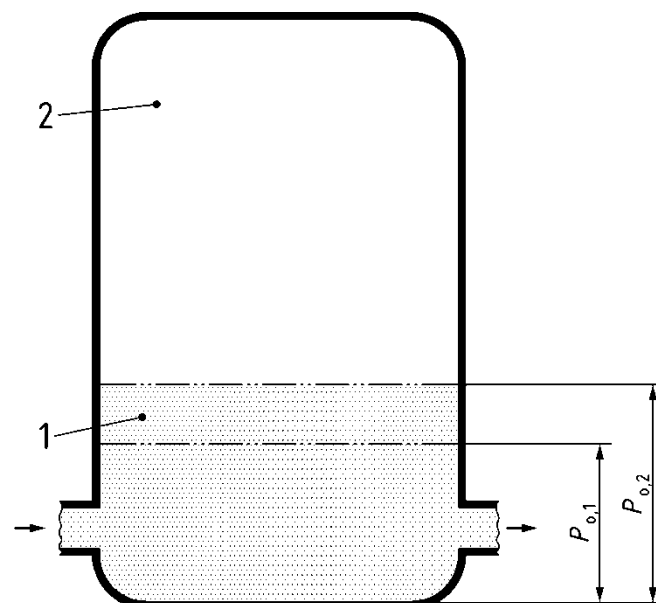
3.1.3.9**above ground**

in or outside construction works without being covered with soil and additionally pipelines and/or installations which are mounted in trenches or ducts that have not been filled in

3.1.4 Control and safety devices for feed pumps**3.1.4.1 Control devices for feed pumps****3.1.4.1.1****pressure control device**

device for opening or closing the liquid fuel supply to the service vessel or the supply system depending on the operating pressure

Note 1 to entry: See Figure 3.

**Key**

- 1 liquid fuel
- 2 Gas (e.g. nitrogen, air) or spring-loaded piston
- $p_{o,1}$ operating pressure based on filling height at opening of the fuel supply
- $p_{o,2}$ operating pressure based on filling height at closing of the fuel supply

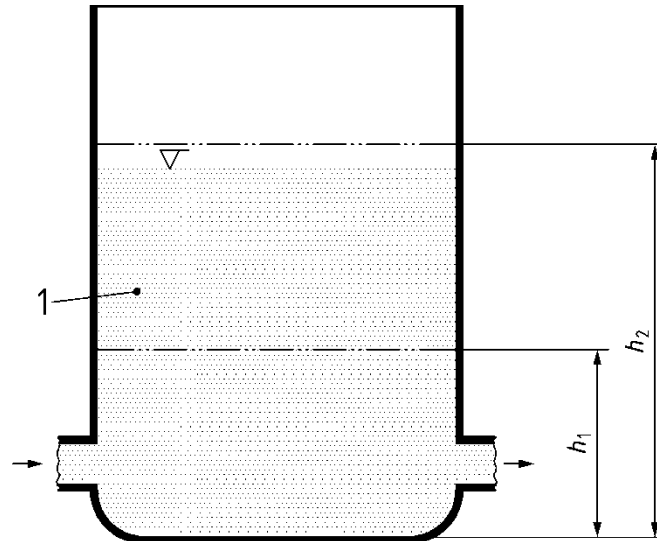
Figure 3 — Operational range of the pressure control device

3.1.4.1.2

level control device

device for opening or closing the liquid fuel supply to the service tank or the supply system depending on the filling height (level)

Note 1 to entry: See Figure 4.



Key

- 1 liquid fuel
- h_1 filling height (level) at opening of the fuel supply
- h_2 filling height (level) at closing of the fuel supply

Figure 4 — Operational range of the level control device

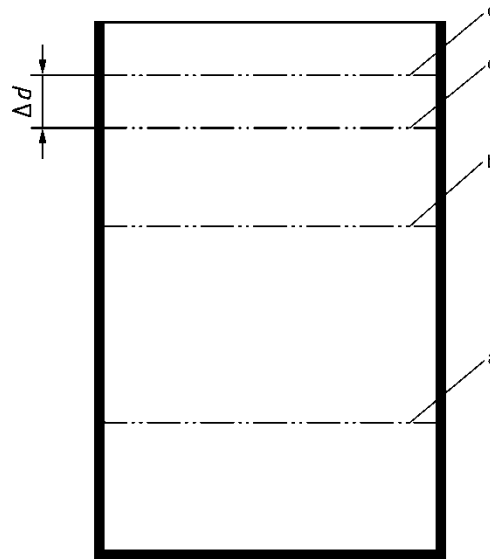
3.1.4.2 Safety devices for feed pumps

3.1.4.2.1

low limit controller

device which closes the liquid fuel supply when the pre-set minimum or maximum values are exceeded and which opens only after manual re-set, for examples

Note 1 to entry: See Figure 5 and Figure 6.

**Key**

- a operating pressure $p_{0,1}$ or filling height h_1 at opening of the liquid fuel supply
- b operating pressure $p_{0,2}$ or filling height h_2 at closing of the liquid fuel supply
- c maximum allowable pressure p_s or maximum filling height $h_{\max}$
- d operating pressure or filling height at safety shut-down
- Δd at least 10 % of the maximum allowable pressure p_s or maximum filling height $h_{\max}$

Figure 5 — Operational range of the low limit controller after falling short of the minimum pre-set values with pressure or level control device

3.1.4.2.2**high limit controller**

device which closes the liquid fuel supply when the pre-set minimum or maximum values of the pressure or level control are exceeded and which opens automatically when the shut-down criterion is no longer present

3.1.5 Supply systems**3.1.5.1****single-pipe system**

supply system in which the liquid fuels are supplied through a suction pipeline and/or a pressure pipeline from (a) tank(s) or vessel(s) to the consuming unit

Note 1 to entry: Examples for suction pipelines see in Annex D.

3.1.5.2**two-pipe system**

supply system in which the feed pump leads the liquid fuel from (a) tank(s) or vessel(s) by means of a pipeline and feeds it to the consuming unit, while any excess liquid fuel is returned to the tank through a return pipeline

Note 1 to entry: Examples see in Annex D.

Note 2 to entry: Combinations of single-pipe and two-pipe systems are possible.

3.1.6 Pressure related terms

3.1.6.1

maximum allowable pressure

maximum pressure for which the component is designed

[SOURCE: EN 764-1:2015+A1:2016, 3.2.87, modified]

Note 1 to entry: PS is not identical with PN according to EN 1333.

3.1.6.2

specific maximum allowable pressure

pressure, for which a defined part of a component with different strength ranges is designed

3.1.6.3

operating pressure

pressure occurring during specified operating conditions

[SOURCE: EN 764-1:2004, 3.6, modified]

Note 1 to entry: The subscript "MAX" or "max" is added to the symbol for maximum values.

Note 2 to entry: The subscript "MIN" or "min" is added to the symbol for minimum values.

Note 3 to entry: EN 764-1:2015+A1:2016, 3.2.88 now uses the term maximum permissible pressure

3.1.6.4

test pressure

pressure to which the component is subjected for test purposes

[SOURCE: EN 764-1:2015+A1:2016, 3.2.151, modified]

3.1.6.5

minimum allowable pressure

minimum pressure in the vacuum range for which the component is designed, as specified by the manufacturer

3.1.6.6

inlet pressure

operating pressure at the inlet of the component

3.1.6.7

outlet pressure

operating pressure at the outlet of the component

Note 1 to entry: The subscript "MAX" or "max" is added to the symbol for maximum values.

Note 2 to entry: The subscript "MIN" or "min" is added to the symbol for minimum values.

3.1.6.8

pressure difference

difference between inlet and outlet pressure

Note 1 to entry: $p_{o,d} = p_{o,i} - p_{o,o}$

3.1.6.9

nominal outlet pressure

nominal value for the set outlet pressure of a pressure reducer

Note 1 to entry: The subscript "MAX" or "max" is added to the symbol for maximum values.

Note 2 to entry: The subscript “MIN” or “min” is added to the symbol for minimum values.

3.1.6.10

lock-up pressure

operating pressure of a component at which it closes and the flow is zero

3.1.6.11

response pressure

operating pressure of a component at which it opens to release the flow

3.1.6.12

nominal response pressure

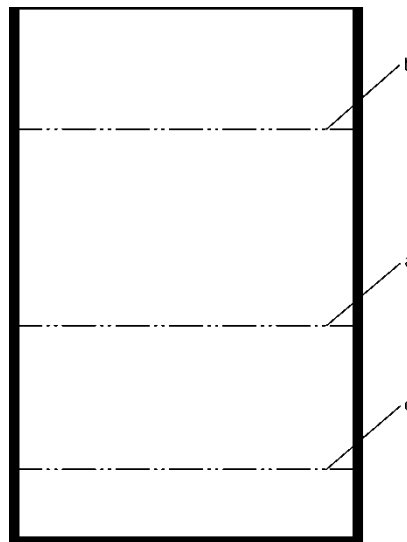
nominal value for the operating pressure of a component at which it is in the open position at nominal flow

3.1.6.13

atmospheric pressure conditions

surrounding pressure ranging from 0,07 MPa to 0,106 MPa

Note 1 to entry: See prEN 60721-3-3:2018



Key

- a operating pressure, $p_{0,1}$, or filling height, h_1 , at opening of the liquid fuel supply
- b operating pressure, $p_{0,2}$, or filling height, h_2 , at closing of the liquid fuel supply
- d operating pressure or filling height at safety shut-down

Figure 6 — Operational range of the low limit controller after exceeding the maximum pre-set values with pressure or level control device

3.1.7 Temperature related terms

3.1.7.1

maximum/minimum allowable temperature

maximum/minimum temperature for which the component is designed as specified by the manufacturer

[SOURCE: EN 764-1:2015+A1:2016, 3.1.9 and 3.1.10, modified]

Note 1 to entry: The subscript "MAX" or "max" is added to the symbol for maximum values.

Note 2 to entry: The subscript "MIN" or "min" is added to the symbol for minimum values.

3.1.7.2

maximum/minimum ambient temperature

maximum/minimum temperature of the surrounding atmosphere at which the component can be operated according to the manufacturer's instructions

Note 1 to entry: The subscript "MAX" or "max" is added to the symbol for maximum values.

Note 2 to entry: The subscript "MIN" or "min" is added to the symbol for minimum values.

3.1.7.3

test temperature

temperature at which the component is subjected to tests

3.1.7.4

operating temperature

temperature for which the component is designed to operate

Note 1 to entry: The subscript "MAX" or "max" is added to the symbol for maximum values.

Note 2 to entry: The subscript "MIN" or "min" is added to the symbol for minimum values.

3.1.7.5

ambient temperature

temperature of the surrounding atmosphere at which the component may be operated and/or tested

3.1.8 Flow related terms

3.1.8.1

flow rate

flowing volume or mass of a liquid fuel through the component during a period of time

[SOURCE: EN 267:2020, 3.2.1, modified]

Note 1 to entry: The liquid fuel flow rate is expressed in kilograms per hour (kg/h) as mass flow rate.

Note 2 to entry: The liquid fuel flow rate is expressed in litre per hour (l/h) as volume flow rate.

3.1.8.2

nominal flow rate

flow rate at a specified pressure difference as indicated by the manufacturer

3.1.8.3

guaranteed flow rate

flow rate of a pressure reducer which shall be reached at the lowest specified outlet pressure irrespectively of the inlet pressure value within the specified limits

3.1.8.4**lock-up flow rate**

flow rate range of a pressure reducer between 0 % and 10 % of the guaranteed flow rate

3.1.8.5**operating flow rate**

flow rate range for which the component is designed to operate

Note 1 to entry: For pressure reducers the operating flow rate is between 10 % and 100 % of the guaranteed flow rate $\dot{V}_g$.

Note 2 to entry: For meters and measurement systems the operating flow rate is between minimum flow rate $\dot{V}_{0,min}$ and maximum flow rate $\dot{V}_{0,max}$. The flow range for meters and measurement systems complies with Annex MI-005 of Directive 2014/32/EU.

Note 3 to entry: The flow range for meters and measurement systems complies with Annex MI-005 of Directive 2014/32/EU.

3.1.8.6**feed volume**

volume discharged by the feed pump per unit of time

3.1.8.7**venting capacity**

volume of gas and air which can be discharged by a de-aerator in combination with a consuming unit per unit of time

3.1.8.8**return flow rate**

flow rate in the return pipeline of filters and de-aerators as indicated by the manufacturer

3.1.9 Other terms**3.1.9.1****maximum filling height**

allowable filling height restricted by safety device

3.1.9.2**safety height**

declared or pre-set height of the anti-siphon safety device at which leakage of liquid fuel is prevented

3.1.9.3**nominal volume**

storage capacity for which the tank or vessel is designed

[SOURCE: EN 12285-1:2018, 3.1.12, modified]

3.1.9.4**nominal size**

numerical designation of size which is common to all components in a pipeline other than components indicated by inside or outside diameters or by thread size

Note 1 to entry: DN is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.

Note 2 to entry: For equivalent DN sizes, see Table A.1 in EN 12266-1:2012.

Note 3 to entry: Please refer for diameters to EN ISO 6708:1995.

3.1.9.5

external tightness

tightness of a liquid fuel-carrying compartment of the component with respect to atmosphere

3.1.9.6

internal tightness

tightness of the control member in the closed position, sealing a liquid fuel-carrying compartment with respect to another compartment or the outlet of the component

3.1.9.7

mounting position

position for mounting the component

3.1.9.8

breather hole

orifice which allows atmospheric pressure to be maintained within a compartment of variable volume

3.1.9.9

control member

movable part of the component which opens, controls and/or shuts-off the flow

3.1.9.10

control valve

valve which changes either the flow rate or the pressure in a system

3.1.9.11

constructional characteristic

technical design of a component for performing its function

Note 1 to entry: For valve examples, see EN 736-1.

3.1.9.12

functional characteristic

function of the component

Note 1 to entry: For valve examples, see EN 736-1.

3.1.9.13

performance characteristic

technical property(ies) of the component

Note 1 to entry: For technical properties examples see 3.1.6, 3.1.7 and 3.1.8.

3.1.9.14

part

piece of a component

Note 1 to entry: Designation of the parts of the valve components according to EN 736-2.

Note 2 to entry: Components may consist of several parts.

3.1.9.15

permeability

ability of a material to transmit gases and liquids by passage through one surface and out at another surface by diffusion and sorption processes

[SOURCE: EN ISO 472:2013]

Note 1 to entry: Not to be confused with porosity or leakage.

3.2 Symbols and abbreviated terms

Table 1 — Symbols and abbreviated terms

Symbol	Term	Subclause
DN	nominal size	3.1.9.4
HA, h_A	safety height	3.1.9.2
HMAX, $h_{\max}$	maximum filling height	3.1.9.1
PM, p_m	minimum allowable pressure	3.1.6.5
PO, p_o	operating pressure	3.1.6.3
POD, $p_{o,d}$	pressure difference	3.1.6.8
POI, $p_{o,i}$	inlet pressure	3.1.6.6
POL, $p_{o,l}$	lock-up pressure	3.1.6.10
POO, $p_{o,o}$	outlet pressure	3.1.6.7
POOL, $p_{o,o,l}$	lock-up pressure of a pressure reducer	4.18.10.2
POON, $p_{o,o,n}$	nominal outlet pressure	3.1.6.9
POR, $p_{o,r}$	response pressure	3.1.6.11
PORN, $p_{o,r,n}$	nominal response pressure	3.1.6.12
PS, p_s	maximum allowable pressure	3.1.6.1
PSD, $p_{s,d}$	specific maximum allowable pressure	3.1.6.2
PT, p_t	test pressure	3.1.6.4
TA, t_a	ambient temperature	3.1.7.2
TO, t_o	operating temperature	3.1.7.4
TS, t_s	maximum/minimum allowable temperature	3.1.7.1
TT, t_t	test temperature	3.1.7.3
V, $\dot{V}$	flow rate	3.1.8.1
VG, $\dot{V}_g$	guaranteed flow rate	3.1.8.3
VL, $\dot{V}_l$	lock-up flow rate	3.1.8.4
VN, $\dot{V}_n$	nominal flow rate	3.1.8.2
VO, $\dot{V}_o$	operating flow rate	3.1.8.5
VF, $\dot{V}_f$	feed volume	3.1.8.6
VR, $\dot{V}_r$	return flow rate	3.1.8.8
VN, V_n	nominal volume	3.1.9.3

4 Characteristics

4.1 General

The quality of the material as well as type and dimensioning of components shall ensure the continuous safe operation of components, provided they are installed according to good practice and used according to the conditions for operation, maintenance and adjustment and the related mechanical, chemical and thermal stresses.

Fixed pipeline connections on components according to this standard shall be included in the type testing and factory production control.

If the standards on pipes and pipeline connections referenced in this European standard contain equivalent or more rigorous essential characteristics, the essential characteristics of this standard are considered as fulfilled and do not need to be tested further.

4.2 Reaction to fire

The reaction to fire indicates the degree of contribution of the material to the behaviour of the construction product in the event of fire. When tested in accordance to the test methods given in clause 5.2, relevant for the claimed class, the test results are expressed as a class according to EN 13501-1:2018.

Type testing according to 5.2.

NOTE 1 Whether products covered by this standard are made from one or more of the materials that have been considered, under established conditions, as belonging to the category "No contribution to fire" because of their low level of combustibility, the reaction to fire class A applies to these product without the need of carrying out reaction to fire tests.

NOTE 2 According to EN 13501-1:2018 the option "NPD: No Performance Determined" can be used when no reaction to fire is to be declared.

NOTE 3 For non-metallic hoses and hose assemblies EN ISO 6806:2017 Annex E can be applied.

NOTE 4 For non-metallic parts of electrical components EN 60335-1:2012, Clause 30.2, can be applied.

4.3 Tightness in case of fire

Piping kits intended for use inside buildings with liquid fuels with a flash point ≤ 55 °C determined according to EN ISO 2719:2016 shall be tight in case of fire. The components of these piping kits are termed "fireproof components" with marking according to 7.2, m).

Type testing shall be done according to 5.3.

The essential characteristics to the tightness in case of fire according to EN ISO 10497:2010 shall be fulfilled.

4.4 Crushing strength

The characteristic for crushing strength is covered with the characteristic for internal pressure strength in clause 4.5.

For the type testing of pipeline connections the test for crushing strength shall be performed according to 5.4.

The pipeline connections shall show no visible leakage at the test pressure p_t .

NOTE Test based on clause 8 of EN ISO 19879:2010.

4.5 Internal pressure strength

4.5.1 Characteristics for pressurised systems

4.5.1.1 General

Components which may be subjected to overpressure shall be designed to withstand a maximum allowable pressure PS of at least 0,6 MPa.

Metallic pipes and hoses shall be designed for a maximum allowable pressure PS of at least 1 MPa.

For feed pumps according to this standard the manufacturer's indications for specific maximum allowable pressure PSD apply.

Optionally, the limits of the minimum allowable vacuum or the maximum allowable pressure may be extended during the procedure of conformity evaluation.

4.5.1.2 Type Testing

4.5.1.2.1 General

For the type testing for internal pressure strength the test shall be performed for all components except pressure reducer:

- according to 5.5.1.2.1 for components made of metallic materials;
- according to 5.5.1.3 and 5.5.1.4 for components made of non-metallic materials only;
- according to 5.5.1.3 and 5.5.1.4 for components made in combination of non-metallic and metallic materials.

The external surfaces of the components shall show no visible sign of leakage. Components/parts shall not have permanent deformation.

4.5.1.2.2 Pressure reducer

4.5.1.2.2.1 Test A

Test according to 5.5.1.3.

No bursting of the diaphragm shall occur during this test.

4.5.1.2.2.2 Test B

Test according to 5.5.1.3, where the specified test pressure is applied at the outlet and the inlet is not closed.

No bursting of the diaphragm shall occur during this test.

4.5.1.2.2.3 Test C

Test according to 5.5.1.2.1, where the specified test pressure is applied at the outlet, and the inlet, the breather hole, as well as all other openings into the atmosphere, are sealed or remain closed from the beginning. The diaphragm may be pierced through at the end of this test.

Test pressure specified for liquids: $p_t = p_{0,i,max}$ at test temperature $t_t = t_a$.

Test purpose is the determination of mechanical strength of the cover/body assembly, therefore, leakage from joints is neglected during this test.

No bursting shall occur in the cover area of the pressure reducer. Displacement or permanent deformation is acceptable.

4.5.1.3 Factory production control

For the factory production control for internal pressure strength the test shall be performed:

- according to 5.5.1.2.2 for components made of metallic materials;
- according to 5.5.1.3 for components made of non-metallic materials only;
- according to 5.5.1.3 for components made in combination of non-metallic and metallic materials.

The test shall be performed with a minimum frequency of one test per year with at least one sample.

The external surfaces of the pressure containing components shall show no visible sign of leakage. Components/parts shall not have permanent deformation.

4.5.2 Characteristics for negative pressurised systems

Components which can additionally be subjected to negative pressure shall be designed to withstand a minimum allowable pressure PM of at least -60 kPa.

Type testing shall be done according to 5.5.2.

The indicated test pressure shall not be increase by more than 3 kPa.

The pressure strength for negative pressurised systems of rigid metallic pipe is demonstrated by calculation according to EN 13480-3 or EN 13480-8.

Alternatively, other suitable test methods according to EN 1779 or EN 13185 may be used to prove the characteristics for negative pressurised systems.

4.6 External pressure strength¹

Components intended for flood loadings shall be designed to withstand an external pressure of at least 100 kPa. There shall be no leakage of liquid fuel from the component once it is installed in the supply system.

Type testing shall be done according to 5.6.

No test medium shall occur in the liquid fuel carrying parts of the component after the test.

4.7 Longitudinal bending strength

The maximum distance between pipe supports shall be declared according to the installation conditions.

Calculations for the distances between pipe supports are given in EN 806-4:2010 or EN 16125:2018

4.8 Maximum load for admissible deformation

The minimum bending radius for pipes shall be declared according to the installation conditions.

The minimum bending radius for pipes shall be declared according to the installation conditions, e.g. according to EN 806-4:2010.

¹ External pressure strength is concerning the flood resistance of components.

4.9 Dimensional Tolerance

The dimensional tolerances of

- Pipes are defined by outside diameter, wall thickness and length.
 - The values of outside diameter and wall thickness for metallic pipes shall conform to the characteristics according to 4.17.1.2.2.
 - The lengths shall be equal to or greater than those ordered.
- Threads shall conform to the requirements given in the specified standards.
- Pipeline connections shall conform to the requirements according to 8.2.20.

4.10 Impact resistance

In case the installation in traffic areas is required, the instructions for installation, operation and maintenance shall include information for safe installation.

4.11 Electrostatic behaviour

For liquid fuels with a flash point $> 55\text{ °C}$ no essential characteristics for electrostatic behaviour have to be considered.

For flammable liquid fuels with a flash point $\leq 55\text{ °C}$ EN 1127-1:2011 shall be met.

Regarding the essential characteristics for electrostatic phenomena, see EN 809:2011, clause 5.2.2.2

4.12 Tightness

4.12.1 External tightness

4.12.1.1 General

Components shall be externally tight.

The external tightness shall be verified for the pipeline connection.

The external tightness for pipes is defined by the standards for pipes (see Annex I for rigid metallic pipes).

The external tightness test shall be performed according to 5.12.2:

- with test medium liquid fuel or water: no visually inspected leakage shall occur

Or

- with test medium gas, one of the following essential characteristics shall be fulfilled:
no bubbles shall occur on the water surface when the component is immersed in water

or

- there shall be no continuous generation of bubbles when the component is covered with the foam producing solution.

Alternatively, other suitable test methods according to EN 1779 or EN 13185 may be used to prove the external tightness.

4.12.1.2 Type testing

The testing of external tightness shall be carried out after the fitness-for-use test according to 5.17.5.2. If a fitness-for-use test is not required, the testing of external tightness shall be performed.

Type testing shall be done according to 5.12.2.1.

Type testing of service tank shall be done according to 5.12.2.3.1.

Type testing of withdrawal device shall be done according to 5.12.2.4.

There shall be no leakage.

4.12.1.3 Factory production control

Factory production control according to 5.12.2.2.

If the external tightness test is performed with test medium gas, the following essential characteristic shall be fulfilled additionally: A component is tight when the measured leakage rate does not exceed leakage rate B according to EN 12266-1:2012 as seat tightness test P12. It includes the equipment accuracy, measurement errors and apparent leakages mainly due to temperature variations.

Alternative testing according to 5.12.2.2.5.

There shall be no leakage.

Service tanks have to be tested according to 5.12.2.3.2. There shall be no visible signs of damage.

For pipeline connections which are not functional until installed, the external tightness test may be carried out at random during type testing only.

4.12.2 Internal tightness

Check valves, components with shut-off function, anti-siphon safety device, pressure reducer and remote acting fire safety valves shall be internally leak-tight.

Type testing and factory production control according to 5.12.3.

For check valves and anti-siphon safety devices, the leakage rate shall not exceed leakage rate B of EN 12266-2:2012.

For other components with shut-off function, the leakage rate in the closed position shall not exceed leakage rate B of EN 12266-1:2012.

For pressure reducer the test of the internal tightness serves as a demonstration of the tightness of the closure member. The leakage rate of the pressure reducer with the closure member in the closed position shall not exceed leakage rate B according to EN 12266-1:2012.

For remote acting fire safety valves the leakage rate of the safety shut-off device shall be in accordance with EN ISO 23553-1:2014, clause 7.2.

4.13 Permeability

The characteristic concerning the permeability are only valid for non-metallic pipes according to Table 5 and hoses.

Type testing according to 5.13.

The rate of permeation shall be declared.

4.14 Effectiveness of safety devices

4.14.1 Control and safety devices for feed pumps

4.14.1.1 General

Feed pumps shall at least be equipped with control and safety devices according to the following Table 2 as well as indication devices.

Table 2 — Minimum equipment of feed pumps with control, safety, and indication devices

Type of feed pump	Control device	Safety device		Indication device ^e
		High limit controller	Low limit controller	
Intermittent, pressure controlled operation	X	X ^g	X ^a	—
Intermittent, external electrically controlled operation ^b	—	X	—	—
Feed pumps limited to a design outlet pressure of $\leq 0,4$ MPa ^d	—	—	—	—
Feed pumps with a design outlet pressure greater than 0,4 MPa	—	X	X ^a	X
Level controlled	X	—	X ^c	—
All other types	—	X	X ^f	—
a The low limit controller shall respond at the minimum value of $p_{0,r,a}$ b External consuming units with flame supervision device. c The low limit controller shall respond at the minimum value of h_1 or the value h_2. d Feed pumps with intermittent, pressure controlled or external electrically controlled operation, e.g. oscillating piston pumps. e e.g. pressure gauges. f The low limit controller shall respond at the minimum value ($p_{0,r,a}$ or h_1, respectively). g The high limit controller shall respond at the value $p_{0,r,b}$.				

4.14.1.2 Control device

Upon reaching the lower limit of the operating range (pressure $p_{0,1}$, level h_1), the device shall automatically switch on the feed pump, and automatically switch off the pump upon reaching the upper limit of the operating range (pressure $p_{0,2}$, level h_2) (see Figure 7 and Figure 8).

Type testing according to 5.14.1.2.

4.14.1.3 Safety device

4.14.1.3.1 High limit controller

The high limit controller shall prevent the pressure from exceeding the maximum allowable pressure p_s or the maximum filling height $h_{\max}$ each reduced by at least 10 % (see Formula 1 and Formula 2).

$$p_{o,r,b} \leq 0,9 \times p \quad (1)$$

$$h_2 \leq 0,9 \times h_{\max} \quad (2)$$

NOTE In the case of oscillating piston pumps, the response pressure of the high limit controller is realized by design with a spring.

Type testing according to 5.14.1.3.1.1.

The feed pump shall re-start when the operating pressure $p_{o,1}$ is reached. The feed pump shall stop the liquid fuel supply again when the operating pressure $p_{o,r,b}$ is reached.

Factory production control according to 5.14.1.3.1.2.

4.14.1.3.2 Low limit controller

The low limit controller shall prevent the pressure from exceeding the maximum allowable pressure, p_s , or the maximum filling height, $h_{\max}$, each reduced by at least 10 % or prevent a falling below the defined lowest switch point for liquid fuel supply (see Figure 1 and Figure 2).

If the controller is adjustable, adjustment shall only be possible by means of tools and any unauthorized adjustment shall be visible (e.g. by means of a lacquer layer or a seal). The operation of the controller may be taken over by means of an electronic control unit with corresponding continuous indication.

In the case of level controlled feed pumps, the low limit controller may be replaced by an overflow pipe. The connection of the overflow pipe shall be dimensioned such that 1,5 times the maximum filling volume can drain off.

Type testing according to 5.14.1.3.2.1:

- Testing of the upper switch point: The feed pump shall not re-start when the operating pressure $p_{o,1}$ is reached.
- Testing of the lower switch point: The feed pump shall not re-start when the response pressure $p_{o,r,a}$ is fallen.
- Testing of the low limit controller at failure of power supply: The feed pump shall not re-start automatically.

Factory production control according to 5.14.1.3.2.2.

In the case of feed pumps of other types according to Table 2, which are equipped with a low limit controller, which in the event of a failure of the power supply within a defined time responds, the feed pump shall not re-start automatically.

4.14.2 Pressure compensating device

A pressure compensating device shall, by providing additional volume, limit the pressure build-up in defined closed pipeline sections due to temperature related volume changes of the liquid fuel, without a draining-off of liquid fuel from the closed pipelines.

NOTE Reference to a method for the calculation of the pressure build-up in defined closed pipe sections can be found in the bibliography.

The manufacturer of the pressure compensating device shall give the following information:

- minimum operating pressure $p_{0,\min}$ at which the pressure compensating device responds;
- maximum operating pressure $p_{0,\max}$ ($\leq p_s$);
- volume $V_{p,0}$ which is compensated between the minimum operating pressure $p_{0,\min}$ and the maximum operating pressure $p_{0,\max}$.

A pressure compensating device shall be able to indicate the complete range of the operating conditions.

Type testing according to 5.14.2.1.

The calculated volume based on the average value of the measured swing of the marked indicated positions at minimum and maximum operating pressure shall be equal to or greater than the volume, $V_{p,0}$.

Factory production control according to 5.14.2.2.

4.14.3 Anti-siphon safety device

4.14.3.1 General

Anti-siphon safety devices shall prevent a leak out of liquid fuel below the declared or adjusted safety height h_A .

The safety height h_A can be distinguished by 2 functional characteristics:

- the geodetic height difference between the centre of the anti-siphon safety device and the lowest point of the suction pipeline for mechanical diaphragm operated anti siphon safety devices

or

- the geodetic height difference between the maximum filling height of the tank and the lowest point of the suction pipeline for electro-mechanical and mechanical piston operated anti siphon safety devices.

Anti-siphon safety devices can be distinguished by 2 constructional characteristics:

- mechanical anti-siphon safety devices as a self-acting device without auxiliary energy

or

- electro-mechanical anti-siphon safety devices which operate by shut-down of the auxiliary energy at an automatically closing control member.

In case of an anti-siphon safety device with test connection this connection shall have an isolating valve.

4.14.3.2 Mechanical anti-siphon safety device

4.14.3.2.1 General

Mechanical anti-siphon safety devices are suitable for use in suction pipelines only.

The mechanical anti-siphon safety devices can be distinguished by 2 constructional characteristics:

- pre-set to the safety height h_A ;
- adjustable for the variable regulating safety height h_A .

The effective vacuum of the liquid column of the anti-siphon safety device ($p_{o,g}$) shall be determined using Formula (3).

$$p_{o,g} = \frac{\rho_{\text{fuel}} \times g \times h_g}{1\,000} \times (-1) \text{ in kPa} \quad (3)$$

where

ρ_{fuel} is the maximum density of the liquid fuel, in kg/m³;

g is the acceleration of gravity (9,81 m/s²);

h_g is the geodetic height of the liquid column of the liquid fuel, in m.

Type testing general according to 5.14.3.2.1.1.

In case of an mechanical diaphragm operated anti-siphon safety device the breather hole shall be designed such that a check pin gauge with a diameter of 1,5 mm passed through the orifice cannot damage the diaphragm.

The body and cover of an anti-siphon safety device shall be so assembled as to ensure that they cannot be separated without permanent damage to parts or sealing.

Adjustable anti-siphon safety devices shall be provided with a marking by numbers or a scale, for the setting of the safety height h_A .

Once set, the value of the safety height of adjustable mechanical anti-siphon safety devices shall be protected against alteration after installation.

NOTE A sealing is sufficient for indication.

4.14.3.2.2 Functional essential characteristics

4.14.3.2.2.1 General

The outlet pressure $p_{o,o}$ shall be within the range according to Formula (4).

$$P_{o,o} = (p_{o,g} - 0,5 \text{ kPa}) \text{ to } (p_{o,g} - 10 \text{ kPa}) \quad (4)$$

The outlet pressure $p_{o,o}$ of adjustable anti-siphon safety devices shall be checked for the highest set value for the variable regulating safety height h_A at nominal flow rate.

4.14.3.2.2.2 Type testing

Type testing of functional essential characteristics according to 5.14.3.2.1.2.

Test A: No water shall flow out of the hose end above height, h_{2,H_2O} (in mm), according to Formula (5).

$$h_{2,H_2O} \geq h_{A,H_2O} + 50 \text{ in mm} \quad (5)$$

Test B: No water shall flow out of the hose end above height, h_{A,H_2O} (in mm), according to Formula (7).

Additional type testing at other minimum allowable temperatures according to 5.14.3.2.1.2 d): No liquid fuel according to 4.17.1.1 shall flow out of the hose end above height, h_{2,H_2O} (in mm), according to Formula (5).

4.14.3.2.3 Factory production control

Factory production control according to 5.14.3.2.2:

The lock-up pressure $p_{0,l}$ of the mechanical anti-siphon safety device equals the value determined using Formula (3) from the weight pressure of the column of the liquid fuel ($p_{0,g}$) plus a safety factor of 500 Pa.

The pressure indicated shall be $\geq p_{0,l}$.

4.14.3.2.3 Response pressure

The mechanical anti-siphon safety device shall be equipped with a device which opens in the reverse flow direction or both directions based on an inlet pressure of 0 Pa at a response pressure $p_{0,r}$ within a range between 20 kPa and 500 kPa.

NOTE The opening of anti-siphon safety devices under pressure conditions in the pipeline in the reverse flow direction or both directions is designated as pressure relief.

Type testing of the response pressure according to 5.14.3.2.1.3.

The pressure applied to the outlet shall be within the range of response pressure $p_{0,r}$.

4.14.3.3 Electro-mechanical anti-siphon safety device

4.14.3.3.1 General

An electro-mechanical anti-siphon safety device shall be designed and tested as a safety shut-off device according to EN ISO 23553-1:2014. The following essential characteristics of EN ISO 23553-1:2014 shall be met:

— design “nc”;

If there is no integrated filter element with a maximum mesh size of 0,5 mm according to EN ISO 23553-1:2014, 6.4.8, an upstream filter according to 8.2.11 having the corresponding filtration grade shall be used.

Type testing according to 5.14.3.3.1.

The outlet pressure $p_{0,o}$ shall be within the range according to Formula (4).

4.14.3.3.2 Functional essential characteristics

4.14.3.3.2.1 Type testing

Type testing of functional essential characteristic according to 5.14.3.3.2.1.

No water shall flow out of the hose end above height, h_{2,H_2O} (in mm), according to Formula (5).

Additional type testing at other minimum allowable temperatures according to 5.14.3.3.2.2.

No liquid fuel shall flow out of the hose end above height, h_{2,H_2O} (in mm), according to Formula (5).

4.14.3.3.2 Factory production control

Factory production control according to 5.14.3.3.2.3. The electro-mechanical anti-siphon safety device shall be tested in a closed position.

The electromechanical anti-siphon safety device shall remain closed up to the value determined using Formula (3) from the weight pressure of the column of the liquid fuel ($p_{0,g}$) plus a safety factor of 500 Pa.

The test pressure shall not increase by more than 3 kPa during test duration of 10 s.

4.14.3.3.3 Response pressure

The electro-mechanical anti-siphon safety device shall be equipped with a device which opens in the reverse flow direction based on an inlet pressure of 0 Pa at a response pressure $p_{0,r}$ within a range between 20 kPa and 500 kPa.

Type testing of the response pressure according to 5.14.3.2.1.3.

The pressure applied to the outlet shall be within the range of response pressure $p_{0,r}$.

4.14.4 Remote acting fire safety valve

A remote acting fire safety valve shall cease the flow of liquid fuel to the consuming unit in the event of sensing a higher than expected operating temperature at the consuming unit.

A remote acting fire safety valve shall comprise of a sensor phial and safety shut-off device designed to be positioned remote from each other and communicate via pneumatic or hydraulic means.

Type testing of temperature sensing according to 5.14.4.2.

The declared minimum and maximum operating temperature shall not exceed a range of 16 K.

Type testing of safety shut-off device closing time test according to 5.14.4.3.

Criterion is that the flow of the liquid fuel shall cease within two minutes.

Type testing of fail safe test according to 5.14.4.4.

Criterion is that the flow of the liquid fuel shall cease within 10 seconds.

4.14.5 Safety shut-off device

Device shall be designed and tested according to EN ISO 23553-1:2014.

4.15 Release of dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets. In the absence of European harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

See also 8.1.4.

4.16 Noise level

The characteristic noise level is only relevant for piping kits containing a supply system including a feed pump as component.

For feed pumps that are intended for use in living areas, the A-weighted emission sound pressure level should be ≤ 50 dB(A).

For feed pumps that are intended for use in other areas, the A-weighted emission sound pressure level should be ≤ 70 dB(A).

Type testing according to 5.16.

The A-weighted emission sound pressure level and relevant uncertainty shall be provided by the manufacturer.

4.17 Durability²⁾

4.17.1 Durability against chemical attack

4.17.1.1 Resistance to liquid fuels

All parts of components in contact with liquid fuels have to be resistant to those liquid fuels they are in use with. This is being ensured by the material resistance.

Three categories are specified for liquid fuels:

Category A Liquid fuels derived from petroleum refining processes with a maximum viscosity of $10 \text{ mm}^2/\text{s}$ at 20°C .

NOTE 1 Liquid fuels derived from petroleum refining processes are listed in CEN/TR 15738.

NOTE 2 Fuels class are classified ISO-F-D in ISO 8216-99.

Category B Liquid fuels from renewable resources, e.g. FAME according to EN 14214:2012+A2:2019, paraffinic diesel fuel from synthesis or hydrotreatment according to EN 15940 2016+A1:2018+AC:2019.

Category C Mixtures of category A and B.

For the testing's according to this standard a test liquid of each relevant group according to Annex C of EN 14879-4:2007 may be used.

The marking of the component according to 7.2 shall indicate the category of liquid fuel.

NOTE 3 For national technical documents for liquid fuels, see Annex A.

4.17.1.2 Material

4.17.1.2.1 General essential characteristics on materials

The components shall be operational for maximum/minimum allowable temperature according to 8.1.2 during the nominal design lifetime.

Third party test results, data sheet of suppliers, as well as empirical values for materials shall be accepted.

The material resistance including the resistance against liquid fuels by maximum/minimum allowable temperature according to 8.1.2 may be demonstrated as follows:

- based on existing supply systems or components which can be inspected or submitted to periodic inspection carried out by the test authority or qualified persons; or
- based on laboratory test records, where the same results are obtained during re-inspections; or

2) The durability affects the following essential characteristics: Tightness in case of fire, internal pressure strength, external pressure strength, tightness, permeability, effectiveness of safety devices.

- based on documents on the resistance of material where the limiting conditions are known and can be verified by laboratory tests.

The resistance to liquid fuels can be verified with the complete component or its single parts.

The resistance to liquid fuels of the component can be also verified by type testing according to 5.17.1.2.1, if above mentioned verifications are not available.

The essential characteristics of external tightness and the internal tightness according to 4.12, effectiveness of safety devices according to 4.14, additional requirements according to 8.1 and/or specific functional requirements according to 8.2 shall be fulfilled.

4.17.1.2.2 Metallic materials

For metallic materials, the essential characteristics of EN 16668:2016+A1:2018 or Annex B shall be applied. The essential characteristics of Annex B shall be applied if they exceed the essential characteristics of EN 16668:2016+A1:2018.

Technical Report CEN/TR 17144:2017 describes the resistance of metallic materials to liquid fuels.

Rigid metallic pipes also according to Annex I.

Durability against internal corrosion of rigid metallic pipes is given by the calculation according to EN 13480-3:2017.

Testing: grade verification at least test report type 2.2 according to EN 10204:2004.

For rigid metallic pipes with a diameter $\leq$ DN 100, a reference in the documentation or a stamping stating the material grade and the manufacturer's trade mark, are sufficient for grade verifications.

NOTE In two-pipe systems copper, brass and zinc high-pressure die castings may have a negative influence on the storage stability of liquid fuels of category B and C.

4.17.1.2.3 Elastomeric materials

Parts manufactured from elastomeric material which are integral elements of components and which can come into contact with the liquid fuel shall be resistant for the maximum/minimum allowable temperature according to 8.1.2.

Parts manufactured from elastomeric material and in contact with liquid fuels (e.g. valve pad, o-ring, diaphragm and seal) shall be homogeneous, free from porosity, inclusions, grit, blisters and other surface imperfections visible with the naked eye.

Seals manufactured from elastomeric material should be of type GB or H according to EN 682:2002 + A1:2005.

Hoses and hose assemblies manufactured from elastomeric material shall meet the essential characteristics for type 1 of EN ISO 6806:2017.

NOTE 1 For the selection of elastomeric materials, ISO 3601-5:2015, EN ISO 23936-2:2011, ISO 16010:2019 or ISO/TR 7620:2005 can be referred to.

NOTE 2 For the selection of elastomeric materials especially diaphragms, EN 549:2019 can be referred to.

Type testing of the resistance to liquid fuels according to 5.17.1.2.3.

The criterion is given in ISO/TR 7620:2005, Table 1 with classification up to group 3.

For parts manufactured from elastomeric material, a supplier's declaration is acceptable, provided that the supplier implements an appropriate FPC system in order to ensure the suitability, consistency and accuracy of the part and characteristics of the elastomeric material.

4.17.1.2.4 Plastic materials

4.17.1.2.4.1 Parts manufactured from plastic material

Parts manufactured from plastic material which are integral elements of components and which can come into contact with the liquid fuel shall be resistant for the maximum/minimum allowable temperature according to 8.1.2.

NOTE For the selection of plastics EN ISO 13274 and EN ISO 23936-1 can be used.

The criterion is the qualitatively estimated changes according to Table 1 of EN ISO 175:2010: None or barely perceptible.

For parts manufactured from plastic material, a supplier's declaration is acceptable, provided that the supplier implements an appropriate FPC system in order to ensure the suitability, consistency and accuracy of the part and characteristics of the plastic material.

4.17.1.2.4.2 Non-metallic pipe

The resistance of non-metallic pipe materials against liquid fuel shall be tested by following test methods 1) to 3). For the results the extrapolation method based on EN ISO 9080:2012 can be used.

Type testings according to 5.17.1.2.4.2:

- Test method 1): OIT shall be ≥ 20 min after 2 000 h of storage.
- Test method 2) Test A: The change in mass Δm shall be between +10 % and -5 %.
- Test method 2) Test B: The change in mass Δm shall be between +5 % and -8 %.
- Test method 3): The values calculated for yield stress, tensile strength, and elongation at break at maximum allowable temperature $t_{s,max}$ shall exceed the minimum values at 23 °C.

4.17.2 Durability against external corrosion³⁾

Components intended for use outside buildings shall be resistant to or protected against corrosion.

Type testing according to 5.17.2.

Alternative type testing is given by accelerated corrosion test according to EN ISO 16701:2015.

After this test the components shall show no visible signs of undue corrosion to the naked eye; salt residues due to the test shall be neglected. The component related functions shall be verified.

4.17.3 Durability in case of extended temperatures

Components with an intended use at a temperature range different from 8.1.2.1 shall be designed for the designated minimum allowable temperature $t_{s,min}$ and/or maximum allowable temperature $t_{s,max}$.

Type testing according to 5.17.3.

For component related numbers of cycles refer to 4.17.5.2.

3) The durability against external corrosion affects the following essential characteristics: Tightness in case of fire, internal pressure strength, external pressure strength, tightness, permeability, effectiveness of safety devices.

The essential characteristics of external tightness and the internal tightness according to 4.12, effectiveness of safety devices according to 4.14, additional requirements according to 8.1 and/or functional requirements according to 8.2 shall be fulfilled.

4.17.4 Durability against ultraviolet light

Hoses and non-metallic pipes exposed to ultra violet light (e. g. for above ground outside installation) shall be resistant against.

Type testing according to 5.17.4.

A criterion for components of polyamide 6 or polyethylene is the essential characteristic of resistance to weathering according to EN 13341:2018.

A criterion for alternative type testing of non-metallic materials: no flaking or cracking on the cover with 2 times magnification and no loss of marking.

NOTE Reference to terms in ISO 4665, EN ISO 4892-1 and EN ISO 8330.

4.17.5 Durability against nominal lifetime operation

4.17.5.1 General

Components shall be designed for a nominal lifetime of at least 10 years.

All the declared number of cycles are provided for a nominal lifetime of 10 years.

Components directly subjected to the operating cycles of the consuming unit shall be designed for a number of 250 000 cycles with the exception of safety shut-off devices. They shall be designed for a number of cycles according to EN ISO 23553-1:2014, Annex E.

NOTE The indicated number of 250 000 cycles has been derived from EN 298.

Rigid metallic pipes and pipeline connections shall be designed for a nominal lifetime of at least 30 years, which is equivalent to 750 000 cycles.

Non-metallic pipes shall be designed for a number of 250 000 cycles.

Remote acting fire safety valves shall be designed for nominal lifetime of at least 20 years.

The durability of both tightness and effectiveness shall be verified according to the fitness-for-use test.

4.17.5.2 Fitness-for-use test

4.17.5.2.1 General

The fitness-for-use test shall be conducted during type testing.

For the component related number of cycles, refer to 4.17.5.2.2 to 4.17.5.2.27.

The fitness-for-use test shall be carried out at test temperature $t_t = t_a$.

After the fitness-for-use test the following tests shall be performed:

- external tightness test according to 4.12.1;
- internal tightness test according to 4.12.2 if applicable;
- effectiveness of safety devices according to 4.14 if applicable;
- specific functional requirements according to 8.2.

General essential characteristics to the fitness-for-use-test: medium is liquid fuel according to 4.17.1.1 or air according to 5.17.5.2.1.

At least the related number of cycles for the component shall be achieved.

4.17.5.2.2 Feed pump

The fitness-for-use test shall be carried out on the complete feed pump with all components and devices. Test medium is liquid fuels according to 4.17.1.1.

The fitness-for-use test shall be carried out according to 5.17.5.2.2 with the number of cycles listed in Table 3.

Table 3 — Number of cycles for the fitness-for-use test for feed pumps

Type of feed pump	Number of cycles minimal
Intermittent, pressure controlled operation	25 000
Intermittent, external electrically controlled operation	250 000
Feed pumps designed with an outlet pressure of $\leq 0,4$ MPa	50 000
Feed pumps designed with an outlet pressure greater than 0,4 MPa	50 000
Level controlled	25 000
All other types	250 000
NOTE In order to reach the nominal lifetime according to 4.17.5.1 the manufacturer should declare the required number of cycles.	

The number of cycles shall be recorded.

4.17.5.2.3 Control and safety device for feed pumps

The fitness-for-use test of safety and control devices according to 4.17.5.2.2.

4.17.5.2.4 Service tank

The fitness-for-use test of service tank according to 4.17.5.2.2.

4.17.5.2.5 Service vessel

The fitness-for-use test of service vessel according to 4.17.5.2.2.

4.17.5.2.6 Isolating valve

An isolating valve directly exposed to the operating cycles of the consuming unit shall withstand 250 000 cycles.

A manually operated isolating valve shall withstand 1 000 cycles.

Type testing according to 5.17.5.2.6.

4.17.5.2.7 Quick-acting valve

A quick-acting valve directly exposed to the operating cycles of the consuming unit shall withstand 250 000 cycles.

A manually operated quick-acting valve shall withstand 1 000 cycles.

Type testing according to 5.17.5.2.7.

4.17.5.2.8 Switch-over valve

A manually operated switch-over valve shall withstand 1 000 cycles.

Type testing according to 5.16.5.2.8.

4.17.5.2.9 Forced switch-over valve

A manually operated forced switch-over valve shall withstand 1 000 cycles.

Type testing according to 5.17.5.2.9.

4.17.5.2.10 Check valve

The check valve shall withstand 250 000 cycles.

Type testing according to 5.17.5.2.10.

4.17.5.2.11 Pressure compensating device

A pressure compensating device shall withstand 1 000 cycles between completely filling and venting.

Type testing according to 5.17.5.2.11.

4.17.5.2.12 Discharge valve

An discharge valve shall withstand 250 000 cycles between the pressure $p_{0,max}$ and the pressure $p_{0,l}$.

Type testing according to 5.17.5.2.12.

4.17.5.2.13 Pressure reducer

A pressure reducer shall withstand 250 000 cycles between opening and complete closing of the closure member.

Type testing according to 5.17.5.2.13.

After the type testing according to 5.17.5.2.13 type testing according to 5.19.10.2.2 shall be repeated.

4.17.5.2.14 Filter

No more testing is required.

4.17.5.2.15 Meter

No more testing is required.

4.17.5.2.16 De-aerator

A de-aerator shall withstand 250 000 cycles.

Type testing according to 5.16.5.2.16.

4.17.5.2.17 Anti-siphon safety device

A mechanical anti-siphon safety device shall withstand 250 000 cycles.

Type testing of a mechanical anti-siphon safety device according to 5.17.5.2.17.1.