BS EN 764-1:2015

BSI Standards Publication

# Pressure equipment

## Part 1: Vocabulary

bsi.

...making excellence a habit.™

**National foreword**

This British Standard is the UK implementation of EN 764-1:2015. It supersedes BS EN 764-1:2004 and BS EN 764-3:2002 which are withdrawn

The UK participation in its preparation was entrusted to Technical Committee PVE/1, Pressure Vessels.

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

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



ISBN 978 0 580 81184 5

ICS 01.040.23; 23.020.30

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2015.

**Amendments issued since publication**

| Date | Text affected |
|---|---|

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 764-1

April 2015

ICS 01.040.23; 23.020.30

Supersedes EN 764-1:2004, EN 764-3:2002

English Version

# Pressure equipment - Part 1: Vocabulary

Equipement sous pression - Partie 1: Vocabulaire

Druckgeräte - Teil 1: Vokabular

This European Standard was approved by CEN on 14 February 2015.

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.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**



Ref. No. EN 764-1:2015 E

# Contents

Page

# Foreword

This document (EN 764-1:2015) has been prepared by Technical Committee CEN/TC 54 “Unfired pressure vessels”, the secretariat of which is held by BSI.

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 October 2015, and conflicting national standards shall be withdrawn at the latest by October 2015.

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

This document supersedes EN 764-1:2004 and EN 764-3:2002.

The 2015 edition of EN 764-1 supersedes both the 2004 edition and EN 764-3:2002. It constitutes a major expansion of the standard, which now comprises definitions for 223 terms as compared to only 18 + 14 in the two superseded standards.

An informative annex on notions of allowable pressures and temperatures has been added.

An annex containing translations of terms to several other languages is in the course of preparation.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

EN 764, *Pressure equipment* comprises the following parts:

— *Part 1: Vocabulary;*

— *Part 2: Quantities, symbols and units;*

— *Part 3: Definition of parties involved;*

— *Part 4: Establishment of technical delivery conditions for metallic materials;*

— *Part 5: Inspection documentation of metallic materials and compliance with the material specification;*

— *Part 6: Structure and content of operating instructions;*

— *Part 7: Safety systems for unfired pressure equipment.*

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

# 1 Scope

This European Standard specifies terms and definitions to be used for pressure equipment and assemblies within the scope of European Directives on pressure equipment.

NOTE It can be applied to other pressure equipment.

# 2 Normative references

Not applicable.

# 3 Terms and definitions

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

If a term or definition only applies to a special area or is different in different areas, the relevant area is shown within brackets <….>.

## 3.1 General terms

**3.1.1**
**ambient temperature**
temperature of the surrounding atmosphere in the immediate vicinity of the pressure component

**3.1.2**
**assembly**
several pieces of pressure equipment assembled by a manufacturer to constitute an integrated and functional whole

**3.1.3**
**cryogenic applications**
applications at low temperature

Note 1 to entry: Normally involving liquefied gases.

**3.1.4**
**design validation**
examination of the design documents to verify that the design conforms to the relevant product standard

**3.1.5**
**fluid**
gas, liquid and vapour in its pure phase as well as mixtures thereof

**3.1.6**
**hazard category**
category of the pressure equipment taking into account the potential hazards

**3.1.7**
**joint coefficient**
reduction coefficient (e.g. for a welded joint) related to the testing group and which is applied to the nominal design stress

**3.1.8**
**main pressure bearing parts**
parts which constitute the envelope under pressure, essential for the integrity of the equipment

**3.1.9**
**maximum allowable temperature**
$TS_{max}$
maximum temperature for which the pressure equipment is designed as specified by the manufacturer

**3.1.10**
**minimum allowable temperature**
$TS_{min}$
minimum temperature for which the pressure equipment is designed as specified by the manufacturer

**3.1.11**
**pipelines**
piping or piping system designed for the conveyance of any fluid or substance to or from an installation (onshore or offshore) starting from and including the first isolation device located within the installation and including all the annexed equipment designed specifically for pipelines

**3.1.12**
**piping**
tubing, fittings, expansion joints, hoses or other pressure-bearing components, intended for the transport of fluid, connected together and integrated into a pressure system

**3.1.13**
**piping class**
category in which piping is classified in accordance with the Pressure Equipment Directive 97/23/EC

**3.1.14**
**piping system**
pipe or system of pipes for the conveyance of fluids within an industrial site

Note 1 to entry: A piping system can be regarded as one single system, provided it conveys substances having the same properties and it is a whole designed for the same allowable pressure.

Note 2 to entry: Interruption by different components such as pumps, machines, vessels, etc. does not preclude the integration to one single piping.

**3.1.15**
**pressure vessel**
housing and its direct attachments up to the coupling point connecting it to other equipment, designed and built to contain fluids under pressure

**3.1.16**
**repair**
process of rectifying a defect in either base material or weld

## 3.2 Terms related to design

**3.2.1**
**action**
imposed mechanical, thermal or thermo-mechanical influence which causes stress and/or strain in a structure, e.g. an imposed pressure, force, displacement or temperature

**3.2.2**
**action type**
classification of action based on statistical properties and duration

**3.2.3**
**analysis thickness**
$e_a$
effective thickness available to resist the loading depending on the load case

**3.2.4**
**anchor**
rigid device, which may itself be subject to imposed displacement, used to prevent all relative pipe rotation and displacement at the point of application, under the design conditions of temperature and loading

**3.2.5**
**annular plate**
flat end of annular form, connected to one cylindrical shell at its outside diameter and another at its inside diameter, and subject predominantly to bending and not shear

**3.2.6**
**application rule**
generally recognized rule that follows the principles of the relevant product standard and satisfies their requirements

**3.2.7**
**assembly condition**
condition applying when the gasket or joint contact surface is seated during assembly of the joint at ambient temperature and the only loading comes from the bolts

**3.2.8**
**assumed thickness**
thickness assumed by the designer between the minimum required shell thickness and the shell analysis thickness

**3.2.9**
**bending stress**
equivalent linear distributed stress through the wall of the pressure part, proportional to the distance from the neutral axis

**3.2.10**
**blind flange**
blank flange
flat closure connected by bolts

**3.2.11**
**bolted domed end**
cover or blind flange consisting of a flange and a dome of constant radius of curvature

**3.2.12**
**calculation pressure**
differential pressure used for the purpose of the design calculations for a component

**3.2.13**
**calculation temperature**
temperature used for the purpose of the design calculations for a component

**3.2.14**
**chamber**
fluid space within a unit of pressure equipment

**3.2.15**
**chamber volume**
internal volume of a chamber, including the volume of nozzles to the first connection (flange, coupling, weld) and excluding the volume of internal permanent parts (e.g. baffles, agitators)

**3.2.16**
**characteristic function**
characteristic function of an action is a representative function (of time) for the action

Note 1 to entry: Required for actions for which, in specific design checks, the time-dependence is of importance, e.g. temperature/pressure transients during start-up or shut-down.

**3.2.17**
**characteristic value**
characteristic value of an action is a representative value which takes account of the variation of an action

**3.2.18**
**coefficient of variation**
measure of statistical dispersion (standard deviation divided by mean value)

**3.2.19**
**collar**
<loose flange> abutment for the flange

<expansion bellows> cylinder attached to the end tangent

**3.2.20**
**combination factor**
factor applied to design values of variable actions with stochastic properties if combined with pressure, or if two or more of these actions are included in one load case

**3.2.21**
**compliance**
inverse of the axial stiffness of the assembly, symbol *Y*, units mm/N

**3.2.22**
**component**
part of pressure equipment which can be considered as an individual item for the calculation

**3.2.23**
**constant hanger**
constant support
pipe support with constant characteristic to carry vertical loads whilst permitting vertical displacements, base mounted or suspended

**3.2.24**
**continuous weld**
weld extending along the entire length of a joint

**3.2.25**
**convolution**
corrugation
flexible unit of an expansion bellows

**3.2.26**
**creep range**
temperature range in which material characteristics used in design are time dependent

**3.2.27**
**critical area**
<fatigue> an area where the total fatigue damage index exceeds a maximum value

**3.2.28**
**critical zone**
<spheroidal graphite cast iron> highly stressed area where a fracture is expected to occur in a burst test or where surface fatigue cracks are expected to be initiated due to fluctuating pressure loads

**3.2.29**
**cut-off limit**
cyclic stress range below which fatigue damage is disregarded

**3.2.30**
**deposited thickness**
weld throat thickness
thickness in the weld metal excluding any reinforcement

Note 1 to entry: The preferred term in ISO/TR 25901 is *penetration depth*.

**3.2.31**
**design check**
investigation of a component's safety under the influence of specified combinations of actions with respect to specified limit states

**3.2.32**
**design model**
structural model used in the determination of effects of actions

**3.2.33**
**design pressure**
pressure chosen for the derivation of the calculation pressure of each component

Note 1 to entry: The design pressure normally refers to the top of the equipment and does not include pressure generated by the weight of its content.

Note 2 to entry: If the equipment consists of several compartments, each compartment may have its own design pressure.

**3.2.34**
**design reference temperature**
$T_R$
temperature used for determining the impact energy requirements

**3.2.35**
**design stress range spectrum**
histogram of the number of occurrences of all stress cycles of various ranges anticipated during the design lifetime

**3.2.36**
**design temperature**
temperature chosen for the derivation of the calculation temperature of each component

**3.2.37**
**differential pressure**
pressure whose algebraic value is equal to the pressure difference on either side of a separation wall

**3.2.38**
**discontinuity**
shape or material change which affects the stress distribution

**3.2.39**
**dished end**
end of pressure vessel formed to have its open end cylindrical

Note 1 to entry: Normally manufactured from plate.

Note 2 to entry: Earlier called "dished head".

**3.2.40**
**effect**
response (e.g. stress, strain, displacement, resultant force or moment, equivalent stress resultant) of a component to a specific action, or combination of actions

**3.2.41**
**effective notch stress**
stress which governs fatigue behaviour at a notch

**3.2.42**
**effective stress concentration factor**
ratio of effective notch stress (total stress), to structural stress at same point

**3.2.43**
**ellipsoidal end**
dished end having a truly ellipsoidal form

**3.2.44**
**end tangents**
straight unconvoluted portions at the ends of an expansion bellows

**3.2.45**
**endurance limit**
<fatigue> cyclic stress range below which, in the absence of any previous loading, no fatigue damage is assumed to occur under constant amplitude loading

**3.2.46**
**equalizing ring**
T-shaped device that is tightly fitted into the root of the convolutions (corrugations) of expansion bellows in order to equalize the movement of the different convolutions

**3.2.47**
**equivalent full pressure cycles**
number of full pressure cycles that cause the same damage as the applied pressure cycles of range $\Delta P$

**3.2.48**
**equivalent stress**
uniaxial stress which produces the same damage as the applied multi-axial stresses

**3.2.49**
**expansion bellows**
flexible element consisting of one or more corrugations and the end tangents

**3.2.50**
**external loads**
forces and/or moments applied to a component due to actions other than internal or external pressure, or static head of contained fluid, e.g. weight, wind loading, earthquake loading or loads from attached piping or equipment

**3.2.51**
**fatigue design curves**
curves showing stress amplitude versus number of cycles

**3.2.52**
**fixed tubesheet heat exchanger**
heat exchanger with two tubesheets, each attached to the shell and channel

**3.2.53**
**flat end**
unstayed flat plate of generally constant thickness, connected to a shell by either welding or bolting, not supported by stays or stay-tubes, not strengthened by beams, and supported only at its periphery so that it is subject predominantly to bending

**3.2.54**
**flexibility modulus**
inverse of the stiffness modulus of a component, excluding the elastic constants of the material; axial: symbol $X$, units 1/mm; rotational: symbol $Z$, units $1/mm^3$

**3.2.55**
**floating tubesheet heat exchanger**
heat exchanger with a stationary tubesheet attached to the shell and channel and a floating tubesheet which can move axially

**3.2.56**
**full face flange**
flange in which the face contact area, either direct or through a gasket or spacer, extends outside the circle enclosing the bolts

**3.2.57**
**full pressure cycles**
pressure cycles of range $\Delta P = P_{max}$

**3.2.58**
**gasketed tubesheet**
tubesheet attached to the shell and/or channel by bolting

**3.2.59**
**global axial force**
force acting along the axis of a shell

**3.2.60**
**global bending moment**
moment acting in a plane containing the axis of a shell

**3.2.61**
**global shear force**
transverse force acting perpendicular to the axis of a shell

**3.2.62**
**governing weld joint**
main full penetration butt joint, the design of which, as a result of membrane stresses, governs the thickness of the component

**3.2.63**
**gross discontinuity**
structural or material discontinuity which affects the stress or strain distribution across the entire wall thickness over a region of significant area

Note 1 to entry: Examples of gross structural discontinuities are end-to-cylindrical shell or conical shell-to-cylindrical shell junction, flange-to-cylindrical shell junction, an opening in a shell, the junction of two cylindrical shells of different diameter, thickness or material, or a stiffener-to-shell junction.

**3.2.64**
**heavy stiffener**
circumferential stiffener for external pressure, designated as 'heavy' by the designer

**3.2.65**
**hub**
cylindrical or conical projection on a flat end or flange provided so that the end or flange may be butt welded to a cylindrical shell

**3.2.66**
**integral flange**
flange either integral with or welded to the shell

**3.2.67**
**integral tubesheet**
tubesheet attached to the shell and/or channel by welding

**3.2.68**
**intermittent weld**
series of weld elements made at intervals along a joint

**3.2.69**
**interstiffener collapse**
collapse of a section of cylinder between two stiffening rings, or between a stiffening ring and a vessel end

**3.2.70**
**Kloepper type end**
torispherical end in which the crown radius is equal to the external diameter and the knuckle radius is 10 % of the external diameter

**3.2.71**
**Korbbogen type end**
torispherical end in which the crown radius is 80 % of the external diameter and the knuckle radius is 15,4 % of the external diameter

**3.2.72**
**lap joint**
<flanges> flange assembly in which the bolt load is transmitted through a loose backing flange onto a stub flange

**3.2.73**
**lifetime monitoring**
requirements for control and examination as stated in the operating instructions with the minimum requirement for continuous recording of pressure and temperature and retention of records

**3.2.74**
**ligament check**
evaluation of the reinforcement between two adjacent openings

**3.2.75**
**light stiffener**
circumferential stiffener for external pressure, designated as ‘light’ by the designer

**3.2.76**
**limit state**
structural condition beyond which the design performance requirements of a component are not satisfied

Note 1 to entry: Limit states are classified into ultimate and serviceability limit states.

**3.2.77**
**line stop**
device to restrain axial displacement of the piping, defined by the restrained direction of motion

**3.2.78**
**load case**
combination of coincident actions

Note 1 to entry: Load cases are classified into normal operating load cases, special load cases and exceptional load cases.

**3.2.79**
**load change**
change of load condition

**3.2.80**
**load condition**
set of applied simultaneous loads; designated by an identifier

**3.2.81**
**load ratio**
calculated load or moment applied to a component divided by the allowable load or moment

**3.2.82**
**local load**
direct force, shear force or bending moment applying at a nozzle or attachment and due to a loading other than the pressure in the vessel

**3.2.83**
**local stress/strain concentration**
stress/strain distribution related to very local geometric or material stress/strain raisers or temperature fields, which affect the stress or strain distribution only through a fraction of the thickness

Note 1 to entry: Local stress/strain distributions are associated solely with localized types of deformation or strain, have no significant non-local effect. Examples are stress concentrations at small fillet radii, small attachments, welds, etc.

**3.2.84**
**local discontinuity**
discontinuity which only very locally affects the stress or strain distribution, across a fraction of the thickness of the wall

Note 1 to entry: Stresses resulting from such a discontinuity can only cause highly localized strains and consequently have no significant influence on the global behaviour of the wall.

Note 2 to entry: Examples of local structural discontinuities are small radius fillets, weld toes, non penetrated zones in partial penetration welds.

**3.2.85**
**loose flange**
separate flange-ring abutting a stub or collar

**3.2.86**
**main joint**
welded joint assembling main pressure bearing parts

**3.2.87**
**maximum allowable pressure**
*PS*
maximum pressure for which the pressure equipment is designed as specified by the manufacturer

**3.2.88**
**maximum permissible pressure**
$P_{max}$
maximum pressure obtained from the design by formulae or relevant procedures for a given component in a given load case, or for the whole pressure equipment the minimum of these maximum permissible pressures of all components

**3.2.89**
**membrane stress**
equivalent average stress through the wall of the pressure equipment

**3.2.90**
**minimum metal temperature**
$T$M
lowest temperature determined for normal operations, start up and shut down procedures, possible process upsets, such as flashings of fluid, which have an atmospheric boiling point below 0 °C, or during pressure or leak testing

**3.2.91**
**minimum possible fabrication thickness**
smallest allowable thickness after fabrication

**3.2.92**
**multiple creep load case**
case where more than one period occurs in the whole lifetime of the vessel

**3.2.93**
**narrow face flange**
flange in which the gasket is entirely inside the circle enclosed by the bolts and there is no contact outside the bolt circle

**3.2.94**
**nominal design stress**
stress value to be used in the formulae for the calculation of pressure components

**3.2.95**
**nominal elastic limit**
elastic limit applied for design of pressure equipment under external pressure

**3.2.96**
**nominal stress**
stress which would exist in the absence of a discontinuity

**3.2.97**
**nominal thickness**
thickness as specified on the drawings

**3.2.98**
**nominal throat thickness**
design value of the height of the largest isosceles triangle that can be inscribed in the section of a fillet weld

**3.2.99**
**notch stress**
total stress located at the root of a notch, including the non-linear part of the stress distribution

**3.2.100**
**obround opening**
opening with a shape given by two semicircles connected by two parallel straight lines

**3.2.101**
**opening**
through penetration of the shell which may or may not be fitted with a reinforcing plate, a reinforcing ring or a nozzle

**3.2.102**
**operating condition**
<flanges> condition when the hydrostatic end force due to the calculation pressure (internal or external) acts on the flange

**3.2.103**
**outer tube limit**
circle which just circumscribes all the tubes

**3.2.104**
**overall check**
evaluation of the reinforcement in the cross-section including the walls on each side of each opening and the reinforcing length of the adjacent shell

**3.2.105**
**overall collapse**
collapse of a section of cylinder which includes a light or heavy stiffener

**3.2.106**
**partial safety factor**
factor which is applied to a characteristic value of an action or a material parameter in order to obtain the corresponding design value

**3.2.107**
**peak stress**
part of stress which is additive to the respective primary and secondary stresses, to form the total stress

Note 1 to entry: Peak stresses do not cause any noticeable distortion and are only important to fatigue and brittle fracture in conjunction with primary and secondary stresses.

**3.2.108**
**period**
duration of a load case with constant loading and constant temperature inside the creep range

**3.2.109**
**pipe guide, piping guide**
device which permits pipe movement in a pre-determined direction whilst preventing movement in one or more other directions

**3.2.110**
**plane of substantial support**
vessel end or a plane dividing a vessel into two parts, each of which is treated separately for external pressure design purposes

**3.2.111**
**primary stress**
stress which satisfies the laws of equilibrium of applied loads (pressure, forces and moments)

Note 1 to entry: General primary membrane stresses are distributed in the structure such that no essential stress redistribution occurs as a result of yielding. As plasticity develops, a stage is reached where the structure fails.

Note 2 to entry: Local primary stresses will be redistributed on yielding and will thus cause no immediate failure, but will cause major (unacceptable) distortion of the structure.

**3.2.112**
**pseudo-elastic stress range**
stress range calculated assuming purely linear elastic material behaviour

**3.2.113**
**reference thickness**
thickness of a component to be used to relate the design reference temperature of the component with its required impact test temperature

**3.2.114**
**reinforced opening**
opening where the reinforcement includes a contribution from the shell, a nozzle, a reinforcing plate or a reinforcing ring

**3.2.115**
**reinforcement**
loaded cross-sectional area of metal considered to provide resistance to the pressure at an opening

**3.2.116**
**reinforcing plate**
<opening> plate which is fillet welded to the shell and contributes to the reinforcement

**3.2.117**
**reinforcing rib**
<flat ends> rectangular plate located along the radius of a circular flat end, located perpendicularly to its plane and welded to it from both sides

**3.2.118**
**reinforcing ring**
<openings> set-in ring which contributes to the reinforcement

<expansion bellows> device that is tightly fitted into the root of the convolutions/corrugations in order to reinforce expansion bellows against internal pressure

**3.2.119**
**relief groove**
peripheral groove in a flat end to be butt welded to a cylindrical shell

**3.2.120**
**required thickness**
thickness excluding corrosion or any other allowances specified in the relevant product standard

Note 1 to entry: The minimum thickness that the component can have in service to fulfil the standard.

**3.2.121**
**reverse flange**
flange attached at its outside diameter to the shell

**3.2.122**
**rigid strut**
device to restrain the piping in a single direction, generally during dynamic loading

**3.2.123**
**rigid support, rigid hanger**
device to carry vertical loads whilst restraining vertical downward movement

**3.2.124**
**roller support**
base support with one or more roles having extremely small axial movement resistance

**3.2.125**
**safety factor**
<external pressure> ratio of the lower bound expected collapse pressure to the calculation pressure

**3.2.126**
**secondary stress**
stress developed by constraints due to geometric discontinuities, by the use of materials of different elastic moduli under external loads, or by constraints due to differential thermal expansions

Note 1 to entry: With respect to the mechanical behaviour of the structure, the basic characteristic of a secondary stress is that it is self-limiting, i.e. local flow deformation leads to a limitation of the stress. Secondary stresses lead to plastic deformation when equalizing different local distortions in the case of excess of the yield strength.

Note 2 to entry: Only stresses that are distributed linearly across the cross-section are considered to be secondary stresses. For non-linearly distributed stresses, the secondary stresses are those of the equivalent linear distribution.

**3.2.127**
**set-in nozzle**
nozzle which at least partly passes through the shell but does not extend beyond the inside surface

**3.2.128**
**set-on nozzle**
nozzle which is welded only to the outside of the shell

**3.2.129**
**set-through nozzle**
nozzle which passes through the shell and projects beyond the inside surface, and which is welded to it on the inside and outside of the shell

**3.2.130**
**shell**
cylinder, sphere, cone or dished end

**3.2.131**
**shell discontinuity**
junction between any two of the following: cylinder, cylinder on a different axis, cone, dished end, spherical end, flange or flat end

**3.2.132**
**shock arrestor, snubber**
device which is self-locking, or self-braking, to limit in one or more directions the rapid displacement of pipework subject to dynamic loadings, whilst permitting slow movements (such as those due to thermal expansion) in these directions

**3.2.133**
**single creep load case**
case where only one period occurs in the whole lifetime of the vessel

**3.2.134**
**sliding support, shoe**
device to carry the vertical load component whilst restraining vertical downward movement but not significantly limiting planar displacements or rotations

**3.2.135**
**small opening**
isolated opening which does not require reinforcement

**3.2.136**
**snubber**
see shock arrestor

**3.2.137**
**spring hanger, spring support**
pipe support with variable characteristic to carry vertical loads whilst permitting vertical displacements, base mounted or suspended

**3.2.138**
**stiffener tripping**
sideways twisting of a stiffener about its point of connection to the shell

**3.2.139**
**stress factor**
factor for determination of the maximum stress that may occur in a vessel detail, due to the geometrical configuration of component(s)

**3.2.140**
**stress on the weld throat**
average stress on the throat thickness in a fillet or partial penetration butt weld

**3.2.141**
**stress range**
value from maximum to minimum in the cycle (twice the stress amplitude)

**3.2.142**
**structural strain**
strain in a stress-concentration-free model of the structure, i.e. the strain determined in an idealized model which takes into account the real geometry of the structure with the exception of the local details which cause only local stress/strain concentrations

Note 1 to entry: Structural strain includes the effects of gross structural details (e.g. branch connections, cone-cylinder intersections, vessel-end junctions, thickness discontinuities, presence of attachments, deviations from design shape with global effect, such as out-of-roundness of cylindrical shells). However it excludes the notch effects of local structural details, such as small fillet radii, weld toe details, weld profile irregularities, small (partial penetration) bores, or of local temperature field details.

Note 2 to entry: Finite element shell or beam elements may give structural strain directly.

**3.2.143**
**structural stress**
linearly distributed stress across the section thickness which arises from applied loads (forces, moments, pressure, etc.) and the corresponding reaction of the particular structural part

Note 1 to entry: Structural stress includes the effects of gross structural discontinuities (e.g. branch connections, cone/cylinder intersections, vessel/end junctions, thickness change, deviations from design shape, presence of an attachment). However, it excludes the notch effects of local structural discontinuities (e.g. weld toe) which give rise to non-linear stress distributions across the section thickness.

**3.2.144**
**structure**
combination of all load carrying parts relevant to the component, e.g. the whole vessel, its load carrying attachments, supports and foundations

**3.2.145**
**(equivalent) stress-concentration-free model**
equivalent idealized model of the structure without local stress/strain raisers

**3.2.146**
**stub**
abutment for a loose flange

Note 1 to entry: See also *collar*.

**3.2.147**
**subsequent condition**
load condition subsequent to the assembly condition, e.g. working condition, test condition, conditions arising during start-up and shut-down, designated by *l* = 1, 2, 3

**3.2.148**
**sway brace**
preloaded device that exerts a restoring force to swaying pipework

**3.2.149**
**temperature adjustment term**
*T*S
temperature relevant to the calculation of the design reference temperature and dependent on the calculated tensile membrane stress at the appropriate minimum metal temperature

**3.2.150**
**temperature factor**
reduction factor applied to the proof strength to take account of temperature influence

**3.2.151**
**test pressure**
pressure to which the equipment is subjected for test purposes

**3.2.152**
**test temperature**
temperature at which the pressure test of the pressure equipment is carried out

**3.2.153**
**theoretical elastic stress concentration factor**
ratio of notch stress, calculated on purely elastic basis, to structural stress at same point

**3.2.154**
**(relevant) thickness**
shortest distance from the critical point, on one surface, to any point on any other surface of the model

**3.2.155**
**throat thickness**
see *nominal throat thickness*

**3.2.156**
**torispherical end**
dished end, made up of a spherical cap, a toroidal knuckle and a cylindrical section, the three components having common tangents where they meet

**3.2.157**
**total fatigue damage index**
value representing the amount of design fatigue damage caused by application of the design stress range spectrum

**3.2.158**
**total stress / strain**
total stress/strain in a design model which includes all stress/strain concentration effects, non-local and local

**3.2.159**
**wall thickness factor**
reduction factor applied to the nominal design stress to take account of reduced mechanical properties

**3.2.160**
**weld creep strength reduction factor**
factor to account for creep strength reduction at the welded joint

**3.2.161**
**weld throat thickness**
see *deposited thickness*

**3.2.162**
**U-tube heat exchanger**
heat exchanger with one tubesheet attached to the shell and channel with tubes formed to a U-shape

## 3.3 Terms related to manufacturing

**3.3.1**
**batch of vessels**
part of a series where the welding of the main joints and branch joints has been essentially continuously produced by the same welding procedures

Note 1 to entry: A stoppage in vessel production greater than three consecutive days requires the designation of a new batch.

**3.3.2**
**cold forming**
forming at temperatures below the temperature at which re-crystallization can take place

Note 1 to entry: Temperature limits for cold forming are given in the relevant product standards.

Note 2 to entry: Cold forming for austenitic materials is forming at temperatures below 300 °C.

**3.3.3**
**continuous fabrication process**
process where the welding of the main joints and branch joints is essentially continuous

**3.3.4**
**field run piping**
piping installed without preplanning by drawings of the piping routing and the support points

**3.3.5**
**hot forming**
forming at temperatures above the temperature at which re-crystallization can take place

Note 1 to entry: Temperature limits for hot forming are given in the relevant product standards.

**3.3.6**
**joint batch**
several joints made by the same welder or welding operator using a single welding procedure specification

Note 1 to entry: The preferred term in ISO/TR 25901 is *weld batch*.

**3.3.7**
**prototype part**
first or representative sample of a series of pressure parts covered by a single model acceptance

**3.3.8**
**prototype vessel**
first or representative sample of a series of pressure vessels covered by a single model acceptance

**3.3.9**
**serial production**
manufacture of identical vessels or parts, which subsequently are joined to form a complete vessel, and which are manufactured to a single model acceptance, using the same manufacturing procedure involving a continuous fabrication process

**3.3.10**
**shift**
period of time per day during which the welders and welding operators remain the same

**3.3.11**
**spool (with or without overlength)**
prefabricated assembly of components which forms part of a piping system

**3.3.12**
**technical specification**
documents stating requirements for a product or procedure

## 3.4 Terms related to testing

**3.4.1**
**burst test**
hydrotest in which the pressure is increased until the pressure equipment bursts

**3.4.2**
**burst test with global deformation control**
hydrotest in which pressure is recorded versus volume variation

**3.4.3**
**defect**
unacceptable imperfection

**3.4.4**
**design approval**
procedure by which a responsible authority ascertains that the design meets the requirements the relevant product standard

**3.4.5**
**design review**
procedure by which a manufacturer ascertains and declares that the design meets the requirements of the relevant product standard

**3.4.6**
**examination**
mechanism that is part of the evaluation, which measures a candidate's competence by one or more means such as written, oral, practical, and observational

**3.4.7**
**fatigue test**
lifetime test with cyclic loads (pressure, movement)

**3.4.8**
**lifetime test with cyclic loads (pressure, movement) impact energy *KV***
energy determined from Charpy-V-notch tests

**3.4.9**
**impact test temperature**
$T_{KV}$
temperature at which the required impact energy has to be achieved

**3.4.10**
**imperfection**
<fusion welding> discontinuity in the weld or a deviation from the intended geometry

**3.4.11**
**inspection**
examination of a product design, product, process or installation and determination of its conformity with specific requirements or, on the basis of professional judgement, with general requirements

Note 1 to entry: Inspection of a process may include inspection of persons, facilities, technology and methodology.

**3.4.12**
**model acceptance**
procedure which ascertains and attests that a representative sample of the production (a prototype vessel/part) meets the requirements of the relevant product standard in respect of design, manufacturing and testing

**3.4.13**
**test**
physical activity (destructive or non-destructive) carried out in accordance with a defined procedure which provides an objective assessment of a characteristic of a component or system

**3.4.14**
**testing**
performance of a test or examination and production of a record of results and evaluation of the results compared to the requirements

**3.4.15**
**testing factor**
<castings>a reduction factor taking into account the amount of NDT testing in castings, applied on the nominal design stress to take account of possible manufacturing deficiencies

**3.4.16**
**testing group**
grouping which determines the appropriate level of non-destructive testing (NDT) on a welded joint

## 3.5 Terms related to interested parties

**3.5.1**
**designer**
individual or organization that performs design of pressure equipment or components complying with the requirements of the relevant product standard

Note 1 to entry: The designer determines the shape, dimensions and thicknesses of the pressure components, selects the materials and details the methods of construction and testing.

**3.5.2**
**fabricator and/or installer**
subcontractor of the manufacturer
individual or organization that respectively performs fabrication, testing, installation where relevant, of pressure equipment under contract to the manufacturer

**3.5.3**
**first party**
individual or organization that designs, manufactures or supplies the pressure equipment or the assembly

**3.5.4**
**inspector**
individual or organization who is independent from production, responsible for carrying out inspections to verify that the requirements of the technical specification(s) are met

**3.5.5**
**manufacturer**
individual or organization responsible for the design, fabrication, testing, installation where relevant, and compliance with the requirements of the relevant product standard, whether executed by him or a subcontractor

Note 1 to entry: The manufacturer can subcontract one or more of the above mentioned tasks under their responsibility.

Note 2 to entry: In EU member states the manufacturer is responsible for compliance with the Pressure Equipment Directive 97/23/EC. For those manufacturers outside of the EU, their authorized representative inside the EU assumes this responsibility.

**3.5.6**
**material manufacturer**
individual or organization that produces material in the basic product form used in the manufacture of pressure components

**3.5.7**
**material supplier**
individual or organization, not being a material manufacturer, that supplies material or prefabricated parts to be used in the construction of pressure components

**3.5.8**
**notified body**
organization according to the Article 12 of the Pressure Equipment Directive 97/23/EC

Note 1 to entry: Names and tasks of the notified bodies are published by the European Commission.

**3.5.9**
**piping fabricator**
individual or organization that carries out the fabrication of industrial piping complying with the requirements of the relevant product standard, under the responsibility of the manufacturer

**3.5.10**
**piping installer**
individual or organization that carries out installation of industrial piping complying with the requirements of the relevant product standard, under the responsibility of the manufacturer

**3.5.11**
**purchaser**
individual or organization that buys pressure equipment, including assemblies or parts, for its own use or on behalf of the user and/or operator

**3.5.12**
**recognized third-party organization**
organization according to the Article 13 of the Pressure Equipment Directive 97/23/EC

Note 1 to entry: Names and tasks of the recognized third-party organizations are published by the European Commission.

**3.5.13**
**responsible authority**
RA
competent organization which is independent of the manufacturer

Note 1 to entry: Responsible authorities may be notified bodies, recognized third-party organizations or user inspectorates.

**3.5.14**
**second party**
individual or organization that uses and/or operates the pressure equipment or the assembly

**3.5.15**
**third party**
individual or organization independent of the first and second party

Note 1 to entry: Inspectors of the suppliers of material, manufacturers, fabricators/installers or their subcontractors are not third party inspectors.

**3.5.16**
**user and/or operator**
individual or organization that uses and/or operates pressure equipment or assemblies

**3.5.17**
**user inspectorate**
organization according to the Article 14 of the Pressure Equipment Directive 97/23/EC

Note 1 to entry: A user inspectorate acts exclusively for the group of which it is part. Names and tasks of user inspectorates are not published by the European Commission. The designation and acceptance of user inspectorates is optional for the Member States.

# Annex A
(informative)

# Additional information on notions of maximum allowable pressure (*PS*) and maximum / minimum allowable temperatures ($TS_{max}$ / $TS_{min}$)

*PS*, $TS_{max}$, and $TS_{min}$ for an item of pressure equipment are specified by the manufacturer who takes into account various considerations such as:

— the mechanical resistance of pressurized components of the equipment;

— other specific factors such as the good behaviour of the leakage preventing systems, the valves' operating capabilities, etc.

$TS_{min}$ aims at preventing brittle fracture of any component of the pressurized components of the equipment.

*PS* and $TS_{max}$ are upper limits of pressures and temperatures liable to occur under normal operating conditions.

*PS* is used to determine:

— test pressure;

— maximum set-pressure of the pressure limiting device if provided.

$TS_{max}$ is used to :

— determine if the equipment has to satisfy the PED essential requirements stated in its Article I (vapour pressure at $TS_{max}$ is greater than 0,5 bar);

— define the category classification according to fluid state and group at $TS_{max}$.

*PS* and $TS_{max}$ do not always constitute a simultaneous combination (i.e. a combination observed under normal operating conditions); therefore, they are not necessarily used for the design of the pressure equipment.

NOTE 1 It is always conservative to use the combination *PS* and $TS_{max}$ for design, otherwise it will be necessary to demonstrate that the condition of *PS* and $TS_{max}$ acting simultaneously could never occur under all reasonably foreseeable circumstances.

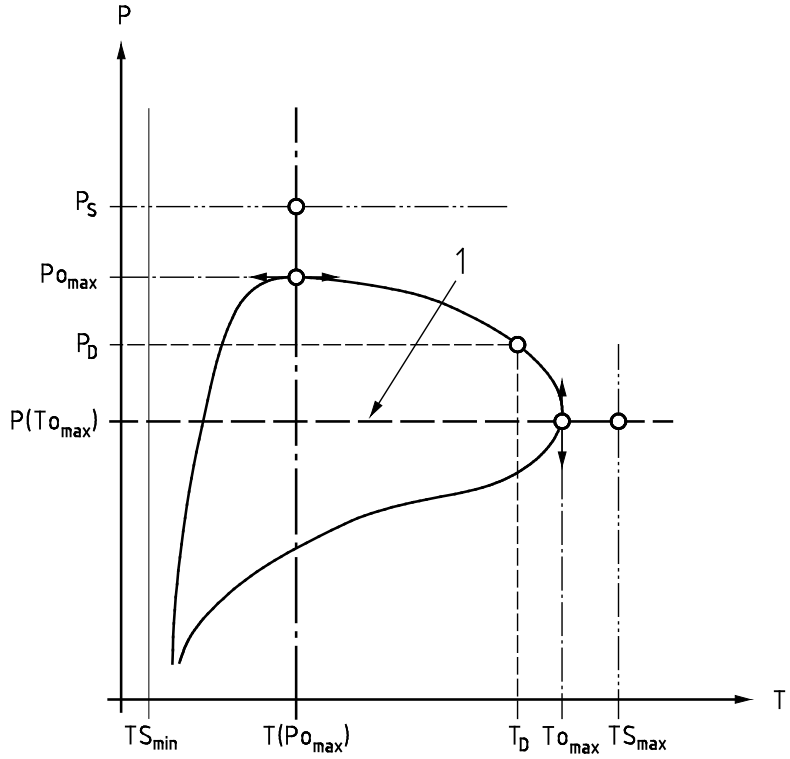
The pressure equipment may be designed with a design pressure/temperature combination ($P_d$, $T_d$) which results in the highest calculated wall thickness or the highest stress, and which is based on the pressure/temperature combination ($P_O$, $T_O$) under normal operating conditions (see Figure A.1). In this case the design pressure $P_d$, associated with the design temperature $T_d$, can be lower than *PS*.

NOTE 2 The most critical combination $P_d$ and $T_d$ may be different in different parts of a component. Each part is then to be designed for the combination that applies to that part.

The design of the pressure equipment should be consistent with *PS* and $TS_{max}$, that is:

— compatible with the combination of *PS* with the temperature $T(Po_{max})$ where $Po_{max}$ is the maximum pressure under normal operating conditions;

— compatible with the combination of $TS_{max}$ at the pressure $P(To_{max})$ where $To_{max}$ is the maximum temperature under normal operating conditions.




**Key**

1 normal operating conditions

**Figure A.1 — Pressure and temperature combinations**

# Bibliography

[1] ISO/TR 25901:2007, *Welding and related processes — Vocabulary*

*This page deliberately left blank*

# British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

## About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

## Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

## Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

## Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

**PLUS** is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

**BSI Group Headquarters**

389 Chiswick High Road London W4 4AL UK

## Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

## Copyright



## Useful Contacts:

**Customer Services**
**Tel:** +44 845 086 9001
**Email (orders):** orders@bsigroup.com
**Email (enquiries):** cservices@bsigroup.com

**Subscriptions**
**Tel:** +44 845 086 9001
**Email:** subscriptions@bsigroup.com

**Knowledge Centre**
**Tel:** +44 20 8996 7004
**Email:** knowledgecentre@bsigroup.com

**Copyright & Licensing**
**Tel:** +44 20 8996 7070
**Email:** copyright@bsigroup.com

bsi.

...making excellence a habit.™