



BSI Standards Publication

Aluminium and aluminium alloys — Wrought products and cast products — Special requirements for products intended for the production of pressure equipment

National foreword

This British Standard is the UK implementation of EN 12392:2025. It supersedes BS EN 12392:2016+A1:2022, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NFE/35, Light metals and their alloys.

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

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© The British Standards Institution 2025
Published by BSI Standards Limited 2025

ISBN 978 0 539 25827 1

ICS 77.120.10; 77.150.10

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2025.

Amendments/corrigenda issued since publication

Date	Text affected

English Version

Aluminium and aluminium alloys - Wrought products and cast products - Special requirements for products intended for the production of pressure equipment

Aluminium et alliages d'aluminium - Produits corroyés et moulés - Exigences particulières pour les produits destinés à la fabrication des équipements sous pression

Aluminium und Aluminium-Legierungen - Knet- und Gusserzeugnisse - Besondere Anforderungen an Erzeugnisse für die Fertigung von Druckgeräten

This European Standard was approved by CEN on 30 June 2025.

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 12392:2025) has been prepared by Technical Committee CEN/TC 132 “Aluminium and aluminium alloys”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by April 2026, and conflicting national standards shall be withdrawn at the latest by April 2026.

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 12392:2016+A1:2022.

Details of significant technical changes between this document and its previous edition are provided at Annex D.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

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1 Scope

This document specifies the material requirements and testing procedures applicable to wrought and cast aluminium and aluminium alloys intended for use in the production of pressure equipment.

This document covers:

- the products forms, grades and tempers of wrought and cast aluminium and aluminium alloys which are used for such applications together with data for wrought and cast alloys over their permissible working temperature ranges;
- the technical conditions for inspection and delivery, mechanical property limits and tolerances on form and dimensions by reference to the appropriate European standards for the relevant wrought and cast aluminium and aluminium alloys;
- additional requirements which are specific to pressure equipment applications.

It applies to hot-rolled plate, cold-rolled sheet/strip/circles, extruded or extruded and cold drawn rod/bar, tube, extruded open/hollow profiles, forgings and castings. Considering this, this document is intended to be used in conjunction with the EN 573 series, EN 485 series, EN 941, EN 754 series, EN 755 series, EN 586 series and EN 1706. The materials and application ranges covered by this document are those given in Annex A, Table A.1 for wrought alloys and Table A.2 for castings.

The objective of this document is to only cover the materials used for components of pressure equipment. Fabrication or fabrication methods for pressure equipment are excluded from this document.

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 485-1:2016, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 1: Technical conditions for inspection and delivery*

EN 485-2:2016+A1:2018, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 2: Mechanical properties*

EN 485-3:2003, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 3: Tolerances on dimensions and form for hot-rolled products*

EN 485-4:1993, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 4: Tolerances on shape and dimensions for cold-rolled products*

EN 573-3:2019+A2:2023, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition and form of products*

EN 586-1:1997, *Aluminium and aluminium alloys — Forgings — Part 1: Technical conditions for inspection and delivery*

EN 586-2:1994, *Aluminium and aluminium alloys — Forgings — Part 2: Mechanical properties and additional property requirements*

EN 586-3:2001, *Aluminium and aluminium alloys — Forgings — Part 3: Tolerances on dimensions and form*

EN 754-1:2016, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 1: Technical conditions for inspection and delivery*

EN 754-2:2024, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 2: Mechanical properties*

EN 754-3:2008, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 3: Round bars, tolerances on dimensions and form*

EN 754-4:2008, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 4: Square bars, tolerances on dimensions and form*

EN 754-5:2008, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 5: Rectangular bars, tolerances on dimensions and form*

EN 754-6:2008, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 6: Hexagonal bars, tolerances on dimensions and form*

EN 754-7:2016, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 7: Seamless tubes, tolerances on dimensions and form*

EN 754-8:2016, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 8: Porthole tubes, tolerances on dimensions and form*

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

EN 755-2:2016, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 2: Mechanical properties*

EN 755-3:2008, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 3: Round bars, tolerances on dimensions and form*

EN 755-4:2008, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 4: Square bars, tolerances on dimensions and form*

EN 755-5:2008, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 5: Rectangular bars, tolerances on dimensions and form*

EN 755-6:2008, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 6: Hexagonal bars, tolerances on dimensions and form*

EN 755-7:2016, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 7: Seamless tubes, tolerances on dimensions and form*

EN 755-8:2016, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 8: Porthole tubes, tolerances on dimensions and form*

EN 755-9:2016, *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles — Part 9: Profiles, tolerances on dimensions and form*

EN 764-5:2014, *Pressure equipment — Part 5: Inspection documentation of metallic materials and compliance with the material specification*

EN 941:2022, *Aluminium and aluminium alloys — Circle and circle stock for the production of general applications — Specifications*

EN 1370:2011, *Founding — Examination of surface condition*

EN 1371-1:2011, *Founding — Liquid penetrant testing — Part 1: Sand, gravity die and low pressure die castings*

EN 1559-1:2011, *Founding — Technical conditions of delivery — Part 1: General*

EN 1559-4:2015, *Founding — Technical conditions of delivery — Part 4: Additional requirements for aluminium alloy castings*

EN 1706:2020+A1:2021, *Aluminium and aluminium alloys — Castings — Chemical composition and mechanical properties*

EN 1779:1999, *Non-destructive testing — Leak testing — Criteria for method and technique selection*

EN 1779:1999/A1:2003, *Non-destructive testing — Leak testing — Criteria for method and technique selection*

EN 2004-1:1993, *Aerospace series — Test methods for aluminium and aluminium alloy products — Part 1: Determination of electrical conductivity of wrought aluminium alloys*

EN 2101:1991, *Aerospace series — Chromic acid anodizing of aluminium and wrought aluminium alloys*

EN 12020-1:2022, *Aluminium and aluminium alloys — Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 — Part 1: Technical conditions for inspection and delivery*

EN 12020-2:2022, *Aluminium and aluminium alloys — Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 — Part 2: Tolerances on dimensions and form*

EN 12258-1:2012, *Aluminium and aluminium alloys — Terms and definitions — Part 1: General terms*

EN 12681-1:2017, *Founding — Radiographic testing — Part 1: Film techniques*

EN 12681-2:2017, *Founding — Radiographic testing — Part 2: Techniques with digital detectors*

EN 13957:2008, *Aluminium and aluminium alloys — Extruded round, coiled tube for general applications — Specification*

EN 13958:2008, *Aluminium and aluminium alloys — Cold drawn, round, coiled tube for general applications — Specification*

EN 14242:2023, *Aluminium and aluminium alloys — Chemical analysis — Inductively coupled plasma optical emission spectrometric analysis*

EN 14361:2025, *Aluminium and aluminium alloys — Chemical analysis — Sampling from metal melts*

EN 14726:2019, *Aluminium and aluminium alloys — Determination of the chemical composition of aluminium and aluminium alloys by spark optical emission spectrometry*

EN ISO 148-1:2016, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2016)*

EN ISO 3452-1:2021, *Non-destructive testing — Penetrant testing — Part 1: General principles (ISO 3452-1:2021)*

EN ISO 6506-1:2014, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2014)*

EN ISO 6892-1:2019, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2019)*

EN ISO 8062-3:2023, *Geometrical product specifications (GPS) — Dimensional and geometrical tolerances for moulded parts — Part 3: General dimensional and geometrical tolerances and machining allowances for castings using $\pm$ tolerances for indicated dimensions (ISO 8062-3:2023)*

EN ISO 8492:2013, *Metallic materials — Tube — Flattening test (ISO 8492:2013)*

EN ISO 8493:2004, *Metallic materials — Tube — Drift-expanding test (ISO 8493:1998)*

EN ISO 8495:2013, *Metallic materials — Tube — Ring-expanding test (ISO 8495:2013)*

EN ISO 8496:2013, *Metallic materials — Tube — Ring tensile test (ISO 8496:2013)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12258-1:2012 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

heat-treatment lot

quantity of products of the same alloy or purity grade of alloy, form, thickness or cross-section and produced in the same way and heat-treated in one furnace load; or such products solution-treated and subsequently precipitation treated in one furnace load

Note 1 to entry: More than one solution-treatment batch can be included in one ageing furnace load.

Note 2 to entry: For heat treatment in a continuous furnace (vertical or horizontal), the products continuously heat-treated during a specified time (e.g. 8 h) can be considered as one heat treatment lot.

Note 3 to entry: For forgings, a heat-treatment lot may consist of a group of forgings of similar size and shape.

[SOURCE: EN 12258-1:2012, 4.1.5, modified – addition of Note 3 to entry]

3.2

inspection lot

consignment, or a part thereof submitted for inspection or sampling and characterised by a set of identical criteria, e.g. grade or alloy, temper, size, shape, thickness or cross-section or fabrication batch

Note 1 to entry: For forgings, an inspection lot may consist of a group of forgings of similar size and shape.

[SOURCE: EN 12258-1:2012, 4.1.2, modified – addition of Note 1 to entry]

3.3**melt**

quantity of molten metal that has simultaneously undergone the same preparatory treatment in the furnace before the casting operation

[SOURCE: EN 12258-1:2012, 4.1.3]

3.4**cast**

quantity of products cast simultaneously from the same melt

[SOURCE: EN 12258-1:2012, 4.1.4]

3.5**casting**

product at or near finished shape, formed by solidification of the metal in a mould or a die

Note 1 to entry: Casting is also the process in which molten metal is poured into a mould and solidified

Note 2 to entry: Pressure die-cast products are excluded from the scope of the present standard.

Note 3 to entry: The mould of concern can be a single use mould (sand) or a permanent mould (e.g. cast iron or steel).

[SOURCE: EN 12258-1:2012, 2.5.1, modified – addition of Notes to entry]

3.6**forging**

wrought product formed by hammering or pressing, typically when hot, such as open die forging, drop or closed die forging or seamless rolled ring forging

[SOURCE: EN 12258-1:2012, 2.10.1]

3.7**tube**

hollow, wrought product with a uniform cross-section, with only one enclosed void and with a uniform wall thickness, supplied in straight lengths or in coiled form

Note 1 to entry: Cross-sections are in a round, oval, square or rectangular shape, or in a shape of an equilateral triangle or a regular polygon, and can have rounded corners, provided the inner and outer cross-sections are concentric and have the same form and orientation.

[SOURCE: EN 12258-1:2012, 2.8.12, modified – text of Note 1 to entry]

3.8**longitudinal extrusion seam**

extrusion seam in a hollow profile or a tube, parallel to the extrusion direction, which has been formed after creating two or more streams of metal and rejoining them around the mandrel of a porthole or bridge die

Note 1 to entry: Extrusion seams are naturally occurring in porthole/bridge dies.

[SOURCE: EN 12258-1:2012, 3.4.13, modified - Note 2 to entry of 3.4.13 is not applicable]

3.9

transverse extrusion seam

extrusion seam which is formed when two successive billets are welded together in the extrusion die

Note 1 to entry: This concept is sometimes termed “Charge Weld”.

[SOURCE: EN 12258-1:2012, 3.4.14, modified – the word “subsequent” replaced by “successive” in the definition and a new Note 1 to entry added from EN 12258-1:2012, 3.4.13, Note 2 to entry]

3.10

vessel

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

Note 1 to entry: A vessel may be composed of more than one chamber.

[SOURCE: European Legislation for Pressure Equipment]

3.11

piping

piping components intended for the transport of fluids, when connected together for integration into a pressure system

Note 1 to entry: Piping includes in particular a pipe or system of pipes, tubing, fittings, expansion joints, hoses, or other pressure-bearing components as appropriate.

Note 2 to entry: Heat exchangers consisting of pipes for the purpose of cooling or heating air shall be considered as piping.

[SOURCE: European Legislation for Pressure Equipment]

3.12

fluids

gases, liquids and vapours in pure phase as well as mixtures thereof; fluids may contain a suspension of solids

[SOURCE: European Legislation for Pressure Equipment]

Note 1 to entry: If the fluid has a vapour pressure at the maximum allowable temperature of the equipment of greater than 0,5 bar above normal atmospheric pressure it is treated as a gas, otherwise as a liquid.

3.13

maximum allowable pressure

PS

maximum pressure for which the equipment is designed, and specified for a specific point on the pressure equipment, being either the connection of protective and/or limiting devices, or the top of equipment or, if not appropriate, any point specified

[SOURCE: European Legislation for Pressure Equipment]

3.14**nominal size****DN**

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

Note 1 to entry: It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions; the nominal size is designated by DN followed by a number.

[SOURCE: European Legislation for Pressure Equipment]

3.15**volume****V**

internal volume of a chamber, including the volume of nozzles to the first connection or weld and excluding the volume of permanent internal parts

[SOURCE: European Legislation for Pressure Equipment]

3.16**operating temperature range**

temperature range at which the material is exposed during its use

3.17**proof strength - yield strength**

stress necessary to produce a defined small plastic deformation in a material under uniaxial tensile or compressive load

Note 1 to entry: If the plastic deformation under tensile load is defined as 0,2 %, then the term “proof strength $R_{p0,2}$ ” or “yield strength 0,2 %” is used.

Note 2 to entry: The term “proof strength” is used in European and ISO standards, whereas the term “yield strength” is used in North American documents.

[SOURCE: EN 12258-1:2012, 4.3.4]

3.18**elongation (to fracture)**

percentage increase in distance between two marks on a test piece, termed “gauge marks”, that results from straining the test piece in tension to fracture between these gauge marks

Note 1 to entry: The elongation depends on the distance between the gauge marks.

Note 2 to entry: The elongation depends on the cross-sectional dimensions of the test piece. For example, the values obtained from sheet specimens will be lower for thin sheet than for thicker sheet. The same is true for extrusions.

Note 3 to entry: Elongation is the simplest and most common representation of the ductility of the material.

[SOURCE: EN 12258-1:2012, 4.3.5]

3.19 elongation

A_{50mm}

percentage elongation after fracture related to an original gauge length of 50 mm and a constant original width of the test piece between the gauge marks

Note 1 to entry: Existing standards specify the original width of the test piece between the gauge marks as 12,5 mm.

Note 2 to entry: In the USA, the gauge length is often 2 inches, i.e. 50,8 mm.

[SOURCE: EN 12258-1:2012, 4.3.7]

3.20 elongation

A

percentage elongation after fracture related to a gauge length of $5,65 \cdot \sqrt{S_0}$, where S_0 is the initial cross-sectional area of the test-piece

Note 1 to entry: The earlier designation A_5 should be avoided.

Note 2 to entry: For round cross-sections the gauge length is calculated as $5 \times d$, where d is the diameter of the test-piece between the gauge marks.

Note 3 to entry: In some USA documents the gauge length is also specified as $4 \times d$.

[SOURCE: EN 12258-1:2012, 4.3.8]

4 Symbols

The symbols used in this document and corresponding designations are given in Table 1.

Table 1 — Symbols and designations

Symbol	Unit	Designation
R_m	MPa	Tensile strength
$R_{p0,2}$	MPa	Proof strength after 0,2 % of permanent elongation
$R_{p1,0}$	MPa	Proof strength after 1,0 % of permanent elongation
A_{50}	%	Percentage elongation after fracture related to an original gauge length of 50 mm
A_5	%	Percentage elongation after fracture related to an original gauge length of $5,65 \cdot \sqrt{S_0}$ 50 mm
A	%	Elongation
H	mm	Distance between platens measured under load
C	mm	Minimum external diameter achieved after flaring test
γ	MS/m	Electrical conductivity
L_0	mm	Initial gauge length of sample at tensile testing
S_0	mm ²	Initial cross-section of sample at tensile testing
t	mm	Nominal thickness of the product (specific definition applies to each product form)
DN	-	Numerical designation for size (piping systems)
PS	bar	Maximum pressure
V	litres	Internal volume of a chamber
OD	mm	Outside diameter
ID	mm	Inside diameter
R_{km10^4}	MPa	Creep rupture strength after 10 000 h of exposition at indicated temperature
R_{km10^5}	MPa	Creep rupture strength after 100 000 h of exposition at indicated temperature

5 Materials

5.1 General

The materials covered by this document are intended to be used in a wide range of pressure equipment operating over diverse range of both pressure and temperature. The range of applications extends from relatively low-pressure automotive equipment such as heat exchangers to heavy duty applications including unfired pressure vessels and piping used in pressure equipment.

Materials (alloys and tempers), which can be used in compliance with the present standard are listed in Table 2, Table 3, Table A.1 and Table A.2, together with their welding characteristics, main field of application and operating temperature ranges.

If the pressure equipment is operating above room temperature for times exceeding 100 h, then the long-time behaviour of the material as provided at Annex B, Tables B.1 to B.4 will need to be taken into consideration.

Materials used for welded components shall be produced with a hydrogen level no greater than 0,20 ml per 100 g aluminium, or an equivalent value/level determined by an alternative defined method stated on the order (see 6.3.3).

5.2 Wrought products

Applicable alloys for wrought products which are used for pressure applications are given in Table 2. Their chemical composition shall be in accordance with EN 573-3:2019+A2:2023.

All grades of wrought aluminium and aluminium alloys shall have a lead (Pb) and tin (Sn) content not exceeding 0,015 0 % (150 ppm) by mass, per each element.

5.3 Cast products

Applicable alloys for cast products are given in Table 3. Their chemical compositions shall be as specified in EN 1706:2020+A1:2021.

5.4 Elongation after fracture

Wrought and cast products in aluminium and aluminium alloys specifically used for welded parts of unfired pressure vessels or metallic industrial piping and subjected to cold forming (e.g. rolled shells and heads) shall have a specified minimum elongation value after fracture A measured on a gauge length as follows:

$$L_0 = 5,65 \cdot \sqrt{S_0} \quad (1)$$

and ≥ 14 % in the longitudinal or transverse direction.

Wrought and cast products in aluminium and aluminium alloys used for parts of unfired pressure vessels or metallic industrial piping that are not subjected to cold forming (e.g. straight flanges and nozzles) shall have a specified minimum elongation value after fracture A measured on a gauge length as follows:

$$L_0 = 5,65 \cdot \sqrt{S_0} \quad (2)$$

and ≥ 10 % in the longitudinal or transverse direction.

where

L_0 is the original gauge length;

S_0 is the original cross-sectional area of the parallel length.

The conversion of A values into A_{50} and vice versa shall be carried out as specified in Annex C.

When using minimum A_{50} values converted from A values as requirements, the converted A_{50} value shall be taken from Table C.1 then rounded up to the next whole number.

EXAMPLE 1 A converted value A_{50} of 12,2 % shall be implemented as a minimum requirement of A value by 13 %.

EXAMPLE 2 A 12,5 mm wide rectangular test piece is prepared from rolled sheet with a thickness of 2,0 mm. As the cross-sectional area of this test piece is 25 mm², then the corresponding gauge length for a proportional test piece is 28,3 mm. In this case, a measured value of A_{50} by 13,0 % corresponds to an approximate elongation value A of 17,0 %.

EXAMPLE 3 An elongation value A of 24,0 % is measured on a proportional test piece with a gauge length of 35,7 mm and a thickness of 3,2 mm. This corresponds to an elongation value A_{50} of 20,9 %, when being measured on a 12,5 mm wide rectangular test piece, which cross-sectional area will be 40 mm².

EXAMPLE 4 A wrought material in thickness 12,0 mm is to be selected for a part to be cold deformed and welded during fabrication. As consequence the tensile test samples can be either:

— a proportional test sample with a cross-section of 150 mm² and a gauge length of 69,2 mm, for which the minimum elongation value A of 14 % will apply, or,

— a non-proportional test sample with a cross-section of 150 mm² and a gauge length of 50 mm. In this case the minimum A_{50} value to apply will be 20 %, as rounded up to the next whole number from the indicated value of 19,1 % in Table C.1.

6 Technical conditions for inspection and delivery

6.1 Manufacturing methods

6.1.1 General

The manufacturing methods used shall be independently selected without obligation to use the same processes or process route for subsequent or similar orders.

When the manufacturing method to be used is restricted or fixed, it shall be stated on the purchase order.

6.1.2 Specific requirements regarding porthole extruded and/or drawn products

Regarding porthole extruded and/or drawn products, limitations for safe application of such products as mentioned in Tables 4 and 5 shall apply.

The stated values for maximum allowable pressure (PS) and volume (V) disclosed in Table 4 and Table 5 are limitations superseding those required by European Legislation for Pressure Equipment.

Table 4 applies to porthole extruded tube specified in EN 755-8:2016, porthole extruded and drawn tube specified in EN 754-8:2016, porthole extruded hollow profiles specified in EN 755-9:2016 and porthole extruded precision profiles specified in EN 12020-1:2022 and shall be used up to and including a nominal diameter of 600 mm (DN 600) and a maximum thickness (t) of 20 mm.

Table 5 applies to porthole extruded coiled tube specified in EN 13957:2008 and porthole extruded and drawn coiled tube specified in EN 13958:2008 and shall be used up to and including a nominal diameter of 50 mm (DN 50) and a maximum thickness (t) of 5 mm.

NOTE 1 Tubular products are generally defined by outside diameter (OD), inside diameter (ID) and wall thickness (t). DN mentioned here corresponds to a nominal diameter average of OD and ID .

When placing an order, it shall be ensured that the following information is provided, in order to implement the requirements of Table 4 or Table 5:

- pressure product category according to European Legislation for Pressure Equipment;
- type of equipment and fluids;
- maximum pressure for which the equipment is designed (PS);
- confirmation that the completed equipment assembly is pressure tested.

In addition to the limitations for nominal size DN and thickness t , additional requirements regarding pressure PS , volume V and testing procedures as specified in Table 4 or Table 5 shall apply. Destructive testing procedure of extrusion seam shall be determined and stated on the order documents (see 6.2) at least with the following frequencies:

P1: Front end of every extrusion string;

P2: Front and back end of every extrusion string;

P3: Front and back end of every extrusion string including additional destructive tests along the length, depending on the dimensions (cross-section and length) of the pressurized profile chamber corresponding to a maximum enclosed volume of 200 l;

S: According to the requirements of EN 755-1 or EN 754-1 regarding the frequency of mechanical testing, and including macroscopic and/or destructive tests as required in these documents;

TBD: higher testing frequency than S, to be specified and stated on the order;

N/A: Not applicable.

In contrast to longitudinal seams which are covered by the above provisions and Tables 4 and 5, transverse extrusion seams (charge welds) shall not be allowed in extruded or extruded/drawn products used for pressure equipment.

However, transverse extrusion seams for coiled tubes according to EN 13957:2008 and EN 13958:2008 may be used, provided that the integrity of the extrusion seams is ensured by quality assurance/testing procedures based on the requirements of Table 5 and stated on the order.

NOTE 2 Some further comment is necessary on the methods of extrusion used for tube and hollow profiles. In particular, seamless extrusion produces a product that does not contain any seams or weld lines in the product cross-section. On the other hand, extruded products manufactured using a porthole or bridge die contains at least one longitudinal weld or seam. The presence of such welds or seams can be a major concern on products that are used for e.g. pressure vessels since the weld/seam can lead to premature failure of the vessel under pressure.

NOTE 3 In addition, despite rigorous process control during the extrusion process, there is no definitive non-destructive test method that can provide total assurance of the integrity of the welds in the product cross-section. In view of the safety implications of using porthole products, guidelines regarding the use of porthole products are provided in this document.

Applicable testing procedures shall be specified and stated on the order for porthole extrusion products used for applications exceeding the limitations specified in Table 4 or Table 5.

6.1.3 Quality control

All inspection and tests required by this document shall be undertaken prior to shipment of the product. Any additional inspection required shall be stated on the purchase order (see 6.2).

6.2 Orders or tenders

The order or tender documents shall define the product required and contain the following minimum information:

- a) the type and form of the product. In the case of tube whether extruded, cold drawn or coiled, it is also essential to state the method of extrusion to be used i.e. seamless or porthole (see also point i) below);
- b) reference to this particular document;
- c) alloy and temper;
- d) the dimensions and shape of the particular product required;
 - 1) plate: thickness, width and length;
 - 2) sheet: thickness, width and length;
 - 3) strip: thickness width and coil dimensions;
 - 4) circles: thickness and diameter;
 - 5) round tube: method of production, outside (OD) or inside (ID) diameter, wall thickness (t), and length;

NOTE 1 Two of the OD/ID/t dimensions can be given tolerances but not all three.

- 6) coiled round tube: outside (OD) or inside (ID) diameter, wall thickness (t), coil dimensions and tube length if required in straight lengths;

NOTE 2 Two of the OD/ID/t dimensions can be given tolerances but not all three.

- 7) round bar: diameter and length;
- 8) square and hexagonal bar: width across flats and length;
- 9) rectangular bar: width, thickness and length;
- 10) extruded profiles and hollow sections: drawing of cross-section and length;
- 11) forgings (open-die forgings, closed-die forgings and seamless rolled rings): reference to drawing or finished size;
- 12) castings: reference to a drawing.
- e) the product tolerances on dimensions and form together with particular reference to the relevant European standard for the specific product concerned;
- f) any requirement regarding mechanical properties, when differing from those specified in the applicable document for a specific product form (see Clause 7);

NOTE 3 This specifically applies to wrought products to be tested to tempers T42 or T62, or castings for which higher mechanical properties than those mentioned in EN 1706:2020+A1:2021.