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**Aluminij in aluminijeve zlitine - Gnetne in ulite zlitine - Posebne zahteve za aluminijeve izdelke za izdelavo naprav, ki delajo pod tlakom**

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

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

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

**Ta slovenski standard je istoveten z: EN 12392:2016+A1:2022**

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EUROPÄISCHE NORM

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

This European Standard was approved by CEN on 18 January 2016 and includes Amendment 1 approved by CEN on 21 February 2022.

This European Standard was corrected and reissued by the CEN-CENELEC Management Centre on 3 August 2022.

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.

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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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## European foreword

This document (EN 12392:2016+A1:2022) 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 January 2023, and conflicting national standards shall be withdrawn at the latest by January 2023.

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 A1 EN 12392:2016 A1.

This document includes Amendment 1 approved by CEN on 21 February 2022.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

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 requirements of EU Directive(s).

For relationship with EU Directive A1 2014/68/EU A1, see informative Annex ZA, which is an integral part of this document.

Comparing to EN 12392:2000 the following modifications were implemented in EN 12392:2016:

- modification of the scope (extension to cast aluminium and aluminium alloys) (Clause 1);
- new normative references (Clause 2);
- new definitions (Clause 3): melt, casting, forging, tube;
- modification of Clause 4 “Materials” which covers Wrought products and Cast products;
- modification of Clause 5 “Technical conditions for inspection and delivery”: new requirements for Manufacturing methods, Orders or tenders, Test procedures, Inspection documents, Marking, Packaging;
- modification of Clause 6 “Mechanical properties”: different specifications are included at room temperature and low and elevated temperature properties;
- modification of Clause 7 “Tolerances on dimensions and form”: inclusions of Tables 1 to 37;
- deletion of Clause 8 “Elevated temperature properties” (initially in 2000 version);
- new Annex A (Informative) “Materials and application range”;
- new Annex B (Informative) “Tensile properties at low and high temperature”;
- new Annex ZA (Informative) “Relationship with EU Directive 2014/68”;
- new references into Bibliography.

■<sup>A1</sup> This Amendment 1 to EN 12392:2016 covers the following major subjects:

- replacement of all textual elements considered as business relationship items such as “to be agreed between customer and supplier” and not allowed in harmonized standards by formal textual elements allowed for harmonized standards and worded as “to be defined before placing an order” and/or “to be stated on the order”;
- introduction of new alloys together with relevant information at specific related sections and/or tables;
- re-introduction of famous and very used A/A50 conversion table for elongation;
- application of most recent European legislation directive (Annex ZA). ■<sup>A1</sup>

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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.

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## 1 Scope

This European Standard 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 European Standard covers:

- the products forms, grades and tempers of wrought and cast aluminium and aluminium alloys which may be used for such applications together with data for wrought and cast alloys over their permissible working temperature ranges;
- A1 *deleted text* A1
- 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, and
- additional requirements which are specific to pressure equipment applications.

A1 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. 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. A1

It is the sole objective of this standard to cover materials only for pressure purposes and it excludes any elements of fabrication or fabrication methods for pressure equipment; such information can be found in the relevant standards listed in the “Bibliography” section.

## 2 Normative references

SIST EN 12392:2016+A1:2022

<https://standards.iteh.ai/catalog/standards/sist/2d808a64-ddb9-4b13-965c->

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

A1 EN 485-1:2016, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 1: Technical conditions for inspection and delivery*

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

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 754-2:2016, *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 941:2014, *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*

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

EN 1779:1999, *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 alloy products*

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

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

EN 12020-1:2008, *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 12020-2:2016, *Aluminium and aluminium alloys — Extruded precision profiles in alloys EN AW-6060 and EN AW-6063 — Part 2: Tolerances on dimensions and form*

EN 12020-2:2016/AC:2017, *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 12681:2003, *Founding — Radiographic examination*

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 14361:2004, *Aluminium and aluminium alloys — Chemical analysis — Sampling from metal melts*

EN 14726:2019, *Aluminium and aluminium alloys — Chemical analysis — Guideline for spark optical emission spectrometric analysis*

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 8062:2007, *Castings — System of dimensional tolerances and machining allowances (ISO 8062)*

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)*

ISO 9591:2004, *Corrosion of aluminium alloys — Determination of resistance to stress corrosion cracking*

ASTM B548:2003, *Standard Test Method for Ultrasonic Inspection of Aluminium-Alloy Plate for Pressure Vessels*

ASTM B594:2019, *Standard Practice for Ultrasonic Inspection of Aluminium-Alloy Wrought Products*

ASTM E112:2013, *Standard Test Methods for Determining Average Grain Size*

ASTM E215:2016, *Standard Practice for Standardizing Equipment for Electromagnetic Testing of Seamless Aluminum-Alloy Tube* <sup>A1</sup>

### 3 Terms and definitions

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

#### 3.1

##### **heat-treatment batch or 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.

#### 3.2

##### **inspection lot**

consignment, or a part thereof, submitted for inspection, comprising products of the same grade or alloy, form, thickness or cross-section, and processed in the same manner

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

#### 3.3

##### **melt**

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

#### 3.4

##### **cast**

quantity of products cast simultaneously from the same melt

#### 3.5

##### **casting**

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

<sup>A1</sup>

Note 1 to entry: Casting is also the process in which molten metal is poured into a mould and solidified. <sup>A1</sup>

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Note  $\text{A}_1$  2  $\text{A}_1$  to entry: Pressure die-cast products are excluded from the scope of the present standard.

Note  $\text{A}_1$  3  $\text{A}_1$  to entry: The mould of concern can be a single use mould (sand) or a permanent mould (e.g. cast iron or steel).

$\text{A}_1$  deleted text  $\text{A}_1$

### 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

### 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 the shape of circles, ovals, squares, rectangles, equilateral triangles or regular polygons and can have rounded corners, provided the inner and outer cross-sections are concentric and have the same form and orientation.

### 3.8 operating temperature range

temperature range at which the material is exposed during its use

## 4 Materials

### 4.1 General

The materials covered by this standard are 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.  $\text{A}_1$  As a result, the standard covers an extensive range of aluminium product forms, alloys and tempers as follows:  $\text{A}_1$

- sheet, strip, plate and circles (EN 485, EN 941);
- cold drawn rod/bar and tube (EN 754);
- extruded rod/bar, tube and profiles (EN 755);
- precision profiles (EN 12020);
- extruded coiled tube (EN 13957);
- cold drawn coiled tube (EN 13958);
- forgings (EN 586);
- castings (EN 1706).

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

$\text{A}_1$  deleted text  $\text{A}_1$

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

Ⓐ Materials to be used for welded components shall be produced with a hydrogen level no greater than 0,2 ml per 100 g aluminium, or an equivalent value/level determined by an alternative agreed method. Ⓐ

## 4.2 Wrought products

Ⓐ Applicable alloys and the chemical compositions for wrought products are given in Tables 1 and 2. The chemical compositions of aluminium and aluminium alloys are specified in percentage by mass. Limits for impurities are expressed as maxima that also will apply to alloying elements unless expressed as a range. Aluminium is specified as a minimum for unalloyed aluminium, and as a remainder for aluminium alloys. Ⓐ

Ⓐ All grades of wrought aluminium and alloys shall have a lead (Pb), tin (Sn) and bismuth (Bi) content not exceeding 0,015 0 % by mass, per each element. For particularly safety-sensitive applications (e.g. high volumes at high pressure), lower values shall be agreed and stated on the order.

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

$$L_o = 5,65\sqrt{S_o} \quad (4.2-1)$$

and  $\geq 14$  % in the longitudinal or transverse direction.

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

$$L_o = 5,65\sqrt{S_o} \quad (4.2-2)$$

and  $\geq 10$  % in the longitudinal or transverse direction.

The conversion of A values into A<sub>50</sub> and vice versa shall be carried out as specified in Annex C.

When using minimum A<sub>50</sub> values converted from A values as requirements, the converted A<sub>50</sub> value shall be taken from Table C.1 then rounded up to the next whole number (example: a converted value A<sub>50</sub> of 12,2 % shall be implemented as a minimum requirement of A value by 13 %).

**EXAMPLE 1** A 12,5 mm wide rectangular test piece prepared from rolled sheet with a thickness of 2,0 mm. Then the cross sectional area of this test piece is 25 mm<sup>2</sup>, and the corresponding gauge length for a proportional test piece is 28,3 mm. The measured value of A<sub>50</sub> is 13,0 % which corresponds to an approximate elongation value for A of 17,0 %.

**EXAMPLE 2** An elongation value for A of 24,0 % measured on a proportional test piece with a gauge length of 35,7 mm. This corresponds to an approximate elongation value for A<sub>50</sub> of 20,4 %, measured on a 12,5 mm wide rectangular test piece with a thickness of 3,2 mm. The cross sectional area of this test piece is 40 mm<sup>2</sup>.

**EXAMPLE 3** A wrought material in thickness 12,0 mm selected for a part to be cold deformed and welded during fabrication. The tensile test samples shall be either:

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— a proportional test sample with a cross section of  $150 \text{ mm}^2$  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  $150 \text{ mm}^2$  and a gauge length of 50 mm. In this case the minimum A50 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.  $\langle A_1 \rangle$

**4.3 Cast products**

$\langle A_1 \rangle$  Applicable alloys and the chemical compositions for cast products are given in Table 3.  $\langle A_1 \rangle$  The chemical compositions of aluminium and aluminium alloys are specified in percentage by mass.

$\langle A_1 \rangle$  Limits for impurities are expressed as maxima which will also apply to all alloying elements unless expressed as a range.  $\langle A_1 \rangle$

**5 Technical conditions for inspection and delivery****5.1 Manufacturing methods****5.1.1 General**

The provisions of EN 485-1 (sheets, strips and plates), EN 941 (circles), EN 755-1 (extruded rods/bars, tubes and profiles), EN 754-1 (cold drawn rods/bars, and tubes), EN 12020-1, EN 13957, EN 13958, EN 586-1 (forgings incl. seamless rolled rings), EN 1559-1 (Founding) and EN 1559-4 (Founding) apply with the amendments and additions specified in 5.2 to 5.5 below.

$\langle A_1 \rangle$  The manufacturing methods used shall be left to the discretion of the producer.  $\langle A_1 \rangle$  In addition, there shall be no obligation on the supplier to use the same processes or process route for subsequent or similar orders.

$\langle A_1 \rangle$  When the manufacturing method to be used is restricted or fixed, it shall be stated on the purchase order (see 5.2).  $\langle A_1 \rangle$

**5.1.2 Specific requirements regarding porthole extruded and/or drawn products**

$\langle A_1 \rangle$  Regarding porthole extruded and/or drawn products, limitations for safe application of such products are given in Tables 4 and 5:  $\langle A_1 \rangle$

- Table 4 applies to porthole extruded tube (EN 755-8), porthole extruded and drawn tube (EN 754-8), porthole extruded hollow profiles (EN 755-9) and porthole extruded precision profiles (EN 12020) and may be used up to and including an outside diameter  $\langle A_1 \rangle$  of 600 mm (DN 600) and a maximum thickness (t) of 20 mm  $\langle A_1 \rangle$ ;
- Table 5 applies to porthole extruded coiled tube (EN 13957) and porthole extruded and drawn coiled tube EN 13958 and may be used up to and including an outside  $\langle A_1 \rangle$  diameter 50 mm (DN 50) and a maximum thickness (t) of 5 mm  $\langle A_1 \rangle$ .

$\langle A_1 \rangle$  The stated values for maximum allowable pressure (PS) and volume (V) disclosed in Tables 4 and 5 are limitations superseding those required by European Legislation for Pressure Equipment.

The purchaser is responsible to cascade the relevant design elements of the final equipment to the producer.

As a result, the purchaser shall, when placing an order with the producer (material manufacturer), provide the following information to ensure that the correct Hazard Category and adequate quality assurance is applied to the particular combination of criteria:



- the type of pressure equipment being considered (vessel or piping acc. European Legislation for Pressure Equipment and intended use);
- the state of the fluid in the equipment (gas or liquid);
- the hazard group of the fluid (acc. to European Legislation for Pressure Equipment);
- maximum pressure for which the equipment is designed (PS);
- confirmation that the completed equipment assembly is pressure tested. <sup>A1</sup>

<sup>A1</sup> NOTE 1 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 to be used for e.g. pressure vessels since the weld/seam could lead to premature failure of the vessel under pressure. <sup>A1</sup>

NOTE 2 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, it is necessary to provide guidelines in this standard as to the permitted product areas where porthole products may or may not be used.

<sup>A1</sup> NOTE 3 Transverse extrusion seams (charge welds) are generally not permitted in extruded or extruded/drawn products used for pressure equipment. However, the use of transverse extrusion seams for coiled tubes according to EN 13957 and EN 13958 is allowed, provided that the integrity of the extrusion seams is ensured by adequate quality assurance/testing procedures based on the recommendations given in Table 5 and stated on the order. <sup>A1</sup>

<sup>A1</sup> NOTE 4 It needs to be highlighted that, beside the limits for nominal size DN and thickness t, Tables 4 and 5 provide additional limitations regarding pressure PS, volume V and testing procedures. The purchaser can decide to use porthole extrusion for products exceeding the stated limits/hazard categories but this has to be stated on the order with defined quality assurance / testing procedures. <sup>A1</sup>

### 5.1.3 Quality control

<sup>A1</sup> All inspection and tests required by the relevant European standard and/or the particular specification shall be undertaken prior to shipment of the product. Any additional inspection required shall be stated on the purchase order (see 5.2). <sup>A1</sup>

## 5.2 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 Standard EN 12392;
- c) the dimensions and shape of the particular product required;
  - 1) plate: thickness, width and length;
  - 2) sheet: thickness, width and length;