AS 1528.1:2019

Australian STANDARD®

Stainless steel tubes and tube fittings for food processing and hygienic applications

Part 1: Tubes

STANDARDS Australia

AS 1528.1:2019

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The following are represented on Committee FT-027:

Australian Chamber of Commerce and Industry
Australian Food Engineering Association
Australian Industry Group
Australian Stainless Steel Development Association
Dairy Australia
Winery Engineering Association

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Australian STANDARD®

Stainless steel tubes and tube fittings for food processing and hygienic applications

Part 1: Tubes

Originated as AS N32—1960.
Previous edition AS 1528.1—2001.
Third edition AS 1528.1:2019.

Preface

This Standard was prepared by the Standards Australia Committee FT-027, Stainless Steel Tubes and Tube Fittings for Food Processing and Hygienic Applications, to supersede AS 1528.1—2001, *Tubes (stainless steel) and tube fittings for the food industry, Part 1: Tubes*.

The objective of this Standard is to specify dimensional, material and hygienic requirements for tubes used in the tube lines for food processing and hygienic applications.

This is Part 1 of a series of Standards for stainless steel tubes and tube fittings for food processing and hygienic applications. The Standards in the series are as follows:

AS 1528.1, *Stainless steel tubes and tube fittings for food processing and hygienic applications, Part 1: Tubes* (this Standard)

AS 1528.2, *Stainless steel tubes and tube fittings for food processing and hygienic applications, Part 2: Screwed tube couplings*

AS 1528.3, *Stainless steel tubes and tube fittings for food processing and hygienic applications, Part 3: Butt weld tube fittings*

AS 1528.4, *Stainless steel tubes and tube fittings for food processing and hygienic applications, Part 4: Clamp tube fittings*

The revision of the AS 1528 series more closely aligns with other national and international Standards applicable to stainless steel tube and tube fittings for hygienic applications, while retaining a number of requirements that were identified in the prefaces to the 2001 editions as lacking in ASTM and ISO Standards.

ISO, European and other national Standards were reviewed and found not suitable for current Australian requirements.

The major changes to this Standard in this revision include the following:

(a) The title of the Standard was changed to include “hygienic applications” in recognition of a broader application than simply for food processing industry.

(b) Exclusion of seamless and duplex tube (in practice they are not used for food processing lines).

(c) Redefining of raw material requirements.

(d) Common internal surface finish for all parts of the Standard.

(e) Closer alignment of tolerances with international, European and US-based Standards.

(f) Expansion of the diameter range and inclusion of wall thicknesses common to various tube diameters.

(g) Inclusion of weld bead and parent material surface roughness measurement and tolerances.

(h) Inclusion of weld bead heat tint tolerance.

The term “informative” is used in Standards to define the application of the appendix to which it applies. An “informative” appendix is only for information and guidance.

Contents

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Australian Standard®

Stainless steel tubes and tube fittings for food processing and hygienic applications

Part 1: Tubes

1 Scope

This Standard specifies requirements and tests for welded austenitic stainless steel tubes for use in food processing and other hygienic applications.

These tubes are intended to be used with stainless steel fittings in accordance with AS 1528.2, AS 1528.3 and AS 1528.4.

NOTE Information to be supplied for purchase is given in Appendix A.

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.

AS 1528.2, *Stainless steel tubes and tube fittings for food processing and hygienic applications, Part 2: Screwed tube couplings*

AS 1528.3, *Stainless steel tubes and tube fittings for food processing and hygienic applications, Part 3: Butt weld tube fittings*

AS 1528.4, *Stainless steel tubes and tube fittings for food processing and hygienic applications, Part 4: Clamp tube fittings*

ISO 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*

ASTM A240M, *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*

ASTM A269M, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*

ASTM A1016M, *Standard Specification for General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes*

AWS D18.1M, *Specification for Welding of Austenitic Stainless Steel Tube and Pipe Systems in Sanitary (Hygienic) Applications*

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

3 Terms and definitions

No terms and definitions are listed in this document.

4 Working pressure

Non-shock maximum working pressure for a tube shall be 10 bar at temperatures from –20 °C up to 100 °C, subject to the engineering requirements of the specific application.

5 Materials

Tubes shall be made from an austenitic stainless steel cold-rolled strip, conforming to the chemical and mechanical properties specified for the relevant grade in ASTM A240M.

6 Process of manufacture

The tubes shall be welded by an inert gas-protected fusion process without the use of a filler rod.

7 Condition of delivery

Tubes 31.75 mm diameter and larger shall be provided in either the cold-worked, or cold-worked annealed condition, as specified prior to manufacturing. The weld shall be cold-worked. Tubes smaller than 31.75 mm diameter may be supplied without cold-working of the inner weld bead.

NOTE For critical applications using smaller diameter tubes, seamless tubes or cold worked options may be required.

8 Dimensions and tolerances

8.1 Outside diameter and wall thickness

Nominal outside diameter and wall thicknesses for standard sizes are shown in Table 1. Tube diameter tolerances shall be those specified in Table 1 and wall thickness tolerance shall be ±10 % of nominal wall thickness.

Other non-standard sizes may be manufactured to this specification; the outside diameter tolerance for the next larger size in Table 1 shall apply.

Ovality is the difference between the maximum and minimum outside diameters measured at any one cross-section. The maximum and minimum outside diameters of any cross-section shall not deviate from the nominal diameter by more than twice the permissible variation in outside diameter; however, the mean diameter at that cross-section shall be within the given permissible variation.

Table 1 — Dimensions for standard tube sizes

Dimensions in millimetres

Outside diameter (D)	Outside diameter tolerance	Wall thickness (t)					
		0.90	1.20	1.60	2.00	2.50	3.00
6.35	±0.13	•					
7.94	±0.13	•	•				
9.53	±0.13	•	•				
12.70	±0.13	•	•	•			
15.88	±0.13	•	•	•			
19.05	±0.13	•	•	•			
22.23	±0.13	•	•	•			
25.40	±0.13	•	•	•	•		
28.58	±0.13	•	•	•	•		
31.75	±0.13	•	•	•	•		
34.93	±0.13	•	•	•	•		
38.10	±0.25		•	•	•		
44.45	±0.25		•	•	•		

Table 1 *(continued)*

Outside diameter (*D*)	Outside diameter tolerance	Wall thickness (*t*)					
		0.90	1.20	1.60	2.00	2.50	3.00
50.80	±0.25		•	•	•		
57.15	±0.25		•	•	•		
63.50	±0.25		•	•	•		
76.20	±0.25			•	•		
101.60	±0.38			•	•		
127.00	±0.38			•	•		
152.40	±0.76			•	•		
203.20	±1.01				•	•	
254.00	±1.01				•	•	•
304.80	±1.26				•	•	•

8.2 Length

The standard tube length shall be a 6 m mill-length or a mill-length nominated prior to manufacturing. For mill-lengths up to and including 7.3 m, the length tolerance shall be +35, 0 mm. For mill-lengths above 7.3 m, an additional length tolerance of +1 mm per additional 1 m of mill-length, up to a maximum length tolerance of +48, 0 mm.

Off-line cut length tolerances shall be +3, 0 mm for tube diameters to 34.93 mm, and +5, 0 mm for tube diameters larger than 34.93 mm.

8.3 Ends

Ends shall be cut square and deburred.

8.4 Straightness

Each tube shall be straight within 2 mm in any 1000 mm length as measured against a straight edge.

9 Tube welds

All tube welds shall have 100 % weld penetration. Tubes with an outside diameter of 31.75 mm and above, shall have the internal weld bead cold-worked. The internal weld bead should be kept to a minimum for tubes with outside diameters below 31.75 mm.

10 Surface finish

10.1 External surface

The external surface of tubes may be as-produced or buff polished as specified. The surface finish shall be agreed upon by methods which may include comparison samples, *Ra* limits or grit specification.

10.2 Internal surface

10.2.1 General

Internal surface weld heat tint shall be no more than level 3 in AWS D18.1M, commonly referred to as "pale straw".

The requirements for pickling and any subsequent finishing may be specified (see Appendix A).

Acceptance criteria of 16 % rule as set out in ISO 4288 shall apply for surface finish evaluation purposes.

10.2.2 Interior surface finish (excluding the weld zone)

The finish of the interior surface of the tube, excluding the weld zone, shall be a maximum 0.80 µm *Ra* as assessed in accordance with the procedure described in ISO 4288. Any visual markings such as scoring or roll marks shall not have an *Rt* value exceeding 14.0 µm, or a single value either side of the nominal line of the roughness profile exceeding 7.0 µm, referred to *Rp* (peak) and *Rv* (valley).

10.2.3 Interior surface finish (of the weld zone)

For tubes with an outside diameter 31.75 mm and above, the profile of the weld bead after cold working —

(a) shall be continuously smooth when visually inspected; and

(b) when measured laterally (across the weld) shall not have an *Rt* value exceeding 14.0 µm, or a single value either side of the nominal line of the roughness profile exceeding 7.0 µm, referred to *Rp* (peak) and *Rv* (valley).

11 Hygienic requirements

11.1 Absence of contaminants

Tubing shall be manufactured and handled in a manner that will avoid ferrous and other organic or inorganic contamination.

11.2 Freedom from defects

The tubes shall be internally clean and smooth. They shall be free from harmful surface defects, inclusions and longitudinal grooving.

12 Heat treatment

Where required, the tubing shall be annealed. The annealing treatment for austenitic stainless steel shall be by heating to 1040 °C minimum followed by rapid cooling. Tubing shall be pickled post-annealing, unless bright annealing is used.

13 Testing

13.1 Flange and reverse flattening test

Flange and reverse flattening tests shall be carried out in accordance with ASTM A269M and ASTM 1016M.

13.2 Surface measurement

Measurement and inspection of the external and internal surface, including the weld zone, shall be performed with the same regularity as the flange and reverse flattening tests. Where potential defects are identified during visual inspection, additional measurement shall be undertaken to verify conformity. Testing of the external surface may be specified; refer to Appendix A.

13.3 Non-destructive testing

Each tube shall be subjected to the non-destructive eddy current test or the hydrostatic test. Unless specified, either test may be used. Testing shall be in accordance with ASTM A1016M.

Hydrostatically tested tube shall be capable of withstanding, without leaking, an internal pressure calculated in accordance with the following equation:

$$P = 220.6t/D$$

where

P = pressure, in megapascals

t = wall thickness (see Table 1)

D = diameter (see Table 1)

14 Visual inspection

The requirements for visual inspection may be specified and agreed at the time of order.

15 Packaging

Tubes shall be packaged for delivery in a manner that will provide protection against the normal hazards of transport and handling.

16 Identification marking

Each length of tube shall be legibly and indelibly marked at approximately 1000 mm intervals with the following information:

(a) The manufacturer's identification.

(b) The number of this Standard, i.e. AS 1528.1.

(c) Nominal outside diameter.

(d) Nominal wall thickness.

(e) Grade of material.

(f) If annealed the designation "ANN".

(g) Manufacturer's batch number.

17 Inspection certificates

Inspection certificates in accordance with EN 10204 Type 3.1 including test results shall be made available if requested.

NOTE The term "inspection certificate" is consistent with the terminology used in EN 10204; the term "test certificate" is more commonly used in Australia.

18 Assembling

Tubes shall be attached to other tube ends or to the various fittings specified in AS 1528.2, AS 1528.3 and AS 1528.4 by means of a full penetration butt weld, or by expansion joints. All welds shall be structurally sound and product contact surfaces shall be free of pits, craters, or any defects which interfere with the hygienic surface. Heat tint in excess of level 3 of AWS D18.1M shall be removed.

Expanded-type fittings shall be attached to the tube ends by expanding; requirements for these joints are given in the relevant sections of AS 1528.2 and AS 1528.4.

Appendix A
(informative)

Information to be supplied for purchase

The following information should be included on the purchase order or enquiry:

(a) The number of this Standard, i.e. AS 1528.1.

(b) The nominal diameter and wall thickness of the tubes (see Clause 8.1).

(c) The condition of the tubes (see Clause 7).

(d) The grade of the material.

(e) Any special requirements, such as cut lengths, external surface finishing, pickling or other internal surface finishing, and requirements for inspection, certification or third party inspection.

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