

INTERNATIONAL  
STANDARD

**ISO**  
**2851**

Second edition  
1993-06-15

---

---

**Stainless steel bends and tees for the food  
industry**

*Coudes et téés en acier inoxydable pour l'industrie alimentaire*



Reference number  
ISO 2851:1993(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 2851 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Sub-Committee SC 1, *Steel tubes*.

This second edition cancels and replaces the first edition (ISO 2851:1973), of which the table giving dimensions and the clause on materials have been technically revised.

Annexes A, B and C of this International Standard are for information only.

© ISO 1993

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization  
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

## Introduction

Face-to-centreline dimensions for pipe bends and tees are an important design feature and have been chosen in this International Standard to give sufficient straight lengths for application of commonly used pipe couplings and to give sufficient bend radius equal to approximately 1,5 times the tube outside diameter.

This page intentionally left blank

# Stainless steel bends and tees for the food industry

## 1 Scope

This International Standard specifies the dimensions, tolerances, surface roughness, materials and hygienic requirements for stainless steel bends and tees for use in the food industry.

The bends and tees which are the subject of this International Standard are intended to be used with stainless steel pipe tubes specified in ISO 2037 and to be welded to pipe ends or fitted with expanded or welded-type couplings.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2037:1992, *Stainless steel tubes for the food industry*.

ISO 5252:1991, *Steel tubes — Tolerance systems*.

## 3 Symbols

$D$	outside diameter of the tube
$T$	thickness
$r$	bend radius
$L_1$	face-to-centreline length (includes fittings where applicable)
$L_2$	straight length (the length over which the perpendicularity tolerance $P$ shall be maintained)
$P$	perpendicularity tolerance of end to straight length
$P_1$	perpendicularity tolerance of end to end

## 4 Dimensions and tolerances

### 4.1 Dimensions and perpendicularity tolerances

The dimensions and perpendicularity tolerances are given in figure 1 and table 1.

### 4.2 Dimensional tolerances

#### 4.2.1 Tolerance on outside diameter $D$ for a straight length $L_2$

The tolerance on outside diameter  $D \leq 101,6$  mm for a straight length  $L_2$  shall be class D4 in accordance with ISO 5252:1991.

For outside diameters  $D > 101,6$  mm, this tolerance shall be class D3 in accordance with ISO 5252:1991.

#### 4.2.2 Tolerance on thickness $T$ for a straight length $L_2$

The tolerance on thickness  $T$  for a straight length  $L_2$  shall be class T3 in accordance with ISO 5252:1991.

#### 4.2.3 Tolerance on face-to-centreline length $L_1$

For outside diameters  $D \leq 101,6$  mm, the tolerance on the face-to-centreline length  $L_1$  shall be

$$\begin{matrix} +0,5 \\ 0 \end{matrix} \text{ mm}$$

For outside diameters  $D > 101,6$  mm, this tolerance shall be

$$\begin{matrix} +1 \\ 0 \end{matrix} \text{ mm}$$

### 4.3 Perpendicularity tolerances

#### 4.3.1 Maximum deviation $P$

Values of  $P$  are given in table 1.

A method for carrying out the acceptance test is described in annex A. This method is applicable to all sizes of bends and tees.

#### 4.3.2 Maximum deviation $P_1$

Values of  $P_1$  are given in table 1.

A method for carrying out the acceptance test is described in annex B. This method is applicable to all sizes of bends and tees.

## 5 Surface roughness

The surface roughness, in accordance with the specifications of ISO 468, shall be as follows.

### 5.1 Finely finished surface

$$R_a \leq 1 \mu\text{m}$$

### 5.2 Other surfaces

$$R_a \leq 2,5 \mu\text{m}$$

The surface roughness on welded seams shall not exceed  $R_v = 16 \mu\text{m}$ .

## 6 Materials

Austenitic stainless steels shall be used. Generally the following steel types are suitable for pressure purposes:

- seamless tubes: TS 47, TS 60 and TS 61 in accordance with ISO 2604-2:1975;
- welded tubes: TW 47, TW 60 and TW 61 in accordance with ISO 2604-5:1978.

When manufactured from longitudinally welded tubes the following requirements apply:

- on bends, the weld on the run shall be located if possible in a section through the centre of the tube, perpendicular to the bending plane;
- on tees, the weld on the run shall be located if possible diametrically opposite the branch.

## 7 Hygienic requirements

**7.1** Care shall be taken that any non-ferrous metals or their alloys coming into contact with the bends and tees during manufacture do not leave deposits which will be harmful during subsequent fabrication and use.

**7.2** The interior surface of the bends and tees shall be clean and smooth. It shall be free from surface defects, inclusions and longitudinal grooving.

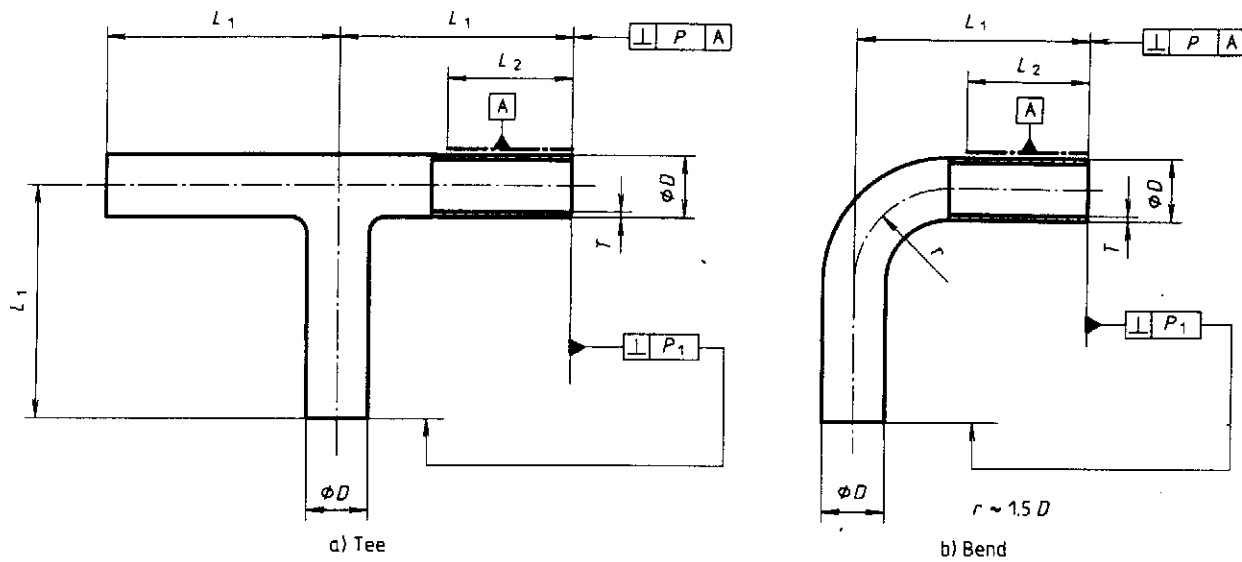


Figure 1

Table 1

Dimensions and perpendicularity tolerances in millimetres

Tube outside diameter <i>D</i>	Thickness <i>T</i>	$L_1$ 1)	$L_2$ min.	Perpendicularity tolerances (see also 4.3)	
				<i>P</i>	<i>P</i> <sub>1</sub>
12 12,7 17,2	1	45	25	0,1	0,2
21,3 25 33,7	1	55	25	0,1	0,2
	1	55	25	0,2	0,3
21,3 25 33,7	1,2; 1,6	60	25	0,2	0,3
	1,2; 1,6	65	25	0,3	0,5
	1,2; 1,6	80	25	0,3	0,5
38 40 51	1,2; 1,6	85	25	0,4	0,6
	1,2; 1,6	90	25	0,4	0,6
	1,2; 1,6	110	30	0,5	0,8
63,5 70 76,1	1,6	135	35	0,7	1
	1,6	145	35	0,7	1
	1,6	155	38	0,8	1
88,9 101,6 114,3	2	175	38	0,9	1,3
	2	195	38	1	1,4
	2	210	38	1,2	1,6
139,7 168,3 219,1	2	250	38	1,4	1,8
	2,6	295	38	1,7	2,2
	2,6	370	38	2,3	2,8

1)  $L_1$  is the face-to-centreline length used when bends and tees are directly welded to the tubing system. If bends and tees are equipped with couplings, the length  $L_1$  includes the length of the coupling part.

## Annex A (informative)

### Method for testing the perpendicularity of end to straight length

#### A.1 Method of measurement

The deviation from perpendicularity of end to straight length can be measured, for example, with a testing apparatus as shown in figure A.1.

This method is applicable to all sizes of bends and tees.

#### A.2 Apparatus

**A.2.1 Two-jaw chuck with soft gripping jaws**, as shown in figure A.1, positioned on a stand and equipped with a measuring mandrel and a dial-gauge. The soft gripping jaws should be adapted to the pipe.

#### A.3 Procedure

Clamp the bend or tee between the jaws of the apparatus.

Measure the deviation from perpendicularity during rotation of the measuring mandrel.

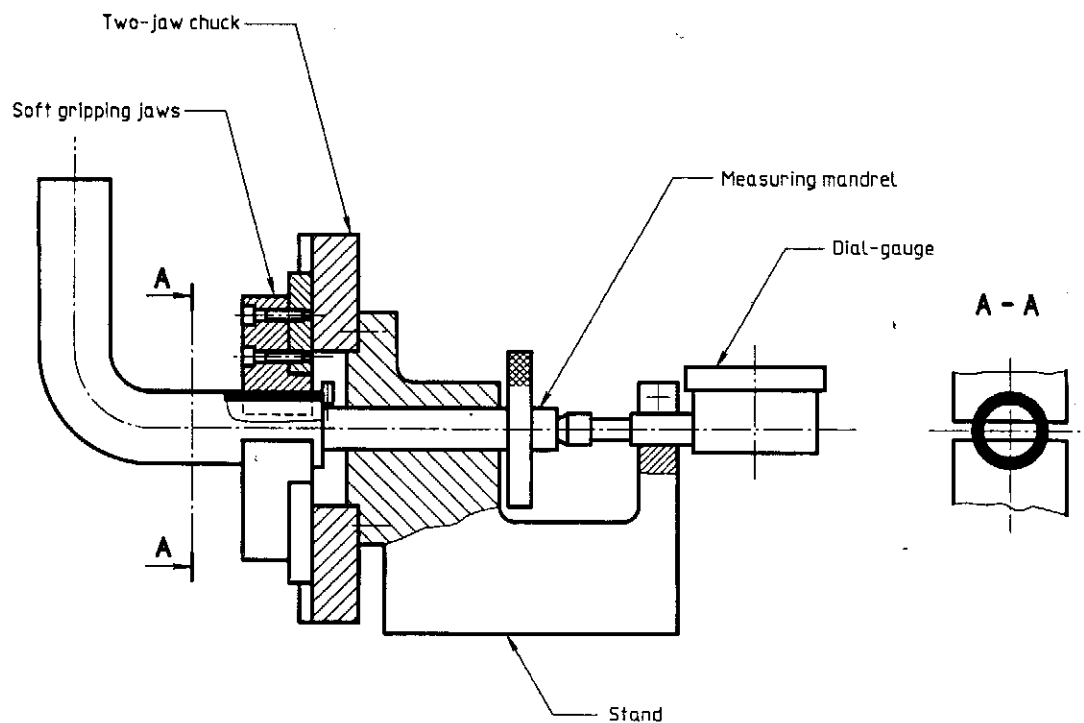


Figure A.1



## Annex B (informative)

### Method for testing the perpendicularity of end to end

#### B.1 Method of measurement

The deviation from perpendicularity of end to end can be measured, for example, with a testing apparatus as shown in figure B.1.

This method is applicable to all sizes of bends and tees.

#### B.2 Apparatus

**B.2.1 Perpendicular angle-plate**, as shown in figure B.1, standing on a plane surface and equipped with a dial-gauge and a fixed measuring point.

#### B.3 Procedure

Measure the deviation from perpendicularity with the bend or tee placed in the apparatus as shown in figure B.1.

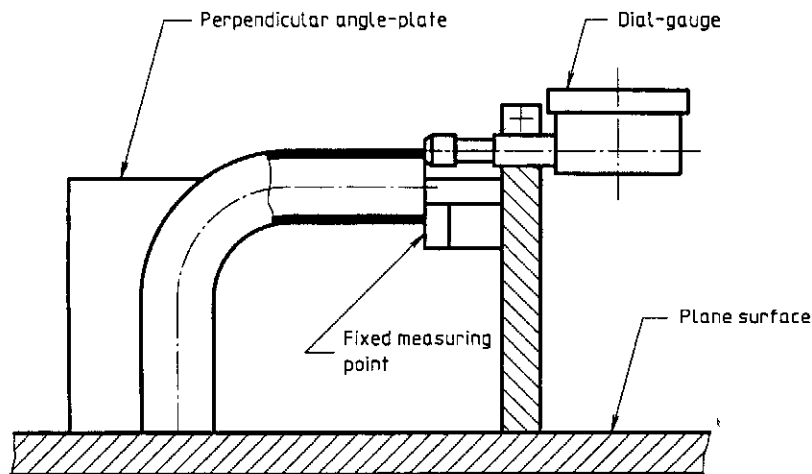


Figure B.1

**Annex C**  
(informative)

**Bibliography**

- [1] ISO 468:1982, *Surface roughness — Parameters, their values and general rules for specifying requirements.*
- [2] ISO 1101:1983, *Technical drawings — Geometrical tolerancing — Tolerances of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.*
- [3] ISO 1127:1992, *Stainless steel tubes — Dimensions, tolerances and conventional masses per unit length.*
- [4] ISO 2604-2:1975, *Steel products for pressure purposes — Quality requirements — Part 2: Wrought seamless tubes.*
- [5] ISO 2604-5:1978, *Steel products for pressure purposes — Quality requirements — Part 5: Longitudinally welded austenitic stainless steel tubes.*

This page intentionally left blank

11

---

---

**UDC 621.643.062/.063-034.14**

**Descriptors:** food industry, stainless steels, steel products, steel tubes, pipe bends, pipe fittings, T fittings, specifications, dimensions.

Price based on 6 pages

---

---