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# INTERNATIONAL STANDARD



# 3785

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Steel — Designation of test piece axes

*Acier — Désignation des axes des éprouvettes*

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## FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3785 was drawn up by Technical Committee ISO/TC17, *Steel*, and was circulated to the Member Bodies in August 1975. Subsequently, responsibility for this document has been transferred to ISO/TC 164, *Mechanical testing of metals*, which was set up in 1975.

It has been approved by the Member Bodies of the following countries :

Australia	India	Spain
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Belgium	Ireland	Switzerland
Bulgaria	Netherlands	Turkey
Canada	New Zealand	United Kingdom
Czechoslovakia	Norway	U.S.A.
Denmark	Portugal	U.S.S.R.
France	Romania	Yugoslavia
Hungary	South Africa, Rep. of	

No Member Body expressed disapproval of the document.

# Steel – Designation of test piece axes

## 0 INTRODUCTION

The mechanical properties of a metallic product, especially those characterizing its deformability and toughness, such as elongation after fracture, reduction of area, fracture toughness and impact resistance, are dependent on the position in the product or the test piece on which these properties are measured. This International Standard provides a method for designating the position of the test piece in relation to product grain flow and its effect on these properties.

## 1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies a method for the identification of test piece axes in relation to the grain flow, by means of a system of co-ordinates.

1.2 It applies to both unnotched and notched metal test pieces.

1.3 The system presented is only intended to be applied in situations where a uniform grain flow can be unambiguously identified (see also 4.2 and the annex).

## 2 DESIGNATORY SYSTEM

2.1 The method of designation is based on the assumption that a system of co-ordinates is laid into a metallic product so that :

- 1) the *X*-axis is coincident with the main direction of grain flow;
- 2) the *Z*-axis is coincident with the direction of the main working force;
- 3) the *Y*-axis is normal to the *X*- and *Z*-axis.

2.2 When applying this system to actual products, the following additional conditions shall obtain :

- 1) all test pieces normal to the grain flow of products whose grain flow has only one direction – so that, in accordance with the above definition, *Y*- and *Z*-test pieces are equivalent – are called *Z*-test pieces;
- 2) in cylindrical sections with an axial grain flow, the radial direction is the *Z*-axis;

3) all test pieces parallel to the surface of sheets processed with the same degree of deformation in two directions normal to each other – so that, in accordance with the above definition, *X*- and *Y*-test pieces are equivalent – are called *Y*-test pieces.

2.3 This system offers the possibility of accurately designating all the positions of test pieces which may occur, and positions which do not coincide with any of the three axes of the system of co-ordinates can also be defined by a simple combination of the relative letters.

2.4 Examples of this system are as follows :

- 1) A test piece taken parallel to the grain flow of a bar (geometrically a **longitudinal test piece**) is an *X*-test piece (or lies in the direction of *X*).
- 2) A test piece taken normal to the grain flow (lamella) of a sheet so that its axis coincides with the broad side of the lamella (geometrically a **transverse test piece**) is a *Y*-test piece (or lies in the direction of *Y*).
- 3) A test piece whose axis lies through the thickness of a plate (**short transverse test piece**) is a *Z*-test piece.
- 4) Test pieces taken either longitudinally or transversely from a (thin-walled) tube with helical grain flow are *XY*-test pieces.

2.5 The examples given in 2.4 and also further examples, applicable to unnotched test pieces, may be taken from figures 1 to 5. It should, however, be noted that the scale of reproduction of these drawings is not the same in all cases and that the place where the test pieces are taken and the actual sampling do not always apply in practice. These drawings, and especially the positions of the test pieces, have been idealized so as to show as clearly as possible the various methods of designating the test piece position by the system of *X*-*Y*-*Z* co-ordinates.

## 3 IDENTIFICATION OF NOTCHED TEST PIECES

3.1 The system described in clause 2 also offers the possibility of combining the designation of the position of the axis of the test piece with the designation of the direction of propagation of fracture during a test. This is of importance in the case of notched test pieces or test pieces for the assessment of the mechanism of fracture. Separated by a hyphen, this designation follows the designation of the position given in clause 2.

3.2 Examples of this system are as follows (further examples are shown in figures 6 to 8) :

- 1) A notched test piece as described in 2.4, paragraph 2), whose notch is normal to the sheet surface so that fracture propagates in the direction of *X*, is called a Y-X-test piece.
- 2) A notched test piece as described in 2.4, paragraph 4), notched so that fracture propagates in the direction of *Z*, is called an XY-Z-test piece.

#### 4 APPLICATION OF DESIGNATORY SYSTEM TO PROPERTIES LISTED IN MATERIAL SPECIFICATIONS

##### 4.1 Application

As pointed out in the annex, the position of the test piece in relation to the grain flow is only one of the characteristics required for ascertaining the properties which may be obtained. Moreover, the position of a test piece relative to the grain flow is only sufficiently defined in simple products whose production and processing are well known. Therefore, the position relative to the direction of the grain flow, the geometrical position in the product, and the various additional effects mentioned in

the annex shall, as a rule, be taken into account when estimating the importance of a special position of the test piece.

##### 4.2 Limits of application

4.2.1 The system described may be used to designate the position of test pieces relative to the direction of the grain flow whenever a uniform grain flow direction can be identified. In all other cases, the location of the test piece shall be related to component geometry and marked on a drawing of the same, together with a brief description of the method of production of the component (i.e. casting, upset forging, etc.).

(The position of the test pieces in actual products shall be taken from the relevant material specifications.)

4.2.2 The cases in which various products may be compared depend on the circumstances and may differ, to a varying extent, from one another. Thus definite numerical relations of the property values which have been obtained in this way for various classifications of the position of the test piece in relation to the grain flow apply to the particular case only and may not be generalized.

FIGURES 1 to 5 – Designation of unnotched test pieces

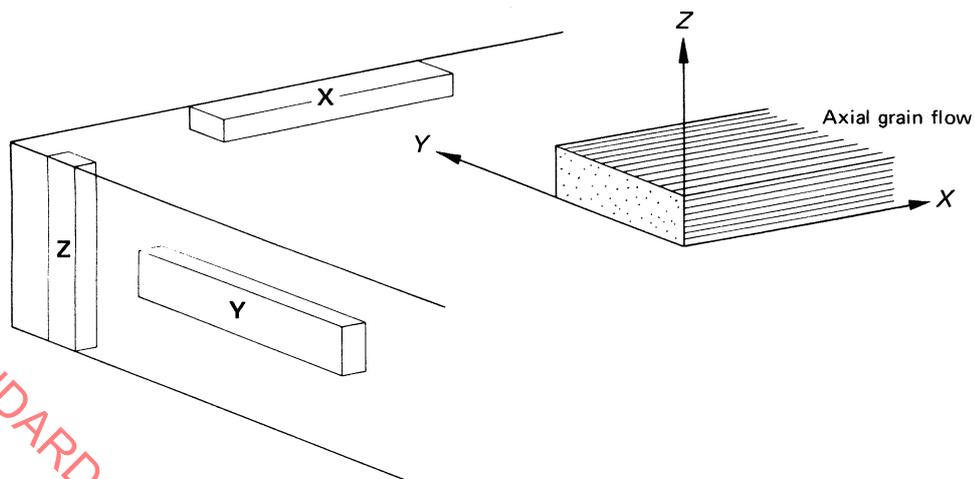


FIGURE 1 – Flat rolled products

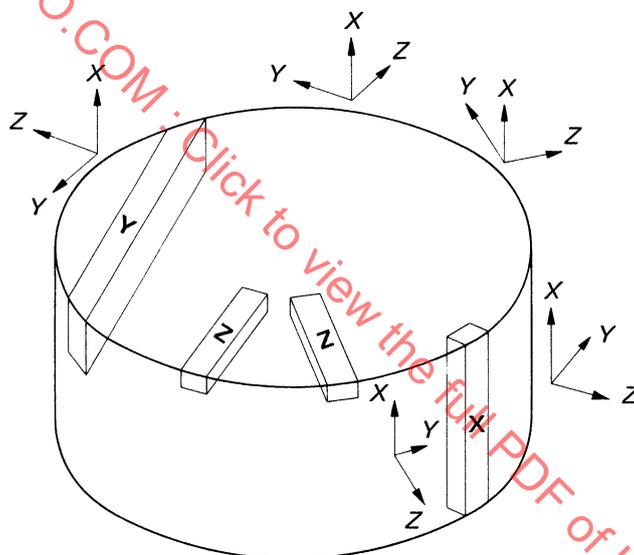


FIGURE 2 – Cylindrical section (axial grain flow)

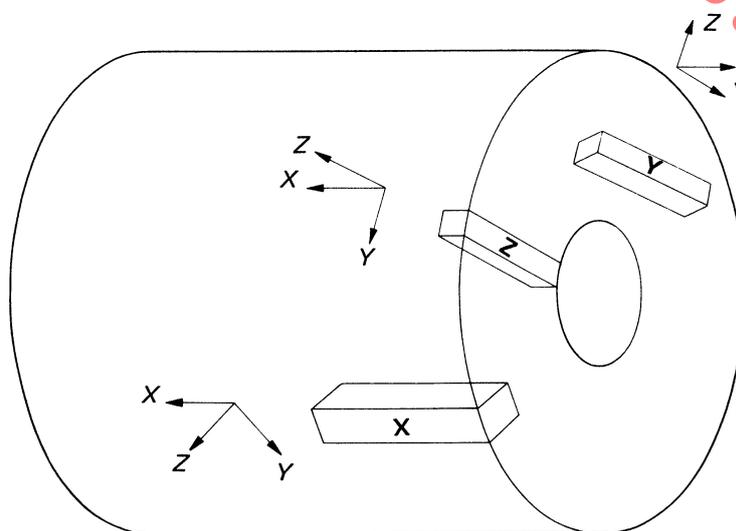


FIGURE 3 – Tube (axial grain flow)

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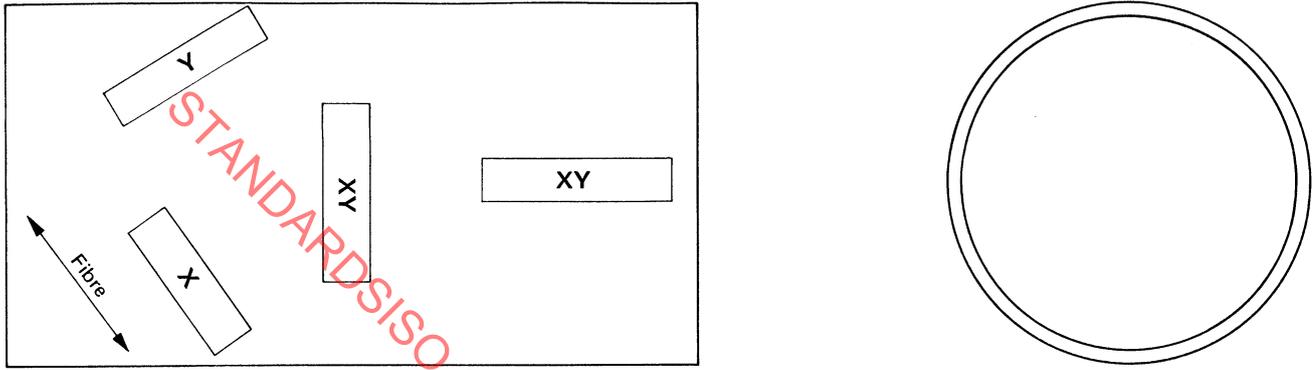


FIGURE 4 – Thin-walled tube with helical grain flow

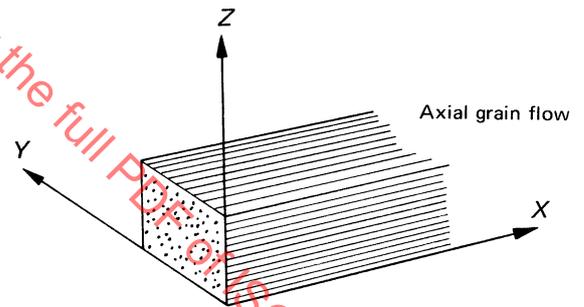
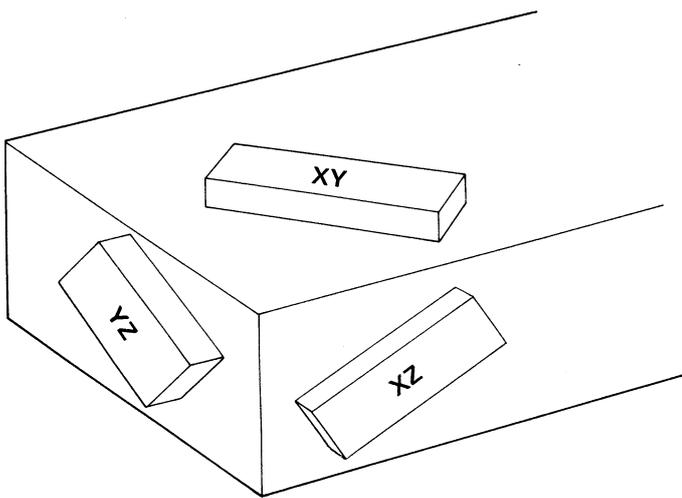


FIGURE 5 – Non-basic flat product