



**International
Standard**

ISO 2773

**Test conditions for pillar type
vertical drilling machines — Testing
of accuracy**

*Conditions d'essais des machines à percer verticales à colonne —
Contrôle de l'exactitude*

**First edition
2024-02**

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Terminology, designation of axes and machine configurations	1
5 Preliminary remarks	2
5.1 Measurement units.....	2
5.2 Reference to ISO 230-1, ISO 230-7 and ISO/TR 230-11.....	2
5.3 Testing sequence.....	3
5.4 Test to be performed.....	3
5.5 Measuring instruments.....	3
5.6 Minimum tolerance.....	3
5.7 Levelling.....	3
6 Test conditions and permissible deviations	4
6.1 Table.....	4
6.2 Spindle (quill).....	6
6.3 Spindle head.....	9
Annex A (informative) Terms in other languages	10
Bibliography	11

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 2, *Test conditions for metal cutting machine tools*.

This first edition of ISO 2773 cancels and replaces ISO 2773-1:1973 and ISO 2773-2:1973.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to standardize methods of testing the accuracy of pillar type vertical drilling machines including geometrical tests.

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Test conditions for pillar type vertical drilling machines — Testing of accuracy

1 Scope

This document specifies, with reference to ISO 230-1, geometrical tests on general purpose and normal accuracy pillar type vertical drilling machines. This document also specifies the applicable tolerances corresponding to the above-mentioned tests.

This document covers only the verification of accuracy of the machine.

This document does not apply to the testing of the machine operation (vibrations, abnormal noises, stick-slip motion of components, etc.) or to machine characteristics (such as speeds and feeds), which are generally checked before testing of machine accuracy.

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.

ISO 230-1:2012, *Test code for machine tools — Part 1: Geometric accuracy of machines operating under no-load or quasi-static conditions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 230-1 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

manual drilling machine

drilling machine where the axial motion of the cutting tool is controlled through the actuation of a handwheel or lever

Note 1 to entry: The handwheel or lever can include powered axial feed or powered unprogrammed positioning of spindle or workpiece.

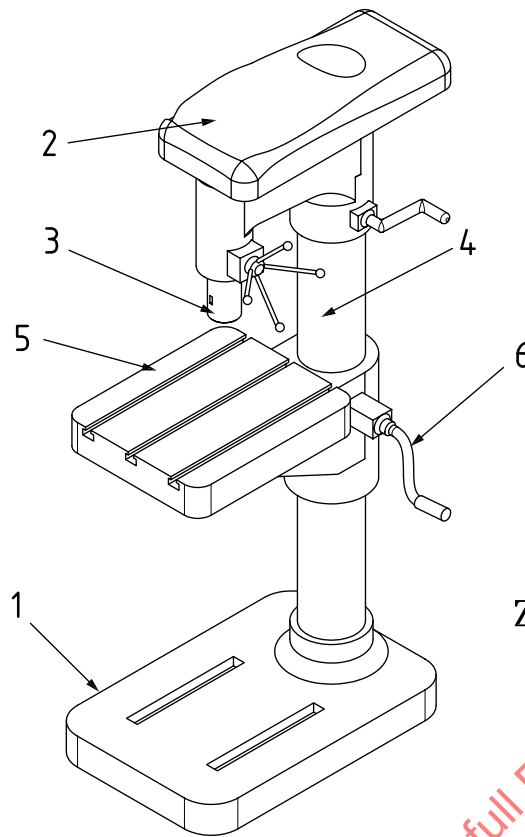
3.2

pillar type vertical manual drilling machine

manual drilling machine (3.1) in which the drilling head and working table are mounted in adjustable positions on a vertical column

4 Terminology, designation of axes and machine configurations

For the nomenclature and terminology of a pillar type vertical manual drilling machine, see [Figure 1](#).

**Key**

- 1 base
- 2 spindle head (Z2 axis)
- 3 spindle/quill (Z axis)
- 4 column
- 5 table (W-axis)
- 6 table height adjuster

NOTE For terms in French, Italian and Persian, see [Table A.1](#).

Figure 1 — Example of a pillar type vertical manual drilling machine

5 Preliminary remarks

5.1 Measurement units

In this document, all linear dimensions, deviations and corresponding tolerances are expressed in millimetres (mm); angular dimensions are expressed in degrees (°), and angular deviations and the corresponding tolerances are expressed in ratios. In some cases, microradians (μrad) or arcseconds (") may be used for clarification purposes. The equivalence of the following expressions should always be kept in mind:

$$0,010 / 1\,000 = 10\,\mu\text{rad} \approx 2''$$

5.2 Reference to ISO 230-1, ISO 230-7 and ISO/TR 230-11

To apply this document, reference shall be made to ISO 230-1, especially for the installation of the machine before testing, the warming up of spindles and other moving components, and the description of measuring methods and recommended accuracy of the test equipment.

Where the test concerned is in compliance with the specifications of ISO 230-1, a reference to the corresponding subclause of ISO 230-1 is shown before the instructions in the "Observations" block of the tests described in [Clause 6](#).

5.3 Testing sequence

The sequence in which the tests are presented in this document in no way defines the practical order of testing. In order to make the mounting of instruments or gauging easier, tests may be performed in any order.

5.4 Test to be performed

When testing a machine, it is not always necessary or possible to carry out all the tests described in this document. When the tests are required for acceptance purposes, it is up to the user to choose, in agreement with the supplier/manufacturer, the relevant tests relating to the components and/or the properties of the machine which are of interest. These tests shall be clearly stated when ordering a machine. A simple reference to this document for the acceptance tests, without specifying the tests to be carried out or without agreement on the relevant expenses, cannot be considered as an agreement between manufacturer/supplier and user.

5.5 Measuring instruments

Measuring instruments indicated in the tests described below are only examples. Other instruments capable of measuring the same quantities and having the same, or a smaller, measurement uncertainty may be used. Reference shall be made to ISO 230-1:2012, Clause 5, which indicates the relationship between measurement uncertainties and the tolerances.

5.6 Minimum tolerance

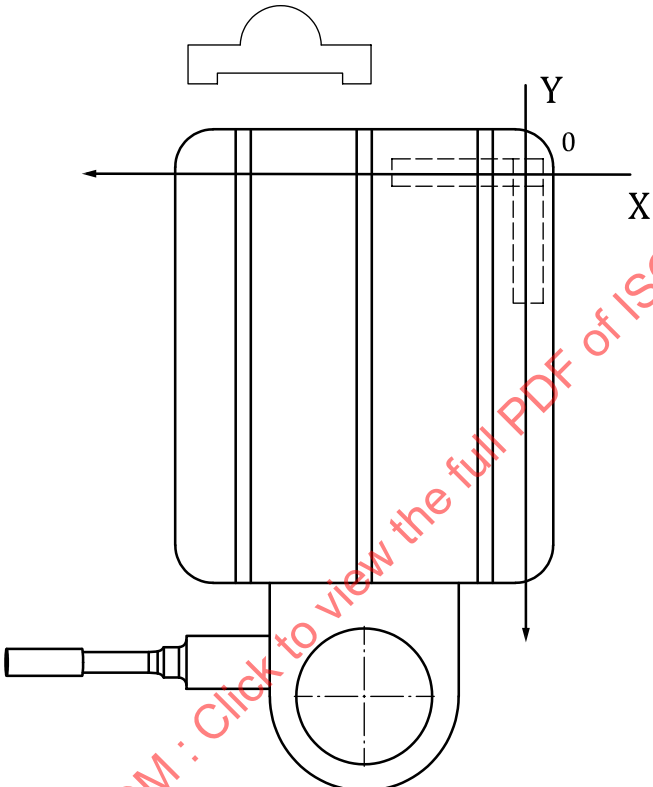
When establishing the tolerance for a measuring length different from that given in this document (see ISO 230-1:2012, 4.1), it shall be taken into consideration that the minimum value of tolerance is 0,010.

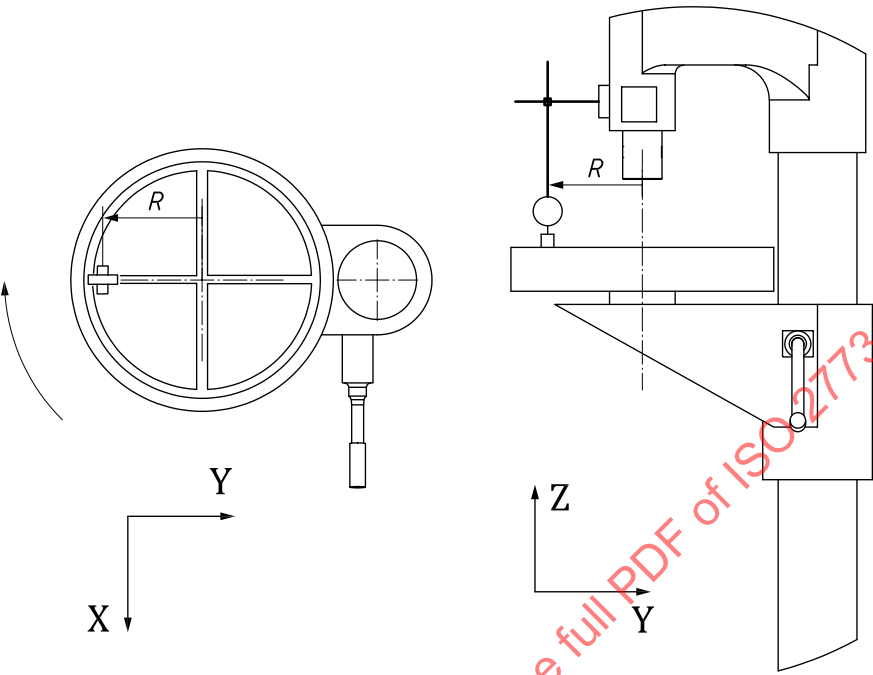
5.7 Levelling

Prior to conducting tests on a pillar type vertical drilling machine, the machine should be levelled according to the recommendations of the manufacturer/supplier (see ISO 230-1:2012, 6.1.2).

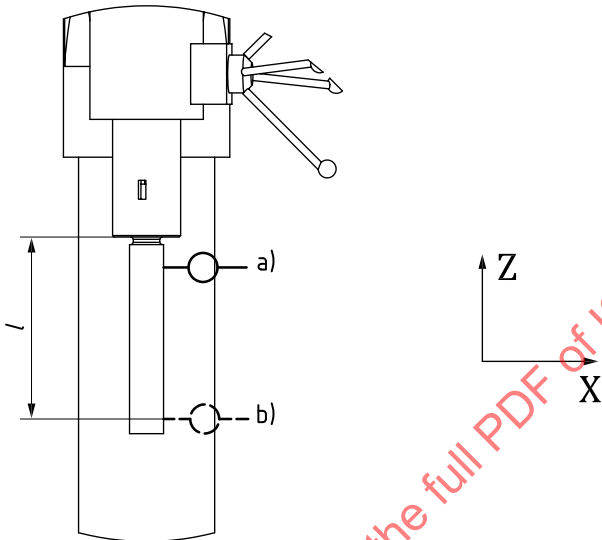
6 Test conditions and permissible deviations

6.1 Table

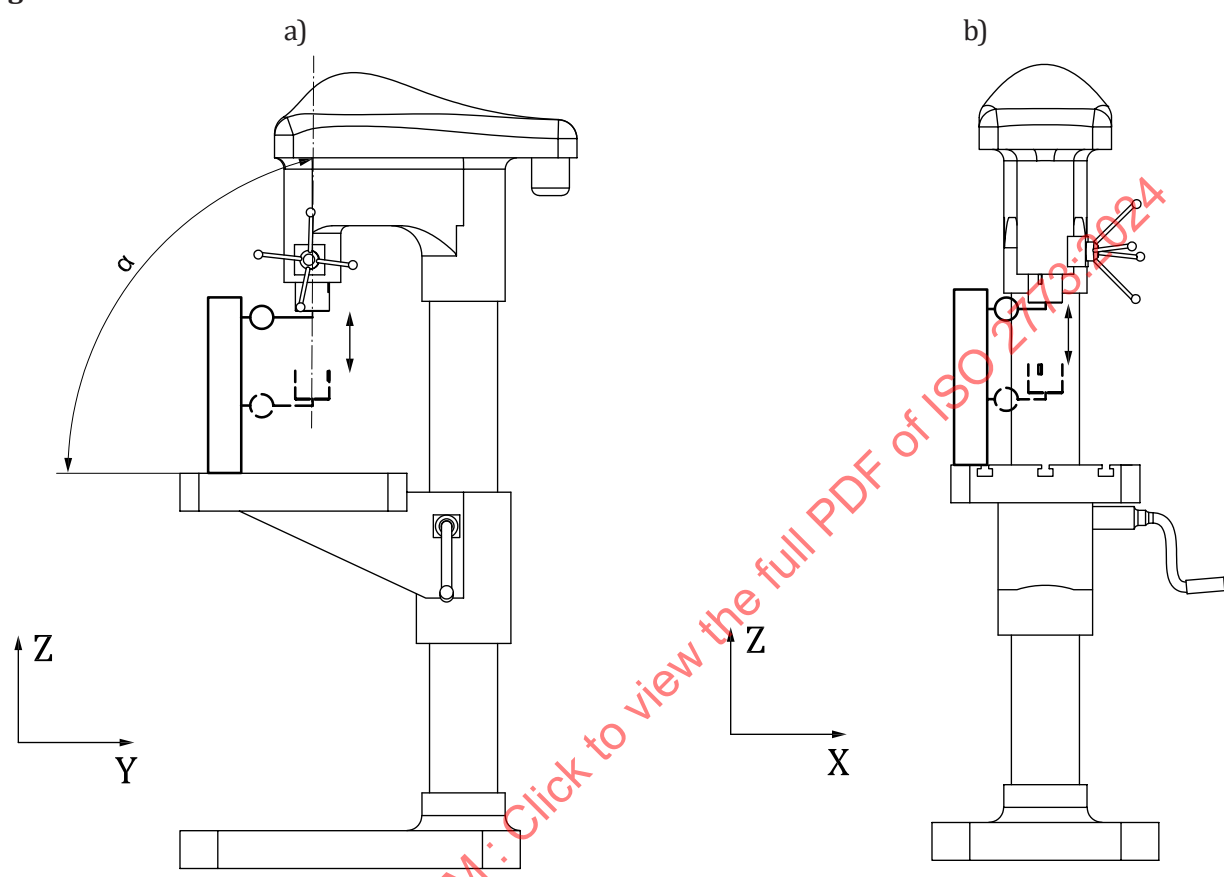
Object Checking of flatness of the table surface (and of the base surface if it is machined).		G1
Diagram 		
Tolerance 0,030 for a measuring area of up to 300 × 300 Total tolerance: 0,050 (flat or concave)		Measured error
Measuring instruments Precision level or straightedge and gauge blocks.		
Observations and references to ISO 230-1:2012, 12.2.3 and 12.2.4		

Object Measurement of face run out of the rotating table (for machines having this feature).		G2
Diagram 		
Key R radial measuring distance		
Tolerance 0,075 for $R = 150$		Measured error for $R =$
Measuring instruments Gauge block and dial gauge.		
Observations and references to ISO 230-1:2012, 12.5.2 and ISO 230-7:2015, 3.4.5 Set the dial gauge base on the spindle head and lock the head to have the best possible stiffness. Place a gauge block on the table, against the dial gauge at the maximum achievable radius (R) of the face and record the dial gauge reading. For a complete table rotation, at least eight measurements should be taken at roughly equal angular intervals. The measured error is the total difference between the dial gauge's minimum and maximum readings.		

6.2 Spindle (quill)

Object Measurement of run-out of the internal taper of the spindle: a) near the spindle nose; b) at a distance of 250 from the spindle nose.		G3
Diagram 		
Key <i>l</i> distance from the spindle nose		
Tolerance a) 0,020 b) 0,035		Measured error a) b)
Measuring instruments Dial gauge and test mandrel.		
Observations and references to ISO 230-1:2012, 12.5.3 and ISO/TR 230-11:2018 For details of the test, reference should be made to ISO 230-1:2012, 12.5.3.		

Object	G4
Checking of squareness of the spindle axis to the table surface and to the base surface (if it is machined):	
a) in the plane of symmetry of the machine (YZ plane);	
b) in the plane perpendicular to the plane of symmetry of the machine (ZX plane).	
Diagram	
Key	
1	upper position
2	lower position
3	base surface
α	angle between the table and Z-axis
Tolerance for positions 1), 2) and 3)	
a) Distance between the two points touched: 0,060/300 with $\alpha \leq 90^\circ$ (since cutting forces will increase α)	
b) Distance between the two points touched: 0,060/300	
Measuring instruments Dial gauge and straightedge.	
Observations and references to ISO 230-1:2012, 12.4.1 and 12.4.8 Squareness checking should be carried out first with the table in the upper position 1 and then in the lower position 2 and base surface 3 by varying the length of support arm of the dial gauge. The quill and table are locked.	

Object Checking of squareness of the quill motion (Z-axis), if available, to the table surface: a) in the plane of symmetry of the machine (YZ plane); b) in the plane perpendicular to the plane of symmetry of the machine (ZX plane).		G5
Diagram 		
Key α angle between the table surface and the quill axis (Z-axis)		
Tolerance a) 0,100/300 with $\alpha \leq 90^\circ$ (since cutting forces will increase α) b) 0,100/300		Measured error a) b)
Measuring instruments Dial gauge and cylindrical square.		
Observations and references to ISO 230-1:2012, 12.4.5 The table is locked in mid-position. The spindle head (for machines having elevating spindle head) is locked.		