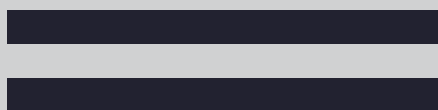


SVENSK STANDARD

SS-ISO 17543-1:2020

**Verktygsmaskiner – Geometrisk kontroll av universalhuvuden –
Del 1: Tillsatshuvuden för maskiner med horisontell spindel
(horisontell Z-axel) (ISO 17543-1:2020, IDT)**

**Machine tools – Test conditions for universal spindle heads –
Part 1: Accessory heads for machines with horizontal spindle
(horizontal Z-axis) (ISO 17543-1:2020, IDT)**



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Den internationella standarden ISO 17543-1:2020 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av ISO 17543-1:2020.

The International Standard ISO 17543-1:2020 has the status of a Swedish Standard. This document contains the official English version of ISO 17543-1:2020.

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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 documents 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).

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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*.

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

Accessory spindle heads are used on machine tools such as milling and boring machines, machining centres, portal and gantry type machines, turning centres, with only one built-in spindle in the head or ram, providing fixed or indexing or tilting spindles which can be oriented in directions different from the built-in spindle axis.

In the same way as the built-in spindle, they can perform multiple machining operations including milling, boring, drilling, grinding and tapping, and, in some cases, automatic tool changing as well from a magazine or similar storage unit in accordance with a machining program.

Some types of heads allow to check only the resulting position of the spindle (as the fixed or indexing ones considered in [3.3](#), [3.4](#) and [3.5](#) and in tests G1 to G15), whereas for some others, i.e. those with continuous movement of the two rotary axes (as those considered in [3.6](#) and [3.7](#)). [Annexes A](#) and [B](#) allow to make additional analysis of the relative positions between axes and to check the accuracy of their offset compensation as well.

Machine tools — Test conditions for universal spindle heads —

Part 1:

Accessory heads for machines with horizontal spindle (horizontal Z-axis)

1 Scope

This document specifies, with reference to the ISO 230 series, some families of tests for accessory spindle heads used on machining centres or numerically controlled milling machines, etc., where applicable, with horizontal spindle (i.e. horizontal Z-axis). The tests considered in this document are also applicable to manual indexing heads.

This document establishes the tolerances or maximum acceptable values for the test results corresponding to general purpose and normal accuracy spindle heads used on different types of machines.

This document specifies several sets of procedures for geometric tests which can be carried out on different types of spindle heads for comparison, acceptance, maintenance, adjustments or any other purpose.

Grinding heads and facing heads are not included in the scope of this document.

This document deals only with the verification of geometric and positioning accuracy of the accessory spindle heads and does not apply to:

- the testing of the machine's head(s) operation (e.g. vibration, abnormal sound noise level, stick slip motion of components);
- the machine's spindle head(s) characteristics (e.g. speeds, feeds and accelerations) which are generally checked separately; or
- the verification of the machining capability under power.

Tests concerning the accuracy of finished test pieces are dealt with in other ISO standards.

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*

ISO 230-2:2014, *Test code for machine tools — Part 2: Determination of accuracy and repeatability of positioning of numerically controlled axes*

ISO 230-7:2015, *Test code for machine tools — Part 7: Geometric accuracy of axes of rotation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 230-1, ISO 230-2, ISO 230-7 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 universal head

spindle head with one or more spindles which are oriented, or can be oriented, parallel to more than one coordinate axis

Note 1 to entry: Terminological entries 3.3 to 3.8 define several types of universal heads which are mostly used on horizontal machining centres or numerically controlled milling machines.

Note 2 to entry: Table 1 shows the five possible orientations of the spindle parallel to the coordinate axes and a short definition of the relevant direction.

Table 1 — Spindle orientations

Coordinate axis	Direction	Definition
Z	Negative	Longitudinal
X	Positive	Left
X	Negative	Right
Y	Positive	Upward
Y	Negative	Downward

3.2 accessory head

spindle head which can be mounted in front of a ram or a head already provided with its own tool holding spindle

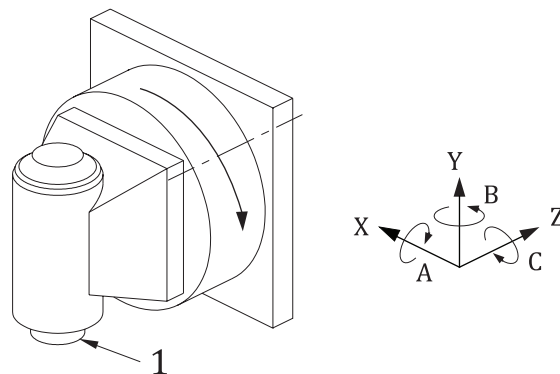
Note 1 to entry: The machine tool can perform machining operations both by its own spindle or by an accessory head, and several different accessory heads can be stored in a head store.

Note 2 to entry: Square head (3.3) through tilting head (3.8) define several types of accessory heads which are mostly used on horizontal machining centres or numerically controlled milling machines.

3.3 square head

spindle head with only one spindle perpendicular to the Z-axis, which can rotate around the Z-axis

Note 1 to entry: See Figure 1.



Key
1 spindle

Figure 1 — Square head

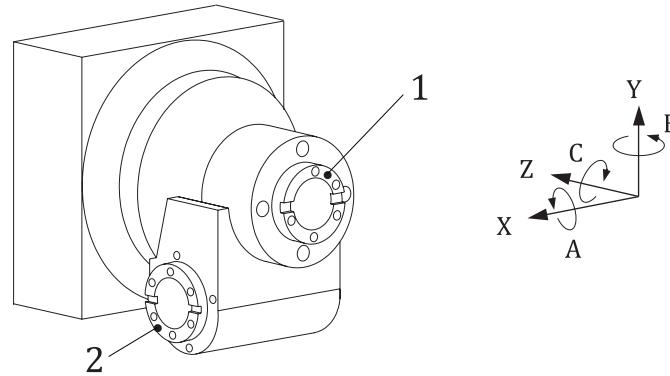
3.4

two-spindle square head

square head (3.3) with two spindles located perpendicular to each other, one parallel to the Z-axis and the other perpendicular to the Z-axis, which can rotate around the Z-axis

Note 1 to entry: The two spindles can be coplanar or skew to each other.

Note 2 to entry: See [Figure 2](#).



Key

- 1 longitudinal spindle
- 2 square spindle

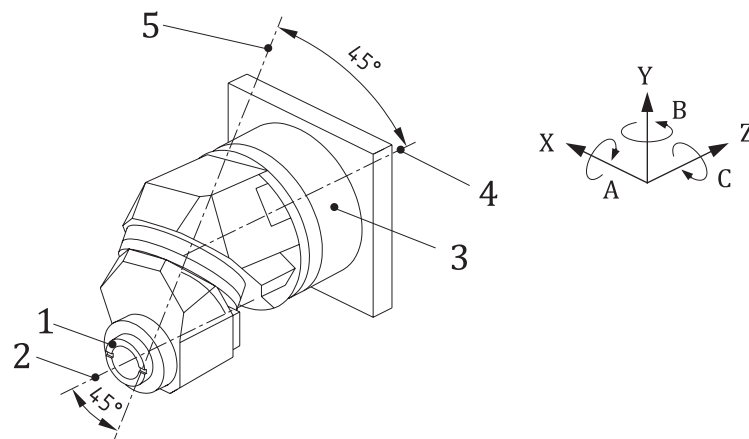
Figure 2 — Two-spindle square head

3.5

45° split indexing head

spindle head with mechanical indexing function in a plane inclined by 45° with respect to the horizontal Z-axis

Note 1 to entry: See [Figure 3](#).



Key

- 1 spindle
- 2 spindle axis S
- 3 head base
- 4 C-axis (head base rotation)
- 5 rotary D-axis (45° oriented)

Figure 3 — 45° split head

3.6
45° split continuous head

spindle head provided with continuous positioning function by two numerically controlled axes of rotation, namely the C-axis parallel to the horizontal Z-axis, and the D-axis in a plane inclined by 45° with respect to the Z-axis

Note 1 to entry: Tests in [Annex A](#) check all the geometric features (planes and axes) which contribute to the resulting angular position of the spindle, by-passing the positioning deviations of the two rotary axes; these tests are also intended for a deeper investigation on the *45° split indexing heads* ([3.5](#)), if their movements and locks allow to do it.

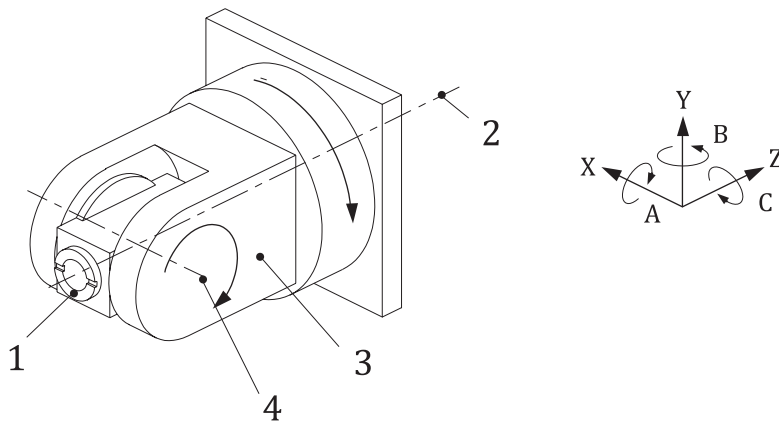
Note 2 to entry: See [Figure 3](#).

3.7
swivelling head

spindle head with two numerically controlled A-axis and C-axis perpendicular to each other

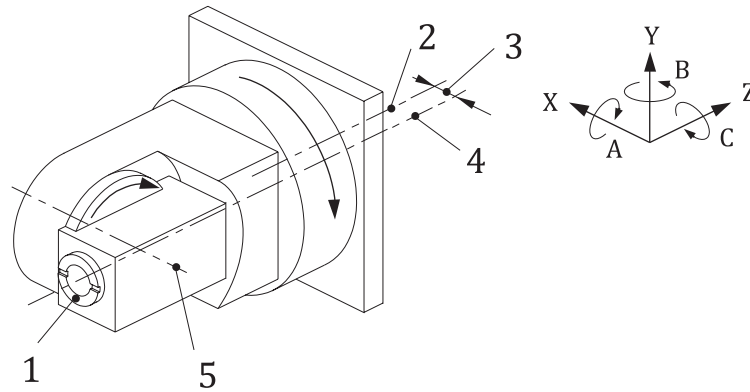
Note 1 to entry: The spindle axis S can be coplanar with C-axis (see [Figure 4](#)) or there can be a built-in offset between the spindle axis S and the C-axis. (see [Figure 5](#)).

Note 2 to entry: Tests in [Annex B](#) check all the relative positions between couples of axes, as A and C, spindle and A, spindle and C and their undesired offsets.



- Key**
- 1 spindle
 - 2 C-axis (yoke rotation)
 - 3 yoke body
 - 4 A-axis (head rotation)

Figure 4 — Swivelling head



Key

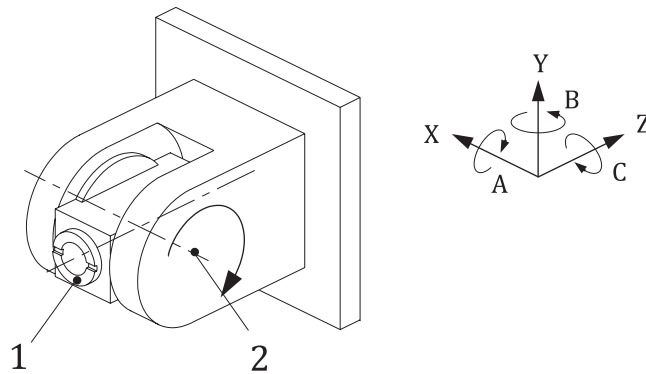
- 1 spindle
- 2 C-axis (yoke rotation)
- 3 built-in offset
- 4 spindle axis S
- 5 A-axis (head rotation)

Figure 5 — Swivelling head with spindle offset

3.8 tilting head

spindle head rotating only around the X-axis

Note 1 to entry: See [Figure 6](#).



Key

- 1 spindle
- 2 A-axis

Figure 6 — Tilting head

4 Preliminary remarks

4.1 Measurement units

In this document, all linear dimensions, deviations and corresponding tolerances are expressed in millimetres, angular dimensions are expressed in degrees and angular deviations and the corresponding tolerances are expressed in ratios as the primary method, but in some cases, microradians or arcseconds