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**Machine tools — Test conditions for  
horizontal spindle turret and single spindle  
automatic lathes — Testing of the accuracy**

*Machines-outils — Conditions d'essai des tours à tourelle revolver à broche  
horizontale et des tours automatiques monobroche — Contrôle de la  
précision*

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Contents	Page
1 Scope .....	1
2 Normative references .....	1
3 Definitions .....	2
4 Machine size range .....	8
5 Preliminary remarks .....	8
5.1 Measuring units .....	8
5.2 Reference to ISO 230-1 .....	8
5.3 Testing sequence .....	8
5.4 Tests to be performed .....	9
5.5 Measuring instruments .....	9
5.6 Machining tests .....	9
5.7 Machine levelling .....	9
6 Geometric tests .....	10
6.1 Work spindle .....	10
6.2 Slide bases .....	14
6.3 Turret .....	16
7 Machining tests .....	25
8 Testing of accuracy and repeatability of positioning by numerical control .....	28
<b>Annex A</b> (informative) Bibliography .....	30

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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.

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 6155 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 6155 cancels and replaces ISO 6155-1:1981 and ISO 6155-2:1986 which have been combined in this technical revision.

Annex A of this International Standard is for information only.

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## Introduction

ISO/TC 39/SC 2 recognized the fact that machines described in this International Standard represent obsolescent technology. Nevertheless, there is no Standard available for machines that represent current technology. Therefore, ISO/TC 39/SC2 responded to the request for revision of this Standard by combining ISO 6155 parts 1 and 2 into a single standard and adding positioning tests.

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# Machine tools — Test conditions for horizontal spindle turret and single spindle automatic lathes — Testing of the accuracy

## 1 Scope

This International Standard describes, with reference to ISO 230-1 and ISO 230-2, geometric tests, machining tests and tests for accuracy and repeatability of numerically-controlled positioning axes on general purpose and normal accuracy turret and single spindle automatic lathes. It also specifies the applicable tolerances corresponding to the above-mentioned tests.

This International Standard applies only to lathes with a multi-tool turret. This turret can be manually indexed, semi-automatically indexed by motion of the turret slide or automatically indexed by an independent control including numerical control. Lathes with sliding headstock are excluded from the scope, but lathes with numerical control are included as far as the contents of this International Standard are applicable.

This International Standard deals only with the verification of accuracy of the machine. It does not apply to the operational testing of the machine (vibration, abnormal noise, stick-slip motion of components, etc.) nor to machine characteristics (such as speeds, feeds, etc.) as such checks are generally carried out before testing the accuracy.

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## 2 Normative references

ISO 6155:1998

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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 68-1:—<sup>1)</sup>, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads.*

ISO 230-1:1996, *Test code for machine tools — Part 1: Geometric accuracy of machines operating under no-load or finishing conditions.*

ISO 230-2:1997, *Test code for machine tools — Part 2: Determination of accuracy and repeatability of positioning of numerically controlled axes.*

ISO 1101:—<sup>2)</sup>, *Geometrical Product Specifications (GPS) — Geometrical tolerancing — Generalities, definitions, symbols, indication on drawings.*

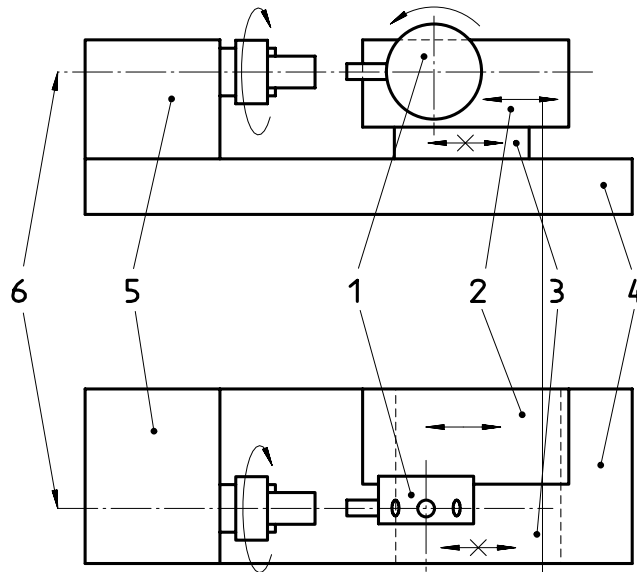
ISO 3442:1991, *Self-centring chucks for machine tools with two-piece jaws (tongue and groove type) — Sizes for interchangeability and acceptance test specifications.*

1) To be published. (Partial revision of ISO 68:1973)

2) To be published. (Revision of ISO 1101:1983)

3 Definitions

Some possible machine architectures referred to this International Standard are given in the following figures.

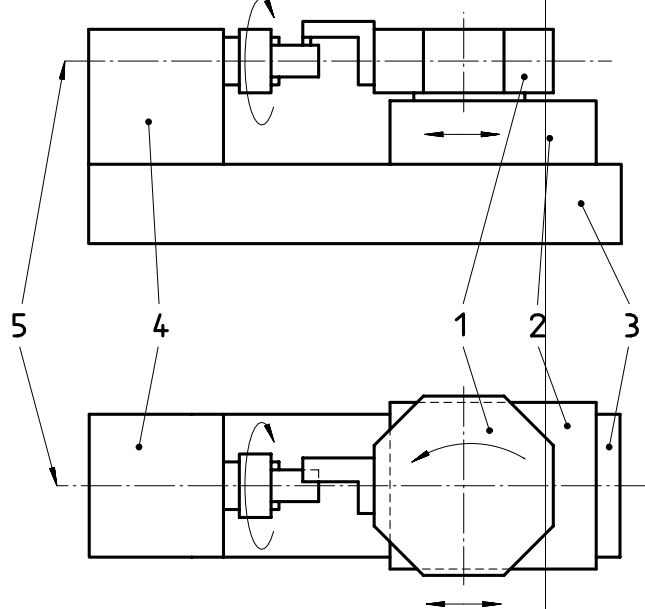


Key

- 1 Indexable turret
- 2 Small slide
- 3 Saddle with manual operation
- 4 Bed
- 5 Fixed headstock
- 6 Spindle axis

Figure 1 — Capstan Lathe

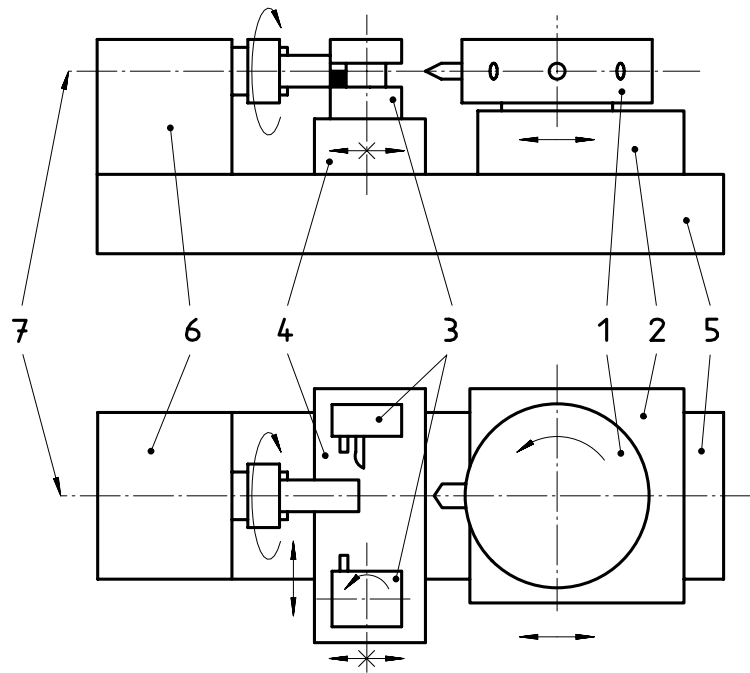
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Key

- 1 Turret
- 2 Saddle
- 3 Bed
- 4 Fixed headstock
- 5 Spindle axis

Figure 2 — Turret lathe



**Key**

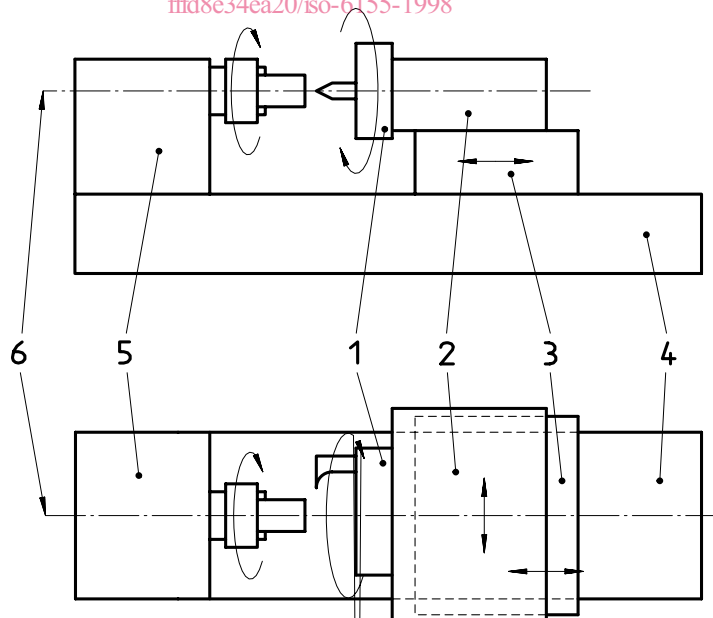
- |                               |                   |
|-------------------------------|-------------------|
| 1 Indexing turret             | 5 Bed             |
| 2 Saddle of turret            | 6 Fixed headstock |
| 3 Small turret or tool holder | 7 Spindle axis    |
| 4 Cross-slide saddle          |                   |

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**Figure 3 — Combination turret lathe**

ISO 6155:1998

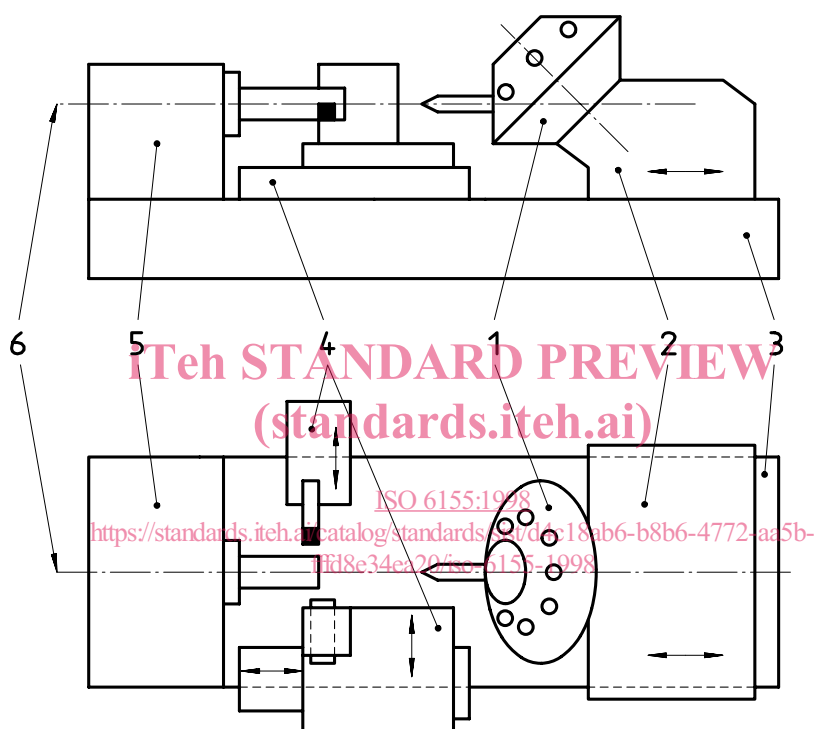
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**Key**

- |                       |                   |
|-----------------------|-------------------|
| 1 Indexing turret     | 4 Bed             |
| 2 Turret holder slide | 5 Fixed headstock |
| 3 Saddle              | 6 Spindle axis    |

**Figure 4 — Cross-feeding turret lathe**

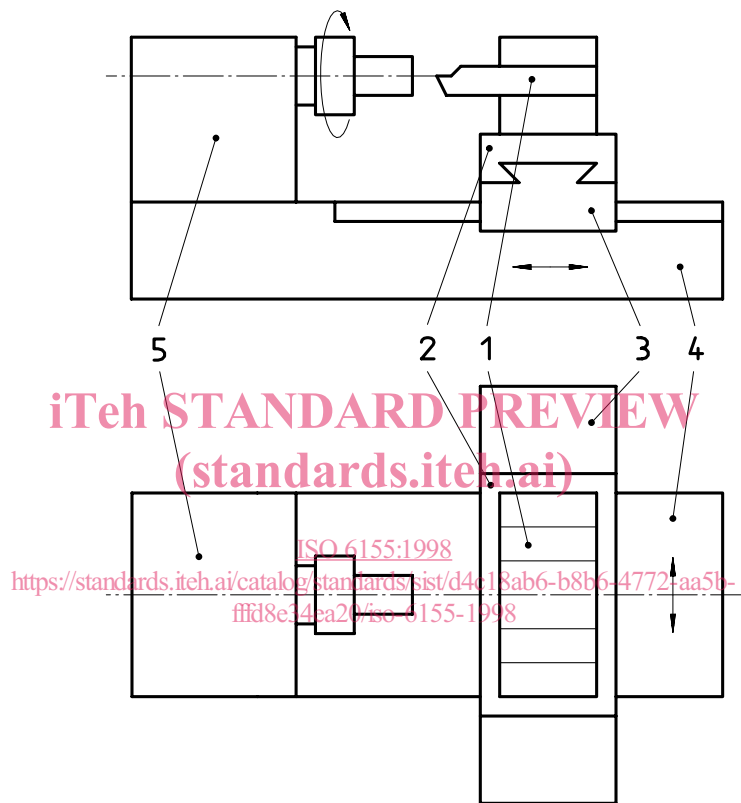


**Key**

- |                        |                            |
|------------------------|----------------------------|
| 1 Indexing turret      | 4 Independent cross-slides |
| 2 Turret holder saddle | 5 Fixed headstock          |
| 3 Bed                  | 6 Spindle axis             |

**Figure 5 — Single spindle automatic lathe**





**Key**

- 1 Linear turret
- 2 Cross slide
- 3 Saddle
- 4 Bed
- 5 Fixed headstock

**Figure 6 — Linear turret lathe**

All these types of lathe are manufactured with a variety of turret configurations. The most common types of configurations are designated types A, B, C (see figure 7) and D and are described below.

**Turret type A:** Circular or multi-sided turret whose axis of rotation intersects the work spindle axis. Whether or not the turret axis is perpendicular to the work spindle axis, the axis of each turret bore must align with the work spindle axis in its working position. Tools may be located in the bore or recess, attached to the flat turret face or located and clamped in the bore itself.

**Turret type B:** Multi-sided turret whose axis of rotation does not intersect the work spindle axis but is parallel or at a right angle to it. Special toolholders mounted and located on the turret sides (faces) are required.

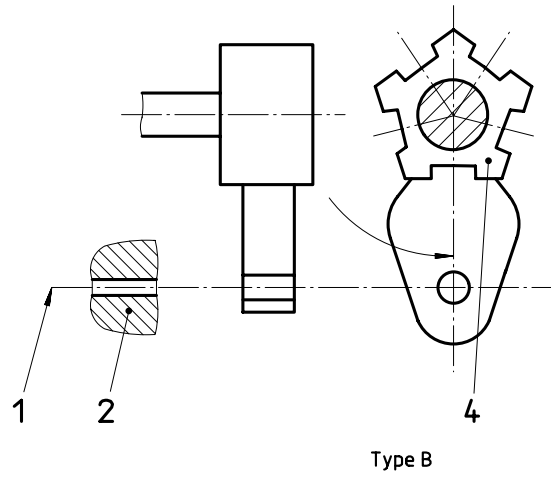
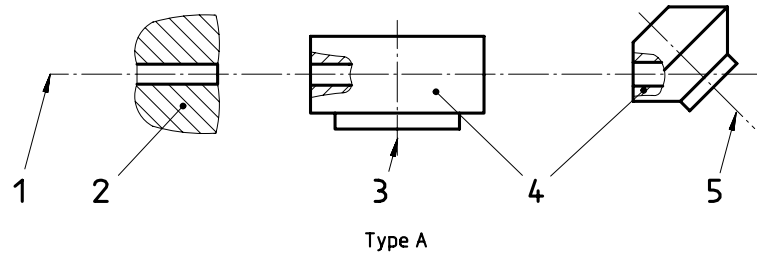
**Turret type C:** Circular (drum or disc type) turret whose axis of rotation is parallel to the work spindle axis. Tools are located in turret bores, which are parallel to the turret axis, and the turret axis is arranged so that the work spindle axis aligns with the axes of the turret bores in their working positions.

**Turret type D:** Linear turret where tools are set on the cross slide. The necessary tool comes to the working position by the cross slide linear movement (see figure 6).

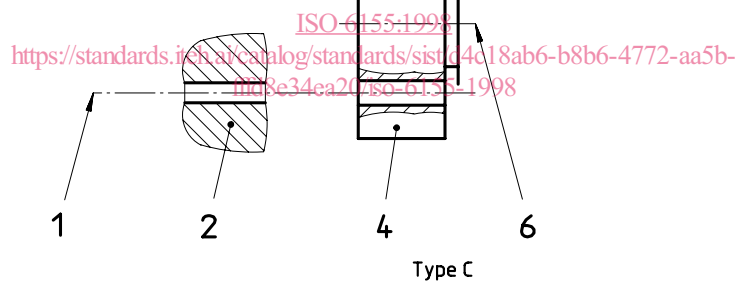
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**Key**

- |                             |                        |
|-----------------------------|------------------------|
| 1 Spindle axis              | 4 Turrets              |
| 2 Spindle                   | 5 Oblique turret axis  |
| 3 Perpendicular turret axis | 6 Parallel turret axis |

**Figure 7 — Different types of turret**

## 4 Machine size range

The machines are classified into three ranges, on the basis of the criteria indicated in table 1.

**Table 1 — Criteria and ranges**

Criteria	Range 0	Range 1	Range 2
Swing diameter over the bed	$\leq 250$	$250 < D \leq 400$	$400 < D \leq 800$
Nominal bar diameter	$\leq 25$	$25 < d \leq 63$	$63 < d$
Nominal chuck diameter as defined in ISO 3442	$\leq 125$	$125 < d \leq 250$	$250 < d$
NOTE — The choice of the criterion is at the supplier/manufacturer's discretion.			

## 5 Preliminary remarks

### 5.1 Measuring units

In this International Standard, all linear dimensions, deviations and corresponding tolerances are expressed in millimeters; angular dimensions are expressed in degrees, and angular deviations and the corresponding tolerances are expressed in ratios but in some cases microradians or arcseconds may be used for clarification purposes. The equivalence of the following expressions should always be kept in mind.

$$0,010/1\ 000 = 10 \times 10^{-6} = 10 \mu\text{rad} \approx 2''$$

### 5.2 Reference to ISO 230-1

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

In the "Observations" block of the tests described in the following sections, the instructions are followed by a reference to the corresponding clause in ISO 230-1 in cases where the test concerned is in compliance with the specifications of that part of ISO 230.

### 5.3 Testing sequence

The sequence in which the tests are presented in this International Standard 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.