## 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. www.iso.org/directives

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 39, *machine tools*, Subcommittee SC 10, *Safety*.

This second edition cancels and replaces the first edition (ISO 23125:2010), of which it constitutes a minor revision. It also incorporates the Amendment ISO 23125:2010/Amd. 1:2012.

The International Standards produced by ISO/TC 39/SC 10 in collaboration with CEN/TC 143 are particular to machine tools and complement the relevant A and B standards on the subject of general safety (see Introduction to ISO 12100 for a description of type-A, -B and -C standards).

This International Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

This corrected version of ISO 23125:2015 incorporates the following corrections: in 5.3 a) 2), normative references to IEC 60204-1 have been substituted for those to IEC 60529 in two instances, and the year of publication of IEC 60529 corrected from 2003 to 2013 in the remaining reference to that standard.

## Introduction

This International Standard has been prepared to be a Harmonized Standard to provide one means of conforming to the Essential Safety Requirements of the Machinery Directive of the European Union and associated EFTA regulations.

This International Standard is a type-C standard as defined in ISO 12100:2010.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered is indicated in the Scope of this International Standard. In addition, turning machines shall comply as appropriate with ISO 12100:2010 for hazards which are not covered by this International Standard.

When provisions of this type-C standard are different from those which are stated in type-A or -B standards, the provisions of this type-C standard take precedence over the provisions of the other International Standards for machines that have been designed and built in accordance with the provisions of this type-C standard.

This International Standard makes reference to the “safety categories” in EN 954-1:1996 as resistance to faults and their subsequent behaviour in the fault condition together with the “performance level” defined in ISO 13849-1:2006 in terms of probability of dangerous failure per hour. It is the decision of the user of this International Standard to apply “safety categories” or “performance levels”.

The requirements of this International Standard concern designers, manufacturers, suppliers and importers of machines described in the Scope.

This International Standard also includes a list of informative items to be provided by the manufacturer to the user.

The requirements for a new mode of operation, Mode 3 “manual intervention machining mode” will be discussed in the future.

## 1 Scope

This International Standard specifies the requirements and/or measures to eliminate the hazards or reduce the risks in the following groups of turning machines and turning centres, which are designed primarily to shape metal by cutting.

— **Group 1**: Manually controlled turning machines without numerical control.

— **Group 2**: Manually controlled turning machines with limited numerically controlled capability.

— **Group 3**: Numerically controlled turning machines and turning centres.

— **Group 4**: Single- or multi-spindle automatic turning machines.

NOTE 1 For detailed information on the machine groups, see the definitions in 3.4 and mandatory and optional modes of operation in3.3.

NOTE 2 Requirements in this International Standard are, in general, applicable to all groups of turning machines. If requirements are applicable to some special group(s) of turning machines only, then the special group(s) of turning machine(s) is/are specified.

NOTE 3 Hazards arising from other metalworking processes (e.g. grinding and laser processing) are covered by other International Standards (see Bibliography).

This International Standard covers the significant hazards listed in Clause 4 and applies to ancillary devices (e.g. for workpieces, tools and work clamping devices, handling devices and chip handling equipment), which are integral to the machine.

This International Standard also applies to machines which are integrated into an automatic production line or turning cell inasmuch as the hazards and risks arising are comparable to those of machines working separately.

This International Standard also includes a minimum list of safety-relevant information which the manufacturer has to provide to the user. See also ISO 12100:2010, Figure 2, which illustrates the interaction of manufacturer's and user's responsibility for the operational safety.

The user's responsibility to identify specific hazards (e.g. fire and explosion) and reduce the associated risks can be critical (e.g. whether the central extraction system is working correctly).

Where additional processes (milling, grinding, etc.) are involved, this International Standard can be taken as a basis for safety requirements; for specific information see the Bibliography.

This International Standard applies to machines that are manufactured after the date of issue of this International Standard.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable to its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 230-5:2000, *Test code for machine tools — Part 5: Determination of the noise emission*

ISO 447:1984, *Machine tools — Direction of operation of controls*

ISO 702 (all parts), *Machine tools — Connecting dimensions of spindle noses and work holding chucks*

ISO 841:2001, *Industrial automation systems and integration — Numerical control of machines — Coordinate system and motion nomenclature*

ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 3746:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 6385:2004, *Ergonomic principles in the design of work systems*

ISO 8525:2008, *Airborne noise emitted by machine tools — Operating conditions for metal-cutting machines*

ISO 9241 (all parts), *Ergonomics of human-system interaction*

ISO 9355-1, *Ergonomic requirements for the design of displays and control actuators — Part 1: Human interactions with displays and control actuators*

ISO 9355-2, *Ergonomic requirements for the design of displays and control actuators — Part 2: Displays*

ISO 9355-3, *Ergonomic requirements for the design of displays and control actuators — Part 3: Control actuators*

ISO 10218-2:2011, *Robots and robotic devices — Safety requirements for industrial robots — Part 2: Robot systems and integration*

ISO 11161:2007+Amd.1:2010, *Safety of machinery — Integrated manufacturing systems — Basic requirements*

ISO 11202:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections*

ISO 11204:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections*

ISO 11228 (all parts), *Ergonomics — Manual handling*

ISO/TR 11688-1:1995, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13849-2:2003, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

ISO 13850:2006, *Safety of machinery — Emergency stop — Principles for design*

ISO 13851:2002, *Safety of machinery — Two-hand control devices — Functional aspects and design principles*

ISO 13854:1996, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

ISO 13855:2010, *Safety of machinery — Positioning of safeguards with respect to the approach speeds of parts of the human body*

ISO 13856-2:2005, *Safety of machinery — Pressure-sensitive protective devices — Part 2: General principles for the design and testing of pressure-sensitive edges and pressure-sensitive bars*

ISO 13856-3:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 3: General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices*

ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 14118:2000, *Safety of machinery — Prevention of unexpected start-up*

ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

ISO 14120:2002, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 14122-1:2001, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels*

ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

ISO 14122-3:2001, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

ISO 14122-4:2004, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders*

ISO 14159:2002, *Safety of machinery — Hygiene requirements for the design of machinery*

ISO 15534-1:2000, *Ergonomic design for the safety of machinery — Part 1: Principles for determining the dimensions required for openings for whole-body access into machinery*

ISO 15534-2:2000, *Ergonomic design for the safety of machinery — Part 2: Principles for determining the dimensions required for access openings*

ISO 16156:2004, *Machine-tools safety — Safety requirements for the design and construction of work holding chucks*

IEC 60204-1:2009, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60825-1:2007, *Safety of laser products — Part 1: Equipment classification and requirements*

IEC 61000-6-2:2005, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments*

IEC 61000-6-4:2011, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments*

IEC 61800-5-2:2007, *Adjustable speed electrical power drive systems — Part 5-2: Safety requirements — Functional*

EN 954-1:1996, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

EN 1837:1999+A1:2009, *Safety of machinery — Integral lighting of machines*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010, ISO 13849-1:2006 and EN 954-1:1996 and the following apply.

### 3.1 General terms

**3.1.1**
**turning machine**
machine tool in which the principal movement is the rotation of the workpiece against the stationary cutting tool(s)

**3.1.2**
**manual control**
mode of operation where each movement of the machine is individually initiated and controlled by the operator

**3.1.3**
**manually controlled turning machine**
**turning machine** (3.1.1) for which process steps for the machining are controlled or started by an operator without support by an NC-machining program

**3.1.4**
**numerical control**
**NC**
**computerized numerical control**
**CNC**
automatic control of a process performed by a device that makes use of numerical data introduced while the operation is in progress

[SOURCE: ISO 2806:1994, 2.1.1]

**3.1.5**
**numerically controlled turning machine**
**NC turning machine**
turning machine that operates under **numerical control** (3.1.4) or computerized numerical control (CNC)

**3.1.6**
**turning centre**
**numerically controlled turning machine** (3.1.5) equipped with power-driven tools and the capability to orientate the work holding spindle around its axis

Note 1 to entry: A turning centre can also include, but is not limited to, functions such as gauging, burnishing, threading, boring, milling, grinding and drilling.

Note 2 to entry: If grinding processes are involved, see EN 13218 for additional safety measures.

**3.1.7**
**work zone**
space where metal cutting is to take place

**3.1.8**
**performance level**
**PL**
discrete level used to specify the ability of safety-related parts of control systems to perform a safety function under foreseeable conditions

[SOURCE: ISO 13849-1:2006, 3.1.23]

**3.1.9**
**mean time to dangerous failure**
**$MTTF_d$**
expectation of the mean time to dangerous failure

[SOURCE: ISO 13849-1:2006, 3.1.25]

**3.1.10**
**category**
classification of safety-related parts of a control system in respect of its resistance to fault and its subsequent behaviour in the fault condition, and which is achieved by the structural arrangement of the parts and/or their reliability

[SOURCE: EN 954-1:1996, 3.2.]

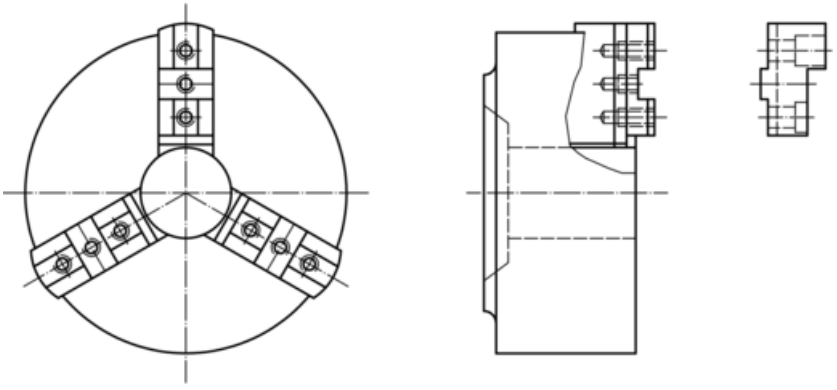
## 3.2 Terms related to parts of turning machines

**3.2.1**
**vision panel**
window provided in a guard through which the operator can view the **work zone** (3.1.7) or other areas of the machine

**3.2.2**
**chuck**
clamping device in which workpieces are clamped with the aid of either manual energy or pneumatic, hydraulic or electric energy

Note 1 to entry: See Figure 1.

**Figure 1 — Chuck**

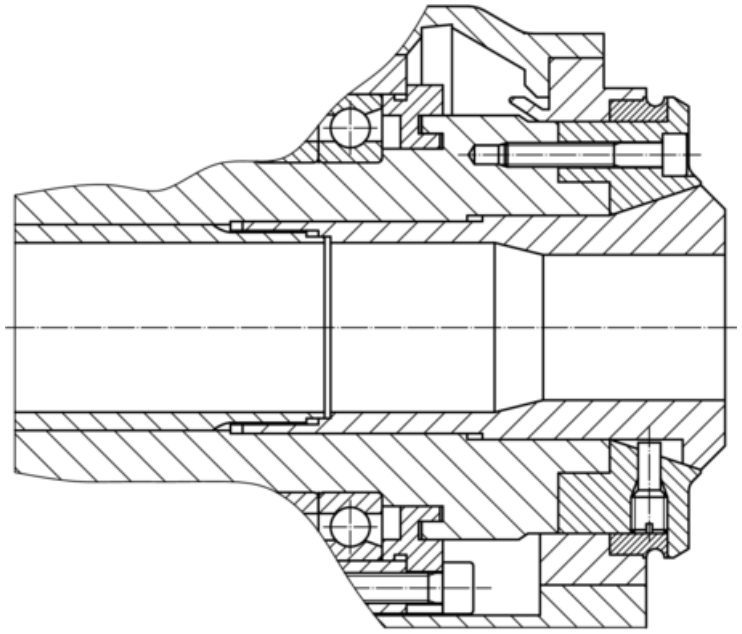


NOTE The chuck with 3 jaws is an example only, a chuck can have 2, 3, 4 or 6 jaws.

**3.2.3**
**collet**
device designed to hold the bar into the turning spindle, e.g. by pressure bar or draw bar

Note 1 to entry: See Figure 2.

**Figure 2 — Collet**



| Group No. | Group name | Subclause in which group is defined | Subdivision in sizes | Subclause in which size is defined |
|---|---|---|---|---|
| Mode of operation | Group 1<br>Manually controlled turning machines without numerical control | Group 2<br>Manually controlled turning machines with limited capability of numerical control | Group 3<br>Numerically controlled turning machines and turning centres | Group 4<br>Single- or multi-spindle automatic turning machines |

**3.2.4**
**electronic handwheel**
manually operated control device which initiates and maintains an axis movement by pulse generation sent to the numerical **control** (3.1.4) during its rotation

### 3.3 Terms related to modes of operation — Mandatory and optional modes of operation for turning machines

NOTE Table 1 gives an overview of the mandatory, optional or not allowed modes of operations for turning machines. Table 1 is mandatory.

**Table 1 — Overview of turning machine groups and modes of operation**

| Mode of operation | Turning machines | | | |
|---|---|---|---|---|
| | **Group 1**<br>Manually controlled turning machines without numerical control | **Group 2**<br>Manually controlled turning machines with limited capability of numerical control | **Group 3**<br>Numerically controlled turning machines and turning centres | **Group 4**<br>Single- or multi-spindle automatic turning machines |
| Mode 0<br>manual mode | Mandatory | Mandatory | Optional | Not allowed |
| Mode 1<br>automatic mode | Not allowed | Mandatory<br>limited Mode 1 | Mandatory | Mandatory |
| Mode 2[a]<br>setting mode | Not allowed | Optional | Mandatory | Mandatory |
| Service mode[a] | Not allowed | Optional | Optional | Optional |

[a] These modes are key protected and only available for well-trained and qualified staff (see 6.2.1). In order to allocate the access, it may be necessary to provide different key switches (or other appropriate access means) for a turning machine.

For example:

— Key 1: Access to setting mode (and automatic mode) for setting staff;

— Key 2: Access to CNC program code and CNC-parameter modifications to adequately trained staff [see 5.8 b) 2)];

— Key 3: Access to service mode for service staff.

NOTE In most applications, key switch 1 (setting mode) and key switch 2 (CNC program code access) can be identical.

**3.3.1**
**Mode 0: manual mode**
operation of the machine by the operator without NC functions or non-automatic mode of the machine axes, where the operator has control over the machining process without the use of pre-programmed operations

**3.3.2**
**Mode 1: automatic mode**
automatic, programmed, sequential operation of the machine with the facility for manual or automatic loading/unloading of workpiece and tools, until stopped by program or operator

**3.3.3**
**Mode 2: setting mode**
mode of operation in which adjustments for the subsequent machining process are performed by the operator

Note 1 to entry: Checking of tool or workpiece position (e.g. by touching the workpiece with a probe or tool) are procedures of the setting mode (see 5.2.4.4).

**3.3.4**
**service mode**
mode for service and maintenance tasks, such as axis calibration by laser, ballbar testing and spindle error analysis

Note 1 to entry: In service mode, the machining of a workpiece is not allowed (see 5.2.4.5).

### 3.4 Terms related to sizes and groups of turning machines defined

NOTE With regard to the relevant hazards, the turning machines are subdivided into four different groups. Group 1, Group 2 and Group 3 turning machines can then be subdivided into “small” or “large” sizes. See the overview in Table 2.

**Table 2 — Overview of sizes and groups of turning machines**

| Group No. | Group name | Subclause in which group is defined | Subdivision in sizes | Subclause in which size is defined |
|---|---|---|---|---|
| **Group 1** | Manually controlled turning machines without numerical control | 3.4.3 | Small<br>Large | 3.4.1<br>3.4.2 |
| **Group 2** | Manually controlled turning machines with limited numerically controlled capability | 3.4.4 | Small<br>Large | 3.4.1<br>3.4.2 |
| **Group 3** | Numerically controlled turning machines and turning centres | 3.4.5 | Small<br>Large | 3.4.1<br>3.4.2 |

| Group No. | Group name | Subclause in which group is defined | Subdivision in sizes | Subclause in which size is defined |
|---|---|---|---|---|
| **Group 4** | Single- or multi-spindle automatic turning machines | 3.4.6 | No subdivision | — |

**3.4.1**
**small turning machine**
turning machine within the following dimensional limits:

— horizontal spindle turning machines and turning centres with distance between centres (BC) up to and including 2 000 mm and which are designed to accept workpiece clamping devices of up to and including 500 mm outside diameter;

— vertical turning machines, inverted spindle turning machines including pick-up machines and turning centres, which are designed to accept workpiece clamping devices of up to and including 500 mm outside diameter

**3.4.2**
**large turning machine**
turning machine which exceeds the following dimensional limits:

— horizontal spindle turning machines and turning centres with distance between centres exceeding 2 000 mm or which are designed to accept work clamping devices exceeding 500 mm outside diameter;

— vertical turning machines, inverted spindle turning machines, including pick-up machines, and turning centres which are designed to accept work clamping devices exceeding 500 mm outside diameter

**3.4.3**
**Group 1: manually controlled turning machine without numerical control**
turning machine, where all movements are initiated and controlled by the operator, one at a time

Note 1 to entry: This group of turning machines may be equipped with the following features:

— mechanical facilities for mechanical feed or thread cutting;

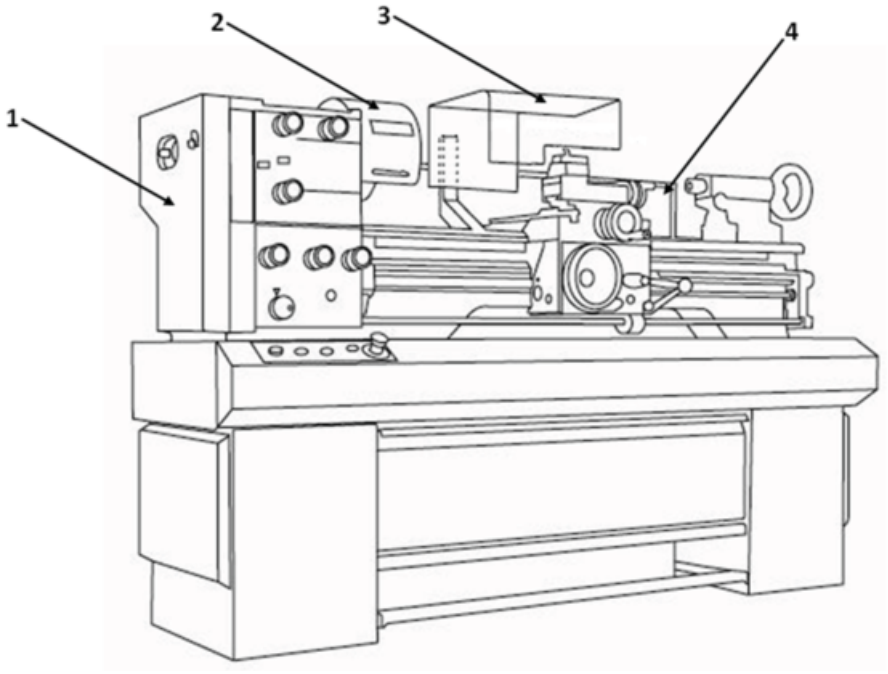
— electronic facilities for constant surface speed (CSS);

— copying attachments (cam, template, etc.);

— but shall have no limited or full numeric control system (NC).

For mandatory and optional modes of operation for this group of turning machines, see Table 1.

**Figure 3 — Group 1: Example of a manually controlled, horizontal spindle turning machine**




**Key**

| | | | |
|---|---|---|---|
| 1 | rear spindle end guard | 3 | front chip/splash guard (saddle mounted) |
| 2 | chuck guard | 4 | rear chip/splash guard |

**3.4.4**
**Group 2: manually controlled turning machine with limited numerically controlled capability**
turning machine that can be operated as a Group 1 machine by the use of electronic handwheels or as a machine with limited NC control by operating controls on NC panel

Note 1 to entry: This group of turning machines may be equipped with some or all of the features of Group 1 turning machines (manual turning machines without NC) and the following:

— a limited numeric control system (NC) providing:

— constant surface speed (CSS);

— axis interpolation (i.e. copying/predefined profiling);

— thread cutting cycles.

However, the following features shall not be provided:

— automatic program start;

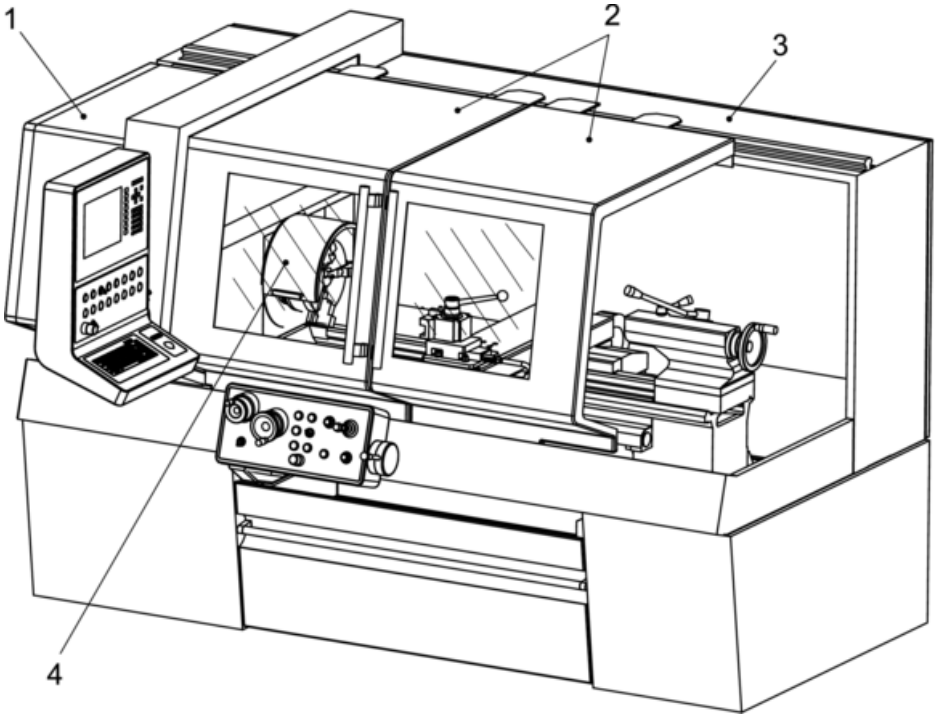
— automatic initiated tool change, turret indexing or tailstock quill advance or retract;

— unlimited rapid axis movements;

— automatic workpiece change or bar feed system.

For mandatory and optional modes of operation for this group of turning machines, see Table 1.

**Figure 4 — Group 2: Example of a manually controlled turning machine with limited NC capability**




**Key**

| | | | |
|---|---|---|---|
| 1 | rear spindle guard | 3 | rear guard |
| 2 | front guard | 4 | chuck guard |

NOTE The partial enclosure comprises 2 and 3.

**3.4.5**
**Group 3: numerically controlled turning machine and turning centre**
turning machine with numerical control (NC) providing automatic function

Note 1 to entry: This group of turning machines may be equipped with some or all of the following features:

— a numeric control system (NC);

— automatic workpiece change or bar feed systems;

— automatic tool magazine, tool transfer and tool changing systems;

— automatic turret indexing or tailstock quill advance or retract;

— counter work holding spindle;

— double work holding spindle;

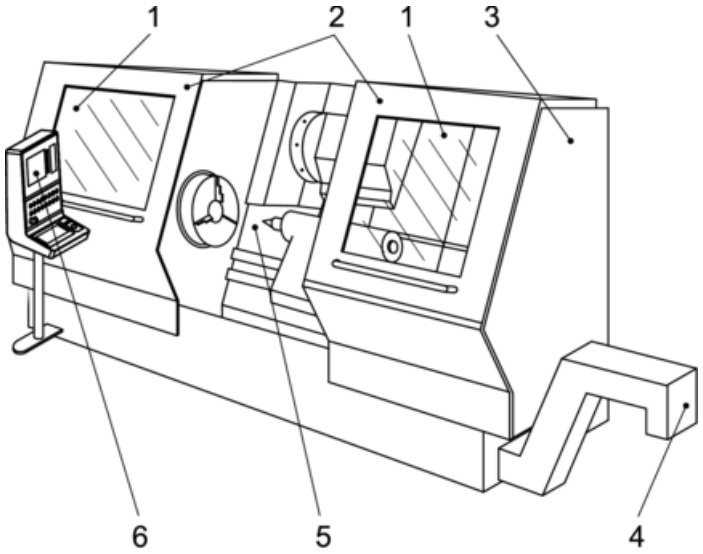
— secondary machining operations (e.g. milling, grinding, drilling);

— ancillary handling devices.

However, it shall not be equipped with a rotating work holding spindle carrier, which moves the work holding spindle(s) from station to station.

For mandatory and optional modes of operation for this group of turning machines, see Table 1.

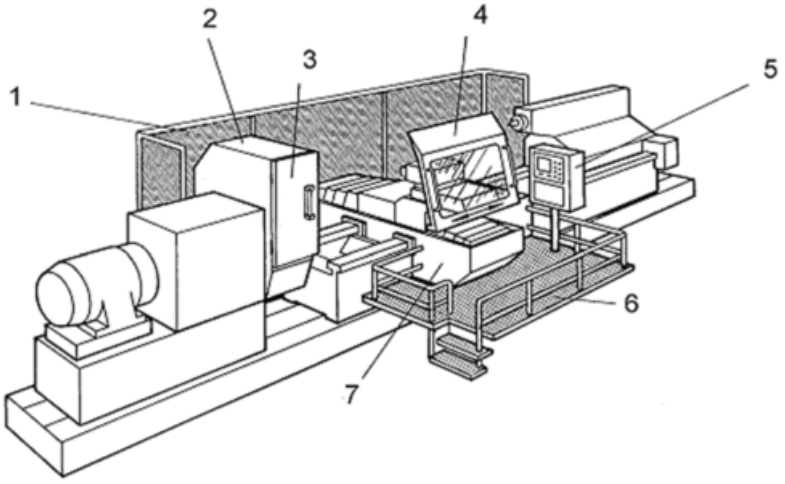
**Figure 5 — Group 3: Example of a small horizontal turning machine**




**Key**

| | | | |
|---|---|---|---|
| 1 | vision panel | 4 | chips conveyor |
| 2 | interlocked movable guards | 5 | work zone |
| 3 | enclosing guard | 6 | main control panel |

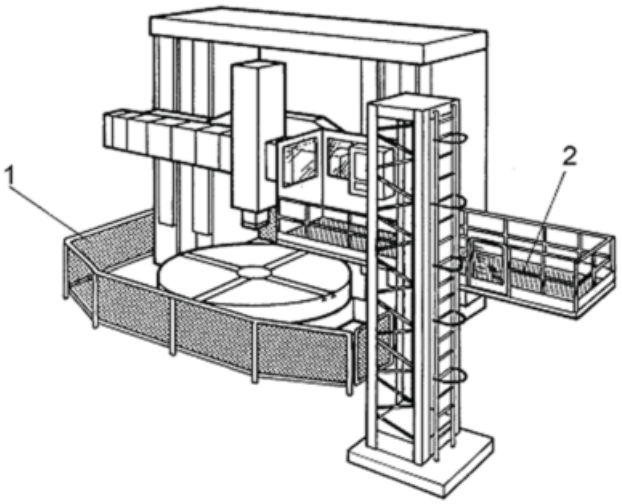
**Figure 6 — Group 3: Example of a large horizontal NC turning machine**




**Key**

| | | | |
|---|---|---|---|
| 1 | rear guard | 5 | control panel |
| 2 | chuck guard | 6 | platform |
| 3 | access door | 7 | saddle |
| 4 | front guard | | |

**Figure 7 — Group 3: Example of a large vertical NC turning machine with operating platform**




**Key**

1 perimeter fence
2 platform

**3.4.6**
**Group 4: single- or multi-spindle automatic turning machine**
horizontal or vertical spindle turning machine, designed for batch production of parts according to an NC and/or mechanical (e.g. by cam or template) pre-set program with fixed sequence of operation

Note 1 to entry: This group of turning machines may be equipped with some or all of the following features:

— a spindle carrier holding two or more work holding spindles, equipped with either power-operated chucks or collets;

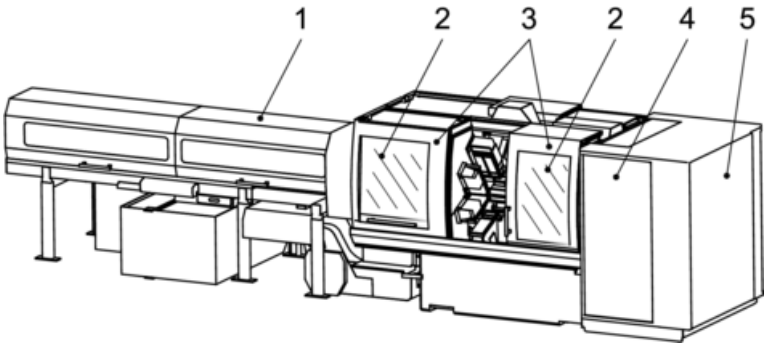
— additional features e.g. power-driven tools and one or more sub/counter spindles;

— the drives of the work holding spindles, tool spindles and sub/counter spindles may be by common and/or independent drives.

However, this group shall have no manually operated chucks.

For mandatory and optional modes of operation for this group of turning machines, see Table 1.

**Figure 8 — Group 4: Example of a multi-spindle NC bar automatic turning machine with second carrier for counterspindles**




**Key**

1 guarding of bar feeder
2 vision panel
3 interlocked movable guard
4 main control panel
5 enclosing guard

## 3.5 Terms related to maximum permissible spindle speeds and axes feeds

**3.5.1**
**maximum spindle speed**
maximum permissible rotational speed for a work holding or tool spindle specified and set as a machine parameter by the machine manufacturer

**3.5.2**
**maximum work holding device speed**
maximum permissible rotational speed of the work holding device specified by its manufacturer

**3.5.3**
**maximum working spindle speed**
maximum permissible rotational speed spindle holding the workpiece, depending on clamping conditions, size, mass and balance of the particular workpiece as well as the permissible working speed for the tool(s)

Note 1 to entry: The maximum permissible rotational speed of spindles depends on constructional limits given by the manufacturer(s) of the machine, the spindle or the clamping device, and the size, mass, balance/unbalance of the particular workpiece specified by the machine setter, which varies with the user.

**3.5.4**
**reduced spindle speed in setting mode**
maximum permissible rotational speed of the spindle in setting mode

Note 1 to entry: The spindle speed in setting mode is reduced for safety reasons (see 5.2.4.4).

**3.5.5**
**maximum axes speed**
maximum permissible speed for axes movement specified and set as a machine parameter by the machine manufacturer

Note 1 to entry: The maximum permissible feed rate of the axes depends on constructional limits specified by the manufacturer of the machine.

**3.5.6**
**reduced axes speed in setting mode**
maximum permissible speed for axes movement in setting mode

Note 1 to entry: The speed for axes movement in setting mode is reduced for safety reasons (see 5.2.4.4).



## Bibliography

[1] ISO 1219-1, *Fluid power systems and components — Graphical symbols and circuit diagrams — Part 1: Graphical symbols for conventional use and data-processing applications*

[2] ISO 1219-2, *Fluid power systems and components — Graphical symbols and circuit diagrams — Part 2: Circuit diagrams*

[3] ISO 2806:1994, *Industrial automation systems — Numerical control of machines — Vocabulary*

[4] ISO 2972, *Numerical control of machines — Symbols*

[5] ISO 3002-1, *Basic quantities in cutting and grinding — Part 1: Geometry of the active part of cutting tools — General terms, reference systems, tool and working angles, chip breakers*

[6] ISO 7000,[1] Graphical symbols for use on equipment — Registered symbols

[7] ISO 9614-1:1993, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points*

[8] ISO 11553-1, *Safety of machinery — Laser processing machines — Part 1: General safety requirements*

[9] ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

[10] ISO 13856-1, *Safety of machinery — Pressure-sensitive protective devices — Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors*

[11] ISO 15641, *Milling cutters for high speed machining — Safety requirements*

[12] IEC 60947-5-1+A.1:2009, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*

[13] IEC 61496-2, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*

[14] IEC 61496-3, *Safety of machinery — Electro-sensitive protective equipment — Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR)*

[15] IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

[16] IEC 61511-1, *Functional safety — Safety instrumented systems for the process industry sector — Part 1: Framework, definitions, system, hardware and software requirements*

[17] EN 414, *Safety of machinery — Rules for the drafting and presentation of safety standards*

[18] ISO 15534-3, *Ergonomic design for the safety of machinery — Part 3: Anthropometric data*

[19] EN 692, *Machine tools — Mechanical presses — Safety*

[20] EN 693, *Machine tools — Safety — Hydraulic presses*

[21] EN 12198-1, *Safety of machinery — Assessment and reduction of risks arising from radiation emitted by machinery — Part 1: General principles*

[22] EN 12198-2, *Safety of machinery — Assessment and reduction of risks arising from radiation emitted by machinery — Part 2: Radiation emission measurement procedure*

[23] EN 12198-3, *Safety of machinery — Assessment and reduction of risks arising from radiation emitted by machinery — Part 3: Reduction of radiation by attenuation or screening*

[24] EN 12417, *Machine tools — Safety — Machining centres*

[25] EN 12717, *Safety of machine tools — Drilling machines*

[26] EN 13128, *Safety of machine tools — Milling machines (including boring machines)*

[27] EN 13218, *Machine tools — Safety — Stationary grinding machines*

[28] EN 13478, *Safety of machinery — Fire prevention and protection*

[29] EN 13736:2003, *Safety of machine tools — Pneumatic presses*

[30] EN 50370-1, *Electromagnetic compatibility (EMC) — Product family standard for machine tools — Part 1: Emission*

[31] EN 50370-2, *Electromagnetic compatibility (EMC) — Product family standard for machine tools — Part 2: Immunity*

[32] Miscellaneous publications from the Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (BGIA)/Institute for Occupational Safety and Health, Sankt Augustin, Germany. Available at: http://www.dguv.de/bgia

[1] The graphical symbol collections of ISO 7000, ISO 7001 and ISO 7010 are also available on line in the ISO web store. For more information, consult http://www.iso.org/iso/fr/publications_and_e-products/databases.htm.