BRITISH STANDARD

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1550 : 1997

Machine-tools safety — Safety requirements for the design and construction of work holding chucks

The European Standard EN 1550 : 1997 has the status of a British Standard

ICS 25.060.20

National foreword

This British Standard is the English language version of EN 1550 : 1997.

The UK participation in its preparation was entrusted to Technical Committee MTE/1, Machine tools, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Summary of pages

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Sécurité des machines-outils — Prescriptions de sécurité pour la conception et la construction des mandrins porte-pièces

Sicherheit von Werkzeugmaschinen — Sicherheitsanforderungen für die Gestaltung und Konstruktion von Spannfuttern für die Werkstückaufnahme

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CEN

European Committee for Standardization
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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 143, Machine tools — Safety, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, etiher by publication of an identical text or by endorsement, at the latest by January 1998, and conflicting national standards shall be withdrawn at the latest by January 1998.

This European 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).

The European Standards produced by CEN/TC 143 are particular to machine tools and complement the relevant A and B standards on the subject of general safety (see introduction of EN 292-1 for a description of A, B and C standards).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

0 Introduction

This standard has been prepared to be a European Standard to provide one means of conforming to the essential health and safety requirements of the Machinery Directive and associated EFTA Regulations.

The extent to which hazards are covered is indicated in the scope of this standard.

1 Scope

This European Standard sets out requirements and/or measures to remove hazards and limit risks for work holding chucks, defined in **3.1**.

This European Standard covers all the hazards relevant to this component.

These hazards are listed in clause **4**.

The requirements of this standard concern designers, manufacturers, suppliers and importers of work holding chucks.

This standard also includes information which the manufacturer shall provide for the user.

This standard is primarily directed to components which are manufactured after the date of issue of this standard.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 292-1 : 1991	*Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*
EN 292-2 : 1991	*Safety of machinery — Basic concepts, general principles for design —*
EN 292-2/A1 : 1995	*Part 2: Technical principles and specifications*
EN 982 : 1996	*Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*
EN 983 : 1996	*Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*
prEN 1005-2 : 1993	*Safety of machinery — Human physical performance — Part 2: Manual handling of objects associated to machinery*
ISO 1940-1 : 1986	*Mechanical vibration — Balance quality requirements of rigid rotors — Part 1: Determination of permissible residual unbalance*
ISO 3089 : 1991	*Self-centring manually-operated chucks for machine tools — Acceptance test specifications (geometrical tests)*
ISO 3442 : 1991	*Self-centring chucks for machine tools with two-pieces jaw (tongue and groove type) — Sizes for interchangeability and acceptance test specifications*
ISO 9401 : 1991	*Machine tools — Jaw mountings on power chucks*

3 Definitions

For the purposes of this European Standard, the following definitions apply.

3.1 work holding chuck

Clamping device with moveable jaws to hold a workpiece designated herein after by 'chuck'.

NOTE. Some chucks may be equipped with grooves or slots.

3.2 manually-operated chuck

Chuck in which workpieces are clamped with the aid of manual energy (e.g. by means of a key).

3.3 power-operated chuck

Chuck in which workpieces are clamped with the aid of pneumatic, hydraulic, or electric energy.

3.4 centrifugally compensated chuck

Chuck in which there is a system which permits compensation of the loss of clamping force due to centrifugal force.

3.5 base jaw

Radial moving part of the chuck which receives the top jaw.

3.6 top jaw

Element mounted on a base jaw for the clamping of workpieces.

3.7 clamping force

Algebraic sum of the individual radial forces applied by the chuck jaws on the workpiece.

3.8 static clamping force

Clamping force of the chuck before the chuck has been rotated.

3.9 maximum static clamping force

Maximum clamping force obtained when the maximum permissible input force (or maximum input torque) is applied to a particular design.

3.10 dynamic clamping force

Actual clamping force when the chuck is rotating.

3.11 clamping cylinder

Cylinder which actuates the chuck with the aid of pneumatic or hydraulic energy.

3.12 centrifugal force

Force generated by rotation that tends to move all parts away radially from the axis of rotation of the chuck.

NOTE. The centrifugal force (F_c) is expressed in newtons (N)

$$F_c = m \times r \times \omega^2 = m \times \frac{v^2}{r} = mr\left(\frac{\pi n}{30}\right)^2$$

where:

- m is the mass of the moving parts (usually jaws);
- r is the distance in metres of the centre of gravity of the moving parts (usually jaws) from the axis of rotation;
- ω is the angular in radians per seconds of the centre of gravity of the moving parts (usually jaws);
- v is the peripheral velocity in metres per second of the centre of gravity of the moving parts (usually jaws);
- n is the rotational speed in min^{-1}.

3.13 input force

Force acting on the chuck applied from an external energy source which actuates the chuck mechanism.

3.14 input torque

Torque acting on the chuck applied from an external energy source which actuates the chuck mechanism.

3.15 rotational balance

Equilibrium of all masses around the axis of rotation (any differences between the axis of rotation and the centre of gravity will cause imbalance).

3.16 maximum rotational speed (n_{max})

Maximum rotational speed in min^{-1} specified by the manufacturer for a chuck with standard jaws in compliance with the manufacturer's instructions (see **6.2**).

3.17 working rotational speed (n_w)

Rotational speed in min^{-1} under machining conditions ($n_w \leq n_{max}$).

4 List of hazards

Significant hazards are:

- crushing;
- entanglement;
- drawing-in or trapping;
- impact;
- ejection of any exchangeable or moveable part.

5 Safety requirements and/or measures

5.1 General

Appropriate means listed below shall be used during the design and construction of chucks in order to protect any person from being exposed to hazards:

a) the chuck and its proper actuating equipment (e.g. cylinder) shall be compatible (see **6.1.9**);

b) the balance quality factor G shall be provided by the manufacturer's accompanying documents (see ISO 1940-1 : 1986);

c) base jaws of chucks shall be positively prevented (e.g. by locking pins) from being flung out by centrifugal force (see **3.23.6** of EN 292-1 : 1991);

d) chucks with mass greater than 20 kg shall be equipped with means (e.g. threaded holes) for their handling (see **6.2**).

Verification: by checking the relevant drawings, inspection and type test certificate.

5.2 Special requirements

For compensated chucks, n_{max} shall be stated by the manufacturer. For non compensated chucks, n_{max} shall not exceed the speed corresponding to a calculated loss of 67 % of the total measured static clamping force with the manufacturer's standard jaws, e.g. hard top jaw of stated mass mounted on the base jaws positioned at the stated radius of gyration.

Verification: by checking the relevant technical file.

5.2.1 *Power operated chuck*

Chuck or chucking equipment (cylinders) shall be equipped with devices to ensure that the clamping force is effectively applied (e.g. travel sensors before stroke end).

In the event of energy supply failure to the actuators/cylinders, devices (e.g. check valves) shall be provided to ensure that the pressure is maintained for a period stated by the manufacturer (see EN 982 : 1996 and/or EN 983 : 1996).

Verification: by checking the relevant drawings and/or inspection.

5.2.2 ***Chuck wrench and similar equipment***

Chuck wrench or similar equipments for manual jaw locking or manually tightening all types of chuck shall be designed so that they do not remain located in the rotating chucks. Wrench, similar equipment, or their locating points within chucks shall either be spring loaded to be self removing when released or shall prevent (by interlocking) the rotation of the spindle when inserted.

Verification: by checking the relevant drawings and/or circuit diagrams and test report on the chuck or wrench.

5.2.3 ***Chucks with grooves or slots***

Chucks fitted with grooves or slots open to the outer periphery shall be equipped with safety devices (e.g. pins) to prevent stops, counter balances or similar devices from being flung out of slots by centrifugal force.

Verification: by checking the relevant drawings and/or inspection.

6 Information for use

(See clause **5** in EN 292-2 : 1991.)

6.1 General

The following information shall be provided in the instruction hand book (see **5.5** in EN 292-2 : 1991).

6.1.1 Safety instructions for the proper use of the chuck including handling (see prEN 1005-2 : 1993), function, maximum rotational speed n_{max}, dimensions, necessary adjustments and fixing elements, permissible clamping ranges and pressure/forces of power drives.

6.1.2 Method for determination of clamping forces to allow the user to assess the suitability of the chuck for the machining operation.

6.1.3 Information on clamping force variation when the chuck is running with a standard jaw (e.g. hard top jaw) to allow the user to determine the dynamic clamping forces.

6.1.4 Maximum permissible mass of the jaw/top jaw at its maximum radius and at maximum rotational speed.

6.1.5 Maximum distance between the centre of gravity of the clamping jaw and the end face of the chuck.

6.1.6 Methods of determination for special top jaw clamping forces.

6.1.7 Instructions for maintenance, including lubrication and intervals between checks of static clamping forces.

6.1.8 Information for component interchangebility with reference to ISO 3089 : 1991, ISO 3442 : 1991 and ISO 9401 : 1991.

6.1.9 Description of the conditions to be fulfilled at the interface between the work holding chuck and its actuating equipment.

6.1.10 Information on the chuck mass expressed in kilograms.

6.1.11 Compliance of the chuck and its accessories with the present standard.

Verification: by checking the instructions for use.

6.2 Instruction for operator

The following statements shall be included in the manufacturer's instruction handbook.

a) Hazards may arise from the characteristics of workpieces and machines used with a given chuck even if the specific requirements in clause **5** of this standard are met. The user shall therefore consider such characteristics of workpieces e.g. dimensions, mass and shape, and of machines e.g. operating speed, feed and depth of cut in order to remove the hazard arising.

b) The maximum permissible speed for the specific machining shall be determined by the user on the basis of the clamping forces required. This speed shall not exceed the maximum rotational speed of the work holding chuck.

c) For special top jaw, the user shall calculate the dynamic clamping force for a particular chuck according to the method provided by the manufacturer in its instruction handbook.

d) Static clamping force measuring devices shall be used to check maintenance conditions at regular intervals according to maintenance instructions

e) Residual risks may arise from a failure to achieve a satisfactory quality of rotational balance.

f) To prevent excessive force being applied to a particular chuck the actuating force available from a machine may need to be reduced.

Verification: by checking the instruction for use.

6.3 Marking

Chucks and clamping cylinders shall be marked. Top jaws shall also be separately marked if they affect the performance of the chuck to which they may be attached.

Marking shall be indelible and clearly legible giving the following data.

6.3.1 ***Chucks***

– name or trade mark of the manufacturer;

– type designation or serial number;

– maximum permissible input force or maximum permissible input torque;

– maximum measured static clamping force at maximum input force (or torque) with chuck as new, lubricated according to manufacturer's instructions;

– maximum rotational speed n_{max}.

Verification: by inspection.

6.3.2 ***Top jaws***

– name or trade mark of the manufacturer;

– type designation or serial number.

Verification: by inspection.

6.3.3 ***Clamping cylinder***

– name or trade mark of the manufacturer;

– type designation or serial number;

– maximum rotational speed n_{max};

– maximum operating force or energy supply input/output.

Verification: by inspection.

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