## ANSI B11.9 (R2020)

American National Standard

## Safety Requirements for Grinding Machines

ANSI-Accredited Standards Developer and Secretariat:



B11 Standards, Inc. POB 690905 Houston, TX 77269, USA

### APPROVED: REAFFIRMED:

by the American National Standards Institute Board of Standards Review

### 17 November 2001 8 May 2020



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#### American National Standard

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stationary grinding machines

Hazards to personnel associated with flying particles and sparks originating from

#### FOREWORD

This Foreword is informative and not part of the requirements of American National Standard B11.9-2020.

The primary objective of this standard is to eliminate, control or reduce hazards to individuals associated with grinding machines by establishing requirements for the design, construction, installation, commissioning, operation, maintenance and decommissioning of these machines. To accomplish this objective, responsibilities have been assigned to the supplier (e.g., supplier, modifier, distributor, rebuilder and integrator), the user, and individuals in the working environment.

The words "safe" and "safety" are not absolutes. An element of safety is attitude. While the objective of this standard is to eliminate, control, or reduce hazards, this standard recognizes that hazards cannot be practically reduced to zero in any human activity. This standard is not intended to replace good judgment, proper training, and personal responsibility. Operator skill, job monotony, fatigue, and experience are safety factors that should be considered by the user.

The original B11.9 Standard was approved in 1975, and has simply been reaffirmed periodically since then. This current standard began revision in 2005, closely collaborating with the ANSI B7.1 Committee. A memorandum of understanding was reached between the two separate standards development committees that going forward, this B11.9 standard would address the safety requirements of the grinding machine only, and B7.1 would address the safety requirements of the abrasive product only (with the largest single area of overlap being the flange, mostly addressed in B7.1).

Technology for grinding machines is continuously evolving. This standard reflects the most commonly used and time-tested state of the art at the time of its approval. The inclusion or omission of language relative to any evolving technology, either in the requirements or explanatory area of this standard, in no way infers acceptance or rejection of such technologies.

This standard was processed and submitted for ANSI approval by the B11 Accredited Standards Committee on safety standards for machine tools. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time this document was approved as an American National Standard, the ANSI B11 Accredited Standards Committee was composed of the following member organizations:

Inquiries with respect to the application of the substantive requirements of this standard and suggestions for its improvement are welcomed and are to be sent to B11 Standards, Inc., POB 690905, Houston, TX 77269. Attention: B11 Secretariat.

#### Effective Date

The following is informative guidance only, and not a normative part of this standard. This Subcommittee recognizes that some period of time after the approval date on the title page of this document is necessary for suppliers and users to develop new designs, or modify existing designs or manufacturing processes in order to incorporate the new or revised requirements of this standard into their product development or production system.

This Subcommittee recommends that suppliers complete and implement design changes for new machines within 30 months of the approval of this standard.

For existing or modified machines, this Subcommittee recommends that users should confirm that the equipment / process has tolerable risk using generally recognized risk assessment methods within 30 months of the approval date of this standard. If the risk assessment shows that modification(s) is necessary, refer to the requirements of this standard to implement protective measures for appropriate risk reduction.

This standard was prepared by the B11.9 Subcommittee, processed and submitted for ANSI approval by the B11 Accredited Standards Committee on Safety Standards for Machine Tools. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time this standard was approved as an American National Standard, the ANSI B11 Accredited Standards Committee was composed of the following member organizations:

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John W. Russell, PE, CSP Chairman Gary D. Kopps, Vice-Chairman David A. Felinski, Secretary

#### **Organizations Represented**

Aerospace Industries Association of America Aluminum Extruders Council American Society of Safety Engineers Association For Manufacturing Technology Automotive Industry Action Group The Boeing Company Canadian Standards Association Deere & Co. **General Motors Corporation** Komatsu America Industries Metal Building Manufacturers Association Metal Powder Industries Federation National Institute for Occupational Safety & Health Occupational Safety & Health Administration Omron Scientific Technologies Incorporated Packaging Machinery Manufacturers Institute Pilz Automation Safety, LP Precision Metalforming Association Presence-sensing Device Manufacturers Association Property Casualty Insurers **Robotic Industries Association** Rockwell Automation Sheet Metal & Air Conditioning Contractors Nat'l. Assn. System Safety Society Toyota Motor Manufacturing North America International United Automotive Workers

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At the time this standard was approved, the ANSI B11 ASC B11.9 Subcommittee had the following members who participated in the development of this revision:

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# Explanation of the format, and ANSI B11 conventions

This ANSI B11.9 – 2010 (R2020) standard is divided into parts formerly referred to as sections or chapters and now referred to as clauses. Major divisions of clauses are referred to as subclauses and, when referenced by other text in the standard, are denoted by the subclause number (e.g., see 5.1).

The standard uses a two-column format to provide supporting information for requirements. The material in the left column is confined to "Standard Requirements" only, and is so captioned. The right column, captioned "Explanatory Information" contains information that the writing Subcommittee believed would help to clarify the requirements contained in the standard. This column is informative only, and should not be construed as being a part of the requirements of this American National Standard.

As in all American National Standards, the term "SHALL" denotes a requirement that is to be strictly followed in order to conform to this standard; no deviation is permitted. The term "SHOULD" denotes a recommendation, a practice or condition among several alternatives, or a preferred method or course of action.

Similarly, the term "CAN" denotes a possibility or capability, whether physical or causal, and the term "MAY" denotes a permissible course of action within the limits of the standard.

**B11 conventions**: Operating rules (safe practices) are not included in either column of this standard unless they are of such nature as to be vital safety requirements, equal in weight to other requirements, or guides to assist in conformance to the standard. The B11 series of standards do not use the term "and/or" but instead, the term "OR" is used as an inclusive disjunction, meaning one or the other or both. A distinction between the terms "*individual*" and "*personnel*" is drawn. Individual includes personnel (employees, subcontractors, consultants, or other contract workers under the indirect control of the supplier or user) but also encompasses persons who are not under the direct or indirect control of the supplier or user (e.g., visitors, vendors, etc.). Gauge refers to a measuring or testing instrument; gage refers to a limiting device (e.g., backgage).

Suggestions for improvement of this standard will be welcome. They should be sent to B11 Standards, Inc., POB 690905, Houston, TX 77269- Attention: B11 Secretariat.

#### Introduction

The primary purpose of every machine tool is to process parts. This is accomplished by the machine imparting process energy onto the workpiece. Inadvertent interference with, or accidental misdirection of the released energy during production, maintenance, commissioning and de-commissioning may result in injury.

The primary purpose of the ANSI B11 series of machine tool safety standards is to devise and propose ways to minimize risks of the potential hazards. This can be accomplished either by an appropriate machine design or by restricting personnel or other individuals' access to hazard zones, and by devising work procedures to minimize personnel exposure to hazardous situations. This is the essence of the ANSI B11 series of safety standards.

The responsibility for the alleviation of these risks is divided between the equipment supplier, the user and the user's operating personnel, as follows (numbers in parentheses refer to the clause numbers in these "base" B11 standards which address that responsibility).

The requirements of this ANSI standard are grouped according to those that apply to the supplier (i.e., manufacturer, rebuilder, modifier) and user. Some are shared between the supplier and user and are so indicated. Figure 1 provides an overview of this standard and in particular the responsibilities of and requirements for the supplier and user, including the user personnel. Numbers in parentheses denote the particular clause or subclause of the standard.

#### Notes for Figure 1:

- 1) Scope Provides the boundaries or limits of the standard (i.e., what is/is not included).
- Normative references Other standards which in whole or in part provide additional requirements when referenced in the normative text (i.e., left-hand column of clauses 4 – 9) of this standard.
- Definitions Terms used in this standard, together with their definitions (terms used in the same context as are generally understood and commonly used in everyday English are not defined).
- Responsibility The general responsibilities of the supplier (builder), user, and the user personnel are listed in clause 4 together with which of the remaining clauses they have primary responsibility.
- 5) Hazard control (task/hazard identification & risk assessment/risk reduction) Although clause 5 is intended to require a shared responsibility between supplier and user, the requirements of this clause may fall primarily on either entity (see B11.0 [B11.TR3] for further explanation of hazard/task identification and risk assessment/risk reduction).
- 6) Design and construction It is assumed that the supplier will be responsible for the requirements of clause 6 with the understanding that the user may add to or modify these requirements through the purchase agreement.
- 7) Installation, testing and start-up Although the requirements of clause 7 are predominantly the responsibility of the user, the supplier will normally provide assistance either directly (providing personnel) or indirectly (instruction materials).
- 8) Safeguarding This is normally a shared responsibility but often, either the supplier or the user will provide and/or meet the requirements of clause 8.
- 9) Operation and maintenance The user is normally responsible for the requirements of clause 9 with possible assistance from the supplier for training.



#### Figure 1 – Typical layout of B11 base standards showing the various responsibilities

The gray shading represents ANSI B11. A solid line between a block showing reference standard(s) and a block showing a normative clause denotes part of the requirements. A dashed line denotes an informative reference.

STANDARD REQUIREMENTS

#### EXPLANATORY INFORMATION

### American National Standard for Machines -Safety Requirements for Grinding Machines

#### 1 Scope

This standard applies to all stationary grinding machines, used in either industrial or commercial applications, that utilize an abrasive product to change the shape, size or surface finish of any material.

#### 1.1 Included machines

This standard includes but is not limited to the following machines, regardless of their control method, that use an abrasive product to remove material:

#### 1.1.1 External cylindrical grinding machine

A machine that grinds the external surface of a rotating workpiece.

(Not part of American National Standard for Safety Requirements for Grinding Machines, B11.9-2010 (R2020)).

#### **E1**

Stationary grinding machines are fixed in position during operation and capable of a combination of one or more types of operations.

Abrasive products include coated abrasives and superabrasives, as well as abrasive products consisting of abrasive grains held together by organic or inorganic bonds.

#### E1.1

Control methods may include pneumatic, hydraulic, servo, NC, CNC, mechanical, manual, etc.).

Figures 1.1 through 1.16 are simplified schematics of different machine configurations and may not depict required guards (removed for clarity).



#### Figure 1.1.1 – External Cylindrical Grinding

Examples: Center-type or cylindrical grinders Gear grinders Profile and cam grinders Thread grinders

## 1.1.2 Centerless external cylindrical grinding Machine

A machine that grinds the external surface of a rotating workpiece. The workpiece is rotated and mechanically guided with reference to the grinding wheel by means of a control-wheel, and rests on a straight-edge placed between the two wheels.



Figure 1.1.2 – Centerless Grinding

#### STANDARD REQUIREMENTS

#### 1.1.2.1 Internal cylindrical grinding machine

(includes either horizontal or vertical spindle configurations)

A machine that grinds the internal surface of a rotating workpiece. The workpiece and the grinding wheel are mechanically guided.

#### EXPLANATORY INFORMATION

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#### Figure 1.1.3 – Internal Grinding

Examples: Center hole grinders Electrolytic grinders Internal grinders Jig grinders Profile and cam grinders Thread grinders Vertical grinders

## 1.1.3 Surface grinding machine – peripheral grinding, reciprocating table, (horizontal spindle)

A machine that grinds the plane surfaces of a workpiece whereby the workpiece is secured to a reciprocating table. The workpiece and the grinding wheel are mechanically guided.

## 1.1.4 Surface grinding machine – peripheral grinding, rotary table (horizontal spindle; table

A machine that grinds the plane surfaces of a workpiece whereby the workpiece is secured to a rotary table. The workpiece and the grinding wheel are mechanically guided.

has a vertical axis of rotation)

Examples: Creep feed grinders Surface grinders



Figure 1.1.5 – Surface Grinding - Peripheral

#### STANDARD REQUIREMENTS

### 1.1.5 Surface grinding machine – face grinding, reciprocating table (vertical spindle)

A machine that grinds the plane surfaces of a workpiece whereby the workpiece is secured to a reciprocating table. The workpiece and the grinding wheel are mechanically guided.

## 1.1.6 Surface grinding machine – face grinding, rotary table (vertical spindle; table has a vertical axis of rotation)

A machine that grinds the plane surfaces of a workpiece whereby the workpiece is secured to a rotary table. The workpiece and the grinding wheel are mechanically guided.

## 1.1.7 Surface grinding – face grinding, Double disc surface grinding machine (includes either horizontal or vertical spindle configurations)

A machine that grinds the workpiece by passing it between two disc or cylinder wheels or segments. The workpiece and the grinding wheels are mechanically guided.

#### 1.1.8 Tool & cutter grinding machine – peripheral and face grinding (includes multiple horizontal spindle configurations)

A machine that grinds or regrinds cutting faces and edges of tools (workpiece). The workpiece and the grinding wheels are mechanically guided.





Figure 1.1.6 – Surface Grinding – Face Linear



Figure 1.1.7 – Surface Grinding – Face Rotary



Figure 1.1.8 – Surface Grinding – Dual Face



Figure 1.1.9 – Tool Grinding

## machine - peripheral grinding

1.1.12 Bench, pedestal or floorstand grinding

A machine that grinds the surface of a workpiece using the wheel periphery. Workpiece is guided by hand.

A machine that uses a hand or mechanically-guided vertically adjustable cutting-off wheel on a firmly

STANDARD REQUIREMENTS

cutting-off wheel is mechanically guided.

Cutting-off machine (guillotine type)

A machine that grinds the workpiece for slotting or cutting-off. The workpiece is firmly fixed and the

1.1.10 Cutting-off machine (chop-saw type)

1.1.11 Cutting-off machine (workpiece

translation type)

clamped workpiece.

on a firmly clamped workpiece.

A machine that uses a hand-guided cutting-off wheel

1.1.9

#### EXPLANATORY INFORMATION





Figure 1.1.11 - Cut-Off - Manual



Figure 1.1.13 – Bench or Pedestal Grinder





#### STANDARD REQUIREMENTS

### 1.1.13 Pedestal grinding machine – face grinding (horizontal spindle)

A machine that grinds the surface of a workpiece using the wheel face. The workpiece is guided by hand.

#### EXPLANATORY INFORMATION



Figure 1.1.14 – Face Grinder

Disc grinders Offhand grinders Surface grinders

### 1.1.14 Swing frame grinding machine – peripheral grinding/cutting-off

A suspended machine that utilizes handlebars to guide the machine to grind or cut the workpiece using the wheel periphery. The workpiece is firmly clamped or stabilized by its own weight. The grinding machine is guided by hand.

Figure 1.1.15 – Swing Frame Grinder

NOTE: A swing frame grinding machine is typically used for **snagging** operations, often for rapid stock removal in foundries.

## 1.1.15 Automatic billet grinding machine – surface grinding (high pressure)

A machine that uses high pressure grinding where the workpiece is secured to a table. The workpiece and the grinding wheel are mechanically guided.



Figure 1.1.16 – Automatic Billet Grinder

#### STANDARD REQUIREMENTS

#### 1.2 Excluded machines

This standard does not apply to portable hand-held arindina machines. machines usina loose abrasives, machines used in wood-working applications, or machines used for concrete cutting in road construction.

Also, this standard does not apply to honing machines, lapping machines, polishing machines or belt grinding machines.

#### EXPLANATORY INFORMATION

#### E1.2

grinding machines.

E2.1

Machines that use free abrasives or reciprocating motion and or very low speed are excluded from this standard because they typically use lighter force than with grinding machines, and the mechanism at the point of operation significantly differs from that of abrasive products used on In addition to the normative voluntary consensus standard references, the reader should investigate the existence of mandatory codes, specifications or regulatory standards, e.g., those standards found at title 29 of the Code of Federal Regulations (OSHA standards - see also www.osha.gov). Since the grinding machine and abrasive product are the fundamental components of the grinding system, it is particularly important that users of ANSI B11.9 concurrently reference ANSI B7.1.

#### References 2

This standard is to be used in conjunction with the following American National Standards:

#### 2.1 Normative references

The following standards contain provisions that, through reference in this document, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI B7.1 - 2000 Safety Requirements for Use, Care and Protection of Abrasive Wheels (and corrigendum)

ANSI B11.0 – 2010, Safety of Machinery; General Requirements and Risk Assessment/Risk Reduction

ANSI B11.19 - 2010, Performance Criteria for Safeguarding.

ANSI / ASSE Z244.1 - 2003 (R2008), Control of hazardous energy - Lockout/tagout and alternative methods

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