ANSI B11.0 – 2023

American National Standard

Safety of Machinery

ANSI-Accredited Standards Developer and Secretariat:

B11 Standards, Inc.
Houston, Texas - USA

APPROVED: 27 JUNE 2023
by the American National Standards Institute
Board of Standards Review

AMERICAN NATIONAL STANDARDS

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FOREWORD (This Foreword is not part of the requirements of this ANSI B11.0 standard on Safety of Machinery)

Overview and History

The B11 series of machinery safety standards are over 100 years old, beginning with the first standard on the safety requirements for power presses in 1922. Since that time, safety requirements for a variety of machines have been developed and are continually updated/revised to become the current series of ANSI B11 American National Standards and Technical Reports on machinery safety.

This American National Standard was promulgated by the B11 Standards Development Committee as a voluntary consensus standard to establish and specify general safety requirements for the design, construction, operation and maintenance (including installation, dismantling and transport) of machinery and machinery systems. This standard also applies to devices that are integral to these machines.

This standard was first published in 2008 as ANSI B11.GSR (General Safety Requirements). It was substantively revised and re-designated as ANSI B11.0 in 2010. The standard was again revised and published in 2015; that third edition of this standard added responsibilities related to machinery components, clarified the relationship between the risk assessment for the machine and the design specification for control systems, provided additional information on documentation requirements, included new subclauses on supervision and training, presented new annexes correlating machinery safety standards in the U.S. and EN/ISO, and generally clarified and simplified text in the standard. The 2020 edition of B11.0 provided additional or improved guidance in several key areas such as existing (legacy) equipment, prevention through design, how to achieve acceptable risk and validate/verify (check, test, confirm) risk reduction measures. It also included new content on alternative methods for the control of hazardous energy, manual and special operation modes, and machinery systems dealing with aspects such as layout analysis and spans of control.

Changes from prior edition

The current edition of this American National Standard on the Safety of Machinery (ANSI B11.0-2023) includes updates / content in the following areas:

- **clarified text related to responsibilities of machinery suppliers, users, modifiers, purchasers of used machinery, and other entities;**
- **introduced concepts of co-manufacturer(s) and their associated responsibilities;**
- **updated and clarified responsibilities for existing (legacy) machinery;**
- **included requirements for when whole body access situations exist and/or apply;**
- **improved the information about validation;**
- **improved information related to remote / tele–operations of machinery;**
- **expanded requirements for radiation hazards and associated risk reduction measures;**
- **added a new section for heated systems and related equipment for processing of materials;**
- **updated requirements for *Information for Use* and manuals, consistent with ISO 20607;**
- **reorganized clauses 4 (*Responsibilities*) and 5 (*Lifecycle Requirements*);**
- **added new definitions and updated existing ones (e.g., recognizing distinctions between, and characterizing energy as hazardous, non-hazardous, or beneficial);**
- **updated and improved existing Annexes to assist the reader in applying the content of the standard;**
- **clarified content of Table D1 on estimating severity of harm;**
- **added a new annex on *Control Devices*.**

Application

The concepts and principles contained in this standard can be applied very broadly to a wide variety of systems and applications. Documented risk assessments were first introduced to the machine tool industry in 2000 with the publication of (ANSI) B11.TR3 – *Risk Assessment and Risk Reduction – A Guide to Estimate, Evaluate and Reduce Risks Associated With Machine Tools;* to the robot industry in 1999 with the publication of ANSI/RIA R15.06-*Requirements for Industrial Robots and Robot Systems;* and to the packaging machinery industry in 2006 with the publication of ANSI / PMMI B155.1-*Safety Requirements for Packaging Machinery and Packaging-Related Converting Machinery*. Since that time, the principles of the risk assessment process have been employed in a wide variety of diverse applications – including traffic control, consumer products, process safety, incident investigations and, of course, machinery. Interested readers are encouraged to apply these principles and concepts to other systems in addition to machinery as suits their needs.

General

"Safe" is the state of being protected from recognized hazards that are likely to cause physical harm. There is no such thing as being *absolutely safe*, or in other words, a complete absence of risk. In turn, there is no machine that is absolutely safe. All machinery contains hazards, and some level of residual risk. However, the risk associated with those hazards should be reduced to an acceptable level.

This standard guides machinery suppliers and users through a risk assessment process that identifies hazards and reduces corresponding risks to an acceptable level. In this standard, the terms "acceptable" and "tolerable" are used as synonyms. Although engineers have long applied an informal risk assessment framework, this standard includes a formal method to conduct and document the risk assessment process. This standard identifies some preparations that need to be made before a risk assessment begins, and presents the basic risk assessment process in a step by step approach to assist in achieving this goal.

The outcome of completing the risk assessment process should be:

- a clear understanding of risk(s) including the potential severity of harm and the probability of the occurrence of harm;
- risk reduction measures appropriate to the circumstances;
- machinery with risks reduced to an acceptable level;
- documentation of the risk assessment.

This standard reflects the best industry practice at the time of its approval. The inclusion or omission of language relative to any evolving technology, either in the normative or informative areas of this standard, in no way infers acceptance or rejection of such technologies. The presentation style used in this standard mixes both informative and explanatory text with normative requirements and was chosen to enhance the readability of the information. The distinction between these texts is illustrated as follows:

The normative text (requirements) appears aligned to the left margin. To meet the requirements of this standard, machinery suppliers and users need to conform to these normative requirements. These requirements typically use the verb "shall." Informative text (recommendations and/or guidance) appears as:

> ***Informative text***
>
> *The informative or explanatory text in this standard appears as indented* ***Informative Notes*** *in italics, in a reduced font size, left justified (vs. full justification), and colored purple (for those with electronic or color printed versions), all of which are in an effort to provide a strong visual signal/reminder to the reader that this is informative text,* ***not*** *normative text, and is* ***not*** *to be considered part of the requirements of this standard; this text is advisory in nature only. The suppliers, the users and the machines themselves are not required to conform to the informative text. The machine-specific "base" (type-C) safety standards all use the more traditional ANSI two-column format, and the informative text appears as the right-hand column and is titled "Explanatory Information." This standard uses the single column format common to many international standards. The informative text is presented in this manner in an attempt to enhance readability and reduce confusion.*

Prevention Through Design or PTD is a recent term in industry. The objectives of risk assessment, risk reduction and elimination of hazards as early as possible are integral and not new to this document. The phrase "Prevention Through Design" is used within this document, as are other equivalent terms such as "elimination by design," "design out," and "substitution" to thoroughly address risk assessment and apply it to the lifecycle and operations of the machine.

Objective

The objective of the B11 series of standards is to eliminate injuries to personnel working with or around machinery or machinery systems by establishing requirements for the design, construction, reconstruction, modification, installation, set–up, operation and maintenance of machinery or machine systems. This standard should be used by suppliers and users, as well as by the appropriate Authority Having Jurisdiction (AHJ). Responsibilities have been assigned to the supplier (i.e., manufacturer, the re-constructor, and the modifier), the user, and the user personnel to implement the requirements of this standard. This standard is not intended to replace good judgment and personal responsibility. Personnel skill, attitude, training and experience are safety factors that need to be considered by the user.

Applying risk reduction measures to machinery is complicated by the wide variety of operations and operating conditions, including, but not limited to the following:

- the variations in size, speed, and type of machinery used;
- the size, thickness, and kind of pieces to be worked;
- the required accuracy of the finished work; the skill of operators;
- the length of run; and
- the method of feeding, including part and scrap removal.

Because of these varying factors in the operations and in the workplace, a wide variety of risk reduction measures have been covered in this standard as well as the machine-specific “base” (type-C) safety standards.

Alignment

This standard has been aligned with international standards (primarily ISO, but ASTM and IEC as well) and European (EN) standards by the introduction of hazard identification and risk assessment as the principal method for analyzing hazards to personnel to achieve a level of acceptable risk. This standard integrates the requirements of ISO 12100:2010, as well as selected U.S. standards.

In 2012, ISO 12100 was adopted as an American National Standard and re-designated as ANSI / ISO 12100-2012 IDT (the “IDT” in the official alpha-numeric ANSI designation means identical and virtually unchanged from the ISO version).

ISO 12100 was used as one of the principal resource documents in developing ANSI B11.GSR (and by extension, ANSI B11.0). However, the technical requirements of ISO 12100 have undergone little change since the early 1990s (the content of ISO 12100:2003 parts 1 and 2, and ISO 14121:2007 were editorially combined without ANY technical changes to create ISO 12100:2010).

In addition, ISO 12100 applies ONLY to the suppliers of machinery and includes NO requirements for users of machinery. ISO 12100 also applies only to new machinery and excludes machinery made prior to its publication in 2010. ANSI B11.0 differs from ISO 12100 in that it specifically includes requirements for **both** suppliers and end users of machinery. It also includes numerous requirements and informative guidance and other information related to the safety of machinery which goes beyond that which is contained in ISO 12100. As a result, conforming with the requirements of ISO 12100 will not assure conformance to the requirements of ANSI B11.0. Conversely, conforming with the requirements of ANSI B11.0 **will** automatically result in conformance to the requirements of ISO 12100. Figure 1 on the following page is a simplistic illustration of the relationship between these two standards in terms of the ISO vice versa principle.

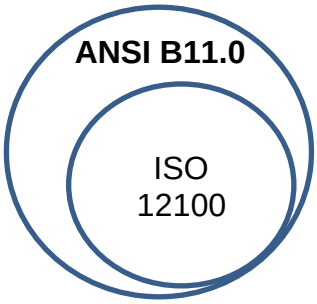

Figure 1 — Illustration of relationship between ISO 12100 and ANSI B11.0

This standard contains references to federal Occupational Safety and Health Administration (OSHA) standards. OSHA standards represent the minimum level of regulatory compliance requirements within the United States. Federal OSHA-approved individual state safety and health programs/agencies (of which approximately half of the U.S. states have (e.g., Michigan OSHA, known as MIOSHA, and California OSHA, known as Cal-OSHA) have standards that may exceed these minimum requirements. Accordingly, the appropriate standards need to be used. Voluntary consensus standards such as this one represent state of the art industry practices and often exceed federal regulatory requirements, and these can be, and often are, used by OSHA compliance officers to augment their dated regulatory standards.

New Terminology

Historically, terms have been used in the B11 community to describe requirements for the safety of machinery. Experience has shown that certain terms (e.g., safeguarding, or complementary equipment) are often used imprecisely, even by technical experts. This revision of B11.0 includes an effort to bring better precision to certain technical terms and has resulted in the deletion of other terms. Although no longer included in B11.0, these terms should still be used in conversations or communications with audiences that have a shared understanding of the intended meaning. In addition, some terms are commonly used but not necessarily with common meanings. As a result, this edition of B11.0 has transitioned to certain new terms, including the following:

Previous term	Current term
Safeguarding	**Risk reduction measures / Engineering controls**
Guards / safeguarding devices	**Engineering controls - guards / Engineering controls - devices**
Awareness devices	**Awareness means**
Complementary equipment	*Term no longer used*
Safeguarding methods	**Part of risk reduction measures**

The terms *repair, rebuild, refurbish, remanufacture, reconstruct* and others are used to describe work done on existing (legacy) equipment. These terms have been defined for use in this standard, and the requirements for the work on existing machinery are described in clause 4.

Context

The writers of this standard understand that the reader/user of this American National Standard is unlikely to read it cover-to-cover but instead (for example), might use the Table of Contents as a sort of 'roadmap' to find a very specific topic and then review *only* that topic. However, the reader/user of this standard is informed that the elements (clauses, subclauses, etc.) of these documents are sequenced and often interrelated in such a way as to state requirements that may very well be dependent on text in a section(s) that precedes the actual requirement. It therefore becomes vital and important for the user of this standard to ensure they understand the depth, range and especially the context of the section or topic in which the actual requirement appears.

Effective Date

The following information on effective dates is informative guidance only, and not a normative part of this standard. The 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, and/or modify existing designs or manufacturing processes in order to incorporate the new and/or revised requirements of this standard into their product development or production system.

The subcommittee recommends that suppliers complete and implement design changes for new machinery and machinery systems within 30 months of the approval of this standard.

The subcommittee recommends that users evaluate whether existing machinery and machinery systems implement this edition within 30 months of the approval date of this standard using generally recognized risk assessment methods. If the risk assessment shows that modification(s) is necessary, refer to the requirements of this standard or the machine-specific "base" (type-C) safety standard to implement risk reduction measures (protective measures) for appropriate risk reduction.

Development

At the time this standard was approved as an American National Standard, the ANSI-accredited consensus body (B11 Standards Development Committee) was composed of the following Members:

Alan Metelsky, FS, Eng., **Chair** / Anne Mathias, PE, **Vice-Chair** / David Felinski, **Secretariat**

Organizations Represented	Delegate	Alternate
Aluminum Extruders Council	Mel Mitchell, CSP	Brad Wyatt, CSP
Amazon	Jeread Sines, B11 LMSS, FS Eng	Josh Owens, B11 LMSS, FS Eng
American Society of Safety Professionals	Ted Sberna, Sr.	Anne Mathias, PE
Association for Advancing Automation	Carole Franklin	Jeff Fryman
Association For Manufacturing Technology	Russ Bensman	Alan Metelsky, FS Eng
Assoc. for Packaging & Processing Tech.	Bruce Main, PE, CSP	Tom Egan
The Boeing Company	Rhiannon McPherson	Mark Ellingson
Bridgestone	Kenji Furukawa, FS Eng	Joey Hinson, FS Eng
Canadian Standards Association	Ana Andronescu, P.Eng.	Walter Veugen
Deere & Co.	Tony Beeth	Scott Winter
Euchner	Andy Smith	Jilani Bouchane
Exponent	Steve Andrew, PE, CSM	Alex Zelhofer, PhD, PE
FDR Safety	Mike Taubitz	Luke Contos, Joe Wolfsberger
Fortress Safety	Jenny Tuertscher, B11 LMSS, FS Eng	Josh Hill
Honda Development & Mfg. of America	Todd Dickey	Doug Titus, Tyler Willis
General Motors Corporation	Tony Ross	Mike Douglas
IDEM Safety	Mark Witherspoon	Amir Mohtasham
Komatsu America Industries	George Schreck	James Landowski
Liberty Mutual	Craig Karasack, CSP	Julie Thompson, CSP
MAG Automotive	Erik Carrier	Doug Watts
Metal Powder Industries Federation	Bill Edwards	James Adams
National Inst. for Occupational Safety & Health	Rick Current, PE	
Occupational Safety & Health Administration	Ken Stevanus	Mary Bauer, CIH, CSP, B11 LMSS
Omron Scientific Technologies Incorporated	Tina Hull, FS Exp	
Pilz Automation Safety, LP	Mike Beerman, CMSE	Dino Mariuz
Plastics Industry Association	Jeff Linder	Dale Bartholomew
Precision Metalforming Association	Jim Barrett, Jr. PhD	David Klotz
Presence–sensing Device Manufacturers Assn.	Jim Kirton	Mike Carlson
Rockwell Automation	Darin Magnuson, FS Eng	Jonathan Barrett, FS Eng
Rockford Systems	Brian Boes	Matt Brenner
Safe–T–Sense	Mike Poynter, FS Eng	Federico Badillo
SICK Product & Competence Centers America	Chris Soranno, FS Exp	Nate Gose, FS Eng
Sheet Met. & Air Cond. Contract. Nat'l. Assoc.	Justin Crandol, CSP	Rick Di Ioli
Toyota Motor Manufacturing North America	Chip Boertlein	Mike Collier, B11 LMSS

At the time this standard was approved, the **B11.0** *Safety of Machinery* **Subcommittee** had the following members who participated in and contributed to the development of this American National Standard:

Bruce Main, PE, CSP – Chair	design safety engineering, inc.	Chris Felinski, Secretary	B11 Standards, Inc.
Anne Mathias, PE – Vice-Chair	Engineering Systems, Inc.	David Felinski, Secretariat	B11 Standards, Inc.

Steve Andrew	Exponent	Brandon Miller	Henkel NA
Jim Barrett	Link Systems	John Piampiano	International Paper
Mike Carlson	Banner Engineering	Pat Rockey	Rockwell
Eddie Crawford	Rockwell	Ted Sberna, Sr.	White Horse Safety
Eric Cummings	Ross Controls	Jeread Sines	Amazon
Rick Current	NIOSH	Chris Soranno	SICK PCA
Todd Dickey	Honda	Marco Tacchini	GT Engineering
Mike Douglas	General Motors	Mike Taubitz	FDR Safety
Bryant Eismeier	Flexware Innovations	Doug Titus	Honda
Kenji Furukawa	Bridgestone	Jenny Tuertscher	Fortress Safety
Chris Gerges	DAK Machine Safety	Jim Van Kessel	JVK Safety
Bryan Harrell	Eli Lilly	Mark Witherspoon	IDEM Safety
Heinz Knackstedt	Machine Control Safety	Scott Whittington	Cincinnati
Rhiannon McPherson	Boeing	Paul Wozniczka	MTS Systems
Alan Metelsky	Gleason Works		

Introduction

Organization and Application of B11 Documents

The B11 series of machinery safety standards and technical reports has aligned with the ISO "type A-B-C" structure of categorizing standards as described immediately below (and shown in Figure 2).

Type-A standards (basis safety standards) give basic concepts, principles for design, and general 'foundational' aspects that can be applied broadly across different types of machinery;

Type-B standards (generic safety standards) deal with one or more safety aspects or one or more types of risk reduction measure that can be used/applied across a wide range of machinery (ISO further divides type-B standards into B1 on safety aspects and B2 on safeguards);

Type-C standards (machine-specific safety standards) deal with detailed safety requirements for a particular machine or "group of machines" (meaning machines having a similar intended use and similar hazards, hazardous situations or hazardous events).

The B11 Standards Development Committee recognizes that an additional type of standard has emerged - these '**Hybrid' standards** represent an evolutionary development in machinery safety standardization that combine some unspecified percentage of the typical content and requirements found in any two (or even all three) of the standard types described above. Usually, they are some combination of requirements generally found in type-A and type-C standards. With the possible exception of this standard, none of the other documents in the B11 portfolio fit into this new type, numerous examples of these hybrid machinery safety standards exist outside of ANSI B11.

This ANSI B11.0 standard on machinery safety is predominantly a "type-A" standard in that it applies to an extremely broad array of machines and contains general requirements. However, in some sections, it also contains very specific requirements, hence, the "exception" noted in the paragraph above. B11.19, B11.20, B11.21, B11.25, B11.26 and the entire B11 series of Technical Reports are all typical "type-B" documents addressing general safety concepts, subjects and/or elements that can be used across a wide range of machinery (such as B11.19 on risk reduction measures, B11.26 on functional safety or (ANSI) B11.TR1 on ergonomics) or as a standard to be used when integrating machinery into a system (B11.20). The B11 series of Technical Reports are informative documents that may be generally applied to many different machines, and as such, would all fall within the "type-B" category. The machine-specific "base" (type-C) B11 standards contain detailed safety requirements for a particular machine type or group of machines (see the list of machine and machinery system safety standards in subclause 7.19).

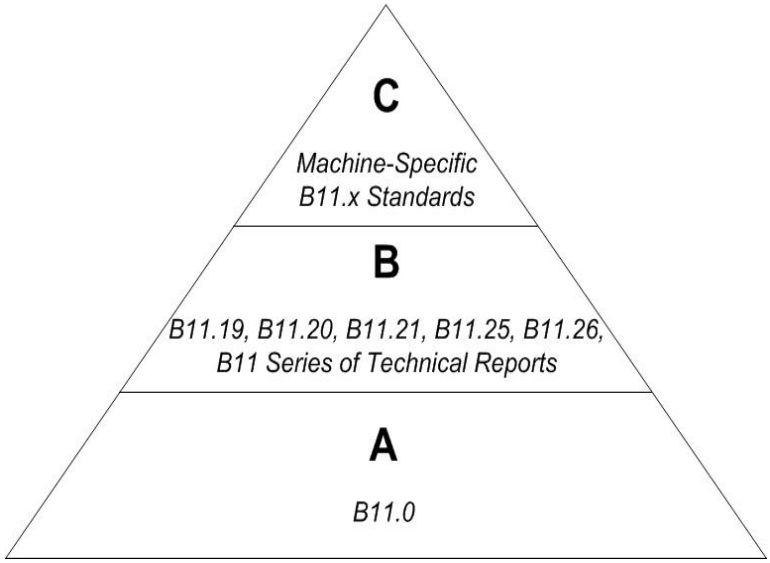

Figure 2 — Organization of the B11 Series of Documents

Machinery safety depends on the practical application of the risk assessment process. The type-A (B11.0) and type-B standards are intended to be used concurrently with the type-C (machine-specific) standards during the risk assessment process, by the supplier and user of machines. See Figure 3.

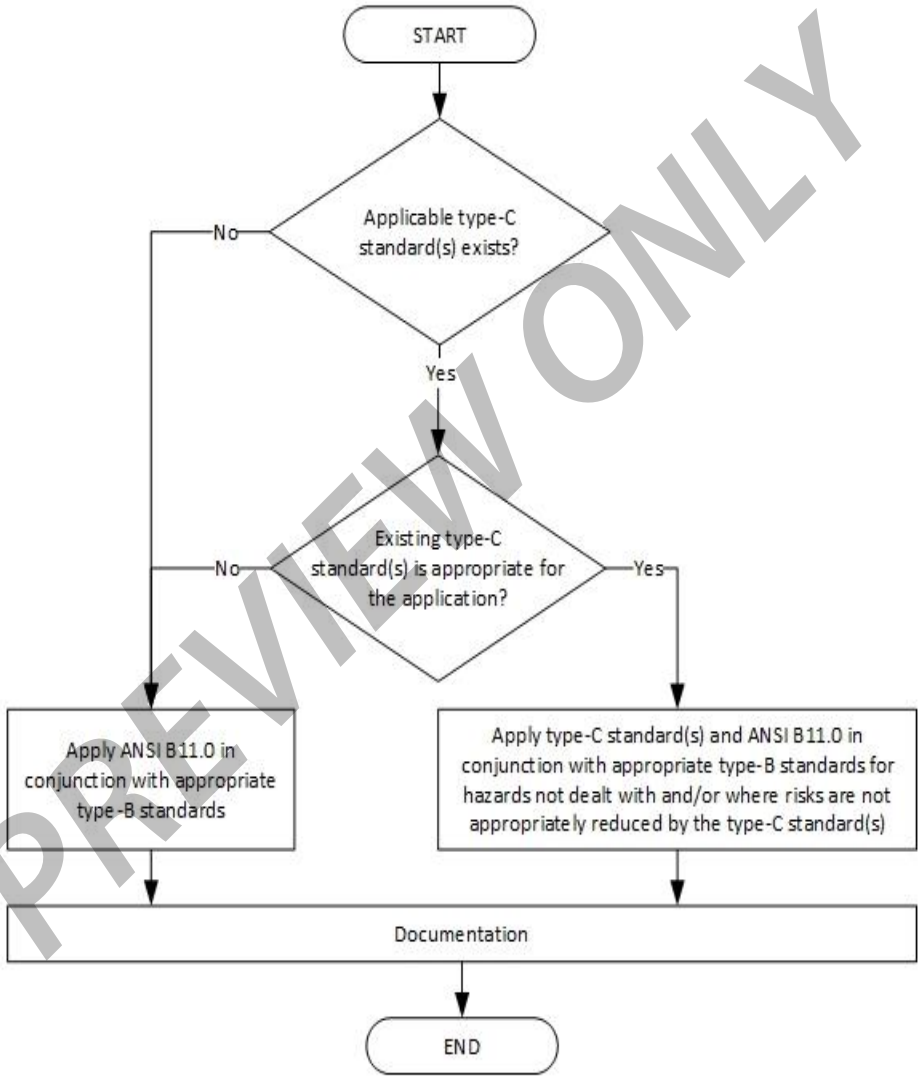

Figure 3 — How to use type-C standards

If a type-C standard exists, for a particular machine or group of machines, the hazards and risk reduction measures identified in the type-C standard assists the standards user in applying the risk assessment process. Readers may rely on the type-C standard for this information, subject to any application-specific hazards. If no type-C standard exists, the reader needs to identify the hazards for the particular application and apply risk reduction measures accordingly.

When a type-C standard deviates from one or more provisions dealt with by this standard or by a type-B standard, the type-C standard requirement generally takes precedence. Any deviation in conforming to a requirement of any standard should be carefully evaluated and based on a documented risk assessment.

This standard is intended for readers with differing levels of familiarity with the B11 series of safety standards and the risk assessment process. Readers new to these standards may benefit from starting with the B11.0 and then reading the applicable machine-specific B11.x standard, B11.19, and other relevant or appropriate standards and technical reports. More experienced users may find efficiencies in beginning with the machine-specific B11.x standard and then reviewing relevant portions of the ANSI B11.0 standard as necessary.

The requirements of the machine-specific ANSI standards are grouped according to those that apply to the supplier (i.e., manufacturer, rebuilder, modifier) and those that apply to the user. Some are shared between the supplier and user and are so indicated.

Risk assessment is a scalable process, which simply means that risk assessment can be applied to a single hazard, to multiple hazards of a simple machine, or to hazards on more complex (automated) machine systems.

Risk assessment can be applied to new machines, to existing machines, or modified machines. To facilitate the process, the risk assessment leader may need to create ad hoc teams that meet together, or with individuals that meet at different times to capture the appropriate information. Much of the risk assessment process can be conducted quite effectively at the shop floor level in the environment where the tasks and hazards occur.

New technologies, or new applications of existing technologies rarely have existing industry standards to describe the hazards and risk reduction measures that can be applied to them. The risk assessment process as described in ANSI B11.0 may be used to achieve acceptable risk under these circumstances.

The writers of this standard recognize that zero risk does not exist and cannot be attained. However, a good faith approach to risk assessment and risk reduction should achieve an acceptable risk level.

As of the date of approval of this standard, the ANSI B11 series of American National Standards and Technical Reports on machinery safety consisted of the following documents shown in the list below. The user should check a licensed reseller such as ANSI (www.ansi.org) for the current versions of any of these documents. All archival / historical versions of the documents are available at www.b11standards.org.

List of the ANSI B11 Series of Safety Standards and Technical Reports

#	SHORT TITLE / TOPIC	YEAR	TYPE
B11.0	Safety of Machinery	2023	A
B11.1	Mechanical Power Presses	2009 (R20)	C
B11.2	Hydraulic & Pneumatic Power Presses	2013 (R20)	C
B11.3	Power Press Brakes	2022	C
B11.4	Shears	2003 (R20)	C
B11.5	Ironworkers	1988 (R20)	C
B11.6	Manual Turning Machines (Lathes) with or without Auto Control	2001 (R20)	C
B11.7	Cold Headers and Cold Formers	2020	C
B11.8	Manual Milling, Drilling, & Boring Machines	2022	C
B11.9	Grinding Machines	2010 (R20)	C
B11.10	Sawing Machines	2003 (R20)	C
B11.11	*Withdrawn* (Gear and Spline Cutting Machines; use B11.0 and B11.19)	2001 (R20)	C
B11.12	Roll Forming and Roll Bending Machines	2005 (R20)	C
B11.13	Single & Multiple-Spindle Automatic Bar and Chucking Machines	2020	C
B11.14	*Withdrawn* (Coil Slitting Machines; combined into B11.18)	(1996)	C
B11.15	Pipe, Tube and Shape Bending Machines	2001 (R20)	C
B11.16	Powder / Metal Compacting Presses	2014 (R20)	C
B11.17	Horizontal Hydraulic Extrusion Presses	2023	C
B11.18	Machines Processing or Slitting Coiled or Non-Coiled Metal	2006 (R20)	C
B11.19	Performance Requirements for Risk Reduction Measures (Safeguarding)	2019	B
B11.20	Integration of Machinery into a System	2017	B
B11.21	Machine Tools Using Lasers for Processing Materials	2006 (R20)	B
B11.22	Turning Centers and Automatic Numerically Controlled Turning Machines	2002 (R20)	C
B11.23	Machining Centers & CNC Milling, Drilling & Boring Machines	2002 (R20)	C
B11.24	Transfer Machines	2002 (R20)	C
B11.25	Large Machines	2022	B
B11.26	Functional Safety for Equipment / Machine Control Systems	2018	B
B11.27	Electro-Discharge Machines	2020	C
B11.TR1	Ergonomics	2016	B
B11.TR2	Metal Working Fluids	1997 (R16)	B
B11.TR3	*Withdrawn* (Risk Assessment / Risk Reduction Guide; use B11.0)	2000 (R15)	B
B11.TR4	Selection of Programmable Electronic Systems (PES/PLC)	2004 (R15)	B
B11.TR5	Noise Measurement	2006	B
B11.TR6	*Withdrawn* (Safety Control Systems for Machines; revised as B11.26)	(2010)	B
B11.TR7	Integration of Lean and Safety	2007 (R17)	B
B11.TR8	Guide to Inspection of Risk Reduction Measures	2022	B
B11.TR9	Cybersecurity	2019	B
B11.TR10	Guidance on Artificial Intelligence into Machinery Safety Applications	2020	B
ANSI / ISO 12100	Safety of machinery (identical adoption of ISO 12100-2010)	2012	A

Safety of Machinery

1 Scope

This type-A standard applies to new, existing, modified or rebuilt power-driven machines, not portable by hand while working, that are used to process materials by cutting; forming; pressure; electrical, thermal or optical techniques; lamination; or a combination of these processes. This includes associated equipment used to transfer material or tooling (including fixtures) to assemble/disassemble, and to inspect or test. The associated equipment, including logic controller(s) and associated software or logic, together with the machine actuators and sensors, are considered a part of the machinery.

This can be a single machine or a machinery system(s).

Informative Note 1: *As used in this standard, a machine can be an assembly of linked parts or components (at least one of which moves) with the appropriate actuators, control and power circuits, etc., that are joined together for a specific application such as, for the processing, treatment, marking, or moving of material.*

Informative Note 2: *To improve readability, the terms "machine," "machinery," "machine tool" or "machinery system(s)" are used interchangeably throughout the document, either in singular or plural form.*

Informative Note 3: *A machine system is a systematic array of one or more machines that is not portable by hand while working and includes any associated material handling, manipulating, gauging, measuring, or inspecting equipment.*

Informative Note 4: *See ANSI B11.20 for additional information on the safety requirements and interactions for when machinery is integrated into a cohesive system.*

This standard specifies basic terminology, principles and a methodology for achieving acceptable risk in the design and the use of machinery. It specifies principles of risk assessment and risk reduction to help designers, integrators and users of machinery in achieving this objective. These principles are based on knowledge and experience of the design, use, incidents, accidents and risks associated with machinery. Procedures are described for identifying hazards and estimating and evaluating risks during relevant phases of the machine lifecycle, and for the elimination of hazards or the provision of sufficient risk reduction. Guidance is given regarding the documentation and confirmation of the risk assessment and risk reduction process.

Other industry sectors can benefit from applying this standard. A risk assessment may be required to determine if a machine-specific "base" (type-C) safety standard adequately covers the hazards associated with the specific application of a machine.

Where a machine-specific (type-C) safety standard exists, the requirements of the machine-specific "base" (type-C) safety standard shall generally apply.

Deviations from the requirements of this standard or from any machine-specific (type-C) safety standard shall be based on a documented risk assessment.

Informative Note 1: *Deviating from the requirements of this document should be considered only when it is not feasible to apply the requirements.*

Informative Note 2: *See clause 6 for additional information on risk assessment.*

Informative Note 3: *See 7.19 for a list of example machines covered by other specific standards.*