ANSI B11.25–2022

An American National Standard –

Safety Requirements for Large Machines

ANSI-Accredited Standards Developer and Secretariat:

B11 Standards, Inc.
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AMERICAN NATIONAL STANDARDS

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FOREWORD

(This Foreword is not part of the normative requirements of American National Standard B11.25-2022)

Machines are made in many sizes and configurations. As machines and machining centers increase in size, function and capacity, new hazards emerge and new risks are introduced. In particular, personnel are typically required to enter into the work envelope of large machines.

Many machines have a 1 m^3 work envelope or less (the traverse is anywhere within one cubic meter) and often are fully enclosed. The probability that personnel could enter the enclosure with the machine in operation is very low. Machines with a 2 m^3 work envelope have a somewhat increased risk of personnel entering the work envelope. Machines larger than a 2 m^3 work envelope are often not enclosed and in many cases, there is an actual or perceived need that entry into the work envelope is required to perform certain tasks.

Risk reduction measures (previously known as “safeguarding”) developed and applied for smaller machines typically focus on prohibiting machining processes and hazardous motions when personnel are in the work envelope. However, such approaches may not be feasible or effective for larger machines. For example, perimeter fencing with safety interlocked movable guards, light curtains, and/or area scanners to stop machining processes are often used in robotic and machining cells. These approaches applied to larger machines will likely be defeated as tasks are required to be performed within the machine work envelope and in some cases can be performed concurrent with machining with minimal risk of harm when following safe operating procedures.

Large machines typically require much higher levels of, and greater reliance on, training and administrative controls than similar smaller machines. Due to the dependence on proper procedures for the safety of personnel and equipment, operators of large machines tend to require additional training (more than what would be considered ‘typical’), greater discipline, and more experience with machinery in general.

The fundamental concerns with large machines are keeping people out of machine hazard zones when there is a risk of significant harm, and keeping components, parts, tooling and swarf from being ejected. A further complication with large machines is that often, the machining application involves unique or particular hazards that are not easily addressed in a standard separate from the context-specific application concerns. This standard addresses these concerns.

HISTORY

This is the second edition of this ANSI B11.25 standard, which would be generally considered as a type-B standard but could potentially be considered by some as more of a type-C standard. It has been developed to align and integrate with the much broader B11.0 (type-A) standard on general machinery safety/risk assessment and the B11.19 (type-B) standard on the implementation requirements for risk reduction measures.

The B11 series of standards for machines began with the code on safety requirements for mechanical power presses in 1922. Since that time, standards dealing with the safety requirements for a variety of machine types have been developed and continually updated and revised to become a series of some three dozen B11 standards and technical reports. This series contains type-A standards such as B11.0 and ANSI/ISO 12100 on broad/general safety requirements, type-B standards such as B11.19, B11.26 and all of the B11 series of Technical Reports dealing with broad safety aspects such as ergonomics, lean/safety integration, noise measurement, inspection of risk reduction measures, artificial intelligence (AI), cybersecurity, and type-C standards addressing specific machine types or groups or like machines.

Correlation to ISO standards

At the date of publication, there is no known ISO standard that specifically applies to the general classification of “large machines.” There may be one or more ISO C-level standards that apply to specific machines that include large sizes, but there is no general ISO standard for large machines.

EFFECTIVE DATE

The following information on effective dates is informative guidance only, and not a normative part of this standard. The B11.25 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 and machinery systems within 30 months of the approval of this standard.

The B11.25 subcommittee recommends that users evaluate whether existing machinery and machinery systems have acceptable risk 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 to implement risk reduction measures for appropriate risk reduction.

Changes from ANSI B11.25 – 2015

- general updating of text and alignment of terms with ANSI B11.0-2020 and ANSI B11.19-2019;
- added text in the Foreword and Introduction;
- substituted practicable for feasible;
- modified/clarified the scope (1) and exclusions (1.1) clauses;
- modified text on entrapment (6.2.3);
- modified text on whole body access (8.1.7);
- modified text on safety-related reset (8.12);
- modified text on maintenance (9.4).

CONTEXT (how to read/use this document)

The writers of this document 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 reader/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.

Explanation of the format, and ANSI B11 conventions

This standard uses a two-column format to provide supporting information for requirements. The material in the left column is confined to "Standards 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 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.

Generally speaking, the term "CAN" denotes a possibility, ability or capability, whether physical or causal, and the term "MAY" denotes a permissible course of action within the limits of the standard, however, the terms can often be used interchangeably.

B11 conventions:

Normative inter-document or intra-document references are denoted by "See #.##." Informative inter-document or intra-document references are denoted by "See also, #.##" *or* "See #.## for further information."

The use of "hard" conversion between metric and English units does not imply a tolerance requirement.

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 with the standard.

The ANSI B11 standards generally use the term "OR" as an inclusive disjunction, meaning *one or the other or both,* but on occasion will use the term "and/or" to emphasize the fact that both are fully intended in cases where the Subcommittee believed it was imperative to make that clear.

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.). See Annex B for further information.

DEVELOPMENT

This standard was processed and submitted for ANSI approval by the B11 Standards Development Committee (B11 SDC). At the time this standard was approved as an American National Standard, the ANSI B11 SDC was composed of the following member organizations:

Alan Metelsky, FS, Eng., **Chair** / Anne Mathias, PE, **Vice–Chair** / David Felinski, **Secretary**

Organizations Represented	**Name of Representative**	
	Delegate	**Alternate**
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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
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Bridgestone	Kenji Furukawa, FS Eng	Joey Hinson, FS Eng
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Fortress Safety	Jenny Tuertscher, B11 LMSS; FS Eng	Josh Hill
Honda Development & Mfg. of America	Todd Dickey	Doug Titus
General Motors Corporation	Mike Douglas	Tony Ross
IDEM Safety	Mark Witherspoon	Amir Mohtasham
Komatsu America Industries	George Schreck	James Landowski
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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
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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 PCA	Chris Soranno, FS Exp	Nate Gose, FS Eng
Sheet Metal & Air Cond. Contractors Nat'l. Assoc.	Justin Crandol, CSP	Rick Di Ioli
Toyota Motor Manufacturing North America	Chip Boertlein	Mike Collier, B11 LMSS

The B11.25 writing Subcommittee had the following members who participated in the development of this standard:

Name	**Organization**
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Rhiannon McPherson, Vice-Chair	Boeing
Chris Felinski, Secretary	B11 Standards
Kenji Furukawa	Bridgestone
Tina Hull	Omron
Heinz Knackstedt	Machine Control Safety Training
Karen Larue	Procter and Gamble
Bruce Main	design safety engineering
Mel Mitchell	MI Metals
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Chris Soranno	SICK PCA
Mike Taubitz	FDR Safety
Jenny Tuertscher	Fortress Safety
Scott Whittington	Cincinnati
Mark Witherspoon	IDEM Safety
Dave Felinski, Secretariat	B11 Standards

Introduction

In the United States, the Occupational Safety and Health Administration (OSHA) regulations govern workplace safety where large machines are used. OSHA has a long history of focusing on eliminating or mitigating hazardous exposures to employees. Large machines raise a particular challenge for risk reduction because OSHA does not tend to view safe distance safeguarding as an effective means to protect employees from harm.

For example, if a worker is cleaning out chips at one end of a large machine while the machining process is taking place 15-20 meters away, OSHA may consider the employee exposed because nothing prevents the worker from walking up to the point of operation of the working machine. Such a situation can lead to installing perimeter barriers which are subsequently defeated because some tasks may require being in the work envelope while the machine is operating.

The main purpose of every machine is to process materials. Inadvertent interference with, or accidental misdirection of the released energy during production, maintenance, commissioning and de-commissioning can result in injury.

The purpose of the ANSI B11 series of machinery safety standards is to devise and propose ways to eliminate or minimize risks of the potential hazards associated with the required tasks. 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. This standard recognizes 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.

Organization and Application of B11 Documents

The B11 standards and technical reports can be associated with the ISO "type A-B-C" structure as described immediately below, and as shown in Figure 1.

- **type-A standards** (basis standards) give basic concepts, principles for design, and general aspects that can be applied to machinery;
- **type-B standards** (generic safety standards) deal with one or more safety aspects or one or more types of engineering controls that can be used across a wide range of machinery:
- **type-C standards** (machinery safety standards) deal with detailed safety requirements for a particular machine or group of machines**.**

The B11.0 standard on general safety requirements common to ANSI B11 machines is primarily a "type-A" standard in that it applies to a broad array of machines and contains very general requirements. However, in many areas it also contains very specific requirements.

B11.19, B11.20, B11.21, B11.25, B11.26, as well as the entire B11 series of Technical Reports are all typical "type-B" documents addressing general safety elements that can be used across a wide range of machinery (such as B11.19 and B11.26) or as a standard when combining machines (B11.20).

The B11 series of Technical Reports are informative documents that may be generally applied to many different machines, and as such would fall into the "type-B" category.

The machine-specific ("type-C") B11 standards contain detailed safety requirements for a particular machine or group of machines (such as this standard).

The type-A B11.0 and the type-C (machine-specific) B11 standards are intended to be used concurrently by the supplier and user of machines. 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.

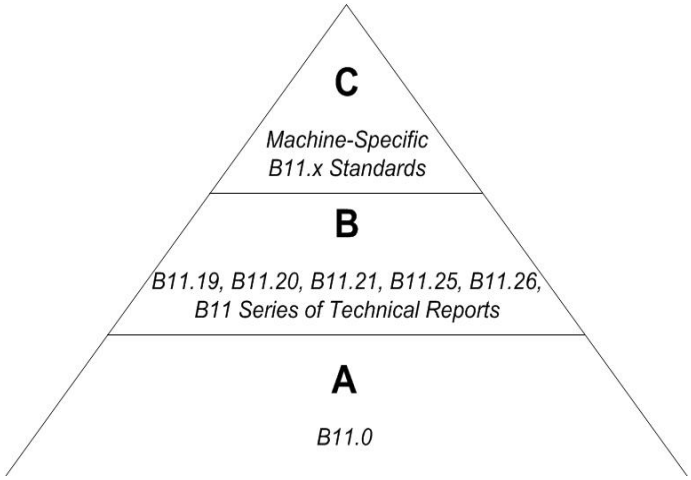

Figure 1 — Organization of the B11 Series of Documents

An overview of each clause of this standard is provided below (clauses 1 through 3 are not shown in Figure 2, for clarity).

1) Scope – Provides the boundaries or limits of the standard (i.e., what is/is not included).
2) 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.
3) 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).
4) Responsibility – The general responsibilities of the supplier (builder), user, modifier and the user personnel are listed in clause 4 together with the remaining clauses for which they have primary responsibility.
5) Risk assessment process –Clause 5 presents the general approach to risk assessment (see B11.0 for further explanation of hazard/task identification and risk assessment/risk reduction).
6) Design and construction – It is assumed that the supplier of new equipment to the user will be responsible for the requirements of clause 6, understanding that the user may add to or modify these requirements through the purchase agreement. For existing machinery, the user is generally responsible for the requirements of clause 6.
7) Layout, 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) Risk reduction measures – 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) Setup, operation and maintenance – The user is normally responsible for the requirements of clause 9 with possible assistance from the supplier for training.
10) Training – The user is normally responsible for the requirements of clause 10 with possible assistance from the supplier for materials or the training itself.
11) Decommissioning – This is primarily a user responsibility, however, the supplier shares responsibility for taking this aspect into consideration during the design.

Notes for Column Headings in Figure 2:

SUPPLIER: The early stages of a project present the greatest opportunity to determine project requirements and to anticipate and eliminate hazards and hazardous situations.

MODIFIER: The entity (OEM, Supplier, or the expert) in that discipline responsible for creating or modifying the system, machinery or equipment, should have all relevant design standards documentation. The entity should begin by working with the end user to list all tasks to achieve an appropriate comprehensive task list base of the "context of use" for the system, machine or equipment.

USER: The company representatives (can be from many disciplines) where the system, machinery or equipment will reside during its productive life. They should engage in participating or reviewing the risk assessment and what will be necessary for a final safety buy-off at the final location.

PERSONNEL: The group "at risk" from any hazards or hazardous situation presented by the system, machinery, or equipment while performing their tasks to achieve the company's desired productive life. This would include at a minimum, operators, maintenance personnel for both planned and unplanned maintenance, housekeeping and safety representatives. This group would evaluate the engineering controls, complementary measures and administrative controls (see ANSI B11.19). Figure 2 provides an overview of this standard and in particular the responsibilities of and requirements for the supplier, modifier, user, and the user personnel. Numbers in parentheses denote the particular clause or subclause of the standard.

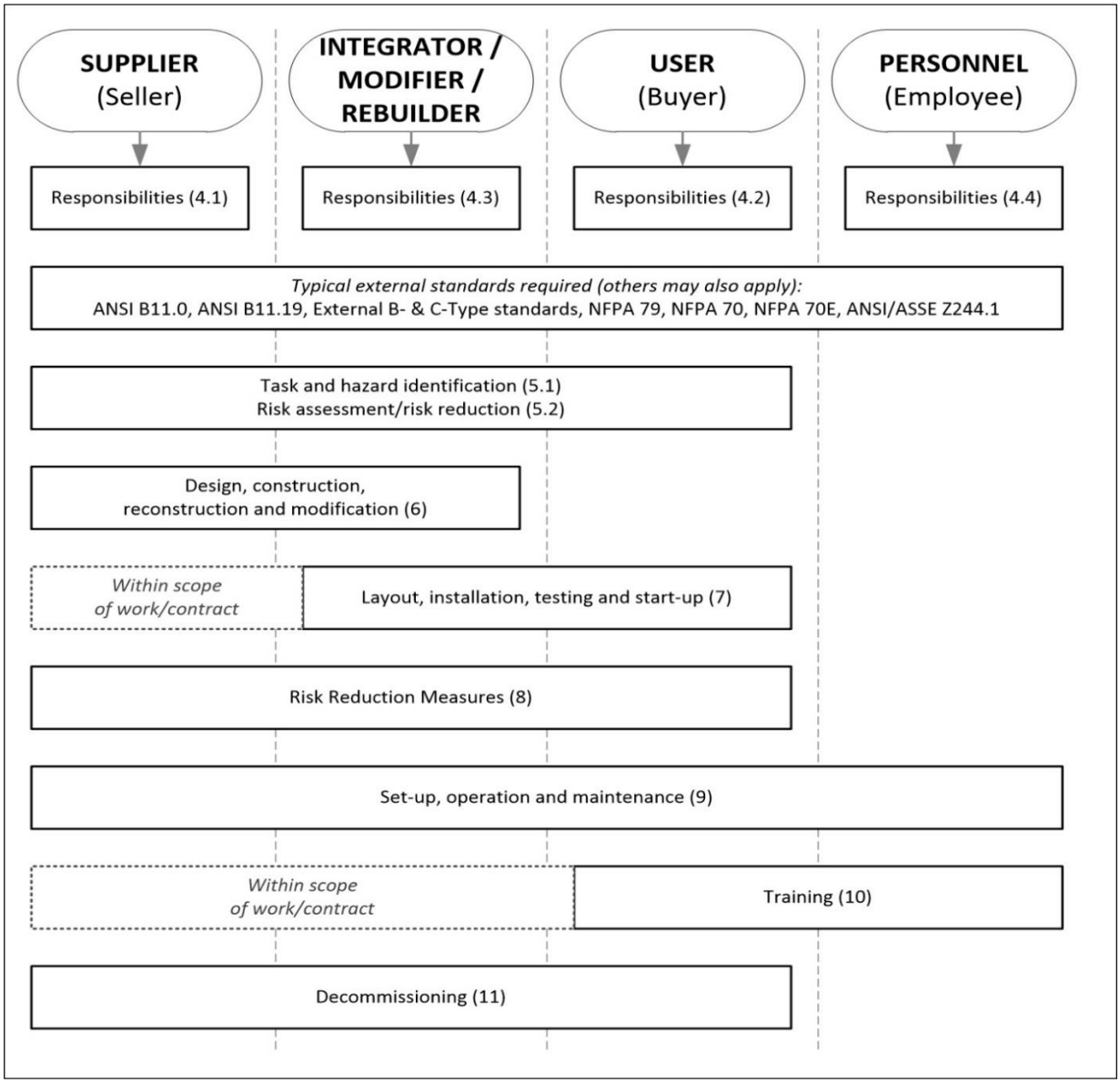

Figure 2 – Typical clause layout of B11 base standards showing the various responsibilities

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	2020	A
B11.1	Mechanical Power Presses	2009 (R20)	C
B11.2	Hydraulic & Pneumatic Power Presses	2013	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 w/ or without Auto Control	2022	C
B11.7	Cold Headers and Cold Formers	2020	C
B11.8	Manual Milling, Drilling, & Boring Machines	2021	C
B11.9	Grinding Machines	2010 (R20)	C
B11.10	Sawing Machines	2003 (R20)	C
B11.11	Gear and Spline Cutting Machines	2001 (R12)	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	2004 (R20)	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)	(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)	(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 Requirements for Large Machines

STANDARD REQUIREMENTS

EXPLANATORY INFORMATION

(This column is not part of the requirements of this American National Standard for – Safety Requirements for Large Machines, ANSI B11.25-2022).

1 Scope

This standard applies to two specific subsets of machinery:

- Machine types that would be covered by machine specific, “type C” B11 standards, but would be excluded by any size limitation in the scope of those standards;
  or
- Machines that, by the nature of the size of the workpiece, tooling, or process travels, require entry into the work envelope to perform normal process tasks.

E1

Examples of standards that exclude large machines on the basis of their working volumes or axis travels include ANSI B11.22 or B11.23.

Entry into the “working envelope” typically means walking or stepping into the envelope, as opposed to accessing the area with a hand or arm. This entry is often associated with whole body access as addressed in ANSI B11.19-2019, clause 9.11. See also, 8.1.7.

Large machines typically operate using a single or a small number of machining processes.

Large machines often require additional use of, and reliance on, administrative controls (training and procedures) than smaller machines.

Examples of large machines may include stretch presses, measurement machines, water jets, laser cutting machines and specialty machines. See also, Annex A.

This document is intended to be used with both ANSI B11.0 and ANSI B11.19 to execute the risk assessment process and apply risk reduction measures (previously known as “safeguarding”) respectively.

1.1 Exclusions

This standard does not apply to machines specifically covered by another standard.

This standard is not intended for machines integrated into a machinery system, industrial robot cells, material handling systems, or other large systems whose size is due to the inclusion of many smaller machines or processes.

E1.1

Other large systems of machines normally involve control zones and spans of control that are more complex than large machines covered by this standard. See also, ANSI B11.20.