ANSI B11.15-2022

American National Standard

Safety Requirements for Bar, Pipe, Tube, and Shape Bending Machines

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

APPROVED: **7 January 2022**

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 American National Standard B11.15-2022)

The primary objective of this standard is to eliminate or control the risk of injuries to personnel associated with bar, pipe, tube and shape bending machines by establishing requirements for the machine's construction, operation and maintenance and for the production systems in which bar, pipe, tube and shape bending machines are used. To accomplish this objective, responsibilities have been assigned to the supplier (manufacturer, rebuilder, reconstructor) and user as well as to personnel in the working environment.

Point-of-operation safeguarding is the single most important factor in the elimination of point-of-operation injuries. A production system consists of three components: the bar, pipe, tube or shape bender itself as one component; the feeding methods (including part or scrap removal) as a second component; and the third component, which is point-of-operation safeguarding. The vital third component can be evaluated for effectiveness only after the first two components and operator involvement is known.

The use of risk reduction measures for production systems in bar, pipe, tube and shape bending operations is complicated by the wide variety of operations and operating conditions, the variations in size, speed, and type of bar, pipe, tube and shape bending machine 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 tube or shape feeding and part and scrap removal. Because of these varying factors in the operations and in the workplace, a wide variety of point-of-operation safeguarding methods (guards and devices) are covered in this standard.

The words "safe" and "safety" are not absolutes. Safety begins with good design. While the goal of this standard is to eliminate injuries, it is recognized that risk factors cannot possibly be reduced to zero in any human activity. This standard is not intended to replace good judgment and personal responsibility. Operator skill, attitude, training, job monotony, ergonomic factors, fatigue and experience are safety factors that must be considered by the user.

Bar, pipe, tube and shape bending machines and associated equipment technologies are 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 sections of this standard, in no way infers acceptance or rejection of such technologies.

Effective Date

The following information on effective dates 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 and machinery systems within 30 months of the approval date of this standard.

The 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 (protective measures) for appropriate risk reduction.

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), the reader/user 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.

Inquiries

Inquiries with respect to the application or the substantive requirements of this standard, and suggestions for its improvement are welcomed, and should be sent to the B11 Standards, Inc. POB 690905, Houston, TX 77069 - Attention: B11 Secretariat.

Development

This standard was processed and submitted for ANSI approval by the B11 Standards Development Committee (B11 SDC) on safety standards for machines. 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 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**
Aluminum Extruders Council	Mel Mitchell, CSP	Bradley Wyatt, CSP
American Society of Safety Professionals	Ted Sberna, Sr.	Anne Mathias, PE
Association for Advancing Automation (A3 Robotics)	Carole Franklin	Jeff Fryman
Association For Manufacturing Technology	Russ Bensman	Alan Metelsky, FS Eng
The Boeing Company	Rhiannon McPherson	Mark Ellingson
Bridgestone	Kenji Furukawa, FS Eng	Joey Hinson, FS Eng
Canadian Standards Association	Andrea Holbeche, P.Eng.	Walter Veugen
Deere & Co.	Tony Beeth	Scott Winter
Euchner	Ron Yemmans	
Exponent	Stephen Andrew, PE	Torsten Skujins
FDR Safety	Mike Taubitz	Joe Wolfsberger
General Motors Corporation	Mike Douglas	Stacey Brooks, CSP
Grantek System Integration	Gerald Kupel	Patric Brown
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 Institute for Occupational Safety & Health	Rick Current, PE	
Occupational Safety & Health Administration	Kenneth Stevanus	Mary Bauer, CIH, CSP
Omron Automation	Tina Hull, FS Exp	Frank Webster
Assn. Packaging & Processing Technologies	Bruce Main, PE, CSP	Tom Egan
Pilz Automation Safety, LP	Mike Beerman	Doug Sten, PhD, CSP
Plastics Industry Association	Jeff Linder	Dale Bartholomew
Precision Metalforming Association	James Barrett, Jr. PhD	David Klotz
Presence-sensing Device Manufacturers Association	James Kirton	Michael Carlson
Rockwell Automation	Michael Poynter, FS Eng	Darin Magnuson, FS Eng
Safe-T-Sense	Chris Gerges	Federico Badillo
SICK, Inc.	Chris Soranno, FS Exp	Nate Gose, FS Eng
Sheet Metal & Air Conditioning Contractors Nat'l. Assn.	Justin Crandol, CSP	Rick Di Ioli
Toyota Motor Manufacturing North America	Chip Boertlein	Michael Collier

The B11.15 Subcommittee which revised the 2001 standard, had the following members:

Organization Represented	Name of Representative
Creation Windows	Robert Grice, Chairman
Pines Manufacturing	Thomas Glissman, Secretary
Drion Safety Service, Inc.	Robert Eggleston
Allegheny Teledyne Industries	Joseph Kelly
AMT	David Felinski, Secretary

Since the last revision of B11.15, the format/style and even some content elements within the ANSI B11 series have evolved. This current revision has maintained many of those same safety requirements and in several instances, updated requirements, up-to-date standards, current safety practices and technology, while updating the format of the standard to the present-day B11 standards structure. Additionally, the ANSI B11 series of standards now incorporates the integration of a stratified approach using "**types**" of standards (i.e., type-A, type-B and type-C standards – see a more detailed explanation of this approach in the Introduction). ANSI B11.15 is considered a type-C standard and is intended to be used (at a minimum) in conjunction with the type-A ANSI B11.0 and type-B ANSI B11.19 (see the B11 documents list on page xi).

The Subcommittee which developed this current revision of ANSI B11.15 had the following members:

Chris Felinski, Chairman, B11 Standards	Bruce Main, PE, CSP, design safety engineering
David Felinski, Secretary, B11 Standards	Ted Sberna, Sr., White Horse Safety
Mike Douglas, General Motors	Chris Soranno, FS Eng, SICK
Jim Kirton, Kirton Industrial Equipment	Mike Taubitz, FDR Safety
Heinz Knackstedt, Machine Control Safety Training	

Explanation of the format, and ANSI B11 conventions

This standard uses a two-column format to provide supporting information for requirements. The text in the left column is confined to “Standards Requirements” 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. 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 compliance with the 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, #.##.”

The use of “hard” conversions 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.

Introduction

The main purpose of every machine tool 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.

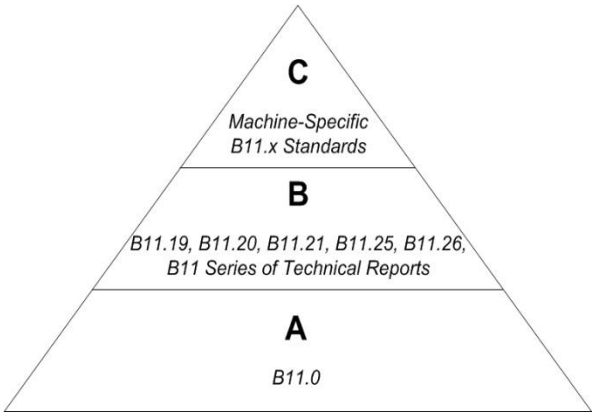

Figure 1 – Organization of the B11 series of documents

An overview of each clause of this standard is provided below.

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 – 11) 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) Responsibilities – 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) Set-up, 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.

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.

#	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	2012 (R20)	C
B11.4	Shears	2003 (R20)	C
B11.5	Ironworkers	1988 (R20)	C
B11.6	Manual Turning Machines w/ or without Auto Control	2001 (R20)	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	Bar, pipe, tube and Shape Bending Machines	2022	C
B11.16	Powder / Metal Compacting Presses	2014 (R20)	C
B11.17	Horizontal Hydraulic Extrusion Presses	2004 (R15)	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	2015 (R20)	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 (R17)	B
B11.TR6	*Withdrawn* (Safety Control Systems for Machines)	(2010)	B
B11.TR7	Integration of Lean and Safety	2007 (R17)	B
B11.TR8	Sustainable Safety Systems Through 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

STANDARD REQUIREMENTS EXPLANATORY INFORMATION

Safety Requirements for Bar, Pipe, Tube, and Shape Bending Machines

STANDARD REQUIREMENTS

EXPLANATORY INFORMATION

(This column is not part of the requirements of this American National Standard – Safety Requirements for Bar, Pipe, Tube and Shape Bending Machines, ANSI B11.25-202x).

1 Scope

The requirements of this standard apply to any power-driven machine designed for bending bar, pipe, tube, and shapes by means of bending dies, clamp dies, pressure dies, mandrels, wiper dies, vertical bending punches, radius dies, wing dies, and associated tooling.

Note – In the context of this standard, the term "machine" refers to bar, pipe, tube, and shape bending machines.

1.1 Applications

The requirements of this standard apply to:

- vertical hydraulic benders;
- horizontal hydraulic benders;
- horizontal mechanical benders;
- horizontal or vertical combination hydraulic and mechanical benders and combination pneumatic and mechanical benders;
- auxiliary equipment associated with bending machines;
- compression benders;
- draw benders;
- pipe benders;
- stretch benders;
- tube benders.

1.2 Exclusions

The requirements of this standard do not apply to:

- bench presses;
- hydro forming;
- forging presses;
- four-slide machines;
- hydraulic presses;
- mechanical presses;
- power press brakes;
- roll benders;
- roll formers;
- assembly machines.

E1

For examples of bending applications, see Figure A.1.