

ANSI B11.21-2006

American National Standard for machine tools—

Safety Requirements for Machine Tools Using a Laser for Processing Materials

Secretariat and Accredited Standards Developer:

AMT – The Association For Manufacturing Technology
7901 Westpark Drive
McLean, VA 22102

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by the American National Standards Institute, Inc.



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FOREWORD (Informative and not part of American National Standard B11.21-2006)

The initial subcommittee to draft this standard was established in November 1993, and the 1997 publication was the first issue. This limited revision of B11.21 standardizes the contents and requirements with common elements in the other B11 series of safety standards, and harmonizes with current requirements found in updated normative reference standards. The purpose of this standard is to reduce the risk or eliminate injuries to personnel as a result of the operation or maintenance of a machine tool using a laser for processing materials, and its associated equipment by establishing requirements for the machine's design, construction, safeguarding, operation and maintenance. To accomplish this objective, responsibilities have been assigned to both the supplier and user, as well as to personnel in the working environment.

The safeguarding of machine tools utilizing lasers for machining operations is complicated by the wide variety of operations and operating conditions, the variations in size, speed, and type of machine used; the size 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 material feeding and part and scrap removal. Because of these varying factors in the operations and in the workplace, a wide variety of safeguarding methods (guards and devices) have been covered in this standard.

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.

Suppliers of machine tools using a laser for processing materials must also comply with the *Manufacturer's Requirements for Laser Products* under Title 21 of the Code of Federal Regulations, section 1040.10 (Federal Laser Product Performance Standards -FLPPS), as well as the recordkeeping and reporting requirements of 21 CFR sections 1000 to 1005, 1010 and 1040. This is in addition to the responsibility of the actual laser device supplier (if different from the machine tool supplier) to do so.

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 be practically 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, fatigue and experience are safety factors that must be considered by the user.

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.

Suggestions for improvement of this standard will be welcome. They should be sent to AMT-The Association For Manufacturing Technology, 7901 Westpark Drive, McLean, VA 22102 - Attention: AMT-B11 Secretariat.

This standard was prepared by the B11.21 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:

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

Organizations Represented

	Name of Representative	
	Delegate	Alternate
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Aluminum Extruders Council	Melvin Mitchell	Doug Hart
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General Motors Corporation	Michael Taubitz	Dallas Gatlin
Deere & Company	Gary Kopps	Ellen K. Blanshan
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Metal Powder Industries Federation	Dennis Cloutier, CSP	Teresa F. Stillman
Natl. Inst. for Occupational Safety & Health	Rick Current	
Occupational Safety & Health Administration	Ken Stevanus	
Packaging Machinery Manufacturers Institute	Charles F. Hayes	Maria Ferrante
Precision Metalforming Association	William Gaskin	Christie Carmigiano
Presence Sensing Device Manufacturing Association	Jim Kirton	Mike Carlson
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Robotic Industries Association	Jeff Fryman	Roberta Nelson Shea
Scientific Technologies, Inc.	Frank Webster	Chris Soranno
Sheet Metal & Air Conditioning Contractors' Natl. Assn.	Mike McCullion, CSP	Roy Brown
Tooling and Manufacturing Association	Daniel Kiraly	Allan Te Ronde
Toyota Motor Manufacturing North America	Barry Boggs	Tom Huff

At the time this standard was approved, the ANSI B11 ASC **B11.21 Subcommittee** had the following members who participated in the development of this revision:

Chairman: Ancel Thompson, Preco Laser Systems (formerly with Amada)	Dennis Cloutier Scott Filzen Peter Keller	Cloutier Consulting W.A. Whitney Trumpf, Inc.
Secretary: David Felinski, AMT	Karl Oberjohn Thomas Lieb	Cincinnati, Inc. LAI International

Explanation of the format, and ANSI B11 conventions

This ANSI B11.21 – 2006 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 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, ability 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 compliance with the standard. The B11 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 limiting device (e.g., backgage).

Suggestions for improvement of this standard will be welcome. They should be sent to AMT-The Association For Manufacturing Technology, 7901 Westpark Drive, McLean, VA 22102 - Attention: B11 Secretariat.

Introduction

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.

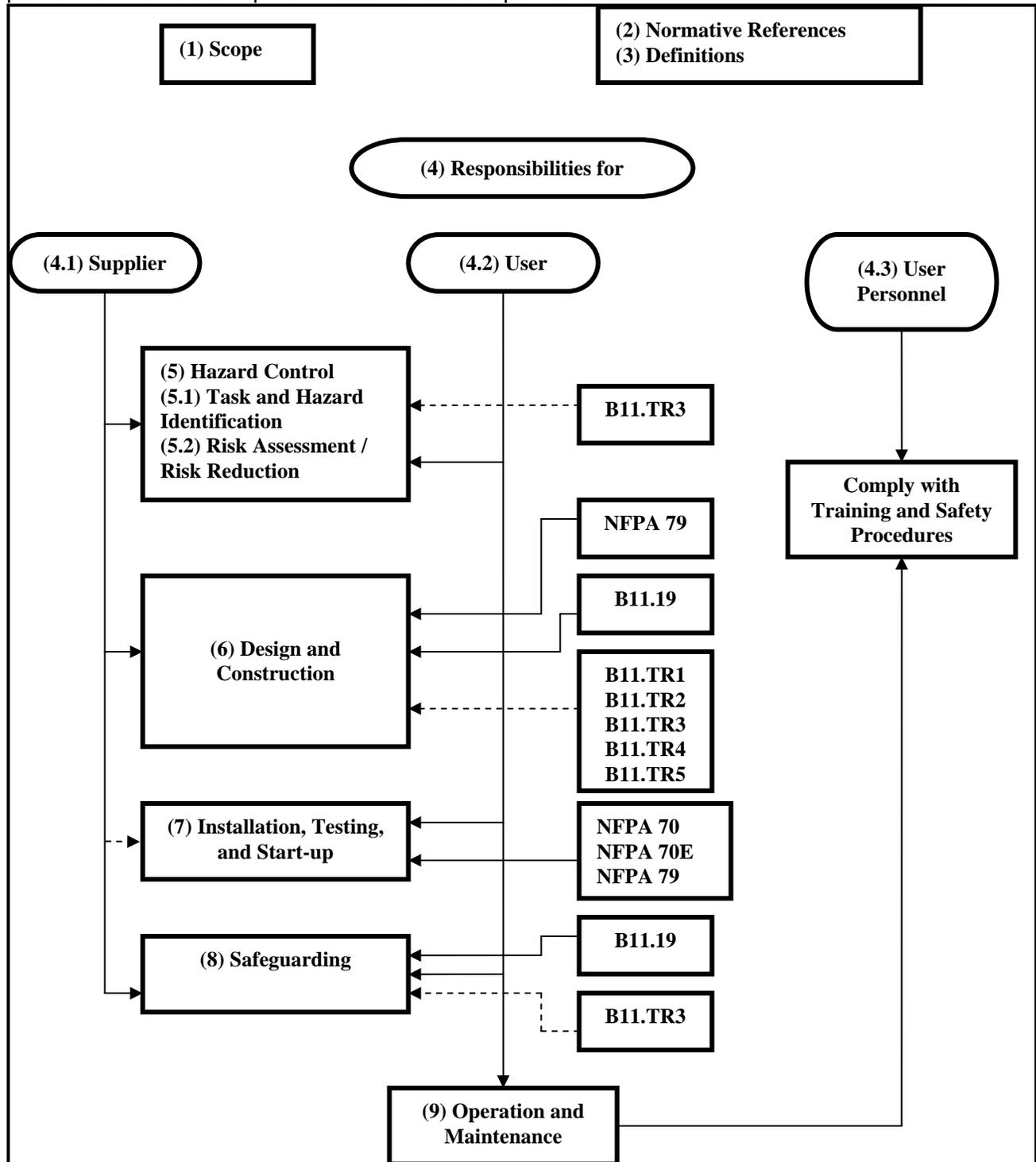


Figure 1 – General layout of the standard showing the various responsibilities

Notes:

- 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, 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.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 entirely responsible for the requirements of clause 6 with the understanding that the user may add 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 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.

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.

American National Standard for Machine Tools – Safety Requirements for Machine Tools Using a Laser for Processing Materials

STANDARD REQUIREMENTS

1 Scope

1.1 Scope

This standard applies to machine tools using a laser for processing materials, and its associated equipment. It describes the hazards generated by such machines and states the protective measures to be incorporated into such machines.

The standard also contains requirements for the information provided with such machines.

1.2 Inclusions

Laser material processing includes, but is not limited to, such applications as:

- drilling;
- cutting;
- welding;
- cladding;
- surface melting;
- transformation hardening;
- marking;
- engraving;
- curing;
- ablation;
- laser-shock hardening;
- scribing;
- sintering;
- rapid prototyping;
- stereolithography.

EXPLANATORY INFORMATION

(Not part of American National Standard – Safety Requirements for Machine Tools Using a Laser for Processing Materials, ANSI B11.21-2006)

E1.1

A machine tool using a laser for processing materials, and its associated equipment using laser radiation is a machine in which a laser(s) provides sufficient energy/power to melt, evaporate, or cause a phase transition in at least a portion of the workpiece.

A machine tool using a laser for processing materials, and its associated equipment is complete and operational when connected to appropriate exhaust/filtration equipment and other utilities (such as gas, electric, coolant, etc.).

This definition differs slightly from the European definition of a complete machine per ISO 12100-1 and 2. Only complete machines may certify compliance to the European Machinery Safety Directive.