

ANSI B11.21-1997

# American National Standard

*for Machine Tools –  
Machine Tools Using Lasers for  
Processing Materials —  
Safety Requirements for  
Design, Construction, Care, and Use*

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 **ANSI** American National Standards Institute

11 West 42nd Street  
New York, New York  
10036

**ANSI B11.21-1997**

American National Standard  
for Machine Tools –

Machine Tools Using Lasers for Processing Materials –  
Safety Requirements for  
Design, Construction, Care, and Use

Secretariat

**AMT - The Association For Manufacturing Technology**

Approved October 28, 1997

**American National Standards Institute, Inc.**

**Abstract**

This standard is part of the ANSI B11 series and pertains to the safety requirements for lasers used in machine tool applications as described in this document. It is limited to the requirements of safeguarding of personnel, installation, verification, operation, maintenance, training, and documentation for individual machines.

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**Foreword** (This Foreword is not part of American National Standard B11.21-1997)

The subcommittee to draft this standard was established in November 1993, and the 1997 publication is the first issue of the standard. The objective of this standard is to eliminate or control the risk of injuries to personnel associated with lasers used in machine tool applications by establishing requirements for the machines' design, construction, care and use. To accomplish this objective, responsibilities have been assigned to the Supplier 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 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.

The words "safe" and "safety" are not absolutes. Safety is an attitude. 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.

To aid all parties concerned in complying with the requirements of this standard, explanatory information has been placed in the right column, adjacent to the applicable requirements.

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 AMT - The Association For Manufacturing Technology, 7901 Westpark Drive, McLean, Virginia 22102-4206, Attention: Safety Department.

This standard was developed by the B11.21 Subcommittee, processed and administered by the AMT, as Secretariat, and approved by the B11 Parent Voting Committee for submittal to ANSI as an American National Standard in accordance with requirements of the ANSI Accredited B11 Operating Procedures.

Subsequent to an annual interest survey conducted by the Secretariat, the organizations listed below have registered a voting interest on this standard. Their listing does not necessarily imply that all organizations voted for its approval. At the time of ballot, the following representatives registered a vote on behalf of their organization.

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 processed and approved for submittal to ANSI by the 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 it approved this standard, the B11 Committee had the following members:

Theodore M. Wire, Chairman  
John W. Russell, P.E., Vice Chairman  
Charles A. Carlsson, Secretary

*Organization Represented*  
Aerospace Industries Association of America, Inc.

Alliance of American Insurers  
American Automobile Manufacturers Association

*Name of Representative*  
Gerald Lancour (D)  
Glynn Rountree (A)  
John W. Russell, P.E. (D)  
Richard Parry (D)  
David Felinski (A)

American Boiler Manufacturers Association  
American Insurance Services Group

American Institute of Steel Construction  
American Ladder Institute

American Society of Safety Engineers  
AMT-The Association For Manufacturing Technology

Can Manufacturers Institute  
Computer & Business Equipment Manufacturers  
Association  
Defense General Supply Center

Forging Industry of America

Graphic & Product Identification Manufacturers Assn.  
Grinding Wheel Institute  
International Association of Machinists & Aerospace  
Workers, District Lodge 142  
International Union, United Automobile, Aerospace and  
Agricultural Implement Workers of America (UAW)  
Machinery Dealers National Association

Metal Building Manufacturers Association  
Metal Powder Industries Federation

National Association of Government Labor Officials  
National Electrical Manufacturers Association  
National Fluid Power Association  
National Tooling and Machining Association  
North American Die Casting Association  
Precision Metalforming Association  
Presence Sensing Device Manufacturers Association

Rubber Manufacturers Association

Sheet Metal & Air Conditioning Contractors' National  
Association, Inc.  
Steel Service Center Institute  
Tooling and Manufacturing Association

U.S. Department of the Navy (NAVSEA)

\* = Deceased

Russell N. Mosher (A)  
Henry S. Pankiw (D)  
Paul Frenier (A)  
Thomas Schlaflly (D)  
Robert Werner (D)  
Joe Ziemba (A)  
Theodore M. Wire  
Emmett McCarthy (D)\*  
William L. Wachs (A)  
O.L. Campbell  
Wayne Loomis

Rolf Anderson (D)  
B. Montague Ingram (A)  
Dale Bos (D)  
Karen Taylor (A)  
Donald Root  
Charles S. Conant  
Jim DeWitt (D)

Barrie E. Brooks, P.E.

Stephen Fisk (D)  
Sid Lieberstein (A)  
Charles M. Stockinger  
Dennis Cloutier (D)  
Donald White (A)  
Dave Renfro (A)  
Larry Miller (D)  
Shirley Seal (A)  
Matthew Coffey  
Michael Cervantes (D)  
Wayne Groenstein  
James Kirton(D)  
Barry Stockton (A)  
Dale Louda (D)  
Peter Pantuso (A)  
David D. DeLorenzo.

Al Walker (D)  
Jeffrey W. Hayes (D)  
Bruce C. Braker (A)  
Various Delegates Depending  
on the Standard

Subcommittee B11.21 on Safety of Laser processing machines, which developed this standard, had the following members:

Chairman: Stanley L. Ream-1993-April 1996  
Chairman: John Crockett- April 1996-  
Secretary: Ancel Thompson

Jerome Dennis  
David Havrilla  
Thomas Lieb  
Paul Salvo  
Ronald Taylor  
Robert Weiner

Greg Guinto  
Sherwood Johnston  
Terry Lyon  
Dale Smyth  
Gerald Van de Voorde

## **Explanation Of The Format Of The Standard**

This ANSI B11.21 standard is divided into parts formerly referred to as sections or chapters and now referred to as clauses in line with the new ANSI style manual. Major divisions of clauses are referred to as subclauses and when referenced by other text in the standard is 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 standards requirements only, and is so captioned. The use of the word *shall* indicates a mandatory requirement.

The right column, captioned "Explanatory Information," contains explanatory information that the subcommittee felt would clarify the standard. This column should not be construed as being a part of American National Standard B11.21 – 1997. The use of the word *should* indicates a recommendation that is advisory and not mandatory.

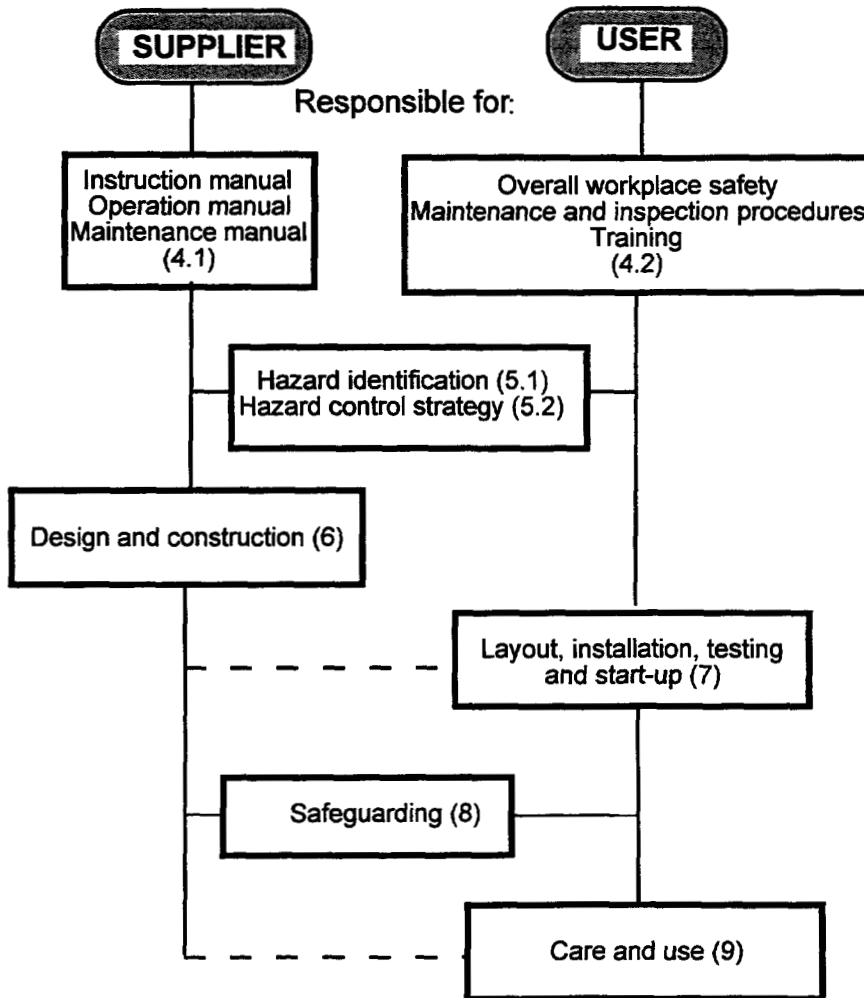
Operating rules (safe practices) are not included in either column of this standard unless they are of such nature as to be vital safety requirements, equal in weight to other requirements, or guides to assist in compliance with the standard.

Figure 1 included in this standard is provided to aid in its understanding. As such, it is to be considered an example and not part of the requirements.



## Introduction

The requirements of this ANSI standard are grouped according to those that apply to the Supplier (i.e. manufacturer, modifier) and User (see chart below). Some of these requirements are shared between the Supplier and User and are so indicated (e.g. hazard identification, hazard control, safeguarding). The responsibility of the Supplier for layout and installation is to the extent that the User requires his involvement.



# **American National Standard for Machine Tools – Machine Tools Using Lasers For Processing Materials– Safety Requirements for Design, Construction, Care, and Use**

## **STANDARD REQUIREMENTS**

## **EXPLANATORY INFORMATION**

(Not part of American National Standard for Machine Tools – Lasers used in machine tool applications - Safety Requirements for Design, Construction, Care, and Use, ANSI B11.21-1997). This Column is for explanation or information only.

### **1 Scope, purpose, and exclusions**

#### **1.1 Scope**

This standard applies to machine tools using laser radiation to process materials, as defined in clause 3. The standard describes the hazards generated by such machines and states the safety measures to be incorporated into such machines.

The standard also contains the description of information required to be provided by Suppliers and Users of such equipment.

#### **1.2 Purpose**

The purpose of this standard is to establish safety requirements with respect to the design, construction, safeguarding, care, and use of machine tools using lasers to process material. Additionally, a purpose of this standard is to assign safety responsibilities for both the Supplier and Users, respectively.

#### **1.3 Exclusions**

This standard is not applicable to laser products or equipment containing such products which are manufactured solely and expressly for the following applications:

- photolithography,
- holography,
- equipment used in medical applications,
- data storage,
- laser printers and copiers.

#### **E1.2 Purpose**

The requirements of this standard are aimed at eliminating injuries to operating, maintenance, and other personnel who are working on, or adjacent to, a laser used in a machine tool application, and minimizing accidental damage to equipment.

Laser material processing includes, but is not limited to, such applications as: drilling, cutting, welding, cladding, surface melting, transformation hardening, engraving, curing, ablation, laser-shock hardening, scribing, sintering and stereolithography.