American National Standard

ANSI Z136.4 - 2021

American National Standard Recommended Practice for Laser Safety Measurements for Classification and Hazard Evaluation

ANSI®
Z136.4 – 2021
Revision of
ANSI Z136.4-2010

American National Standard
Recommended Practice for
Laser Safety Measurements for
Classification and Hazard Evaluation

Secretariat
Laser Institute of America

Approved February 05, 2021
American National Standards Institute, Inc.

American National Standard

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Published by

Laser Institute of America
12001 Research Parkway, Suite 210
Orlando, FL 32826

ISBN: 978-1-940168-26-5 (Electronic)

Printed in the United States of America.

Foreword

(This introduction is not a normative part of ANSI Z136.4-2021, American National Standard Recommended Practice for Laser Safety Measurements for Classification and Hazard Evaluation*.)*

In 1968, the American National Standards Institute (ANSI) approved the initiation of the Safe Use of Lasers Standards Project under the sponsorship of the Telephone Group.

Prior to 1985, Z136 standards were developed by ANSI Committee Z136 and submitted for approval and issuance as ANSI Z136 standards. Since 1985, Z136 standards have been developed by the standards committee ASC Z136 for Safe Use of Lasers and have been published by Accredited Standards Developer (ASD) and secretariat to ASC Z136, Laser Institute of America (LIA). A copy of the procedures for development of these standards can be obtained from the secretariat, LIA, 12001 Research Parkway, Suite 210, Orlando, FL 32826, or viewed at www.z136.org.

The present scope of ASC Z136 is to protect against hazards associated with the use of lasers and optically radiating diodes. ASC Z136 is responsible for the development and maintenance of this standard. In addition to the consensus body, ASC Z136 is composed of standards subcommittees (SSC) and technical subcommittees (TSC) involved in Z136 standards development and an editorial working group (EWG). At the time of this printing, the following standards and technical subcommittees were active:

SSC-1	Safe Use of Lasers (parent document)
SSC-2	Safe Use of Lasers and LEDs in Telecommunications Applications
SSC-3	Safe Use of Lasers in Health Care
SSC-4	Measurements and Instrumentation
SSC-5	Safe Use of Lasers in Educational Institutions
SSC-6	Safe Use of Lasers Outdoors
SSC-7	Eyewear and Protective Barriers
SSC-8	Safe Use of Lasers in Research, Development, and Testing
SSC-9	Safe Use of Lasers in Manufacturing Environments
SSC-10	Safe Use of Lasers in Entertainment, Displays, and Exhibitions
TSC-1	Biological Effects and Medical Surveillance
TSC-2	Hazard Evaluation and Classification
TSC-4	Control Measures, Training, and Laser Safety Programs
TSC-5	Non-Beam Hazards
TSC-7	Analysis and Applications
EWG	Editorial Working Group

The nine standards currently issued are:

ANSI Z136.1-2014, *American National Standard for Safe Use of Lasers*

ANSI Z136.2-2012, *American National Standard for Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources*

ANSI Z136.3-2018, *American National Standard for Safe Use of Lasers in Health Care*

ANSI Z136.4-2021, *American National Standard Recommended Practice for Laser Safety Measurements for Classification and Hazard Evaluation*

ANSI Z136.5-2020, *American National Standard for Safe Use of Lasers in Educational Institutions*

ANSI Z136.6-2015, *American National Standard for Safe Use of Lasers Outdoors*

ANSI Z136.7-2020, *American National Standard for Testing and Labeling of Laser Protective Equipment*

ANSI Z136.8-2021, *American National Standard for Safe Use of Lasers in Research, Development, or Testing*

ANSI Z136.9-2013, *American National Standard for Safe Use of Lasers in Manufacturing Environments*

This American National Standard Recommended Practice provides guidance for optical measurements associated with laser safety requirements. The information provided in this recommended practice is intended to assist users who are entrusted with the responsibility of conducting laser hazard evaluations to ensure that appropriate control measures are implemented. Laser safety requirements and the rationale for them are specified in *ANSI Z136.1 American National Standard for Safe Use of Lasers*. The procedures and methodologies described in this recommended practice are based on requirements previously established in ANSI Z136.1. As the name implies, this recommended practice contains recommendations that will lead to the desired end result. On many occasions, there is more than one measurement approach to achieve the end result, and the recommended measurement techniques in this recommended practice should be viewed as plausible practical options, and not necessarily as the exclusive techniques to perform a given task.

This recommended practice has been published as part of the ANSI Z136 series of laser safety standards. The basic document is the ANSI Z136.1, *American National Standard for Safe Use of Lasers*. In general, this recommended practice may be used as a supplement to ANSI Z136.1 when additional details on laser safety measurements are desired.

It is expected that this standard will be periodically revised as new information and experience in the use of lasers are gained. Future revisions may have modified content, and the use of the most current document is highly recommended.

While there is considerable compatibility among existing laser safety standards, some requirements differ among state, federal, and international standards and regulations. These differences may have an effect on the particulars of the applicable control measures.

Occasionally questions may arise regarding the meaning or intent of portions of this standard as it relates to specific applications. When the need for an interpretation is brought to the attention of the secretariat, the secretariat will initiate action to prepare an appropriate response. Since ANSI-approved Z136 standards represent a consensus of concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason, the secretariat is not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration. Requests for interpretations and suggestions for improvements of the standard are welcome. They should emailed to ASC Z136 Secretariat, Laser Institute of America (lia@lia.org).

This standard was developed by Standards Subcommittee 4 (SSC-4) "Measurements & Instrumentation" and approved by a consensus body balloting group made up of members of ASC Z136. Committee approval of the standard does not necessarily imply that all members voted for its approval.

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Notice

(This notice is not a normative part of ANSI Z136.4-2021, American National Standard Recommended Practice for Laser Safety Measurements for Classification and Hazard Evaluation.*)*

Z136 standards and recommended practices are developed through a consensus standards development process approved by the American National Standards Institute. The process brings together volunteers representing varied viewpoints and interests to achieve consensus on laser safety related issues. As secretariat to ASC Z136 and as an ASD, LIA administers the process and provides financial and clerical support to the committee.

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American National Standard Recommended Practice for Laser Safety Measurements for Classification and Hazard Evaluation

1. General

1.1 Scope.

This document provides practical guidance for measurement procedures used for classification and hazard evaluation of lasers. This document is intended to provide guidance for manufacturers, laser safety officers (LSOs), and trained laser users.

1.2 Application.

This document addresses only the measurement of those parameters associated with the laser output beam required for classification and hazard evaluation. Evaluation consists of comparing measured exposures with the maximum permissible exposure (MPE) values found in the American National Standards Institute (ANSI) Z136.1 *American National Standard for Safe Use of Lasers* (latest revision). The MPE is based on the ability of the direct, reflected, or scattered laser beam to cause biological damage to the eye or skin. Classification consists of comparing accessible radiation levels with accessible emission limits (AEL), such as those in the latest editions of the ANSI Z136.1, the Code of Federal Regulations (CFR) 21 CFR 1040.10 and 21 CFR 1040.11, or the International Electrotechnical Commission (IEC) 60825-1 laser safety standard. The two CFR sections are commonly known as the Federal Laser Product Performance Standard (FLPPS) and are referred to as such by the Occupational Safety and Health Administration (OSHA) and others in reference to laser hazards and safety measures.

Regulations such as in the FLPPS or IEC 60825-1 require laser manufacturers to self-certify their laser products. Other circumstances under which measurements for laser classification or hazard evaluation may be appropriate are when:

a) the manufacturer's information is not available,
b) the laser or laser system has not been classified,
c) suspected malfunctions or alterations to a system may have changed its classification or the potential hazard,
d) there is uncertainty in the laser parameters that determine the optical density (OD) requirements for laser eyewear protection (LEP),
e) the borders of a nominal hazard zone (NHZ) cannot be determined from the laser controlled area (LCA) configuration, or
f) it is useful to determine a smaller NHZ than what the LCA configuration provides.

For laser manufacturers and developers of lasers modified for specific application in the research environment, measurements are important, but other laser users may find these measurement techniques useful or even needed as well.