ASME Y14.46-2022

Product Definition for Additive Manufacturing

Engineering Product Definition and Related Documentation Practices

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

ASME Y14.46-2022

Product Definition for Additive Manufacturing

Engineering Product Definition and Related Documentation Practices

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

Two Park Avenue • New York, NY • 10016 USA

Date of Issuance: June 8, 2022

This Standard will be revised when the Society approves the issuance of a new edition.

Periodically certain actions of the ASME Y14 Committee may be published as Cases. Cases are published on the ASME website under the Y14 Committee Page at http://go.asme.org/Y14committee as they are issued.

Errata to codes and standards may be posted on the ASME website under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The Y14 Committee Page can be found at http://go.asme.org/Y14committee. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting "Errata" in the "Publication Information" section.

The American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990

CONTENTS

Tables

FOREWORD

The Charter of the ASME Y14.46 Subcommittee was approved by the ASME Y14 Standards Committee on October 10, 2014, with the task to develop requirements in geometric dimensioning and tolerancing for additive manufacturing (AM). The goal of the Subcommittee was to create a broadly accepted standard that incorporates, expands, or refines international practices and symbology to enable AM product definition data to be created, interpreted, and consumed on a global basis. The Y14.46 Subcommittee has brought together subject matter experts (SMEs) who have generously volunteered a significant amount of time and resources to this effort over the last 5 years.

The Subcommittee approved the ASME Y14.46 Draft Standard for Trial Use on June 19, 2017. The Subcommittee welcomed comments and/or proposals for revisions to the Draft Standard, as submitted through the provided forms and additional balloting process. Since the initial release of the Draft Standard for Trial Use, the Subcommittee has received important feedback from the additive manufacturing and product definition communities. The Subcommittee has incorporated the feedback into this document to make it a released Standard.

Some appendices are introduced in this Standard because the Subcommittee is aware of the need to address these topics. Work to enhance these appendices is ongoing, and feedback from the public is welcome (see Correspondence With the Y14 Committee). The following appendices are identified as "forward work":

(a) Nonmandatory Appendix C, Reference Documents to Test for Conformance

(b) Nonmandatory Appendix D, Complex Geometry and Forward Work

This Standard has been created and edited to be distributed in the pdf format. It was approved as an American National Standard by the American National Standards Institute on May 19, 2022.

ASME Y14 COMMITTEE
Engineering Product Definition and Related Documentation Practices

(The following is the roster of the Committee at the time of approval of this Standard.)

STANDARDS COMMITTEE OFFICERS

J. B. Hoskins, *Chair*
J. D. Meadows, *Vice Chair*
F. Constantino, *Secretary*

STANDARDS COMMITTEE PERSONNEL

A. R. Anderson, Dimensional Dynamics, LLC
T. Bowers, Lockheed Martin Co.
J. Burleigh, Unaffiliated
W. Cockrell, Raytheon Technologies
F. Constantino, The American Society of Mechanical Engineers
D. O. Coon, Applied Geometrics, Inc.
R. Courson, SAE International
K. Dobert, Siemens PLM Software
P. Drake, MechSigma Consulting, Inc.
B. Fischer, TDP360, LLC
S. Hauger, Deere and Co.
J. B. Hoskins, The Boeing Co.
J. Houck, Woodward, Inc.
R. Jensen, Hexagon Manufacturing Intelligence
W. A. Kaba, Spirit AeroSystems, Inc.
A. Krulikowski, Krulikowski Consulting, LLC
S. Lege, U.S. Army
E. F. McCarthy, E. F. McCarthy Consulting, Inc.
P. J. McCuistion, PolitoMac DMS
J. D. Meadows, James D. Meadows and Associates, Inc.
M. E. Meloro, Northrop Grumman Corp.
J. Michalowicz, Stryker Corp.
J. I. Mi[illegible] Technical Consultants, Inc.
H. W. Oake[illegible] U.S. Air Force (University of Dayton Research Institute)
K. F. Wiegandt, Consultant
B. A. Wilson, Consultant
E. Zwettler, Sigmetrix
J. Scheibel, *Alternate*, The Boeing Co.

SUBCOMMITTEE 46 — PRODUCT DEFINITION FOR ADDITIVE MANUFACTURING

J. Gardner, *Chair,* Lockheed Martin Co.
D. Wallace, *Vice Chair,* Texas A&M University
G. Ameta, Siemens Technology
L. Bergquist, Tec-Ease, Inc.
C. Brown, Honeywell FM&T
W. Cockrell, Raytheon Technologies
A. Frey, U.S. Army
J. Herron, Action Engineering
K. Losoncy, Orbital ATK Space Systems Group
J. Michalowicz, Stryker Corp.
G. Nair, Lloyd's Register
S. K. Ramasamy, Apple
B. Roberts, The Boeing Co.
J. Schmelzle, Naval Air Systems Command
M. J. Shaw, Rolls Royce Co.
J. Sykes, Profile Services
M. Toye, General Electric
W. Weiss, IBW — Ingenieurbuero Wolfgang Weiss
P. Witherell, National Institute of Standards and Technology
J. V. Van Horn, *Alternate,* The Boeing Co.

Y14.46 SUPPORT GROUP

Y. B. Dama, Geometric America, Inc.
B. Fischer, TDP360, LLC
S. Hauger, Deere and Co.
E. R. Henry, JT3
P. Hojnacki, Deere and Co.
P. Huang, Office of Naval Research
E. Kline, Naval Air Systems Command
Y. Lin, University of Missouri
R. Lipman, National Institute of Standards and Technology
B. Lucht, National Nuclear Security Administration, Kansas City
L. Maggiano, Mitutoyo America Co.
E. Morse, University of North Carolina, Charlotte
B. Nielsen, The Boeing Co.
M. Nielsen, Tech Azul
H. W. Oakes, U.S. Air Force (University of Dayton Research Institute)
B. Romero, Raytheon Technologies
C. Sahay, University of Hartford
A. Schmidt, Woodward, Inc.
J. Shah, Ohio State University
H. Taylor, HDT-GDT, LLC
M. Taylor, Raytheon Technologies
T. T. Taylor, Siemens Power Generation
H. Tran, Sandia National Laboratories
L. C. Webster, The MITRE Corp.
O. Wu, DS Solidworks
E. Zwettler, Sigmetrix

CORRESPONDENCE WITH THE Y14 COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by proposing revisions or a case and attending Committee meetings. Correspondence should be addressed to:

Secretary, Y14 Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued to provide alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard and the paragraph, figure, or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Attending Committee Meetings. The Y14 Standards Committee regularly holds meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the Y14 Standards Committee. Future Committee meeting dates and locations can be found on the Committee Page at http://go.asme.org/Y14committee.

PRODUCT DEFINITION FOR ADDITIVE MANUFACTURING

1 GENERAL

1.1 Scope

This Standard covers the definitions of terms and features unique to additive manufacturing (AM) technologies with recommendations for their uniform specification in product definition data and in related documents. Unless otherwise specified, any reference to features, parts, or processes shall be interpreted as applying to parts or assemblies manufactured using an AM process. Additively manufactured parts or assemblies are referred to as "parts" throughout the Standard. The Standard extends to capturing relevant AM detail from design, manufacturing, and quality engineering.

1.2 ASME Y14 Series Conventions

The conventions in paras. 1.2.1 through 1.2.12 are used in this and other ASME Y14 standards.

1.2.1 Mandatory, Recommended, Guidance, and Optional Words

(a) The word "shall" establishes a requirement.
(b) The word "will" establishes a declaration of purpose on the part of the design activity.
(c) The word "should" establishes a recommended practice.
(d) The word "may" establishes an allowed practice.
(e) The words "typical," "example," "for reference," and the Latin abbreviation "e.g." indicate suggestions given for guidance only.
(f) The word "or" used in conjunction with a requirement or a recommended practice indicates that there are two or more options for complying with the stated requirement or practice.
(g) The phrase "unless otherwise specified" or the abbreviation "UOS" shall be used to indicate a default requirement. The phrase is used when the default is a generally accepted requirement and an exception may be provided by another document or requirement.

1.2.2 Cross-Reference of Standards. Cross-reference of standards in text with or without a date following the standard designator shall be interpreted as follows.
(a) Reference to other ASME Y14 standards in the text without a date following the standard designator indicates that the edition of the standard identified in the References section (para. 1.5) shall be used to meet the requirement.
(b) Reference to other ASME Y14 standards in the text with a date following the standard designator indicates that only that edition of the standard shall be used to meet the requirement.

1.2.3 Invocation of Referenced Standards. The following examples define the invocation of a standard when specified in para. 1.5 and referenced in the text of this Standard:
(a) When a referenced standard is cited in the text with no limitations to a specific subject or paragraphs of the standard, the entire standard is invoked. For example, "Dimensioning and tolerancing shall be in accordance with ASME Y14.5" is invoking the complete standard because the subject of the standard is dimensioning and tolerancing and no specific subject or paragraphs within the standard are invoked.
(b) When a referenced standard is cited in the text with limitations to a specific subject or paragraphs of the standard, only the paragraphs on that subject are invoked. For example, "Assign part or identifying numbers in accordance with ASME Y14.100" is invoking only the paragraphs on part or identifying numbers because the subject of the standard is engineering drawing practices and part or identifying numbers is a specific subject within the standard.
(c) When a referenced standard is cited in the text without an invoking statement such as "in accordance with," the standard is invoked for guidance only. For example, "For gaging principles, see ASME Y14.43" is only for guidance and no portion of the standard is invoked.

1.2.4 Definitions. Section 2 provides definitions specific to this Standard. For definitions of words used in but not defined in this Standard, see Merriam-Webster's Unabridged Dictionary at https://www.merriam-webster.com/.