

Product Definition for Additive Manufacturing

Engineering Product Definition and Related Documentation Practices

This is a Draft Standard for Trial Use and comment. This Draft Standard is not an approved consensus standard of ASME nor is it an American National Standard. ASME has approved its issuance and publication as a Draft Standard only. Distribution of this Draft Standard for comment shall not continue beyond 1 year from the date of publication. The content of this Draft Standard for Trial Use and comment was not approved through ASME's consensus process. Following the 1-year trial and comment period, this Draft Standard, along with comments received, will be submitted to a Consensus Committee or Project Team. The Consensus Committee or Project Team will review and revise this Draft Standard based, in part, upon experience during the trial term and resulting comments. A public review in accordance with established American National Standards Institute (ANSI) procedures is required at the end of the Trial-Use Period and before a Draft Standard for Trial Use is submitted to ANSI for approval as an American National Standard. Thereafter, it is expected that this Standard (including any revisions thereto) will be submitted to ANSI for approval as an American National Standard. Suggestions for revision should be directed to the Secretary, Y14.46 Subcommittee using the following form: <http://go.asme.org/Y14CommentForm>.



Date of Issuance: November 15, 2017

This Draft Standard for Trial Use will be revised following the conclusion of the Trial-Use Period. There will be no written interpretations of the requirements of this Draft Standard for Trial Use issued to this edition.

ASME is the registered trademark of The American Society of Mechanical Engineers.

The Standards Committee that approved the Draft Standard was balanced to assure that individuals from competent and concerned interests have had an opportunity to participate.

ASME does not “approve,” “rate,” or “endorse” any item, construction, proprietary device, or activity.

ASME does not take any position with respect to the validity of any patent rights asserted in connection with any items mentioned in this document, and does not undertake to insure anyone utilizing a standard against liability for infringement of any applicable letters patent, nor assume any such liability. Users of a code or standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Participation by federal agency representative(s) or person(s) affiliated with industry is not to be interpreted as government or industry endorsement of this code or standard.

No part of this document may be reproduced in any form,
in an electronic retrieval system or otherwise,
without the prior written permission of the publisher.

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

Copyright © 2017 by
THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
All rights reserved
Printed in U.S.A.

CONTENTS

Foreword		v
Committee Roster		vi
1	General	1
2	Definitions	3
3	Supplemental Geometry	5
4	Product and Process Definition Requirements	8
5	Product Data Packages (PDP)	28
Nonmandatory Appendices		
A	Example AM Notes	31
B	Defining Transition Regions	32
C	Reference Documents to Test for Conformance	35
Figures		
3-1	Single Coordinate System Related to the Model	5
3-2	Multiple Coordinate Systems	6
3-3	Unit Vector Indicating Build Direction	6
3-4	Unit Vector Indicating Gravity Direction	7
3-5	A Surface Representing a Build Surface	7
4-1	Example of a Theoretical Supplemental Surface Used on a Rectangular Lattice Cuboid	8
4-2	Example of a Theoretical Supplemental Surface Within a Rectangular Lattice Cuboid	9
4-3	Example of a Nonplanar Theoretical Supplemental Surface	9
4-4	Example of a Tolerance Zone Derived From Figure 4-3	10
4-5	Both Bounded Volume and Surface Regions to Indicate Internal and External Surfaces and Volumes	10
4-6	Bounded Volume Region Indicator (VOL1) With a Profile of a Surface Tolerance	11
4-7	Multiple Bounded Volume Region Indicators With Profiles of Surface Tolerances	11
4-8	Bounded Volume Regions Represented by Several Bounded Volume Region Indicators in a Single Part	12
4-9	Bounded Surface Region Indicator Coupled With a Feature Control Frame	12
4-10	Examples of Unit Cell Geometries and Lattice Structures	13
4-11	Lattice Structure With Multiple Bounded Volume Regions	14
4-12	VOL Local Notes That Describe Material Gradient Allocations Shown in Table 4-1	15
4-13	Material Transition Specification Between Bounded Volume Regions With Lattice Fill	16
4-14	Complex Geometries Generated From Topology Optimization	17
4-15	Wrench Produced as a Single Build With Three Parts	18
4-16	Build Direction Indicated Using the Direction Unit Vector	18
4-17	Multiple Build Directions	19
4-18	Planar Build Surface and a Nonplanar Build Surface	19
4-19	Identifying Build Location With Respect to a Specified Build Surface	20

4-20	Coordinate Systems Are Used to Locate Parts Within a Build Envelope	20
4-21	Four Separate Parts Nested Inside One Another on a Build Surface	21
4-22	Free Zone Description With an Offset Dimension	21
4-23	Free Zone Bounding Box Description	22
4-24	Layer Thickness Specification	22
4-25	Specification of a Track Path With Three Contours	23
4-26	Specification of a Track Path Using a Follow Boundary (FB) Modifier	23
4-27	Specification of Track Paths on Different Layers	23
4-28	Examples of Infill and Unit Cells	24
4-29	Example Where Support Structure Location Is Not Specified	25
4-30	Example Where Bounded Surface Region 1 (SURF1) Is Annotated to Indicate a Structure Exclusion Area (SEA)	25
4-31	Example Where SURF1 Is Annotated to Indicate a Structure Limiting Area (SLA) of 20%	26
4-32	Example Where SURF1 Is Annotated to Indicate a Structure Required Area (SRA)	26
4-33	Indication of Geometry Created Inside the Part to Specify Support Structure	27
4-34	Local Notes Identifying Test Coupons	27
B-1	Part With Material Transition Region (Heterogeneous Material Indicator) and Specification of Tolerance	33
B-2	Acceptable Void Fractions for MAT1 and MAT2	33
B-3	Allowable Material Fractions for MAT1 and MAT2	34
 Tables		
4-1	Material Gradient Values Used in Figure 4-12	15
5-1	Required and Optional Data Packages for AM Products	28
5-2	Required and Optional Elements Within the AM Design DP	28
5-3	Required and Optional Elements Within the AM Build DP	29
5-4	Required and Optional Elements Within the AM Processed DP	29
5-5	Required and Optional Elements Within the End Product DP	29
5-6	Examples of AM Use Cases Using the Codes in ASME Y14.41.1 to Show the Level of Content in an AM Data Package (ADP)	30
5-7	Examples of Metadata Requirements for Model-Based Definition (MBD) Data Sets	30
B-1	Material Gradient Values (Figure 4-12)	32
C-1	Select Reference Documents	35