



Use of a Support Model (i.e. 9925016) for Acceptance

E. A. “Tony” Bryce (SNL/NM)



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Question?

- How many of you are familiar with or have perhaps heard of the document titled “Identification, Support Model (SH) 3D CAD Part”?
- Purpose of this presentation is to provide possible impact scenario's this document may have on acceptance practices?

R. DeVilbiss 832 KC
G. Whited 833 KC
T. Henderson 2981 SA
T. Christie 2982 SA
D. Vortolomei 2982 SA
C. Wong 8233 SL
R. Van Cleave 8234 SL

**(U) IDENTIFICATION, SUPPORT MODEL (SH),
3D CAD PART**

CHANGE HISTORY

<u>CONTROL NUMBER</u>	<u>ISSUE</u>	<u>RELEASE/CHANGE NO.</u>	<u>DATE</u>
9925016-00	A	AER 20133089SA	10/11/13
9925016-01	B	FCO 20133580SA	5/30/14
9925016-01		IER 20141720SA	5/30/14
9925016-02	C	FCO 20143858SA	10/20/14
9925016-03	D	FCO 20162451SA	10/11/16

Callout for part defining drawings and support model:

SUPPORT MODEL REPRESENTS (1) GEOMETRY PER 9925016.

(1) Insert "NOMINAL" or "MEAN" to represent the support model's state of geometry.

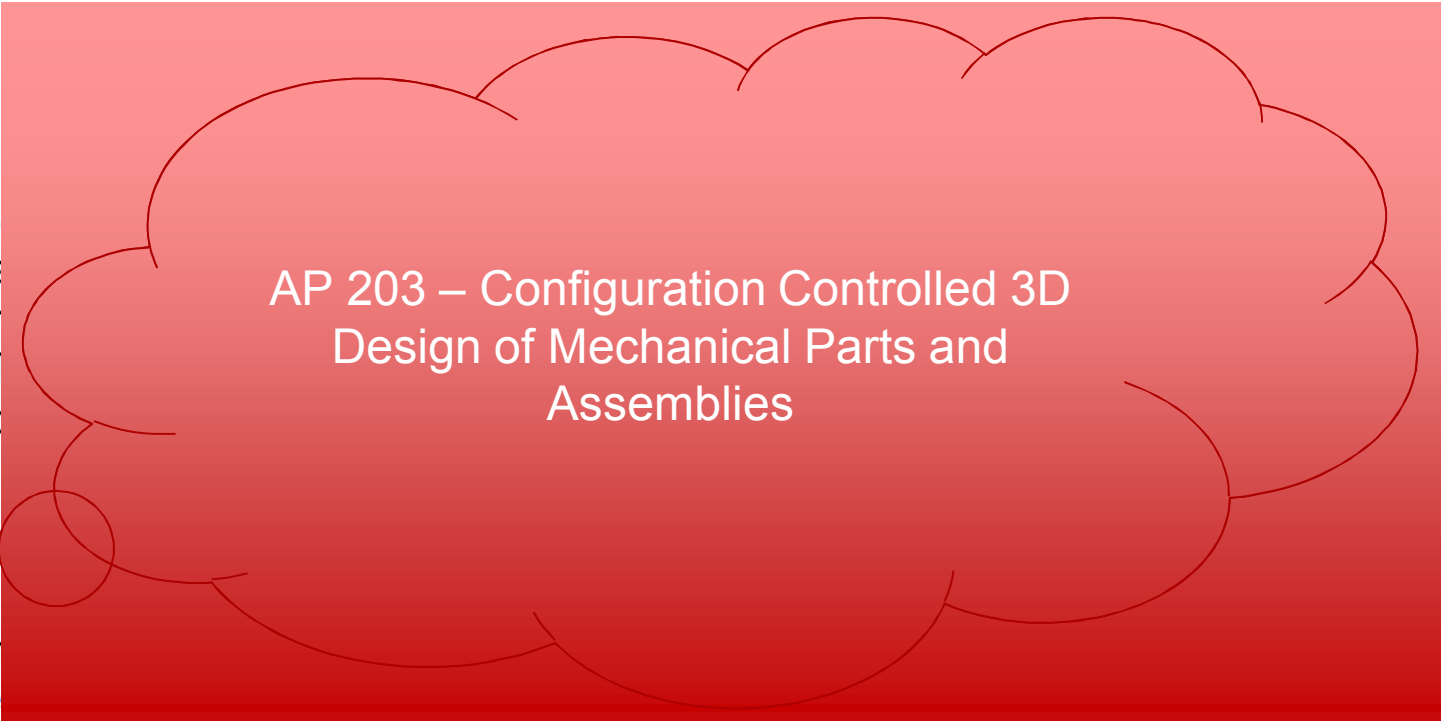
*Note: The nominal support model is considered the primary support model for 9925016.
Refer to Section 3.3 for additional information.*

Support Model (SH) 3D CAD Part

1.2 Purpose

The purpose of this

- configuration ma
- three dimension
- authorize the ST
- identify and call



AP 203 – Configuration Controlled 3D
Design of Mechanical Parts and
Assemblies

1.3.14 STEP

A STEP file is a **ST**ar
CAD file. Acceptable

Final Acceptance Based on Drawing



3.6 Support Model Authorization and Release at Issue A

Specific use(s) of a Support Model identified in product definition is at the discretion of the PRT or design owner and shall be captured by the Engineering Authorization (AER or CER) released to IMS. A DER may be used to release a development Support Model. Support Models may be used, for example, in manufacturing, inspection, or analysis processes.

The Support Model and associated graphic drawing issues (AY or IPL) shall be in accordance with T039. Refer to Section 6.1 for additional information.

Final acceptance of product is based on the drawing. However, this does not preclude the use of Support Models in conjunction with the drawing in situations where it provides clarity or other advantage during the final acceptance process. In cases regarding interpretation of the intent of the Support Model versus the intent of the drawing, it is the responsibility of the Support Model user to contact the design owner of the 3D CAD supported product drawing for resolution.

Support Model Callout in Product Definition

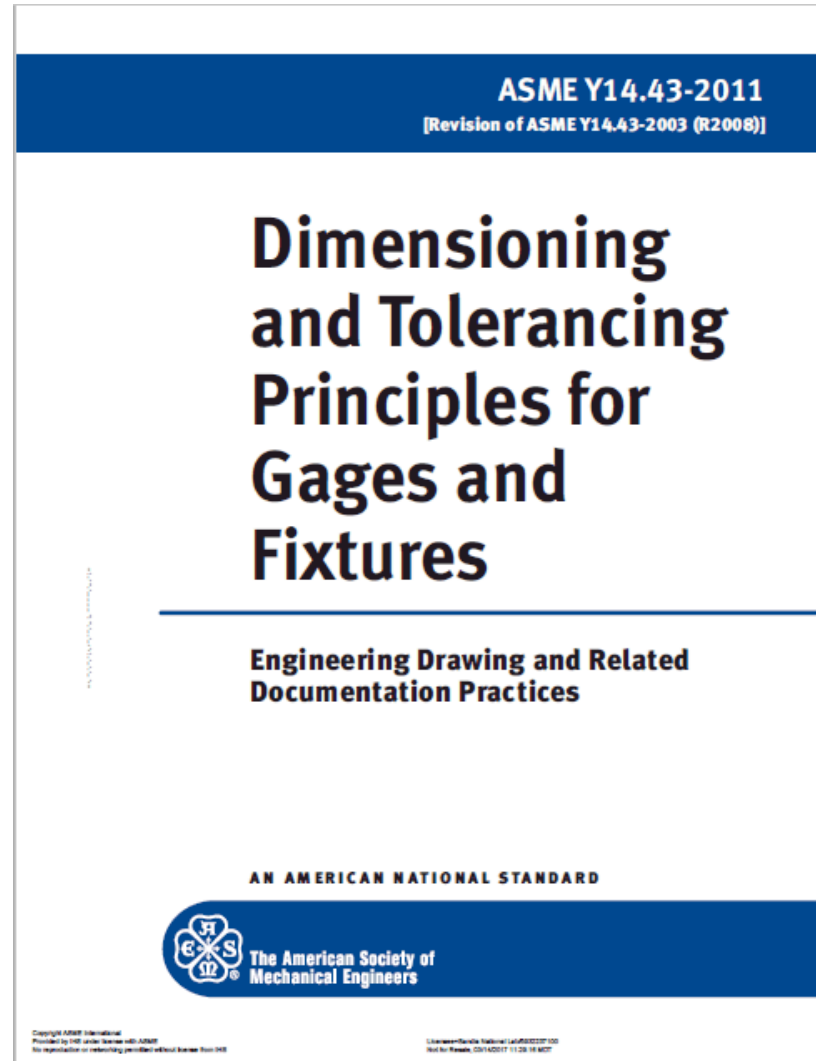
NOTES:

1. SUPPORT MODEL REPRESENTS NOMINAL GEOMETRY PER 9925016.

IPL callout:

AR	SH5A6789-000	SUPPORT MODEL, WIDGET	1		
ARS	1234567-00	BULK MATERIAL			
NA	9925016	IDENTIFICATION, SUPPORT MODEL, 3D CAD PART			
NA	9919100	MARKING, GENERAL METHODS			
NA	9900000	GENERAL REQUIREMENTS			
NO REQD	PART / CONTROL NUMBER	DESCRIPTION / MATERIAL	NOTE	SHEET ZONE	ITEM

What does this mean for product acceptance?



4.12 Economics

When a GO or functional gage is not economically feasible, suitable simulations may be constructed using other inspection tools. For example, a computer-controlled coordinate measurement machine may be used to acquire a digital data set. The points may then be used to model actual values and compare these with a worst-case computer design model of the feature under test to determine violations of the boundaries normally inspected with a hard (physical) GO or functional gage. These computer-generated GO and functional gages simulate the function of hard gages. The simulated soft gage will verify or reject only the points probed, which are not necessarily representative of all points on the workpiece being gaged. Also, it is recommended for features being gaged for interrelationships to datums that these workpieces be fixtured whenever possible to give a better simulation of the high-point planes and axes than may be possible through the use of probes directly on the datum features. Fixtures shall be produced at a sufficient level of accuracy to ensure acceptable uncertainty.

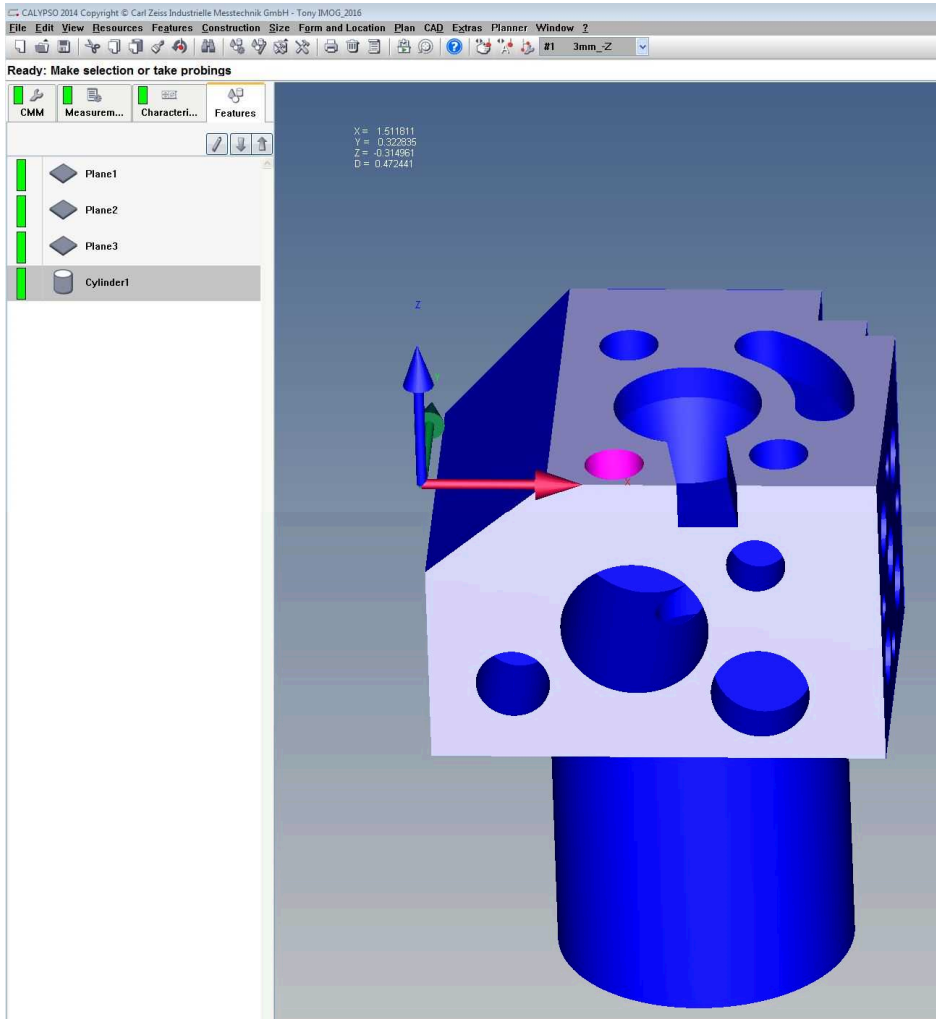
Soft Gaging

B-2 SOFT GAGING

Soft gaging is the term used when a set of coordinate measurement data, such as data generated by a coordinate measuring machine (CMM), is compared with a design model for purposes of part acceptance/rejection. In general terms, the soft gaging process works as follows:

- Step 1:* A part's nominal geometry is modeled with CAD software.
- Step 2:* The design model is imported into the soft gaging software where tolerance attributes are attached to part features. (Some CAD systems perform this step internally.)
- Step 3:* The soft gaging software is used to generate a worst-case model based on the nominal CAD geometry varying by the amount allowed by the tolerances. This worst-case model is called a soft gage.
- Step 4:* A part is measured on a CMM, generating a cloud of coordinate data points.
- Step 5:* The soft gaging software compares this cloud of points (or sometimes a reverse-engineered design model based on it) with the soft gage model and displays out-of-tolerance conditions.

Example - Zeiss Calypso



Features

Cylinder1

Comment Strategy
 Cylinder Evaluation...

Clearance Group Nominal Definition Alignment
 CP +Z Options [Base Alignment]

Tolerance For:	Nominal	Actual
<input type="checkbox"/> X	38.400000	38.118026
<input type="checkbox"/> Y	8.200000	8.068194
<input type="checkbox"/> Z	-8.000000	-8.000000
<input checked="" type="checkbox"/> D	12.000000	12.004251
<input type="checkbox"/> A1 X/Z	-0.000000	0.056350
<input type="checkbox"/> A2 Y/Z	0.000000	0.225913
Space Axis	Z	Z
Depth	8.000000	8.000066
Start Angle	0.000000	0.000000
Angle Segment	360.000000	360.000000

Sigma	Form	Points	
0.044347	0.080166	1015	
Min	Point no	Point no	Max
-0.000000	352	131	0.080166

OK Reset

Example - Zeiss Calypso

Features

Curve3

Comment Projection Strategy

Nominal Vector Linear projectio Evaluation...

Clearance Group Nominal Data Alignment

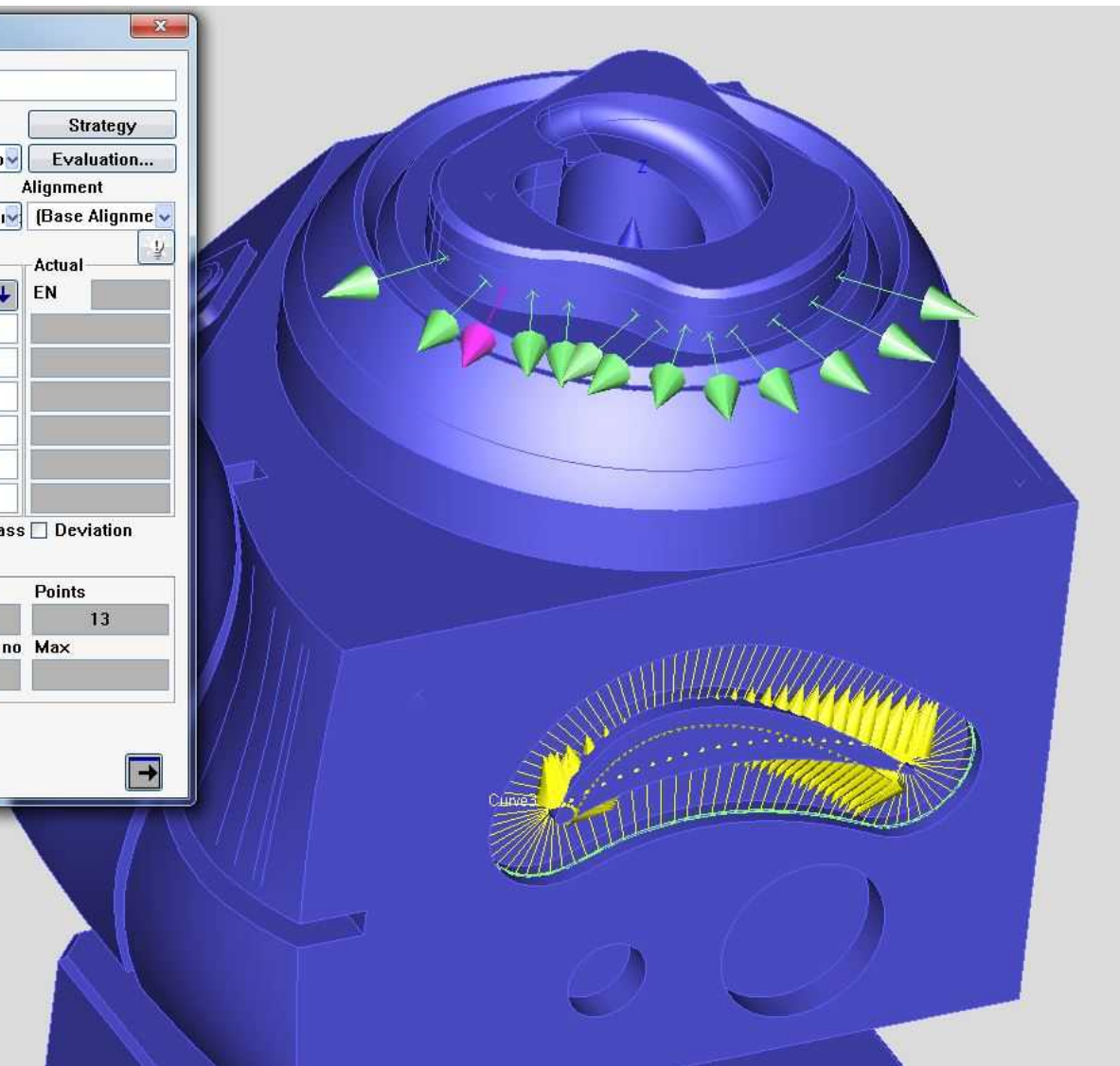
CP-Y Nominal point i (Base Alignme

Point No.	Nominal	Actual
	1	EN
X	-1.50944	
Y	-1.77165	
Z	-1.31046	
Nx	0.97775	
Ny	-0.00000	
Nz	-0.20977	

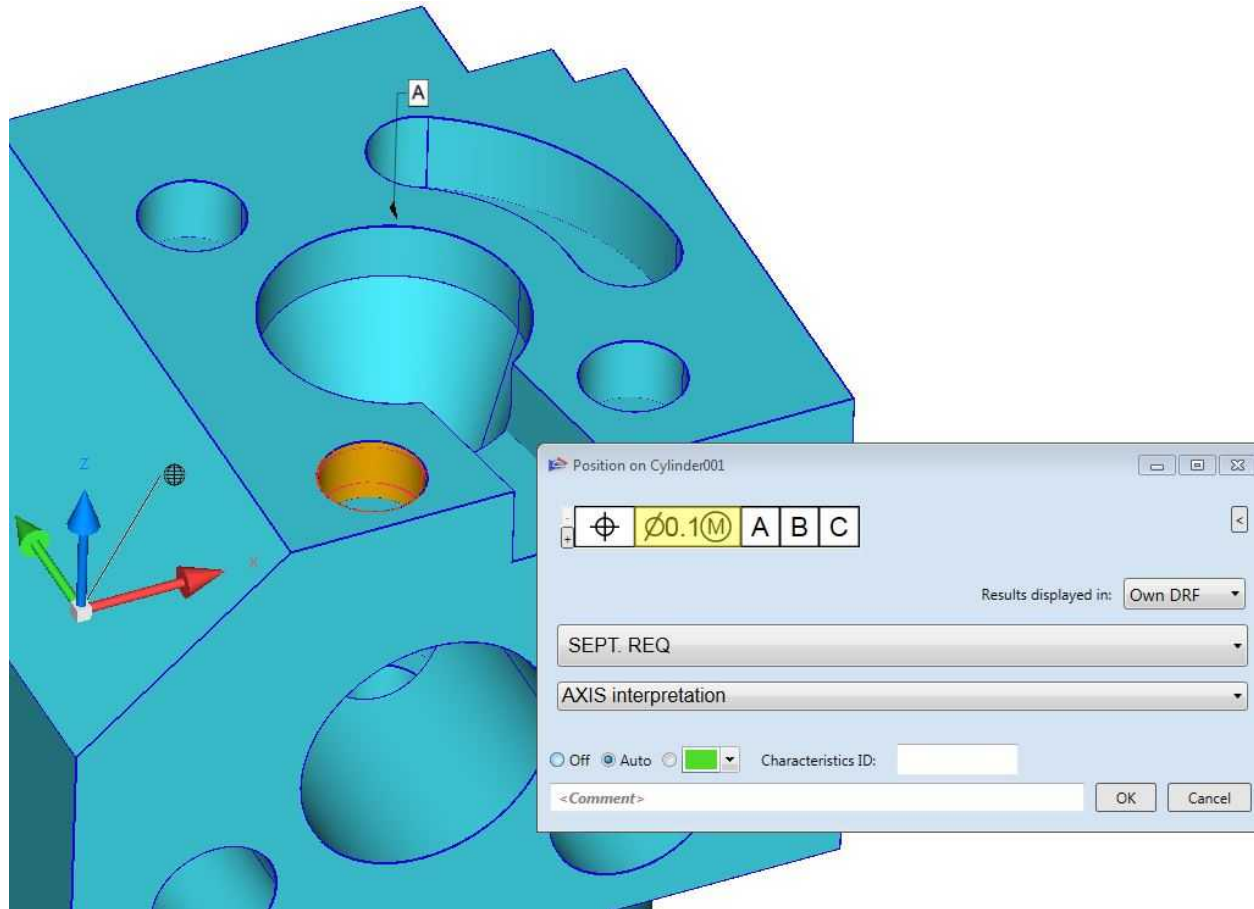
Best Fit Center of Mass Deviation

Sigma	Form	Points	
		13	
Min	Point no	Point no	Max

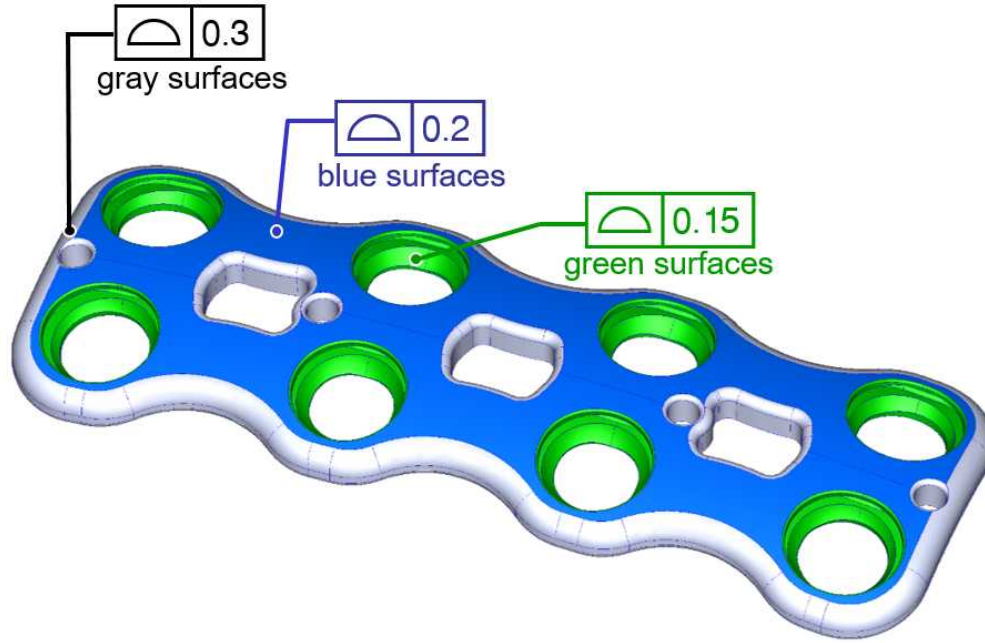
OK Reset



Example - Smart Profile



3D Profile Definition using ASME Y14.41



Drawing Note: Unless Otherwise Specified All Dimensions Are Basic and Controlled By The CAD Model and Controlled Simultaneously

ASME Y14.41-2012
[Revision of ASME Y14.41-2003 (R2008)]

Digital Product Definition Data Practices

Engineering Drawing and Related Documentation Practices

AN AMERICAN NATIONAL STANDARD

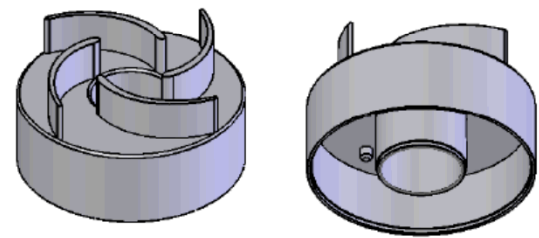
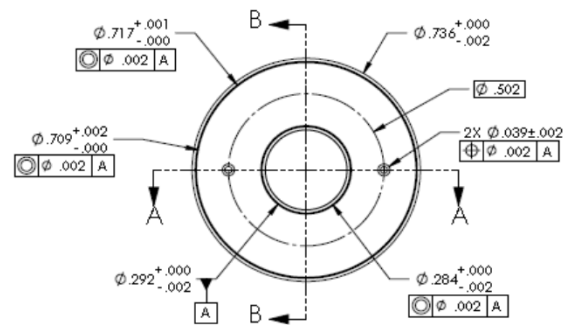
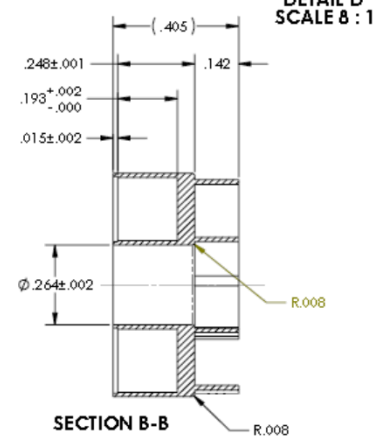
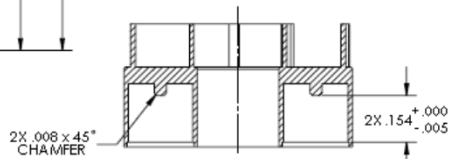
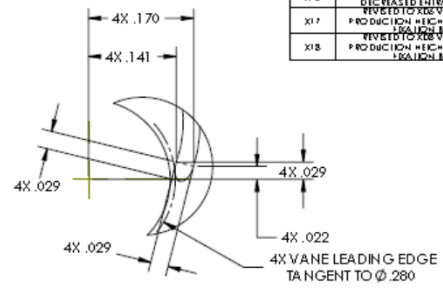
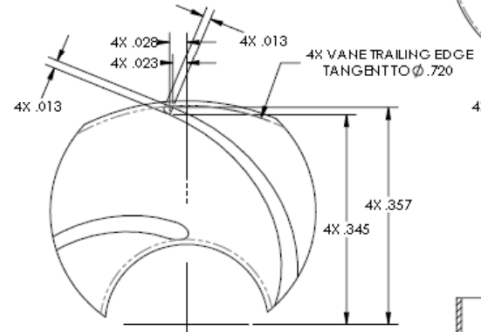
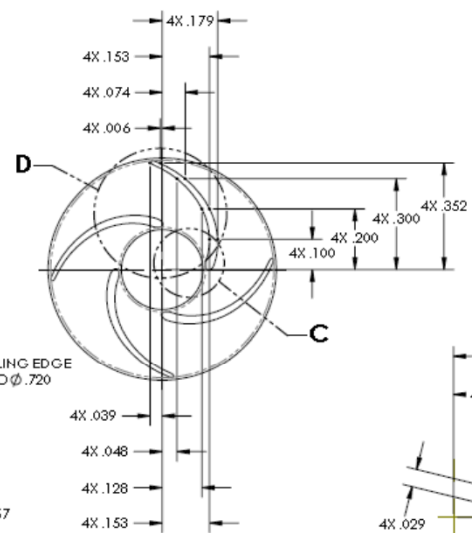


The above engineering drawing example depicts profile tolerancing of all 3D surfaces being fully defined with three explicit profile of a surface callouts per the ASME Y14.41-2012 Standard.

NOTES:

1. MATERIAL: GRADE S T1 EU.
2. PARTS ARE TO BE CLEAN AND FREE OF DIRT, LUBRICANTS, AND MACHINE OIL.
3. PARTS ARE TO BE FREE OF BURRS, SCRATCHES, MARKS, AND DENTS.
4. PARTS MUST BE PACKED IN A MANNER THAT ASSURES THEY WILL NOT BE DAMAGED IN SHIPMENT.
5. A MATERIAL CERTIFICATE OF COMPLIANCE IS REQUIRED.
6. ALL SURFACES MUST BE DEBURRED, SMOOTHED, AND BLENDED TO A 16 MICROINCH OR BETTER FINISH.
7. ALL LEADING AND TRAILING BLADE EDGES SHOULD BE RADIUSED AS SHOWN AND BLENDED INTO THE ROTOR ID AND OD AS SHOWN.
8. DELETED.
9. FOUR BLADES, AS DIMENSIONED IN THIS VIEW, EQUALLY SPACED.

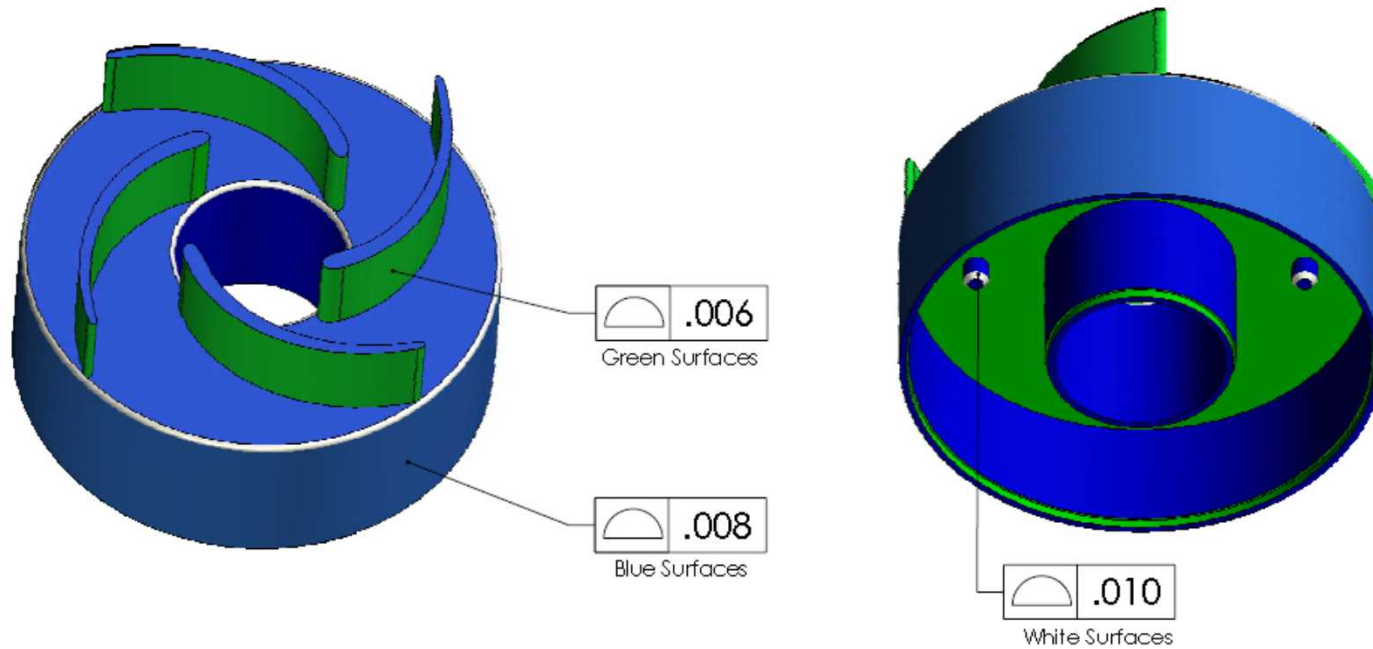
REVISION			
REV.	DESCRIPTION	DATE	INITIALS
X01	INITIAL RELEASE	3-20-10	B. KENNEY
X02	REVISED TO S VANE VERSION	4-14-10	B. KENNEY
X03	MATERIAL WAS II AS IN GRADE I FOR GRADE 2. RECALCULATED FOR BALANCE	5-7-10	B. KENNEY
X04	REVISED TO A VANE VERSION	6-22-10	B. KENNEY
X05	REVISED TO MODIFIED A VANE VERSION	6-22-10	B. KENNEY
X06	REVISED TO S VANE VERSION WITH LESS ACCESSIBLE ENTRANCE ANGLE	7-20-10	B. KENNEY
X07	REVISED TO A VANE VERSION	7-21-10	B. KENNEY
X08	ADJUST VANES TO CONTACT TO MAKE ENDS IN CONTACT TO FOLD TO D. AND EDGE OF HUB TO HUB. REMOVED SKEWED	7-29-10	B. KENNEY
X09	REVISED TO X08 VERSION WITH A VANES	7-24-10	B. KENNEY
X10	DECREASED ENTRANCE ANGLE	7-15-10	B. KENNEY
X11	INCREASED I/O S VANES	7-15-10	B. KENNEY
X12	INCREASED OVERALL HEIGHT ENLARGED VANE INLET RADIIUS. FINISHED I/O S VANES	7-15-10	B. KENNEY
X13	REDUCED VANE INLET RADIIUS TO 20% HUBS	7-15-10	B. KENNEY
X14	REVISED TO X10 VERSION WITH INCREASED OVERALL HEIGHT	10-7-10	B. KENNEY
X15	REVISED TO X08 VERSION WITH INCREASED ENTRANCE ANGLE	10-7-10	B. KENNEY
X16	REVISED TO X08 VERSION WITH DECREASED ENTRANCE ANGLE	10-7-10	B. KENNEY
X17	REVISED TO X08 VERSION WITH PRODUCTION HEIGHT AND MACHINE FINISH	10-10-10	B. KENNEY
X18	REVISED TO X08 VERSION WITH PRODUCTION HEIGHT AND MACHINE FINISH	10-15-10	B. KENNEY



Original Drawing

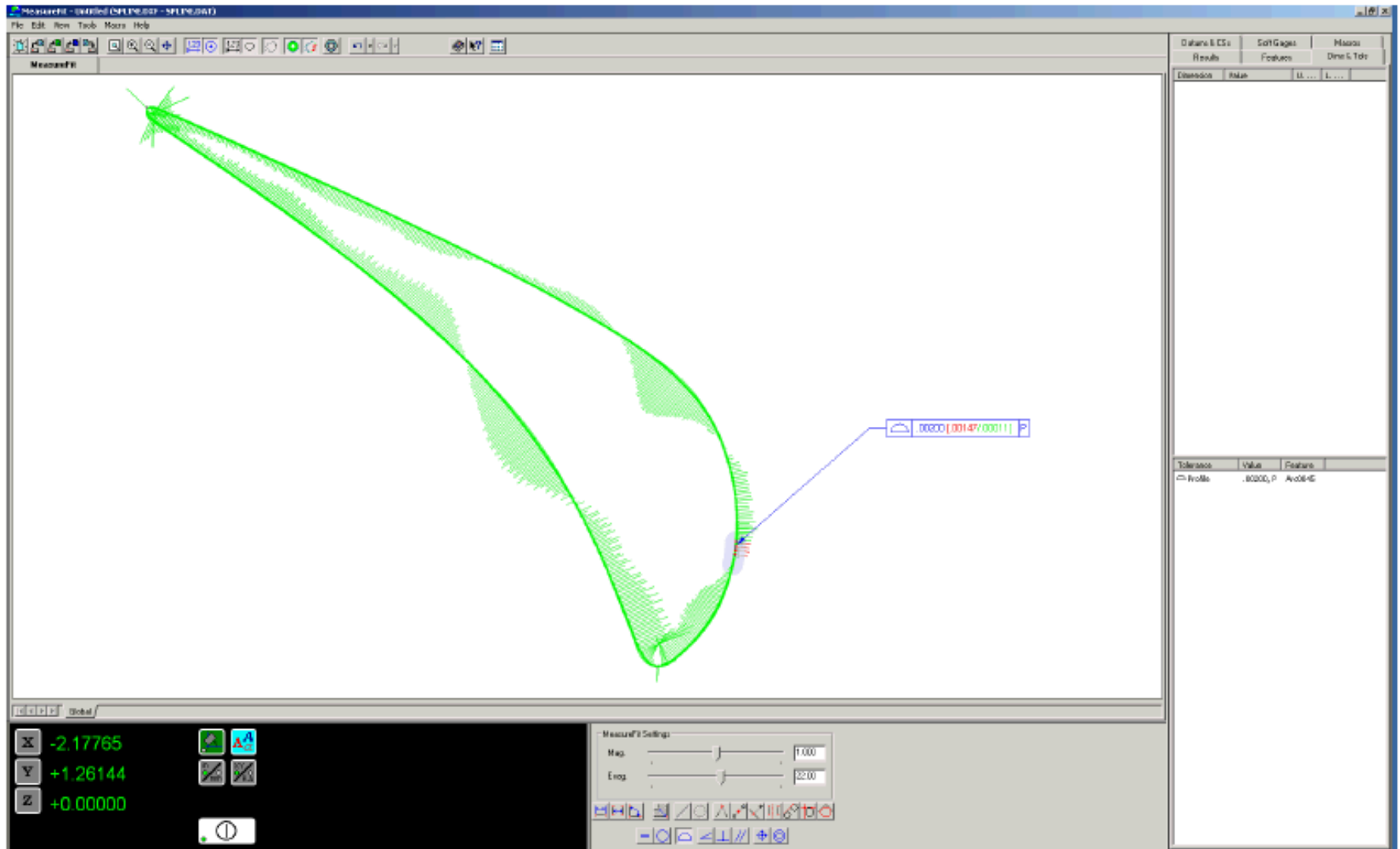
3D Model Based Drawing

ASME Y14.41 - 3D Modeling Standard

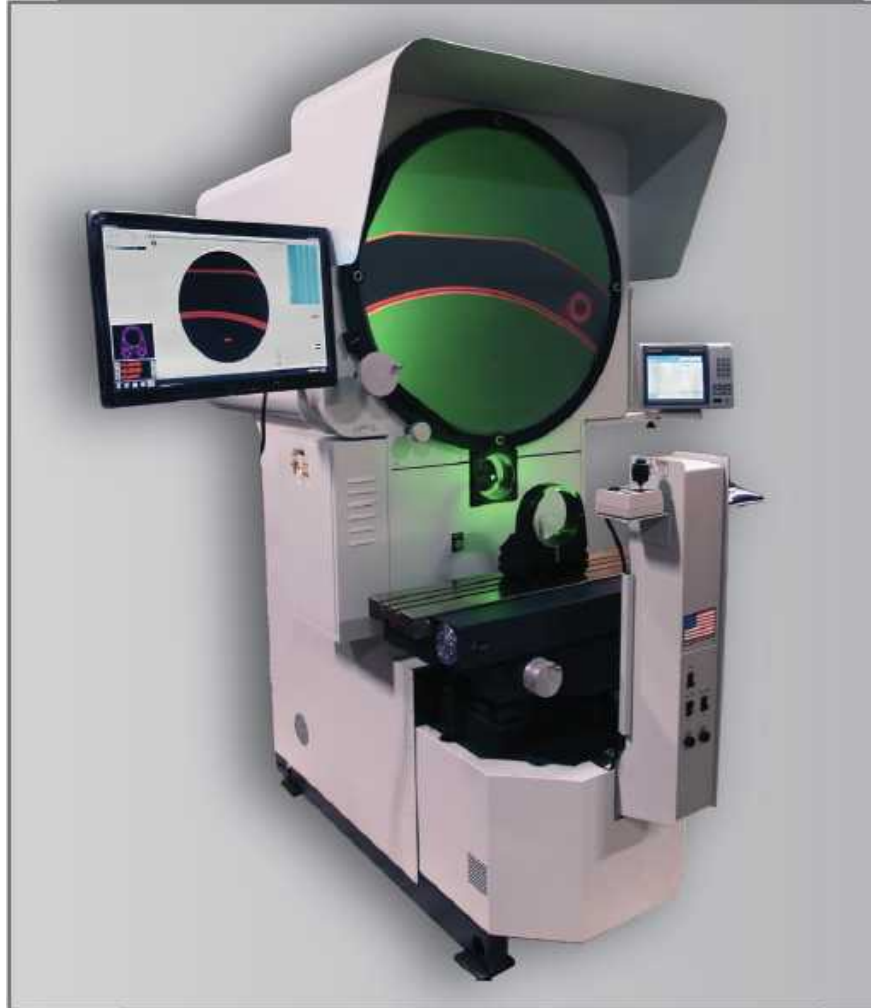


Notes: Unless Otherwise Specified
All Dimensions Are Basic and
Controlled By The CAD Model
and Controlled Simultaneously

Example – OGP MeasureFit



Example – QVI/CCP Comparators



Questions?

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Two Park Avenue tel 1.212.591.2000
New York, NY fax 1.212.591.7674
10016-5990 U.S.A. www.asme.org

March 15, 2017

Mr. E.A. "Tony" Bryce
Team Lead, R&D Science and Engineering (2522-1)
Sandia National Laboratories
P. O. Box 5800
Mail Stop 0616
Albuquerque, NM 87185

Dear Mr. Bryce:

In response to your e-mail dated March 14, 2017, ASME grants you permission to use excerpts from the standard listed below:

ASME Y14.43-2011

Cover Page
Section 4.12 – 4.12.2
Section B-2
Figure B-2

as requested to be used in a presentation titled "Use Support Models in Acceptance" at National Nuclear Security Administration (NNSA) Lawrence Livermore Laboratory (LLNL) site on April 18-19, 2017. As is customary, we ask that the source document and ASME be fully acknowledged. "Reprinted from ASME Y14.43-2011, by permission of The American Society of Mechanical Engineers. All rights reserved". No further copies can be made without written permission. This permission is for this edition only. If you have any questions do not hesitate to contact me.

Sincerely,



Ivette Estevez
Systems Administrator
(212) 591-8482

/s/