SAND2011-1027P

Geometric Dimensioning and Tolerancing Overview of Importance

Tony Bryce & Bill Moffatt
Sandia National Laboratories

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ENGINEERING DRAWING AND
RELATED DOCUMENTATION PRACTICES

ASME Y14.5M-1994

[REVISION OF ANSI Y14.5M-1982 (R1988)]

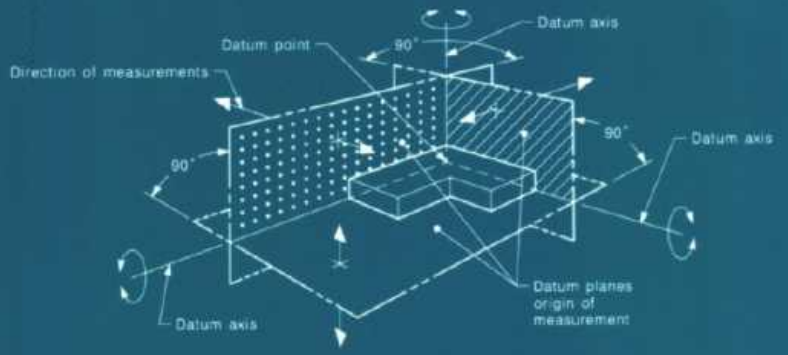
REAFFIRMED 1999

FOR CURRENT COMMITTEE PERSONNEL
PLEASE SEE ASME MANUAL AS-11

REAFFIRMED 2004

FOR CURRENT COMMITTEE PERSONNEL
PLEASE E-MAIL CS@asme.org

Dimensioning and Tolerancing



AN AMERICAN NATIONAL STANDARD

The American Society of
Mechanical Engineers

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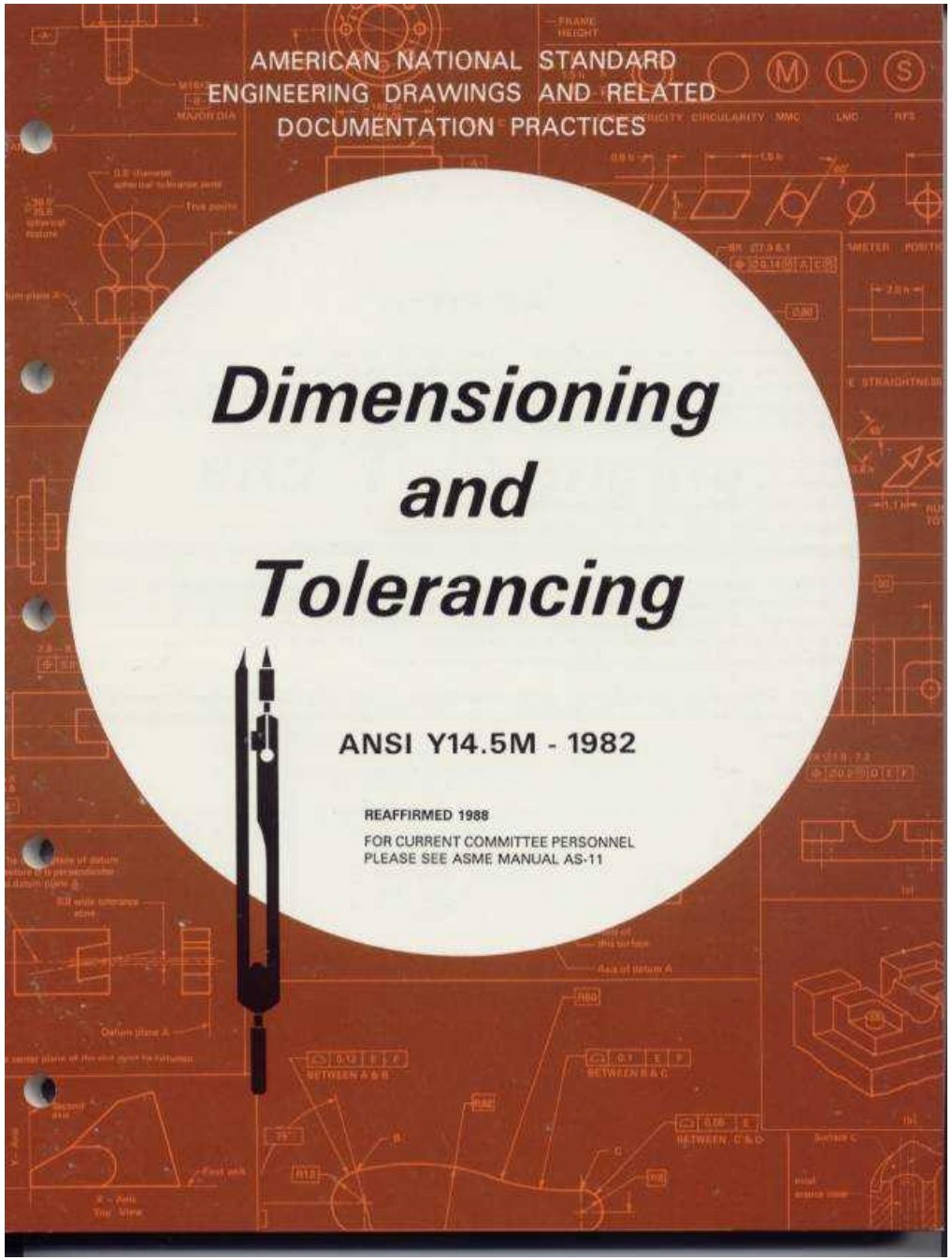

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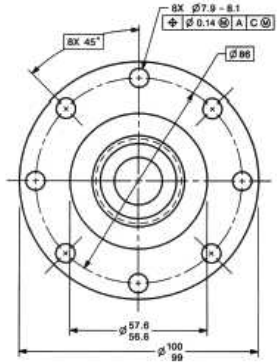
ASME Y14.5-2009
[Revision of ASME Y14.5M-1994 (R2004)]

Dimensioning and Tolerancing

Engineering Drawing and Related Documentation Practices



AN INTERNATIONAL STANDARD

The American Society of Mechanical Engineers

ASME
SETTING THE STANDARD

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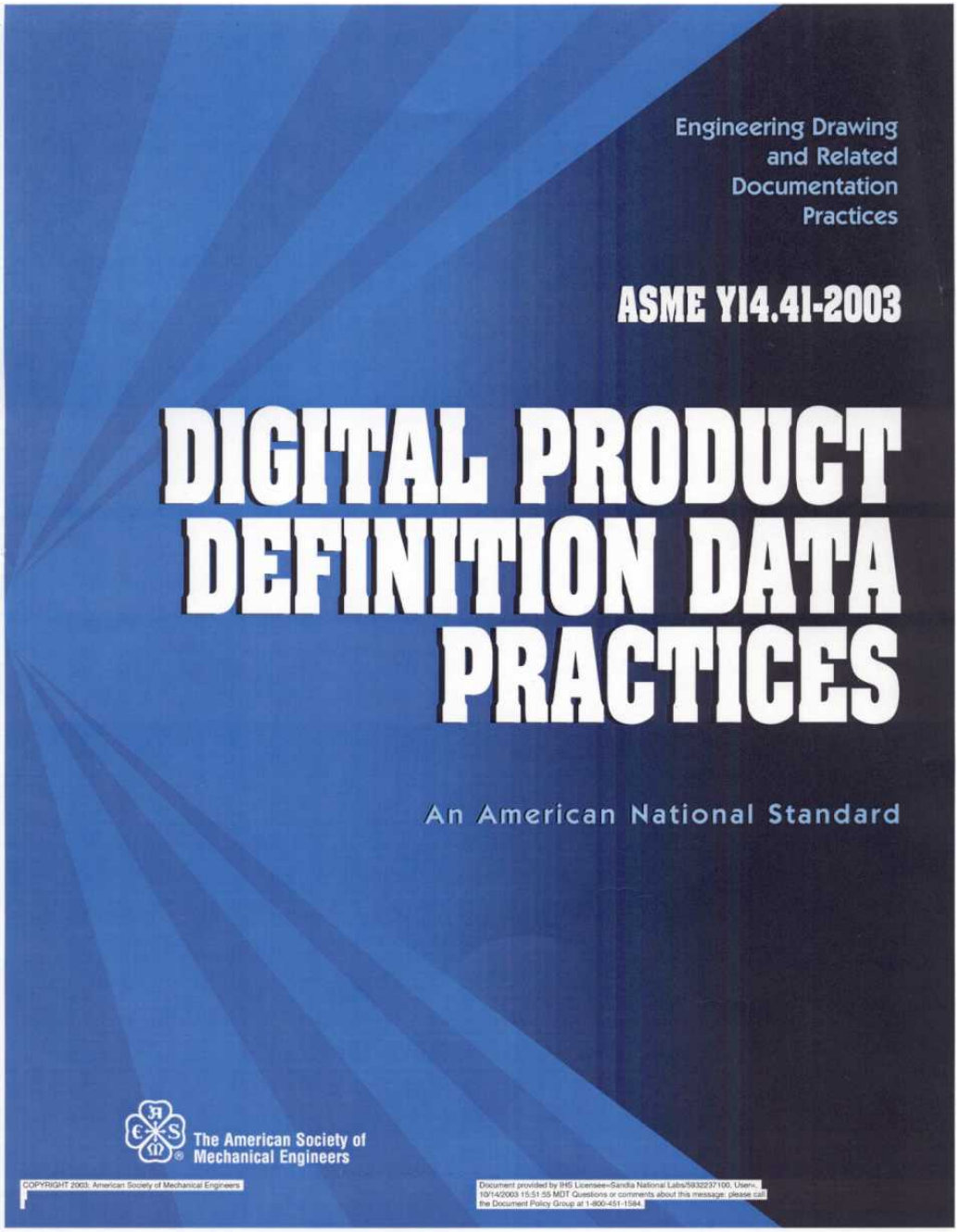

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It is estimated that over 80% of the engineering documents generated in the United States are flawed in some way.

Why Should We Care About Drawing Quality at All?

- Drawings are legal documents; we may buy expensive doorstops if they're not right – cost and schedule affected
- The achievable safety, security and reliability of hardware is 90% locked in by our documented design: bad design → bad product
- Getting the drawings right requires us to think about part functions and interfaces; this makes us do our job better

Why Should Companies Care About GD&T?

- Reduction in Good Parts Rejected
  - Reduced production costs through reduced waste
- Reduction in Bad Parts Accepted
  - Improved customer satisfaction – parts work as advertised
- Improved Communication
  - A single consistently applied and unambiguous process for documenting design intent will result in drawings that have the same meaning to design, manufacturing and inspection – better schedule and cost performance.

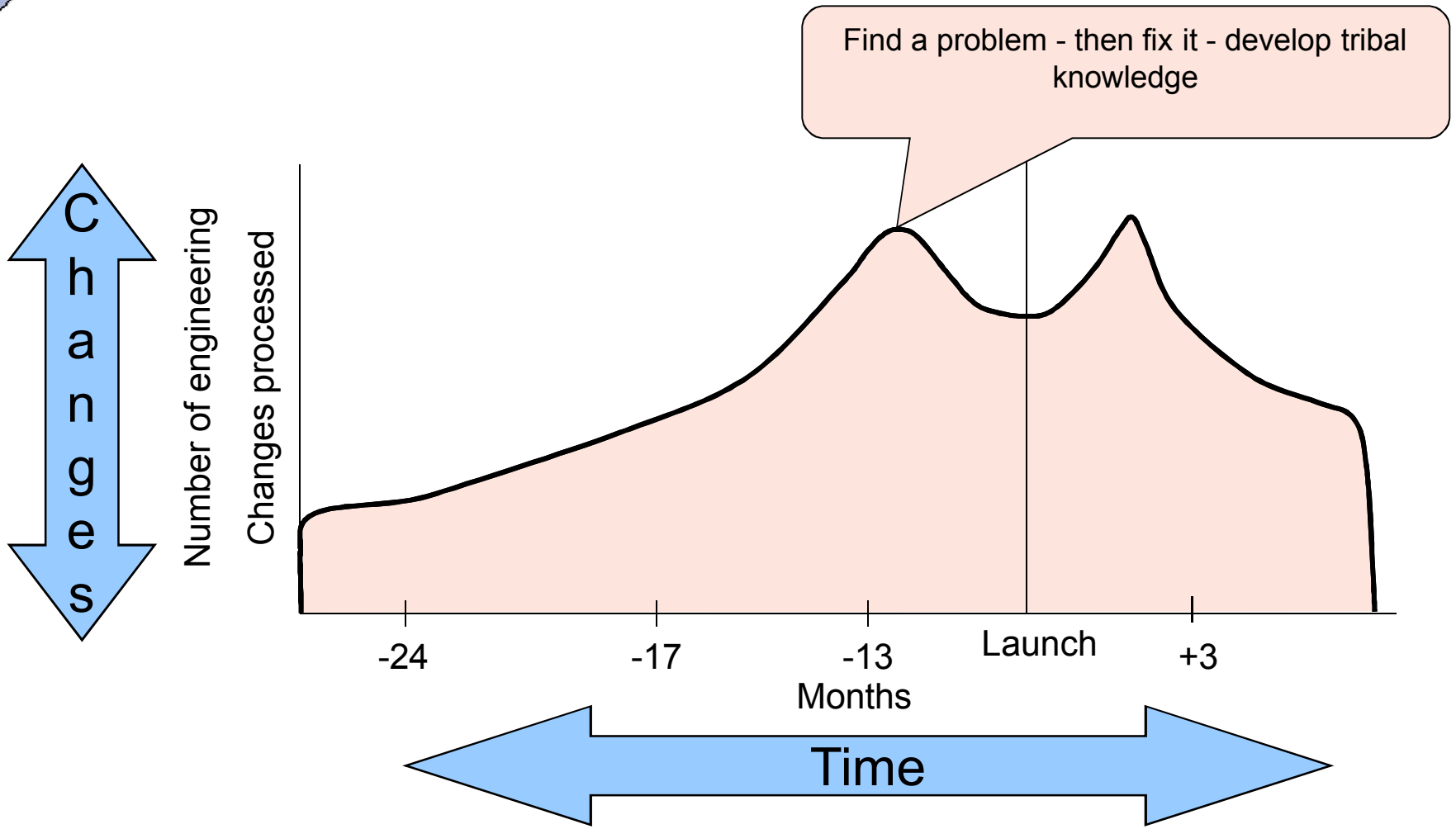
Why Should You Care About GD&T?

- The skill is valuable in design and manufacturing environments
  - This increases career flexibility
- This skill is valuable outside of Sandia, particularly in large businesses that out-source manufacturing
  - Skill in GD&T can be certified through the ASME International Personnel Certification program – a portable, third-party credential

Craftsmen do not need GD&T.

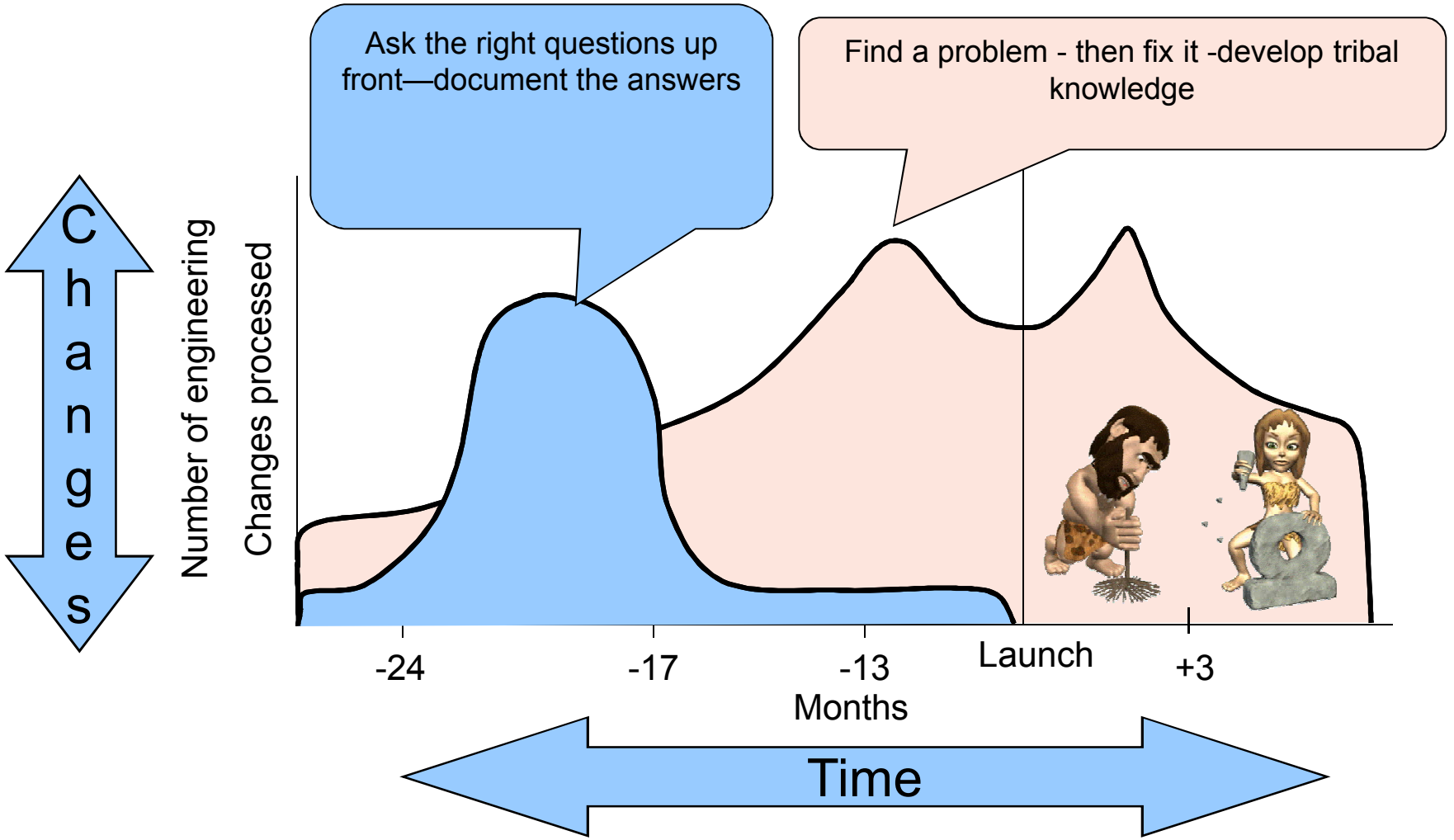
If you want it to fit the first time every time, you do need GD&T.

Interchangeability:
Making two or more parts separately and expecting them to fit together – even if you are only making one assembly.


Find a problem - then fix it - develop tribal knowledge
Changes
Number of engineering Changes processed
-24
-17
-13
Launch
+3
Months
Time

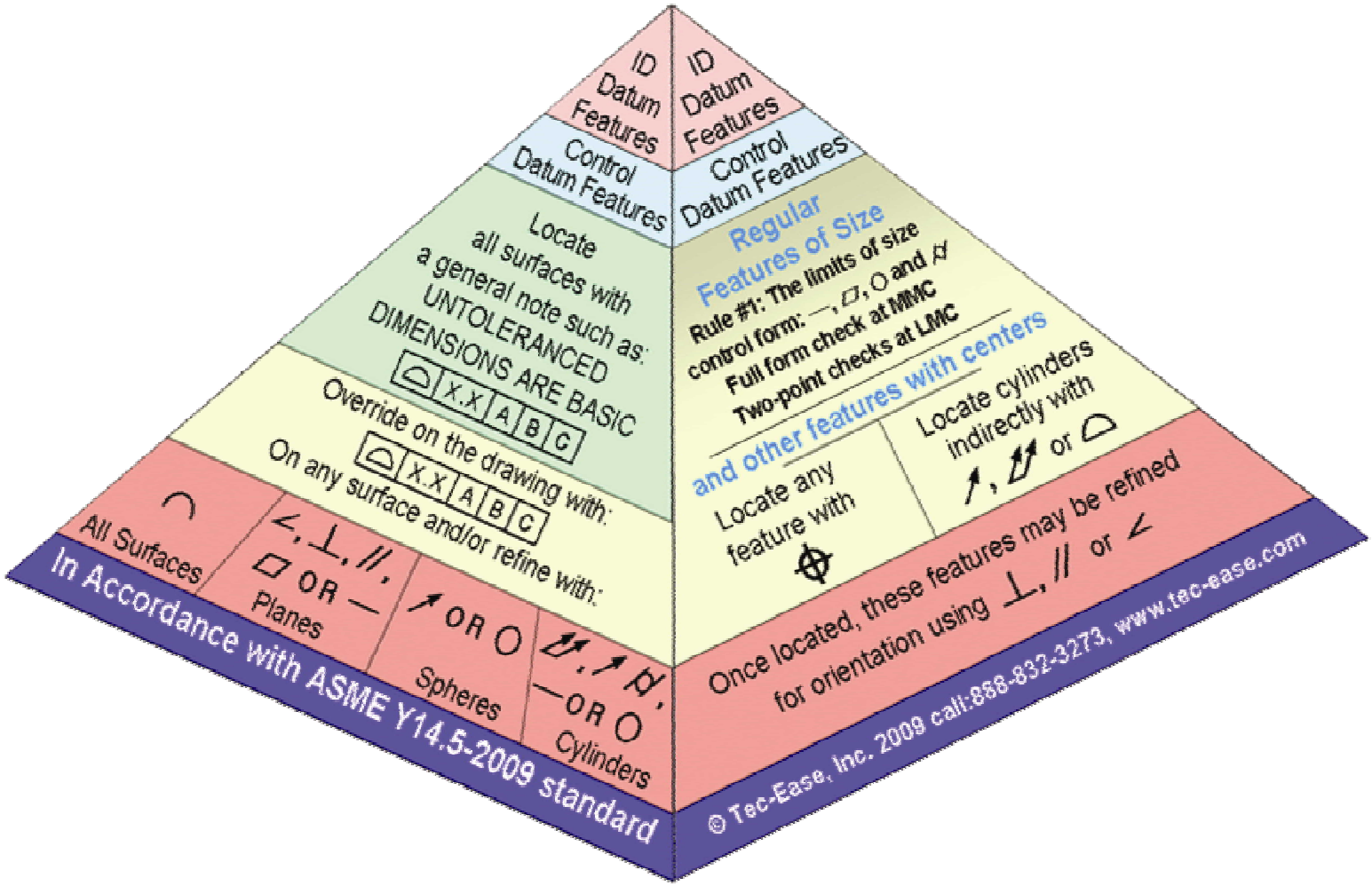
Tribal Knowledge

How can this be avoided?


Ask the right questions up front—document the answers
Find a problem - then fix it -develop tribal knowledge
Changes
Number of engineering Changes processed
-24
-17
-13
Launch
+3
Months
Time

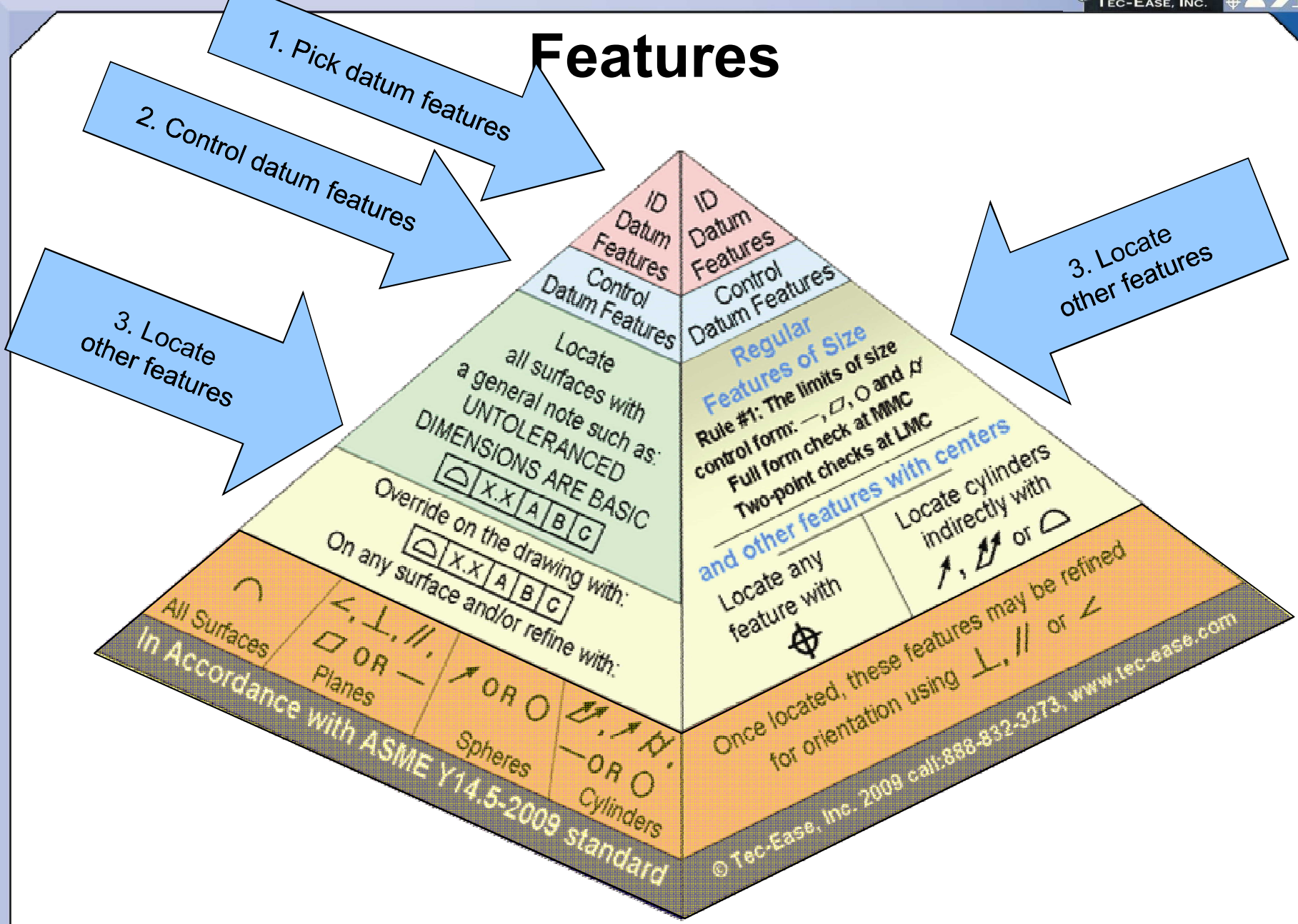
Time for Drawing Previews!

Features



In accordance with ASME Y14.5-2009

Features


1. Pick datum features
2. Control datum features
3. Locate other features
3. Locate other features
ID Datum Features
ID Datum Features
Control Datum Features
Control Datum Features
Regular Features of Size
Rule #1: The limits of size control form: —, ▱, ○ and ⌭
Full form check at MMC
Two-point checks at LMC
and other features with centers
Locate any feature with
Locate cylinders indirectly with ⊥, // or ∠
Locate all surfaces with a general note such as: UNTOLERANCED DIMENSIONS ARE BASIC
X.X A B C
Override on the drawing with:
X.X A B C
On any surface and/or refine with:
All Surfaces
∠, ⊥, //, ▱ OR —
Planes
OR ○
Spheres
⌭, ↗, ⌓, — OR ○
Cylinders
In Accordance with ASME Y14.5-2009 standard
Once located, these features may be refined for orientation using ⊥, // or ∠
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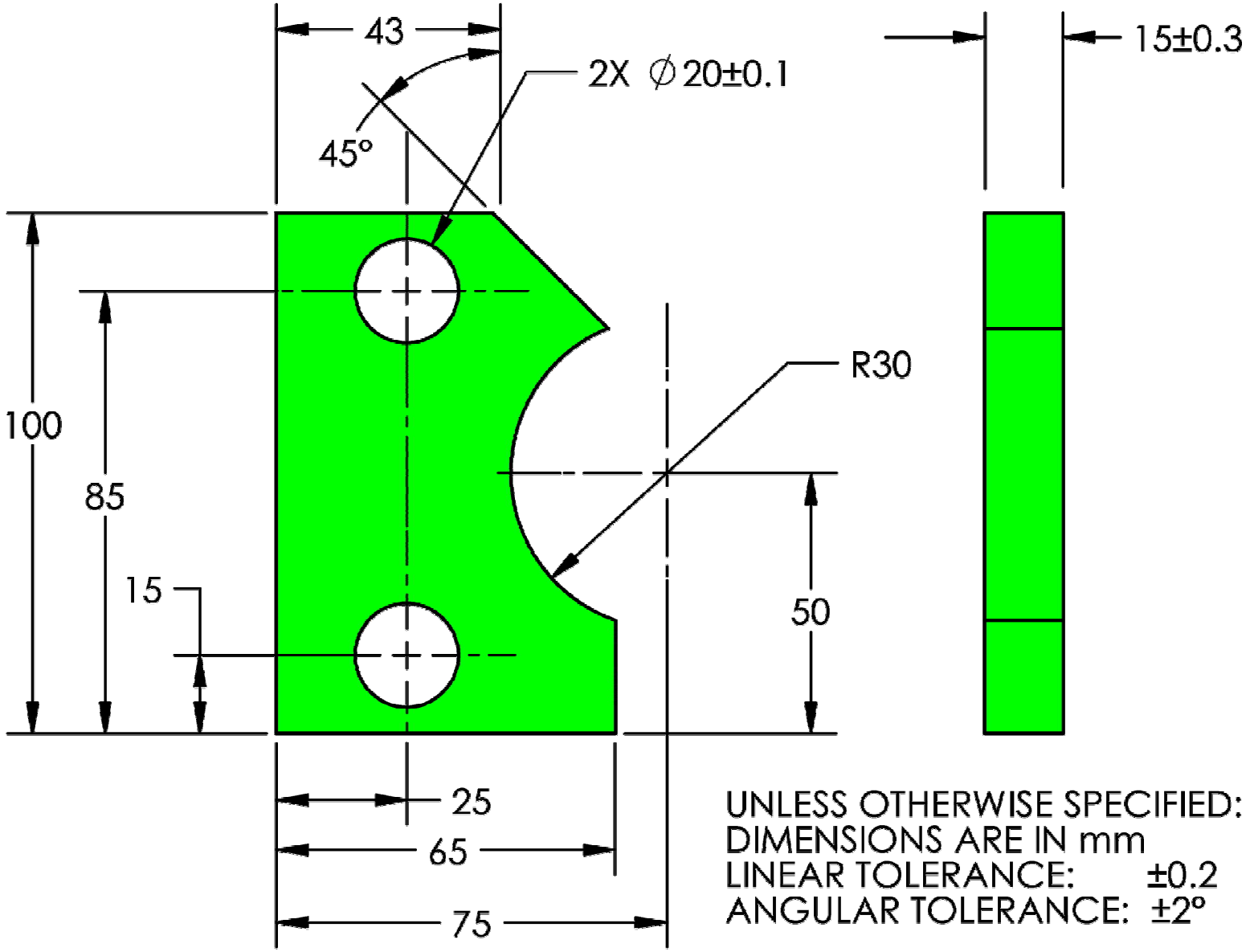
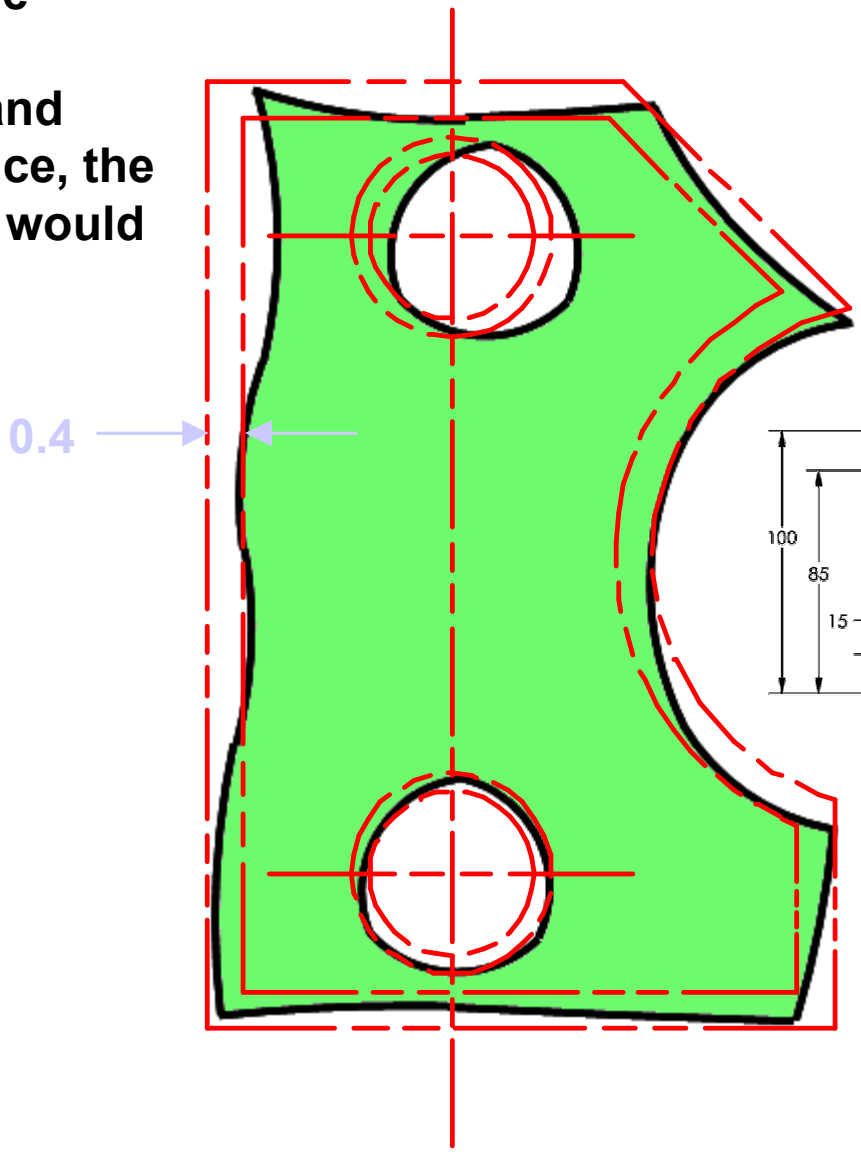
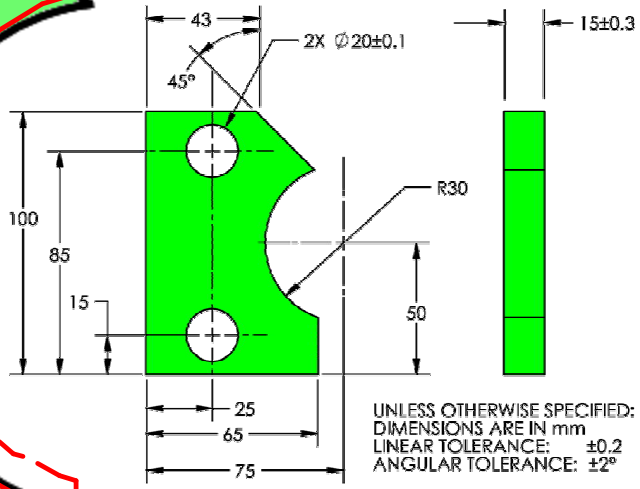
This drawing is "old school" tolerancing.

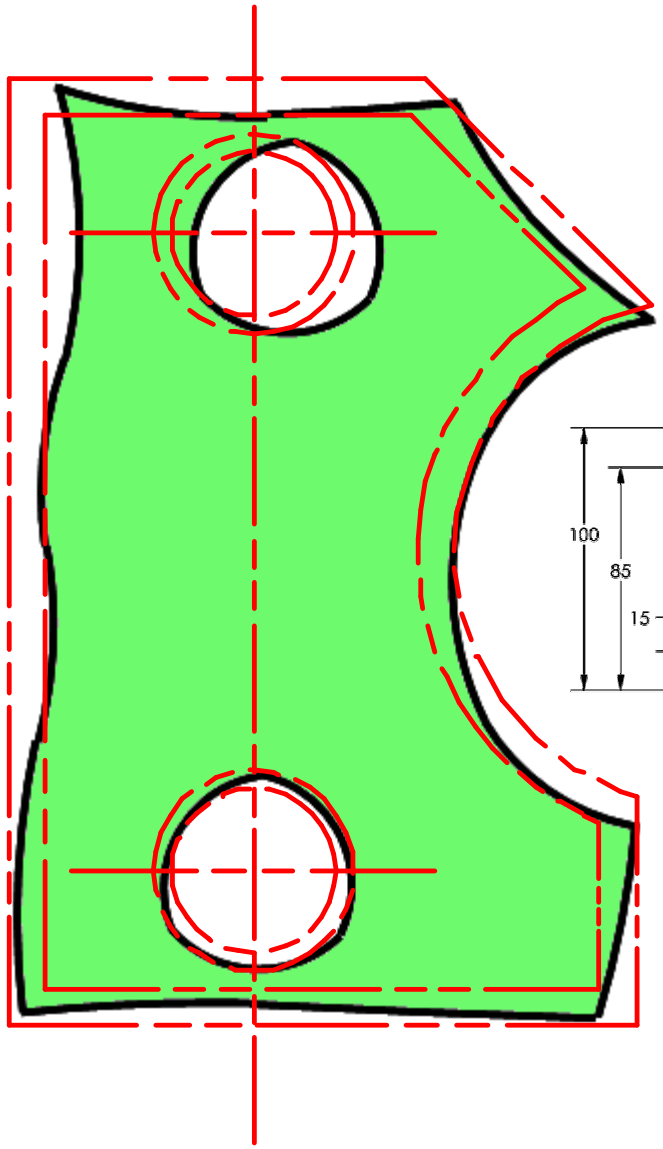


If you ignore the tolerance accumulation and angular tolerance, the tolerance zone would look like this:

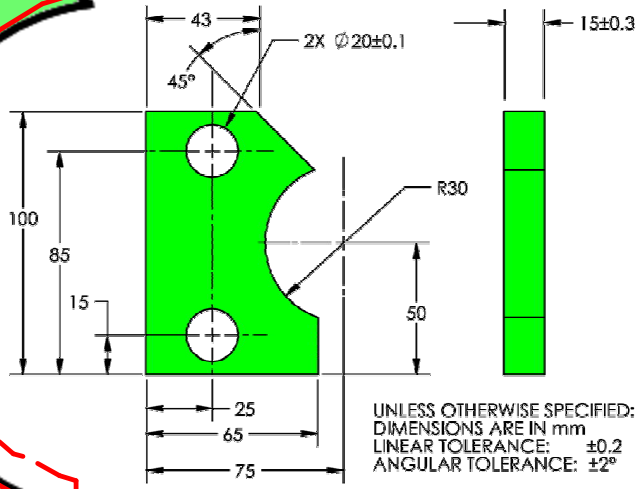


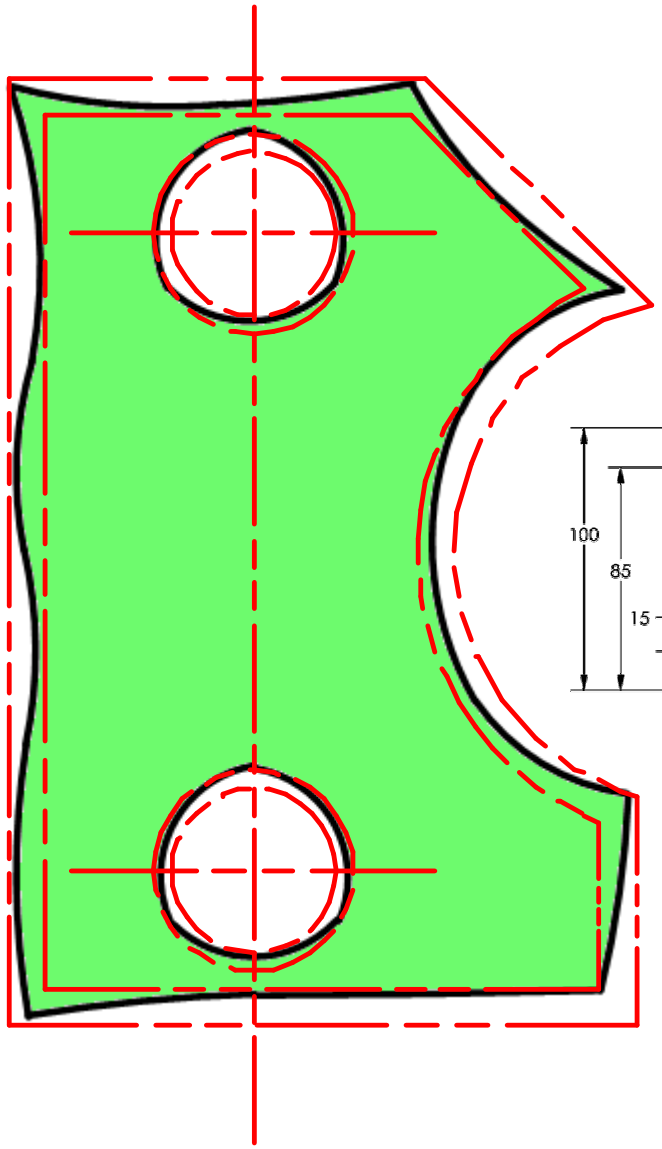
But, how do you line the part up with the tolerance zone?



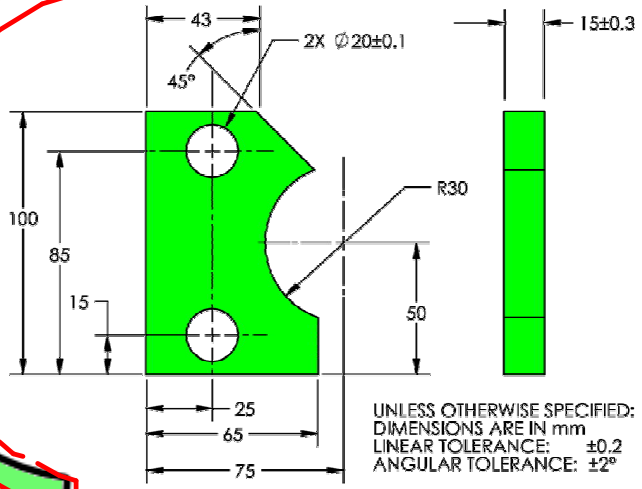


Buying?

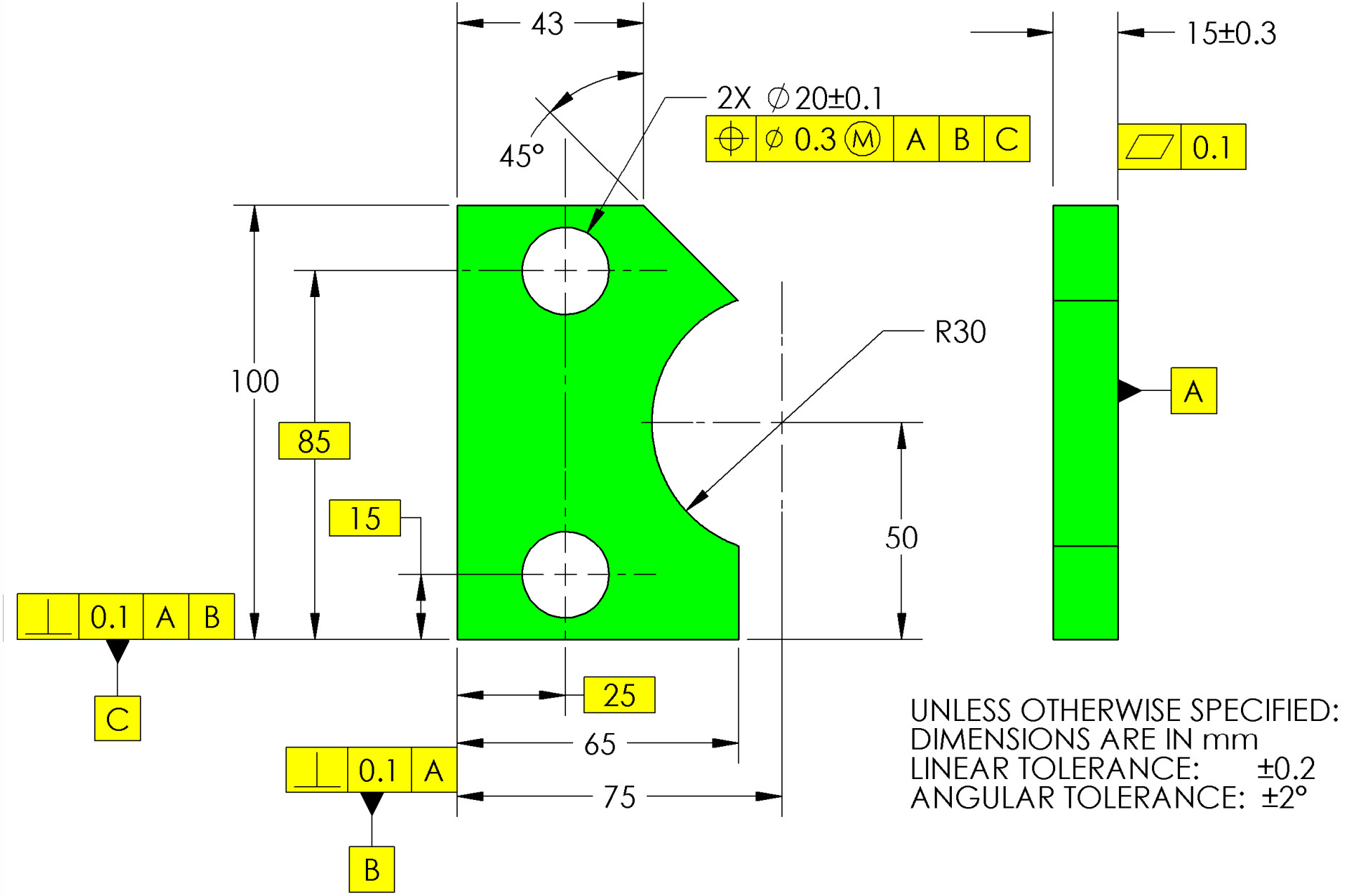

43
2X ∅20±0.1
45°
15±0.3
100
85
15
R30
50
25
65
75
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN mm
LINEAR TOLERANCE: ±0.2
ANGULAR TOLERANCE: ±2°

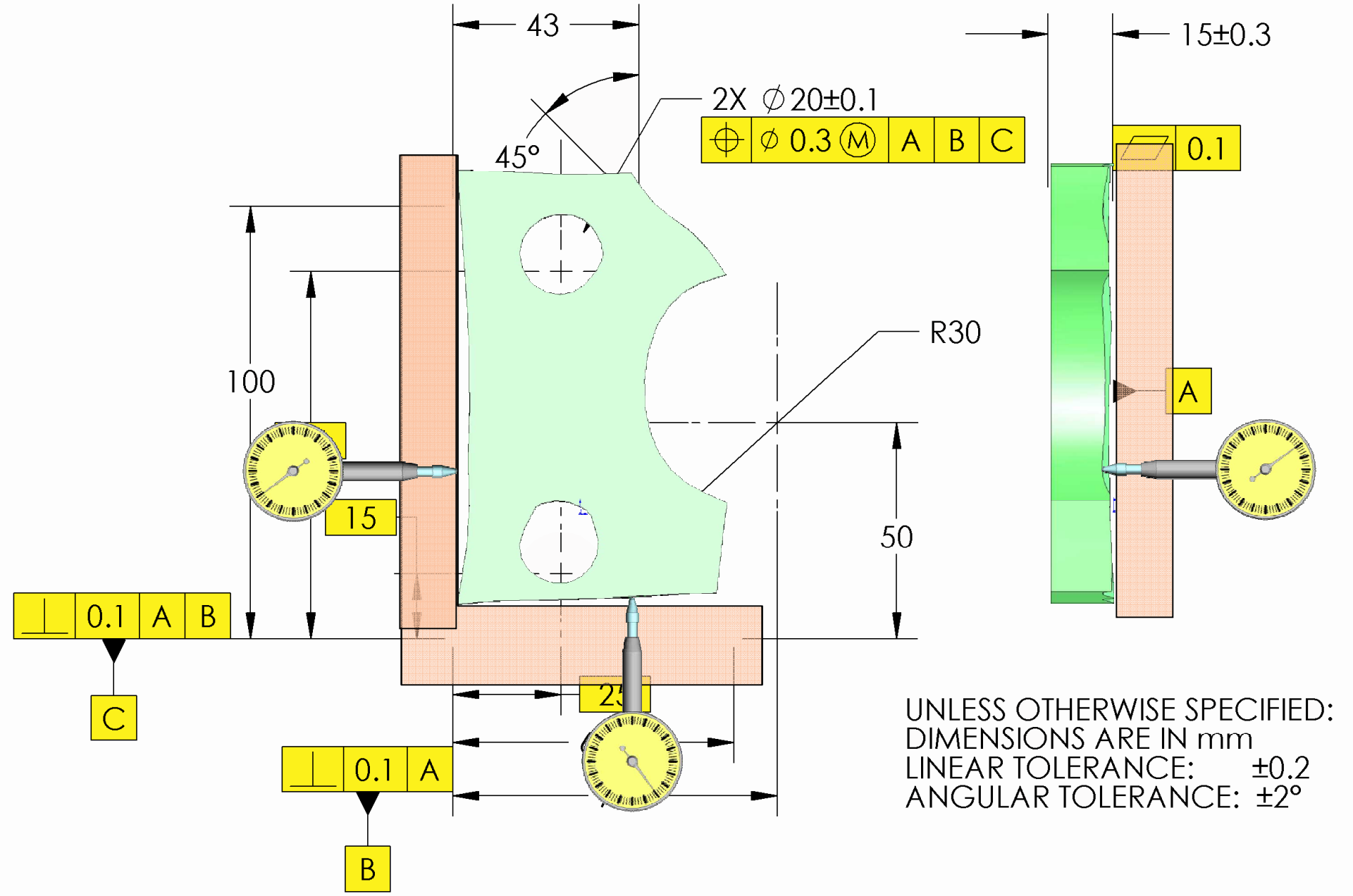


Selling?


43
2X ∅20±0.1
45°
15±0.3
100
85
15
R30
50
25
65
75
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN mm
LINEAR TOLERANCE: ±0.2
ANGULAR TOLERANCE: ±2°

This drawing is GD&T Lite.





UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN mm
LINEAR TOLERANCE: ±0.2
ANGULAR TOLERANCE: ±2°

Questions?

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