



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Engineering / Technical Drawing

A Guide to the Production & Interpretation of Drawings to
BS8888

Lecture 7

Geometric Dimensioning & Tolerancing 2

Richard Morgan



Prerequisites to this Subject Area

You should have covered (and understood) the following subject areas before moving onto Geometric Dimensioning and Tolerancing (GD&T):

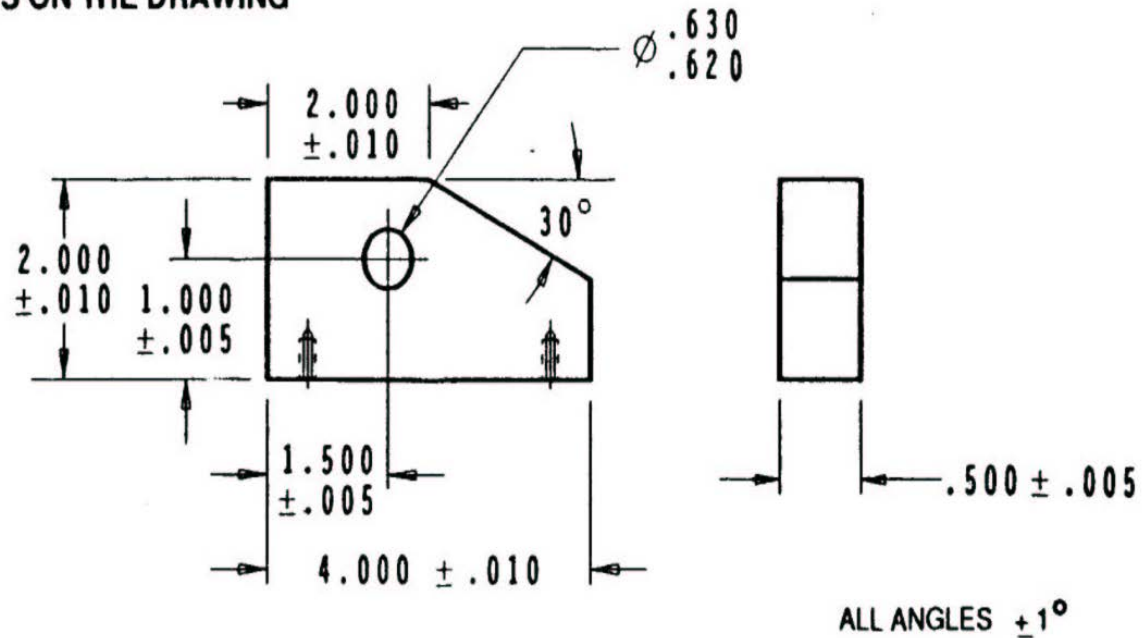
- ✓ Orthographic Projection (1st/3rd angle, line types etc.)
- ✓ Principles of General Dimensioning
- ✓ Auxiliary Views
- ✓ Principles of Limit Tolerancing
- ✓ Limit & Fit Specifications & Calculations
- ✓ Introduction to GD&T Principles

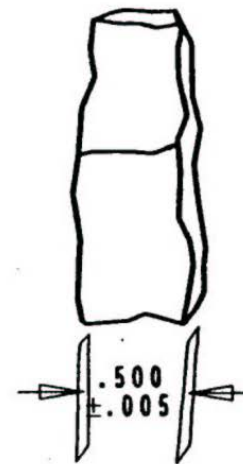
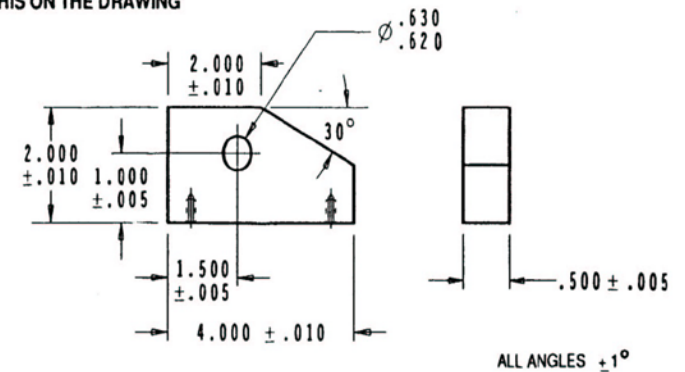
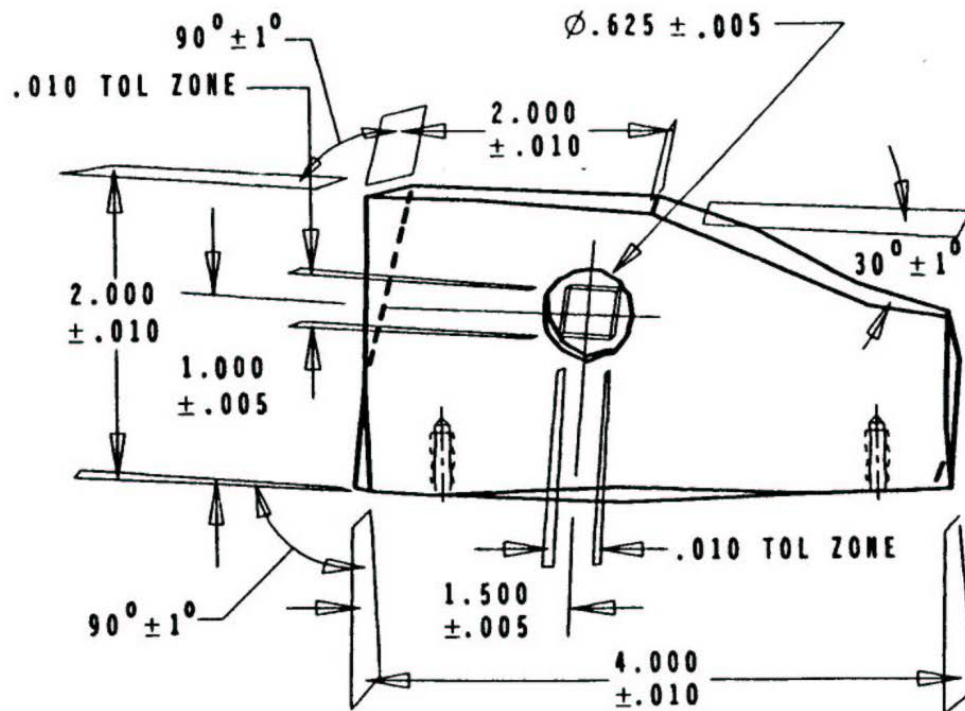
The 14 Geometric Controls

TYPE OF FEATURE	TYPE OF TOLERANCE	CHARACTERISTIC	SYMBOL
INDIVIDUAL (No Datum Reference)	FORM	FLATNESS	
		STRAIGHTNESS	
		CIRCULARITY	
		CYLINDRICITY	
INDIVIDUAL or RELATED FEATURES	PROFILE	LINE PROFILE	
		SURFACE PROFILE	
RELATED FEATURES (Datum Reference Required)	ORIENTATION	PERPENDICULARITY	
		ANGULARITY	
		PARALLELISM	
	RUNOUT	CIRCULAR RUNOUT	
		TOTAL RUNOUT	
	LOCATION	CONCENTRICITY	
		POSITION	
		SYMMETRY	

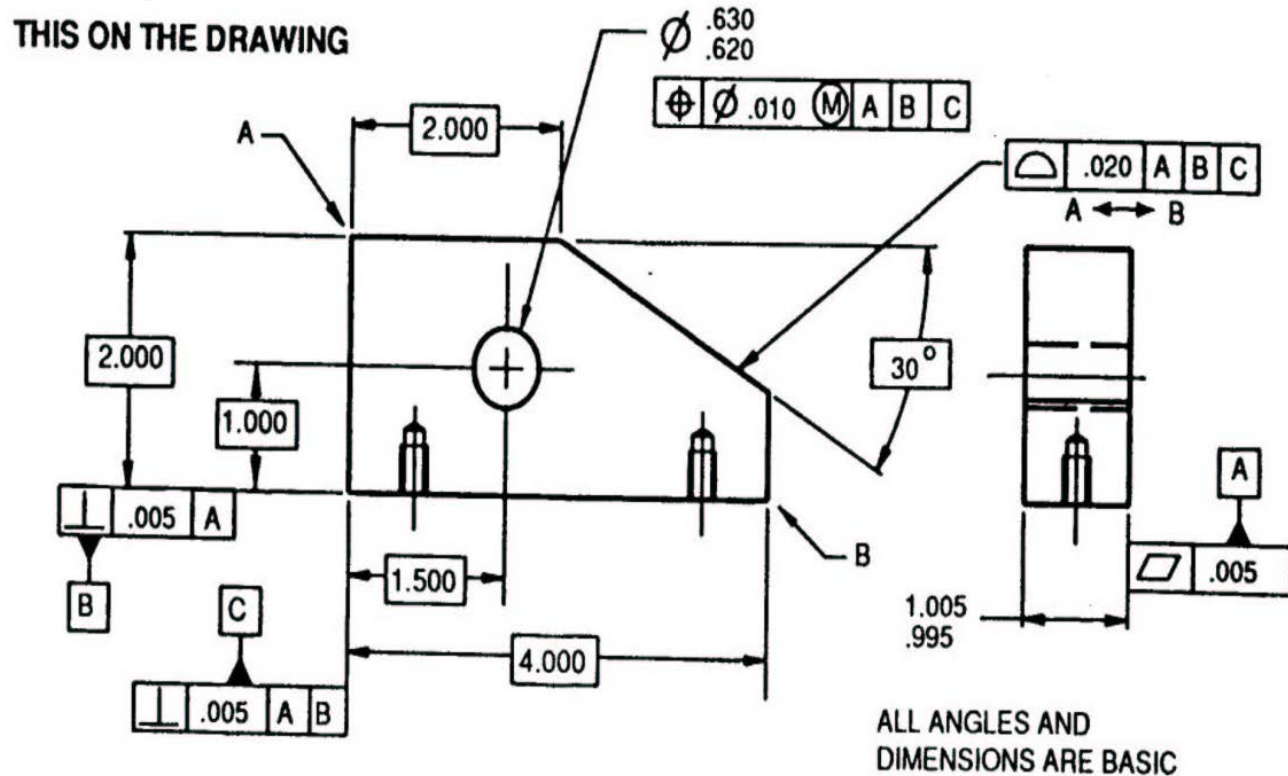
Limit Tolerancing Applied to an Angle Block

THIS ON THE DRAWING



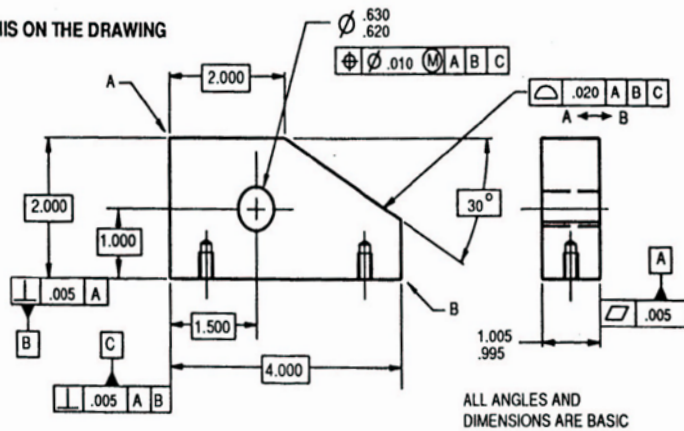


Limit Tolerancing Applied to an Angle Block

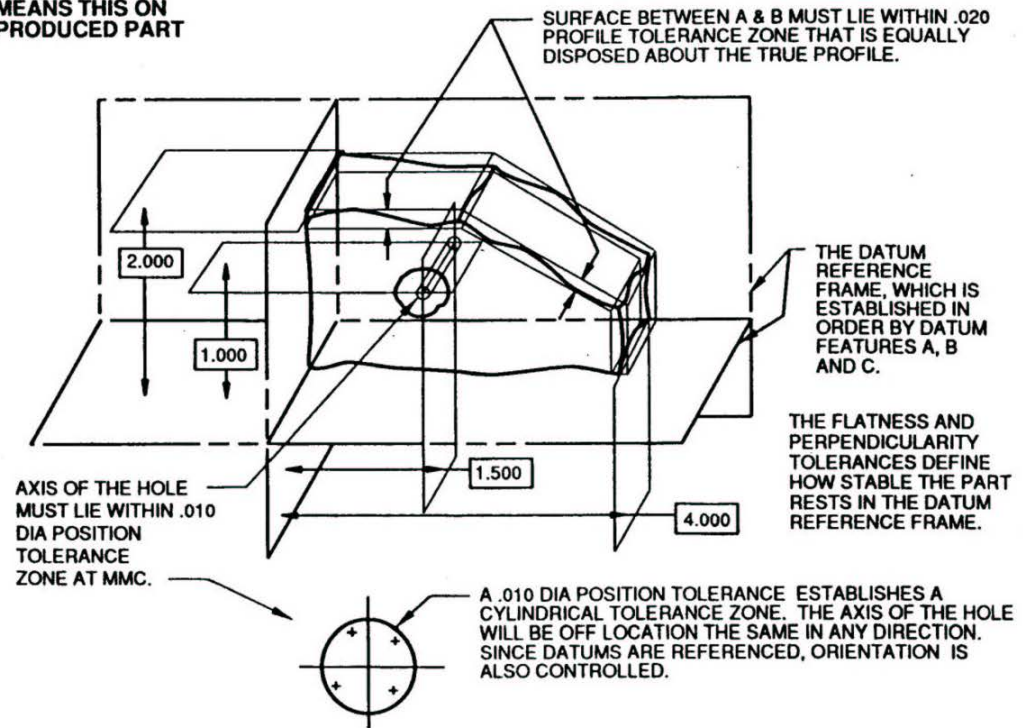


Limit Tolerancing Applied to an Angle Block

THIS ON THE DRAWING



MEANS THIS ON PRODUCED PART



Limit Tolerancing Applied to Table/Stool

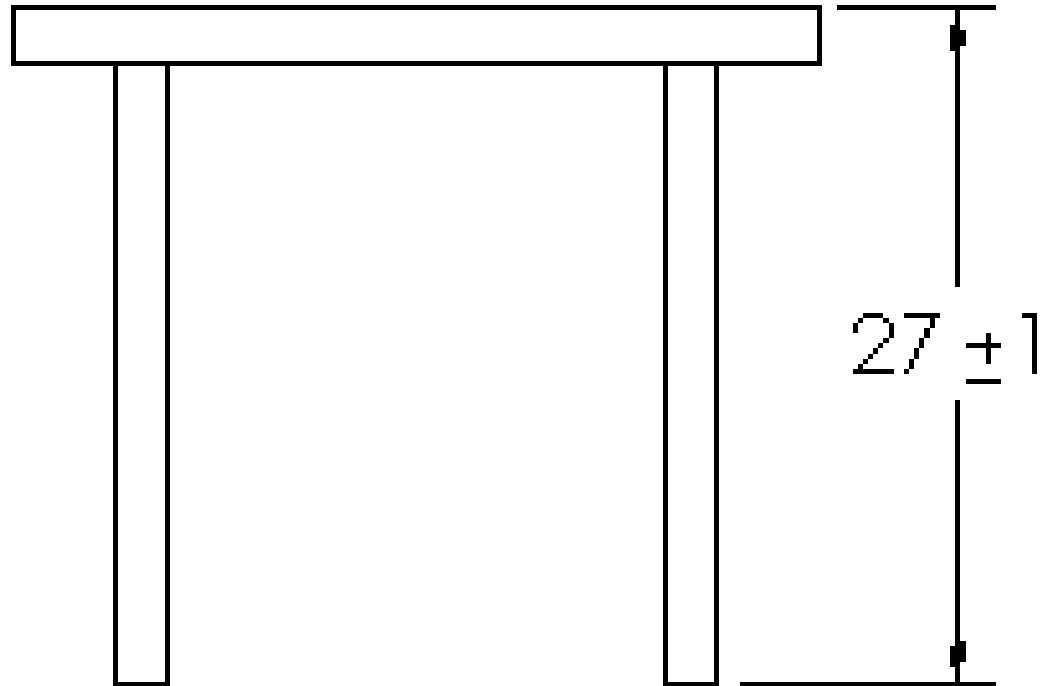
Given Table Height

Assume all 4 legs will be cut to length at the same time.

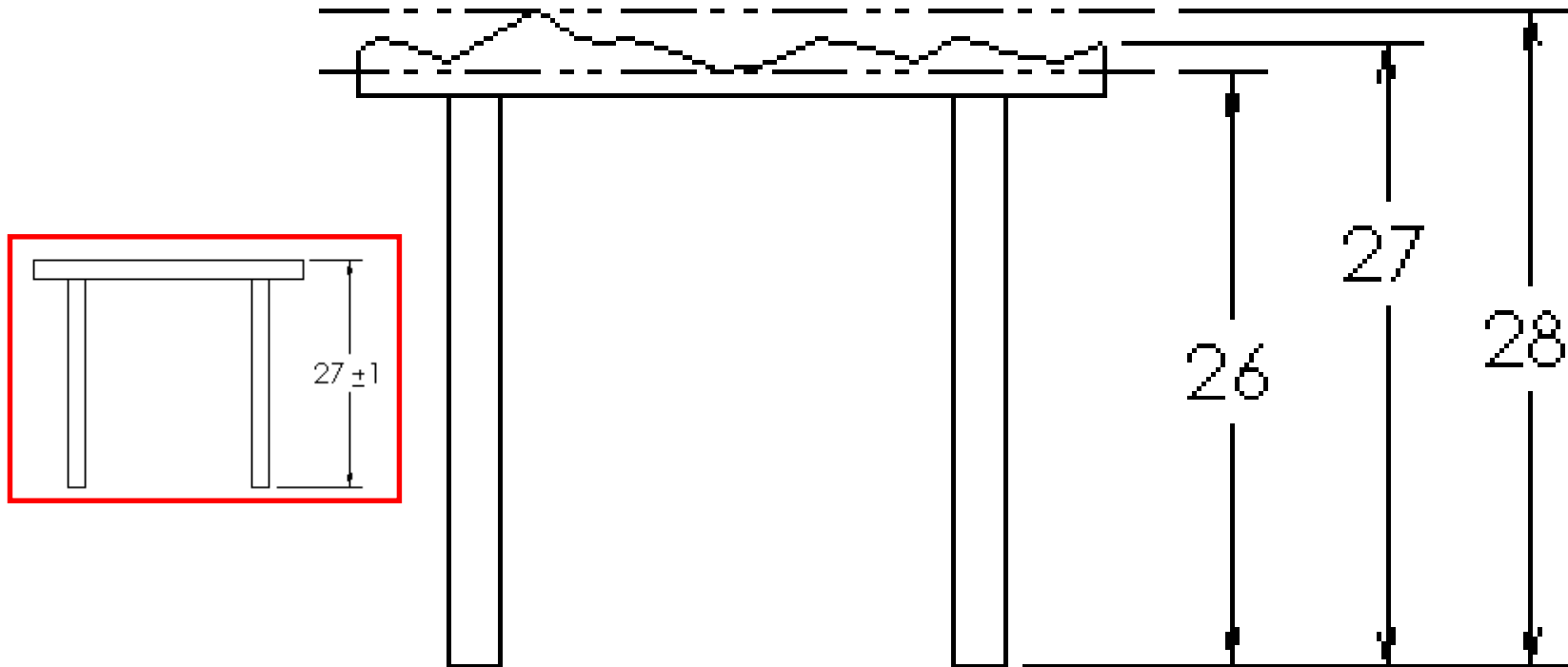
All Surfaces have a degree of waviness or smoothness.

For example, the surface of cut timber would be much wavier than a sheet of glass.

We've decided that it is acceptable for the table height to be between **26mm** and **28mm**



Limit Tolerancing Applied to Table/Stool

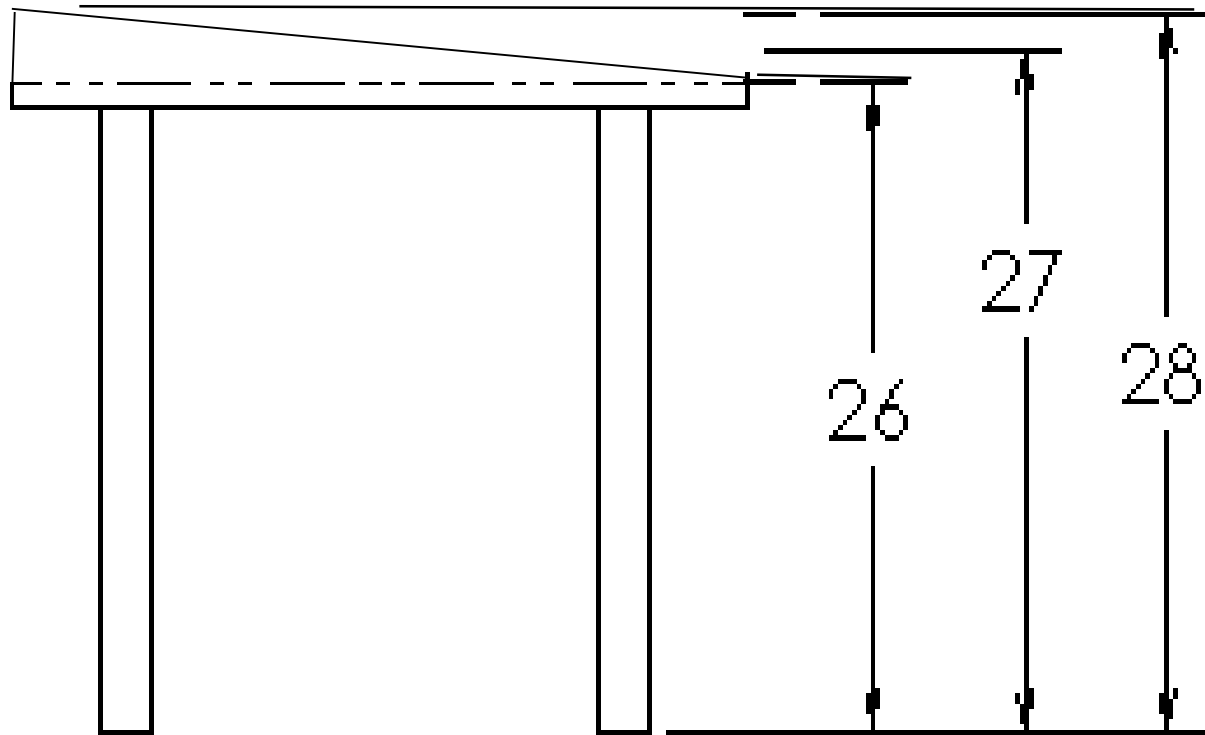
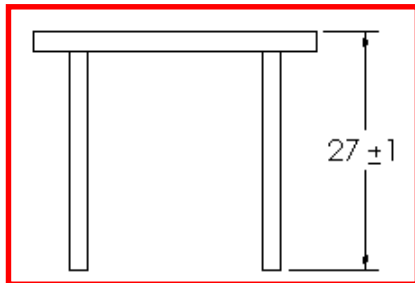


Would this pass
quality inspection?



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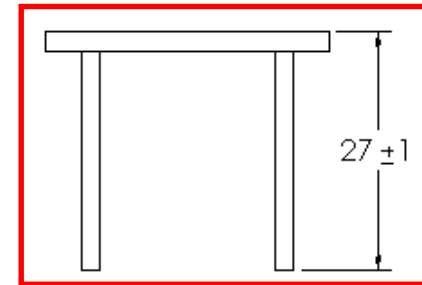
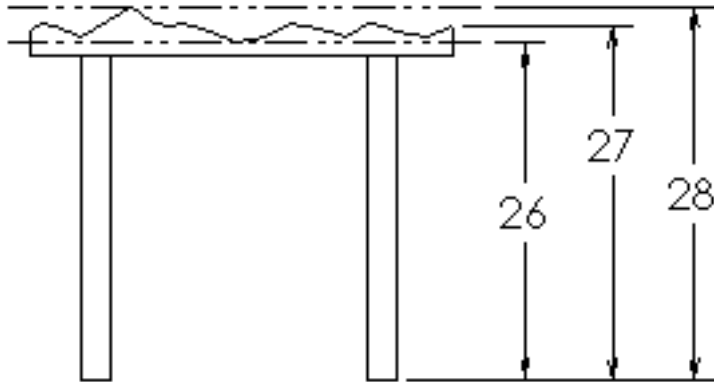
Limit Tolerancing Applied to Table/Stool



Would this pass
quality inspection?



Limit Tolerancing Applied to Table/Stool

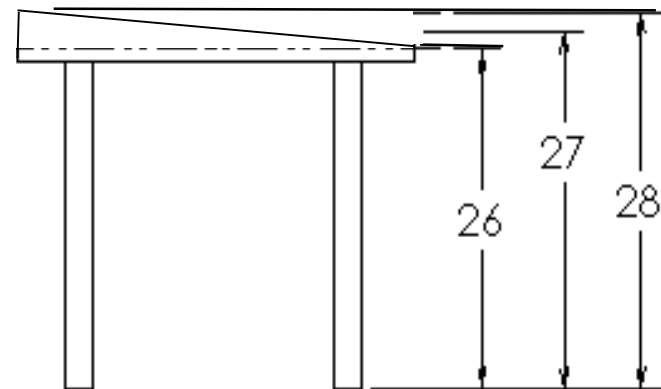


Let's say, the top must be "flatter".

How could we achieve this?

You could tighten the tolerance to ± 0.6

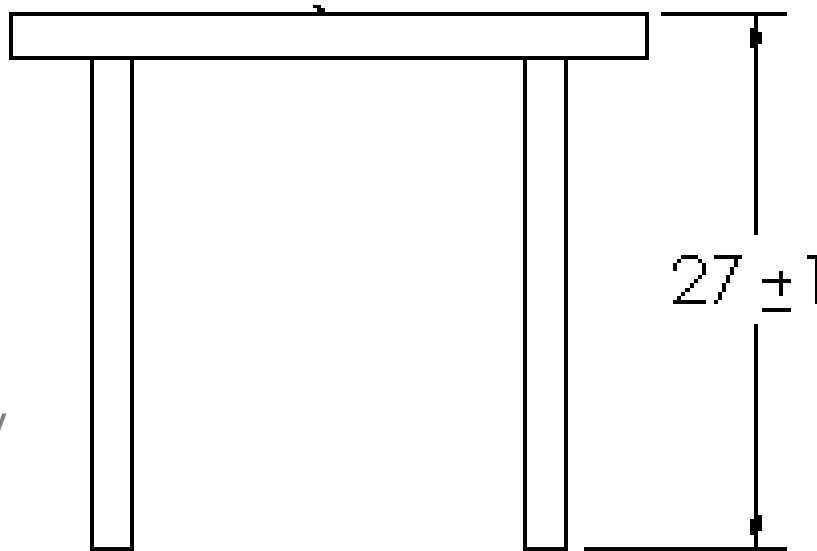
Why is this a poor solution?



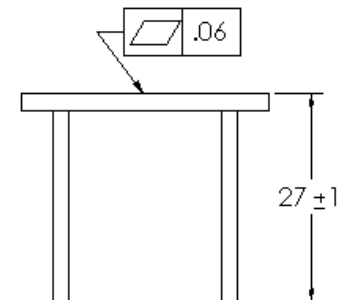
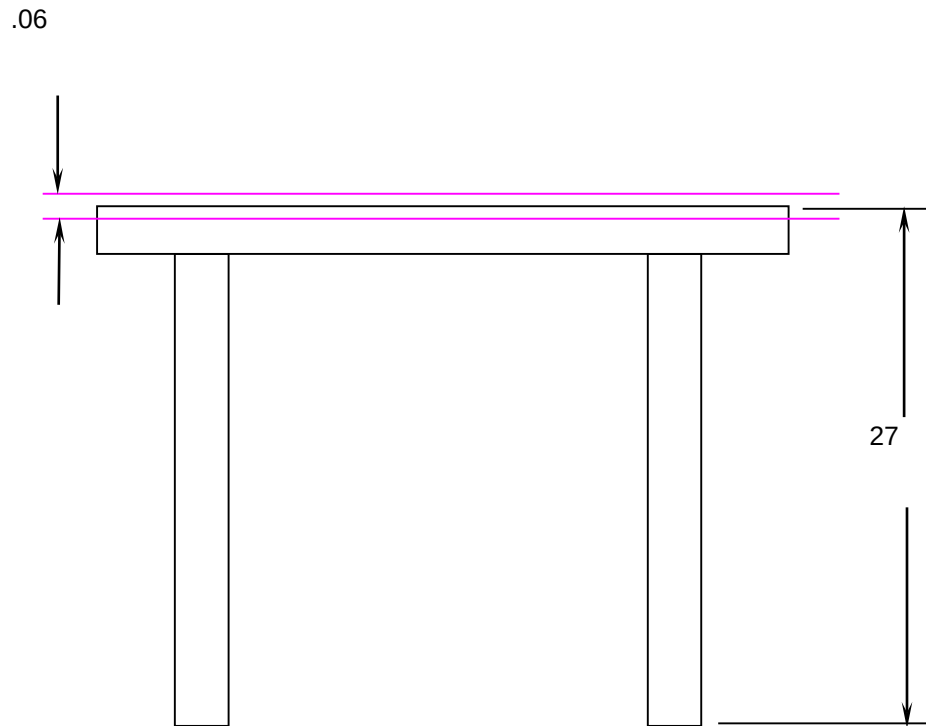
Limit Tolerancing Applied to Table/Stool

We could apply the following Geometric Tolerance to the drawing.

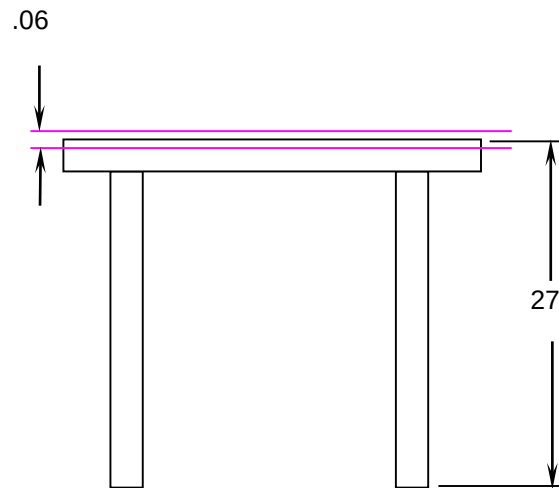
What does it actually mean in practical terms?



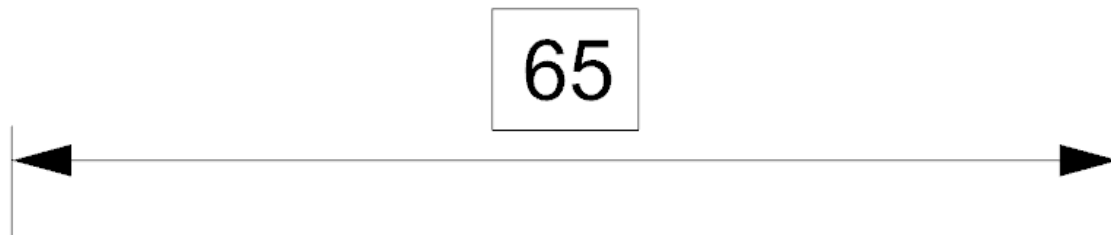
Limit Tolerancing Applied to Table/Stool



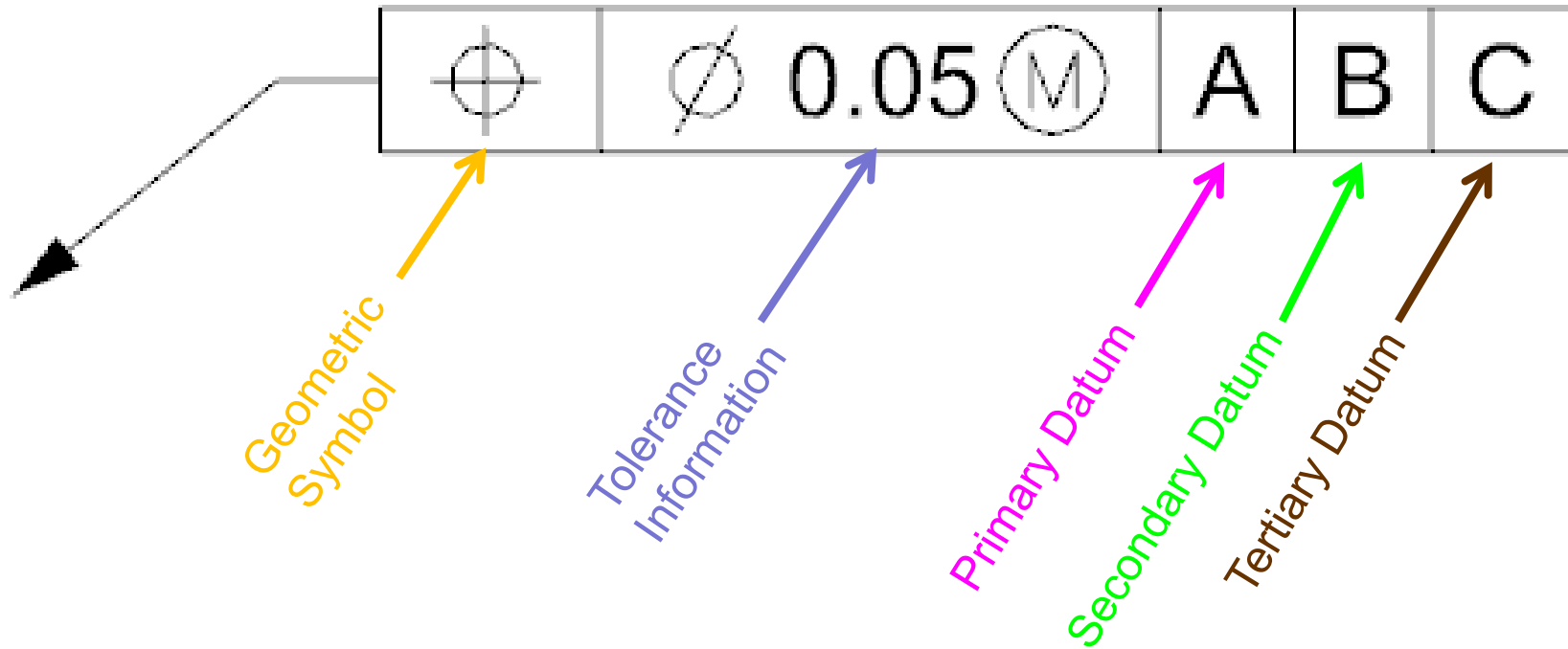
Limit Tolerancing Applied to Table/Stool



Additional Characters & Symbols



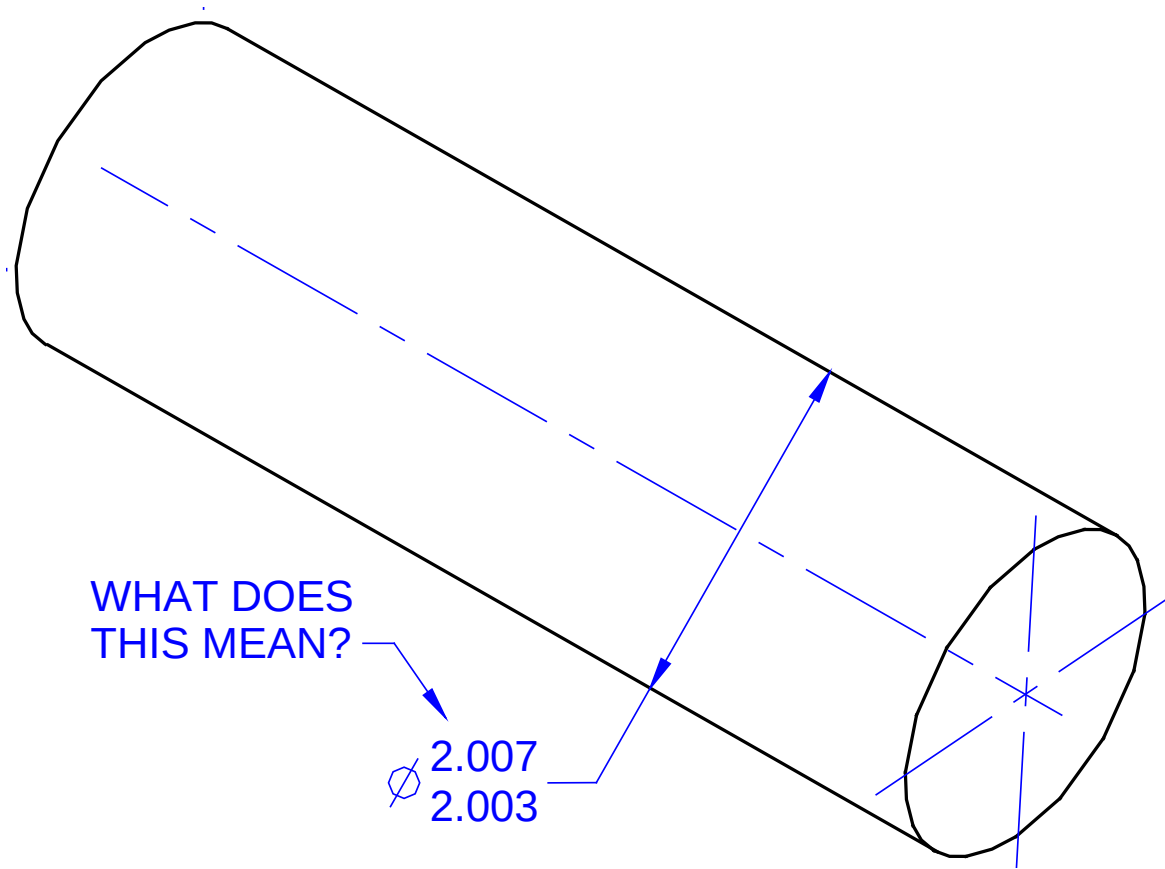
Feature Control Frame – Definition



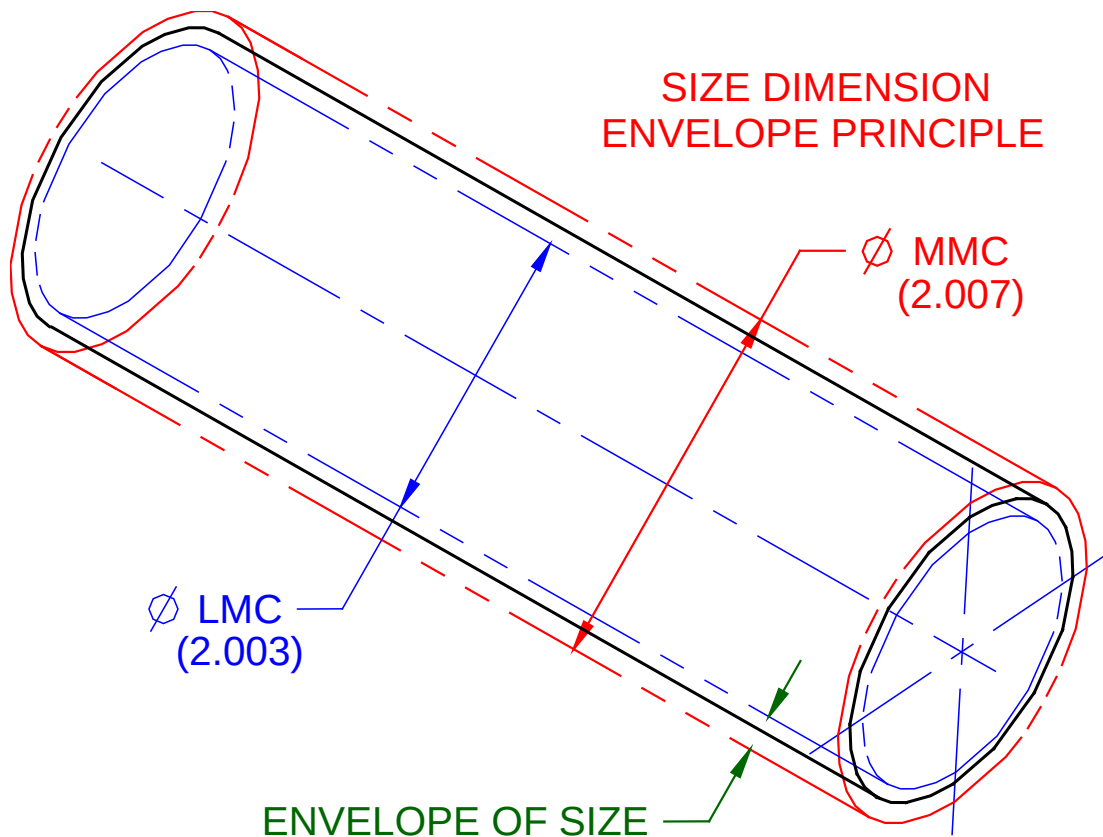
The **position** of the feature must be within a **0.05mm** diametrical tolerance zone at **maximum material condition** relative to datums **A**, **B** and **C**.

Limits of Size

Size Dimension



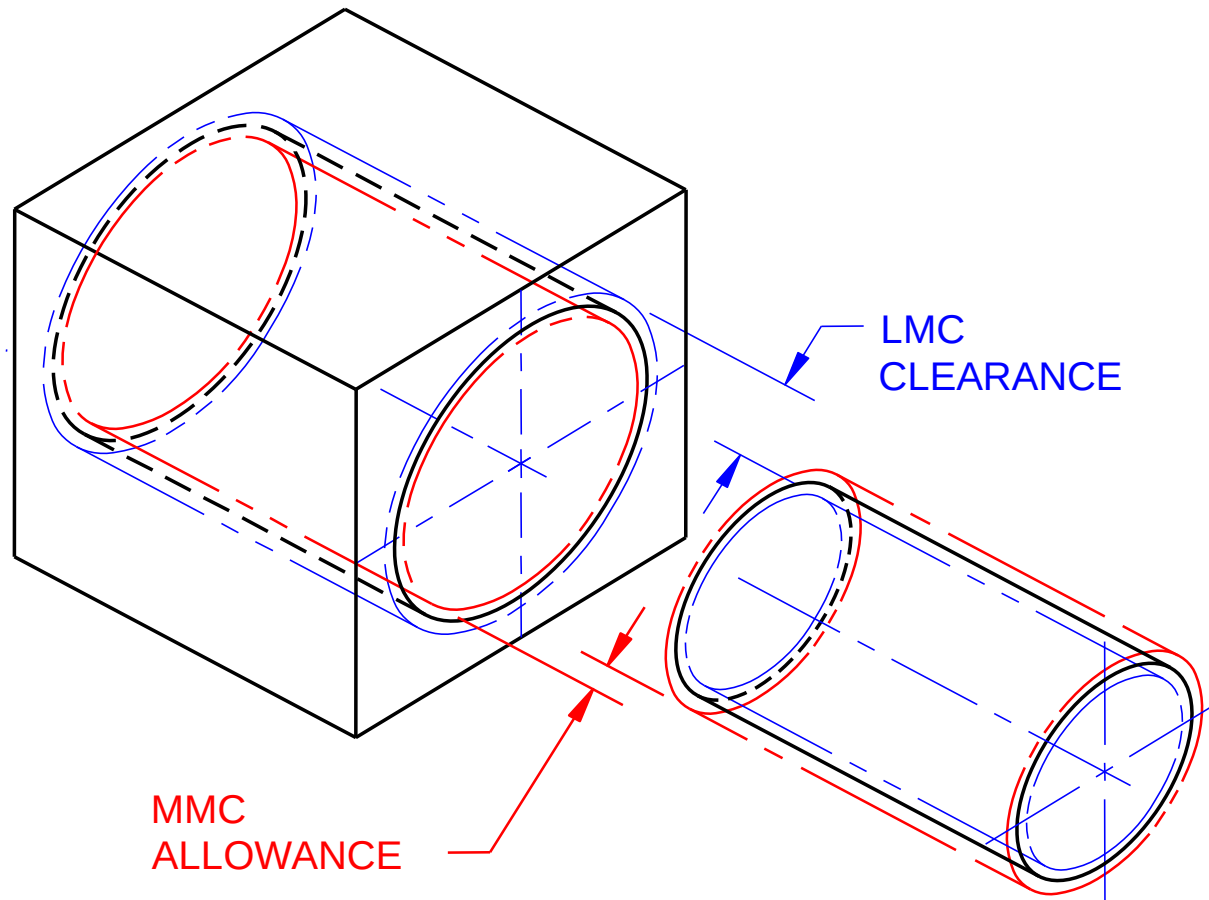
Limits of Size



A variation in form is allowed between the least material condition (LMC) and the maximum material condition (MMC)

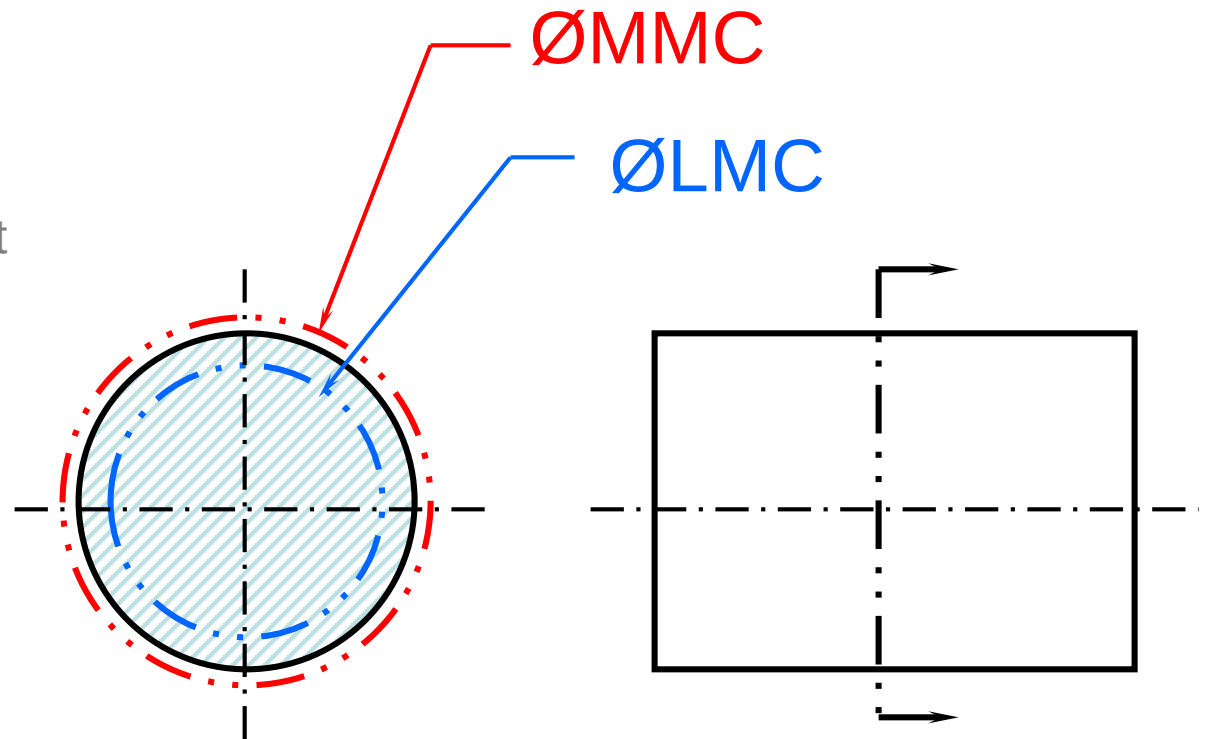
Limits of Size

Envelope Principle



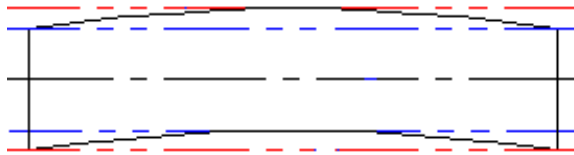
Limits of Size

The actual size of the feature at any cross-section must be within the size boundary.

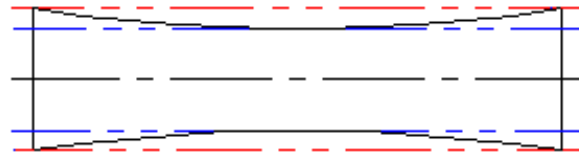


Limits of Size

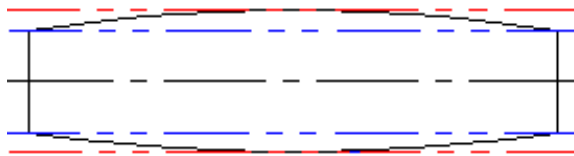
Feature Form



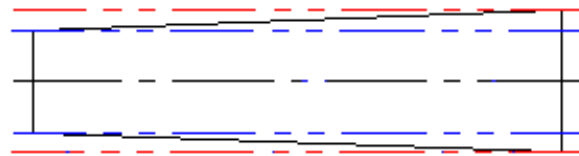
BOWED



WAISTED



BARRELED

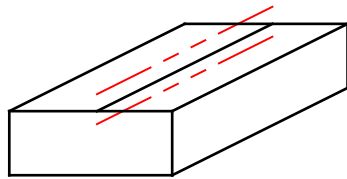


TAPERED

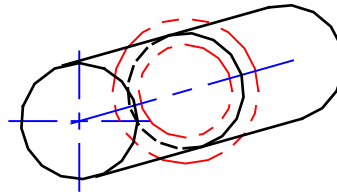
No portion of the feature may be outside a perfect form barrier at maximum material condition (MMC)

Limits of Size

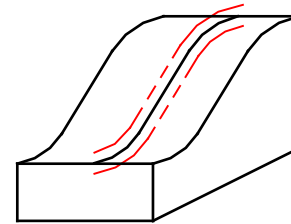
Other parallel line tolerance zones



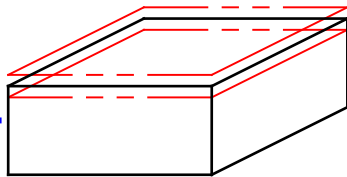
PARALLEL LINES



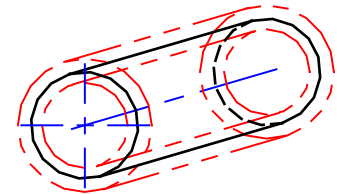
PARALLEL LINES



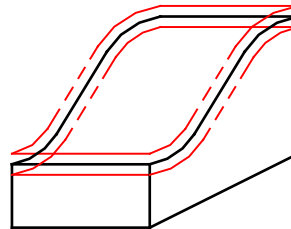
PARALLEL LINES



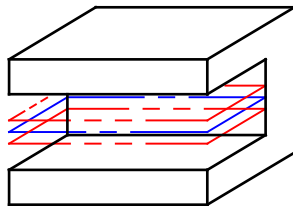
PARALLEL PLANES



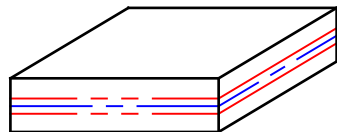
PARALLEL PLANES



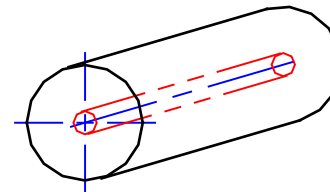
PARALLEL PLANES



PARALLEL PLANES



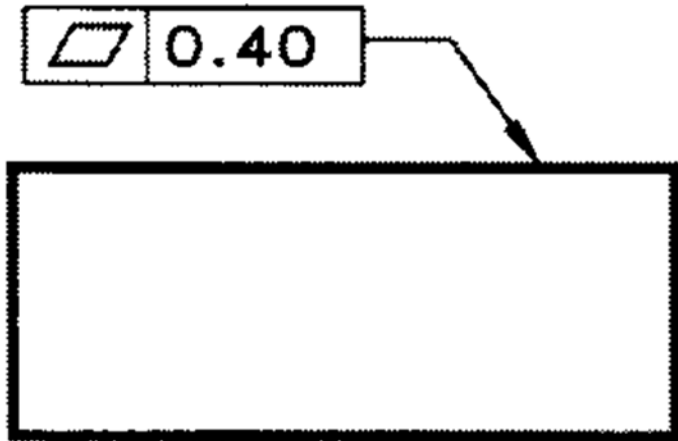
PARALLEL PLANES



CYLINDER ZONE

Form Tolerancing Examples

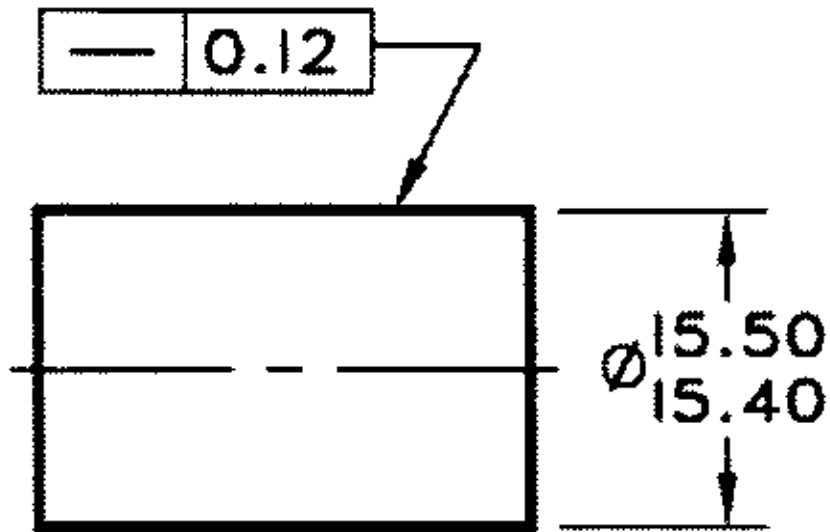
Flatness



A. DRAWING

Form Tolerancing Examples

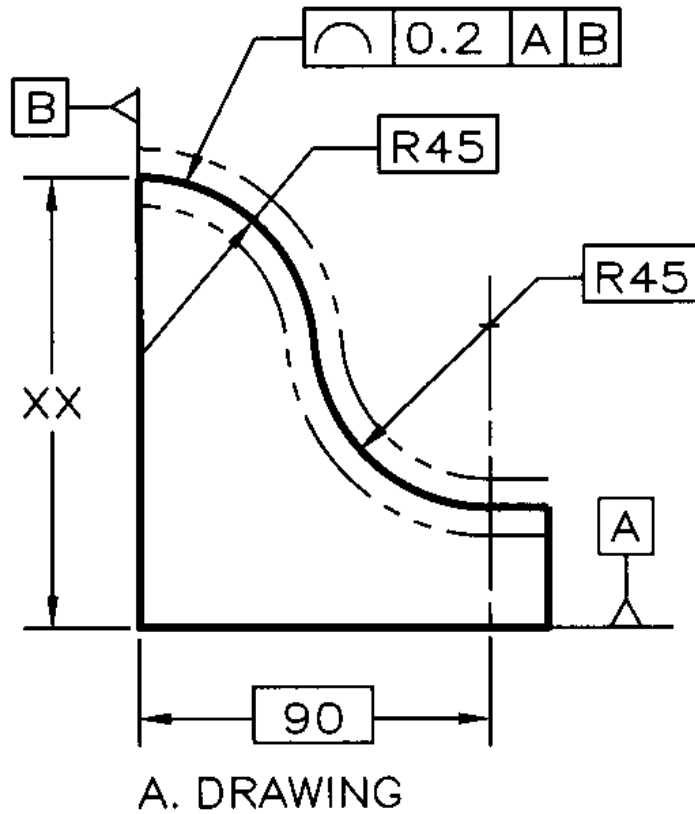
Straightness



A. DRAWING

Profile Tolerancing Examples

Profile Tolerancing – Line Type

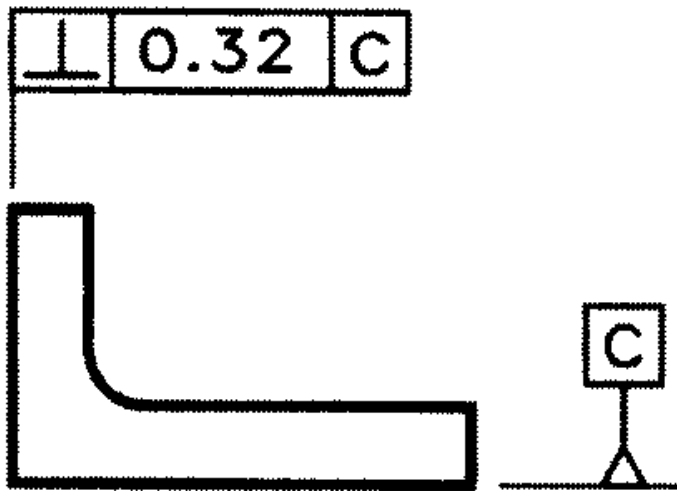


Profile Tolerancing Examples

Parallel Line and Plane Tolerance Zones Examples

Orientation Tolerancing Examples

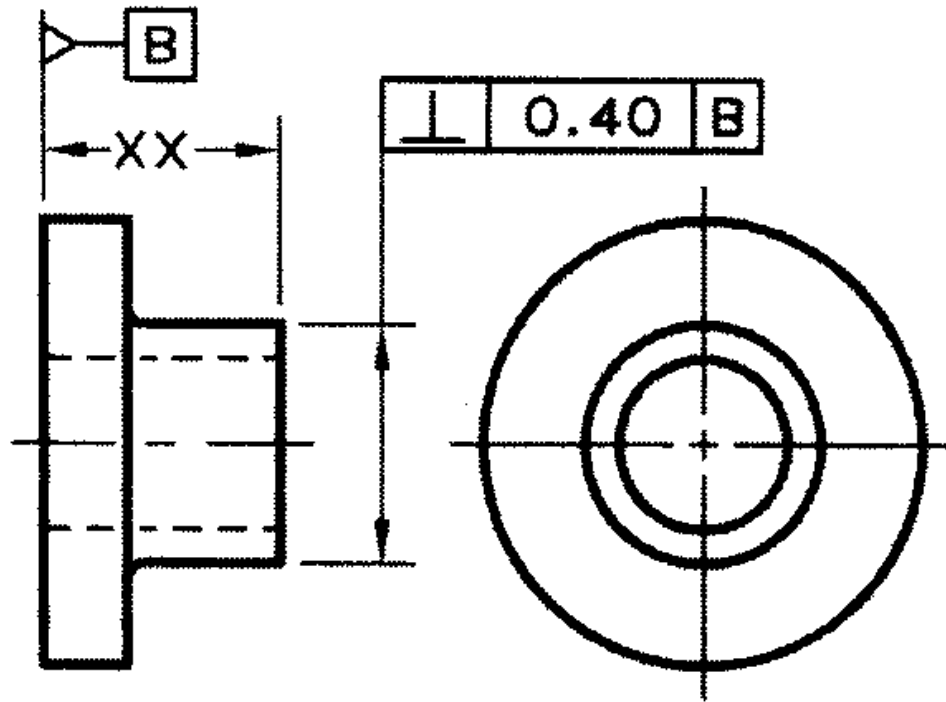
Perpendicularity – Example 1



A. DRAWING

Orientation Tolerancing Examples

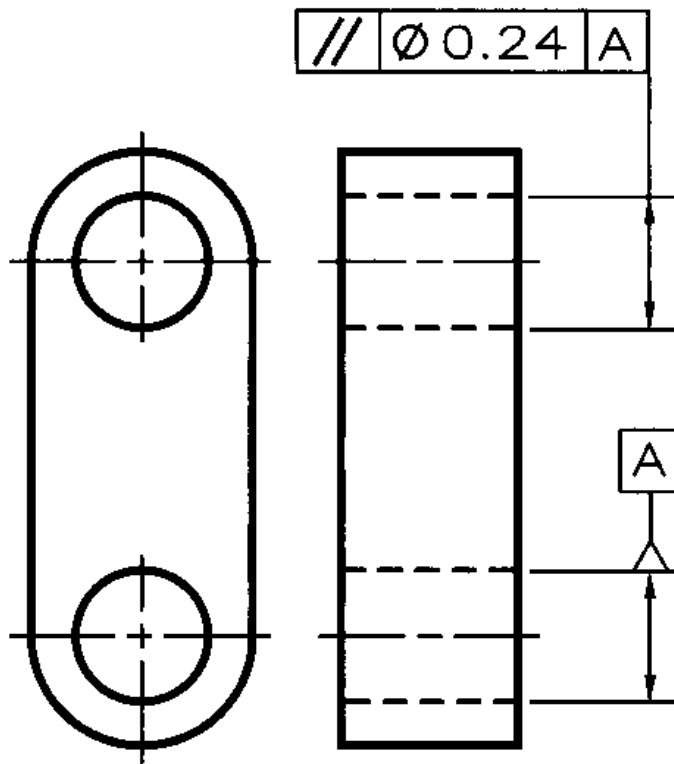
Perpendicularity – Example 2



A. DRAWING

Orientation Tolerancing Examples

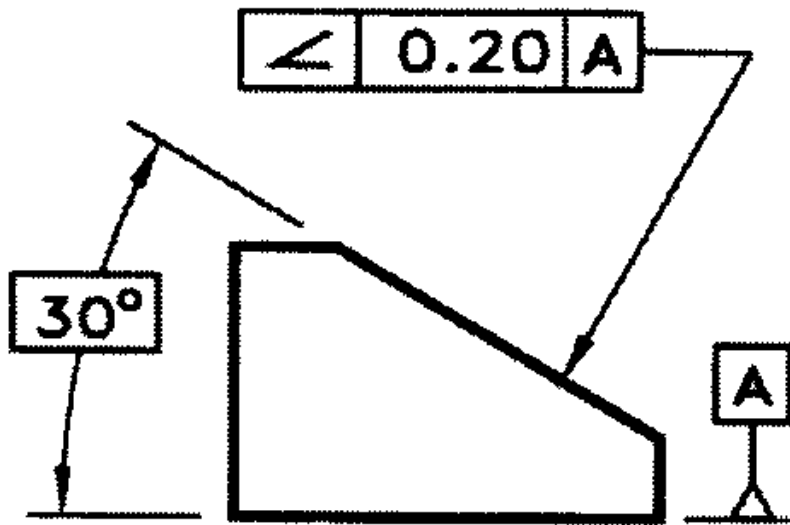
Parallelism



A. DRAWING

Orientation Tolerancing Examples

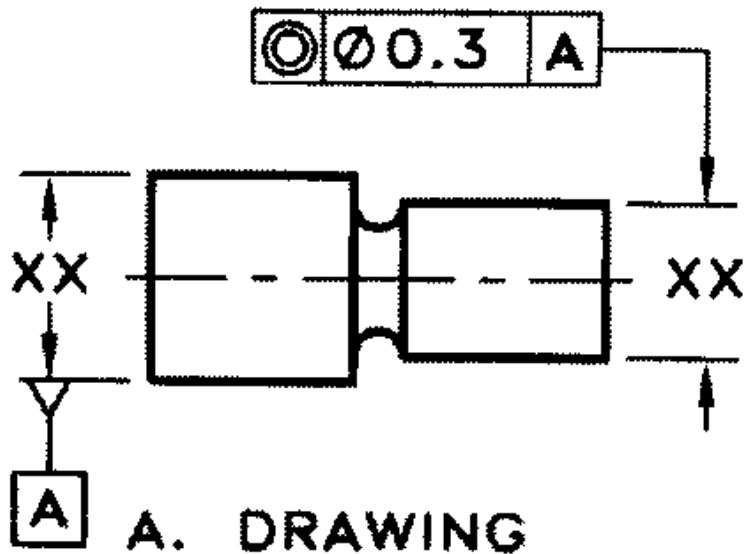
Angular



A. DRAWING

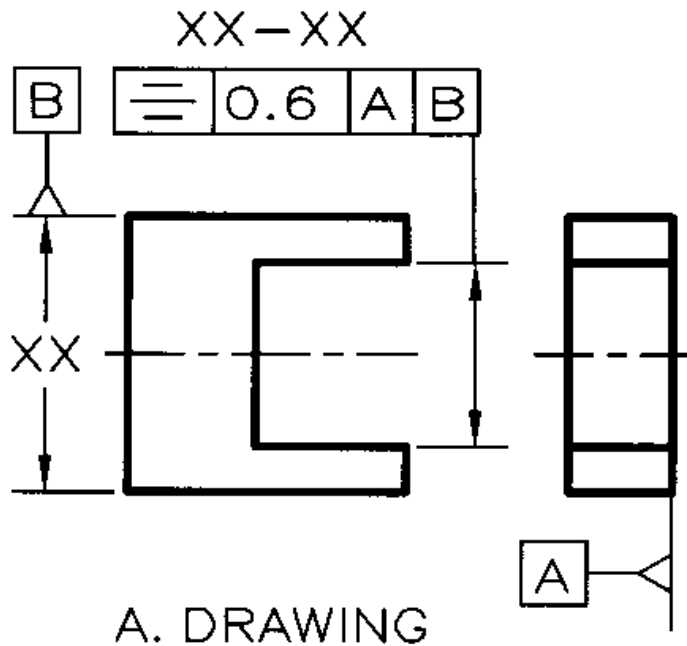
Location Tolerancing Examples

Concentricity

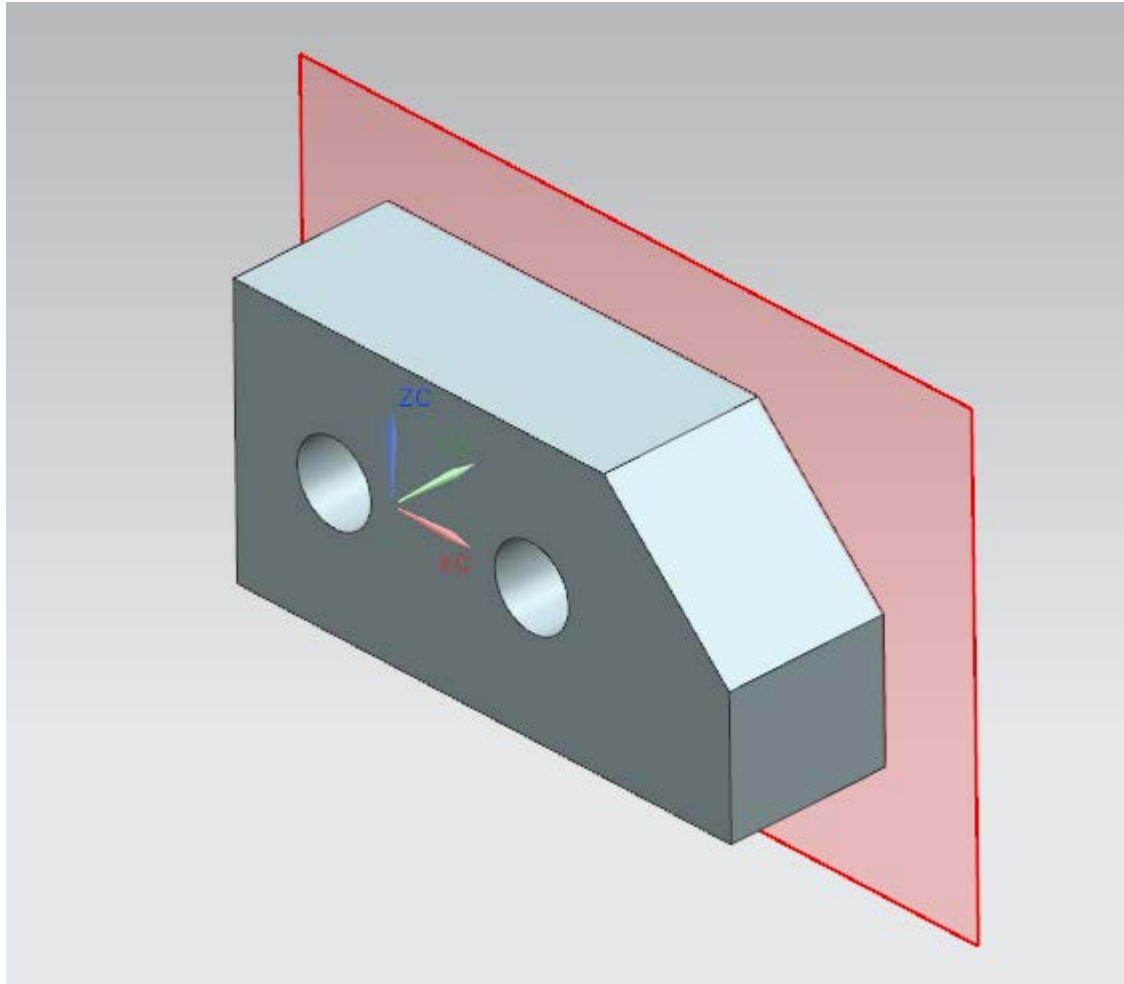


Location Tolerancing Examples

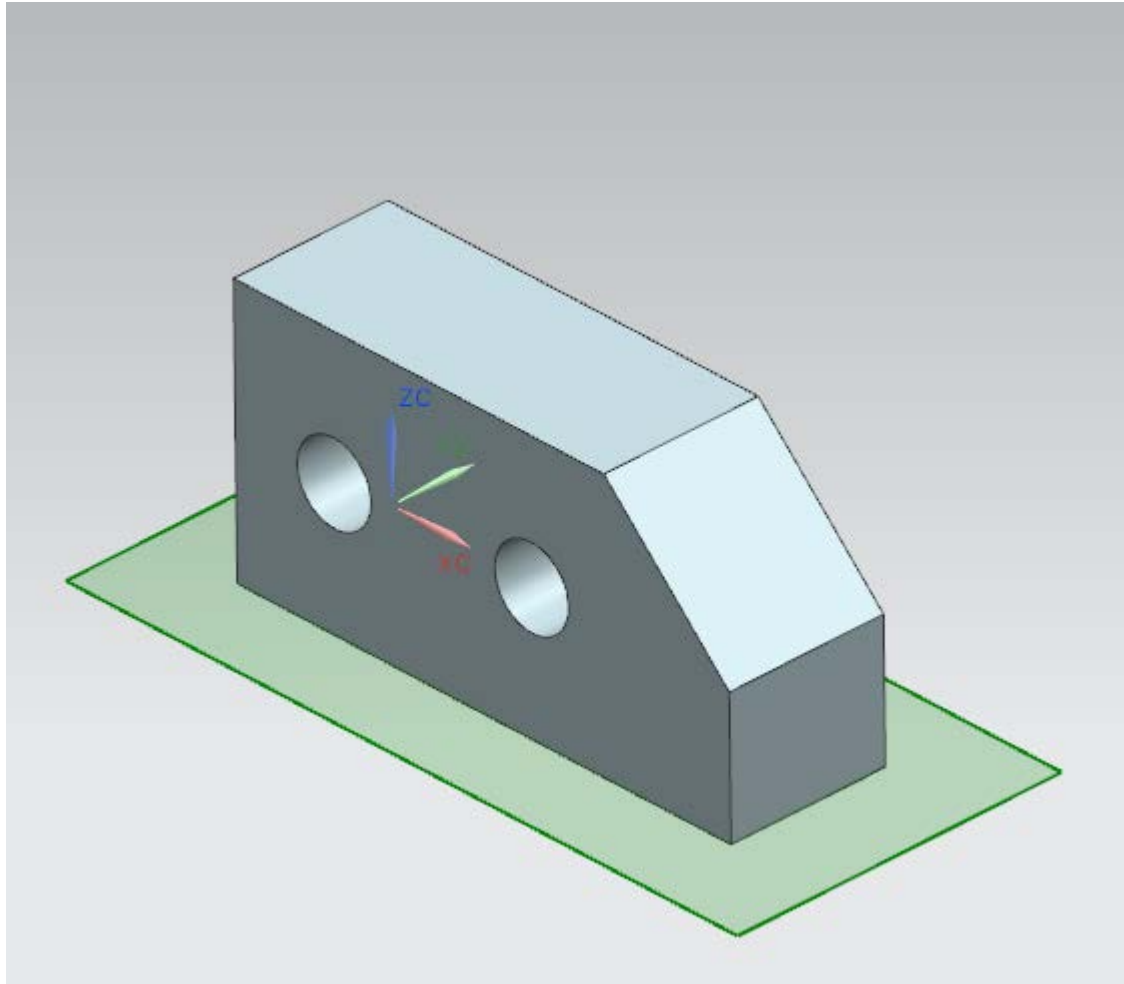
Concentricity



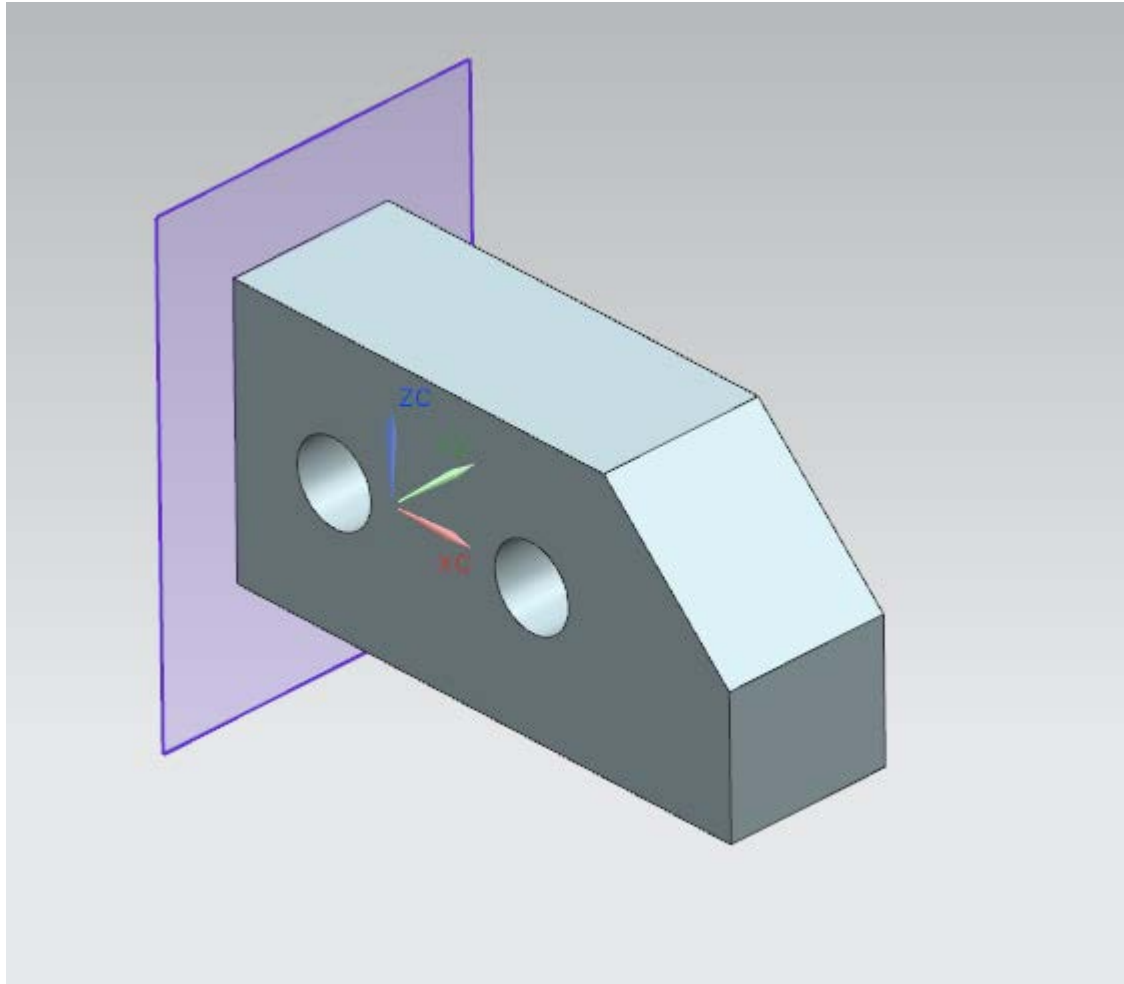
Primary Datum (A)



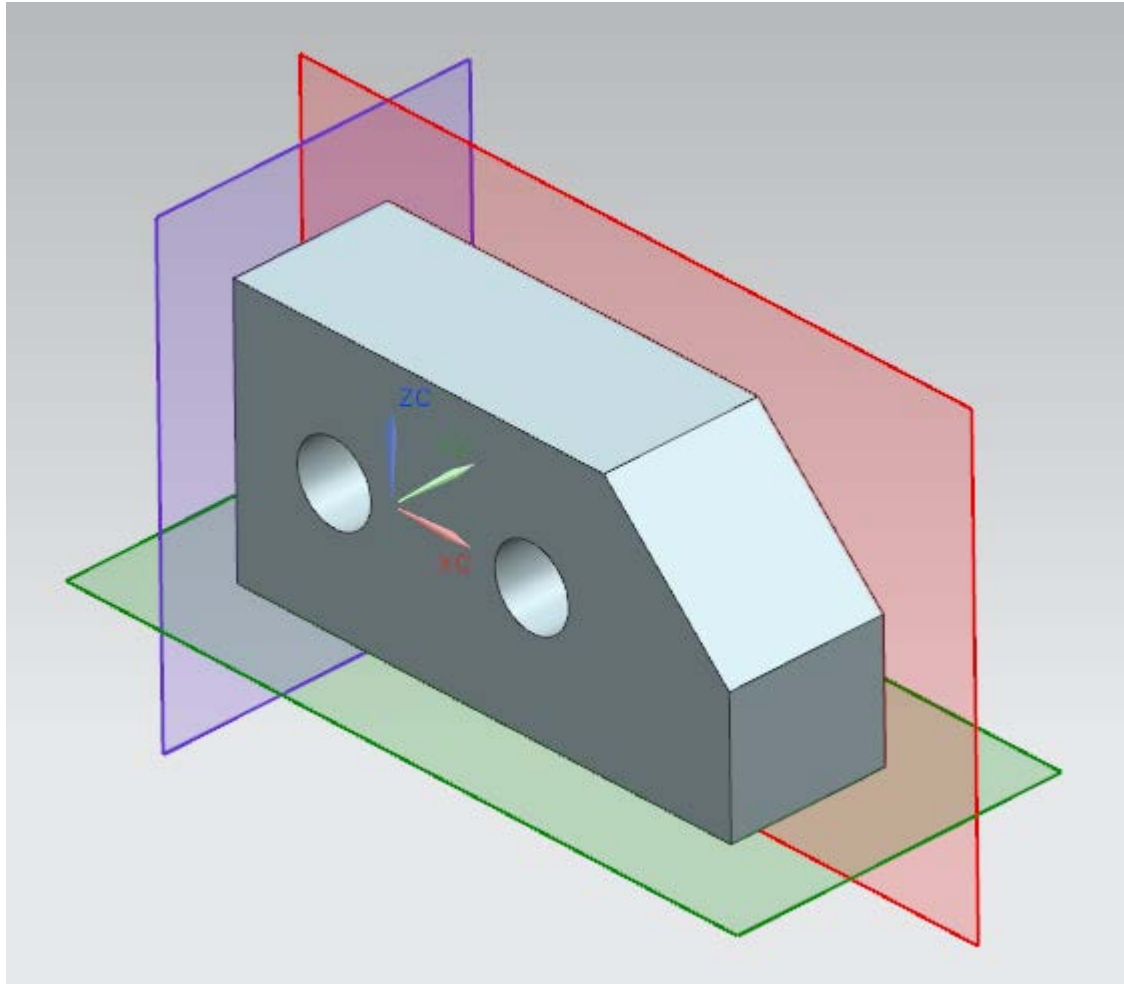
Secondary Datum (B)



Tertiary Datum (C)

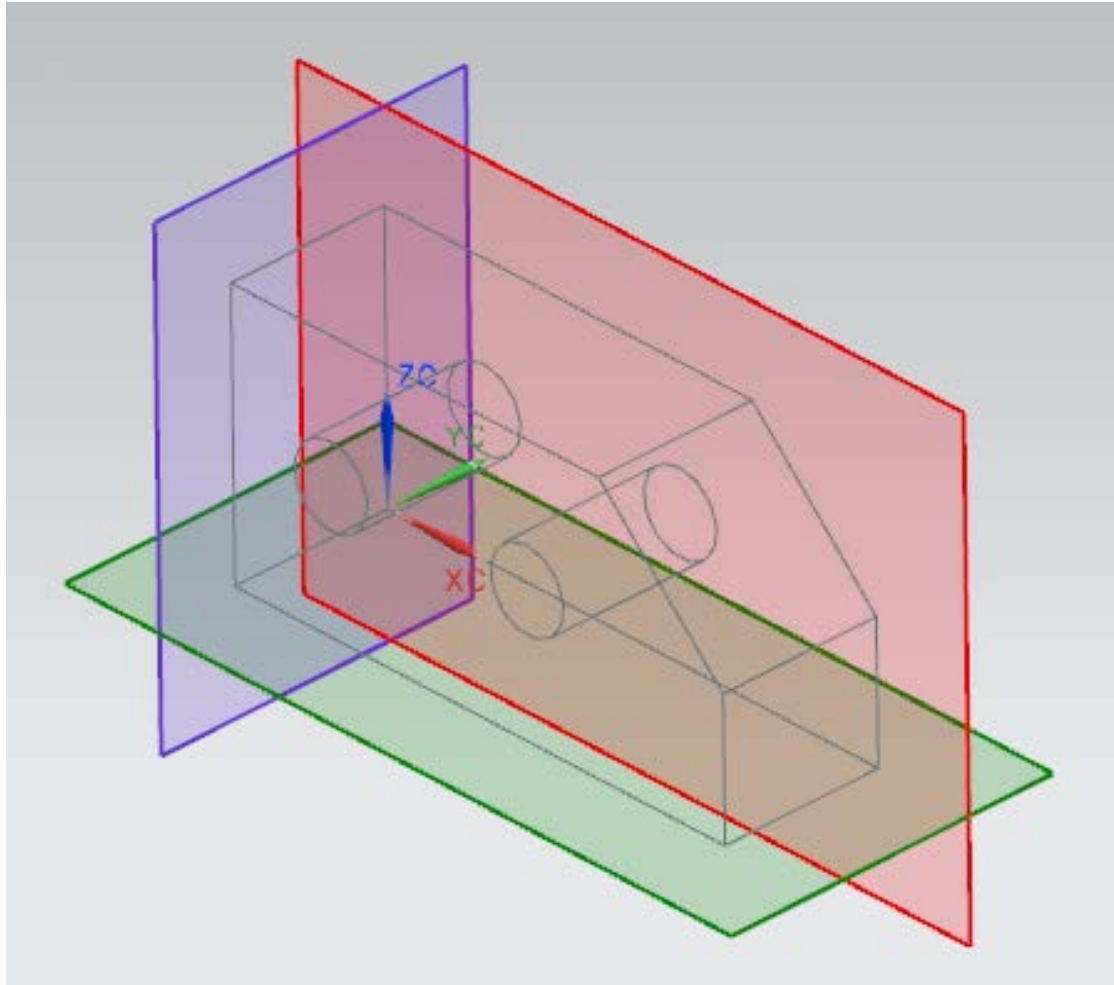


Datums A, B, & C



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Datums A, B, & C



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Component B (Step Block)

Create a Technical Drawing of Component B using GD&T to specify the following conditions.

- The component has a general tolerance of $\pm 0.2\text{mm}$
- The two stepped surfaces (upper and lower) must be parallel to within a tolerance zone of 0.05.
- The angled surface must be within an angled tolerance zone of 0.1 with respect to the upper/top surface
- The holes must be positioned to within 0.05mm of each other.

