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Engineering / Technical Drawing

A Guide to the Production & Interpretation of Drawings to
BS8888



Lecture 6
Geometric Dimensioning & Tolerancing

Richard J Morgan



Prerequisites to this Subject Area

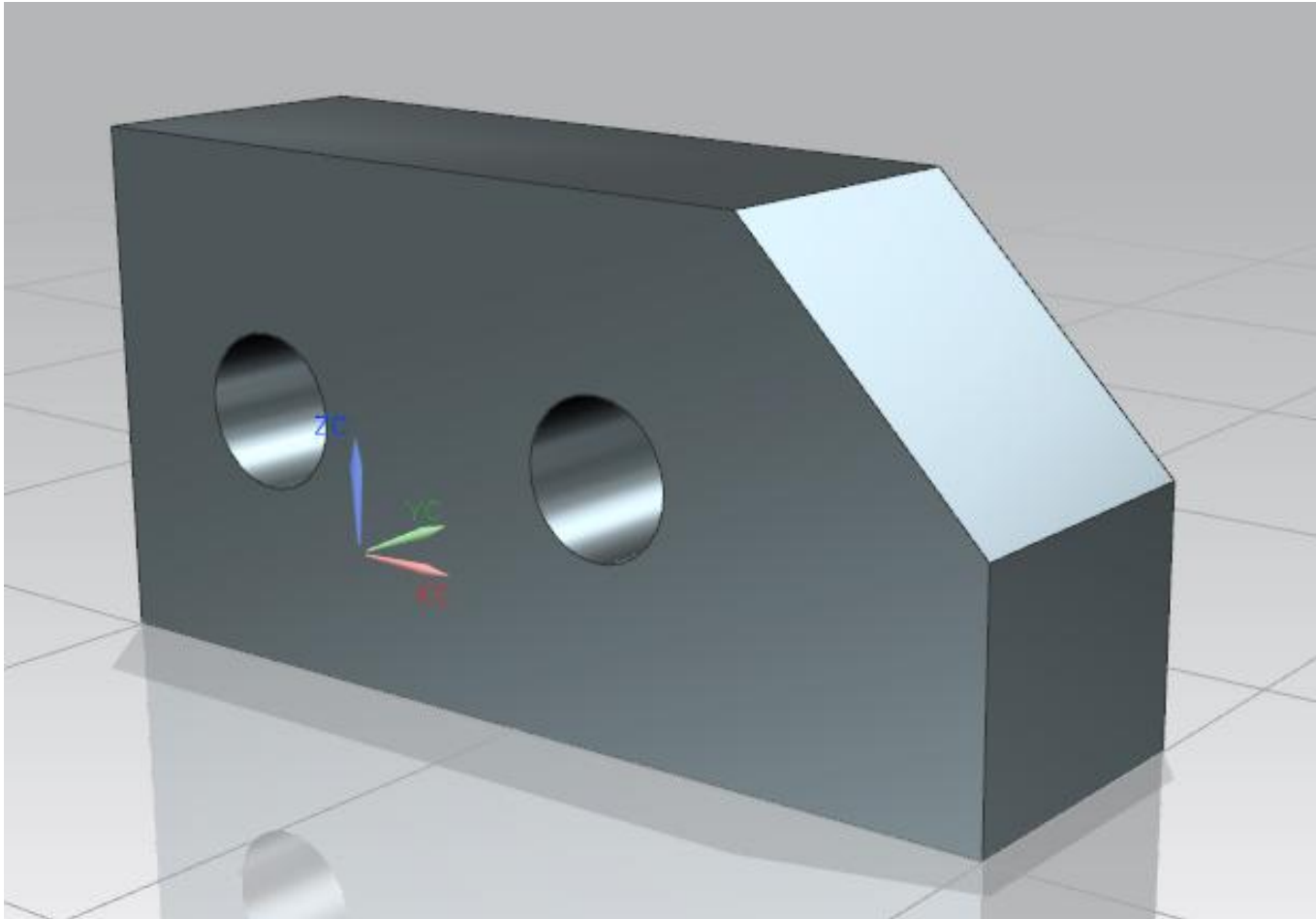
You should have covered (and understood) the following subject areas before moving onto Geometric Dimensioning and Tolerancing (GD&T):

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

What is Geometric Dimensioning & Tolerancing (GD&T)?

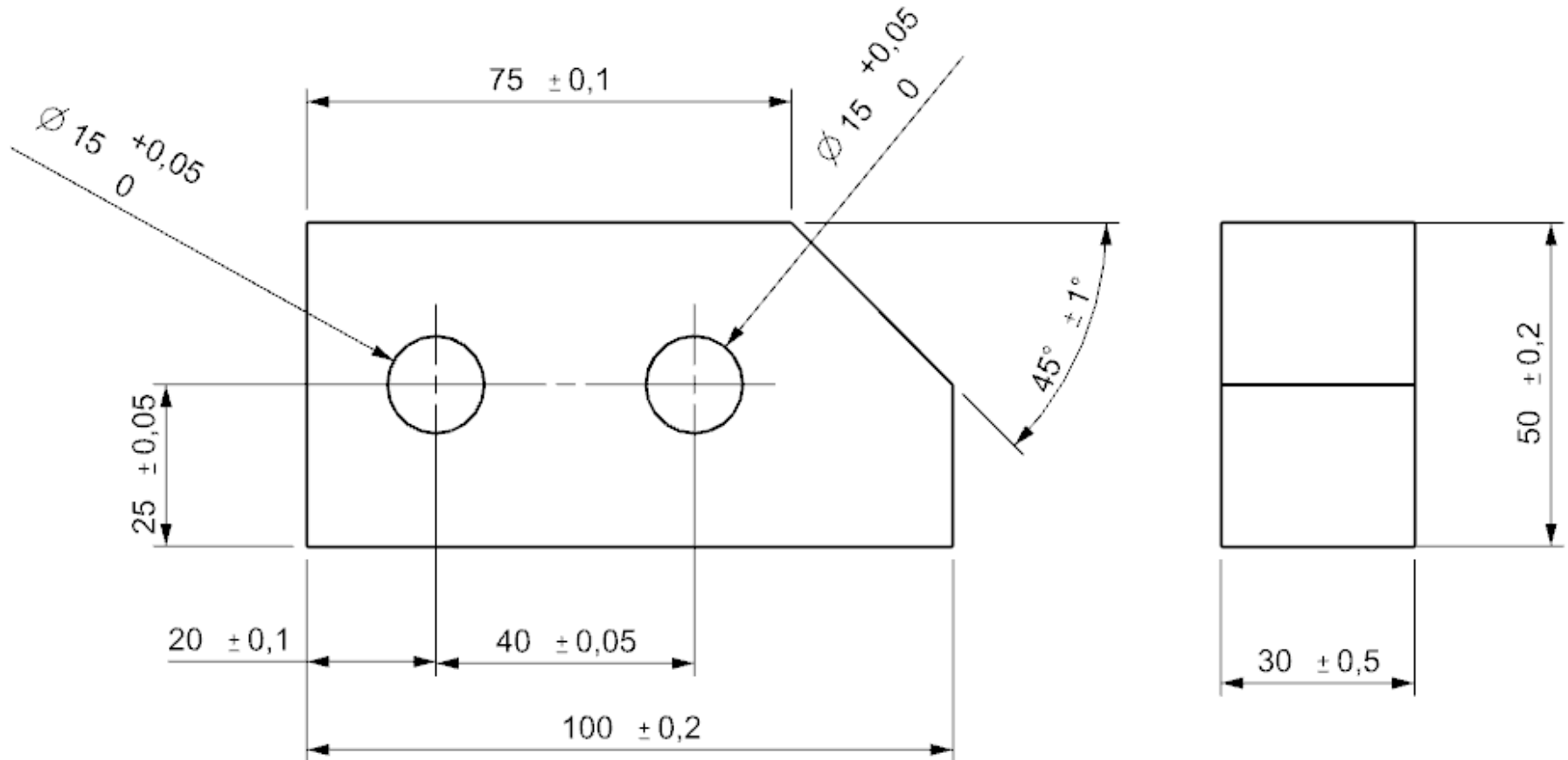
- Like limit tolerancing, GD&T is a standardised method of specifying component geometry and acceptable limits of variation.
- The component's intended function along with it's relationship with related/mating parts is considered when GD&T is applied.
- The use of GD&T allows the Designer to define/specify a feature more accurately without tightening tolerances.

Component A (Angle/Hole Block)

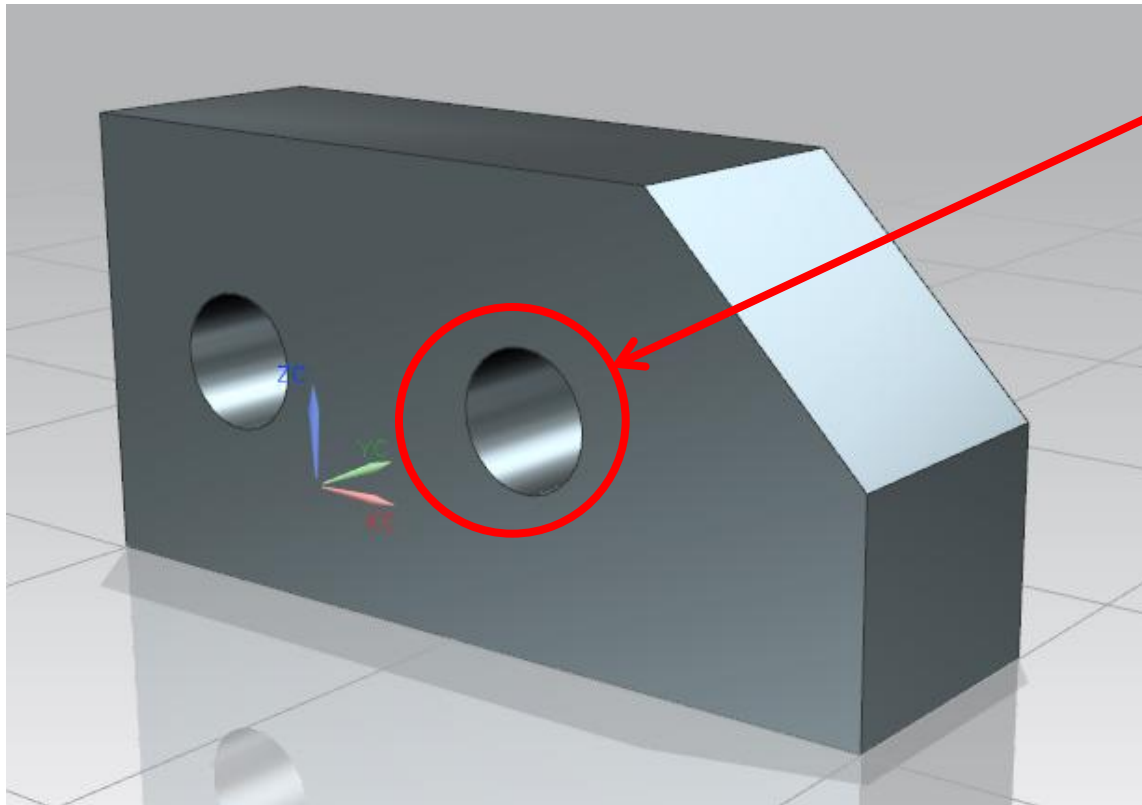


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Technical Drawing of *Component A* with Limit Tolerancing Applied



Component A (Angle/Hole Block)



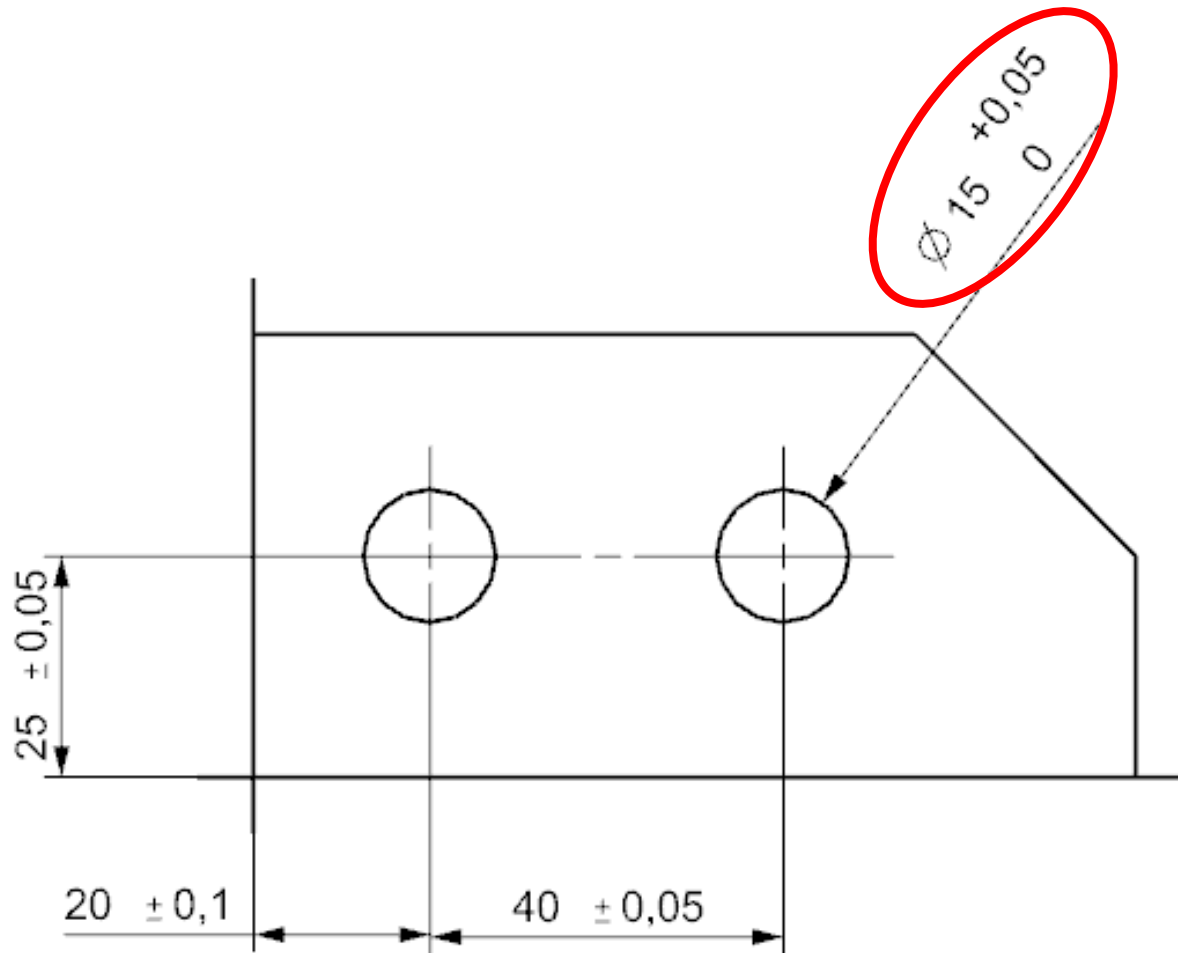
Let's consider the specification this hole.

Using limit tolerances, we have previously specified:

a) Size

b) Position

Using Limit Tolerances to Define the Hole Feature (Size and Position)



Hole Size Tolerance Limits

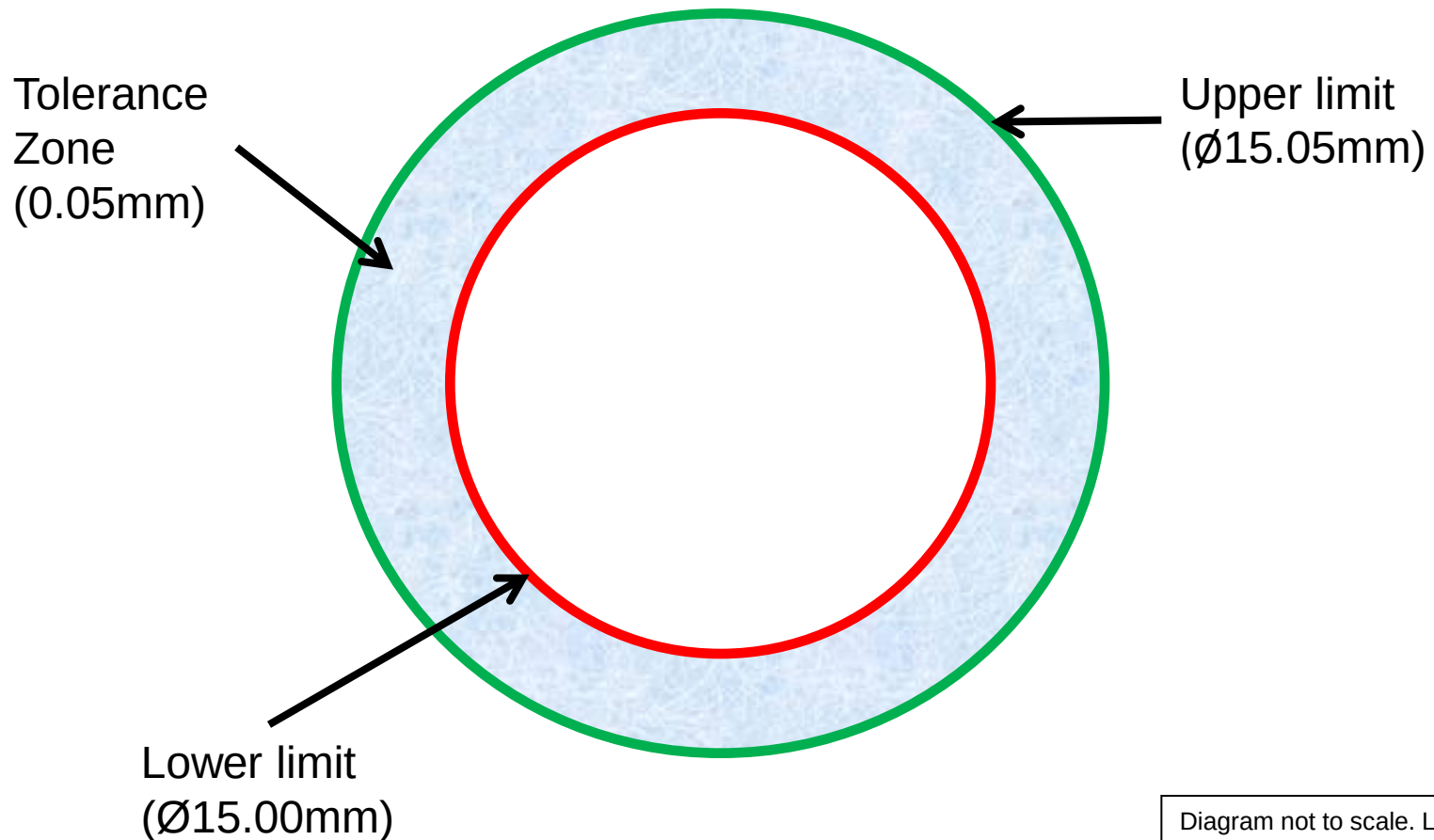
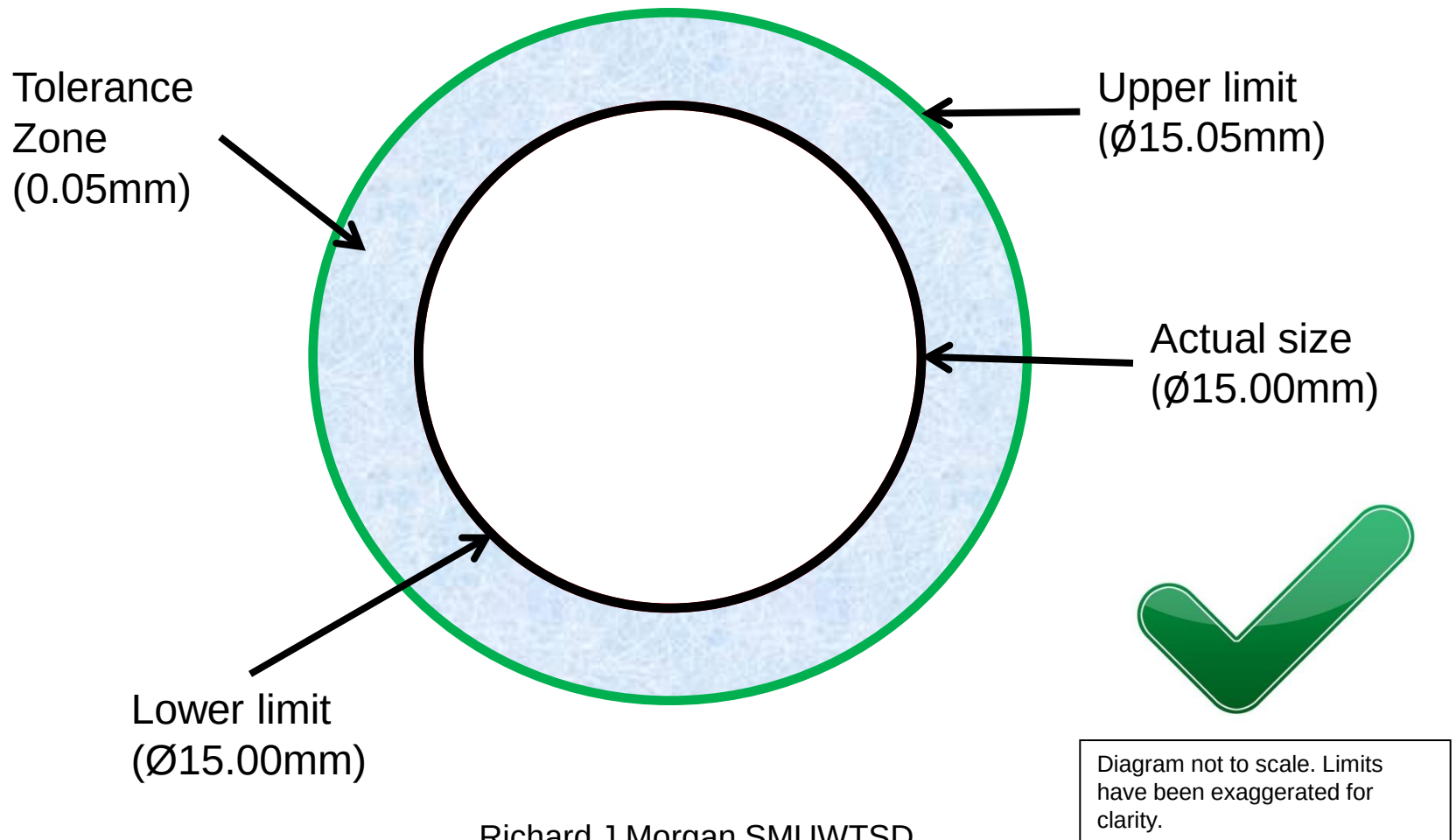


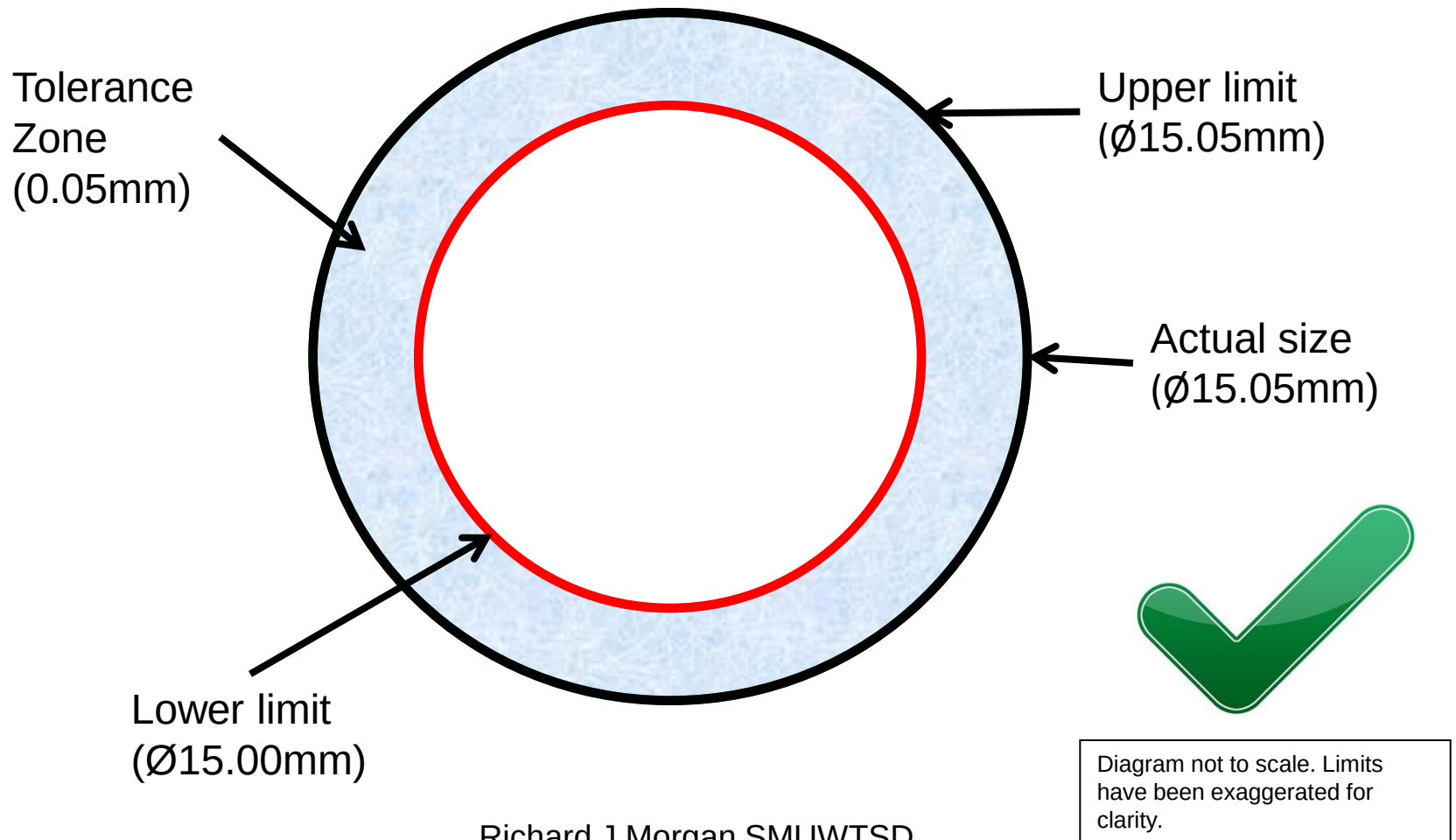
Diagram not to scale. Limits have been exaggerated for clarity.

Hole Size Tolerance Limits



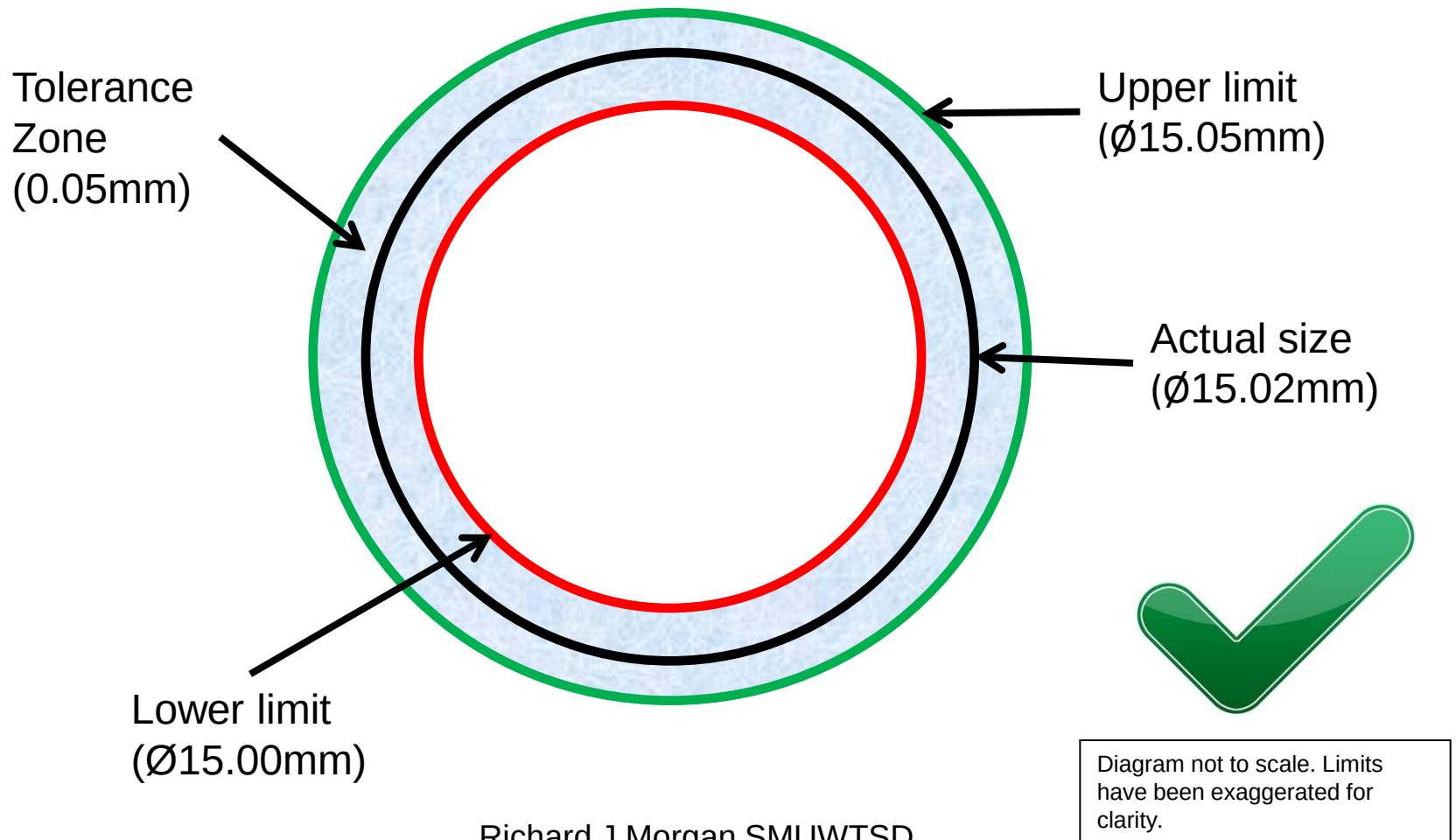
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Hole Size Tolerance Limits



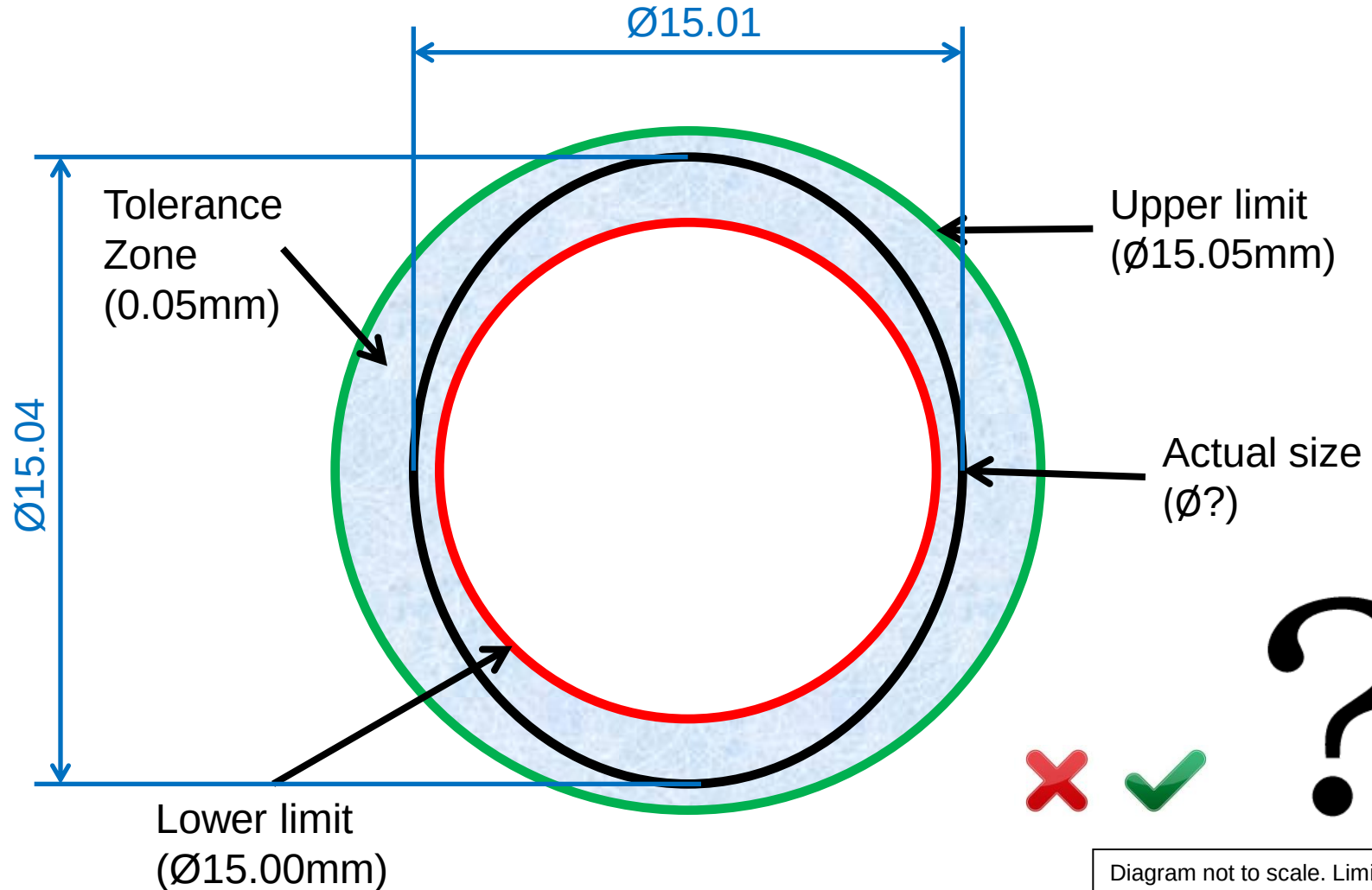
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Hole Size Tolerance Limits



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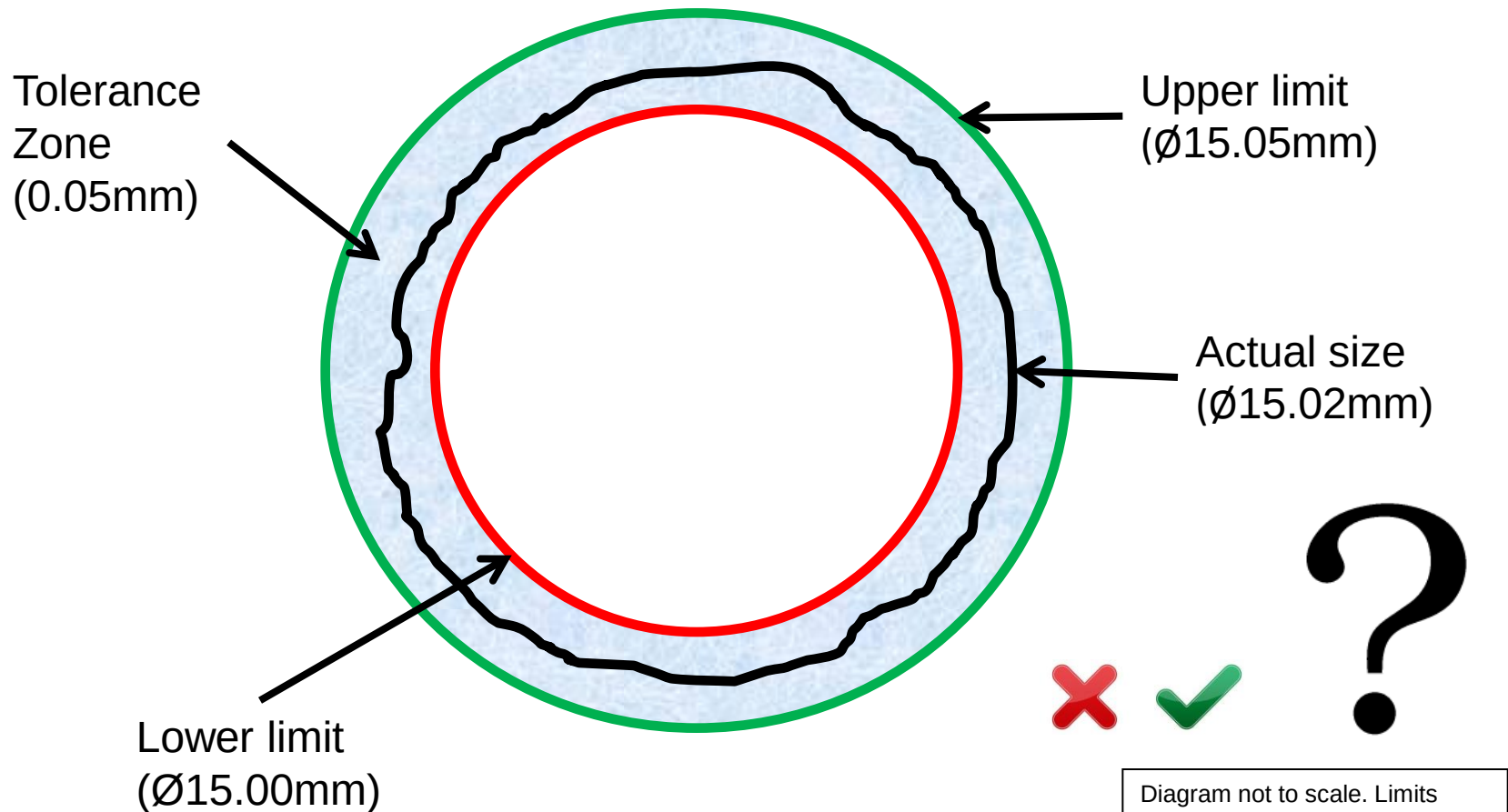
Hole Size Tolerance Limits



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Diagram not to scale. Limits have been exaggerated for clarity.

Hole Size Tolerance Limits



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Diagram not to scale. Limits have been exaggerated for clarity.

Hole Size Tolerance Limits

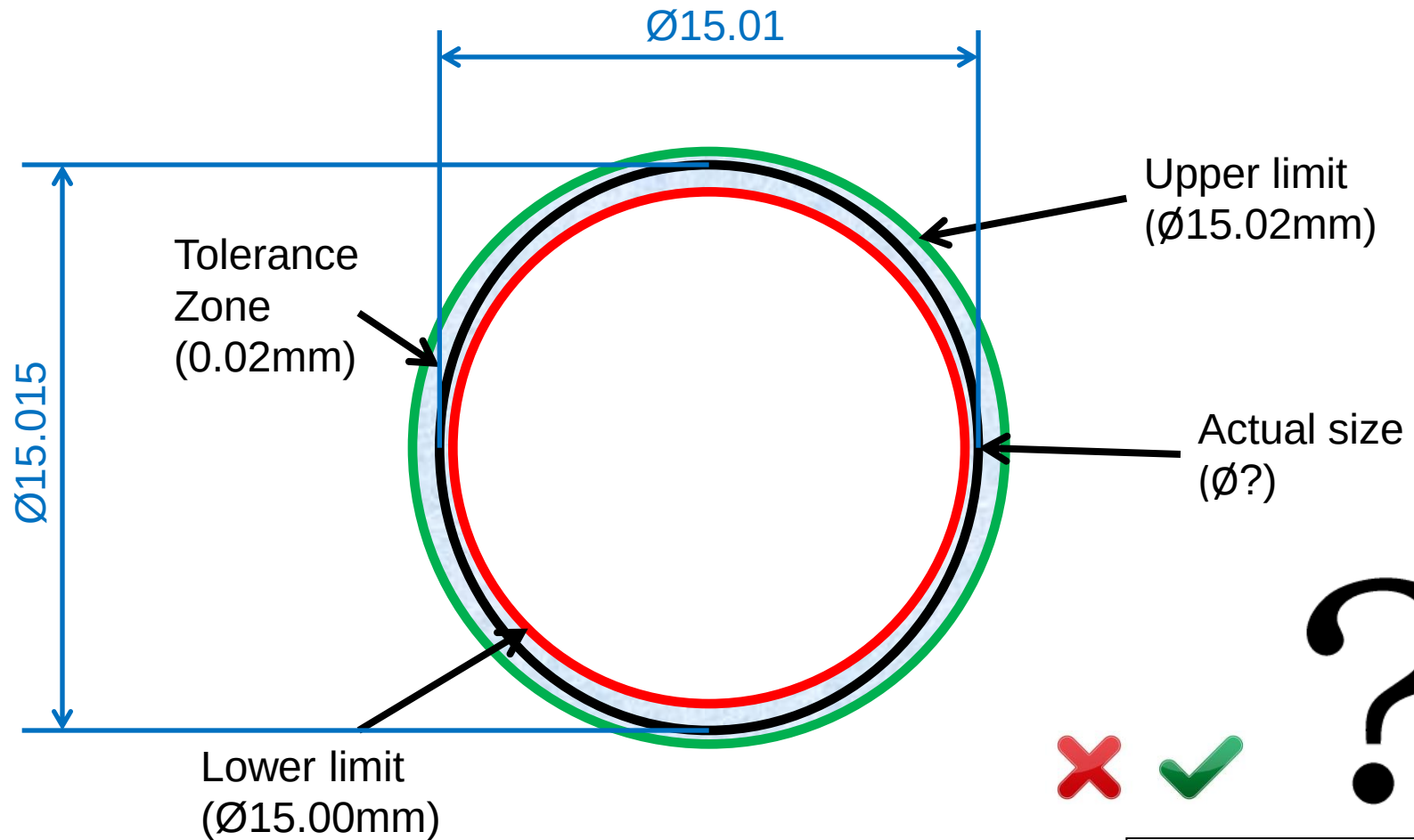


Diagram not to scale. Limits have been exaggerated for clarity.

Hole/Shaft Size Tolerance Limits Feature Form

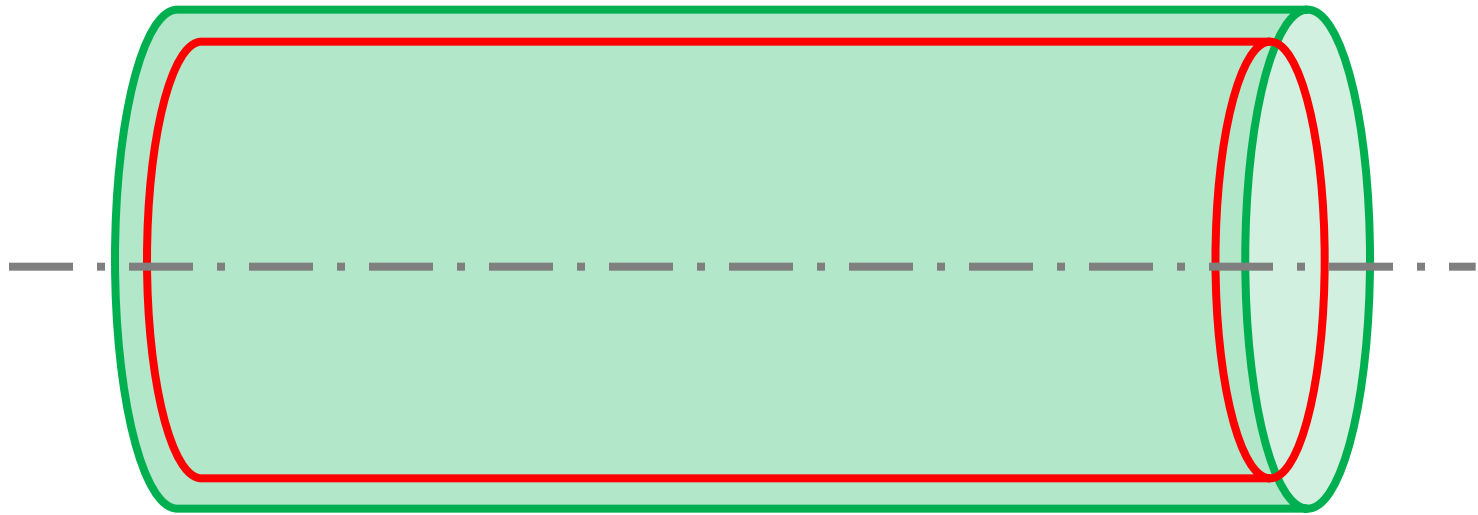
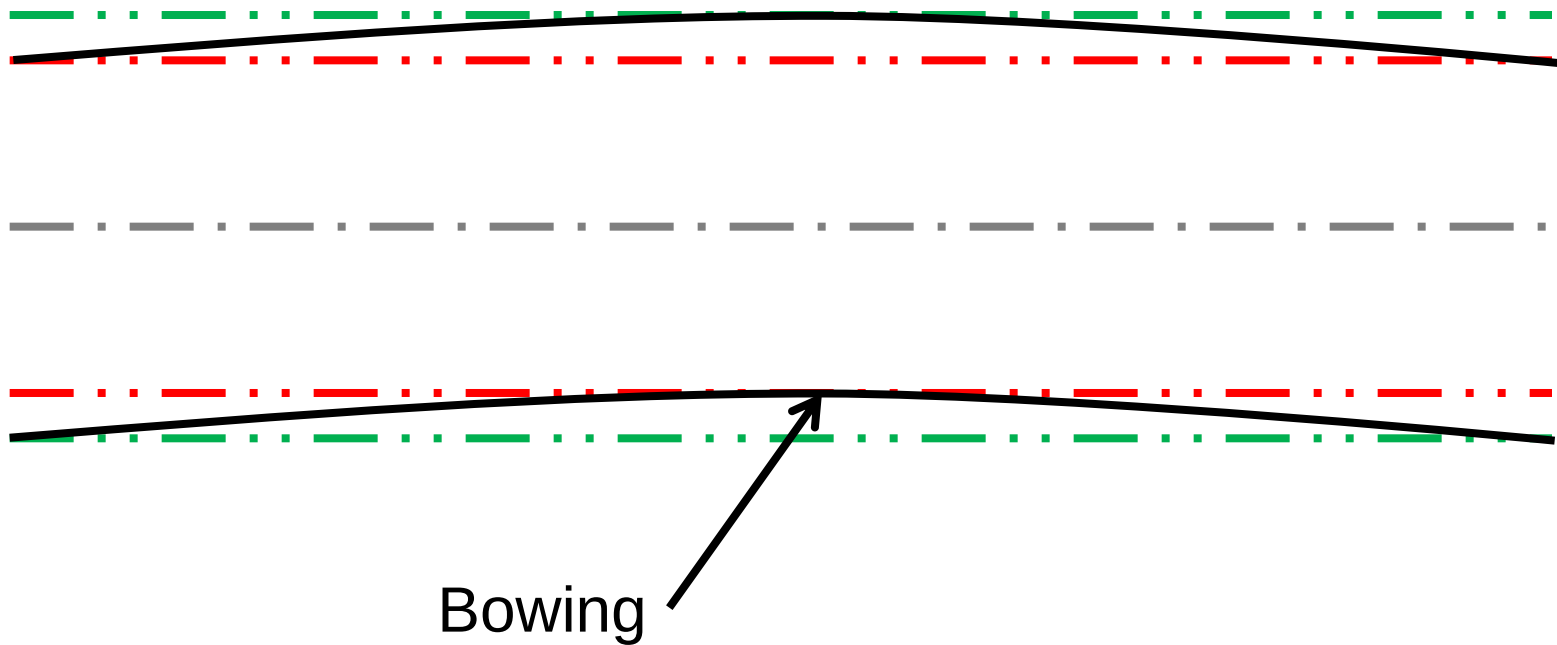


Diagram not to scale. Limits have been exaggerated for clarity.

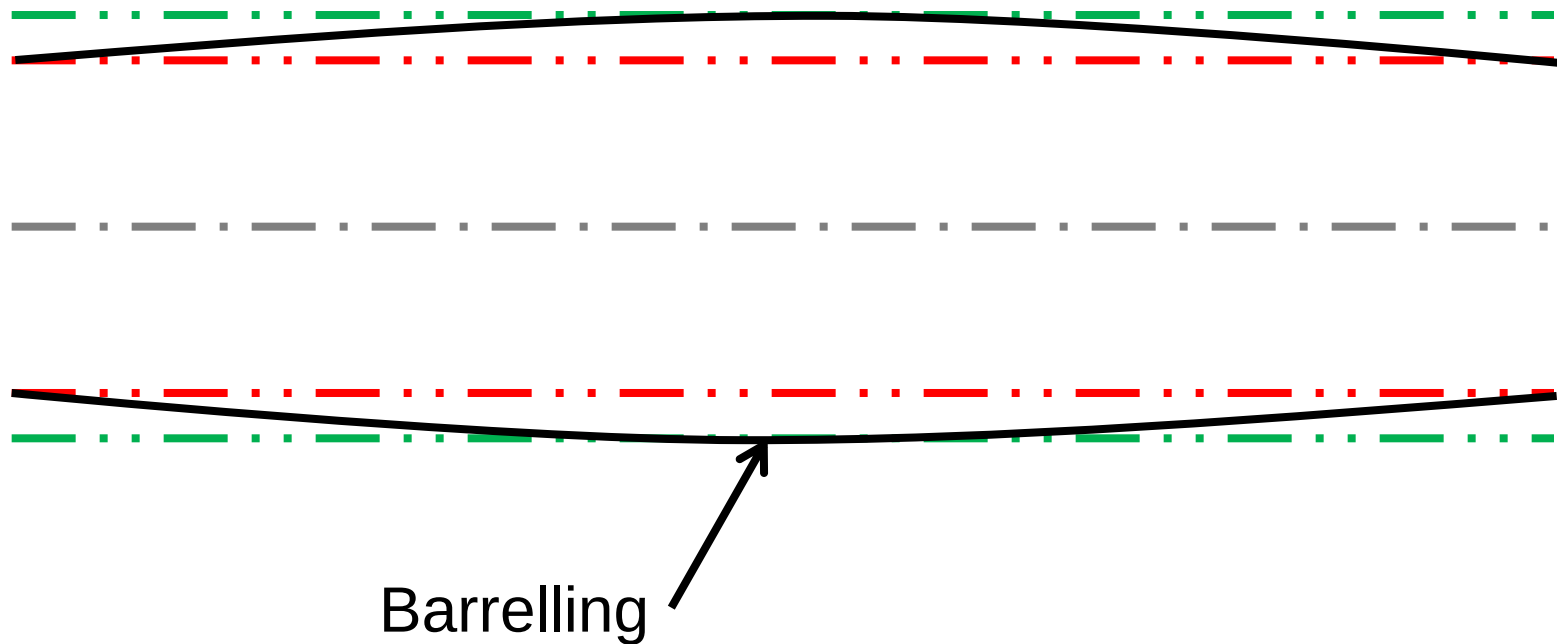
Hole/Shaft Size Tolerance Limits Feature Form



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Diagram not to scale. Limits have been exaggerated for clarity.

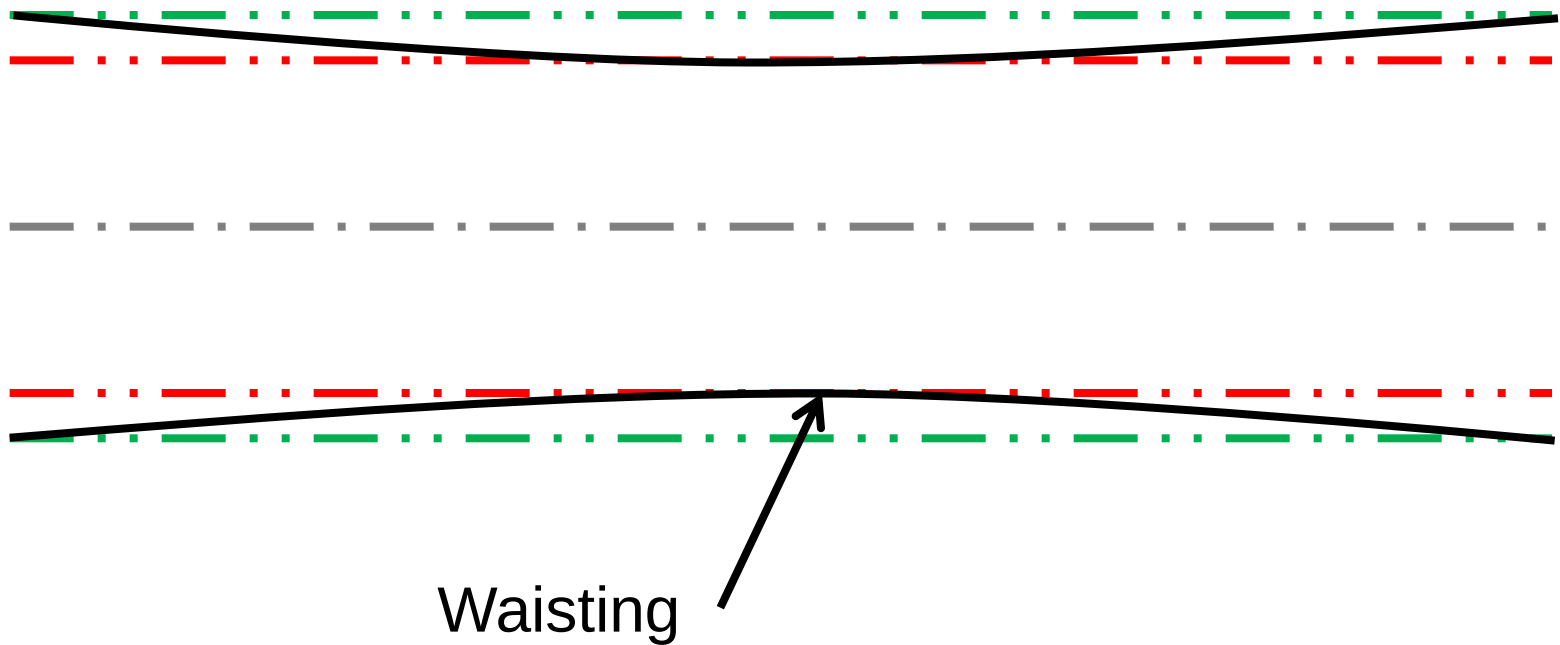
Hole/Shaft Size Tolerance Limits Feature Form



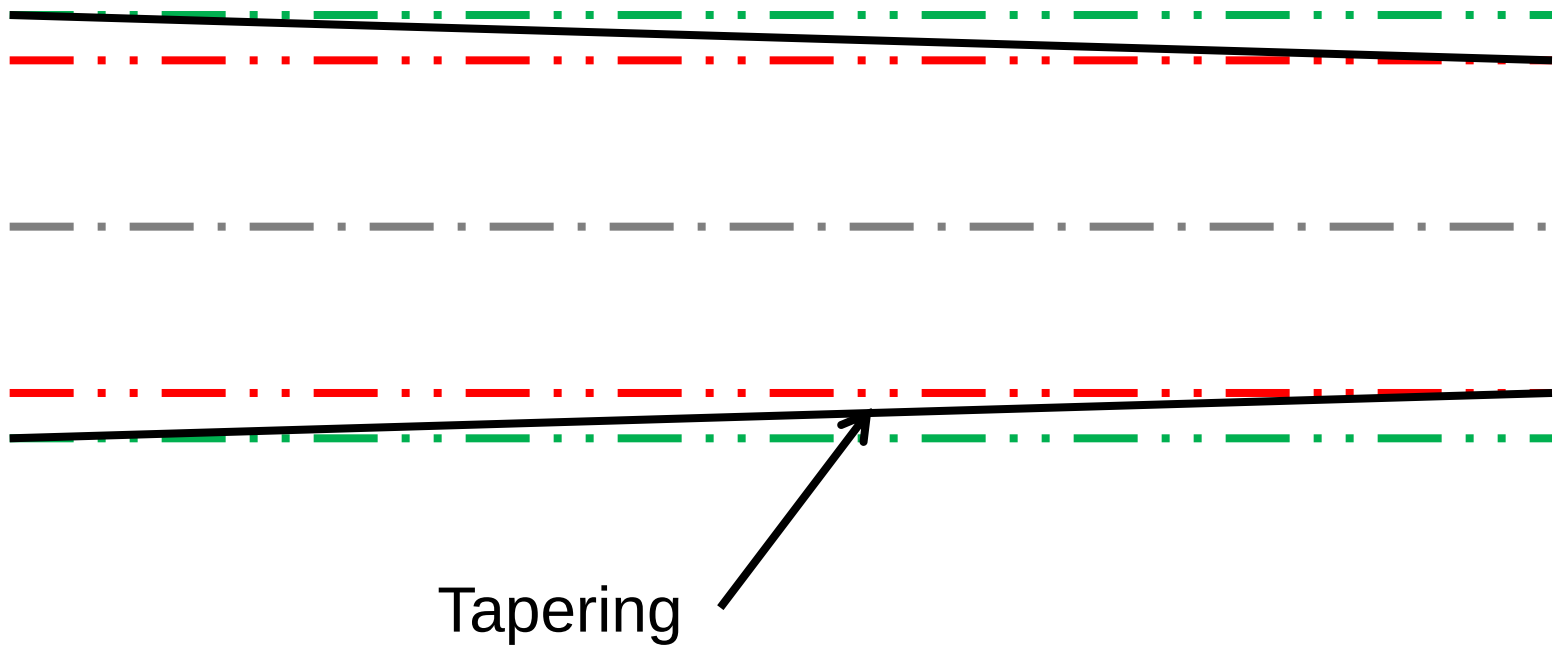
Barrelling

Diagram not to scale. Limits have been exaggerated for clarity.

Hole/Shaft Size Tolerance Limits Feature Form



Hole/Shaft Size Tolerance Limits Feature Form



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Diagram not to scale. Limits have been exaggerated for clarity.

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	

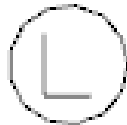
Additional Characters & Symbols



Datum Feature



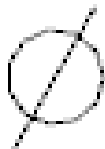
Maximum Metal Condition (MMC)



Least Metal Condition (LMC)



Regardless of Feature Size (RFS)



Diametrical or Cylindrical Tolerance Zone or Feature

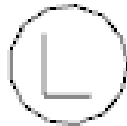
Additional Characters & Symbols



Datum Feature



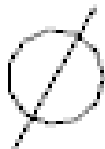
Maximum Metal Condition (MMC)



Least Metal Condition (LMC)

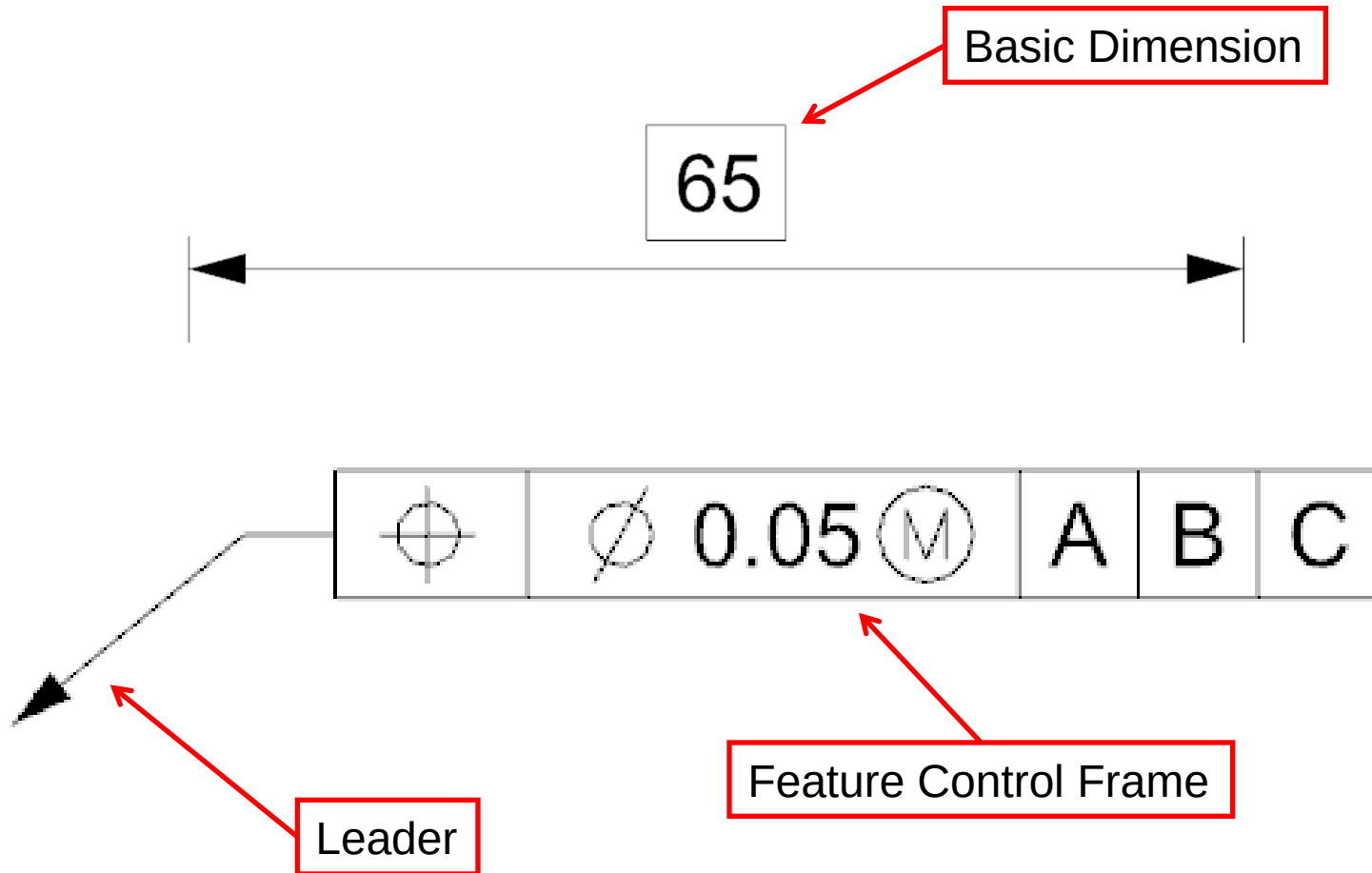


Regardless of Feature Size (RFS)

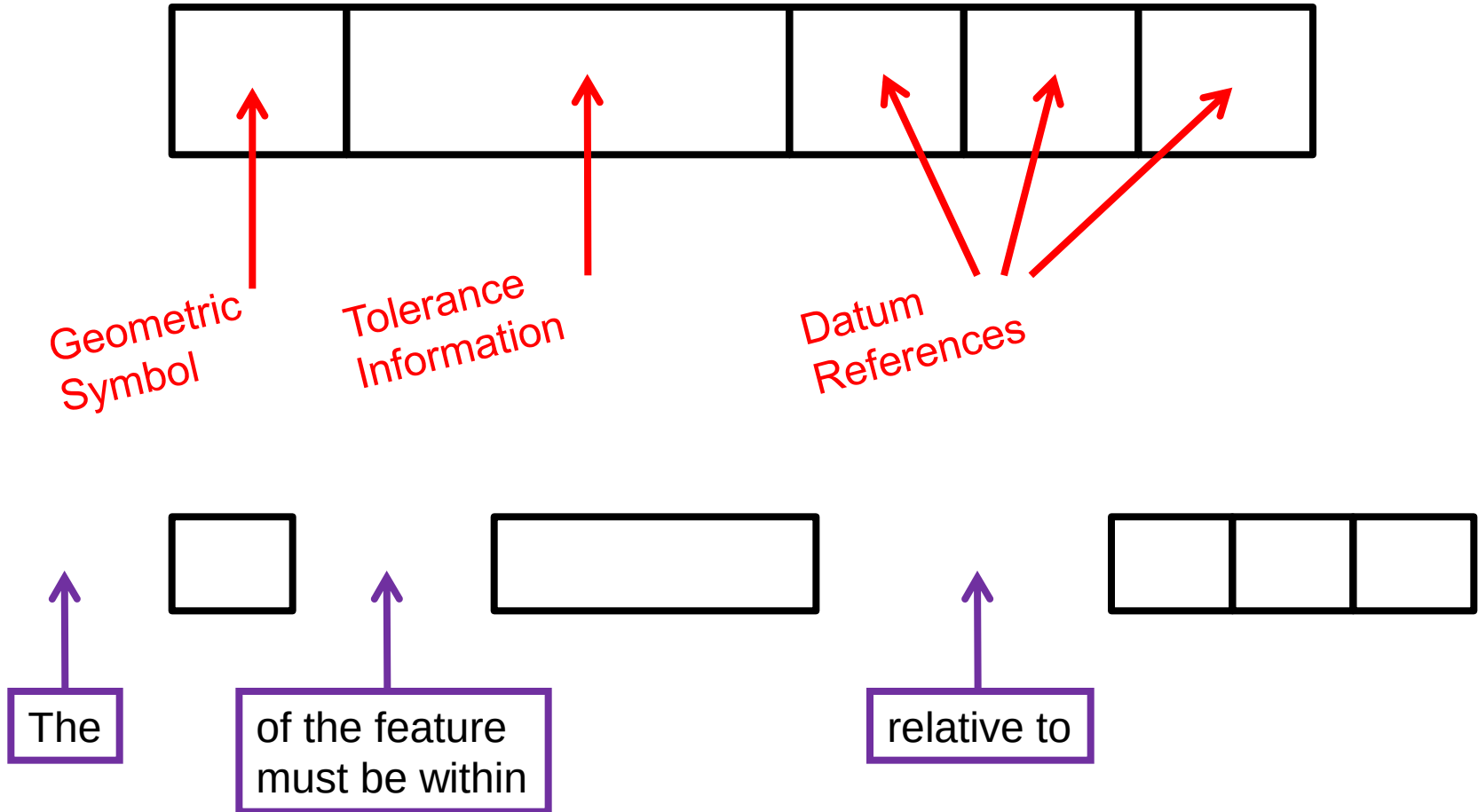


Diametrical or Cylindrical Tolerance Zone or Feature

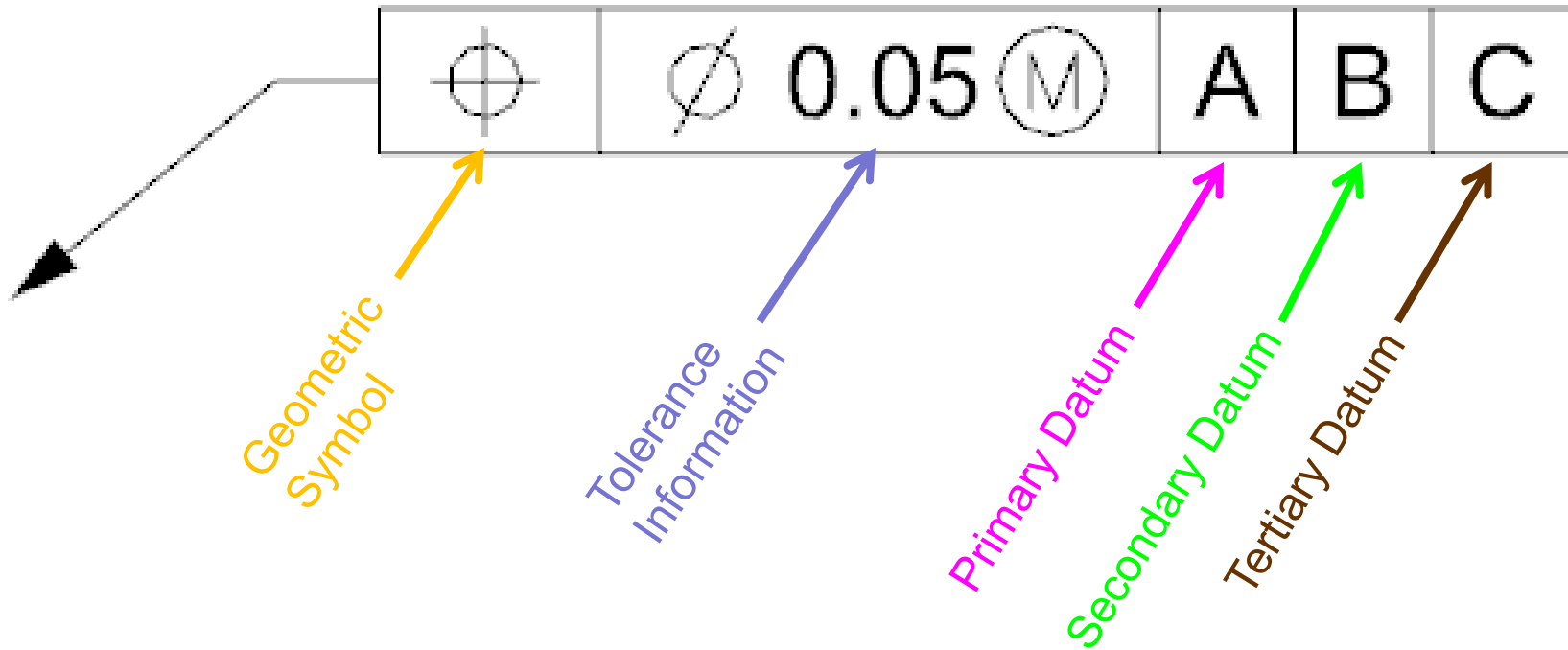
Additional Characters & Symbols



Feature Control Frame – Definition

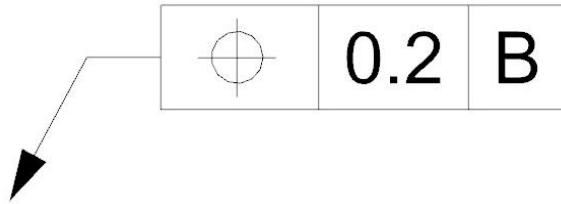


Feature Control Frame – Definition

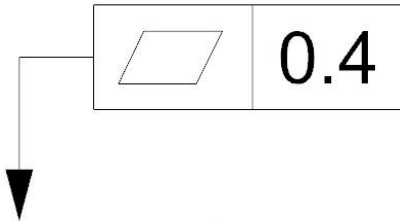


The **position** of the feature must be within a **0.05mm** diametrical tolerance zone at **maximum material condition** relative to datums **A**, **B** and **C**.

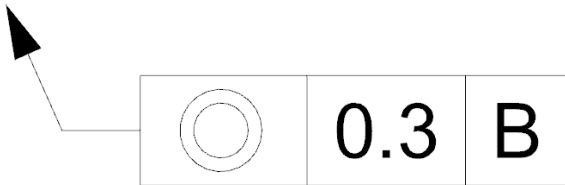
Feature Control Frame – Definition



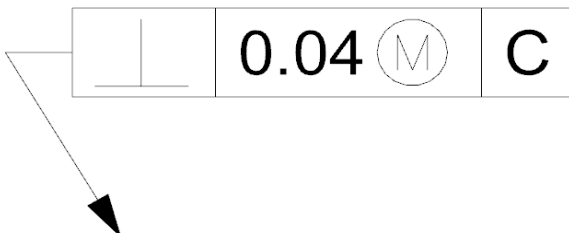
The _____ of the feature must be within a _____ tolerance zone relative to datum _____.



The _____ of the feature must be within a _____ tolerance zone.

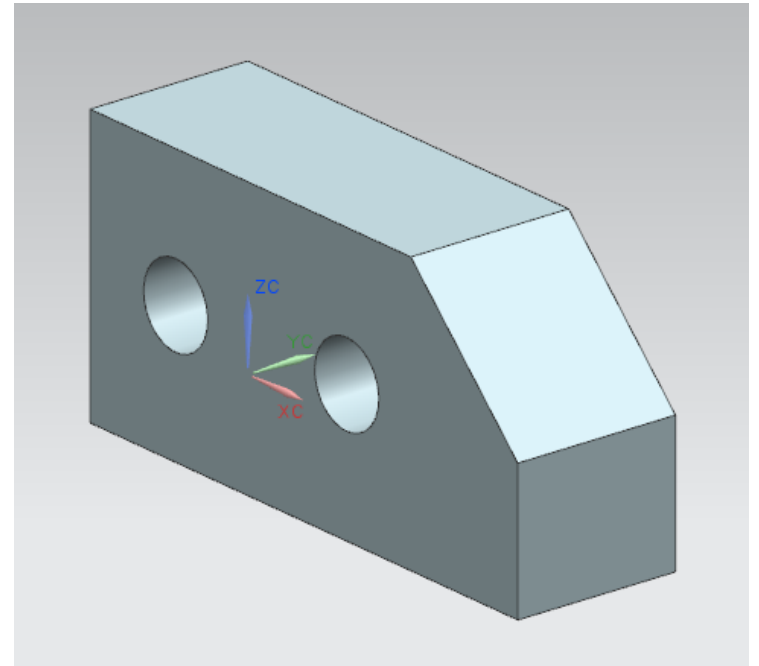
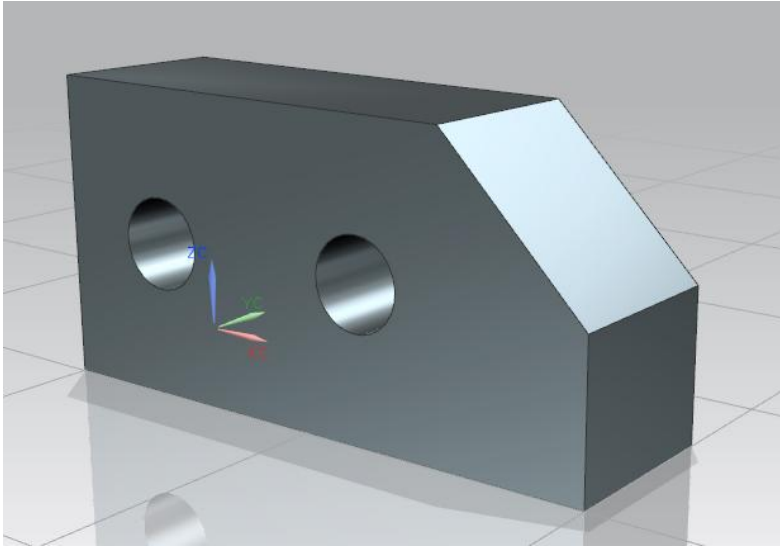


The _____ of the feature must be within a _____ tolerance zone relative to datum _____.



The _____ of the feature must be within a _____ tolerance zone at _____ relative to datum _____.

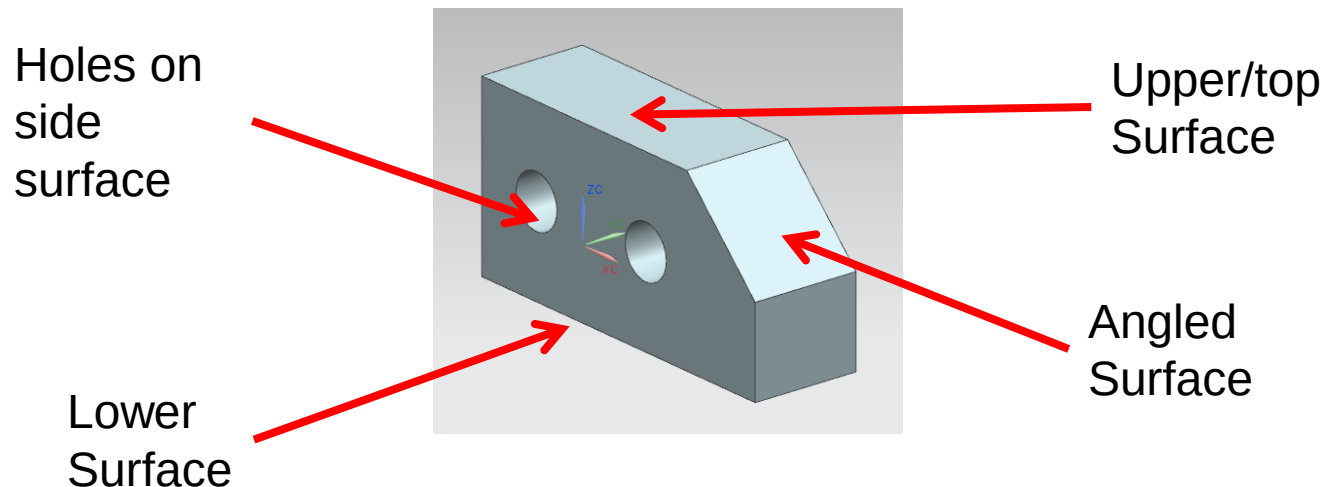
Component A (Angle/Hole Block)



Component A (Angle/Hole Block)

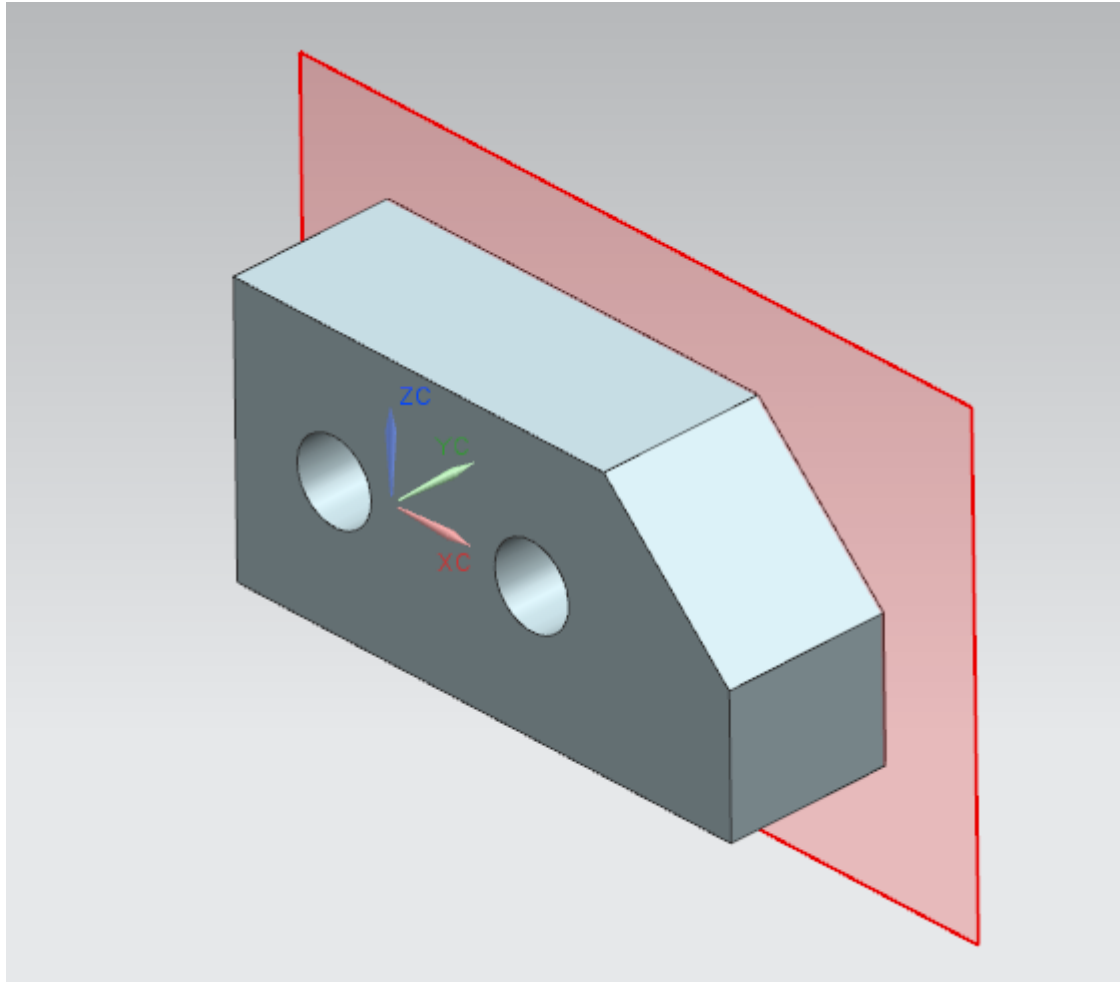
Create a Technical Drawing of Component B using GD&T to specify the following conditions.

- The component has a general tolerance of $\pm 0.2\text{mm}$
- The upper surface must be parallel to the lower surface to within a tolerance zone of 0.03.
- 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.



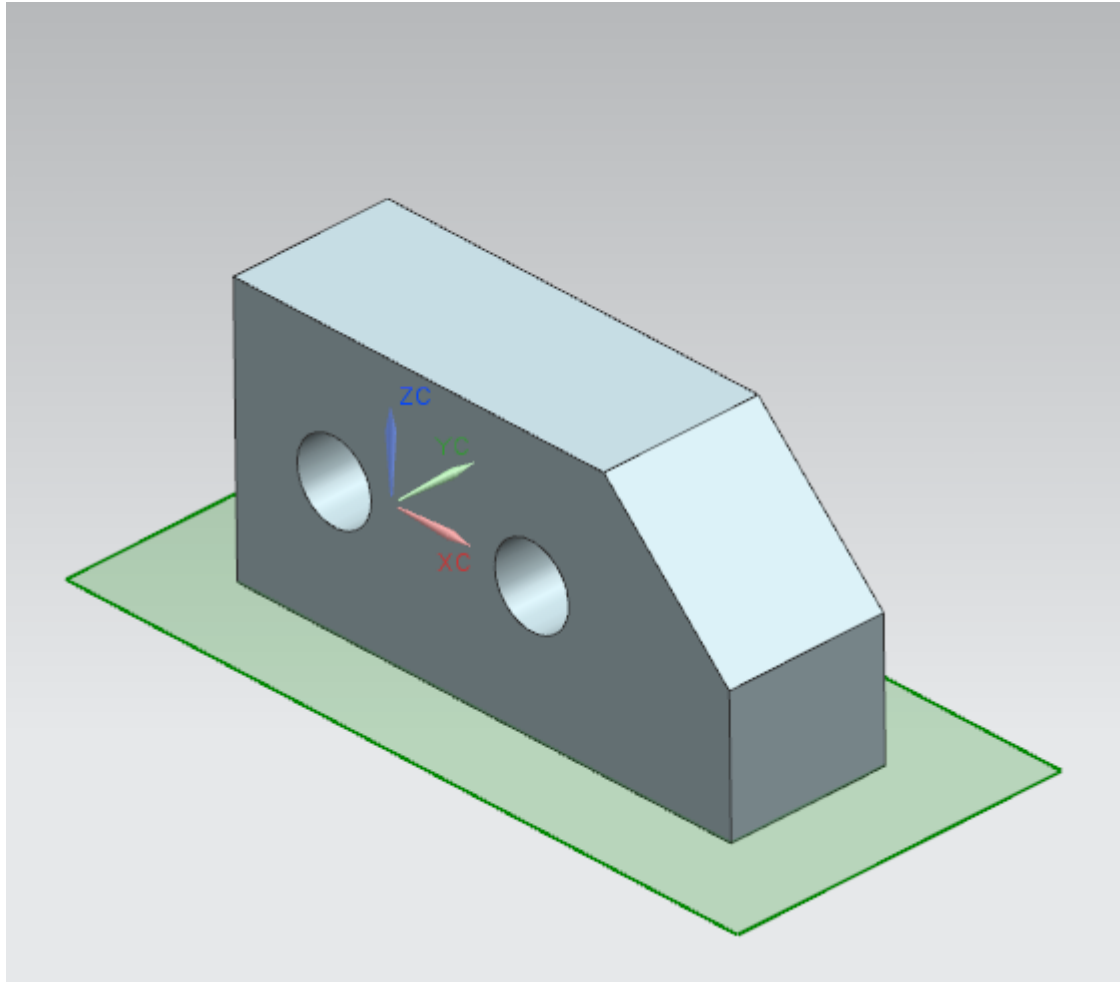
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Primary Datum (A)



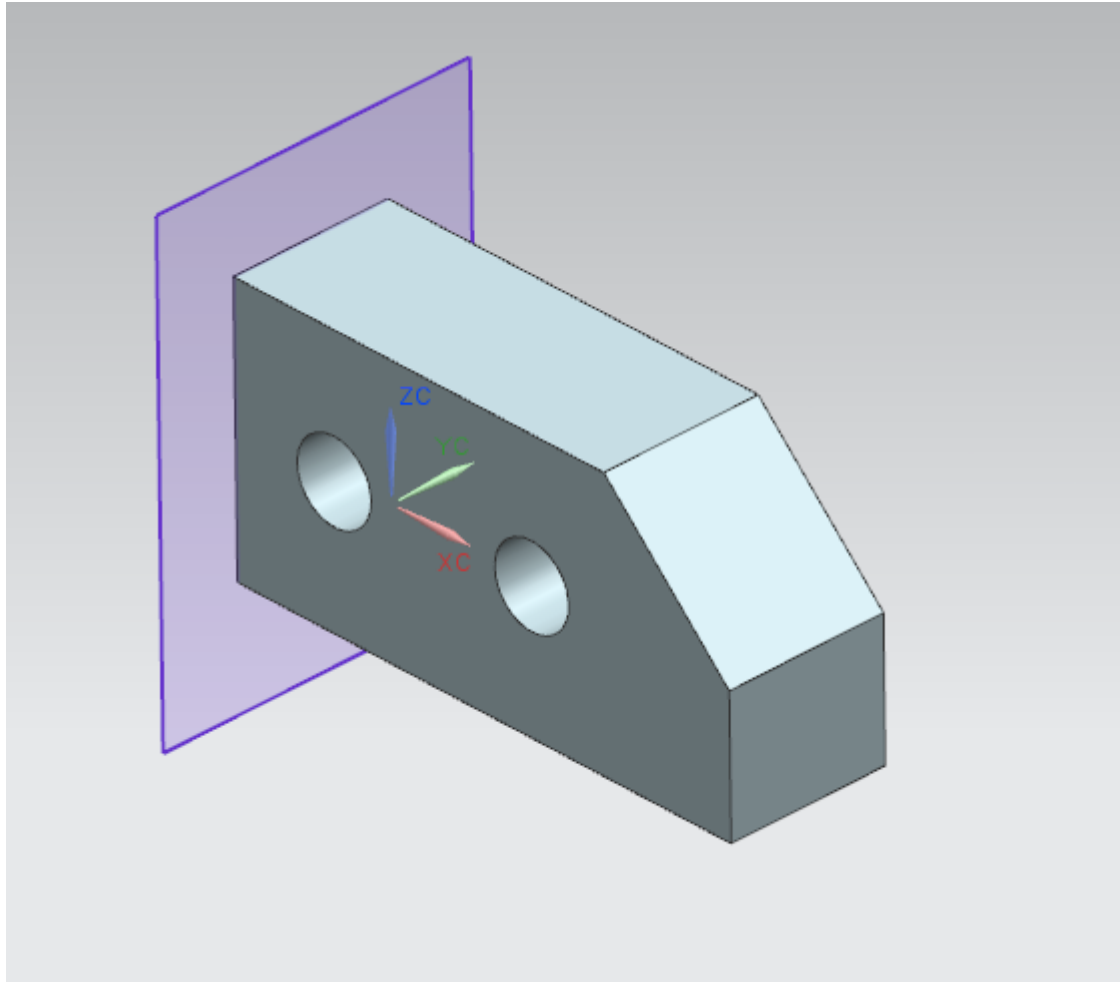
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Secondary Datum (B)



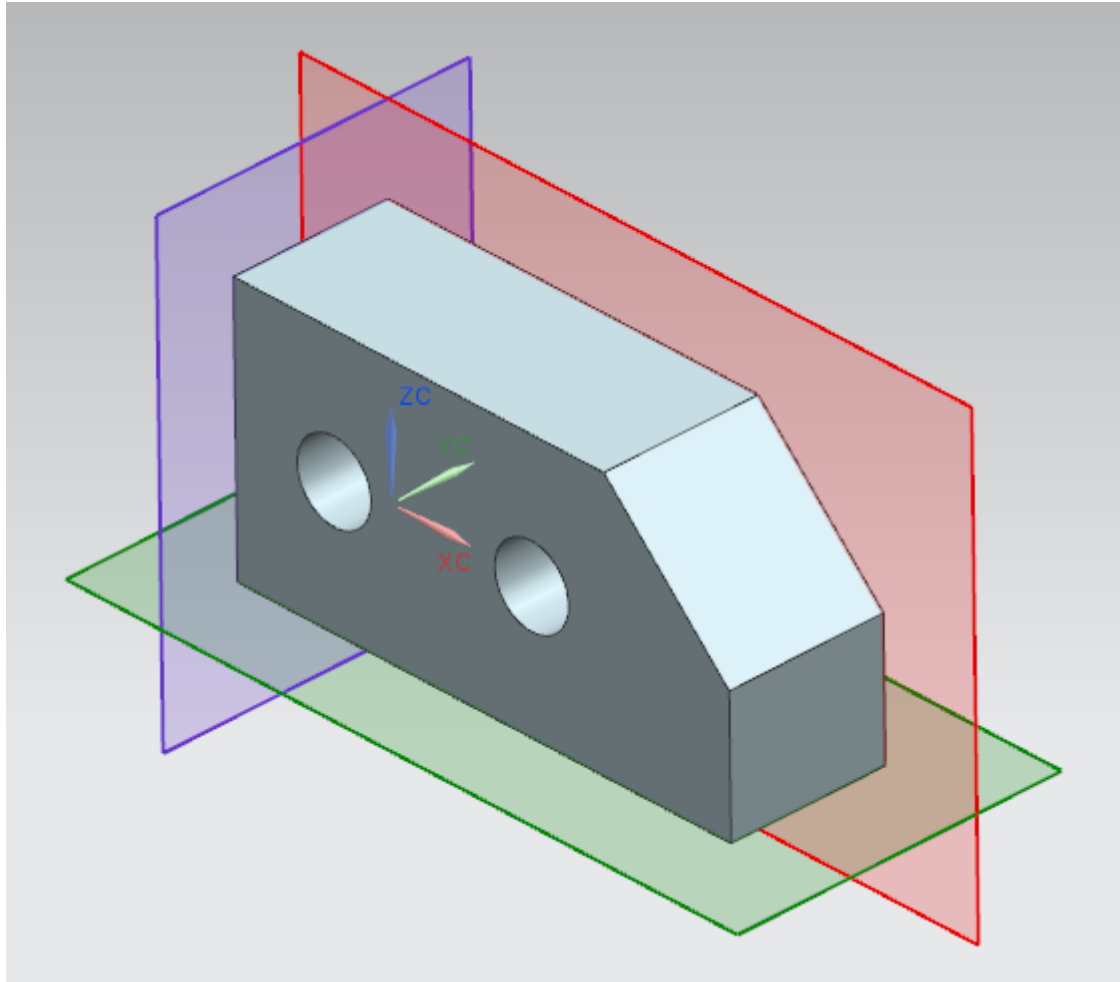
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Tertiary Datum (C)



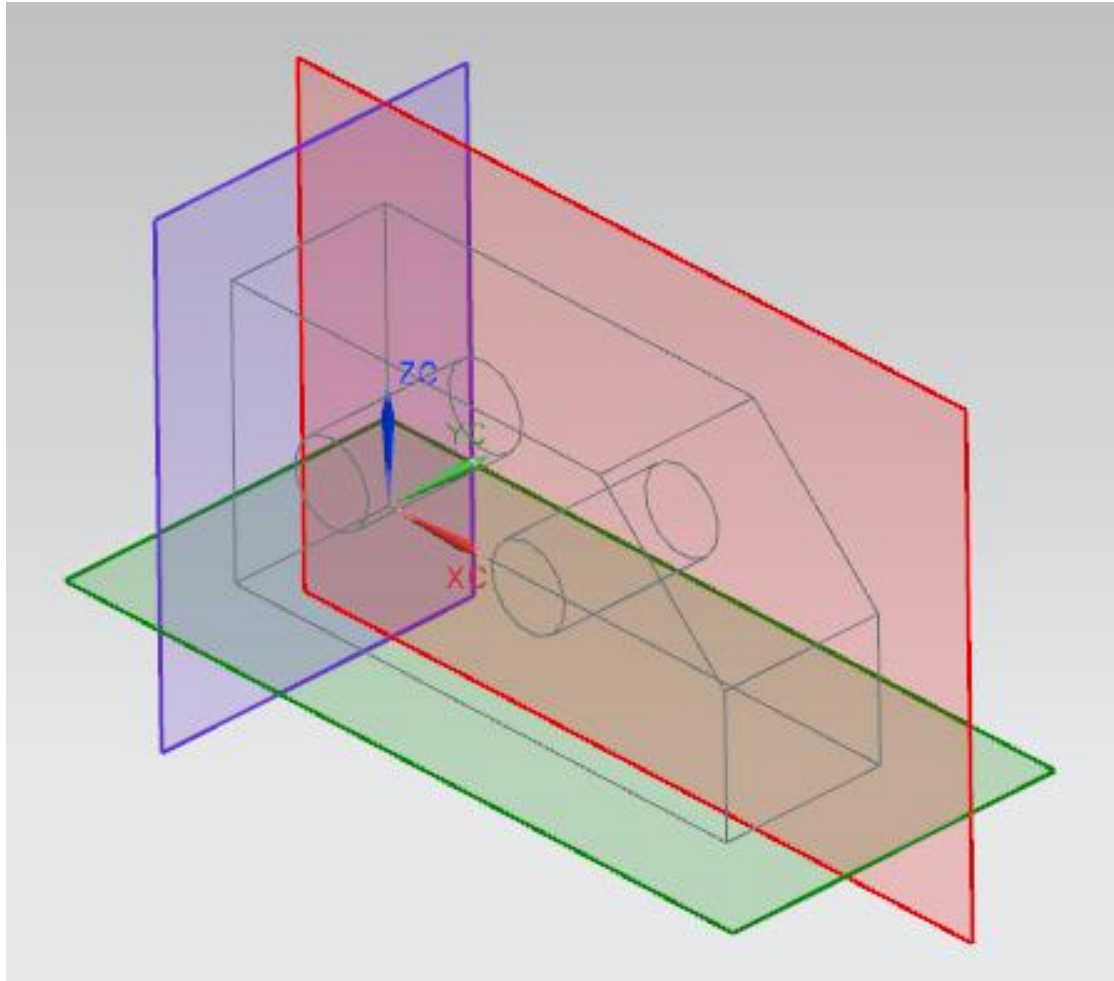
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Datums A, B, & C



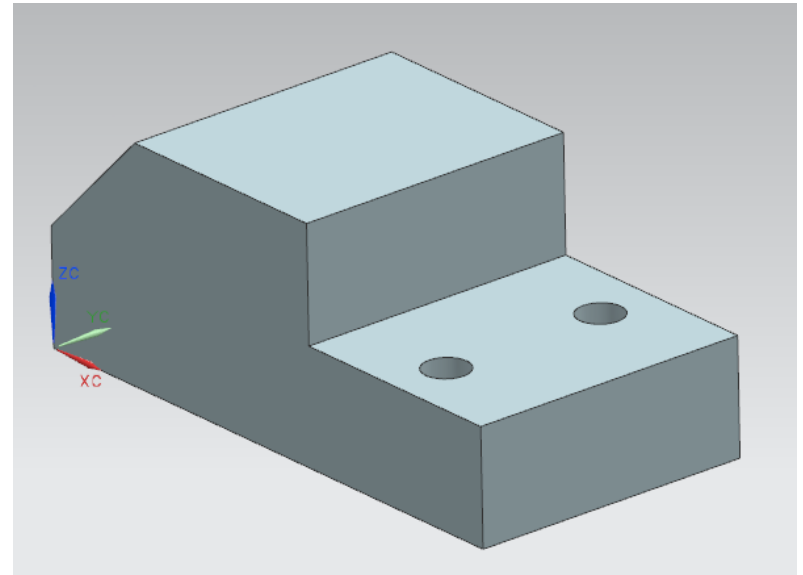
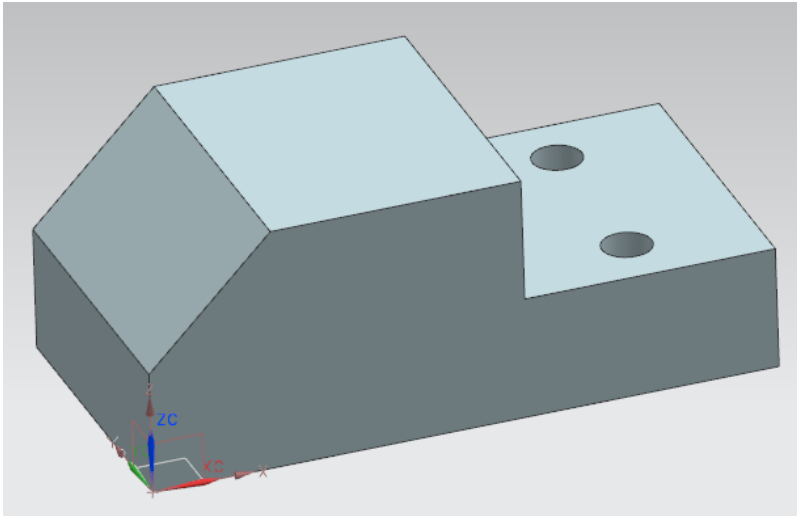
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Datums A, B, & C



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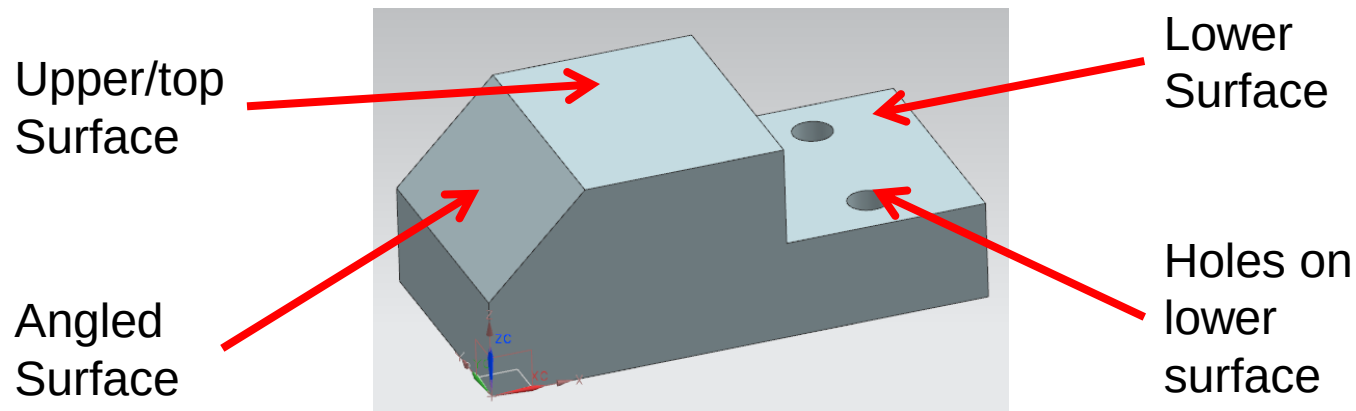
Component B (Angle/Hole Block)



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.



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