

Significant Figures and Rounding

Supplier Briefing Pack

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Introduction

Dimensional Measurement and Significant Figures

This document describes the acceptable methods of treating and recording dimensional measured results for component inspection. All dimensions and tolerances are always absolute values as indicated on the drawing. Dimensions and positions taken from digital models or CAD data must always be used as a reference, unless specific instructions are given.

Conformance of components

The measured result will be compared to the drawing tolerance and the conformance state determined on the measured result. Examples are shown in Table 1:

Stated tolerance	Maximum size	Minimum size	Result (as measured)	Feature sentence
10.42 ±0.1[mm]	10.520[mm]	10.320[mm]	10.520[mm]	Conforming
			10.251[mm]	Non-conforming
			10.319[mm]	Non-conforming
			10.320[mm]	Conforming

Table 1 – Conformance state assessment



Introduction

Dimensions and trailing zeroes

When an engineering drawing specifies dimensions of less than 3 decimal places in metric, or less than 4 decimal places for inches, it should be assumed that trailing zeroes have been omitted (unless stated otherwise). Examples are as follows:

- 10.45 can be considered the same as 10.450 or 10.4500
- 12.2 is the same as 12.2000
- 123.01 is the same as 123.010000 and so on...

The impact of measurement equipment

Selection of equipment used for measurement is critical and can affect the measured result.

- If a feature is defined with 3 decimal places in its tolerance, the measurement equipment shall have at least 3 decimal places in its measurement scale.
- It is good practice to select equipment with a measurement scale that has a minimum measurement increment of 10% of feature tolerance.
- The measurement results shall not be recorded to any more decimal places than available on the measuring equipment.
- Estimates of measurement readings between scale marks shall be avoided.



Introduction

Measurement Rounding

There are different methods that can be applied to a measurement result to accomplish rounding. The selection of these is based on the size of the feature tolerance:

A. Where the drawing has a total tolerance of more than 0.010mm or 0.00039 inches:

The measurement data shall be reported to the following rules:

- Metric measurements use no more than 3 decimal places when expressed in millimetres
- Inch measurements use no more than 4 decimal places when expressed in inches

Treatment of the measured result:

1. Select the appropriate decimal figure, using the rules stated above:

3rd decimal place figure [mm]

Metric 10.4567

4th decimal place figure [inches]

Inch 10.45673



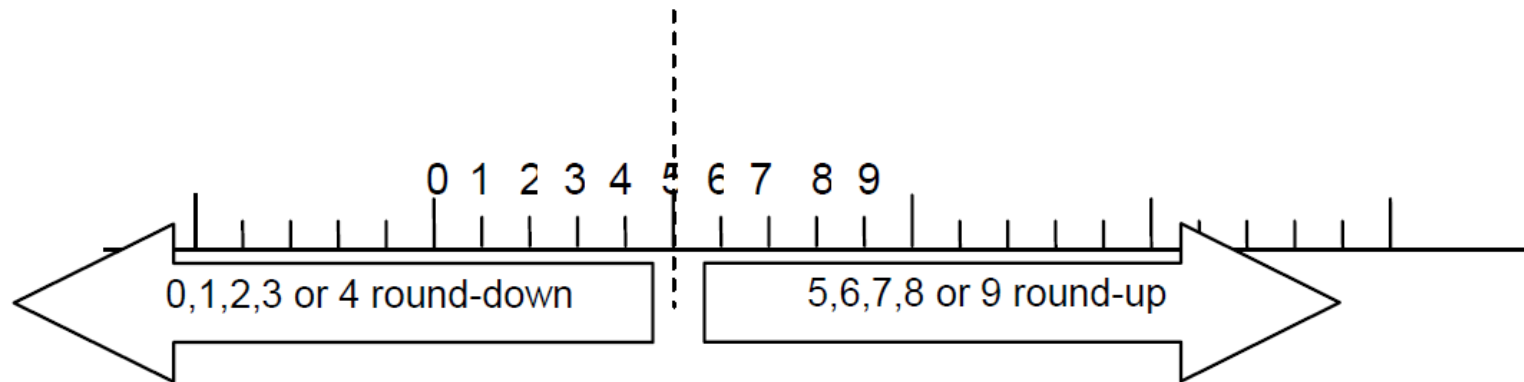
Introduction

2. Look at the next digit along:

Metric 10.4567

Inch 10.45673

3. Use the following arithmetic rule set to “round” this digit:



Example

Example in Metric (i.e., reporting to 3 decimal places):

Stated tolerance	Maximum size	Minimum size	Result as measured	Result as reported	Feature sentence
10.42 ±0.1[mm]	10.52[mm]	10.32[mm]	10.52[mm]	10.520[mm]	Conforming
			10.5195[mm]	10.520[mm]	Conforming
			10.5205[mm]	10.521[mm]	Non-conforming
			10.5204[mm]	10.520[mm]	Conforming
			10.32[mm]	10.320[mm]	Conforming
			10.319[mm]	10.319[mm]	Non-conforming
			10.3199[mm]	10.320[mm]	Conforming
			10.3205[mm]	10.321[mm]	Conforming

Table 2 – Conformance state after rounding

The assessment of conformance shall be conducted using the reported result!

Note: Rounding of measurement results can only be conducted once. Applying rounding 2 or more times will invalidate the result.

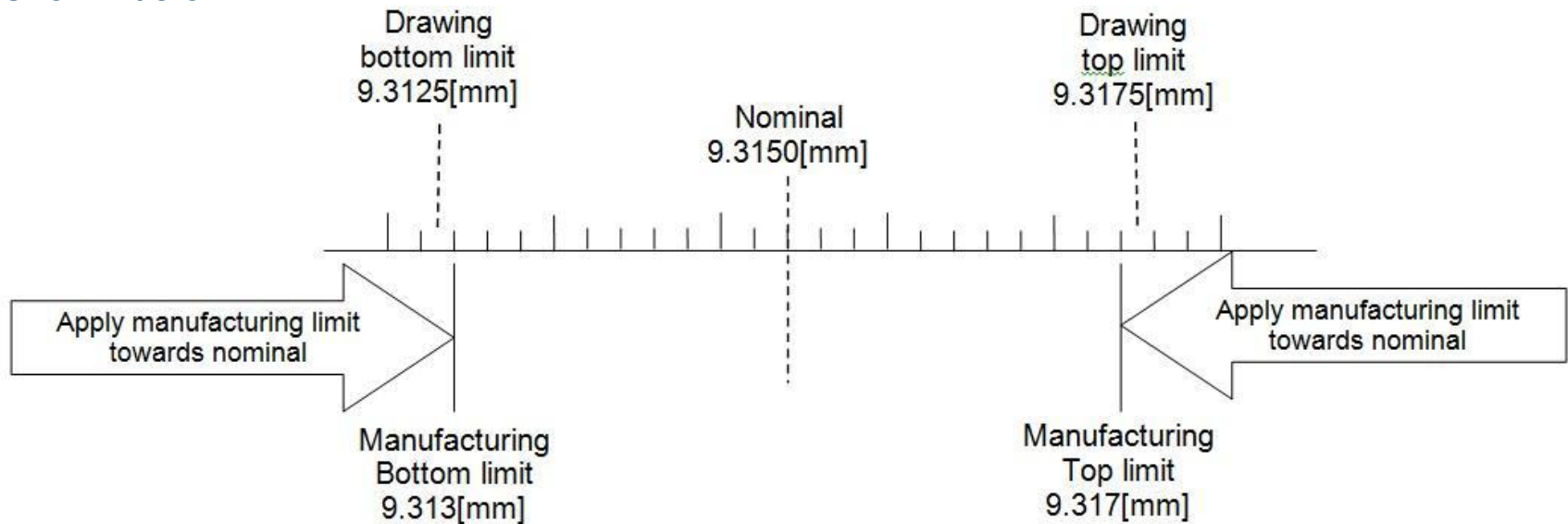


Example

B. Where the drawing has a total tolerance of less than 0.010mm or 0.00039 inches:

Where the ability to measure to this accuracy is available, measurements shall be reported to the number of decimal places required by the drawing feature.

Where the ability to report to this resolution is not available, manufacturing limits shall be applied to reduce the drawing tolerance to the required number of decimal places, as shown below:



Example

Example in Metric (i.e., reporting to 3 decimal places):

Drawing tolerance	Drawing top limit	Drawing bottom limit	Result		
9.3155 ±0.0025[mm]	9.3180[mm]	9.3130[mm]	No action is taken as the top and bottom limit are recorded within the 3 decimal point metric rule. Note that trailing zeroes are assumed to be infinite and so have no effect.		
			Drawing	Top limit:	9.3180[mm]
				Bottom limit:	9.3130[mm]
			Manufacturing	Top limit:	9.318[mm]
				Bottom limit:	9.313[mm]
			9.3150 ±0.0025[mm]	9.3175[mm]	9.3125[mm]
Drawing	Top limit:	9.3175[mm]			
	Bottom limit:	9.3125[mm]			
Manufacturing	Top limit:	9.317[mm]			
	Bottom limit:	9.313[mm]			

Table 3 – Application of manufacturing limits

All results shall be reported to 3 decimal places in metric and 4 decimal places in inches. Components shall be sentenced using the manufacturing limits.

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