

CMM Guidelines
Co-ordinate Measuring Machine (CMM)
DST 1.1.4

Scope:

This document outlines the procedure and measuring requirements required for the effective use of the Co-ordinate measurement machine (CMM). The CMM is used for testing and verifying geometric features of ASM components. Reference information used in this document is extracted from BS 7172: 1989.

CMM Definition:

CMM is a device used in the measurement of the physical geometrical characteristics of an object. It provides precise measurements of objects for design, testing, assessment, profiling and reverse engineering of parts.

A probe is used to measure different points on it by mapping the x, y, z coordinates. These points are uploaded to a computer interface where they can be analysed using model software (e.g. Creo, NX) and regression algorithms for further development.

Applications:

- CMM can be used for determining dimensional accuracy of the components.
- Ideal for determination of shape and position, maximum metal condition, linkage of results etc.
- Ideal for the test and inspection of test equipment, gauges and tools.

Advantages:

- High precision and accuracy.
- Flexibility.
- Robustness against external force and error accumulation.
- Reduction in setup time.
- Reduction of scrap and good part rejection.

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Measurement requirements:

- All features including; planes/surfaces, datums and holes unless otherwise stated on component drawing.
- Measure datums first.
- Ensure features are measured with respect to their referenced datums.

Rule for number of points:

- Follow instruction as shown below in table **BS 7172: 1989** for the recommended minimum number of points for each geometric feature.

Geometric Feature	Min. number of points Recommended	Comments
Line	5	
Plane	9	Approx. 3 lines of 3
Circle	7	To detect up to 6 lobes
Sphere	9	Approx. 3 circles of 3 in parallel planes
Cylinder	12	Circles in 4 parallel planes for information on straightness
Cylinder	15	5 points on each circle for information on roundness
Cone	12	Circles in 4 parallel planes for information on straightness
Cone	15	5 points on each circle for information on roundness

Measuring multiple surface controlled by Common Zone (CZ) or “multiple times dimension references”:

- Apply ‘Rule for number of points’ for each individual plane or surface.
- Provide measurement results for each individual plane or surface in report.
- Provide measurement results for combined planes or surfaces if required to satisfy drawing requirements.

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Measuring a plane or surface additional requirement:

- Apply 'Rule for number of points' for a single specified plane or surface.

Measuring small planes or surfaces:

- If a plane or surface width is too small to allow sensible distribution of points, then treat as a line i.e. 2mm tall.

Measuring large planes or surfaces:

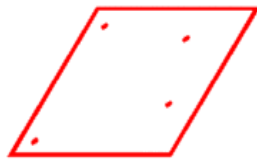
- The recommended number of points for a plane or surface is 9.
- Increase the number of points to ensure a minimum of 3 points within a 40mm by 40mm square with a maximum space between points of 25mm.

Point distribution for planes or surfaces:

- Ensure that the enough points are taken, and they are distributed uniformly and completely on the element.



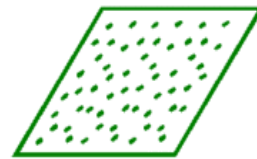
Probing points distributed non-uniformly measure the real shape incorrectly



Few probing points measure the real shape incorrectly



Probing points distributed uniformly measure the real shape correctly



Many probing points measure the real shape correctly

Point distribution sign off:

- Vendor has the option to supply point distribution data for discussion and/or sign off with ASM.

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Drawings

- Marked up (bubble) detailed drawings are required and must form part of the report.
- Flag 2 details must be fully detailed on the marked up (bubble) drawings.

Report Structure

- The report must be in a table form noting the 'bubble dimension' idents, required dimension, tolerance, actual measured dimension and a pass or a fail column (this can be either by colour, text or numeric).
- True position should always be noted if tagged with a Flag 2.
- Any Abbreviations should also be explained e.g. 'CZ'.

Following table is an example of a report structure:

ID	Sheet	Reference	Dimension / Measurement (i.e. Flat, Perpendicular, Parallel, Linear Dimension etc.)	Required Dimension	Tolerance (of required dimension)	Actual Measurement	Deviation	Pass/ Fail

Contact Protocol:

Should clarification be required for any issues contact Supplier Quality or Manufacturing Engineering who will note the issue and assist with resolution. Please email details of your request to engineering_enquiries@asmpt.com

Note: This document maybe replaced by First Article Inspection (FAI) procedure in future. To be confirmed with Supplier Quality or Manufacturing Engineering.

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