Surface Profile Inspection Guideline for CMM

MAN-00040 / 1

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1.0 Intended purpose

This document provides a recommended CMM setup when inspecting parts for surface profile characteristics. The outlined specifications in this document are recommended requirements for the collection of measurement data to achieve confident inspection results. The scope of the measurement may vary for individual conditions such as a machined surface vs a non-machined surface. It is expected that a machined surface will have less variation, and therefore, will require less inspection points than a non-machined surface. In cases where inspection results are in question, additional points or alternative measurement methods may be required.

Note 1: The recommended values in this document may not be applicable in all cases. Case by case factors are to be considered when determining the appropriate pitch distance. (I.e., time/cost of inspection (number of measured points) versus risk of non-detection of areas of nonconformance).

Note 2: Surface profile tolerance applies to entire surface as specified. The recommendations included in this document may not be used as justification for part acceptance if a NOK surface area lies between measured points.

2.0 Setup

2.1 Theoretical geometry

A correct version of 3D CAD model should be obtained from the provided Technical Data Package; it is to be used as the theoretical reference for the measured value.

2.2 Mounting

The parts should be mounted according to the setup instruction outlined in drawing or 3D PDF. Proper mounting and clamping are needed to ensure proper datum alignment. The parts should be secured in a way where the part is not deflecting during measurement collection process.

2.3 Equipment and Parameter

Select appropriate probe size to avoid collision with surrounding features. Placement of inspection points should be uniform and maintain a 2mm margin from surface edges (Figure 1). This margin can be decreased for small features to ensure enough inspection points are collected.

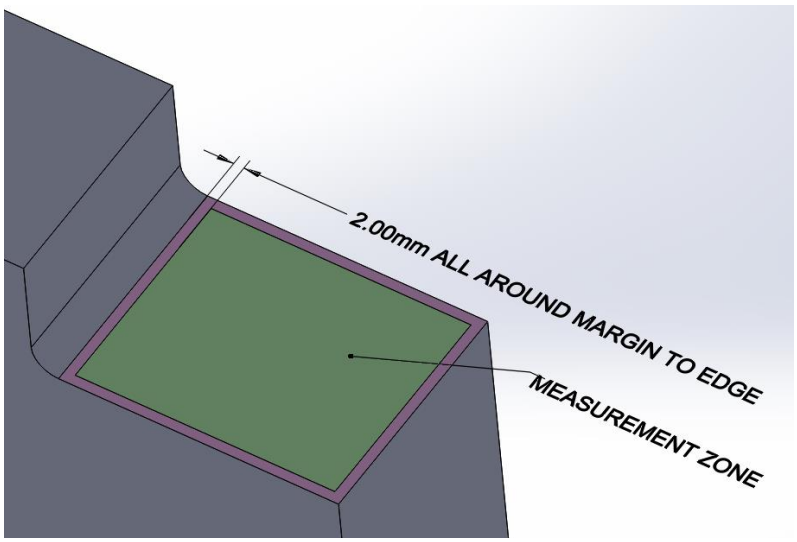


Figure 1. Define Measurement Zone with 2mm margin to edges of the face

Table 1 shows the recommended pitch numbers for different surface area range and Surface Profile Tolerance values. The pitch number is defined as the distance between inspection points.

Table 1: Recommended Pitch Numbers

Surface Area (mm^2)	**Surface Profile Tolerance Value**	**Pitch Number (mm)**
< 100	ALL	4 *Adjust margin to ensure at least **3** inspection points are taken from the surface*
100 and above	0.01-0.5	4
	0.5-1	8
	>1	12

3.0 Reporting

Deviations from the theoretical 3D model are gathered for the measured feature. Measurement data are default to be 3 significant digits unless otherwise specified in General Notes of the part.

A graphical report for surface profile tolerance is preferred. In the report, the following information should be included:

- Date of inspection
- Largest deviation measured
- Tolerance Value
- Part Number and Revision
- Dimension ID (can be included in report name)

The feature orientation must be identifiable in the result presentation, see examples in Figure 2. All measurement points should be visible in the report (use multiple figures to present the point distribution

if needed). The out-of-tolerance measurement points should be differentiated from those within the tolerance specification as shown in Figure 3. The location of the largest deviation point should be identified in the report. See Appendix for an example of how the largest deviation point could be identified. The largest deviation should be recorded to the Dimension List, found in the Technical Data Package.

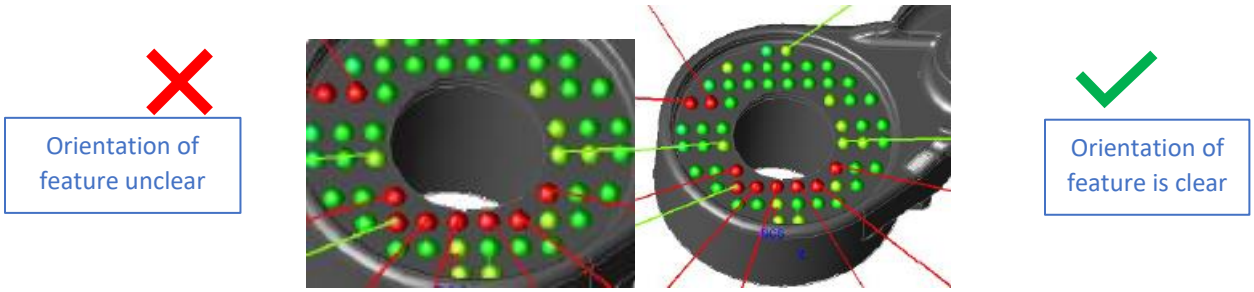


Figure 2. Capture of measurement results should include features for one to identify feature orientation. Unacceptable Capture (Light) and Acceptable Capture (Right)

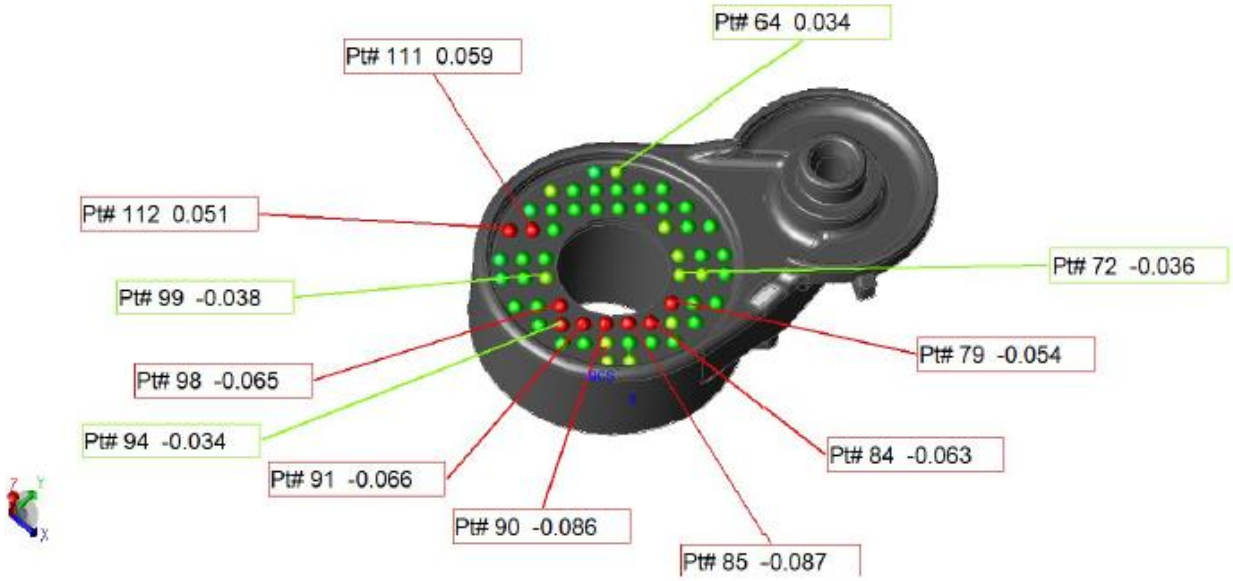


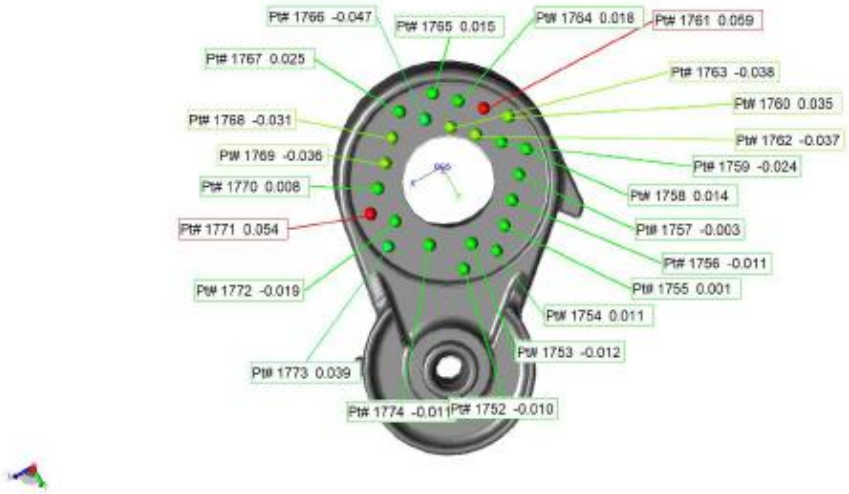
Figure 3. The report should present a distinguishment between out-of-spec measurement points and in-spec measurement points.

Appendix A

A.1 Sample Report

1234567011 DIM# 21

User name Admin Date 13:55 01.02.2022



Sheet Thickness	0.000 mm	
Meas. mode surf		Tolerances
Max. deviation	0.059 mm(1761)	Upper.Tol
Mean deviation	-0.000 mm	LowerTol.
Min. deviation	-0.047 mm(1743)	
Bestfit		
Move	0.048 mm	-0.000 mm
Rot.	-0.001 °	-0.059 °

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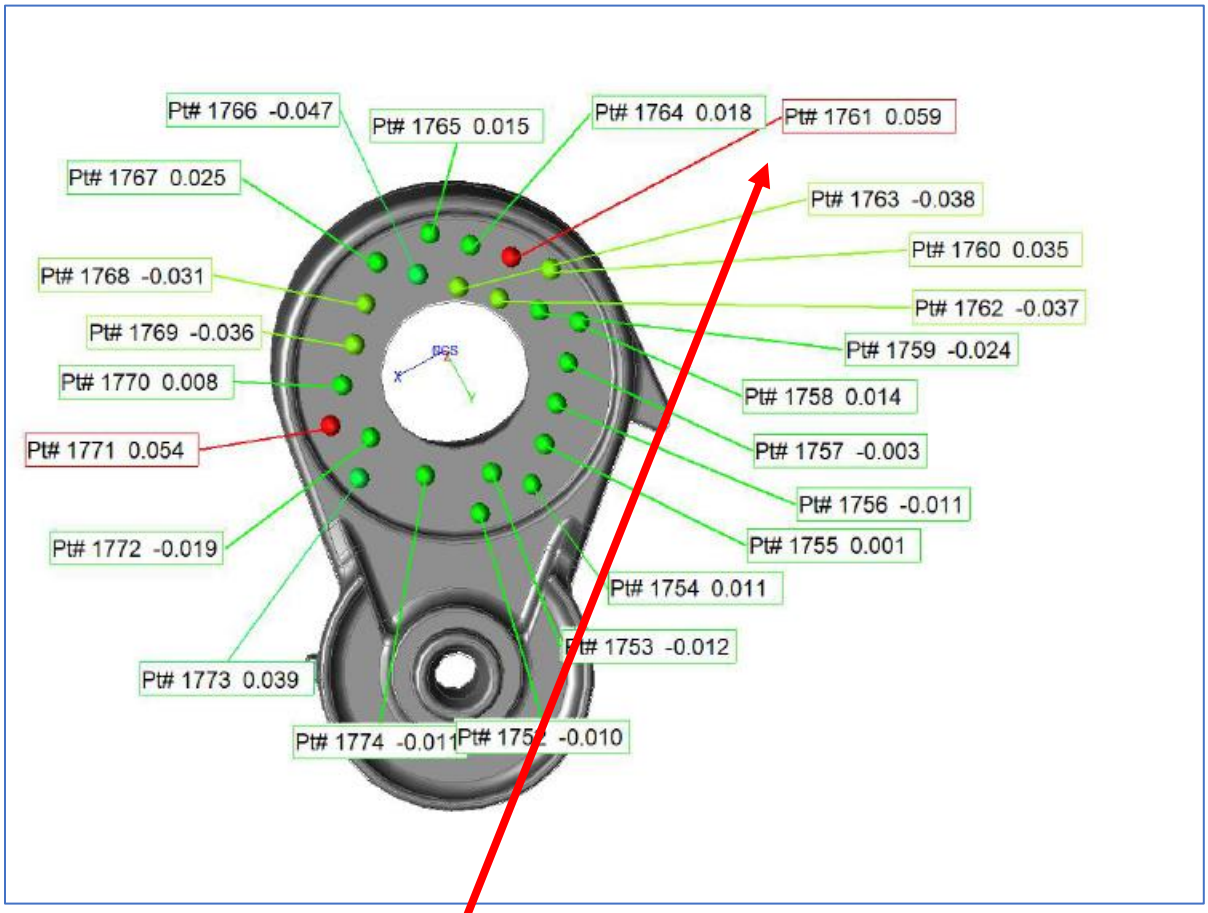
A.2 An example of how the maximum deviation point could be located on the surface through Pt#. The method of locating the maximum deviation point can be different with different CMM software.



Sheet Thickness	0.000 mm	
Meas. mode surf.		Tolerances
Max. deviation	0.059 mm(1761)	Upper.Tol
Mean deviation	-0.000 mm	LowerTol.
Min. deviation	-0.047 mm(1743)	
Bestfit		
Move	0.048 mm	-0.000 mm
Rot.	-0.001 °	-0.059 °