



# ***G Series***

## ***Infinite Focus***

### **Application Note**

Full Report available at: <https://bit.ly/2DduEUb>

**Application: Safety Washer Measurement**



**Bruker alicona**

Bruker Alicona is a leading global supplier of optical metrology solutions based on the principle of Focus Variation.

Focus Variation works based on moving a focal plane over a surface and collecting robust 3D data which can then be used to measure geometric form and surface finish from a single optical sensor.

Measurement processes can be fully automated and provide GD&T measurement capabilities across all industrial & medical sectors.

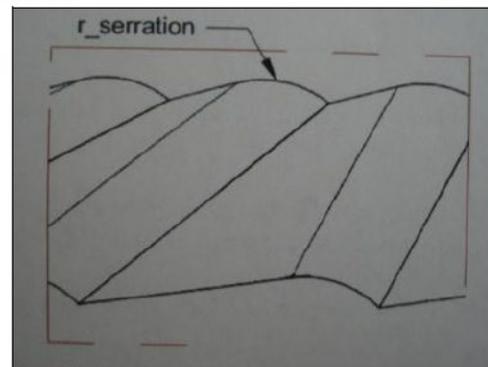
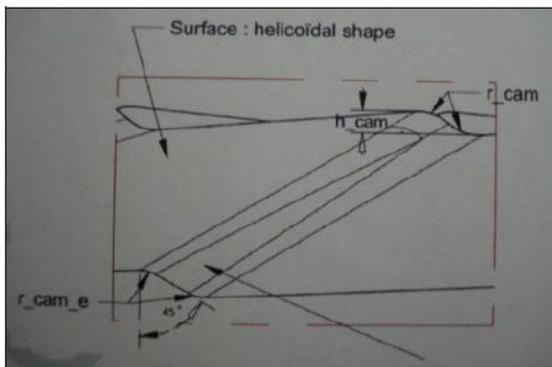
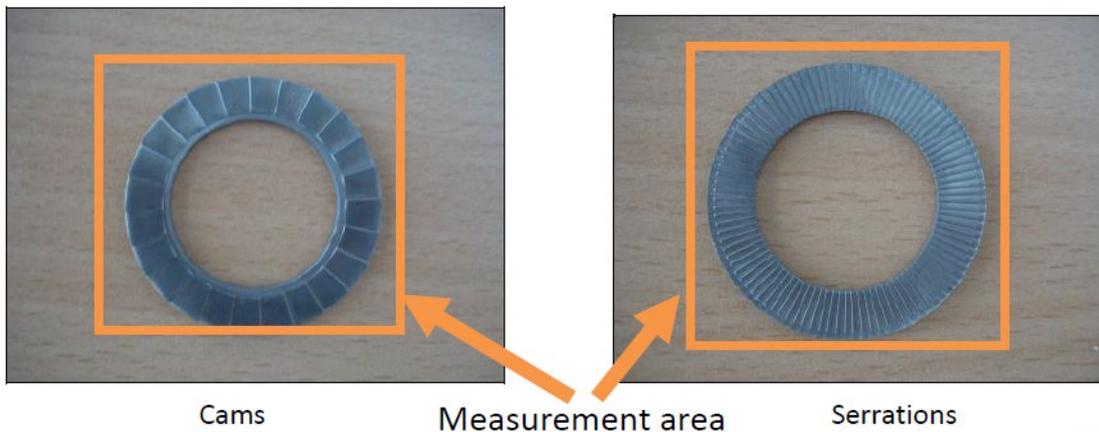
The systems are in use in Industry, Industrial Research, Universities and production facilities globally.

[www.alicona.com](http://www.alicona.com)

## Safety Washer Measurement

In this measurement report summary, we describe the use of the Bruker Alicona G-Series InfiniteFocus to measure safety washers to ensure they meet specification and comply with the relevant ISO standard.

These measurements were made with the InfiniteFocusG4, this is the previous version to the InfiniteFocusG5 plus shown in the front-page illustration. Using this instrument, it is possible to easily measure all these parameters quickly, easily and repeatably.



The parameters to be measured are

- Pitch of Cams/serrations
- Radius on the top of the cam/serration
- Radius on the bottom of the cam/serration
- Surface roughness of serrations/cams

The full measurement report is available at <https://bit.ly/2DduEUb>

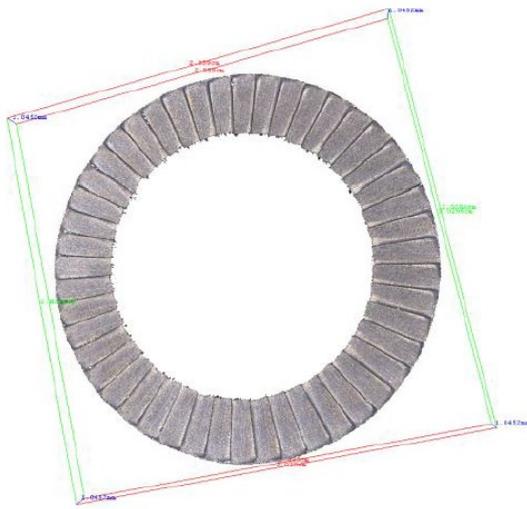
Safety washers are components designed to prevent fasteners from loosening when subjected to vibration. This is a critical aspect in many areas, such as in military applications or construction equipment where fasteners that become loose could cause a catastrophic accident.

The complex geometric shape of these devices makes them difficult to measure with conventional tactile methods of measurement, optical metrology, with the ability to measure both form and finish provide an efficient and easy to use solution.

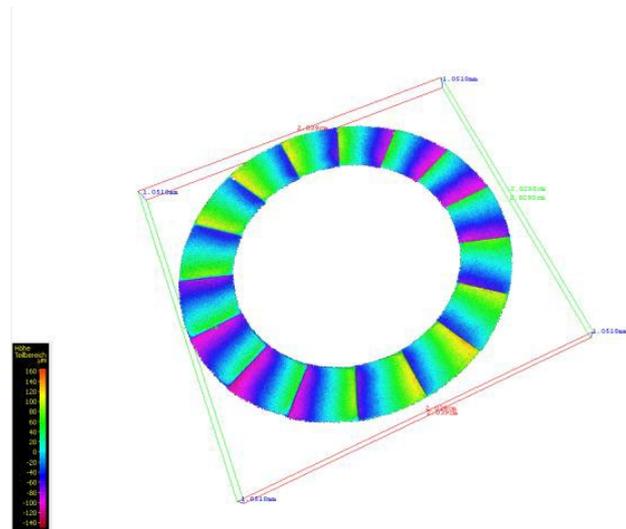


The measurement system used in this report is the Bruker AliconaG4 **optical metrology system** as illustrated above (now replaced by the InfiniteFocusG5 pls system illustrated on the front cover).

The washer is simply placed on the measurement table and a 3D view of the subject is presented to the user as either a natural colour image or in Pseudo Colour related to height, as illustrated below.

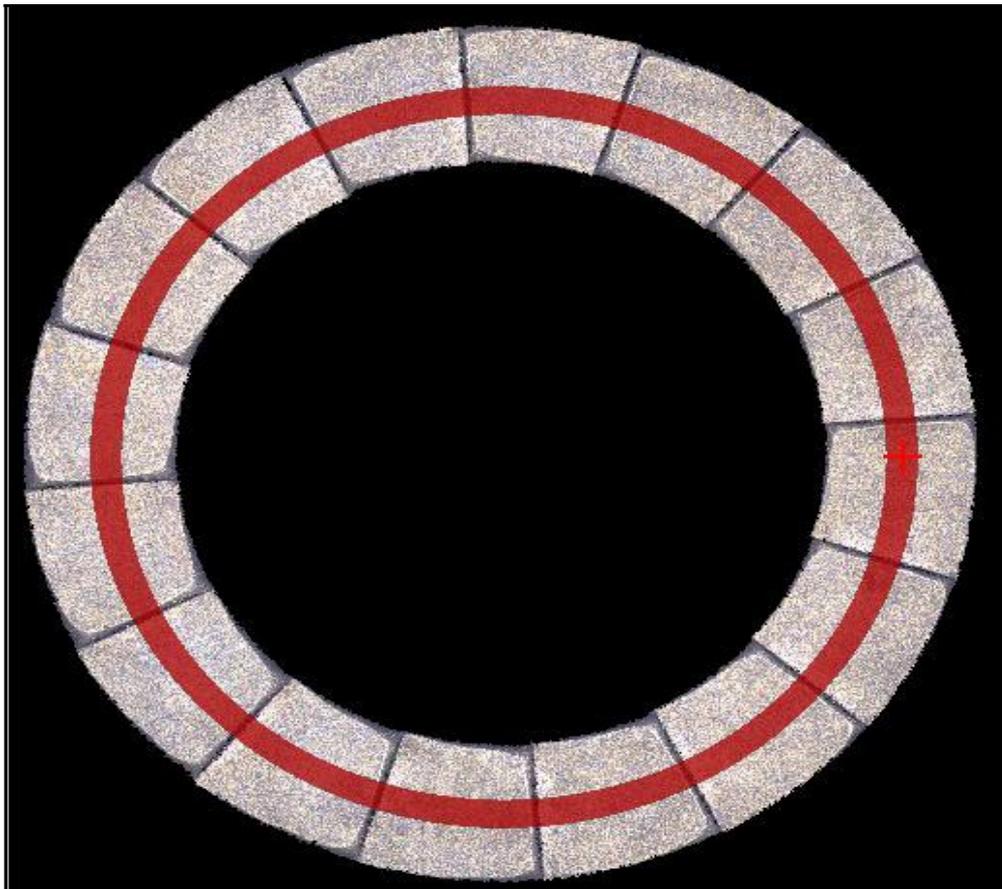


Surface Dataset, real colour

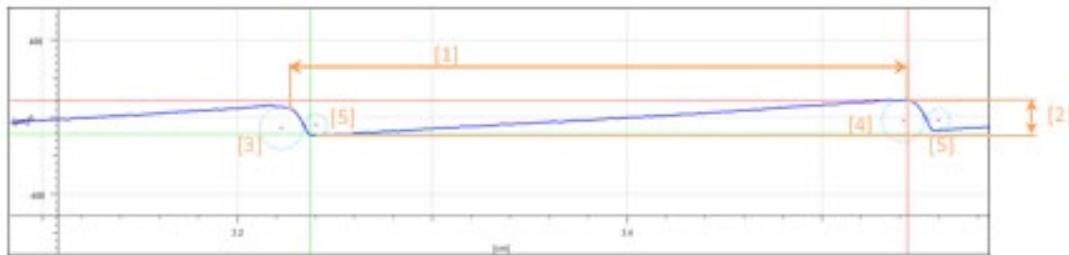
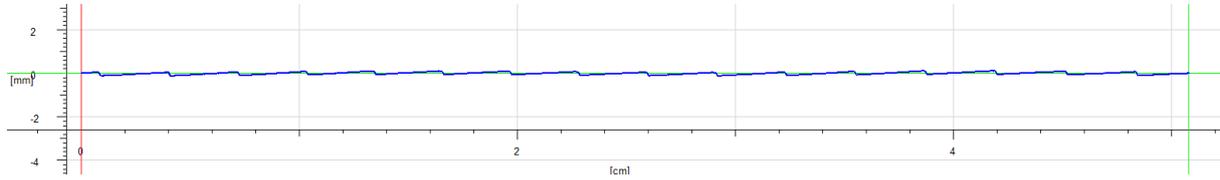


Surface Dataset, pseudo colour

Using the Profile Measurement Tool a profile path is placed on the surface to be measured



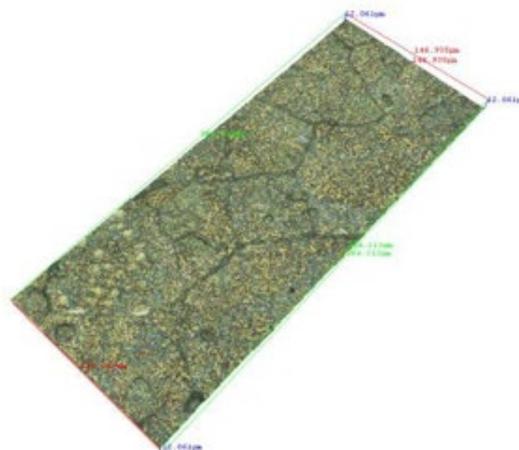
The profile is then displayed and then detailed measurements can be made of sections of the profile as shown below for the Cam side which meets the required tasks of Pitch and radius as described.



Measurement	Result	Units
[1] Pitch	3.18	mm
[2] Height of cam	181.23	$\mu\text{m}$
[3] Radius on the top of the cam 1	110.41	$\mu\text{m}$
[4] Radius on the top of the cam 2	109.42	$\mu\text{m}$
[5] Radius on the bottom of the cam 1	57.49	$\mu\text{m}$
[6] Radius on the bottom of the cam 2	57.94	$\mu\text{m}$

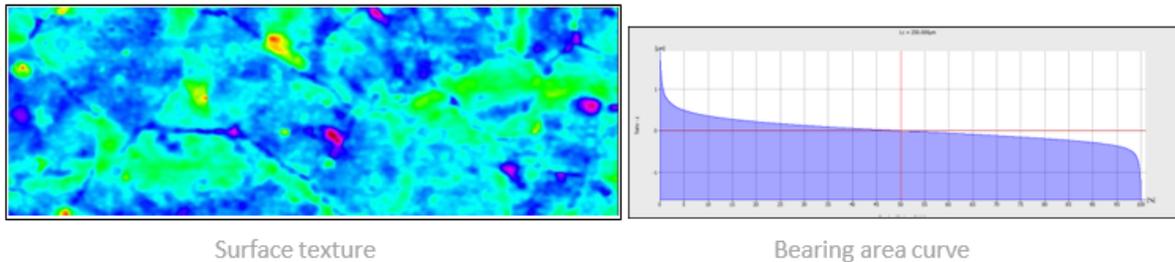
These measurements can then also be made on the serrated side.

To enable the measurement of surface finish scan is made of a surface of the washer and displayed as a real colour surface dataset as shown below.



Surface dataset, realcolor

Using the surface texture measurement capability the surface is then measured to display the surface texture (according to ISO 21578). It is also possible to display the roughness values according to ISO 4287/4288.



Measurement	Result	Units	Description
Sa	206.27	nm	Average height of selected area
Sq	282.68	nm	Root-Mean-Square height of selected area
Sp	1.91	μm	Maximum peak height of selected area
Sv	1.66	μm	Maximum valley depth of selected area
Sz	3.57	μm	Maximum height of selected area
S10z	3.27	μm	Ten point height of selected area
Ssk	0.80		Skewness of selected area
Sku	6.83		Kurtosis of selected area
Sdq	0.09		Root mean square gradient
Sdr	0.43	%	Developed interfacial area ratio
FLTt	3.57	μm	Flatness using least squares reference plane
Lc	250	μm	LambdaC: cut off wavelength

These measurements can then be repeated on the serrations side providing full measurement data.

## Summary

Using the Bruker Alicona G-Series InfiniteFocus it is easily possible to carry out this measurement task providing a convenient and easy to use solution.

This measurement solution can be placed alongside the production line and a batch measurement regime established. The task can be fully automated allowing production workers, with no knowledge of Metrology to perform the task.

Results can be shown in a “traffic light manner” to describe a Go/NoGo scenario for each of the measurements presented.