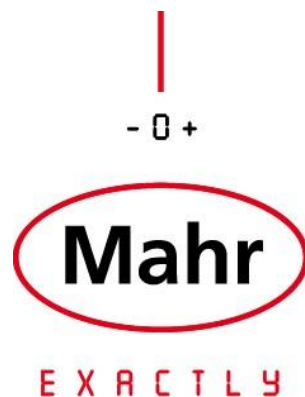


MAHR UK PLC | APPLICATION TIP

APPLICATION TIP CONTOUR MEASUREMENT
PRACTICE-ORIENTED EDGE MEASUREMENT



Measuring edges with MarSurf XC 20 and Option Bevel Evaluation V 2.00

Introduction

Distances, geometric forms and acceptable tolerances are defined in technical drawings. According to the drawings, all parts can be produced. An edge which is the intersection between two surfaces is created in the production line as a radius, an edge or as an edge with an undefined shape. For designers, it is easy to define radii or edges in technical drawings. It is more difficult, however, to describe edges with undefined shapes. You can find descriptions like "No sharp edge", or "Burr not permitted". These definitions do not allow for objective criteria for tolerances or ideal edge curves. It is also impossible to create a practice-oriented test method.

DIN ISO 13715:2000-12: Edges of undefined shapes

The International Standard DIN ISO 13715 defines different edges, areas and burrs. With this standard, designers can define edges with tolerances and dimensions.

Basically there are two types of edges: external edges and internal edges. There are three different areas of an external edge; the "size of undercut", the "size of sharp edge" and the "size of burr", Fig.1.

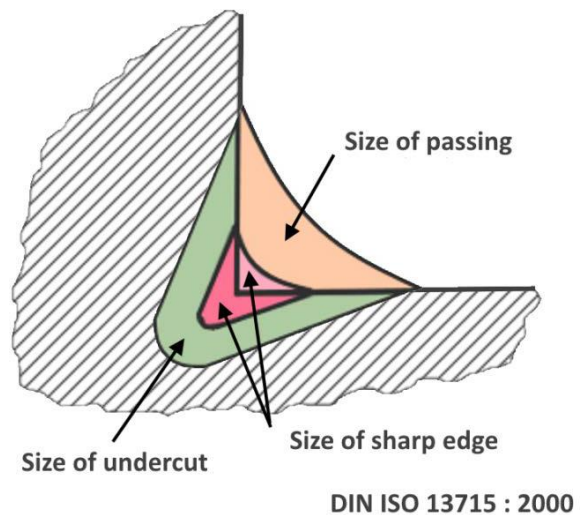
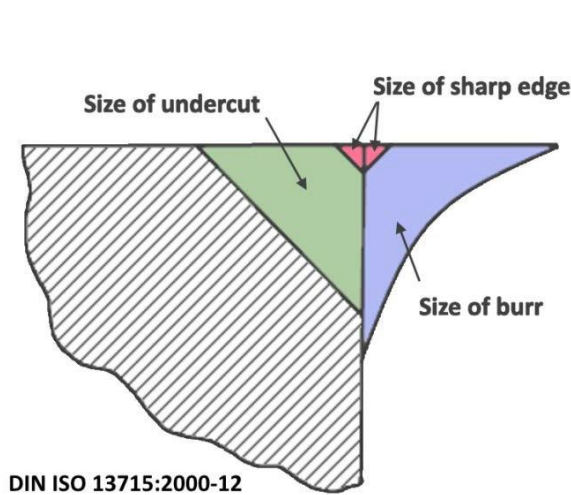


Fig. 1: Sizes of an external edge (DIN ISO 13715:2000-12¹⁾)

Fig.2: Sizes of an internal edge (DIN ISO 13715:2000-12¹⁾)

An internal edge has also three areas: the "size of passing", the "size of undercut" and the "size of sharp edge", Fig.2.

Dimensioning according to DIN ISO 13715:2000-12

Dimensioning of burrs and edges are described in DIN ISO 13715:2000-12:

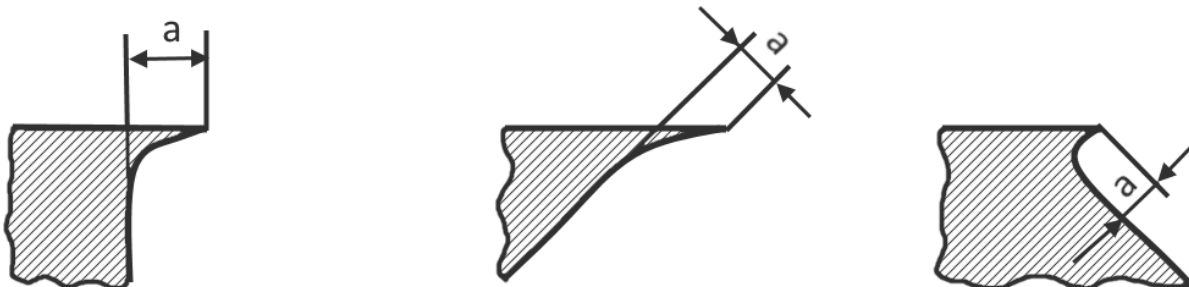


Fig. 3: Examples of external edge; "a" is the size of the burr; DIN ISO 13715:2000-12¹⁾

Measuring edges with MarSurf XC 20 and Option Bevel Evaluation V 2.00

Dimension of wane of an external edge according to Bosch Standard N42AP 620

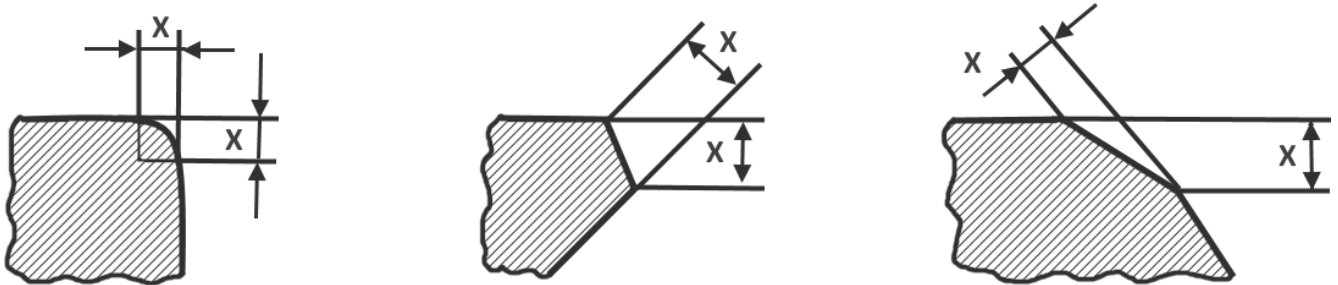


Fig. 4: Samples of wane from an external wane according to Bosch-Norm N42AP 620 and DIN ISO 13715:2000-12 ¹. "X" is the dimension of wane.

According to DIN ISO 13715:2000-12 the wane of an external edge is named "a".

Examples of indications of edges (DIN ISO 13715:2000-12)

Table 2 — Examples of indications of edges

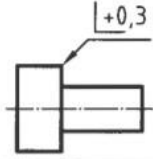
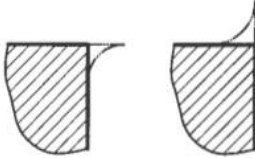
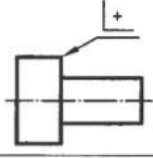
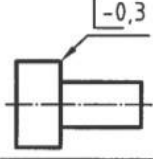
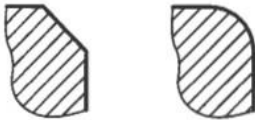
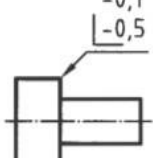
No.	Indication	Meaning	Explanation
5.1			External edge with burr acceptable up to 0,3 mm; burr direction undefined
5.2			External edge with acceptable burr; size and direction of burr undefined
5.5			External edge without burr; undercut up to 0,3 mm
5.6			External edge without burr; undercut in the zone from 0,1 mm to 0,5 mm

Fig. 5: Examples of indications of edges (DIN ISO 13715:2000-12 ¹)

Practice-orientated testing methods are necessary for each dimensioning of edges. Otherwise these features could not be verified.

Measuring edges with Option Bevel Evaluation V 2.00 according to Bosch Standard N42AP 620 2015-10-29

Testing method of edge measurement

In the past different testing methods were used to measure work piece edges with undefined shape. They were mostly measured tactile by contour or roughness measurement systems, with optical measurement systems or CMM's. No standard of the testing and evaluation method even existed, so different measurements created different results. The repeatability of the results was bad and the comparability of different measurements was not given.

4 497 037 113

Bosch-Norm

2015-10-29

N42AP 620

Testing of workpiece edges with undefined shape

Folder: N42AP Test procedures, general
Technical responsibility: ksu/4fe FeP/TEF13 (011)



BOSCH

Measuring edges of work piece with undefined shapes according to Bosch Standard N42AP 620 2015-10-29

The Bosch Standard N42AP 620 2015-10-29 describes a testing method to measure work piece edges with undefined shapes, which are defined in DIN ISO 13715 (2000-12) so that these edges can be measured reliably, uniformly and with a high repeatability.

Determination of a reference point from an external edge

The edge evaluation method differentiates between two surfaces of the work piece; the material side and the air side. Near of the edge, two best fit straight lines are created according to the Gaussian method. The common intersection point is the reference point of the edge area.

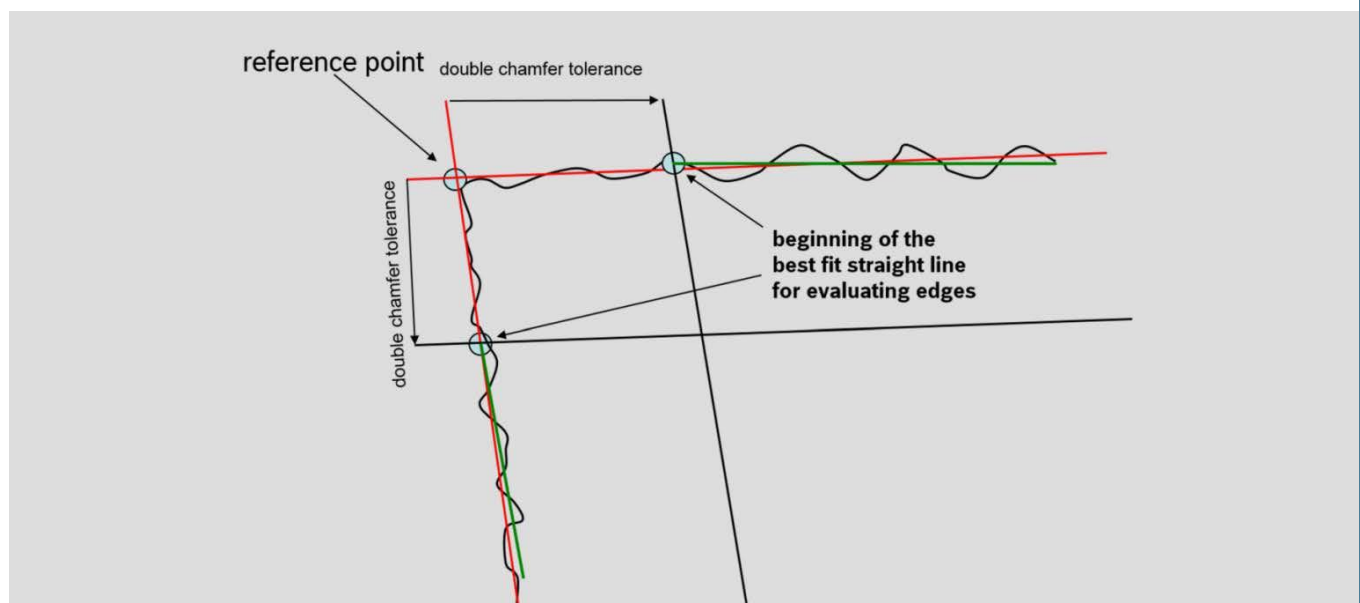


Fig. 6: Start point of the best fit straight line

Belonging to the reference point two other best fit straight lines are determined. Preferably the starting point of the best fit straight line is at a distance that is double the chamfer tolerance, starting at the reference point. The best fit straight line shall be as long as possible, its length depending on the available evaluation length. Usually the length of the best fit straight line is at least three times the maximum chamfer tolerance.

Parallel to these new lines, two other new lines are created. The distance of the parallel line to the regression line is $\frac{1}{2} R_z$ from the surface. The parallel line at the material side is "ki", and at the air side "ka". These lines are the corridor limits.

Measuring edges with Option Bevel Evaluation V 2.00 according to Bosch Standard N42AP 620 2015-10-29

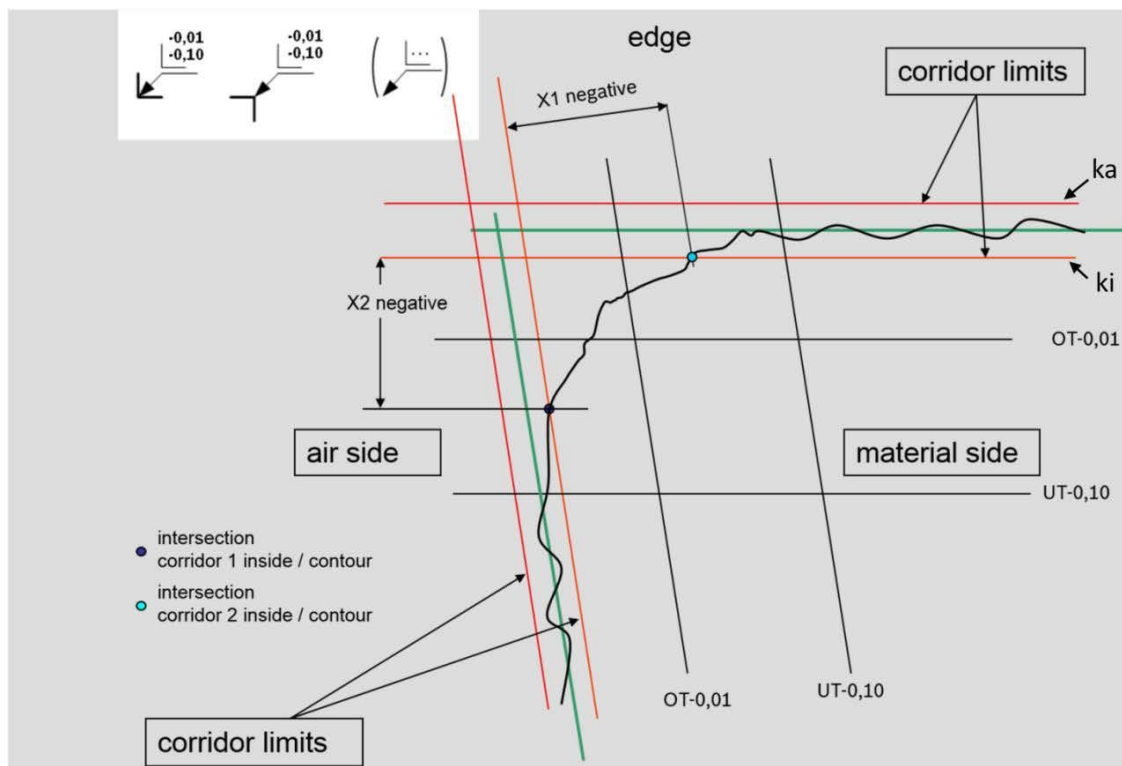


Fig. 7: The measured contour of an external edge is leaving the corridor limit to the material side (wane)

Chamfer characteristics X1 und X2

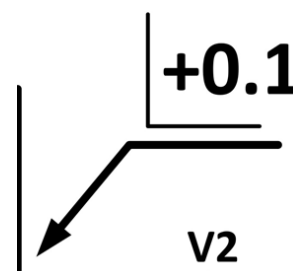
If a measured contour is leaving the corridor limit at the material side, but not the corridor limit at the air side, a wane is given. So the characteristics X1 and X2 are negative values. The measured dimensions of the characteristic X1 and X2 are the results of the measured edge.

The tolerances of an external edge are negative, because the edge has an abrasion. The tolerance borders are parallel to the internal corridor limits "ki". The distance to these lines are the upper tolerances "OT1" and "OT2" and the Lower tolerances "UT1" and "UT2".

The tolerances of the surface 1 and surface 2 can be different.

MarSurf Software Option Bevel Evaluation V 2.0

Mahr has developed the Software Option Bevel Evaluation V 2.0 so that the edge evaluation is according to Bosch Standard N42AP 620. This software option realizes all types of edges like line-line, circle-line, line-circle and circle-circle from external edges and internal edges as well. Only a few parameters are necessary to measure the edge characteristics according to the Bosch Standard.



With the Software Option Bevel Evaluation V 2.0 you can get edge characteristics according to the Bosch Standard with entering only a few parameters

Both surfaces around the edge must be measured in the rectangular direction with a tactile contour or roughness measuring system. Normally the measured length at each surface should be 6 times of the tolerance of the edge characteristics in relation to the reference point of the edge. Two reference lines in a sure distance of the edge are responsible for finding the reference point of the edge.

If the characteristic of X is larger than 0.1 mm, the edge can be measured with a contour measuring system like MarSurf XC 20. This measuring system has stylus tip radius compensation, which compensates the stylus tip radius of 25 µm. If the characteristic of X is smaller than 0.1 mm, a stylus tip with a radius of 2 µm or 5 µm, and an angle of 60° is recommended, and the measurement should be done with a roughness measurement device like MarSurf XR 1, XR 20, GD 25, GD 120, LD 120, LD 130 or LD 260. At least all parameters according to the Bosch Standard N42AP 620 should be entered.

Measuring edges with MarSurf XC 20 and Option Bevel Evaluation V 2.00

Measurement of a wane from an external edge; Bevel type: Line-Line



Fig. 8: Selection of bevel type

Entering the bevel parameter or loading a project file

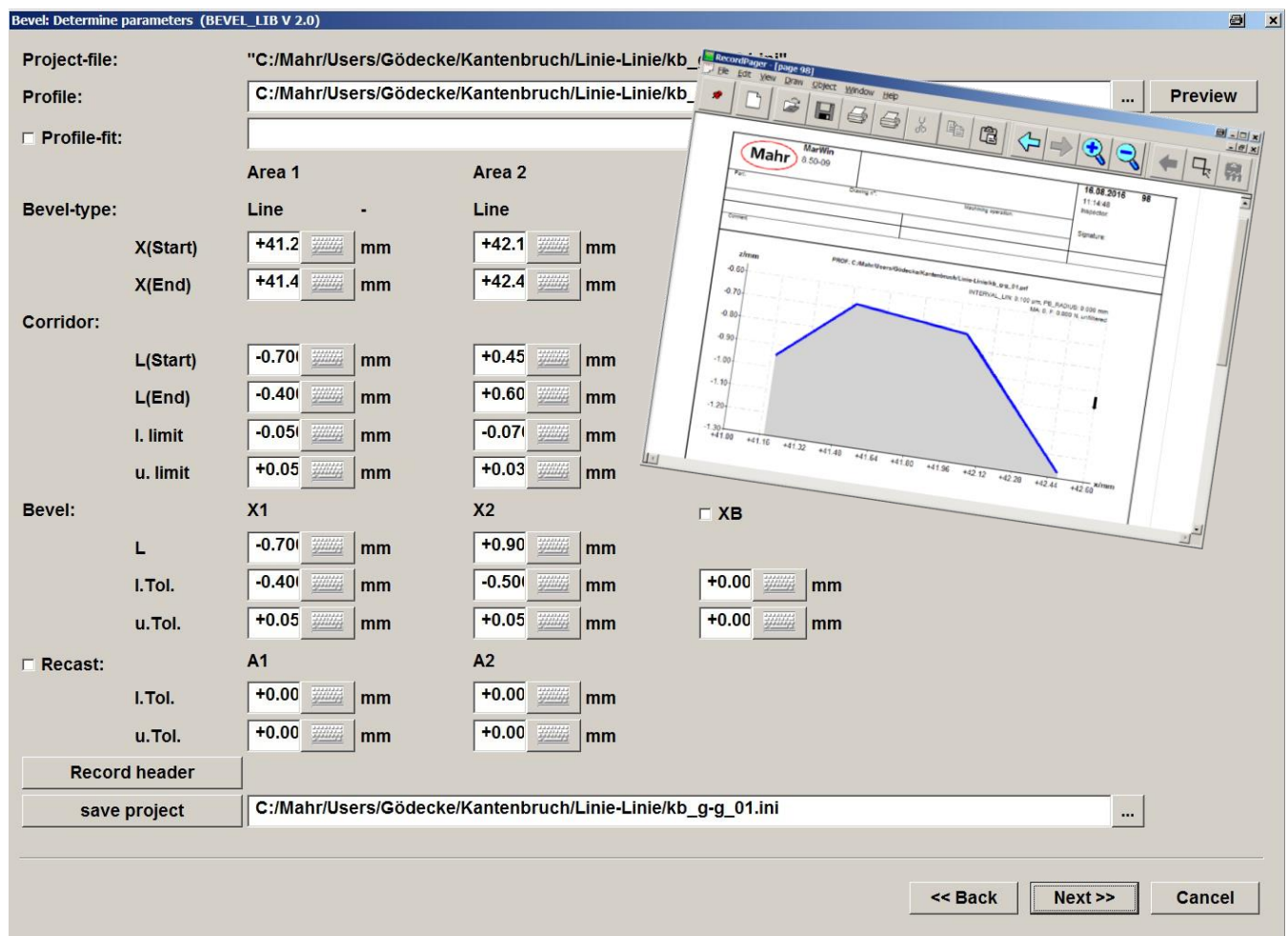


Fig. 9: Parameter of the Option Bevel Evaluation and showing the profile graphic

According to the Bosch Standard, all areas of best fit straight lines, length of the lines, distances of the corridor limits and the length of the bevel and burrs can be entered for the left area 1 and the right area 2. At last the tolerances of the edge characteristic can be entered.

The preview shows the measured edge in a total view or magnified with an individual zoom.

For serial measurements, the "Profile-fit" in particular is very useful, because the evaluation should be done in the same areas.

The tolerances of both areas can be defined differently.

Measuring edges with MarSurf XC 20 and Option Bevel Evaluation V 2.00

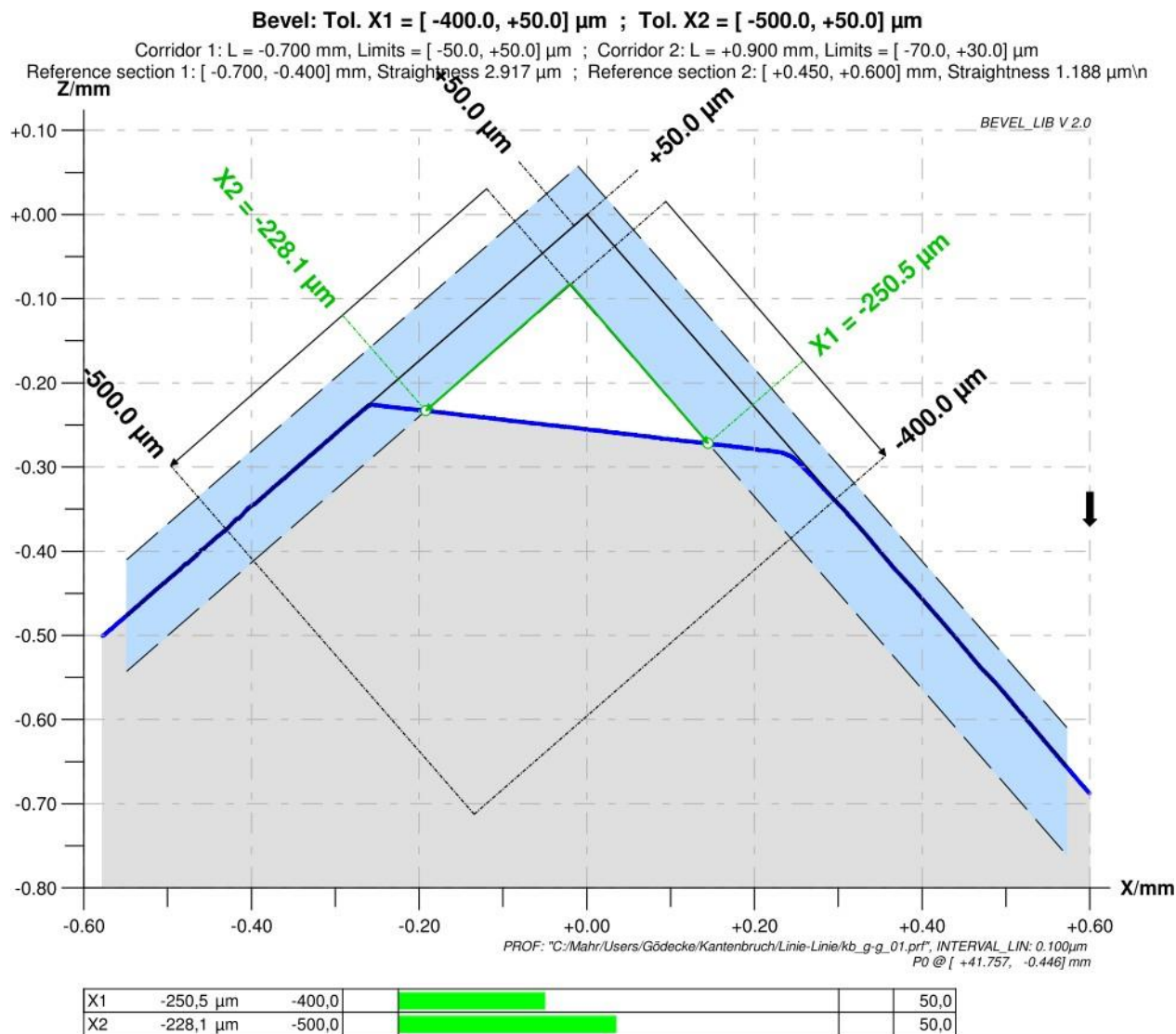
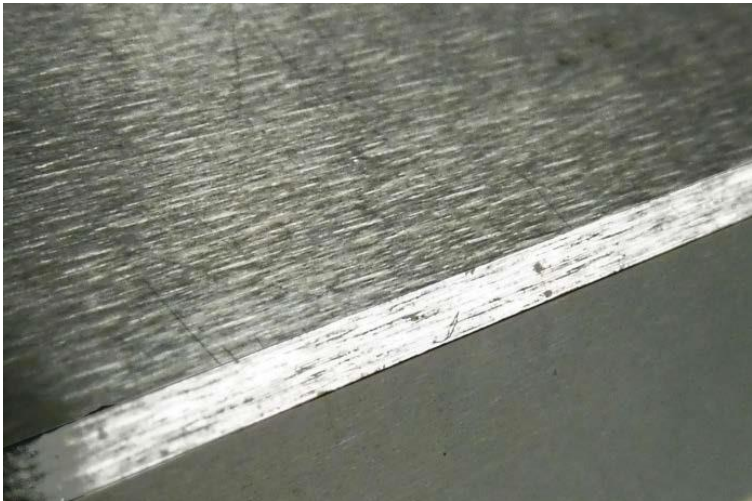


Fig. 10: Results of the bevel evaluation from a chamfer, 45°

The Option Bevel Evaluation documented the characteristics X1 and X2 and shows the measured profile in the area of the edge with the corridor limits, the tolerance zones for the area 1 and area 2.

Additionally, the straightness of the reference area and the parameter of the bevel evaluation is documented.



Measuring edges with MarSurf XC 20 and Option Bevel Evaluation V 2.00

Bevel type: Circle-Line

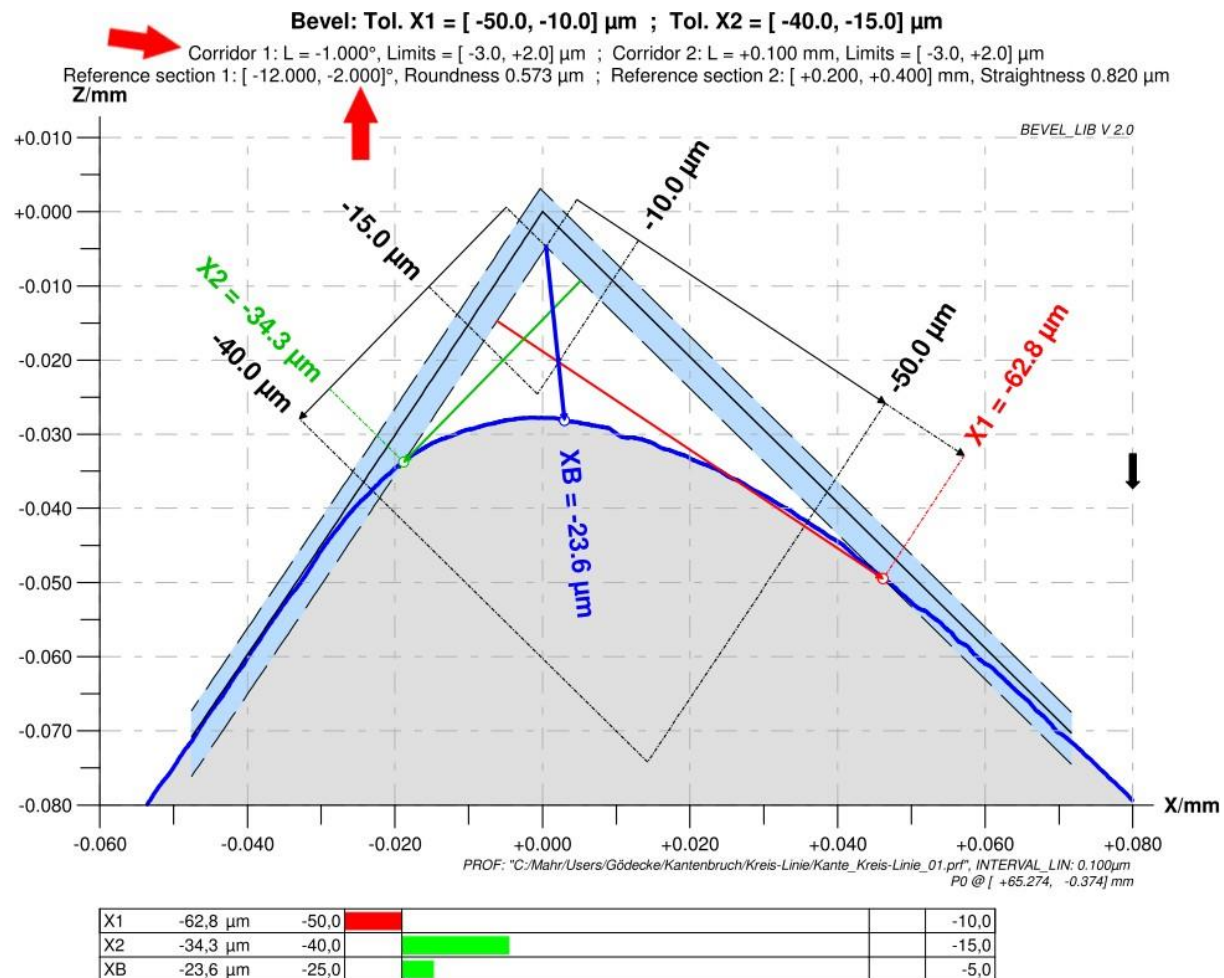


Fig. 11: Bevel type: Circle-Line



Line with edge characteristics X1, X2 and XB

This sample of an edge shows the left area 1 with a circle and the right area 2 with a straight line.

At the circle side the areas are defined with angle sectors for the reference line and the corridor.

Measuring edges with MarSurf XC 20 and Option Bevel Evaluation V 2.00

Documentation of edge characteristics

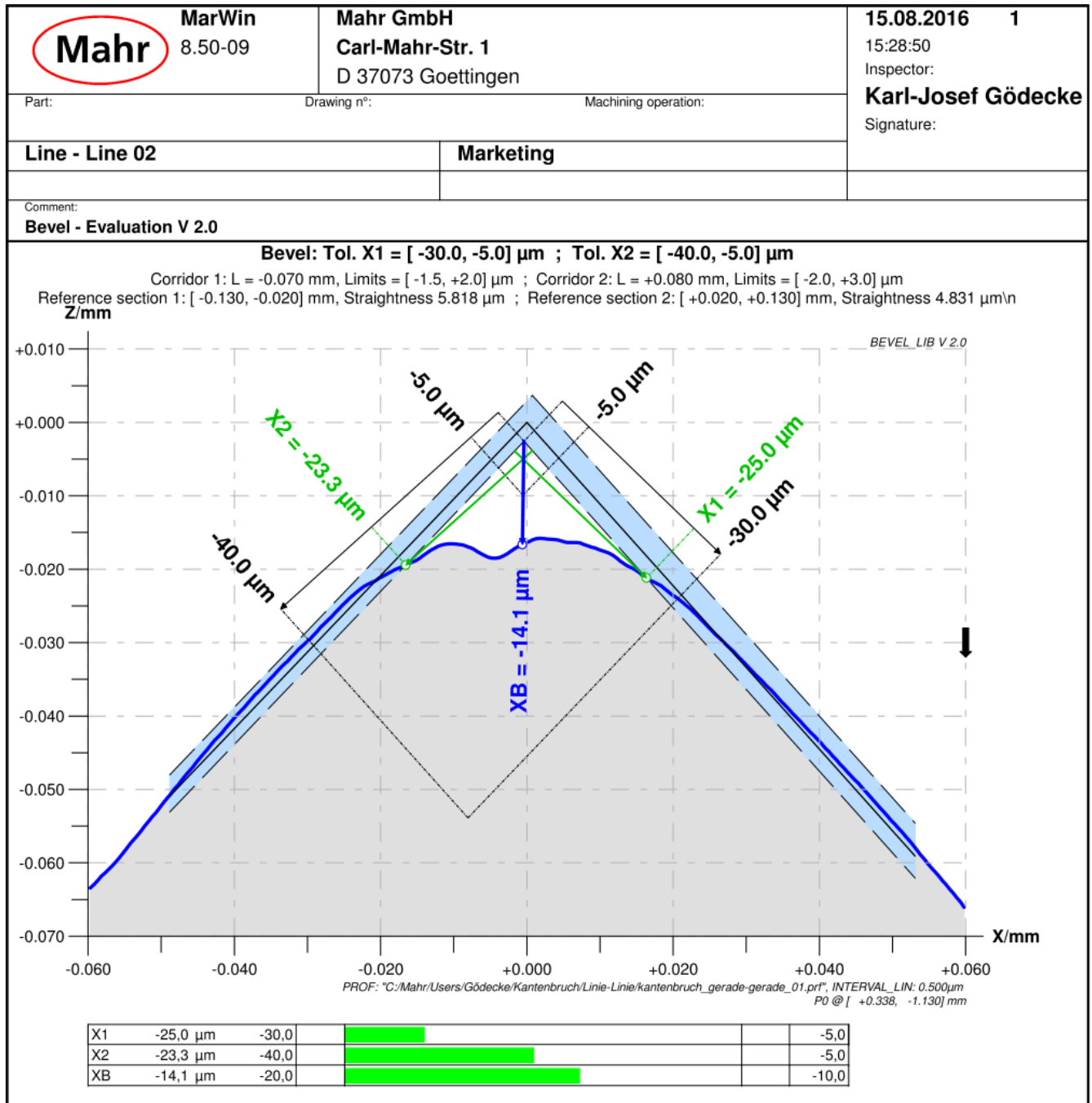


Fig. 12: Documentation of an external edge with undefined shape

In addition to the characteristics X1 and X2 according to the Bosch Standard, the characteristic of XB can be measured with the Option Bevel Evaluation. This is the distance between the intersection point of the internal corridor limit and the measured profile in the direction of the bisector from both best fit straight lines.

Measuring warping with MarSurf XC 20 and Option Bevel Evaluation V 2.00

Measurement of warping with the Option Bevel Evaluation

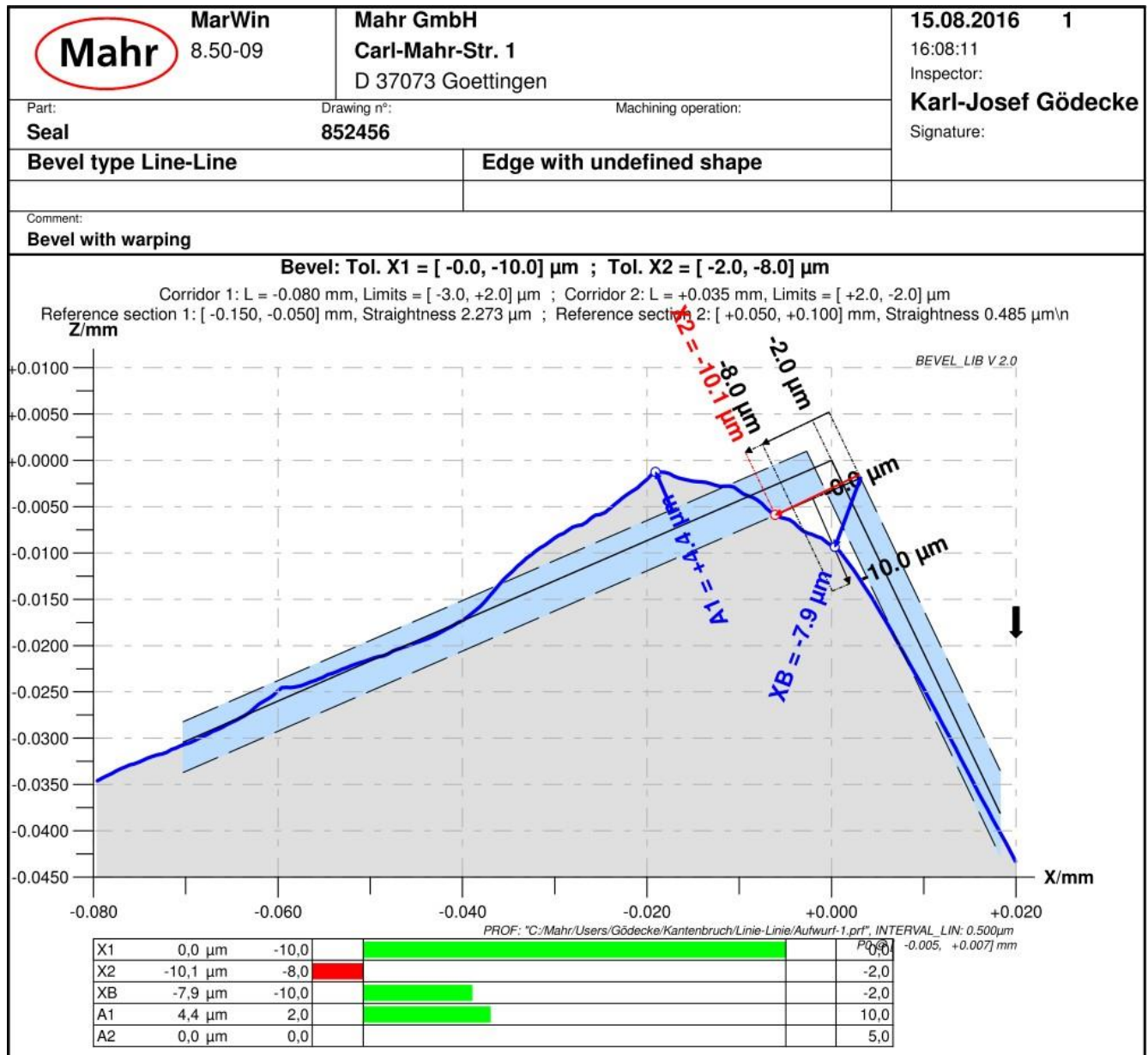


Fig. 13: Documentation of warping from an external edge

This edge shows warping A1 and the edge characteristics X2 and XB. The value of the warping A1 is positive.

Efficient edge measurement with MarSurf XC 20

The evaluation of the edge characteristics can also be performed by the high-performance MarSurf XC 20 software. According to the Bosch Standard N42AP 620, all elements such as best fit straight lines, reference point, corridor limits, intersection points between corridor limits and measured profile and the tolerance lines as well, can be created. All measured results receive positive signs, so it is not possible to indicate the direction of the edge results. Application programmers must have very good knowledge of MarSurf XC 20 and the Bosch Standard N42AP 620 if they want to perform this evaluation with a Quick&Easy program.

Measuring wane with MarSurf XCR 20 and Option Bevel Evaluation V 2.00

Measurement of wane with Roughness and Contour Measuring System MarSurf XCR 20

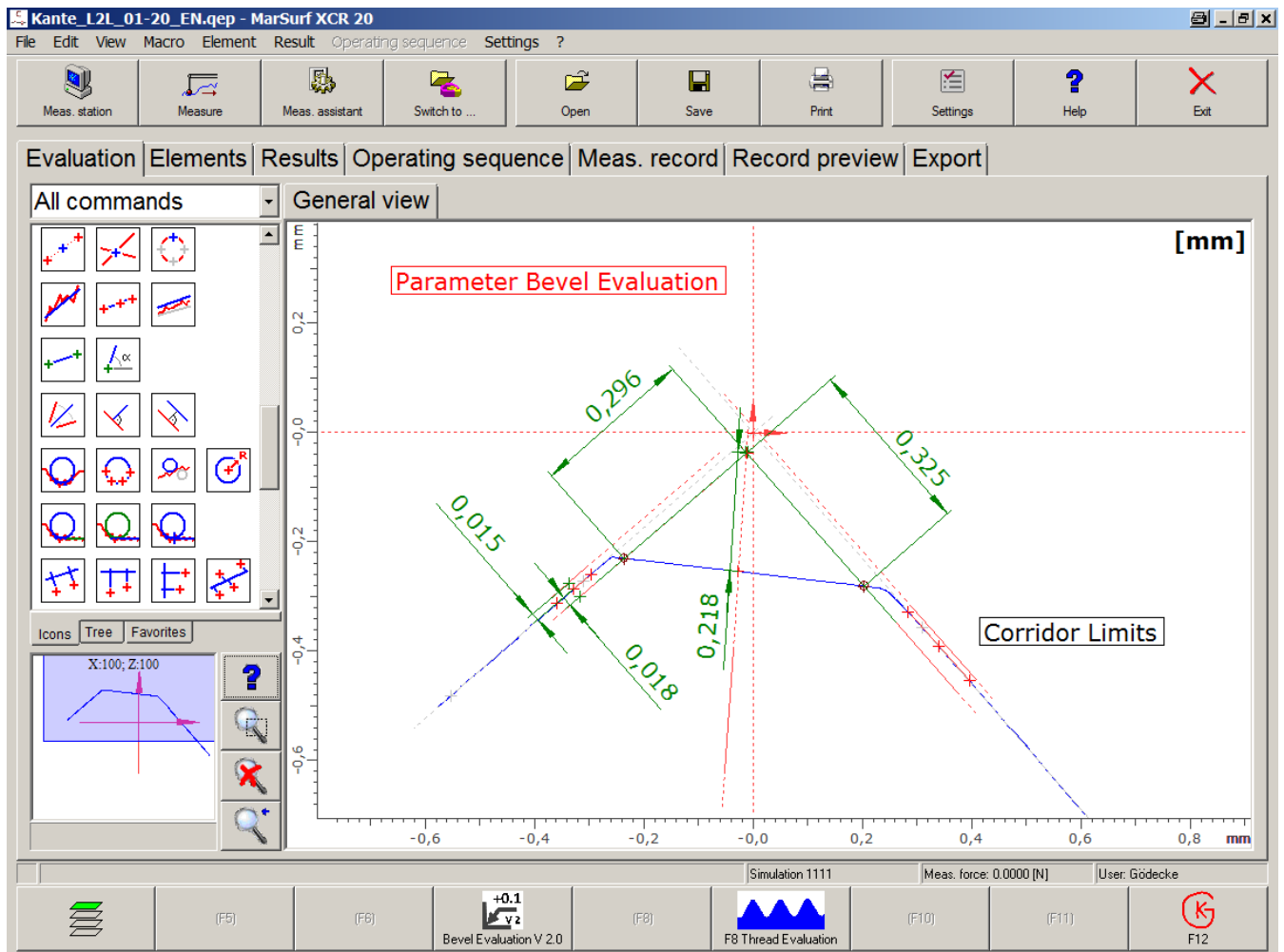


Fig. 14: Evaluation of wane with MarSurf XCR20

Measuring of edges or wanes can be done practice-orientated by contour-measuring systems MarSurf XC 20 and with roughness measuring systems MarSurf XR 20 as well. The stylus tips of roughness probes are available with a tip radius of 2 µm or 5 µm and with a cone angle of 60° or 47°. The drive unit MarSurf LD 130 or LD 260 has a vertical measuring range of ± 13 mm and the horizontal measuring length is maximal 130 mm or 260 mm.

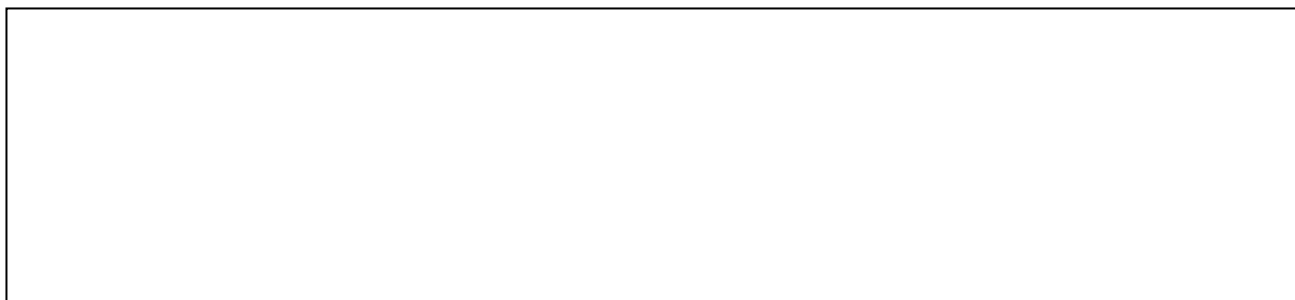
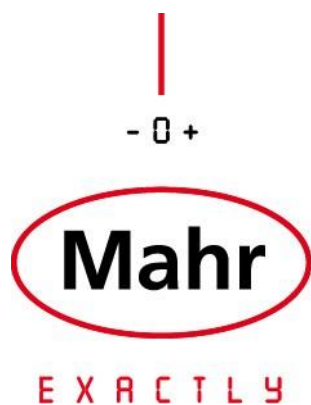
The vertical measuring range of the contour measuring system MarSurf XC 20 in combination with the drive unit PCV is ± 25 mm and the maximum of the horizontal measuring length is 200 mm. The stylus tip for contour measurements has a radius of 25 µm and an angel of 12° in measuring direction.

For difficult to access measuring positions a wide range of different, special styli are available from Mahr to measure work piece edges, the contour of the profile and roughness parameters.

Option Bevel Evaluation V 2.00

Order No.: 6292267

The practice-orientated and high-performance Option Bevel Evaluation according to Bosch Standard N42AP 620 2015-10-29 is available for MarSurf XC 20, XCR 20 and MarSurf XP from Version 8.0.



© MAHR UK PLC
We reserve the right to modify our products, especially in light of technical improvements and further developments. All illustrations numerical values etc. are therefore subject to change.

Version EN 1.0